

Ozone Records Services

The ozone layer is of vital importance for life on Earth because it strongly absorbs the harmful ultraviolet (UV) radiation from the Sun. The 1984 discovery of a rapid decline of ozone over Antarctica each spring - the ozone hole - came as an unexpected and unpleasant surprise. Since the discovery that the negative trend observed in the ozone abundance over the South Pole is related to the use of man-made chlorofluorocarbons (CFCs), the international Montreal protocol was implemented and has resulted in a large reduction of emissions of CFCs. As a consequence the Antarctic ozone hole is expected to recover this century. However, this expected recovery remains uncertain because it will depend on complex climate-chemistry interactions associated with the greenhouse effect as well as on future emissions of ozone-depleting substances. A long series of available satellite sensors allows for monitoring of the amount of stratospheric ozone, while new sensors and models can be combined to gather information on the vertical profile of the stratospheric ozone layer.

Total Ozone Record

The PROMOTE consortium will provide a global-scale, long-term (1979-present), consistent record of total ozone column distributions using data from multiple satellites and, where required, data assimilation techniques. Ground-based ozone observations will be used to validate and improve the quality of the data record. One area of special attention for this service will be the annual development (duration, depth, and extension) of the Antarctic ozone hole, starting in 1995. The figure to the right shows the size of the Antarctic ozone hole for all years between

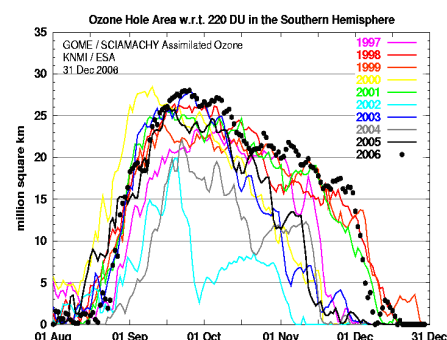
1997 and 2006 based on the use of data from the GOME and SCIAMACHY sensors. It can be noted from the information in the figure that no definitive trend towards the recovery of the ozone layer over Antarctica can be ascertained. Furthermore, the ozone hole of 2006 was actually one of the largest recorded.

Stratospheric Ozone Profile Record

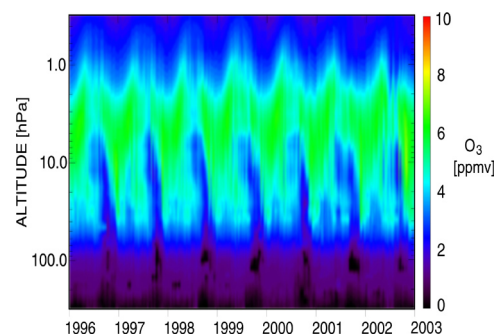
The state of Earth's ozone layer and its future trend requires a better understanding of stratospheric processes related to ozone depletion. In order to perform analyses of trends in reactive trace gases and inorganic reservoir species, information on the vertical profile of stratospheric ozone is required as is information on ozone depleting chemical species. Because of this PROMOTE will provide such information with 24- and 6-hour resolutions which should prove invaluable to other researchers such as those looking at stratospheric processes and their role in climate change.

In order to provide multi-year (starting in 1992) records, PROMOTE partners are assimilating stratospheric ozone analyses combining satellite observations, meteorological data and chemical-transport modelling. Data from ERS-2, ENVISAT, MetOP and UARS atmospheric instruments will be processed in synergy (see figure on the right). Two state-of-the-art four-dimensional variational (4Dvar) assimilation systems are deployed which will allow the derivation of the most consistent analyses of the atmospheric chemical state.

