

7.2. Palmer Station

Figure 7.2.1 shows total column ozone over Palmer Station as measured by TOMS. Between September and November, ozone values in 1998 were within the range of minimum and maximum values of previous years (1991-1994). In early December, however, ozone levels fell well below the minimum values observed historically during this part of the year. This drop in ozone was observed at all austral network sites. Apparently the ozone hole did not recover as quickly in 1998 as it did in previous years. The initial start of the recovery in November was interrupted for about one week in December before ozone values came back to normal levels.

The low ozone values are clearly visible in UV-data. For example, in December 1998 noontime values of the 298.51 - 303.03 nm integral (Figure 7.2.2), DNA-weighted irradiance (Figure 7.2.3), and UVB-irradiance (Figure 7.2.4) exceed maximum levels observed between 1991-1997. Note that the record UV levels in December 1998 are even higher than UV-levels in the month of October of previous years, although total column ozone is usually lowest in October. This is because the sun is much higher in the sky in December than in October. Figure 7.2.5 confirms that the high radiation levels are really due to ozone and not, for example, unusually low cloud cover. The variability of irradiance in the 400-600 nm band in 1998 does not appear systematically different from previous years.

A comparison of Figure 7.2.1 with Figure 7.2.2 through Figure 7.2.4 also reveals the anticorrelation of ozone and UV also in different periods of the year. For example, the local ozone minimum of 132 DU around day 10/21/98 caused a distinct peak in DNA-weighted irradiance. On the other hand, the relatively high ozone levels between the end of October and beginning of November 1998 led to very low irradiance values in the 298.51 - 303.03 nm wavelength domain.

A pattern similar to that observed for noontime values is also visible in daily doses, i.e., irradiance integrated over one day. In early December 1998 both DNA-weighted dose (Figure 7.2.6) and erythemal-dose (Figure 7.2.7) exceed the 2σ -limit of doses typical for this period. There is also a local maximum of both doses on day 10/21/98, corresponding to low ozone values. Daily doses in the 400-600 nm region (Figure 7.2.8), on the other hand, are within the $\pm 2\sigma$ -limits calculated from the years 1991-1997, indicating no significant difference in cloud cover in 1998.

In Figure 7.2.9, finally, average daily DNA doses are directly contrasted with radiation levels in the 400-600 nm range. Both curves were averaged over the period 1991-1997, allowing a comparison of the general pattern of both doses beyond year-to-year variability. The asymmetry of DNA doses can clearly be seen. DNA values between February and May are always below the curve for the 400-600 nm integral while the DNA curve equals or exceeds the integral in the visible between September and October. This can be explained by the ozone hole, which leads to increased DNA values in the second half of the year only.

