

Characterizes on Evolution of the Heavy Rainfall Cells Structure in the Leading Line Mesoscale Convective System and Lightning Activity

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Abstract

The data from Doppler radar, SAFIR3000 lightning location system and high-density automatic meteorological stations observations are used to design a variety of radar quantitative parameter and analyze the evolution of cells structures, lightning activity and electrical vertical structure of the heavy rainfall cells structure in a Leading Line Meso-scale Convective System(LL-MCS). The relationship between convective cells and β -mesoscale LL-MCS is revealed. The conclusions are as follows. At first, the four cells (GUAN in Hebei, SHUNYI and FANGSHAN in Beijing, BAODI in Tianjin) in one squall respectively brought about 23 mm, 50 mm, 27mm and 70mm in 1 hour. In FANGSHAN cell, two smaller monomers were merged. The cell of SHUNYI was followed by other cell. In GUAN and BAODI cell, the development and LL-MCS were feeding, swallowing relationship. Secondly, V_{40} (40dBZ echo volume range), V_{40UP-6} (up 6 km height level more than 40dBZ echo volume areas), Set11 (echo area range at 11km level) could describe the 3D quantitative structure change of cell, and F_{cg} (CG lightning frequency) and F_{ic} (IC flash frequency) were closely related to the radar parameters, such as the correlation coefficient of V_{40UP-6} and it between 0.63 and 0.97. The flash frequency of IC was more sensitive than CG when echo structure changed. Thirdly, the radiant point maximum concentration area of height in the GUAN cell was below 6km, which was far lower than other cells at the same stage. At last, the feature of lightning frequency of CG and lightning frequency of IC and H increased significantly lift after the merger in convective cell, and the characteristics of lightning frequency had relationship with the rainfall intensity increasing and lightning frequency peak maximum of rainfall intensity have positive significance for warning of disaster weather.

Key words MCS, γ -mesoscale convective cell, Structure evolution, Radar parameter, Lightning activity