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Ground based UV/Vis observations of atmospheric trace gases above two different Antarctic sites (78º and 64º S)

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Reactive halogens (containing Cl, Br or I) have been identified as important reactants in both the stratosphere and the troposphere. BrO and OClO are efficient catalysts of the ozone destruction in the lower stratosphere and BrO and IO have been clearly identified as responsible for ozone depletion events in the polar boundary layer during springtime. Accurate measurements of these components are important to understand the halogen chemistry in the highly perturbed spring atmosphere in the polar regions, especially in Antarctica, where halogens ground based measurements are very sparse and satellite observations have limitations. Multi-axis DOAS (MAXDOAS) observations allow to obtain the vertical distribution of such components due to its high sensitivity to near-surface trace gases as BrO and IO. Scattered skylight is used to study stratospheric and tropospheric components by ground-based absorption spectroscopy combining zenith sky and off-axis measurements.

Ground-based MAXDOAS observations have been performed at Belgrano (78ºS) and Marambio (64ºS) by INTA during 2015. Stations are located close in longitude but separated 14º in latitude. Both are coastal stations but with very different geographical conditions.

Belgrano is representative of an in-polar vortex station during the winter-spring season until the vortex breakdown, while Marambio is frequently located in the edge region of the vortex. Simultaneous measurements of halogen species in both stations, using the same kind of instrumentation developed at INTA, can be of importance to characterize the vertical distribution of halogens, ozone and NO_2 in two different although close scenarios and to get a better understanding of the mechanisms that release halogens into the troposphere.

We report measurements performed during 2015 showing tropospheric BrO and IO as well as stratospheric BrO, OClO, NO_2 and O_3 above both stations. Regarding the stratosphere, we present the seasonal evolution of NO_2, O_3, BrO and OClO, as well as their role in the ozone depletion observed during the austral spring. The south polar vortex of 2015 was unusually stable and long-lived, so ozone depletion lasted longer than seen in recent years. In both stations, tropospheric BrO is detected during the whole period of measurements above detection limit,with a vertical distribution reaching its maximum concentration in lower layers and decreasing towards higher altitudes. The observed tropospheric BrO presents a high variability along the year with a maximum in spring and with some strong and sudden enhancements episodes during the months of September and October under particular meteorological conditions. Both data sets are investigated for sudden strong increases in BrO, and surface ozone values for the corresponding sudden decrease in the observed ozone amount; being clear indicators of bromine explosion events. In Belgrano we have observed during 2015 less BrO enhancements events than previous years.

The preliminary analysis of tropospheric IO indicates lower differential slant columns in Marambio than in Belgrano, almost the whole period of measurements, under the detection limit of the instrument. Preliminary differential slant columns densities at Belgrano show a very similar behaviour to the preceding years, with positive detection at low elevation angles.