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2008-2020 lidar measurements of Polar Stratospheric Clouds at the French antarctic station Dumont d'Urville

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Polar Stratospheric Clouds (PSCs) are precursors in the polar stratospheric ozone depletion processes. Aside from recent improvements in both spaceborne PSCs monitoring and classification as well as investigations on microphysics and modeling, there are still uncertainties associated to solid particle formation and their denitrification potential. Besides, complex pathways in PSC formation microphysics lead to mixtures of particles with different optical properties and chemical efficiencies. In that regard, groundbased instruments deliver detailed and valuable measurements that complement the global spaceborne coverage especially in areas near the vortex edge where spaceborne coverage is more difficult and PSC fields present finer structures, especially regarding altitude, similar to the Arctic.

Operated at the French antarctic station Dumont d'Urville (DDU) in the frame of the international Network for the Detection of Atmospheric Composition Change (NDACC), the Rayleigh/Mie/Raman stratospheric lidar provides a solid dataset to feed both process and classification studies, by monitoring cloud and aerosol occurrences in the upper troposphere and lower stratosphere. Located on the antarctic shore (66°S - 140°E), the station has a privileged access to polar vortex dynamics and also recorded persistent signatures of the 2019/2020 Australian originated wildfires.

We hereby present a consolidated dataset from 10 years of lidar measurements using the 532nm backscatter ratio, the aerosol depolarisation and local atmospheric conditions to help in building an aerosol/cloud classification based on existing works using 2008-2020 data.

Overall, the DDU PSC pattern is very consistent with expected typical temperature controlled microphysical calculations. Outside of background sulfate aerosols and anomalies related to volcanic activity (like in 2015), Supercooled Ternary Solution (STS) particles are the most observed particle type, closely followed by Nitric Acid Trihydrate (NAT). ICE clouds are less but regularly observed. ICE clouds also have to be cleary separated from cirrus clouds, raising the issue of accurate tropopause calculations.

Validation of the spaceborne classification schemes as well as careful speciation of the multiple signatures of volcanic or biomass originated aerosol plumes strengthens the need for groundbased monitoring especially in polar regions.