Records set by 2003 ozone hole

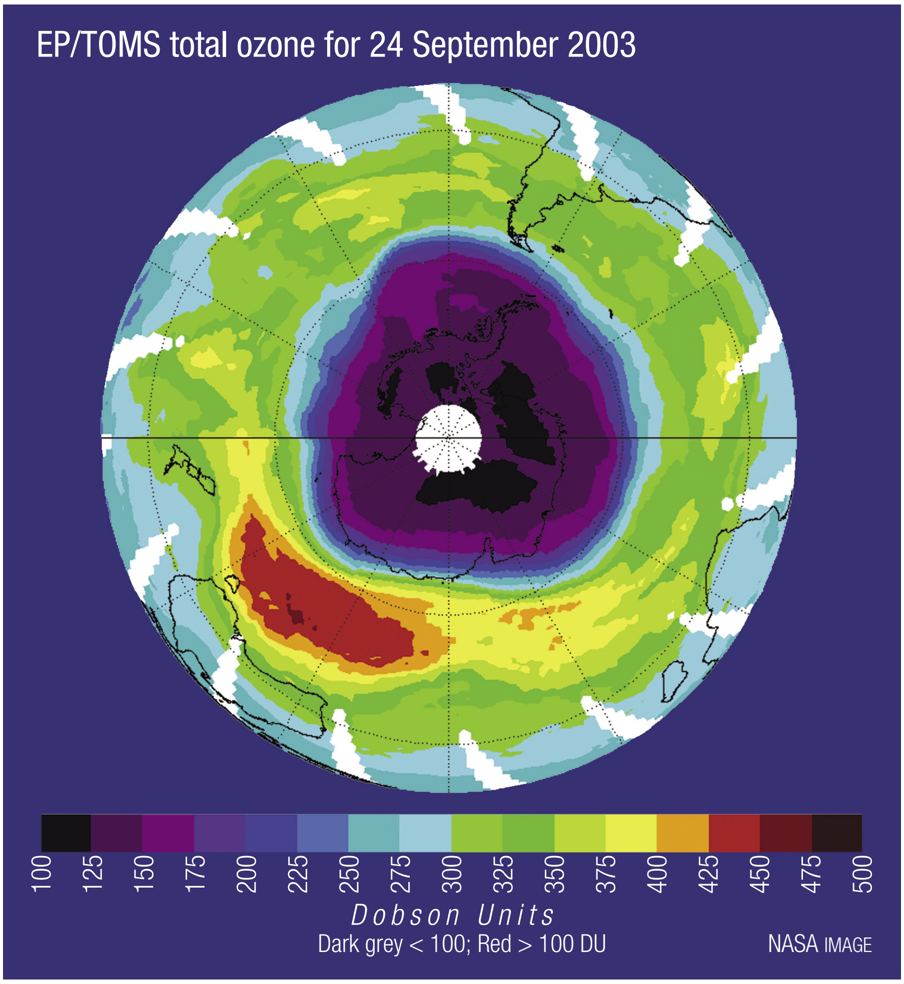
As anticipated in July ('Stop Press: Large ozone hole predicted', *Australian Antarctic Magazine* 5:25), a large hole formed in the ozone layer over Antarctica during the spring of 2003. At its maximum extent on 24 September, the hole equalled in size the record set on 10 September 2000. This situation strongly contrasted with the behaviour seen in 2002, when the ozone hole was the smallest in over a decade ('Unusual behaviour of the Antarctic ozone hole', *Australian Antarctic Magazine,* 5:24).

At Davis, atmospheric measurements by the AAD and Bureau of Meteorology using balloons and lidar followed the evolution of the ozone hole as part of a study into the microphysics of stratospheric ozone. These measurements also contributed to the first year of an international program which is investigating polar ozone loss.

Because of below average temperatures in the polar stratosphere over the 2003 winter, and the relative stability of the polar vortex, the ozone hole grew rapidly during August, attaining a size and depth not previously witnessed for that time of year. Significantly, the region over Antarctica where more than 50% of the total column ozone was destroyed reached an area about 20% higher than the previous record set in 2000. The growth phase peaked in early September, and the areal extent of the hole remained near record levels for much of the month. During October and November, the hole decayed relatively quickly, following a trend similar to that observed in 2000. Interestingly, the 'filling-in' of the hole was more rapid than the decay of the polar vortex, and is probably related to influences on stratospheric circulation from the tropics.

