7.1. McMurdo Station

The "ozone hole" in the austral fall of 2001 was one of the largest and deepest on record. Ozone levels below 200 DU were observed by TOMS over the Antarctic continent until 12/7/01. This contrasts the situation in 2000, when a very rapid and sustained decrease of the ozone hole area started in October.

Figure 7.1.1 shows total column ozone at McMurdo Station measured by TOMS. From the beginning of September 2001 until mid October, ozone levels were clearly lower than the 1991-2000 average. Between mid-October to mid-November 2001 ozone levels were comparable to the average. During end of November and beginning of December ozone levels were amongst the lowest on record.

The signature of the ozone fluctuations can clearly be seen in UV data. The 298.51 - 303.03 nm integral (Figure 7.1.2) exhibits several peaks between 11/09/01 and 12/3/01 that are coincident with low ozone episodes. Peak values of this period where close to historic maximum levels. Erythemal noon-time irradiance values (Figure 7.1.3) show a similar pattern. Measurement on 12/3/01 exceeded values measured on that day in previous years. The peaks are even more distinct in DNA-weighted daily dose (Figure 7.1.4). Between 11/20/01 and 12/7/01, doses are about twice as high than the average. The highest value was measured on 11/26/01, which was a day with little cloud cover and low column ozone values (TOMS measured 195 DU). Erythemally weighted daily dose (Figure 7.1.5) are about 50-70% higher than the average during this period. Note that the variability of both doses is much lower between January and March than it is between September and November, the period affected by the ozone hole.

Radiation in the visible is only marginally affected by total ozone. Daily doses in the visible measured during the Volume 11 period should therefore be similar to historical observations. Yet Figure 7.1.6 suggest that daily doses in the 400-600 nm wavelength range were about 6% lower in 2001 compared to doses from previous years. This discrepancy was already described in the previous Operations Report and is due to the collector upgrade performed during the site visit in January 2000. Before the modification, the instrument's angular response exhibited an azimuth asymmetry that was most pronounced when the sun was in the North. Noon-time values were therefore significantly overestimated. This also affected daily doses due to the large contribution of measurements taken around noon to the daily integral. Measurements in the visible are more affected by this error than measurements in the UV as the ratio of direct/global irradiance increases with increasing wavelength. This can be demonstrated by plotting daily doses calculated from measurements in the 337.5 – 342.5 nm wavelength band. This spectral region is not affected by atmospheric ozone concentrations and also less prone to azimuth errors. Figure 7.1.7 shows that daily doses for this wavelength band exhibit only a difference of approximately 4% between 2001 and years prior to 2000. It can therefore be expected that the upgrade introduced only a small step-change in time-series of biologically weighted daily doses.

Both UV measurements affected by ozone and measurements in the visible showed a distinct drop in irradiance between 12/12/01 and 12/17/01. This rapid decrease in radiation levels was not caused by ozone but by unusually thick clouds.

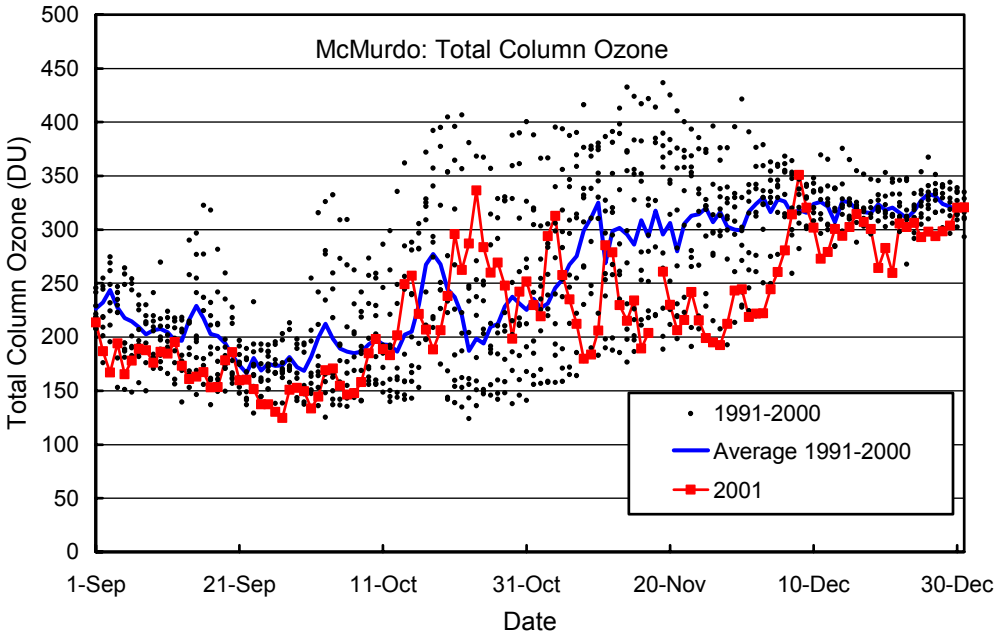

Figure 7.1.1. *Total column ozone in McMurdo. TOMS/Earth Probe measurements from 2001 are contrasted with ozone data from the years 1991-2000 recorded by TOMS /Nimbus-7(1991-1993),TOMS/ Meteor-3 (1993-1994), NOAA/TOVS (1995-1996), and TOMS/Earth Probe (1997-2001) satellites.*

