7.1. McMurdo Station

The size of Antarctic ozone hole in the austral fall of 2007 was slightly above the 10-year average, both in depth and overall area. The ozone hole area reached a maximum of approximately 25 million km^2 in mid-September, according to data of the Ozone Monitoring Instrument (OMI) onboard NASA's AURA satellite. The minimum total ozone column within the vortex was 107 DU and was observed by OMI on 30 September 2007. While the 2007 ozone hole was not as deep and large as the ozone hole of 2006, it lasted exceptionally long. Small areas with ozone columns below 230 DU were still present even at the end of December, according to OMI. The late break-up led to unusually large UV levels during the second half of December at McMurdo.

Figure 7.1.1 shows total column ozone at McMurdo Station measured by satellites. Total ozone observations between 5 and 19 November 2007 were low compared to measurements of the last 15 years. The late break-up of the ozone hole is most apparent by the low ozone values between 19 and 24 December.

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 atmospheric ozone amount. Measurements were well below the climatological mean in September and October but low atmospheric ozone concentrations in November led to some marked spikes. Comparatively large values were also observed between 19 and 24 December.

Figure 7.1.3 shows the daily maximum UV Index at McMurdo. It peaked between 7 and 19 November, the maximum UV Index of 5.5 occurred on 15 November. UV Indices in excess of 5 were also observed on 19 and 20 November.

The DNA-weighted daily dose and the erythemal daily dose are shown in Figures 7.1.4 and 7.1.5, respectively. The effect of the ozone hole can clearly be seen when comparing measurements from spring and fall. Both datasets exhibit a similar pattern but the amplitude of the ozone influence is smaller for erythemal dose.

Figure 7.1.6 shows daily doses integrated over the wavelength range 400-600 nm. Measurements in this wavelength range are only marginally affected by ozone absorption. Data measured under cloudless skies during the Volume 17 period should therefore be similar to historical observations. Figure 7.1.6 suggest that daily doses were about 8-10% lower in 2007 compared to the envelope formed by clear-sky observations from previous 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 since the contribution of the direct solar beam to global irradiance is comparatively small in the UV. The step change in biologically weighted data is typically 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 "Version 2" dataset is available at http://www.biospherical.com/nsf/Version2/Version2.asp. Figure 7.1.6 was redrawn based on Version 2 data, and results are shown in Figure 7.1.7. Clear-sky data from the Volume 17 period agree well with the upper envelope formed by historical measurements. A publication introducing Version 2 data from McMurdo was published by *Journal of Geophysical Research* (*Bernhard et al*., 2006). We recommend the use Version 2 data due to their higher accuracy.

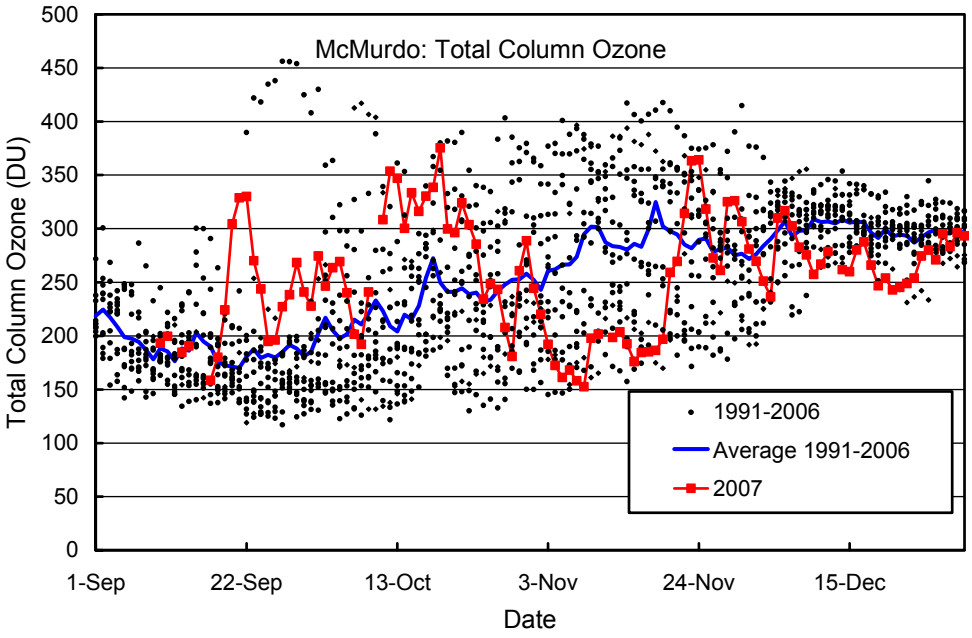

Figure 7.1.1. *Total column ozone in McMurdo. OMI measurements from 2007 are contrasted with ozone data from the years 1991-2005 recorded by TOMS /Nimbus-7(1991-1993), TOMS/Earth Probe (1996-2004), and OMI (2005-2006). TOMS data are from the "TOMS Version 8" data edition. OMI data are from the Version 8.5 (collection 3) data edition.*

