Satellite-based Evidence of Wavelength-dependent Aerosol Absorption in Biomass Burning Smoke Inferred from Ozone Monitoring Instrument

Hiren Jethva[1] and Omar Torres[1] and P. K. Bhartia[2]
[1]*Dept.Atmospheric & Planetary Sciences, Hampton University, Hampton VA-23668 USA*
[2]*NASA Goddard Space Flight Center, Greenbelt, MD-20771 USA*

We provide first satellite-based evidence of the spectral dependence of absorption in biomass burning aerosols over South America, Central Africa, and Northern India using near-UV measurements made by Ozone Monitoring Instrument (OMI) during 2004-2008. Currently, OMI aerosol algorithm charac terizes biomass burning aerosol as \gray" aerosols, meaning no wavelength dependence in aerosol absorption. This assumption is valid for aerosols dominated by black carbon whose spectral absorption can be characterized by power law with Absorption Angstrom Exponent (α_{abs}) of 1.0. With this assumption, OMI-derived aerosol optical depth (AOD) is found to be over-estimated significantly compared to that of AERONET at several sites during intense biomass burning events. The assumption on height of aerosols and other parameters seem to be reasonable and unable to explain large discrepancy in the retrieval. A new set of OMI aerosol retrieval with the assumption of wavelength-dependent aerosol absorption in the near-UV region provided much improved AOD with significantly reduced bias. Also, the new retrieval of single-scattering albedo at 441 nm is in better agreement with those of AERONET within the uncertainties (0.03). Increasing number of ground-based studies that reveal strong spectral dependence in aerosol absorption in the near-UV region, indicating presence of organic carbon, provide indirect validation of the spectral aerosol absorption (α_{abs} 2.49-2.92) derived using the near-UV OMI technique. Together with suggesting vast improvement in the retrieval of aerosol properties from OMI, present study demonstrates the near-UV capabilities of OMI to separate aerosols containing organics from black carbon based on their distinct spectral absorption signature. This finding assumes importance in atmospheric chemistry, determining spectral aerosol absorption globally and thus in aerosol led global change.

Keywords: near-UV measurements; spectral aerosol absorption; black carbon and organics;