



High resolution mapping of dust sources in Central Asia using MODIS imagery

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Dust impacts the energy balance of the Earth via absorption and scattering of radiation in the atmosphere and through the mechanism by which aerosols modify the optical properties of clouds and land surfaces. It is now established that the deposition of mineral dust significantly affects high-altitude environments, including both snow pack and glacier ice. Central Asia is a region where large deserts are located in close proximity to the mountains whose extensive glaciers and snow pack provide runoff supporting agriculture in the densely populated foothills. More than 75% of the territory in Central Asia is desert lowland varying from sandy to stony, salt, and clay deserts. Significant amounts of wind-blown desert dust, originating from these deserts, are deposited on glaciers of Tian Shan Mountains in Central Asia. Satellite remote sensing using optical imagery has provided us with a powerful tool for identification and characterization of dust emission sources. In this study we investigated the spatial distribution and seasonal pattern of dust emissions in surrounding lowlands of the Tian Shan Mountains using Moderate Resolution Imaging Spectroradiometer (MODIS) imagery. Seasonality of dust emission is studied by analyzing MODIS Deep Blue aerosol optical depth, acquired over a period of 12 years from January 2003 to December 2014. We analyzed the spatial distribution and frequency of occurrence of dust optical depth to identify the main dust sources in this region. In order to produce a detailed map of dust emission sources, we also employed a dust enhancement algorithm to obtain high resolution (1km) dust enhancement products from MODIS imageries. The high resolution of MODIS dust enhancement products enabled us to identify several small, eroding point sources within the dust source areas. Different seasonal patterns of dust emissions were observed in northern, western and southern deserts around the Tian Shan Mountains and their relation to climatological processes in these regions are explored. Finally, Land use characteristics and meteorological conditions at each individual point source are investigated.