Study on the Warning of Hail Clouds in Beijing Based on Lightning Jump Algorithm

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Abstract: The broadband observations of VLF emissions obtained by Beijing Lightning NETwork (BLNET), which consists of 16 stations across Beijing, make it possible to detect the total lightning flashes (cloud-to-ground and intra-cloud) in Beijing City. Based on the hail report during 2015-2017 in Beijing and the corresponding lightning location results of BLNET, as well as the data of a S-band radar of Beijing Meteorological Observation Center, a total of 197 hail-producing thunderstorms are analyzed with an identification method of strong convection cells (similar to Thunderstorm Identification Tracking Analysis and Nowcasting, TITAN) and 2σ lightning jump algorithm (with 4 and 10 flashes/min activation thresholds for different regions). Through the analysis, it is achieved that the average lead times of lightning jump is 26 min, with a 60-min hit constraint. The higher the lightning density in the convection cell, the longer the lead time. Lightning jumps precede 82% of these hail events and 35% of lightning jumps are not followed by hail reports. The merging of two adjacent strong convection cells usually forms hail-bearing thunderstorms producing jump of total lightning. In addition, most hails occurred at the boundary of the strong convection cells, instead of central regions. This study demonstrates a potential useful tool for hail nowcasting in Beijing.

Keywords: hail; radar reflectivity; strong convection cell; total lightning; lightning jump