Installation Instructions for the Community Satellite Processing Package for Geostationary Data (CSPP Geo) GEOCAT Version 1.0 Beta for Himawari AHI and GOES Imager

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Section 1: Introduction

1.1 Overview

This document contains instructions for installation and operation of the CSPP Geo Geostationary Cloud Algorithm Testbed (GEOCAT) software package for processing Advanced Himawari Imager (AHI) Himawari Standard Data (HSD), HimawariCast High Resolution Image Transmission Files (HRIT) and GOES Imager AREA files to generate NetCDF-4 Level 2 output products.

The software in this release is capable of creating Himawari AHI Level 1 and Level 2 data products from HSD and HimawariCast HRIT files. GOES Imager Level 1 and Level 2 products can also be created from GVAR Imager AREA files processed through CSPP Geo GVAR, AREA files created in McIDAS-X (see Appendix A) or obtained from NOAA CLASS. Ancillary data is automatically retrieved and used in the generation of Level 2 NetCDF-4 output files containing cloud and fog/low stratus products.

This package contains a mix of original software developed at the University of Wisconsin, and third-party software libraries.

This is a beta release of the GEOCAT software package, and is provided for purposes of testing and evaluation. Known issues affecting this software are described in the section 5.1 “Caveats and Known Issues”. Users should expect changes to interfaces and core functionality before the final release.

Please provide feedback regarding this beta to csppgeo.issues@ssec.wisc.edu. Thank you for beta testing this software.

For more information on CSPP Geo software, refer to the CSPP Geo website at:
http://cimss.ssec.wisc.edu/csppgeo/

1.2 System requirements

Minimum system requirements for the CSPP GEOCAT software are as follows:

- Intel Xeon E5 v2 "Ivy Bridge", 20-core (2 x 10-core), 2.8GHz CPU with 64-bit instruction support,
- 192 GB RAM
- CentOS 6 64-bit Linux (or other compatible 64-bit Linux distribution),
- 14 TB disk space (does not include long-term storage)

1.3 Input data requirements

CSPP Geo GEOCAT can process current operational AHI data in HSD or HimawariCast format. The HSD and HimawariCast files must match the standard naming formats, which can be found:

HSD Users Guide
http://www.data.jma.go.jp/mscweb/en/himawari89/space_segment/hsd_sample/HS_D_users_guide_en_v12.pdf , eg.,
`HS_aaa_yyyymmdd_hhnn_Bbb_cccc_Rjj_Skkll.DAT.`

HimawariCast: dataset information
http://www.data.jma.go.jp/mscweb/en/himawari89/himawari_cast/note/HimawariCast_dataset_20150624_en.pdf . Supported files include sectorized and non-sectorized HRIT files compressed or uncompressed, eg.,
`IMG_DKppccccYYYYMMDDhhmm_0nn, IMG_DKppcccYYYYMMDDhhmm_00nn.bz2.`

Current operational GOES data (GOES-13 or GOES-15) in single banded McIDAS AREA files from CSPP Geo GVAR, McIDAS-X or NOAA CLASS are required. The files must match the CSPP Geo GVAR naming format, eg., goes_15_1_2015_143_2130.area. For more information on CSPP Geo GVAR, please see the CSPP Geo website. For more information on processing AREA files in McIDAS-X, see Appendix A.

1.4 Test data

The test data is provided solely for purposes of testing the CSPP Geo GEOCAT software, and is not intended to be used for product evaluation or verification. Test HSD and HimawariCast data was obtained from the SSEC Data Center and the National Weather Service. The GVAR test data was obtained from a SSEC Data Ingestor (SDI) and processed through CSPP Geo GVAR.

1.5 Disclaimer

Original source code, scripts and automation included as part of this package are distributed under the GNU GENERAL PUBLIC LICENSE agreement version 3. Binary executable files and third-party source code included as part of this software package are copyrighted and licensed by their respective organizations, and distributed consistent with their licensing terms.

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Section 2: Installation of the CSPP Geo GEOCAT software

2.1 Installation

Download the following files from the CSPP Geo FTP site,
ftp.ssec.wisc.edu/pub/CSPP/GEO/GEOCAT/v1.0b/ :

```
cspp-geo-geocat-1.0b.tar.gz
cspp-geo-geocat-static-1.0b.tar.gz
```

Install the software as shown below (a new directory named '`cspp-geo-geocat-1.0b`' will be created). In this example, the tar files are assumed to be in the user's home directory.

```
tar xzf cspp-geo-geocat-1.0b.tar.gz
tar xzf cspp-geo-geocat-static-1.0b.tar.gz
```

Set the `CSPP_GEO_GEOCAT_HOME` environment variable to the name of the directory where CSPP Geo GEOCAT was installed (`$HOME/cspp-geo-geocat-1.0b` in this example), and then execute the environment setup script as shown below:

```
export CSPP_GEO_GEOCAT_HOME=$HOME/cspp-geo-geocat-1.0b
source $CSPP_GEO_GEOCAT_HOME/geocat_env.sh
```

These lines can be added to your shell login script if you plan to run the GEOCAT software again. For the rest of this document, we assume you have set up your environment accordingly.

The GEOCAT software is now installed.

Section 3: GEOCAT Processing

Section 3.1 GEOCAT Main Processing Script

The main processing script is `geocat_l2.sh`, which operates by default in the current directory. It creates intermediate files, as well as the final NetCDF-4 output files. It is recommended that all files be removed from the work directory before each execution of `geocat_l2.sh`.

Here is an example:

```
geocat_l2.sh --satellite him8 -W /data/work /data/1800/IMG*201601011800
```

This command will process the HimwariCast data from 1800Z on January 1, 2016. By default, geocat will partition the image into 4 sections (2 in the row, 2 in the column) and stitch the final product together. The final output will be in the defined work directory, `/data/work`.

