7.3. Amundsen Scott South Pole Station

The Antarctic "ozone hole" in the austral fall of 2002 was one of the smallest since 1988. The maximum total area in late September was about 19 million km^2, which is considerably less than the area of 26.5 million km^2 observed in 2001. The ozone hole was virtually gone by late-October, one of its earliest disappearances since more than a decade. The small size and early disappearance can be attributed to the occurrence of a comparatively large number of "planetary waves", which lead to a warming of the lower stratosphere. Warmer stratospheric temperatures lead in turn to a lower frequency of Polar Stratospheric Clouds, which help to transform inactive forms of chorine to ozone-destroying active forms. It should be pointed out that the small hole in 2002 is not an indication that the ozone layer is recovering. The small size is rather caused by an unusual global weather pattern in 2002.

The ozone hole was centered at the South Pole between 10/12/02 and 10/22/02. This is the only period in 2002 when ozone levels were close to average (Figure 7.3.1). October 25th was the last day in 2002 with ozone levels below 220 Dobson Units.

UV levels at the South Pole were the lowest on record for almost the entire season. This can be seen at all wavelength intervals affected by ozone, including the 298.51 - 303.03 nm integral (Figure 7.3.2), erythemal irradiance (Figure 7.3.3), DNA-weighted daily dose (Figure 7.3.4), and erythemal daily dose (Figure 7.3.5). The only period with close-to-average UV levels is the period between 10/15/02 and 10/24/02. This is the time when the center of the ozone hole was located over the South Pole.

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 12 period should be similar to historic observations. Yet Figure 7.3.6 suggest that measurements from 2002 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 azimuth asymmetry, which was substantially reduced by the upgrade. Daily doses in the visible from the years 2000, 2001, and 2002 agree to within 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. The effect of this modification on solar data is described in more detail in the introduction to Section 5. We are planning to reprocess our entire data set to remove the step change. See *Bernhard et al.* (2003) for details.

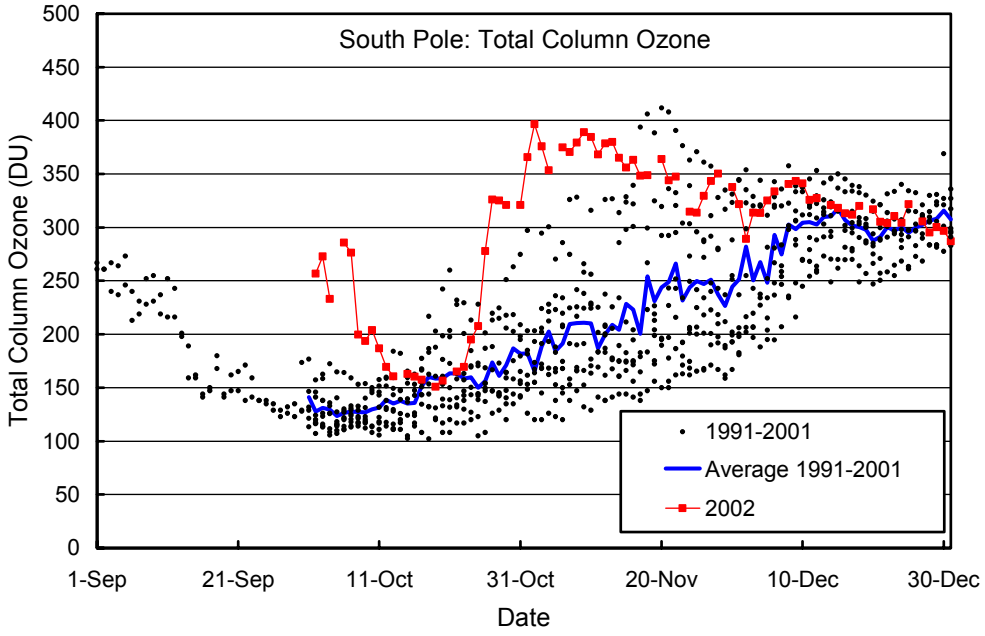

Figure 7.3.1. *Total column ozone at South Pole. TOMS/Earth Probe measurements from 2002 are contrasted with ozone data from the years 1991-2001 recorded by TOMS /Nimbus-7(1991-1993),TOMS/ Meteor-3 (1993-1994), NOAA/TOVS (1995-1996), and TOMS/Earth Probe (1997-2001) satellites. September data are from NOAA/TOVS measured in 1995 and 1996.*

