OMDOAO3 README FILE

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Overview

This document provides a brief description of the OMDOAO3 data product. The OMDOAO3 Level 2 data product contains total ozone and ancillary information produced by the OMI DOAS algorithm. Each file contains the sunlit part of an OMI orbit, from the South Pole to the North Pole. In the so-called global observation mode, the OMI swath is approximately 2600 wide, providing daily global coverage.

The OMDOAO3 is produced as a standard product as well as in near-real-time (within three hours of observation) and as a very fast delivery product (within 20 minutes of observation with limited spatial coverage). Although it is expected that the differences will be very small, this document describes the standard data product.

You may refer to release specific information about OMDOAO3 for details about software versions and known problems.

Algorithm Description

The OMI DOAS algorithm is described in the OMI Algorithm Theoretical Basis Document (ATBD). In addition, a paper that contains a description of the algorithm has been published in IEEE Transactions on Geoscience and Remote Sensing (IEEE TGRS, Vol 44, No. 5, 2006, doi:10.1109/TGRS.2006.871204).

In the DOAS (Differential Optical Absorption Spectroscopy) implementation for OMI the ozone vertical column is determined in three steps. In the first step the actual DOAS fitting is performed, resulting in the so-called slant column density, which is the amount of ozone along an average photon path from the Sun -through the atmosphere- to the satellite. In the second step the air mass factor is determined, which is needed to convert the slant column density into a vertical column. In the last step a correction is performed for clouds. All the results from intermediate steps are also contained in the product.

The OMI DOAS spectral fitting uses a 5 nm wide fit window centered around 334.1 nm. This window has been selected based on the very low temperature sensitivity for this window. In the spectral fitting, the inelastic rotational Raman scattering, as well as the effective ozone temperature are explicitly accounted for. The air mass factor is determined off-line, by simulating OMI spectra using a radiative transfer model. The cloud pressure needed to derive accurate air mass factors and for correction factors for cloudy and partly cloudy conditions, is

obtained from the OMCLDO2 cloud product. This product derives the cloud fraction and pressure from the O2-O2 absorption band around 477 nm. The OMI Algorithm Theoretical Basis Document (ATBD) and the above mentioned paper in IEEE TGRS contain a complete description of the algorithm. The effective cloud fraction is derived from the fit window itself.

This algorithm is one of the two algorithms that will be used to derive total ozone values from OMI. The other is an algorithm based on the well-known TOMS method (OMTO3 data product). Initial comparisons show good overall agreement between the two algorithms, but there are noticeable differences over clouds and snow/ice, as well as at large solar zenith angles.

Data Quality Assessment

In this section the general data quality is discussed. The release specific information about OMDOAO3 contains details on specific features and problems in the data product and this document should be read before using the data.
The OMI project team uses two total ozone (O3) retrieval algorithms, OMI-TOMS and OMI-DOAS, in order to maintain the long term TOMS data record as well as to improve the ozone column estimate using the hyperspectral capability of OMI. Kroon *et al.* (J. Geophys. Res., 2008, 113, D16S28, doi:10.1029/2007JD008798) assessed where the algorithms produce comparable results and where the differences are significant. Mean differences in the two ozone column estimates vary from 0-9 DU (0-3%), and their correlation coefficients vary between 0.89 and 0.99 with latitude and season. The largest differences occur in the Polar regions and over clouds. These differences have been exemplified by comparisons of OMI satellite data with AVE airborne data in the paper by Kroon *et al.* (J. Geophys. Res., 2008, 113, D15S13, doi:10.1029/2007JD008795). Continuing the TOMS total ozone column data record that dates back to November 1978 is the primary OMI mission goal that is achievable with either OMI total ozone column data product.

The paper by Balis *et al.* (J. Geophys. Res., 2007, 112, D24S46, doi:10.1029/2007JD008796) present the validation of the OMI total ozone column data products through comparisons with quality controlled and archived data from ground-based observations by Dobson and Brewer spectrophotometer instruments located at stations worldwide. The study focused on global comparisons and seasonal dependence, and the possible dependence on latitude and solar zenith angle. The results show a globally averaged agreement of better than 1% for OMI-TOMS data and better than 2% for OMI-DOAS data with the ground-based observations. The OMI-TOMS data product is shown to be of high overall quality with no significant dependence on solar zenith angle or latitude. The OMI-DOAS data product shows no significant dependence on latitude except for the high latitudes of the Southern Hemisphere where it systematically overestimates the total ozone value. In addition a significant dependence on solar zenith angle is found between OMI-DOAS and ground-based data.

Ground-based observations with a Fourier transform spectrometer in the infrared region (FTIR) were performed in Kiev (Ukraine) during the time frames August-October 2005 and June-October 2006 by Shavrina *et al.* (J. Geophys. Res., 2007, 112, D24S45, doi:10.1029/2007JD008787). FTIR based estimates of ozone columns from the 2006

observations compare rather well with the OMI total ozone column data: standard errors are of 1.11 DU and 0.68 DU, standard deviation are of 8.77 DU and 5.37 DU for OMI DOAS and OMI TOMS, respectively.

The overview paper by McPeters *et al.* (J. Geophys. Res., 2008, 113, D15S14, doi:10.1029/2007JD008802) summarized these and other validation exercises for the OMI total ozone column data products.
To assess the quality of individual retrievals it is very important to look at the quality flags fields in the data products. Especially the ProcessingQualityFlags are important to filter for bad quality data. The best quality data have a ProcesingQualityFlags of 0. It is recommended to apply a bitwise AND on the ProcessingQualityFlags field using a value of 43679 to filter the data. This will filter all data for which the ProcessingQualityFlags bits 0, 1, 2, 3, 4, 7, 9, 11, 13 and/or 15 are set.

Product Description

A single OMDOAO3 product file contains all OMI measurements on the sunlit portion of the Earth, for one Aura orbit. During one orbit OMI performs approximately 1650 measurements, which take 2 seconds each. In the global observation mode, 60 across track ground pixels are measured simultaneously during a measurement. These 60 measurements cover a swath of approximately 2600 km wide. During so-called zoom-in measurements the swath width maybe reduced. The operational baseline includes zoom-in measurements for 1 day a month. In case of zoom-in measurements 30 of the 60 across track pixels contain data, the other 30 contain fill values.

The OMDOAO3 product is written as an HDF-EOS5 swath file. Some guidance specific for OMI level 2 files is given on the KNMI OMI website.

Data Availability

The OMDOAO3 product can be obtained from the Goddard Earth Sciences (GES) Distributed Active Archive Center (DAAC) website, more specifically the OMI/Aura pages at the GES-DAAC. OMDOAO3 files can be ordered through the Mirador website.
Full OMDOAO3 data, as well as subsets of these data over many ground stations and along Aura validation aircraft flights paths are also available through the Aura Validation Data Center (AVDC) website to those investigators who are associated with the various Aura science teams. Christian Retscher is the point of contact at the AVDC.

For users not interested in the detailed information provided on OMDOAO3 dataset we are developing several gridded products. In addition, OMDOAO3 data is made available in a geographically ordered (rather than time-ordered) format that can be more easily subsetted and manipulated on-line prior to ordering. Please check the Mirador website if you are interested in these products.

Contact Information

Questions related to the OMDOAO3 dataset should be directed to the GES DISC. For questions and comments related to the OMDOAO3 algorithm and data quality please send mail to contact omdoao3@ltpmail.gsfc.nasa.gov.