This command will produce output NetCDF4 files similar to:

```
geocatL1.HIMAWARI-8.2016284.180000.FLDK.R40.nc
geocatL2.HIMAWARI-8.2016284.180000.FLDK.R40.nc
```

For a full list of the Level 2 products available in GEOCAT, refer to the table in Appendix B.

Several options are available for geocat_l2.sh as shown below. To list the standard help options, run "`geocat_l2.sh -h`". The full list of options, including expert options (can be obtained by using the `-x` flag) is shown below:

```
usage: geocat_l2.py [-h] --satellite {goes,him8} [-W work_dir]
                    [--tmp_dir TMP_DIR] [--ancillary_only] [--no_rap]
                    [--cache_window CACHE_WINDOW] [--preserve_cache]
                    [--viewport LLCRNRX LLCRNRY URCRNRX URCRNRY]
                    [--viewport_xy YSTART YEND XSTART XEND]
                    [--xstride XSTRIDE] [--num_cpu NUM_CPU]
                    [--geocat_nscans GEOCAT_NSCANS]
                    [--line_segments LINE_SEGMENTS]
                    [--element_segments ELEMENT_SEGMENTS]
                    [--interrogate]
                    [-d] [-v] [-V] [-x]
                    [inputs [inputs ...]]

Run GEOCAT level-2 algorithms on GOES area files, or Himawari-8 HSD or
HimawariCast files.

positional arguments:
inputs                  One or more input files or directories.
```

```
optional arguments:
-h, --help            show this help message and exit
--satellite {goes,him8}
                      The satellite to run geocat on. Possible values
                      are
                      {'goes','him8'}. This option is mandatory.
-W work_dir, --work-dir work_dir
                      work directory which all activity will occur in,
                      defaults to current dir
--tmp_dir TMP_DIR     The directory where the Level 1 and 2
                      intermediate HDF4 file(s) are written.
--ancillary_only      Only retrieve and process ancillary data, don't
                      run geocat. [default: False]
--no_rap              Do not use Mesoscale model (RAP) files.
                      [default: False]
--cache_window CACHE_WINDOW
                      Limit product cache to hold no more that this
                      number of hours preceding the target time.
                      [default: 6. hours]
--preserve_cache      Do not flush old files from the product cache.
                      [default: False]
--viewport LLCRNRX LLCRNRY URCRNRX URCRNRY
                      Lower-left and upper-right coordinates
                      [*llcrnrx*, *llcrnry*, *urcrnrx*, *urcrnry*] of
                      the projection viewport, in the range
                      [-0.5,+0.5]. [default: None]
--viewport_xy YSTART YEND XSTART XEND
                      Starting and ending lines [*ystart*, *yend*],
                      and starting and ending elements with stride
                      [*ystart*, *yend*, *xstride*], of the projection
                      viewport. [default: None]
--xstride XSTRIDE     The number of elements *xstride* to stride in
                      the x-direction.
--num_cpu NUM_CPU     The number of CPUs to try and use. [default: 1]
--geocat_nscans GEOCAT_NSCANS
                      Geocat will partition its processing tasks into
                      chunks of 'geocat_nscans'. [default: 200]
--line_segments LINE_SEGMENTS
                      Partition the input image into *line_segments*
                      rows, which will be processed separately by
                      geocat. Should not exceed 20. [default: 2]
--element_segments ELEMENT_SEGMENTS
                      Partition the input image into
                      *element_segments* columns, which will be
                      processed separately by geocat. Should not exceed
                      20. [default: 2]
--interrogate         List the file metadata, and exit. [default:
                      False]
-d, --debug           always retain intermediate files. [default:
                      False]
-v, --verbosity       each occurrence increases verbosity 1 level from
                      ERROR: -v=WARNING -vv=INFO -vvv=DEBUG
                      [default: 2]
-V, --version         Print the CSPP Geo package version
-x, --expert          Display all help options, including the expert
                      ones.
```

Running:

```
geocat_l2.sh --sat goes --ancillary_only \
./goes13/goes*2016_143_1745.area
```

will only download and process the ancillary data required for the GOES-13 AREA files from May 22, 2016 at 1745Z. The GEOCAT processing will not run.

```
geocat_l2.sh --satellite him8 --interrogate \
../2016_10_10_0020/IMG_DK01B04_201610100020
```

will list the input file metadata and exit. An example output:

```
2016-10-17 21:01:37.160 (INFO) : Interrogating
../2016_10_10_0020/IMG_DK01B04_201610100020 ...
2016-10-17 21:01:37.205 (INFO) :  file path  : ../2016_10_10_0020
2016-10-17 21:01:37.205 (INFO) :  filename   : IMG_DK01B04_201610100020
2016-10-17 21:01:37.205 (INFO) :  satellite_name        : Himawari-8
2016-10-17 21:01:37.205 (INFO) :  source type           : HimawariCast
2016-10-17 21:01:37.205 (INFO) :  image date     : 2016-10-10 00:20:00
2016-10-17 21:01:37.205 (INFO) :  band                  : 4
2016-10-17 21:01:37.205 (INFO) :  band_type             : 1 (reflective)
2016-10-17 21:01:37.205 (INFO) :  central_wavelength    : 0.86 microns
2016-10-17 21:01:37.205 (INFO) :  available_lines       : 2750
2016-10-17 21:01:37.205 (INFO) :  begin_line            : 1
2016-10-17 21:01:37.205 (INFO) :  end_line                      : 2750
2016-10-17 21:01:37.206 (INFO) :  total image lines (rows)      : 2750
2016-10-17 21:01:37.206 (INFO) :  total image elements (cols)   : 2750
```

and

```
geocat_l2.sh --satellite goes -W test goes13_1_2015_299_1430.area
```

will process the five individual banded GOES-13 AREA files in the current directory using the '`test`' directory as the work directory. The resulting output would be two NetCDF-4 file containing Level 1 radiances and Level 2 products, labeled as:

```
geocatL1.GOES-13.2015299.143000.nc
geocatL2.GOES-13.2015299.143000.nc
```

