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

Changwoo Ahn 1, Gordon J. Labow 1, Steven L. Taylor 1, Glen R. Jaross 1, Richard P. Cebula 1, Kai Yang 2, and Pawan K. Bhartia 1

1. Science Systems and Applications, Inc., Lanham, MD USA 2. NASA Goddard Space Flight Center, Greenbelt, MD USA

ahn@chescat.gsfc.nasa.gov

The official Level 3 OMI gridded product will be using a smaller grid size such as ¼ degree cell. The OMI instrument IFOV has a higher spatial resolution than EPTOMS.

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 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 FOV must nearly co-located with the ground site as taken as the OMI measurement for the day. The center of the OMI measurement is always located within 75 km of the nadir scan position of 17 compatible with SBUV/2 (nadir measurement only instrument).

Total Ozone Maps for Oct 08, 2004

• OMI - EPTOMS
• OMI - SBUV/2

Figure [1]: Comparisons of total ozone values as a function of OMI total column ozone values. Only 45 days of data were available for this study. The dashed line represents the average of the 45-day comparison.

Figure [2]: Comparisons of total ozone values as a function of OMI solar zenith angle. For each day, the OMI data are colocated within each EPTOMS instantaneous field of view (IFOV) at nadir scan position of 17 compatible with SBUV/2 (nadir measurement only instrument) comparisons. 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 making more daily coincidences. 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 making more daily coincidences.

Figure [3]: Comparisons of total ozone values as a function of OMI solar zenith angle. The dashed line represents the average of the 45-day comparison.

Total Ozone Difference Analyses (OMI - 39 Ground Stations)

The figures above show mean 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 total ozone dependence at high reflectivity beyond 80%

OMI - EPTOMS

• A difference map of OMI and EPTOMS for each day with 1 x 2.5 degree grid cell is averaged for 10 days from Nov 1-10, separately.

OMI - SBUV/2

• A difference map of OMI and SBUV/2 from 10 days (Nov 1-10) collocated data sets. Instead of using a gridding method for a 1 x 2.5 degree map, we used a difference composite map of OMI and SBUV/2 from 10 days. The OMI data are collocated with SBUV/2 at nadir reflectivity at high reflectivity beyond 80%.

OMI - EPTOMS

• Both OMI – EPTOMS and OMI – SBUV/2 comparisons show a slight reflectivity dependence at high reflectivity beyond 80%

OMI - SBUV/2

• The absolute value of pair total ozone (318nm,331nm) is adjusted using external comparisons with EPTOMS data have not been corrected by a reprocessing.

OMI - EPTOMS

• Detector: CCD: 780 x 576 (spectral x spatial) pixels
• Spectral resolution: 1.0-0.45 nm FWHM
• Wavelength: UV -1 (270 to 314 nm), UV-2 (306 to 380 nm), Visible (350 to 500 nm)
• Orbit: 438° polar, sun-synchronous, 1:45 ascending node

OMI - SBUV/2

• Detector: CCD: 780 x 576 (spectral x spatial) pixels
• Spectral resolution: 1.0-0.45 nm FWHM
• Wavelength: UV -1 (270 to 314 nm), UV-2 (306 to 380 nm), Visible (350 to 500 nm)
• Orbit: 438° polar, sun-synchronous, 1:45 ascending node

CONCLUSIONS

• OMI - EPTOMS comparisons show a relatively strong total ozone and latitude dependence with higher variability than OMI – SBUV/2, mainly because of changing changes in the optical properties of the OMI’s cloud top measurement. The OMI 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.

• 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].

OMI total ozone data for 15 September to 31 October, 2004 is used to map ozone 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 FOV must nearly co-located with the ground site as taken as the OMI measurement for the day. The center of the OMI measurement is always located within 75 km of the nadir scan position of 17 compatible with SBUV/2 (nadir measurement only instrument) comparisons. 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 making more daily coincidences. 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 making more daily coincidences.

OMI - EPTOMS

• A difference map of OMI and EPTOMS for each day with 1 x 2.5 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 ± 6 DU difference on average. A sudden change of difference over the boundary of Antarctica is because of using different snow/ice climatology inputs.

OMI - SBUV/2

• A difference map of OMI and SBUV/2 from 10 days (Nov 1-10) collocated data sets. Instead of using a gridding method for a 1 x 2.5 degree map, we used a difference composite map of OMI and SBUV/2 from 10 days. The OMI data are collocated with SBUV/2 at nadir reflectivity at high reflectivity beyond 80%.

Acknowledgments: This work was performed under NASA contract NAS5-00220.