Geophysical Research Abstracts
Vol. 20, EGU2018-3381, 2018
EGU General Assembly 2018

Modeling of the effects of anthropogenic heat fluxes on regional meteorology and air quality in typical city clusters of China

Min Xie, Kuanguang Zhu, Jingbiao Liao, and Tijian Wang
School of Atmospheric Sciences, Nanjing University, Nanjing, China (minxie@nju.edu.cn)

Anthropogenic heat (AH) can affect regional meteorology and air quality. The spatial distributions of AH fluxes in the Yangtze River Delta (YRD) region and the Pearl River Delta (PRD) region are estimated. Moreover, in order to study their impacts on regional atmospheric environment, these heat fluxes are incorporated into the modified WRF/Chem with the seasonal and the diurnal variation. The modeling results show that AH fluxes over YRD and PRD have been growing from 1990 to 2014. Nowadays, the high values of AH in YRD and PRD can reach 113.5 W/m2 and 60 W/m2, respectively. Including AH can significantly change the urban meteorology. In Shanghai, 2-m air temperature increases by 1.6 ° in January and 1.4° in July, the planetary boundary layer height (PBLH) rises up by 140m in January and 160m in July, and 10-m wind speed is intensified by 0.7 m/s in January and 0.5 m/s in July. More moisture can be transported to higher levels, and increase the accumulative precipitation by 15-30% in July of YRD. In the cities of PRD, 2-m air temperature rises up by 1.1° in January and over 0.5° in July, the PBLH increases by 120m in January and 90m in July, 10-m wind speed is enhanced over 0.35 m/s in January and 0.3 m/s in July, and the accumulative precipitation is intensified by 20-40% in July. These changes in meteorology can influence the distribution of air pollutants over YRD and PRD. Due to the increase of PBLH, surface wind speed and upward movement, the concentrations of primary air pollutants decrease near surface and increase at the upper layers over the cities. Chemical effects can play a significant role in ozone changes over the urban areas of YRD, so ozone concentrations increase at surface and decrease at the upper layers. But in PRD cities, the surface ozone concentrations in big cities increase in January, but decrease at the lower layers and increase at the upper layers in July. This phenomenon should be attributed to the facts that the chemical effects play a significant role in ozone changes over South China in winter, while the vertical movement can be the dominant effect in big cities in summer. In all, AH fluxes should not be ignored in climate and air quality assessments.