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The 2008 Antarctic Ozone Hole Summary: Monday 1 December 2008

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Instrumentation

Data from the Ozone Monitoring Instrument (OMI) on board the Earth Observing Satellite (EOS) Aura, processed with the NASA TOMS Version 8.5 algorithm, are being utilized again this year in our weekly ozone hole reports. OMI continues the NASA TOMS satellite record for total ozone and other atmospheric parameters related to ozone chemistry and climate.

The 2008 ozone hole

The data show that the ozone minimum dipped to 100 DU by early October, about a week later than in 2005 (Figure 1, top panel), and has since recovered to 155 DU by the end of the 2nd week of November, staying at that value until the end of the 3rd week of November and reaching almost 160 DU by the end of November. The 2008 ozone hole is recovering quite slowly over the past 5 weeks and now appears similar to the 2006 hole – expect a very rapid closure in early December.

The ozone hole reached a maximum area of 27 million km^2 for 2008 in early October, declined to 17 million km^2 by the end of October (Figure 1, bottom panel), increased again to 17-18 million km^2 during the first week of November, declining rapidly to 15-16 million km^2 by the end of the 2nd week of November. By the end of the 3rd week of November the area increased slightly to 16-17 million km^2, decreasing again to 14-15 million km^2 by the end of November. The ozone hole area remained quite stable over the 3-4 weeks at 15-18 million km^2. Only over the past 5 days has the area started to decline again. It is now similar to 2006 at the maximum range in area for this time of the year. The maximum area is below that of the 2006 hole (29 million km^2), similar to the 2005 area but greater than the 2007 area maximum (24 million km^2). The record area hole was in 2000 (30 million km^2).

The ozone deficit grew to a maximum of 40 Mt by early October, declining to 12-13 Mt by the end of the 2nd week of November (Figure 2, top panel) and it has stayed at 12-13 Mt by the end of the 3rd week of November, falling sharply to 10 Mt by the end on November. This rapid decline in deficit has occurred when the vortex has again become distorted (see below). The maximum deficit for 2008 is less than in 2006 (44 Mt), but larger than 2005 (37 Mt) and 2007 (32 Mt). The record deficit was 45 Mt in 2000. The integrated ozone loss in 2008 (1824 Mt to date) is already larger than in 2007.

The average ozone amount in the hole (averaged column ozone amount in the hole weighted by area, Figure 2 bottom panel) fell to 150 DU by early October, and has since recovered to 180-185 DU by the end of 2nd week of November, staying at that value until the end of the 3rd week of November and ring to 190 DU by the end of November. The 2008 hole is now similar to 2006. 2008 reached a similar minimum to the 2005 hole, but a week later, lower than 2007 (155 DU) and higher than 2006 (145 DU). The record low was 138 DU in 2000.

At present the 2008 ozone hole is as persistent as any that have gone before. The next few weeks will decide whether it is the most persistent ever. The data suggest a rapid closure from now on (as in 2006) may occur.

Total column ozone data over Australia and Antarctica for 16 to 27 November are shown in Figure 3. The Antarctic coast south of Australia has been outside the hole for this entire period. The vortex was relatively symmetrical from 16-22 November. This symmetrical nature is what is causing the current persistence of this year's hole. The symmetrical nature lasted until 22 November and since then the vortex has become significantly distorted along the 30°E-120°W axis. The South Pole is now on the edge of the hole. Due to this distortion, the ozone hole again passed over the southern tip of South America on 27 November.

It is now possible to rank the 2008 Antarctic ozone hole for all the metrics we calculate except integrated ozone deficit, which is not completely defined until early December.

