7.3. Amundsen Scott South Pole Station

According to the World Meteorological Organisation[+], the Antarctic "ozone hole" in the austral fall of 2008 reached a maximum 27 million km^2. This is only slightly smaller than the all-time record of 29 million km^2 that was observed in 2006. The ozone hole is typically closed by mid-December but lasted exceptionally long in 2008: areas with total ozone below 220 DU were observed until the end of December 2008, according to measurements of NOAA's SBUV/2 satellites[1]. The minimum ozone column in 2008 was 100 DU and was reached on 4-October, according to measurements by the Ozone Monitoring Instrument (OMI) onboard NASA's AURA satellite. The value of 100 DU is similar to the average "minimum total ozone" observed between 1990 and 2001[2].

On 7 February 2008, a partial solar eclipse was visible in Antarctica. At South Pole, the moon started to block the Sun at 02:11 UT. The time of maximum eclipse was 03:12, when 84.9% of the Sun was blocked. The end of the eclipse was on 04:14. Radiation levels during this time were reduced by almost 90% compared to levels observed immediately before the start of the eclipse. There was some influence by clouds during the period. Figure 7.3.1 shows the UV Index measured by GUV-541 and SUV-100 during the time of the eclipse.

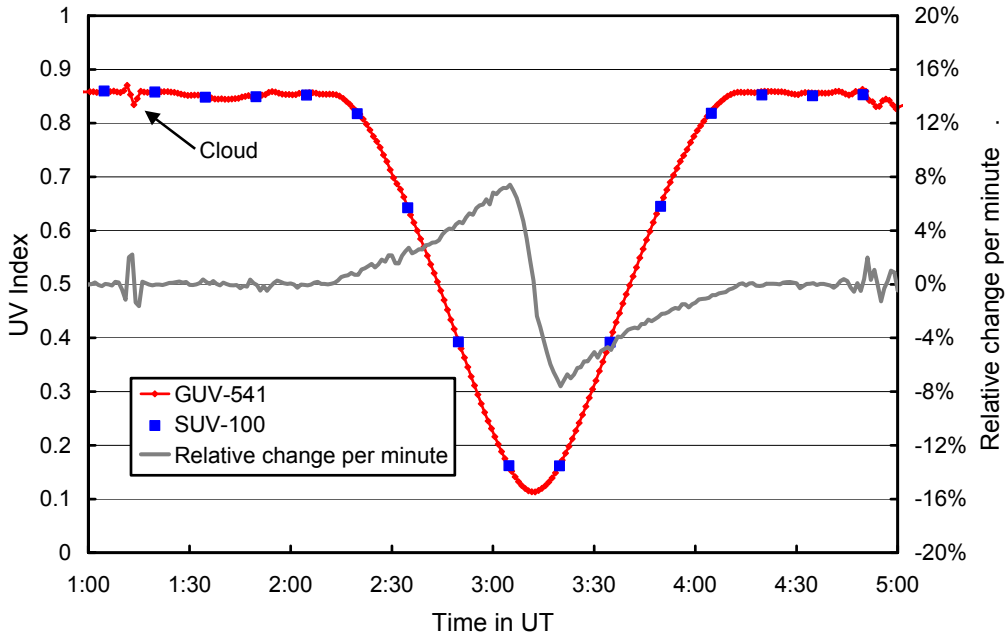

Figure 7.3.1. UV Index measured by SUV-100 and GUV-541 radiometers during the time of the solar eclipse on 7 February 2008.

Figure 7.3.2 shows total column ozone measured by satellites at the South Pole. For 2008, ozone values derived from SUV-100 spectra are also shown. These data are from the Version 2 edition. Record-low ozone column were observed between 13 and 17 December and on 25 December, illustrating the late break-up of the ozone hole at the South Pole. These low values occurred close to the solstice when the Sun is highest in the sky. Comparatively low ozone columns were also observed between 16 and 23 of November.

Figure 7.3.3 shows measurements of the 298.51 – 303.03 nm integral at 00:00 UT. This integral is strongly affected by the total ozone column. Values peak on 17 and 22 November and on 9 and 14 December. The value on 9 December is about 4.8 times of that the climatological average for this day. The daily maximum

[+] See http://www.wmo.ch/pages/prog/arep/gawozobull06_en.html
[1] See http://www.cpc.ncep.noaa.gov/products/stratosphere/polar/gif_files/ozone_hole_plot.png
[2] See ftp://jwocky.gsfc.nasa.gov/pub/eptoms/images/qcplots/zmqchl_v8.png

UV Index on 9 December was 3.1 (Figure 7.3.4). The UV Index on 13 and 14 December was 3.0, which is a new record for these days. UV Indices larger than 3.5 were observed in 1998 only, when the break-up of the ozone hole was also unusually late. DNA-weighted daily dose (Figure 7.3.5), and erythemal daily dose (Figure 7.3.6) show similar patterns than instantaneous measurements at 00:00 UT.

