The 2007 Antarctic Ozone Hole Summary: Friday 21 September 2007

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Instrumentation and new corrected Earth Probe TOMS data for 1996-2005

The new EP TOMS ozone record has been released and the data will be re-analysed by CSIRO over coming weeks for the standard metrics we report on, namely: ozone hole area; ozone minima; ozone deficit; and average ozone amount within the hole.

The 2007 ozone hole

The OMI data show that the ozone minimum dropped below 220 DU at the beginning of August, about the same time as in 2006 and 2005, and, by the end of the 3rd week of September, the ozone minimum in the Antarctic ozone hole had dropped to about 110 DU, very similar to the same time in 2005 and 2006 (Figure 1, top panel).

By mid-September the ozone hole area reached 25 million km^2 (Figure 1, bottom panel) which is similar to 2006 and 2005 at the same date. However there has been a significant fall in area (back to 22 million km^2) over the 3rd week of September. It is very unlikely that the 2007 ozone hole will be near to record largest area.

Figure 2 (top panel) shows that the estimated daily ozone deficit by mid-September had reached 26-27 million tonnes (similar to 2005 and 2006), but in the following week, as the area declined, so did the ozone loss, falling to 23-24 million tonnes, by the end of the 3rd week of September. The average ozone amount in the hole (averaged column ozone amount in the hole weighted by area, Figure 2 bottom panel) shows the normal rapid decline at this time of the year to 170 DU by mid-September (the same as in 2005 and 2006), followed by a week of values stalled at about 170 DU. In 2005 and 2006 this 'stall' period occurred a week later at about 150 DU. It looks unlikely that the 2007 ozone hole will reach near record depths.

Figure 3 shows SH ozone from 7 September to 18 September. The ozone hole was growing symmetrically (stable) until about mid-September, and then showed signs of instability on 15 September, with a significant elongation along the Southern African-mid–Pacific Ocean axis. As the ozone hole elongated from 15 September to 18 September, a significant pool of high ozone has emerged along the mid-latitude ridge south of Western Australia.

