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10 years of Polar Stratospheric Clouds lidar measurements at the French antarctic station Dumont d'Urville

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Polar Stratospheric Clouds (PSCs) play a primary role in polar stratospheric ozone depletion processes. Aside from recent improvements in both spaceborne monitoring as well as investigations on microphysics and modeling, there are still caveats on building a comprehensive picture of the PSC particle population, especially considering the fine optical signatures of some particles. In that regard, groundbased instruments provide fine and long term reference measurements that complement the global spaceborne coverage.

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 lidar provides over the years 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 antarctic shore (66°S - 140°E), the station has a privileged access to polar vortex dynamics. Measurements are weather-dependent with a yearly average of 130 nights of monitoring. Expected PSC formation temperatures are used to evaluate the whole PSC season occurrence statistics.

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. Overall, the DDU PSC pattern is very consistent with expected typical temperature controlled thresholds. Supercooled Ternary Solution (STS) particles are the most observed particle type, closely followed by Nitric Acid Trihydrate (NAT). ICE clouds are more rarely observed. The measurements also feature significant and detailed signatures of various aerosols events having reached the polar antarctic stratosphere, like the Calbuco eruption (2015) or the 2 australian wildfires episodes (2009 and 2019). We aim at refining the identification of those aerosols to include their impact in the scope of the scientific questions studied at DDU.