SPATIAL VARIATION OF INHALABLE PARTICULATE MATTER AND ITS INFLUENCE FACTOR ANALYSIS DURING THE REGIONAL AIR POLLUTION STUDY

Zhao Wen-hui[1], Gong Hui-li[1], Zhao Wen-ji[1], Tao Tang[2]

1. College of Resources Environment and Tourism, Capital Normal University, Beijing, China
Beijing Key Lab of Resource Environment and GIS, Beijing, 100048, China
2. Department of Geography and Planning, State University of New York College at Buffalo, USA

1. INTRODUCTION

The quality and pollution of inhalable particulate matter (short for IPM) and its impact on the environment and particularly on human health, is an issue of significant public and governmental concern. It has a great realistic meaning on analyzing its spatial characteristic and influencing factors for setting down the more effective controlling policies on IPM. Inhalable particulate matter has several environmental impacts, some of which are global but mostly are regional. Therefore, there is a need to better understand the spatial variability of inhalable particles across regional air pollution study and the variation in exposure to inhalable particles arising from different sources.

2. CONTENT

The objective of this study is to characterize the spatial uniformity and heterogeneity in different diameter of inhalable particle source contributions so that the potential for exposure characterization impact factors in source identification studies can be better understood. In this paper, our research is focus on the spatial variation of inhalable particulate in different aerodynamic diameter from 2007 to 2008 in Beijing urban city, meanwhile, we analyst the correlativity between IPM and some influence factors, such as different underlying surface and meteorological factors. Furthermore, by means of CCA (canonical correlation analysis) between IPM concentration and meteorological factors, the influences of meteorological factors on pollutant concentration were compared.

The 93 air samples data were collected in Beijing urban city using the Handheld Laser Particle Counter (Model 3886 GEO-X) between June 12 and July 3 in 2007 and 2008 respectively. The location of sample sites and Meteorological data including temperature, humidity and wind speed were also collected synchronously. The spatial distribution of PM1.0, PM3.0 and PM5.0 concentration are simulated by using Kriging method with 93 air samples data. The different types of underlying surface were extracted from SPOT5 image in eCogniton7.0 software. It including water, green area, road area, structural area and residential area. The spatial variation of IPM concentration have been analyzed by using statistics approaches including correlation analysis，principle component analysis and cross correlation analysis. Meanwhile, by taking streets and towns as the basic spatial analysis unit, the correlation between underlying surface and IPM, are quantitatively evaluated by using GIS multifactor integrated analysis and GIS overlay of ranked data layers. Finally, we analyzed possible meteorological factors by using CCA method.

3. CONCLUSION

The concentrations of PM1.0、PM3.0 and PM5.0 from 2007 to 2008 summer were found to range from 0.0255 to 0.0204 mg/m^3、0.0745 to 0.0733 mg/m^3 and 0.1425 to 0.0871 mg/m^3. The results showed spherical models with nuggets could fit the variograms of PM1.0、PM3.0 and PM5.0. The IPM concentration had significant decreasing trend from 2007 to 2008 summer. Meanwhile, the center of pollution has transferred from north and northeast district to southwest and northwest. The spatial distributions of IPM concentrations however were different with monitoring sites. The spatial relativity between three air particles and their impact factors also have spatial heterogeneity. Among the three pollutants, the spatial distribution of PM1.0 is firstly influenced by the distribution of impact factors; PM0.5 is secondly, PM0.3 is the least. Moreover vegetation cover ratio (one of the underlying surface types) is also important to the spatial distribution of IPM concentration. The local regions where vegetation cover ratio are high having relative low IPM annual average on concentrations. The main sources

of air particles are the dust from soil, soot and construction, and the exhaust gases. The long distance transportation from vicinage maybe also gives contribution to regional air particles pollution in Beijing.
The results of preliminary investigations revealed the need for the continuous and long-term systematical sampling, measurements and analysis of interaction of the IPM as well as meteorological factors, other influence factors in the ground level.

Key words: inhalable particulate matter, spatial variation, Kriging, canonical correlation analysis

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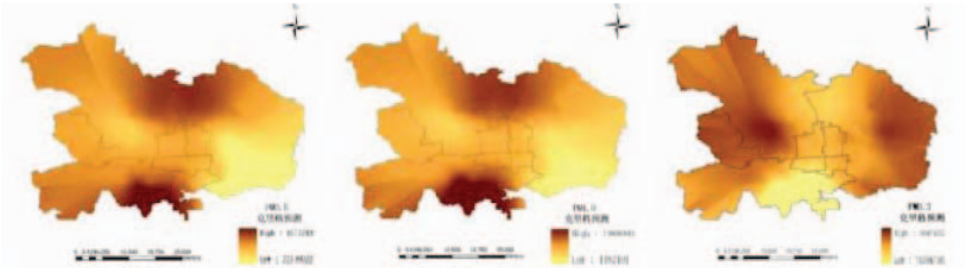

Fig.1 The spatial distribution of the IPM in 2007 in Beijing

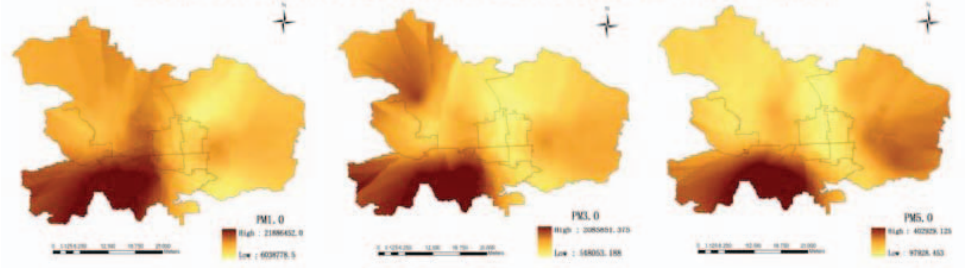

Fig.2 The spatial distribution of the IPM in 2008 in Beijing

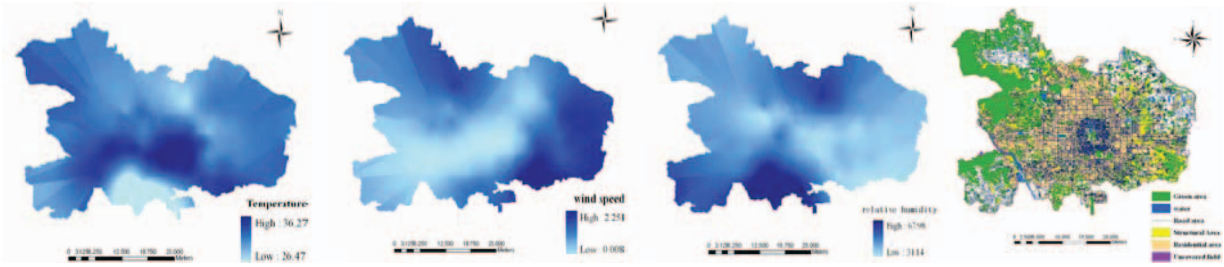

Fig.3 the spatial distribution of meteorological factors and the underlying surface in 2007 Beijing summer