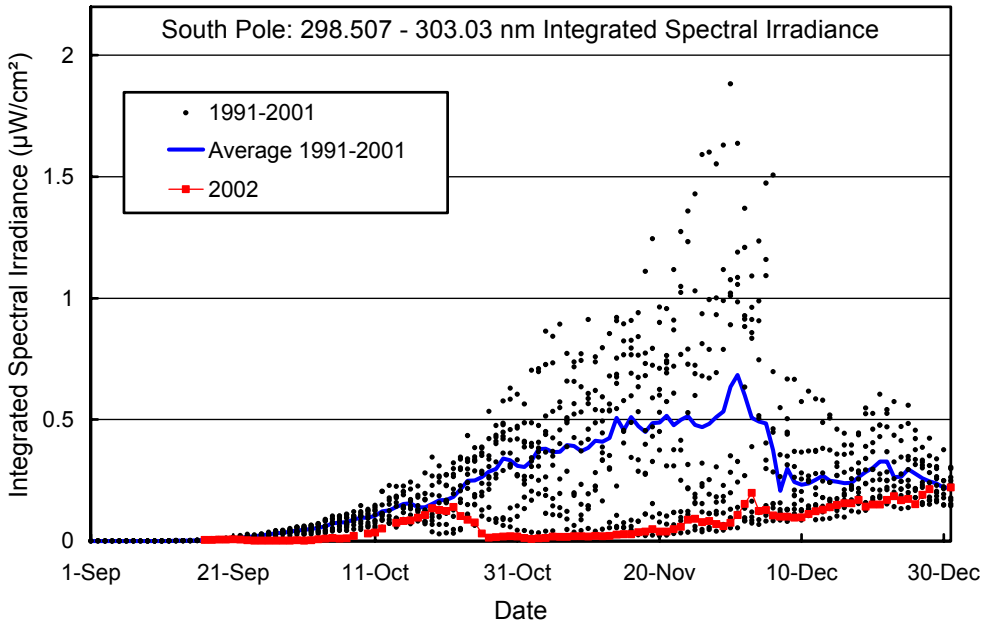

Figure 7.3.2. *Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at South Pole. Measurements from 2002 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2001.*

