Aerosol radiative forcing over East Asia determined from ground-based sunphotometry measurements

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Aerosol radiative forcings over East Asia are calculated using ground-based measurements of sunphotometry at Sri-Samrong (17.17°N, 99.87°E) in Thailand, Mandalgovi (45.59°N, 106.19°E) in Mongolia, Dunhuang (40.16°N, 94.80°E), and Yinchuan (38.48°N, 106.22°E) in China, and Anmyon (36.52°N, 126.32°E), Gosan (33.29°N, 126.17°E) in Korea and Amami-Oshima (28.44°N, 129.70°E) in Japan. For investigating aerosol radiative forcings (ARF) over East Asia for long term measurements and during Asian dust events, we have developed a method to retrieve ARF using the aerosol parameters from skyradiometer and optimum single scattering albedo from surface flux measurements as inputs into the RT model. Mean radiative forcing efficiencies ($\Delta F/\tau_{0.5}$) over East Asia range from −65 to −95 W m−2 at the surface while −20 to −40 W m−2 at TOA under clear-sky conditions. These aerosol direct radiative forcings over East Asia are similar to other experimental results for different regions, i.e., the Indian Ocean Experiment (INDOEX) and the Tropospheric Aerosol Radiative Forcing Observational Experiment (TARFOX), from which radiative forcing efficiencies of −75 W m−2 and −70 W m−2 for the Indian Ocean and the East Coast of the United States are reported. Nevertheless, the differences in aerosol parameters and relatively large STD values with regard to spatiotemporal variations suggest that the impact of aerosol on ARF over East Asia is more significant than previously recognized for other regions and should be continuously observed to determine the relation between increasing aerosols and associated radiative forcings in the region. The internal mixing processes between elemental carbon and weak absorbing dust particles could explain the lower single scattering albedo at Korean and Japanese areas

than other areas, i.e., Sahara and Arabian dusts or source regions during Asian dust events. If we consider radiative forcing's effect with dust presence, increased radiative heating in the atmosphere and increased surface cooling could produce increased atmospheric stability and thus suppressed convection during dust outbreaks.