

7.2. Palmer Station

According to the World Meteorological Organisation⁺, the Antarctic “ozone hole” in the austral fall of 2008 reached a maximum 27 million km². This is only slightly smaller than the all-time record of 29 million km² that was observed in 2006. The ozone hole is typically closed by mid-December but lasted exceptionally long in 2008: areas with total ozone below 220 DU were observed until the end of December 2008, according to measurements of NOAA’s SBUV/2 satellites¹. The minimum ozone column in 2008 was 100 DU and was reached on 4-October, according to measurements by the Ozone Monitoring Instrument (OMI) onboard NASA’s AURA satellite. The value of 100 DU is similar to the average “minimum total ozone” observed between 1990 and 2001².

Figure 7.2.1 shows total column ozone measured by satellites at Palmer Station. A large day-to-day variability can be observed. Measurements from 2008 are generally within the range defined by measurements of previous years. A notable exception is the period of 22-31 December when total ozone was the lowest since the start of ozone observations at this site. On 22 and 29 October as well as 25 November, total ozone was close to the lower border of the envelope formed by measurements of prior years. The minimum total ozone was 137 DU and observed on 22-October 2008.

Noontime values of the 298.51 - 303.03 nm integral (Figure 7.2.2) anticorrelate with ozone. For example, the peak in UV irradiance on 28-October and 24-November 2008 occurred when total ozone was exceptionally low. The daily maximum UV Index was 10 on 24-November 2008 (Figure 7.2.3).

Figure 7.2.4 and Figure 7.2.5 show the annual cycles in DNA-weighted daily dose and erythemally weighted daily dose, respectively. Doses observed between September and November are generally below the average. Exceptions are the periods 3-6 October, 19-22-October, 28-29 October, and 23-28 November when the ozone column was low. Both figures also demonstrate that variability in daily UV doses is much smaller between January and March than it is between September and November, the period affected by the ozone hole.

Daily doses in the 400-600 nm range are shown in Figure 7.2.6. This data product depends only little on atmospheric ozone concentrations. For the months of January and February, measurements of 2008 and 2009 varied about the long-term mean calculated from measurements of the years 1991-2007. For the months of September to November, measurements of 2008 were well below the long-term average, indicating larger-than-usual attenuation by clouds in 2008. Additional analysis revealed that the monthly average irradiation for the three months was one of the lowest in the history of the network. The comparatively large attenuation by clouds seen in the visible also affected UV levels. This may explain why DNA and erythemally weighted daily doses were comparatively low in 2008.

⁺ See http://www.wmo.ch/pages/prog/arep/gawozobull06_en.html

¹ See http://www.cpc.ncep.noaa.gov/products/stratosphere/polar/gif_files/ozone_hole_plot.png