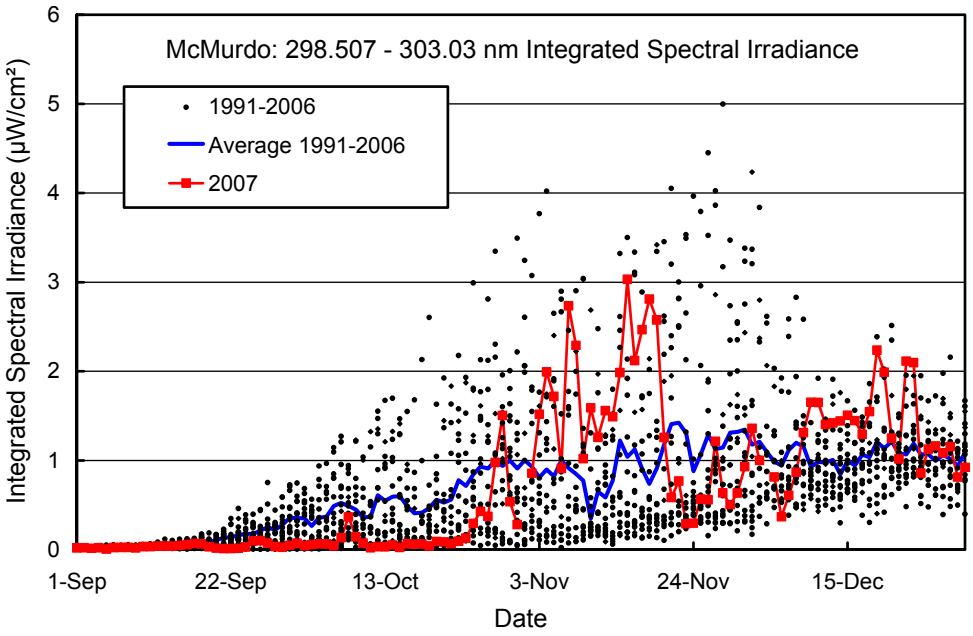

Figure 7.1.2. *Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at McMurdo. Measurements from 2007 are contrasted with individual data points and the average of measurements taken between 1991 and 2006.*

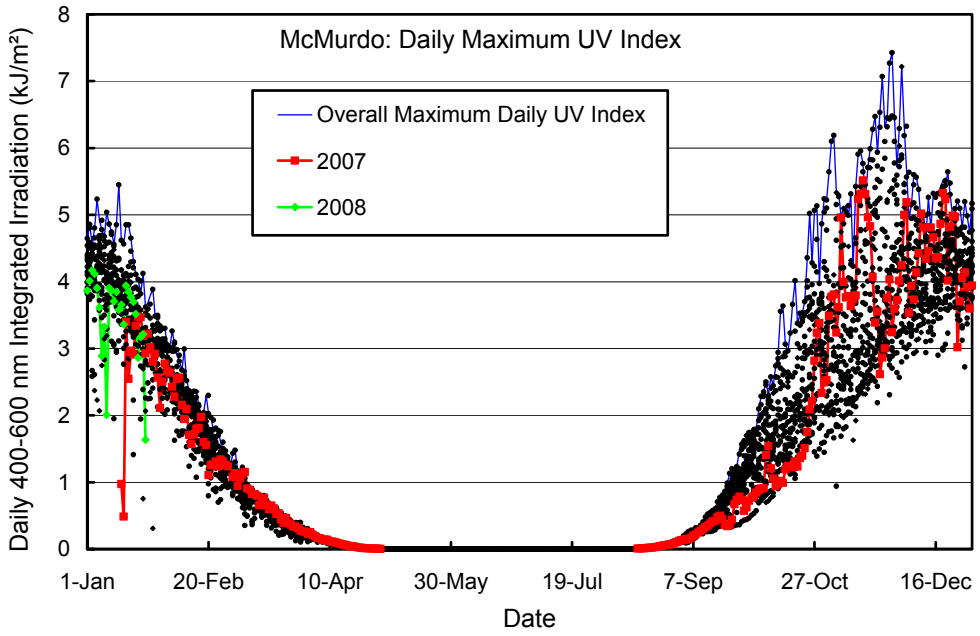

Figure 7.1.3. *Daily Maximum UV Index at McMurdo. Measurements from 2007 and 2008 are contrasted with individual data points and the average of measurements taken between 1991 and 2006.*

