7.1. McMurdo 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 7.1.1 shows total column ozone at McMurdo Station measured by TOMS. Ozone levels fluctuated around 200 DU until 10/6/05. Between 10/7/05 and 10/18/05, the center of the ozone hole was displaced toward the Atlantic Ocean, leading to large ozone columns at McMurdo. Between 10/21/05 and 10/25/05, the hole's center was close to McMurdo and total ozone dropped to 146 DU. For the remainder of the year, McMurdo Station was mostly outside the immediate area of the hole and ozone values were comparatively high.

Figure 7.1.2 shows measurements of the 298.51 - 303.03 nm integral at 01:00 UT. This integral is strongly affected by the total ozone column. Radiation levels are below the long-term mean until 10/18/05. Relatively high levels were measured between 10/21/05 and 10/25/05, which is the period with low ozone columns. Erythemal irradiance (Figure 7.1.3), DNA-weighted daily dose (Figure 7.1.4), and erythemal daily dose (Figure 7.1.5) show a similar pattern but with reduced amplitude due to the lesser dependence of these data products on atmospheric ozone amounts.

Note that the figures also include Volume 14 measurements from January 2005. Measurements between 1/3/05 and 1/9/05 were exceptionally low at all wavelengths when a storm with high cloudiness passed over McMurdo. Similar low radiation levels were measured by the PSP and TUVR instruments.

Radiation in the visible is only marginally affected by total ozone. Daily doses in the visible measured under cloudless skies during the Volume 15 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 10-15% lower in 2005 compared to the envelope formed by clear-sky observations from prior years. The reason is related to the collector upgrade performed during the site visit in January 2000 (see Volume 10 and 11 Operations Reports). 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 measurements in the visible were overestimated by about 5-10%. This also affected daily doses due to the large contribution of measurements taken around solar noon to the daily integral. The collector upgrade removed the azimuth asymmetry but slightly increased the average cosine error. Measurements taken after the collector upgrade tend to be low by 3-5%. The diffuser modification therefore introduced a step-change of about 8-15% in time series of "visible" solar data. Measurements in the UV are less affected by this problem as the contribution of the direct solar beam to global irradiance is comparatively small in the UV. We estimate the step change in biologically weighted data to be less than 5%. In order to remove the step change and to improve the overall data accuracy we have reprocessed the entire McMurdo data set. The new data set is named "Version 2" and is available at http://www.biospherical.com/nsf/Version2/Version2.asp. A publication introducing Version 2 data from McMurdo was published by *Journal of Geophysical Research* (*Bernhard et al*., 2006).