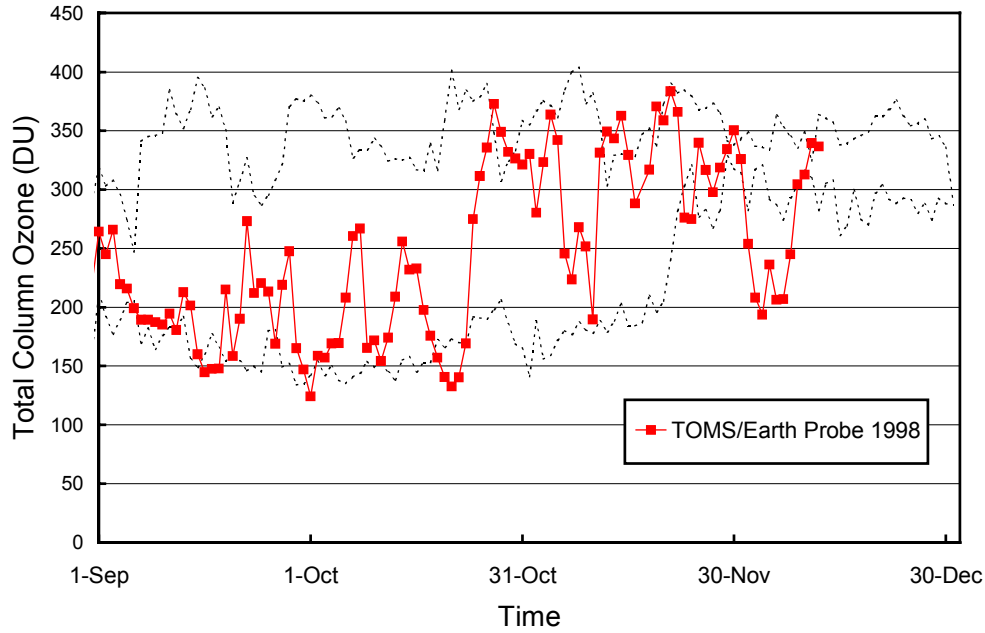


Figure 7.2.1. Total column ozone in Palmer. TOMS/Earth Probe measurements from 1998 are contrasted with minimum and maximum values (broken lines) from the years 1991-1994 recorded by TOMS onboard NASA's Nimbus-7 and Meteor-3 satellites. A one-and-a-half year gap in data occurred after the loss of the Meteor-3 satellite in December 1994. No ozone values exist between 12/13/98 and 12/31/98 because of TOMS instrumental problems.

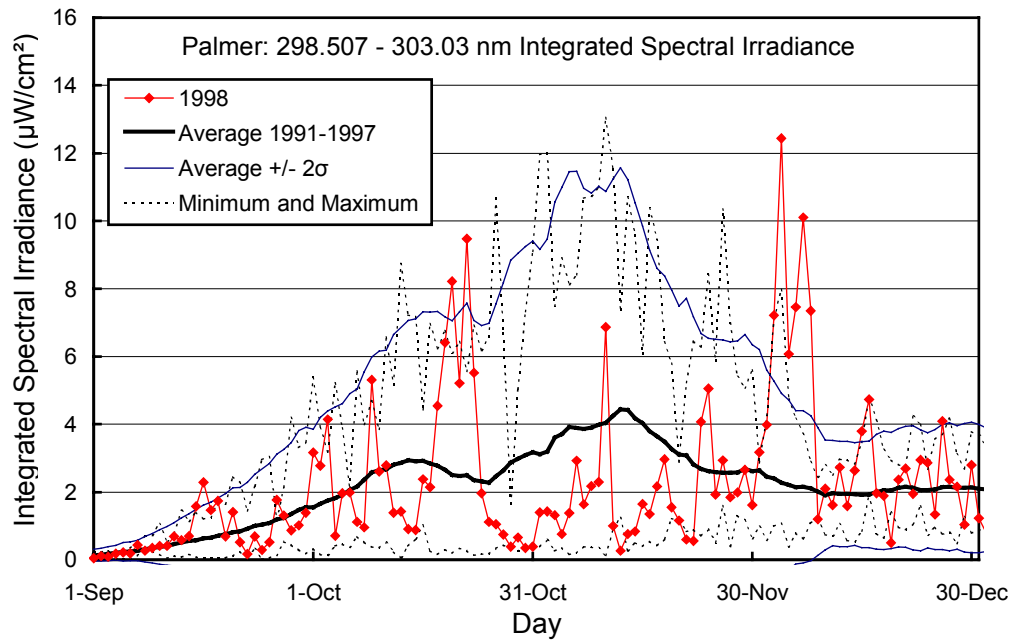


Figure 7.2.2. Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at Palmer. The measurements from 1998 (diamonds) are contrasted with the mean of measurements taken between 1991 and 1997 (thick line). The thin lines are the mean ± 2 standard deviation (mean $\pm 2\sigma$) limits, also calculated from the 1991-1997 period. A ten-day running average was applied to both mean and mean $\pm 2\sigma$ to reduce day-to-day fluctuations in order to make the presentation clearer. The broken lines represent historical (1991-1997) minima and maxima without further smoothing.