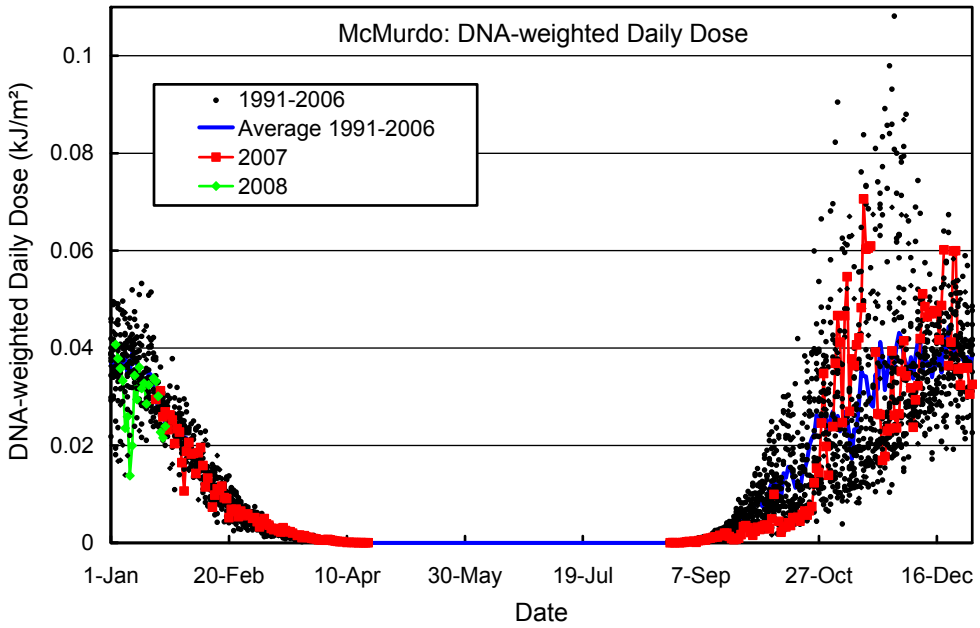

Figure 7.1.4. *Daily DNA-weighted dose for McMurdo. Volume 17 measurements from 2007 and 2008 are contrasted with individual data points and the average of measurements taken between 1991 and 2006.*

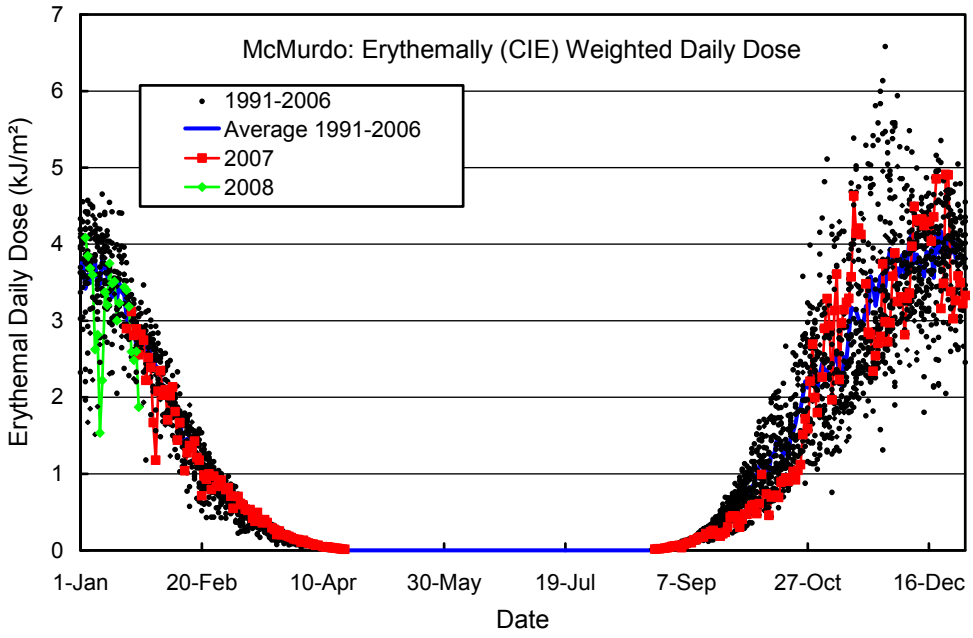

Figure 7.1.5. *Daily erythemal dose for McMurdo. Volume 17 measurements from 2007 and 2008 are contrasted with individual data points and the average of measurements taken between 1991 and 2006.*

