7.2. Palmer Station

The ozone hole in the austral fall of 2000 was very unusual. Already in early August an exceptionally large area of very low stratospheric temperatures was noted over Antarctica, which set the state for the earlier than usual development of the annual Austral Spring ozone hole. After a particularly rapid growth during August, the ozone hole reached the largest size on record with an extent of close to 30 million km^2 on September 9. In early October , it was also the deepest with ozone losses exceeding 50% within most of the area of the ozone hole when compared to the pre-ozone-hole conditions. The hole in 2000 grew three weeks earlier than in 1999 and reached its peak one week earlier than in 1999. Its edge was located above southern South America several times in September and October, leading to record UV levels at Ushuaia (see Section 7.4.). After October 20, 2000, the ozone hole begun a very rapid, sustained decreased in size, closing between November 20 and 25. This was the earliest break-up since 1991 and took place almost a month earlier than in 1998 and 1999.[1]

Figure 7.2.1 shows total column ozone over Palmer Station as measured by TOMS. From the beginning of September 2000 until 10/21/00, ozone levels were exceptionally low. They were similar to minimum levels observed the 1990s, with the exception of a short episode between 9/29/00 and 10/6/00 when Palmer Station was shortly outside the region of the ozone hole. After October 21, ozone values increased rapidly as the ozone hole was shrinking and its center was moving toward the Atlantic Ocean. There was virtually no influence of the ozone hole after 10/27/00.

The influence of low ozone values in September and early October on UV irradiance, and the effect of relatively high values thereafter can clear be seen in UV data. Noontime values of the 298.51 - 303.03 nm integral showed record values in mid-September, 10/13/00, and 10/17/00, and decreased to almost insignificant values between end of October and mid-November (Figure 7.2.2). Short-wave UV levels remained low until 12/8/00, and were comparable with average values for the remainder of December. Erythemally weighted noontime irradiance exhibited a similar pattern with record high values around 9/21/00 and relatively low values in November (Figure 7.2.3).

Figure 7.2.4 and Figure 7.2.5 show the annual cycles in DNA-weighted daily dose and erythemally weighted daily dose, respectively. In general, daily doses show a similar pattern than noon-time UV levels. Both figures also demonstrate that variability in daily UV doses is much lower between January and March than it is between September and November, the period affected by the ozone hole. UV levels measured during the austral spring have frequently been a factor two to three higher, compared to values measured six months earlier. Volume 10 data from 2001 compare well with doses from previous years.

Daily doses in the 400-600 nm range are shown in Figure 7.2.6. Since radiation in the visible is not affected by atmospheric ozone concentrations, Volume 10 measurements agree well with measurements from previous years. The good agreement also confirms that the modification of the instrument's collector in March 2000 did not introduce an appreciable bias in the measurement of daily doses.

[1] The summary of the year 2000 ozone hole was compiled from Pablo O. Canziani, "The Evolution of the Antarctic zone hole in 2000", http://www.aero.jussieu.fr/~sparc/News16/16_Canziani.html, and the WMO Antarctic ozone bulletins, http://www.wmo.ch/web/arep/00/