Of the 29 holes for which we have data since 1979, the 2008 hole ranked

6th:	15-day average area	11th:	15-day average minimum ozone
7th:	daily maximum area	10th:	daily minimum ozone
6th:	daily ozone deficit	8th:	daily min average ozone amount in the hole

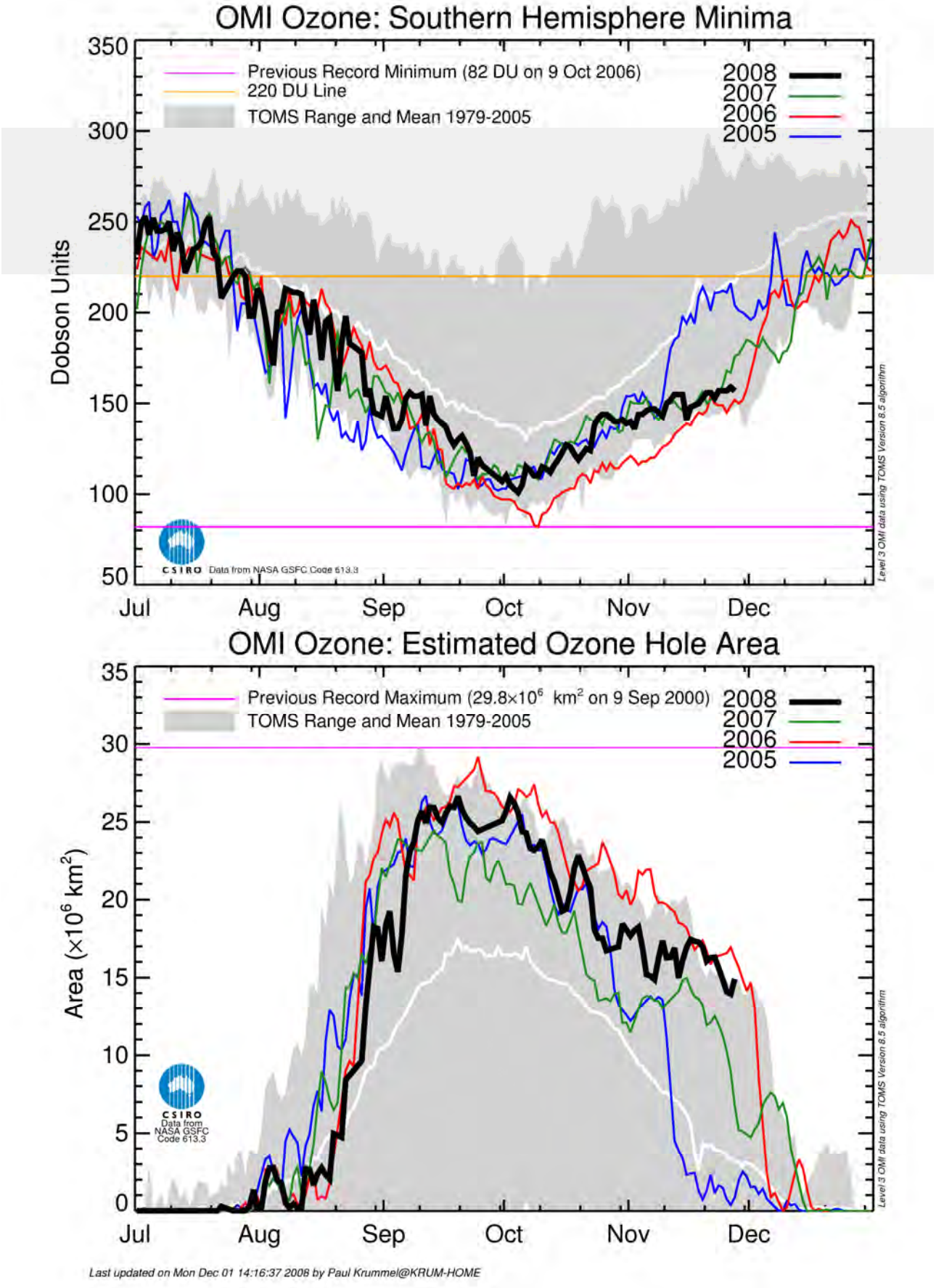

Figure 1: Ozone hole depth (top panel) and area (bottom panel) based on OMI satellite data, as of 27 November 2008.