[+] See http://www.wmo.int/web/arep/05/bulletin-8-2005.pdf

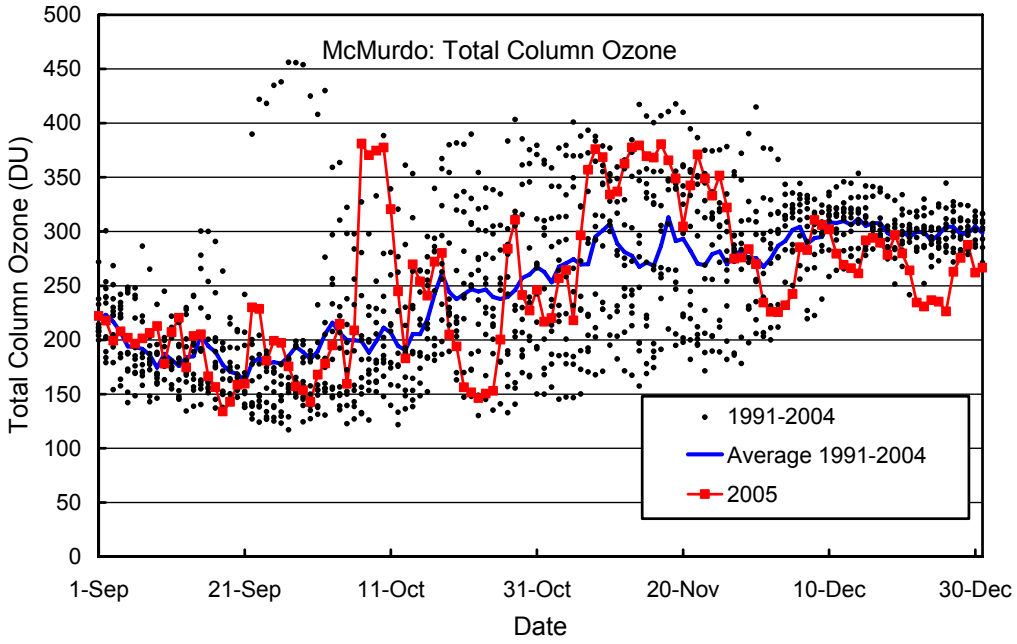

Figure 7.1.1. *Total column ozone in McMurdo. TOMS/Earth Probe measurements from 2005 are contrasted with ozone data from the years 1991-2004 recorded by TOMS /Nimbus-7(1991-1993) and TOMS/Earth Probe (1996-2004) satellites. All TOMS data are from the "TOMS Version 8" data edition.*

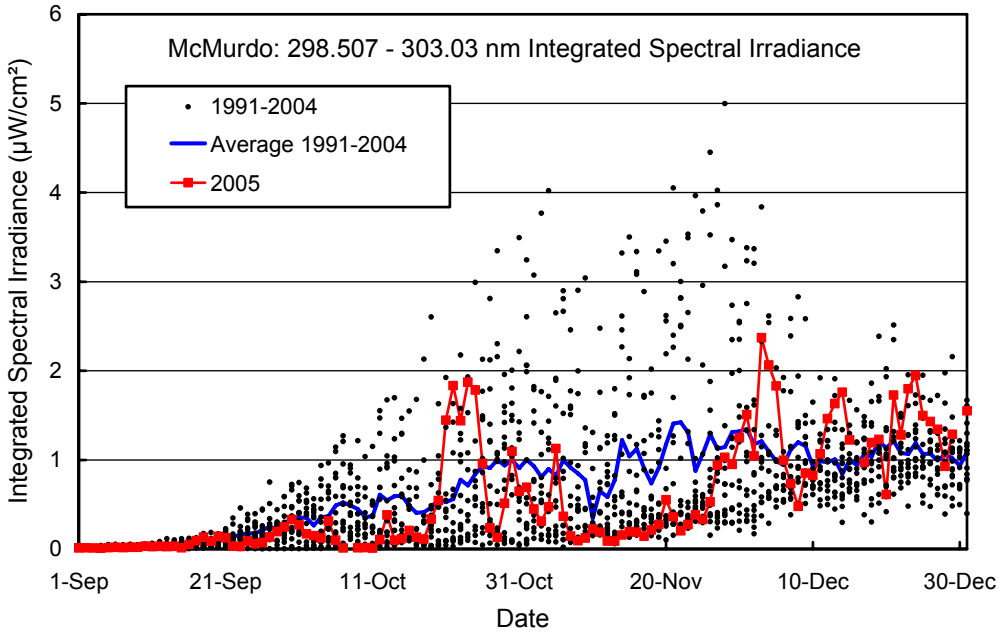

Figure 7.1.2. *Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at McMurdo. Measurements from 2005 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2004.*