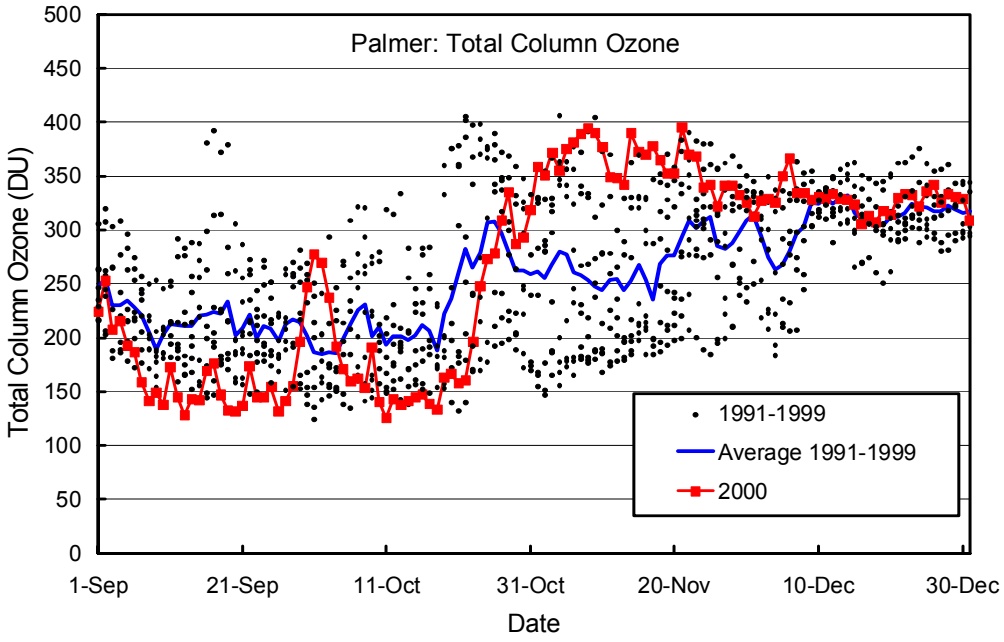

Figure 7.2.1. *Total column ozone in Palmer. TOMS/Earth Probe measurements from 2000 are contrasted with ozone data from the years 1991-1999 recorded by TOMS /Nimbus-7(1991-1993),TOMS/ Meteor-3 (1993-1994), NOAA/TOVS (1995-1996), and TOMS/Earth Probe (1997-1999) satellites.*

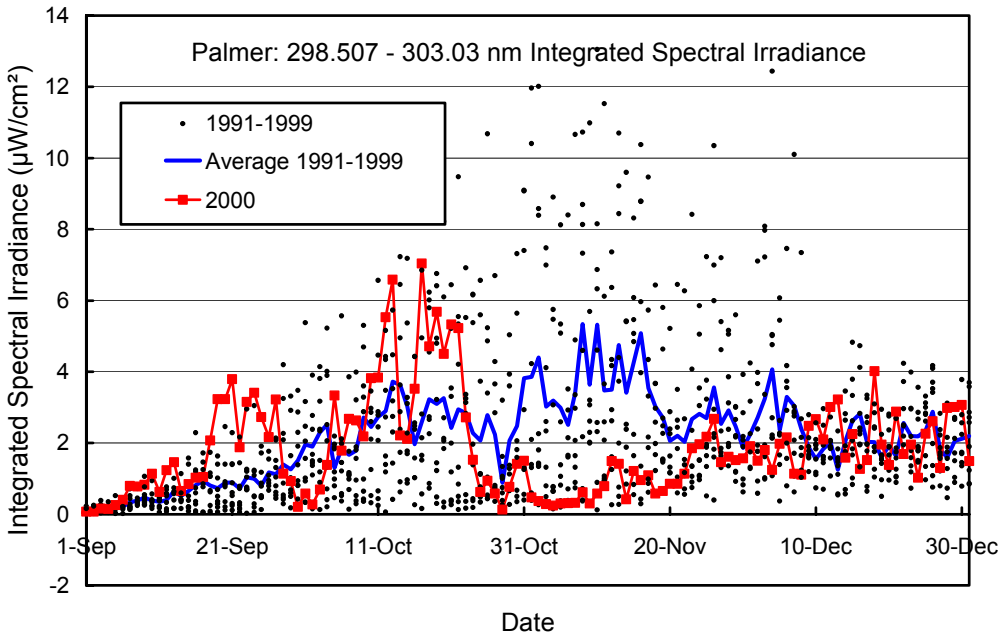

Figure 7.2.2. *Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at Palmer. Measurements from 2000 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 1999.*

