# GeoIPS ['geoips'] Documentation

*Release 1.11.1.post4*

**U.S. NAVAL RESEARCH LABORATORY**

**Aug 22, 2023**

# CONTENTS

**Date**: Aug 22, 2023 **Version**: 1.11.1.post4

**Download PDF documentation**: `GeoIPS_geoips.pdf`

**Previous versions**: Documentation of previous geoips versions are available at github.com/NRLMMD-GEOIPS.

**Useful links**: Source Repository | GeoIPS License | NRLMMD |

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```


The Geolocated Information Processing System (GeoIPS).

# CHAPTER ONE

## GEOIPS ® BASE PACKAGE

The GeoIPS Base Package provides a Python 3 based architecture supporting a wide variety of satellite and weather data processing. The modular nature of the GeoIPS base infrastructure also allows plug-and-play capability for user-specified custom functionality.

Homepage: https://github.com/NRLMMD-GEOIPS/geoips

User Guide

The user guide provides in-depth information on the key concepts of geoips with useful background information and explanation.

User Guide

The API reference guide

The reference guide contains a detailed description of geoips API. The reference describes how the methods work and which parameters can be used. It assumes that you have an understanding of the key concepts.

API

To the release notes

Change logs, versioning and contribution history.

Release Notes

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# CHAPTER TWO

# INTRODUCTION

*Software Requirements Specification*

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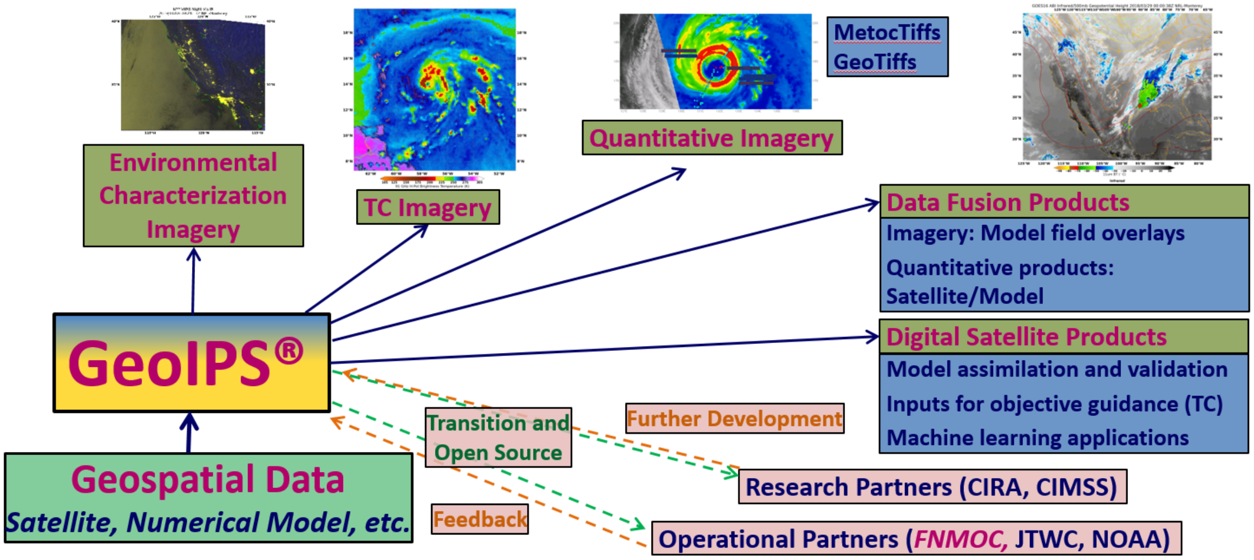
## 2.1 Description of GeoIPS

### 2.1.1 GeoIPS Overview

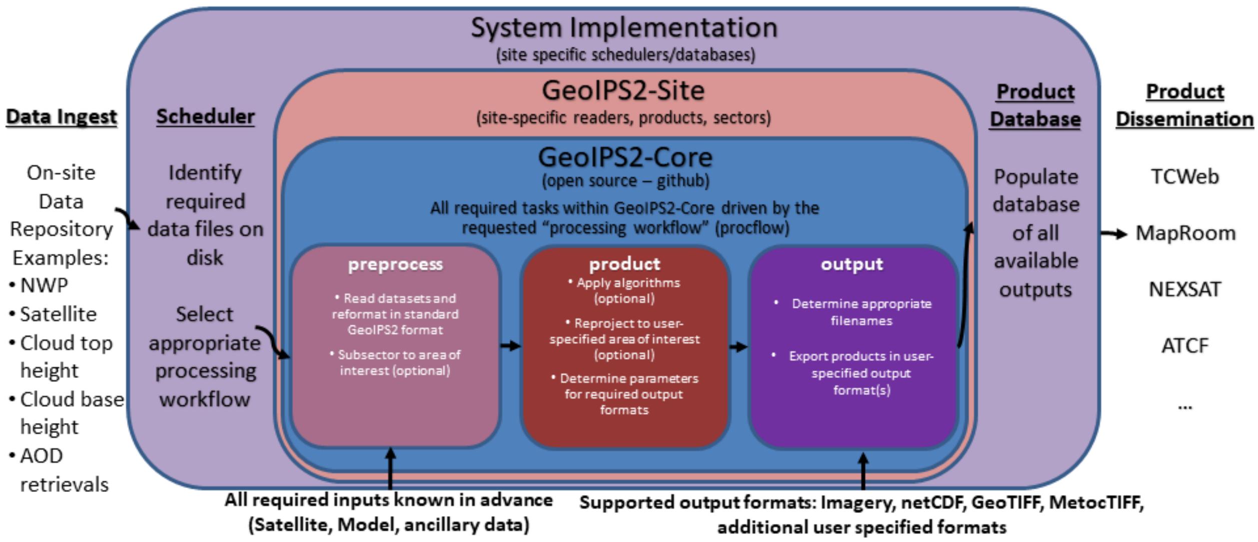
The Geolocated Information Processing System (GeoIPS) is a generalized processing system, providing a collection of algorithm and product implementations facilitating consistent and reliable application of specific products across a variety of sensors and data types.




GeoIPS acts as a toolbox for internal GeoIPS-based product development - all modules are expected to have simple inputs and outputs (Python numpy or dask arrays or xarrays, dictionaries, strings, lists), to enable portability and simplified interfacing between modules.

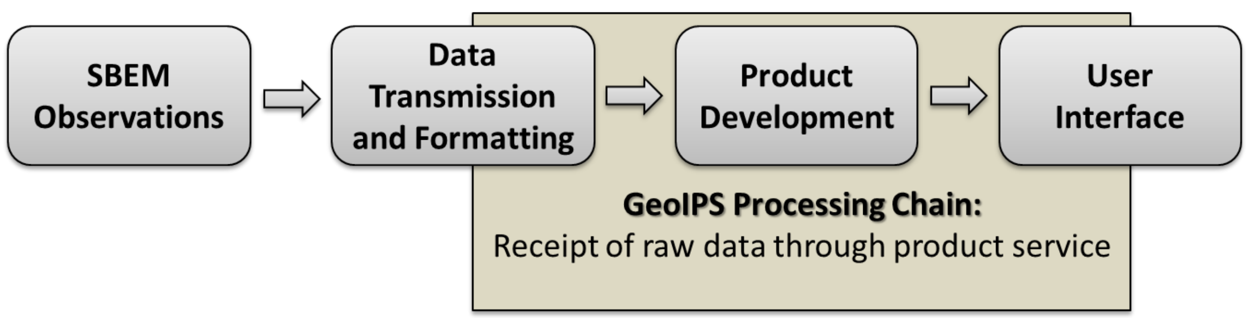
**Some of the primary benefits / requirements of GeoIPS include:**

- Seamless application to proprietary data types and products (no reference to external functionality within the main code base)
- Consistent product application across multiple sensors (both open source and proprietary)
- Flexible workflow to allow efficient real-time processing as well as interactive processing
- Modular interfaces to facilitate product development
- Consistent code base for research and development through operational transitions
- Ability to generate log outputs
- Ability to interface with workflow management tools (cylc)
- Ability to interface with databases (postgres)




## 2.1.2 GeoIPS Scope

The GeoIPS® "core" package is responsible for data processing from reading and reformatting the data into the common internal GeoIPS® internal format, through algorithm and product application, to outputting user configurable data formats (imagery, NetCDF, etc).




Data collection, data transfers, and product dissemination are all site specific implementations for driving GeoIPS® processing, and fall outside the scope of the GeoIPS® "core" processing system.

## 2.1.3 Using GeoIPS for Research

## 2.1.4 Using GeoIPS for Operations

### Static sectors

### Dynamic sectors

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## 2.2 Summary of current Functionality

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## 2.3 Example Output Images

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CHAPTER

THREE

# GETTING STARTED

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## 3.1 Conda-based Installation

Using a fresh Mini/Anaconda Python 3.9+ Environment is the easiest way to get geoips up and running.

### 3.1.1 Complete Local conda-based GeoIPS Installation

The following instructions will guide you through installing GeoIPS using Anaconda Python. This installation method allows users to install GeoIPS without requiring administrative privileges by using Conda to install all of the "Required" system dependencies, then installing geoips into that conda environment.

### 1. Set GeoIPS Environment Variables

In order to support GeoIPS' testing infrastructure, there are a few required environment variables. You can change your installation location by changing the value of `$GEOIPS_PACKAGES_DIR` below.

```
# GeoIPS Default Locations
export GEOIPS_REPO_URL=https://github.com/NRLMMD-GeoIPS  # Point to base␣
↪URL for git clone commands
export GEOIPS_PACKAGES_DIR=$HOME/geoips
export GEOIPS_TESTDATA_DIR=$GEOIPS_PACKAGES_DIR/test_data
export GEOIPS_OUTDIRS=$GEOIPS_PACKAGES_DIR/outdirs
```

If desired, the GeoIPS environment variables can be added to your `$HOME/.bashrc` by running the following commands:

```
echo "export GEOIPS_REPO_URL=$GEOIPS_REPO_URL" >> ~/.bashrc
echo "export GEOIPS_PACKAGES_DIR=$GEOIPS_PACKAGES_DIR" >> ~/.bashrc
echo "export GEOIPS_TESTDATA_DIR=$GEOIPS_TESTDATA_DIR" >> ~/.bashrc
echo "export GEOIPS_OUTDIRS=$GEOIPS_OUTDIRS" >> ~/.bashrc
```

### 2. Clone the GeoIPS git repository, for installation and testing commands

```
mkdir -p $GEOIPS_PACKAGES_DIR
git clone ${GEOIPS_REPO_URL}/geoips.git $GEOIPS_PACKAGES_DIR/geoips
```

### 3. Install Anaconda or Miniconda

- Download the appropriate version of Conda, Miniconda, or Miniforge/Mambaforge.

For example, for Linux with Intel chips, one of the following:

```
# wget https://repo.anaconda.com/archive/Anaconda3-2023.03-1-Linux-x86_64.
↪sh
# wget https://repo.anaconda.com/miniconda/Miniconda3-latest-Linux-x86_64.
↪sh
# wget https://github.com/conda-forge/miniforge/releases/latest/download/
↪Miniforge3-Linux-x86_64.sh
wget https://github.com/conda-forge/miniforge/releases/latest/download/
↪Mambaforge-Linux-x86_64.sh
```

- Make the install script executable and run the installer, following the prompts (particularly the bit about conda init / restarting terminal!):

```
chmod u+x Mambaforge-Linux-x86_64.sh
./Mambaforge-Linux-x86_64.sh
# Follow instructions regarding conda init / restarting your terminal !
```

### 4. Create and activate a conda environment with some dependencies

Next we'll create a conda environment named `geoips` that contains all system requirements for GeoIPS. Many of these may already be installed on your system, but this command will ensure that for everyone.

```
# Note geos no longer required for cartopy >= 0.22
# openblas / gcc required for recenter_tc / akima build.
# imagemagick required for image comparisons
# git required for -C commands
conda create -y -n geoips -c conda-forge python=3.10 gcc gxx openblas␣
↪imagemagick git
conda activate geoips  # RUN EVERY TIME YOU WANT TO USE GEOIPS!
```

**Note:** You will need to run `conda activate geoips` every time you want to run or work on GeoIPS.

### 5. Install the GeoIPS git repository

This command installs all GeoIPS Python dependencies, and GeoIPS itself.

```
# Ensure geoips python environment enabled before installing geoips
pip install -e "$GEOIPS_PACKAGES_DIR/geoips"[doc,lint,test,debug]
```

### 6. Test your installation

To test your installation you will call two scripts:

- `base_install.sh` will clone repositories containing test data.
- `base_test.sh` will run a few integration tests to ensure that your installation is working correctly.

```
# Ensure geoips python environment enabled
conda activate geoips
# Download the test data
$GEOIPS_PACKAGES_DIR/geoips/tests/integration_tests/base_install.sh
```

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```
# Run integration tests
$GEOIPS_PACKAGES_DIR/geoips/tests/integration_tests/base_test.sh
```

### 7. Test output

For reference, the end of the output from the base_test.sh command should look something like below, indicating that none of the tests failed:

```
Package: geoips_base
Total run time: 82 seconds
Number data types run: 3
Number data types failed: 0
```

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## 3.2 Expert User Installation (Administrative privileges)

The *Complete Local conda-based GeoIPS Installation <./installation.rst>* is the easiest way to get GeoIPS up and running, but if you have administrative privileges on your system, and are confident you can install all the required system dependencies yourself, you can install GeoIPS by setting a few environment variables for testing purposes.

### 3.2.1 Expert User GeoIPS Installation

#### System Dependencies

**Use the** *Complete Local conda-based GeoIPS Installation <./installation.rst>* **for the fully supported installation, which includes all dependencies**

Required (**included in** *Complete Local conda-based GeoIPS Installation <./installation.rst>*)

- wget (Miniconda installation)
- git >= 2.19.1 (git -C commands in complete installation)
- imagemagick (required for test output comparisons)
- openblas (required for scipy pip install)
- Python >= 3.9 (3.9 required for entry points)
- Test data repos contained in $GEOIPS_TESTDATA_DIR (required for tests to pass)

Optional

- gfortran (only required for plugins including fortran builds, build-essential)
- gcc & g++ (required for plugins including fortran or C builds, build-essential)
- screen (convenience package)
- ncurses (only required if building vim, ncurses and libncurses5-dev)

#### Minimal install

**Use the** *Complete Local conda-based GeoIPS Installation <./installation.rst>*. **for the fully supported installation, which includes all dependencies**

If you are confident you have all system requirements installed (Python+cartopy), and do not wish to go through the full installation process (which includes conda, rclone, test data, etc), you can clone the geoips repo and pip install from your local copy.

**For the fully supported installation, please use the** *Complete Local conda-based GeoIPS Installation <./installation.rst>*.

```
# NOTE: ALL dependencies above MUST be installed/available
#       to use this installation method.
# Please follow complete conda-based installation in the
#       next section for fully supported complete install.
export GEOIPS_REPO_URL=https://github.com/NRLMMD-GEOIPS
export GEOIPS_PACKAGES_DIR=<installation_location>
export GEOIPS_TESTDATA_DIR=<desired_test_data_location>
```

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```
export GEOIPS_OUTDIRS=<desired_output_file_location>

git clone $GEOIPS_REPO_URL/geoips.git $GEOIPS_PACKAGES_DIR/geoips
pip install -e $GEOIPS_PACKAGES_DIR/geoips
$GEOIPS_PACKAGES_DIR/geoips/tests/integration_tests/base_install.sh
$GEOIPS_PACKAGES_DIR/geoips/tests/integration_tests/base_test.sh
```

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## 3.3 Simple command line examples

### 3.3.1 Full Install

In order to obtain all test repos and plugin repositories currently available publicly, you can run the test script $GEOIPS_PACKAGES_DIR/geoips/tests/test_full_install.sh. This will download, install, and test all possible data types and products.

### 3.3.2 Step by Step

In the future, we will provide simple step by step examples using Jupyter Notebooks in order to quickly get up to speed on GeoIPS capabilities and functionality. Maybe we could link to some Jupyter notebooks here?

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## 3.4 Extending GeoIPS with your own functionality

### 3.4.1 Discussion

Please see "Extending GeoIPS with Plugins" in the User's Guide for more information on using GeoIPS for your own use cases.

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CHAPTER

FOUR

# USER GUIDE

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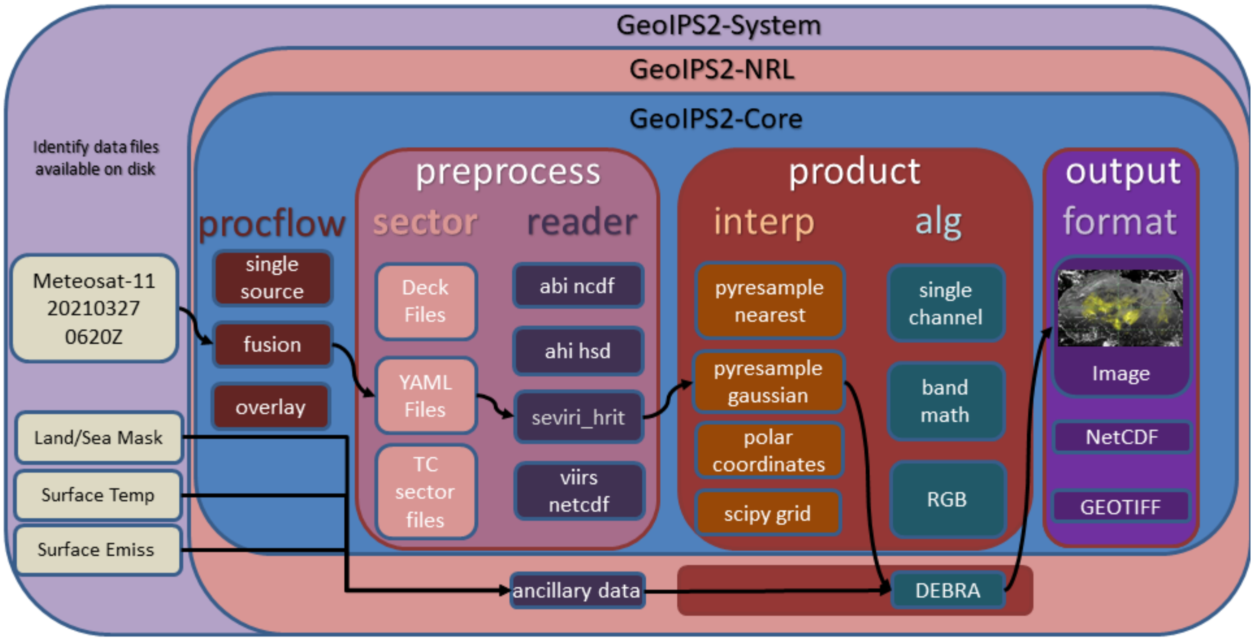
## 4.1 Description of GeoIPS structure

### 4.1.1 Overview of interfaces and plugins

A primary goal of GeoIPS is to provide seamless integration of external functionality, with no reference to proprietary algorithms and readers from the base open source geoips code base.

GeoIPS Interfaces are used to abstract the process of accessing different pieces of GeoIPS functionality (plugins) in order to support installing GeoIPS Plugins from external repositories with no reference to those pieces of functionality from within the main code base.

Example external plugin functionality:




GeoIPS makes use of Python entry points to install external packages within the geoips namespace, then an internal Application Programming Interface to access specific modules.

GeoIPS is made up of a collection of plugins of different types, accessed via specific plugin interfaces.

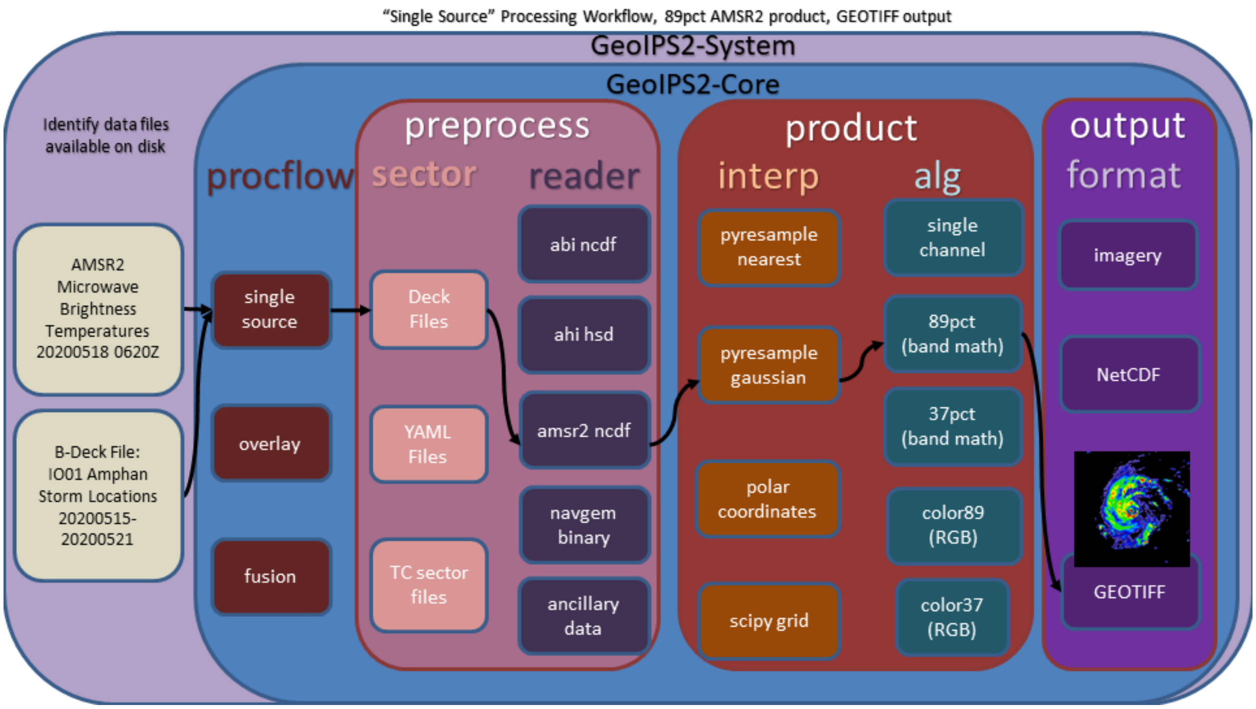
The primary plugin interfaces include:

- **processing workflows (procflows)** - drive a specific collection of steps for a particular type of processing
- **static sectors** - specifications of domains of interest
- **dynamic sectors** - specifications of dynamic domains of interest
- **readers** - specifications for ingesting a specific data type, and storing in the GeoIPS xarray-based internal format
- **products** - overall product specification, including interpolation routine, algorithm, colormaps, etc (see YAML-based interfaces)
  - **interpolators** - interpolation routine to apply when reprojecting data
  - **algorithms** - data manipulations to apply to dataset
  - **colormaps** - colormap to apply to resulting product
- **output_formatters** - data format for the resulting output product (ie, netCDF, png, etc)
- **filename_formatters** - full path and file name formatting specification, using attributes within the xarray objects

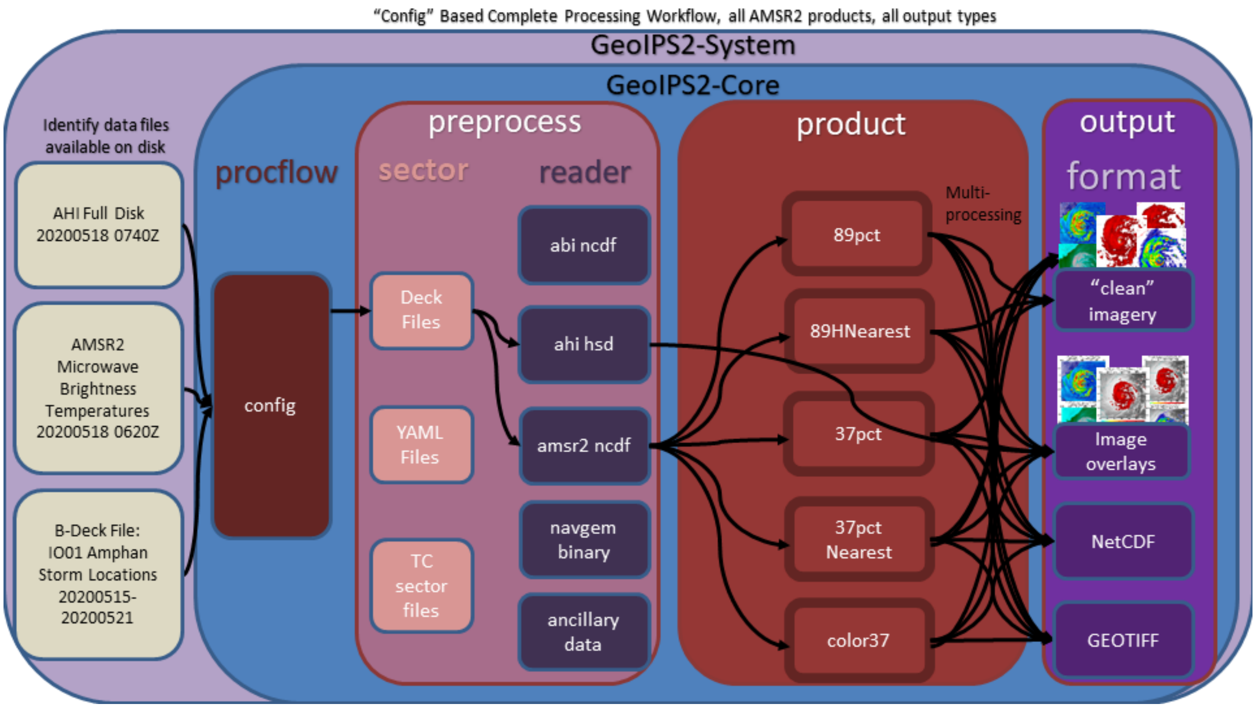
The primary processing workflows available at this time, which access the appropriate plugins at the appropriate point in the processing stream using the appropriate plugin interface, include:

- **single_source** - single input type and single output type
- **config_based** - efficient method for producing all possible outputs for a given set of data files.

Example single_source processing workflow:




Example of config based processing workflow


"Config" Based Complete Processing Workflow, all AMSR2 products, all output types
GeoIPS2-System
GeoIPS2-Core
Identify data files available on disk
AHI Full Disk 20200518 0740Z
AMSR2 Microwave Brightness Temperatures 20200518 0620Z
B-Deck File: IO01 Amphan Storm Locations 20200515-20200521
procflow
config
preprocess
sector
reader
Deck Files
YAML Files
TC sector files
abi ncdf
ahi hsd
amsr2 ncdf
navgem binary
ancillary data
product
Multi-processing
89pct
89HNearest
37pct
37pct Nearest
color37
output
format
"clean" imagery
Image overlays
NetCDF
GEOTIFF

### 4.1.2 Module-based interfaces

#### Algorithms

#### Colormaps

#### Filename formatters

#### Interpolators

#### Output formatters

#### ProcFlows

#### Readers

#### Title formatters

### 4.1.3 YAML-based Interfaces

#### Feature Annotator

#### Gridline Annotator

#### Product defaults

#### Products

#### Dynamic sectors

#### Static sectors

#### ProcFlow configurations

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## 4.2 Command Line Interface

The GeoIPS Command Line Interface is currently under development - once the functionality is finalized, instructions will be included here for interrogating GeoIPS capabilities via the CLI.

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## 4.3 GeoIPS Functionality

The GeoIPS Command Line Interface is currently under development - once the CLI is complete, it will provide a simple method of listing all possible GeoIPS Plugins with a single command. The resulting functionality list will be outlined in this section.

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## 4.4 Extend GeoIPS with Plugins

### 4.4.1 Developing Module-based plugin

### 4.4.2 Developing YAML-based plugin

### 4.4.3 Example Module-based Plugins

#### Algorithnms

#### Colormaps

#### Filename formatters

#### Interpolators

#### Output Formatters

#### ProcFlows

#### Readers

#### Title Formatters

### 4.4.4 Example YAML-based Plugins

#### Boundary Annotators

#### Gridline Annotators

#### Product Defaults

#### Products

#### Dynamic Sectors

#### Static Sectors

#### ProcFlow Configurations

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# CHAPTER FIVE

# DEVELOPER GUIDE

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## 5.1 Software Requirements Specification

For **Geolocated Information Processing System**

Version 1.1 approved
Prepared by Mindy Surratt and Chris Camacho
Naval Research Laboratory Marine Meteorology Division
7 February 2023

### 5.1.1 Table of Contents

### 5.1.2 Revision History

| Name | Date | Reason For Changes | Version |
|---|---|---|---|
| Surratt/Camacho | 2021-10-20 | Initial version | 1.0 |
| Surratt/Camacho | 2023-02-06 | Google -> NumPy docstrings black/flake8/bandit code checks | 1.1 |

#### 1. Introduction

#### 1.1 Purpose

The Geolocated Information Processing System (GeoIPS) is a generalized processing system, providing a collection of **algorithm and product implementations** facilitating **consistent and reliable application** of specific products across a **variety of sensors and data types**.

GeoIPS acts as a toolbox for internal GeoIPS-based product development - all modules are expected to have simple inputs and outputs (Python numpy or dask arrays or xarrays, dictionaries, strings, lists), to enable portability and simplified interfacing between modules.

Some of the primary benefits / requirements of GeoIPS include:

- Seamless application to proprietary data types and products (no reference to external functionality within the main code base)
- Consistent product application across multiple sensors (both open source and proprietary)
- Flexible workflow to allow efficient real-time processing as well as interactive processing
- Modular interfaces to facilitate product development
- Consistent code base for research and development through operational transitions
- Ability to generate log outputs
- Ability to interface with workflow management tools (cylc)
- Ability to interface with databases (postgres)

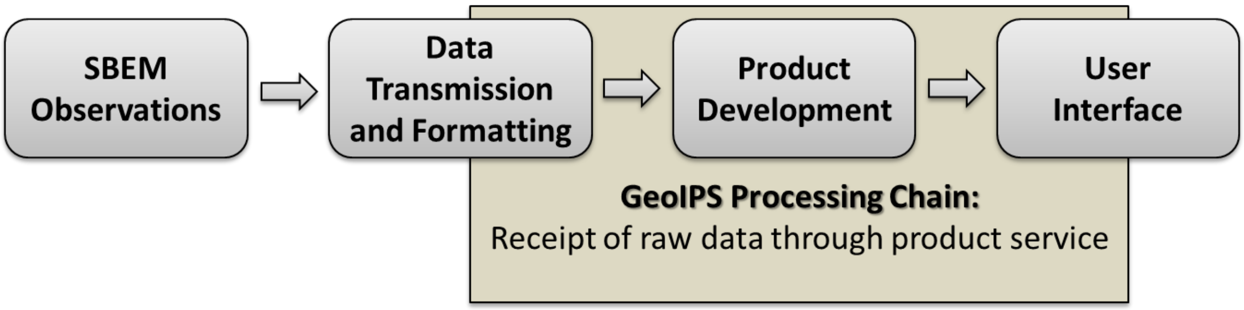
## 1.2 Intended Audience and Reading Suggestions

This document is primarily intended for system administrators, users, testers and project managers.

Software developers should consider this required reading prior to working through the documentation.

## 1.3 Product Scope

The GeoIPS® "core" package is responsible for data processing from reading and reformatting the data into the common internal GeoIPS® internal format, through algorithm and product application, to outputting user configurable data formats (imagery, NetCDF, etc).




Data collection, data transfers, and product dissemination are all site specific implementations for driving GeoIPS® processing, and fall outside the scope of the GeoIPS® "core" processing system.

## 1.4 References

### Software Requirements Specification Template

This Software Requirements Specification Document was developed using the following template:

https://github.com/rick4470/IEEE-SRS-Tempate

### Documentation and Style Strategy

GeoIPS uses Sphinx with the Napoleon extension for automated documentation generation.

https://www.sphinx-doc.org/en/master/usage/extensions/napoleon.html

### GeoIPS Syntax and Style Checking

GeoIPS uses the NumPy docstring format within the code base for simplicity:

https://numpydoc.readthedocs.io/en/latest/format.html

bandit, flake8, and black are used to enforce appropriate style, security, and syntax usage. flake8-rst and flake8-rst-docstring plugins are used to enforce numpy docstring formatting.

### Overall Description

### 2.1 Product Perspective

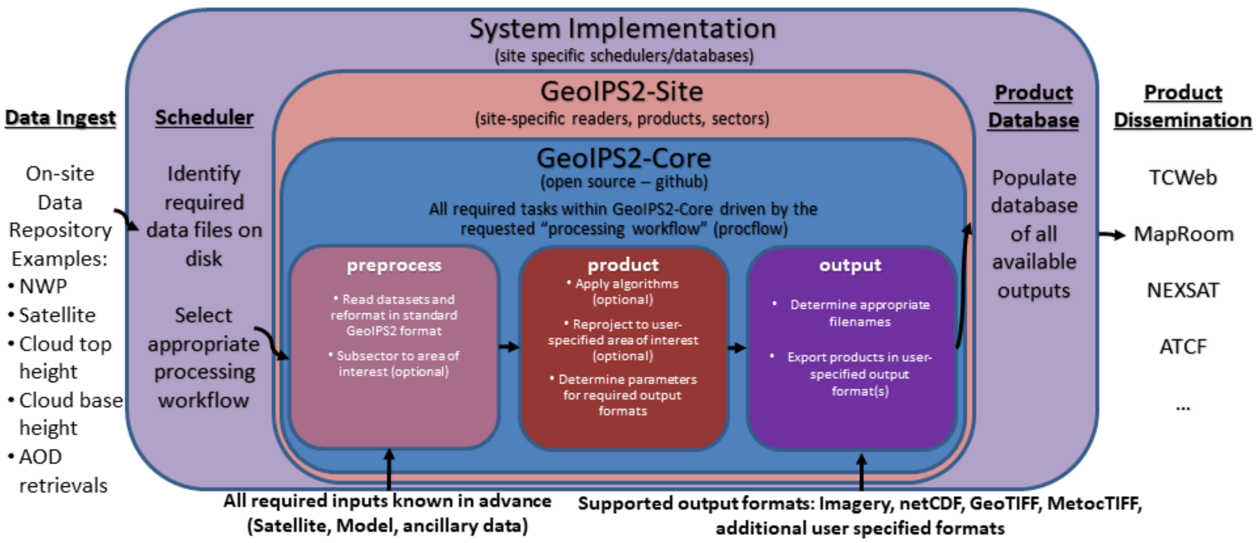
The Meteorology and Oceanography (METOC) community has an increasingly large number of disparate data sources available for advanced environmental exploitation – numerical model outputs, rapid refresh next generation geostationary weather satellites, polar orbiting microwave imagers and sounders, radar data, direct observations from ships and weather stations, climatology, elevation and emissivity databases, and many more data types, both static and dynamic. Additionally, with the upcoming launch of countless microsats, an efficient and easy-to-use processing system is imperative for rapid implementation of these new datasets.

The amount of information that can be gained by combining these datasets in unique ways is far greater than from any single data type. GeoIPS® will result in a collaborative, easy-to-use processing system that can support development efforts integrating these disparate data sources into unique products, and facilitate streamlined operational transitions. This common platform will be used across the METOC community – including basic research, real-time implementation, and operational processing.

With the plethora of weather satellites coming on line, it is imperative to develop a sustainable, open source, community supported, efficient, modular processing platform to enable future functionality and facilitate near real-time operational capability for all new sensors and products.

The GeoIPS® project will deliver a much needed capability for efficient environmental data processing, benefiting METOC users across the community. The collaborative nature of GeoIPS® development will lead to increased efficiency and functionality of the final product.

### 2.2 Product Functions




### 2.3 User Classes and Characteristics

There are 4 primary user classes for the GeoIPS® system: researchers, light developers, expert developers, and operators.

**Researchers** will use the system to generate output products for further analysis, but will not be implementing major changes to the products or algorithms themselves – only using the output of GeoIPS® to aid in their research.

**Light developers** will make minor changes to the code base (slight modifications to basic products, algorithms, sectors, etc), but will not make major changes to the internals of the GeoIPS® infrastructure. This allows product customization, without a deep knowledge of the backend processing architecture.

**Expert developers** will work with the internals of the main GeoIPS-Core code base – providing new functionality and features that are commonly used by multiple site-specific implementations. Expert developers should be intimately familiar with all aspects of the Software Requirements Specification.

**Operators** will drive GeoIPS® processing via YAML config files, specifying all required products and sectors. Operators will implement minimal changes to the GeoIPS® code base, and will require additional software outside of the GeoIPS® system to drive the real-time processing (processing workflows, database management systems, data dissemination protocols).

### 2.4 Operating Environment

GeoIPS® is developed and tested under the GNU/Linux operating system, on 64-bit x86 hardware architecture.

GeoIPS® must be fully functional under RHEL 8.4 with SELinux enabled (including Fortran and C compiled code)

### 2.5 Design and Implementation Constraints

GeoIPS® is a Python 3 based processing system, with support for Fortran and C routines.

Minimum Base Python package requirements include xarray, scipy, pyresample, and pyyaml, with additional requirements for specific readers and algorithms.

GeoIPS® requires gfortran and gcc compilers – must support gcc version 8, 9, or 10.

### 2.6 User Documentation

The GEOIPS-Core code base, documentation, and tutorial support are available on github.

Test datasets can be obtained from geoips@nrlmry.navy.mil.

### 2.7 Assumptions and Dependencies

Hardware and software requirements stated in this document are pertinent to the GeoIPS-Core version of the codebase. Additional site-specific packages and system implementations could incur additional resource requirements or software dependencies.

### External Interface Requirements

### 3.1 User Interfaces

- Must support Linux-based processing, no GUI requirement.
- Must run via command line interactively, one product at a time.
- Must be able to run via config-based processing to efficiently drive multiple outputs.
- Command line and config-based interfaces must map user requested options to modular software interfaces.
- Must be able to support web-based requests. (Config-based processing supports web-based requests – potentially separate application to generate config file to drive processing)

- Must be able to operate via queueing and scheduling systems (covered via config-based processing)
- Must provide feedback throughout processing to monitor progress.
  - Log output (errors, warnings, status)
  - Messages during runtime identifying which part of the processing is currently active

## 3.2 Hardware Interfaces

GeoIPS® is developed and tested under the GNU/Linux operating system, on 64-bit x86 hardware architecture. GeoIPS® must successfully operate under Red Hat Enterprise Linux 8.4 with SELinux enabled.

Processing medium resolution next generation geostationary satellite data (ABI, AHI) and polar orbiter satellite data with GeoIPS® requires a minimum of 2 processors with 16GB memory. High resolution next generation geostationary satellite datasets requires at least 24GB memory.

## 3.3 Software Interfaces

Requirements:

- **Must allow internal multi-processing**
  - Individual modules are allowed to include multi-threading and multi-processing
    - Dask based processing
  - Managing queues to ensure multi-processing is handled properly is outside the scope of GeoIPS itself.
  - Config-based processing allows driving processing in different configurations to ensure optimal efficient processing.
- **Must be able to map each point to**
  - Latitude
  - Longitude
  - vertical position
  - observation time (ie, when the model was run)
  - valid time (ie, observation time + tau)
- **Must store satellite specific attributes**
  - Satellite zenith and azimuth angles
  - Orbital parameters

- **Must be able to ingest geo-located data with temporal and vertical information**
  - LIDAR data, sounder data, model data, and other datasets including vertical coordinates
- **Must store metadata on projections**
- **Must have common backend data format**
  - dictionary of xarray datasets, one for each shape/resolution/attribute set of data.
  - Each individual xarray dataset contains the following variables:
    * 'latitude' - REQUIRED 2d array the same shape as data variables
    * 'longitude' - REQUIRED 2d array the same shape as data variables
    * 'vertical_position' – OPTIONAL 2d array the same shape as data variables
      · Required for feature height, volumetric, models, curtain – ie, if heights change
    * 'time' - OPTIONAL 2d array the same shape as data variables
- **Each individual xarray dataset must contain the following metadata attributes**
  - 'source_name' – REQUIRED
  - 'platform_name' – REQUIRED
  - 'data_provider' – REQUIRED
  - 'start_datetime' – REQUIRED
  - 'end_datetime' – REQUIRED
  - 'interpolation_radius_of_influence – REQUIRED
  - 'vertical_data_type'
    * Surface
    * Column integrated
    * Feature height (ie, Cloud top, ocean, etc)
    * Volumetric (3d)
    * Curtain (2d)
  - Projection information (how it was, or how it will be mapped onto a grid)
- **Each reader return must contain a 'METADATA' dictionary key with only metadata attributes**
  - Must include required metadata fields
  - May include any additional optional desired metadata fields
- **Variables and attributes on xarray datasets will follow CF Standards, with units matching the CF canonical units**

    - http://cfconventions.org/Data/cf-standard-names/current/build/cf-standard-name-table.html

- **Model xarray objects are organized with separate datasets for each level type**
    - Mean sea level
    - Pressure
    - Surface
    - Top
    - Zheight
- **Time-series data (model, fire ) is stored in 3 dimensional DataArrays, where the 3rd dimension relates to time (tau for model data), with a separate "time" data array**
- **Must have modular capability for different output formats**
    - Request output format modules during run-time (via config files or command line) – no reference to specific output formats within code base.
        * Xarray based inputs containing
            · data to plot
            · requested region of interest
            · plotting parameters (optional)
        * Performs actual plotting / output commands
            · Generates output directly within the module
        * Returns list of filenames that were generated
- **Must have modular capability for user-specified output filenames**
    - Request filename module during run-time
    - Xarray based inputs with required metadata to compile filename
    - Returns string of resulting filename
- **Must have modular capability for sector specifications**
    - Request sector specification modules during run-time
    - Xarray based inputs
    - Pyresample area definition based output
- **Must support config-file specified "product" parameters referencing one or more of**
    - Interpolation scheme
    - Colormap

- Algorithm to apply, and required algorithm arguments
- Separate mapping of sensor to required variables for each supported product (allowing implementation of existing products to proprietary data types)

## System Features

## 4.1 Data Fusion Capability

### 4.1.1 Description and Priority

High Priority - Must be able to produce output products from different combinations of input datasets.

