



The 2007 Antarctic Ozone Hole Summary: Monday 22 October 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 beginning of October, the ozone minimum in the Antarctic ozone hole had dropped to about 106 DU, very similar to 2005. The 2007 ozone hole is now filling in, with the current minimum (19 October) at 128 DU (Figure 1, top panel). The similarity to the 2005 ozone hole is obvious.

By 19 October, the ozone hole area had fallen to below 18 million km² (Figure 1, bottom panel), having reached a peak of 25 million km² during the second week of September. This ozone hole is about the same size as in 2004, which, apart from the 'warm' ozone hole of 2002, are the smallest ozone holes since 1991.

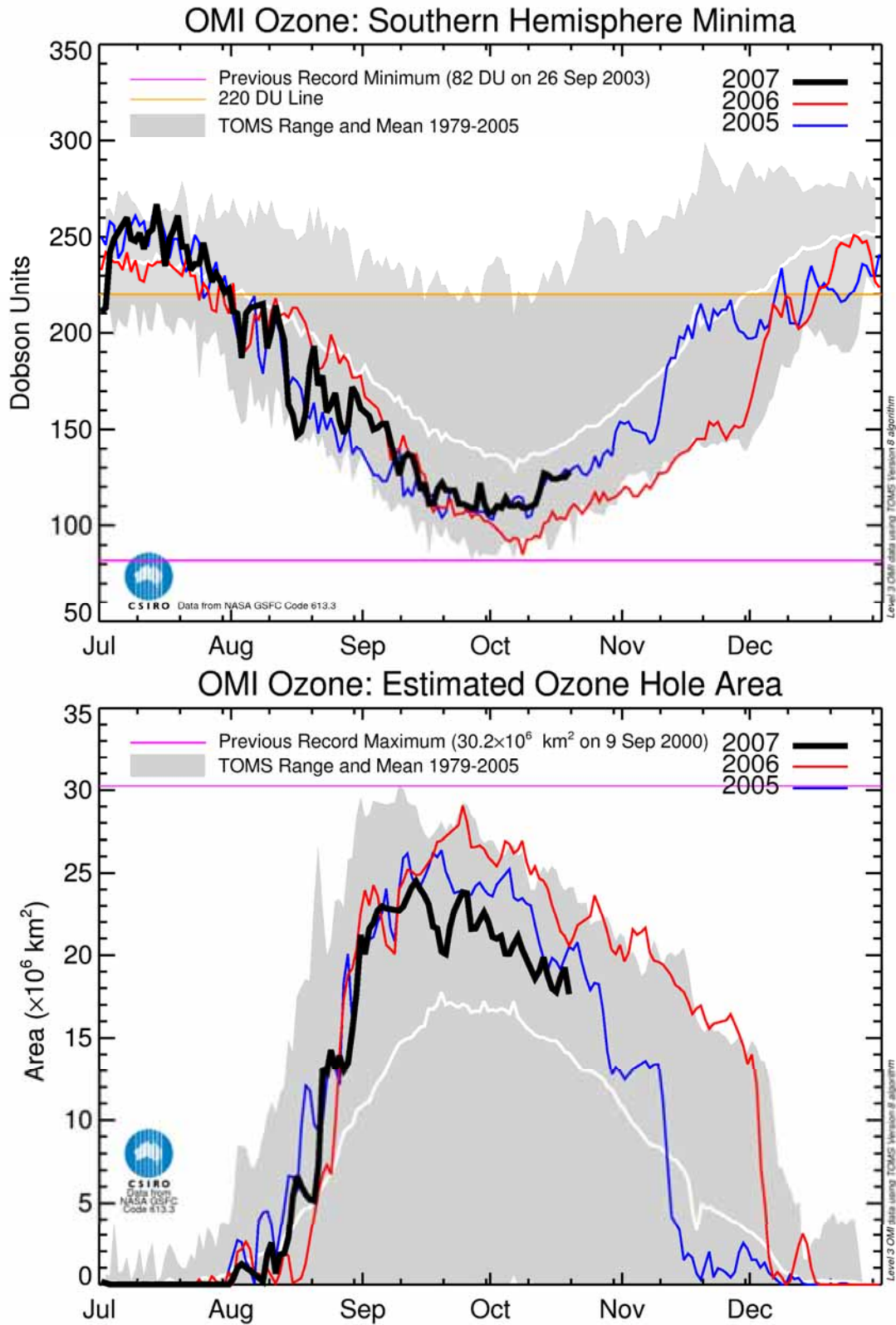
Figure 2 (top panel) shows the estimated daily ozone deficit. By 19 October, the deficit had fallen to about 20 million tonnes, after reaching a peak of 32 million tonnes during the last week of September. This is significantly lower than the maximum ozone deficit observed in 2005 and 2006 (36 and 43 million tonnes respectively) and is similar to the deficit measured in 2004. The 2004 and 2007 deficits are the lowest seen since 1991.

