

Ground-based observation of Dust Optical Properties in the Chinese Dust Source Region and Intercomparison with MISR aerosol retrievals

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Abstract:

Using 22 months of Sunphotometer (SP) Aerosol Optical Thickness (AOT) data collected near the Taklamakan and Gobi dust source regions (Dunhuang, 40.09°N, 94.41°E) in China; we examine the diurnal and seasonal change of dust aerosol properties and perform comparisons with the Multi-angle Imaging Spectroradiometer (MISR) AOT retrievals. Most dust events are during the spring through early summer months with a season-invariant diurnal change of more than $\pm 10\%$ for AOT and $\pm 30\%$ for Angström exponent, with larger AOT and smaller Angström exponent values late in the afternoon. These values are much larger when compared to recent studies that have reported a much smaller ($\pm 5\%$) diurnal variability of dust AOT over various AERONET sites where dust is a major contributor to AOT. The MISR AOT and SP AOT are highly correlated, with linear correlation coefficients (R) ranging from 0.85 to 0.95 depending on the different comparison criteria used for removal of cloud-contamination. With one exception where MISR AOT shows large differences (>0.3) when compared to SP AOT during the passage of a dust front, all other collocated SP AOT and MISR AOT pairs are highly correlated with $R > 0.9$ and with root mean square error of 0.06 when cloud contamination is minimized and retrieval conditions become favorable. Overall, the MISR AOT systemically overestimate SP AOT by 0.05, but they all fall within the predicted uncertainties (0.05 or 20% of τ_{SP} , whichever is larger). Due to diurnal change of AOT, the difference between daily-averaged SP AOT values and MISR AOT measured during MISR overpass time is about 0.09. The implications of these results to satellite aerosol retrievals and radiative forcing studies are then discussed.