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Fusion of satellite data and ground observed PM2.5 in Pearl River Delta region with Linear Mixed Effect and Bayesian Maximum Entropy method

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Fine ground-level partculate matter(PM2.5) becomes the primary pollutant affecting the air quality of most cities in China. Due to its environmental effects of visibility reduction, and its adversely health affects of cardiovascular disease due to access to alveoli, PM2.5 has attracted extensive attention from the public, government and science.Remote sensing data has been widely used in PM2.5 invertion due to its wide coverage and spatial continuity. Therefore, It is necessary and significant to estimate fine ground-level particulate matter(PM2.5) with satellite-derived aerosol optical thickness (AOD) for air quality forecast, air pollution control, and human health impact assessment. Combining Linear Mixed Effect (LME) model and Bayesian Maximum Entropy (BME) method, ground-level PM2.5 from October 2015 to March 2016 in Pearl River Delta region were estimated in this paper by AOD, NDVI and meteorological data. The results showed that the prediction accuracy of LME+BME method were greatly improved compared with that of the LME method. The cross-validation R2 of LME+BME model is 0.751, and root mean squared prediction error (RMSE) is 6.886μg·m-3, the mean prediction error (MPE) is 4.52μg·m-3, while R2=0.703, RMSE=7.546μg·m-3, and MAE=4.927μg·m-3 for the LME method. The high PM2.5 concentration is mainly located in Guangzhou, Foshan, Dongguan, and the low PM2.5 concentration is mainly distributed in Zhaoqing, Huizhou, Jiangmen. In terms of seasonal variation, PM2.5 pollution is more serious in mid-October in 2015, late November in 2015 and late March in 2016, while it is relatively low in early October in 2015, early December in 2015 and late January in 2016.
Key words [U+FF1A] PM2.5; MODIS AOD; Linear mixed-effect model; Bayesian maximum entropy; Pearl River Delta region