

7.7. Summit, Greenland

This Section compares ozone and UV measurements at Summit performed in 2013 with historical measurements. In 2013, the total ozone column at Summit was generally above the long-term average, leading to below-average UV levels.

In Figure 7.7.1, column ozone data from the Ozone Monitoring Instrument (OMI) onboard NASA's AURA satellite measured in 2013 are compared with ozone records from the years 1991-2010. There is a strong seasonal dependence: ozone columns are generally higher and have a larger variability in spring than autumn. Measurements in 2013 were well below the average ozone column (blue line) between 3/17/13 and 3/20/13, but still within the typically range of values for this part of the year. Long periods with above-average ozone were observed between 4/22/13 and 5/16/13 and between 6/18/13 and 7/12/13.

With few exceptions, UV Indices measured in 2013 remained below the long-term mean, calculated from data of the years 2004 (year of instrument installation) through 2012 (Figure 7.7.2). Exceptions to this observation include higher-than-average UV Indices measured on 3/18/13, and the period between 4/3/13 and 4/15/13. Both enhancement occurred at times when total ozone was below the average.

Measurements in the 298.51 - 303.03 nm band generally remained below the long term average (Figure 7.7.3). Periods that led to small UV Index enhancement occurred at a time when measurements in the 298.51 - 303.03 nm band have very small absolute values because of the large solar zenith angle during those periods.

Figure 7.7.4 shows measurements in the 337.5-342.5 nm band, integrated over 24 hours. This band is not affected by the atmospheric ozone content. Data show remarkable little day-to-day variation and change from one year to the next. On one hand, this is a confirmation of the consistency of calibrations applied during the ten years of operation. On the other hand, the low level of variability is also a consequence of constant, high surface albedo at Summit, which mitigates attenuation of UV radiation by clouds.

Figure 7.7.5 shows measurements in the 400 - 600 nm band, integrated over 24 hours. These data look very similar to those shown in Figure 7.7.4 because this band is also very little affected by variations in total ozone. The somewhat larger variability in the 400 - 600 nm band compared to the 337.5-342.5 nm band is caused by the fact that clouds have a larger effect on radiation in the visible than the UV.

Lastly, Figure 7.7.6 compares the daily maximum UV Index with daily irradiation in the 400-600 nm spectral range. The latter quantity is symmetrical about the solstice. The UV Index on the other hand is suppressed during the spring due to the annual cycle in total ozone (Figure 7.7.1).

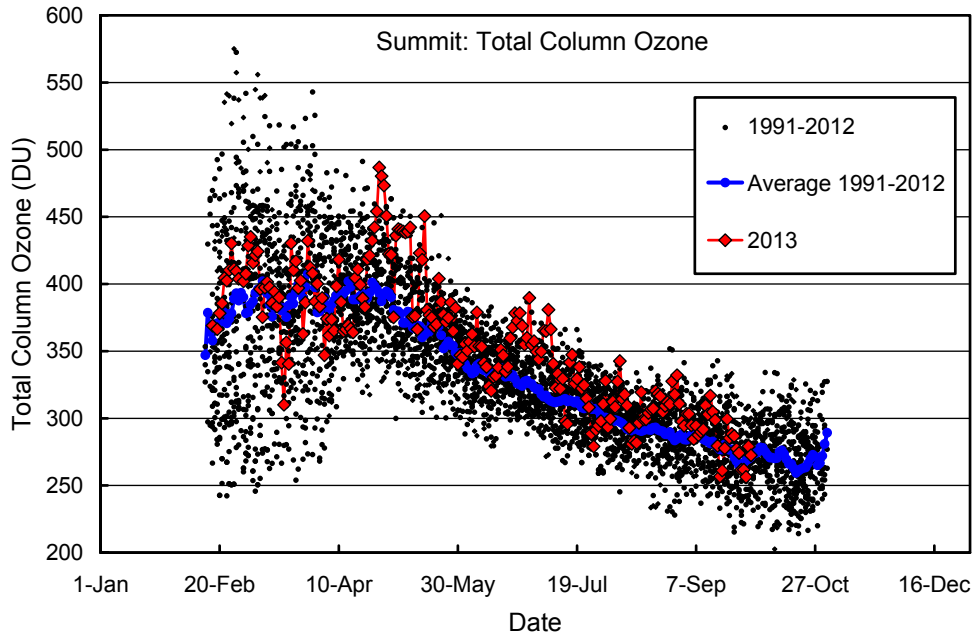


Figure 7.7.1. Total column ozone at Summit. OMI measurements from 2013 are contrasted with ozone data from prior years recorded by TOMS on Nimbus-7 (1991-1993), Earth Probe (1996-2004), and OMI (2005-2012) satellites. TOMS data are from the Version 8 data set.

