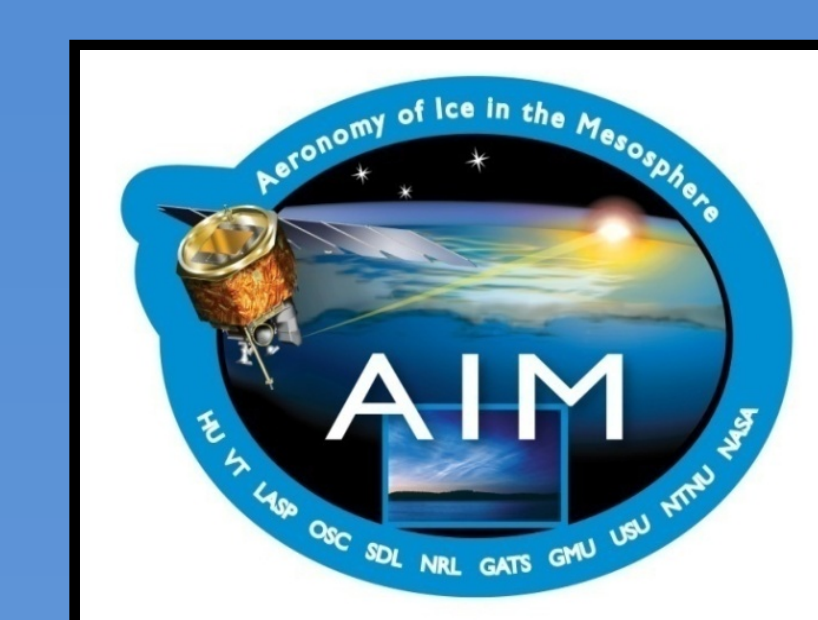




New Retrievals from AIM/CIPS

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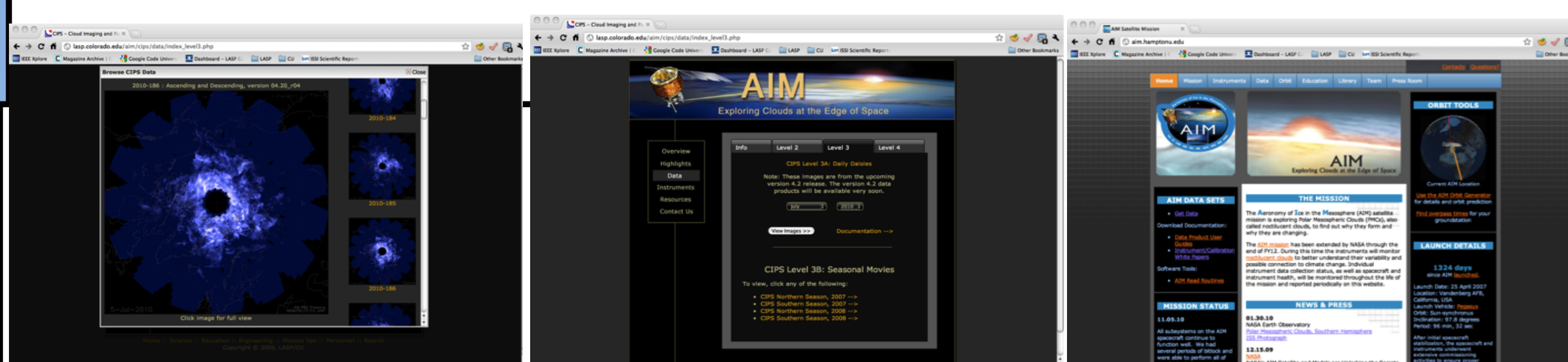
Overview

The Cloud Imaging and Particle Size (CIPS) instrument is a nadir-viewing UV imager aboard the Aeronomy of Ice in the Mesosphere (AIM) satellite. CIPS measures scattered solar radiation at 265 nm using a unique four-camera configuration providing an instantaneous field of view of 120° (along-track) by 80° (cross-track). By combining data from multiple cameras, CIPS observes a given volume of air at multiple scattering angles ranging from 20 to 180 degrees.

CIPS has performed flawlessly since first measurements were obtained in April 2007 and the CIPS data set now includes four complete Northern Hemisphere (NH) and three Southern Hemisphere (SH) seasons. The CIPS team has just released a new operational data product – Version 4.20. The V4.20 data processing algorithms are a fundamental departure from the approach used in the previous version (3.20), and the new data set is a significant improvement over V3.20 in terms of spatial resolution, background removal, and cloud detection sensitivity.

This poster gives an overview of the CIPS Version 4.20 algorithm and presents highlights of the data set, which consists of cloud albedo, particle radius and ice water content at a spatial resolution of 25 km². The V4.20 data set and accompanying documentation will be available to the science community before the end of 2010.

Data Archiving & Distribution



Daily Datasets are provided for qualitative assessments of the global PMC cloudiness on any particular day. Currently, the Datasets are based on CIPS Level 1 albedos, with Rayleigh background parameters derived from the level 2 retrieval. Daily Datasets are available at http://lasp.colorado.edu/aim/cips/data/index_level3.php

CIPS data products are available via a web interface hosted at the CIPS instrument team facility: <http://lasp.colorado.edu/aim/cips/data>

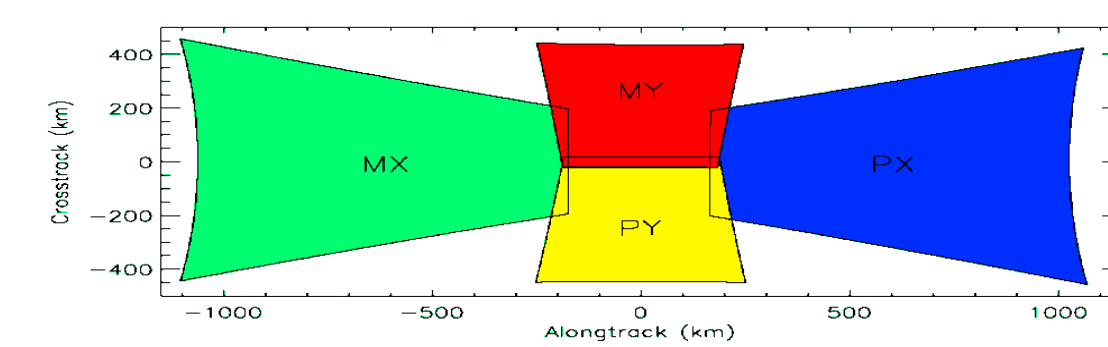
The AIM project website maintains news, instrument descriptions, an orbit overpass predictor, press info, papers written by the AIM science team, and access to data products. <http://aim.hamptonu.edu/>

