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Aerosol optical properties at a coastal site in Hong Kong, South China: temporal features, size dependencies and source analysis

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Hong Kong is a typical coastal city adjacent to the Pearl River Delta (PRD) region in southern China, which is one of the regions suffering from severe air pollution. Atmospheric aerosols can affect the earth's radiative balance by scattering and absorbing incoming solar radiation. Black Carbon (BC) aerosol is a particularly emphasized component due to its strong light absorption. Aerosol transported from different source areas consists of distinct size distributions, leading to different optical properties. As the byproducts of the incomplete oxidation, BC and CO both have relatively long life time, their relationship is a good indicator for distinguishing different pollutant sources.

In this study, temporal variations of aerosol optical properties and concentrations of BC and CO at a coastal background station in Hong Kong were investigated. Transport characteristics and origins of aerosol were elucidated by analyzing backward Lagrangian particle dispersion modeling (LPDM) results, together with related parameters including the relationships between optical properties and particle size, BC-CO correlations, ship location data and meteorological variables.

From February 2012 to September 2013 and March 2014 to February 2015, continuous in-situ measurements of light scattering and absorption coefficients, particle size distribution and concentrations of BC and CO were conducted at Hok Tsui (HT), a coastal background station on the southeast tip of Hong Kong Island (22.22ºN, 114.25ºE, 60 m above the sea level) with few local anthropogenic activities. Affected by the Asian monsoon, this region is dominated by continental outflow in winter and by marine inflow from the South China Sea in summer, which is an ideal station for identifying the transport characteristics of aerosol and their effects on optical properties from different anthropogenic emission sources. 7-day backward Lagrangian particle dispersion modeling was performed for source identification. Three types of cases dominantly influenced by the PRD regional emission, long-range transport and marine exhaust were compared and discussed in detail.