² See ftp://jwocky.gsfc.nasa.gov/pub/eptoms/images/qcplots/zmqchl_v8.png

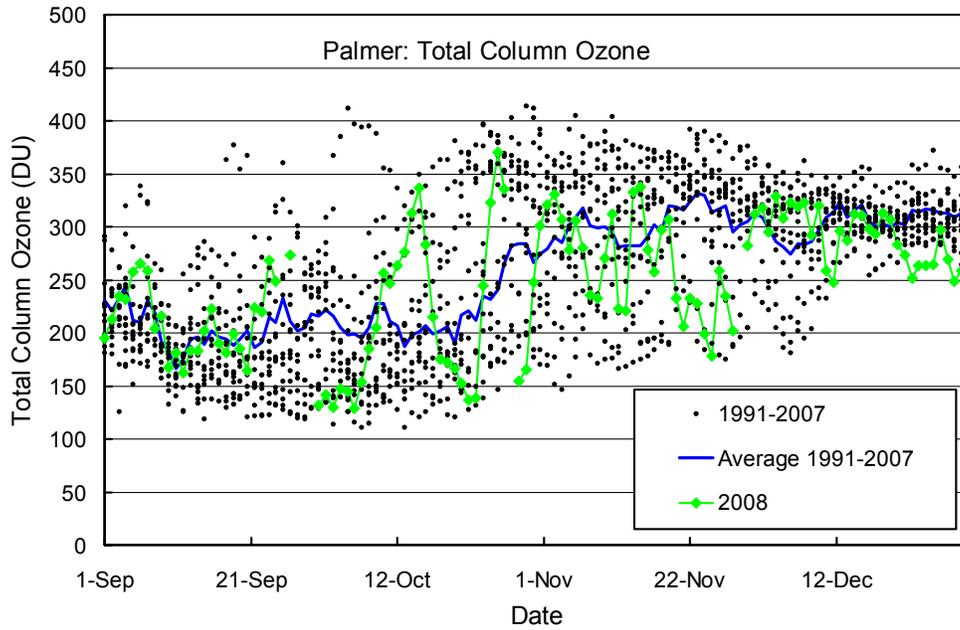


Figure 7.2.1. Total column ozone in Palmer. OMI measurements from 2008 are compared with ozone data from the years 1991-1999 recorded by TOMS /Nimbus-7(1991-1993), TOMS/ Meteor-3 (1993-1994), NOAA/TOVS (1995-1996), TOMS/Earth Probe (1997-2003) satellites, and OMI (2004-2007).

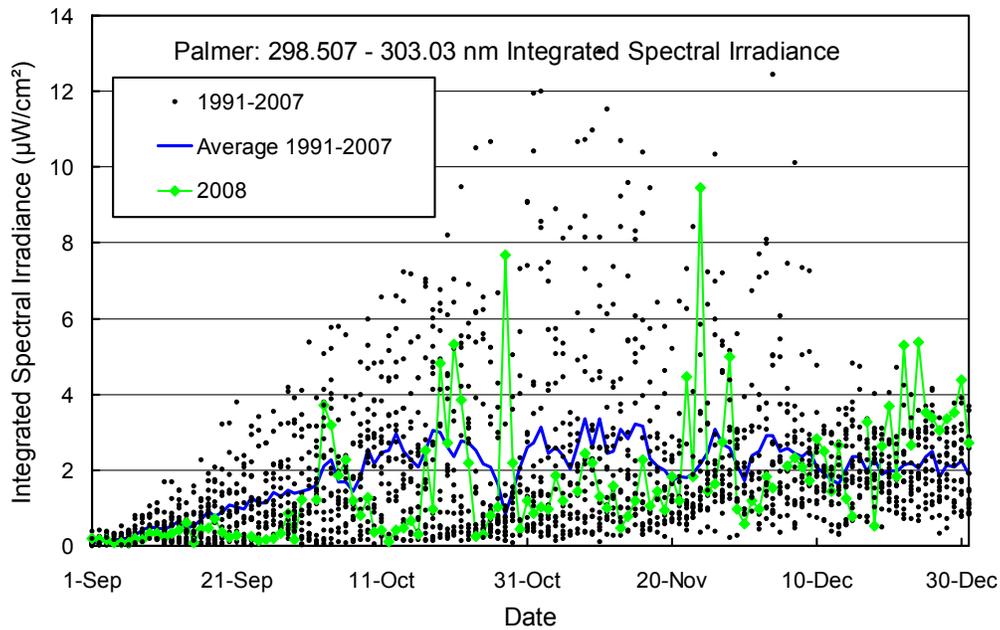


Figure 7.2.2. Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at Palmer. Measurements from 2008 are compared with individual data points and the average of measurements taken between 1991 and 2007.

