Retrieval of Aerosol Absorption Properties from Satellite Observations

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The Angstrom Absorption Exponent (AAE) is a parameter commonly used to characterize the wavelength-dependence of aerosol absorption optical depth (AAOD). It is closely related to aerosol composition. Black carbon (BC) containing aerosols yield AAE values near unity whereas Organic carbon (OC) aerosol particles are associated with values larger than 2. Even larger AAE values have been reported for desert dust aerosol particles. Knowledge of spectral AAOD is necessary for the calculation of direct radiative forcing effect of aerosols and for inferring aerosol composition. We have developed a satellite-based method of determining the spectral AAOD of absorbing aerosols. The technique uses multi-spectral measurements of upwelling radiation from scenes where absorbing aerosols lie above clouds as indicated by the UV Aerosol Index. For those conditions, the satellite measurement can be explained, using an approximations of Beer's Law (BL), as the upwelling reflectance at the cloud top attenuated by the absorption effects of the overlying aerosol layer. The upwelling reflectance at the cloud-top in an aerosol-free atmospheric column is mainly a function of cloud optical depth (COD). In the proposed method of AAE derivation, the first step is determining COD which is retrieved using a previously developed color-ratio based approach. In the second step, corrections for molecular scattering effects are applied to both the observed ad the calculated cloud reflectance terms, and the spectral AAOD is then derived by an inversion of the BL approximation. The proposed technique will be discussed in detail and application results making use of OMI multi-spectral measurements in the UV-Vis. will be presented.