CIPS Data is archived and distributed through both Hampton University and the University of Colorado Laboratory for Atmospheric and Space Physics (CU/LASP)

Level 2 Data

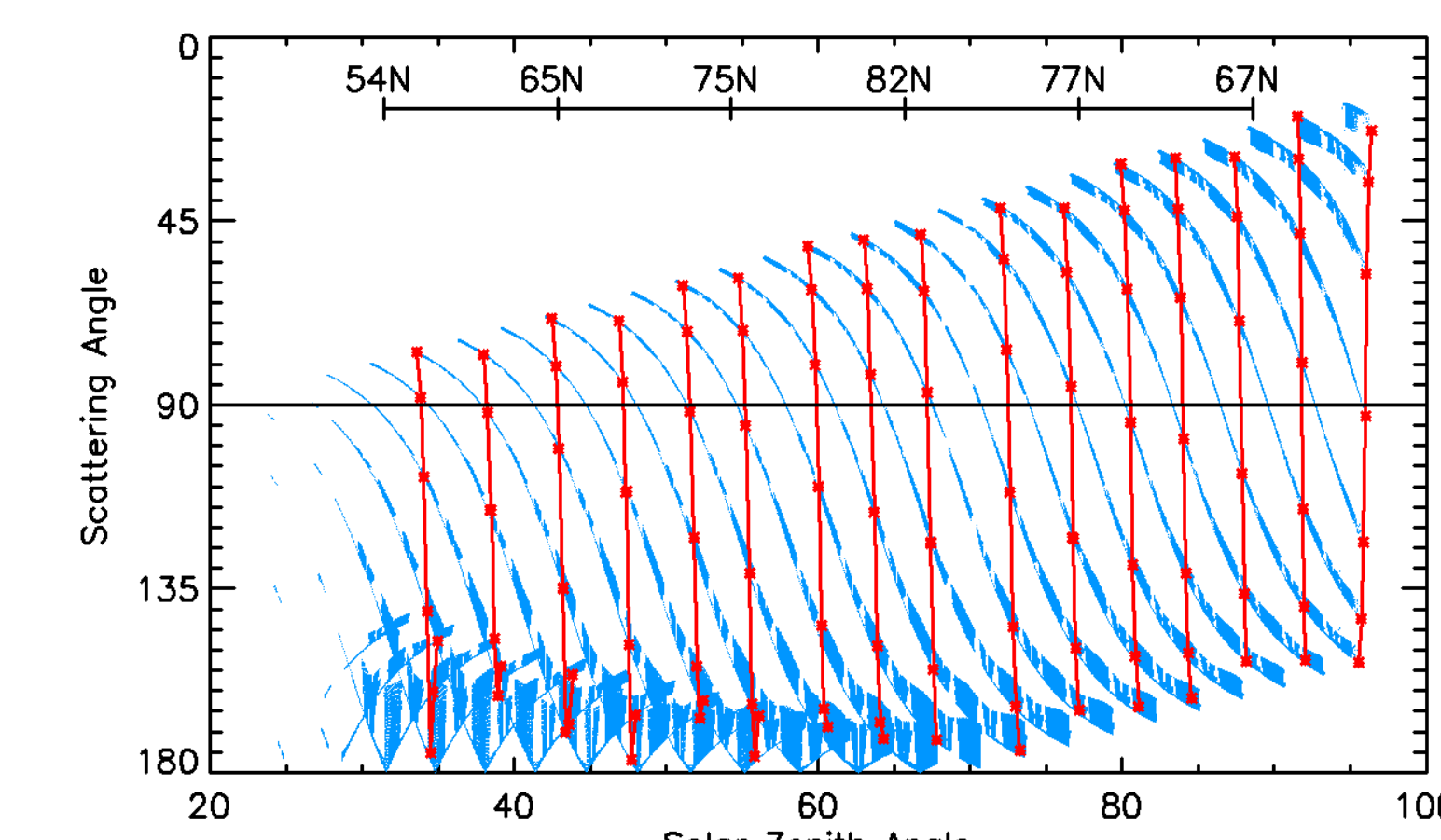
CIPS Level 2 data files contain an orbit of retrieved cloud parameters - cloud albedo, particle radius, ice water content & cloud phase function Vs scattering angle – plus associated geolocation data.

CIPS Measurement Technique & Sampling

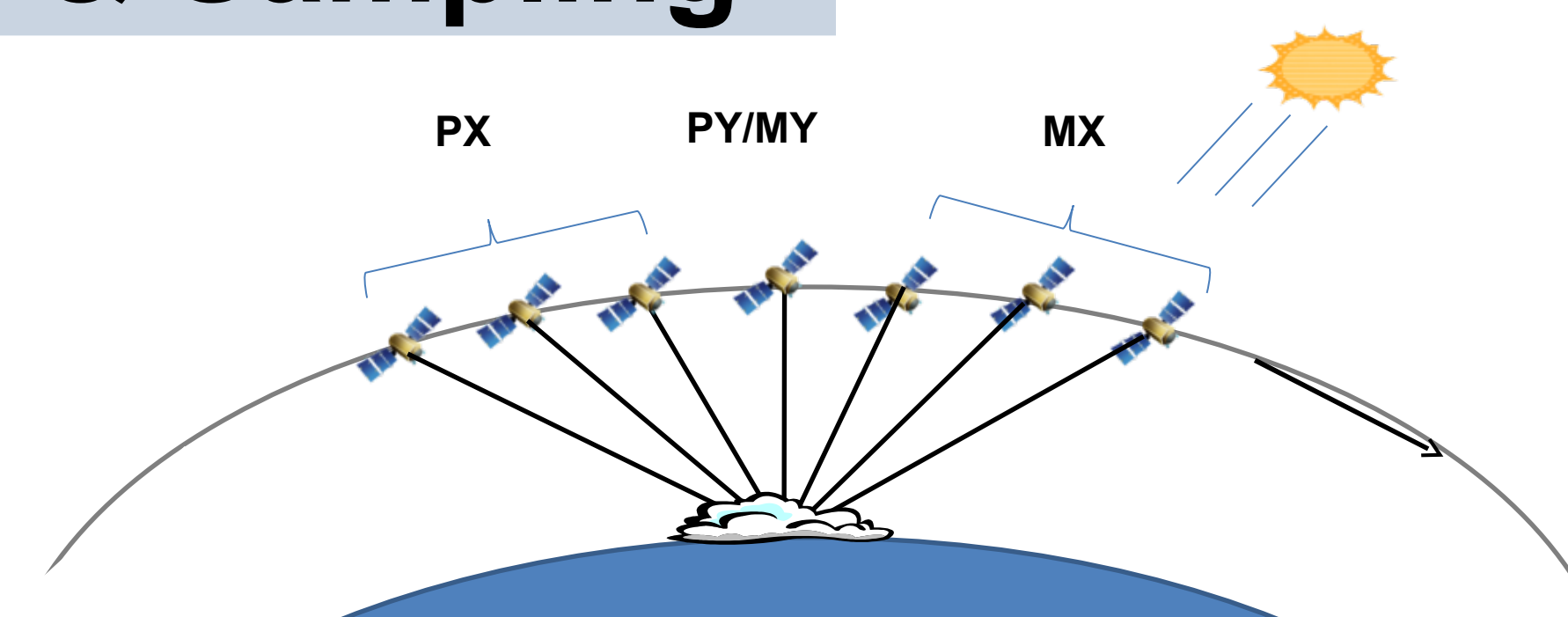


CIPS employs four nadir-pointing cameras to image clouds.

