Apportionment study of the dust sources in the Middle East and North Africa using GEOS-5

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Dust particles lifted by wind from deserts and other arid surfaces are known to be important in a series of chemical and physical processes in the Earth's atmosphere, climate system, and biogeochemical cycles. Results from previous studies have indicated that dust composition and optical properties can vary depending on its source region. In this study, we use a new multi-component dust scheme implemented in the Goddard Chemistry Aerosol Radiation and Transport (GOCART) module within the Goddard Earth Observing System - version 5 (GEOS-5) Earth system model to investigate the relative importance of individual dust source regions in the Middle East and North Africa for the global aerosol budget. To capture the variation of optical properties of dust particles in the atmosphere that can be attributed to their origin we defined several dust source regions and performed simulations with dust tracers tagged by source region. We examine the contribution of each source region at different receptor locations, in particular, along the path of dust plumes transported across the Atlantic Ocean and over the Caribbean Sea. Further, in order to evaluate the sensitivity of satellite observations to dust mineralogy differences, we use the Ozone Monitoring Instrument (OMI) simulator built on the Vector Radiative Transfer Model (VLIDORT) to simulate the OMI top-of-atmosphere radiances based on the GEOS-5 simulated aerosol profiles. We investigate the potential to observe differences in dust mineral composition in remote sensing observations by comparing simulated radiances in which dust is assigned globally uniform dust optical properties versus different scenarios where more than one set of the optical properties are used to represent dust properties.