An Initial Comparison of Ozone Monitoring Instrument (OMI) Total Ozone with EP/TOMS, SBUV/2, and Ground Stations

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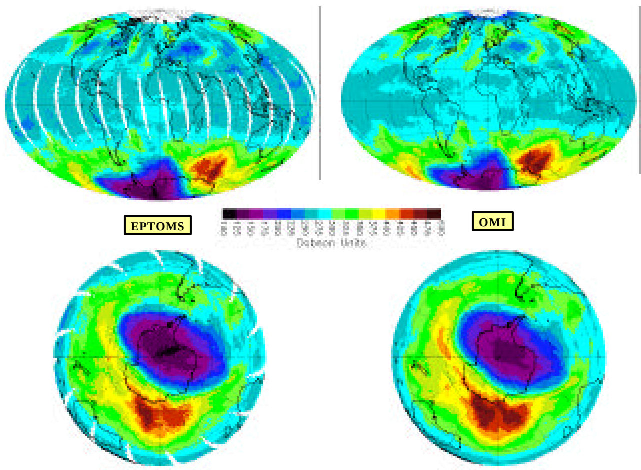
Total Ozone Maps for Oct 08, 2004



OMI with a preliminary calibration is providing TOMS-like total ozone using 4 wavelengths (312nm, 318nm, 331nm, 360nm) from OMI's UV2 channel. In above, both EPTOMS and OMI total column ozone data are gridded into 1 x 1.25 degree cell. The OMI instrument IFOV has a higher spatial resolution than EPTOMS. The official Level 3 OMI gridded product will be using a smaller grid size such as ¼ degree cell.

CONCLUSIONS

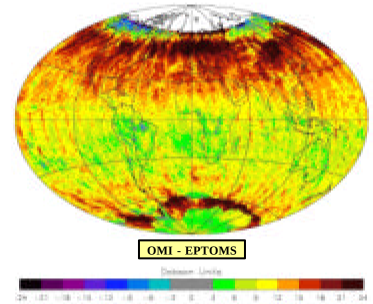
- [OMI - EPTOMS] comparisons show a relatively strong total ozone and latitude dependence with higher variability than [OMI –SBUV/2], mainly because of continuing changes in the optical properties of the EPTOMS front scan mirror. EPTOMS is lower than OMI about 8~15 DU. These EPTOMS data have not been corrected by a reprocessing.
- SBUV/2 agrees well with OMI within ± 6 DU (~ 2%).
- Both [OMI - EPTOMS] and [OMI – SBUV/2] comparisons show a slight reflectivity dependence at high reflectivity beyond 80%.
- Ground stations are lower than OMI about 5 DU (~2%). No dependences of time, total ozone, and SZA.

EOS-Aura Satellite Specifications and OMI Key Parameters

- Orbit: 438 *mi* (705 *km*) polar, sun-synchronous, 1:45 *PM* ascending node
- Wavelength: UV-1 (270 to 314 nm), UV-2 (306 to 380 nm), Visible (350 to 500 nm)
- Spectral resolution: 1.0-0.45 nm FWHM
- Telescope FOV: 114° (2600 km on ground)
- IFOV: 3 km, binned to 13 x 24 km
- Detector: CCD: 780 x 576 (spectral x spatial) pixels

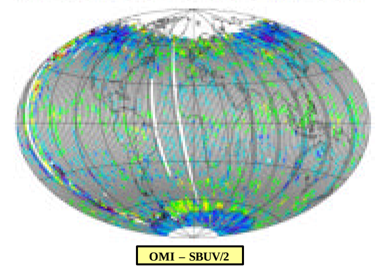
Preliminary Scan Bias Corrections (Soft Calibration)

- The "Soft Calibration" methods are adjustments to the radiance/irradiance ratio. These adjustments are applied to relative "off-track" of OMI 331nm surface reflectivity, 360nm residual (Aerosol Index), and total ozone.
- The absolute value of pair total ozone (318nm,331nm) is adjusted using external comparisons with NOAA-16 SBUV/2 profile total ozone.
- A detailed information of the "Soft"calibration is being presented, entitled as "First Look at Internal Validation and Soft Calibration Preliminary OMI to Produce TOMS-Like Version 8 Total Ozone" [A33A-0133].



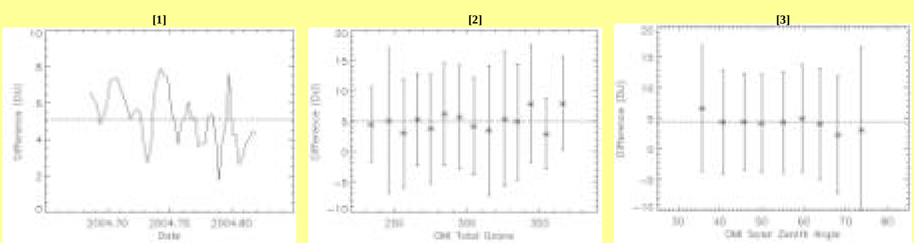
- A difference map of OMI and EPTOMS : Each data set with 1 x 1.25 degree grid cell is averaged for 10 days from Nov 1 - 10, separately.

