CALIPSO Polar Stratospheric Cloud Observations from 2006-2015

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Polar stratospheric clouds (PSCs) play a crucial role in the springtime chemical depletion of ozone at high latitudes. PSC particles (primarily supercooled ternary solution, or STS droplets) provide sites for heterogeneous chemical reactions that transform stable chlorine and bromine reservoir species into highly reactive ozone-destructive forms. Furthermore, large nitric acid trihydrate (NAT) PSC particles can irreversibly redistribute odd nitrogen through gravitational sedimentation (a process commonly known as denitrification), which prolongs the ozone depletion process by slowing the reformation of the stable chlorine reservoirs. Spaceborne observations from the CALIOP (Cloud-Aerosol Lidar with Orthogonal Polarization) lidar on the CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations) satellite are providing a rich new dataset for studying PSCs.

CALIPSO is an excellent platform for studying polar processes with CALIOP acquiring, on average, over 300,000 backscatter profiles daily at latitudes between 55 and 82 degrees in both hemispheres. PSCs are detected in the CALIOP backscatter profiles using a successive horizontal averaging scheme that enables detection of strongly scattering PSCs (e.g., ice) at the finest possible spatial resolution (5 km), while enhancing the detection of very tenuous PSCs (e.g., low number density NAT) at larger spatial scales (up to 135 km). CALIOP PSCs are separated into composition classes (STS; liquid/NAT mixtures; and ice) based on the ensemble 532-nm scattering ratio (the ratio of total-to-molecular backscatter) and 532-nm particulate depolarization ratio (which is sensitive to the presence of non-spherical, i.e. NAT and ice particles). In this paper, we will provide an overview of the CALIOP PSC detection and composition classification algorithm and then examine the vertical and spatial distribution of PSCs in the Arctic and Antarctic on vortex-wide scales for entire PSC seasons over the more than nine-year data record from 2006-2015.