Radiation in the visible is only marginally affected by total ozone. As the influence of clouds is small at the South Pole, daily doses measured in the visible during the Volume 18 period should be similar to historic observations. Figure 7.3.7 suggests that measurements from 2008 are somewhat lower than in the past. This is caused by the upgrade of the radiometer's collector in January 2000 (see Volume 10 Operations Report). Before the modification, the instrument's angular response exhibited an azimuthal asymmetry, which was substantially reduced by the upgrade. Daily doses in the visible from the years 2000-2008 agree to within a few percent, and the main bias seen in Figure 7.3.7 is between data sampled before and after the collector modification. We have reprocessed our entire data set to remove the step change. The new "Version 2" data set is available via the website http://www.biospherical.com/nsf/Version2/Version2.asp.

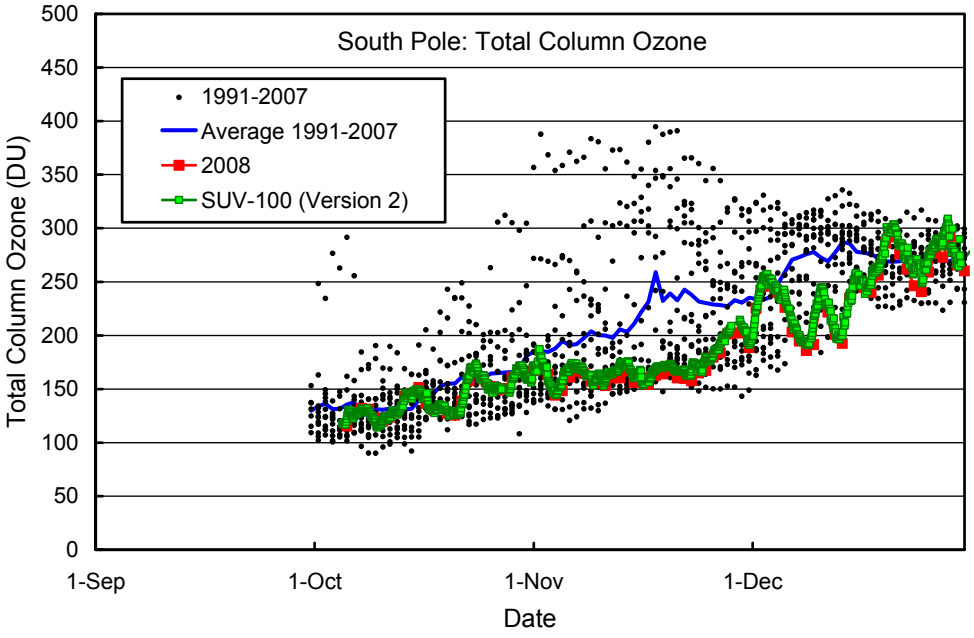

Figure 7.3.2. *Total column ozone at South Pole. OMI measurements from 2008 are contrasted with ozone data from the years 1991-2005 recorded by TOMS /Nimbus-7(1991-1993), TOMS/Earth Probe (1996-2004), and OMI (2005-2007). TOMS data are from the "TOMS Version 8" data edition. SUV-100 ozone measurements from 2008 are also shown and are from the Version 2 data set.*

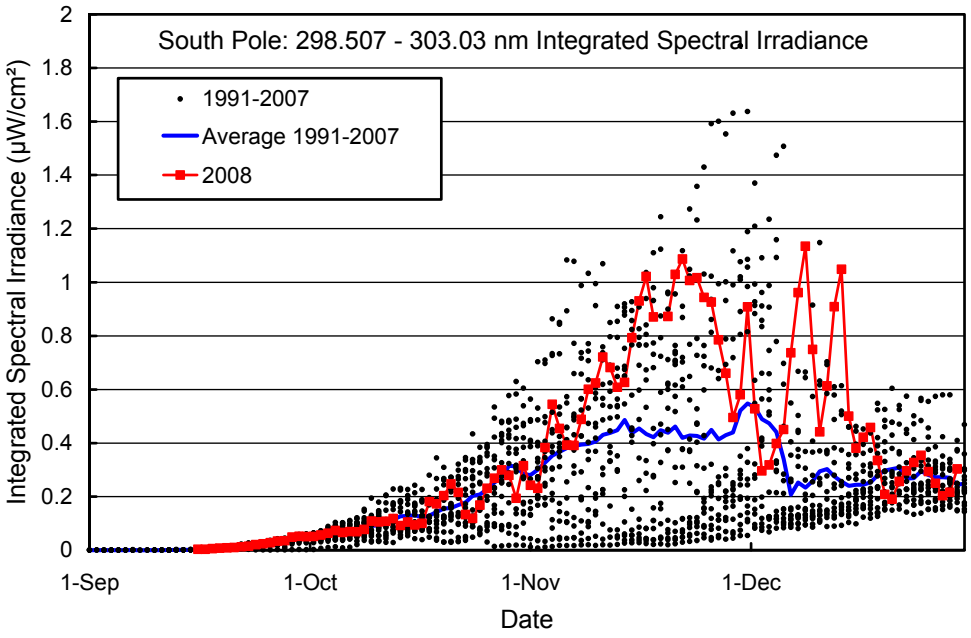

Figure 7.3.3. *Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at South Pole. Measurements from 2008 are contrasted with individual data points and the average of measurements taken between 1991 and 2007.*