Despite the large extent of the ozone hole in 2003, solar ultraviolet (UV) levels near the surface were not unduly elevated. The only populated region to lie under the hole was the southern tip of South America, and this region was exposed on four occasions in September and early October. During these times, low solar elevation angles combined with cloud cover restricted UV exposure to levels comparable with mid-latitude summer sites.

What will happen in 2004? The winds in the equatorial stratosphere should reverse in direction to flow eastward during the year, and this may enhance the size of the ozone hole by restricting the poleward flow of



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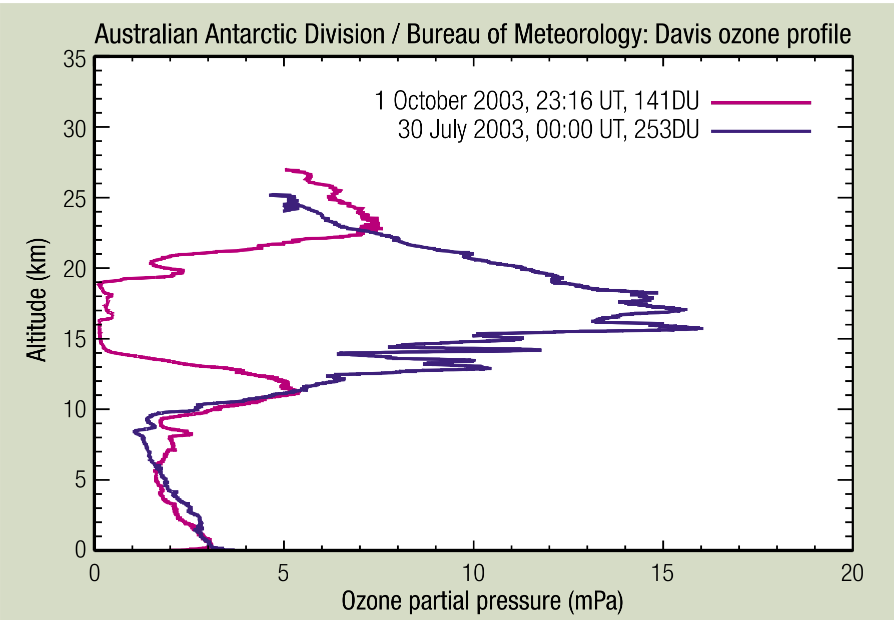
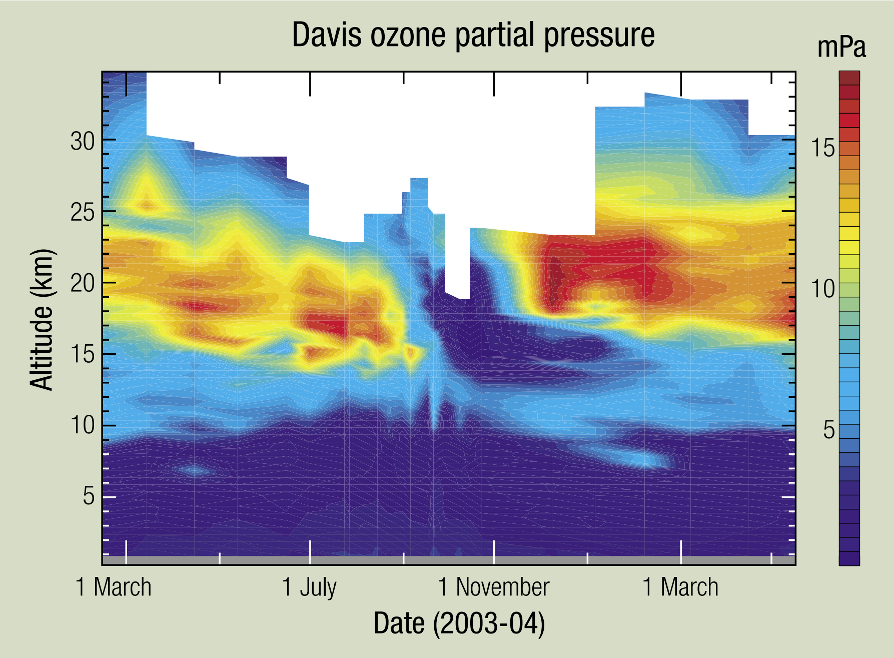
Southern Hemisphere total ozone concentration for 24 September 2003, when the ozone hole over Antarctica reached its maximum size, as measured by NASA's Earth Probe satellite. Smaller Dobson Unit values represent lower ozone concentrations. Note the region of high ozone levels between Australia and Antarctica. This was associated with a persistent region of low pressure over the Southern Ocean.



