

## 7.1. McMurdo Station

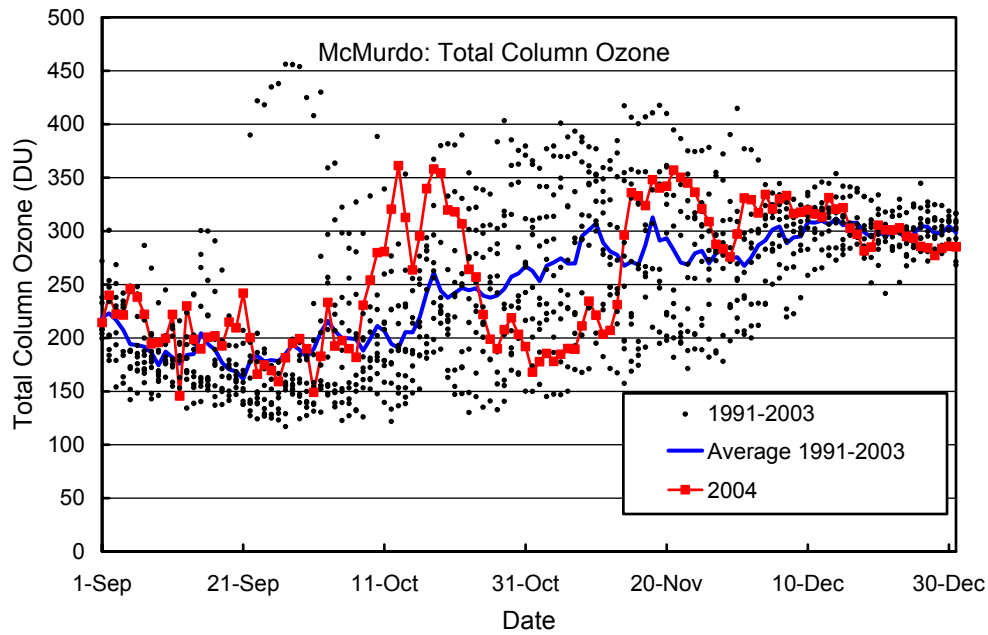
The Antarctic “ozone hole” in the austral spring of 2004 was considerably smaller than the average size observed during the last decade. According to “ozone bulletins” published by the World Meteorology Organization, meteorological conditions in the stratosphere during mid October limited the depth and size of the ozone hole in 2004. However, stable meteorological conditions that promote the persistence and intensity of the ozone hole replaced the earlier less stable conditions and permitted the gradual growth of the ozone hole into mid November. This led to comparatively high UV levels during the first two weeks of November.

Figure 7.1.1 shows total column ozone at McMurdo Station measured by TOMS. Ozone levels fluctuated around 200 DU until 10/7/04. Between 10/9/04 and 10/24/04, total ozone was clearly above the long-term mean calculated from data measured between 1991 and 2003. Ozone columns during the first two weeks of November were considerably below the mean. The ozone hole finally started to dissolve around 11/15/04.

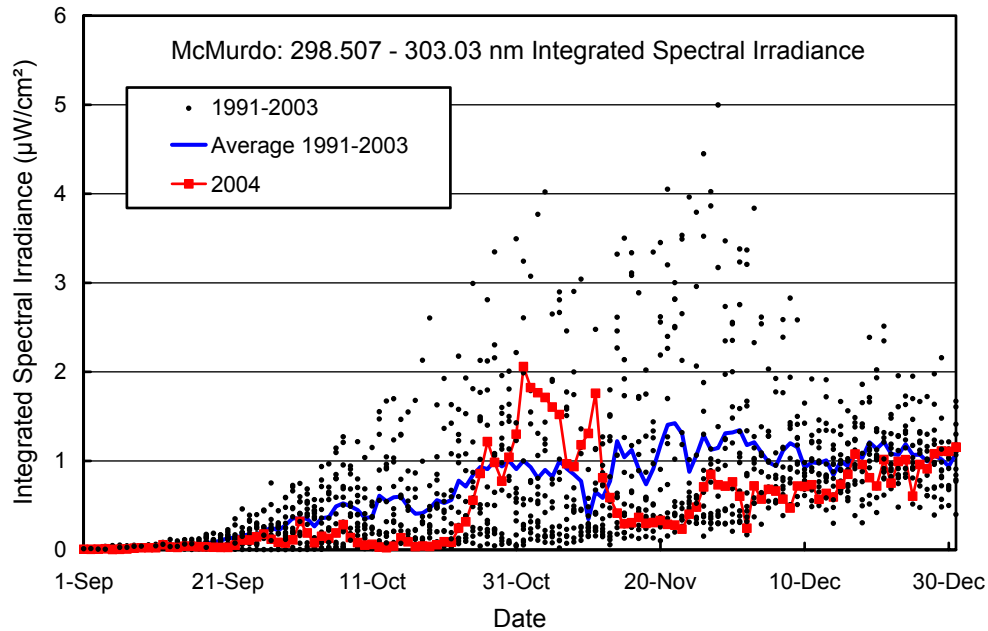
Figure 7.1.2 shows measurements of the 298.51 - 303.03 nm integral at 01:00 UT. This integral is strongly affected by the total ozone column. Radiation levels are well below the long-term mean until 10/25/04. Relatively high levels were measured between 11/1/04 and 11/11/04, which is the period with 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.