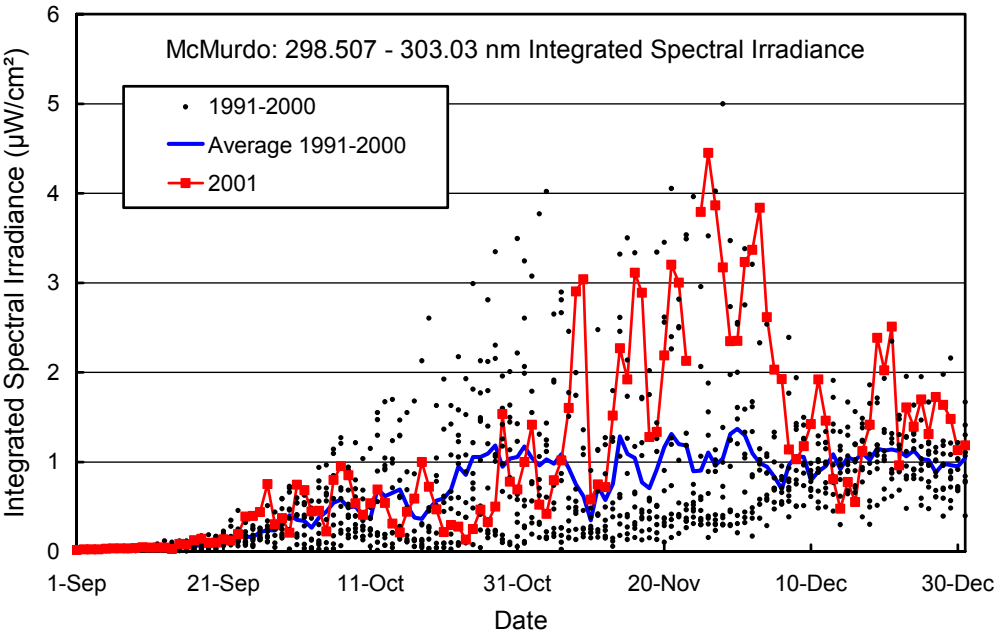

Figure 7.1.2. *Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at McMurdo. Measurements from 2001 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2000.*

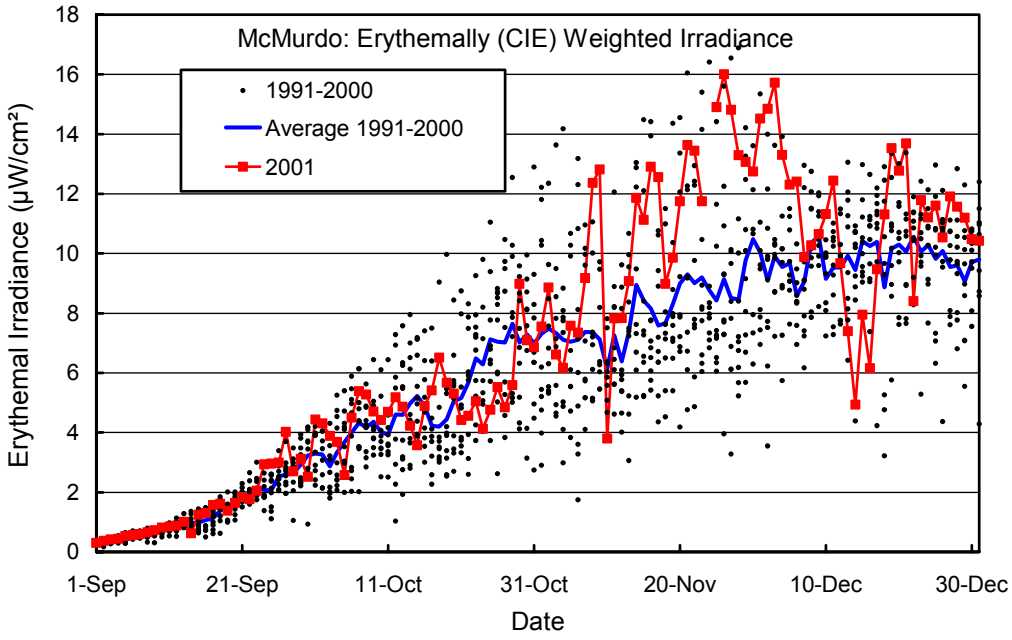

Figure 7.1.3. *Erythemally (CIE) weighted irradiance at McMurdo. Measurements from 2001 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2000.*