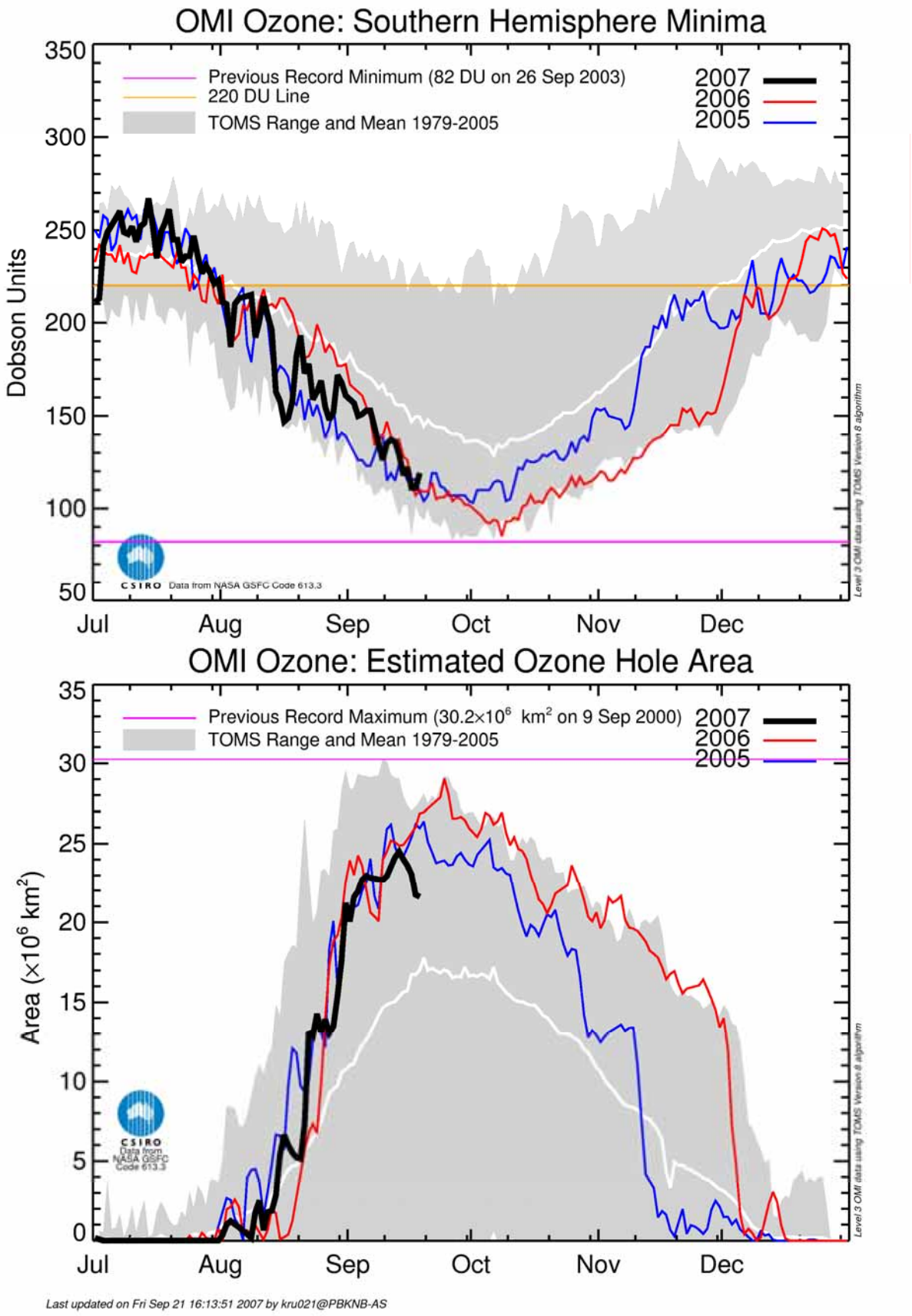

Figure 1: Ozone hole depth (top panel) and area (bottom panel) based on OMI satellite data, as of 18 September 2007.

