OMTO3 Release Specific Information

Software Version

The current release of OMTO3 is version 1.1.0.

Collection 3 OMTO3 V1.1.0 is the third release of the software designed to produce total ozone from the OMI data. Changes from the previous version (V0.9.45) are listed below, in the Release History.

Known Issue List

This section describes significant issues related to the OMTO3 V1.1.0 product:

1. The V1.1.0 OMTO3 software applies adjustments to the radiance measurements for the twelve wavelengths (308.70, 310.80, 311.85, 312.61, 313.20, 314.40, 317.62, 322.42, 331.34, 345.40, 360.15, and 372.80 nm) used by the OMTO3 product. However the values of these adjustments are different from the previous version (V0.9.45) due to the improvements in the OMI radiometric calibrations. The OMTO3 orbital output file stores the wavelengths and their corresponding adjustments for each cross-track position in the ADDITIONAL/FILE_ATTRIBUTES section in the HDF data files. The wavelength values are in the attribute "WavelengthOfAdjustment", and the values of the adjustments, stored as N-values, are in "NVXAdjustment."
2. The OMI measured radiances have shown significant reductions at cross-track position 54 since late June 2007. Similar anomaly at position 55 has also developed but more slowly over the following two and a half months. It is believed that the radiances at these two cross-track positions are affected by an unknown blockage in the earth-view optical path. This blockage may have started and developed gradually since the middle of 2006. The effects on measured radiances have stabilized recently, yielding a reduction about 3% in the reflectivity at 331 nm, and leading to increased values of Aerosol Index (AI). Anomalous ozone values at these cross-track positions have resulted from the erroneous reflectivity and AI values. Until this problem can be addressed through possible radiance corrections at the affected cross-track positions, users should avoid these data.
3. Compared to TOMS, OMI's smaller field-of-view results in more "sea-glint" per unit field-of-view and a corresponding larger error in derived ozone under these conditions. The ozone error typically manifests itself as a cross-track dependence over water that is not corrected by the adjustments described in the previous item. This uncorrected error in the ozone can be up to 3%.
4. The OMTO3 AI is not valid for solar zenith angles greater than approximately 60

degrees. Because the OMI solar zenith angles are typically higher than the solar zenith angles for TOMS at the same latitude, the OMI AI become invalid at somewhat lower latitudes than TOMS. This may show up as a cross-track dependence in the OMI AI, and is not corrected by the radiance measurement adjustments. This uncorrected error in the AI can be up to 4%.

5. The snow/ice climatological data set, developed for the TOMS processing and used by OMTO3 to identify observing conditions, may yield erroneous snow/ice coverage due to the changes in snow/ice distribution over the decades. The misidentifications of observing conditions could lead to noticeable step changes in the derived ozone values across cloud/ice boundaries perceived by the OMTO3 algorithm.
6. The averaging for this release of OMI level 3 gridded products has been changed from the traditional 1º x 1.25º to 1º x 1º (lat long).

Release History

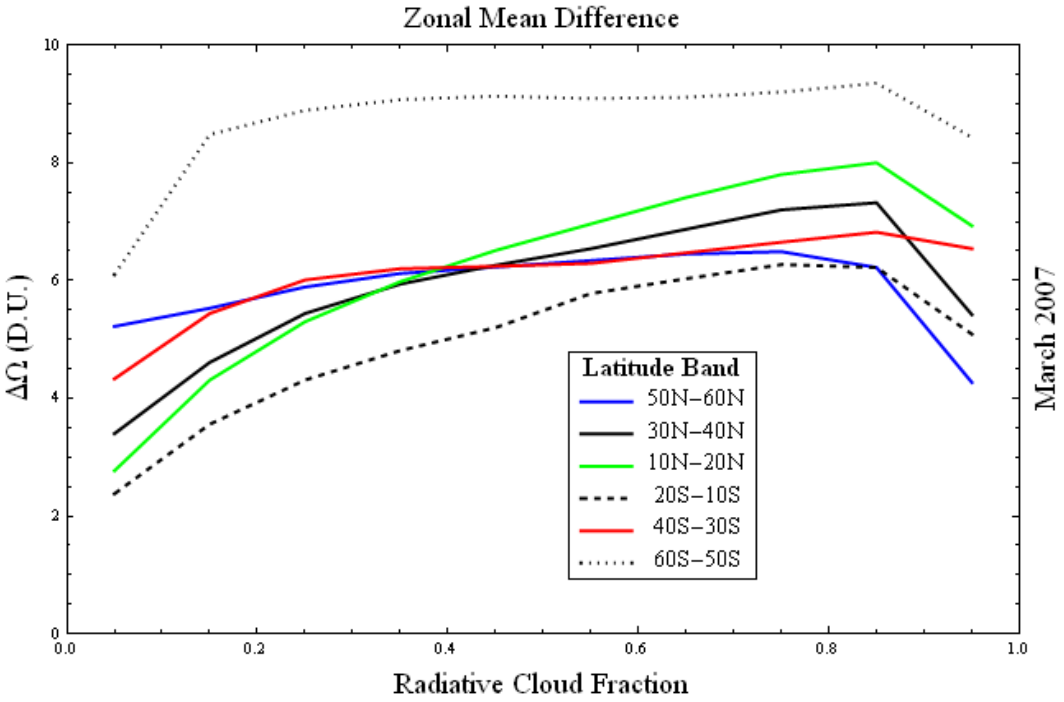
V1.1.0 OMTO3 contains the following changes from the previous release V0.9.45:

