Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02533, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02533
EGU General Assembly 2008

Boundary layer structure and ozone loss in coastal Antarctica - classic and novel views

A.E. Jones(1), P.S. Anderson(1) and H.K.Roscoe(1)

(1) British Antarctic Survey, Natural Environment Research Council, High Cross, Madingley Road, Cambridge, UK

Ozone depletion events (ODEs) have been studied in both polar regions for a number of years, and a broad picture of recurring features, and hence conditions for their occurrence, has been built up. They provide an excellent example of a phenomenon that arises through the interplay of chemistry and boundary layer dynamics - initiation and propagation are driven by chemical processes (involving halogens), with boundary layer structure maintaining a pseudo-reaction vessel within which the chemistry can proceed.

During Antarctic spring 2007 a variety of measurements were carried out at the coastal British Antarctic Survey station, Halley, to extend our understanding of ODEs. Previous work at Halley has shown that ODEs characteristically occur at this site during periods of low speed winds arriving from across the sea ice to the west of the station. The target for this season was to probe the vertical structure. Tethered-sondes were flown during a number of ODEs to make in-situ measurements of O3, potential temperature and wind (speed and direction). In addition, profiles of acoustic back scatter (for boundary layer structure) were made using a sodar. The results demonstrate the absolutely key role played by boundary layer structure in controlling the ozone-depleted air under conditions of low wind speeds.

However, on one exceptional occasion, the relationship between boundary layer structure and ozone loss was completely overridden by larger-scale features. Severe ozone depletion was recorded during a vigorous storm, with 20 m/s winds arriving from the snow-covered land to the east of Halley. SCIAMACHY satellite images for this day reveal a pool of enhanced BrO covering the majority of the Weddell Sea and lapping the continent around Halley. The sodar data show that air at Halley was homogeneously mixed to at least 600 m (the vertical extent of the sodar). These data suggest that on this occasion, the bulk ozone loss was so severe and extensive that the whole of the Halley region (as well as the majority of the Weddell Sea) was under its influence. Given that tropospheric ozone is inaccessible to satellites over the polar regions, these data provide an unusual direct example of how extensive and severe such ozone loss can be.