

7.7. Summit, Greenland

This Section compares ozone and UV measurements at Summit performed in 2014 with historical measurements. The total ozone column at Summit was very variable between February and April 2014, but these fluctuations occurred at a time when the Sun was still low and UV levels small.

In Figure 7.7.1, column ozone data from the Ozone Monitoring Instrument (OMI) onboard NASA's AURA satellite measured in 2014 are compared with ozone records from the years 1991-2013. There is a strong seasonal dependence: ozone columns are generally higher and have a larger variability in spring than autumn. Total ozone columns in 2014 were well below the average up to mid-March, followed by an episode of very high columns (500 - 550 DU) between 3/14/14 and 3/24/14. Total ozone remained above the long-term average until 4/21/14. Between 4/22/14 and 9/9/14, ozone varied about the climatological mean. There was also an episode of elevated ozone between 9/12/14 and 10/3/14.

With few exceptions, UV Indices measured in 2013 fluctuated about their long-term mean, calculated from data of the years 2004 (year of instrument installation) through 2013 (Figure 7.7.2). Exceptions to this observation include the periods 3/14/14-3/24/14 and 9/12/14-10/3/14 when ozone was abnormally large and the UV Index suppressed as a consequence. Measurements in the 298.51 - 303.03 nm band also scattered about the long-term mean with no periods of unusually high or low measurements (Figure 7.7.3).

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 eleven years of operation. On the other hand, the low level of variability is also a consequence of constant, high surface albedo at Summit, which reduces 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.

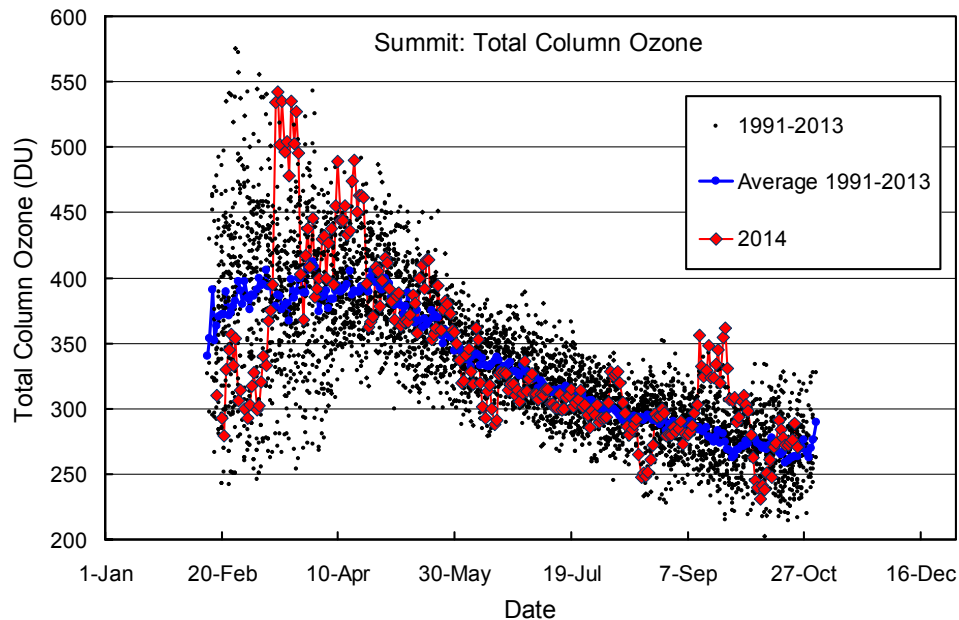


Figure 7.7.1. Total column ozone at Summit. OMI measurements from 2014 are contrasted with ozone data from prior years recorded by TOMS on Nimbus-7 (1991-1993), Earth Probe (1996-2004), and OMI (2005-2013) satellites. TOMS data are from the Version 8 data set.

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).

