



Long-term measurements of Polar Stratospheric Clouds with the Esrangle lidar

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Polar Stratospheric Clouds (PSCs) play a key role for ozone depletion in the polar stratosphere whose magnitude depends on the type of PSC and its lifetime and extent. PSCs are classified into three types (PSC Ia: nitric acid di- or trihydrate crystals, NAD or NAT; PSC Ib: supercooled liquid ternary solutions, STS; PSC II: ice) according to their particle composition and to their physical phase.

This study presents long-term statistics of PSC occurrence from measurements with the lidar system at the Esrangle Space Centre (68°N, 21°E), northern Sweden. The study gives an overview of the occurrence frequency of different PSC types in connection to the prevailing meteorological conditions for the northern hemispheric winters from 1996/97 to 2013/14. During these 18 years, most of the measurements were conducted in January. The geographical location of Esrangle in the lee of the Scandinavian mountain range allows for the observation of a wide range of PSC growth conditions due to mountain-wave activity.

The Esrangle lidar data set contains hourly mean values of the parallel and perpendicularly polarized backscatter ratio and the linear particle depolarization ratio — all measured at 532 nm. These parameters are used for PSC classification. The lowest occurrence frequency is found for PSCs of type II (6% for the entire period). This low occurrence rate is reasonable since PSCs of type II are formed at temperatures below the ice–frost point. Such temperatures are rarely reached in the Arctic polar vortex. Most of the observations between 1997 and 2014 showed low particle depolarization ratios and low backscatter ratios according to which observed PSCs were classified as type Ib (47%) or mixtures (33%). The remaining 13% of the observation were classified as type Ia PSCs (NAT particles).