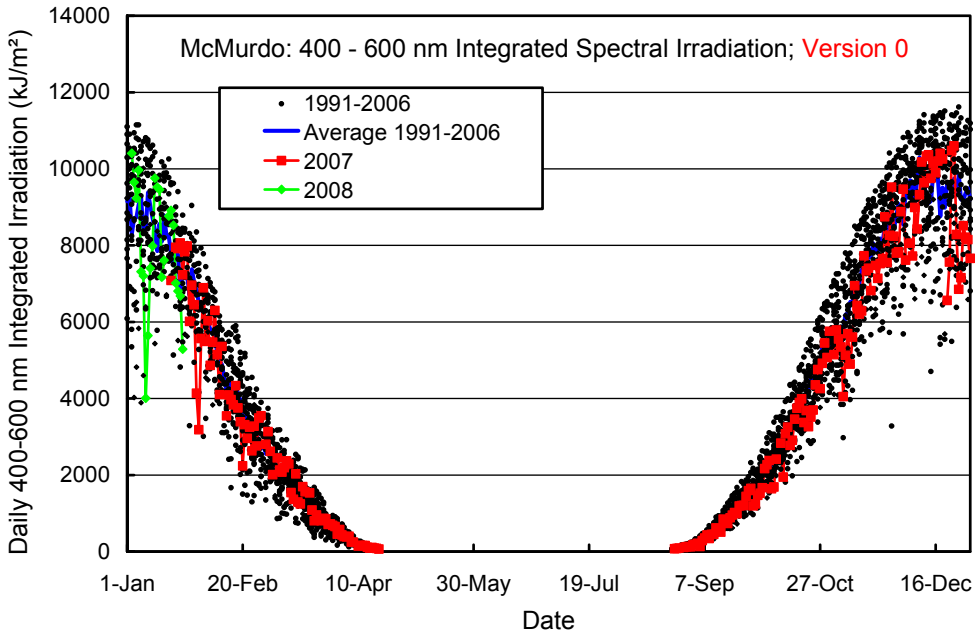

Figure 7.1.6. *Daily irradiation of the 400-600 nm band for McMurdo. Volume 17 measurements from 2007 and 2008 are contrasted with individual data points and the average of measurements taken between 1991 and 2006. Data are based on the "Version 0" data release discussed in this report. Figure 7.1.7 shows the same wavelength integral based on "Version 2" data.*

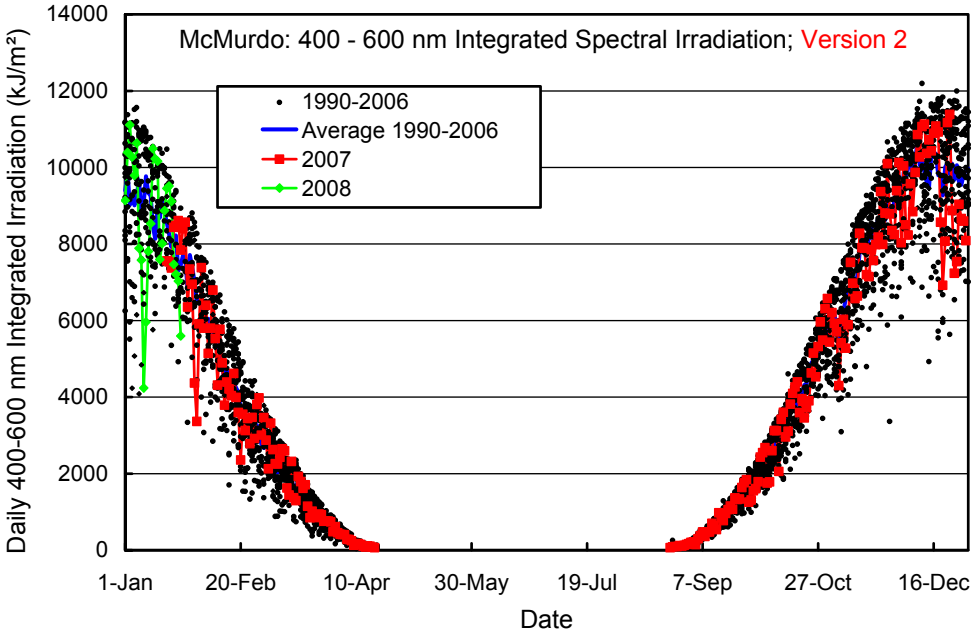

Figure 7.1.7. *Daily irradiation of the 400-600 nm band for McMurdo. Volume 17 measurements from 2007 and 2008 are contrasted with individual data points and the average of measurements taken between 1990 and 2006. Data are based on the "Version 2" data release , which are generally not subject of this report.*