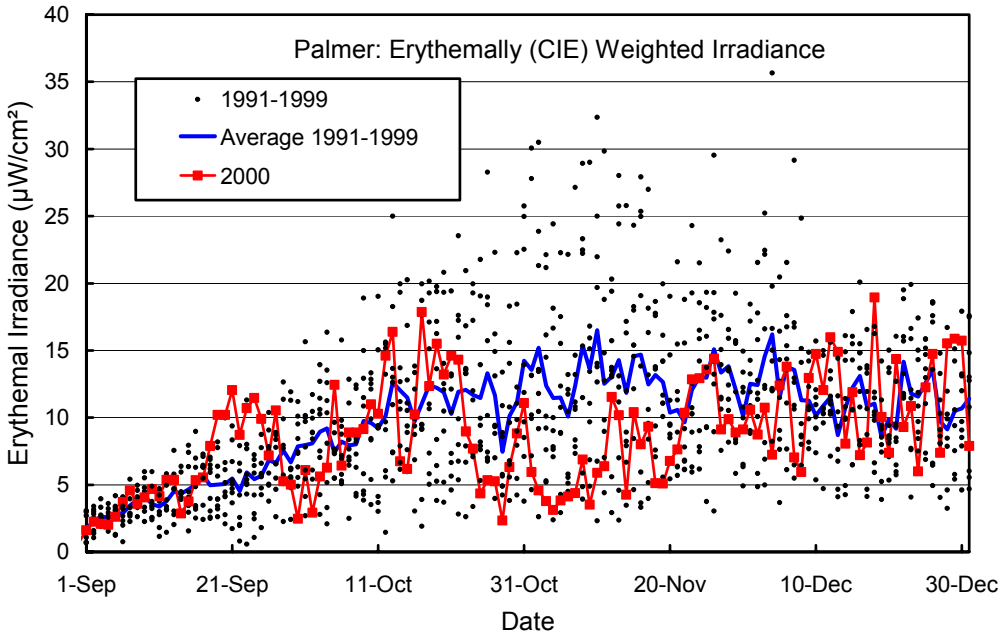

Figure 7.2.3. *Erythemally (CIE) weighted irradiance at Palmer. Measurements from 2000 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 1999.*

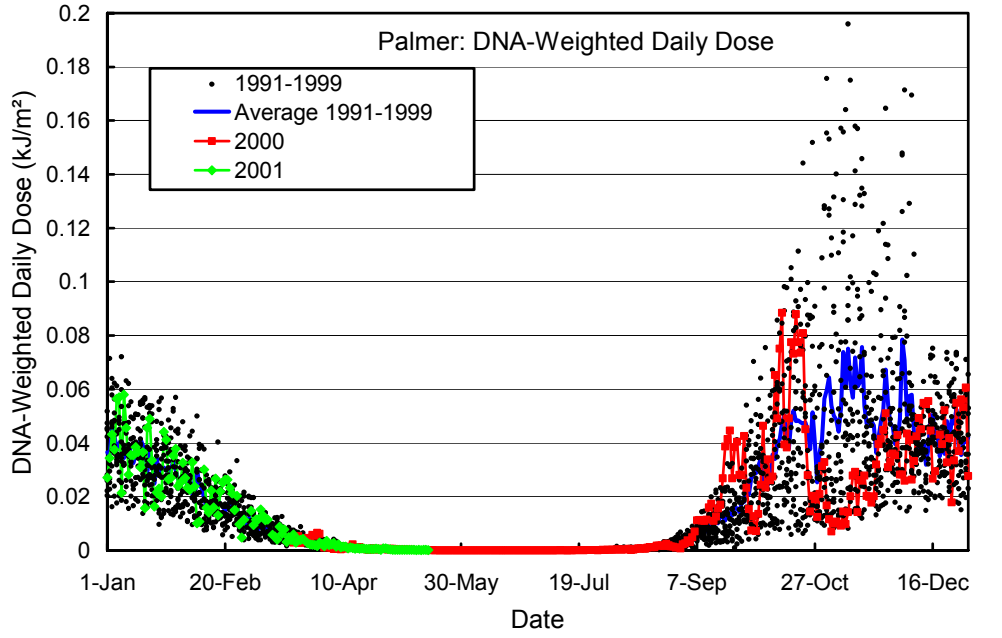

Figure 7.2.4. *Daily DNA-weighted dose for Palmer. Volume 10 measurements from 2000 and 2001 are contrasted with individual data points and the average of measurements taken between 1991 and 1999.*

