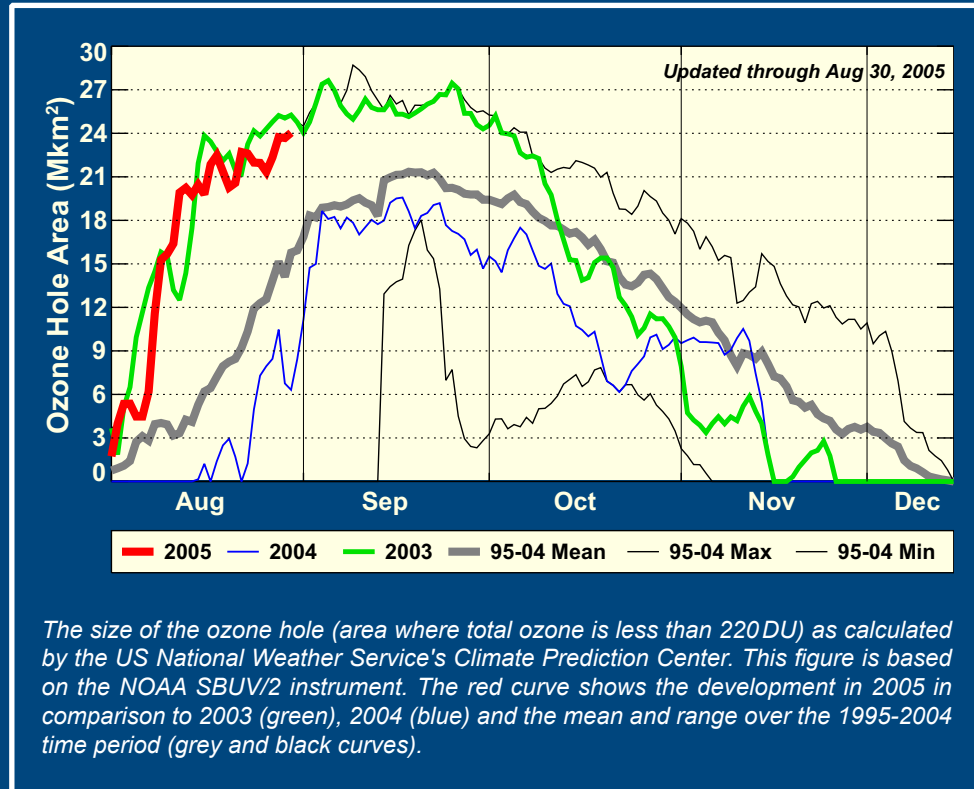


Antarctic Ozone Bulletin

No 2/2005



Executive summary

Since the last WMO Antarctic Ozone Bulletin, which was published on 23 August, temperatures have remained cold inside the south polar vortex, and at 20 km altitude ECMWF data show a cooling of a few Kelvin during the last week. Minimum total ozone columns are around 130-140DU, which is only slightly less than 10 days ago. However, the area where the total ozone column is less than 220 DU has increased from 12 to 22 million km² during the 10-day period since the previous Bulletin. A forecast for the next 7 days indicates a further increase to about 26 million km². Although the development of the ozone hole of 2005 is similar to what was observed in 2003, it is still too early to make a statement about the maximum size of this year's ozone hole.



**World
Meteorological
Organization**

Weather • Climate • Water

1 Sep 2005

Global Atmosphere Watch



Introduction

For background information on the Antarctic ozone hole and ozone loss in general the reader is referred to the previous issue of this Bulletin, which can be found here: <http://www.wmo.int/web/arep/ozone.html>

More background information is also found here: http://www.wmo.int/web/arep/O3_summaries/O3_summaries_afischer.html.

Meteorological conditions

During the 10 days since the last bulletin minimum temperatures at the isentropic level of 500K in the south polar vortex have dropped by a few Kelvin, as can be seen from Figure 1. This cooling is also reflected in the area where $T < T_{NAT}$, which has increased

during the last days, as seen in Figure 2.

