Geophysical Research Abstracts
Vol. 14, EGU2012-5700, 2012
EGU General Assembly 2012

Exploring triggers for polar tropospheric ODEs, using a 1-D snow photochemistry model (MISTRA-SNOW).

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Tropospheric Ozone Depletion Events (ODEs) have been known to occur in polar regions for over 20 years. During such events, ozone concentrations can fall from background amounts to below instrumental detection limits within a few minutes and remain suppressed for on the order of hours to days. The chemical destruction of ozone is driven by halogens (especially bromine radicals) that have a source associated with the sea ice zone. Although our knowledge of ODEs has increased greatly since their discovery, some of the key processes involved are not yet fully understood.

We now know that heterogeneous reactions lead to the activation of Br2 and BrCI, via uptake of HOBr onto aqueous salt solutions /aerosol/ surface snowpack (Fickert et al., 1999), and it is widely accepted that bromine catalytic reaction cycles (the 'bromine explosion') in the gas phase are responsible for surface ozone destruction (Simpson et al., 2007). There is still much debate over the source of bromine in the atmosphere that drives ODEs, but there is strong evidence to suggest a source associated with the sea ice zone.

A 1D Marine Boundary Layer (MBL) chemistry model (MISTRA; von Glasow et al., 2002) has been modified to be representative of Antarctic conditions. The chemistry module includes chemical reactions in the gas phase, in and on aerosol particles and takes into account transfer between the gas and aqueous phase. A new snow-photochemistry module has been developed which includes chemistry which takes place in the quasi-liquid layer on aerosol (Thomas et al., 2011), which is of great importance to our understanding of the chemistry which initiates a bromine explosion. Here we use this newly developed 1-D snow photochemistry model (MISTRA-SNOW) to look at some of the suggested triggers for, and the different meteorological conditions required to produce, tropospheric ODEs in polar regions.