

## 城市布局规模与大气环境影响的数值研究

王咏薇<sup>1</sup>, 蒋维楣<sup>1</sup>, 郭文利<sup>2</sup>, 王晓云<sup>2</sup>

1 南京大学大气科学系, 南京 210093; 2 北京市气象局, 北京 100089

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**摘要** 为探索城市建设对局地及周边大气环境的影响, 本文采用典型代表性天气条件, 以北京主城区及其东部发展带小城镇群的发展变化为例, 设计算例进行数值模拟. 分析结果表明: 城镇群建设发展通过地气的相互作用对局地环境产生显著影响, 在本文选择的夏日晴好天气条件下, 就1980~2004年城市区域布局状况, 模拟域内北京城市用地增加19%, 城市区域平均气温增加1.91℃, 植被覆盖率减少20%, 城市区域平均比湿减少3.3 g·kg<sup>-1</sup>, 并且城市发展的格局规模不同, 对城市气象环境的影响程度也不同. 此外, 由于地气多因子的相互影响和反馈作用, 城建规模的变化对周边的环境也存在显著的影响, 城建规模越大, 对周边的影响越大. 例如, (1) 北京主城区的存在对周边小城镇午间14:00近地面温度影响最大可达到1.2℃, 混合层高度可增高150 m左右; (2) 城市建设在影响周边气象环境的同时, 也改变了城市污染物的输送扩散能力, 北京主城区的存在使周边小城镇PM10的允许排放总量减小18.02 t·d<sup>-1</sup>, 同时, 随着周边小城镇城市规模的扩大, 影响主城区PM10逐渐由净的输出转变为净的收入, 小城镇群的存在对主城区PM10净收支的贡献率达到0.192 t·d<sup>-1</sup>.

**关键词** [城建规模](#), [气象环境](#), [空气质量](#), [地气相互作用](#), [数值模拟](#)

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## Numerical study of the urban scale and layout effect on atmospheric environment

WANG Yong-Wei<sup>1</sup>, JIANG Wei-Mei<sup>1</sup>, GUO Wen-Li<sup>2</sup>, WANG Xiao-Yun<sup>2</sup>

1 Department of Atmospheric Sciences, Nanjing University, Nanjing 210093, China; 2 Beijing Meteorological Bureau, Beijing 100089, China

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**Abstract** For investigating the urbanization development effect on the local and surrounding atmospheric environment, some numerical experiments are employed by adopting the typical meteorological condition in this paper. The simulation region was chosen for the urban district and three important satellite town of Beijing city, which are the main developing direction of Beijing planning in recent twenty years. The simulation results show that, firstly, the urban development has great effect on the local environment. On a clear, calm summer meteorological condition, as urban area fraction in simulation region increasing of 19%, the mean air temperature on urban region increase 1.91℃; and as the vegetation fraction reducing the mean specific humidity decrease 3.3 g·kg<sup>-1</sup>. Furthermore, the different urban layout and scale lead to the different influence on meteorological environment. At the same time, the variety of local urban scale and layout influence the atmospheric environment of surrounding region greatly, and the urban area is larger, the influence is more marked. Such as, 1) reasoning for the existent of Beijing urban district, the temperature increment of surrounding town reach the maximum of 1.2℃ at 14:00, and the mixture layer depth rise about 150 m, and the turbulence kinetic energy increase about 0.15 m<sup>2</sup>·s<sup>-2</sup>; 2) the urban construction and development change the meteorological environment, at the same time, the air pollution transporting and dispersing has been altered. The existent of Beijing urban district lead to the decrease of the total allowable emission reaching 18.02 t·d<sup>-1</sup>. Identically, the contribution ratio of the surrounding towns expanding to PM10 concentration of urban district reaches 0.192 t·d<sup>-1</sup>.

**Key words** [Urban layout and scale](#) [Meteorological environment](#) [Air quality](#) [Ground-air interaction](#) [Numerical simulation](#)

通讯作者:

王咏薇 [amuwang@163.com](mailto:amuwang@163.com)

作者个人主页: 王咏薇<sup>1</sup>; 蒋维楣<sup>1</sup>; 郭文利<sup>2</sup>; 王晓云<sup>2</sup>

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