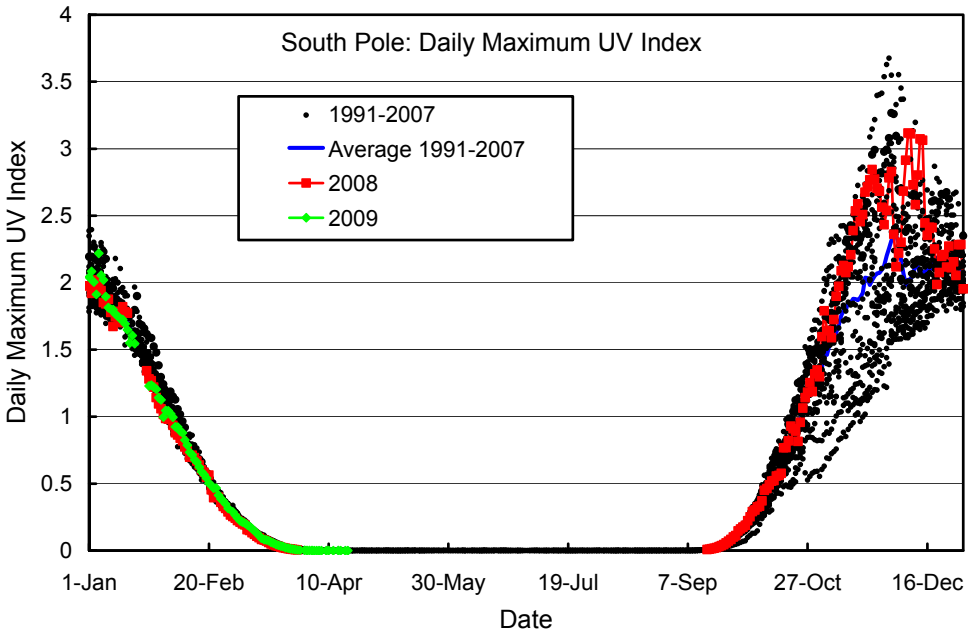

Figure 7.3.4. *Daily maximum UV Index at South Pole. Measurements from 2008 and 2009 are contrasted with individual data points and the average of measurements taken between 1991 and 2007.*

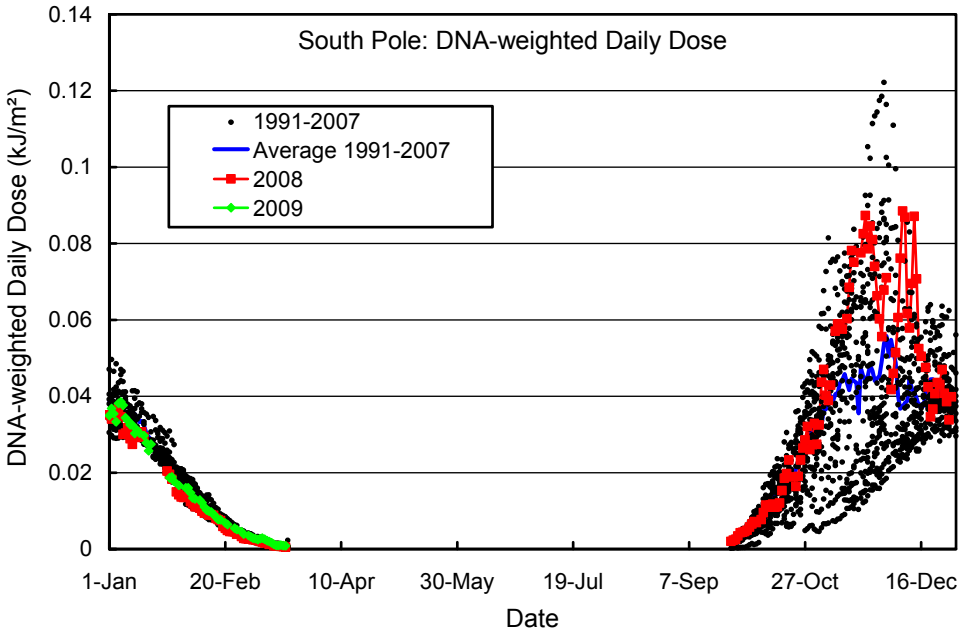

Figure 7.3.5. *Daily DNA-weighted dose at South Pole. Volume 18 measurements from 2008 and 2009 are contrasted with individual data points and the average of measurements taken between 1991 and 2007.*