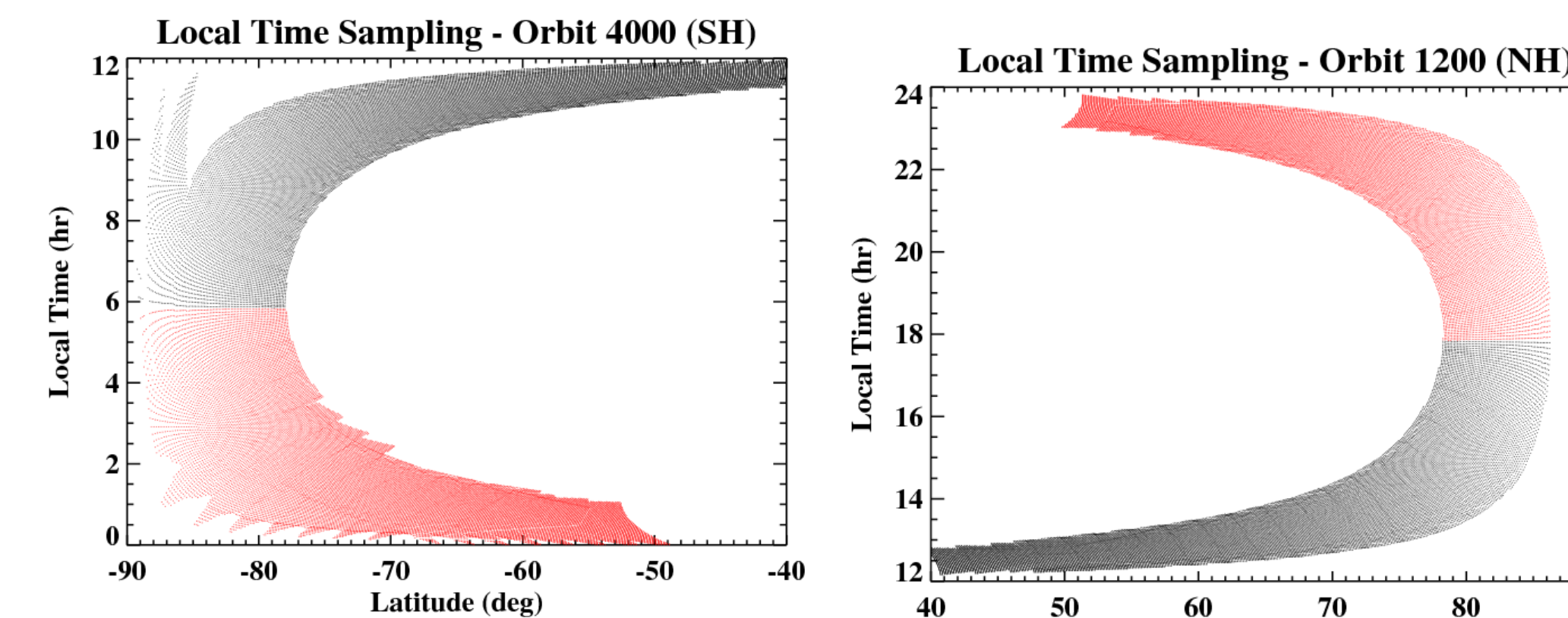
$$\lambda_0 = 265 \text{ nm}, \Delta\lambda = 15 \text{ nm}$$



Range of scattering angles observed in one orbit. Note that forward scattering (< 90°) points are better sampled at higher solar zenith angles.



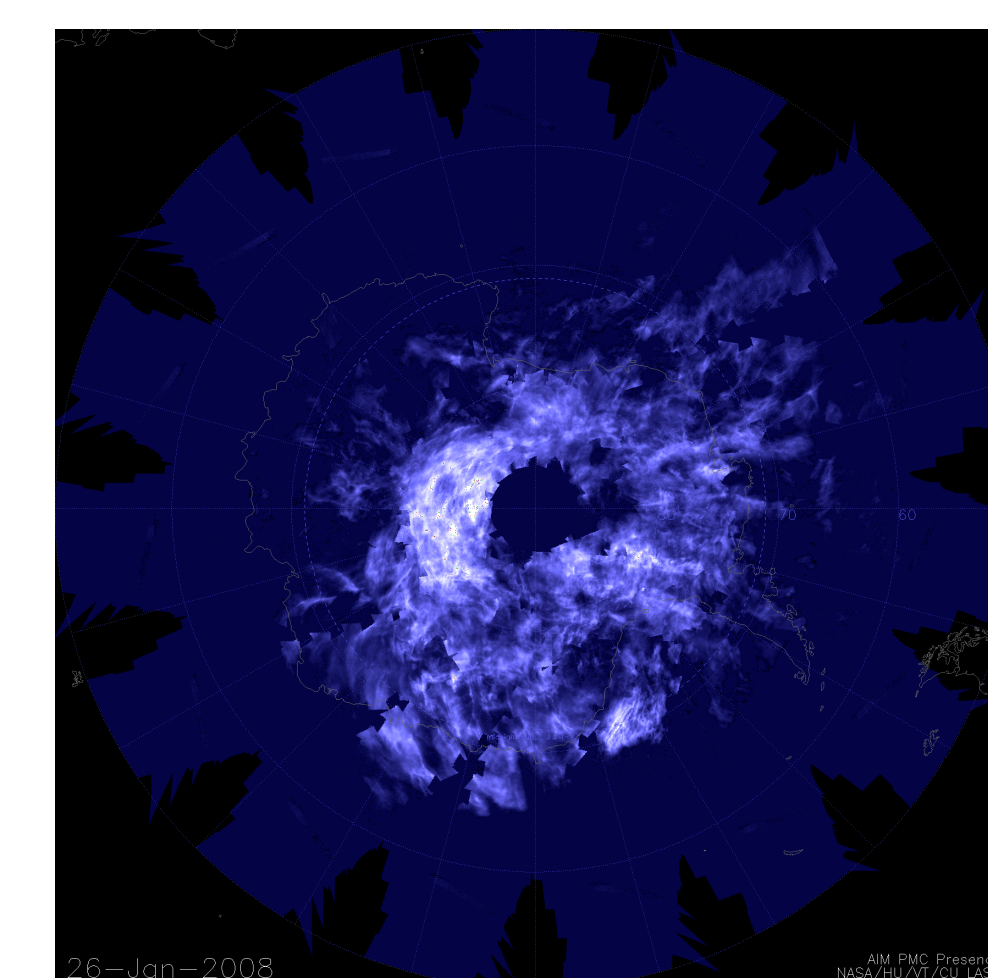
CIPS sampling frequency provides multiple measurements of a given air parcel at different scattering angles.