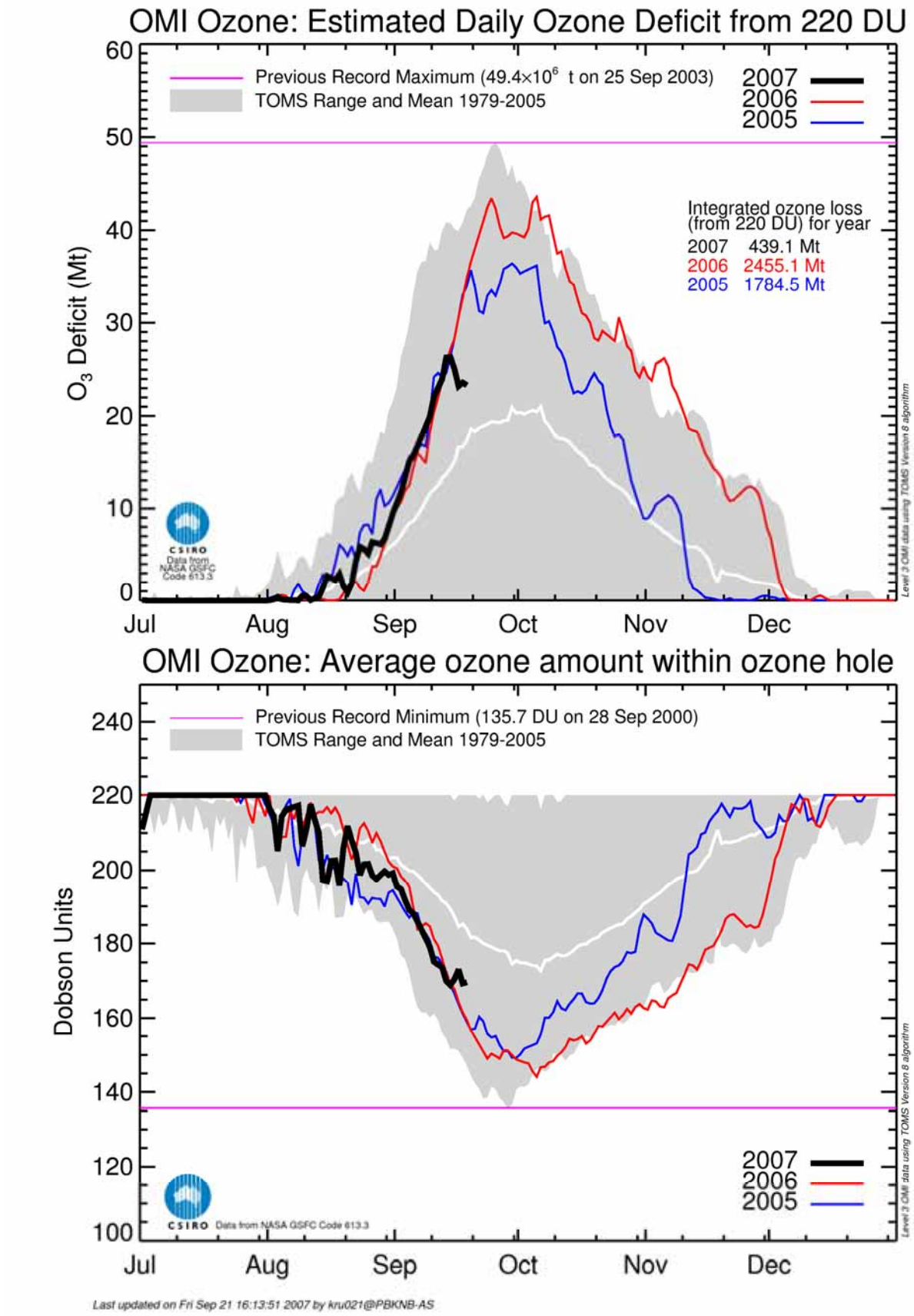

Figure 2: Estimated daily ozone deficit (top panel) and average ozone amount within the ozone hole (bottom panel) based on OMI satellite data, as of 18 September 2007.

