The 8 May 2009 "Super Derecho": Analysis of a 3 km WRF-ARW Realtime Forecast

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During the morning of 8 May, 2009, a large bow echo system developed over western Kansas and proceeded eastward, spawning 18 tornadoes and packing wind speeds of 70 to 100 mph over a swath of up to 100 miles wide over an 8 hour period, finally dissipating in southern Illinois. During its most intense phase, the bow echo occluded, producing a warm-core eye-like structure similar in many respects to tropical cyclones. Indeed, much of the wind damage with this system was associated with an intense (8 mb) mesolow located at the tip of the occlusion well behind the leading gust front. The circulation associated with this mesolow extended about 60 km across, and, although strongest at low-to-mid levels (100 kts at 850 mb), extended up to 10 km as a vertically coherent feature.

This convective system was forecast in realtime 24 h in advance with the WRF-ARW model using a 3 km horizontal grid interval, accurately reproducing the observed occluded eye-like structure and accompanying intense mesolow. This forecast allows for an unprecedented analysis of the structure and evolution of such a unique convectively produced mesoscale vortex, addressing the source of the unusually intense, large scale rotation, especially with regard to the role of the ambient vertical wind shear and CAPE and a preexisting boundary extending eastward from the system. Surprisingly, it is found that the occluding phase of the system, which was associated with the most widespread damaging surface winds, occurred in conjunction with a weakening of the convection, including its associated cold pool, in an environment of weakening vertical wind shear and CAPE.

For this presentation, we will describe the overall evolution of both the observed and simulated system from formation to decay. A companion paper submitted to the Cyclone Workshop by Clark et al. will then address the mechanisms of vortex
development for this case in more detail.