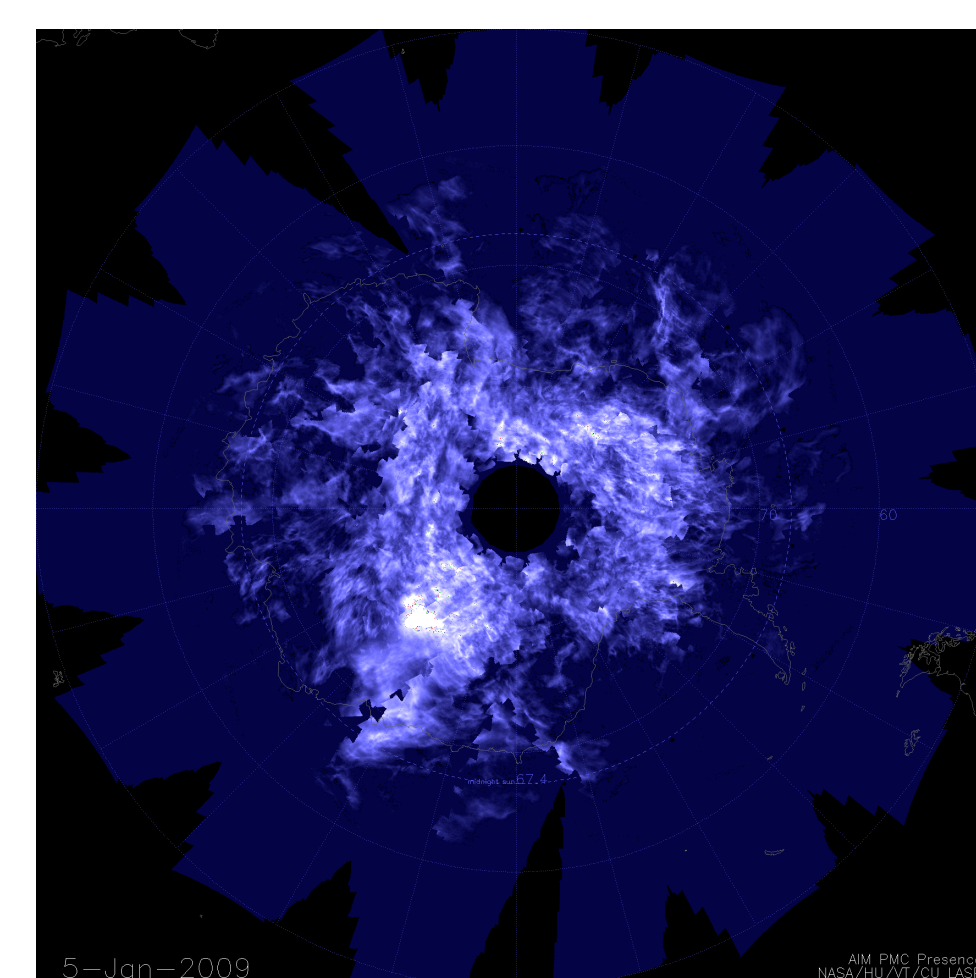
CIPS local time sampling. Red & black points denote ascending & descending node data, respectively.

Level 3 Data

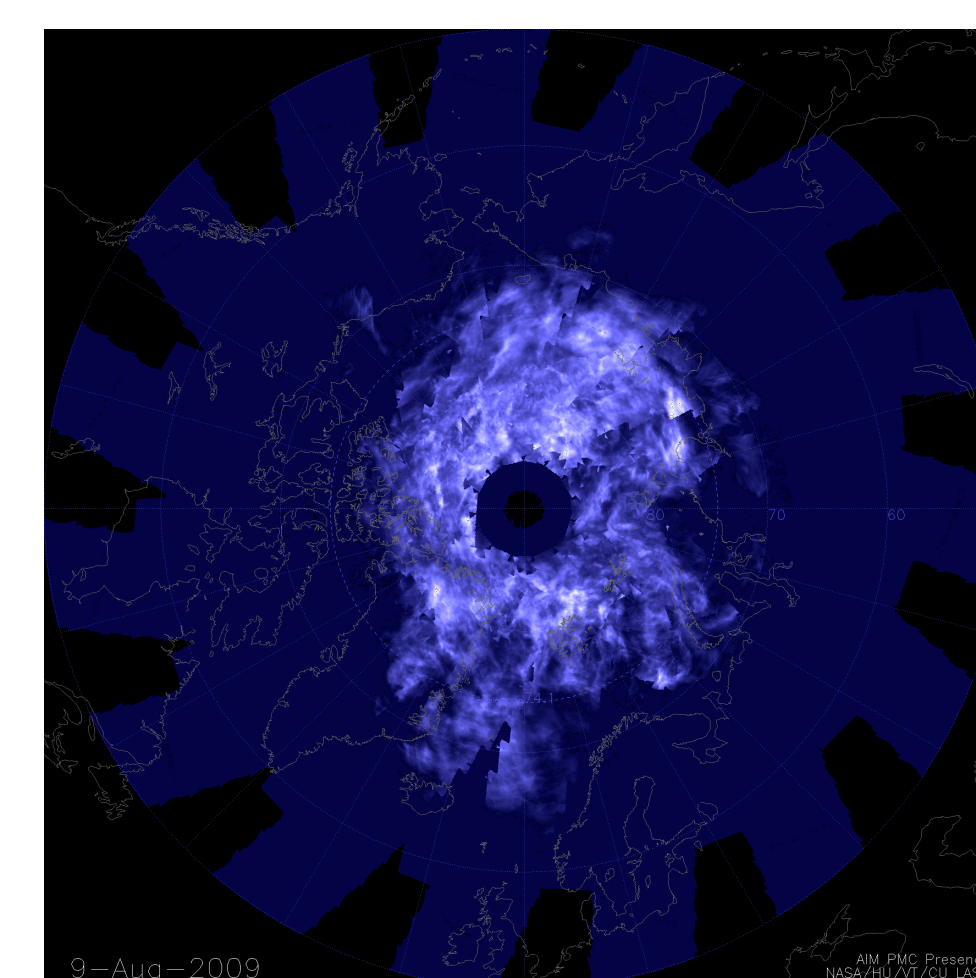
CIPS Level 3a data files ("daily dasics") are created by combining a day's worth of level 2 albedo data. Where multiple measurements are made in a common pixel the brightest one is retained to maximize dynamic range. Four examples are shown below.



