



Lidar Measurements of water ice clouds on Mars and Earth

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A LIDAR instrument was operated from the surface of Mars on the NASA Phoenix Mission. Water ice clouds were observed to form and precipitate at temperatures of around -65° C in the nighttime residual planetary boundary layer (PBL). The interpretation is that water vapor mixed upward by daytime turbulence and convection forms ice crystal clouds at night that precipitate back toward the surface.

Airborne LIDAR measurements were also conducted to study cirrus clouds that form on Earth at similar temperatures and water vapour densities as the clouds observed with the LIDAR on Mars. Simultaneous airborne in situ microphysical sampling in the cirrus clouds was used to obtain a relationship between the optical extinction coefficient derived from the LIDAR and the ice water content (IWC). This was used to determine that the IWC in the Mars clouds had values similar to Earth cirrus at around 1 mg per cubic metre. A model that incorporated mixing, radiation and microphysics in the PBL of Mars was applied to interpret the observation of clouds, and the simulated IWC was in agreement with that derived from the LIDAR measurements.