Intercomparison of O3M SAF OUV and OMI/Aura OMUVBL3 Surface UV Products

Niilo Kalakoski¹, Jukka Kujanpää¹, Anders Lindfors¹,², Johanna Tamminen¹, Antti Arola¹

¹Finnish Meteorological Institute, Erik Palménin aukio 1, Helsinki, Finland, ²University of Edinburgh, Edinburgh, United Kingdom

Abstract

The surface UV products from EUMETSAT’s Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (O3M SAF) and Aura OMI are described. Erythemal daily doses from both products are compared for the period from June 2007 to April 2009.

PRODUCT DESCRIPTION

The Offline surface UV product (OUV) of the Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (O3M SAF) is produced operationally during 15-year EUMETSAT Polar System programme using the measurements of the three Metop satellites. UV product is based on the O3M SAF near real time total column ozone product derived from Metop/GOME-2 measurements. OUV is a global gridded (level-3) product, with 0.5° x 0.5° grid. The diurnal cloud cycle needed in calculating the daily UV doses is sampled using Metop/AVHRR level 1b products in the morning side and NOAA/AVHRR level 1b products in the afternoon side. Included in the product are daily doses and maximum dose rates of integrated UV-B and UV-A radiation together with values obtained by different biological weighting functions. Example product field for 1 October 2007 is shown in figure 1.

Aura OMI Level-3 Global Gridded Surface UVB Irradiance product (OMUVBL3) is processed at Finnish Meteorological Institute. The input data for UV products is level-2 OMI total ozone product (OMTO3) derived from measurements from Ozone Monitoring Instrument (OMI) nadir viewing spectrometer. OMI is a contribution of the Netherland’s Agency for Aerospace Programs (NIVR) in collaboration with FMI to the EOS Aura mission. OMUVBL3 is global surface UV product in 1° x 1°

Figure 1: Example of global OUV Erythemal daily dose [kJ/m²] for 1 October 2007.
grid including local solar noon irradiances at 305, 310, 324 and 380 nm, as well as erythemally weighted irradiance. In addition, erythemally weighted daily surface UV dose is included. Example product field for 1 October 2007 is shown in figure 2.

Figure 2: Example of global OMUVB Erythematic daily dose [kJ/m$^2$] for 1 October 2007.

**COMPARISON**

Erythemal daily doses from products were compared for the period from 1 June 2007 to 20 April 2009. Example of relative difference [100% * (OUV-OMUVB)/OMUVB] for 1 October 2007 is shown in figure 3. Figures 4. and 5. shown absolute [OUV-OMUVB] and relative [100% * (OUV-OMUVB)/OMUVB] mean differences for the whole period, respectively. Figure 6. shows histogram of mean relative differences.

In general, agreement is good with mean bias of 0.20 kJ/m$^2$ (3.7 %). Large differences can be seen in figure 3. in middle latitudes. These are likely due to different cloud detection used in OUV and OMUVB products. OMUVB gives clearly higher values than OUV in mountainous areas and Antarctic ice shelves (figures 4. and 5.). Smaller difference around Africa is results from aerosol correction used in OUV product.

Figure 3: Relative difference [(OUV-OMUVB)/OMUVB] for October 1, 2007.
Figure 4: Mean absolute difference between OUV and OMUVB for June 2007 to April 2009.

Figure 5: Mean relative differences [(OUV-OMUVB)/OMUVB] for June 2007 to April 2009.
Figure 6: Histogram of relative differences [(OUV-OMUVB)/OMUVB] for June 2007 to April 2009.

Figures 7., 8. and 9. show time series of zonal mean absolute differences [kJ/m$^2$] for three latitude bands (50°N to 60°N, 10°S to 10°N and 20°S to 40°S). Also shown are standard deviations of absolute differences. Some seasonal variation can be seen, with OUV daily doses being relatively higher compared to OMUVB in July and lower in January.

Figure 7: Zonal mean absolute differences and standard deviations of absolute differences for 50°N to 60°N. Mean bias for this latitude band is 0.02 kJ/m² and standard deviation of differences is 0.28 kJ/m².
CONCLUSIONS

Erythemal daily doses from O3M SAF OUV and Aura OMI OMUVBL3 products in general show good agreement. However some differences can also be seen. These will be further investigated in the future.

Acknowledgements: This work is done as part of EUMETSAT’s Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (O3M SAF).