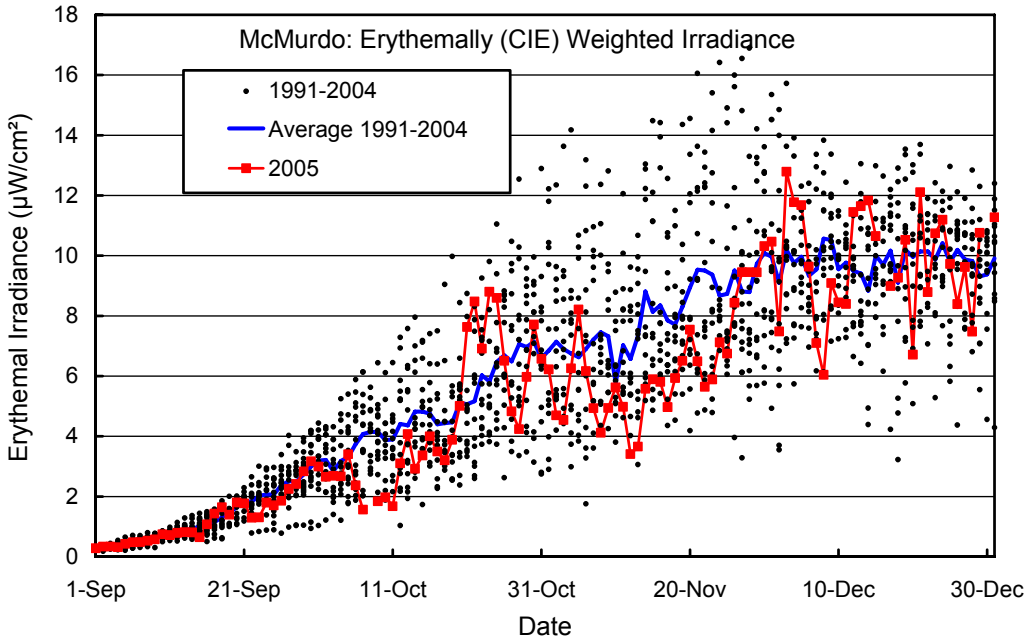

Figure 7.1.3. *Erythemally (CIE) weighted irradiance at McMurdo. Measurements from 2005 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2004.*

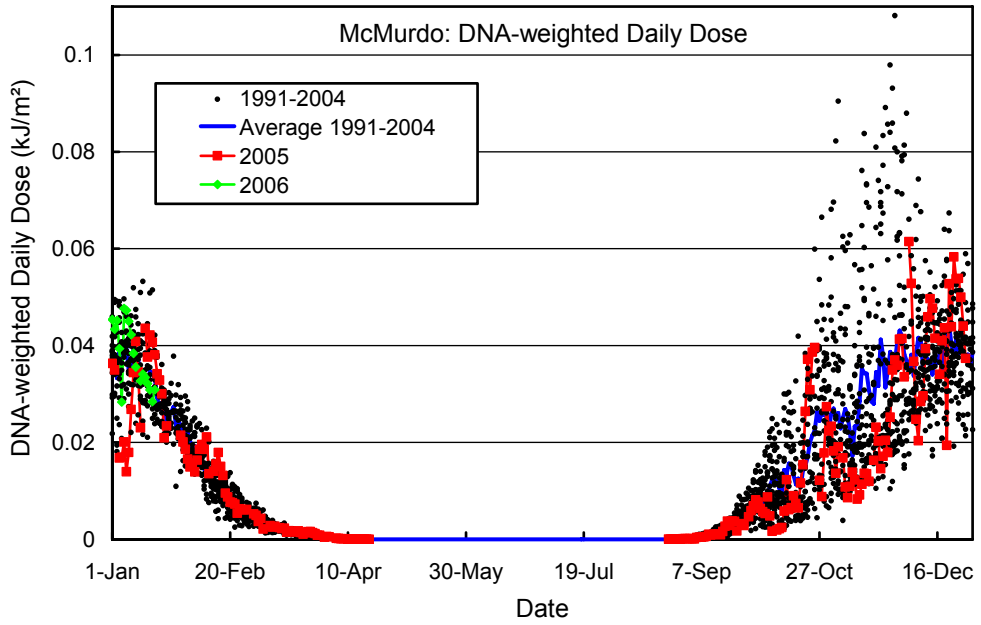

Figure 7.1.4. *Daily DNA-weighted dose for McMurdo. Volume 15 measurements from 2005 and 2006 are contrasted with individual data points and the average of measurements taken between 1991 and 2004.*

