

Intercomparison of multiple satellite aerosol products against AERONET over the North China Plain

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Using Aerosol Robotic Network aerosol optical depth (AOD) products at three stations in the North China Plain (NCP), a heavily polluted region in China, the AOD products from six satellite-borne radiometers, i.e., the Moderate Resolution Imaging Spectroradiometer (MODIS), the Multiangle Imaging Spectroradiometer (MISR), Ozone Mapping Imaging (OMI), the Visible Infrared Imaging Radiometer (VIIRS), the Sea-Viewing Wide Field-of-View Sensor (SeaWiFS), and Polarization and Directionality of the Earth's Reflectances (POLDER), are thoroughly validated, shedding new light on their advantages and disadvantages. The MODIS Deep Blue (DB) products provide more accurate retrievals than the MODIS Dark Target (DT) and other satellite products at the BJ site (a megacity), with higher correlations with AERONET ($R > 0.93$), lower mean absolute bias ($MB < 0.012$), and higher percentages ($>68\%$) falling within the expected error (EE). All MODIS DT and DB products perform better than the other satellite products at the XH site (a suburb). The MODIS/Aqua DT products at both 3-km and 10-km resolutions perform better than the other space-borne AOD products at the XL site (a rural area at the top of a mountain). MISR, VIIRS, SeaWiFS tend to underestimate high AOD values and overestimate AOD values under very low AOD conditions in the NCP. Both OMI and POLDER significantly underestimate the AOD. In terms of data volume, MISR with the limited swath width of 380 km has less data volume than the other satellite sensors. The MODIS products have the highest sampling rate, especially the MODIS DT and DB merged products, and can be used for various climate study and air-quality monitoring.

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