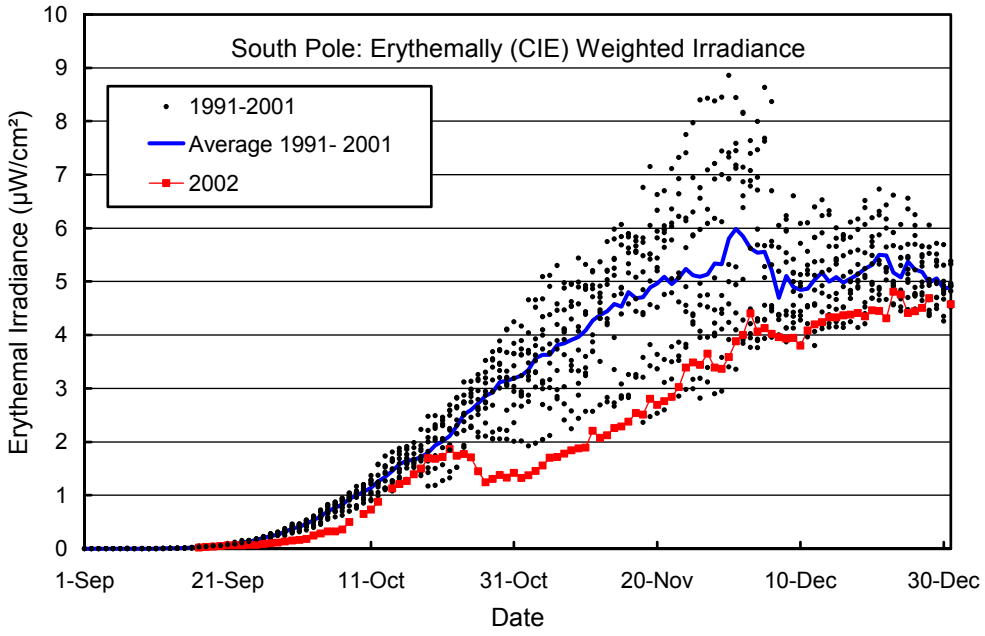

Figure 7.3.3. *Erythemally (CIE) weighted irradiance at South Pole. Measurements from 2002 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2001.*

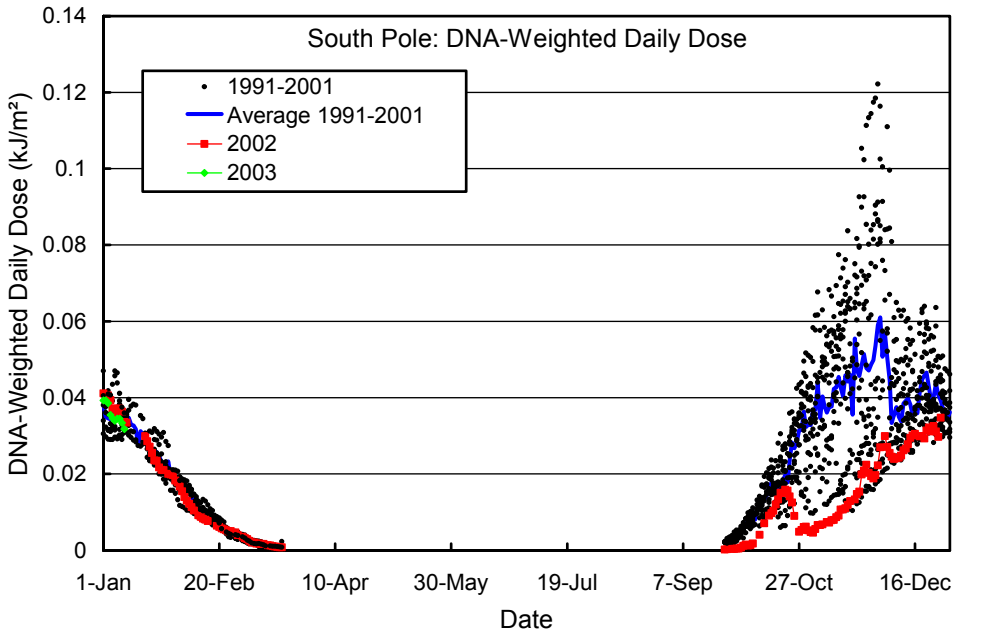

Figure 7.3.4. *Daily DNA-weighted dose at South Pole. Volume 12 measurements from 2002 and 2003 are contrasted with individual data points and the average of measurements taken between 1991 and 2001.*

