

Characteristics of Aerosols Properties Over Different Desert-Influenced Aeronet Sites

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Abstract : The characteristics of optical and microphysical properties of aerosols near deserts are analyzed using 11 AEROSOL ROBOTIC NETWORK (AERONET) sites located in 6 major desert areas (the Sahara, Arabia, Thar, Karakum, Taklamakan, and Gobi) between 1998 and 2021. The regional mean of Aerosol Optical Depth (AOD) (coarse AOD (CAOD)) are 0.44 (0.187), 0.38 (0.26), 0.35 (0.24), 0.23 (0.11), 0.20 (0.14), 0.10 (0.05) in the Thar, Arabian, Sahara, Karakum, Taklamakan and Gobi Deserts respectively, while an opposite for AE and Fine Mode Fraction (FMF). Higher extinctions are associated with larger particles (dust) over all the main desert regions. This is shown by the almost inversely proportional variations of AOD and CAOD compared with AE and FMF. Coarse particles contribute the most to the total AOD over the Sahara Desert compared to those in the other deserts all year round. Related to the seasonality of dust events, the maximum AOD (CAOD) generally appears in summer and spring, while the minimum is in winter. The mean values of absorbing AOD (AAOD), Absorbing AE (AAE), and the Single Scattering Albedo (SSA) for all sites ranged from 0.017 to 0.037, from 1.16 to 2.81 and from 0.844 to 0.944, respectively. Generally, the highest absorbing aerosol load are observed over the Thar, followed by the Karakum, the Sahara, the Gobi, and then the Taklamakan Deserts, while the largest absorbing particles are observed in the Sahara followed by Arabia, Thar, Karakum, Gobi, and the smallest over the Taklamakan Desert. Similar absorption qualities are observed over the Sahara, Arabia, Thar, and Karakum Deserts, with SSA values varying between 0.90 and 0.91, whereas the most and least absorbing particles are observed at the Taklamakan and the Gobi Deserts, respectively. The seasonal AAODs are distinctly different over the deserts, with parts of Sahara and Arabia, and the Dalanzadgad sites experiencing the maximum in summer, the Southern Sahara, Western Arabia, Jaipur, and Dushanbe in winter, while the Eastern Arabia and the Muztagh Ata in autumn. AAOD and SSA spectra are consistent with dust-dominated conditions that resulted from aerosol typing (dust and polluted dust) at most deserts, with a possible presence of other absorbing particles apart from dust at Arabia, the Taklamakan, and the Gobi Desert sites.

Keywords : sahara, AERONET, desert, dust belt, aerosols, optical properties

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