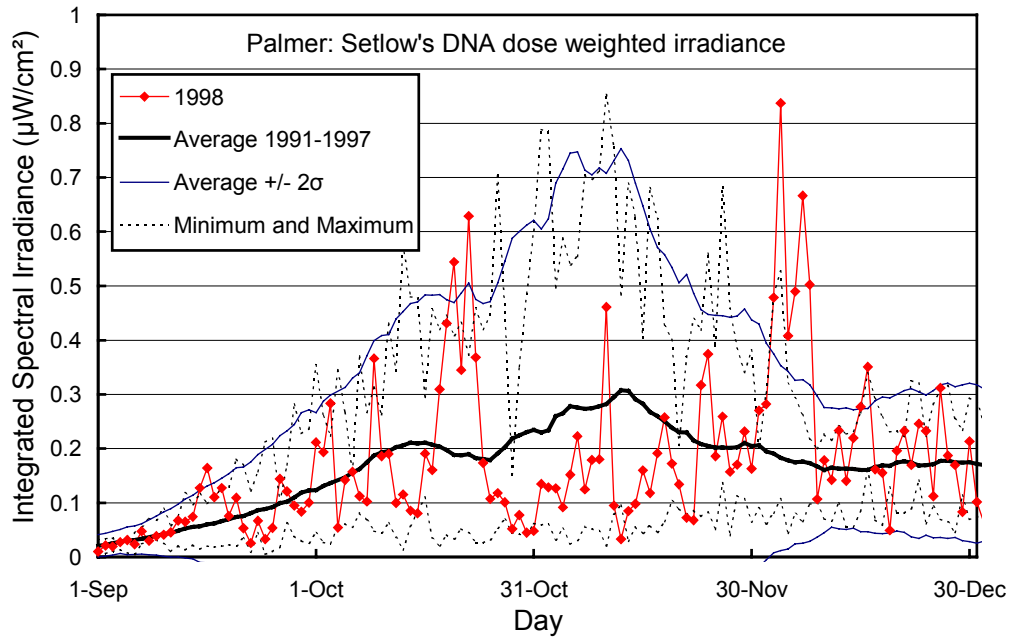


Figure 7.2.3. Setlow's DNA-weighted irradiance at Palmer. Measurements from 1998 are contrasted with the mean of measurements taken between 1991 and 1997 (thick line). Thin lines and broken lines represent the mean $\pm 2\sigma$ limits, and historical minima and maxima values as in Figure 7.2.2.

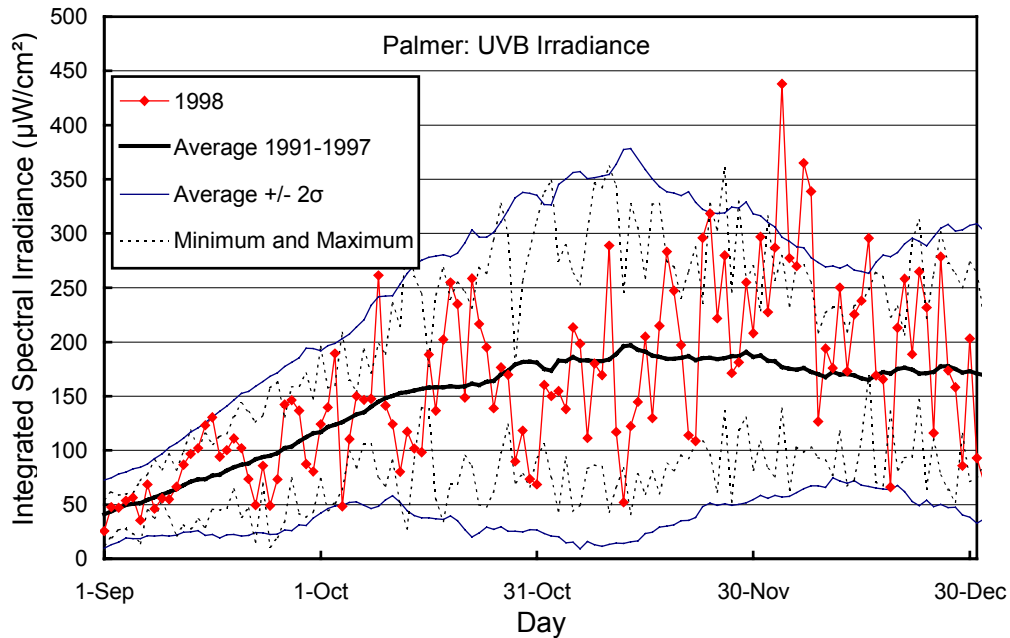


Figure 7.2.4. Noontime Palmer UV-B Irradiance. Measurements from 1998 are contrasted with the mean of measurements taken between 1991 and 1997 (thick line). Thin lines and broken lines represent the mean $\pm 2\sigma$ limits and historical minima and maxima values as in Figure 7.2.2.