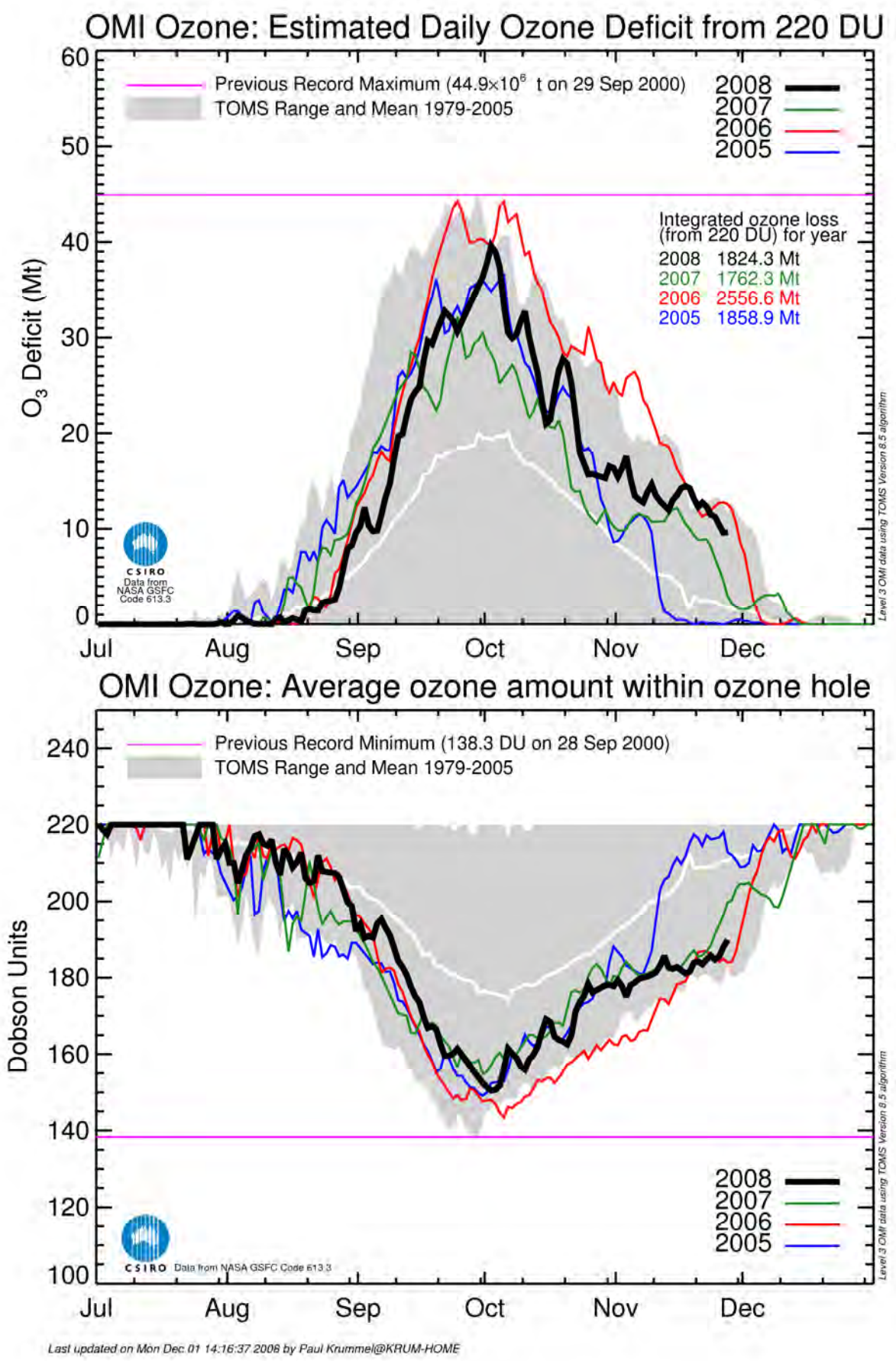

Figure 2: Estimated daily ozone deficit (top panel) and average ozone amount within the ozone hole (bottom panel) based on OMI satellite data, as of 27 November 2008.

