7.3. Amundsen Scott South Pole Station

According to WMO[+], the Antarctic "ozone hole" in the austral fall of 2005 ranks as the third largest on record. The ozone hole reached a maximum area of about 27 million square kilometers on September 19, 2005. During the last week of September and through October, the ozone hole area declined at about the same rate as during most of the previous ten years, but in mid-November it dropped from 14 to 3 million square kilometers in a matter of one week.

Figure 7.3.1 shows total column ozone measured by satellites at the South Pole. Between mid-October and mid-November of 2005, total ozone was below the long-term average calculated from measurements of the years 1991-2004. For the remainder of November, the center of the ozone hole was shifted toward the Atlantic Ocean, and the South Pole was outside the core area of the ozone hole. Ozone dropped again in December when the vortex became more centered over the South Pole. On December 12, total ozone was 198 DU. This is the lowest value observed on this day since start of TOMS measurements in 1978.

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. Measurements between 11/11/05 and 11/30/05 were very low. The low ozone value on 12/12/05 led to record high UV levels for this day. Erythemal irradiance (Figure 7.3.3), DNA-weighted daily dose (Figure 7.3.4), and erythemal daily dose (Figure 7.3.5) show similar patterns but with reduced amplitude due to the lesser dependence of these data products on atmospheric ozone amounts.

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 15 period should be similar to historic observations. Yet Figure 7.3.6 suggest that measurements from 2005 are somewhat lower than typical. 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 - 2005 agree to within a few percent (see Section 5.3), 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.int/web/arep/05/bulletin-8-2005.pdf

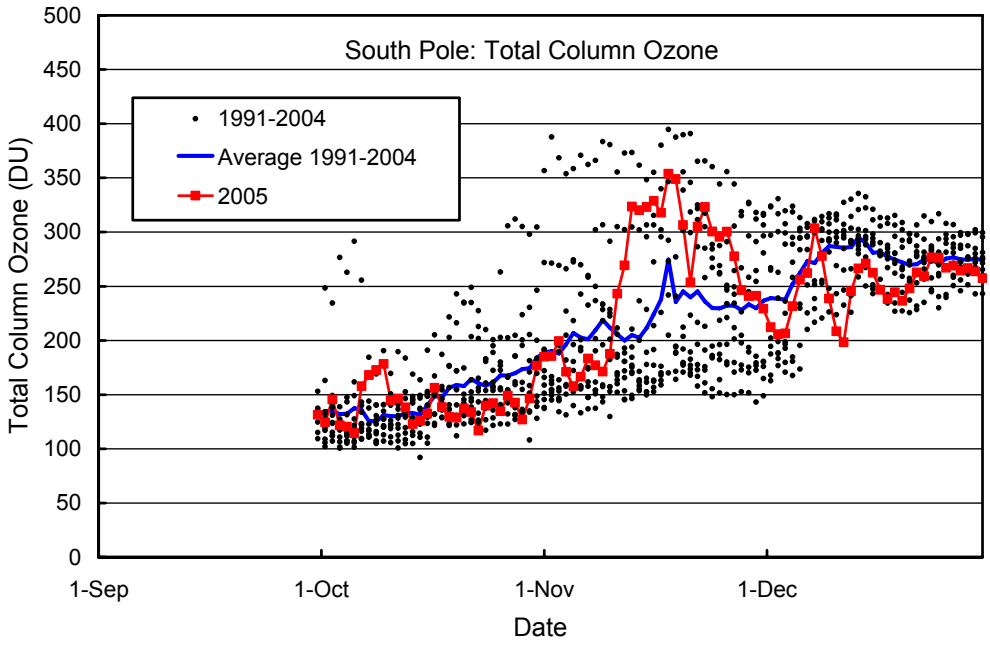

Figure 7.3.1. *Total column ozone at South Pole. Measurements of TOMS/Earth Probe measurements from 2005 are contrasted with ozone data from TOMS /Nimbus-7 (1992-1993) and TOMS/Earth Probe (1997-2004) satellites. All TOMS data are from the TOMS "Version 8" data set.*

