Importance of Lidar Observations for Studies of Cloud Radiative Properties

Objectives

- Cirrus cloud top altitude and vertical structure can readily be determined, thereby improving accuracy of heating and cooling rate calculations.
- Multilevel cloud systems can unambiguously be identified, both day and night.
- Cloud base height can be determined for optically thin, but geometrically thick, clouds.
- Spectral emissivity of clouds can be inferred more accurately if lidar and infrared measurements are combined.

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GLRS-A

Advantages

- Improve image analysis of cloud top altitude and effective emissivity (e.g., MODIS-N and AIRS).
- Could obtain measurements of the frequency and thickness of arctic haze, stratus and cirrus clouds even when over snow and sea ice surfaces.
- Cloud vertical structure can be determined even in polar darkness and when temperature inversions inhibit passive analysis.

Disadvantages

- Measurements would only be available along the nadir track.

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Recommendations

- A monostatic lidar be deployed along with CERES, MODIS-N, and MISR to improve global coverage of cloud vertical structure.
  - The requirements on simultaneity may be reduced to 5-10 min and the same orbit.
  - Either GLRS-A or LAWS would be valuable if orbit conditions can be met.
- If GLRS-A is flown on a separate spacecraft to meet the objectives of polar ice sheet science, it is essential that the entire return signal be digitized.