The average ozone amount in the hole (averaged column ozone amount in the hole weighted by area, Figure 2 bottom panel) reached a minimum of 155 DU in early October, significantly higher than in 2005 and in 2006 (148 DU and 144 DU respectively) and by 19 October had risen to about 170 DU, currently tracking the 2005 hole. This is the highest ozone minimum since 1990 (apart from the 'warm' hole of 2002).

Figure 3 shows SH ozone from 8 October to 19 October. The major feature of the distribution of ozone over the Southern Hemisphere this spring is the persistent ridge of high ozone (up to 500 DU) at relatively high latitudes (50°S to 70°S), from 60°E to 150°W (longitude), resulting in the Antarctic coast south of Australia being consistently outside the hole. This ridge started to weaken on 3-4 October and moved eastwards. By 12 October this ozone maximum had diminished significantly in size and was in the eastern half of the Pacific Ocean at 60°S. By 16 October the ridge of high ozone had returned to south of Perth. Throughout most of October, the ozone hole has continued to be distorted, with the ozone minimum off the Pole and the Antarctic coast south of Australia outside the ozone hole.

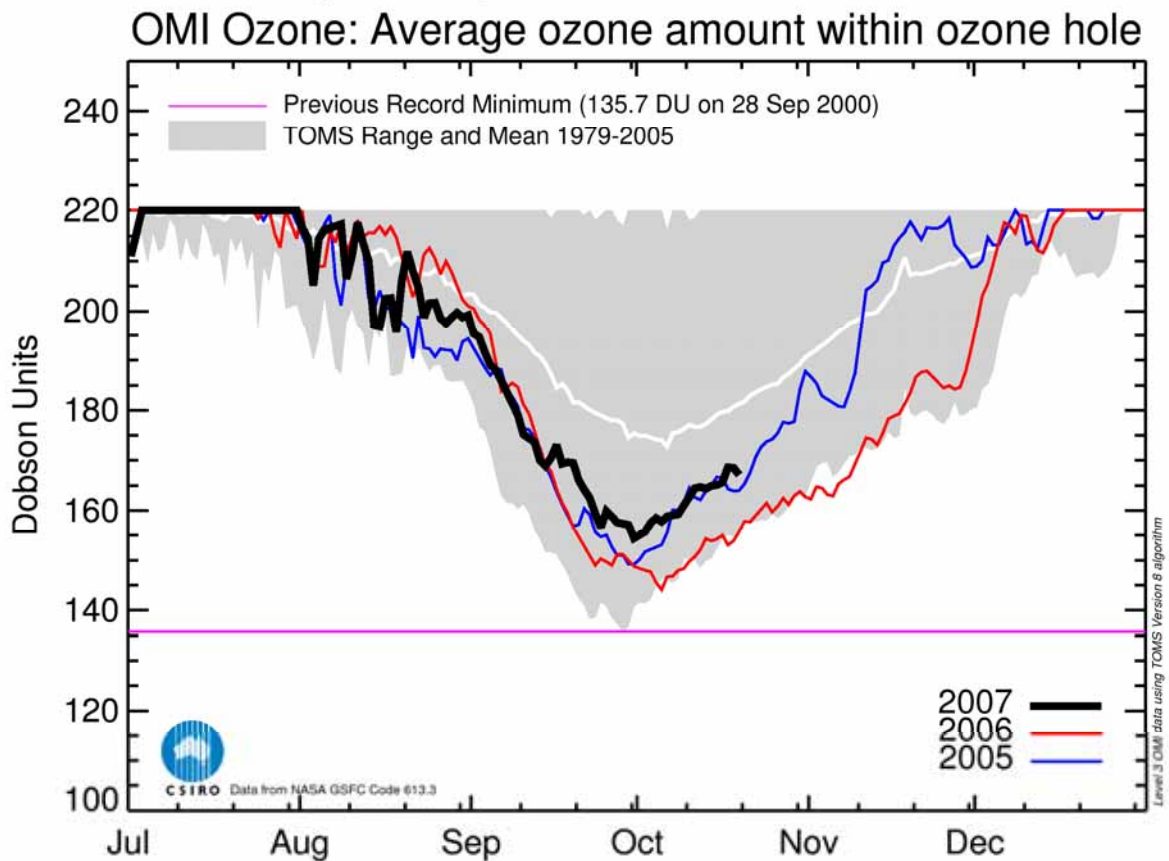
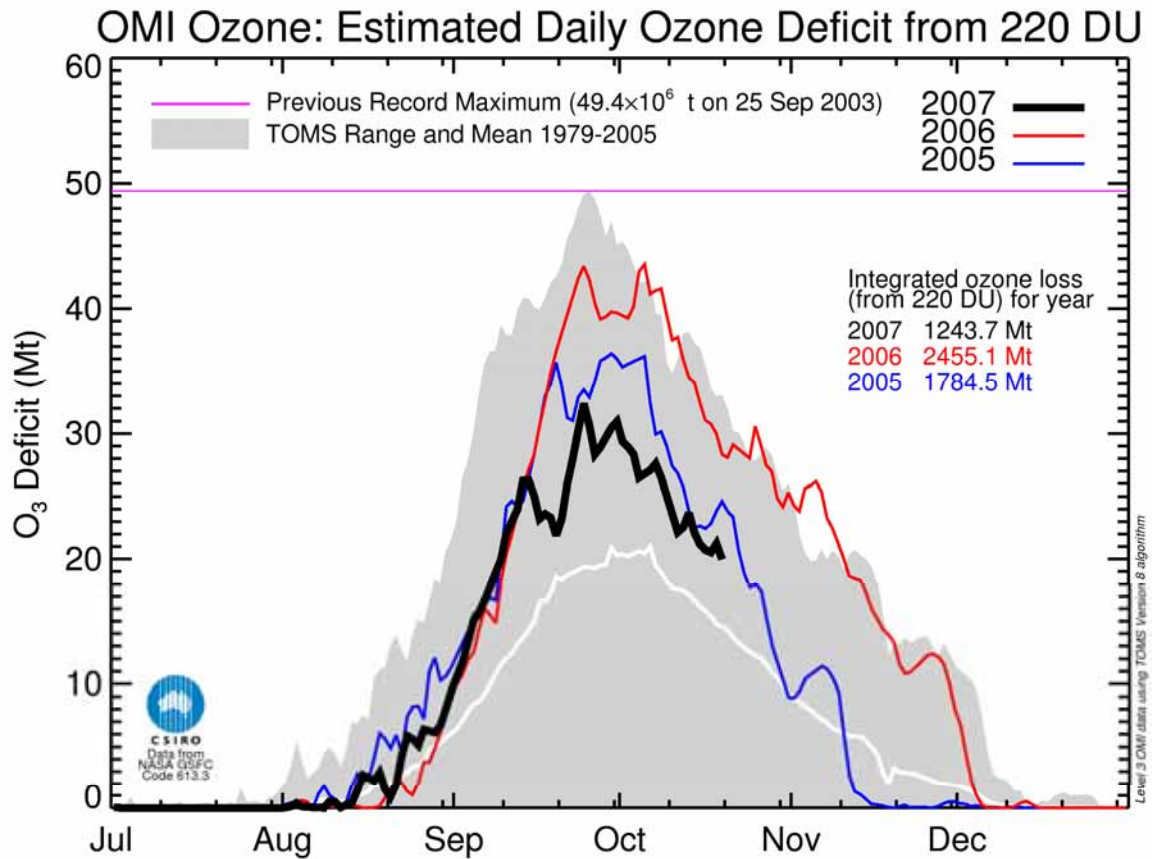
Historical comparisons of TOMS/OMI ozone hole metrics from 1979-2007 are shown in Figure 4. The anomalously warm years are indicated by open circles, and for 2005, the metrics for both TOMS and OMI are shown. The top panel shows the 15-day moving average ozone area. Apart from the warm years, the 2007 and 2004 holes (23 million km²) are the smallest since 1991. The middle panel of Figure 4 shows the TOMS/OMI column ozone minima and, apart from 2002, the 2007 hole has the largest minimum since

1990. The bottom panel shows the maximum daily ozone deficit. The 2007 deficit (32 million tonnes) is one of the smallest since 1991 (apart from 2002 and 2004).