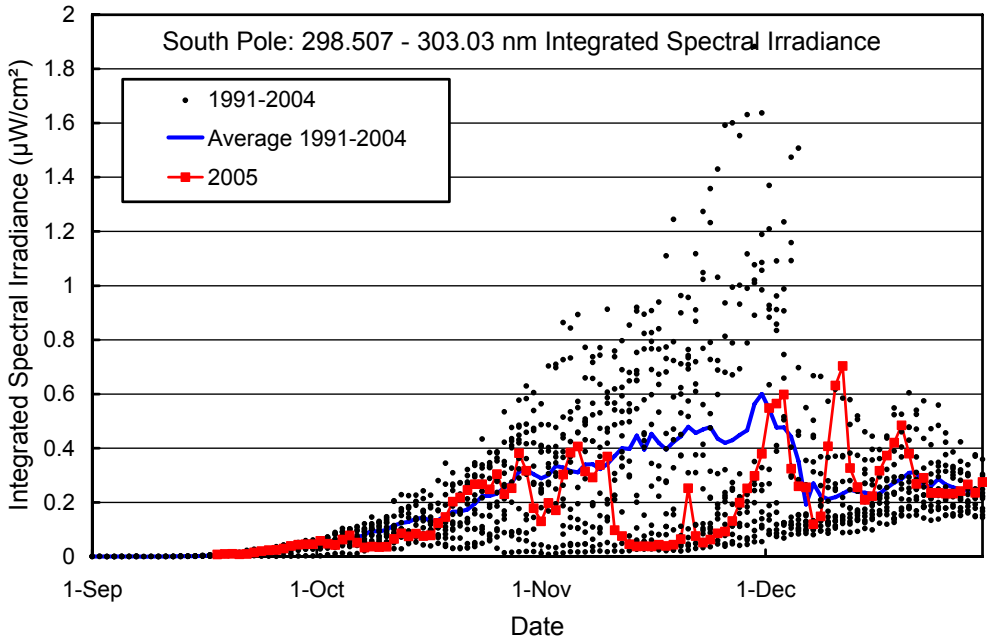

Figure 7.3.2. *Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at South Pole. Measurements from 2005 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2004.*

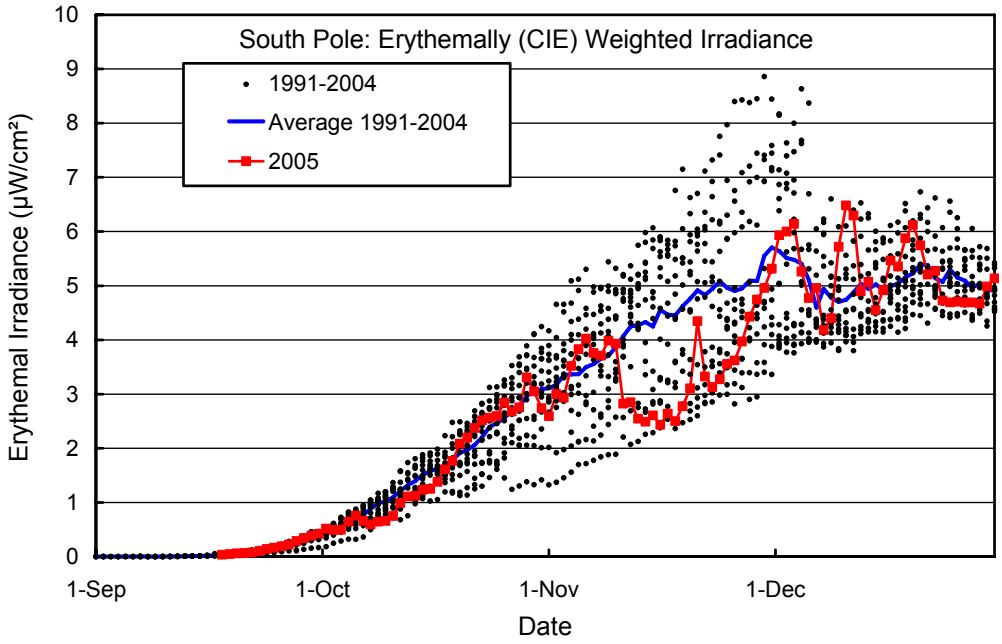

Figure 7.3.3. *Erythemally (CIE) weighted irradiance at South Pole. Measurements from 2005 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2004.*

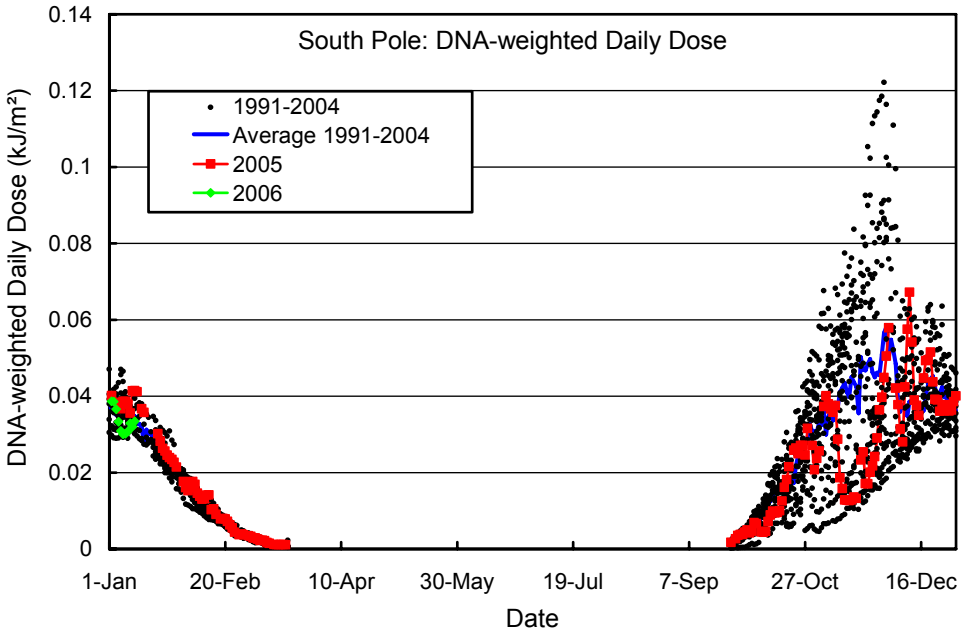

Figure 7.3.4. *Daily DNA-weighted dose at South Pole. Volume 15 measurements from 2005 and 2006 are contrasted with individual data points and the average of measurements taken between 1991 and 2004.*