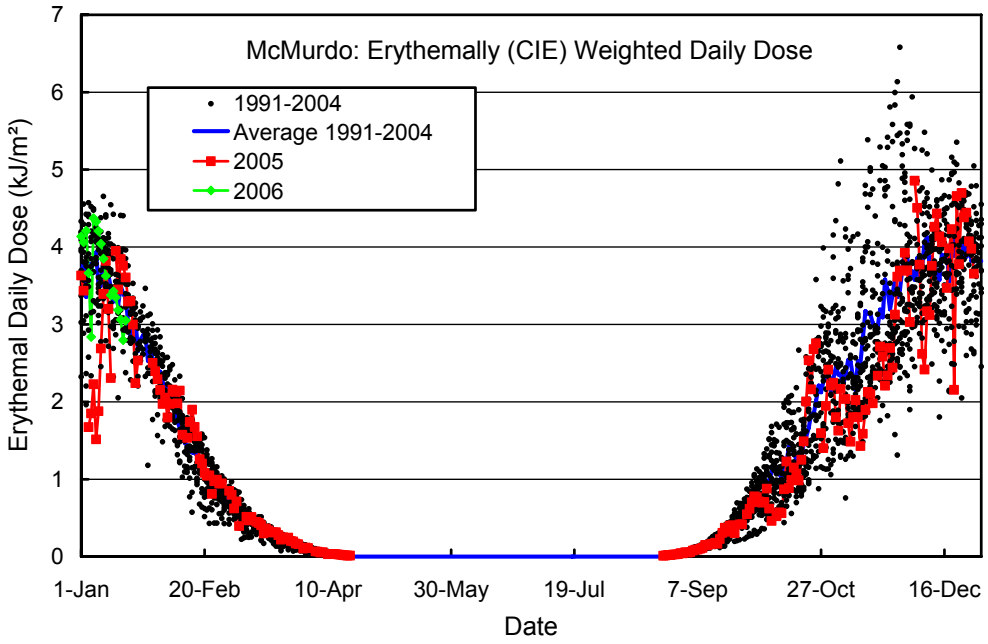

Figure 7.1.5. *Daily erythemal dose for McMurdo. Volume 15 measurements from 2005 and 2006 are contrasted with individual data points and the average of measurements taken between 1991 and 2004.*

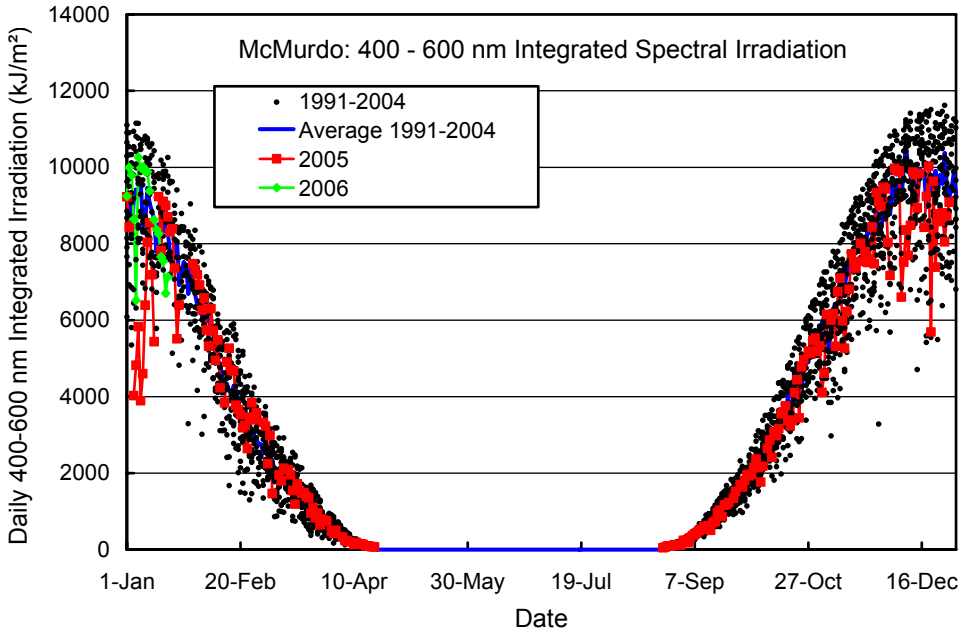

Figure 7.1.6. *Daily irradiation of the 400-600 nm band for McMurdo. Volume 15 measurements from 2004 and 2005 are contrasted with individual data points and the average of measurements taken between 1991 and 2004.*