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Observing a Severe Dust Storm Event over China using Multiple Satellite Data

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ABSTRACT

A severe dust storm (SDS) event occurred from 19 to 21 March 2010 in China, originated in western China and Mongolia and propagated into eastern/southern China, affecting human's life in a large area. As reported by National Meteorological Center of CMA (China Meteorological Administration), 16 provinces (cities) of China were hit by the dust storm (Han et al., 2012).

Satellites can provide global measurements of desert dust and have particular importance in remote areas where there is a lack of in situ measurements (Carboni et al., 2012). To observe a dust, it is necessary to estimate the spatial and temporal distributions of dust aerosols. An important metric in the characterisation of aerosol distribution is the aerosol optical depth (AOD) (Adhikary et al., 2008). Satellite aerosol retrievals have improved considerably in the last decade, and numerous satellite sensors and algorithms have been generated. Reliable retrievals of dust aerosol over land were made using POLarization and Directionality of the Earth's Reflectance instrument-POLDER (Deuze et al., 2001), Moderate Resolution Imaging Spectroradiometer-MODIS (Kaufman et al., 1997; Hsu et al., 2004), Multiangle Imaging Spectroradiometer-MISR (Martonchik et al., 1998), and Cloud-aerosol Lidar and infrared pathfinder satellite observations (CALIPSO).

However, intercomparison exercises (Myhre et al., 2005) have revealed that discrepancies between satellite measurements are particularly large during events of heavy aerosol loading. The reason is that different AOD retrieval algorithms make use of different instrument characteristics to obtain retrievals over bright surfaces. For MISR, POLDER and MODIS instrument, the multi-angle approaches, the polarization measurements and single-view approaches were used to retrieval AOD respectively. Combining of multi-sensor AOD data can potentially create a more consistent, reliable and complete picture of the space–time evolution of dust storms (Ehlers, 1991).

In order to make use of all useful satellite data to observe one severe dust procedure, multi-sensor and multi-algorithm AOD data were combined. In this paper, the satellite instruments considered are MISR, MODIS, POLDER and CALIPSO. In addition, air pollution index (API) data were used to validate the satellite AOD data. We chose the study region with a longitude range from 76°N to 136°N and a latitude range from 15°E to 60°E.

Index Terms—aerosol optical depth, dust, satellite

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