Observation of Polar Stratospheric Clouds at Dome C, Antarctica.

Marcel Snels[(1)], Luca Di Liberto[(1)], Ilir Shuli[(1)], Francesco Colao[(2)], Andrea Scoccione [(3)] ,Federico Serva[(4)]

[(1)] CNR-Institute of Atmospheric Sciences and Climate, Via Fosso del Cavaliere 100, 00133 Roma (Italy), *E-mail:m.snels@isac.cnr.it, l.diliberto@isac.cnr.it, ilir.shuli@isac.cnr.it*

[(2)] ENEA, Via Enrico Fermi 45, 00044 Frascati (Italy), *E-mail:francesco.colao@enea.it*

[(3)] Aeronautica Militare, Pratica di Mare (Italy), *E-mail:andrea.scoccione@aeronautica.difesa.it*

[(4)] Agenzia Spaziale Italiana (ASI); European Space Agency (ESA) Φ-lab , Roma(Italy), *E-mail: federico.serva@asi.it*

The lidar observatory at Dome C, Antarctica has been active since 2014. Its main goal is the observation of polar stratospheric clouds during the Antarctic winter, from early May until the end of September. Polar stratospheric clouds typically occur at altitudes between 12 and 26 km, when the stratospheric temperature is low enough to form liquid STS (Supercooled Ternary Solutions), solid NAT (Nitric Acid Trihydrate) and ice crystals. These aerosols reflect part of the light emitted by the lidar and its backscattered fraction as well as its polarization can be measured. The recorded optical signals can then be used to distinguish the various aerosols composing the polar stratospheric clouds (PSCs). PSCs are important for the catalytic destruction of ozone and for the removal of nitric acid and water vapor from the stratosphere.

The Dome C lidar observatory is one of the few Antarctic stations accredited as a main station of the NDACC (Network for the Detection of Atmospheric Composition Change). The lidar can be remotely controlled and operates several times per day during the austral winter. Recently a tropospheric channel has been added for the observation of cirrus clouds. Here we present recent results of the PSC occurrences in 2020 and 2021, compared with the observations performed by the spaceborne CALIOP lidar aboard of the CALIPSO satellite.

Generally, PSCs can be observed at Dome C from the beginning of June until the second half of August, when a displacement of the polar vortex towards the Antarctic Peninsula can been observed and stratospheric temperatures rise above those required for the formation of PSCs. However, the observations in 2021, which are very similar to those in 2015, show PSC occurrences until late September. This is in good agreement with the large extent of the ozone hole for the period 7 September -13 October in these years, being the 8th (2021) and 3rd (2015) largest extents observed since 1979. On the other hand, there were very few PSC observations after the first half of August both by the ground based lidar and CALIOP in 2017, when the ozone hole was the smallest since 1988. This would suggest a correlation between the PSC occurrences and the size of the ozone hole. The ground based lidar observations at Dome C in 2020 are anomalous from this point of view, since even with a cold and stable polar vortex, few PSC occurrences have been observed in September, likely due to chemical and radiative processes.