Analyses of zonal mean temperatures from the US National Center for Environmental Prediction (NCEP) show that 2005 is between 2003 and 2004 with regard to duration of the lowest temperatures.

Ozone observations

Ozone observations are available from many different instrument types based on the ground, carried by balloons or on satellites. Minimum ozone values as observed by the SCIAMACHY instrument on ENVISAT are now around 140DU. The daily minimum ozone value is not expected to change much over the next week according to forecasts from the Royal Netherlands Meteorological Institute. Data from the Total

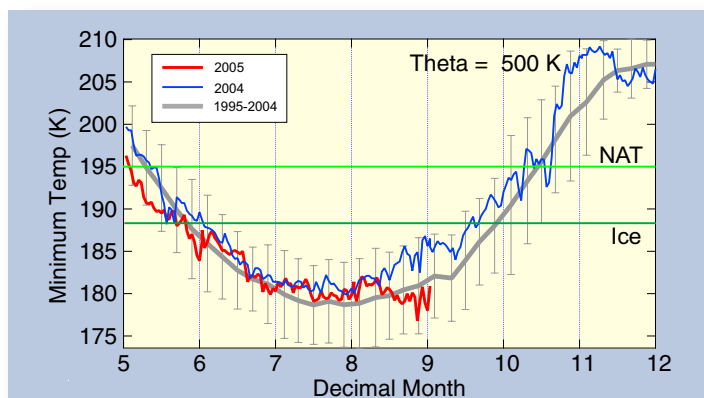


Figure 1. Time series of ECMWF daily minimum temperatures at the 500K isentropic level south of 30°S. The thick red curve shows 2005 (until 31 August). The blue line shows 2004. The average of the 1995-2004 period is shown for comparison in grey. The error bars represent $\pm 2\sigma$ (standard deviations). The two horizontal green lines at 195 and 188K show the thresholds for formation of PSCs of type I and type II, respectively.

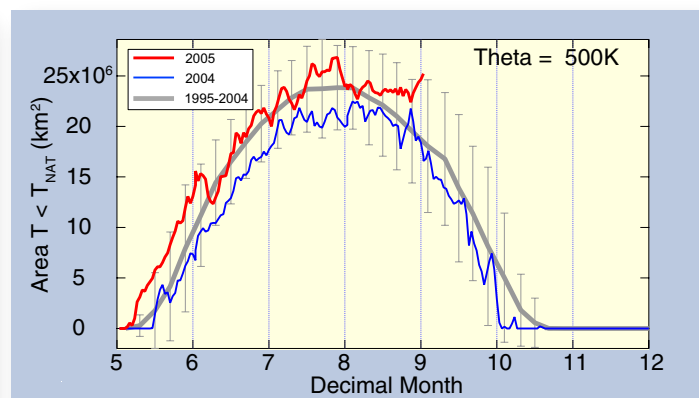


Figure 2. Time series of the area where ECMWF temperatures are low enough for the formation of PSCs of type I at the 500K isentropic level. This corresponds to an altitude of approximately 20km. The thick red curve shows 2005 (until 31 August). The blue curve represents 2004. The average of the 1995-2004 period is shown for comparison in grey. The error bars represent $\pm 2\sigma$ (standard deviations).

