EMS Annual Meeting Abstracts
Vol. 16, EMS2019-56, 2019

Multiscale configuration of the 20 July 2016 cyclone induced severe torrential rain and its relationship with the development of MγCS

Xiaoyuan Yi and Hong Chen
Tianjin Meteorological Observatory, Tianjin 300074,China (yixy123@sina.com)

Affected by northward cyclone, a rarely seen severe rainstorm hit the region of northern China on 20 July 2016, resulting in a new extremum of daily mean precipitation amount in this region in the past 50 years. The extreme value of the process rainfall at a single station was up to 453.7mm. Besides, the losses were even devastating with 130 deaths and 110 missing reported.
The results are as follows. (1) The thermodynamic and vapor configurations of different parts of the comma cloud system are: the vortex center (Zone D) coincides with the center of the cyclonic circulation and is a low value zone of the 700hPa pseudo equivalent temperature (θse). The west side of the tail cloud zone is a dry, cold and cloudless zone. The smooth zone at the edge of the cloud zone corresponds to the energy front zone. The head of the cloud system (Zones A and B) corresponds to the θse high energy zone of the 700hPa and the jet stream core of the 850hPa, while the Zones A and B correspond to northeast and southeast jets, respectively. In the jet zone, the θse of 700hPa is as high as 78[U+2103], the 850 hPa specific humidity is 18 g·kg-1, the maximum jet core wind speed is 30m·s-1, and the entire precipitable water amount is 70 mm. (2) The comma cloud system has two MαCSs and one MβCS embeded in the head, which are the major contributors to the severe torrential rains, but the rain intensity is only 20-30 mm·h-1. However the MγCS in Beijing (MγCS-BJ) and MγCS in Tianjin (MγCS-TJ) both caused extremely heavy precipitation with the intensity getting to 40-70 mm·h-1. The two MγCSs are generated and maintained under different multi-scale background conditions: (a) MγCS-BJ is located in the vortex center (Zone D), which is the left front convective instability zone of the low level jet, combined with the wind direction convergence line formed by the northerly wind and the east wind. The convergence line appears about 1.5h earlier than the convective system. (b) MγCS-TJ is located in the edge zone between the cloud head and the vortex center. It occurs in the high gradient energy frontal zone of θse and matches the surface wind speed convergence line. (3) The development of MγCS-TJ is closely related to the large value zone of TBB gradient in the MβCS edge. MγCS TJ has a deep meso-cyclone inside, with the axis tilting to northwest, and the maximum rain intensity occurs at the moment when the rotation speed is the fastest.