Geophysical Research Abstracts
Vol. 20, EGU2018-17553, 2018
EGU General Assembly 2018

Satellite-based estimation of regional particulate matter (PM) using multiple regression model and vertical/humidity correction method

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Aerosols or airborne particulate matters (PMs) from both natural and anthropogenic emission sources have significant influences on climate, environment, and human health. The assessment of air quality, particularly in terms of PM10 and PM2.5 (PMs with aerodynamic diameters less than 10 and 2.5 μm, respectively) and their compositions, is a very urgent problem at present. Thus, ground-based observations have been in operation to provide important spatiotemporal information on atmospheric PM concentration and composition. However, due to the highly variable concentration in space and time and to high operational costs, in situ observations are insufficient to capture high-resolution, temporal and spatial variation of PM concentrations, especially on a regional scale. To complement this, satellite remote sensing can step in to monitor regional air quality where ground monitors are not available or sparsely distributed. Satellite-derived aerosol optical depth (AOD) is related to ground-level PM concentration and can be empirically converted into PM mass. A number of empirical models have been developed to estimate ground-level PM concentration from various satellite-derived AOD products for different parts of the world (e.g., Liu et al., 2009; Lee et al., 2011; Ma et al., 2014; Seo et al., 2015; Xie et al., 2015). In order to improve the accuracy of PM estimation, related parameters, such as land use, geographical data, and local or model-assimilated meteorological information, were also used to develop more complex models, such as multiple regression models and nonlinear models. In this study, empirical model to estimate PM concentration using satellite AOD have been developed and various correction methods have been analyzed to improve estimation accuracy.