7.3. Amundsen Scott South Pole Station

According to World Meteorological Organisation[+], the Antarctic "ozone hole" in the austral fall of 2006 was one of the largest and deepest on record. The 21-30 September average area of the ozone hole derived from data of the Ozone Monitoring Instrument (OMI) onboard NASA's AURA satellite was 27.4 million km^2. This is the largest area on record since satellite measurements began in 1979. The ozone mass deficit, averaged over the entire vortex period from 19 July to 1 December reached a record of 16.3 megatons. The previous maximum of 15.0 megatons was observed in 1998. The minimum total ozone column within the vortex was approximately 90 DU and was observed by OMI on 8 October 2006. The unusual size and persistence of the ozone hole and the record high ozone mass deficit can be explained by the low temperatures that have reigned in the south polar region in combination with an unusually stable and large vortex.

Figure 7.3.1 shows total column ozone measured by satellites at the South Pole. Between 8 October and 20 November of 2006, total ozone was close to the lower envelope formed by measurements of the last 15 years. Measurements of 2006 increased to above-average levels on 4 December when the ozone hole started to dissolve.

Figure 7.3.2 shows measurements of the 298.51 – 303.03 nm integral at 00:00 UT. This integral is strongly affected by the total ozone column. Peaks seen in the figure correlate with drops in Figure 7.3.1. Record UV levels were observed between 5 November and 19 November when total ozone was close to the historical minimum for this period (Figure 7.3.3). The daily maximum UV Index for this period ranged between 1.5 and 2.8. These are comparatively high values for November at the South Pole. UV Indices larger than 3.5 were observed in 1998 only, when the break-up of the ozone hole was unusually late.

DNA-weighted daily dose (Figure 7.3.4), and erythemal daily dose (Figure 7.3.5) show similar patterns than instantaneous measurements at 00:00 UT. Daily doses of several days are not available due to gaps in measurements.

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 16 period should be similar to historic observations. Figure 7.3.6 suggests that measurements from 2006 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 2000–2006 agree to within a few percent, and the main bias seen in Figure 7.3.6 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.

