

OMDOA03 Release Specific Information

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05 September 2011

Latest release discussed in this document: 1.2.3.1

Known Issues List

- 1 There is a “row anomaly” present in OMI data, affecting some (but *not* all) viewing directions of OMI. Details on the starting dates of the various stages of the development of this anomaly can be found [on the web](#). The effects on OMCLD02 are discussed [below](#).

Row anomaly

The row anomaly has four distinct effects on the OMI radiance spectra:

- 1 A decrease in the radiance level for several viewing directions. It is currently assumed that this is caused by a partial blocking of the OMI nadir port. The blocking object is assumed to be opaque. This is effectively a multiplicative error on the radiances.
- 2 An increase in the radiance level at (mostly) the same viewing directions as are affected by a decrease in the radiance for the northern part of the orbit. This occurs when the part of OMI containing the nadir port is directly illuminated by the sun. This is assumed to be caused by reflection of sunlight into the nadir port via the blocking object (outside of OMI). This is an additive error on the radiances. This increase in the radiance level is not observed for the first anomaly in rows 53-54 (0-based).
- 3 The blocking object causes an inhomogeneous illumination of the spectral slit in OMI. This causes a change in the slit function, shifting the center of weight away from the nominal center. This causes light of a specific wavelength to hit the detector in a slightly different location than expected. In the OMI level 0 to level 1 software, the wavelengths are not fitted, but assigned. Corrections are made based on the homogeneity of clouds and the temperature of the optical bench. Therefore the effect of an object blocking part of the incoming light is not included in the nominal level 1B wavelength assignment.
- 4 Light reflected by the earth from outside the nominal field of view is coupled into the nadir port. This light is collected over a large area, giving an additive error on the radiances, with a not quite constant term.

Effect on OMDOA03

The wavelength shift has a strong effect on the fit quality on OMDOA03. Starting from version 1.1.1, a correction for the wavelength shift is implemented in OMDOA03. This not only reduces the impact of the row anomaly, but also reduces the noise on the OMDOA03 ozone columns outside the affected viewing directions. OMDOA03 relies directly on the radiance levels for its the cloud fractions. The anomaly reduced the radiance level for most scenes, producing cloud fractions that are too low for the affected viewing directions. For cloud-free scenes, the row anomaly reflects light from cloudy scenes outside the field of view into the nadir port. The additive error causes an overestimation of the cloud fraction for those scenes, and adds ozone signal from some different location into the spectrum.

The cloud pressures are taken from [OMCLD02](#), and these are affected as well, as described in the OMCLD02 readme file.

Level 1B contains an XTrackQualityFlags field. This field specifically indicates the presence of row anomaly effects. From version 1.2.3 of OMDOA03 onwards a consistent set of flags is present in this datafield, due to the use of post-processed level 1B data. We recommend to only use groundpixels that correspond to a value of zero in the XTrackQualityFlags field.

Release History

OMDOA03 1.2.3.1

The surface albedo is taken from the Kleipool database. In some cases the value in this database is too high because of lack of input data. This is especially true for the polar regions. We now allow information from the NISE snow/ice cover input to lower the surface albedo if it indicates no snow or ice at the surface (if this change of the surface albedo is larger than 0.1, and the original database value is larger than 0.4). With an internal test version we noticed scenes where the observed radiance and assumed surface albedo were incompatible, leading to interpolation artifacts. This change resolves that.

OMDOA03 v1.2.0

Some rather extensive changes were made in this version. Some changes are a mere preparation for future releases, others are currently active.

- 1 The XTrackQualityFlags are now handled in a more appropriate manner. The XTrackQualityFlags can now be propagated selectively into the normal error flags. This is currently *not* used.
- 2 The OMI L1B contain two wavelength calibration methods. The current version of the algorithm can use the fitted wavelengths when available, using the previous method as a fall-back option. A global metadata attribute in the HDF-5 file called "WavelengthCalibraionMethod" indicates which method was actually used ("assigned" or "fitted"). We perform a fit of a wavelength offset on the radiance spectrum if the assigned wavelengths are used. This fit of the offset uses a larger wavelength window than that of the DOAS fit itself. The DOAS fit window is too narrow to reliably fit a wavelength offset. The DOAS fit window itself is left unchanged.
- 3 An OPF parameter controls an override, to force the use of the older assigned wavelengths. To provide a consistent dataset, this override is used to force the use of the assigned wavelength calibration. We anticipate that a future reprocessing of the L1B data will provide the fitted wavelength calibration for the whole dataset, and that we can use the fitted wavelength assignments at that moment.
- 4 The reference spectrum for ozone has been updated to Brion, Malicet and Daumont in this release (D. Daumont, J. Brion, J. Charbonnier, and J. Malicet, "Ozone UV spectroscopy I: Absorption cross-section at room-temperature," J. Atmos. Chem. **15**, 145-155 (1992); J. Brion, A. Chakir, D. Daumont, J. Malicet, and C. Parisse, "High-resolution laboratory absorption cross section of O₃. Temperature effect," Chem. Phys. Lett. **213**, 610-612 (1993); J. Malicet, D. Daumont, J. Charbonnier, C. Parisse, A. Chakir, and J. Brion, "Ozone UV spectroscopy. II. Absorption cross-sections and temperature dependence," J.