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 TUVB instruments.

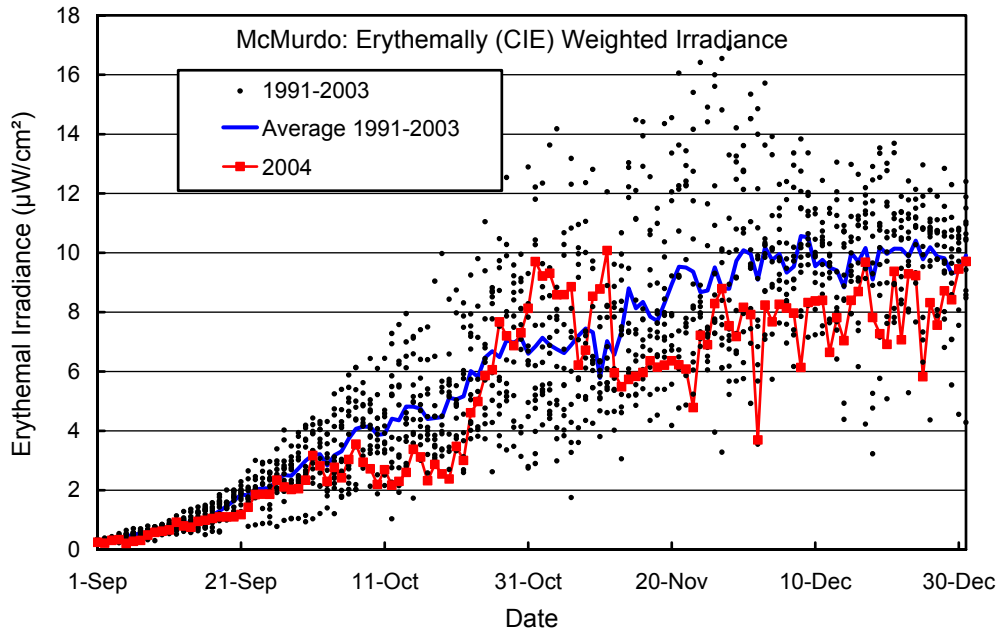
Radiation in the visible is only marginally affected by total ozone. Daily doses in the visible measured under cloudless skies during the Volume 14 period should therefore be similar to historical observations. Yet Figure 7.1.6 suggest that daily doses in the 400-600 nm wavelength range were about 10-15% lower in 2004 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>.



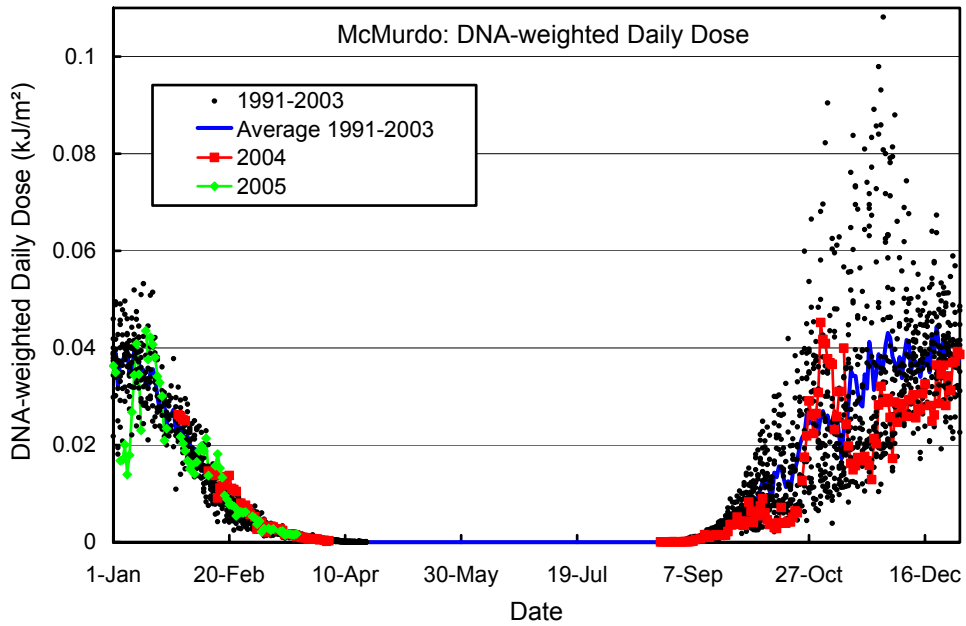
**Figure 7.1.1.** Total column ozone in McMurdo. TOMS/Earth Probe measurements from 2004 are contrasted with ozone data from the years 1991-2003 recorded by TOMS/Nimbus-7(1991-1993) and TOMS/Earth Probe (1996-2003) satellites. All TOMS data are from the “TOMS Version 8” data edition.



