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A Decade of Polar Stratospheric Cloud Observations from CALIPSO

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Polar stratospheric clouds (PSCs) form at very cold temperatures (below about 195 K) during winter and early spring at the high latitudes and play a critical twofold role in the chemical depletion of stratospheric ozone. First, heterogeneous chemical reactions occurring on PSC particles, primarily supercooled ternary (H_2SO_4-H_2O-HNO_3) solution (STS) droplets, convert stable chlorine reservoir species to highly reactive ozone-destructive forms. Secondly, sedimentation and evaporation of large nitric acid trihydrate (NAT) PSC particles can redistribute odd nitrogen irreversibly and prolong ozone depletion by slowing the reformation of the stable chlorine reservoirs. The CALIOP (Cloud-Aerosol Lidar with Orthogonal Polarization) instrument on the CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations) satellite has been observing PSCs at latitudes up to 82 degrees in both hemispheres since mid-June 2006 and has provided a rich new database for studying PSC processes. PSCs are detected by CALIOP at unprecedented high spatial resolution: 180 m in the vertical and 5 to 135 km along the CALIPSO orbit track, depending on backscatter signal level. The combination of measured 532-nm scattering ratio (the ratio of total-to-molecular backscatter) and 532-nm particulate depolarization ratio also enables the separation of PSC observations into composition classes: STS, liquid/NAT mixtures, or ice. CALIPSO observations of PSCs over the last decade are the foundation of a new initiative under SPARC (Stratospheric-Tropospheric Processes and their Role in Climate, a core project of the World Climate Research Program) to develop a state-of-the-art reference PSC data record and climatology that will be valuable for testing existing and future global models. In this paper, we will discuss the CALIPSO PSC detection and composition classification methodology and highlight findings with regard to the temporal, vertical, and spatial distribution of PSCs in the Arctic and Antarctic over the last decade. In addition, we will present an overview of the SPARC PSC initiative and its current status.