Section 3: Ancillary Data

3.1 Ancillary scripts

There are several static and dynamic ancillary datasets that are required as input to CSPP Geo GEOCAT. The required dynamic ancillary files are automatically identified based upon the date and time of the input files. The software first checks locally for the files, and if they are not found, they are downloaded from the CSPP Geo ancillary website:

http://geodb.ssec.wisc.edu/ancillary/

A reliable internet connection is required. The datasets and their sources are described in further detail at the CSPP Geo ancillary data archive site:

http://geodb.ssec.wisc.edu/ancillary/00README_GEO_ANCILLARY.txt

Section 4: Running the GEOCAT Test Case

4.1 Running the GEOCAT main processing script

If you want to run the test case, download the following file:

```
cspp-geo-geocat-test-data-1.0b.tar.gz
```

This tarball contains test data for all four accepted data inputs: Himawari-8 HSD, Himawari-8 HimawariCast, GVAR for GOES-13 and GVAR for GOES-15. Each data type is separated into its own directory.

The test data should be unpacked in a directory separate from the CSPP Geo GEOCAT installation, e.g.:

```
cd $HOME
tar xzf cspp-geo-geocat-test-data-1.0b.tar.gz
```

The test data will be unpacked into a new folder called `geocat_test`.

4.1.1 Processing HSD Data

Run the following set of commands to create GEOCAT output files on the provided HSD data from 0000Z on October 10, 2016:

```
cd geocat_test
mkdir hsd_work
geocat_l2.sh --sat him8 -W ./hsd_work --num_cpu 4 ./hsd/2016_10_10_0000
```

This sequence of commands will create a work directory and run GEOCAT on the HSD files in the `./hsd/2016_10_10_0000` directory using 4 CPUs. GEOCAT will partition the image into four sections (2 rows and 2 columns, which is the default) and stitch the final product together. The final output will be in the `hsd_work` directory. For each image sector (FDLK, JP0[1-4], R30[1-4], a Level 1 GEOCAT NetCDF file and a Level 2 GEOCAT NetCDF file will be created. The list of output files should look like:

```
geocatL1.HIMAWARI-8.2016284.000000.FLDK.R20.nc
geocatL1.HIMAWARI-8.2016284.000000.JP01.R20.nc
geocatL1.HIMAWARI-8.2016284.000230.JP02.R20.nc
geocatL1.HIMAWARI-8.2016284.000500.JP03.R20.nc
geocatL1.HIMAWARI-8.2016284.000730.JP04.R20.nc
geocatL1.HIMAWARI-8.2016284.000000.R301.R20.nc
geocatL1.HIMAWARI-8.2016284.000230.R302.R20.nc
```

```
geocatL1.HIMAWARI-8.2016284.000500.R303.R20.nc
geocatL1.HIMAWARI-8.2016284.000730.R304.R20.nc
geocatL2.HIMAWARI-8.2016284.000000.FLDK.R20.nc
geocatL2.HIMAWARI-8.2016284.000000.JP01.R20.nc
geocatL2.HIMAWARI-8.2016284.000230.JP02.R20.nc
geocatL2.HIMAWARI-8.2016284.000500.JP03.R20.nc
geocatL2.HIMAWARI-8.2016284.000730.JP04.R20.nc
geocatL2.HIMAWARI-8.2016284.000000.R301.R20.nc
geocatL2.HIMAWARI-8.2016284.000230.R302.R20.nc
geocatL2.HIMAWARI-8.2016284.000500.R303.R20.nc
geocatL2.HIMAWARI-8.2016284.000730.R304.R20.nc
```

If you wanted to run GEOCAT on all of the HSD test files, you could run the following command:

```
geocat_l2.sh --sat him8 -W ./hsd_work --tmp_dir ./tmp_dir_him8 \
--num_cpu 4 ./hsd/2016_10_10_*
```

which would run GEOCAT on the directories `2016_10_10_0000`, `2016_10_10_0010` and `2016_10_10_0020`.

4.1.2 Processing HimawariCast Data

CSPP Geo GEOCAT can also take AHI HimawariCast data as input. The test data provided is uncompressed and non-segmented. To run GEOCAT on HimawariCast input data from 0010Z on October 10, 2016 (for this example we are assuming your system meets the required system specifications):

```
cd geocat_test
mkdir hcast_work
geocat_l2.sh --sat him8 -W ./hcast_work --tmp_dir ./tmp_dir_him8 \
--num_cpu 16 --line_segments 4 --element_segments 4 \
./himawaricast/2016_10_10_0010
```

This example will use 16 cores and GEOCAT will partition the image into sixteen sections (4 rows and 4 columns). If you wanted to run GEOCAT on all of the HimawariCast test files, you could run the following command:

```
geocat_l2.sh --sat him8 -W ./hcast_work --tmp_dir ./tmp_dir_him8 \
--num_cpu 4 ./himawaricast/2016_10_10_*
```

which would run GEOCAT on the directories `2016_10_10_0000`, `2016_10_10_0010` and `2016_10_10_0020`.

4.1.3 Processing GVAR Data

Process GOES-13 GVAR data using AREA files from May 23, 2015 provided in the geocat_test directory:

```
cd geocat_test
mkdir goes13_work
geocat_l2.sh --sat goes -W ./goes13_work --num_cpu 4 ./goes13
```

4.2 Creating GEOCAT Quicklook Images

Quicklook images in PNG format can be created for both Level 1 and Level 2 products.