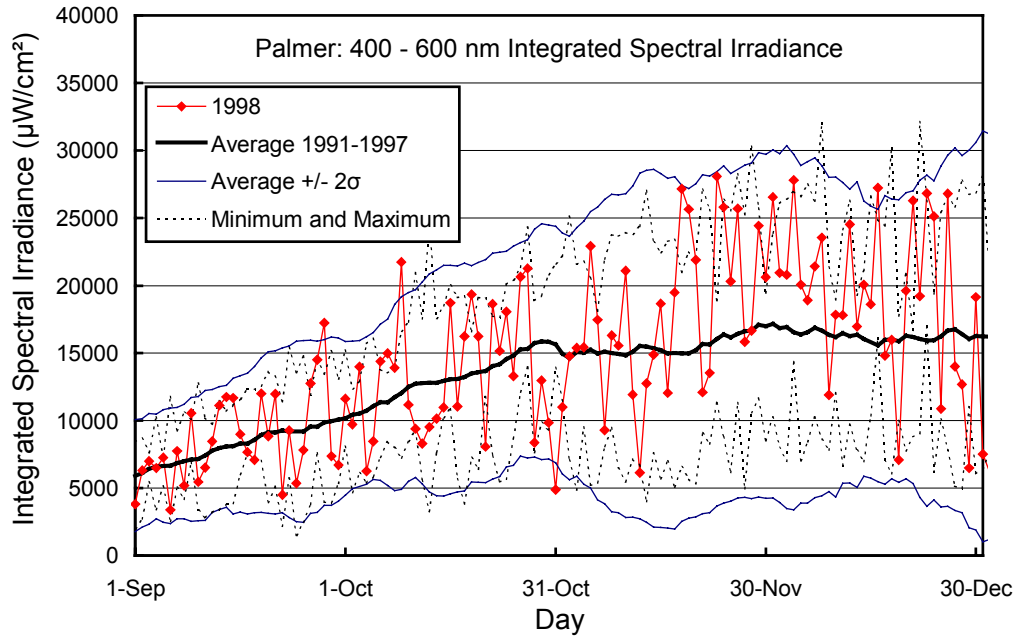


Figure 7.2.5. Noontime broadband visible irradiance (400 - 600 nm) at Palmer. Measurements from 1998 are contrasted with the mean of measurements taken between 1991 and 1997 (thick line). Thin lines and broken lines represent the mean $\pm 2\sigma$ limits, and historical minima and maxima values as in Figure 7.2.2.

