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Analysis of Boundary Layer Characteristics of a Heavily Polluted Weather Process in Beijing, China in Winter 2016

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Abstract: Several days of heavy pollution weather occurred in Beijing, Tianjin and Hebei province during December 16 to 21, 2016, many places issued red warnings of heavy air pollution. In this paper, the characteristics of the pollution process, the relationship between the pollution process and meteorological conditions, and the structure of the boundary layer are analyzed in detail by using the ground routine observation data of China Meteorological Administration, the MINI-MPL data, the wind profiler radar data and the atmospheric composition data of the Ministry of Ecology and Environment. The results show that the atmosphere is in a static and stable state, and the lower atmosphere is prevalent in the southerly airflow. The continuous increase of atmospheric humidity and the special terrain around the mountains on three sides of Beijing which is not conducive to the diffusion of pollutants are the important factors causing the serious air pollution in Beijing. During the period of heavy pollution, the pollutants mainly accumulate below 800 meters. When the pollution is serious, the height of pollutants is only about 400 meters. During the pollution weather process, the depolarization ratio is less than 0.25, reflecting that the main pollution is the aerosol generated by human activities. In the early stage, primary particulate matter is the main pollutant, and in the later stage, secondary transformation particulate matter is the main pollutant. The depolarization ratio showed obvious diurnal variation in the early stage of pollution process, and the depolarization ratio was higher in daytime than at night. .Wind field retrieved wind profile radar shows that the two rapid rising stages of PM2.5 concentration during the polluted weather process are accompanied by persistent southerly wind. When the southerly wind speed reaches 6-8m/s at 800-1200m altitude, it is conducive to the continuous transport of regional pollution to Beijing. When the wind speed exceeds 12m/s, the vertical diffusion of the atmosphere increases significantly, while the pollutant concentration shows a fluctuating change.