The Cloud, Aerosol Backscatter and Polarization LiDAR at Summit, Greenland

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Precise measurements of cloud properties over Greenland are necessary to document the full range of cloud conditions and characteristics throughout the Arctic. The Cloud, Aerosol Polarization and Backscatter LiDAR (CAPABL) has been developed to address this need by measuring depolarization, particle orientation and backscatter of clouds and aerosols in the troposphere and lower stratosphere. CAPABL uses recent developments in optical methods to detect horizonatally oriented ice crystals (HOIC) by quantifying the diattenuation of the returned signal. The LiDAR is located at Summit, Greenland (72.6° N, 38.5° W; 3200 m.a.s.l) as part of the Integrated Characterization of Energy, Clouds, Atmospheric State, and Precipitation at Summit project and NOAA's Global Monitoring Division's LiDAR network. Here the instrument is described with particular emphasis placed upon the implementation of the new polarization methods developed as part of this instrument. Initial results of the LiDAR are also shown to demonstrate the ability of the LiDAR to observe cloud properties.
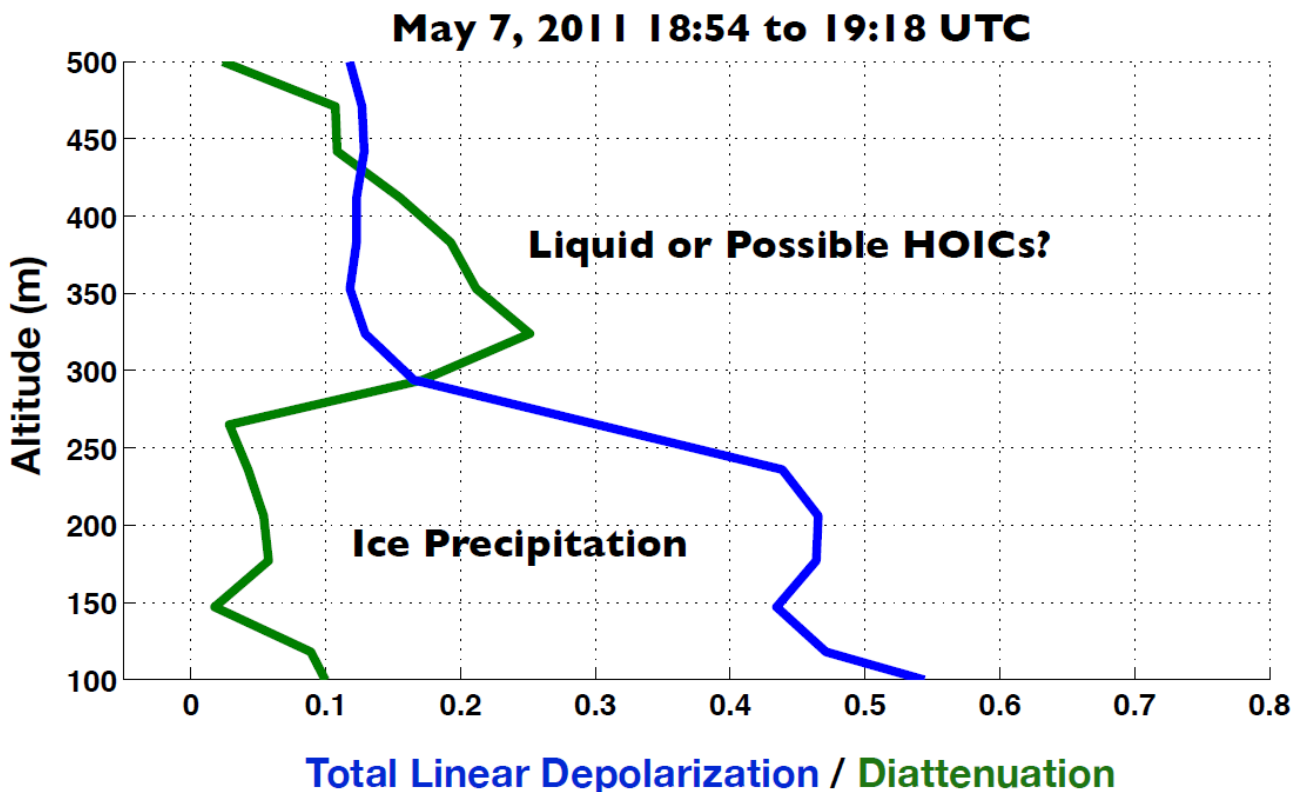
Figure 1. On May 7, 2011, CAPABL observed a diattenuation signature that appeared to coincide with a cloud at an altitude of 400 to 500 m. During that same time, a higher altitude cloud with low depolarization, strong backscatter and no diattenuation (liquid water cloud) was also observed. This observation suggests that CAPABL can detect horizontally oriented ice crystals while simultaneously determining cloud phase using their unique polarization signature.