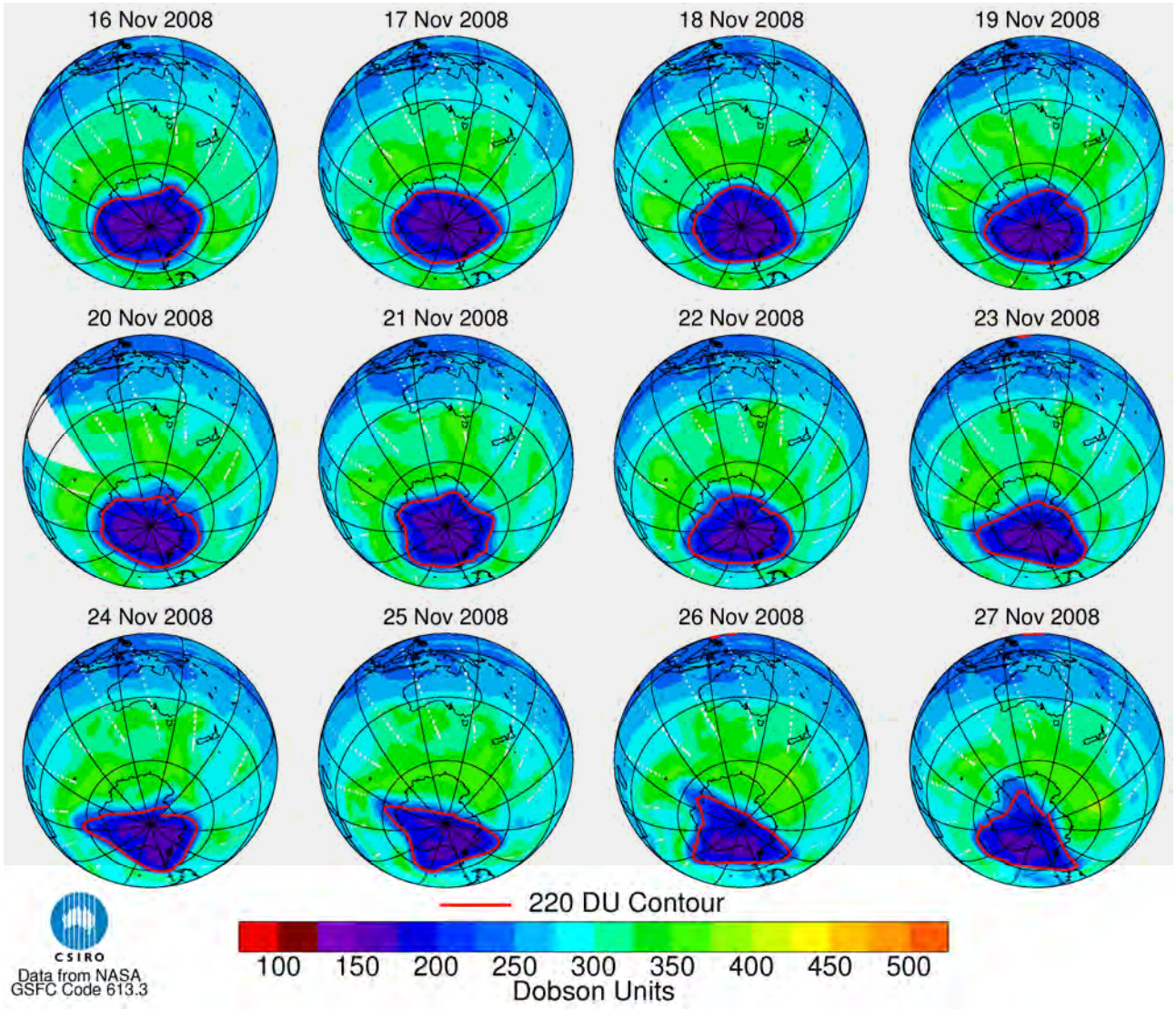

Figure 3: OMI ozone hole images for 16 – 27 November 2008; the ozone hole boundary is indicated by the red 220 DU contour line.

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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