As described on the other side of this information sheet, availability of

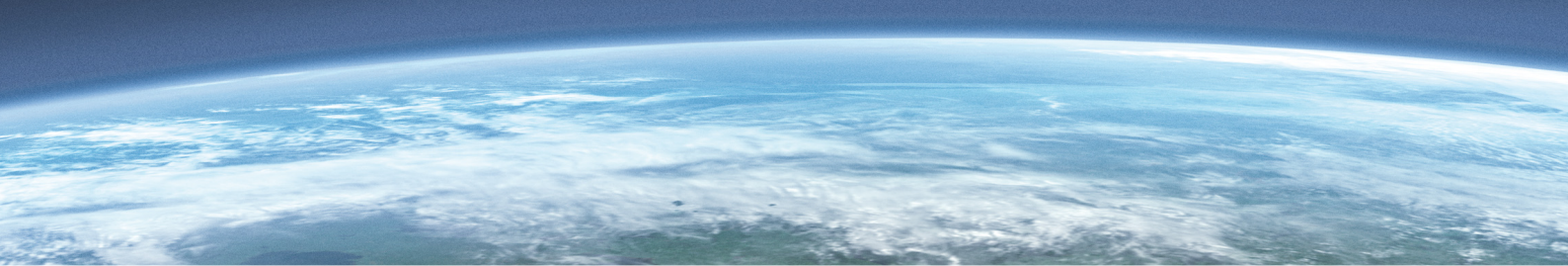


Size and duration of the ozone hole over Antarctica from 1997 to 2006 (see text)
 Source: KNMI



Results of assimilation of ERS-2 and ENVISAT chemical observations over Neumayer station, Antarctica showing daily ozone profiles from 1996 to 2003

Source: DLR, ESA



Near- Real-Time and Forecasted Ozone Services

Information about the stratospheric ozone layer is of great importance for many areas of science. Timely and accurate information about the current global concentration of ozone as well as forecasts of it are of critical importance for weather services. The services of PROMOTE will assist them in accurately forecasting the weather and the amount of Ultraviolet (UV) radiation reaching the Earth's surface. In an effort to serve that community of information providers, the PROMOTE consortium offers the following two products within its ozone service: Near-Real-Time (NRT) Total Column Ozone concentrations and total ozone forecasts.

Near-Real-Time (NRT) Ozone Column Concentrations

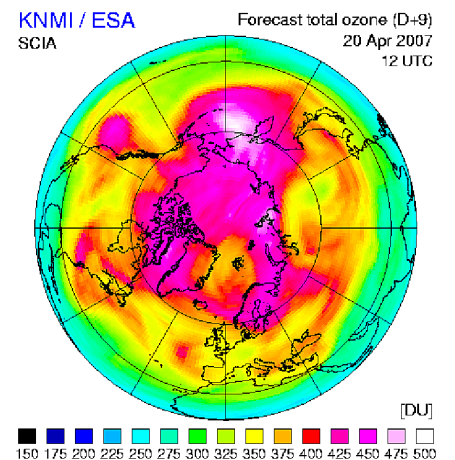
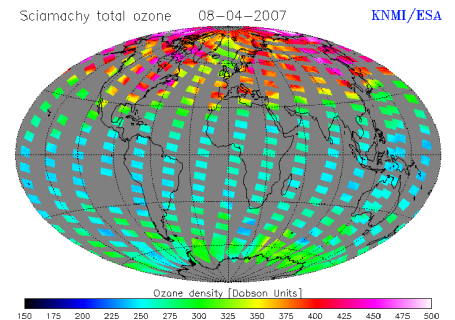
In order to provide timely information on ozone concentrations to Numerical Weather Prediction (NWP) centres, the aim of the PROMOTE partners is to provide – within 3-9 hours after observation – global total ozone column values. Of particular interest to NWP centres is the potential for this information to be used to improve the warning accuracy for extreme weather events.

At this time, these global data sets are based on retrievals from satellite data from the OMI, SCIAMACHY, and GOME sensors. The figure at the top right represents ozone columns as retrieved from the SCIAMACHY instrument data on April 8th 2007 and delivered within hours after acquisition to the European Centre for Medium-Range Weather Forecasts (ECMWF).

Total Ozone Forecasts

The PROMOTE partners provide operational nine-day forecasts of total ozone columns, based on total column retrievals. They are important for the forecasting of UV radiation reaching the Earth's surface and for the prediction of large and rapid ozone variation and the occurrence and evolution of „mini-ozone hole“ events. This service is aimed at a broad community including the general public, scientific organisations, and meteorological organisations delivering UV forecasts.

The forecasts are provided freely on the basis of data acquired by the SCIAMACHY and OMI sensors. The figure on the right shows a nine-day forecast of ozone over the northern hemisphere based on the global retrievals, which show very low ozone levels over Europe. This information is invaluable for accurate predictions of UV radiation reaching the ground.



Global ozone measurements (top) and 9-day ozone forecast (bottom) based on SCIAMACHY data.

Source: KNMI, ESA