### 4.1.2 Stimulus/Response Sequences

Required input data sets and desired output products must be specified via a single command line call.

Required data files and product parameters can be specified either via:

- explicit command line options or
- YAML config specifications

### 4.1.3 Functional Requirements

- **Must be able to produce output products from combinations of**
  - Geostationary satellites
  - Vis/IR Polar orbiters
  - Passive microwave polar orbiters
  - Numerical Weather Prediction model outputs
  - Radar data
  - Sounder data
  - Lidar data
  - Other ancillary datasets (elevation, surface emissivity, etc)

## 4.2 Products Over Various Spatial Domains

### 4.2.1 Description and Priority

High Priority - Must be able to produce output products over a variety of user-specifiable spatial domains.

### 4.2.2 Stimulus/Response Sequences

Requested spatial domains (referred to as area definitions or sectors) must be requested via a single command line call. Sector information can be specified either via:

- explicit command line options or
- YAML config specifications

### 4.2.3 Functional Requirements

- **Must be able to produce products over various spatial domains for the above datasets**
  - Tropical cyclone centered imagery
  - Static regions of varying spatial resolutions and coverage, at any location on the globe
  - Algorithms applied to raw datasets (original resolution / coverage)
  - 3 and 4 dimensional outputs (model data, sounder data, lidar data, etc)

## 4.3 Products of Varied Output Formats

### 4.3.1 Description and Priority

High Priority - Must be able to produce output products of various user-specifiable output formats.

### 4.3.2 Stimulus/Response Sequences

Requested output formats must be requested via a single command line call.

Requested output format information can be specified either via:

- explicit command line options or
- YAML config specifications

### 4.3.3 Functional Requirements

- **Must be able to produce the following output types for any combination of the above datasets and domains**
  - Annotated imagery outputs (titles, coastlines, gridlines)
  - Non-annotated imagery outputs with associated metadata for displaying within external image viewers
  - METOCTIFF quantitative imagery output (for ATCF/JMV/MapRoom viewers)
  - GeoTIFF output
  - GeoJSON output
  - netCDF output with pre-processed data
  - text outputs

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## 5.2 Contributors Guide

The GeoIPS Team encourages active participation by the user and developer community, so we welcome any and all feedback on and updates to the code base.

Each step in this process can be completed by one or more individuals (we encourage collaboration!), so feel free to submit Issues even if you have no intention of resolving it yourself. And feel free to submit a Pull Request even if all tests are not complete - someone else may have time to finalize for approval even if you are unable.

Contributions generally follow the process of:

1. Submit a GitHub Issue for a bug fix or feature request. *GeoIPS GitHub Issue Creation Workflow*
2. Branch off a given Issue in order to make the required changes *FROM WEB: MEMBERS: Create Branch from Existing Issue*
3. Create a github Pull Request in order for your changes to be reviewed prior to being merged to the integration branch *GeoIPS GitHub Pull Request workflow*
4. Ensure all required tests pass prior to PR approval (more info coming soon)
   - Unit tests
   - Integration tests
   - Code formatting/style tests
   - Documentation formatting/style tests
5. Merge your changes into the main code base! *GeoIPS Merge PR and Close Issue workflow*

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## 5.3 Setting up for development

### 5.3.1 Instructions for setting up a new data type

Instructions for setting up a new data type, including:

- creating a new geoips test data repository from template,
- creating a new geoips plugin repository from template,

This example will use a data type called "mydatatype".

Anything denoted with an '@' symbol within these instructions and within the associated templates will need to be modified accordingly, based on your desired functionality

### Follow Issue, Branch Pull Request Process if within GEOIPS org

This only required if you are creating a new repository within the NRLMMD GEOIPS organization. If you are creating functionality within your own organization, you can follow your own version control process.

1. **Create branch for updates**
   - Follow Issue, Branch, Pull Request process in $GEOIPS/docs/source/devguide/git_workflow.rst
   - *Git Workflow <./git_workflow.rst>*

### Create test data repo

If a new data type is required for your plugin, create a separate test data repo to hold the test datasets. Source code and test outputs are stored separately from test datasets (idea being test datasets are effectively static, and will very infrequently require updates, unless new datasets are added).

Use the "template_test_data" template on github

- https://github.com/NRLMMD-GEOIPS/template_test_data
- Click green "Use this template" button top right
- Owner: GEOIPS
  - NOTE if you do not have permissions to create a repo, contact geoips@nrlmry.navy.mil, or create it under your own organization / user.
- Repository name: geoips_@mydatatype@
- Description: @Include useful description@
- Private: Select "Private"
- Include all branches: SELECT
- Click green "Create repository from template" button at bottom
- Repository name: geoips_@mydatatype@
- Description: @Include useful description@
- Private: Select "Private"
- Include all branches: SELECT
- Click green "Create repository from template" button at bottom

```
cd $GEOIPS_TESTDATA_DIR     # By standard convention, place within
                            # $GEOIPS_TESTDATA_DIR/test_data_@mydatatype@␣
↪on the filesystem.
git clone https://github.com/NRLMMD-GEOIPS/test_data_@mydatatype@
```

Follow instructions in template README

### Create GeoIPS plugin repository for readers / products

Use the "template_basic_plugin" template on github

- https://github.com/NRLMMD-GEOIPS/template_basic_plugin
- Click green "Use this template" button top right
- Owner: GEOIPS
  - NOTE if you do not have permissions to create a repo, contact geoips@nrlmry.navy.mil, or create it under your own organization / user.
- Repository name: geoips_@mydatatype@
- Description: @Include useful description@
- Private: Select "Private"
- Include all branches: SELECT
- Click green "Create repository from template" button at bottom

```
  cd $GEOIPS_PACKAGES_DIR
  git clone https://github.com/NRLMMD-GEOIPS/geoips_@mydatatype@
##########################################################################
↪##
```

Follow instructions in template README

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## 5.4 Building documentation

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## 5.5 GeoIPS git workflow

Follow these steps when making modifications to geoips-based packages or plugins

### 5.5.1 GeoIPS GitHub Issue Creation Workflow

#### FROM WEB: Create an Issue for something that needs to be done

- Select an appropriate Issue template
  - Navigate to: https://github.com/NRLMMD-GEOIPS/geoips/issues
    - NOTE: you can create Issues on repos besides "geoips" if desired.
  - Click green "New Issue" button in top right
  - Click green "Get started" box to the right of the desired template
- Populate Issue contents appropriately

  - **Title**: Short descriptive name for the Issue (example: "Update GEOIPS_REPO_URL to GitHub")
  - **Write**: Follow template within "Write" tab to populate with appropriate content
  - **Assignees**: Add Assignees as appropriate
  - **Labels**: Add descriptive labels as appropriate
  - **Projects**: Link to "GeoIPS - All Repos and all Functionality", other Projects as appropriate
- Click "Submit new issue"

### FROM WEB: MEMBERS: Create Branch from Existing Issue

**NOTE: Those who are NOT members of the GeoIPS organization will fork, not branch. Skip to NON MEMBERS section**

- Navigate to Issue you would like to resolve
- Click on Development->Create Branch
  - **Branch name** Use auto-populated default branch name
  - **Repository Destination** Select repository to which you would like to make changes
    - NOTE you can create branches on repositories outside the repository the Issue resides in
  - **Change branch source** optional (defaults to "main")
  - Select **"Checkout locally"**
  - Click **"Create branch"**
  - Copy and paste the resulting "git fetch" and "git checkout" commands

### FROM WEB: NON-MEMBERS: Create fork of repo

- **NOTE: NRLMMD-GEOIPS members will branch following steps above, **skip this section if you are a member**
- Navigate to desired repository
- Click drop down next to "Fork"
- Click "+ Create a new fork"
- Select appropriate owner/organization to own the fork (could be your individual github username)
- Uncheck "copy main branch only"

- Click "create fork"

## 5.5.2 GeoIPS command line workflow

### FROM COMMAND LINE: Switch to new branch, Make changes as usual

- Navigate to repository of your choice
  - Issue only needs to be created on a single repository
  - You can create branches and make changes on any number of repos, as appropriate.
  - Related changes on different repositories will all be linked to the same Issue.
- Switch to new branch, and make changes as appropriate
  - *Ensure you copy and paste git fetch and git checkout commands when creating branch above*
  - Switch to new branch: Paste git fetch / git checkout commands specified when creating branch from Issue
    - git fetch origin
    - git checkout <new_branch_name>
  - <Make changes to code>
  - git commit # Frequently commit your changes
- Use enforced commit message format for all commits
  - Please follow Commit Message Template
  - Summary line <= 120 characters
  - Blank line (if commit message is more than one line)
  - OPTIONAL: additional details
  - Issue ID
- Update CHANGELOG.md in each repository with changes related to this Issue
  - Before pushing your final changes to GitHub and creating a pull request, you MUST update CHANGELOG.md appropriately
  - Please follow CHANGELOG Template
  - You will Copy and paste CHANGELOG modifications directly into the "Summary" section of pull request.
  - If CHANGELOG.md is not updated appropriately, pull request will be rejected.

- **Create test scripts and associated outputs for any new functionality**
    - **Ensure any new functionality is tested in:**
        - <repo>/tests/scripts/<test_name>.sh
    - **Ensure new test scripts are included in:**
        - <repo>/tests/test_all.sh

#### Push changes to github

- **From command line**: When you have made all of the changes required for the current Issue, push changes to GitHub
    - Perform once for each repository with changes related to this Issue
    - git push

### 5.5.3 GeoIPS GitHub Pull Request workflow

#### FROM WEB: Create pull request from new ticket branch to "dev" branch

Follow these instructions for each repo that requires changes for a given Issue.

- IF NEEDED: Navigate to Issue URL via web browser, and finalize with any last minute notes or resolutions
    - IF APPROPRIATE: Summary of overall changes
    - IF APPROPRIATE: Complete testing instructions (if multiple repostiories involved)
    - IF APPROPRIATE: Complete test output (if multiple repositories involved)
- Create a Pull Request on each repo with changes associated with the current Issue ID
    - Click on "Pull requests" tab within current repo
    - Click green "New pull request" button
    - **Source**: <new_branch_name>
    - **Destination**: main
    - Click green "Create pull request" button
- Fill Auto-populated template with appropriate content:
    - Generated from Global Pull Request Template
    - **Important to follow template title and contents directions for ease of review**
    - **Pull request will be denied if template is not followed appropriately**

- Ensure appropriate tags and attributes are set on the pull request
  - **Reviewers**: *Identify at least two Reviewers*
  - **Labels**: As appropriate
  - **Projects**: **VERY IMPORTANT**: *Select "GeoIPS - * *All Repos and All Functionality*, additional Projects if desired.
- Click "Create"
  - Now wait for the automated emails from GitHub saying your changes have been approved and merged.

### 5.5.4 GeoIPS Merge PR and Close Issue workflow

#### FROM WEB: Merge pull requests

This could include related pull requests from multiple repositories.

- Navigate to GeoIPS Project
- Find current Issue card - Issue will have all associated PRs linked
- CTRL-Click on each linked pull request
  - Click green "Merge branch" from each PR
  - Click "Delete head branch" from each PR
- This should automatically update the Project so all related PRs and Issues are moved to the "Done" columnn

#### FROM WEB: Ensure all Issues and Pull Requests were successfully closed

- Could require approvals / merges from multiple pull requests in multiple repos before closing Issue
- Navigate to GeoIPS Project
- Ensure all related Issue and Pull Request cards were automatically moved to the "Done" column

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## 5.6 Documentation and Style Strategy

GeoIPS uses Sphinx with the Napoleon extension for automated documentation generation.

https://www.sphinx-doc.org/en/master/usage/extensions/napoleon.html

The **geoips/docs** directory contains high level restructured text (rst) format documentation (including this page), along with a **build_docs.sh** script that will setup sphinx and build complete documentation from the high level rst files as well as docstrings contained within the GeoIPS source code.

### 5.6.1 GeoIPS Syntax and Style Checking

GeoIPS uses the NumPy docstring format within the code base for simplicity:

https://numpydoc.readthedocs.io/en/latest/format.html

bandit, flake8, and black are used to enforce appropriate style, security, and syntax usage. flake8-rst and flake8-rst-docstring plugins are used to enforce numpy docstring formatting. Sphinx is used to validate the formatting and syntax within RST files themselves.

All branches must pass the `geoips/tests/utils/check_code.sh` script prior to any Pull Requests being approved and merged. Please ensure this script has a successful 0 return as you develop code within the GeoIPS Ecosystem to expedite the review and approval process.

VSCode plugins are also available to provide automated syntax checking and highlighting:

https://github.com/NRLMMD-GEOIPS/.vscode

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## 5.7 Xarray and NetCDF Metadata Standards

All GeoIPS readers read data into xarray Datasets - a separate dataset for each shape/resolution of data - and contain standard metadata information for standardized processing.

Readers should return a dictionary of the resulting xarray Datasets, with human readable keys for the different datasets (no standard for dictionary key names).

### 5.7.1 Xarray Standard Variables

Internal to GeoIPS, our xarray standards include the following variables for automated temporal and spatial sectoring.

- 'latitude' - REQUIRED 2d array the same shape as data variables
- 'longitude' - REQUIRED 2d array the same shape as data variables
- 'time' - OPTIONAL 2d array the same shape as data variables

*NOTE: Additional methods of storing spatial and temporal information will be implemented in the future for efficiency, but currently latitude and longitude arrays are strictly required, and time array is required for automated temporal sectoring*

### 5.7.2 Xarray Standard Attributes

The following standard attributes are used internally to GeoIPS for consistent generation of titles, legends, regridding, etc

- 'source_name' - REQUIRED
- 'platform_name' - REQUIRED
- 'data_provider' - REQUIRED
- 'start_datetime' - REQUIRED
- 'end_datetime' - REQUIRED
- 'interpolation_radius_of_influence' - REQUIRED used for pyresample-based interpolation

The following optional attributes can be used within processing if available.

- 'source_file_names' - OPTIONAL
  - list of strings containing names of all files that went into the current dataset. To ensure consistent output between users, these file names can either be
    - base paths, including only the filename and excluding the path altogether, or
    - full paths with GeoIPS environment variables replacing specific paths (ie, $GEOIPS_OUTDIRS, $GEOIPS_TESTDATA_DIR, etc)
- 'source_file_attributes' - OPTIONAL
  - attribute associated with the list of source files.
  - dictionary with name of each source file as keys, and attributes specific to that source file as values.
- 'source_file_datetimes' - OPTIONAL
  - list of datetime objects corresponding to the datetime listed in each of the 'source_file_names'. List must be same length as 'source_file_names'
- 'area_definition' - OPTIONAL
  - specify area_definition current dataset is registered to, if applicable
- 'registered_dataset' - OPTIONAL
  - True if current dataset is registered to a specific area_definition, False otherwise
- 'minimum_coverage' - OPTIONAL
  - if specified, products will not be generated with coverage < minimum_coverage
- 'sample_distance_km' - OPTIONAL
  - if specified, sample_distance_km can be used to produce a "minimum" sized image. Web images are often up sampled to provide a conveniently sized image for viewing with titles/legends, this allows producing minimal sized "clean" imagery for overlaying in external viewers (such as the Automated Tropical Cyclone Forecasting System)

### 5.7.3 NetCDF CF Standards

All additional attributes should follow the **NetCDF Climate and Forecast (CF) Conventions**.

Attributes and metadata on output NetCDF files should follow the **CF Metadata Conventions**

- http://cfconventions.org/Data/cf-conventions/cf-conventions-1.8/cf-conventions.html

Names of attributes describing individual products and variables in output NetCDF files should use **CF Standard Names** when available

- http://cfconventions.org/Data/cf-standard-names/76/build/cf-standard-name-table.html

# # # Distribution Statement A. Approved for public release. Distribution unlimited.
# # #
# # # Author:
# # # Naval Research Laboratory, Marine Meteorology Division
# # #
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# # # https://github.com/U-S-NRL-Marine-Meteorology-Division/

CHAPTER

SIX

# API REFERENCE

## 6.1 geoips package

### 6.1.1 Subpackages

#### geoips.commandline package

#### Submodules

#### geoips.commandline.args module

Command line script for kicking off geoips based procflows.

`geoips.commandline.args.`**`add_args`**(*parser*, *arglist=None*)

List of available standard arguments for calling data processing command line.

**Parameters**

- **`parser`** (*`ArgumentParser`*) – argparse ArgumentParser to add appropriate arguments
- **`arglist`** (*`list, optional`*) – list of requested arguments to add to the ArgumentParser, default None. if None, include all arguments

**Return type**

No return values (parser modified in place)

`geoips.commandline.args.`**`check_command_line_args`**(*arglist*, *argdict*)

Check formatting of command line arguments.

**Parameters**

- **`arglist`** (*`list of str`*) – List of desired command line arguments to check within argdict for appropriate formatting
- **`argdict`** (*`dict`*) – Dictionary of command line arguments

**Returns**
Return True if all arguments are of appropriate formatting.

**Return type**
bool

**Raises**
**TypeError** – Incorrect command line formatting

`geoips.commandline.args.`**`get_command_line_args`**(*arglist=None*, *description=None*, *add_args_func=None*, *check_args_func=None*)

Parse command line arguments specified by the requested list of arguments.

**Parameters**

- **arglist** (*list, optional*) – list of requested arguments to add to the ArgumentParser, default None. if None, include all arguments
- **description** (*str, optional*) – String description of arguments, default None
- **add_args_func** (*function, optional*) – Alternative "add_args" function, default None If None, use internal "add_args"
- **check_args_func** (*function, optional*) – Alternative "check_args" function, default None If None, use internal "check_args"

**Returns**
Dictionary of command line arguments

**Return type**
dict

### geoips.commandline.list_available_modules module

Simple script to list available modules for each interface.

This includes both dev and stable interfaces. Note this will be deprecated with v2.0, replaced with a new class-based interface implementation.

`geoips.commandline.list_available_modules.`**`main`**()

Script to list all modules available in the current geoips instantiation.

### geoips.commandline.log_setup module

Geoips module for setting up logging handlers with a specified verbosity.

`geoips.commandline.log_setup.`**`setup_logging`**(*verbose=True*)

Set up logging handler.

If you do this the first time with no argument, it sets up the logging for all submodules. Subsequently, in submodules, you can just do LOG = logging.getLogger(__name__)

### geoips.commandline.run_procflow module

Command line script for kicking off geoips based procflows.

MUST call with –procflow.

`geoips.commandline.run_procflow.`**`main`**(*get_command_line_args_func=None*)

Script to kick off processing based on command line args.

**Parameters**

**`get_command_line_args_func`** (*`function, optional`*) – Function to use in place of "get_command_line_args", default None If None, use geoips.commandline.args.get_command_line_args

### geoips.commandline.test_interfaces module

Simple test script to run "test_<interface>_interface" for each interface.

This includes both dev and stable interfaces. Note this will be deprecated with v2.0 - replaced with a new class-based interface implementation.

`geoips.commandline.test_interfaces.`**`main`**()

Script to test all dev and stable interfaces.

### geoips.commandline.update_tc_tracks_database module

Command line script for updating the TC database.

`geoips.commandline.update_tc_tracks_database.`**`main`**()

Update TC tracks database via command line.

### Module contents

geoips.commandline init file.

## geoips.data_manipulations package

### Submodules

### geoips.data_manipulations.conversions module

Routines for converting between units.

`geoips.data_manipulations.conversions.unit_conversion(data_array, input_units=None, output_units=None)`

Convert array in units 'input_units' to units 'output_units'.

**Parameters**

- **data_array** (*ndarray*) – numpy.ndarray or numpy.MaskedArray of data values to be converted
- **input_units** (*str, optional*) – Units of input data array, defaults to None
- **output_units** (*str, optional*) – Units of output data array, defaults to None

**Returns**

Return numpy.ma.MaskedArray, with units converted from 'input_units' to 'output_units'

**Return type**

MaskedArray

### geoips.data_manipulations.corrections module

Apply min/max values, normalize, and invert data arrays.

`geoips.data_manipulations.corrections.apply_data_range(data, min_val=None, max_val=None, min_outbounds='crop', max_outbounds='crop', norm=True, inverse=False)`

Apply minimum and maximum values to an array of data.

Normalize, invert, and handle out of bounds data as requested.

**Parameters**

- **data** (*numpy.ndarray or numpy.ma.MaskedArray*) – data values to which the data range will be applied.
- **min_val** (*float, default None*) –
  - The minimum bound to be applied to the input data as a scalar,
  - If None, use data.min().
- **max_val** (*float, default=None*) –
  - The maximum bound to be applied to the input data as a scalar.
  - If None, use data.max().
- **min_outbounds** (*str, default='crop'*) – Method to use when applying bounds as a string. Valid values are:
  - retain: keep all pixels as is
  - mask: mask all pixels that are out of range.
  - crop: set all out of range values to min_val
- **max_outbounds** (*str, default='crop'*) – Method to use when applying bounds as a string. Valid values are:
  - retain: keep all pixels as is
  - mask: mask all pixels that are out of range.
  - crop: set all out of range values to max_val
- **norm** (*bool, default=True*) – Boolean flag indicating whether to normalize (True) or not (False).
  - If True, returned data will be in the range from 0 to 1.
  - If False, returned data will be in the range min_val to max_val.
- **inverse** (*bool, default=False*) – Boolean flag indicating whether to invert data (True) or not (False).
  - If True, returned data will be inverted
  - If False, returned data will not be inverted

**Returns**

Return numpy.ndarray or numpy.ma.MaskedArray Input data array with values above 'max_val' or below 'min_val' retained, cropped, or masked.

**Return type**
numpy.ndarray

`geoips.data_manipulations.corrections.apply_gamma`(*data_array*, *gamma*)

Apply gamma correction to all values in the data array.

Gamma correction applied as: data_array ** (1.0 / float(gamma))

**Parameters**

- **data_array** (*numpy.ndarray or numpy.ma.MaskedArray*) – data array to which gamma will be applied
- **gamma** (*float*) – gamma correction value

**Returns**
Return numpy.ndarray or numpy.ma.MaskedArray if data_array was MaskedArray with gamma correction applied data_array ** (1.0 / float(gamma))

**Return type**
numpy.ndarray

`geoips.data_manipulations.corrections.apply_maximum_value`(*data*, *max_val*, *outbounds*)

Apply maximum value to an array of data.

**Parameters**

- **data** (*numpy.ndarray or numpy.ma.MaskedArray*) – data values to which the maximum value will be applied.
- **max_val** (*float*) – The maximum bound to be applied to the input data as a scalar.
- **outbounds** (*str*) –

  **Method to use when applying bounds as a string. Valid values are:**
  retain: keep all pixels as is mask: mask all pixels that are out of range. crop: set all out of range values to max_val.

**Returns**
Return numpy.ndarray or numpy.ma.MaskedArray Input data array with values above 'max_val' retained, cropped, or masked appropriately.

**Return type**
numpy.ndarray

`geoips.data_manipulations.corrections.apply_minimum_value`(*data*, *min_val*, *outbounds*)

Apply minimum values to an array of data.

**Parameters**

- **data** (*numpy.ndarray or numpy.ma.MaskedArray*) – data values to which the minimum value will be applied.
- **min_val** (*float*) – The minimum bound to be applied to the input data as a scalar.
- **outbounds** (*str*) –

  **Method to use when applying bounds as a string. Valid values are:**
  retain: keep all pixels as is mask: mask all pixels that are out of range. crop: set all out of range values to min_val.

**Returns**
Return numpy.ndarray or numpy.ma.MaskedArray Input data array with values below 'min_val' retained, cropped, or masked appropriately.

**Return type**
numpy.ndarray

`geoips.data_manipulations.corrections.`**`apply_offset`**(*data_array*, *offset*)

Apply offset to all values in data_array.

Offset applied as: data_array + offset

**Parameters**

- **data_array** (*numpy.ndarray or numpy.ma.MaskedArray*) – data values to which offset will be applied.
- **scale_factor** (*float*) – requested offset.

**Returns**
Return numpy.ndarray or numpy.ma.MaskedArray Input data array with offset applied data_array + offset

**Return type**
numpy.ndarray

`geoips.data_manipulations.corrections.`**`apply_scale_factor`**(*data_array*, *scale_factor*)

Apply scale factor to all values in data_array.

Scale factor applied as: data_array * scale_factor

**Parameters**

- **data_array** (*numpy.ndarray or numpy.ma.MaskedArray*) – data values to be scaled
- **scale_factor** (*float*) – requested scale factor

**Returns**
Return numpy.ndarray or numpy.ma.MaskedArray Input data array with scale factor applied data_array * scale_factor

**Return type**
numpy.ndarray

`geoips.data_manipulations.corrections.`**`apply_solar_zenith_correction`**(*data_array*, *sunzen_array*)

Apply solar zenith angle correction to all values in data_array.

Solar zenith correction applied as: data / cos(sunzen)

**Parameters**

- **`data_array`** (*`numpy.ndarray or numpy.ma.MaskedArray`*) – data values to be masked
- **`sunzen_array`** (*`numpy.ndarray or numpy.ma.MaskedArray`*) – solar zenith angles of the same shape as the data array.

**Returns**
Return numpy.ndarray or numpy.ma.MaskedArray if original data_array was MaskedArray with each value in the data_array divided by cos(sunzen).

**Return type**
numpy.ndarray

`geoips.data_manipulations.corrections.`**`invert_data_range`**(*data*, *min_val=None*, *max_val=None*)

Invert data range to an array of data.

**Parameters**

- **`data`** (*`numpy.ndarray or numpy.ma.MaskedArray`*) – data values to which the data range will be applied.
- **`min_val`** (*`float, optional`*) – The minimum bound to be applied to the input data as a scalar, by default None, which results in data.min().
- **`max_val`** (*`float, optional`*) – The maximum bound to be applied to the input data as a scalar. by default None, which results in data.max().

**Returns**
Return numpy.ndarray or numpy.ma.MaskedArray Input data array with values inverted.

**Return type**
numpy.ndarray

`geoips.data_manipulations.corrections.mask_day(data_array, sunzen_array, max_zenith=90)`

Mask where solar zenith angle less than the maxinum specified value.

Mask all pixels within the data array where the solar zenith angle is less than the maxinum specified value.

**Parameters**

- **data_array** (*numpy.ndarray or numpy.ma.MaskedArray*) – data values to be masked
- **sunzen_array** (*numpy.ndarray*) – numpy.ndarray or numpy.ma.MaskedArray of solar zenith angles, of the same shape as the data array
- **max_zenith** (*float, optional*) – Mask all locations in data_array where sunzen_array is less than max_zenith, by default 90

**Returns**

Data array with all locations corresponding to a solar zenith angle less than max_zenith masked.

**Return type**

numpy.ma.MaskedArray

`geoips.data_manipulations.corrections.mask_night(data_array, sunzen_array, min_zenith=90)`

Mask where solar zenith angle greater than the minimum specified value.

Mask all pixels within the data array where the solar zenith angle is greater than the mininum specified value.

**Parameters**

- **data_array** (*numpy.ndarray or numpy.ma.MaskedArray*) – data values to be masked.
- **sunzen_array** (*numpy.ndarray or numpy.ma.MaskedArray*) – array of solar zenith angles, same shape as the data array.
- **min_zenith** (*float, optional*) – Mask all locations in data_array where sunzen_array is greater than min_zenith, by default 90.

**Returns**

Data array with all locations corresponding to a solar zenith angle greater than min_zenith masked.

**Return type**

numpy.ma.MaskedArray

`geoips.data_manipulations.corrections.`**`normalize`**(*data*, *min_val=None*, *max_val=None*, *min_bounds='crop'*, *max_bounds='crop'*)

Normalize data array with min_val and max_val to range 0 to 1.

Default to cropping outside requested data range.

**Parameters**

- **data** (*numpy.ndarray or numpy.ma.MaskedArray*) – data values to which the data range will be applied.
- **min_val** (*float, default=None*) –
  - The minimum bound to be applied to the input data as a scalar,
  - If None, use data.min().
- **max_val** (*float, default=None*) –
  - The maximum bound to be applied to the input data as a scalar.
  - If None, use data.max().
- **min_outbounds** (*str, default='crop'*) – Method to use when applying bounds as a string. Valid values are:
  - retain: keep all pixels as is
  - mask: mask all pixels that are out of range.
  - crop: set all out of range values to min_val
- **max_outbounds** (*str, default='crop'*) – Method to use when applying bounds as a string. Valid values are:
  - retain: keep all pixels as is
  - mask: mask all pixels that are out of range.
  - crop: set all out of range values to max_val

**Returns**

Return numpy.ndarray or numpy.ma.MaskedArray Input data array normalized between 0 and 1, with values above 'max_val' or below 'min_val' retained, cropped, or masked.

**Return type**

numpy.ndarray

### geoips.data_manipulations.info module

Introspection functions on data arrays.

geoips.data_manipulations.info.**percent_not_nan**(*data_array*)

Determine percent of a numpy.ndarray that is not NaN values.

**Parameters**
**data_array** (*numpy.ndarray*) – Final processed array from which to determine coverage, invalid values specified by "numpy.nan".

**Returns**
percent of input data array that is not numpy.nan.

**Return type**
float

geoips.data_manipulations.info.**percent_unmasked**(*data_array*)

Determine percent of a numpy.ma.Masked array that is not masked.

**Parameters**
**data_array** (*numpy.ma.MaskedArray*) – Final processed array from which to determine coverage

**Returns**
percent of input data array that is not masked.

**Return type**
float

### geoips.data_manipulations.merge module

Utilities for merging granules into a single data array.

These utilities can apply to potentially different data sources - spanning a variety of sensors and platforms into a single final dataset.

geoips.data_manipulations.merge.**daterange**(*start_date*, *end_date*)

Check one day at a time.

If end_date - start_date is between 1 and 2, days will be 1, and range(1) is 0. So add 2 to days to set range.

`geoips.data_manipulations.merge.find_datafiles_in_range(sector_name, platform_name, source_name, min_time, max_time, basedir, product_name, every_min=True, verbose=False, time_format='%H%M', actual_datetime=None, single_match=False)`

Find datafiles from a specified set of parameters.

**Parameters**

- **sector_name** (*str*) – Sector of interest
- **platform_name** (*str*) – platform of interest
- **source_name** (*str*) – Source of interest
- **min_time** (*datetime.datetime*) – Minimum time to search
- **max_time** (*datetime.datetime*) – Maximum time to search
- **basedir** (*str*) – Base directory to search
- **product_name** (*str*) – Product of interest
- **every_min** (*bool, optional*) – Check every minute, by default True
- **verbose** (*bool, optional*) – Print a lot of log output during the search, by default False
- **time_format** (*str, optional*) – Format of time information in filenames, by default "%H%M"
- **actual_datetime** (*datetime.datetime, optional*) – Actual datetime of the requested data, required if single_match is True, by default None
- **single_match** (*bool, optional*) – Only return the closest matching file if True, else return all matching files, by default False

**Returns**

List of all filenames matching the given parameters (list of length 1 if single_match is True, all matching files if single_match is false)

**Return type**

list of str

`geoips.data_manipulations.merge.get_matching_files`(*primary_sector_name*, *subsector_names*, *platforms*, *sources*, *max_time_diffs*, *basedir*, *merge_datetime*, *product_name*, *time_format='%H%M'*, *buffer_mins=30*, *verbose=False*, *single_match=False*)

Given the current set of parameters, find all matching files.

Given the current primary sector, and associated subsectors, platforms, and sources, find all matching files.

**Parameters**

- **primary_sector_name** (*str*) – The final sector that all data will be stitched into. ie 'GlobalGlobal'
- **subsector_names** (*list of str*) – List of all subsectors that will be merged into the final sector. (potentially including the full primary_sector_name.) ie ['GlobalGlobal', 'GlobalAntarctic', 'GlobalArctic']
- **platforms** (*list of str*) – List of all desired platforms. platforms, sources, and max_time_diffs correspond to one another and should be the same length and in the same order.
- **sources** (*list of str*) – List of all desired sources. platforms, sources, and max_time_diffs correspond to one another and should be the same length and in the same order.
- **max_time_diffs** (*list of int*) – Minutes. List of allowed time diffs for given platform/source. Matches max_time_diff before the requested merge_datetime argument. platforms, sources, and max_time_diffs correspond to one another and should be the same length and in the same order.
- **basedir** (*str*) – Base directory in which to look for the matching files.
- **merge_datetime** (*datetime*) – Attempt matching max_time_diff prior to merge_datetime
- **product_name** (*str*) – product_name string found in matching files
- **time_format** (*str, optional*) – Requested time format for filenames (strptime format string), by default '%H%M'
- **verbose** (*bool, optional*) – Print a lot of log output during the search, by default False

- **single_match** (*bool, optional*) – Only return the closest matching file if True, else return all matching files, by default False

**Returns**
List of all filenames matching the given parameters (list of length 1 if single_match is True, all matching files if single_match is false)

**Return type**
list of str

`geoips.data_manipulations.merge.`**`hourrange`**`(`*start_date*, *end_date*`)`

Check one hour at a time.

`geoips.data_manipulations.merge.`**`minrange`**`(`*start_date*, *end_date*`)`

Check one minute at a time.

### Module contents

geoips.data_manipulations init file.

### geoips.dev package

### Submodules

### geoips.dev.output_config module

Interpolation interface will be deprecated v2.0.

Wrapper functions for geoips output_config specifications.

This functionality will be replaced with a class-based implementation v2.0, and deprecated at that time.

`geoips.dev.output_config.`**`get_filename_formatter_kwargs`**`(`*filename_formatter*, *output_dict*`)`

Interface will be deprecated v2.0.

Return dictionary of filename_formatters_kwargs.

based on what was passed in via the YAML output config dictionary, as well as default kwargs.

If "filename_formatter_kwargs (singular) is passed command line, use that to override ALL filename_formatters_kwargs specified in YAML output config.

`geoips.dev.output_config.`**`get_filename_formatters`**`(`*output_dict*`)`

Interface will be deprecated v2.0.

`geoips.dev.output_config.`**`get_metadata_filename_formatter`**`(`*filename_formatter*, *output_dict*`)`

Interface will be deprecated v2.0.

`geoips.dev.output_config.`**`get_metadata_filename_formatter_kwargs`**`(`*filename_formatter*, *output_dict*`)`

Interface will be deprecated v2.0.

Return dictionary of filename_formatters_kwargs.

based on what was passed in via the YAML output config dictionary, as well as default kwargs

`geoips.dev.output_config.`**`get_metadata_output_formatter`**`(`*output_dict*`)`

Interface will be deprecated v2.0.

`geoips.dev.output_config.`**`get_metadata_output_formatter_kwargs`**`(`*output_dict*`)`

Interface will be deprecated v2.0.

`geoips.dev.output_config.`**`get_minimum_coverage`**`(`*product_name*, *output_dict*`)`

Interface will be deprecated v2.0.

`geoips.dev.output_config.`**`get_output_config_type`**`(`*output_config_dict*`)`

Interface will be deprecated v2.0.

**Retrieve output_config_type of the passed output_config_dict, found in:**
output_config_dict['output_config_type']

See: geoips.dev.output_config.is_valid_output_config for full list of supported output_config types.

**Parameters**
**`output_config_dict`** (*`dict`*) – dictionary of complete output config parameters

**Returns**
**(str)**

**Return type**
output_config type, found in output_config_dict['output_config_type']

`geoips.dev.output_config.`**`get_output_formatter`**`(`*output_dict*`)`

Interface will be deprecated v2.0.

geoips.dev.output_config.**get_output_formatter_kwargs**(*output_dict*, *xarray_obj=None*, *area_def=None*, *sector_type=None*, *bg_files=None*, *bg_xarrays=None*, *bg_product_name=None*)

Interface will be deprecated v2.0.

geoips.dev.output_config.**is_valid_output_config**(*output_config_dict*)

Interface will be deprecated v2.0.

Check that requested output_config dictionary is properly formatted.

The dictionary of output_config parameters fully determines the outputs required for a given set of data files.

Dictionary of output_config parameters currently specified by a full path to a YAML file: and requested via commandline with: `--output_config <full_path_to_YAML_output_config>`

**Parameters**
**output_config_dict** (*dict*) – Dictionary of output config parameters

**Returns**

**is_valid** –

- True if `output_config_dict` is a properly formatted dictionary of output parameters.
- **False if output_config_dict:**
  - does not contain supported `output_config_type`,
  - does not contain all `required` fields,
  - contains non-supported `optional` fields

**Return type**
bool

### Notes

**output_config_types currently one of:**

- `single_source`
- `fused`

`geoips.dev.output_config.`**`produce_current_time`**(*config_dict*, *metadata_xobj*, *output_dict_keys=None*)

Interface will be deprecated v2.0.

**Determine if the current data file needs to be processed,**
based on the requested times.

**If output_dict_key is included, apply to only the currently**
requested output_dict.

**If output_dict_key is None, check ALL outputs to determine if**
ANY need the current time.

`geoips.dev.output_config.`**`set_lonlat_spacing`**(*gridline_annotator*, *area_def*)

Interface will be deprecated v2.0.

`geoips.dev.output_config.`**`test_output_config_interface`**(*output_config_dict*)

Interface will be deprecated v2.0.

Finds and opens every product params dict available within the current geoips instantiation

**See geoips.dev.output_config.is_valid_output_config?**
for a list of available product params dict types and associated call signatures / return values.

**Returns**
List of all successful output_config information

**Return type**
list

## geoips.dev.product module

Interpolation interface will be deprecated v2.0.

Wrapper functions for geoips product specifications.

This functionality will be replaced with a class-based implementation v2.0, and deprecated at that time.

`geoips.dev.product.`**`get_cmap_from_product`**(*prod_plugin*, *output_dict=None*)

Interface will be deprecated v2.0.

Retrieve colormapper information, based on requested product and source

**Parameters**

- **product_name** (*str*) – Name of requested product (ie, 'IR-BD', '89H', 'color89Nearest', etc)

- **source_name** (*str*) – Name of requested source (ie, 'ahi', 'modis', etc)

**Returns**
**cmap_func(**cmap_args)** – Return actual colormapper information

**Return type**
function

**See also:**

**geoips.dev.check_cmap_func**
additional information on colormapper types, arguments, and return values

`geoips.dev.product.`**`get_covg_args_from_product`**(*prod_plugin*, *output_dict=None*, *covg_field=None*)

Interface will be deprecated v2.0.

Retrieve coverage check function args, based on requested product and source

**Parameters**

- **product_name** (*str*) – Name of requested product (ie, 'IR-BD', '89H', 'color89Nearest', etc)
- **source_name** (*str*) – Name of requested source (ie, 'ahi', 'modis', etc)

**Returns**
**covg_func_name** – Return dictionary of coverage args required for given product/source

**Return type**
str

**See also:**

**geoips.dev.check_cmap_func**
additional information on colormapper types, arguments, and return values

`geoips.dev.product.`**`get_covg_from_product`**(*prod_plugin*, *output_dict=None*, *covg_field=None*)

Interface will be deprecated v2.0.

Retrieve coverage check function name, based on requested product and source

**Parameters**

- **product_name** (*str*) – Name of requested product (ie, 'IR-BD', '89H', 'color89Nearest', etc)
- **source_name** (*str*) – Name of requested source (ie, 'ahi', 'modis', etc)

**Returns**
**covg_func_name** – Return name of coverage function required for given product/source

**Return type**
str

**See also:**

`geoips.dev.check_cmap_func`
additional information on colormapper types, arguments, and return values

`geoips.dev.product.`**`get_data_range`**`(`*prod_plugin*, *output_dict=None*`)`

Interface will be deprecated v2.0.

Retrieve required data range for requested product

**Parameters**
**product_name** (*str*) – Name of requested product (ie, 'IR-BD', '89H', 'color89Nearest', etc)

**Returns**
**data_range** – List of float specifying min and max value for the output product `<geoips_package>.algorithms.<algorithm_name>.alg_params['output_data_range']`

**Return type**
list

`geoips.dev.product.`**`get_product_display_name`**`(`*prod_plugin*, *output_dict=None*`)`

Interface will be deprecated v2.0.

Retrieve product display name. For titles, etc.

**Parameters**

- **product_name** (*str*) – Name of requested product (ie, 'IR-BD', '89H', 'color89Nearest', etc)
- **source_name** (*str*) – Name of requested source (ie, 'ahi', 'modis', etc)

**Returns**
**product_display_name** – Return display name for given product

**Return type**
str

**See also:**

`geoips.dev.check_cmap_func`
additional information on colormapper types, arguments, and return values

geoips.dev.product.**get_requested_datasets_for_variables**(*prod_plugin*)

Interface will be deprecated v2.0.

Retrieve required datasets if specified for product variables, based on requested product and source

Within product_inputs YAML specifications, variables can be requested with `<DATASET>:<VARNAME>` if you need a particular variable from a specific dataset.

If `<DATASET>:` is not specified, the first variable found when looping through the datasets is used.

**Parameters**

- **product_name** (*str*) – Name of requested product (ie, 'IR-BD', '89H', 'color89Nearest', etc)
- **source_name** (*str*) – Name of requested source (ie, 'ahi', 'modis', etc)

**Returns**

**datasets_for_variable** –

- Dictionary of
  - `{'<variable_name>': '<requested_dataset>'}` OR
  - `{'variable_type': {'<variable_name>': '<requested_dataset>'}`

**Return type**

dict

geoips.dev.product.**get_required_variables**(*prod_plugin*)

Interface will be deprecated v2.0.

