Highlights from a Decade of OMI-TOMS Total Ozone Observations on EOS Aura

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Abstract
Total ozone measurements from OMI have been instrumental in meeting Aura science objectives. In the last decade, OMI has extended the length of the TOMS total ozone record to over 35 years to monitor stratospheric ozone recovery. OMI-TOMS total ozone measurements have also been combined synergistically with measurements from other Aura instruments and MLS in particular, which provides vertically resolved information that complements the total O3 mapping capability of OMI. With this combined approach, the EOS Aura platform has produced more accurate and detailed measurements of tropospheric ozone. This has led in turn to greater understanding of the sources and transport of tropospheric ozone as well as its radiative forcing effect. The combined use of OMI and MLS data was also vital to the analysis of the severe Arctic ozone depletion event of 2011. The quality of OMI-TOMS total O3 data used in these studies is the result of several factors: a mature and well-validated algorithm, the striking stability of the OMI instrument, and OMI’s hyperspectral capabilities used to derive cloud pressures. The latter has changed how we think about the effects of clouds on total ozone retrievals. We will discuss the evolution of the operational V8.5 algorithm and provide an overview and motivation for V9. After reviewing results and developments of the past decade, we finally highlight how ozone observations from EOS Aura are playing an important role in new ozone mapping missions.

Is the Stratospheric Ozone Layer Recovering? (in maps?)

Hard to impossible to tell from these figures, but they communicate an important story.

OMI is a mapping instrument, and while extension of the total O₃ record is a main goal of OMI, for NASA the recommended total O₃ column long-term dataset is SBUV total O₃. But OMI-TOMS data quality is very good as well. The figure to the right compares OMI-TOMS and SBUV(2) total ozone data.

"...in a rare piece of good news about the health of the planet..." – AP

Assessment for Decision-Makers
Scientific Assessment of Ozone Depletion: 2014

Tropospheric O₃ Applications

Tropospheric column ozone is determined using the tropospheric ozone residual method which involves subtracting measurements of MLS stratospheric column ozone (SCO) from OMI total column ozone after adjusting for intercalibration differences of the two instruments using the convective-cloud differential (CCD) method.

Synergy: OMI + MLS

The synergy of OMI and MLS measurements has been particularly advantageous to the study of both tropospheric and stratospheric ozone processes. Differential sensitivity among these two instruments on the same platform have made Aura an excellent orbiting O3 laboratory.

Clouds pressures used in OMI-TOMS

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OMI TOMS data quality

The optical centroid pressure of the scattering cloud layer is much higher than IR pressures assumed early versions of OMI-TOMS. OMI Raman cloud pressures were adopted in V8.5 of the OMI-TOMS algorithm, improving tropospheric O3 results from cloud differential methods.

Arctic Depletion in 2011

The mechanism responsible for the unprecedented depletion of Arctic ozone was elucidated with the help of OMI-TOMS total ozone data, which was used to establish the magnitude of the ozone deficit. This information was used in CTM runs to help constrain possible scenarios responsible for the large depletion.