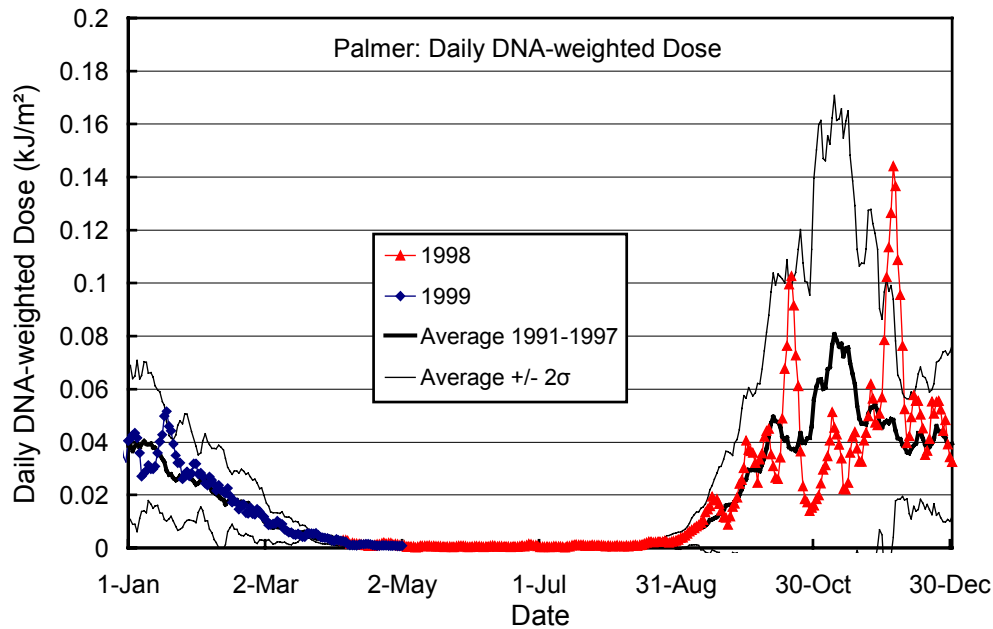


Figure 7.2.6. Daily DNA-weighted dose for Palmer. The measurements from 1998 are contrasted with the mean of measurements taken between 1991 and 1997 (thick line). The thin lines are the mean ± 2 standard deviation (mean $\pm 2\sigma$) limits, also calculated from the 1991-1997 period. A five-day running average was applied to all curves to reduce day-to-day fluctuations and make the presentation clearer.

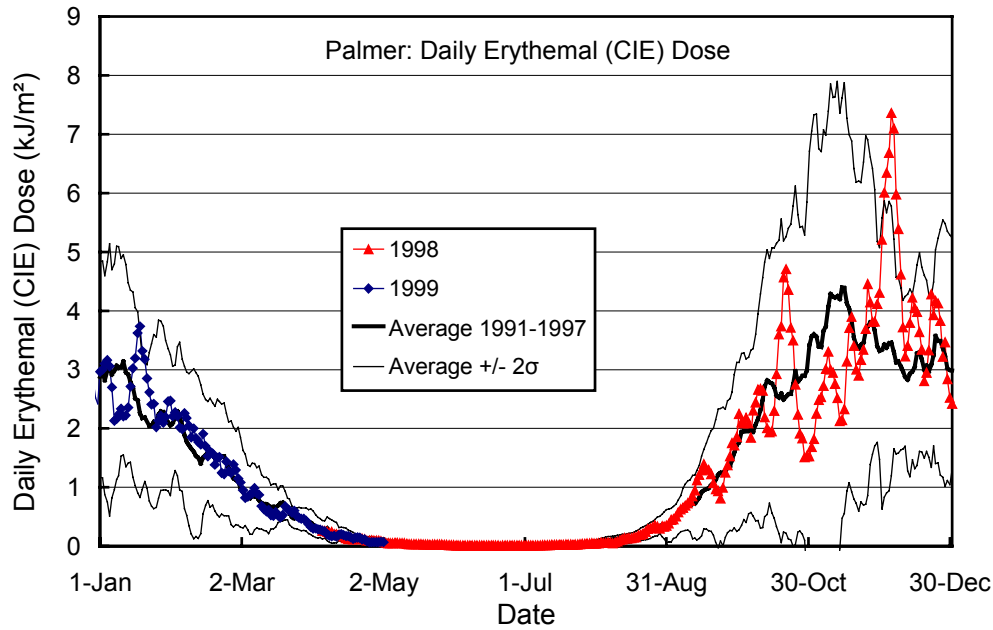


Figure 7.2.7. Daily erythemal dose for Palmer. Measurements from 1998 are contrasted with the mean of measurements taken between 1991 and 1997 (thick line). Thin lines represent the mean $\pm 2\sigma$ as in Figure 7.2.6.