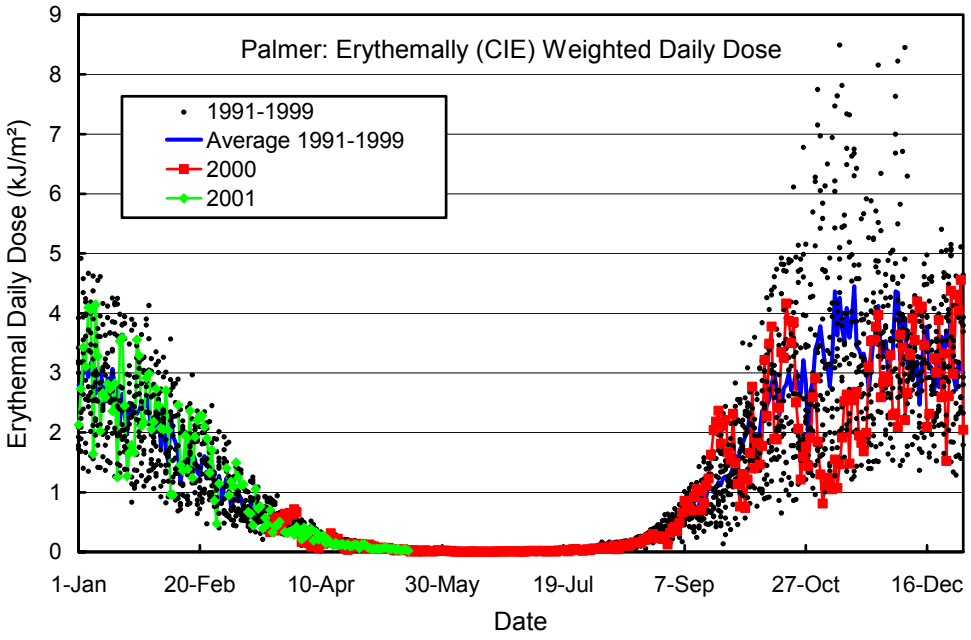

Figure 7.2.5. *Daily erythemal dose for Palmer. Volume 10 measurements from 2000 and 2001 are contrasted with individual data points and the average of measurements taken between 1991 and 1999.*

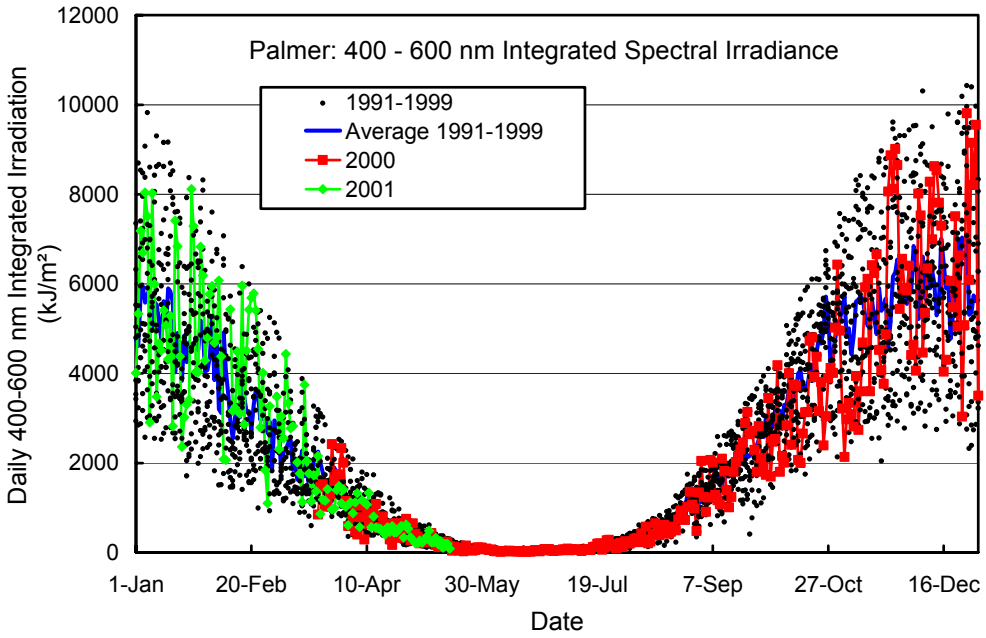

Figure 7.2.6. *Daily irradiation of the 400-600 nm band for Palmer. Volume 10 measurements from 2000 and 2001 are contrasted with individual data points and the average of measurements taken between 1991 and 1999.*