[+] See http://www.wmo.ch/web/arep/gawozobull06.html

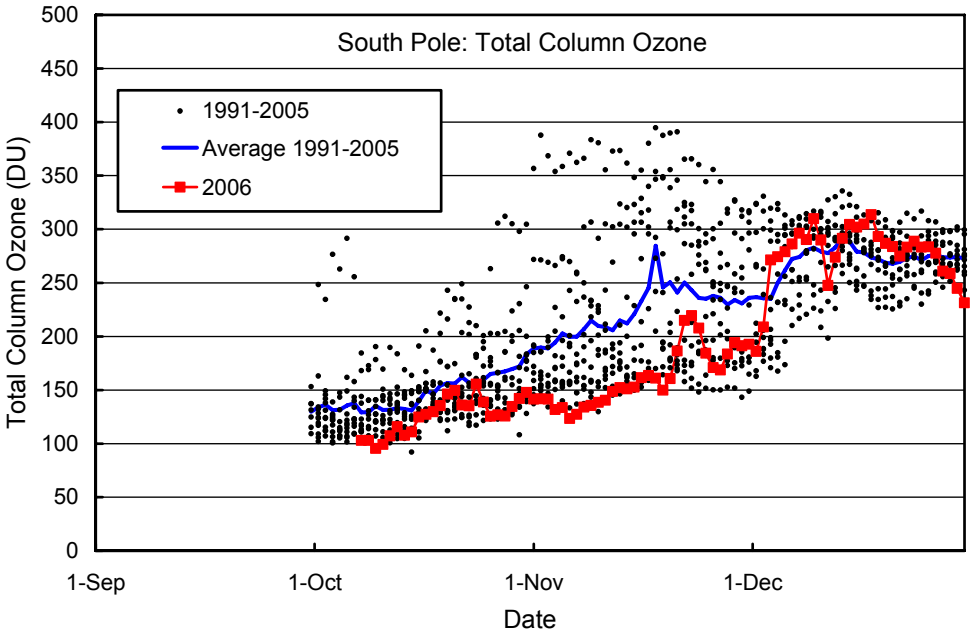

Figure 7.3.1. *Total column ozone at South Pole. OMI measurements from 2006 are contrasted with ozone data from the years 1991-2005 recorded by TOMS /Nimbus-7(1991-1993), TOMS/Earth Probe (1996-2004), and OMI (2005). TOMS data are from the "TOMS Version 8" data edition.*

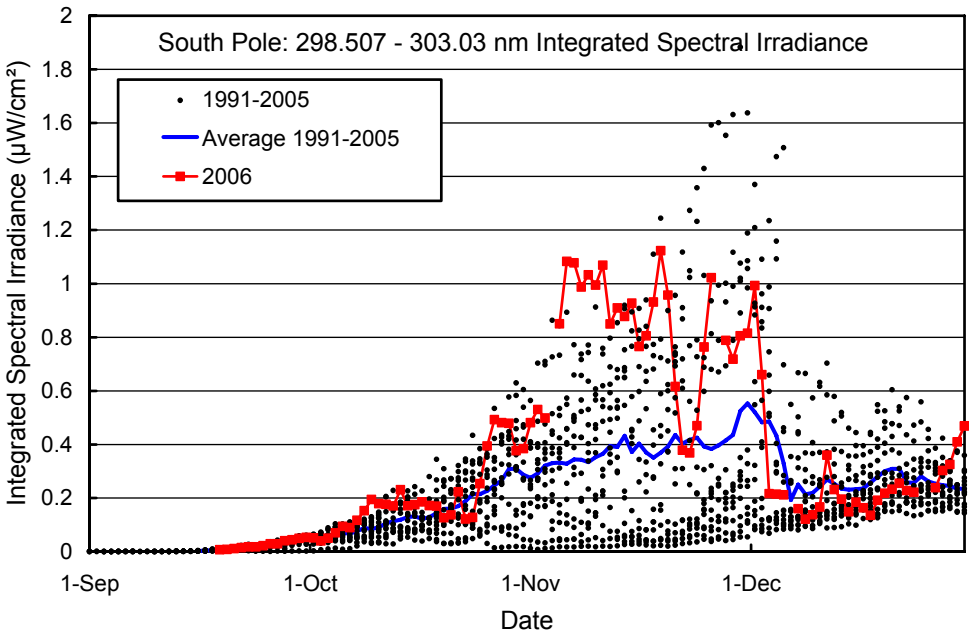

Figure 7.3.2. *Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at South Pole. Measurements from 2006 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2005.*

