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SHORT COMMUNICATION

What factors are responsible for the Beijing storm?

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Abstract The Beijing storm of 21 July attracted public and social attention widely. Recently, some scientists expressed their opinion that urbanization has exacerbated the storm. However, our analysis suggests that while urbanization might have played some role, it is mainly the topographic effect that made the storm intense. Our conclusion is that the Beijing storm of 21 July is generated due to natural climatic factors in a changing climate system. Moreover, we think that the factor that contributes to the tremendous flooding disaster of 21 July is the low standards for mountain torrents control for medium and small rivers in the affected region. Therefore, the mountain torrents disasters control and medium and small rivers harnessing should be the foremost task in China's water conservancy construction in the future, and effective adaptation strategies should also be developed and implemented to cope with the climate change impacts.

Keywords Beijing storm · Urbanization · Climate change

The Beijing storm of 21 July, which claimed at least 77 lives and caused great economic losses of about US$1.6 billion, attracted public and social concerns widely. Recently, some scientists expressed their opinion that urbanization has exacerbated the storm (Qiu 2012). However, what is the dominant factor causing the heavy storm?

The storm center was in the windward slope of the Taihang Mountain areas in the southwestern storm region, and most of all 77 lives died there but not in the downtown (http://zhengwu.beijing.gov.cn/zwzt/ydbyzh/zxdt/t1234841.htm), which indicate that the topographic effect more than urbanization exacerbated the storm, with the average magnitude

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of 215 mm in 16 h, although the urbanization effect played a part in the storm. We knew from another highly urbanized region of the Yangtze River Delta that variations of the rainstorms of 25–100 mm/day are impacted by urbanization, but variations of the rainstorms bigger than 100 mm/day are mainly determined by climate change (Sang et al. 2012). Therefore, the Beijing storm of 21 July should be mainly generated due to unfavorable natural climatic conditions under the changing climatic systems.

Our recent studies indicated the decreases of rainstorm magnitudes in the Haihe River Basin (where Beijing is located in), which is consistent with the downward trends of water in North China due to the climate change impacts (Cong et al. 2011). The Beijing storm of 21 July with so high magnitude should also reflect the climate change impacts. Climate change is increasing the number of extreme weather events and water-related calamities in China, with more uncertainties (Xia et al. 2011).

However, the factor that contributes to the tremendous flooding disaster of 21 July is the low standards for mountain torrents control for medium and small rivers in the affected region. Factually, flood and water-logging calamities frequently occur along the medium and small rivers (generally with the basin area of smaller than 1,000 km^2) in China. More than 90 % of flood-related disasters and 67 % deaths due to flooding over the last decade took place in small towns, cities, and in rural areas, and in most cases were caused by landslides and flashfloods from heavy rainstorms. The Beijing storm this time is just a case of them. These events have serious impacts on China's social and economic developments, and the flood-related disasters will increase with the impacts of climate change.

The mountain torrents disasters control and medium and small rivers harnessing should be the foremost task in China's water conservancy construction in the future. To mitigate the effects of heavy storms, integrated flood risk management strategy at medium and small river basins should be established, and the drainages systems in large metropolitan areas also should be improved. Moreover, effective adaptation strategies should be developed and implemented to cope with the climate change impacts, as a common scientific challenge worldwide.

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