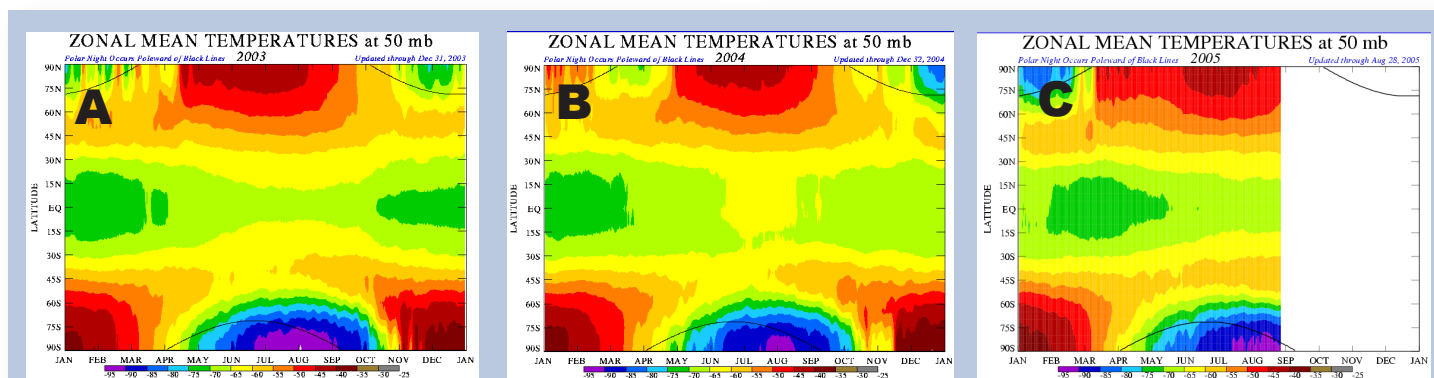


Figure 3. Zonal mean temperatures at 50hPa from the National Center for Environmental Prediction (NCEP) for the years 2003, 2004 and 2005 are shown in panel A, B and C, respectively. The blue and violet regions at the bottom of the plots show the low temperatures in the south polar vortex during the austral winter. From these plots it is clear that low temperatures prevailed for a longer period of time (horizontal axis) in 2003 than in both 2004 and 2005. It can also be seen that low temperatures are more prevalent in 2005 compared to 2004.

Ozone Mapping Spectrometer (TOMS) on the NASA Earth Probe satellite show minimum ozone values around 130 DU.

Total ozone column maps synthesised by the World Ozone and UV Data Centre at Environment Canada, using surface-based WMO/GAW network observations and satellite data, show that the sunlit parts of the vortex in late August have total ozone column values well below 200 DU and even close to 150 DU. Figure 4 shows the change in the area affected by low ozone values from 21 August to 31 August, as analysed by Environment Canada.

Low total ozone values have also been observed from the ground. The Global Atmosphere Watch (GAW) stations at Marambio (64.2°S, 56.7°W), Rothera (67.6°S, 68.1°W) and Faraday-Vernadsky (65.2°S, 64.2°W) report ozone columns in the 150-200 DU range during the last week of August.

The lowest daily total ozone columns observed in the Southern Hemisphere during the last decade can be seen in Figure 5. This graph shows that the ozone hole of 2005 is developing in a way that is similar to what has been observed during the last decade. Minimum total ozone columns in mid-August are comparable