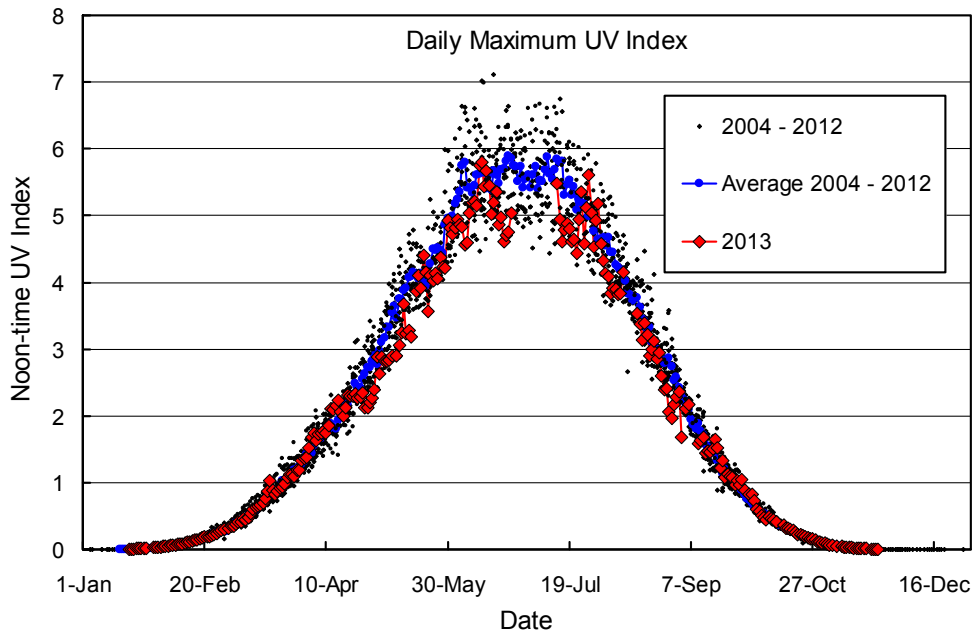


Figure 7.7.2. Daily maximum UV Index at Summit. Measurements from 2013 are contrasted with individual data points and the average of measurements taken between 2004 and 2012.

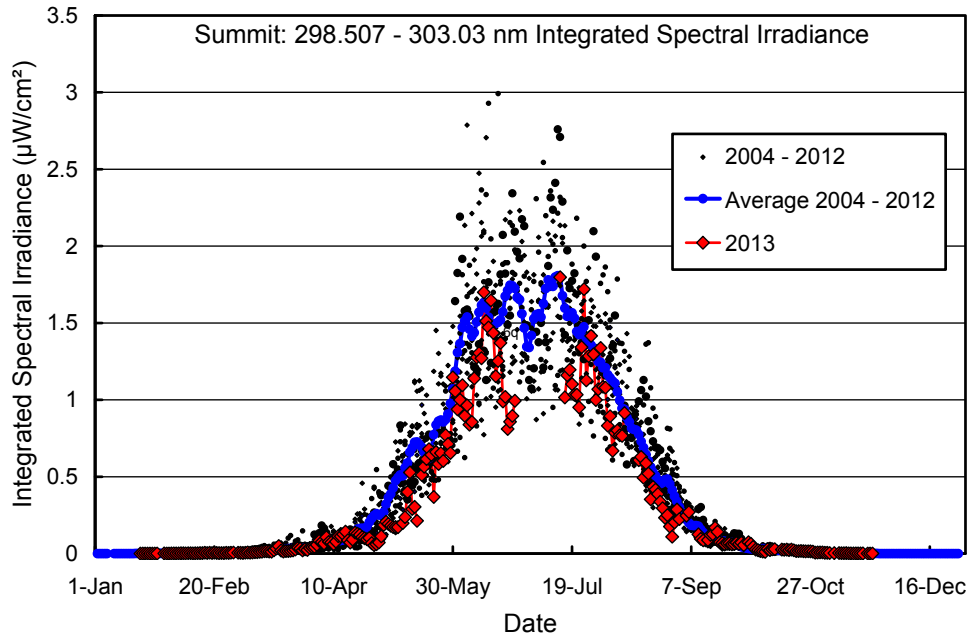


Figure 7.7.3. Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at Summit. Measurements from 2013 are contrasted with individual data points and the average of measurements taken between 2004 and 2012.