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Figure 1: Ozone hole depth (top panel) and area (bottom panel) based on OMI satellite data, as of 19 October 2007.



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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 19 October 2007.

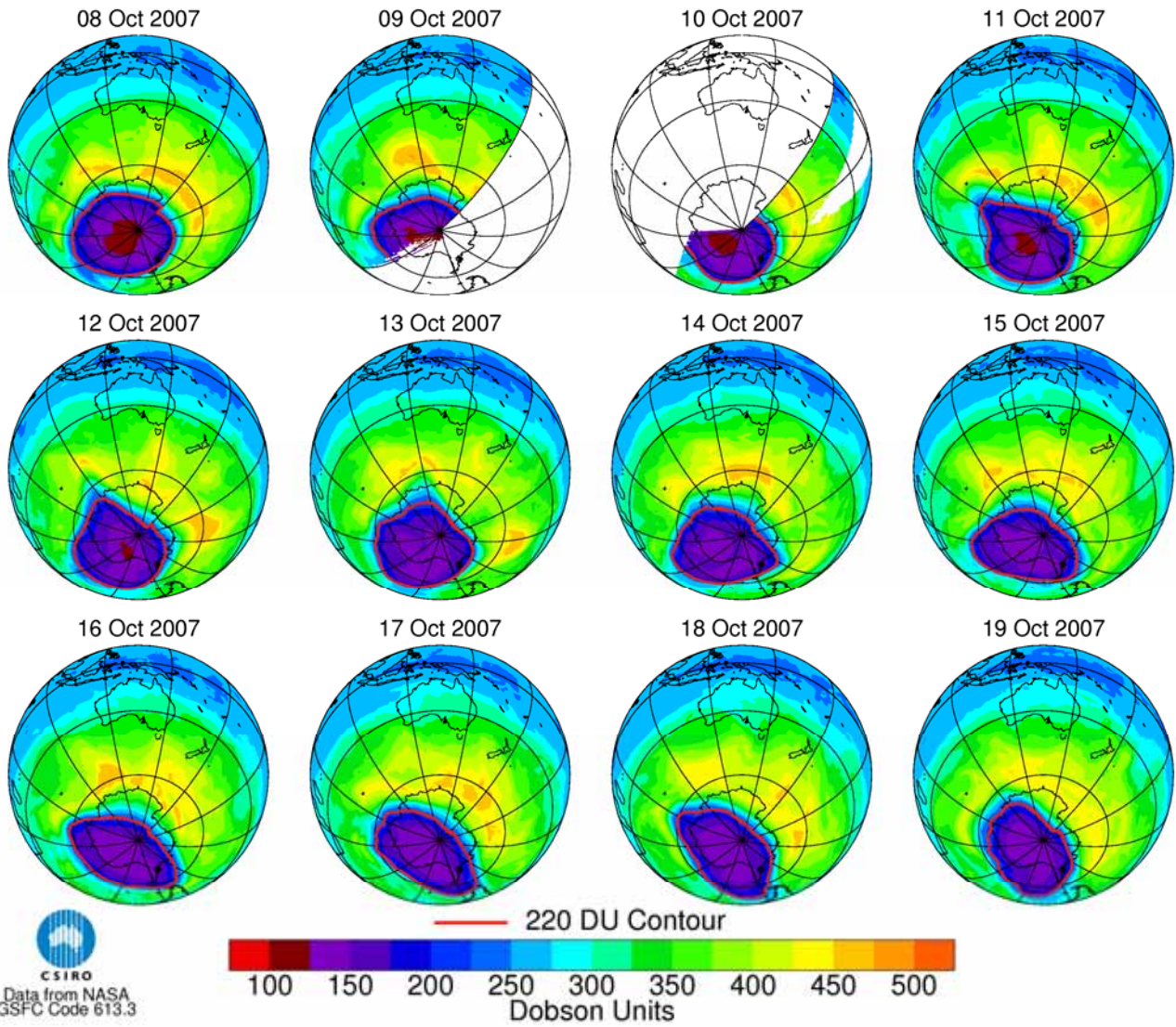


Figure 3: OMI ozone hole images for 8-19 October 2007; the ozone hole boundary is indicated by the red 220 DU contour line.

