Polar Stratospheric Cloud Composition Studies using CALIPSO Lidar Data

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CALIPSO Is Providing A Wealth of Information on Polar Stratospheric Clouds

- CALIPSO is part of the ‘A-Train’ satellite constellation
  - Operating nearly continuously since mid-June 2006
  - Measurements made at latitudes up to 82°
  - High spatial resolution (5-km horizontal x 180-m vertical resolution PSC product)
- Lidar backscatter data collected in 3 channels
  - 532-nm parallel polarized
  - 532-nm perpendicular polarized
  - 1064-nm total backscatter
PSCs are detected as statistical outliers in scattering ratio (total/molecular backscatter) or $\beta_\perp$ at 532 nm.

- Successive horizontal averaging (5, 15, 45, & 135 km)
- Spatial coherence test to minimize false positives
- Aura MLS H$_2$O and HNO$_3$ and derived meteorological products (vortex, tropopause)

CALIPSSO PSC Composition Classification

The diagram illustrates the classification of CALIPSO PSC (Polar Stratospheric Clouds) based on their composition. The axes represent various parameters, such as $R_{532}$ and $1/R_{532}$, which are used to classify the clouds into different mixes.

- **Mix 1**: Located in the lower left quadrant of the diagram, representing a specific composition category.
- **Mix 2**: Found in the upper middle quadrant, indicating another composition type.
- **STS**: Positioned near the origin, signifying a distinct category.
- **Ice**: Marked in the upper right, denoting ice-related compositions.

The color scale on the right indicates the number of observations for each composition type, ranging from 5000 to 150000.
PSC Composition Example

July 24, 2006

(Please refer to the diagram for details on PSC Composition.)
Seasonal Evolution of PSC Composition

Antarctic 2007 Season
Composition Spatial Distribution

26 June - 2 July 2007
PSCs between 20-25 km
Onset of PSCs in May 2007

Mix 2 (NAT)

GM

60S

STS

26 May 2007

STS Cloud

NAT Cloud

2007-05-26

2 September 2008

SPARC 4th General Assembly

MCP-8
Onset of PSCs in May 2007

See Vincent Noel's poster B-00416
Summary and Future Work

- Robust second generation PSC detection and composition discrimination algorithms have been developed.
- Forging partnerships with modeling groups for detailed process studies and larger-scale CTM simulations (Niels Larsen, DMI and Frank Daerden, BIRA).
- Participating in ‘Match’ campaign with Antarctic ground-based lidars (see Christine David’s Poster B-00442).
- Comparing CALIPSO data with limb emission spectra from MIPAS to assess composition discrimination (Michael Hoepfner, IMK)
2007 Antarctic PSC Season
“The Movie”