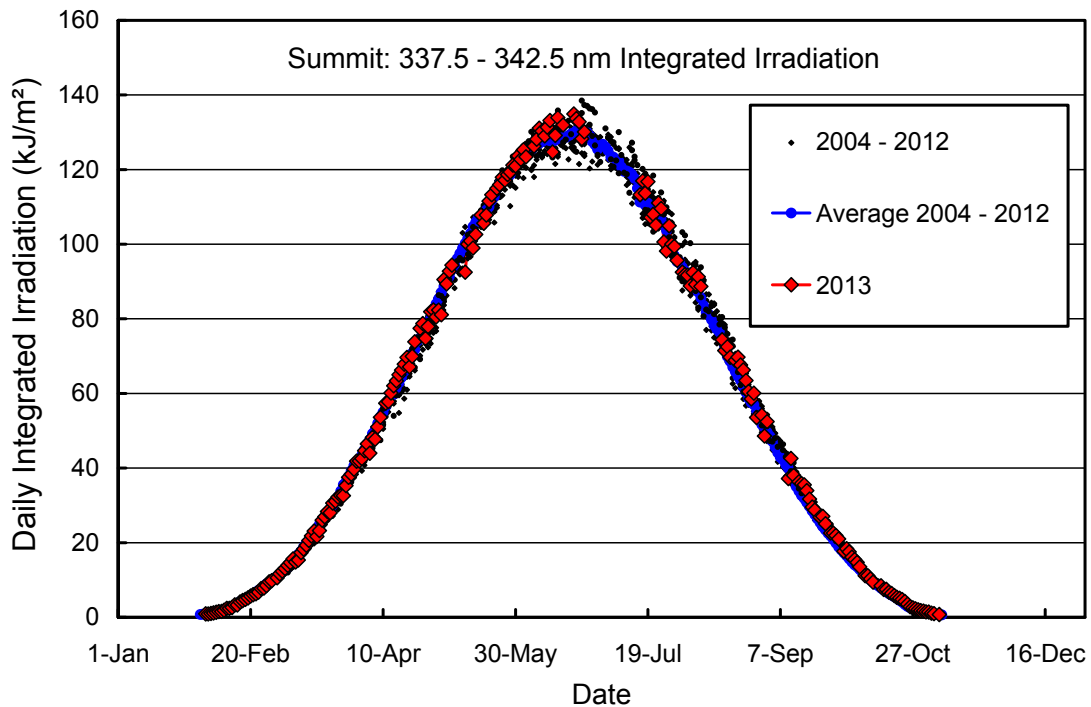


Figure 7.7.4. Daily irradiation of the 337.5 - 342.5 nm band at Summit. Volume 23 measurements from 2013 are contrasted with individual data points and the average of measurements taken between 2004 and 2012.