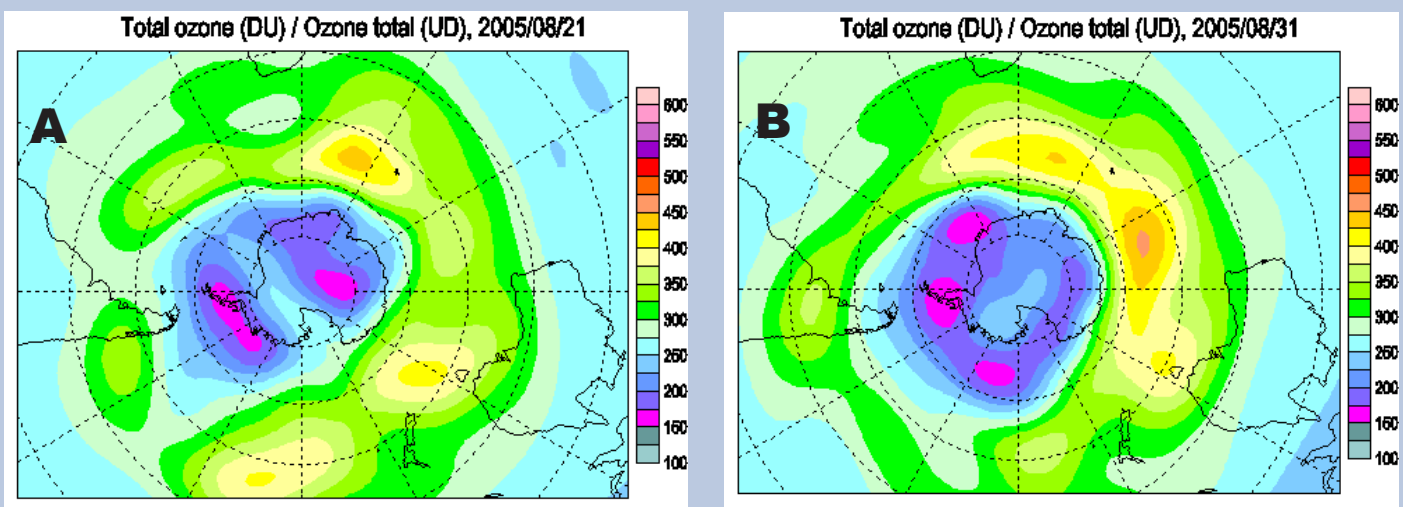


Figure 4. Total ozone maps synthesised by the World Ozone and UV Data Centre at Environment Canada. Panel A shows the situation on 21 August 2005 and panel B shows the situation on 31 August 2005. It is clearly visible that the area with a total ozone column inferior to 200 DU (dark blue and violet) has increased significantly during this 10-day period.

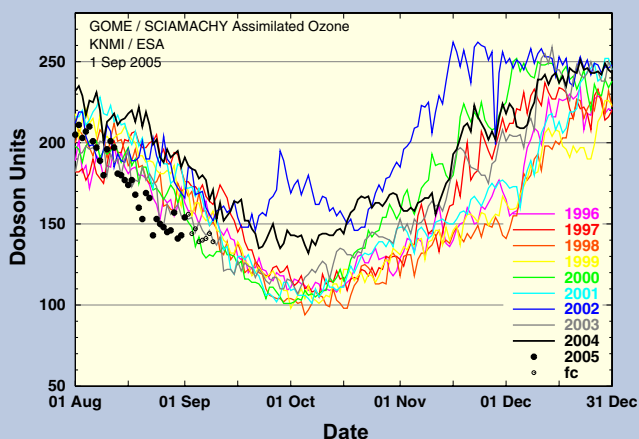


Figure 5. Daily minimum total ozone columns in the Southern Hemisphere as observed by GOME and SCIAMACHY from 1996 to now. The black dots show the observations for 2005. During most of August, minimum ozone columns have been lower than at the same time of the year for the 1996-2004 period. The forecast indicates that the first week of September will be similar to 2003.

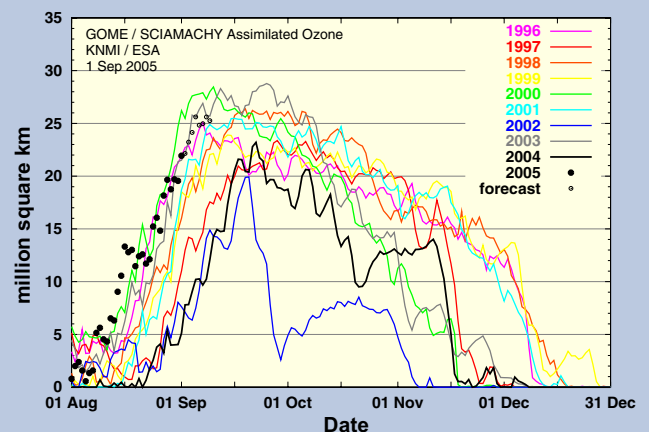


Figure 6. Area (millions of km²) where the total ozone column is less than 220 Dobson units. All the years from 1996 to 2005 (black dots) are shown. The open circles are forecasts for the next 8 days. This figure shows that the size of the ozone hole has increased from 12 to 22 Mkm² during the last 10 days. The forecasts indicate a further increase to about 26 Mkm² during the next week.

to, or even a bit lower than, mid-August of the nine previous years. The forecast in Figure 5 shows that the minimum ozone values next week will be quite similar to those of the first week of September 2003.