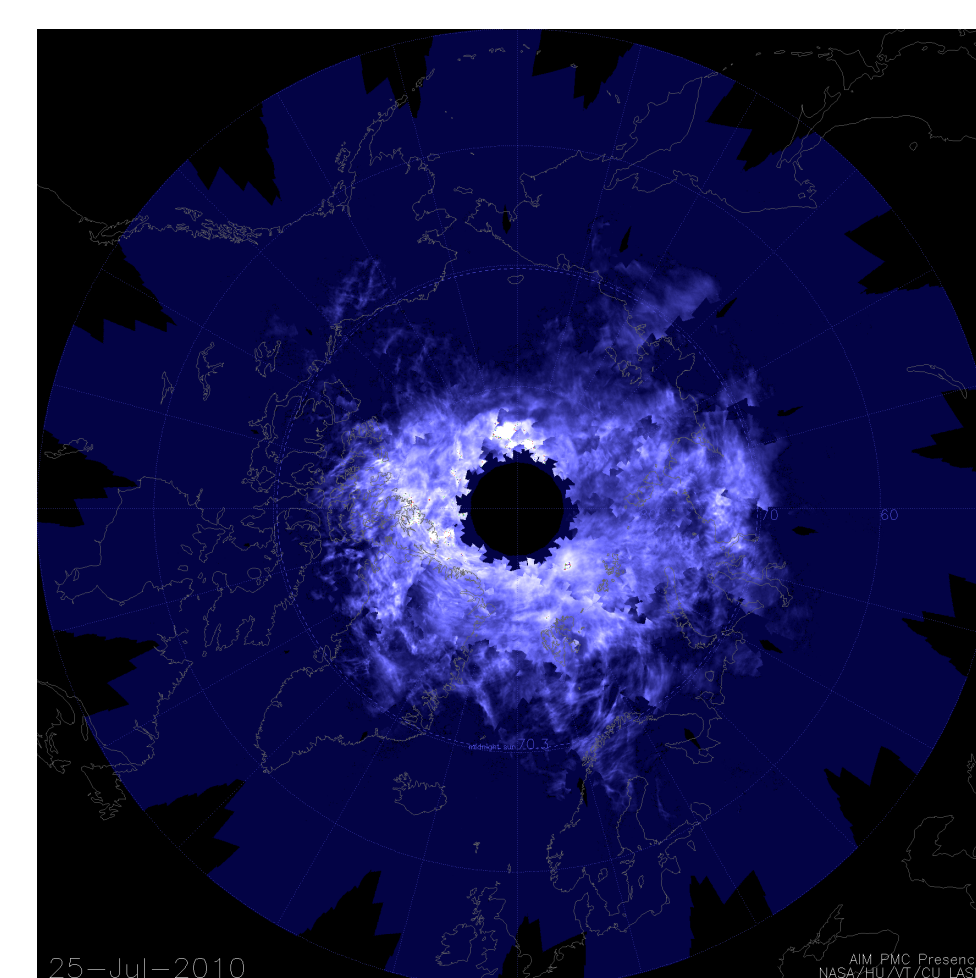
Jan 26 2008 (SH)



Jan 5 2009 (SH)



Aug 9 2009 (NH)

