WHAT IS A SUPERCELL?

Charles A. Doswell III

NOAA/ERL National Severe Storms Laboratory
Norman, Oklahoma

I have already stated my definition of a supercell in several publications (notably, Doswell and Burgess 1993). That definition is that *a supercell is a convective storm that possesses a deep, persistent mesocyclone.* By "deep" I mean that the circulation meeting mesocyclone criteria is present and vertically connected through a significant (say, 1/3) fraction of the depth of the convective storm. By "persistent" I mean in comparison to a convective time scale defined by the time it takes a parcel to rise from the base of the updraft to its top (on the order of 10-20 min). A "mesocyclone" can be defined in many ways; I prefer to use the vorticity magnitude, where a "mesocyclonic vorticity unit" is 10^{-2} s^{-1}.

My perspective is both that of an observer and a *user* of models, although I lean toward the observational side. Browning (1977) was the first to make this proposal for defining a supercell; Weisman and Klemp (1984) have advocated a similar concept. The difficulty with this definition is that which plagues any essentially arbitrary criteria for classifying anything. That is, is a storm that has a deep, persistent cyclonic circulation which attains a maximum vorticity of only 0.95 mesocyclone units of vorticity different in some essential way from a similar storm that attains 1.05 units of vorticity? The answer clearly is a resounding "No!" Similar statements can be made for the other criteria. Nevertheless, the point in favor of quantitative criteria is that they do not depend on subjective judgment of such things as echo morphology.

My opinion about the existence of a supercell spectrum can be exemplified by asking some questions. Does every legitimate supercell (however one defines it) look, behave, and come about in exactly the same way? If you've seen one supercell, have you learned all there is to know about supercells? What characteristic of convective storms might one choose to describe the variability among supercells, assuming that one is willing to grant that such variability exists? In our paper, Don Burgess and I chose to present a "spectrum" based on the extent to which a mesocyclone is wrapped in precipitation; this arose from observations that Al Moller and I have made over a number of years of storm chasing. Is this classification imbued with some divine insight? Hardly. Can there be other classifications? No doubt about it. The existence of variability suggests the likelihood of some sort of spectrum, but I make no claims to have created the only legitimate scheme.

As for the applicability of storm models developed in the Great Plains, I continue to maintain that the atmosphere knows nothing about geography! The reason that storms have different typical structural and behavioral character in different regions is that those regions have different characteristic environments. Put a convective storm in the same environment and one gets the same convective storm structure and evolution. Anyone believing that storms in the Great Plains are different than storms anywhere else in the world is acknowledging only that the Great Plains is a unique environment. But if the relevant environmental characteristics (a tough issue to define) are present, I maintain that the storms will look just the same no matter where in the world they occur. The proliferation of Doppler radar is revealing mesocyclonic storms where nearly everyone thought that supercells never happened. If there has been any flaw in the Great Plains storm studies, it is that the results from a very limited sample of storms have been overgeneralized. Moreover, many if not all of the storm structures and evolution that prevail in other parts of the world do occur also in the Great Plains, but those storms have not been subjected to the same degree of scrutiny as the "classic" storms upon which too-broad generalizations were made.

The definition of a supercell matters to an operational forecaster only to the extent that the probability of a given severe weather event changes when those events are partitioned between supercell and non-supercell storms. Does the likelihood of a tornado change, given a supercell versus a non-supercell storm? What about giant hail? What about violent straight line winds? I leave it to the readers to decide these questions for themselves.

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Corresponding Author Address: Dr. Charles A. Doswell III, National Severe Storms Laboratory, Norman, OK 73069; e-mail <doswell@nssl.uoknor.edu>