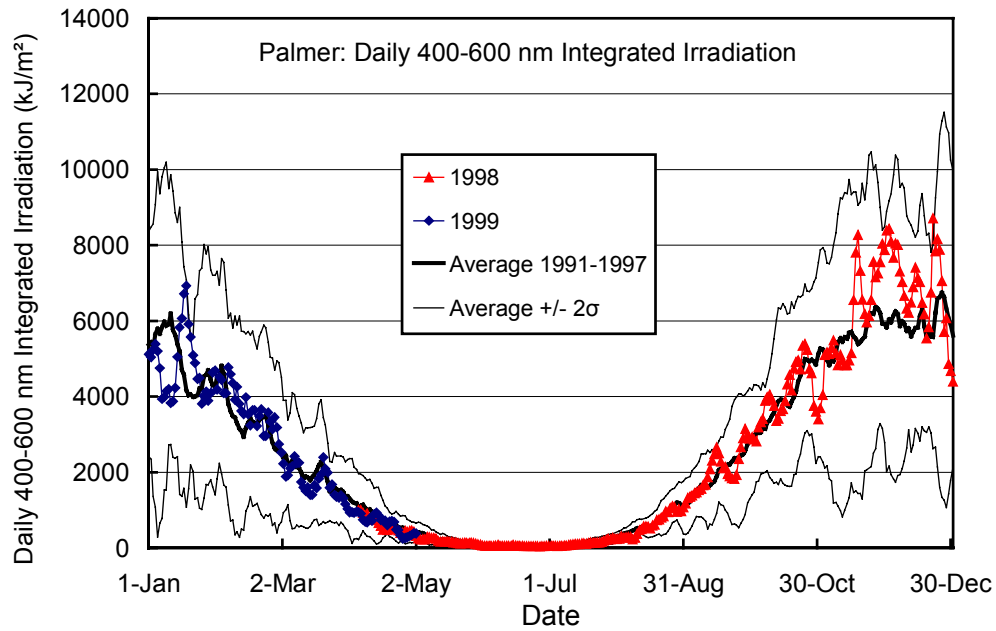


Figure 7.2.8. Daily irradiation of the 400-600 nm band for Palmer. Measurements from 1998 are contrasted with the mean of measurements taken between 1991 and 1997 (thick line). Thin lines represent the mean $\pm 2\sigma$ as in Figure 7.2.6.

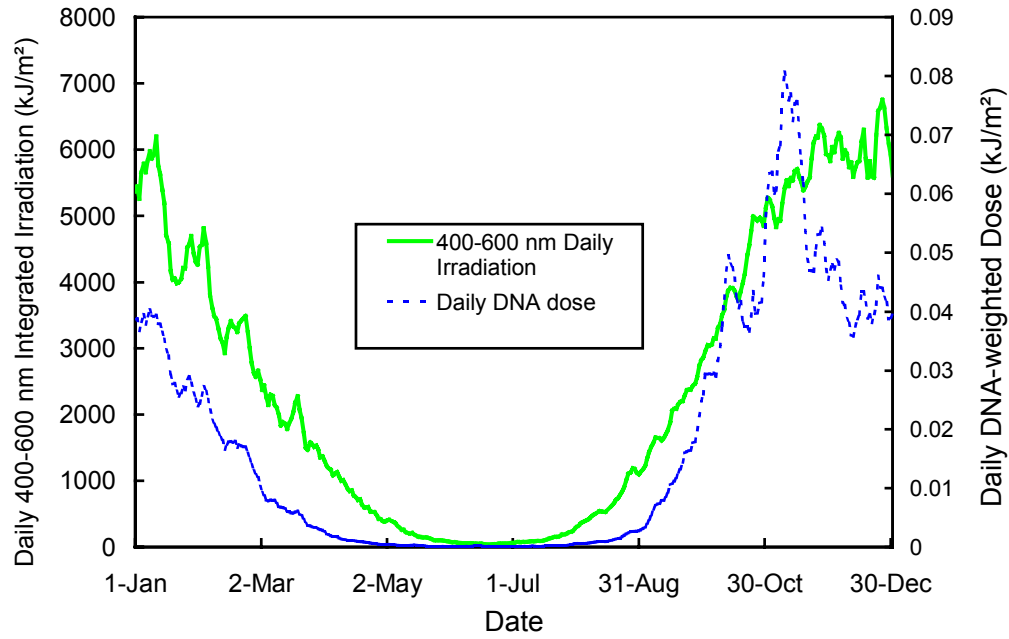


Figure 7.2.9. Comparison of DNA-weighted dose (right axis) with daily irradiation in the 400-600 nm spectral range (left axis) at Palmer. Both curves represent the mean values from the period 1991-1997 with a 5-day running average smoothing applied.