The Level 1 quicklook script, `ql_geocat_level1.sh`, has several options. A selection of options has been listed below. Run `ql_geocat_level1.sh -h` to see the full list of available options:

```
usage: ql_geocat_level1.py [-h] [--cbar_axis LEFT BOTTOM WIDTH HEIGHT]
                           [--cbar_title CBAR_TITLE] [--cmap CMAP]
                           [-d DPI] [--font_scale FONT_SCALE]
                           [--image_size WIDTH HEIGHT] [--list_datasets]
                           [--logscale]
                           [--map_axis LEFT BOTTOM WIDTH HEIGHT]
                           [-m {c,l,i}] [--no_logscale] [-o OUTPUT_FILE]
                           [-O OUTPUTFILEPREFIX] [--plotMin PLOTMIN]
                           [--plotMax PLOTMAX] [--plot_title PLOT_TITLE]
                           [-P POINTSIZE] [--region {FD}]
                           [--scatter_plot] [-S STRIDE] [--unnavigated]
                           [--viewport LLCRNRX LLCRNRY URCRNRX URCRNRY]
                           [-v] [-V]
                           input_file dataset

Create a plot of a level-1 dataset from a geocat netCDF4 file.

positional arguments:
input_file             The fully qualified path to a single geocat
                       level-1 NetCDF4 input file.
dataset                The geocat level-1 dataset to plot. See the
                       --list_datasets option for available datasets.

optional arguments:
-h, --help             show this help message and exit
--cbar_axis LEFT BOTTOM WIDTH HEIGHT
                       Set the colorbar axes within the figure at
                       position [*left*, *bottom*, *width*, *height*]
                       where all quantities are in the range [0..1].
                       [default: '[0.1, 0.05, 0.8, 0.05]']
--cbar_title CBAR_TITLE
                       The colourbar title. Must be placed in double
                       quotes.
--cmap CMAP            The matplotlib colormap to use. See the
                       --list_datasets option for details and default
                       values.
-d DPI, --dpi DPI      The resolution in dots per inch of the output
                       png file. [default: 200]
--font_scale FONT_SCALE
                       The scale factor to apply to the default font
                       size for the plot labels. [default: 1.0]
--image_size WIDTH HEIGHT
                       The size of the output image [*width*, *height*]
                       in inches. [default: '[7.5, 7.5]']
```

```
--list_datasets        List the available datasets, the default
                       colormap and whether a log plot is created by
                       default, then Exit. The required dataset must be
                       given as 'None'.
--logscale             Plot the dataset using a logarithmic scale.
--map_axis LEFT BOTTOM WIDTH HEIGHT
                       Set the map axes within the figure at position
                       [*left*, *bottom*, *width*, *height*] where all
                       quantities are in the range [0..1].
                       [default: '[0.1, 0.15, 0.8, 0.8]']
-m {c,l,i}, --map_res {c,l,i}
                       The map coastline resolution. Possible values
                       are 'C' (coarse),'l' (low) and 'i'
                       (intermediate). [default: 'c']
--no_logscale          Plot the dataset using a linear scale.
-o OUTPUT_FILE, --output_file OUTPUT_FILE
                       The filename of the output png file.
-O OUTPUTFILEPREFIX, --output_file_prefix OUTPUTFILEPREFIX
                       String to prepend to the automatically generated
                       png names. [default: None]
--plotMin PLOTMIN      Minimum value to plot.
--plotMax PLOTMAX      Maximum value to plot.
--plot_title PLOT_TITLE
                       The plot title. Must be placed in double quotes.
-P POINTSIZE, --pointSize POINTSIZE
                       Size of the plot point used to represent each
                       pixel. [default: 1]
--region {FD}          The satellite region. [default: 'None']
--scatter_plot         Generate the plot using a scatterplot approach.
-S STRIDE, --stride STRIDE
                       Sample every STRIDE rows and columns in the
                       data. [default: 1]
--unnavigated          Do not navigate the data, just display the
                       image.
--viewport LLCRNRX LLCRNRY URCRNRX URCRNRY
                       Lower-left and upper-right coordinates
                       [*llcrnrx*, *llcrnry*, *urcrnrx*, *urcrnry*] of
                       the projection viewport, where the default is
                       [-0.5,-0.5,+0.5,+0.5] for a full disk (for
                       navigated plots only)
-v, --verbosity        each occurrence increases verbosity 1 level from
                       ERROR: -v=WARNING -vv=INFO -vvv=DEBUG
-V, --version          Print the CSPP Geo package version
```

For example,

```
ql_geocat_level1.sh --list_datasets geocatL1.GOES-13.2015143.1445.nc \
None
```