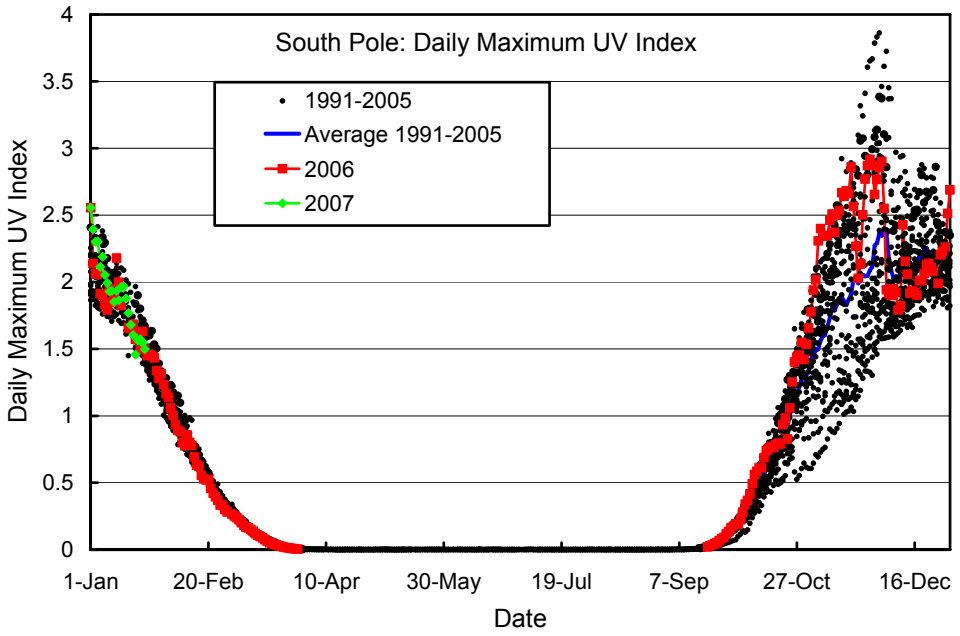

Figure 7.3.3. *Daily maximum UV Index at South Pole. Measurements from 2006 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2005.*

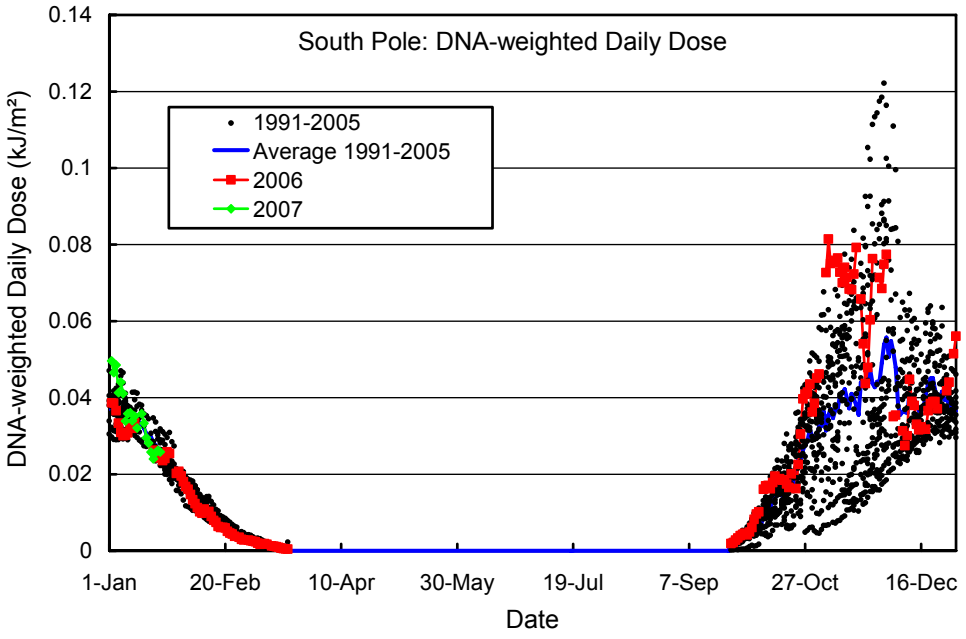

Figure 7.3.4. *Daily DNA-weighted dose at South Pole. Volume 16 measurements from 2006 and 2007 are contrasted with individual data points and the average of measurements taken between 1991 and 2005. Large changes in UV where observed between 11/2/06 and 11/5/06, and between 12/1/06 and 12/4/06, periods where no SUV-100 data are available.*

