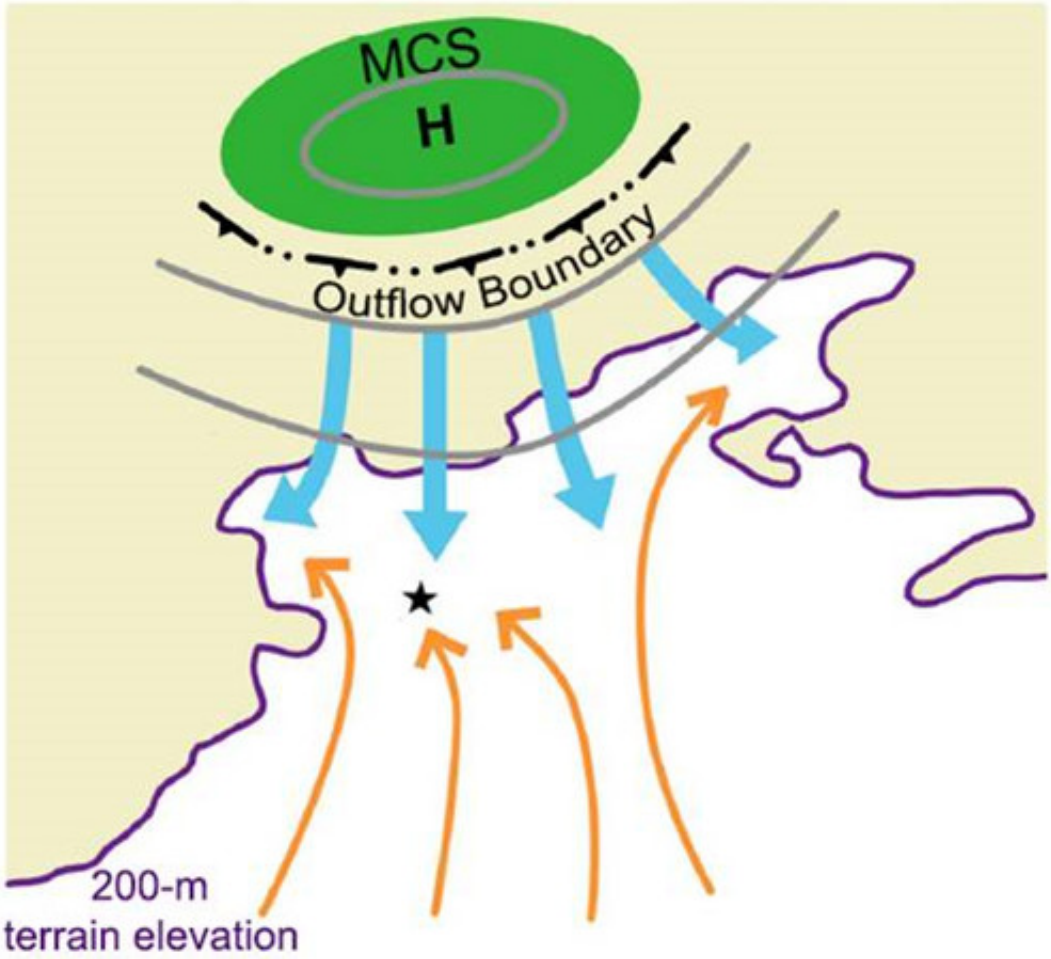
New understanding of local heavy rainfall events over the Beijing metropolitan region

November 22 2016



Schematic diagram for the CI of the Haidian storm on Aug. 9, 2011. The star marks the CI location. Orange arrows indicate the surface southerly flow. Thick blue arrows indicate the northerly flow associated with a convectively generated meso-high depicted by grey contours. Yellow shadings denote the mountainous regions. Credit: Li et al., 2016

The Beijing metropolitan region (BMR) often suffers from heavy rainfall events. The complex topography with the Yan Mountains to the north and the Taihang Mountains to the west, as well as the diverse underlying urban surfaces, make it difficult to predict convective initiations (CIs) and local heavy rainfall events over the BMR. Significantly, the CIs and consequent heavy rainfall events occurring under weak synoptic forcing are extremely great challenges to today's operational NWP models and even experienced forecasters.

Recently, scientists from the University of Maryland, the Institute of Urban Meteorology, and Beijing Meteorological Services performed observational and modeling studies on two local heavy rainfall events over the BMR occurring under weak synoptic forcing. The CI processes were specially investigated.

Their results revealed that the cold pool outflows associated with precipitation systems around the BMR, the underlying urban surface and the local topography dominated where and when CIs and consequent heavy rainfall occurred. A sudden local heavy rainfall event produced by several scattered convective storms in 2008 interrupted the scheduled matches of the ongoing 2008 Beijing Olympic Games. The detailed observational analysis showed that small-scale topography and cold pool outflows were two key influencing factors in the development of the convective storms.

An isolated convective storm was initiated suddenly over Haidian district of Beijing in 2011, far away from the outflow boundary associated with a precipitation system over the northwestern mountains. The "northwestward-concaved valley" near Haidian and Changping districts and the urban surface accounted for the formation of a favorable convergence zone near the border of those two districts, facilitating the confluence of high-equivalent potential temperature air. The isolated convective outbreak would not be possible without the sustained low-

level convergence of high-equivalent potential temperature air between south- to southeasterly flows and a northerly flow. The latter occurred far ahead of the outflow boundary associated with a convectively generated cold pool by the northwestern precipitation system.

The studies revealed the mechanisms for the development of local storms and consequent heavy rain in the BMR, which have important implications for improving relative prediction skills. The results were recently published in *Atmospheric Science Letters* and *Monthly Weather Review*.

More information: Huiqi Li et al, On the Initiation of an Isolated Heavy-Rain-Producing Storm near the Central Urban Area of Beijing Metropolitan Region, *Monthly Weather Review* (2016). DOI: 10.1175/MWR-D-16-0115.1

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