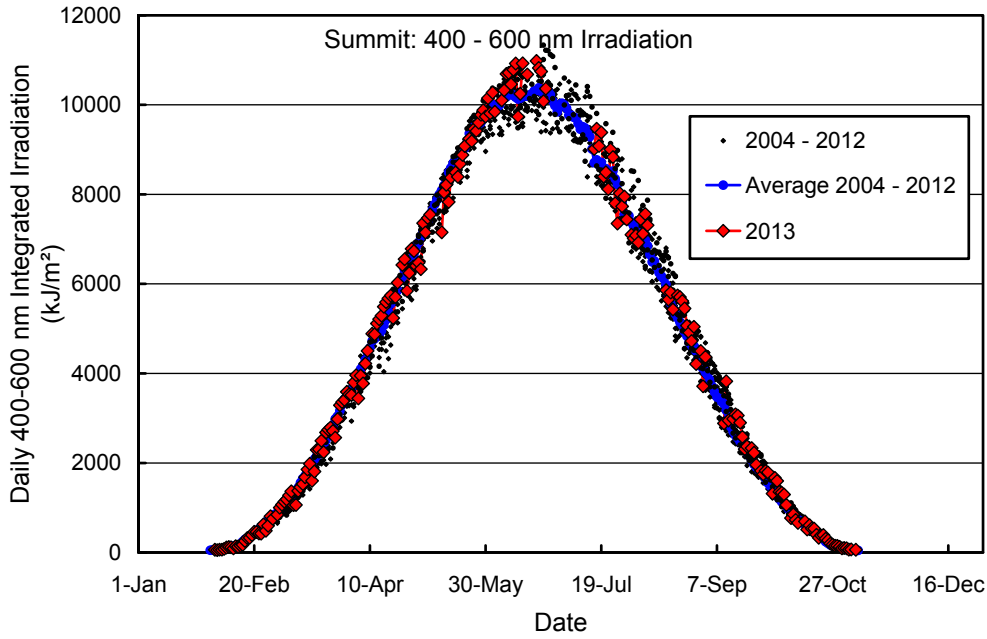


Figure 7.7.5. Daily irradiation of the 400-600 nm band at Summit. Volume 23 measurements from 2013 are contrasted with individual data points and the average of measurements taken between 1991 and 2012.

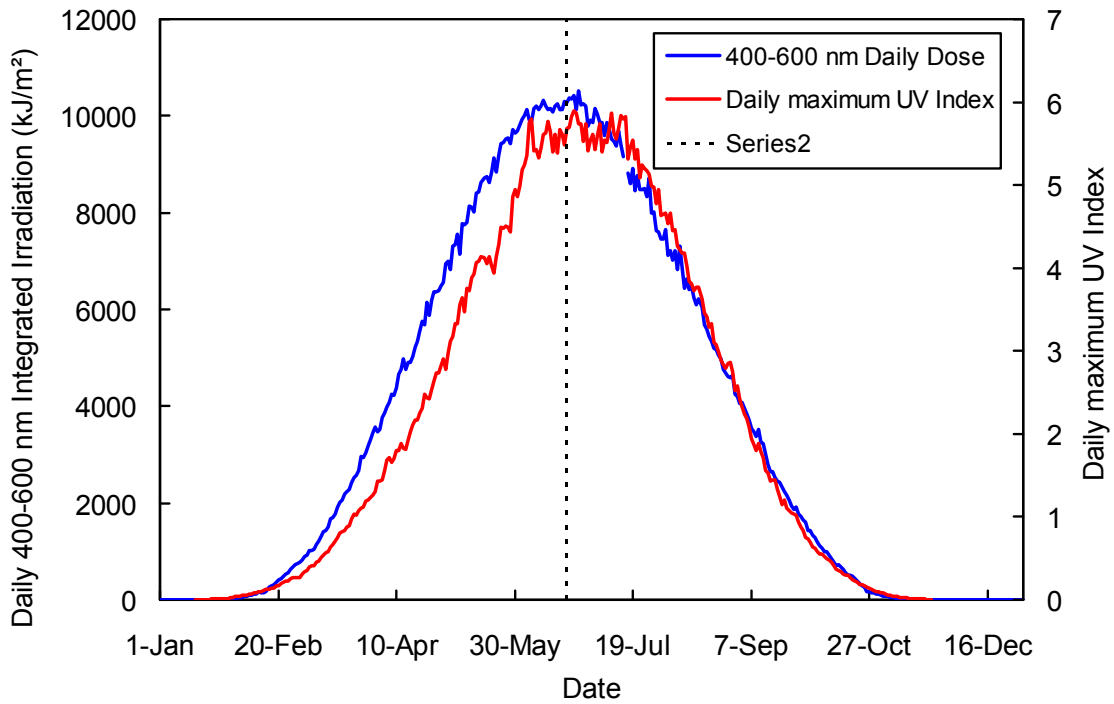


Figure 7.7.6. Comparison of the daily maximum UV Index (right axis) with daily irradiation in the 400-600 nm spectral range (left axis) at Summit. Both curves are average values for the period 2004-2012. The broken vertical line indicates the solstice.