The Ozone Mapping and Profiler Suite Limb Profiler (OMPS/LP) on board the Suomi National Polar-Orbiting Partnership (S-NPP) satellite (1:30 PM ascending node & 833 km altitude) was launched on October 28, 2011. Instruments include OMPS, VIIRS, ATMS, CrIS and CERES.

The LP instrument measures the radiance scattered from the Earth's atmosphere in limb viewing mode and retrieves ozone profiles from the tropopause to 60 km. OMPS/LP views the Earth limb 0–110 km vertical range; 250 km horizontal separation between 3 slits every 18.75s (1° latitude sampling); 290 nm – 1000 nm @ 0.8 nm – 25 nm resolution.

Effect of ASD on Ozone Retrieval

\[
\text{ASI}(z, \text{SSA}, \lambda) = \frac{I_{\text{m}}(\text{LP}, \text{SSA})}{I_{\text{c}0}(\text{LP}, \text{SSA})} - \frac{I_{\text{m}}(\text{SAGE})}{I_{\text{c}0}(352\text{nm}, \text{SSA})}
\]

The two maps above are qualitatively similar.

The ozone error also depends on scattering angle. The left figure above shows that aerosol scattering phase function varies with the scattering angle by about a factor of 40 as Rayleigh scattering weakens. The right figure above shows aerosol Jacobians at 351 (top panel) and 525 nm (bottom panel) for two SSAs of 45 (right panel) and 139° (left panel). For the small SSA, the Jacobians are positive. For the larger SSA at a certain tangent altitude, the Jacobian becomes negative and reduces the sensitivity of the limb radiance to aerosols. This characteristic is problematic for the inversion algorithm.

Aerosols are a problem for Ozone Retrievals

Ozone Retrieval Algorithm

\[
a(z) = \frac{100}{\text{Refractivity}(\lambda)}
\]

\[
\text{Refractivity} = 1.448 + 0.000021 \lambda^2
\]

Change in ASI(674nm), daily mean for three days

Before correction

With original SAGE

With the adjusted SAGE

Evaluation of the Aerosol Correction

Aerosols have a detectable effect on OMS/LP data. Our analysis shows that ignoring the aerosol contribution can produce an ozone density bias of up to 15% in the region of maximum aerosol extinction. The Aerosol Scattering Index (ASI), as defined in the text, is used to evaluate the effect of aerosols on OMS/LP radiances and to assess errors in ozone retrievals. An aerosol correction algorithm is then developed for ozone retrieval by scaling the SAGE climatology using the ratio ASI(LP)/ASI(SAGE). The algorithm improvement is verified by comparison to MLS ozone profile. This work suggests that using the proposed aerosol correction algorithm would significantly reduce the residual variance and improve the quality of the retrieved ozone concentration profile.

Summary

Aerosol Correction for Improving OMS/LP Ozone Retrieval

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