

AIRBORNE LIDAR OBSERVATIONS OF ARCTIC POLAR STRATOSPHERIC CLOUDS

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Polar stratospheric clouds (PSC's) have been detected repeatedly during Arctic and Antarctic winters since 1978-1979 by the SAM II (Stratospheric Aerosol Measurement II) instrument aboard the NIMBUS-7 satellite. PSC's are believed to form when supercooled sulfuric acid droplets freeze, and subsequently grow by deposition of ambient water vapor as the local stratospheric temperature falls below the frost point (which is typically less than -80°C .)

In order to study the characteristics of PSC's at higher spatial and temporal resolution than that possible from the satellite observations, aircraft missions were conducted within the Arctic polar night vortex in January 1984 and January 1986 using the NASA Langley Research Center airborne dual-polarization ruby lidar system. The 1984 measurements spanned a 4-day period during which PSC's were observed in the 17-23-km-altitude range over an extensive area of the polar cap (from about 80°N to the Pole). In contrast, PSC's were observed only on a single flight during the 1986 mission over the 23-26-km-altitude range in a limited area between Iceland and Scotland. These measurements were made apparently near the southern edge of a PSC formation and in a time period just prior to a rather rapid warming at the cloud level, which led to dissipation.

This paper will present a synopsis of the 1984 and 1986 PSC observations, illustrating short-range spatial changes in cloud structure, the variation of backscatter ratio with temperature, and the depolarization characteristics of cloud layers. Implications will be noted with regard to PSC particle characteristics and the physical process by which the clouds are thought to form.