

# Relation of severe storm reports to jet streaks and storm morphology

William A. Gallus, Jr.  
*Iowa State University, Ames, IA*

## ABSTRACT

The relation of severe storm reports to both jet streaks and storm morphology is explored. First, the climatology of tornado, hail, and severe wind reports relative to upper-level jet streaks, along with temporal trends in storm report frequencies and changes in report distributions for different jet streak directions are analyzed over the period from 1994 to 2004. During this period, 84% of storm reports were associated with upper-level jet streaks, with June-August having the lowest percentages. In March and April the left-exit quadrant had the most storm reports, while after April the right-exit quadrant was associated with the most reports. Composites revealed that tornado and hail reports are concentrated in the jet-exit region along the major jet axis and in the right-entrance quadrant. Wind reports have similar maxima, but the right entrance-quadrant maximum is more pronounced. Upper-level composite divergence fields generally correspond to what would be expected from the "four quadrant" model, but differences in magnitude of vertical velocity between the quadrants and locations of divergent/convergent centers may have resulted from jet-curvature. The maxima in the storm report distributions are not well co-located with the maxima in the upper-level divergence fields, but are much better co-located with low-level convergence maxima that exist in both exit regions and extend into the right-entrance region. Upper-level divergence and vertical velocity in all jet-quadrants have a tendency to decrease as jet streak directions shift from SSW to NNW.

Next, the relationship of severe storm reports to convective system morphologies are examined for the warm season of 2007. The nine convective system morphologies used in a recent study of the 2002 warm season by Gallus et al. were assigned to the systems, but an additional morphology, supercell storms, was now included making use of radar algorithm information on storm rotation. Archived radar imagery was used to classify systems as non-linear convective events, isolated cells, clusters of cells, broken lines of cells, squall lines with no stratiform precipitation, trailing stratiform precipitation, parallel stratiform precipitation, and leading stratiform precipitation, and bow echoes. In addition, the three cellular classifications were subdivided to allow an analysis of severe weather reports for events in which supercells were present and those in which they were not.

As in the earlier study, all morphologies were found to pose some risk of severe weather, and differences in the two datasets were generally small. The 2007 climatology confirmed the theory that supercellular systems produce severe weather more frequently than other morphologies, and also produce more intense severe weather. Supercell systems were especially prolific producers of tornadoes and hail relative to all other morphologies, but also produced severe wind and flooding much more often than non-supercell cellular morphologies. These results suggest that it is important to differentiate between cellular morphologies containing rotation and those that do not when associating severe weather reports with convective morphology.