CIPS Data Overview
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The CIPS instrument [McClintock et al., 2009] consists of four wide-angle cameras that measure 265-nm radiation scattered by the atmosphere over a wide range of scattering angles. The fundamental measurement is an albedo, which is the measured radiance divided by the input solar irradiance. On each orbit, ~27 images are acquired with each camera. Prior to February of 2016, these 27 images were acquired every 43 seconds over the summer pole, between the terminator and about 40° latitude on the sunlit side, with overlapping successive images.

In late February of 2016 CIPS began operating in continuous imaging (CI) mode, where images are taken every 3 minutes instead of every 43 seconds. Albedo measurements since Feb 2016 are thus available globally on the sunlit portion of the orbit. The 3-minute cadence means less overlap between successive images, which compromises the retrieval of PMC particle size. On the other hand, the addition of images in the winter hemisphere enables global investigations of gravity waves (GW), so the CIPS team began producing a "Rayleigh Albedo Anomaly" (RAA) data product, from which GW information near an altitude of 50-55 km can be inferred [Randall et al., 2017]. Users will find information about this data product, as well as browse images and data files, on other pages on this web site.

We are currently releasing two versions of the CIPS PMC data: v4.20 [see Lumpe et al., 2013] and v5.10. Version 5.10 was developed to account for artifacts that began to appear in the v4.20 retrievals in the 2014 northern hemisphere PMC season because of new viewing conditions as the AIM orbit precessed. These artifacts caused a high bias in the PMC albedo and more false detections. The day-to-day variations in NH14 data are considered to be realistic, but the retrieval failed in NH15; SH data was not significantly impacted. We will continue to provide both versions until v5 data have been comprehensively validated.

RAA data rely on v5 level 1A data, but the level 2a and level 2b products are both v1.0 at the current time.

Below we list the PMC and RAA data products for all levels. More details can be found in documentation specific to the individual levels. CIPS data for levels 2 and 3 are currently available online.

Internal (not publicly released) Data Products:

Level 0: Raw, uncalibrated images. Images are binned on-chip to 170 × 340 pixels (cross track by along track) for each camera. Effective spatial resolution varies from ~2.4 km × 2 km (nadir) to ~4.5 km × 3 km (forward & aft cameras). This is common to both PMC and RAA retrievals.

Level 1a: Calibrated and geolocated albedo. NetCDF files contain all images from a single camera over one orbit, so there are 4 files per orbit (one per camera). This is common to both PMC and RAA retrievals.

Level 1b: Map-projected albedo at 25 km^2 resolution, calculated from level 1a data. One NetCDF file per orbit. These files register all measurements of a single location into data

“stacks” to facilitate level 2 retrievals. This is used only for PMC retrievals for v4.20 and earlier versions.

Level 1p: Map-projected albedo at 56.25 km^2 resolution, calculated from level 1a data. One NetCDF file per orbit. This is used to create level 2 files for v5 and later PMC retrievals, and for all RAA retrievals.

Publicly Available PMC Data Products:

Level 2: Retrieved cloud parameters at 25 km^2 resolution for v4 and earlier versions, and at 56.25 km^2 resolution for v5 and later versions. Four NetCDF files per orbit containing, respectively: (1) geolocation ("catalog") data (e.g., latitude, longitude, time, etc.); (2) cloud properties, including albedo, particle radius, and ice water content; (3) cloud phase function (cloud albedo vs. scattering angle); (4) retrieved ozone parameters. Cloud albedo in file #2 is normalized to 90° scattering angle and nadir view. Most users of level 2 data will only require files #1 and #2. File #4 is experimental and not publicly available at this time. Images (png files) of cloud albedo, particle radius and ice water content for each orbit are also available.

Level 3a: Daily cloud albedo maps, produced by combining level 2 data from all individual orbits on a given day. Where pixels from different orbits overlap, the brightest pixel (not the average) is used. Same resolution as level 2. One NetCDF and one png file per day. Each individual png file uses a color scale appropriate for that day.

Level 3b: Movies of daily cloud albedo maps for an entire PMC season. One MPEG4 file per season. 5×5 km resolution for v4 and earlier; 7.5×7.5 km resolution for v5 and later. Each individual MPEG4 file uses a single color scale appropriate for that season.

Level 3c: Season-long files of level 2 data. Retrievals of cloud albedo, particle size, and ice water content from each orbit are binned in one-degree latitude bins and output for an entire PMC season. Nine files (ascii text or IDL binary save) are generated per season, corresponding to three cloud brightness thresholds and screening by cloud-only, non-cloud or all pixels.

Level 3d: Season-long files of level 2 data in the "common volume" viewed by both CIPS and SOFIE. The CIPS Level 3d data are pulled directly from the Level 2 data files, and consist of the subset of pixels that are co-located with the SOFIE line-of-sight (LOS). The CIPS level 3d file contains the primary CIPS level 2 retrieval products and associated auxiliary data, in the CV, for each orbit over an entire PMC season. The file format is ASCII text, and an IDL read program is provided.

Level 3e: Like Level 3d, but these files contain data that are coincident with a selected group of ground stations.

Publicly Available RAA Data Products:

Level 2a: Retrieved CIPS RAA data in a scene-by-scene format. A CIPS scene contains simultaneous images from the four CIPS cameras, with a footprint of approximately 2000 km along-track by 900 km cross-track, as described in Lumpe et al., [2013]. Three files are provided:

(1) Geolocation file, including variables such as date, time, latitude, longitude, solar zenith angle, etc. The file name extension is _cat.nc.

(2) Albedo anomaly file, including derived Rayleigh albedo anomaly and error, and diagnostics. The file name extension is _alb.nc.

(3) Measurement geometry file, containing satellite view angles and scattering angles for each scene. The file name extension is _ang.nc.

Level 2b: Retrieved RAA in an orbit-by-orbit format. All the scenes from an orbit are merged together by combining overlapping pixels from different cameras in much the same way as the CIPS Level 2 PMC data products. Three files are provided:

(1) Geolocation file, including variables such as date, time, latitude, longitude, solar zenith angle, etc. File content is similar to the Level 2a cat file. The file name extension is _cat.nc.

(2) Albedo anomaly file, including derived Rayleigh albedo anomaly and error, and total measured Rayleigh albedo. The file name extension is _alb.nc.

(3) Orbit-strip image of albedo anomaly. The file name extension is _alb.png.

References:

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McClintock, W.E., et al. (2009), The cloud imaging and particle size experiment on the Aeronomy of Ice in the Mesosphere mission: Instrument concept, design, calibration, and on-orbit performance, doi: 10.1016/j.jastp.2008.10.011.

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