Ozone hole

The area where the ozone column is less than 220 DU has increased from 12 to 22 million km² during the last 10 days (see Figure 6). A forecast produced by the Royal Netherlands Meteorological Institute (KNMI) shows that the size is expected to continue to increase and reach about 26 million km² during the next seven days. This development is very similar to what was observed in 2003, the year with the largest ozone hole on record.

The ozone hole size, as calculated by the US Climate Prediction Center using SBUV/2 data, has reached 24 million km² (see figure on the cover) and is therefore quite similar to the result from KNMI. Data from Earth Probe TOMS (NASA) also show that the ozone hole of 2005 so far develops similarly to the one in 2003 (see links below).

The ozone hole usually does not reach its maximum size until mid- to late September, so it is still too early to make a reliable statement about the maximum size of this year's ozone hole.

As the sun rises over Antarctica during the coming weeks, the ozone hole is expected to deepen (see Figure 5) and also grow somewhat in size (see Figure 6). The amount of ozone loss will be dependent upon prevailing meteorological conditions in the stratosphere, particularly during September and October. Annually recurring ozone holes are expected as long as the stratosphere contains an excess of ozone depleting substances.

In August, ozone loss is limited and the sun is still low in the sky, so the intensity of ultraviolet (UV) radiation in areas usually affected by the ozone hole is modest. UV levels will be reported in future ozone bulletins.

Distribution of the bulletins

The Secretariat of the World Meteorological Organization (WMO) distributes Bulletins providing current Antarctic ozone hole conditions beginning mid-August of each year. The Bulletins are distributed via the WMO Global Telecommunication System (GTS) and are also available through the Global Atmosphere Watch programme web page at <http://www.wmo.ch/web/arep/ozone.html>. In addition to the National Mete-

orological Services, the information in these Bulletins is made available to the national bodies representing their countries with UNEP and that support or implement the Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol.

Acknowledgements and links

These Bulletins use provisional data from the WMO Global Atmosphere Watch (GAW) stations operated within or near Antarctica by: Argentina (Comodoro Rivadavia, San Martin, Ushuaia), Argentina/Finland (Marambio), Argentina/Italy/Spain (Belgrano), Australia (Macquarie Is), France (Dumont D'Urville and Kerguelen Is), Germany (Neumayer), Japan (Syowa), New Zealand (Arrival Heights), Russia (Mirny), Ukraine (Vernadsky), UK (Halley Bay, Rothera) and USA (South Pole). Satellite ozone data are provided by NASA/TOMS (http://toms.gsfc.nasa.gov/eptoms/ep_v8.html and <http://jwocky.gsfc.nasa.gov/eptoms/dataqual/ozone.html>), NOAA/TOVS (<http://www.cpc.ncep.noaa.gov/products/stratosphere/tovsto/>), NOAA/SBUV/2 (<http://www.cpc.ncep.noaa.gov/products/stratosphere/sbuv2to/>) and ESA/Sciamachy (<http://envisat.esa.int>) Potential vorticity and temperature data are provided by the European Centre for Medium Range Weather Forecasts (ECMWF) and their daily T₁₀₆ meteorological fields are analysed and mapped by the Norwegian Institute for Air Research (NILU) Kjeller, Norway, to provide vortex extent, PSC area and extreme temperature information (<http://www.nilu.no/projects/nadir/o3hole>). Meteorological data from the US Climate Prediction Center are also used to assess the extent of PSC temperatures and the size of the polar vortex (<http://www.cpc.ncep.noaa.gov/products/stratosphere/polar/polar.html>). Ozone data analyses and maps are prepared by the World Ozone and UV Data Centre at Environment Canada (<http://exp-studies.tor.ec.gc.ca/cgi-bin/selectMap>) and by the Royal Netherlands Meteorological Institute (<http://www.temis.nl/protocols/O3global.html>). UV data are provided by the U.S. National Science Foundation's (NSF) UV Monitoring Network.

Questions regarding the scientific content of this Bulletin should be addressed to Geir O. Braathen, <mailto:GBraathen@wmo.int>, tel: +41 22 730 8235.

The next bulletin is planned for 15 September.

End of WMO Antarctic Ozone Bulletin 2/2005.