1. V1.1.0 OMTO3 uses a seven-day (centered on December 31, 2004) composite solar irradiance data (V1.1.00 OML1BIRR) collected under conditions where measurement error is considered the smallest. This composite filters out spurious data and reduces noise compared to solar data from a single-day measurement.
2. V1.1.0 OMTO3 uses collection 3 OMI radiance (V1.1.00 OML1BRUG) dataset, which contains significant improvements over its previous version, collection 2. These improvements include an internally consistent instrument calibration, a more elaborate dark current correction, and a more accurate stray-light correction. Note that straight-light correction has a larger impact on a smaller radiance. Consequently radiance measurements at short wavelength (< 315 nm) and high solar zenith angle (> 70°) have undergone bigger revisions to the correction, leading to larger changes in the retrieved ozone under these conditions (identified in the OMTO3 output with algorithm flag = 2).
3. The bias in the V0.9.45 OMTO3 AI relative to the TOMS data record has been removed by reducing OMI radiance measurements at 360 nm by approximately 0.5 N-value (1%) relative to other wavelengths. Users who were previously making their own adjustments to OMTO3 AI data for consistency with the TOMS record are advised this is no longer necessary. Note that under low ozone and low solar zenith conditions (algorithm flag = 1), ozone values are adjusted by aerosol corrections that are dependent on the AI values; at high ozone and high solar zenith conditions (algorithm flag = 3), ozone values are also changed due to the use of C-pair (331 and 360 nm) measurements for retrievals. In summary, ozone values for a majority of the retrievals are revised as a result of these adjustments to radiance measurements at 360 nm.
4. V1.1.0 OMTO3 replaces the infrared-derived climatological cloud top pressure (used in V0.9.45 and earlier versions) inputs with the collection 3 http://daac.gsfc.nasa.gov/Aura/OMI/omcldrr_v003.shtml radiative cloud pressure. The OMCLDRR pressure is consistent with MLER model used in the OMTO3 algorithm, consequently ozone values and other derived parameters are more accurate

than those of the previous releases for observations under cloudy conditions.

5. V1.1.0 OMTO3 algorithm change: the onset of profile shape correction for the ozone values is changed from a threshold of solar zenith angle of 70° to a slant ozone column threshold of 2000 D.U. which, when exceeded, activates this correction (identified in the OMTO3 output with algorithm flag=2). This change eliminates the step change across 70° solar zenith angle boundaries on maps of the total ozone field.
6. V1.1.0 OMTO3 algorithm change: a condition is imposed such that if input cloud pressure is higher than the input terrain pressure (i.e., cloud is lower than the terrain surface), input cloud pressure value is reset to that of the terrain. This eliminates the negative ozone-below-cloud values sometimes observed in the Himalayas and the Andes mountain ranges.
7. V1.1.0 OMTO3 algorithm change: Radiative transfer tables used in the retrieval calculations are now interpolated where reflecting surfaces, generally clouds, lie between 0.4 and 0.25 atm. In V0.9.45 OMTO3, calculations were extrapolated at pressures below 0.4 atm. This change improves the ozone values derived for the high cloud conditions, which are rare occurrences according to observations.

In summary, the most important changes from collection 2 (V0.9.45) to collection 3 (V1.1.0) OMTO3 are their inputs, i.e., L1B radiance and cloud pressure. To illustrate the impacts of these changes, we show the zonal mean differences in ozone (calculated as $\Delta\Omega$ = collection 2 – collection 3) as a function of radiative cloud fraction for six latitude bands in the figure below. This figure shows that when the radiative cloud fraction is low, the monthly zonal mean differences are mainly resulted from the changes in input L1B radiances; for retrieval with large radiative cloud fractions, the changes in cloud pressures induce additional changes in the retrieved total ozone.



OMTO3 V0.9.45 contains two modifications from the previous release V0.9.41:

1. V0.9.45 OMTO3 calculates radiance residuals at 12 wavelengths (listed below), which include the six EP/TOMS wavelengths used in the v0.9.41 release, plus six additional wavelengths. The residuals at the additional wavelengths are used to check instrument calibration and also serve as input for deriving the SO2 column. Note, that the algorithm for deriving total ozone remains the same as in v0.9.41.

   308.70nm, 310.80nm, 311.85nm, 312.61nm, 313.20nm, 314.40nm,
   317.62nm, 322.42nm, 331.34nm, 345.40nm, 360.15nm, 372.80nm

2. The OMTO3 algorithm uses the solar irradiances measured by OMI on a single day (orbit 3725 on March 28, 2005), and assumes that neither the true solar irradiance (at 1 AU) nor the instrument calibration change with time. However, the solar irradiance needs to be corrected for the Sun-Earth distance effect. This was inadvertently left out in Version 0.9.41 for orbits 3709 through 4794. Version 0.9.45 makes the necessary adjustment. Orbits 3709 through 4794 have been reprocessed with v0.9.45 and the data replaced.