FINNISH METEOROLOGICAL INSTITUTE

OMUVB L2 Readme

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Overview

This document describes the OMUVB Level 2 data product. OMUVB L2 contains surface UV irradiance data along with ancillary information generated using the OMI global mode measurements. In this mode each file contains the sunlit portion of a single orbit from pole-to-pole, with an approximately 2600 km wide swath composed of 60 ground pixels. The OMI measurements are used to estimate the ultraviolet (UV) radiation reaching the Earth's surface. The OMUVB product contains erythemally weighted daily dose and erythemal dose rate both at the overpass time and local solar noon. Additionally, the product includes spectral irradiances at 305.1, 310.1, 324.1, and 380.1 nm also corresponding to both the overpass time and the local solar noon. These spectral irradiances assume triangular slit function with full width half maximum of 0.55 nm. The algorithm is based on use of a radiative transfer model whose input parameters are derived from the OMI measurements using the OMTO3 total ozone data product as input data. Surface UV irradiance data is also produced by the Sodankylä Direct Broadcast processing system. However, Direct Broadcast processing provides only local data in form of images and different data is used as an input (ozone from OMDOAO3 and radiances from Level-1B).

Algorithm Description

The OMUVB algorithm is documented in the Algorithm Theoretical Basis Document (ATBD). The algorithm is similar to the TOMS UV algorithm developed by NASA. It first estimates the clear-sky surface irradiance using measured total ozone and surface albedo from the data set using moving time window method. The clear-sky value is then adjusted by a transmittance factor that accounts for the attenuation of UV radiation by clouds and aerosols. The attenuation factor is derived from the ratio of measured back scatter radiances and solar irradiances at 360 nm, accounting for clouds and scattering aerosols. The current surface UV algorithm (1.3) uses a monthly aerosol climatology to correct additionally for absorbing aerosols (Arola et al. 2009).

Data Quality Assessment

The overall accuracy of OMI surface UV estimates depend on UV wavelength and atmospheric and other geolocation specific conditions ranging from about 5% to more than 30%. The radiative transfer model assumes that clouds are plane parallel and homogeneous, i.e., the model doesn't account for broken, multi-layer or mixed phase clouds. This error is the principal source of noise in comparing satellite measurements with ground-based instruments. The OMI surface UV irradiance represents the spatial average over the OMI footprint. OMI measurements are made once a day around 1:45 p.m. local time. No correction is made for the change in cloudiness, ozone and aerosols between local noon and satellite overpass time, or for their diurnal variability. Previous validation studies with TOMS data suggest that OMI UV irradiance estimates are on the average 0-30% larger than the ground-based reference data. The OMI surface UV data were compared with spectral ground-based measurement data of several stations, e.g. Jokioinen (60.8N,23.5E), Sodankylä (67.4N,26.6E), Toronto (43.8N,79.5W), San Diego (32.8N,117.2W), Ushuaia (54.8S,68.3W), and Barrow (71.3N,156.7W). The validation results of Tanskanen et al. 2007 imply similar results as the previous validation studies with TOMS surface UV data. The systematic bias can be attributed to absorbing aerosols from natural and anthropogenic sources. In the current version of the data (1.3) correction for absorbing aerosols has been implemented, and therefore it can be anticipated that a reduced bias will be seen in the future validation studies. Snow and ice further complicate estimation of the surface UV since clouds cannot be distinguished from them. Therefore, in regions with temporary snow or ice or highly heterogeneous surface albedo the OMI UV irradiance estimates have much higher uncertainty. Future version of the algorithm may use snow cover information to reduce this uncertainty.

Product Description

An OMUVB product file contains the sun-lit portion of a single Aura orbit or some 1650 measurements. Each measurement consists of a 2600 km wide OMI scan of 60 pixels. Due to optical aberrations and small asymmetry between the instrument optic axis with the spacecraft nadir, the pixels on the swath are not symmetrically aligned on the line perpendicular to the orbital plane. The latitude and longitude provided with each pixel represent the center of each pixel on ground. The OMUVB product is written as an HDF-EOS5 swath file. The data are ordered in time. The information provided in these files includes latitude, longitude, solar zenith angle, and a large number of ancillary parameters that provide information to assess data quality. The most important of these parameters is the OMUVBQuality field, that describes the quality of the data and can be used for filtering of the data. For a complete list of the parameters, please read the OMUVB format specification document. Questions and comments related to the OMUVB data set, the OMI Surface UV algorithm, or data quality should be directed to Antti Arola, Jari Hovila or Simo Tukiainen (firstname.lastname@fmi.fi).

References

Arola, A., et al. (2009), A new approach to correct for absorbing aerosols in OMI UV, Geophys. Res. Lett., 36, L22805, doi:10.1029/2009GL041137.

Tanskanen, A., et al. (2007), Validation of daily erythemal doses from Ozone Monitoring Instrument with ground-based UV measurement data, J. Geophys. Res., 112, D24S44, doi:10.1029/2007JD008830.