will list all available datasets while

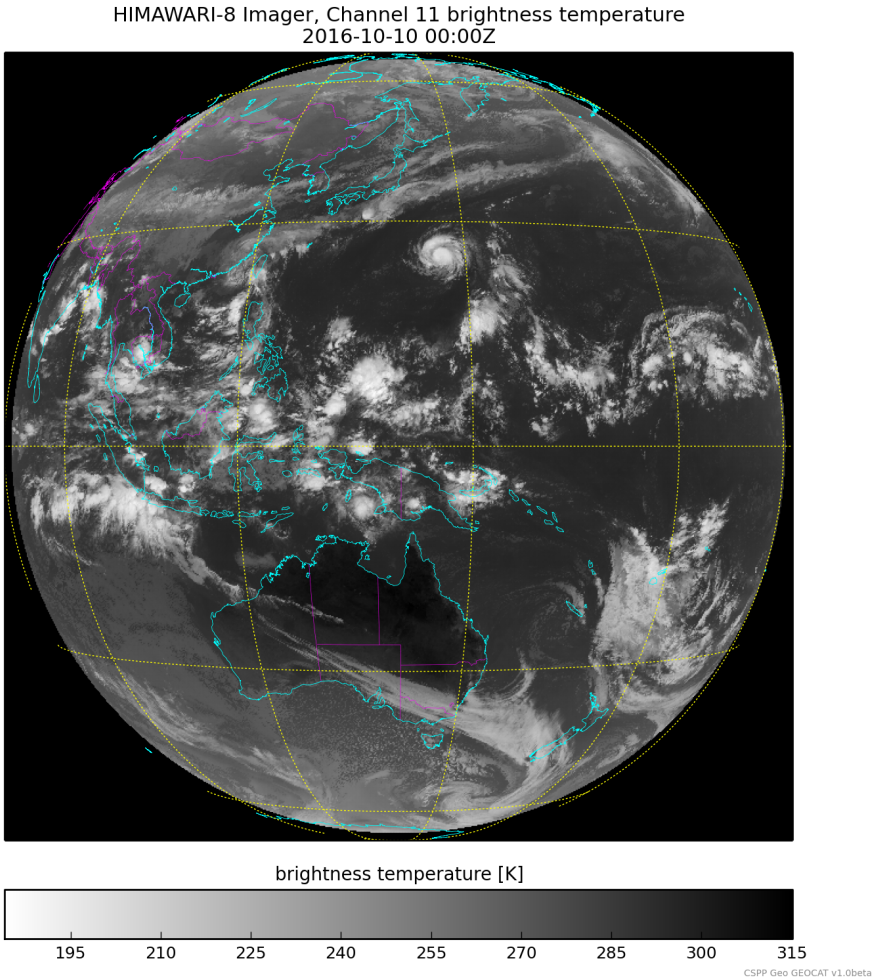
```
ql_geocat_level1.sh geocatL1.GOES-13.2015143.1445.nc \
      goes_13_imager_channel_1_reflectance -S 2
```

will create a quicklook image of the Channel 2 reflectance utilizing the stride option to sample every second row and column in the data.

To create Level 1 quicklooks for the 0000Z Full Disk on October 10, 2016 from HSD data, run the following set of commands:

```
cd hsd_work
in_file=geocatL1.HIMAWARI-8.2016284.000000.FLDK.R20.nc
for dsets in $(ql_geocat_level1.sh $in_file None \
--list_datasets | grep channel|awk '{print $1}');
 do
 ql_geocat_level1.sh $in_file $dsets -vv -O $in_file -m l \
 -S 8 --scatter_plot
done
```

This example will create a PNG image for all datasets that contain 'channel' in the dataset name. The images will be created by using a scatterplot approach and a stride of 8 on the data to reduce the time taken to create the images. An example of the Channel 11 Brightness Temperatures is located below.



Quicklook images for Level 2 products can be created using the `ql_geocat_level2.sh` script:

```
usage: ql_geocat_level2.py [-h] [--cbar_axis LEFT BOTTOM WIDTH HEIGHT]
                           [--cbar_title CBAR_TITLE] [--cmap CMAP]
                           [-d DPI] [--font_scale FONT_SCALE]
                           [--image_size WIDTH HEIGHT] [--list_datasets]
                           [--logscale]
                           [--map_axis LEFT BOTTOM WIDTH HEIGHT]
                           [-m {c,l,i}] [--no_logscale] [-o OUTPUT_FILE]
                           [-O OUTPUTFILEPREFIX] [--plotMin PLOTMIN]
                           [--plotMax PLOTMAX] [--plot_title PLOT_TITLE]
                           [-P POINTSIZE] [--region {FD}]
                           [--scatter_plot] [-S STRIDE] [--unnavigated]
                           [--viewport LLCRNRX LLCRNRY URCRNRX URCRNRY]
                           [-v] [-V]
                           input_file dataset

Create a plot of a level-2 dataset from a geocat netCDF4 file.

positional arguments:
input_file             The fully qualified path to a single geocat
                       level-2 NetCDF4 input file.
dataset                The geocat level-2 dataset to plot. See the
                       --list_datasets option for available datasets.

optional arguments:
-h, --help             show this help message and exit
--cbar_axis LEFT BOTTOM WIDTH HEIGHT
                       Set the colorbar axes within the figure at
                       position [*left*, *bottom*, *width*, *height*]
                       where all quantities are in the range [0..1].
                       [default: '[0.1, 0.05, 0.8, 0.05]']
--cbar_title CBAR_TITLE
                       The colourbar title. Must be placed in double
                       quotes.
--cmap CMAP            The matplotlib colormap to use. See the
                       --list_datasets option for details and default
                       values.
-d DPI, --dpi DPI      The resolution in dots per inch of the output
                       png file. [default: 200]
--font_scale FONT_SCALE
                       The scale factor to apply to the default font
                       size for the plot labels. [default: 1.0]
--image_size WIDTH HEIGHT
                       The size of the output image [*width*, *height*]
                       in inches. [default: '[7.5, 7.5]']
--list_datasets        List the available datasets, the default
                       colormap and whether a log plot is created by
                       default, then Exit. The required dataset must be
                       given as 'None'.
--logscale             Plot the dataset using a logarithmic scale.
```

```
--map_axis LEFT BOTTOM WIDTH HEIGHT
                        Set the map axes within the figure at position
                        [*left*, *bottom*, *width*, *height*] where all
                        quantities are in the range [0..1].[default:
                        '[0.1, 0.15, 0.8, 0.8]']
-m {c,l,i}, --map_res {c,l,i}
                        The map coastline resolution. Possible values
                        are 'C' (coarse),'l' (low) and 'i'
                        (intermediate). [default: 'c']
--no_logscale           Plot the dataset using a linear scale.
-o OUTPUT_FILE, --output_file OUTPUT_FILE
                        The filename of the output png file.
-O OUTPUTFILEPREFIX, --output_file_prefix OUTPUTFILEPREFIX
                        String to prepend to the automatically generated
                        png names. [default: None]
--plotMin PLOTMIN       Minimum value to plot.
--plotMax PLOTMAX       Maximum value to plot.
--plot_title PLOT_TITLE
                        The plot title. Must be placed in double quotes.
-P POINTSIZE, --pointSize POINTSIZE
                        Size of the plot point used to represent each
                        pixel. [default: 1]
--region {FD}           The satellite region. [default: 'None']
--scatter_plot          Generate the plot using a scatterplot approach.
-S STRIDE, --stride STRIDE
                        Sample every STRIDE rows and columns in the
                        data. [default: 1]
--unnavigated           Do not navigate the data, just display the
                        image.
--viewport LLCRNRX LLCRNRY URCRNRX URCRNRY
                        Lower-left and upper-right coordinates
                        [*llcrnrx*, *llcrnry*, *urcrnrx*, *urcrnry*] of
                        the projection viewport, where the default is
                        [-0.5,-0.5,+0.5,+0.5] for a full disk (for
                        navigated plots only)
-v, --verbosity         each occurrence increases verbosity 1 level from
                        ERROR: -v=WARNING -vv=INFO -vvv=DEBUG
-V, --version           Print the CSPP Geo package version
```