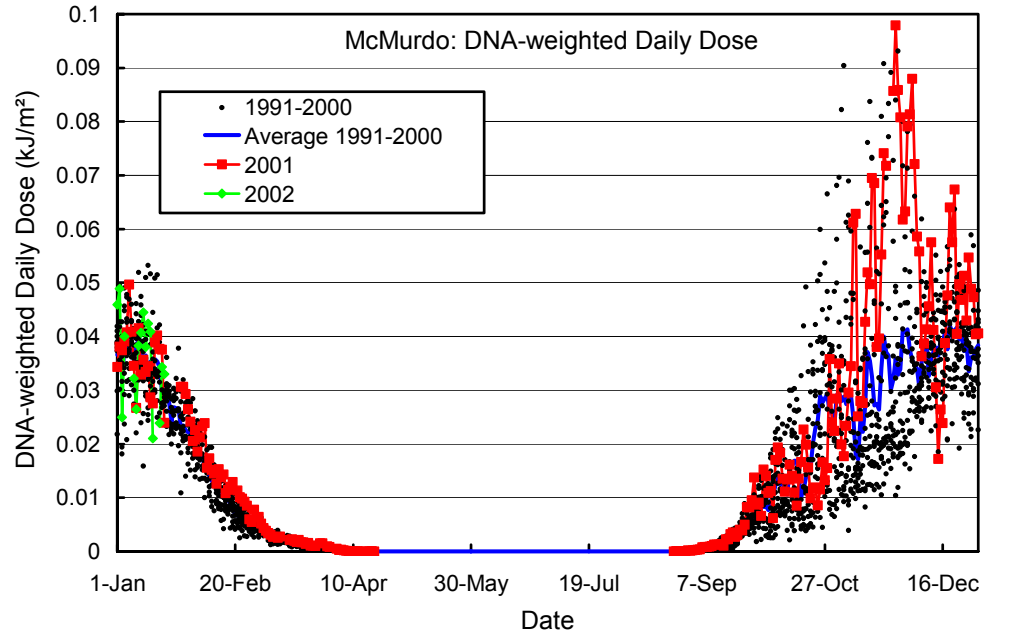

Figure 7.1.4. *Daily DNA-weighted dose for McMurdo. Volume 11 measurements from 2001 and 2002 are contrasted with individual data points and the average of measurements taken between 1991 and 2000.*

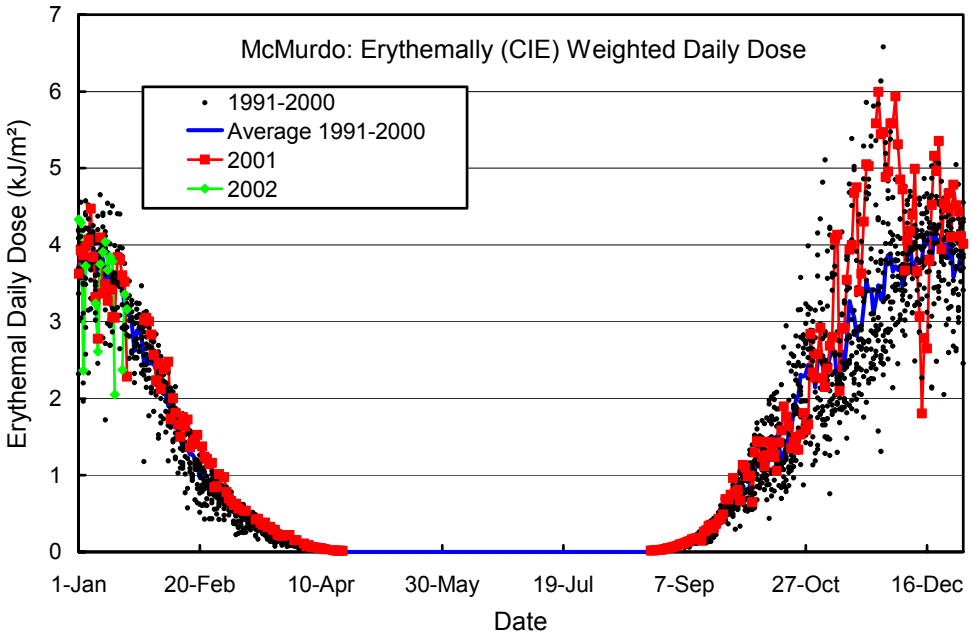

Figure 7.1.5. *Daily erythemal dose for McMurdo. Volume 11 measurements from 2001 and 2002 are contrasted with individual data points and the average of measurements taken between 1991 and 2000.*