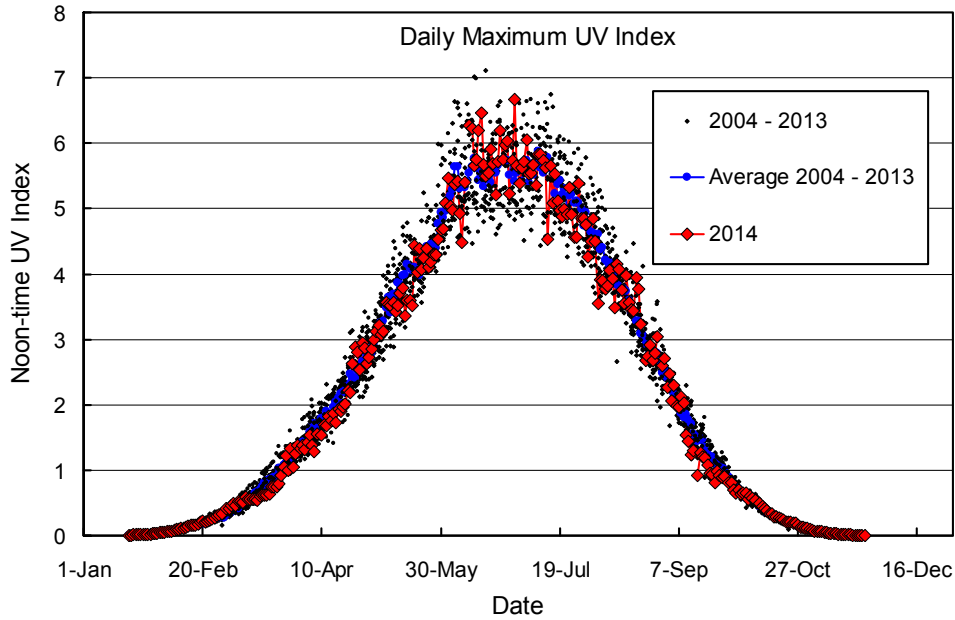


Figure 7.7.2. Daily maximum UV Index at Summit. Measurements from 2014 are contrasted with individual data points and the average of measurements taken between 2004 and 2013.

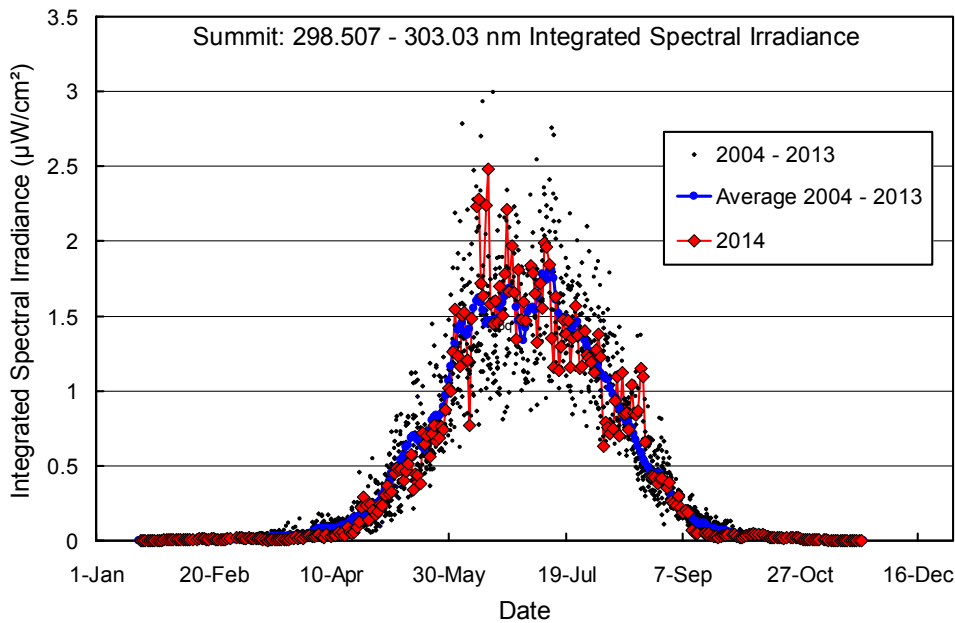


Figure 7.7.3. Noontime integrated spectral UV irradiance (298.51 - 303.03 nm) at Summit. Measurements from 2014 are contrasted with individual data points and the average of measurements taken between 2004 and 2013.

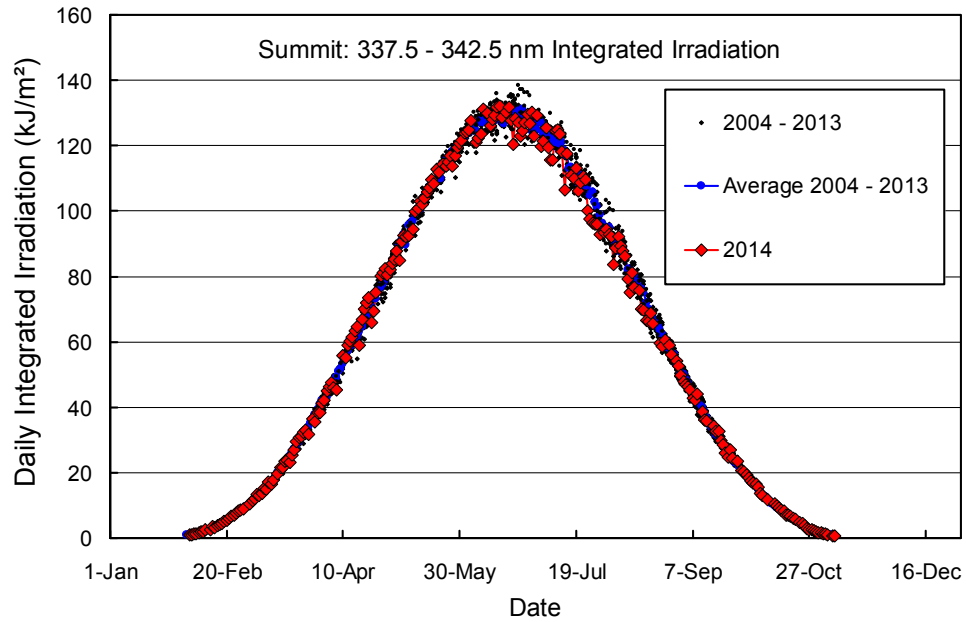


Figure 7.7.4. Daily irradiation of the 337.5 - 342.5 nm band at Summit. Volume 24 measurements from 2014 are contrasted with individual data points and the average of measurements taken between 2004 and 2013.