Return required variables names for the input product plugin. If variables are combined with their dataset name, the dataset name will be stripped and only the variable names will be returned.

**Parameters**

**prod_plugin** (*ProductPlugin*) – An instance of the GeoIPS ProductPlugin class.

**Returns**

**required_variables** –

- If list: List of strings specifying required variables.
- If dict: Dictionary of variable types of lists of variable names
  - {'<variable_type>': ['var1', 'var2', … , 'varn']}

**Return type**
list or dict

### Module contents

dev init file.

### geoips.filenames package

### Submodules

### geoips.filenames.base_paths module

Collection of base path names used throughout GeoIPS.

Everything defaults to subdirectories relative to the REQUIRED environment variable GEOIPS_OUTDIRS.

Individual GEOIPS_OUTDIRS relative paths can be overridden by setting appropriate environment variables.

`geoips.filenames.base_paths.`**`make_dirs`**`(`*`path`*`)`

Make directories, catching exceptions if directory already exists.

**Parameters**
**path** (*str*) – Path to directory to create

**Returns**
Path if successfully created

**Return type**
str

### geoips.filenames.duplicate_files module

Module to handle removing duplicate files, based on filename formats.

If an individual filename format has a method named "<filename_formatter>_remove_duplicates" defined, use that method to remove duplicates for the given current filename.

`geoips.filenames.duplicate_files.`**`remove_duplicates`**`(`*`fnames`*`, `*`remove_files=False`*`)`

Remove duplicate files from all filenames included in dict fnames.

**Parameters**

- **fnames** (*dict*) – Dictionary with individual filenames as keys, and a field named "filename_formatter" which indicates the filename format used to generate the given filename.
- **remove_files** (*bool, optional*) – Specify whether to remove files (True), or just list what would have been removed, default to False

**Returns**

- **removed_files** (*list*) – List of files that were removed.
- **saved_files** (*list*) – List of files that were not removed.

#### Module contents

geoips.filenames init file.

### geoips.image_utils package

#### Submodules

#### geoips.image_utils.colormap_utils module

Module for generating specific colormaps on the fly.

geoips.image_utils.colormap_utils.**create_linear_segmented_colormap**(*cmapname*, *min_val*, *max_val*, *transition_vals*, *transition_colors*)

Create a LinearSegmentedColormap instance.

**Parameters**

- **cmapname** (*str*) – Name to attach to the matplotlib.color ColorMap object
- **min_val** (*float*) – Overall minimum value for the colormap Range must be normalized between 0 and 1
- **max_val** (*float*) – Overall maximum value for the colormap Range must be normalized between 0 and 1

- **transition_vals** (*array-like*) – A list of value ranges specified as tuples for generating a specific range of colors ie [(0, 10), (10, 30), (30, 60)]
- **transition_colors** (*array-like*) – A list of color ranges specified as tuples for generating a specific range of colors corresponding to the transition_vals (see Notes below)

**Returns**
**cm** – matplotlib colormap object

**Return type**
LinearSegmentedColormap

## Notes

Transition colors specified as:

```
[('yellow', 'orange'),
 ('pink', 'red'),
 ('violet', 'purple')]
```

Where:

```
TRANSITIONPOINT1 = 0.0
TRANSITIONPOINT4 = 1.0
cmdict = { 'red' :  ((TRANSITIONPOINT1, IGNORED, 1to2STARTCOLOR),
                  (TRANSITIONPOINT2, 1to2ENDCOLOR, 2to3STARTCOLOR),
                  (TRANSITIONPOINT3, 2to3ENDCOLOR, 3to4STARTCOLOR),
                  (TRANSITIONPOINT4, 3to4ENDCOLOR, IGNORED)),
       'green' :  ((TRANSITIONPOINT1, IGNORED, 1to2STARTCOLOR),
                  (TRANSITIONPOINT2, 1to2ENDCOLOR, 2to3STARTCOLOR),
                  (TRANSITIONPOINT3, 2to3ENDCOLOR, 3to4STARTCOLOR),
                  (TRANSITIONPOINT4, 3to4ENDCOLOR, IGNORED)),

       'blue' :  ((TRANSITIONPOINT1, IGNORED, 1to2STARTCOLOR),
                  (TRANSITIONPOINT2, 1to2ENDCOLOR, 2to3STARTCOLOR),
                  (TRANSITIONPOINT3, 2to3ENDCOLOR, 3to4STARTCOLOR),
                  (TRANSITIONPOINT4, 3to4ENDCOLOR, IGNORED)),
    }
```

`geoips.image_utils.colormap_utils.`**`from_ascii`**(*fname*, *cmap_name=None*, *reverse=False*)

Create a ListedColormap instance from an ASCII file of RGB values.

**Parameters**

- **fname** (*str*) – Full path to ascii RGB colortable file
- **cmap_name** (*str, default=None (basename(fname))*) – Identifying name of colormap - if None, default to basename(fname)
- **reverse** (*bool, default=False*) – If True, reverse the colormap

**Returns**
**cmap** – If cmap_name not specified, the colormap name will be the os.path.basename of the file.

**Return type**
ListedColormap object

### Notes

- Lines preceded by '#' are ignored.
- 0-255 or 0-1.0 RGB values (0-255 values are normalized to 0-1.0 for matplotlib usage)
- One white space delimited RGB value per line

geoips.image_utils.colormap_utils.**set_matplotlib_colors_rgb**()

Create matplotlib Colors parameters dictionary.

For rgb imagery, we require no color information (it is entirely specified by the RGB(A) arrays).

**Returns**
**mpl_colors_info** – Specifies matplotlib Colors parameters for use in both plotting and colorbar generation. For RGBA arrays, all fields are "None".

**Return type**
dict

geoips.image_utils.colormap_utils.**set_matplotlib_colors_standard**(*data_range*, *cmap_name='Greys'*, *cbar_label=None*, *create_colorbar=True*)

Set the matplotlib colors information.

For use in colorbar and image production.

**Parameters**

- **data_range** (*list*) – the minimum and maximum value for the data range [min_val, max_val]
- **cmap_name** (*str, default='Greys'*) – Specify the standard matplotlib colormap

- **cbar_label** (*str, optional*) – If specified, use cbar_label string as colorbar label
- **create_colorbar** (*bool, default=True*) – Specify whether the image should contain a colorbar or not

**Returns**
**mpl_colors_info** – Specifies matplotlib Colors parameters for use in both plotting and colorbar generation. See geoips.image_utils.mpl_utils.create_colorbar for field descriptions.

**Return type**
dict

`geoips.image_utils.colormap_utils.`**`set_mpl_colors_info_dict`**(*cmap, norm, cbar_ticks, cbar_tick_labels=None, boundaries=None, cbar_label=None, cbar_spacing='proportional', create_colorbar=True, cbar_full_width=False*)

Create the mpl_colors_info dictionary directly from passed arguments.

**Parameters**

- **cmap** (*Colormap*) – This is a valid matplotlib cm Colormap object that can be used for both plotting and colorbar creation.
- **norm** (*Normalize*) – This is a valid matplotlib Normalize object that can be used for both plotting and colorbar creation.
- **cbar_ticks** (*list*) – List of values where tick marks should be placed on colorbar
- **cbar_tick_labels** (*list, optional*) – List of tick label values
- **boundaries** (*list, optional*) – List of boundaries to use in matplotlib plotting and colorbar creation
- **cbar_label** – The label for the colorbar
- **optional** – The label for the colorbar
- **cbar_spacing** (*str, default='proportional'*) – One of 'proportional' or 'uniform'
- **create_colorbar** (*bool, default=True*) – True if colorbar should be created with the set of color info, False otherwise

- **cbar_full_width** (*bool, default=False*) – True if colorbar should be full width of figure, center 50% if False

**Returns**
**mpl_colors_info** – Dictionary of mpl_colors_info for use in plotting and colorbar creation.

**Return type**
dict

### geoips.image_utils.maps module

matplotlib geographic map (basemap or cartopy) utilities.

`geoips.image_utils.maps.`**`check_feature_annotator`**(*feature_annotator*)

Check that the provided feature_annotator plugin has all required fields.

**Parameters**
**feature_annotator** (*YamlPlugin*) – A feature annotator plugin.

**Raises**
**ValueError** – if any field is missing

**See also:**

**geoips.image_utils.maps.get_feature_annotator**
For complete list of fields, and appropriate defaults

`geoips.image_utils.maps.`**`check_gridline_annotator`**(*gridline_annotator*)

Check gridlines_info dictionary for that all required fields.

**Parameters**
**gridline_annotator** (*YamlPlugin*) – A gridline annotator plugin instance.

**Raises**
**ValueError** – If required field is missing

`geoips.image_utils.maps.`**`compute_lat_auto_spacing`**(*area_def*)

Compute automatic spacing for latitude lines based on area definition.

`geoips.image_utils.maps.`**`compute_lon_auto_spacing`**(*area_def*)

Compute automatic spacing for longitude lines based on area definition.

`geoips.image_utils.maps.`**`draw_features`**(*mapobj*, *curr_ax*, *feature_annotator*, *zorder=None*)

Draw cartopy features.

Draw features on specified cartopy map instance, based on specs found in the feature_annotator plugin.

**Parameters**

- **mapobj** (*map object*) – CRS object for plotting map features
- **curr_ax** (*matplotlib.axes._axes.Axes*) – matplotlib Axes object for plotting map features
- **feature_annotator** (*dict*) – Dictionary of parameters for plotting map features
- **zorder** (*int, optional*) – The matplotlib zorder

**See also:**

*geoips.image_utils.maps.check_feature_annotator*
for required dictionary entries and defaults.

geoips.image_utils.maps.**draw_gridlines**(*mapobj*, *area_def*, *curr_ax*, *gridline_annotator*, *zorder=None*)

Draw gridlines on map object.

Draw gridlines on a cartopy map object, as specified by a gridline_annotator plugin instance

**Parameters**

- **mapobj** (*map object*) – CRS object for plotting gridlines
- **area_def** (*AreaDefinition*) – pyresample AreaDefinition object
- **curr_ax** (*matplotlib.axes._axes.Axes*) – matplotlib Axes object for plotting gridlines
- **gridline_annotator** (*YamlPlugin*) – A gridline_annotator plugin instance
- **zorder** (*int, optional*) – The matplotlib zorder value

**See also:**

**geoips.image_utils.maps.get_gridlines_info_dict**
For complete list of fields, and appropriate default

geoips.image_utils.maps.**ellps2axis**(*ellps_name*)

Get semi-major and semi-minor axis from ellipsis definition.

**Parameters**
**ellps_name** (*str*) – Standard name of ellipsis

**Returns**

- **avar** (*float*) – semi-major axis
- **bvar** (*float*) – semi-minor axis

`geoips.image_utils.maps.`**`is_crs`**`(`*mapobj*`)`

Determine if the map object we are using is a cartopy crs instance.

**Parameters**
`mapobj` (*map object*) – Basemap or cartopy._PROJ4Projection object

**Returns**
**crs** – True if it is a CRS object, False otherwise.

**Return type**
bool

`geoips.image_utils.maps.`**`meridians`**`(`*area_def*, *grid_size*`)`

Calculate the meridians (longitude) that are within the input sector.

**Parameters**

- **area_def** (*AreaDefinition*) – pyresample AreaDefinition
- **grid_size** (*float*) – grid spacing in degrees

**Returns**
**meridians_to_draw** – longitude locations for gridlines

**Return type**
list

`geoips.image_utils.maps.`**`parallels`**`(`*area_def*, *grid_size*`)`

Calculate the parallels (latitude) that fall within the input sector.

**Parameters**

- **area_def** (*AreaDefinition*) – pyresample AreaDefinition
- **grid_size** (*float*) – grid spacing in degrees

**Returns**
**lat_ticks** – latitude locations for gridlines

**Return type**
list

`geoips.image_utils.maps.`**`set_gridlines_info_dict`**`(`*gridlines_info*, *area_def*`)`

Set plotting gridlines.

Set the final values for gridlines plotting params, pulling from argument and defaults.

**Parameters**

- **gridlines_info** (*dict*) – Dictionary of parameters for plotting gridlines. The following fields are available. If a field is not included in the dictionary, the field is added to the return dictionary and the default is used.
- **area_def** (*AreaDefinition*) – pyresample AreaDefinition

**Returns**
**use_gridlines_info** – gridlines_info dictionary, with fields as specified above.

**Return type**
dict

## Notes

Defaults specified as:

```
gridlines_info['grid_lat_spacing']      default auto calculated 5␣
↪lat grid lines
gridlines_info['grid_lon_spacing']      default auto calculated 5␣
↪lon grid lines
gridlines_info['grid_lat_xoffset']      default None (0.01 * image␣
↪height)
gridlines_info['grid_lon_xoffset']      default None (0.01 * image␣
↪width)
gridlines_info['grid_lat_yoffset']      default None (0.01 * image␣
↪height)
gridlines_info['grid_lon_yoffset']      default None (0.01 * image␣
↪width)
gridlines_info['grid_lat_fontsize']     default None (plot fontsize)
gridlines_info['grid_lon_fontsize']     default None (plot fontsize)
gridlines_info['left_label']            default True
gridlines_info['right_label']           default False
gridlines_info['top_label']             default True
gridlines_info['bottom_label']          default False
gridlines_info['grid_lat_linewidth']    default 1
gridlines_info['grid_lon_linewidth']    default 1
gridlines_info['grid_lat_color']        default 'black'
gridlines_info['grid_lon_color']        default 'black'
gridlines_info['grid_lat_dashes']       default [4, 2]
gridlines_info['grid_lon_dashes']       default [4, 2]
```

### geoips.image_utils.mpl_utils module

matplotlib utilities.

`geoips.image_utils.mpl_utils.`**`alpha_from_masked_arrays`**(*arrays*)

Convert from arrays to alpha.

Return an alpha transparency array based on the masks from a list of masked arrays. 0=transparent, 1=opaque

**Parameters**

**arrays** (*numpy.ndarray*) – list of numpy masked arrays, must all be the same shape

**Returns**

**alp** – the alpha transparency layer in matplotlib, values between 0 and 1, where 0 is fully transparent and 1 is fully opaque

**Return type**

numpy.ndarray

`geoips.image_utils.mpl_utils.`**`create_colorbar`**(*fig*, *mpl_colors_info*)

Routine to create a single colorbar.

**Parameters**

- **fig** (*matplotlib.figure.Figure*) – Figure object to attach the colorbar - the colorbar will create its own ax
- **mpl_colors_info** (*dict*) – Dictionary of matplotlib Color information, required fields in Notes below.

**Returns**

**cbar** – This will have all the pertinent information for ensuring plot and colorbar use the same parameters

**Return type**

matplotlib.colorbar.Colorbar

#### Notes

Required mpl_colors_info fields:

```
mpl_colors_info['cmap'] (Colormap):
    matplotlib.colors.Colormap object (LinearSegmentedColormap, etc)
    this is used to plot the image and to generated the colorbar
mpl_colors_info['norm'] (Normalize):
    matplotlib.colors.Normalize object (BoundaryNorm, Normalize, etc)
```

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```
    again, this should be used to plot the data also
mpl_colors_info['cbar_ticks'] (list):
    list of floats - values requiring tick marks on the colorbar
mpl_colors_info['cbar_tick_labels'] (list)
    list of values to use to label tick marks, if other than
    found in cbar_ticks
mpl_colors_info['boundaries'] (list):
    if cmap_norm is BoundaryNorm, list of boundaries for discrete␣
↪colors
mpl_colors_info['cbar_spacing'] (string):
    DEFAULT 'proportional', 'uniform' or 'proportional'
mpl_colors_info['cbar_label'] (string):
    string label for colorbar
mpl_colors_info['colorbar']: (bool)
    True if a colorbar should be included in the image, False if no␣
↪cbar
```

Colorbar set as:

```
cbar_ax = fig.add_axes([<cbar_start_pos>, <cbar_bottom_pos>,
                        <cbar_width>, <cbar_height>])
cbar = fig.colorbar(mappable=matplotlib.cm.ScalarMappable(norm=cmap_
↪norm,
                                                          cmap=mpl_
↪cmap),
                    cax=cbar_ax,
                    norm=cmap_norm,
                    boundaries=cmap_boundaries,
                    spacing=cbar_spacing,
                    **cbar_kwargs)
cbar.set_ticks(cbar_ticks, labels=cbar_tick_labels, **set_ticks_
↪kwargs)
if cbar_label:
    cbar.set_label(cbar_label, **set_label_kwargs)
```

geoips.image_utils.mpl_utils.**create_figure_and_main_ax_and_mapobj**(*x_size*, *y_size*, *area_def*, *font_size=None*, *existing_mapobj=None*, *noborder=False*)

Create a figure of x pixels horizontally and y pixels vertically.

Use information from matplotlib.rcParams.

**Parameters**

- **x_size** (*int*) – number pixels horizontally xsize = (float(x_size)/dpi)/(right_margin - left_margin)
- **y_size** (*int*) – number pixels vertically ysize = (float(y_size)/dpi)/(top_margin - bottom_margin)
- **font_size** (*int*) – matplotlib font size
- **area_def** (*AreaDefinition*) – pyresample AreaDefinition object - used for initializing map object (basemap or cartopy)
- **existing_mapobj** (*CRS or basemap, optional*) – If specified, do not regenerate mapobj. If None, create CRS or basemap object from specified area_def.
- **noborder** (*bool, default=False*) – If true, use [0, 0, 1, 1] for axes (allowing for image exact shape of sector).

**Returns**

- **fig** (*matplotlib.figure.Figure*) – matplotlib Figure object to subsequently use for plotting imagery / colorbars / etc
- **main_ax** (*matplotlib.axes._axes.Axes*) – matplotlib Axes object corresponding to the single main plotting area.
- **mapobj** (*mapobject*) – cartopy crs or Basemap object for plotting

geoips.image_utils.mpl_utils.**get_title_string_from_objects**(*area_def*, *xarray_obj*, *product_name_title*, *product_datatype_title=None*, *bg_xarray=None*, *bg_product_name_title=None*, *bg_datatype_title=None*, *title_copyright=None*, *title_formatter=None*)

Get the title from object information.

**Parameters**

- **area_def** (*AreaDefinition*) – pyresample AreaDefinition object specifying the area covered by the current plot

- **xarray_obj** (*xarray.Dataset*) – data used to produce product
- **product_name_title** (*str*) – name to display for the title
- **product_datatype_title** (*str, optional*) – the data type
- **bg_xarray** (*xarray, optional*) – data used for background
- **bg_product_name_title** (*str, optional*) – background product title
- **bg_datatype_title** (*str, optional*) – background data type
- **title_copyright** (*str, optional*) – string for copyright
- **title_formatter** (*str, optional*) – format for title

**Returns**
**title_string** – the title to use for matplotlib

**Return type**
str

`geoips.image_utils.mpl_utils.`**`percent_unmasked_rgba`**`(`*rgba*`)`

Convert to percent.

Return percentage of array that is NOT fully transparent / masked (ie, non-zero values in the 4th dimension)

**Parameters**
**rgba** (*numpy.ndarray*) – 4 dimensional array where the 4th dimension is the alpha transparency array: 1 is fully opaque, 0 is fully transparent

**Returns**
**coverage** – Coverage in percentage, between 0 and 100.

**Return type**
float

`geoips.image_utils.mpl_utils.`**`plot_image`**`(`*main_ax*, *data*, *mapobj*, *mpl_colors_info*, *zorder=None*`)`

Plot the "data" array and map in the matplotlib "main_ax".

**Parameters**

- **main_ax** (*Axes*) – matplotlib Axes object for plotting data and overlays
- **data** (*numpy.ndarray)*) – Numpy array of data to plot
- **mapobj** (*Map Object*) – Basemap or Cartopy CRS instance
- **mpl_colors_info** (*dict*) – Specifies matplotlib Colors parameters for use in both plotting and colorbar

**See also:**

*geoips.image_utils.mpl_utils.create_colorbar*
for field descriptions for mpl_colors_info

`geoips.image_utils.mpl_utils.`**`plot_overlays`**`(`*mapobj*, *curr_ax*, *area_def*, *feature_annotator=None*, *gridline_annotator=None*, *features_zorder=None*, *gridlines_zorder=None*`)`

Plot specified coastlines and gridlines on the matplotlib axes.

**Parameters**

- **mapobj** (*map object*) – Basemap or CRS object for boundary and gridline plotting.
- **ax** (*matplotlib.axes._axes.Axes*) – matplotlib Axes object for boundary and gridline plotting.
- **area_def** (*AreaDefinition*) – pyresample AreaDefinition object specifying the area covered by the current plot
- **feature_annotator** (*YamlPlugin*) – A feature annotator plugin instance.
- **gridline_annotator** (*YamlPlugin*) – A gridlines annotator plugin instance.

`geoips.image_utils.mpl_utils.`**`remove_duplicates`**`(`*fname*, *min_range*`)`

Not implemented.

`geoips.image_utils.mpl_utils.`**`rgba_from_arrays`**`(`*red*, *grn*, *blu*, *alp=None*`)`

Return rgba from red, green, blue, and alpha arrays.

**Parameters**

- **red** (*numpy.ndarray*) – red gun values
- **grn** (*numpy.ndarray*) – green gun values
- **blu** (*numpy.ndarray*) – blue gun values
- **alp** (*numpy.ndarray, optional*) – alpha values 1 is fully opaque, 0 is fully transparent If none, calculate alpha from red, grn, blu guns

**Returns**
**rgba** – 4 layer dimensional numpy.ndarray

**Return type**
numpy.ndarray

geoips.image_utils.mpl_utils.**save_image**(*fig*, *out_fname*, *is_final=True*, *image_datetime=None*, *remove_duplicate_minrange=None*, *savefig_kwargs=None*)

Save the image specified by the matplotlib figure "fig" to the filename out_fname.

**Parameters**

- **fig** (*matplotlib.figure.Figure*) – Figure object that needs to be written to a file.
- **out_fname** (*str*) – full path to the output filename
- **is_final** (*bool, default=True*) – Final imagery must set_axis_on for all axes. Non-final imagery must be transparent with set_axis_off for all axes, and no pad inches.

## Notes

No return values (image is written to disk and IMAGESUCCESS is written to log file)

geoips.image_utils.mpl_utils.**set_fonts**(*figure_y_size*, *font_size=None*)

Set the fonts in the matplotlib.rcParams dictionary, using matplotlib.rc.

**Parameters**

**figure_y_size** (*int*) – Font size set relative to number of pixels in the y direction

geoips.image_utils.mpl_utils.**set_title**(*ax*, *title_string*, *figure_y_size*, *xpos=None*, *ypos=None*, *fontsize=None*)

Set the title on figure axis "ax" to string "title_string".

**Parameters**

- **ax** (*Axes*) – matplotlib.axes._axes.Axes object to add the title
- **title_string** (*str*) – string specifying title to attach to axis "ax"
- **figure_y_size** (*int*) – vertical size of the image, used to proportionally set the title size
- **xpos** (*float, optional*) – x position of the title
- **ypos** (*float, optional*) – y position of the title
- **fontsize** (*int, optional*) – matplotlib font size

#### Module contents

image_utils init file.

### geoips.interfaces package

#### Subpackages

#### geoips.interfaces.module_based package

##### Submodules

##### geoips.interfaces.module_based.algorithms module

Algorithms interface module.

**class** geoips.interfaces.module_based.algorithms.**AlgorithmsInterface**

Bases: *BaseModuleInterface*

GeoIPS interface for algorithms plugins.

**name = 'algorithms'**

**required_args = {'channel_combination': ['arrays'], 'list_numpy_to_numpy': ['arrays'], 'rgb': ['arrays'], 'scalar_to_scalar': [], 'single_channel': ['arrays'], 'xarray_dict_area_def_to_numpy': ['xarray_dict', 'area_def'], 'xarray_dict_dict_to_xarray': ['xarray_dict_dict'], 'xarray_dict_to_xarray': ['xarray_dict'], 'xarray_dict_to_xarray_dict': ['xarray_dict'], 'xarray_to_numpy': ['xobj']}**

**required_kwargs = {'channel_combination': [], 'list_numpy_to_numpy': [], 'rgb': [], 'scalar_to_scalar': ['value'], 'single_channel': [], 'xarray_dict_area_def_to_numpy': [], 'xarray_dict_dict_to_xarray': [], 'xarray_dict_to_xarray': [], 'xarray_dict_to_xarray_dict': [], 'xarray_to_numpy': []}**

### geoips.interfaces.module_based.colormappers module

Colormappers interface module.

**class** geoips.interfaces.module_based.colormappers.**ColormappersInterface**

Bases: *BaseModuleInterface*

GeoIPS interface for colormappers plugins.

**allowable_kwargs = {'matplotlib': ['data_range', 'cmap_name', 'ascii_path', 'create_colorbar', 'cbar_label', 'cbar_ticks', 'cbar_tick_labels', 'cbar_spacing', 'cbar_full_width', 'colorbar_kwargs', 'set_ticks_kwargs', 'set_label_kwargs']}**

**name = 'colormappers'**

**required_args = {'matplotlib': []}**

**required_kwargs = {'matplotlib': []}**

### geoips.interfaces.module_based.coverage_checkers module

Interpolators interface module.

**class**
geoips.interfaces.module_based.coverage_checkers.**CoverageCheckersInterface**

Bases: *BaseModuleInterface*

GeoIPS interface for coverage_checkers plugins.

**allowable_kwargs = {'standard': {'area_def', 'radius_km'}}**

**get_plugin_for_product**(*product*, *checker_field='coverage_checker'*)

Get plugin for product.

**name = 'coverage_checkers'**

**required_args = {'standard': ['xarray_obj', 'variable_name']}**

**required_kwargs = {'standard': {}}**

### geoips.interfaces.module_based.filename_formatters module

Filename formatters interface module.

**class** geoips.interfaces.module_based.filename_formatters.**FilenameFormattersInterface**

Bases: *BaseModuleInterface*

GeoIPS interface for filename_formatters plugins.

**find_duplicates**(**args*, ***kwargs*)

Find duplicate files.

**name = 'filename_formatters'**

**remove_duplicates**()

Remove duplicate files.

**required_args = {'data': ['area_def', 'xarray_obj', 'product_names'], 'standard': ['area_def', 'xarray_obj', 'product_name'], 'standard_metadata': ['area_def', 'xarray_obj', 'product_filename'], 'xarray_metadata_to_filename': ['xarray_obj']}**

**required_kwargs = {'data': ['coverage', 'output_type', 'output_type_dir', 'product_dir', 'product_subdir', 'source_dir', 'basedir'], 'standard': ['coverage', 'output_type', 'output_type_dir', 'product_dir', 'product_subdir', 'source_dir', 'basedir'], 'standard_metadata': ['metadata_dir', 'metadata_type', 'basedir'], 'xarray_metadata_to_filename': ['extension', 'basedir']}**

### geoips.interfaces.module_based.interpolators module

Interpolators interface module.

**class** geoips.interfaces.module_based.interpolators.**InterpolatorsInterface**

Bases: *BaseModuleInterface*

GeoIPS interface for interpolators plugins.

**name = 'interpolators'**

**required_args = {'2d': ['area_def', 'input_xarray', 'output_xarray', 'varlist'], 'grid': ['area_def', 'input_xarray', 'output_xarray', 'varlist']}**

**required_kwargs = {'2d': ['array_num'], 'grid': ['array_num']}**

### geoips.interfaces.module_based.output_formatters module

Output formatters interface module.

**class**
geoips.interfaces.module_based.output_formatters.**OutputFormattersInterface**

Bases: *BaseModuleInterface*

GeoIPS interface for output_formatters plugins.

**name = 'output_formatters'**

**required_args = {'image': ['area_def', 'xarray_obj', 'product_name', 'output_fnames'], 'image_multi': ['area_def', 'xarray_obj', 'product_names', 'output_fnames', 'mpl_colors_info'], 'image_overlay': ['area_def', 'xarray_obj', 'product_name', 'output_fnames'], 'standard_metadata': ['area_def', 'xarray_obj', 'metadata_yaml_filename', 'product_filename'], 'unprojected': ['xarray_obj', 'product_name', 'output_fnames'], 'xarray_data': ['xarray_obj', 'product_names', 'output_fnames'], 'xrdict_area_product_outfnames_to_outlist': ['xarray_dict', 'area_def', 'product_name', 'output_fnames'], 'xrdict_area_product_to_outlist': ['xarray_dict', 'area_def', 'product_name'], 'xrdict_area_varlist_to_outlist': ['xarray_dict', 'area_def', 'varlist'], 'xrdict_varlist_outfnames_to_outlist': ['xarray_dict', 'varlist', 'output_fnames']}**

**required_kwargs = {'image': ['product_name_title', 'mpl_colors_info', 'existing_image'], 'image_multi': ['product_name_titles'], 'image_overlay': ['product_name_title', 'clean_fname', 'mpl_colors_info', 'clean_fname', 'feature_annotator', 'gridline_annotator', 'clean_fname', 'product_datatype_title', 'clean_fname', 'bg_data', 'bg_mpl_colors_info', 'clean_fname', 'bg_xarray', 'bg_product_name_title', 'bg_datatype_title', 'clean_fname', 'remove_duplicate_minrange'], 'standard_metadata': ['metadata_dir', 'basedir', 'output_dict'], 'unprojected': ['product_name_title', 'mpl_colors_info'], 'xarray_data': [], 'xarray_dict_data': ['append', 'overwrite'], 'xarray_dict_to_image': [], 'xrdict_area_product_outfnames_to_outlist': [], 'xrdict_area_product_to_outlist': [], 'xrdict_area_varlist_to_outlist': [], 'xrdict_varlist_outfnames_to_outlist': []}**

### geoips.interfaces.module_based.procflows module

Procflows interface module.

**class** `geoips.interfaces.module_based.procflows.`**`ProcflowsInterface`**

Bases: *BaseModuleInterface*

GeoIPS interface for procflows plugins.

**name = 'procflows'**

**required_args = {'standard': ['fnames']}**

**required_kwargs = {'standard': ['command_line_args']}**

### geoips.interfaces.module_based.readers module

Readers interface module.

**class** `geoips.interfaces.module_based.readers.`**`ReadersInterface`**

Bases: *BaseModuleInterface*

GeoIPS interface for readers plugins.

**name = 'readers'**

**required_args = {'standard': ['fnames']}**

**required_kwargs = {'standard': ['metadata_only', 'chans', 'area_def', 'self_register']}**

### geoips.interfaces.module_based.sector_adjusters module

Sector adjusters interface module.

**class** `geoips.interfaces.module_based.sector_adjusters.`**`SectorAdjustersInterface`**

Bases: *BaseModuleInterface*

GeoIPS interface for sector_adjusters plugins.

**name = 'sector_adjusters'**

**required_args = {'list_xarray_list_variables_to_area_def_out_fnames': ['xobjs', 'area_def', 'variables']}**

**required_kwargs = {'list_xarray_list_variables_to_area_def_out_fnames': ['recenter_variables']}**

### geoips.interfaces.module_based.sector_metadata_generators module

Sector metadata generators interface module.

**class** geoips.interfaces.module_based.sector_metadata_generators.**SectorMetadataGeneratorsInterface**

Bases: *BaseModuleInterface*

GeoIPS interface for sector_metadata_generators plugins.

**name = 'sector_metadata_generators'**

**required_args = {'tc': ['trackfile_name']}**

**required_kwargs = {'tc': []}**

### geoips.interfaces.module_based.sector_spec_generators module

Sector spec generators interface module.

**class** geoips.interfaces.module_based.sector_spec_generators.**SectorSpecGeneratorsInterface**

Bases: *BaseModuleInterface*

GeoIPS interface for sector_spec_generators plugins.

**name = 'sector_spec_generators'**

**required_args = {'area_definition': []}**

**required_kwargs = {'area_definition': []}**

### geoips.interfaces.module_based.title_formatters module

Title formatters interface module.

**class** geoips.interfaces.module_based.title_formatters.**TitleFormattersInterface**

Bases: *BaseModuleInterface*

GeoIPS interface for title_formatters plugins.

`name = 'title_formatters'`

`required_args = {'standard': []}`

`required_kwargs = {'standard': []}`

### Module contents

Module based interfaces init file.

## geoips.interfaces.yaml_based package

### Submodules

### geoips.interfaces.yaml_based.feature_annotators module

Feature Annotator interface module.

**class** `geoips.interfaces.yaml_based.feature_annotators.`**FeatureAnnotatorsInterface**

Bases: *BaseYamlInterface*

Interface for feature annotator plugins.

`name = 'feature_annotators'`

### geoips.interfaces.yaml_based.gridline_annotators module

Gridline Annotator interface module.

**class** `geoips.interfaces.yaml_based.gridline_annotators.`**GridlineAnnotatorsInterface**

Bases: *BaseYamlInterface*

Interface for gridline annotator plugins.

`name = 'gridline_annotators'`

### geoips.interfaces.yaml_based.product_defaults module

Product Defaults interface module.

**class** geoips.interfaces.yaml_based.product_defaults.**ProductDefaultsInterface**

Bases: *BaseYamlInterface*

Default values that can be applied to products.

**name = 'product_defaults'**

### geoips.interfaces.yaml_based.products module

Products interface module.

**class** geoips.interfaces.yaml_based.products.**ProductsInterface**

Bases: *BaseYamlInterface*

GeoIPS interface for Products plugins.

**get_plugin**(*source_name*, *name*, *product_spec_override=None*)

Retrieve a Product plugin by source_name, name, and product_spec_override.

If product_spec_override dict is passed, values contained within product_spec_override will be used in place of those found in products list and product_defaults.

product_spec_override[product_name] matches the format of the product "spec" field.

Additionall, if the special key product_spec_override["all"] is included, it will apply to all products not specified by name within the dictionary.

**get_plugins**()

Retrieve a plugin by name.

**name = 'products'**

**plugin_is_valid**(*source_name*, *name*)

Test that the named plugin is valid.

**test_interface**()

Test interface method.

**validator = <geoips.interfaces.yaml_based.products.ProductsPluginValidator object>**

**class** geoips.interfaces.yaml_based.products.**ProductsPluginValidator**

Bases: *YamlPluginValidator*

Validator for Products plugins.

This differs from other validators for two reasons:

1. Most plugins are identified solely by 'name'. Products are identified by 'source_name' and 'name.
2. Most plugins supply their 'family' directly. Products can supply it directly, but can, alternatively, specify a 'product_defaults' plugin from which to pull 'family' and most other properties. This validator handles filling in a product plugin based on its specified product defaults plugin.

**validate**(*plugin*, *validator_id=None*)

Validate a Products plugin against the relevant schema.

The relevant schema is determined based on the interface and family of the plugin.

**validate_product**(*product*)

Validate single product.

### geoips.interfaces.yaml_based.sectors module

Sector interface module.

**class** geoips.interfaces.yaml_based.sectors.**SectorsInterface**

Bases: *BaseYamlInterface*

Interface for sector plugins.

**name = 'sectors'**

### Module contents

YAML based interfaces init file.

## Submodules

### geoips.interfaces.base module

Base classes for interfaces, plugins, and plugin validation machinery.

**class** geoips.interfaces.base.**BaseInterface**

Bases: `object`

Base class for GeoIPS interfaces.

This class should not be instantiated directly. Instead, interfaces should be accessed by importing them from `geoips.interfaces`. For example: ` from geoips.interfaces import algorithms ` will retrieve an instance of `AlgorithmsInterface` which will provide access to the GeoIPS algorithm plugins.

**class** geoips.interfaces.base.**BaseModuleInterface**

Bases: *BaseInterface*

Base Class for GeoIPS Interfaces.

This class should not be instantiated directly. Instead, interfaces should be accessed by importing them from `geoips.interfaces`. For example: ` from geoips.interfaces import algorithms ` will retrieve an instance of `AlgorithmsInterface` which will provide access to the GeoIPS algorithm plugins.

**get_plugin**(*name*)

Retrieve a plugin from this interface by name.

**Parameters**
**name** (*str*) – The name the desired plugin.

**Returns**

- An object of type `<interface>Plugin` where `<interface>` is the name of
- *this interface.*

**Raises**
***PluginError*** – If the specified plugin isn't found within the interface.

**get_plugins**()

Get a list of plugins for this interface.

**plugin_is_valid**(*name*)

Check that an interface is valid.

Check that the requested interface function has the correct call signature. Return values should be as specified below, but are not programmatically verified.

**Parameters**
**name** (*str*) – Name of the interface to be validated

**Returns**
True if valid, False if invalid

**Return type**
bool

`plugins_all_valid()`

Test the current interface by validating every Plugin.

**Return type**
True if all plugins are valid, False if any plugin is invalid.

`test_interface()`

Test the current interface by validating each Plugin and testing each method.

Test this interface by opening every Plugin available to the interface, and validating each plugin by calling *plugin_is_valid* for each. Additionally, ensure all methods of this interface work as expected:

- get_plugins
- get_plugin
- plugin_is_valid
- plugins_all_valid

**Returns**

- *A dictionary containing three keys*
- *'by_family', 'validity_check', 'func', and 'family'. The value for each*
- *of these keys is a dictionary whose keys are the names of the Plugins.*
- *- 'by_family' contains a dictionary of plugin names sorted by family.*
- *- 'validity_check' contains a dict whose keys are plugin names and whose* – values are bools where *True* indicates that the Plugin's function is valid according to *plugin_is_valid*.
- *- 'func' contains a dict whose keys are plugin names and whose values are* – the function for each Plugin.
- *- 'family' contains a dict whose keys are plugin names and whose vlaues* – are the contents of the 'family' attribute for each Plugin.

`class geoips.interfaces.base.BaseModulePlugin`

Bases: `object`

Base class for GeoIPS plugins.

`class geoips.interfaces.base.BaseYamlInterface`

Bases: `BaseInterface`

Base class for GeoIPS yaml-based plugin interfaces.

This class should not be instantiated directly. Instead, interfaces should be accessed by importing them from `geoips.interfaces`. For example: ` from geoips.interfaces import products ` will retrieve an instance of `ProductsInterface` which will provide access to the GeoIPS products plugins.

**get_plugin**(*name*)

Get a plugin by its name.

This default method can be overridden to provide different search functionality for an interface. An example of this is in the ProductsInterface which uses a tuple containing 'source_name' and 'name'.

**get_plugins**()

Retrieve a plugin by name.

**plugin_is_valid**(*name*)

Plugin is valid method.

**plugins_all_valid**()

Plugins all valid method.

**test_interface**()

Test interface method.

**validator = <geoips.interfaces.base.YamlPluginValidator object>**

**class** geoips.interfaces.base.**BaseYamlPlugin**(**args*, ***kwargs*)

Bases: `dict`

Base class for GeoIPS plugins.

**class** geoips.interfaces.base.**YamlPluginValidator**

Bases: `object`

PluginValidator class.

schemas = {'bases.docstring': {'$id': 'bases.docstring', 'description': 'A docstring that describes the plugin following numpy docstring style', 'type': 'string'}, 'bases.family': {'$id': 'bases.family', '$ref': 'bases.valid_identifier', 'description': 'The family that the plugin belongs to within its interface'}, 'bases.interface': {'$id': 'bases.interface', '$ref': 'bases.valid_identifier', 'description': 'The name of the interface that the plugin belongs to'}, 'bases.name': {'$id': 'bases.name', '$ref': 'bases.valid_identifier', 'description': 'The name of the plugin', 'type': 'string'}, 'bases.product_defaults': {'$id': 'bases.product_defaults', '$ref': 'bases.valid_identifier', 'description': 'The name of the product defaults plugin to use'}, 'bases.top': {'$id': 'bases.top', 'properties': {'abspath': {'type': 'string'}, 'docstring': {'$ref': 'bases.docstring'}, 'family': {'$ref': 'bases.family'}, 'interface': {'$ref': 'bases.interface'}, 'name': {'$ref': 'bases.name'}, 'package': {'type': 'string'}, 'relpath': {'type': 'string'}}, 'required': ['interface', 'family', 'name', 'docstring'], 'type': 'object'}, 'bases.valid_identifier': {'$id': 'bases.valid_identifier', 'description': 'A valid Python identifier', 'type': 'string'}, 'feature_annotators.cartopy': {'$id': 'feature_annotators.cartopy', '$ref': 'bases.top', 'description': 'Defines which geographical boundaries should be drawn over the output products and\nhow they should be drawn. Can enable coastlines, countries, states, and rivers and\ncontrol their line width and color.\n', 'properties': {'spec': {'default': {}, 'properties': {'borders': {'if': {'properties': {'enabled': {'const': True}}}, 'properties': {'enabled': {'type': 'boolean'}}, 'then': {'properties': {'edgecolor': {'type': 'string'}, 'linewidth': {'type': 'number'}}, 'required': ['edgecolor', 'linewidth']}, 'type': 'object', 'unevaluatedProperties': False}, 'coastline': {'if': {'properties': {'enabled': {'const': True}}}, 'properties': {'enabled': {'type': 'boolean'}}, 'then': {'properties': {'edgecolor': {'type': 'string'}, 'linewidth': {'type': 'number'}}, 'required': ['edgecolor', 'linewidth']}, 'type': 'object', 'unevaluatedProperties': False}, 'rivers': {'if': {'properties': {'enabled': {'const': True}}}, 'properties': {'enabled': {'type': 'boolean'}}, 'then': {'properties': {'edgecolor': {'type': 'string'}, 'linewidth': {'type': 'number'}}, 'required': ['edgecolor', 'linewidth']}, 'type': 'object', 'unevaluatedProperties': False}, 'states': {'if': {'properties': {'enabled': {'const': True}}}, 'properties': {'enabled': {'type': 'boolean'}}, 'then': {'properties': {'edgecolor': {'type': 'string'}, 'linewidth': {'type': 'number'}}, 'required': ['edgecolor', 'linewidth']}, 'type': 'object', 'unevaluatedProperties': False}}, 'required': ['coastline', 'borders', 'rivers', 'states'], 'type': 'object', 'unevaluatedProperties': False}}, 'required': ['spec'], 'title': 'Feature Annotators'}, 'gridline_annotators.cartopy': {'$id': 'gridline_annotators.cartopy', '$ref': 'bases.top', 'description':

`validate`(*plugin*, *validator_id=None*)

Validate a YAML plugin against the relevant schema.

The relevant schema is determined based on the interface and family of the plugin.

`validate_list`(*plugin*)

Validate a list of YAML plugins.

Some interfaces allow a 'list' family. These list plugins will contain a property that is the same as the interface's name. Under that is a list of individual plugins.

This function will add the interface property to each plugin in the list, then validate each plugin.