The differences increase at higher latitudes. At equatorial regions, there is about 8 DU difference on average. A sudden change of difference over the boundary of Antarctica is because of using different snow/ice climatology inputs.



- A difference composite map of OMI and SBUV/2 from 10-day (Nov 1-10) collocated data sets : Instead of using a gridding method for a [OMI - EPTOMS] difference map above, a SBUV/2 IFOV collocation method is used for making a difference composite map because of a larger SBUV/2 IFOV (190km). Therefore, each pixel represents a SBUV/2 IFOV in the map. Some missing locations are mainly due to orbital mismatch between Aura/OMI and NOAA-16 SBUV/2. In most of areas, SBUV/2 agrees well with OMI within ± 6 DU (~ 2%) except for polar regions.

Total Ozone Difference Analyses [OMI - 39 Ground Stations]



OMI total ozone data from 15 September to 31 October, 2004 is compared to data from 39 ground stations. Thirty of these stations are in the Northern Hemisphere and nine are south of the equator. The ground-based data were obtained from the WMO World Ozone Data Center (WODC) and NOAA/CMDL. For each day the ozone measured within a single OMI IFOV most nearly co-located with the ground site is taken as the OMI measurement for the day. The center of the OMI measurement is always located within 75 km of the station and within two hours of local noon. When multiple matches are possible, at high latitudes for instance, the OMI measurement with the shorter optical path is chosen. In all, there are 929 individual matchups between OMI and the ground stations. More data is needed to determine whether or not any systematic biases exist in the OMI ozone retrievals.

Figure [1]: Time series comparisons of OMI total column ozone and ozone values from 39 Ground Stations. Only 45 days of data were available for this study. The dashed line represents the average offset for the comparisons.

Figure [2]: Comparisons of total ozone values as a function of OMI total column ozone values.

Figure [3]: Comparisons of total ozone values as a function of OMI solar zenith angle.

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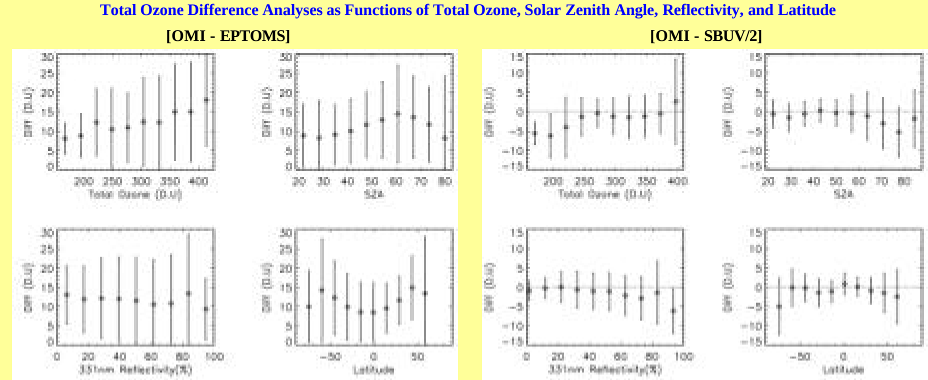
Total Ozone Difference Analyses as Functions of Total Ozone, Solar Zenith Angle, Reflectivity, and Latitude



The figures above show means and +/- 1 standard deviation bars of total ozone differences of 10-day collocated data sets (Nov 1-10). The OMI data are collocated within each EPTOMS instantaneous field of view (IFOV) at nadir scan position of 17 compatible with SBUV/2 (nadir measurement only instrument) comparison. The total ozone values of OMI pixels falling within each EPTOMS IFOV(40 x 40 km) or SBUV/2 IFOV(190 x 190 km) are averaged for comparison. All of 60 scan positions of OMI data are used for making more daily coincidences. A relatively strong dependence of total ozone, SZA, and latitude from the [OMI – EPTOMS] comparisons confirms that EPTOMS has a serious scan mirror problem. Both [OMI – EPTOMS] and [OMI-SBUV/2] comparisons show a slight reflectivity dependence at high reflectivity beyond 80%. We hypothesized that a better resolution of OMI IFOV (13 x 24km) can detect a very high convective cloud with the least amount of ozone near equatorial regions, which was not observed very often by a larger IFOV instrument such as EPTOMS and SBUV/2. However, further studies are needed to verify these new findings.