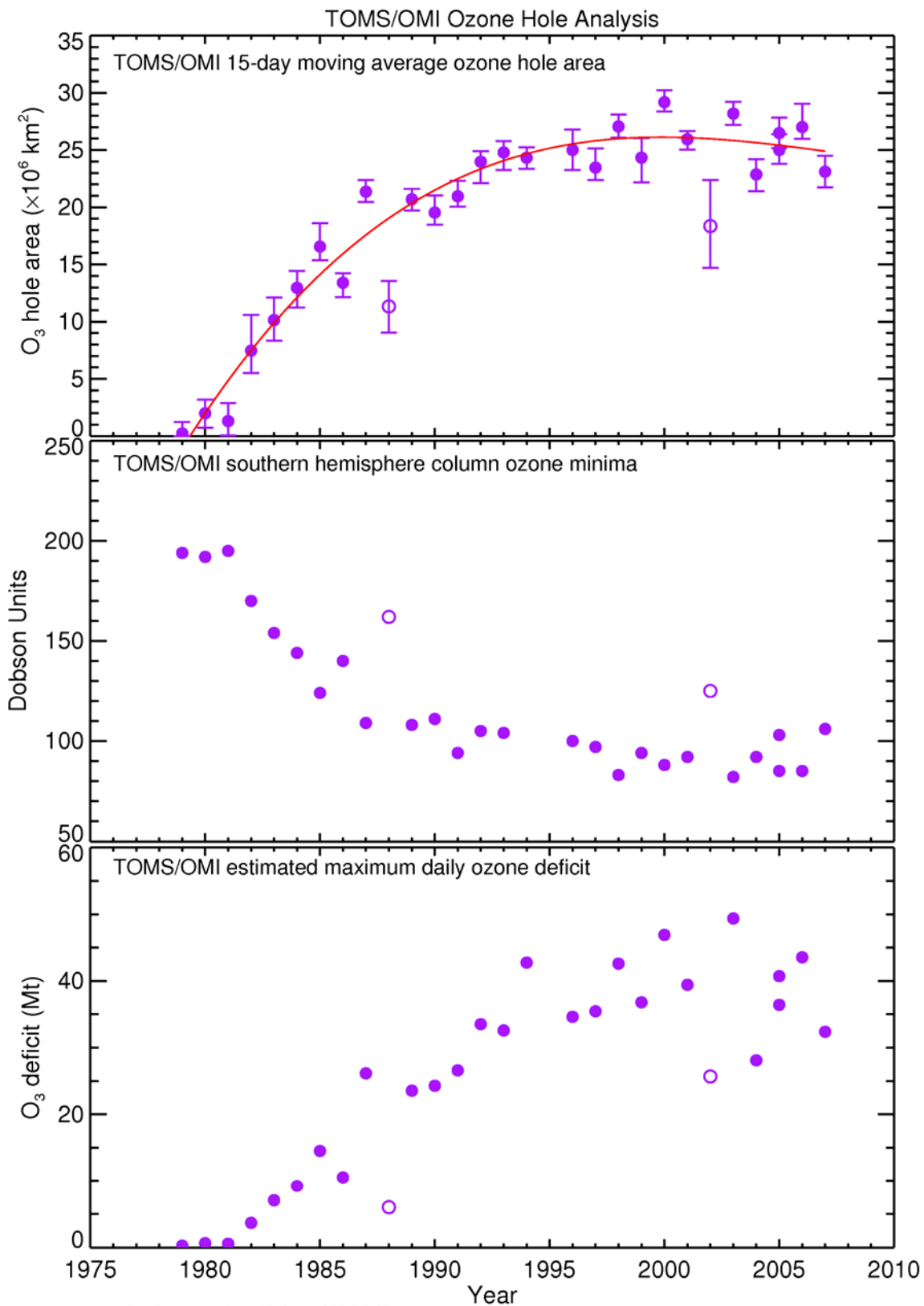


Figure 4: Historical comparisons of TOMS/OMI ozone hole metrics for 1979 through to 2007 inclusive. The anomalously warm years are shown with open circles, and for 2005, the metrics for both TOMS and OMI data are shown. The top panel shows the 15-day moving average ozone area metric. The middle panel shows the southern hemisphere column ozone minima during the ozone hole season and the bottom panel shows the estimated maximum daily ozone deficit within the ozone hole.

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 $60^\circ S$ 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 $-78^\circ C$) inside the vortex.

PSCs: polar stratospheric clouds are formed when the temperatures in the stratosphere drop below $-78^\circ C$, 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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