```
validators = {'bases.docstring':  Draft202012Validator(schema={'$id':
'bases.docstring', 'description':  'A docstring ...cstring style',
'type':  'string'}, format_checker=None), 'bases.family':
Draft202012Validator(schema={'$id':  'bases.family', '$ref':
'bases.valid_identifier', 'description':  'The family t...its
interface'}, format_checker=None), 'bases.interface':
Draft202012Validator(schema={'$id':  'bases.interface', '$ref':
'bases.valid_identifier', 'description':  'The name of ...in belongs
to'}, format_checker=None), 'bases.name':
Draft202012Validator(schema={'$id':  'bases.name', '$ref':
'bases.valid_identifier', 'description':  'The name of the plugin',
'type':  'string'}, format_checker=None), 'bases.product_defaults':
Draft202012Validator(schema={'$id':  'bases.product_defaults',
'$ref':  'bases.valid_identifier', 'description':  'The name of
...plugin to use'}, format_checker=None), 'bases.top':
Draft202012Validator(schema={'$id':  'bases.top', 'properties':
{'abspath':  {'type':  'string'}, 'docstring':  {'$ref':
'bases.docstring'}, 'family':  {'$ref':  'bases.family'},
'interface':  {'$ref':  'bases.interface'}, ...}, 'required':
['interface', 'family', 'name', 'docstring'], 'type':  'object'},
format_checker=None), 'bases.valid_identifier':
Draft202012Validator(schema={'$id':  'bases.valid_identifier',
'description':  'A valid Python identifier', 'type':  'string'},
format_checker=None), 'feature_annotators.cartopy':
Draft202012Validator(schema={'$id':  'feature_annotators.cartopy',
'$ref':  'bases.top', 'description':  'Defines whic... and color.\n',
'properties':  {'spec':  {'default':  {}, 'properties':  {'borders':
{'if':  {'properties':  {...}}, 'properties':  {'enabled':  {...}},
'then':  {'properties':  {...}, 'required':  [...]}, 'type':
'object', ...}, 'coastline':  {'if':  {'properties':  {...}},
'properties':  {'enabled':  {...}}, 'then':  {'properties':  {...},
'required':  [...]}, 'type':  'object', ...}, 'rivers':  {'if':
{'properties':  {...}}, 'properties':  {'enabled':  {...}}, 'then':
{'properties':  {...}, 'required':  [...]}, 'type':  'object', ...},
'states':  {'if':  {'properties':  {...}}, 'properties':  {'enabled':
{...}}, 'then':  {'properties':  {...}, 'required':  [...]}, 'type':
'object', ...}}, 'required':  ['coastline', 'borders', 'rivers',
'states'], 'type':  'object', ...}}, ...}, format_checker=None),
'gridline_annotators.cartopy':  Draft202012Validator(schema={'$id':
'gridline_annotators.cartopy', '$ref':  'bases.top', 'description':
'Defines lati...he imagery.\n', 'properties':  {'spec':
{'properties':  {'labels':  {'properties':  {'bottom':  {...},
'left':  {...}, 'right':  {...}, 'top':  {...}}, 'required':  ['top',
'bottom', 'left', 'right'], 'type':  'object',
'unevaluatedProperties':  False}, 'lines':  {'properties':  {'color':
{...}, 'linestyle':  {...}, 'linewidth':  {...}}, 'required':
['color', 'linestyle', 'linewidth'], 'type':  'object',
'unevaluatedProperties':  False}, 'spacing':  {'properties':
{'latitude':  {...}, 'longitude':  {...}}, 'required':  ['latitude',
'longitude'], 'type':  'object', 'unevaluatedProperties':  False}},
```

`geoips.interfaces.base.`**`extend_with_default`**`(`*validator_class*`)`

Extend a jsonschema validator to make it respect default values.

Note: This does not pollute the input validator object. Calling *jsonschema.validators.extend* returns a new object.

This will cause the validator to fill in fields that have default values. In cases where fields with default values are contained inside a mapping, that mapping must have *default: {}* and may not have *requires*.

`geoips.interfaces.base.`**`get_schemas`**`(`*path*, *validator*`)`

Collect all of the interface schema.

`geoips.interfaces.base.`**`get_validators`**`(`*schema_dict*, *validator_class*`)`

Create validators for each schema in *schema_dict*.

**Parameters**

**`schema_dict`** (*`dict`*) – A dictionary whose keys are schema *$id* and whose values are the full schema.

**Returns**

A dictionary whose keys are schema *$id* and whose values are *jsonschema* validator instances.

**Return type**

dict

`geoips.interfaces.base.`**`plugin_module_to_obj`**`(`*name*, *module*, *obj_attrs={}*`)`

Convert a module plugin to an object.

Convert the passed module plugin into an object and return it. The returned object will be derrived from a class named `<interface>Plugin` where interface is the interface specified by the plugin. This class is derrived from `BasePlugin`.

This function is used instead of predefined classes to allow setting `__doc__` and `__call__` on a plugin-by-plugin basis. This allows collecting `__doc__` and `__call__` from the plugin modules and using them in the objects.

For a module to be converted into an object it must meet the following requirements:

- The module must define a docstring. This will be used as the docstring for the plugin class as well as the docstring for the plugin when requested on the command line. The first line will be used as a "short" description, and the full docstring will be used as a more detailed discussion of the plugin.
- The following global attributes must be defined in the module: - interface: The name of the interface that the plugin belongs to. - family: The family of plugins that the plugin belongs to within the interface. - name: The name of the plugin which must be unique within the interface.

- A callable named *call* that will be called when the plugin is used.

**Parameters**

- **module** (*module*) – The imported plugin module.
- **obj_attrs** (*dict, optional*) – Additional attributes to be assigned to the plugin object.

**Returns**

- An object of type `<interface>InterfacePlugin` where `<interface>` is the name
- *of the interface that the desired plugin belongs to.*

geoips.interfaces.base.**plugin_repr**(*obj*)

Repr plugin string.

geoips.interfaces.base.**plugin_yaml_to_obj**(*name, yaml_plugin, obj_attrs={'__doc__': 'The default products_source_name fusion plugin configuration.\n', 'abspath': '/satops/users/surratt/public_test_install/template_fusion_ 'docstring': 'The default products_source_name fusion plugin configuration.\n', 'family': 'list', 'id': 'my_layered_list', 'interface': 'products', 'name': 'my_layered_list', 'package': 'my_fusion_package', 'relpath': 'yaml/products/my_layered.yaml', 'yaml': {'abspath': '/satops/users/surratt/public_test_install/template_fusion_ 'docstring': 'The default products_source_name fusion plugin configuration.\n', 'family': 'list', 'interface': 'products', 'name': 'my_layered_list', 'package': 'my_fusion_package', 'relpath': 'yaml/products/my_layered.yaml', 'spec': {'products': [{'name': 'My-Layered-Winds', 'source_names': ['my_layered_source'], 'docstring': 'Layered winds product using default 2 colorbar placement.\n\nThis example layered image includes default colorbar placement\nfor both windspeed and ir products, and no colorbar for windbarbs.\n', 'spec': {'coverage_checker': {'plugin': {'name': 'masked_arrays', 'arguments': {'variable_name': 'windspeed:wind_speed_kts'}}}, 'mpl_colors_info': {'windbarbs': {'colorbar': False, 'colorbar_positioning': {'start_x_pos': 0.7666666666666667, 'end_x_pos': 1.0, 'start_y_pos': -0.07792207792207793, 'end_y_pos': -0.05194805194805195}}, 'windspeed': {'colorbar': True, 'colorbar_positioning': {'start_x_pos': 0.26666666666666666, 'end_x_pos': 0.7333333333333334, 'start_y_pos': -0.07792207792207793, 'end_y_pos': -0.05194805194805195}}, 'ir': {'colorbar': True, 'colorbar_positioning': {'start_x_pos': 0.0, 'end_x_pos': 0.23333333333333334, 'start_y_pos': -0.07792207792207793, 'end_y_pos': -0.05194805194805195}, 'cbar_label': 'BT (degrees C)'}}}, 'interface': 'products', 'family': 'xarray_dict_to_output_format', 'package':*

Convert a yaml plugin to an object.

Convert the passed YAML plugin into an object and return it. The returned object will be derived from a class named `<interface>Plugin` where interface is the interface specified by the plugin. This class is derived from `BasePlugin`.

This function is used instead of predefined classes to allow setting `__doc__` on a plugin-by-plugin basis. This allows collecting `__doc__` and from the plugin and using them in the objects.

For a yaml plugin to be converted into an object it must meet the following requirements:

- Must match the jsonschema spec provided for its interface.
- The plugin must have the following top-level attributes and the must not be empty. - interface: The name of the interface that the plugin belongs to. - family: The family of plugins that the plugin belongs to within the interface. - name: The name of the plugin which must be unique within the interface. - docstring: A string to be used as the object's docstring.

### Module contents

GeoIPS interface module.

## geoips.plugins package

### Subpackages

#### geoips.plugins.modules package

##### Subpackages

###### geoips.plugins.modules.algorithms package

###### Subpackages

###### geoips.plugins.modules.algorithms.pmw_tb package

###### Submodules

###### geoips.plugins.modules.algorithms.pmw_tb.pmw_37pct module

Passive Microwave 37 GHz Polarization Corrected Temperature.

Data manipulation steps for the "37pct" product. This algorithm expects Brightness Temperatures in units of degrees Kelvin.

`geoips.plugins.modules.algorithms.pmw_tb.pmw_37pct.call`(*arrays*, *output_data_range=None*, *min_outbounds='crop'*, *max_outbounds='mask'*, *norm=False*, *inverse=False*)

37pct product algorithm data manipulation steps.

This algorithm expects Brightness Temperatures in units of degrees Kelvin, and returns degrees Kelvin

**Parameters**

`arrays` (*list of numpy.ndarray*) –

- **numpy.ndarray or numpy.MaskedArray of channel data, in order of sensor**
  "channels" list
- Degrees Kelvin

**Returns**

numpy.ndarray or numpy.MaskedArray of appropriately scaled channel data, in degrees Kelvin.

**Return type**
numpy.ndarray

### geoips.plugins.modules.algorithms.pmw_tb.pmw_89pct module

Passive Microwave 89 GHz Polarization Corrected Temperature.

Data manipulation steps for the "89pct" product. This algorithm expects Brightness Temperatures in units of degrees Kelvin

`geoips.plugins.modules.algorithms.pmw_tb.pmw_89pct.call`(*arrays*, *output_data_range*, *min_outbounds='crop'*, *max_outbounds='mask'*, *norm=False*, *inverse=False*)

89pct product algorithm data manipulation steps.

This algorithm expects Brightness Temperatures in units of degrees Kelvin, and returns degrees Kelvin

**Parameters**
**arrays** (*list of numpy.ndarray*) –

- **list of numpy.ndarray or numpy.MaskedArray of channel data**
  and other variables, in order of sensor "variables" list
- Channel data: Degrees Kelvin

**Returns**
numpy.ndarray or numpy.MaskedArray of appropriately scaled channel data, in degrees Kelvin.

**Return type**
numpy.ndarray

### geoips.plugins.modules.algorithms.pmw_tb.pmw_color37 module

Passive Microwave 37 GHz Colorized Brightness Temperature.

Data manipulation steps for the "color37" product. This algorithm expects Brightness Temperatures in units of degrees Kelvin

`geoips.plugins.modules.algorithms.pmw_tb.pmw_color37.call`(*arrays*)

color37 product algorithm data manipulation steps.

This algorithm expects Brightness Temperatures in units of degrees Kelvin, and returns red green and blue gun arrays.

**Parameters**
`data` (*list of numpy.ndarray*) –

- **list of numpy.ndarray or numpy.MaskedArray of channel data,** in order of channels list above
- Degrees Kelvin

**Returns**
numpy.ndarray or numpy.MaskedArray of qualitative RGBA image output

**Return type**
numpy.ndarray

## geoips.plugins.modules.algorithms.pmw_tb.pmw_color89 module

Passive Microwave 89 GHz Colorized Brightness Temperature.

Data manipulation steps for the "color89" product. This algorithm expects Brightness Temperatures in units of degrees Kelvin

`geoips.plugins.modules.algorithms.pmw_tb.pmw_color89.call(arrays)`

color89 product algorithm data manipulation steps.

This algorithm expects Brightness Temperatures in units of degrees Kelvin, and returns red green and blue gun arrays.

**Parameters**
`arrays` (*list of numpy.ndarray*) –

- **list of numpy.ndarray or numpy.MaskedArray of channel data and** other variables, in order of sensor "variables" list
- Channel data: Degrees Kelvin

**Returns**
numpy.ndarray or numpy.MaskedArray of qualitative RGBA image output

**Return type**
numpy.ndarray

### Module contents

geoips pmw_tb algorithm init file.

## geoips.plugins.modules.algorithms.sfc_winds package

### Submodules

### geoips.plugins.modules.algorithms.sfc_winds.windbarbs module

Surface Winds plotted as Barbs in Knots.

Data manipulation steps for surface winds products. This algorithm expects surface wind speeds in units of kts

`geoips.plugins.modules.algorithms.sfc_winds.windbarbs.call`(*arrays*, *output_data_range=None*, *input_units=None*, *output_units=None*, *min_outbounds='crop'*, *max_outbounds='crop'*, *norm=False*, *inverse=False*)

Windbarbs product algorithm data manipulation steps.

This algorithm expects input windspeed with units "kts" and returns in "kts"

**Parameters**

- **arrays** (*list of numpy.ndarray*) –
  - **list of numpy.ndarray or numpy.MaskedArray of channel data,** in order of sensor "channels" list
  - kts
- **output_data_range** (*list of float, default=None*) –
  - list of min and max value for wind speeds (kts)
  - defaults to None, which results in using data.min and data.max.
- **input_units** (*str, default=None*) –
  - Units of input data, for applying necessary conversions
  - defaults to None, resulting in no unit conversions.
- **output_units** (*str, default=None*) –

  - Units of output data, for applying necessary conversions
  - defaults to None, resulting in no unit conversions.
- **min_outbounds** (*str, default='crop'*) –
  - Method to use when applying bounds. Valid values are:
    - retain: keep all pixels as is
    - mask: mask all pixels that are out of range
    - crop: set all out of range values to either min_val or max_val as appropriate
- **max_outbounds** (*str, default='crop'*) –
  - Method to use when applying bounds. Valid values are:
    - retain: keep all pixels as is
    - mask: mask all pixels that are out of range
    - crop: set all out of range values to either min_val or max_val as appropriate
- **norm** (*bool, default=False*) –
  - Boolean flag indicating whether to normalize (True) or not (False)
    - If True, returned data will be in the range from 0 to 1
    - If False, returned data will be in the range from min_val to max_val
- **inverse** (*bool, default=False*) –
  - Boolean flag indicating whether to inverse (True) or not (False)
    - If True, returned data will be inverted
    - If False, returned data will not be inverted

**Returns**

numpy.ndarray or numpy.MaskedArray of appropriately scaled channel data, dstacked as follows:

- (spd, direction, rain_flag)
- spd in kts
- direction in degrees
- rain_flag 0 or 1

**Return type**

numpy.ndarray

### Module contents

geoips sfc_winds algorithm init.

### geoips.plugins.modules.algorithms.visir package

#### Submodules

#### geoips.plugins.modules.algorithms.visir.Night_Vis module

Data manipulation steps for "Night_Vis" product, standard Version.

This algorithm expects one VIIRS channel (DNBRad) for a single channel image.

`geoips.plugins.modules.algorithms.visir.Night_Vis.`**`call`**(*arrays*, *output_data_range=None*, *scale_factor=None*, *gamma_list=None*, *input_units=None*, *output_units=None*, *min_outbounds=None*, *max_outbounds=None*, *max_night_zen=None*, *norm=None*, *inverse=None*)

Night-Vis algorithm data manipulation steps, standard version.

DNB obs for visible product.

This algorithm expects radaiance, between 0 and 2.5*10^-8

This is only for nighttime product.

**Parameters**

**arrays** (*list of numpy.ndarray*) –

- list of numpy.ndarray or numpy.MaskedArray of channel data
- Channel data: Radiance, between 0 and 2.5*10^-8

**Returns**

numpy.ndarray or numpy.MaskedArray of appropriately scaled channel data

**Return type**

numpy.ndarray

### Notes

Due to a relative maximum value of the DNBRad is much larger than that of the majority pixels in moonlight/lighting situation, it could lead to a black image if the original maximum is used to normalize the data (i.e., the normlized value is close to 0). Thus, we need to setup an tuning factor to normalize the DNBRad.

We start to use 0.05 to tune the val_max in moonlight/other lighing source, 0.5 for no lighting source.

We might have to generate night-vis product only when moonlight is present (TBD).

## geoips.plugins.modules.algorithms.visir.Night_Vis_GeoIPS1 module

Data manipulation steps for "Night_Vis" product, GeoIPS 1 Version.

This algorithm expects one VIIRS channel (DNBRad) for a single channel image.

`geoips.plugins.modules.algorithms.visir.Night_Vis_GeoIPS1.`**`call`**`(`*arrays*, *min_outbounds='crop'*, *max_outbounds='crop'*, *max_night_zen=90*`)`

Night Vis product algorithm data manipulation steps, GeoIPS 1 version.

This algorithm expects DNBRad in reflectance, and returns the adjusted array.

**Parameters**

**arrays** (*list of numpy.ndarray*) –

- **list of numpy.ndarray or numpy.MaskedArray of channel data,** in order of sensor "channels" list
- Degrees Kelvin

**Returns**

numpy.ndarray or numpy.MaskedArray of adjusted DNB output.

**Return type**

numpy.ndarray

### Notes

It will generate a product in daytime if we do not apply the daytime check. For now, it is for both day/night.

We will decide whether this product is only for nighttime. If so, a daytime check will be required.

We may focus only on nighttime product with moonlight after additional validation (TBD).

## geoips.plugins.modules.algorithms.visir.Night_Vis_IR module

Data manipulation steps for "Night_Vis_IR" product.

This algorithm expects two VIIRS channels (DNBRad and M16BT) for a RGB image

`geoips.plugins.modules.algorithms.visir.Night_Vis_IR.call(arrays)`

Night_Vis_IR RGB product algorithm data manipulation steps.

This algorithm expects DNBRad in reflectance and M16BT Brightness Temperatures in units of degrees Kelvin, and returns red green and blue gun arrays.

**Parameters**

**arrays** (*list of numpy.ndarray*) –

- **list of numpy.ndarray or numpy.MaskedArray of channel data,** in order of sensor "channels" list
- Degrees Kelvin

**Returns**

numpy.ndarray or numpy.MaskedArray of qualitative RGBA image output

**Return type**

numpy.ndarray

### Notes

It will generate a product in daytime if we do not apply the daytime check. For now, it is for both day/night.

We will decide whether this product is only for nighttime. If so, a daytime check will be required.

We may focus only on nighttime product with moonlight after additional validation (TBD).

## geoips.plugins.modules.algorithms.visir.Night_Vis_IR_GeoIPS1 module

Data manipulation steps for "Night_Vis_IR" product, GeoIPS 1 Version.

This algorithm expects two VIIRS channels (DNBRad and M16BT) for a RGB image

`geoips.plugins.modules.algorithms.visir.Night_Vis_IR_GeoIPS1.call`(*arrays*, *max_night_zen=90*)

Night Vis IR RGB product algorithm data manipulation steps.

This algorithm expects DNBRad in reflectance and M16BT Brightness Temperatures in units of degrees Kelvin, and returns red green and blue gun arrays.

**Parameters**

**arrays** (*list of numpy.ndarray*) –

- **list of numpy.ndarray or numpy.MaskedArray of channel data,** in order of sensor "channels" list
- Degrees Kelvin

**Returns**

numpy.ndarray or numpy.MaskedArray of qualitative RGBA image output

**Return type**

numpy.ndarray

### Notes

It will generate a product in daytime if we do not apply the daytime check. For now, it is for both day/night.

We will decide whether this product is only for nighttime. If so, a daytime check will be required.

We may focus only on nighttime product with moonlight after additional validation (TBD).

### Module contents

geoips visir algorithm init file.

### Submodules

#### geoips.plugins.modules.algorithms.single_channel module

Data manipulation steps for standard "single_channel" algorithm.

Generalized algorithm to apply data manipulation steps in a standard order to apply corrections to a single channel output product.

`geoips.plugins.modules.algorithms.single_channel.call`(*arrays*, *output_data_range=None*, *input_units=None*, *output_units=None*, *min_outbounds='crop'*, *max_outbounds='crop'*, *norm=False*, *inverse=False*, *sun_zen_correction=False*, *mask_night=False*, *max_day_zen=None*, *mask_day=False*, *min_night_zen=None*, *gamma_list=None*, *scale_factor=None*)

Apply data range and requested corrections to a single channel product.

Data manipulation steps for applying a data range and requested corrections to a single channel product

**Parameters**

- **arrays** (*list of numpy.ndarray*) –
  - list of numpy.ndarray or numpy.MaskedArray of channel data
  - MUST be length one for single_channel algorithm.
- **output_data_range** (*list of float, default=None*) –
  - list of min and max value for output data product.
  - This is applied LAST after all other corrections/adjustments
  - If None, use data min and max.
- **input_units** (*str, default=None*) –
  - Units of input data, for applying necessary conversions
  - If None, no conversion

- **output_units** (*str, default=None*) –
  - Units of output data, for applying necessary conversions
  - If None, no conversion
- **min_outbounds** (*str, default='crop'*) –
  - Method to use when applying bounds. Valid values are:
    * retain: keep all pixels as is
    * mask: mask all pixels that are out of range
    * crop: set all out of range values to either min_val or max_val as appropriate
- **max_outbounds** (*str, default='crop'*) –
  - Method to use when applying bounds. Valid values are:
    * retain: keep all pixels as is
    * mask: mask all pixels that are out of range
    * crop: set all out of range values to either min_val or max_val as appropriate
- **norm** (*bool, default=False*) –
  - Boolean flag indicating whether to normalize (True) or not (False)
    * If True, returned data will be in the range from 0 to 1
    * If False, returned data will be in the range from min_val to max_val
- **inverse** (*bool, default=False*) –
  - Boolean flag indicating whether to inverse (True) or not (False)
    * If True, returned data will be inverted
    * If False, returned data will not be inverted
- **sun_zenith_correction** (*bool, default=False*) –
  - Boolean flag indicating whether to apply solar zenith correction (True) or not (False)
    * If True, returned data will have solar zenith correction applied (see data_manipulations.corrections.apply_solar_zenith_correction)
    * If False, returned data will not be modified based on solar zenith angle

#### Notes

Order of operations, based on the passed arguments, is:

1. Mask night
2. Mask day
3. Apply solar zenith correction
4. Apply gamma values
5. Apply scale factor
6. Convert units
7. Apply data range.

NOTE: If "norm=True" is specified, the "output_data_range" will NOT match the actual range of the returned data, since the normalized data will be returned between 0 and 1.

If you require a different order of operations than that specified within "single_channel" algorithm, please create a new algorithm for your desired order of operations.

**Returns**
numpy.ndarray or numpy.MaskedArray of appropriately scaled channel data, in units "output_units".

**Return type**
numpy.ndarray

### Module contents

geoips algorithms init file.

### geoips.plugins.modules.colormappers package

### Subpackages

### geoips.plugins.modules.colormappers.pmw_tb package

### Submodules

### geoips.plugins.modules.colormappers.pmw_tb.cmap_150H module

Module containing colormap for ~150GHz PMW products.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_150H.call`(*data_range=[110, 310]*, *cbar_label='TB (K)'*)

Colormap for displaying ~150GHz PMW data.

**Parameters**
**data_range** (*list of float, default=[110, 310]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include 110 and 310

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

## geoips.plugins.modules.colormappers.pmw_tb.cmap_37H module

Module containing colormap for ~37GHz PMW products.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_37H.call`(*data_range=[125, 310]*, *cbar_label='TB (K)'*)

Colormap for displaying ~37GHz PMW data.

**Parameters**
**data_range** (*list of float, default=[125, 310]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- The 37GHz colormap MUST include 125 and 310

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

### geoips.plugins.modules.colormappers.pmw_tb.cmap_37H_Legacy module

Module containing Legacy colormap for ~37GHz PMW products.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_37H_Legacy.call(data_range=[180, 280], cbar_label='TB (K)')`

Legacy Colormap for displaying ~37GHz PMW data.

**Parameters**

**data_range** (*list of float, default=[180, 280]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- The 37GHz colormap MUST include 180 and 280

**Returns**

**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**

dict

### geoips.plugins.modules.colormappers.pmw_tb.cmap_37H_Physical module

Module containing colormap for ~37GHz PMW products.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_37H_Physical.call(data_range=[125, 310], cbar_label='TB (K)')`

Colormap for displaying ~37GHz PMW data.

**Parameters**

**data_range** (*list of float, default=[125, 310]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include 125 and 210

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

## geoips.plugins.modules.colormappers.pmw_tb.cmap_37pct module

Module containing colormap for 37pct product.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_37pct.call`(*data_range=[230, 280]*, *cbar_label='TB (K)'*)

Colormap for displaying 37pct PMW data.

**Parameters**
`data_range` (*list of float, default=[230, 280]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- The 37pct colormap MUST include 230 and 280

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

## geoips.plugins.modules.colormappers.pmw_tb.cmap_89H module

Module containing colormap for ~89GHz PMW products.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_89H.call`(*data_range=[105, 305]*, *cbar_label='TB (K)'*)

Colormap for displaying ~89GHz PMW data.

**Parameters**
`data_range` (*list of float, default=[105, 305]*) –

- Min and max value for colormap.

- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include 105 and 305

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

## geoips.plugins.modules.colormappers.pmw_tb.cmap_89HW module

Module containing colormap for ~89GHz PMW products, highlighting weak convection.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_89HW.call`(*data_range=[220.0, 280.0]*, *cbar_label='TB (K)'*)

Colormap for displaying ~89GHz PMW data for weak TCs.

**Parameters**
**data_range** (*list of float, default=[220, 280]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include 220 and 280

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

## geoips.plugins.modules.colormappers.pmw_tb.cmap_89H_Legacy module

Module containing Legacy colormap for ~89GHz PMW products.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_89H_Legacy.call`(*data_range=[180.0, 280.0]*, *cbar_label='TB (K)'*)

Legacy Colormap for displaying ~89GHz PMW data.

**Parameters**
**data_range** (*list of float, default=[180, 280]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include 180 and 280

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

## geoips.plugins.modules.colormappers.pmw_tb.cmap_89H_Physical module

Module containing colormap for ~89GHz PMW products.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_89H_Physical.call`(*data_range=[105, 305]*, *cbar_label='TB (K)'*)

Colormap for displaying ~89GHz PMW data.

**Parameters**
**data_range** (*list of float, default=[105, 305]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include 105 and 305

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

### geoips.plugins.modules.colormappers.pmw_tb.cmap_89pct module

Module containing colormap for 89pct product.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_89pct.call`(*data_range=[105, 280]*, *cbar_label='TB (K)'*)

Colormap for displaying ~89GHz PMW data for weak TCs.

**Parameters**

**data_range** (*list of float, default=[105, 280]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include 105 and 280

**Returns**

**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**

dict

### geoips.plugins.modules.colormappers.pmw_tb.cmap_Rain module

Module containing colormap for Rain Rate products.

`geoips.plugins.modules.colormappers.pmw_tb.cmap_Rain.call`(*data_range=[0.05, 50.0]*, *cbar_label='Rainrate $(mm hr^{-1})$'*)

Colormap for displaying Rain Rate products.

**Parameters**

**data_range** (*list of float, default=[0.05, 50.0]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include 0.05 and 50.0

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

### Module contents

Geoips passive microwave brightness temperature colormaps init file.

### geoips.plugins.modules.colormappers.tpw package

### Submodules

### geoips.plugins.modules.colormappers.tpw.tpw_cimss module

Module containing tpw_cimss ASCII palette based colormap.

`geoips.plugins.modules.colormappers.tpw.tpw_cimss.call()`

Colormap for displaying data using TPW CIMSS ascii colormap.

Data range of ASCII palette is 5 to 65 mm, with transitions at 15, 25, 35, 45, and 55.

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

**See also:**

*API Reference*
ASCII palette is found in image_utils/ascii_palettes/tpw_cimss.txt

### geoips.plugins.modules.colormappers.tpw.tpw_purple module

Module containing tpw_purple ASCII palette based colormap.

`geoips.plugins.modules.colormappers.tpw.tpw_purple.call()`

Colormap for displaying data using purple TPW ascii colormap.

Data range of ASCII palette is 5 to 65 mm, with transitions at 15, 25, 35, 45, and 55.

**Returns**
: **mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
: dict

**See also:**

*API Reference*
: ASCII palette is found in image_utils/ascii_palettes/tpw_purple.txt

### geoips.plugins.modules.colormappers.tpw.tpw_pwat module

Module containing tpw_pwat ASCII palette based colormap.

`geoips.plugins.modules.colormappers.tpw.tpw_pwat.call()`

Colormap for displaying data using TPW PWAT ascii colormap.

Data range of ASCII palette is 1 to 90 mm, with numerous transitions

**Returns**
: **mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
: dict

**See also:**

*API Reference*
: ASCII palette is found in image_utils/ascii_palettes/tpw_pwat.txt

### Module contents

Geoips Total Precipitable Water colormap init file.

### geoips.plugins.modules.colormappers.visir package

### Submodules

### geoips.plugins.modules.colormappers.visir.IR_BD module

Module containing user-specified IR-BD algorithm colormap.

`geoips.plugins.modules.colormappers.visir.IR_BD.call`(*data_range=[-90.0, 40.0]*)

Colormap for displaying algorithms/visir/IR_BD.py processed data.

**Parameters**

**data_range** (*list of float, default=[-90, 40]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include -90 and 40

**Returns**

**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**

dict

## geoips.plugins.modules.colormappers.visir.Infrared module

Module containing Infrared algorithm colormap.

`geoips.plugins.modules.colormappers.visir.Infrared.call`(*data_range=[-90, 30]*)

Colormap for displaying algorithms/visir/Infrared.py processed data.

**Parameters**

**data_range** (*list of float, default=[-90, 30]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include -90 and 30

**Returns**

**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**

dict

### geoips.plugins.modules.colormappers.visir.WV module

Module containing WV (water vapor) algorithm colormap.

`geoips.plugins.modules.colormappers.visir.WV.call`(*data_range=[-70.0, 0.0]*)

Colormap developed for displaying algorithms/WV.py processed data.

**Parameters**

`data_range` (*list of float, default=[-70, 0]*) –

- Min and max value for colormap.
- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include -70 and 0

**Returns**

**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**

dict

### Module contents

Geoips Visible/Infrared colormap init file.

### geoips.plugins.modules.colormappers.winds package

### Submodules

### geoips.plugins.modules.colormappers.winds.wind_radii_transitions module

Module containing wind speed colormap with transitions at 34, 50, 64, and 80.

`geoips.plugins.modules.colormappers.winds.wind_radii_transitions.call`(*data_range=[0, 200]*)

Generate appropriate matplotlib colors for plotting standard wind speeds.

wind_radii_transitions contains hard coded transition values for different colors, in order to have consistent imagery across all sensors / products.

**Parameters**

`data_range` (*list of float, default=[0, 200]*) –

- Min and max value for colormap.

- Ensure the data range matches the range of the algorithm specified for use with this colormap
- This colormap MUST include 0 and 200

**Returns**
**mpl_colors_info** – Dictionary of matplotlib plotting parameters, to ensure consistent image output

**Return type**
dict

### Module contents

Geoips surface winds colormap init file.

### Submodules

### geoips.plugins.modules.colormappers.cmap_rgb module

Module containing matplotlib information for RGB or RGBA imagery.

`geoips.plugins.modules.colormappers.cmap_rgb.call()`

For rgb imagery, we require no color information.

colormap is entirely specified by the RGB(A) arrays, so no specific matplotlib color information required.

**Parameters**
**arguments** (*No*) –

**Returns**
**mpl_colors_info** –

- Specifies matplotlib Colors parameters for use in both plotting and colorbar generation
- For RGBA arrays, all fields are "None"

**Return type**
dict

## geoips.plugins.modules.colormappers.matplotlib_linear_norm module

Matplotlib information for standard imagery with an existing system colormap.

geoips.plugins.modules.colormappers.matplotlib_linear_norm.**call**(*data_range=None, cmap_name='Greys', cmap_source='matplotlib', cmap_path=None, create_colorbar=True, cbar_label=None, cbar_ticks=None, cbar_tick_labels=None, cbar_spacing='proportional cbar_full_width=False, colorbar_kwargs=None, set_ticks_kwargs=None, set_label_kwargs=None*)

Set the matplotlib colors information for matplotlib linear norm cmaps.

This information used in both colorbar and image production throughout GeoIPS image output specifications.

**Parameters**

- **data_range** (*list, default=None*) –
  - [min_val, max_val], matplotlib.colors.Normalize(vmin=min_val, vmax=max_val)
  - If data_range not specified, vmin and vmax both None.
- **cmap_name** (*str, default="Greys"*) –
  - Specify the name of the resulting matplotlib colormap.
  - If no ascii_path specified, will use builtin matplotlib colormap of name cmap_name.
- **ascii_path** (*str, default=None*) –
  - Specify full path to ASCII palette to convert to matplotlib colormap.
  - If not specified, use internal matplotlib colormap "cmap_name".
- **cbar_label** (*str, default=None*) –
  - Positional parameter passed to cbar.set_label
  - If specified, use cbar_label string as colorbar label.

- **create_colorbar** (*bool, default=True*) –
  - Specify whether the image should contain a colorbar or not.
- **cbar_ticks** (*list, default=None*) –
  - Positional parameter passed to cbar.set_ticks
  - Specify explicit list of ticks to include for colorbar.
  - None indicates ticks at int(min) and int(max) values
- **cbar_tick_labels** (*list, default=None*) –
  - "labels" argument to pass to cbar.set_ticks.
  - can also specify directly within "set_ticks_kwargs"
- **cbar_spacing** (*string, default="proportional"*) –
  - "spacing" argument to pass to fig.colorbar
  - can also specify directly within "colorbar_kwargs"
- **cbar_full_width** (*bool, default=True*) –
  - Extend the colorbar across the full width of the image.
- **colorbar_kwargs** (*dict, default=None*) –
  - keyword arguments to pass through directly to "fig.colorbar"
- **set_ticks_kwargs** (*dict, default=None*) –
  - keyword arguments to pass through directly to "cbar.set_ticks"
- **set_label_kwargs** (*dict, default=None*) –
  - keyword arguments to pass through directly to "cbar.set_label"

**Returns**

**mpl_colors_info** –

- Specifies matplotlib Colors parameters for use in both plotting and colorbar generation

**Return type**

dict

**See also:**

*API Reference*

See geoips.image_utils.mpl_utils.create_colorbar for field descriptions.

### Module contents

Geoips colormappers init file.

## geoips.plugins.modules.coverage_checkers package

### Submodules

### geoips.plugins.modules.coverage_checkers.center_radius module

Coverage check routine for center radius coverage checks.

`geoips.plugins.modules.coverage_checkers.center_radius.`**`call`**(*xarray_obj*, *variable_name*, *area_def=None*, *radius_km=300*)

Coverage check routine for xarray objects with masked projected arrays.

**Parameters**

- **`xarray_obj`** (*`xarray.Dataset`*) – xarray object containing variable "variable_name"
- **`variable_name`** (*`str`*) – variable name to check percent unmasked
- **`radius_km`** (*`float`*) – Radius of center disk to check for coverage

**Returns**

Percent coverage of variable_name

**Return type**

float

`geoips.plugins.modules.coverage_checkers.center_radius.`**`create_radius`**(*temp_arr*, *radius_pixels=300*, *x_center=0*, *y_center=0*)

Create a radius around given x,y coordinates in the 2d array.

Given the radius and the x,y coordinates it creates a circle around those points using the skimage.draw library

**Parameters**

- **`temp_arr`** (*`int`*) – The 2D array.

- **radius** (*int, optional*) – The radius of the circle. 500 is default value.
- **x** (*int, optional*) – The x coordinate of middle circle point. 0 is default value.
- **y** (*int, optional*) – The x coordinate of middle circle point. 0 is default value.

**Returns**
2D array with circle created at the x,y coordinate with the given radius All circles are marked as 1.

**Return type**
numpy.ndarray

`geoips.plugins.modules.coverage_checkers.center_radius.`**`plot_coverage`**(*main_ax*, *area_def*, *covg_args*)

Plot the coverage specified by the 'center_radius' function.

**Parameters**

- **main_ax** (*matplotlib.axis*) – Axis on which to plot coverage representation
- **area_def** (*pyresample.AreaDefinition*) – area def for current plot
- **covg_args** (*dict*) – product params dictionary for current product - to ensure we plot the correct coverage params

**Return type**
No return value

## geoips.plugins.modules.coverage_checkers.center_radius_rgba module

Coverage check routine for RGBA center radius coverage checks.

`geoips.plugins.modules.coverage_checkers.center_radius_rgba.`**`call`**(*xarray_obj*, *variable_name*, *area_def=None*, *radius_km=300*)

Coverage check routine for xarray objects with masked projected arrays.

Only calculates coverage within a "radius_km" radius of center.

**Parameters**

- **xarray_obj** (*xarray.Dataset*) – xarray object containing variable "variable_name"
- **variable_name** (*str*) – variable name to check percent unmasked radius_km (float) : Radius of center disk to check for coverage

**Returns**
Percent coverage of variable_name

**Return type**
float

### geoips.plugins.modules.coverage_checkers.masked_arrays module

Coverage check routine for masked arrays.

`geoips.plugins.modules.coverage_checkers.masked_arrays.call`(*xarray_obj*, *variable_name*, *area_def=None*)

Coverage check routine for xarray objects with masked projected arrays.

**Parameters**

- **xarray_obj** (*xarray.Dataset*) – xarray object containing variable "variable_name"
- **variable_name** (*str*) – variable name to check percent unmasked

**Returns**
Percent coverage of variable_name

**Return type**
float

### geoips.plugins.modules.coverage_checkers.numpy_arrays_nan module

Coverage check routine for masked arrays.

`geoips.plugins.modules.coverage_checkers.numpy_arrays_nan.call`(*xarray_obj*, *variable_name*, *area_def=None*)

Coverage check routine for xarray objects with projected numpy arrays.

**Parameters**

- **xarray_obj** (*xarray.Dataset*) – xarray object containing variable "variable_name"

- **variable_name** (*str*) – variable name to check percent unmasked

**Returns**
Percent coverage of variable_name

**Return type**
float

### geoips.plugins.modules.coverage_checkers.rgba module

Coverage check routine for RGBA arrays.

`geoips.plugins.modules.coverage_checkers.rgba.call`(*xarray_obj*, *variable_name*, *area_def=None*)

Coverage check routine for xarray objects with projected RGBA arrays.

**Parameters**

- **xarray_obj** (*xarray.Dataset*) – xarray object containing variable "variable_name"
- **variable_name** (*str*) – variable name to check percent unmasked

**Returns**
Percent coverage of variable_name

**Return type**
float

### geoips.plugins.modules.coverage_checkers.windbarbs module

Coverage check routine for windbarb xarrays.

`geoips.plugins.modules.coverage_checkers.windbarbs.call`(*xarray_obj*, *variable_name*, *area_def=None*)

Coverage check routine for wind barb xarray object.

**Parameters**

- **xarray_obj** (*xarray.Dataset*) – xarray object containing variable "variable_name"
- **variable_name** (*str*) – variable name to check percent unmasked.

**Returns**
Percent coverage of variable_name over area_def

**Return type**
float

### Module contents

geoips coverage_checkers init file.

## geoips.plugins.modules.filename_formatters package

### Subpackages

## geoips.plugins.modules.filename_formatters.utils package

### Submodules

### geoips.plugins.modules.filename_formatters.utils.tc_file_naming module

Utilities for TC filenaming, for use within geoips filename formatters.

`geoips.plugins.modules.filename_formatters.utils.tc_file_naming.`**`get_storm_subdir`**(*basin_ base_t tc_stor out- put_di sec- tor_inf*

Get the TC storm subdirectory.

`geoips.plugins.modules.filename_formatters.utils.tc_file_naming.`**`tc_storm_basedir`**(*basedi tc_yea tc_bas tc_stor out- put_di sec- tor_inf*

Produce base storm directory for TC web output.

**Parameters**

- **basedir** (*str*) – base directory
- **tc_year** (*int*) – Full 4 digit storm year

- `tc_basin` (*str*) –

  **2 character basin designation**
  SH Southern Hemisphere WP West Pacific EP East Pacific CP Central Pacific IO Indian Ocean AL Atlantic

- `tc_stormnum` (*int*) –

  **2 digit storm number**
  90 through 99 for invests 01 through 69 for named storms

**Returns**
**path** – Path to base storm web directory

**Return type**
str

`geoips.plugins.modules.filename_formatters.utils.tc_file_naming.update_extra_field`(*outp xar- ray_ area prod uct_ ex- tra_ ex- ist- ing_ ex- tra_ ex- tra_ ex- tra_ in- clud*

Finalize extra field using standard geoips arguments.

### Module contents

geoips filename formatters utils package init file.

### Submodules

#### geoips.plugins.modules.filename_formatters.basic_fname module

Filename specification using minimal basic attributes, and no subdirs.

`geoips.plugins.modules.filename_formatters.basic_fname.call`(*xarray_obj*, *area_def*, *product_name*, *output_type='.png'*, *basedir='/users/surratt/geoips/out*, *extra_field=None*)

Create basic filename, in a specific directory (with no subdirectories).

This filename format includes only the start time, platform name, source name, product name, sector name, and data provider, and a full path to basedir with no additional subdirectories.

#### geoips.plugins.modules.filename_formatters.geoips_fname module

Standard geoips filename production.

geoips.plugins.modules.filename_formatters.geoips_fname.**assemble_geoips_fname**(*basedir*, *product_name*, *source_na*, *platform_name*, *sector_name*, *coverage*, *resolution*, *product_datetir*, *output_type=*, *data_provi*, *extra=None*, *product_dir=N*, *source_dir*, *continent=None*, *country=None*, *area=None*, *subarea=None*, *state=Non*, *city=None*

Produce full output product path from product / sensor specifications.

**standard web paths are of the format:**
<basedir>/<continent>-<country>-<area>/<subarea>-<state>-<city>/ <product-name>/<sensorname>``

**standard filenames are of the format:**
<date{%Y%m%d}>.<time{%H%M%S}>.<satname>.<sensorname>.<productname>. <sectorname>.<coverage>.<dataprovider>.<extra>

**Parameters**

- **basedir** (*str*) – Full path to base directory of final product.
- **product_name** (*str*) – Name of product
- **source_name** (*str*) – Name of data source (sensor)
- **platform_name** (*str*) – Name of platform (satellite)
- **coverage** (*float*) – Image coverage, float between 0.0 and 100.0
- **resolution** (*float*) – Image resolution, float greater than 0.0
- **product_datetime** (*datetime.datetime*) – Datetime object - start time of data used to generate product.
- **output_type** (*str, optional*) – file extension type, default is png
- **data_provider** (*str, optional*) – String to include in filename "data_provider" field
- **extra** (*str, optional*) – String to include in filename "extra" field, default is None If None, use fillval of 'x'
- **continent** (*str, optional*) – String to include in filename "continent" field, default is None If None, use fillval of 'x'
- **country** (*str, optional*) – String to include in filename "country" field, default is None If None, use fillval of 'x'
- **area** (*str, optional*) – String to include in filename "area" field, default is None If None, use fillval of 'x'
- **subarea** (*str, optional*) – String to include in filename "subarea" field, default is None If None, use fillval of 'x'
- **state** (*str, optional*) – String to include in filename "state" field, default is None If None, use fillval of 'x'
- **city** (*str, optional*) – String to include in filename "city" field, default is None If None, use fillval of 'x'

`geoips.plugins.modules.filename_formatters.geoips_fname.call(area_def, xarray_obj, product_name, coverage=None, output_type='png', output_type_dir=None, product_dir=None, product_subdir=None, source_dir=None, basedir='/users/surratt/geoips/ou`

Create GeoIPS standard filenames, sector-based subdirs.

This uses the sector specification (continent, country, area, subarea, state, city), product name, source name, and platform name to generate a full unique path, as well as additional attributes to create a fully unique file name.

`geoips.plugins.modules.filename_formatters.geoips_fname.geoips_fname_remove_duplicates`

remove_duplicates function currently not defined.

If defined, this function will identify duplicate files, and remove appropriately. It should identify duplicates specifically based on the format/location of the geoips_fname formatted files.

Currently returns empty lists. When defined, will return a list of deleted files and a list of saved files.

## geoips.plugins.modules.filename_formatters.geoips_netcdf_fname module

Standard GeoIPS NetCDF filename production.

`geoips.plugins.modules.filename_formatters.geoips_netcdf_fname.assemble_geoips_netcdf_`

Produce full output product path from product / sensor specifications.

**netcdf paths are of the format:**

**<basedir>/<product_name>/<source_name>/<platform_name>/**
<sector_name>/date{%Y%m%d}

**netcdf filenames are of the format:**

**<date{%Y%m%d}>.<time{%H%M%S}>.<platform_name>.<product_name>.**
<sector_name>.nc

**Parameters**

- **basedir** (*str*) – Base directory (additional subdirectories assembled below basedir)
- **product_name** (*str*) – Name of product, used in path and filename
- **source_name** (*str*) – Name of data source (sensor), used in path and filename
- **platform_name** (*str*) – Name of platform (satellite), used in path and filename
- **coverage** (*float*) – Image coverage, float between 0.0 and 100.0, used in filename
- **product_datetime** (*datetime*) – Datetime object - start time of data used to generate product, used in filename

geoips.plugins.modules.filename_formatters.geoips_netcdf_fname.**call**(*area_def*, *xarray_obj*, *product_names*, *coverage=None*, *output_type='nc'*, *output_type_dir=None*, *product_dir=None*, *product_subdir=None*, *source_dir=None*, *basedir=None*)

Filename formatting for standard GeoIPS-style NetCDF outputs.

This uses the "assemble_geoips_netcdf_fname" function to appropriately assemble the filename from a base directory, product name, source name, platform nae, sector name, and product time, to allow reuse of this basic filename format from multiple filename formatter plugins.

### geoips.plugins.modules.filename_formatters.geotiff_fname module

Standard GeoIPS GEOTIFF filename formatter.

geoips.plugins.modules.filename_formatters.geotiff_fname.**call**(*area_def*, *xarray_obj*, *product_name*, *coverage=None*, *output_type='tif'*, *output_type_dir=None*, *product_dir=None*, *product_subdir=None*, *source_dir=None*, *basedir='/users/surratt/geoips/c*, *output_dict=None*)

GEOTIFF filename formatter.

This uses the standard "geoips_fname" formatter, but with a default output type of "tif".

## geoips.plugins.modules.filename_formatters.metadata_default_fname module

Default TC metadata filename formatter.

`geoips.plugins.modules.filename_formatters.metadata_default_fname.call`(*area_def*, *xarray_obj*, *product_filename*, *metadata_dir='metadata*, *metadata_type='sector_i*, *basedir='/users/sur*, *output_dict=None*)

Generate TC metadata filenames.

This uses attributes on both the xarray and area_def in order to produce the YAML metadata output specifically for TC sectors. Not valid for other sector types.

This uses the "tc_storm_basedir" utility to ensure a consistent path to the storm directory (so products and metadata end up in the same location)

## geoips.plugins.modules.filename_formatters.tc_clean_fname module

Clean TC filename production (no backgrounds or overlays).

geoips.plugins.modules.filename_formatters.tc_clean_fname.**call**(*area_def*, *xarray_obj*, *product_name*, *coverage=None*, *output_type='png'*, *output_type_dir=None*, *product_dir=None*, *product_subdir=None*, *source_dir=None*, *basedir='/users/surratt/geoips*, *output_dict=None*)

Clean TC product filename formatter (no gridlines, titles, etc).

This ensures output ends up in "png_clean" directory, with "-clean" appended to the extra field, to avoid conflict with tc_fname based annotated imagery. Uses "tc_fname" module as a base.

**Parameters**

- **area_def** (*pyresample AreaDefinition*) – Contains metadata regarding sector
- **xarray_obj** (*xarray Dataset*) – Contains metadata regarding dataset
- **product_name** (*str*) – String product_name specification for use in filename
- **coverage** (*float*) – Percent coverage, for use in filename
- **output_type** (*str, optional*) – Requested output format, ie png, jpg, tif, etc, defaults to None.
- **output_type_dir** (*str, optional*) – Directory name for given output type (ie png_clean, png, etc), defaults to None.
- **product_dir** (*str, optional*) – Directory name for given product, defaults to None.
- **product_subdir** (*str, optional*) – Subdir name for given product, if any, defaults to None.
- **source_dir** (*str, optional*) – Directory name for given source, defaults to None.

- **basedir** (*str, optional*) – Base directory, defaults to $TCWWW.

**Returns**
Full path to output "clean" filename - with "-clean" appended to extra field, and "_clean" appended to output_type_dir.

**Return type**
str

## geoips.plugins.modules.filename_formatters.tc_fname module

Standard TC filename formatter.

geoips.plugins.modules.filename_formatters.tc_fname.**assemble_tc_fname**(*basedir*, *tc_year*, *tc_basin*, *tc_stormnum*, *output_type*, *product_name*, *source_name*, *platform_name*, *coverage*, *product_datetime*, *intensity=None*, *extra=None*, *output_type_dir=None*, *product_dir=None*, *product_subdir=None*, *output_dict=None*, *sector_info=None*)

Produce full output product path from product / sensor specifications.

**tc web paths are of the format:**

**<basedir>/tc<tc_year>/<tc_basin>/<tc_basin><tc_stormnum><tc_year>/**
<output_type>/<product_name>/<platform_name>/

**tc web filenames are of the format:**

**<date{%Y%m%d%H%M>_<tc_basin><tc_stormnum><tc_year>_<source_name>_**
<platform_name>_<product_name>_<intensity>_<coverage>_ <extra>.<output_type>

**Parameters**

- **basedir** (*str*) – Base directory for output file.
- **tc_year** (*int*) – Full 4 digit storm year
- **tc_basin** (*str*) –

  **2 character basin designation**
  SH Southern Hemisphere WP West Pacific EP East Pacific CP Central Pacific IO Indian Ocean AL Atlantic

- **tc_stormnum** (*int*) –

  **2 digit storm number**
  90 through 99 for invests 01 through 69 for named storms

- **output_type** (*str*) – file extension type
- **product_name** (*str*) – Name of product
- **source_name** (*str*) – Name of data source (sensor)
- **platform_name** (*str*) – Name of platform (satellite)
- **coverage** (*float*) – Image coverage, float between 0.0 and 100.0
- **product_datetime** (*datetime.datetime*) – Datetime object - start time of data used to generate product
- **output_type_dir** (*str*) – Default output_type, dir name
- **product_dir** (*str*) – Default product_name, dir name

**Returns**
full path to output file

**Return type**
str

geoips.plugins.modules.filename_formatters.tc_fname.**call**(*area_def*, *xarray_obj*, *product_name*, *coverage=None*, *output_type='png'*, *output_type_dir=None*, *product_dir=None*, *product_subdir=None*, *source_dir=None*, *basedir='/users/surratt/geoips/outdirs*, *extra_field=None*, *output_dict=None*)

Create standard TC filenames.

**See also:**

*geoips.plugins.modules.filename_formatters.tc_fname.assemble_tc_fname*
This uses the shared utility "assemble_tc_fname", such that a common filename can be used by related filename formatters.

geoips.plugins.modules.filename_formatters.tc_fname.**tc_fname_remove_duplicates**(*fname*, *mins_to_*, *remove_file*

Remove tc_fname duplicate files.

Matches storm name, sensor name, platform name, product name, and resolution for all files within "mins_to_remove" minutes of the current file. All other fields are wild carded during the matching process.

## geoips.plugins.modules.filename_formatters.text_winds_day_fname module

Filename formatter for full-day text windspeed products.

geoips.plugins.modules.filename_formatters.text_winds_day_fname.**call**(*xarray_obj*, *extension='.txt'*, *basedir='/users/surrat*

Create full-day text windspeed filenames.

text_winds_day_fname includes only YYYYMMDD in the filename, so all data for a full day is appended into a single file.

**See also:**

`geoips.plugins.modules.filename_formatters.text_winds_full_fname.`
assemble_text_windspeeds_text_full_fname Shared utility for generating similarly formatted windspeed filenames.

## geoips.plugins.modules.filename_formatters.text_winds_full_fname module

Filename formatter for text windspeed products.

`geoips.plugins.modules.filename_formatters.text_winds_full_fname.`**`assemble_windspeeds_t`**

Produce full output product path using product / sensor specifications.

**Parameters**

- **`basedir`** (*str*) – base directory
- **`source_name`** (*str*) – Name of source (sensor)
- **`platform_name`** (*str*) – Name of platform (satellite)
- **`data_provider`** (*str*) – Name of data provider
- **`product_datetime`** (*datetime.datetime*) – Start time of data used to generate product
- **`dt_format`** (*str, default="%Y%m%d.%H%M"*) – Format used to display product_datetime within filename
- **`extension`** (*str, default=".txt"*) – File extension, specifying type.
- **`creation_time`** (*datetime.datetime, default=None*) – Include given creation_time of file in filename If None, do not include creation time.

**Returns**

**full path of output filename of the format:**

<basedir>/<source_name>_<data_provider>_<platform_name>_ surface_winds_<YYYYMMDDHHMN>

**Return type**
str

### Examples