ANDREW KLEKOCIUK

Vertical profiles of ozone obtained using balloons at Davis before (30 July) and during (1 October) the passage of the ozone hole over the station. The measurements on 1 October show that almost all of the ozone between altitudes of 14km and 19km was destroyed.



ANDREW KLEKOCIUK

Left: Time evolution of ozone levels above Davis during 2003 and 2004 from balloon measurements. The ozone layer (represented by red colours near 20km) gradually descended in altitude during autumn and winter of 2003 as the atmosphere cooled. The layer was almost completely absent between late August and the end of October as a result of the ozone hole. Low ozone values near 15km persisted until the end of the year.

Below: A Type II Polar Stratospheric Cloud observed at Mawson on 08 July 2003. Stratospheric clouds play a central role in the destruction of ozone over Antarctica. This cloud formed down-wind of the mountains around Mawson.

GREG HEMSWORTH

ozone from the tropics. A similar situation occurred in 2002, however other meteorological factors disturbed the Antarctic atmosphere and created an abnormally small hole. We'll have to wait and see, as there are still many subtleties in global atmospheric dynamics that remain to be understood.

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Antarctica Online

AAD ozone hole press release: <http://www.aad.gov.au/default.asp?casid=11817>

World Meteorological Organization 2003 ozone bulletins and press release: <http://www.wmo.ch/web/arep/ozone.html>

Australia's first micro-satellite to elevate our Antarctic magnetometer science

Scientists are set to conduct high resolution ground-space measurements of Earth's magnetic field above Antarctica using a magnetometer on board the Australian polar orbiting micro-satellite, FedSat, and magnetometers in Antarctica. This represents a significant enhancement of the role of the Antarctic ground-magnetometer array from the summer of 2002–03.

On 14 December 2002, the 58 kg FedSat, Australia's first scientific micro satellite, was launched from the NASDA/JAXA Tanegashima Space Centre in southern Japan and placed in an 800 km altitude Sun-synchronous polar orbit with a 100 minute period. The primary scientific payload on FedSat is Newmag, a fluxgate magnetometer experiment built by the University of Newcastle as its contribution to the Australian Cooperative Research Centre for Satellite Systems. Fedsat and Newmag will enable the first Australian based ground-

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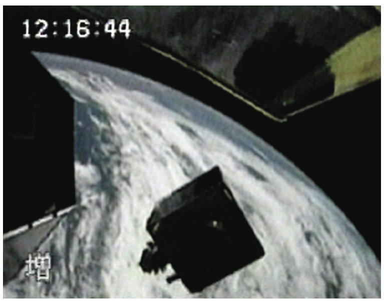

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Lift-off! Launch of Australia's scientific polar orbiting micro-satellite FedSat. Above: Fedinject

satellite investigation of magnetic pulsations and current systems over Antarctica.

For the past several years two Narod fluxgate magnetometers have been deployed at sites about 110 km inland from Australia's Davis and China's Zhongshan stations to form a square array of magnetometers. Permanent induction magnetometers have been operating at Davis since 1981 and at Zhongshan since 1992 under the auspices of an international collaboration between the University of Newcastle, the Polar Research Institute of China, and the Australian Antarctic Division. The summer deployments have been made by helicopter.

The Narod magnetometer systems, also developed by the University of Newcastle space physics group, are housed in boxes, sealed against drift snow, and connected to the magnetometer head via a 60 m cable. Power is supplied by battery coupled to a solar panel secured on the snow to prevent