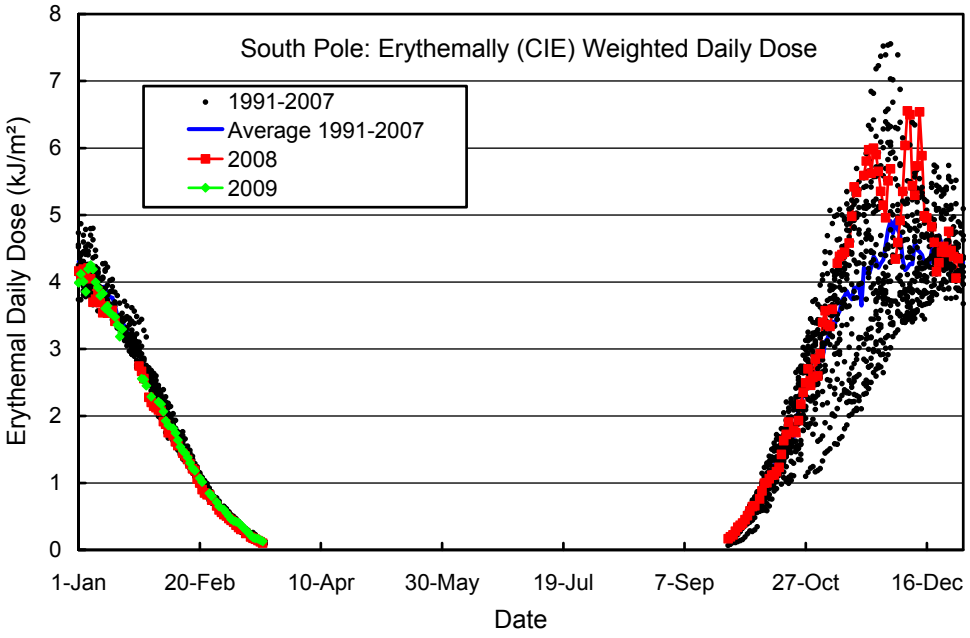

Figure 7.3.6. *Daily erythemal dose at South Pole. Volume 18 measurements from 2008 and 2009 are contrasted with individual data points and the average of measurements taken between 1991 and 2007.*

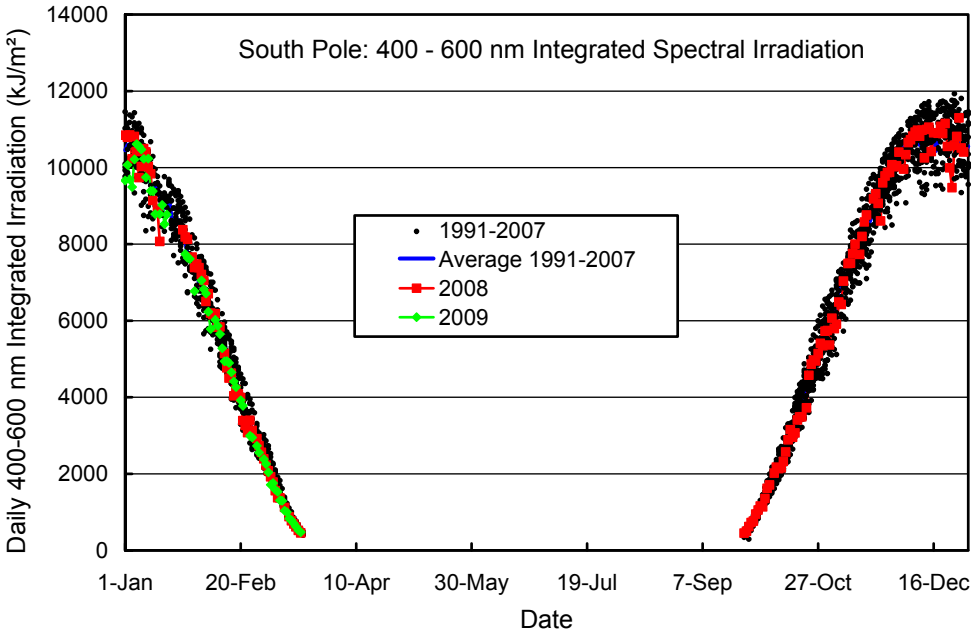

Figure 7.3.7. *Daily irradiation of the 400-600 nm band at South Pole. Measurements from 2008 and 2009 are contrasted with individual data points and the average of measurements taken between 1991 and 2007.*