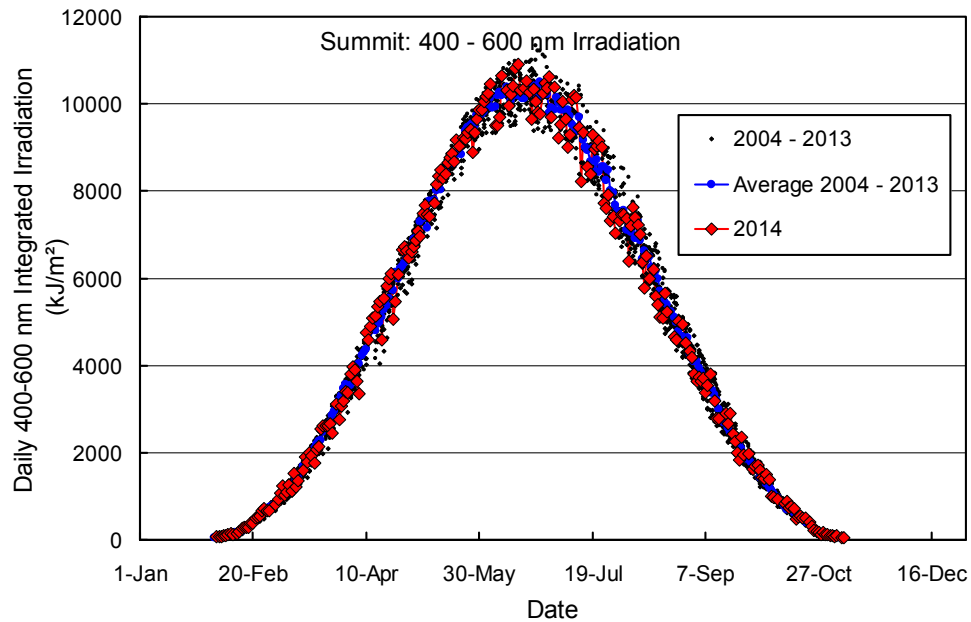


Figure 7.7.5. Daily irradiation of the 400-600 nm band at Summit. Volume 24 measurements from 2014 are contrasted with individual data points and the average of measurements taken between 1991 and 2013.

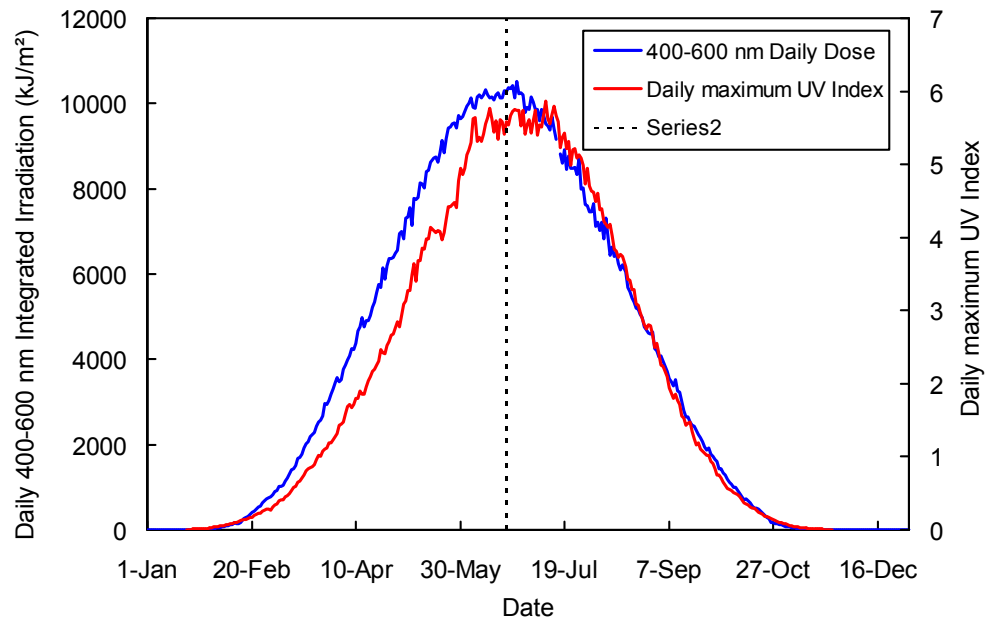


Figure 7.7.6. Comparison of the daily maximum UV Index (right axis) with daily irradiation in the 400-600 nm spectral range (left axis) at Summit. Both curves are average values for the period 2004-2013. The broken vertical line indicates the solstice.