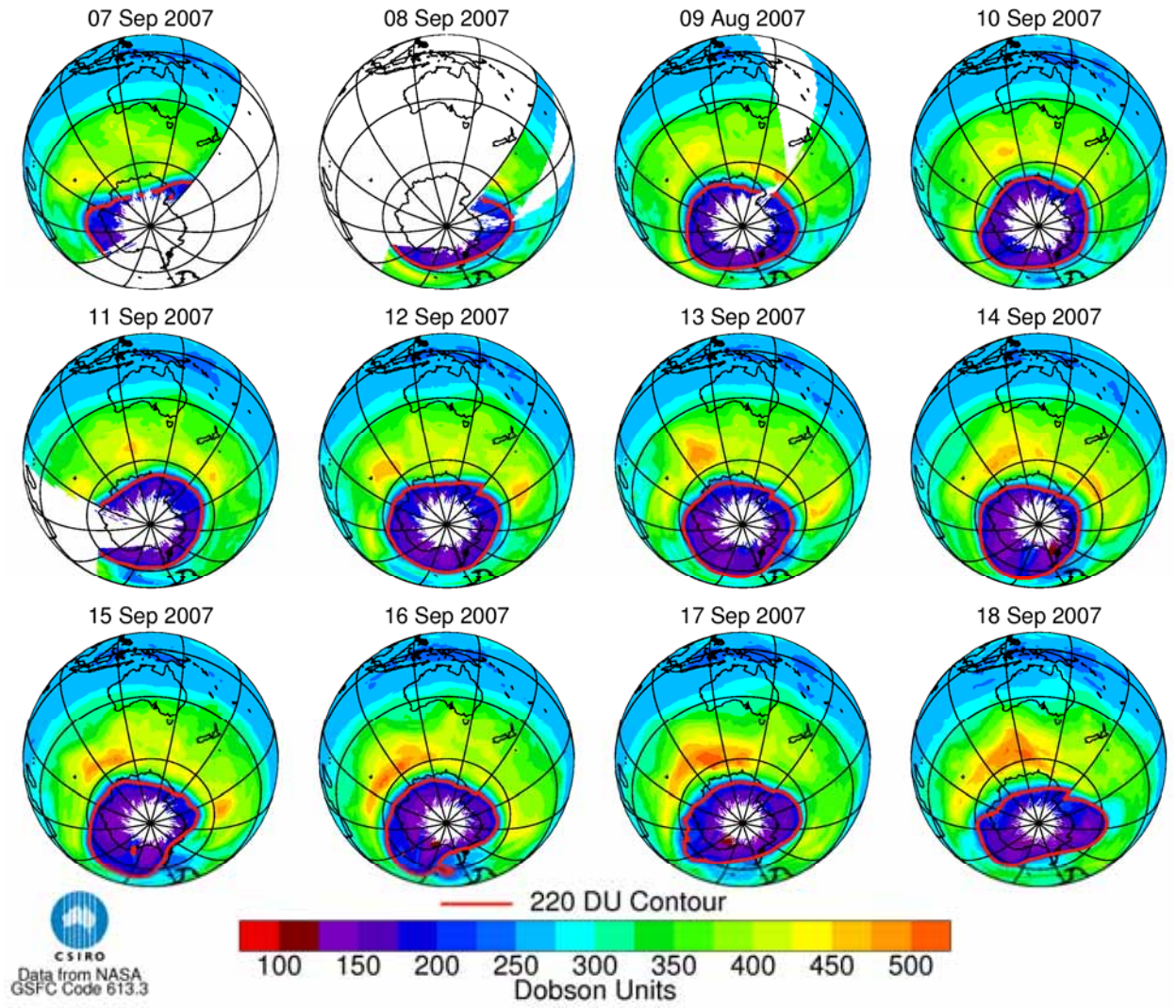

Figure 3: OMI ozone hole images for 7-18 September 2007; the ozone hole boundary is indicated by the red 220 DU contour line. The white area over Antarctica is missing data and indicates the approximate extent of the polar night. The OMI instrument requires solar radiation to the earth's surface in order to measure the column ozone abundance.

Definitions

CFCs: chlorofluorocarbons, synthetic chemicals containing chlorine, once used as refrigerants, aerosol propellants and foam-blowing agents, that break down in the stratosphere (15-30 km above the earth's surface), releasing reactive chlorine radicals that catalytically destroy stratospheric ozone.

DU: Dobson Unit, a measure of the total ozone amount in a column of the atmosphere, from the earth's surface to the upper atmosphere, 90% of which resides in the stratosphere at 15 to 30 km.

Halons: synthetic chemicals containing bromine, once used as fire-fighting agents, that break down in the stratosphere releasing reactive bromine radicals that catalytically destroy stratospheric ozone. Bromine radicals are about 50 times more effective than chlorine radicals in catalytic ozone destruction.

Ozone: a reactive form of oxygen with the chemical formula O_3; ozone absorbs most of the UV radiation from the sun before it can reach the earth's surface.

Ozone Hole: ozone holes are examples of severe ozone loss brought about by the presence of ozone depleting chlorine and bromine radicals, whose levels are enhanced by the presence of PSCs (polar stratospheric clouds), usually within the Antarctic polar vortex. The chlorine and bromine radicals result from the breakdown of CFCs and halons in the stratosphere. Smaller ozone holes have been observed within the weaker Arctic polar vortex.

Polar night terminator: the delimiter between the polar night (continual darkness during winter over the Antarctic) and the encroaching sunlight. By the first week of October the polar night has ended at the South Pole.

Polar vortex: a region of the polar stratosphere isolated from the rest of the stratosphere by high west-east wind jets centred at about 60°S that develop during the polar night. The isolation from the rest of the atmosphere and the absence of solar radiation results in very low temperatures (less than -78°C) inside the vortex.

PSCs: polar stratospheric clouds are formed when the temperatures in the stratosphere drop below -78°C, usually inside the polar vortex. This causes the low levels of water vapour present to freeze, forming ice crystals and usually incorporates nitrate or sulphate anions.

TOMS & OMI: the Total Ozone Mapping Spectrometer & Ozone Monitoring Instrument, are satellite borne instruments that measure the amount of back-scattered solar UV radiation absorbed by ozone in the atmosphere; the amount of UV absorbed is proportional to the amount of ozone present in the atmosphere.

UV radiation: a component of the solar radiation spectrum with wavelengths shorter than those of visible light; most solar UV radiation is absorbed by ozone in the stratosphere; some UV radiation reaches the earth's surface, in particular UV-B which has been implicated in serious health effects for humans and animals; the wavelength range of UV-B is 280-315 nanometres.

Acknowledgements

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