Interpreting the OMI ultraviolet Aerosol Index to understand absorption by organic carbon aerosols and implications for atmospheric oxidation

Melanie S. Hammer1*, Randall V. Martin1,2, Aaron van Donkelaar1, Virginie Buchard3, Omar Torres3, Robert J.D. Spurr4
1. Dalhousie University 2. Harvard Smithsonian Center for Astrophysics 3. NASA/Goddard Space Flight Center 4. RT Solutions Inc

Introduction

Biomass burning aerosols consist mainly of black and organic carbon. Traditionally, black carbon is assumed to be the sole absorbing carbonaceous aerosol species in models. Several recent studies have found evidence of absorption by a subset of organic carbon known as "brown carbon" (BrC), which is thought to contribute significantly to the overall absorption by biomass burning aerosol. We introduce BrC to GEOS-Chem and examine its effect on aerosol absorption in biomass burning regions.

Aerosol Index (AI)

- The AI is a method of detecting absorbing aerosols from satellite measurements, and is a product of the Ozone Monitoring Instrument (OMI) [Torsati et al., 2007, 2013].
- The AI is calculated by separating the spectral contrast of radiances due to aerosol effects and those due to Rayleigh scattering at two wavelengths (354 and 388 nm) in the near-UV region.

Simulation

We follow the method of Buchard et al., 2014 for simulating the AI using the vector radiative transfer model VILDORT (Spurr 2006).

Comparison of Aerosol Composition

OMI observations and simulated BrC in biomass burning regions

Effect of BrC Absorption on OH Concentrations

- The figure below shows the percent changes in OH concentrations in the lower troposphere due to the addition of absorbing brown carbon to the GEOS-Chem simulation.
- The tendency of models to overestimate OH concentrations [Mao et al., 2013] is reduced.

The simulation including BrC is more consistent than the base case simulation in reproducing the OMI AI over major biomass burning regions.

References