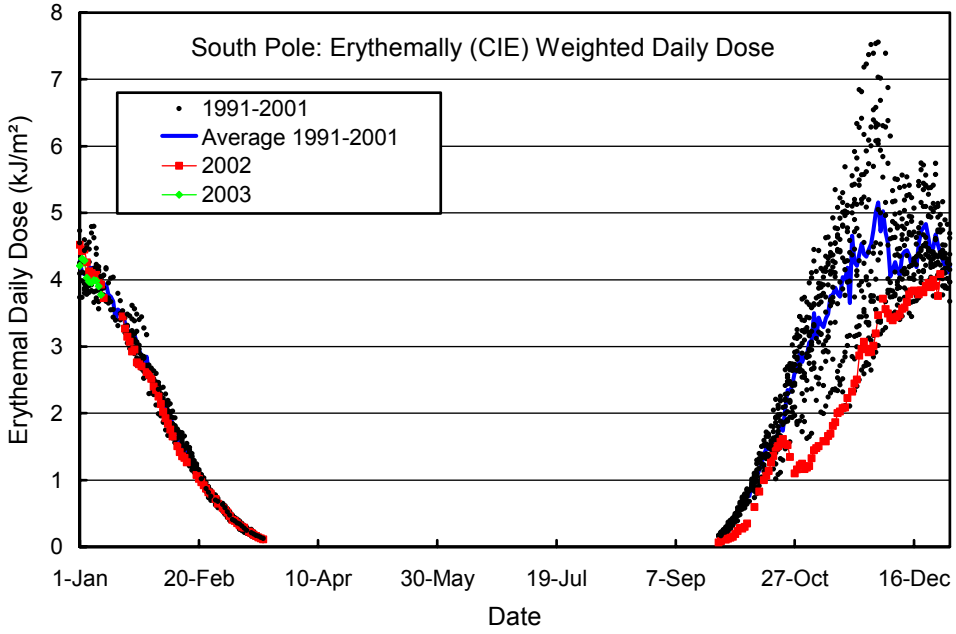

Figure 7.3.5. *Daily erythemal dose at South Pole. Volume 12 measurements from 2002 and 2003 are contrasted with individual data points and the average of measurements taken between 1991 and 2001.*

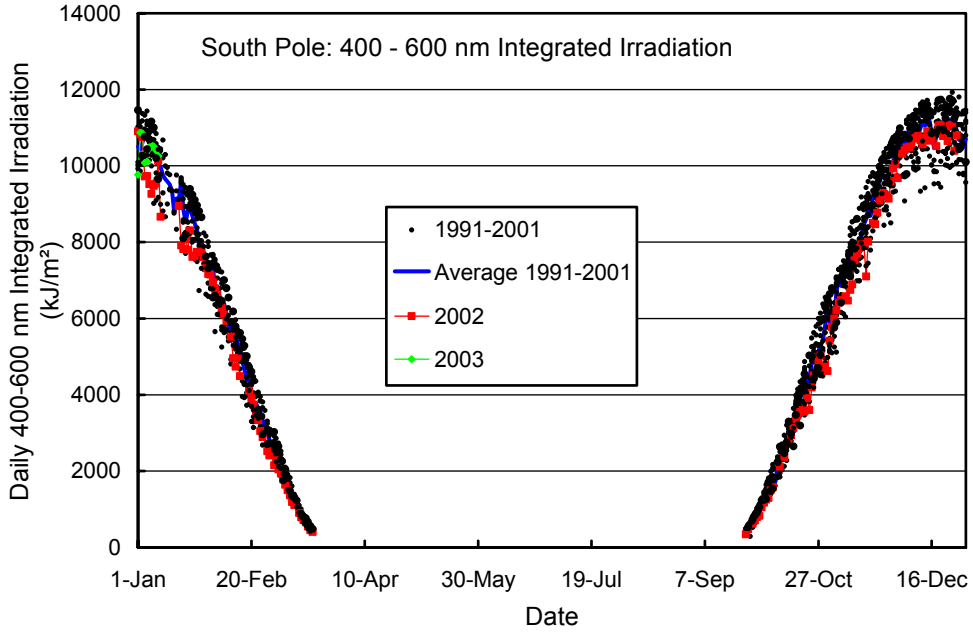

Figure 7.3.6. *Daily irradiation of the 400-600 nm band at South Pole. Measurements from 2002 - 2003 are contrasted with individual data points and the average of measurements taken between 1991 and 2001.*