Validation of the MODIS aerosol optical properties along the northeastern US coastal regions

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Aerosol optical properties are being retrieved operationally from MODIS measurements using various algorithms. The MODIS-Atmosphere team algorithm for aerosol property retrievals actually includes two independent algorithms, one for use over land surfaces and another for ocean scenes. MODIS-Atmosphere aerosol products are retrieved at a 10 by 10 km2 spatial resolution. In addition, the MODIS-Ocean team derives aerosol properties over the ocean. Their algorithms are mainly concerned with retrieval of spectral water-leaving radiances using MODIS optical bands. To obtain accurate ocean color measures, the dominant aerosol-related signal must be estimated and precisely removed. MODIS-Ocean aerosol properties are thus retrieved at a 1 by 1 km2 resolution over all ocean pixels. Numerous recent studies validate MODIS-retrieved aerosol products with “ground truth” aerosol properties, particularly using data from AERONET sun-photometer stations. The validation of MODIS-Atmosphere algorithm aerosol optical products both over ocean and over land shows remarkable skill globally (Remer et al. 2005). Similarly, aerosol products derived using the SeaWiFS algorithm (similar to the MODIS-Ocean algorithm) have been favorably validated against the ground truth aerosol properties (Wang et al. 2005).

Global validation, however, does not give a representative measure of MODIS-retrieved aerosol product accuracy near the continental margins. Complexity in the atmosphere is one of the major sources of inaccuracy in both oceanic and atmospheric products derived from satellite sensors for the coastal ocean. For instance, mischaracterizing coastal aerosols has led to the frequent occurrence of negative water-leaving radiance values retrieved by ocean color sensors, a long-standing and important issue in coastal waters, particularly along northeastern U.S. coastal regions. How do the differing MODIS ocean and atmosphere teams address the marine-continent air mass mixing issue, and what can be learned in each to improve coastal ocean color data? This paper provides a cross-team algorithm assessment comparing MODIS-Atmosphere and MODIS-Ocean aerosol products in the U.S. northeastern coastal regions. The reference data come from AERONET measurement stations at coastal locations from Virginia to Maine and for the period of 2004-2005. The analysis will focus on aerosol spatial and temporal variability impacts upon satellite aerosol property retrieval uncertainties.