```
>>> startdt = datetime.strptime('20200216T001412', '%Y%m%dT%H%M%S')
>>> assemble_windspeeds_text_full_fname(
...     '/outdir',
...     'smap-spd',
...     'smap',
...     'remss',
...     startdt,
...     '%Y%m%d'
...     )
'/outdir/smap-spd_remss_smap_surface_winds_20200216'
```

`geoips.plugins.modules.filename_formatters.text_winds_full_fname.call`(*xarray_obj*, *extension='.txt'*, *basedir='/users/surra*

Create a single text winds file for all data in the current xarray.

This text windspeed filename includes YYYYMMDD.HHMN in the filename in order to include only the current datafile in the file.

**See also:**

**geoips.plugins.modules.filename_formatters.text_winds_full_fname.**
assemble_windspeeds_text_full_fname Shared utility to create filenames with similar formatting requirements.

## geoips.plugins.modules.filename_formatters.text_winds_tc_fname module

Filename formatter for TC-specific text windspeed outputs.

`geoips.plugins.modules.filename_formatters.text_winds_tc_fname.assemble_windspeeds_tex`

Produce full output product path from product / sensor specifications.

**Parameters**

- **basedir** (*str*) – base directory
- **tc_year** (*int*) – Full 4 digit storm year
- **tc_basin** (*str*) –

  **2 character basin designation**
  SH Southern Hemisphere WP West Pacific EP East Pacific CP Central Pacific IO Indian Ocean AL Atlantic
- **tc_stormnum** (*int*) –

  **2 digit storm number**
  90 through 99 for invests 01 through 69 for named storms
- **platform_name** (*str*) – Name of platform (satellite)
- **product_datetime** (*datetime*) – Start time of data used to generate product

**Returns**

**full path of output filename of the format:**

**<basedir>/tc<tc_year>/<tc_basin>/<tc_basin><tc_stormnum><tc_year>/**
txt/<source_name>_<platform_name>_surface_winds_<data_provider>_ <YYYYMMDDHHMN>

**Return type**
str

### Examples

```
>>> startdt = datetime.strptime('20200216T001412', '%Y%m%dT%H%M%S')
>>> assemble_windspeeds_text_tc_fname('/outdir',
...     2020,
...     'SH',
...     16,
...     'smap-spd',
...     'smap',
...     startdt,
...     'remss')
'/outdir/tc2020/SH/SH162020/txt/
```

`geoips.plugins.modules.filename_formatters.text_winds_tc_fname.call`(*xarray_obj*, *extension='.txt'*, *basedir='/users/surratt/*, *output_dict=None*)

Create TC-specific text windspeed filename.

**See also:**

**geoips.plugins.modules.filename_formatters.text_winds_tc_fname.**
assemble_windspeeds_text_tc_fname Shared utility to facilitate creating multiple similar filenames from the same code.

## Module contents

geoips filename_formatters init file.

### geoips.plugins.modules.interpolators package

#### Subpackages

##### geoips.plugins.modules.interpolators.pyresample_wrappers package

###### Submodules

###### geoips.plugins.modules.interpolators.pyresample_wrappers.interp_gauss module

Geoips plugin for driving pyresample Gaussian interpolation.

geoips.plugins.modules.interpolators.pyresample_wrappers.interp_gauss.**call**(*area_def*, *input_xarray*, *output_xarray*, *varlist*, *array_num=Non*, *sigmaval=None*, *drop_nan=Fal*

Pyresample interp_kd_tree gaussian interpolation GeoIPS plugin.

###### geoips.plugins.modules.interpolators.pyresample_wrappers.interp_nearest module

Geoips plugin for driving pyresample Nearest Neighbor interpolation.

geoips.plugins.modules.interpolators.pyresample_wrappers.interp_nearest.**call**(*area_def*, *input_xarray*, *output_xarray*, *varlist*, *array_num=N*

Pyresample interp_kd_tree nearest neighbor GeoIPS plugin.

geoips.plugins.modules.interpolators.pyresample_wrappers.interp_nearest.**get_final_roi**(

Get the final interpolation Radius of Influence.

This takes the maximum of the xarray attribute, area_def pixel width, and area_def pixel height.

### Module contents

Geoips pyresample interpolators init file.

### geoips.plugins.modules.interpolators.scipy_wrappers package

#### Submodules

#### geoips.plugins.modules.interpolators.scipy_wrappers.interp_grid module

Geoips plugin for driving scipy griddata interpolation.

`geoips.plugins.modules.interpolators.scipy_wrappers.interp_grid.call`(*area_def*, *input_xarray*, *output_xarray*, *varlist*, *array_num=None*, *method=None*)

Scipy griddata interpolation GeoIPS plugin.

#### Module contents

Geoips scipy-based interpolators init file.

### geoips.plugins.modules.interpolators.utils package

#### Submodules

#### geoips.plugins.modules.interpolators.utils.boxdefinitions module

Classes for geometry operations allowing masked data in swath corners.

This package uses the pyresample geometry package as base classes:

# pyresample, Resampling of remote sensing image data in python # # Copyright (C) 2010-2015 # # Authors: # Esben S. Nielsen # Thomas Lavergne

`class geoips.plugins.modules.interpolators.utils.boxdefinitions.Line(start, end)`

Bases: `object`

A Line between two lat/lon points.

**end = None**

**intersection**(*other*)

Identify intersection between two lines.

Says where, if two lines defined by the current line and the *other_line* intersect.

**intersects**(*other_line*)

Test two lines intersect.

Says if two lines defined by the current line and the *other_line* intersect. A line is defined as the shortest tracks between two points.

**start = None**

`class geoips.plugins.modules.interpolators.utils.boxdefinitions.MaskedCornersSwathDefi`

Bases: `SwathDefinition`

Swath defined by lons and lats.

Allows datasets with potentially masked data in the corners.

**Parameters**

- **lons** (*numpy array*) – Longitude values
- **lats** (*numpy array*) – Latitude values
- **nprocs** (*int, optional*) – Number of processor cores to be used for calculations.

**shape**

Swath shape

**Type**

tuple

**size**

Number of elements in swath

**Type**

int

**ndims**

Swath dimensions

**Type**
int

**Properties**

**----------**

**lons**

Swath lons

**Type**
object

**lats**

Swath lats

**Type**
object

**cartesian_coords**

Swath cartesian coordinates

**Type**
object

**property corners**

Return current area corners.

**get_bounding_box_lonlats**(*npts=100*)

Return lon/lats along bounding Arcs.

**Parameters**
**npts** (*int*) – Number of points to return along each line

**Returns**

- **(top, right, bottom, left)** (*4 tuples containing lists*) – of len npts of lons/lats
- *retval = (list(tplons),list(tplats)),* – (list(rtlons),list(rtlats)), (list(btlons),list(btlats)), (list(ltlons),list(ltlats))
- *eg for n=3* – ([tplon0,tplon1,tplon2],[tplat0,tplat1,tplat2]), ([rtlon0,rtlon1,rtlon2],[rtlat0,rtlat1,rtlat2]), ([bt-lon0,btlon1,btlon2],[btlat0,btlat1,btlat2]), ([lt-lon0,ltlon1,ltlon2],[ltlat0,ltlat1,ltlat2]),

**intersection**(*other*)

Return current area intersection polygon corners.

*other* allows for potentially masked data in the corners.

**Parameters**
**other** (*object*) – Instance of subclass of BaseDefinition

**Returns**
**(corner1, corner2, corner3, corner4)**

**Return type**
tuple of points

**overlaps_minmaxlatlon**(*other*)

Test current area overlaps *other* area.

**This is based solely on the min/max lat/lon of areas, assuming the**
boundaries to be along lat/lon lines.

**Parameters**
**other** (*object*) – Instance of subclass of BaseDefinition

**Returns**
**overlaps**

**Return type**
bool

class geoips.plugins.modules.interpolators.utils.boxdefinitions.**PlanarPolygonDefinitio**

Bases: `CoordinateDefinition`

Planar polygon definition.

**property corners**

Return corners.

**get_bounding_box_lonlats**(*npts=100*)

Return array of lon/lats along the bounding lat/lon lines.

**Parameters**
**npts** (*int*) – Number of points to return along each line

**Returns**

- **(top, right, bottom, left)** (*4 tuples containing lists*) – of len npts of lons/lats

- *retval = (list(tplons),list(tplats)),* – (list(rtlons),list(rtlats)), (list(btlons),list(btlats)), (list(ltlons),list(ltlats))
- *eg for n=3* – ([tplon0,tplon1,tplon2],[tplat0,tplat1,tplat2]), ([rtlon0,rtlon1,rtlon2],[rtlat0,rtlat1,rtlat2]), ([btlon0,btlon1,btlon2],[btlat0,btlat1,btlat2]), ([ltlon0,ltlon1,ltlon2],[ltlat0,ltlat1,ltlat2]),

**intersection**(*other*)

Return current area intersection polygon corners against other.

**Parameters**
**other** (*object*) – Instance of subclass of BaseDefinition

**Returns**
**(corner1, corner2, corner3, corner4)**

**Return type**
tuple of points

**overlaps**(*other*)

Test if the current area overlaps the *other* area.

This is based solely on the corners of areas, assuming the boundaries to be straight lines.

**Parameters**
**other** (*object*) – Instance of subclass of BaseDefinition

**Returns**
**overlaps**

**Return type**
bool

**overlaps_minmaxlatlon**(*other*)

Determine if overlaps.

geoips.plugins.modules.interpolators.utils.boxdefinitions.**get_2d_false_corners**(*box_def*)

Identify false corners.

geoips.plugins.modules.interpolators.utils.boxdefinitions.**planar_intersection_polygon**(

Get the intersection polygon between two areas.

geoips.plugins.modules.interpolators.utils.boxdefinitions.**planar_point_inside**(*point*, *corners*)

Identify point inside 4 corners.

This DOES NOT USE great circle arcs as area boundaries.

## geoips.plugins.modules.interpolators.utils.interp_pyresample module

Interpolation methods using pyresample routines.

`geoips.plugins.modules.interpolators.utils.interp_pyresample.`**`get_data_box_definition`**`(`*so*
*lo*
*la*

Obtain pyresample geometry definitions.

For use with pyresample based reprojections

**Parameters**

- **`source_name`** (*`str`*) – geoips source_name for data type
- **`lons`** (*`ndarray`*) – Numpy array of longitudes, 0 to 360
- **`lats`** (*`ndarray`*) – Numpy array of latitudes, -90 to 90

`geoips.plugins.modules.interpolators.utils.interp_pyresample.`**`interp_kd_tree`**`(`*list_of_array*
*area_definitio*
*data_box_def*
*ra-*
*dius_of_influ*
*in-*
*terp_type='ne*
*sig-*
*mas=None*,
*neigh-*
*bours=None*,
*nprocs=None*
*fill_value=No*

Interpolate using pyresample's kd_tree.resample_nearest method.

**Parameters**

- **`list_of_array`** (*`list of numpy.ndarray`*) – list of arrays to be interpolated
- **`area_definition`** (*`areadef`*) – pyresample area_definition object of current region of interest.
- **`data_box_definition`** (*`datadef`*) – pyresample/geoips data_box_definition specifying region covered by source data.
- **`radius_of_influence`** (*`float`*) – radius of influence for interpolation
- **`interp_type`** (*`str, default='nearest'`*) – One of 'nearest' or 'gauss' - kd_tree resampling methods.
- **`sigmas`** (*`int, default=None`*) –

**Used for interp_type 'gauss' - multiplication factor for sigmas option:**

- sigmas = [sigmas]*len(list_of_arrays)

### geoips.plugins.modules.interpolators.utils.interp_scipy module

Interpolation routines from the scipy package.

`geoips.plugins.modules.interpolators.utils.interp_scipy.`**`interp_gaussian_kde`**(*data_lons*, *data_lats*, *target_lons*, *target_lats*, *vw_method=*

Interpolate a given array of non-uniform data using scipy.stats.gaussian_kde.

This is not finalized.

**Parameters**

- **`data_array`** (*`numpy.ma.core.MaskedArray`*) – numpy array of data to interpolate
- **`data_lons`** (*`numpy.ma.core.MaskedArray`*) – numpy array of longitudes corresponding to original data, same shape as data_array
- **`data_lats`** (*`numpy.ma.core.MaskedArray`*) – numpy array of latitudes corresponding to original data, same shape as data_array
- **`target_lons`** (*`numpy.ma.core.MaskedArray`*) – 2d numpy array of desired longitudes
- **`target_lats`** (*`numpy.ma.core.MaskedArray`*) – 2d numpy array of desired latitudes
- **`bw_method`** (*`str`*) – Bandwidth selection method (see scipy.stats.gaussian_kde)|

**See also:**

`scipy.stats.gaussian_kde`

`geoips.plugins.modules.interpolators.utils.interp_scipy.`**`interp_griddata`**(*data_array*, *data_lons*, *data_lats*, *min_gridlon*, *max_gridlon*, *min_gridlat*, *max_gridlat*, *numx_grid*, *numy_grid*, *method='linear'*)

Interpolate a given array of non-uniform data to a specified grid.

Uses scipy.interpolate.griddata

**Parameters**

- **data_array** (*numpy.ma.core.MaskedArray*) – numpy array of original data to be interpolated
- **data_lons** (*numpy.ma.core.MaskedArray*) – numpy array of longitudes corresponding to original data, same shape as data_array
- **data_lats** (*numpy.ma.core.MaskedArray*) – numpy array of latitudes corresponding to original data, same shape as data_array
- **min_gridlon** (*float*) –

  **minimum desired lon for the output grid**

  – -180.0 < min_gridlon < 180.0
- **max_gridlon** (*float*) –

  **maximum desired lon for the output grid**

  – -180.0 < max_gridlon < 180.0
- **min_gridlat** (*float*) –

  **minimum desired lat for the output grid**

  – -90.0 < min_gridlat < 90.0
- **max_gridlat** (*float*) –

  **maximum desired lat for the output grid**

  – -90.0 < max_gridlat < 90.0
- **numx_grid** (*int*) – number desired longitude points in the output grid
- **numy_grid** (*int*) – number desired latitude points in the output grid

- **method** (*str, default='linear'*) – A string specifying the interpolation method to use for scipy.interpolate.griddata. One of 'nearest', 'linear' or 'cubic'

### Module contents

Geoips interpolators utils init file.

### Module contents

Geoips interpolators init file.

### geoips.plugins.modules.output_formatters package

### Submodules

### geoips.plugins.modules.output_formatters.full_disk_image module

Full disk image matplotlib-based output format.

`geoips.plugins.modules.output_formatters.full_disk_image.`**`call`**(*area_def*, *xarray_obj*, *product_name*, *output_fnames*, *clean_fname=None*, *product_name_title=None*, *mpl_colors_info=None*, *feature_annotator=None*, *gridline_annotator=None*, *product_datatype_title=None*, *bg_data=None*, *bg_mpl_colors_info=None*, *bg_xarray=None*, *bg_product_name_title=None*, *bg_datatype_title=None*, *remove_duplicate_minrange=Non*

Plot full disk image.

## geoips.plugins.modules.output_formatters.geotiff_standard module

Geotiff image rasterio-based output format.

`geoips.plugins.modules.output_formatters.geotiff_standard.call(area_def, xarray_obj, product_name, output_fnames, product_name_title=None, mpl_colors_info=None, existing_image=None)`

Create standard geotiff output using rasterio.

`geoips.plugins.modules.output_formatters.geotiff_standard.get_rasterio_cmap_dict(mpl_cr scale_ scale_`

Get rasterio cmap dict.

`geoips.plugins.modules.output_formatters.geotiff_standard.scale_geotiff_data(plot_data, mpl_colors_ scale_data_ scale_data_ missing_value=(`

Scale geotiff data.

## geoips.plugins.modules.output_formatters.imagery_annotated module

Matplot-lib based annotated image output.

`geoips.plugins.modules.output_formatters.imagery_annotated.call(area_def, xarray_obj, product_name, output_fnames, clean_fname=None, product_name_title=None, mpl_colors_info=None, feature_annotator=None, gridline_annotator=None, product_datatype_title=None, bg_data=None, bg_mpl_colors_info=None, bg_xarray=None, bg_product_name_title=None, bg_datatype_title=None, remove_duplicate_minrange=None, title_copyright=None, title_formatter=None, output_dict=None)`

Plot annotated imagery.

## geoips.plugins.modules.output_formatters.imagery_clean module

Matplotlib-based clean image output.

geoips.plugins.modules.output_formatters.imagery_clean.**call**(*area_def*, *xarray_obj*, *product_name*, *output_fnames*, *product_name_title=None*, *mpl_colors_info=None*, *existing_image=None*, *remove_duplicate_minrange=None*, *fig=None*, *main_ax=None*, *mapobj=None*)

Plot clean image on matplotlib figure.

### geoips.plugins.modules.output_formatters.imagery_windbarbs module

Matplotlib-based windbarb annotated image output.

geoips.plugins.modules.output_formatters.imagery_windbarbs.**call**(*area_def*, *xarray_obj*, *prod-uct_name*, *out-put_fnames*, *clean_fname=None*, *prod-uct_name_title=None*, *mpl_colors_info=None*, *fea-ture_annotator=None*, *grid-line_annotator=None*, *prod-uct_datatype_title=None*, *bg_data=None*, *bg_mpl_colors_info=None*, *bg_xarray=None*, *bg_product_name_title=Non* *bg_datatype_title=None*, *re-move_duplicate_minrange=N* *ti-tle_copyright=None*, *ti-tle_formatter=None*)

Plot annotated windbarbs on matplotlib figure.

geoips.plugins.modules.output_formatters.imagery_windbarbs.**format_windbarb_data**(*xarray_* *prod-uct_nam*

Format windbarb data before plotting.

geoips.plugins.modules.output_formatters.imagery_windbarbs.**output_clean_windbarbs**(*area_* *clean* *mpl_c* *im-age_d* *for-mat-ted_d* *fig=N* *main_* *mapo*

Plot and save "clean" windbarb imagery.

No background imagery, coastlines, gridlines, titles, etc.

**Returns**
Full paths to all resulting output files.

**Return type**
list of str

`geoips.plugins.modules.output_formatters.imagery_windbarbs.plot_barbs(main_ax, mapobj, mpl_colors_info, formatted_data_dict)`

Plot windbarbs on matplotlib figure.

### geoips.plugins.modules.output_formatters.imagery_windbarbs_clean module

Matplotlib-based windbarb clean image output (no overlays or backgrounds).

`geoips.plugins.modules.output_formatters.imagery_windbarbs_clean.call(area_def, xarray_obj, product_name, output_fnames, product_name_title=None, mpl_colors_info=None, existing_image=None, remove_duplicate_min`

`fig=None, main_ax=None, mapobj=None)`

Plot clean windbarb imagery on matplotlib figure.

## geoips.plugins.modules.output_formatters.metadata_default module

Default YAML metadata output format.

geoips.plugins.modules.output_formatters.metadata_default.**call**(*area_def*, *xarray_obj*, *metadata_yaml_filename*, *product_filename*, *metadata_dir='metadata'*, *basedir='/users/surratt/geoips*, *output_dict=None*, *include_metadata_filename=Fa*

Produce metadata yaml file of sector info associated with final_product.

**Parameters**

- **area_def** (*AreaDefinition*) – Pyresample AreaDefintion object
- **final_product** (*str*) – Product that is associated with the passed area_def
- **metadata_dir** (*str, default='metadata'*) – Subdirectory name for metadata (using non-default allows for non-operational outputs)

**Returns**
Metadata yaml filename, if one was produced.

**Return type**
str

geoips.plugins.modules.output_formatters.metadata_default.**output_metadata_yaml**(*metadata*, *area_def*, *xarray_obj*, *product_filena*, *output_dict=*, *include_me*

Write out yaml file "metadata_fname" of sector info found in "area_def".

**Parameters**

- **metadata_fname** (*str*) – Path to output metadata_fname
- **area_def** (*AreaDefinition*) – Pyresample AreaDefinition of sector information
- **xarray_obj** (*xarray.Dataset*) – xarray Dataset object that was used to produce product
- **productname** (*str*) – Full path to full product filename that this YAML file refers to

**Returns**
Path to metadata filename if successfully produced.

**Return type**
str

geoips.plugins.modules.output_formatters.metadata_default.**update_sector_info_with_defa**

Update sector info found in "area_def" with standard metadata output.

**Parameters**

- **area_def** (*AreaDefinition*) – Pyresample AreaDefinition of sector information
- **xarray_obj** (*xarray.Dataset*) – xarray Dataset object that was used to produce product
- **product_filename** (*str*) – Full path to full product filename that this YAML file refers to

**Returns**

**sector_info dict with standard metadata added**

- bounding box
- product filename with wildcards
- basename of original source filenames

**Return type**
dict

### geoips.plugins.modules.output_formatters.metadata_tc module

TC product YAML metadata output format.

geoips.plugins.modules.output_formatters.metadata_tc.**call**(*area_def*, *xarray_obj*, *metadata_yaml_filename*, *product_filename*, *metadata_dir='metadata'*, *basedir='/users/surratt/geoips/outdir*, *output_dict=None*, *metadata_fname_dict=None*, *output_fname_dict=None*)

Produce metadata yaml file of sector info associated with final_product.

**Parameters**

- **area_def** (*AreaDefinition*) – Pyresample AreaDefintion object
- **final_product** (*str*) – Product that is associated with the passed area_def
- **metadata_dir** (*str, default="metadata"*) – Subdirectory name for metadata (using non-default allows for non-operational outputs)

**Returns**

Metadata yaml filename, if one was produced.

**Return type**

str

geoips.plugins.modules.output_formatters.metadata_tc.**output_tc_metadata_yaml**(*metadata_fn*, *area_def*, *xarray_obj*, *product_filenam*, *output_dict=No*, *metadata_fname*, *output_fname_*

Write out yaml file "metadata_fname" of sector info found in "area_def".

**Parameters**

- **metadata_fname** (*str*) – Path to output metadata_fname
- **area_def** (*AreaDefinition*) – Pyresample AreaDefinition of sector information
- **xarray_obj** (*xarray.Dataset*) – xarray Dataset object that was used to produce product
- **productname** (*str*) – Full path to full product filename that this YAML file refers to

**Returns**
Path to metadata filename if successfully produced.

**Return type**
str

geoips.plugins.modules.output_formatters.metadata_tc.**update_sector_info_with_coverage**(

Update sector info with coverage, for YAML metadata output.

geoips.plugins.modules.output_formatters.metadata_tc.**update_sector_info_with_data_time**

Update sector info with data times, for YAML metadata output.

## geoips.plugins.modules.output_formatters.netcdf_geoips module

Geoips style NetCDF output format.

geoips.plugins.modules.output_formatters.netcdf_geoips.**call**(*xarray_obj*, *product_names*, *output_fnames*)

Write GeoIPS style NetCDF to disk.

### geoips.plugins.modules.output_formatters.netcdf_xarray module

Standard xarray-based NetCDF output format.

`geoips.plugins.modules.output_formatters.netcdf_xarray.`**`call`**(*xarray_obj*, *product_names*, *output_fnames*)

Write xarray-based NetCDF outputs to disk.

`geoips.plugins.modules.output_formatters.netcdf_xarray.`**`write_xarray_netcdf`**(*xarray_obj*, *ncdf_fname*, *clobber=False*)

Write out xarray_obj to netcdf file named ncdf_fname.

### geoips.plugins.modules.output_formatters.text_winds module

Routines for outputting formatted text wind speed and vector data files.

`geoips.plugins.modules.output_formatters.text_winds.`**`call`**(*xarray_dict*, *varlist*, *output_fnames*, *append=False*, *overwrite=True*, *source_names=None*)

Write text windspeed output file.

`geoips.plugins.modules.output_formatters.text_winds.`**`write_text_winds`**(*xarray_obj*, *varlist*, *output_fnames*, *append=False*, *overwrite=True*, *source_names=None*)

Write out TC formatted text file of wind speeds.

**Parameters**

- **text_fname** (*str*) – String full path to output filename
- **speed_array** (*ndarray*) – array of windspeeds
- **time_array** (*ndarray*) – array of POSIX time stamps same length as speed_array

- **lon_array** (*ndarray*) – array of longitudes of same length as speed_array
- **lat_array** (*ndarray*) – array of latitudes of same length as speed_array
- **platform_name** (*str*) – String platform name

### geoips.plugins.modules.output_formatters.unprojected_image module

Matplotlib-based unprojected image output.

geoips.plugins.modules.output_formatters.unprojected_image.**call**(*xarray_obj*, *product_name*, *output_fnames*, *product_name_title=None*, *mpl_colors_info=None*, *x_size=None*, *y_size=None*, *savefig_kwargs=None*)

Plot unprojected image to matplotlib figure.

### Module contents

Geoips output formatter init file.

### geoips.plugins.modules.procflows package

### Submodules

### geoips.plugins.modules.procflows.config_based module

Processing workflow for config-based processing.

geoips.plugins.modules.procflows.config_based.**call**(*fnames*, *command_line_args=None*)

Workflow for efficiently running all required outputs.

Includes all sectors and products specified in a YAML output config file. Specified via a YAML config file

**Parameters**

- **fnames** (*list*) – List of strings specifying full paths to input file names to process
- **command_line_args** (*dict*) – dictionary of command line arguments

**Returns**

0 for successful completion, non-zero for error (incorrect comparison, or failed run)

**Return type**

int

`geoips.plugins.modules.procflows.config_based.`**`get_area_def_list_from_dict`**`(`*area_defs*`)`

Get a list of actual area_defs from full dictionary.

Dict returned from get_area_defs_from_available_sectors

`geoips.plugins.modules.procflows.config_based.`**`get_area_defs_from_available_sectors`**`(`*avai com man xobj vari able*

Get all required area_defs for the given set of parameters.

YAML config parameters (config_dict), command_line_args, xobjs, and required variables. Command line args override config specifications.

**Parameters**

- **available_sectors_dict** (*dict*) – Dictionary of all requested sector_types (specified in YAML config)
- **command_line_args** (*dict*) – Dictionary of command line arguments - any command line argument that is also a key in available_sectors_dict[<sector_type>] will replace the value in the available_sectors_dict[<sector_type>]
- **xobjs** (*dict*) – Dictionary of xarray datasets, used in determining start/end time of data files for identifying dynamic sectors
- **variables** (*list*) – List of required variables, for determining center coverage for TCs

**Returns**

Dictionary of required area_defs, with area_def.name as the dictionary keys. Based on YAML config-specified available_sectors, and command line args

**Return type**

dict

### Notes

- Each area_def.name key has one or more "sector_types" associated with it.
- Each sector_type dictionary contains the actual "requested_sector_dict" from the YAML config, and the actual AreaDefinition object that was returned.
  - `area_defs[area_def.name][sector_type]['requested_sector_dict']`
  - `area_defs[area_def.name][sector_type]['area_def']`

`geoips.plugins.modules.procflows.config_based.`**`get_bg_xarray`**`(`*sect_xarrays*, *area_def*, *prod_plugin*, *resampled_read=False*`)`

Get background xarray.

`geoips.plugins.modules.procflows.config_based.`**`get_config_dict`**`(`*config_yaml_file*`)`

Populate the full config dictionary from a given YAML config file.

Includes both sector and output specifications.

**Parameters**

**`config_yaml_file`** (*str*) – Full path to YAML config file, containing sector and output specifications. YAML config files support environment variables in entries flagged with !ENV

**Returns**

Return dictionary of both sector and output specifications, as found in config_yaml_file. The output dictionary references the "sector_types" found in the available_sectors dictionary, each output_type requests a specific "sector_type" to be used for processing.

**Return type**

dict

`geoips.plugins.modules.procflows.config_based.`**`get_required_outputs`**`(`*config_dict*, *sector_type*`)`

Get only the required outputs from the current sector_type.

`geoips.plugins.modules.procflows.config_based.`**`get_resampled_read`**`(`*config_dict*, *area_defs*, *area_def_id*, *sector_type*, *reader*, *fnames*, *variables*`)`

Return dictionary of xarray datasets for a given area def.

Xarrays resampled to area_def

`geoips.plugins.modules.procflows.config_based.`**`get_sectored_read`**(*config_dict*, *area_defs*, *area_def_id*, *sector_type*, *reader*, *fnames*, *variables*)

Return dictionary of xarray datasets for a given area def.

Xarrays sectored to area_def

`geoips.plugins.modules.procflows.config_based.`**`get_variables_from_available_outputs_dic`**

Get required variables for all outputs for a given "source_name".

Outputs specified within the YAML config.

**Parameters**

- **`available_outputs_dict`** (*`dict`*) – Dictionary of all requested output_types (specified in YAML config)
- **`source_name`** (*`str`*) – Find all required variables for the passed "source_name"
- **`sector_types`** (*`list, default=None`*) – if sector_types list of strings is passed, only include output_types that require one of the passed "sector_types"

**Returns**

List of all required variables for all output products for the given source_name

**Return type**

list

`geoips.plugins.modules.procflows.config_based.`**`initialize_final_products`**(*final_products*, *cpath*, *cmodule*)

Initialize the final_products dictionary with cpath dict key if needed.

**Parameters**

- **final_products** (*dict*) – Dictionary of final products, with keys of final required "compare_path" Products with no compare_path specified are stored with the key "no_comparison"
- **cpath** (*str*) – Key to add to final_products dictionary

**Returns**
Return final_products dictionary, updated with current "cpath" key: final_products[cpath]['files'] = <list_of_files_in_given_cpath>

**Return type**
dict

`geoips.plugins.modules.procflows.config_based.`**`is_required_sector_type`**`(`*available_outputs_di sector_type*`)`

Check if current sector is required for any outputs.

Check if a given sector_type is required for any currently requested output_types

**Parameters**

- **available_outputs_dict** (*dict*) – Dictionary of all requested output_types (specified in YAML config)
- **sector_type** (*str*) – Determine if any output_types require the currently requested "sector_type"

**Returns**

- True if any output_types require the passed "sector_type"
- False if no output_types require the passed "sector_type"

**Return type**
bool

`geoips.plugins.modules.procflows.config_based.`**`process_unsectored_data_outputs`**`(`*final_prod available_outpu available_secto xobjs, variables, command_line write_to_p*`)`

Process unsectored data output.

Loop through all possible outputs, identifying output types that require unsectored data output. Produce all required unsectored data output, update final_products dictionary accordingly, and return final_products dictionary with the new unsectored outputs.

**Parameters**

- **final_products** (*dict*) – Dictionary of final products, with keys of final required "compare_path" Products with no compare_path specified are stored with the key "no_comparison"
- **available_outputs_dict** (*dict*) – Dictionary of all available output product specifications
- **available_sectors_dict** (*dict*) – Dictionary of available sector types - we are looking for available sectors that contain the "unsectored" keyword.
- **xobjs** (*dict*) – Dictionary of xarray datasets, for use in producing unsectored output formats
- **variables** (*list*) – List of strings of required variables in the given product.

**Returns**

Return final_products dictionary, updated with current "cpath" key: final_products[cpath]['files'] = <list_of_files_in_given_cpath>

**Return type**

dict

geoips.plugins.modules.procflows.config_based.**requires_bg**(*available_outputs_dict*, *sector_type*)

Check if current sector requires background imagery.

Check if a given sector_type is requested for any product_types that also require background imagery.

**Parameters**

- **available_outputs_dict** (*dict*) – Dictionary of all requested output_types (specified in YAML config)
- **sector_type** (*str*) – sector_type to determine if any output_types that require background imagery also request the passed sector_type

**Returns**

- True if any output_types that require background imagery require the passed "sector_type"
- False if no output_types require both background imagery and the passed "sector_type"

**Return type**
bool

`geoips.plugins.modules.procflows.config_based.`**`set_comparison_path`**(*output_dict*, *product_name*, *output_type*, *command_line_args=None*)

Replace variables specified by <varname> in compare_path.

**Parameters**

- **config** (*dict*) – Dictionary of output specifications, containing key "compare_path"
- **product_name** (*str*) – Current requested product name, all instances of <product> in compare_path replaced with product_name argument
- **output_type** (*str*) – Current requested output type, all instances of <output> in compare_path replaced with output argument

**Returns**
Return a single string with the fully specified comparison path for current product

**Return type**
str

`geoips.plugins.modules.procflows.config_based.`**`update_output_dict_from_command_line_arg`**

Update output dict from command line args.

## geoips.plugins.modules.procflows.single_source module

Processing workflow for single data source processing.

`geoips.plugins.modules.procflows.single_source.`**`add_filename_extra_field`**(*xarray_obj*, *field_name*, *field_value*)

Add filename extra field.

`geoips.plugins.modules.procflows.single_source.`**`call`**(*fnames*, *command_line_args=None*)

Workflow for running products from a single data source.

**Parameters**

- **fnames** (*list*) – List of strings specifying full paths to input file names to process
- **command_line_args** (*dict*) – dictionary of command line arguments

**Returns**
Return list of strings specifying full paths to output products that were produced

**Return type**
list

**See also:**

**geoips.commandline.args**
Complete list of available command line args.

geoips.plugins.modules.procflows.single_source.**combine_filename_extra_fields**(*source_xarr*
*dest_xarray*

Combine filename extra fields.

geoips.plugins.modules.procflows.single_source.**get_alg_xarray**(*sect_xarrays*, *area_def*, *prod_plugin*, *resector=True*, *resampled_read=False*, *variable_names=None*)

Get alg xarray.

geoips.plugins.modules.procflows.single_source.**get_area_defs_from_command_line_args**(*co*
*xo*
*va*
*ab*
*fil-*
*ter*

Get area def from command line args.

geoips.plugins.modules.procflows.single_source.**get_filename**(*filename_formatter*, *prod_plugin=None*, *alg_xarray=None*, *area_def=None*, *supported_filenamer_types=None*, *output_dict=None*, *filename_formatter_kwargs=None*)

Get filename.

geoips.plugins.modules.procflows.single_source.**get_output_filenames**(*fname_formats*, *output_dict*, *prod_plugin*, *xarray_obj=None*, *area_def=None*, *supported_filenamer_types*

Get output filenames.

geoips.plugins.modules.procflows.single_source.**output_all_metadata**(*output_dict*, *output_fnames*, *metadata_fnames*, *xarray_obj*, *area_def=None*)

Output all metadata.

geoips.plugins.modules.procflows.single_source.**pad_area_definition**(*area_def*, *source_name=None*, *force_pad=False*, *x_scale_factor=1.5*, *y_scale_factor=1.5*)

Pad area definition.

geoips.plugins.modules.procflows.single_source.**plot_data**(*output_dict*, *alg_xarray*, *area_def*, *prod_plugin*, *output_kwargs*, *fused_xarray_dict=None*, *no_output=False*)

Plot data.

alg_xarray used for filename formats, etc. If included, fused_xarray_dict used for output format call

`geoips.plugins.modules.procflows.single_source.`**`print_area_def`**(*area_def*, *print_str*)

Print area def.

`geoips.plugins.modules.procflows.single_source.`**`process_sectored_data_output`**(*xobjs*, *variables*, *prod_plugin*, *output_dict*, *area_def=No*

Process sectored data output.

If product family is 'sectored_xarray_dict_to_output_format', call 'process_xarray_dict_to_output_format', store the result in a list, and return it.

`geoips.plugins.modules.procflows.single_source.`**`process_xarray_dict_to_output_format`**(*xol*

*va*
*ab*
*pro*
*ou*
*pu*
*are*

Process xarray dict to output format.

`geoips.plugins.modules.procflows.single_source.`**`remove_unsupported_kwargs`**(*module*, *requested_kwargs*)

Remove unsupported keyword arguments.

`geoips.plugins.modules.procflows.single_source.`**`verify_area_def`**(*area_defs*, *check_area_def*, *data_start_datetime*, *data_end_datetime*, *time_range_hours=3*)

Verify current area definition is the closest to the actual data time.

When looping through multiple dynamic area definitions for a full data file that temporally covers more than one dynamic area_def, there is no way of knowing which dynamic area_def has the best coverage until AFTER we have actually sectored the data to the specific area_def.

Call this utility on the current area_def (check_area_def) for the sectored data file, plus the full list of area definitions (area_defs) that cover the FULL data file.

**Returns**

- True if the current area definition is NOT dynamic
- True if the current area definition IS dynamic and is the closest temporally to the sectored data.
- False if the current area definition is removed when filtering the list of area definitions based on the actual sectored data time.

**Return type**
bool

### Module contents

Geoips procflow init file.

## geoips.plugins.modules.readers package

### Subpackages

#### geoips.plugins.modules.readers.utils package

##### Submodules

##### geoips.plugins.modules.readers.utils.geostationary_geolocation module

Generalized geolocation calculations for geostationary satellites.

**exception** `geoips.plugins.modules.readers.utils.geostationary_geolocation.`**`AutoGenError`**

Bases: `Exception`

Raise exception on auto generated geolocation error.

`geoips.plugins.modules.readers.utils.geostationary_geolocation.`**`calculate_solar_angles(`**

Calculate solar angles.

geoips.plugins.modules.readers.utils.geostationary_geolocation.**get_geolocation**(*dt*, *gmd*, *fldk_lats*, *fldk_lons*, *BAD-VALS*, *area_def*=

Gather and return the geolocation data for the input metadata.

Input metadata should be the metadata for a single ABI data file.

If latitude/longitude have not been calculated with the metadata form the input data file they will be recalculated and stored for future use. They shouldn't change often. This will be slow the first time it is called after a metadata update, but fast thereafter.

The same is true for satellite zenith and azimuth angles.

Solar zenith ang azimuth angles are always calculated on the fly. This is because they actually change. This may be slow for full-disk images.

geoips.plugins.modules.readers.utils.geostationary_geolocation.**get_geolocation_cache_f**

Set the location and filename format for the cached geolocation files.

There is a separate filename format for satellite latlons and sector latlons

### Notes

Changing geolocation filename format will force recreation of all files, which can be problematic for large numbers of sectors.

geoips.plugins.modules.readers.utils.geostationary_geolocation.**get_indexes**(*metadata*, *lats*, *lons*, *area_def*)

Return two 2-D arrays containing the X and Y indexes.

These are indices that should be used from the raw data for the input sector definition.

geoips.plugins.modules.readers.utils.geostationary_geolocation.**get_satellite_angles**(*me* *lat* *lon* *BA* *VA* *sec*

Get satellite angles.

### geoips.plugins.modules.readers.utils.hrit_reader module

Utility for reading HRIT datasets.

**class** geoips.plugins.modules.readers.utils.hrit_reader.**HritDtype**

Bases: `object`

HRIT data type.

**types = {'byte': 'B', 'int16': '>i2', 'int32': '>i4', 'int64': '>i8', 'int8': 'i1', 'uint16': '>u2', 'uint32': '>u4', 'uint64': '>u8', 'uint8': 'u1', 'unicode': 'U'}**

**exception** geoips.plugins.modules.readers.utils.hrit_reader.**HritError**(*msg*, *code=None*)

Bases: `Exception`

Raise exception when errors occur in reading xRIT data files.

**class** geoips.plugins.modules.readers.utils.hrit_reader.**HritFile**(*fname*)

Bases: `object`

Hrit File class.

**property annotation_metadata**

Return annotation metadata (ie, platform, start time, etc).

**property band**

Return band specified in block_128, if it exists.

**property basename**

Return file basename.

**property block_info**

Block info.

**property block_map**

Return block map.

**property compressed**

Return True if compressed, False if not.

**decompress**(*outdir*)

Decompress an xRIT file and return a file handle.

The file will be decompressed to *outdir* and read from there.

Returns an HritFile instance for the decompressed file. If already decompressed, raises an HritError.

**property dirname**
Return file dirname.

**property epilogue**
Return epilogue.

**property file_type**
Return file_type.

**property geolocation_metadata**
Return geolocation metadata.

**property metadata**
Return metadata.

**property name**
Return name.

**property prologue**
Return prologue.

**property segment**
Return segment specified in block_128, if it exists.

**property start_datetime**
Return start_datetime.

geoips.plugins.modules.readers.utils.hrit_reader.**read10bit**(*buff*)
Read 10 bit little endian data from a buffer.

**Returns**
16 bit unsigned int.

**Return type**
int

## geoips.plugins.modules.readers.utils.remss_reader module

Read derived surface winds from REMSS SMAP, WINDSAT, and AMSR netcdf data.

geoips.plugins.modules.readers.utils.remss_reader.**read_remss_data**(*wind_xarray*, *data_type*)
Reformat SMAP or WindSat xarray object appropriately.

variables: latitude, longitude, time, wind_speed_kts attributes: source_name, platform_name, data_provider, interpolation_radius_of_influence

### Module contents

geoips reader utils init file.

### Submodules

### geoips.plugins.modules.readers.abi_l2_netcdf module

ABI Level 2 NetCDF reader.

`geoips.plugins.modules.readers.abi_l2_netcdf.`**`calculate_abi_geolocation`**`(`*metadata*, *area_def*`)`

Calculate ABI geolocation.

`geoips.plugins.modules.readers.abi_l2_netcdf.`**`call`**`(`*fnames*, *area_def=None*, *metadata_only=False*, *chans=False*, *self_register=False*`)`

Read ABI Level 2 NetCDF data from a list of filenames.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**
dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.abi_l2_netcdf.`**`get_metadata`**`(`*fname*`)`

Get metadata.

## geoips.plugins.modules.readers.abi_netcdf module

Standard GeoIPS xarray dictionary based ABI NetCDF data reader.

`geoips.plugins.modules.readers.abi_netcdf.`**`call`**`(`*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*`)`

Read ABI NetCDF data from a list of filenames.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - register all data to the specified dataset id (as specified in the return dictionary keys).

– Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.abi_netcdf.`**`get_band_metadata`**`(`*all_metadata*`)`

Get band metadata.

This method basically just reformats the all_metadata dictionary that is set based on the metadata found in the netcdf object itself to reference channel names as opposed to filenames as the dictionary keys.

`geoips.plugins.modules.readers.abi_netcdf.`**`get_data`**`(`*md*, *gvars*, *rad=False*, *ref=False*, *bt=False*`)`

Read data for a full channel's worth of files.

`geoips.plugins.modules.readers.abi_netcdf.`**`get_latitude_longitude`**`(`*metadata*, *BADVALS*, *sect=None*`)`

Get latitudes and longitudes.

This routine accepts a dictionary containing metadata as read from a NCDF4 format file, and returns latitudes and longitudes for a full disk.

`geoips.plugins.modules.readers.abi_netcdf.`**`metadata_to_datetime`**`(`*metadata*`)`

Use information from the metadata to get the image datetime.

## geoips.plugins.modules.readers.ahi_hsd module

Advanced Himawari Imager Data Reader.

**`exception`** `geoips.plugins.modules.readers.ahi_hsd.`**`AutoGenError`**

Bases: `Exception`

Raise exception on geolocation autogeneration error.

`geoips.plugins.modules.readers.ahi_hsd.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read AHI HSD data data from a list of filenames.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.ahi_hsd.findDiff`(*d1*, *d2*, *path=''*)

Find diff.

geoips.plugins.modules.readers.ahi_hsd.**get_band_metadata**(*all_metadata*)

Get band metadata.

This method basically just reformats the all_metadata dictionary that is set based on the metadata found in the netcdf object itself to reference channel names as opposed to filenames as the dictionary keys.

geoips.plugins.modules.readers.ahi_hsd.**get_data**(*md*, *gvars*, *rad=False*, *ref=False*, *bt=False*, *zoom=1.0*)

Read data for a full channel's worth of files.

geoips.plugins.modules.readers.ahi_hsd.**get_latitude_longitude**(*metadata*, *BADVALS*, *area_def=None*)

Get latitudes and longitudes.

This routine accepts a dictionary containing metadata as read from an HSD format file and returns latitudes and longitudes for a full disk image.

Note: This code has been adapted from Dan Lindsey's Fortran90 code. This was done in three steps that ultimately culminated in faster, but more difficult to understand code. If you plan to edit this, I recommend that you return to Dan's original code, then explore the commented code here, then finally, look at the single-command statements that are currently being used.

geoips.plugins.modules.readers.ahi_hsd.**metadata_to_datetime**(*metadata*, *time_var='ob_start_time'*)

Use information from block_01 to get the image datetime.

geoips.plugins.modules.readers.ahi_hsd.**set_variable_metadata**(*xobj_attrs*, *band_metadata*, *dsname*, *varname*)

Set variable metadata.

MLS 20180914 Setting xobj_attrs at the variable level for the associated channel metadata pulled from the actual netcdf file. This will now be accessible from the scifile object. Additionally, pull out specifically the band_wavelength and attach it to the _varinfo at the variable level - this is automatically pulled from the xobj_attrs dictionary and set in the variable._varinfo dictionary in scifile/scifile.py and scifile/containers.py (see empty_varinfo at the beginning of containers.py for dictionary fields that are automatically pulled from the appropriate location in the xobj_attrs dictionary and set on the _varinfo dictionary)

geoips.plugins.modules.readers.ahi_hsd.**sort_by_band_and_seg**(*metadata*)

Sort by band and segment.

### geoips.plugins.modules.readers.amsr2_netcdf module

Read AMSR2 data products.

`geoips.plugins.modules.readers.amsr2_netcdf.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read AMSR2 netcdf data products.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.amsr2_netcdf.`**`read_amsr_data`**(*full_xarray*, *chans*)

Read non-AMSR2_OCEAN data.

`geoips.plugins.modules.readers.amsr2_netcdf.`**`read_amsr_mbt`**(*full_xarray*, *varname*, *time_array=None*)

Reformat AMSR xarray object appropriately.

- variables: latitude, longitude, time, brightness temperature variables
- attributes: source_name, platform_name, data_provider, interpolation_radius_of_influence

`geoips.plugins.modules.readers.amsr2_netcdf.`**`read_amsr_winds`**(*wind_xarray*)

Reformat AMSR xarray object appropriately.

- variables: latitude, longitude, time, wind_speed_kts
- attributes: source_name, platform_name, data_provider, interpolation_radius_of_influence

## geoips.plugins.modules.readers.amsr2_remss_winds_netcdf module

Read derived surface winds from REMSS AMSR netcdf data.

`geoips.plugins.modules.readers.amsr2_remss_winds_netcdf.`**`call`**(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read REMSS AMSR2 derived winds from netcdf data.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –

  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

### geoips.plugins.modules.readers.amsub_hdf module

Read AMSU-B and MHS passive microwave data files.

This reader is desgined for importing NOAA Advanced Microwave Sounding Unit (AMSU)-B/Microwave Humidity Sounder (HMS) and EUMETSAQT MHS data files in hdf format, such as

- NPR.MHOP.NP.D20153.S2046.E2230.B5832021.NS (N19),
- NPR.MHOP.NN.D20153.S1927.E2105.B7748081.NS (N18),
- NPR.MHOP.M1.D20153.S2229.E2318.B3998282.NS (METOP).

V1.0: Initial version, NRL-MRY, June 1, 2020

Basic information on AMSU-B product file:

```
Input SD Variables
(nscan, npix):
    npix=90 pixels per scan;
    nscan: vary with orbit
chan-1 AT:  89 GHz as ch16 anttenna temperature at V-pol   FOV 16km at␣
↪nadir
chan-2 AT:  150 (157) GHz as ch17 the number in bracket is for MHS from
                                  metops at V-pol, 16km at nadir
chan-3 AT:  183.31 +-1 GHz as ch18    at H-pol, 16km
chan-4 AT:  183.31 +-3 GHz as ch19    at H-pol, 16km
chan-5 AT:  183.31 +-7 (190.3) GHz as ch20    at V-pol, 16km
lat:     -90, 90     deg
lon:     -180, 180   deg
RR:  surface rainrate (mm/hr)
Snow: surafce snow cover
IWP:  ice water path (unit?)
SWE:  snow water equvelent  (unit)
Sfc_type:  surface type
Orbit_mode:   -1: ascending, 1: decending, 2: both
SFR:  snowfall rate (unit?)
LZ_angle:  local zinath angle (deg)
SZ_angle:  solar zinath angle (deg)

Vdata info (definition of AMSU-B date):
ScanTime_year
ScanTime_month
ScanTime_day
ScanTime_hour
ScanTime_minute
ScanTime_second
ScanTime_Jday
Time
```

`geoips.plugins.modules.readers.amsub_hdf.`**`call`**(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read AMSU-B hdf data products.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –

  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

### geoips.plugins.modules.readers.amsub_mirs module

Read AMSU-B and MHS MIRS NetCDF data files.

This reader is desgined for importing the Advanced Microwave Sounding Unit (AMSU)-B/Microwave Humidity Sounder (HMS) and EUMETSAQT MHS data files in hdf5 from NOAA MIRS. These new data files have a different file name convention and and data structure from previous MSPPS. Example of MIRIS files:

- NPR-MIRS-IMG_v11r4_ma1_s202101111916000_e202101112012000_c202101112047200.nc
  - (ma1 is for metop-B)
- NPR-MIRS-IMG_v11r4_ma2_s202101111715000_e202101111857000_c202101111941370.nc
  - (ma2 is for metop-A)
- NPR-MIRS-IMG_v11r4_n19_s202101111730000_e202101111916000_c202101112001590.nc
  - (NOAA-19)

AMSU-A channel information:

```
Chan# / Freq(GHz) / bands / Bandwidth(MHz) / Beamwidth(deg) / NE#T(K) /
                             (Spec.) Polarization at nadir / Instrument␣
↪Component
1   23.800  1       270     3.3     0.30    V       A2
2   31.400  1       180     3.3     0.30    V       A2
3   50.300  1       180     3.3     0.40    V       A1-2
4   52.800  1       400     3.3     0.25    V       A1-2
5   53.596 +-115    2       170     3.3     0.25    H       A1-2
6   54.400  1       400     3.3     0.25    H       A1-1
7   54.940  1       400     3.3     0.25    V       A1-1
8   55.500  1       330     3.3     0.25    H       A1-2
9   f0=57,290.344   1       330     3.3     0.25    H       A1-1
10  f0+-217 2       78      3.3     0.40    H       A1-1
11  f0+-322.2+-48   4       36      3.3     0.40    H       A1-1
12  f0+-322.2+-22   4       16      3.3     0.60    H       A1-1
13  f0+-322.2+-10   4       8       3.3     0.80    H       A1-1
14  f0+-322.2+-4.5  4       3       3.3     1.20    H       A1-1
15  89,000  1       <6,000  3.3     0.50    V       A1-1
```

AMSU-B/MHS channel information:

```
Channel / Centre Frequency (GHz) / Bandwidth (MHz) / NeDT (K) /
                                  Calibration Accuracy (K) / pol. angle␣
↪(degree)
16  89.0    <6000   1.0     1.0     90-q                    (Vertical pol)
```

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```
17  150       <4000   1.0     1.0     90-q                (Vertical)
18  183.31+-1.00     500     1.1     1.0     nospec       (Horizontal)
19  183.31+-3.00     1000    1.0     1.0     nospec       (Horizontal)
20  190.31+17.00     2000    1.2     1.0     90-q         (Vertical)
```

Since AMSU-A sensor is no longer available, we select only the AMSU-B/MHS channels. We decide to use the same names of the five channels used for previous NOAA MSPPS data files. i.e., select frequench index 15-19 (start from 0).

V1.0: Initial version, NRL-MRY, January 26, 2021

Dataset information:

```
Basic information on AMSU-B product file
index: 1     2    3    4      5      6    7
freq: 23.8,31.4,50.3,52.799,53.595,54.4,54.941,
55.499,57.29,57.29,57.29,57.29,57.29,57.29,
index:   8     9      10     11    12    13     14
freq: 55.499,57.29,57.29,57.29,57.29,57.29,57.29,
index: 15  16  17    18      19     20
freq: 89.,89.,157.,183.311,183.311,190.311

dimensions:
      Scanline = 2370 ;
      Field_of_view = 90 ;
      P_Layer = 100 ;
      Channel = 20 ;
      Qc_dim = 4 ;
variables:
      Freq(Channel): Central Frequencies (GHz)
      Polo(Channel): Polarizations
      ScanTime_year(Scanline): Calendar Year 20XX
      ScanTime_doy(Scanline: julian day 1-366
      ScanTime_month(Scanline): Calendar month 1-12
      ScanTime_dom(Scanline): Calendar day of the month 1-31
      ScanTime_hour(Scanline: hour of the day 0-23
      ScanTime_minute(Scanline): minute of the hour 0-59
      ScanTime_second(Scanline): second of the minute 0-59
      ScanTime_UTC(Scanline): Number of seconds since 00:00:00 UTC
      Orb_mode(Scanline): 0-ascending,1-descending
      Latitude(Scanline, Field_of_view):Latitude of the view (-90,90),
                                        unit: degree
      Longitude(Scanline, Field_of_view):Longitude of the view (-180,180),
                                         unit: degree
```

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```
     Sfc_type(Scanline, Field_of_view):type of surface:0-ocean,1-sea ice,
                                  2-land,3-snow
     Atm_type(Scanline, Field_of_view): type of atmosphere:currently␣
↪missing
                                ( note: not needed for geoips␣
↪products)
     Qc(Scanline, Field_of_view, Qc_dim): Qc: 0-good, 1-usable with␣
↪problem,
                                       2-bad
     ChiSqr(Scanline, Field_of_view): Convergence rate: <3-good,>10-bad
     LZ_angle(Scanline, Field_of_view): Local Zenith Angle degree
     RAzi_angle(Scanline, Field_of_view):Relative Azimuth Angle 0-360␣
↪degree
     SZ_angle(Scanline, Field_of_view):Solar Zenith Angle (-90,90) degree
     BT(Scanline, Field_of_view, Channel): Channel Temperature (K)
     YM(Scanline, Field_of_view, Channel): UnCorrected Channel␣
↪Temperature(K)
     ChanSel(Scanline, Field_of_view, Channel):Channels Selection Used in
                                        Retrieval
     TPW(Scanline, Field_of_view): Total Precipitable Water (mm)
     CLW(Scanline, Field_of_view):Cloud liquid Water (mm)
     RWP(Scanline, Field_of_view): Rain Water Path (mm)
     LWP(Scanline, Field_of_view): Liquid Water Path (mm)
     SWP(Scanline, Field_of_view): Snow Water Path (mm)
     IWP(Scanline, Field_of_view): Ice Water Path (mm)
     GWP(Scanline, Field_of_view): Graupel Water Path (mm)
     RR(Scanline, Field_of_view): Rain Rate (mm/hr)
     Snow(Scanline, Field_of_view): Snow Cover (range: 0-1) i.e., 1 ->␣
↪100%
     SWE(Scanline, Field_of_view): Snow Water Equivalent (cm)
     SnowGS(Scanline, Field_of_view):Snow Grain Size (mm)
     SIce(Scanline, Field_of_view):Sea Ice Concentration (%)
     SIce_MY(Scanline, Field_of_view): Multi-Year Sea Ice Concentration (
↪%)
     SIce_FY(Scanline, Field_of_view): First-Year Sea Ice Concentration (
↪%)
     TSkin(Scanline, Field_of_view): Skin Temperature (K)
     SurfP(Scanline, Field_of_view): Surface Pressure (mb)
     Emis(Scanline, Field_of_view, Channel):Channel Emissivity
                                (unit:1,  Emis:scale_factor = 0.
↪0001)
     SFR(Scanline, Field_of_view): Snow Fall Rate in mm/hr
     CldTop(Scanline, Field_of_view): Cloud Top Pressure (scale_factor =␣
```

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```
↪0.1)
     CldBase(Scanline, Field_of_view): Cloud Base Pressure
                                       (scale_factor = 0.1)
     CldThick(Scanline, Field_of_view): Cloud Thickness (scale_factor =␣
↪0.1)
     PrecipType(Scanline, Field_of_view): Precipitation Type (Frozen/
↪Liquid)
     RFlag(Scanline, Field_of_view): Rain Flag
     SurfM(Scanline, Field_of_view): Surface Moisture (scale_factor = 0.
↪1)
     WindSp(Scanline, Field_of_view): Wind Speed (m/s) (scale_factor = 0.
↪01
     WindDir(Scanline, Field_of_view: Wind Direction (scale_factor = 0.
↪01)
     WindU(Scanline, Field_of_view):U-direction Wind Speed (m/s)
                                   (scale_factor = 0.01)
     WindV(Scanline, Field_of_view: V-direction Wind Speed (m/s)
                                   (scale_factor = 0.01)
     Prob_SF(Scanline, Field_of_view): Probability of falling snow (%)
```

Additional info:

```
Variables (nscan, npix):  npix=90 pixels per scan; nscan: vary with orbit
chan-1 AT:  89 GHz              as ch16    anttenna temperature at V-pol
                                           FOV 16km at nadir
chan-2 AT:  150 (157) GHz       as ch17 the number in bracket is for MHS
                                       from metops at V-pol, 16km at nadir
chan-3 AT:  183.31 +-1 GHz          as ch18    at H-pol, 16km
chan-4 AT:  183.31 +-3 GHz          as ch19    at H-pol, 16km
chan-5 AT:  183.31 +-7 (190.3) GHz  as ch20    at V-pol, 16km
lat:     -90, 90     deg
lon:     -180, 180   deg
RR:  surface rainrate (mm/hr)
Snow: surafce snow cover
IWP:  ice water path
SWE:  snow water equvelent
Sfc_type:  surface type
Orbit_mode:   -1: ascending, 1: decending, 2: both
SFR:  snowfall rate (unit?)
LZ_angle:  local zinath angle (deg)
SZ_angle:  solar zinath angle (deg)
```

`geoips.plugins.modules.readers.amsub_mirs.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read AMSU/MHS MIRS data products.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*

Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

### geoips.plugins.modules.readers.ascat_uhr_netcdf module

Read derived surface winds from BYU ASCAT UHR NetCDF data.

`geoips.plugins.modules.readers.ascat_uhr_netcdf.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read ASCAT UHR derived winds or normalized radar cross section data.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**
dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.ascat_uhr_netcdf.`**`read_byu_data`**`(`*wind_xarray*, *fname*`)`

Reformat ascat xarray object appropriately.

- variables: latitude, longitude, time, wind_speed_kts, wind_dir_deg_met
- attributes: source_name, platform_name, data_provider, interpolation_radius_of_influence

### geoips.plugins.modules.readers.atms_hdf5 module

Reader to read a grannual NOAA ATMS SDR TBs in h5 format.

Output variables in xarray object for geoips processing system

V0: August 25, 2021

The date is generated by the NOAA community satellite processing package (CSPP), developed at CIMSS

Example of ATMS file names:

```
'SATMS_j01_d20210809_t0959306_e1000023_b19296_fnmoc_ops.h5'
    SDR TBs variables
'GATMO_j01_d20210809_t0959306_e1000023_b19296_fnmoc_ops.h5'
    SDR Geolocation variables
```

Dataset info:

```
TB[12,96,22]:  for each granuel

CHAN#  Center-Freq(GHz)  POL
1      23.8               V
2      31.4               V
3      50.3               H
4      51.76              H
5      52.8               H
6      53.596+-0.115      H
```

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```
7       54.4                H
8       54.94               H
9       55.5                H
10      57.290(f0)          H
11      f0 +-0.217          H
12      f0 +-0.322+-0.048   H
13      f0 +-0.322+-0.022   H
14      f0 +-0.322+-0.010   H
15      f0 +-0.322+-0.0045 H

16      88.2                V
17      165.5               H
18      183.1+-7            H
19      183.1+-4.5          H    (FNMOC used this chan for 183 GHz image)
20      183.1+-3.0          H
21      183.1+-1.8          H
22      183.1+-1.0          H

BeamTime[12,96]:  microsecond, i.e., 1*10^-6.  IET "IDPS Epoch Time" is␣
↪used
                  It is a signed 64-bit integer giving microseconds since
                  00:00:00.000000 Jan 1 1958.
BrightnessTemperatureFactors[2]: 1: scale (unitless); 2: offset (K)
BrightnessTemperature[12,96,22]: [scan,pix,chans]

SDR geolocation Info
Latitude/Longitude[12,96]:   for Chan 17 only (for initial product,
                                              it is used for all␣
↪channels)
BeamLatitude[12,96,5]:       for chan 1,2,3,16,17. They will be used for
                                       associated TBs at a later date.
BeamLongitude[12,96,5]:      for chan 1,2,3,16,17
SatelliteAzimuthAngle, SatelliteZenithAngle,
SolarAzimuthAngle, SolarZenithAngle[12,96]
```

### Notes

Unix epoch time is defined as the number of seconds that have elapsed since January 1, 1970 (midnight UTC/GMT). Thus, there is a 12 years difference for the JPSS data when datetime.datetime.utcfromtimestamp(epoch) is used to convert the JPSS IDPS Epoch time to the humman-readable date.

This reader is developed to read one granual a time from ATMS npp and jpss-1(n20) data files.

The example files are:

- `SATMS_j01_d20210809_t0959306_e1000023_b19296_fnmoc_ops.h5`: for TBs. 'b': orbit#
- `GATMO_j01_d20210809_t0959306_e1000023_b19296_fnmoc_ops.h5`: for geolocations

`geoips.plugins.modules.readers.atms_hdf5.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read ATMS hdf5 data products.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED

- register all data to the specified dataset id (as specified in the return dictionary keys).
- Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.atms_hdf5.`**`convert_epoch_to_datetime64`**(*time_array*, *use_shape=None*)

Convert time to datetime object.

**Parameters**

- **`time_array`** (*`array`*) – Array of start time integers (multiplied by 1e-6 in function)
- **`use_shape`** (*`tuple, optional`*) – desired output shape of time array, by default None

**Returns**

array of converted datetime objects

**Return type**

array

`geoips.plugins.modules.readers.atms_hdf5.`**`read_atms_file`**(*fname*, *xarray_atms*)

Read ATCF data from file fname.

### geoips.plugins.modules.readers.ewsg_netcdf module

Read EWS-G data.

This EWS-G(Electro-Optical Infrared Weather System - Geostationary) reader is designed for reading theEWS-G data files (EWS-G is renamed from GOES-13). The reader is only using the python functions and xarray variables. The reader is based on EWS-G data in netcdf4 format.

V1.0: NRL-Monterey, 02/25/2021

EWS-G file information:

```
Example of the gvar filename:   2020.1212.0012.goes-13.gvar.nc

Note that channel-3 is not available for EWS-G.
  gvar_Ch3(TIR=5.8-7.3um, ctr=6.48um,4km): unit=temp-deg(C), scale_
↪factor=0.01

variables:
  gvar_Ch1(VIS=0.55-0.75um, ctr=0.65um,1km): unit=albedo*100,  scale_
↪factor=0.01
  gvar_Ch2(MWIR=3.8-4.0um,  ctr=3.9um, 4km): unit=temp-deg(C), scale_
↪factor=0.01
  gvar_Ch4(TIR=10.2-11.2um, ctr=10.7um,4km): unit=temp-deg(C), scale_
↪factor=0.01
  gvar_Ch6(TIR=12.9-13.7um, ctr=13.3um 4km): unit=temp-deg(C), scale_
↪factor=0.01
  latitude: unit=degree
  longitude:unit=degree
  sat_zenith: unit=degree
  sun_zenith: unit=degree
  rel_azimuth:unit=degree

  variable array definition:  var(scan,pix); scan-->lines, pix-->samples

attributes: many
```

`geoips.plugins.modules.readers.ewsg_netcdf.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read EWS-G data in netcdf4 format.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files

- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*

Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

### geoips.plugins.modules.readers.geoips_netcdf module

Read pre-processed GeoIPS-formatted NetCDF data.

`geoips.plugins.modules.readers.geoips_netcdf.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read preprocessed geoips netcdf output.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.geoips_netcdf.`**`read_xarray_netcdf`**(*ncdf_fname*)

Read NetCDF file written out using the xarray python package.

## geoips.plugins.modules.readers.gmi_hdf5 module

Read NASA GPM GMI hdf5 data files.

Read a grannual NASA GPM GMI TBs in h5 format (each grannual file is about 5 minutes GPM GMI data)

Output variables in xarray object for geoips processing system

V0: August 4, 2020

Dataset information:

```
variables in original TBs structure format
tb_info = { 'S1': {  'tb10v': 0,
                     'tb10h': 1,
                     'tb19v': 2,
                     'tb19h': 3,
                     'tb23v': 4,
                     'tb37v': 5,
                     'tb37h': 6,
                     'tb89v': 7,
                     'tb89h': 8,},
            'S2': { 'tb166v': 0,
                     'tb166h': 1,
                     'tb183_3v': 2,
                     'tb183_7v': 3}
        }
```

`geoips.plugins.modules.readers.gmi_hdf5.`**`call`**(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read GMI hdf5 data products.

**Parameters**

- **fnames** (*list*) –

  - List of strings, full paths to files

- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.gmi_hdf5.`**`read_gmi_file`**(*fname*, *xarray_gmi*)

Read a single GMI file fname.

### geoips.plugins.modules.readers.imerg_hdf5 module

Read IMERG rainfall data.

A reader is designed to import IMERG rainfall data for GeoIPS using only python libraries

Aug 17, 2020

**for a IMERG 30min data file, the time is the start time of a 30min interval:**
0000-0030-0100-0130-0200 ….

Dataset information:

```
Spatial resolution is 0.1 deg.
1st grid is at (-179.95, -89.95).
Last grid is at (175.95, 89.95)
variable array is (3600,1800)

 metadata['top']['dataprovider'] = 'NASA-GPM'

 dataset_info = { 'Grid': {'MWtime': 'HQobservationTime',
                           'MWid': 'HQprecipSource',
                           'MWrr': 'HQprecipitation',
                           'IRweight': 'IRkalmanFilterWeight',
                           'IRrr': 'IRprecipitation',
                           'rain': 'precipitationCal',
                           'rrQC': 'precipitationQualityIndex',
                           'rrUncal': 'precipitationUncal',
                           'rrProb': 'probabilityLiquidPrecipitation',
                           'rrErr': 'randomError',},
          }
```

geoips.plugins.modules.readers.imerg_hdf5.**call**(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read IMERG hdf5 rain rate data products.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –

- NOT YET IMPLEMENTED
- List of desired channels (skip unneeded variables as needed).
- Include all channels if None.

• **area_def** (*pyresample.AreaDefinition, default=None*) –

- NOT YET IMPLEMENTED
- Specify region to read
- Read all data if None.

• **self_register** (*str or bool, default=False*) –

- NOT YET IMPLEMENTED
- register all data to the specified dataset id (as specified in the return dictionary keys).
- Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

### geoips.plugins.modules.readers.mimic_netcdf module

MIMIC TPW NetCDF reader.

geoips.plugins.modules.readers.mimic_netcdf.**call**(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read TPW MIMIC data from a list of filenames.

Dataset information:

```
<xarray.Dataset>
Dimensions:             (lat: 721, lon: 1440)
Dimensions without coordinates: lat, lon
Data variables:
    lonArr              (lon) float32 ...
    latArr              (lat) float32 ...
    tpwGrid             (lat, lon) float32 ...
    tpwGridPrior        (lat, lon) float32 ...
    tpwGridSubseq       (lat, lon) float32 ...
    timeAwayGridPrior   (lat, lon) timedelta64[ns] ...
    timeAwayGridSubseq  (lat, lon) timedelta64[ns] ...
    footGridPrior       (lat, lon) float32 ...
    footGridSubseq      (lat, lon) float32 ...
    satGridPrior        (lat, lon) uint8 ...
    satGridSubseq       (lat, lon) uint8 ...
```

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**
dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

## geoips.plugins.modules.readers.modis_hdf4 module

MODIS HDF4 reader.

This reader is designed for geoips for importing MODIS data files in hdf4 format Example files are:

```
AQUA:       MYD files
     MYD021KM.A2021004.2005.061.NRT.hdf
     MYD03.A2021004.2005.061.NRT.hdf
     MYD14.A2021004.2005.006.NRT.hdf
Terra:      MOD files
     MOD021KM.A2021004.2005.061.NRT.hdf
     MOD02HKM.A2021004.2005.061.NRT.hdf
     MOD02QKM.A2021004.2005.061.NRT.hdf
     MOD03.A2021004.2005.061.NRT.hdf
     MOD14.A2021004.2005.006.NRT.hdf
```

The MOD03 and MOD14 files have the geolocation (lat/lon) and sensor geoometry infomation, while other files have values at each channels.

`geoips.plugins.modules.readers.modis_hdf4.`**`add_to_xarray`**(*varname*, *nparr*, *xobj*, *cumulative_mask*, *data_type*)

Add variable to xarray Dataset.

`geoips.plugins.modules.readers.modis_hdf4.`**`call`**(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read MODIS Aqua and Terra hdf data files.

**Parameters**

- **fnames** (*list*) –

  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

geoips.plugins.modules.readers.modis_hdf4.**parse_archive_metadata**(*metadata*, *metadatastr*)

Parse archive metadata.

geoips.plugins.modules.readers.modis_hdf4.**parse_core_metadata**(*metadata*, *metadatastr*)

Parse core metadata.

`geoips.plugins.modules.readers.modis_hdf4.`**`parse_metadata`**(*metadatadict*)

Parse MODIS metadata dictionary.

`geoips.plugins.modules.readers.modis_hdf4.`**`parse_struct_metadata`**(*metadata*, *metadatastr*)

Parse metadata struct.

### geoips.plugins.modules.readers.saphir_hdf5 module

Read SAPHIR hdf files.

`geoips.plugins.modules.readers.saphir_hdf5.`**`call`**(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read SAPHIR hdf data products.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

### geoips.plugins.modules.readers.sar_winds_netcdf module

Read derived surface winds from SAR netcdf data.

`geoips.plugins.modules.readers.sar_winds_netcdf.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read SAR derived winds from netcdf data.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read

- Read all data if None.

- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.sar_winds_netcdf.`**`read_sar_data`**(*wind_xarray*)

Reformat SAR xarray object appropriately.

- variables: latitude, longitude, time, wind_speed_kts
- attributes: source_name, platform_name, data_provider, interpolation_radius_of_influence

### geoips.plugins.modules.readers.scat_knmi_winds_netcdf module

Read derived surface winds from KNMI scatterometer netcdf data.

`geoips.plugins.modules.readers.scat_knmi_winds_netcdf.`**`call`**(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read KNMI scatterometer derived winds from netcdf data.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files

- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

geoips.plugins.modules.readers.scat_knmi_winds_netcdf.**read_knmi_data**(*wind_xarray*)

Reformat ascat xarray object appropriately.

- variables: latitude, longitude, time, wind_speed_kts, wind_dir_deg_met
- attributes: source_name, platform_name, data_provider, interpolation_radius_of_influence

### geoips.plugins.modules.readers.scat_noaa_winds_netcdf module

Read derived surface winds from KNMI scatterometer netcdf data.

`geoips.plugins.modules.readers.scat_noaa_winds_netcdf.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read KNMI scatterometer derived winds from netcdf data.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**
dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.scat_noaa_winds_netcdf.`**`read_noaa_data`**(*wind_xarray*)

Reformat ascat xarray object appropriately.

- variables: latitude, longitude, time, wind_speed_kts, wind_dir_deg_met
- attributes: source_name, platform_name, data_provider, interpolation_radius_of_influence

## geoips.plugins.modules.readers.seviri_hrit module

Read SEVIRI hrit data.

### Notes

1) At present, this reader does not work for High Resolution Visible data, which is ignored. Additionally, to ease generation of geolocation fields, datasets are assumed to be square and centered at their sub longitude.

**20170330 MLS Try to only decompress what we need (VERY filename dependent),**
make scifile and hrit channel names match (more filename dependence), don't try to decompress/open file for import_metadata (more filename dependence for time). satpy requires time to open file, and requires standard (decompressed) filenames, so built in filename dependence by using satpy.

**class** `geoips.plugins.modules.readers.seviri_hrit.`**`Chan`**(*name*)

Bases: `object`

Channel class.

**property band**

Band property.

**property band_num**

Band number property.

**property name**

Name property.

**property type**

Type property.

**class** geoips.plugins.modules.readers.seviri_hrit.**ChanList**(*chans*)

Bases: `object`

ChanList Class.

**property bands**

Bands property.

**property chans**

Chans property.

**property names**

Names property.

**exception** geoips.plugins.modules.readers.seviri_hrit.**XritError**(*msg*, *code=None*)

Bases: `Exception`

Raise exception on XritError.

geoips.plugins.modules.readers.seviri_hrit.**calculate_chebyshev_polynomial**(*coefs*, *start_dt*, *end_dt*, *dt*)

Calculate Chebyshev Polynomial.

geoips.plugins.modules.readers.seviri_hrit.**call**(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read SEVIRI hrit data products.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –

- Specify region to read
- Read all data if None.

- **self_register** (*str or bool, default=False*) –
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

geoips.plugins.modules.readers.seviri_hrit.**compare_dicts**(*d1*, *d2*, *skip=None*)

Compare the values in two dictionaries.

If they are equal, return True, otherwise False If skip is set and contains one of the keys, skip that key

geoips.plugins.modules.readers.seviri_hrit.**countsToRad**(*counts*, *slope*, *offset*)

Convert counts to rad.

geoips.plugins.modules.readers.seviri_hrit.**get_latitude_longitude**(*gmd*, *BADVALS*, *area_def*)

Generate full-disk latitudes and longitudes.

geoips.plugins.modules.readers.seviri_hrit.**get_top_level_metadata**(*fnames*, *sect*)

Get top level metadata.

geoips.plugins.modules.readers.seviri_hrit.**radToBT**(*rad*, *platform*, *band*)

Convert rad to BT.

geoips.plugins.modules.readers.seviri_hrit.**radToRef**(*rad*, *sun_zen*, *platform*, *band*)

Convert Rad to Ref.

### geoips.plugins.modules.readers.sfc_winds_text module

Read derived surface winds from SAR, SMAP, SMOS, and AMSR text data.

`geoips.plugins.modules.readers.sfc_winds_text.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read one of SAR, SMAP, SMOS, AMSR derived winds from text data.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

## geoips.plugins.modules.readers.smap_remss_winds_netcdf module

Read derived surface winds from REMSS SMAP netcdf data.

`geoips.plugins.modules.readers.smap_remss_winds_netcdf.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read one of SMAP derived winds from netcdf data.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**
dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

### geoips.plugins.modules.readers.smos_winds_netcdf module

Read derived surface winds from SAR, SMAP, SMOS, and AMSR netcdf data.

`geoips.plugins.modules.readers.smos_winds_netcdf.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read SMOS derived winds from netcdf data.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read

- Read all data if None.

- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.smos_winds_netcdf.`**`read_smos_data`**`(`*wind_xarray*, *fname*`)`

Reformat SMOS xarray object appropriately.

- variables: latitude, longitude, time, wind_speed_kts
- attributes: source_name, platform_name, data_provider, interpolation_radius_of_influence

## geoips.plugins.modules.readers.ssmi_binary module

SSMI binary reader.

This SSMI reader is desgined for importing SSMI sdr data files (such as ssmi_orbital_sdrmi_f15_d20200427_s104500_e123100_r05323_cfnoc.def). This reader is created to read in TBs at 19 (V,H),22V, 37(V,H) and 85 (V,H) GHz channels. There are A/B scans for 85 GHz. The combined A/B scans will be used for TC imagery products at 85 GHz.

This GEOIPS python code is based on a SSMI SDR reader in C.

Convert SSMI_HIRES_AB for 85GHz and SSMI_LORES for 19-37GHz into xarray for GEOIPS framework

V1.0: Initial version, NRL-MRY, May 19, 2020

SSMI input data info:

```
pixels per scan:
LORES=64 for 19, 22, and 37 GHz channels;
HIRES=128 for 85 GHz channels
    19V[LORES]                                        FOV:   69km x 43km
    19H[LORES]
    22V[LORES]                                               50km x 40km
    37V[LORES]                                               37km x 28km
    37H[LORES]
    85V[HIRES][2]    [][0]: A scans; [][1]: B scans      15km x 13km
    85H[HIRES][2]

       -----header info-----
int32
    cyr, cmon, cday,       /* file creation date */
    chr, cmin,             /* file creation time */
    scans,                 /* number of scans in file (from DataSeq) */
    scid,                  /* spacecraft ID */
    rev,                   /* nominal rev  */
    bjld, bhr, bmin, bsec, /* begin day of year (julian day), time=hr,min,
↪sec */
    ejld, ehr, emin, esec, /* ending day of year, time */
    ajld, ahr, amin, asec, /* ascending node DOY, time */
    lsat;                  /* logical satellite ID */

   -----scan data-----
int32 scann;               /* scan number (from ScanHdr1) */
int32 bst;                 /* B-scan start time (sec) scaled by 10000 */
double xtime;              /* bst as seconds since 0z 1 Jan 1987 */
uint16
    v19[LORES],            /* TBs */
    h19[LORES],
    v22[LORES],
    v37[LORES],
    h37[LORES],
    v85[HIRES][2],
    h85[HIRES][2],
    lon[HIRES][2];         /* longitudes */
int16 lat[HIRES][2];       /* latitudes */
char sft[HIRES][2];        /* surface types */
```

geoips.plugins.modules.readers.ssmi_binary.**call**(*fnames*, *metadata_only=False*, *chans=False*, *area_def=None*, *self_register=False*)

Read SSMI FNMOC Binary Data.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*

Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

### geoips.plugins.modules.readers.ssmis_binary module

SSMIS Binary reader.

This code is converted from geoips v1 into geoipd v2 framework. This new version of reader is indepent from the GEOIPS system whose environmental parametrs must be used in V1. Now, only python functipns are used with geoips framework and xarray is utilized to process datasets for product applications.

**Version Histopry:**
V1: initial code, July 24, 2020, NRL-MRY

**Input File**
SSMIS SDR data

**Output Fields**
XARRAY onjectives to hold variables

`geoips.plugins.modules.readers.ssmis_binary.`**`append_xarray_dicts`**(*xobjs_list*)

Append two dictionaries of xarray objects.

`geoips.plugins.modules.readers.ssmis_binary.`**`call`**(*fnames*, *metadata_only=False*, *chans=False*, *area_def=None*, *self_register=False*)

Read SSMIS binary data products.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –

– NOT YET IMPLEMENTED
– register all data to the specified dataset id (as specified in the return dictionary keys).
– Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**
dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.ssmis_binary.`**`read_ssmis_data_file`**(*fname*, *metadata_only=False*)

Read a single SSMIS data file.

### geoips.plugins.modules.readers.viirs_netcdf module

VIIRS NetCDF reader.

This VIIRS reader is designed for reading the NPP/JPSS VIIRS files geoips. The reader is only using the python functions and xarray variables. Although the file name indicates the data is in netcdf4 format.

Thus, the reader is based on the netcdf4 data format.

The orginal reader (viirs_aotcimss_ncdf4_reader.py) was developed for geoips1, which applied many geoips1 function.

V1.0: NRL-Monterey, 09/17/2020

VIIRS file infOrmation:

```
There are 6 files for each time of VIIRS data, i.e.,
For NASA NPP VIIRS
20200826.074800.npp.viirs.viirs_npp_nasaearthdata_x.x.VNP02DNB.sdr.x.x.nc
20200826.074800.npp.viirs.viirs_npp_nasaearthdata_x.x.VNP02IMG.sdr.x.x.nc
```

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```
20200826.074800.npp.viirs.viirs_npp_nasaearthdata_x.x.VNP02MOD.sdr.x.x.nc
20200826.074800.npp.viirs.viirs_npp_nasaearthdata_x.x.VNP03DNB.sdr.x.x.nc
20200826.074800.npp.viirs.viirs_npp_nasaearthdata_x.x.VNP03IMG.sdr.x.x.nc
20200826.074800.npp.viirs.viirs_npp_nasaearthdata_x.x.VNP03MOD.sdr.x.x.nc

For JPSS VIIRS
20200914.150000.npp.viirs.viirs_sips_jpss_uwssec_001.x.VJ102DNB.sdr.x.x.nc
20200914.150000.npp.viirs.viirs_sips_jpss_uwssec_001.x.VJ102IMG.sdr.x.x.nc
20200914.150000.npp.viirs.viirs_sips_jpss_uwssec_001.x.VJ102MOD.sdr.x.x.nc
20200914.150000.npp.viirs.viirs_sips_jpss_uwssec_001.x.VJ103DNB.sdr.x.x.nc
20200914.150000.npp.viirs.viirs_sips_jpss_uwssec_001.x.VJ103IMG.sdr.x.x.nc
20200914.150000.npp.viirs.viirs_sips_jpss_uwssec_001.x.VJ103MOD.sdr.x.x.nc

DNB: VIIRS day-night Band obs
MOD: VIIRS M-Band  obs
IMG: VIIRS I-Band  obs
```

The *.VNP02* files are for the data records, while the *.VNP03* files are for the geolocation data records.

The xarray of geoips reader need both the data and lat/lon info. Thus, this VIIRS reader is designed to read in the paired VNP02 and VNP03 files, depending on any one of DNB or IMG or MOD file. In order to minimize dupilcated excution of VIIRS files, additional adjust of excution of the VIIRS files will be needed (discussion with Mindy on how to do it).

`geoips.plugins.modules.readers.viirs_netcdf.`**`add_to_xarray`**`(`*varname*, *nparr*, *xobj*, *dataset_masks*, *data_type*, *nparr_mask*`)`

Add variable to xarray Dataset.

`geoips.plugins.modules.readers.viirs_netcdf.`**`call`**`(`*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*`)`

Read VIIRS netcdf data products.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - List of desired channels (skip unneeded variables as needed).

  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.viirs_netcdf.`**required_chan**(*chans*, *varnames*)

Return True if required channel.

`geoips.plugins.modules.readers.viirs_netcdf.`**required_geo**(*chans*, *data_type*)

Return True if required geolocation dataset.

`geoips.plugins.modules.readers.viirs_netcdf.`**required_geo_chan**(*xarrays*, *xvarname*)

Return True if required geolocation channel.

### geoips.plugins.modules.readers.wfabba_ascii module

WFABBA ascii data reader.

WFABBA is a geostationary fire product produced by SSEC

`geoips.plugins.modules.readers.wfabba_ascii.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read WFABBA ascii data from a list of filenames.

WFABBA ascii files contain list of fire detects with their latitude, longitude, and scan location

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**
dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

`geoips.plugins.modules.readers.wfabba_ascii.`**`parse_header_line`**`(`*line*`)`
Parse header line.

`geoips.plugins.modules.readers.wfabba_ascii.`**`read_wfabba_header`**`(`*wfabba_file*`)`
Read WFABBA header.

`geoips.plugins.modules.readers.wfabba_ascii.`**`read_wfabba_text`**`(`*wfabba_file*`)`
Read WFABBA text from file wfabba_file into xarray Dataset.

## geoips.plugins.modules.readers.windsat_idr37_binary module

Windsat binary data reader.

This code is designed to read windsat sdr binary data (idr37) file for windsat 37 GHz products in GEOIPS environments. the input file name is something alike US058SORB-BINspp.wndmi_fws_d20191126_s134102_e153244_r87467_cfnmoc.idr37.

V1.0: initial version. Song Yang, NRL-MRY, 01/08/2020

errflag is the important parameter of the windsat edr dataset. It is a 32-bit integer which describes what is the current data point status. Here are the meaning of each bit:

```
0-7: Wilheit rain flag
  8: forward/aft scan (bit set to 1 for forward part of scan, 0 for aft␣
↪scan )
  9: ascending/descending pass flag (1 for ascending, 0 for descending)
 10: Warm load flag
 11: Warm load gains applied (1 = gains applied, 0 = gains not applied)
 12: Glare angle invalid because no 1 vector or LOS doesn't pierce earth
 13-18: Glare angle (0 to 30 represents angles of 0 to 60 degree in␣
↪increments
        of 2 deg; 31 represents angles .gt. 60 deg; 32 represents invalid
        glare angle)
 19: Cold load flag. If set to 1 the VH channel data had to be corrected␣
↪due
    to interference in the cold load signal, such as the moon or a
    geostationary satellite.
```

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```
20: Gain Saturation flag. Set to 1 when strong RFI causes the gain to␣
↪change.
    This is set if any TDR saturation flag is set at this frequency
23: used to hold the rfi flag so that it may be passed on to other␣
↪structures
    such as the resampling and intermediate structures. Finally RFI is␣
↪placed
    in the sdr structure.
other bits are spare
```

Here is the original sdr record in Fortran:

```
type IDRRecord_short
   real(double) :: JD2000            8 bytes
   real, dimension(4)::  stokes      16 bytes
   real :: latitude                  4 bytes
   real :: longitude                 4 bytes
   real :: EIA                       4 bytes: earth incidence angle, the␣
↪angle
                                              on the ground between␣
↪vertical and
                                              the satellite look vector
   real :: PRA                       4 bytes: rotation of the polarization␣
↪plane
                                              from true
   real :: CAA                       4 bytes: compass azimuth angle on the␣
↪ground
   real :: tI45, tIcp, pra45         12 bytes
   integer :: errflag                4 bytes (32-bits integer):a set of bit
                                             flags for data quality and
                                             conditions (above explanation)
   integer :: Scan                   4 bytes: scan line number in the␣
↪orbit.
                                              WindSat scans every 1.9␣
↪seconds
   integer(int16) :: dcnum           2 bytes: pixel number along the scan,
                                              called 'downcount number',
                                              because the highest pixel␣
↪number
                                              is measured first.
   integer(int16) :: SurfaceType     2 bytes: legacy SSMI surface type
   integer(int16) :: scanAngle       2 bytes: angle on the ground between␣
↪the
```

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```
                                                          flight direction and the look
                                                          direction
   integer(int8) :: water2land ! copied from IDRL record   1 byte:
   integer(int8) :: land2water ! copied from IDRL record   1 byte:
end type IDRRecord_short
```

- Gain saturation is when a sudden, large signal causes the gain to change quickly and make averaged gain unreliable.
- Forward/Aft is for sensor view position
- The warm load flag indicates that calibration may be unreliable due to solar intrusion into the warm load.
- Cold load flags do not mean calibration is unreliable. It's a way for us to check the cold load correction algorithm.
- Sun glare is not something to worry about.
- The RFI flag is never set at 37 GHz.
- tI45, tIcp, pra45, scanAngleI, water2land, and land2water aren't commanly used.
  - The first four are for recreating the 6-element pre-Stokes polarization vector, and the last two measure coastal contamination

The actual idr37 data record (idr_record) in C:

```
typedef struct {
   double jd2000;
   float stokes[4];
   float plat;     lat of earth observation
   float plon;     lon of earth observation
   float eia;      radiance= ~53deg
   float pra;
   float caa;
   float slat;  latitude of satellite position?  not
   float slon;  longitude of satellite position? not
   float salt;  altitude of satellite (meter? km?) not
   int errflag;
   int scan;
   short dcnum;
   short surf;
   float spare;
idr_record;

Its total length of idr_record is 72 bytes
```

`geoips.plugins.modules.readers.windsat_idr37_binary.call`(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read Windsat binary data products.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**

dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

## geoips.plugins.modules.readers.windsat_remss_winds_netcdf module

Read derived surface winds from REMSS WINDSAT netcdf data.

`geoips.plugins.modules.readers.windsat_remss_winds_netcdf.`**`call`**(*fnames*, *metadata_only=False*, *chans=None*, *area_def=None*, *self_register=False*)

Read Remote Sensing Systems Windsat data.

**Parameters**

- **fnames** (*list*) –
  - List of strings, full paths to files
- **metadata_only** (*bool, default=False*) –
  - NOT YET IMPLEMENTED
  - Return before actually reading data if True
- **chans** (*list of str, default=None*) –
  - NOT YET IMPLEMENTED
  - List of desired channels (skip unneeded variables as needed).
  - Include all channels if None.
- **area_def** (*pyresample.AreaDefinition, default=None*) –
  - NOT YET IMPLEMENTED
  - Specify region to read
  - Read all data if None.
- **self_register** (*str or bool, default=False*) –
  - NOT YET IMPLEMENTED
  - register all data to the specified dataset id (as specified in the return dictionary keys).
  - Read multiple resolutions of data if False.

**Returns**

- dictionary of xarray.Dataset objects with required Variables and Attributes.
- Dictionary keys can be any descriptive dataset ids.

**Return type**
dict of xarray.Datasets

**See also:**

*Xarray and NetCDF Metadata Standards*
Additional information regarding required attributes and variables for GeoIPS-formatted xarray Datasets.

### Module contents

Geoips readers init file.

## geoips.plugins.modules.sector_metadata_generators package

### Submodules

### geoips.plugins.modules.sector_metadata_generators.bdeck_parser module

TC trackfile parser for B-Deck formatted TC deck files.

Each B-Deck file contains the full history of storm BEST tracks, on storm per location per line (split between 3 lines each in comments for readability):

```
AL, 20, 2020091318,   , BEST,   0, 126N,  374W,  30, 1006, TD,   0,    , ␣
↪  0,
   0,    0,    0, 1011,  240, 100,  40,    0,   L,   0,    ,   0,   0,
        TWENTY, M, 12, NEQ,   60,    0,    0,   60, genesis-num, 039,
AL, 20, 2020091400,   , BEST,   0, 130N,  386W,  30, 1006, TD,   0,    , ␣
↪  0,
       0,    0,    0, 1011,  240, 100,  40,   0,   L,   0,    ,   0,   0,
        TWENTY, M, 12, NEQ,   60,   60,    0,    0, genesis-num, 039,
AL, 20, 2020091406,   , BEST,   0, 130N,  404W,  35, 1004, TS,  34, NEQ, ␣
↪  0,
       0,   40,   40, 1011,  240,  40,   0,   0,   L,   0,    ,   0,   0,
         TEDDY, M,  0,    ,    0,    0,    0,    0, genesis-num, 039,
AL, 20, 2020091412,   , BEST,   0, 128N,  422W,  35, 1004, TS,  34, NEQ, ␣
↪ 50,
```

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```
       30,    0,   50, 1011,  240,  40,  45,   0,   L,   0,    ,   0,   0,
          TEDDY, M,  0,    ,    0,    0,    0,    0, genesis-num, 039,
AL, 20, 2020091418,    , BEST,   0, 129N,  434W,  40, 1003, TS,  34, NEQ, ␣
↪ 80,
       40,    0,   70, 1012,  210,  50,  55,   0,   L,   0,    ,   0,   0,
          TEDDY, M, 12, NEQ,   90,   30,    0,   30, genesis-num, 039,
AL, 20, 2020091500,    , BEST,   0, 130N,  445W,  45, 1002, TS,  34, NEQ, ␣
↪100,
       50,    0,   80, 1012,  210,  40,  55,   0,   L,   0,    ,   0,   0,
          TEDDY, M, 12, NEQ,   90,   30,    0,   30, genesis-num, 039,
AL, 20, 2020091506,    , BEST,   0, 134N,  455W,  50, 1001, TS,  34, NEQ, ␣
↪100,
       50,   20,   80, 1012,  210,  20,  60,   0,   L,   0,    ,   0,   0,
          TEDDY, M, 12, NEQ,  300,  210,   30,    0, genesis-num, 039,
AL, 20, 2020091506,    , BEST,   0, 134N,  455W,  50, 1001, TS,  50, NEQ, ␣
↪ 20,
        0,    0,    0, 1012,  210,  20,  60,   0,   L,   0,    ,   0,   0,
          TEDDY, M, 12, NEQ,  300,  210,   30,    0, genesis-num, 039,
AL, 20, 2020091512,    , BEST,   0, 138N,  466W,  55,  999, TS,  34, NEQ, ␣
↪140,
   60,   40,  160, 1011,  250,  20,  65,   0,   L,   0,    ,   0,   0,
      TEDDY, D, 12, NEQ,  300,  210,   30,   30, genesis-num, 039,
AL, 20, 2020091512,    , BEST,   0, 138N,  466W,  55,  999, TS,  50, NEQ, ␣
↪ 30,
    0,    0,   30, 1011,  250,  20,  65,   0,   L,   0,    ,   0,   0,
          TEDDY, D, 12, NEQ,  300,  210,   30,   30, genesis-num, 039,
AL, 20, 2020091518,    , BEST,   0, 142N,  475W,  55,  997, TS,  34, NEQ, ␣
↪140,
   80,   40,  160, 1011,  250,  20,  65,   0,   L,   0,    ,   0,   0,
          TEDDY, D, 12, NEQ,  300,  240,   60,   60, genesis-num, 039,
AL, 20, 2020091518,    , BEST,   0, 142N,  475W,  55,  997, TS,  50, NEQ, ␣
↪ 30,
    0,    0,   30, 1011,  250,  20,  65,   0,   L,   0,    ,   0,   0,
          TEDDY, D, 12, NEQ,  300,  240,   60,   60, genesis-num, 039,
AL, 20, 2020091600,    , BEST,   0, 147N,  480W,  65,  987, HU,  34, NEQ, ␣
↪140,
   80,   40,  150, 1010,  180,  20,  75,   0,   L,   0,    ,   0,   0,
          TEDDY, D,  0,    ,    0,    0,    0,    0, genesis-num, 039,
AL, 20, 2020091600,    , BEST,   0, 147N,  480W,  65,  987, HU,  50, NEQ, ␣
↪ 40,
   30,    0,   30, 1010,  180,  20,  75,   0,   L,   0,    ,   0,   0,
          TEDDY, D,  0,    ,    0,    0,    0,    0, genesis-num, 039,
AL, 20, 2020091600,    , BEST,   0, 147N,  480W,  65,  987, HU,  64, NEQ, ␣
```

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```
↪ 20,
    0,     0,     0, 1010,  180,  20,  75,    0,    L,    0,     ,    0,    0,
            TEDDY, D,   0,     ,     0,     0,     0,     0, genesis-num, 039,
AL, 20, 2020091606,     , BEST,    0, 154N,  486W,  80,  978, HU,  34, NEQ, ␣
↪140,
   80,    40,   150, 1010,  180,  20, 100,    0,    L,    0,     ,    0,    0,
            TEDDY, D, 12, NEQ,  300,  240,  120,  150, genesis-num, 039,
AL, 20, 2020091606,     , BEST,    0, 154N,  486W,  80,  978, HU,  50, NEQ, ␣
↪ 40,
   30,    20,    30, 1010,  180,  20, 100,    0,    L,    0,     ,    0,    0,
            TEDDY, D, 12, NEQ,  300,  240,  120,  150, genesis-num, 039,
AL, 20, 2020091606,     , BEST,    0, 154N,  486W,  80,  978, HU,  64, NEQ, ␣
↪ 20,
   10,    10,    20, 1010,  180,  20, 100,    0,    L,    0,     ,    0,    0,
            TEDDY, D, 12, NEQ,  300,  240,  120,  150, genesis-num, 039,
AL, 20, 2020091612,     , BEST,    0, 161N,  493W,  85,  973, HU,  34, NEQ, ␣
↪170,
  170,    40,   150, 1010,  180,  20, 100,    0,    L,    0,     ,    0,    0,
            TEDDY, D, 12, NEQ,  270,  270,  240,  270, genesis-num, 039,
AL, 20, 2020091612,     , BEST,    0, 161N,  493W,  85,  973, HU,  50, NEQ, ␣
↪ 50,
   50,    20,    30, 1010,  180,  20, 100,    0,    L,    0,     ,    0,    0,
            TEDDY, D, 12, NEQ,  270,  270,  240,  270, genesis-num, 039,
AL, 20, 2020091612,     , BEST,    0, 161N,  493W,  85,  973, HU,  64, NEQ, ␣
↪ 25,
   25,    10,    20, 1010,  180,  20, 100,    0,    L,    0,     ,    0,    0,
            TEDDY, D, 12, NEQ,  270,  270,  240,  270, genesis-num, 039,
AL, 20, 2020091618,     , BEST,    0, 168N,  502W,  85,  973, HU,  34, NEQ, ␣
↪190,
  100,    70,   170, 1010,  180,  20, 105,    0,    L,    0,     ,    0,    0,
            TEDDY, D, 12, NEQ,  300,  300,  240,  300, genesis-num, 039,
AL, 20, 2020091618,     , BEST,    0, 168N,  502W,  85,  973, HU,  50, NEQ, ␣
↪ 80,
   50,    30,    90, 1010,  180,  20, 105,    0,    L,    0,     ,    0,    0,
            TEDDY, D, 12, NEQ,  300,  300,  240,  300, genesis-num, 039,
AL, 20, 2020091618,     , BEST,    0, 168N,  502W,  85,  973, HU,  64, NEQ, ␣
↪ 30,
   25,     0,    30, 1010,  180,  20, 105,    0,    L,    0,     ,    0,    0,
            TEDDY, D, 12, NEQ,  300,  300,  240,  300, genesis-num, 039,
AL, 20, 2020091700,     , BEST,    0, 174N,  511W,  85,  973, HU,  34, NEQ, ␣
↪220,
  100,    80,   170, 1009,  210,  20, 100,    0,    L,    0,     ,    0,    0,
            TEDDY, D, 12, NEQ,  330,  300,  270,  300, genesis-num, 039,
```

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```
AL, 20, 2020091700,   , BEST,   0, 174N,  511W,  85,  973, HU,  50, NEQ, ␣
↪ 60,
   50,    50,    70, 1009,  210,   20, 100,   0,   L,   0,    ,   0,   0,
          TEDDY, D, 12, NEQ,  330,  300,  270,  300, genesis-num, 039,
AL, 20, 2020091700,   , BEST,   0, 174N,  511W,  85,  973, HU,  64, NEQ, ␣
↪ 30,
   25,    20,    30, 1009,  210,   20, 100,   0,   L,   0,    ,   0,   0,
          TEDDY, D, 12, NEQ,  330,  300,  270,  300, genesis-num, 039,
AL, 20, 2020091706,   , BEST,   0, 180N,  520W,  85,  973, HU,  34, NEQ, ␣
↪220,
  100,    80,   170, 1009,  210,   20, 105,   0,   L,   0,    ,   0,   0,
          TEDDY, D, 12, NEQ,  330,  360,  300,  300, genesis-num, 039,
AL, 20, 2020091706,   , BEST,   0, 180N,  520W,  85,  973, HU,  50, NEQ, ␣
↪ 60,
   50,    50,    70, 1009,  210,   20, 105,   0,   L,   0,    ,   0,   0,
          TEDDY, D, 12, NEQ,  330,  360,  300,  300, genesis-num, 039,
AL, 20, 2020091706,   , BEST,   0, 180N,  520W,  85,  973, HU,  64, NEQ, ␣
↪ 30,
   25,    20,    30, 1009,  210,   20, 105,   0,   L,   0,    ,   0,   0,
          TEDDY, D, 12, NEQ,  330,  360,  300,  300, genesis-num, 039,
```

`geoips.plugins.modules.sector_metadata_generators.bdeck_parser.`**`call`**`(`*trackfile_name*`)`

TC deckfile parser for B-Deck files.

Each B-Deck file contains the full history of storm BEST tracks, one storm location per line. Example b-deck files are available in the GeoIPS repo.

**Parameters**

**`trackfile_name`** (*str*) – Path to bdeck file, with full 6 hourly storm track history, formatted as follows:

**Returns**

List of Dictionaries of storm metadata fields from each storm location

**Return type**

list

**See also:**

*API Reference*

Valid fields can be found in geoips.sector_utils.utils.SECTOR_INFO_ATTRS

`geoips.plugins.modules.sector_metadata_generators.bdeck_parser.`**`get_final_storm_name_bd`**

Get final storm name from full bdeck file.

`geoips.plugins.modules.sector_metadata_generators.bdeck_parser.`**`get_invest_number_bdeck`**

Get invest number from full bdeck file.

`geoips.plugins.modules.sector_metadata_generators.bdeck_parser.`**`get_storm_start_datetim`**

Get storm start datetime from full bdeck file.

`geoips.plugins.modules.sector_metadata_generators.bdeck_parser.`**`get_storm_start_datetim`**

Get storm start datetime from bdeck file name.

`geoips.plugins.modules.sector_metadata_generators.bdeck_parser.`**`get_stormyear_from_bdec`**

Get the storm year from the B-deck filename.

**Parameters**

**`bdeck_filename`** (*str*) –

- Path to deck file to search for storm year
- Must be of format: xxxxxYYYY.dat - pulls YYYY from filename based on location

**Returns**

Storm year

**Return type**

int

`geoips.plugins.modules.sector_metadata_generators.bdeck_parser.`**`lat_to_dec`**(*lat_str*)

Return decimal latitude based on N/S specified string.

`geoips.plugins.modules.sector_metadata_generators.bdeck_parser.`**`lon_to_dec`**(*lon_str*)

Return decimal longitude based on E/W specified string.

`geoips.plugins.modules.sector_metadata_generators.bdeck_parser.`**`parse_bdeck_line`**(*line*, *source_*, *storm_y*, *fi-nal_stor*, *in-vest_nur*, *storm_s*, *orig-i-nal_stor*, *parser_*

Retrieve the storm information from the current line from the deck file.

**Parameters**

**`line`** (*str*) – Current line from the deck file including all storm information

- AL, 20, 2020091618, , BEST, 0, 168N, 502W, 85, 973, HU, 64, NEQ, 30, 25, 0, 30, 1010, 180, 20, 105, 0, L, 0, , 0, 0, TEDDY, D, 12, NEQ, 300, 300, 240, 300, genesis-num, 039,
- AL, 20, 2020091700, , BEST, 0, 174N, 511W, 85, 973, HU, 34, NEQ, 220, 100, 80, 170, 1009, 210, 20, 100, 0, L, 0, , 0, 0, TEDDY, D, 12, NEQ, 330, 300, 270, 300, genesis-num, 039,
- AL, 20, 2020091700, , BEST, 0, 174N, 511W, 85, 973, HU, 50, NEQ, 60, 50, 50, 70, 1009, 210, 20, 100, 0, L, 0, , 0, 0, TEDDY, D, 12, NEQ, 330, 300, 270, 300, genesis-num, 039,

**Returns**
Dictionary of the fields from the current storm location from the deck file

**Return type**
dict

**See also:**

*API Reference*
Valid fields can be found in geoips.sector_utils.utils.SECTOR_INFO_ATTRS

## geoips.plugins.modules.sector_metadata_generators.tc_sector_file_parser module

TC trackfile parser for flat text sectorfiles containing current active storms.

These files contain no storm history, only the currently active storm locations. Potentially useful for real-time processing.

10S JOSHUA 210120 1200 21.8S 78.1E SHEM 20 1007 12S ELOISE 210120 1800 15.6S 44.9E SHEM 35 1001 92S INVEST 210120 1800 14.9S 120.8E SHEM 30 1002 93S INVEST 210120 1800 12.6S 98.5E SHEM 30 1003

`geoips.plugins.modules.sector_metadata_generators.tc_sector_file_parser.`**`NSEW_to_float(`**

Convert lat/lon values with NSEW identifiers to positive or negative floats.

**Parameters**
**`lat_lon_val`** (*str*) – Latitude or longitude value as a string, with hemisphere specified by NSEW identifiers

**Returns**
Latitude or Longitude value as a float.

**Return type**
float

`geoips.plugins.modules.sector_metadata_generators.tc_sector_file_parser.call`(*trackfile_na*

TC trackfile parser for flat text sectorfiles containing current active storms.

These files contain no storm history, only the currently active storm locations. Potentially useful for real-time processing.

**Parameters**

**trackfile_name** (*str*) – Flat text sector file name containing all currently active storm locations, formatted as follows: * 10S JOSHUA 210120 1200 21.8S 78.1E SHEM 20 1007 * 12S ELOISE 210120 1800 15.6S 44.9E SHEM 35 1001 * 92S INVEST 210120 1800 14.9S 120.8E SHEM 30 1002 * 93S INVEST 210120 1800 12.6S 98.5E SHEM 30 1003

**Returns**

List of Dictionaries of storm metadata fields from each storm location in the flat text sector file

**Return type**

list

**See also:**

*API Reference*

Valid fields can be found in geoips.sector_utils.utils.SECTOR_INFO_ATTRS

`geoips.plugins.modules.sector_metadata_generators.tc_sector_file_parser.get_storm_year`

Ensure correct storm_year is applied.

For Southern Hemisphere storms that initiate late in the year, the storm year identifier is for the following year.

**Parameters**

- **storm_basin** (*str*) – basin of current storm, one of SH, AL, EP, CP, WP, IO
- **current_month** (*int*) – Current month of storm location
- **current_year** (*int*) – Current year of storm location

**Returns**

Storm year identifier. current year, unless SH storm later than June, then current year + 1

**Return type**

int

`geoips.plugins.modules.sector_metadata_generators.tc_sector_file_parser.`**`parse_flat_sec`**

Retrieve the storm information from the current line from the deck file.

**Parameters**
: **line** (*str*) – Current line from the deck file including all storm information
* 10S JOSHUA 210120 1200 21.8S 78.1E SHEM 20 1007

**Returns**
: Dictionary of the fields from the current storm location from the deck file

**Return type**
: dict

**See also:**

*API Reference*
: Valid fields can be found in geoips.sector_utils.utils.SECTOR_INFO_ATTRS

### Module contents

GeoIPS trackfile parsers init file.

### geoips.plugins.modules.sector_spec_generators package

### Submodules

### geoips.plugins.modules.sector_spec_generators.center_coordinates module

Generate standard pyresample area definitions given center coordinates.

Given desired center lat/lon, projection, resolution, and shape, return a valid pyresample area definition object.

`geoips.plugins.modules.sector_spec_generators.center_coordinates.`**`call`**(*area_id*, *long_description*, *clat*, *clon*, *projection*, *pixel_width*, *pixel_height*, *num_samples*, *num_lines*)

Create area definition using clat, clon, resolution, and shape.

`geoips.plugins.modules.sector_spec_generators.center_coordinates.set_clat_clon_proj_in`

Create standard proj4 dictionary from passed projection information.

### Module contents

Geoips sector_spec_generators init file.

### geoips.plugins.modules.title_formatters package

### Submodules

### geoips.plugins.modules.title_formatters.static_standard module

Standard GeoIPS static title production.

`geoips.plugins.modules.title_formatters.static_standard.call`(*area_def*, *xarray_obj*, *product_name_title*, *product_datatype_title=None*, *bg_xarray=None*, *bg_product_name_title=None*, *bg_datatype_title=None*, *title_copyright=None*)

Generate standard GeoIPS formatted title.

### geoips.plugins.modules.title_formatters.tc_copyright module

Standard GeoIPS formatted titles for TC products, with copyright info.

`geoips.plugins.modules.title_formatters.tc_copyright.call(area_def, xarray_obj, product_name_title, product_datatype_title=None, bg_xarray=None, bg_product_name_title=None, bg_datatype_title=None, title_copyright=None)`

Create GeoIPS formatted title for TC products, with copyright info.

### geoips.plugins.modules.title_formatters.tc_standard module

Standard GeoIPS formatted titles for tropical cyclone products.

`geoips.plugins.modules.title_formatters.tc_standard.call(area_def, xarray_obj, product_name_title, product_datatype_title=None, bg_xarray=None, bg_product_name_title=None, bg_datatype_title=None, title_copyright=None)`

Create standard GeoIPS formatted title for tropical cyclone products.

### Module contents

GeoIPS title formatters init file.

### Module contents

geoips.plugins.modules init file.

### Module contents

Plugins init file.

### geoips.sector_utils package

### Submodules

### geoips.sector_utils.estimate_area_extent module

Utility for estimating the area extent, used in pyresample area definitions.

`geoips.sector_utils.estimate_area_extent.`**`center_longitude`**(*min_longitude*, *max_longitude*)

Determine the center longitude based off longitude in either degW or degE.

**Parameters**

- **min_longitude** (*float*) – Min and Max Longitude (degrees West or East)
- **max_longitude** (*float*) – Min and Max Longitude (degrees West or East)

**Returns**

Center longitude in degrees West or East

**Return type**

float

`geoips.sector_utils.estimate_area_extent.`**`convert_west2east`**(*longitude*)

Convert Longitude from degrees West to degrees East, if applicable.

**Parameters**

**longitude** (*float*) – Longitude (degrees West or East)

**Returns**

Longitude in degrees East

**Return type**

float

`geoips.sector_utils.estimate_area_extent.`**`esitmate_area_from_center`**(*lat_0*, *lon_0*, *height*, *width*, *resolution*)

Estimate the area extent for use in the YAML area definition.

**Parameters**

- **lat_0** (*float*) – Center lat/lon values in degrees
- **lon_0** (*float*) – Center lat/lon values in degrees
- **height** (*int*) – Pixel dimensions
- **width** (*int*) – Pixel dimensions
- **resolution** (*int*) – Resolution in meters

**Returns**

Dictionary holding:

- lower_left_xy - list of projection x/y coordinates of lower left corner of lower left pixel
- upper_right_xy - list of projection x/y coordinates of upper right corner of upper right pixel
- height - number of grid rows
- width - number of grid columns
- lat_0 - Center latitude in degrees
- lon_0 - Center longitude in degrees

**Return type**

dict

geoips.sector_utils.estimate_area_extent.**estimate_area_extent**(*min_lat*, *min_lon*, *max_lat*, *max_lon*, *resolution*)

Estimate the area extent for use in the YAML area definition.

**Parameters**

- **min_lat** (*float*) – Min/Max lat/lon values in degrees
- **min_lon** (*float*) – Min/Max lat/lon values in degrees
- **max_lat** (*float*) – Min/Max lat/lon values in degrees
- **max_lon** (*float*) – Min/Max lat/lon values in degrees
- **resolution** (*float*) – Resolution in meters

**Returns**

Dictionary holding:

- lower_left_xy - list of projection x/y coordinates of lower left corner of lower left pixel
- upper_right_xy - list of projection x/y coordinates of upper right corner of upper right pixel
- height - number of grid rows
- width - number of grid columns
- lat_0 - Center latitude in degrees
- lon_0 - Center longitude in degrees

**Return type**

dict

`geoips.sector_utils.estimate_area_extent.`**`generateMinMaxLatLong`**`(`*lat_0*, *lon_0*, *height*, *width*, *resolution*`)`

Generate minimum and maximum latitude longitude pairs.

Min/max lat/lon based off the resolution and height/width provided.

**Parameters**

- **lat_0** (*float*) – Pair of latitude and longitude coordinates in degrees
- **lon_0** (*float*) – Pair of latitude and longitude coordinates in degrees
- **height** (*int*) – Represents pixel dimensions and resolution of image in meters
- **width** (*int*) – Represents pixel dimensions and resolution of image in meters
- **resolution** (*int*) – Represents pixel dimensions and resolution of image in meters

**Returns**

min_lat, max_lat, min_lon, max_lon

**Return type**

list of floats

`geoips.sector_utils.estimate_area_extent.`**`haversine_distance`**`(`*lat1*, *lon1*, *lat2*, *lon2*`)`

Calculate the distance between two latitude and longitude points.

Uses the haversine formula.

**Parameters**

- **lat1** (*float*) – Pair of latitude and longitude coordinates in degrees
- **lon1** (*float*) – Pair of latitude and longitude coordinates in degrees
- **lat2** (*float*) – Pair of latitude and longitude coordinates in degrees
- **lon2** (*float*) – Pair of latitude and longitude coordinates in degrees

**Returns**
Distance in meters between two coordinates

**Return type**
float

## geoips.sector_utils.overpass_predictor module

Overpass predictor, based on Two Line Element files.

geoips.sector_utils.overpass_predictor.**calculate_overpass**(*tle*, *observer_lat*, *observer_lon*, *date*, *satellite_name*)

Calculate next overpass for a satellite at an observer location and time.

**Parameters**

- **tle** (*ephem.EarthSatellite*) – tle for satellite
- **observer_lat** (*float*) – observer latitude
- **observer_lon** (*float*) – observer longitude
- **date** (*datetime.datetime*) – start time for next overpass
- **satellite_name** (*str*) – name of satellite

**Returns**
next overpass information

**Return type**
dict

geoips.sector_utils.overpass_predictor.**check_tle_name_to_passed_names**(*tle_name*, *satellite_names_list*)

Check if the satellite name in the TLE files is in the satellite names list.

Satellite names in the TLE files may be longer than the names passed to the overpass predictor For example, a user might request 'GCOM-W1', and the name in the TLE file is 'GCOM-W1 (SHIZUKU)'.

**Parameters**

- **tle_name** (*str*) – satellite name read from the TLE file
- **satellite_names_list** (*list of str*) – list of user specified satellites to read from TLE file

**Returns**
True if tle_name is in the passed satellite names list

**Return type**
bool

geoips.sector_utils.overpass_predictor.**floor_minute**(*datetime_obj*)

Remove seconds and microseconds from datetime object.

**Parameters**
**datetime_obj** (*datetime.datetime*) – datetime

**Returns**
datetime with no seconds/microseconds

**Return type**
datetime.datetime

geoips.sector_utils.overpass_predictor.**predict_overpass_area_def**(*tlefile*, *area_definition*, *satellite_list*, *start_datetime*, *check_midpoints=False*)

Predict satellite overpass for an area_definition.

**Parameters**

- **tlefile** (*str*) – file path of TLE
- **area_definition** (*pyresample AreaDefinition*) – pyresample area definition
- **satellite_list** (*list*) – list of satellites to predict the overpass times
- **start_datetime** (*datetime.datetime*) – start time to find the next available overpass
- **check_midpoints** (*bool*) – check mid points of area definition for additional overpassses

**Returns**
dictionary holding next satellite overpass estimates (sorted by satellite -> overpass info)

**Return type**
dict

`geoips.sector_utils.overpass_predictor.`**`predict_overpass_yaml`**(*tlefile*, *sectorfile*, *sector_list*, *satellite_list*, *start_datetime*, *check_midpoints=False*)

Predict satellite overpass for sectors from a given yaml sector file.

**Parameters**

- **tlefile** (*str*) – file path of TLE
- **sectorfile** (*str*) – file path of sectorfile
- **sector_list** (*list*) – list of sectors held within the sectorfile
- **satellite_list** (*list*) – list of satellites to predict the overpass times
- **start_datetime** (*datetime.datetime*) – start time to find the next available overpass
- **check_midpoints** (*bool*) – check mid points of area definition for additional overpassses

**Returns**
dictionary holding next satellite overpass estimates for sectors (sorted by sector -> satellite -> overpass info)

**Return type**
dict

`geoips.sector_utils.overpass_predictor.`**`predict_satellite_overpass`**(*tlefile*, *satellite_name*, *satellite_tle*, *area_def*, *start_datetime*, *check_midpoints=False*)

Estimate next satellite overpass information with ephem.

**Parameters**

- **tlefile** (*str*) – file path of TLE
- **satellite_name** (*str*) – name of satellite
- **satellite_tle** (*dict*) – dictionary holding satellite tle line1 and line2 data

- **area_def** (*pyresample AreaDefinition*) – area definition
- **start_datetime** (*datetime.datetime*) – start time to find the next available overpass
- **check_midpoints** (*bool*) – check mid points of area definition for additional overpassses

**Returns**
dictionary holding next overpass information

**Return type**
dict

geoips.sector_utils.overpass_predictor.**read_satellite_tle**(*tlefile*, *satellite_list*)

Open and extract satellite infromation from TLE file.

**Parameters**

- **tlefile** (*str*) – file path of TLE
- **satellite_list** (*list of str*) – list of satellites to read from TLE

**Returns**
satellite TLE data

**Return type**
dict

### geoips.sector_utils.projections module

Projection information for setting up pyresample area definitions.

geoips.sector_utils.projections.**get_projection**(*name*)

Get a dictionary of projection names containing the specified keys.

**Dictionary keys:**

- name: the basemap projection short name
- p4name: the Proj4 projection name
- longname: a long name describing the projection
- type: an integer indicating how the projection must be set up

The type field tells the program which arguments will be useful to a given projection

- Can use corner lats and lons or center lats and lons with width and height
- Ignores corner lats and lons and width/height arguments. Uses center lat/lon

- Can use corner lats and lons or corner coordinates in the local projection space, but ignores all other location parameters.

### geoips.sector_utils.tc_tracks module

Modules to access TC tracks, based on locations found in the deck files.

`geoips.sector_utils.tc_tracks.`**`create_tc_sector_info_dict`**(*clat*, *clon*, *synoptic_time*, *storm_year*, *storm_basin*, *storm_num*, *aid_type=None*, *storm_name=None*, *final_storm_name=None*, *deck_line=None*, *source_sector_file=None*, *pressure=None*, *vmax=None*)

Create storm info dictionary from items.

**Parameters**

- **clat** (*float*) – center latitude of storm
- **clon** (*float*) – center longitude of storm
- **synoptic_time** (*datetime.datetime*) – time of storm location
- **storm_year** (*int*) – 4 digit year of storm
- **storm_basin** (*str*) – 2 digit basin identifier
- **storm_num** (*int*) – 2 digit storm number
- **aid_type** (*str, default=None*) – type of TC aid (BEST, MBAM, etc)
- **storm_name** (*str, default=None*) – Common name of storm
- **final_storm_name** (*str, default=None*) – Final name found throughout entire track file (ie, if reprocessing, will ensure early storm locations are identified with final storm name)
- **deck_line** (*str, default=None*) – source deck line for storm information
- **pressure** (*float, default=None*) – minimum pressure
- **vmax** (*float, default=None*) – maximum wind speed

**Returns**
: **fields** – Dictionary of sector information, as passed into function.

**Return type**
: dict

`geoips.sector_utils.tc_tracks.get_tc_area_id`(*fields*, *finalstormname*, *tcyear*)

Get TC area_id from fields, to be used as pyresample AreaDefinition area_id.

Will be of form: * tcYYYYBBNNname (ie, tc2016io01one)

`geoips.sector_utils.tc_tracks.get_tc_long_description`(*area_id*, *fields*)

Return long_description of TC sector.

This is commonly used as the long name/description on the pyresample AreaDefinition.

`geoips.sector_utils.tc_tracks.interpolate_storm_location`(*interp_dt*, *longitudes*, *latitudes*, *synoptic_times*)

Interpolate the storm location at a specific time.

Based on a list of known locations and times

`geoips.sector_utils.tc_tracks.set_tc_area_def`(*fields*, *tcyear=None*, *finalstormname=None*, *source_sector_file=None*, *clat=None*, *clon=None*, *tc_spec_template='tc_web'*, *aid_type=None*)

Set the TC area definition, using specified arguments.

**Parameters**

- **fields** (*dict*) – Dictionary of TC sector_info fields (clat, clon, storm name, etc) Valid fields can be found in geoips.sector_utils.utils.SECTOR_INFO_ATTRS
- **tcyear** (*int, default=None*) – Passed tcyear - since current year may not match tcyear for SHEM storms
- **finalstormname** (*str, default=None*) – finalstormname allows re-processed storms to go in final storm directory
- **source_sector_file** (*str, default=None*) – attach source_sector_file to area_definition if known
- **clat** (*float, default=None*) – specify clat/clon separately from that found in 'fields'
- **clon** (*float, default=None*) – specify clat/clon separately from that found in 'fields'

- **tc_spec_template** (*str, default="tc_web"*) – Path to template YAML file to use when setting up area definition.
- **aid_type** (*str, default=None*) – type of TC aid (BEST, MBAM, etc)

**Returns**
pyresample AreaDefinition object with specified parameters.

**Return type**
pyresample.AreaDefinition

`geoips.sector_utils.tc_tracks.`**`trackfile_to_area_defs`**(*trackfile_name*, *trackfile_parser='bdeck_parser'*, *tc_spec_template=None*)

Get TC area definitions for the specified text trackfile.

Limit to optionally specified trackfile_sectorlist

**Parameters**

- **trackfile** (*str*) – Full path to trackfile, convert each line into a separate area_def
- **trackfile_parser** (*str*) – Parser to use from plugins.modules.sector_metadata_generators on trackfiles

**Returns**
List of pyresample AreaDefinition objects

**Return type**
list

### geoips.sector_utils.tc_tracks_database module

Utilities for creating a database of tropical cyclone tracks.

`geoips.sector_utils.tc_tracks_database.`**`check_db`**(*filenames=None*, *process=False*)

Check TC database for passed filenames.

filenames is a list of filenames and directories. if a list element is a string directory name, it expands to list of files in dir.

`geoips.sector_utils.tc_tracks_database.`**`get_all_storms_from_db`**(*start_datetime*, *end_datetime*, *tc_spec_template=None*, *trackfile_parser=None*, *include_track_files=False*)

Get all entries from all storms within a specific range of time from the TC DB.

**Parameters**

- **start_datetime** (*datetime.datetime*) – Start time of desired range
- **end_datetime** (*datetime.datetime*) – End time of desired range

**Returns**

List of pyresample Area Definitions, each storm location that falls within the desired time range.

**Return type**

list of pyresample Area Definitions

### Examples