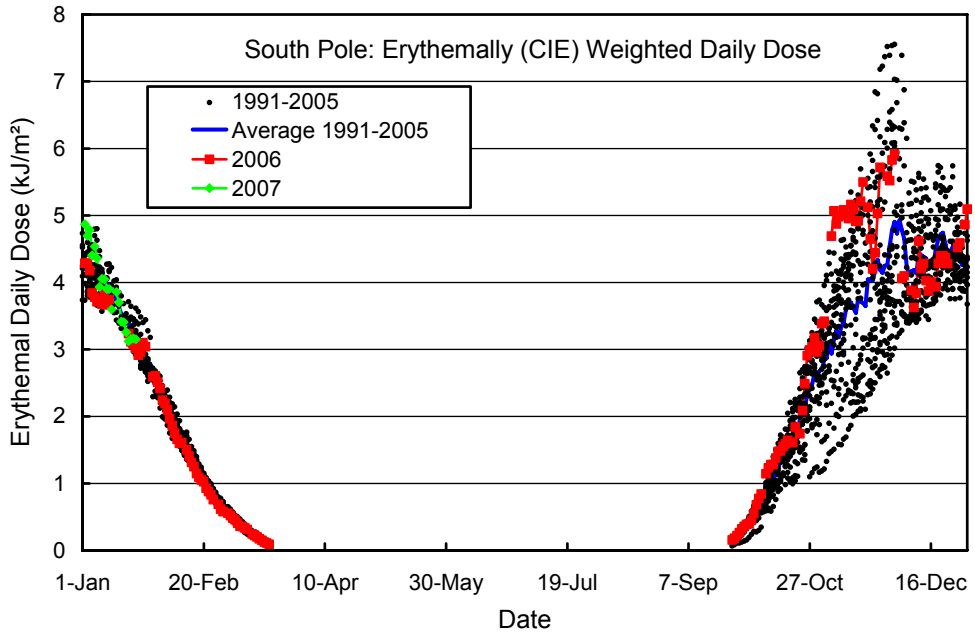

Figure 7.3.5. *Daily erythemal dose at South Pole. Volume 16 measurements from 2006 and 2007 are contrasted with individual data points and the average of measurements taken between 1991 and 2005.*

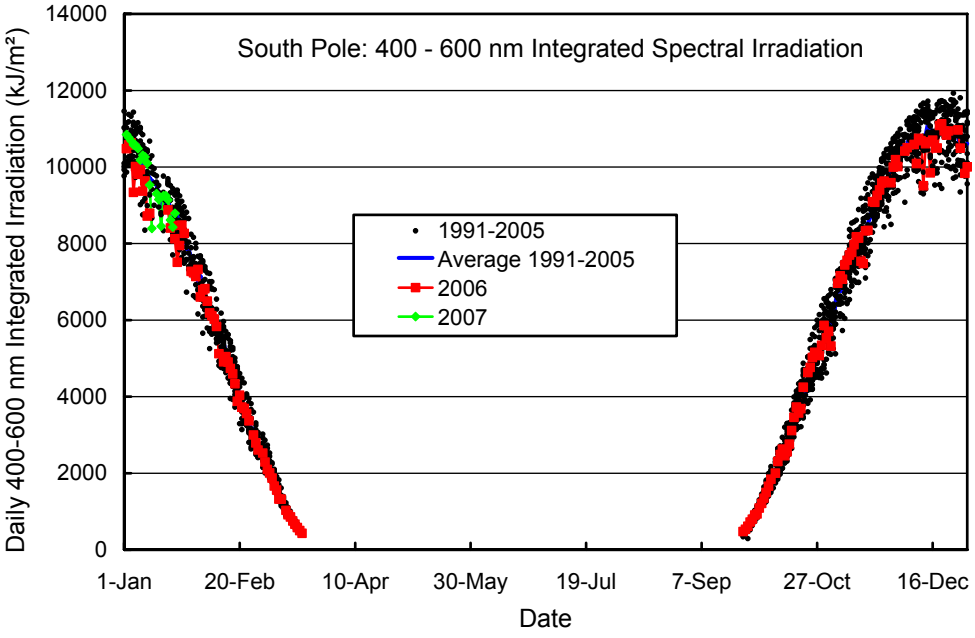

Figure 7.3.6. *Daily irradiation of the 400-600 nm band at South Pole. Measurements from 2006 and 2007 are contrasted with individual data points and the average of measurements taken between 1991 and 2005.*