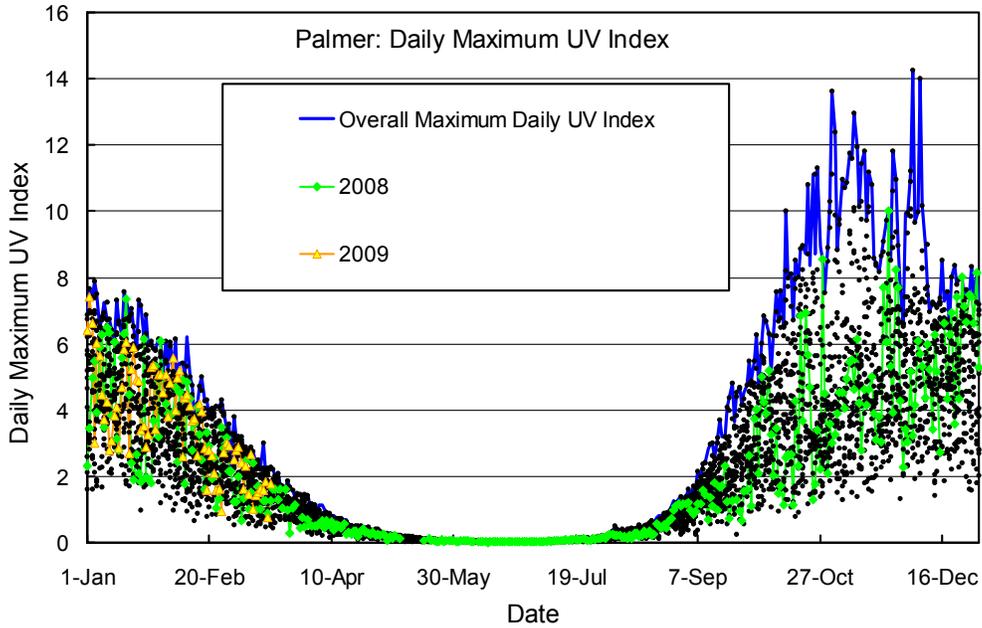


Figure 7.2.3. The daily maximum UV Indices at Palmer Station measured in 2008 and 2009 are compared with UV Indices measured between 1991 and 2007. The overall maximum daily UV Index is also highlighted.

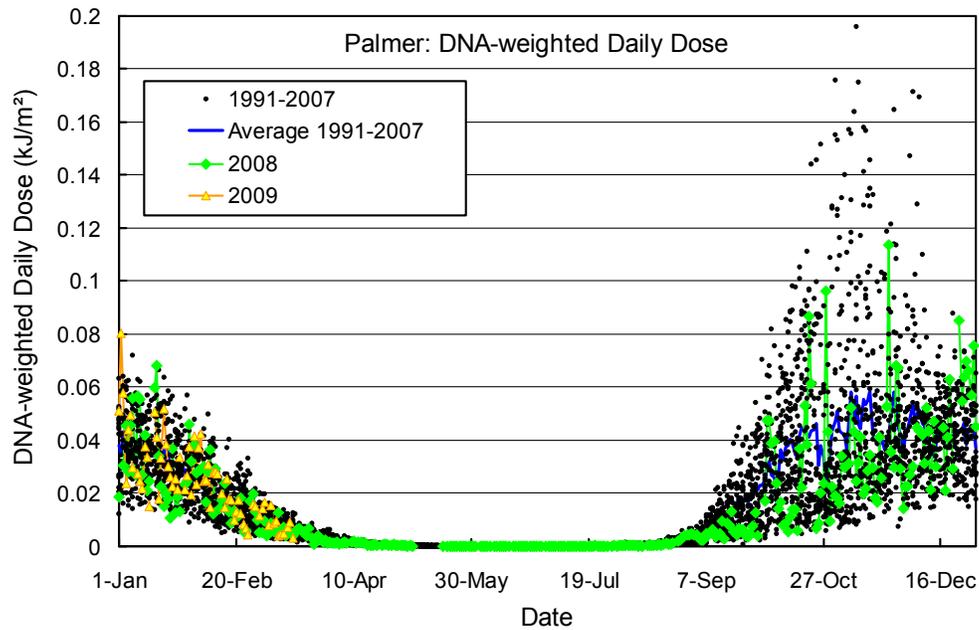


Figure 7.2.4. Daily DNA-weighted dose for Palmer. Volume 18 measurements from the years 2008 and 2009 are compared with individual data points and the average of measurements taken between 1991 and 2007.

