**Cloud Imaging and Particle Size (CIPS) Instrument Overview**

The NASA Aeronomy of Ice in the Mesosphere (AIM) mission was designed to study polar mesospheric clouds (PMCs), the highest clouds in the earth's atmosphere (*Russell et al*., 2009). Also known as noctilucent clouds, PMCs form near the summer polar mesopause in both hemispheres, about 82 km (50 miles) above the surface of the earth. They are composed of water ice crystals, with particle sizes less than about 100 nanometers. PMCs form in the summer because the mesopause region is colder in summer than at any other time. Changes observed in PMCs in recent decades are possibly related to anthropogenic effects on the atmosphere. The AIM mission measures the clouds and their environment to better understand the underlying chemistry and physics, and the forces that cause the clouds to vary.

The AIM satellite has three instruments: CIPS, CDE (Cosmic Dust Experiment), and SOFIE (Solar Occultation For Ice Experiment). CDE, which is no longer operational, is an *in-situ* dust detector that measured cosmic dust input, a potential key factor in PMC formation (*Poppe et al*., 2011). SOFIE measures vertical profiles of particle extinction as well as temperature, water vapor, ozone, nitric oxide and methane (*Gordley et al*., 2009). For more information on CDE and SOFIE, please visit http://aim.hamptonu.edu/instrmt/cde.html and http://sofie.gats-inc.com/sofie/index.php.

The CIPS instrument (*McClintock et al*., 2009) is a panoramic imager that measures ultraviolet radiation scattered by PMCs and atmospheric gases. The instrument consists of a 2×2 array of cameras operating in a 10 nm passband centered at 265 nm, each with an overlapping field of view (FOV). The total FOV is 80° × 120°, centered at the sub-satellite point. CIPS images are acquired simultaneously in each camera. From 2007 through February of 2016 images were acquired every 43 seconds in the summer hemisphere between the terminator and a dayside latitude of about 40 degrees. Since February of 2016 images have been acquired at all sunlit latitudes. There are ~15 orbits per day, and ~20-30 four-camera images per orbit.

CIPS PMC data products include cloud albedo, particle radius, and ice water content along each orbit strip, with 56.25 $km^2$ spatial resolution. The version 4 CIPS PMC retrieval algorithm is described in *Lumpe et al*. (2013). Version 5 PMC data were first released for all CIPS seasons in 2020; a description of the version 5 PMC retrieval algorithm is currently in preparation.

In addition to PMCs, CIPS measures gravity waves (GWs) near the stratopause, at an altitude of 50-55 km (*Randall et al*., 2017). GWs play a significant role in coupling the atmosphere, because they transfer momentum and energy from the troposphere to higher altitudes. CIPS is unique in providing the only available imaging data set that can reveal horizontal GW structures near the stratopause. GWs are inferred from 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).

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