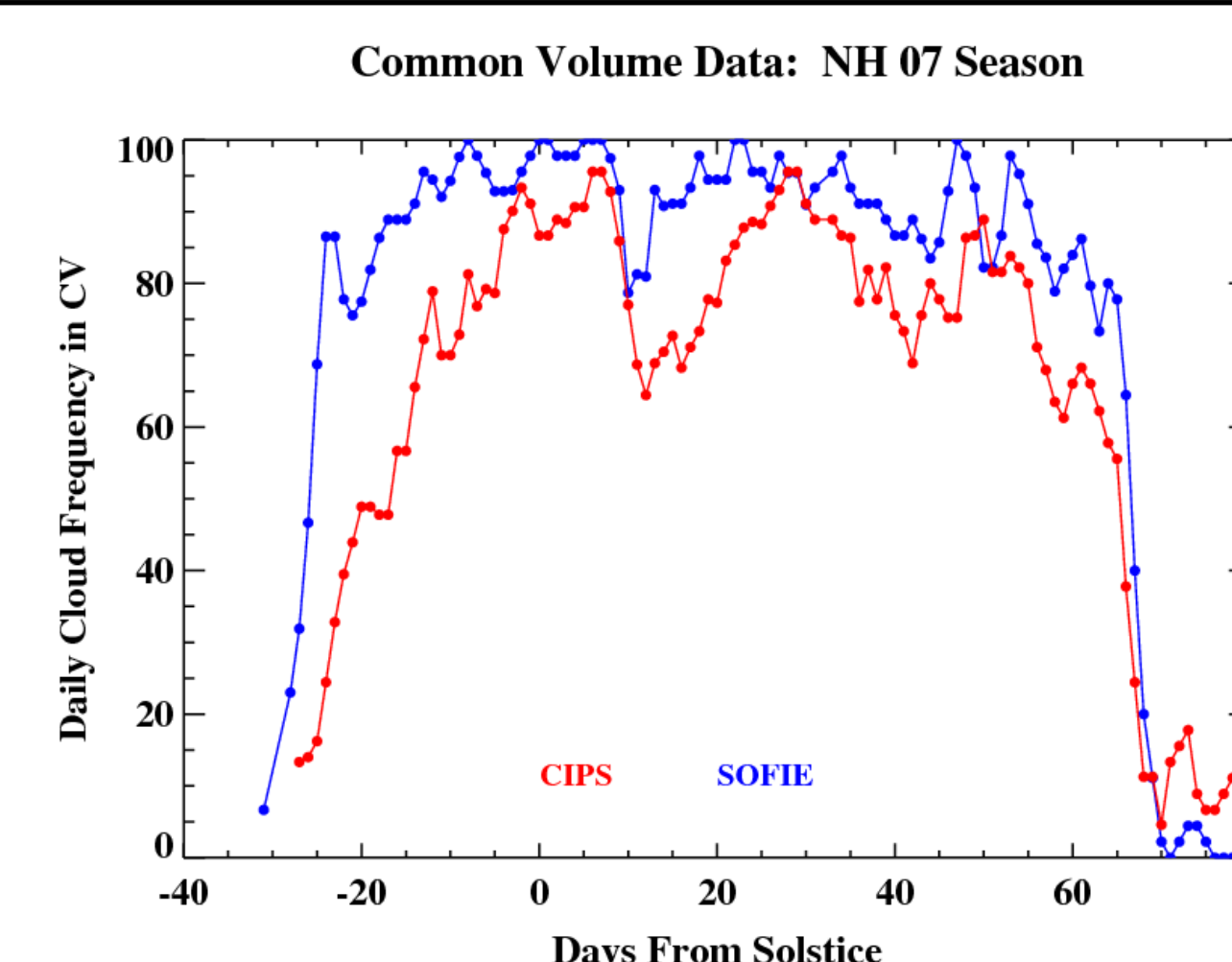


July 25 2010 (NH)

AIM Common Volume (CV) Data

CIPS makes coincident measurements with the SOFIE line-of-sight (LOS) in the AIM common volume (CV). This allows for direct cross-comparison of common measurements - particle size and ice water content (IWC) – as