Challenges of absorbing aerosols in atmospheric correction for ocean color retrievals

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Satellite remote sensing of ocean color is a critical tool for assessing the productivity of marine ecosystems and monitoring changes resulting from climatic or environmental influences. Yet water-leaving radiance comprises less than 10% of the signal measured from space, making correction for absorption and scattering by the intervening atmosphere imperative. Traditional ocean color retrieval algorithms utilize a standard set of aerosol models and the assumption of negligible water-leaving radiance in the near-infrared. Modern improvements have been developed to handle absorbing aerosols such as urban particulates in coastal areas and transported desert dust over the open ocean, where ocean fertilization can impact biological productivity at the base of the marine food chain. Even so, imperfect knowledge of the absorbing aerosol optical properties or their height distribution results in well-documented sources of error. In the UV, which future spaceborne spectrometry plans to exploit to improve the separation of chlorophyll from colored dissolved organic matter (CDOM) as well use to quantify different phytosynthetic pigments contributing to light absorption spectra, the problem of UV-enhanced absorption and nonsphericity of certain aerosol types are amplified due to the increased Rayleigh and aerosol optical depth, especially at off-nadir view angles.

Multi-angle spectro-polarimetric measurements have been advocated as an additional tool to better understand and retrieve the aerosol properties needed for atmospheric correction for ocean color retrievals. The central concern of the work to be described is the assessment of the effects of absorbing aerosol properties on water leaving radiance measurement uncertainty by neglecting UV-enhanced absorption of carbonaceous particles and by not accounting for dust nonsphericity.

The phase matrices for the spherical smoke particles were calculated using a standard Mie code, while those for non-spherical dust particles were calculated using the numerical approach described by Dubovik et al., 2006. A vector Markov Chain radiative transfer code including bio-optical models was used to quantitatively evaluate in water leaving radiances between atmospheres containing realistic UV-enhanced and non-spherical aerosols and the SEADAS carbonaceous and dust-like aerosol models.