

Statistical Analysis of the Impacts of Regional Transportation on the Air Quality in Beijing

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From October to December 2015, Beijing-Tianjin-Hebei (BTH) region had experienced several severe haze events. In order to assess the effects of the regional transportation on the air quality in Beijing, the air monitoring data (PM_{2.5}, SO₂, NO₂ and CO) from that period published by Chinese National Environmental Monitoring Center (CNEMC) was collected and analyzed with various statistical models. The cities within BTH area were clustered into three groups according to the geographical conditions, while the air pollutant concentrations of cities within a group sharing similar variation trends. The Granger causality test results indicate that significant causal relationships exist between the air pollutant data of Beijing and its surrounding cities (Baoding, Chengde, Tianjin and Zhangjiakou) for the reference period. Then, linear regression models were constructed to capture the interdependency among the multiple time series. It shows that the observed air pollutant concentrations in Beijing were well consistent with the model-fitted results. More importantly, further analysis suggests that the air pollutants in Beijing were strongly affected by regional transportation, as the local sources only contributed 17.88%, 27.12%, 14.63% and 31.36% of PM_{2.5}, SO₂, NO₂ and CO concentrations, respectively. And the major foreign source for Beijing was from Southwest (Baoding) direction, account for more than 42% of all these air pollutants. Thus, by combining various statistical models, it may not only be able to quickly predict the air qualities of any cities on a regional scale, but also to evaluate the local and regional source contributions for a particular city.

Key words: regional transportation, air pollution, Granger causality test, statistical models