AIM Mission Status and Preliminary Science Results

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Airline Pilot PMC Photograph
John Boardman
What are noctilucent or “night shining” clouds?

- Highest altitude clouds in our atmosphere (≈ 83 km or 50 miles above the Earth)
- Form at coldest place on Earth (~130 K) near the mesopause in polar summers
- First reported in 1885
- Have been increasing over the past 24 years
- Usually seen poleward of 55° but have been sighted at ~ 40°N in recent NH summers
A PMC is observed and photographed at 40° latitude for the first time!

By Aim Co-Investigator Dr. Michael Taylor
PMCs are changing

North and South PMCs are different

Increasing numbers are occurring

NLCs are moving equatorward

Brighter clouds are being observed
Three Instruments on the AIM payload

Cosmic Dust Experiment (CDE) measures the input of cosmic dust into the atmosphere

Solar Occultation for Ice Experiment (SOFIE) T, H2O, Ice mass

Cloud Imaging Particle Size (CIPS) Nadir images Cloud particle size
SOFIE: Solar Occultation for Ice Experiment

SOFIE is an 8-channel differential absorption radiometer capable of simultaneously determining cloud and air properties.

SOFIE measures T, PMCs, CO₂, H₂O, CH₄, NO, O₃, and aerosols.

± 2K tropopause to 105 km
Four CCD cameras to image PMCs and determine microphysical properties

CIPS provides PMC images, cloud morphology and properties
1 X 2.5 km resolution. Total FOV is 2000 x 960 km at 83 km altitude
CDE: Cosmic Dust Experiment

In-situ dust detector
Measures cosmic dust input to the PMC region

![Image of Cosmic Dust Experiment]

![Graph showing CDE predicted fluxes]

CDE predicted fluxes.
AIM observing approach: SOFIE

H₂O, Ice, T, Chemistry
AIM observing approach: SOFIE, CIPS, CDE

Cosmic Dust

CDE

6 min
AIM Instrument and spacecraft status

- Early commissioning period including spacecraft and initial science instrument checkouts has been completed
- All three instruments working well and data quality is high
- Instruments are already returning information on the global extent and variability of PMCs and preliminary information on their size distribution and shape
- Clouds are being observed regularly and appearing more frequently as the season progresses
A PMC is clearly identified in the SOFIE channel 5 transmission profiles.

Note, this cloud is about a factor of 3 below the HALOE detection threshold.

The PMC extinction spectrum obtained from 9 SOFIE wavelengths validates instrument performance and is consistent with modeled ice PMC spectra.
**Particle Shape:**

Axial ratios (AR) obtained using two extinction ratios suggest aspherical particles:

\[
\beta(3.06) / \beta(3.19): \text{AR} = 0.55 \text{ or } 1.80 \\
\beta(3.06) / \beta(3.38): \text{AR} = 0.51 \text{ or } 1.85
\]

**Size Distribution:**

Gaussian PMC particle size distributions retrieved using SOFIE multi-wavelength extinctions

- Concentration = 12 cm\(^{-3}\)
- Median radius = 42 nm
- Width = 11 nm
CIPS PMC image on May 26 2007 shows PMC bands
AIM Summary

- All AIM instruments are functioning well
- Excellent science return is occurring
- All AIM objectives will be achieved
- Collaborative research with ground-based observers will be very helpful for validation studies
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