Classification of Squall Line Evolutions near the Mississippi River in Illinois

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ABSTRACT

The purpose of this study is to investigate how squall lines evolve as they cross the Mississippi River into Illinois by creating a climatology. Also, the frequency of each evolution and evolutionary pattern, in terms of annual, monthly, and diurnal occurrence, is determined in order to identify patterns.

Surface analysis maps and national radar reflectivity mosaics are used to identify squall lines in the study area. Once squall lines are identified, Level-III base reflectivity is analyzed in ArcGIS to assign squall lines and their resulting evolutions to one of four classifications: classic squall lines, bow echo squall lines, serial derecho squall lines, and multiple-cell (supercell) squall lines. Classification schemes are assigned depending on the areas, number of polygons, arc value, number of arcs, and dimensions of the convectively active region (40+dbZ) for squall lines before and after crossing the Mississippi River.

The statistical significance of each evolution and evolutionary pattern is determined. The only statistically significant evolution is multiple-cell, and the statistically significant evolutionary patterns are classic to multiple-cell squall lines and classic to classic squall lines. Also, when the annual, monthly, and diurnal frequencies of the total number of squall lines, squall line evolutions, and evolutionary patterns are plotted and compared to previous studies, similarities are seen in patterns of occurrence.