well as the use of CIPS imagery to help estimate the effect of spatial inhomogeneity on the SOFIE limb measurements.

The images at left show the SOFIE LOS projected onto the CV portion of the CIPS Level 2 image.

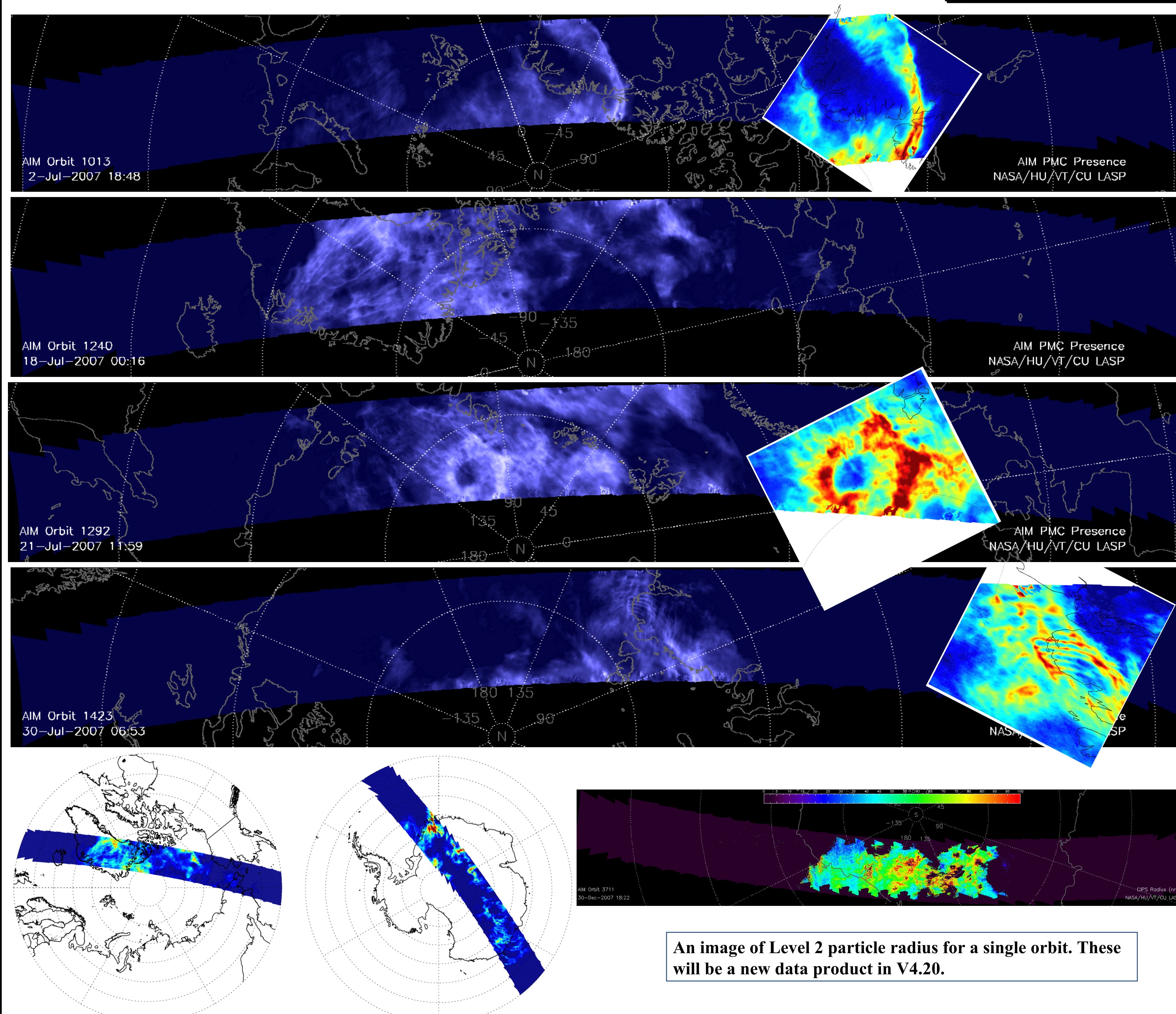
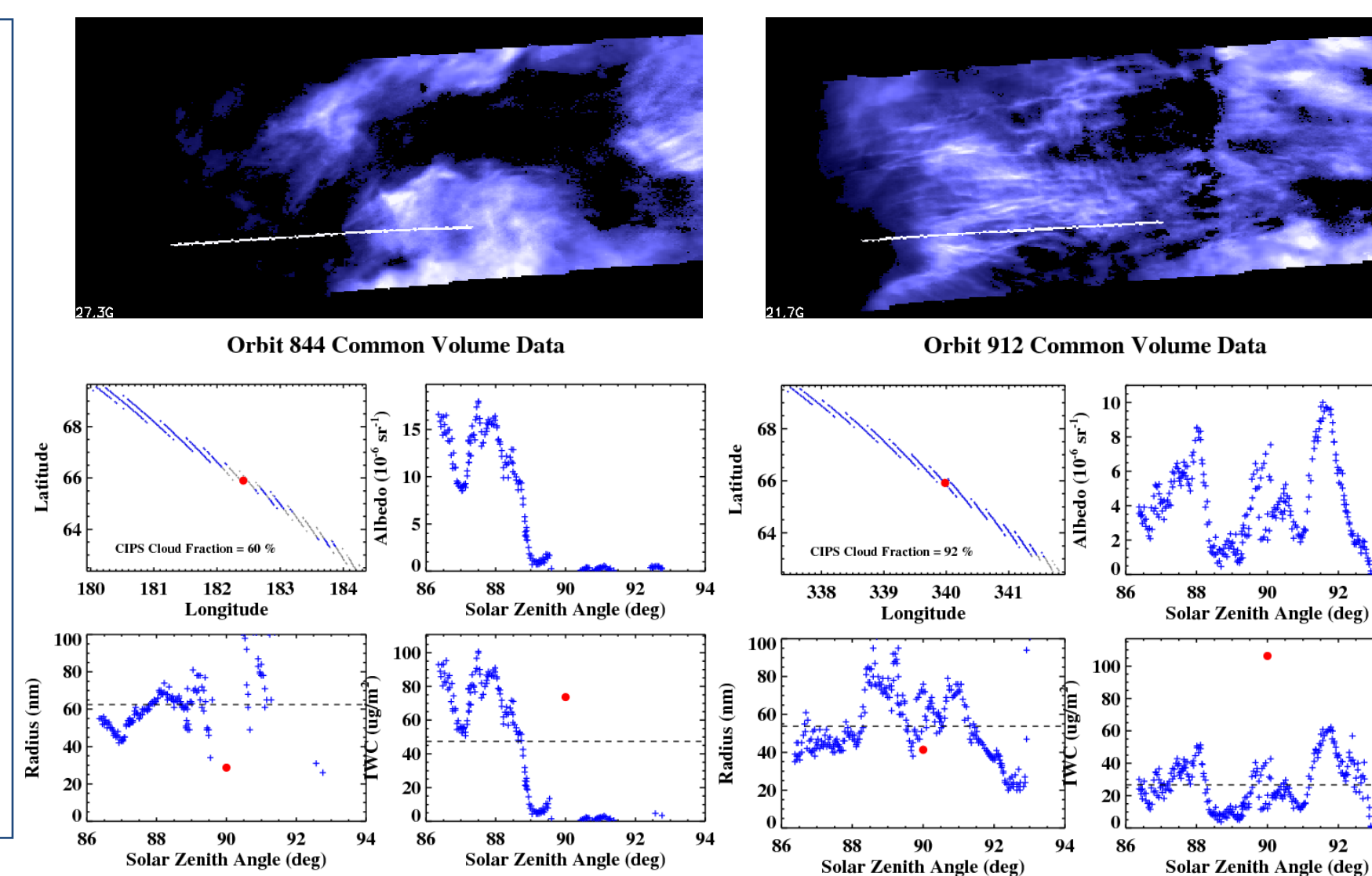


