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PSC climatology based on CALIOP measurements from 2006-2018

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After more than three decades of research, the role of polar stratospheric clouds (PSCs) in stratospheric ozone depletion is well established. However, important questions remain unanswered that have limited our understanding of PSC processes and how to accurately represent them in global models, calling into question our prognostic capabilities for future ozone loss in a changing climate. A more complete picture of PSC processes on vortex-wide scales has emerged from the CALIOP (Cloud-Aerosol Lidar with Orthogonal Polarization) instrument on the CALIPSO satellite that has been observing PSCs at latitudes up to 82 degrees in both hemispheres since June 2006. A new CALIOP Version 2.0 (v2) PSC algorithm has been developed that addresses known deficiencies in previous algorithms and includes additional refinements to increase the robustness of the inferred PSC composition. In this paper, we present a state-of-the-art PSC reference data record and comprehensive climatology constructed by applying the v2 algorithm to the more than 13-year CALIOP spaceborne lidar dataset. In addition to 4-D (latitude, longitude, altitude, and time) information on the occurrence, composition, and variability of PSCs in both hemispheres, it also includes the estimated particulate SAD and VD to facilitate comparisons with in situ data and PSC measurements by other remote sensors, as well as with theoretical models relating PSCs to heterogeneous chemical processing and ozone loss. Finally, we compare the post-Pinatubo CALIOP PSC data record with the 1979-1989 SAM II (Stratospheric Aerosol Measurement II) solar occultation PSC record to investigate possible long-term variability in PSC occurrence.