Estimating dust abundance and transport from satellite depolarization measurements

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Desert dust, one of the most abundant aerosols in the atmosphere, is recognized as an integral component of the Earth system that influences weather and climate via a suite of complex interactions with the energy, water, and carbon cycles. Estimating dust abundance from satellites is appealing because routine and multi-year satellite measurements can capture large temporal and spatial variations of dust and hence be used to assess dust's roles in the Earth system. Dust particles are largely coarse in size and non-spherical in shape and hence have a much larger linear depolarization ratio than primarily spherical marine and combustion-generated particles, which offers an opportunity of separating dust from other aerosol types. In this talk we present a method of deriving dust component, fine and coarse dust separately, using the depolarization ratio measured by the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) and the Cloud Aerosol Transport System (CATS). The dust profiles are used to estimate the zonal and meridional transport of dust. We also discuss a use of CALIOP dust profile to constrain the retrieval of dust optical depth and effective diameter from the thermal infrared channels of the Moderate resolution Imaging Spectrometer (MODIS) and comparisons of CALIOP dust optical depth with other satellite-based estimates.