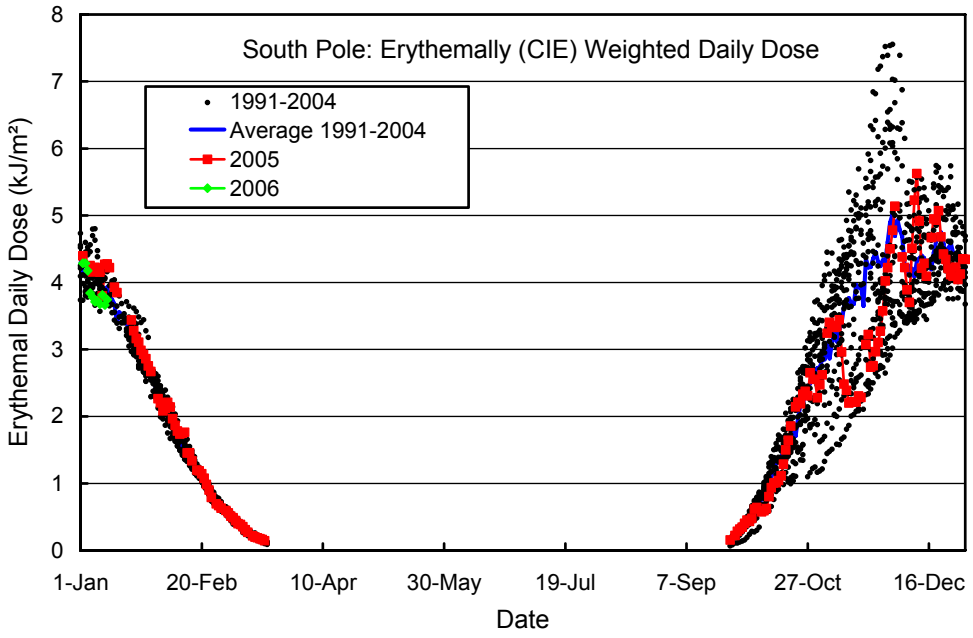

Figure 7.3.5. *Daily erythemal dose at South Pole. Volume 15 measurements from 2005 and 2006 are contrasted with individual data points and the average of measurements taken between 1991 and 2004.*

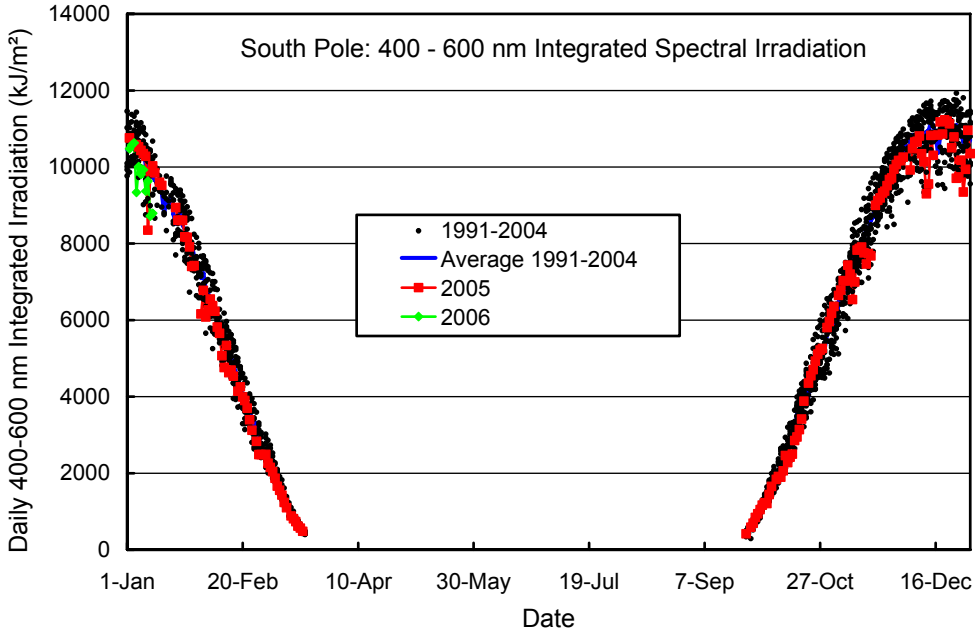

Figure 7.3.6. *Daily irradiation of the 400-600 nm band at South Pole. Measurements from 2005 and 2006 are contrasted with individual data points and the average of measurements taken between 1991 and 2004.*