Geophysical Research Abstracts
Vol. 13, EGU2011-8509, 2011
EGU General Assembly 2011

Airborne Cloud Radar and Lidar for Sensing Aerosol and Clouds

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One of the largest remaining uncertainties in assessing the future trajectory of earth's climate is the proper treatment of cloud processes and in particular, the interactions between aerosols and clouds . Aerosols affect cloud formation and evolution, and hence have strong indirect effects on the radiative forcing of clouds, and even on the timing and magnitude of precipitation. Models and field observations have shown that an increase in manmade aerosols can ultimately lead to higher concentrations of cloud drops, which can enhance the cloud albedo, thereby leading to a cooling effect and affecting precipitation . Because these processes are highly dependent on detailed microphysics, the interaction of aerosol and clouds is currently treated very crudely in the global models used to estimate future climate states. In order to make progress in global modeling, further measurements will be necessary to constrain model parameterizations of cloud microphysics.

The Earth Observing Laboratory (EOL) of NCAR is in the process of building the first phase of a three phase dual wavelength W/Ka-band airborne cloud radar to be called the HIAPER Cloud Radar (HCR). It is a pod based radar system with scanning capability. The pod-based radar is primarily designed to fly on Gulfstream V (GV) . One of the attractive features of a millimeter wave radar system is its ability to detect micron-sized particles that constitute clouds with lower than 0.1 g m-3 liquid or ice water content. The envisioned capability of a millimeter wave radar system on HIAPER is enhanced by coordination with High-Spectral Resolution Lidar (HSRL). The lidar, designed and built by the University of Wisconsin, provides unique measurements of both backscatter and extinction. Lidar and cloud radar measurements are used for estimating microphysical properties of aerosol and clouds respectively. This presentation describes an engineering overview and measurement capabilities of the cloud radar and lidar.