The Level 2 quicklook script has nearly identical options to the Level 1 quicklook script. The `--list_datasets` flag can be used to identify the available datasets to create a quicklook. For example,

```
ql_geocat_level2.sh /data/geocatL2.GOES-15.2015285.2100 \
 goesr_fog_bridge_MVFR_fog_probability -o MVFR_prob.png \ --
scatter_plot
```

will create a quicklook image of the GOES-R Marginal Visual Flight Rules (MVRF) fog probability product using a scatterplot approach to create the quicklook. The output PNG file, containing data from October 12, 2015, will be named "`MVFR_prob.png`".

Running this command:

```
ql_geocat_level2.sh geocatL2.GOES-15.2015285.2100 \
 DCOMP_mode_3_cloud_albedo --image_size 15 15
```

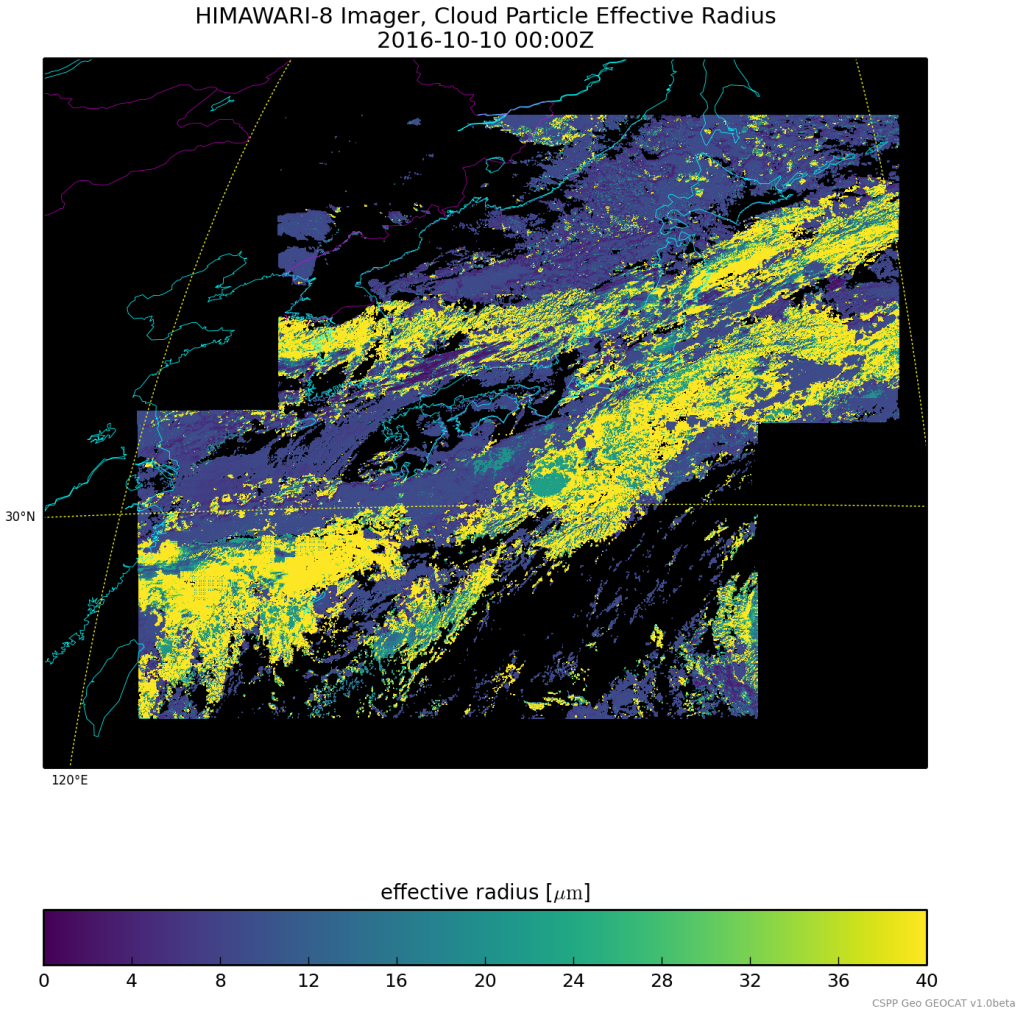
will create a quicklook image of the Daytime Cloud Optical and Microphysical Properties (DCOMP) cloud albedo product. The size of the quicklook image will be 15x15 inches.