```
>>> startdt = datetime.strptime('20200216', '%Y%m%d')
>>> enddt = datetime.strptime('20200217', '%Y%m%d')
>>> get_storm_from_db(startdt, enddt)
```

geoips.sector_utils.tc_tracks_database.**open_tc_db**(*dbname='/users/surratt/geoips/outdirs/longterm*

Open the TC Decks Database, create it if it doesn't exist.

geoips.sector_utils.tc_tracks_database.**reprocess_storm**(*tc_trackfilename*)

Reprocess storm tc_trackfilename, using info in TC tracks database.

geoips.sector_utils.tc_tracks_database.**update_fields**(*tc_trackfilename*, *cc*, *conn*, *process=False*)

Update fields in TC track database with passed tc_trackfilename.

## geoips.sector_utils.utils module

Utilities for working with dynamic sector specifications.

geoips.sector_utils.utils.**check_center_coverage**(*xarray_obj*, *area_def*, *varlist*, *covg_varname=None*, *covg_varlist=None*, *width_degrees=8*, *height_degrees=8*, *verbose=False*, *hours_before_sector_time=18*, *hours_after_sector_time=6*)

Check if there is any data covering the center of the sector.

Do not provide any longitude padding for coverage check sectoring - we want to see if there is any data within the exact center box, not within +- 3 degrees of the center box.

`geoips.sector_utils.utils.`**`copy_sector_info`**(*src_area_def*, *dest_area_def*)

Copy sector info from src_area_def to dest_area_def.

`geoips.sector_utils.utils.`**`create_areadefinition_from_yaml`**(*yamlfile*, *sector*)

Take a YAML with misc metadata and create a pyresample areadefinition.

Misc. metadata will be parsed from the YAML file and manually added to the areadefinition

**Parameters**

- **`yamlfile`** (*str*) – full path to YAML area definition file
- **`sector`** (*str*) – name of sector

**Returns**

pyresample AreaDefinition based on YAML specification.

**Return type**

pyresample.AreaDefinition

`geoips.sector_utils.utils.`**`filter_area_defs_actual_time`**(*area_defs*, *actual_datetime*)

Filter list of area_defs to only include the passed actual_datetime.

`geoips.sector_utils.utils.`**`get_lat_center`**(*lats*)

Return the center longitude point from lats array.

`geoips.sector_utils.utils.`**`get_lon_center`**(*lons*)

Return the center longitude point from lons array.

`geoips.sector_utils.utils.`**`get_max_lat`**(*lats*)

Get maximum latitude from array of latitudes.

**Parameters**

**`lats`** (*numpy.ndarray*) – numpy MaskedArray of latitudes

**Returns**

Maximum latitude, between -90 and 90

**Return type**

float

`geoips.sector_utils.utils.`**`get_max_lon`**(*lons*)

Get maximum longitude from array of longitudes, handling date line.

**Parameters**

**`lons`** (*numpy.ndarray*) – numpy MaskedArray of longitudes

**Returns**

Maximum longitude, between -180 and 180

**Return type**
float

`geoips.sector_utils.utils.get_min_lat(lats)`

Get minimum latitude from array of latitudes.

**Parameters**
`lats` (*numpy.ndarray*) – numpy MaskedArray of latitudes

**Returns**
Minimum latitude, between -90 and 90

**Return type**
float

`geoips.sector_utils.utils.get_min_lon(lons)`

Get minimum longitude from array of longitudes, handling date line.

**Parameters**
`lons` (*numpy.ndarray*) – numpy MaskedArray of longitudes

**Returns**
Minimum longitude, between -180 and 180

**Return type**
float

`geoips.sector_utils.utils.get_sectors_from_yamls(sector_list)`

Get AreaDefinition objects with custom "sector_info" dictionary.

Based on YAML area definition contained in "sectorfnames" files.

**Parameters**
`sector_list` (*list of str*) – list of strings of desired sector names to retrieve from YAML files

**Returns**
List of pyresample AreaDefinition objects, with arbitrary additional YAML entries added as attributes to each area def (this is to allow specifying "sector_info" metadata dictionary within the YAML file)

**Return type**
list

`geoips.sector_utils.utils.get_static_area_defs_for_xarray(xarray_obj, sectorlist)`

Get all STATIC area definitions for the current xarray object.

Filter based on requested sectors.

**Parameters**

- **xarray_obj** (*xarray.Dataset*) – xarray Dataset to which we are assigning area_defs
- **sectorlist** (*list of str*) – list of sector names

**Returns**
List of pyresample AreaDefinition objects

**Return type**
list of pyresample.AreaDefinition

geoips.sector_utils.utils.**get_tc_area_defs_for_xarray**(*xarray_obj*, *tcdb_sector_list=None*, *tc_spec_template=None*, *trackfile_parser=None*, *hours_before_sector_time=18*, *hours_after_sector_time=6*, *aid_type=None*)

Get all TC area definitions for the current xarray object, and requested sectors.

**Parameters**

- **xarray_obj** (*xarray.Dataset*) – xarray Dataset to which we are assigning area_defs
- **tcdb_sector_list** (*list of str, default=None*) –
  - list of sector names to process, of format: tc2020io01amphan.
  - If None, or 'all' contained in list, process all matching TC sectors.
- **actual_datetime** (*datetime.datetime, default=None*) – Optional datetime to match for dynamic sectors
- **var_for_coverage** (*str*) – Default None, optional variable to sector to check exact time
- **hours_before_sector_time** (*float, default=18*) – hours to look before sector time
- **hours_after_sector_time** (*float, default=6*) – hours to look after sector time
- **aid_type** (*str, default=None*) – string to look for in "aid_type" TC deck file field for inclusion

**Returns**
List of pyresample AreaDefinition objects required for passed xarray

**Return type**
list of pyresample AreaDefinition

geoips.sector_utils.utils.**get_trackfile_area_defs**(*trackfiles*, *trackfile_parser*, *trackfile_sectorlist=None*, *tc_spec_template=None*, *aid_type=None*, *start_datetime=None*, *end_datetime=None*)

Get all TC area definitions for the current xarray object, and requested sectors.

**Parameters**

- **trackfiles** (*list*) – List of trackfiles to convert into area_defs
- **trackfile_parser** (*str*) – Parser to use from plugins.modules.sector_metadata_generators on trackfiles
- **str** (*trackfile_sectorlist list of*) –
  - list of sector names to process, of format: tc2020io01amphan.
  - If None, or 'all' contained in list, process all matching TC sectors.
- **default=None** –
  - list of sector names to process, of format: tc2020io01amphan.
  - If None, or 'all' contained in list, process all matching TC sectors.
- **aid_type** (*str, default=None*) – If specified, string to look for in "aid_type" TC deck file field for inclusion

**Returns**

List of pyresample AreaDefinition objects

**Return type**

list of pyresample.AreaDefinition

geoips.sector_utils.utils.**is_dynamic_sector**(*area_def*)

Determine if the AreaDefinition object is a dynamic region of interest.

**Parameters**

**area_def** (*pyresample.AreaDefinition*) – pyresample AreaDefinition object specifying region of interest

**Returns**

- True if area_def.sector_start_datetime exists and is not None,
- False otherwise

**Return type**

bool

geoips.sector_utils.utils.**is_requested_aid_type**(*area_def*, *aid_type=None*)

Return True if passed area_def is of requested aid_type.

geoips.sector_utils.utils.**is_sector_type**(*area_def*, *sector_type_str*)

Determine if the type of area_def sector is as specified in passed sector_type.

**Parameters**

- **area_def** (*pyresample.AreaDefinition*) – pyresample AreaDefinition object specifying region of interest
- **sector_type_str** (*str*) –
  - String specifying the type of sector, must match 'sector_type' attribute on AreaDefinition object
  - currently one of 'tc', 'pyrocb', 'volcano', 'atmosriver' 'static'

**Returns**

True if area_def.sector_type == 'sector_type', False otherwise

**Return type**

bool

geoips.sector_utils.utils.**remove_duplicate_storm_positions**(*area_defs*, *aid_type=None*)

Remove duplicate storm positions from passed list of area_defs.

Uses "is_requested_aid_type" and "storm_locations_match" utilities.

geoips.sector_utils.utils.**set_tc_coverage_check_area_def**(*area_def*, *width_degrees=8*, *height_degrees=8*)

Set the area definition for checking coverage for TC overpasses.

Take a small box around the center of the storm to evaluate coverage, rather than the entire image.

**Parameters**

**area_def** (*pyresample.AreaDefinition*) – original area definition

**Returns**

pyresample AreaDefinition pertaining to the region for plotting

**Return type**

pyresample.AreaDefinition

geoips.sector_utils.utils.**set_text_area_def**(*xarray_obj*, *area_def*)

Set the area definition for text files.

This uses raw sectored data, not interpolated.

**Parameters**

- **xarray_obj** (*xarray.Dataset*) – xarray dataset
- **area_def** (*pyresample.AreaDefinition*) – original area definition

**Returns**
pyresample AreaDefinition pertaining to the region for generating text file

**Return type**
pyresample.AreaDefinition

`geoips.sector_utils.utils.`**`storm_locations_match`**`(`*area_def*, *other_area_def*`)`

Return True if passed pyresample AreaDefinitions are the same location.

Match if center lat, center lon, storm year, storm basin, and synoptic time all match.

### geoips.sector_utils.yaml_utils module

Utilities for working with YAML sector specifications.

`geoips.sector_utils.yaml_utils.`**`add_description_to_yamldict`**`(`*yaml_dict*, *sectorname*, *sector_type*, *sector_start_datetime=None*, *info_dict=None*`)`

Add passed sector description information to passed YAML dictionary.

`geoips.sector_utils.yaml_utils.`**`add_dynamic_datetime_to_yamldict`**`(`*yaml_dict*, *sectorname*, *sector_start_datetime*, *sector_end_datetime*`)`

Add passed dynamic datetime info to passed YAML dictionary.

`geoips.sector_utils.yaml_utils.`**`add_projection_to_yamldict`**`(`*yaml_dict*, *sectorname*, *center_lat*, *center_lon*, *center_x=0*, *center_y=0*, *template_yaml=None*`)`

Add projection information to YAML dictionary.

`geoips.sector_utils.yaml_utils.`**`add_sectorinfo_to_yamldict`**`(`*yaml_dict*, *sectorname*, *sector_info_dict*`)`

Add sector_info dictionary to YAML dictionary.

geoips.sector_utils.yaml_utils.**area_def_to_yamldict**(*area_def*)

Convert passed pyresample AreaDefinition to a valid YAML dictionary.

geoips.sector_utils.yaml_utils.**area_def_to_yamlfile**(*area_def*, *out_fname*)

Write pyresample AreaDefinition out as a valid YAML dictionary.

geoips.sector_utils.yaml_utils.**write_yamldict**(*yamldict*, *out_fname*, *force=False*)

Write yamldict to out_fname.

**Parameters**

- **yamldict** (*dict*) – Dictionary to write out to YAML file
- **out_fname** (*str*) – Output filename to write YAML dict to
- **force** (*bool, default=False*) – If True, overwrite existing file.

**Returns**

Path to output file if successfully produced

**Return type**

str

## Module contents

Geoips sector utils init file.

## geoips.utils package

## Submodules

## geoips.utils.decorators module

GeoIPS decorators module.

class geoips.utils.decorators.**deprecated**(*replacement=None*)

Bases: object

A decorator that deprecates a function.

When applied to a function, will cause that function to raise a DeprecationWarning when called.

geoips.utils.decorators.**developmental**(*func*)

Mark an interfaces as developmental.

When applied to a function, will prepend a "developmental" message to the beginning of that function's docstring.

### geoips.utils.memusg module

Utilities for tracking and monitoring memory and resource usage.

geoips.utils.memusg.**print_mem_usage**(*logstr=''*, *verbose=False*)

Print memory usage to LOG.info.

- By default include psutil output.
- If verbose is True, include output from both psutil and resource packages.

geoips.utils.memusg.**print_resource_usage**(*logstr=''*)

Print verbose resource usage, using "resource" package.

### Module contents

Geoips utilities init file.

### geoips.xarray_utils package

### Submodules

### geoips.xarray_utils.data module

Utilities for manipulating xarray Datasets and DataArrays.

geoips.xarray_utils.data.**get_lat_lon_points**(*checklat*, *checklon*, *diff*, *sect_xarray*, *varname*, *drop=False*)

Pull values from xarray Datasets in specified geographic location.

Return points a given distance around a specified lat/lon location, from xarray Datasets.

**Parameters**

- **checklat** (*float*) – latitude of interest
- **checklon** (*float*) – longitude of interest
- **diff** (*float*) – check +- diff of latitude and longitude
- **sect_xarray** (*Dataset*) – xarray dataset containing 'latitude' 'longitude' and varname variables
- **varname** (*str*) – variable name of data array to use for returning data values

**Returns**

- min value in range
- max value in range
- and number of points in range

**Return type**
float, float, int

`geoips.xarray_utils.data.`**`get_lat_lon_points_numpy`**(*checklat*, *checklon*, *diff*, *lat_array*, *lon_array*, *data_array*)

Pull values from numpy arrays in specified geographic location.

Return points a given distance around a specified lat/lon location, from numpy arrays.

**Parameters**

- **checklat** (*float*) – latitude of interest
- **checklon** (*float*) – longitude of interest
- **diff** (*float*) – check +- diff of latitude and longitude
- **lat_array** (*ndarray*) – numpy ndarray of latitude locations - same shape as lon_array and data_array
- **lon_array** (*ndarray*) – numpy ndarray of longitude locations - same shape as lat_array and data_array
- **data_array** (*ndarray*) – numpy ndarray data values - same shape as lat_array and lon_array

**Returns**

- min value in range
- max value in range
- and number of points in range

**Return type**
float, float, int

`geoips.xarray_utils.data.`**`get_sectored_xarrays`**(*xobjs*, *area_def*, *varlist*, *get_bg_xarrays=False*, *check_center=True*, *drop=False*)

Get all xarray objects sectored to area_def.

Return primary dataset, as well as VIS/IR overlay datasets.

`geoips.xarray_utils.data.`**`get_vis_ir_bg`**(*sect_xarray*)

Find matching vis/ir background for data in sect_xarray.

`geoips.xarray_utils.data.`**`sector_xarray_dataset`**(*full_xarray*, *area_def*, *varnames*, *lon_pad=3*, *lat_pad=0*, *verbose=False*, *hours_before_sector_time=18*, *hours_after_sector_time=6*, *drop=False*)

Use the xarray to appropriately sector out data by lat/lon and time.

`geoips.xarray_utils.data.`**`sector_xarray_spatial`**(*full_xarray*, *extent_lonlat*, *varnames*, *lon_pad=3*, *lat_pad=0*, *verbose=False*, *drop=False*)

Sector an xarray object spatially. If full_xarray is None, return None.

**Parameters**

- **full_xarray** (*xarray.Dataset*) – xarray object to sector spatially
- **extent_lonlat** (*list of float*) – Area to sector: [MINLON, MINLAT, MAXLON, MAXLAT]
- **varnames** (*list of str*) – list of variable names that should be sectored based on 'time'
- **drop** (*bool*) – Specify whether to remove points with no coverage (rather than masking)

**Returns**

- if full_xarray is None, return None,
- else return resulting xarray Dataset.

**Return type**

xarray.Dataset

`geoips.xarray_utils.data.`**`sector_xarray_temporal`**(*full_xarray*, *mindt*, *maxdt*, *varnames*, *verbose=False*, *drop=False*)

Sector an xarray object temporally. If full_xarray is None, return None.

**Parameters**

- **full_xarray** (*xarray.Dataset*) – xarray object to sector temporally
- **mindt** (*datetime.datetime*) – minimum datetime of desired data
- **maxdt** (*datetime.datetime*) – maximum datetime of desired data
- **varnames** (*list of str*) – list of variable names that should be sectored based on 'time', mindt, maxdt

**Returns**

- if full_xarray is None, return None
- return full original xarray object if 'time' is not included in varnames list
- else, return sectored xarray object with only the desired times, specified by mindt and maxdt

**Return type**
xarray Dataset, or None

`geoips.xarray_utils.data.`**`sector_xarrays`**`(`*xobjs*, *area_def*, *varlist*, *verbose=False*, *hours_before_sector_time=18*, *hours_after_sector_time=6*, *check_center=True*, *drop=False*, *lon_pad=3*, *lat_pad=0*`)`

Return list of sectored xarray objects.

## geoips.xarray_utils.time module

Utils to handle time stamp information within xarray objects.

`geoips.xarray_utils.time.`**`get_datetime_from_datetime64`**`(`*dt64*`)`

Get a python datetime object from a numpy datetime64 object.

**Parameters**
**dt64** (*numpy.datetime64'*) – numpy.datetime64 object

**Returns**
Python datetime object

**Return type**
datetime.datetime

### Notes

Backwards compatible with numpy versions

`geoips.xarray_utils.time.`**`get_max_from_xarray_time`**`(`*xarray_obj*, *varname*`)`

Get the maximum time as a datetime object from xarray object.

**Parameters**

- **xarray_obj** (*xarray.Dataset or xarray.DataArray*) – xarray object from which to extract the maximum time
- **varname** (*str*) – Timestamp variable name from which to extract the maximum time

**Returns**
Python datetime.datetime object representing maximum time of the Dataset or DataArray

**Return type**
datetime.datetime

`geoips.xarray_utils.time.`**`get_min_from_xarray_time`**(*xarray_obj*, *varname*)

Get the minimum time as a datetime object from xarray object.

**Parameters**

- **xarray_obj** (*xarray.Dataset or xarray.DataArray*) – xarray object from which to extract the minimum time
- **varname** (*str*) – Timestamp variable name from which to extract the minimum time

**Returns**
Python datetime.datetime object representing minimum time of the Dataset or DataArray

**Return type**
datetime.datetime

`geoips.xarray_utils.time.`**`get_posix_from_datetime`**(*dt*)

Return the POSIX timestamp in seconds.

**Parameters**
**dt** (*datetime.datetime*) – datetime object to convert to posix timestamp

**Returns**
representing seconds since 1 January 1970 at 00Z (epoch seconds)

**Return type**
long

### Module contents

Geoips xarray utils init file.

### 6.1.2 Submodules

### 6.1.3 geoips.cli module

GeoIPS

The Geolocated Information Processing System (GeoIPS) is a generalized processing system, providing a collection of algorithm and product implementations facilitating consistent and reliable application of specific products across a variety of sensors and data types.

GeoIPS acts as a toolbox for internal GeoIPS-based product development - all modules are expected to have simple inputs and outputs (Python numpy or dask arrays or xarrays, dictionaries, strings, lists), to enable portability and simplified interfacing between modules.

**class** `geoips.cli.`**`RawDescriptionArgumentDefaultsHelpFormatter`**(*prog*, *indent_increment=2*, *max_help_position=24*, *width=None*)

Bases: `ArgumentDefaultsHelpFormatter`, `RawDescriptionHelpFormatter`

Compound formatter class for user-readable help.

- preserves the raw description formatting
- adds defaults to helps.

`geoips.cli.`**`add_list_interface_parser`**(*subparsers*, *name*, *aliases=None*)

Add list interface parser.

`geoips.cli.`**`formclass`**

alias of *`RawDescriptionArgumentDefaultsHelpFormatter`*

`geoips.cli.`**`get_interface`**(*name*)

Get interface.

`geoips.cli.`**`list_dev_interfaces`**()

Return a list of all developmental interfaces.

`geoips.cli.`**`list_interface_plugins`**(*interface_name*)

List interface plugins.

`geoips.cli.`**`list_interfaces`**(*dev=False*)

List interfaces.

`geoips.cli.`**`main`**()

Command line interface main function.

`geoips.cli.`**`print_table`**(*title*, *headings*, *rows*)

Print a column formatted table.

**Parameters**

- **title** (*str*) – A title for the table
- **headings** (*list of str*) – A list of strings to use as column headings
- **rows** (*list of tupl of str*) – A list of equal-length tuples

### 6.1.4 geoips.compare_outputs module

Test script for representative product comparisons.

geoips.compare_outputs.**compare_outputs**(*compare_path*, *output_products*, *test_product_func=None*)

Compare the "correct" imagery found the list of current output_products.

Compares files produced in the current processing run with the list of "correct" files contained in "compare_path".

**Parameters**

- **compare_path** (*str*) – Path to directory of "correct" products - filenames must match output_products
- **output_products** (*list of str*) – List of strings of current output products, to compare with products in compare_path
- **test_product_func** (*function, default=None*) – Alternative function to be used for testing output product
  - Call signature must be:
    - output_product, compare_product, goodcomps, badcomps, compare_strings
  - Return must be:
    - goodcomps, badcomps, compare_strings
  - If None, use geoips.compare_outputs.test_product)

**Returns**

Binary code: 0 if all comparisons were completed successfully.

**Return type**

int

geoips.compare_outputs.**geoips_netcdf_match**(*output_product*, *compare_product*)

Check if two geoips formatted netcdf files match.

**Parameters**

- **output_product** (*str*) – Full path to current output product
- **compare_product** (*str*) – Full path to comparison product

**Returns**
Return True if products match, False if they differ

**Return type**
bool

`geoips.compare_outputs.`**`geotiffs_match`**(*output_product*, *compare_product*)

Use diff system command to compare currently produced image to correct image.

**Parameters**

- **output_product** (*str*) – Full path to current output product
- **compare_product** (*str*) – Full path to comparison product

**Returns**
Return True if images match, False if they differ

**Return type**
bool

`geoips.compare_outputs.`**`get_out_diff_fname`**(*compare_product*, *output_product*, *ext=None*, *flag=None*)

Obtain the filename for output and comparison product diff.

**Parameters**

- **compare_product** (*str*) – Full path to product filename in the comparison directory
- **output_product** (*str*) – Full path to product filename in the current output directory
- **ext** (*str, default=None*) – Extension to use as an alternative to the original file extension
- **flag** (*str, default=None*) – Additional identifying string to include in output diff filename

**Returns**
**out_diff_fname** – Full path to output diff file.

**Return type**
str

`geoips.compare_outputs.`**`gunzip_product`**(*fname*)

Gunzip file fname.

**Parameters**
**fname** (*str*) – File to gunzip.

**Returns**
Filename after gunzipping

**Return type**
str

`geoips.compare_outputs.gzip_product(fname)`

Gzip file fname.

**Parameters**
**fname** (*str*) – File to gzip.

**Returns**
Filename after gzipping

**Return type**
str

`geoips.compare_outputs.images_match(output_product, compare_product, fuzz='5%')`

Use imagemagick compare system command to compare two images.

**Parameters**

- **output_product** (*str*) – Current output product
- **compare_product** (*str*) – Path to comparison product
- **fuzz** (*str, optional*) – "fuzz" argument to pass to compare - larger "fuzz" factor to make comparison less strict, by default 5%.

**Returns**
Return True if images match, False if they differ

**Return type**
bool

`geoips.compare_outputs.is_geoips_netcdf(fname)`

Check if fname is a geoips formatted netcdf file.

**Parameters**
**fname** (*str*) – Name of file to check.

**Returns**
True if it is a geoips netcdf file, False otherwise.

**Return type**
bool

`geoips.compare_outputs.is_geotiff(fname)`

Determine if fname is a geotiff file.

**Parameters**
**fname** (*str*) – Name of file to check.

**Returns**
True if it is a geotiff file, False otherwise.

**Return type**
bool

`geoips.compare_outputs.`**`is_gz`**`(`*fname*`)`

Check if fname is a gzip file.

**Parameters**
**fname** (*str*) – Name of file to check.

**Returns**
True if it is a gz file, False otherwise.

**Return type**
bool

`geoips.compare_outputs.`**`is_image`**`(`*fname*`)`

Determine if fname is an image file.

**Parameters**
**fname** (*str*) – Name of file to check.

**Returns**
True if it is an image file, False otherwise.

**Return type**
bool

`geoips.compare_outputs.`**`is_text`**`(`*fname*`)`

Check if fname is a text file.

**Parameters**
**fname** (*str*) – Name of file to check.

**Returns**
True if it is a text file, False otherwise.

**Return type**
bool

`geoips.compare_outputs.`**`print_gunzip_to_file`**`(`*fobj*, *gunzip_fname*`)`

Write the command to gunzip the passed "gunzip_fname" to file.

Writes to the currently open file object, if required.

`geoips.compare_outputs.`**`print_gzip_to_file`**`(`*fobj*, *gzip_fname*`)`

Write the command to gzip the passed "gzip_fname" to file.

Writes to the currently open file object, if required.

`geoips.compare_outputs.`**`test_product`**(*output_product*, *compare_product*, *goodcomps*, *badcomps*, *compare_strings*)

Test output_product against "good" product stored in "compare_path".

**Parameters**

- **`output_product`** (*`str`*) –
  - Full path to current output product
- **`compare_product`** (*`str`*) –
  - Full path to "good" comparison product
- **`goodcomps`** (*`list of str`*) –
  - List of full paths to all "good" successful comparisons (output and compare images match)
  - Each str is prepended with a "compare_string" tag to identify which comparison type was performed.
- **`badcomps`** (*`list of str`*) –
  - List of full paths to all "bad" unsuccessful comparisons (output and compare images differ)
  - Each str is prepended with a "compare_string" tag to identify which comparison type was performed.
- **`compare_strings`** (*`list of str`*) –
  - List of all comparison "tags" included in goodcomps and badcomps lists.
  - This list is used to remove the comparison tags from goodcomps and badcomps to retrieve only the file path.

**Returns**

- **goodcomps** (*list of str*) – All current good comparisons appended to the list passed in.
- **badcomps** (*list of str*) – All current bad comparisons appended to the list passed in.
- **compare_strings** (*list of str*) – All current comparison "tags" added to the list passed in.

**Raises**

**`TypeError`** – Raised when current output product does not have an associated comparison test defined.

`geoips.compare_outputs.`**`text_match`**`(`*output_product*, *compare_product*`)`

Check if two text files match.

**Parameters**

- **`output_product`** (*`str`*) – Full path to current output product
- **`compare_product`** (*`str`*) – Full path to "good" comparison product

**Returns**

Return True if products match, False if they differ

**Return type**

bool

### 6.1.5 geoips.errors module

GeoIPS error module.

**`exception`** `geoips.errors.`**`CoverageError`**

Bases: `Exception`

Raise exception on data coverage error.

**`exception`** `geoips.errors.`**`EntryPointError`**

Bases: `Exception`

Exception to be raised when an entry-point cannot be found.

**`exception`** `geoips.errors.`**`PluginError`**

Bases: `Exception`

Exception to be raised when there is an error in a plugin module.

### 6.1.6 geoips.geoips_utils module

General high level utilities for geoips processing.

`geoips.geoips_utils.`**`copy_standard_metadata`**`(`*orig_xarray*, *dest_xarray*, *extra_attrs=None*, *force=True*`)`

Copy standard metadata from orig_xarray to dest_xarray.

**Parameters**

- **`orig_xarray`** (*`xarray.Dataset`*) – Original xarray to copy attributes from
- **`dest_xarray`** (*`xarray.Dataset`*) – Destination xarray to copy attributes to

- **extra_attrs** (*list of str, optional*) – Additional attributes to copy, beyond the standard metadata, by default None
- **force** (*bool, optional*) – If force is True, overwrite existing attributes, by default True

**Returns**
dest_xarray with standard metadata copied in place from orig_xarray.

**Return type**
xarray.Dataset

geoips.geoips_utils.**deprecation**(*message*)

Print a deprecation warning during runtime.

geoips.geoips_utils.**find_all_txt_plugins**(*subdir=''*)

Find all txt plugins in registered plugin packages.

Search the `plugins` directory of each registered plugin package for files ending in `.txt`. Return list of files

geoips.geoips_utils.**find_ascii_palette**(*name*)

Find ASCII palette named "name".

Search the plugins/txt/ascii_palettes directory for ASCII palettes to use as colormaps.

geoips.geoips_utils.**find_config**(*subpackage_name, config_basename, txt_suffix='.yaml'*)

Find matching config file within GEOIPS packages.

Given 'subpackage_name', 'config_basename', and txt_suffix, find matching text file within GEOIPS packages.

**Parameters**

- **subpackage_name** (*str*) – subdirectory under GEOIPS package to look for text file ie text_fname = geoips/<subpackage_name>/<config_basename><txt_suffix>
- **config_basename** (*str*) – text basename to look for, ie text_fname = geoips/<subpackage_name>/<config_basename><txt_suffix>
- **txt_suffix** (*str*) – suffix to look for on config file, defaults to ".yaml" ie text_fname = geoips/<subpackage_name>/<config_basename><txt_suffix>

**Returns**
**text_fname** – Full path to text filename

**Return type**
str

`geoips.geoips_utils.find_entry_point(namespace, name, default=None)`

Find object matching 'name' using GEOIPS entry point namespace 'namespace'.

Automatically add 'geoips' prefix to namespace for disambiguation.

**Parameters**

- **namespace** (*str*) – Entry point namespace (e.g. 'readers')
- **name** (*str*) – Entry point name (e.g. 'amsr2_netcdf')
- **default** (*entry point, optional*) – Default value if no match is found. If this is not set (i.e. None), then no match will result in an exception

`geoips.geoips_utils.get_all_entry_points(namespace)`

Return all entry points in GEOIPS entry point namespace 'namespace'.

Automatically add 'geoips' prefix to namespace for disambiguation.

**Parameters**

**namespace** (*str*) – Entry point namespace (e.g. 'readers')

`geoips.geoips_utils.get_entry_point_group(group)`

Get entry point group.

`geoips.geoips_utils.get_required_geoips_xarray_attrs()`

Interface deprecated v2.0.

`geoips.geoips_utils.list_entry_points(namespace)`

List names of objects in GEOIPS entry point namespace 'namespace'.

Automatically add 'geoips' prefix to namespace for disambiguation.

**Parameters**

**namespace** (*str*) – Entry point namespace (e.g. 'readers')

`geoips.geoips_utils.list_product_source_dict_yamls()`

List all YAML files containing product source specifications.

Search in all geoips packages.

**Returns**

List of all product source dict YAMLs in all geoips packages

**Return type**

list

`geoips.geoips_utils.list_product_specs_dict_yamls()`

List all YAML files containing product params in all geoips packages.

**Returns**

List of all product params dict YAMLs in all geoips packages

**Return type**
list

`geoips.geoips_utils.load_all_yaml_plugins()`

Find all YAML plugins in registered plugin packages.

Search the `plugins` directory of each registered plugin package for files ending in `.yaml`. Read each plugin file

`geoips.geoips_utils.merge_nested_dicts(dest, src, in_place=True)`

Perform an in-place merge of src into dest.

Performs an in-place merge of src into dest while preserving any values that already exist in dest.

`geoips.geoips_utils.output_process_times(process_datetimes, num_jobs=None, job_str='GeoIPS 2')`

Calculate and print the process times from the process_datetimes dictionary.

**Parameters**
**process_datetimes** (*dict*) – dictionary formatted as follows:

- `process_datetimes['overall_start']` - overall start datetime of the entire script
- `process_datetimes['overall_end']` - overall end datetime of the entire script
- `process_datetimes[process_name]['start']` - start time of an individual process
- `process_datetimes[process_name]['end']` - end time of an individual process

`geoips.geoips_utils.replace_geoips_paths(fname, replace_paths=None, base_paths=None)`

Replace standard environment variables with their non-expanded equivalents.

Ie, replace

- `$HOME/geoproc/geoips_packages with $GEOIPS_PACKAGES_DIR`
- `$HOME/geoproc/geoips_outdirs with $GEOIPS_OUTDIRS`
- `$HOME/geoproc with $GEOIPS_BASEDIR`

This allows generating output YAML fields / NetCDF attributes that can match between different instantiations.

**Parameters**

- **fname** (*str*) – Full path to a filename on disk

- **replace_paths** (*list, default=None*) –
  - Explicit list of standard variable names you would like replaced.
  - If None, replace `['GEOIPS_OUTDIRS', 'GEOIPS_PACKAGES_DIR', 'GEOIPS_TESTDATA_DIR', 'GEOIPS_DEPENDENCIES_DIR', 'GEOIPS_BASEDIR']`
- **base_paths** (*list, default=None*) –
  - List of PATHS dictionaries in which to find the "replace_paths" variables
  - If None, use geoips.filenames.base_paths

**Returns**
**fname** – Path to file on disk, with explicit path replaced with environment variable name and/or full URL.

**Return type**
str

#### Notes

Note it replaces ALL standard variables that have a corresponding <key>_URL variable.

Additionally, it replaces variables specified in "replace_paths" list with the unexpanded environment variable name.

### 6.1.7 Module contents

The Geolocated Information Processing System (GeoIPS).

#### GeoIPS ® Base Package

The GeoIPS Base Package provides a Python 3 based architecture supporting a wide variety of satellite and weather data processing. The modular nature of the GeoIPS base infrastructure also allows plug-and-play capability for user-specified custom functionality.

Homepage: https://github.com/NRLMMD-GEOIPS/geoips

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CHAPTER

SEVEN

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# PYTHON MODULE INDEX

## g

# INDEX

## A

## D

## H

## N



## O

## T



## U

## V



## W



## X



## Y