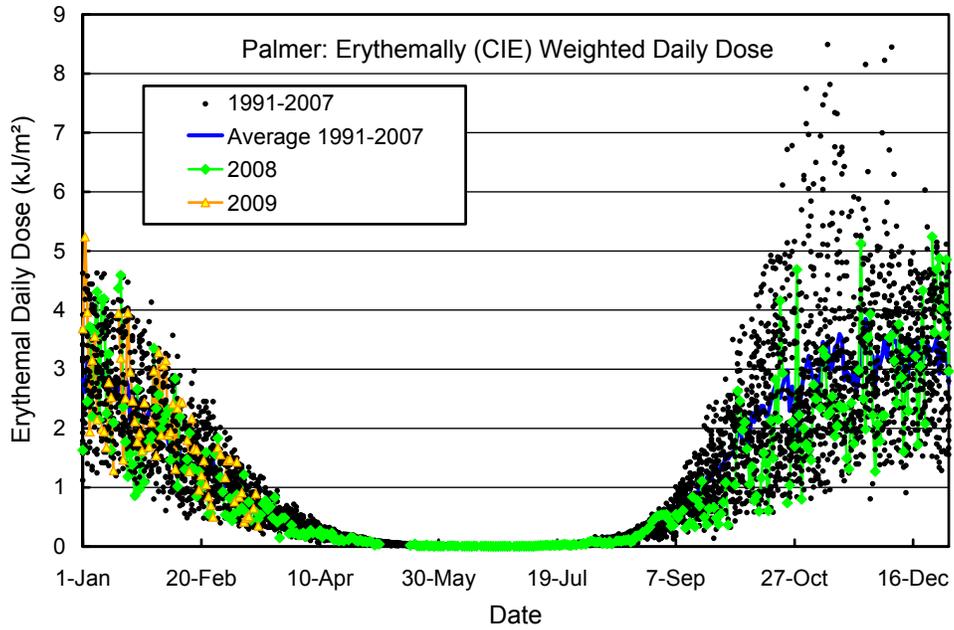


Figure 7.2.5. Daily erythemal dose for Palmer. Volume 18 measurements from the years 2008 and 2009 are compared with individual data points and the average of measurements taken between 1991 and 2007.

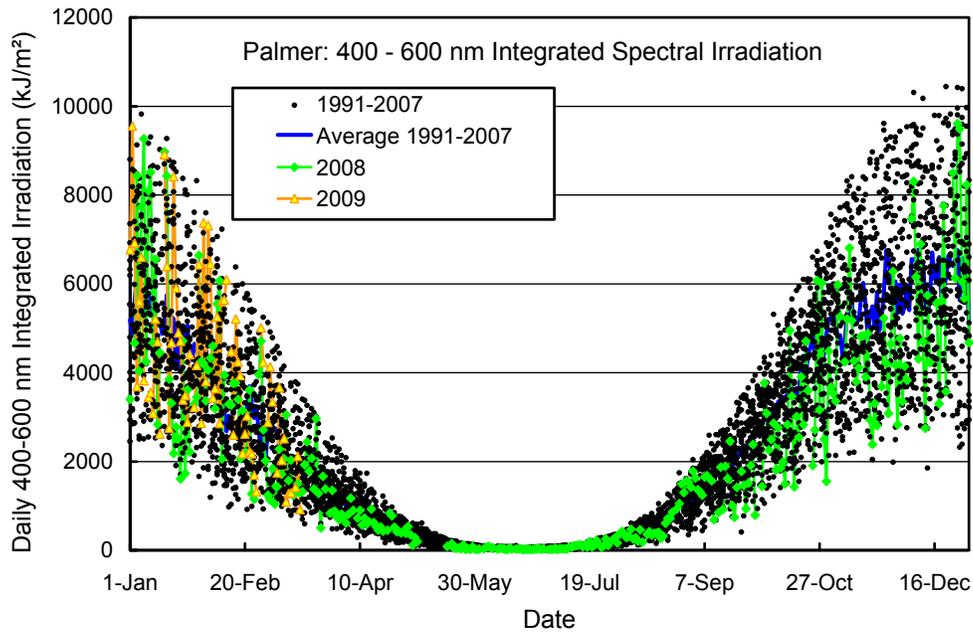


Figure 7.2.6. Daily irradiation of the 400-600 nm band for Palmer. Volume 18 measurements from the years 2008 and 2009 are compared with individual data points and the average of measurements taken between 1991 and 2007.