- Atmos. Chem. **21**, 263-273 (1995); and J. Brion, A. Chakir, J. Charbonnier, D. Daumont, C. Parisse, and J. Malicet, "Absorption spectra measurements for the ozone molecule in the 350 - 830 nm region," J. Atmos. Chem. **30**, 291-299 (1998); data is available from the [MPI-Mainz UV-VIS spectral atlas of gaseous molecules](#)). Previous releases used a reference spectrum from Bass and Paur (Bass A.M., and R.J. Paur, The ultraviolet cross-sections of ozone: I. The measurements in Atmospheric ozone (Ed. C.S. Zerefos and A. Ghazi), Reidel, Dordrecht, Boston, Lancaster, pp. 606-610, 1985). The reference spectrum has been convolved with the OMI slit function, with a slant column of 900 DU to account for the I_0 effect (this is the same as before).
- 5 An update to the surface albedo database is used, using five years of OMI data. This database is an update to the database published in the Journal of Geophysical Research (Q.L. Kleipool, M.R. Dobber, J.F. de Haan and P.F. Levelt, *Earth surface reflectance climatology from 3 years of OMI data*, J. Geophys. Res., 2008, **113**, [doi:10.1029/2008JD010290](https://doi.org/10.1029/2008JD010290)). The database is [available for download](#), and includes an updated readme file.
 - 6 The EffectiveTemperature results are now stored as a floating point value, not as an integer. Internally they were always calculated as floating point numbers, but the storage never matched this.
 - 7 The orbit phase is copied from L1B. This field was added in L1B to reference events within the duration of an orbit.

OMDOA03 v1.1.1

- 1 The surface albedo database is updated, and uses data measured by OMI itself. This database is described in the Journal of Geophysical Research (Q.L. Kleipool, M.R. Dobber, J.F. de Haan and P.F. Levelt, *Earth surface reflectance climatology from 3 years of OMI data*, J. Geophys. Res., 2008, **113**, [doi:10.1029/2008JD010290](https://doi.org/10.1029/2008JD010290))
- 2 Changed AMF lookup tables
- 3 Copy over XTrackQualityFlags from L1B (when present)
- 4 Perform wavelength registration fit and shift radiance wavelength grid accordingly. Wavelength fit includes simplified version of DOAS fit, including O₃ absorption spectrum. Added fields to report results from this fit.

OMDOA03 v1.0.5:

- 1 Release for OMI Collection 3 data.
- 2 The treatment of high reflective surfaces (snow/ice) has been changed. If a highly reflective surface is detected, the effective cloud fraction is set to zero, and the surface albedo is fitted instead of the cloud fraction. The reason for setting the cloud fraction to zero is that it is not possible to derive an accurate effective cloud fraction over snow/ice surfaces. Validation data from the Polar Ave campaign have shown that setting the cloud fraction to zero results in the most accurate results. It is noted that this approach is similar to what is used in the OMT03 data product.
- 3 The airmass factor tables have been updated. The previous air mass factor tables were the primary cause for the solar zenith angle dependent bias. The new air mass factor tables are based on a new set of radiative transfer calculations.

- 4 The look-up table for the cloud radiance fraction has been updated. The radiative transfer calculations of the previous version were based on a plane-parallel atmosphere. In the new version, corrections are done for the sphericity of the atmosphere.
- 5 A new static irradiance file has been produced by combining all the Solar irradiance data of Collection 3 for the year 2005.

OMDOA03 v1.0.1:

The median solar irradiance file has been updated such that the Sun-normalized radiance is correct. The most important correction was done for across track pixel 0.

OMDOA03 v1.0.0:

- 1 Updated the reference cross sections for O3, Sun and ring reference spectra. The main differences are a new Sun reference spectrum and updated OMI slit functions.
- 2 Updated OMDOA03_OPF.txt file. This file contains settings for the algorithm. The following changes were made to this file: the file version was set to 1.0, the albedo for snow surfaces was set to 0.6, and several limit values were updated.
- 3 Changed the flagging strategy: Now level 1b pixel qflag bits 0-5 are errors, bits 6-13 are warnings and the rest are ignored. This reduces the stripes in the ozone column.
- 4 Corrected the radiances and irradiance for Sun-Earth distance. This allows radiance and irradiance product to be more distant in time.
- 5 The current baseline is to use a static median solar irradiance file. This reduces the stripes.
- 6 Corrected bug in High-Sampling interpolation that appeared when flagged spectral pixels are removed from spectra.

OMDOA03 v0.9.42

OMDOA03 v0.9.42 is the first version to be released provisionally.