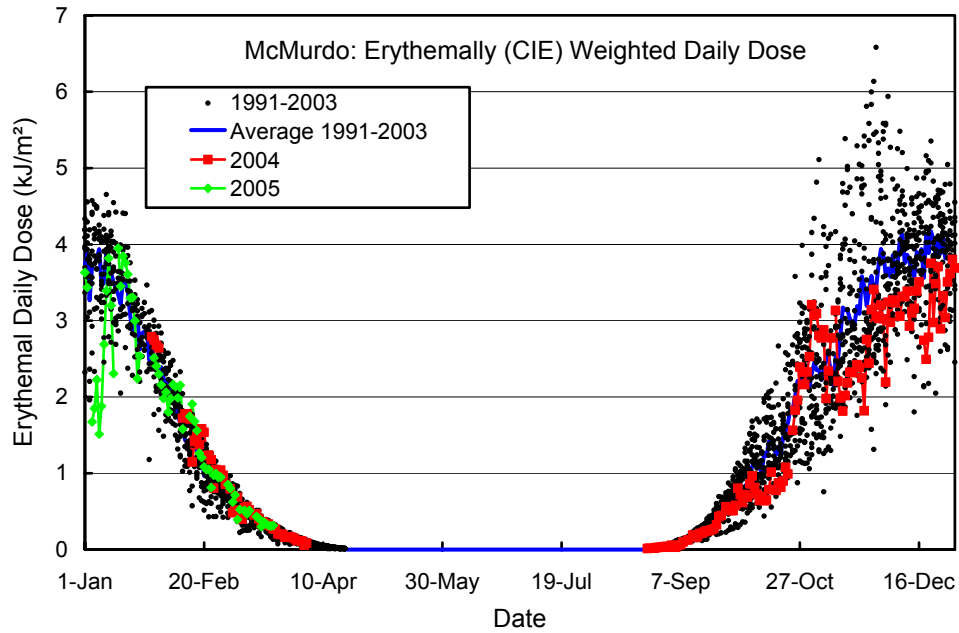
**Figure 7.1.2.** Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at McMurdo. Measurements from 2004 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2003.



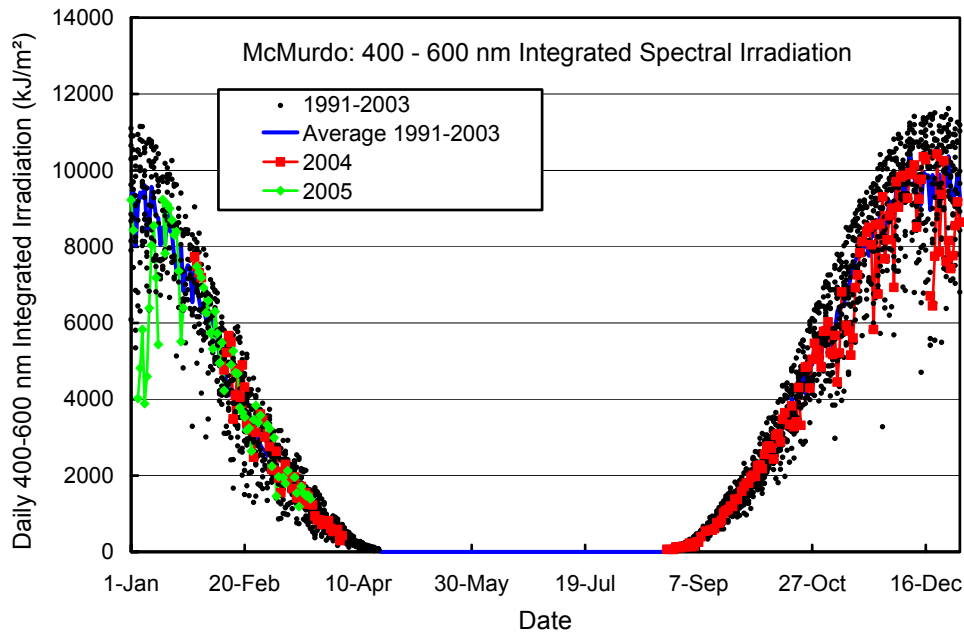
**Figure 7.1.3.** Erythemally (CIE) weighted irradiance at McMurdo. Measurements from 2004 (squares) are contrasted with individual data points and the average of measurements taken between 1991 and 2003.



**Figure 7.1.4.** Daily DNA-weighted dose for McMurdo. Volume 14 measurements from 2004 and 2005 are contrasted with individual data points and the average of measurements taken between 1991 and 2003.



**Figure 7.1.5.** Daily erythemal dose for McMurdo. Volume 14 measurements from 2004 and 2005 are contrasted with individual data points and the average of measurements taken between 1991 and 2003.



**Figure 7.1.6.** Daily irradiation of the 400-600 nm band for McMurdo. Volume 14 measurements from 2004 and 2005 are contrasted with individual data points and the average of measurements taken between 1991 and 2003.