The plots above summarize the comparison between CIPS and SOFIE CV data in the NH 2007 season. Left – daily cloud frequency. Right – a comparison of retrieved particle radius.

The plots on the right illustrate two specific AIM orbits. The images at top show the CIPS Level 2 cloud albedo with the CV pixels (corresponding to the SOFIE line-of-sight) highlighted in white. Orbit 912 is almost uniformly cloud-filled (CIPS CV cloud cover = 92%) whereas orbit 844 is patchy, with only 60% cloud cover. Note there are NO clouds detected at the SOFIE tangent point for this orbit.

The 4-panel plots for each orbit show:

Top left - the CIPS CV pixel lat/lon. Pixels with clouds are blue, SOFIE occultation point is in red.
Top right - CIPS cloud albedo in the CV.
Bottom left - CIPS particle radius. Dashed line is CIPS mean and red point is SOFIE value.
Bottom right - same thing but for ice water content.

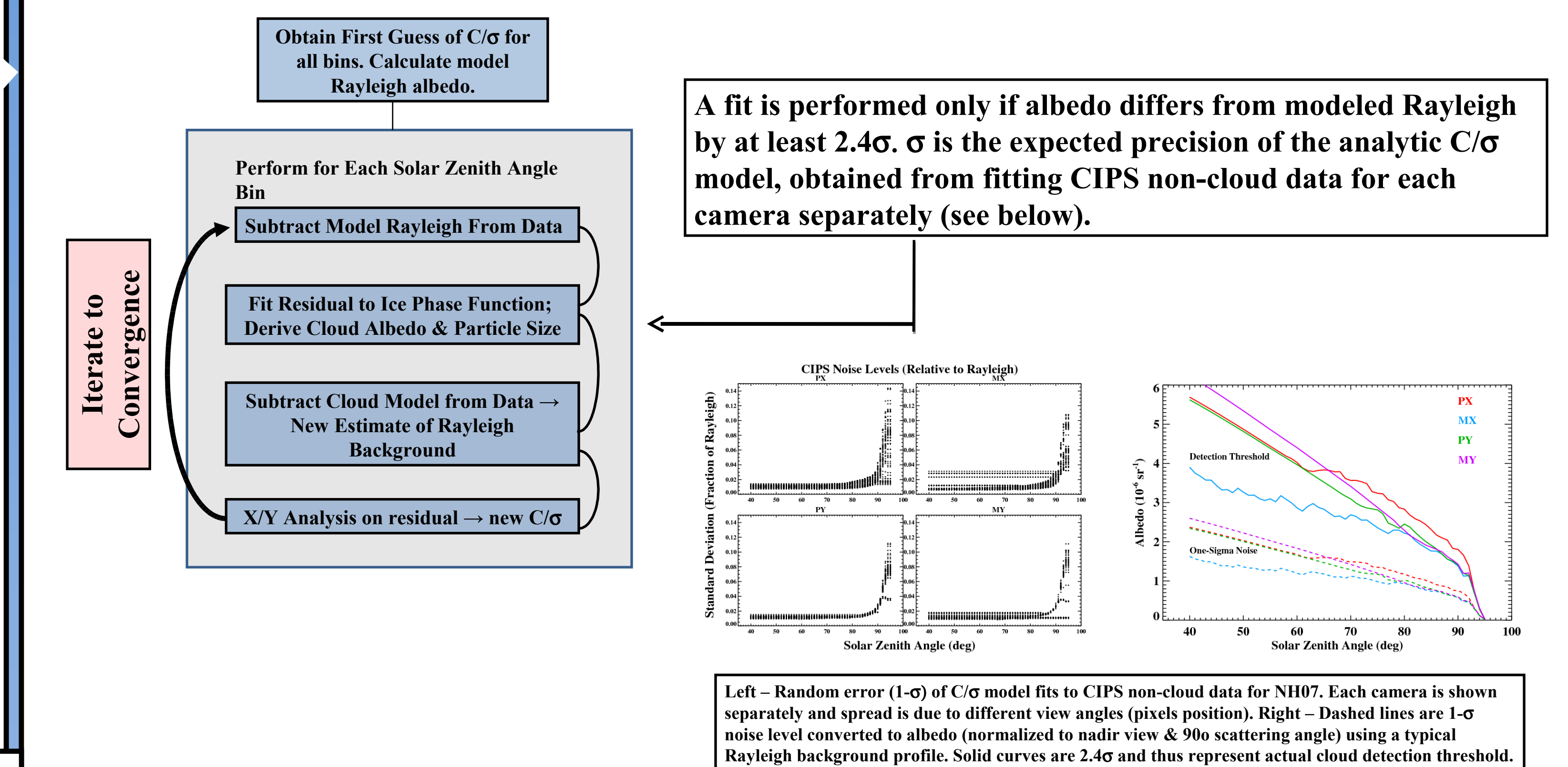


An image of Level 2 particle radius for a single orbit. These will be a new data product in V4.20.

Version 4.20 Algorithm

The fundamental CIPS data analysis problem is to remove the background atmospheric Rayleigh signal from the total albedo measured by the instrument. This provides a direct measurement of the PMC ice phase function, from which cloud microphysical parameters may be derived. In previous CIPS data versions the Rayleigh background was retrieved pixel-by-pixel, resulting in increased retrieval noise in the presence of clouds. The Version 4.20 algorithm takes a fundamentally different approach, assuming that the underlying ozone parameters that modulate the Rayleigh albedo vary smoothly over an area spanning many CIPS pixels. This provides a much smoother and more constrained cloud parameter retrieval, which may be done at much higher resolution than the previous algorithm.

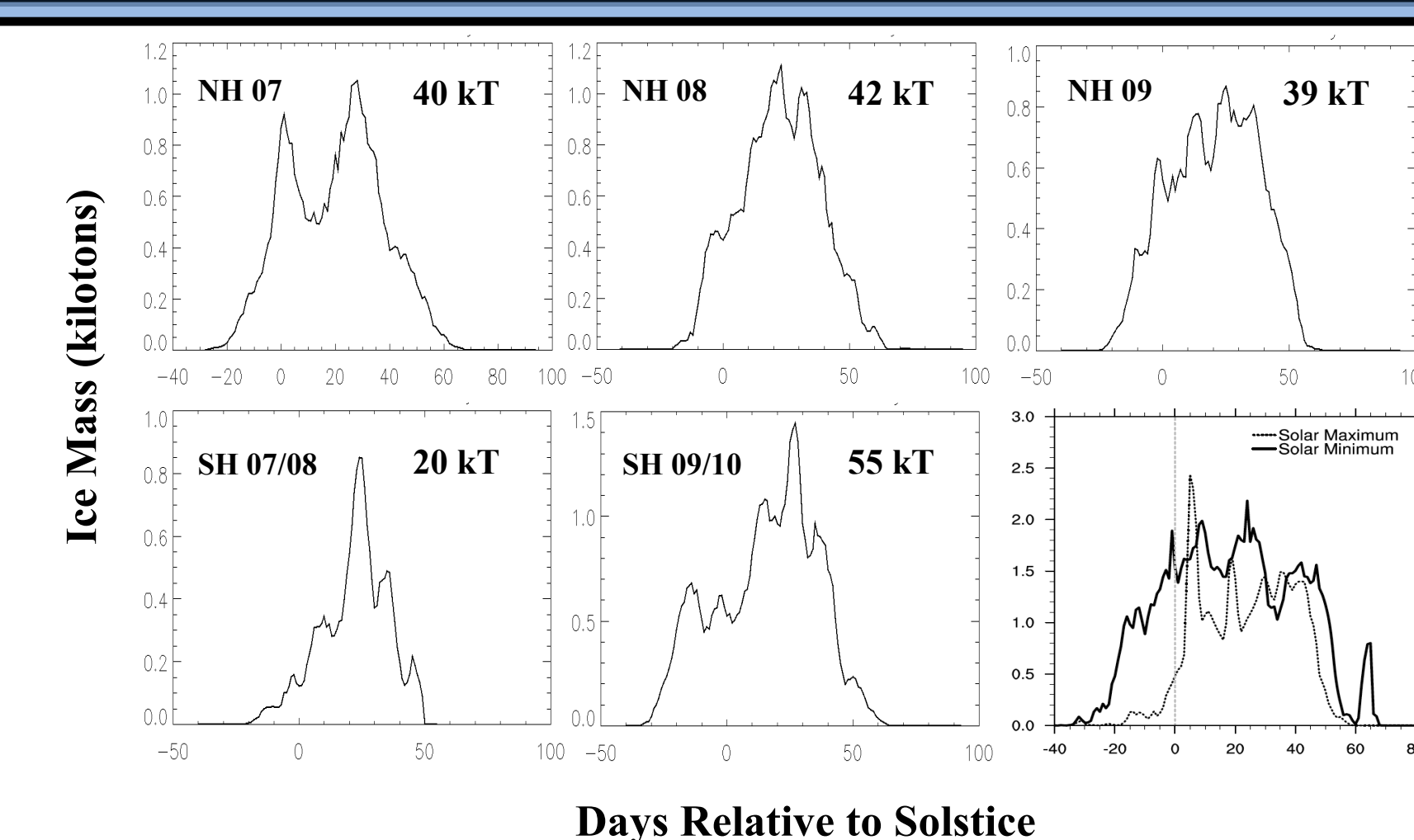
The analysis divides the orbit into 0.25 deg solar zenith angle bins. These bins are essentially cross-track slices spanning an area of ~25x800 km². A single ozone retrieval [C/σ] is performed in each bin and used to characterize the Rayleigh background for all points in that bin. The flow of the V4.20 algorithm is summarized in the diagram below.



Results from CIPS V4.20 summary files: Total Ice Mass

Shown for three northern and two southern seasons is the total ice mass (5-day smoothed), summed from latitude 60 deg to 85 deg on the ascending side only. The numbers in kilotons are seasonal totals.

For comparison, the bottom right panel shows the same quantity from the WACCM/CARMA model by Bardeen et al (2009). CIPS results are expected to be less than the total since we are not sensitive to all the ice.



Summary Files (Level 3b) are created by binning CIPS Level 2 data in 1-deg latitude bins for each orbit for an entire season. Albedo thresholds of 1, 2, & 5 G are used. These plots use daily averages created from the 2G summary files.

