

Relationships between Narrow Bipolar Events and Radar Echo in Southwest China

Intended for the Lightning Occurrence Relative to Meteorology Session Topic

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A very low frequency and low frequency (VLF/LF) lightning location network has been established since 2010 in the southwestern Chinese city of Chongqing, which consisting 11 stations of fast electric field change meters. Using this system, we recorded the distinct class of intracloud lightning discharges named NBEs (Narrow Bipolar Events).

In this study, six thunderstorm cases are used to analyze the relationships between NBEs and thunderstorm convective strength. Every storm produced two polarities of NBEs, and one of them produced more negative NBEs than positive NBEs. We statistically compare both polarities of NBEs rates to the Doppler radar-inferred proxies of convective strength and analyze the spatiotemporal relation of positive and negative NBEs to thunderstorm convection.

We find that although both polarities of NBEs rates show much weaker dependence on the volume of 40dBZ radar reflectivity (V_{40}) than ordinary lightning, they increase rapidly with the increased V_{40} and largely occur in high V_{40} area, especially for negative NBEs. Compared with positive NBEs, the negative NBEs cluster more closely in time and space, they generally occur in the strongest development stage of the thunderstorm, largely cluster at the top of the core of deepest convection. It seems like that more negative NBEs always correspond to a more vigorous thunderstorm. Positive NBEs are scattered around the convective cores. These results indicated that negative NBEs are closely related to the deep convection, which is useful and meaningful to indicate thunderstorm convective strength.