To create Level 2 quicklook images of the ABI Cloud Height Algorithm (ACHA) products from the Himawari Japan Sector 1 Level 2 GEOCAT file from 0000Z on October 10, 2016, run the following:

```
cd hsd_work
in_file=geocatL2.HIMAWARI-8.2016284.000000.JP01.R20.nc
l2_datasets="ACHA_mode_8_cloud_particle_effective_radius
ACHA_mode_8_cloud_optical_depth_vis ACHA_mode_8_cloud_top_height
ACHA_mode_8_cloud_top_pressure ACHA_mode_8_cloud_top_temperature"

for dataset in $(echo $l2_datasets);
do
 ql_geocat_level2.sh $in_file $dataset -O $in_file -m l
done
```

An example quicklook image of ACHA Cloud Particle Effective Radius is shown on the next page:



Section 5: Known Issues

5.1 Caveats and known issues

1. The following output datasets are not produced by this beta release. They will be added for the version 1 release:
   - `ACHA_mode_8_quality_flags1`
   - `enterprise_cldphase_10_11_13_14_15_Cldphase_Qpi`
   - `Eps_cmask_ahi_cloud_mask_packed`
   - `night_optprop_NCOMP_Qpi`

2. Some Level 2 algorithms will use data from previous timesteps if it is available to improve product quality. This capability has not been enabled for this beta release, but will be added in a future release.

3. Some products may contain linear artifacts due to segmentation of the input data. This issue will be addressed in a future release.

4. Some products may contain blocky artifacts that are believed to be caused by the coarse granularity of input ancillary data. Changes will be made in a future version to mitigate this effect.

5. Projection information and other metadata will be added in a future version to improve compatibility with downstream applications

6. Occasionally the successful completion of GEOCAT cannot be reliably determined, resulting in the remaining part of the GEOCAT processing to fail. In this instance, the processing intermediate files will be preserved in the work directory, and will be contained in a directory with a name like:

   ```
   geocat_HS_H08_20161010_0000_B05_R301_R20_S0101.DAT_run_0
   ```

   where the input files was called

   ```
   geocat_HS_H08_20161010_0000_B05_R301_R20_S0101.DAT
   ```

   Usually the offending input file can successfully processed on a subsequent attempt.

7. When processing current GOES input (GOES-13 and GOES-15), acceptable ways of specifying the in files are:

   A directory containing area files:
   `input/goes13/goes13_2015_143_1700`

   or a single area file:
   `input/goes13/goes13_2015_143_1700/goes13_1_2015_143_1700.area`

   If we give as input an area file path with a wildcard for the channel number, i.e.: `goes13_*_2015_143_1700.area`, GEOCAT will treat each area file that matches the filename pattern as a distinct input, with the result that GEOCAT will process the same GOES timestep five times (once for each channel).

   HSD and HimawariCast inputs are unaffected by this issue. For GOES this behavior will be corrected in a subsequent release.

8. When CSPP Geo GEOCAT is processing an input area, HSD or HimawariCast file, the dynamic ancillary files matching the input are downloaded, and converted to other formats if necessary. If a particular ancillary type cannot be downloaded or prepared, the remaining ancillary types will be completed, and the failing ancillary type will be retried, up to a maximum of five (5) times. If the failing ancillary type cannot be completed, you will get a warning message like:

```
Maximum number of attempts (5) of ancillary retrieval reached,
aborting...
Ancillary type gfs_12_hdf completed: True
Ancillary type snow_map_4km_hdf completed: True
Ancillary type oisst_daily_avhrr_prelim completed: True
Ancillary type rap13_2_3_4_hdf completed: False
…
Ancillary retrieval failed for input file
HS_H08_20161017_1100_B05_FLDK_R20_S0110.DAT, proceeding...
```

… which indicates that the "RAP-13 2-, 3- and 4-hour forecast HDF" ancillary files failed to download or be converted. In such an instance CSPP Geo GEOCAT would proceed the next input file.

Appendix A: Using McIDAS to Create AREA Files for Input into GEOCAT

Users who run McIDAS-X (http://www.ssec.wisc.edu/mcidas/software/x/index.html) at their sites can use McIDAS-X to create AREA files for input into CSPP Geo GEOCAT. This appendix explains the necessary requirements in order for McIDAS users to utilize this option.

First, the McIDAS AREA files must be single banded, have the same projection, and be at the same resolution across all five bands. Example McIDAS commands are shown below:

```
IMGCOPY WESTS/CONUS A.5011 DAY=28/JAN/2016 TIME=19:30 BAND=1 STA=KLAX
MAG=-2 -4 SIZE=1000 1000
IMGCOPY WESTS/CONUS A.5012 DAY=28/JAN/2016 TIME=19:30 BAND=2 STA=KLAX
MAG=2 1 SIZE=1000 1000
IMGCOPY WESTS/CONUS A.5013 DAY=28/JAN/2016 TIME=19:30 BAND=3 STA=KLAX
MAG=2 1 SIZE=1000 1000
IMGCOPY WESTS/CONUS A.5014 DAY=28/JAN/2016 TIME=19:30 BAND=4 STA=KLAX
MAG=2 1 SIZE=1000 1000
IMGCOPY WESTS/CONUS A.5016 DAY=28/JAN/2016 TIME=19:30 BAND=6 STA=KLAX
MAG=2 1 SIZE=1000 1000
```

Second, the McIDAS AREA files need to be renamed to match the GEOCAT AREA naming convention:

```
<sat>_<band>_YYYY_DDD_HHMM.area
```

where:

`<sat>`	is the satellite, either "goes13" or "goes15"
`<band>`	is the image band (1-4,6)
`YYYY`	is the year of the AREA file
`DDD`	is the day of year of the AREA file
`HHMM`	is the hour and minute of the AREA file

Below is the renamed AREA files from the example McIDAS commands above:

```
goes15_1_2016_028_1930.area
goes15_2_2016_028_1930.area
goes15_3_2016_028_1930.area
goes15_4_2016_028_1930.area
goes15_6_2016_028_1930.area
```