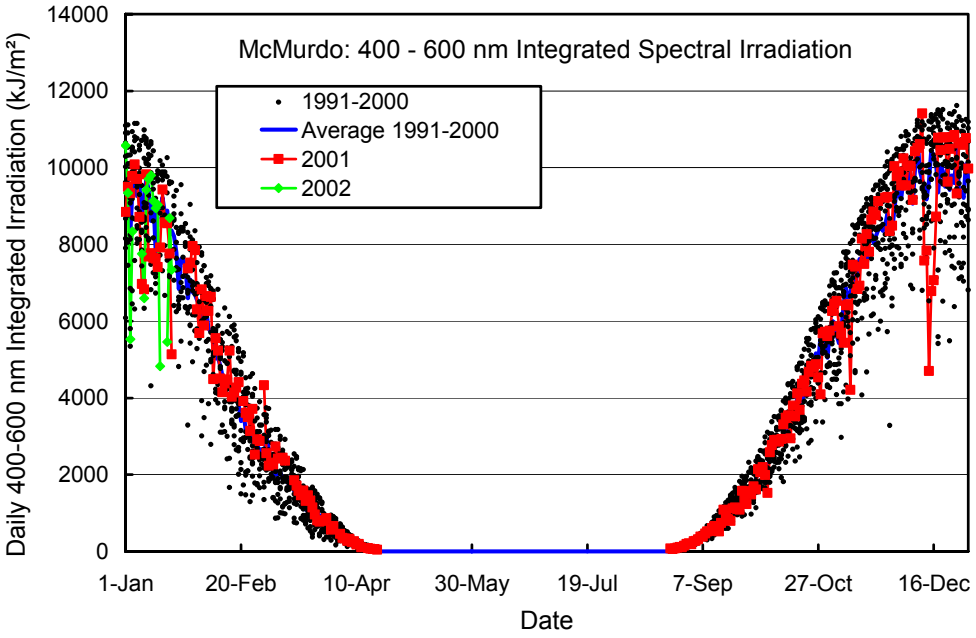

Figure 7.1.6. *Daily irradiation of the 400-600 nm band for McMurdo. Volume 11 measurements from 2001 and 2002 are contrasted with individual data points and the average of measurements taken between 1991 and 2000.*

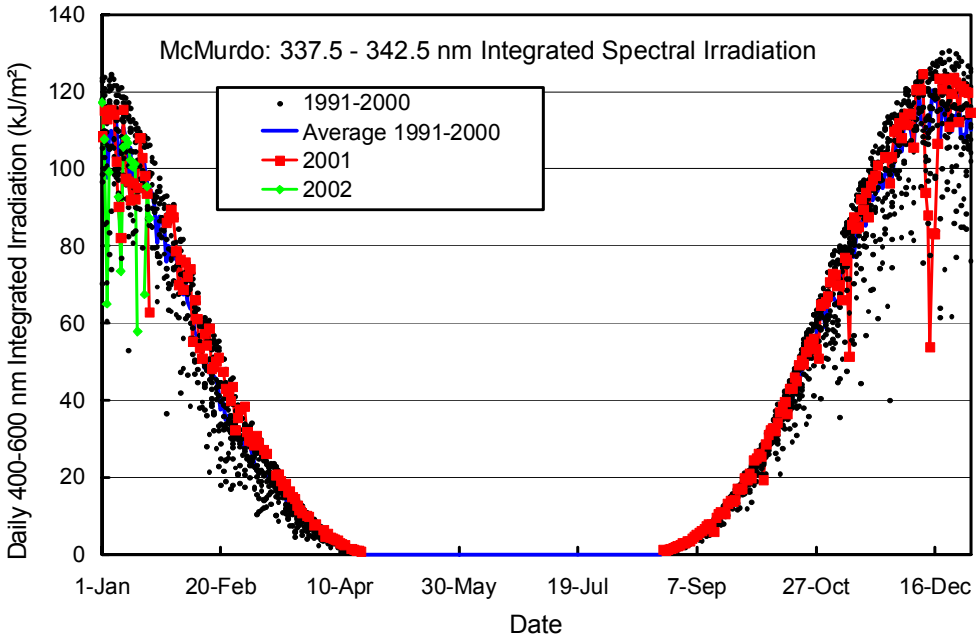

Figure 7.1.7 *Daily irradiation of the 337.5 – 342.5 nm nm band for McMurdo. Volume 11 measurements from 2001 and 2002 are contrasted with individual data points and the average of measurements taken between 1991 and 2000.*