Appendix B: GEOCAT Products

The table below shows the list of all AHI Level 2 products released in this beta version. The product Algorithm Theoretical Basic Documents (ATBD)s can be found: ftp.ssec.wisc.edu/pub/CSPP/GEO/Documents/ATBD/

Table 1 AHI Level 2 Products

variable name	variable description	GOES-R product name	product ATBD
eps_cmask_ahi_cloud_mask	cloud mask	Clear Sky Masks	Cloud_Mask_Enterprise_ATBD_v1.2_2016.pdf
eps_cmask_ahi_cld_probability	cloud probability	N/A	Cloud_Mask_Enterprise_ATBD_v1.2_2016.pdf
eps_cmask_ahi_emiss11_high	Derived 11.0 µm channel top of the tropopause emissivity	N/A	Cloud_Mask_Enterprise_ATBD_v1.2_2016.pdf
enterprise_cldphase_10_11_13_14_15_cloud_phase	Cloud phase	Cloud Phase	Cloud_CldType_v2.0_no_color.pdf
enterprise_cldphase_10_11_13_14_15_cloud_type	Cloud type	Cloud Type	Cloud_CldType_v2.0_no_color.pdf
enterprise_cldphase_10_11_13_14_15_Cldphase_Qf	Cloud phase quality flags	(applies to multiple products)	Cloud_CldType_v2.0_no_color.pdf
ACHA_mode_8_cloud_top_height	Cloud top height	Cloud Top Height	cloud_height_atbd_viirs_update_Aug2016.docx
ACHA_mode_8_cloud_top_temperature	Cloud top temperature	Cloud Top Temperature	cloud_height_atbd_viirs_update_Aug2016.docx
ACHA_mode_8_cloud_top_pressure	Cloud top pressure	Cloud Top Pressure	cloud_height_atbd_viirs_update_Aug2016.docx
ACHA_mode_8_cloud_optical_depth_vis	Cloud visible optical depth	N/A	cloud_height_atbd_viirs_update_Aug2016.docx

ACHA_mode_8_cloud_particle_effective_radius	Cloud particle size (cloud effective radius)	N/A	cloud_height_atbd_viirs_update_Aug2016.docx
ACHA_mode_8_Cloud_Height_QF	Cloud height quality flags	(applies to multiple products)	cloud_height_atbd_viirs_update_Aug2016.docx
ACHA_mode_8_Cloud_Height_Qpi	Cloud height processing information	(applies to multiple products)	cloud_height_atbd_viirs_update_Aug2016.docx
DCOMP_mode_3_cloud_optical_depth_vis	Cloud visible optical depth	Cloud Optical Depth	DCOMP_ATBD.pdf (Rev 1 / Mar 17, 2014)
DCOMP_mode_3_cloud_particle_effective_radius	Cloud particle size (cloud effective radius)	Cloud Particle Size Distribution	DCOMP_ATBD.pdf (Rev 1 / Mar 17, 2014)
DCOMP_mode_3_cloud_liquid_water_path	Cloud liquid water path	Cloud Liquid Water Path	DCOMP_ATBD.pdf (Rev 1 / Mar 17, 2014)
DCOMP_mode_3_cloud_ice_water_path	Cloud ice water path	Cloud Ice Water Path	DCOMP_ATBD.pdf (Rev 1 / Mar 17, 2014)
DCOMP_mode_3_cloud_albedo	Cloud albedo	N/A	DCOMP_ATBD.pdf (Rev 1 / Mar 17, 2014)
DCOMP_mode_3_cloud_spherical_albedo	Cloud spherical albedo	N/A	DCOMP_ATBD.pdf (Rev 1 / Mar 17, 2014)
DCOMP_mode_3_dcomp_info_flag	DCOMP quality info	(applies to multiple products)	DCOMP_ATBD.pdf (Rev 1 / Mar 17, 2014)
DCOMP_mode_3_dcomp_quality_flag	DCOMP quality flags	(applies to multiple products)	DCOMP_ATBD.pdf (Rev 1 / Mar 17, 2014)
night_optprop_cloud_optical_depth_vis	Cloud visible optical depth	Cloud Optical Depth	Cloud_NCOMP_20_no_color.pdf
night_optprop_cloud_particle_effective_radius	Cloud particle size (cloud effective radius)	Cloud Particle Size Distribution	Cloud_NCOMP_20_no_color.pdf
night_optprop_cloud_liquid_water_path	Cloud liquid water path	Cloud Liquid Water Path	Cloud_NCOMP_20_no_color.pdf
night_optprop_cloud_ice_water_path	Cloud ice water path	Cloud Ice Water Path	Cloud_NCOMP_20_no_color.pdf
night_optprop_NCOMP_Qf	NCOMP quality flags	(applies to multiple products)	Cloud_NCOMP_20_no_color.pdf
goesr_fog_bridge_fog_depth	Fog thickness	Low Cloud and Fog	Aviation_Fog_v1.0_no_color.pdf

goesr_fog_bridge_IFR_fog_probability	IFR fog probability	Low Cloud and Fog	Aviation_Fog_v1.0_no_color.pdf
goesr_fog_bridge_LIFR_fog_probability	LIFR fog probability	Low Cloud and Fog	Aviation_Fog_v1.0_no_color.pdf
goesr_fog_bridge_MVFR_fog_probability	MVFR fog probability	Low Cloud and Fog	Aviation_Fog_v1.0_no_color.pdf
goesr_fog_bridge_Fog_Qf	Fog quality flags	Low Cloud and Fog	Aviation_Fog_v1.0_no_color.pdf
goesr_fog_bridge_Fog_Qpi	Fog processing information	Low Cloud and Fog	Aviation_Fog_v1.0_no_color.pdf

GOES Imager Level 2 Products

To be added in a later version of this document.