The 2 March 2012 Tornado Outbreak: Where Tornadoes Did Not Form Across the Ohio Valley

Michael J. Paddock[1] and Angela Lese[2]

[1]NOAA/NWS Louisville, Kentucky and [2]NOAA/NWS Nashville, Tennessee

Introduction

On the morning of March 2, 2012 surface low pressure was centered over southern Missouri with a warm front reaching east into the Ohio Valley. Showers and thunderstorms were scattered along the warm front, and produced hail to the size of nickels during the morning hours. By late morning the low had deepened and moved to central Illinois, lifting the warm front north of the Louisville, Kentucky Weather Forecast Office's County Warning Area and bringing an end to the morning thunderstorms. It also put southern Indiana and central Kentucky within the warm sector of the storm system, with the system's cold front stretched from the low in central Illinois southward through Arkansas to Texas.

- Temperatures over southern Indiana and central Kentucky soared well into the 70s ºF by mid day, with southern Kentucky actually setting record highs in the lower 80s.
- The convective available potential energy utilizing the most unstable parcel reached 2000+ J/kg.
- Effective system-relative helicity ranged between 400-600+ m^2/s^2
- 0-6 km effective bulk shear values reached 60+ knots.

Storms developed in this extremely unstable atmosphere, while the wind shear promoted rotating updrafts and subsequent tornado development. The parent low of the system continued to deepen as it quickly tracked towards southern Michigan and dragged its attendant cold front into the Ohio and Tennessee Valleys.

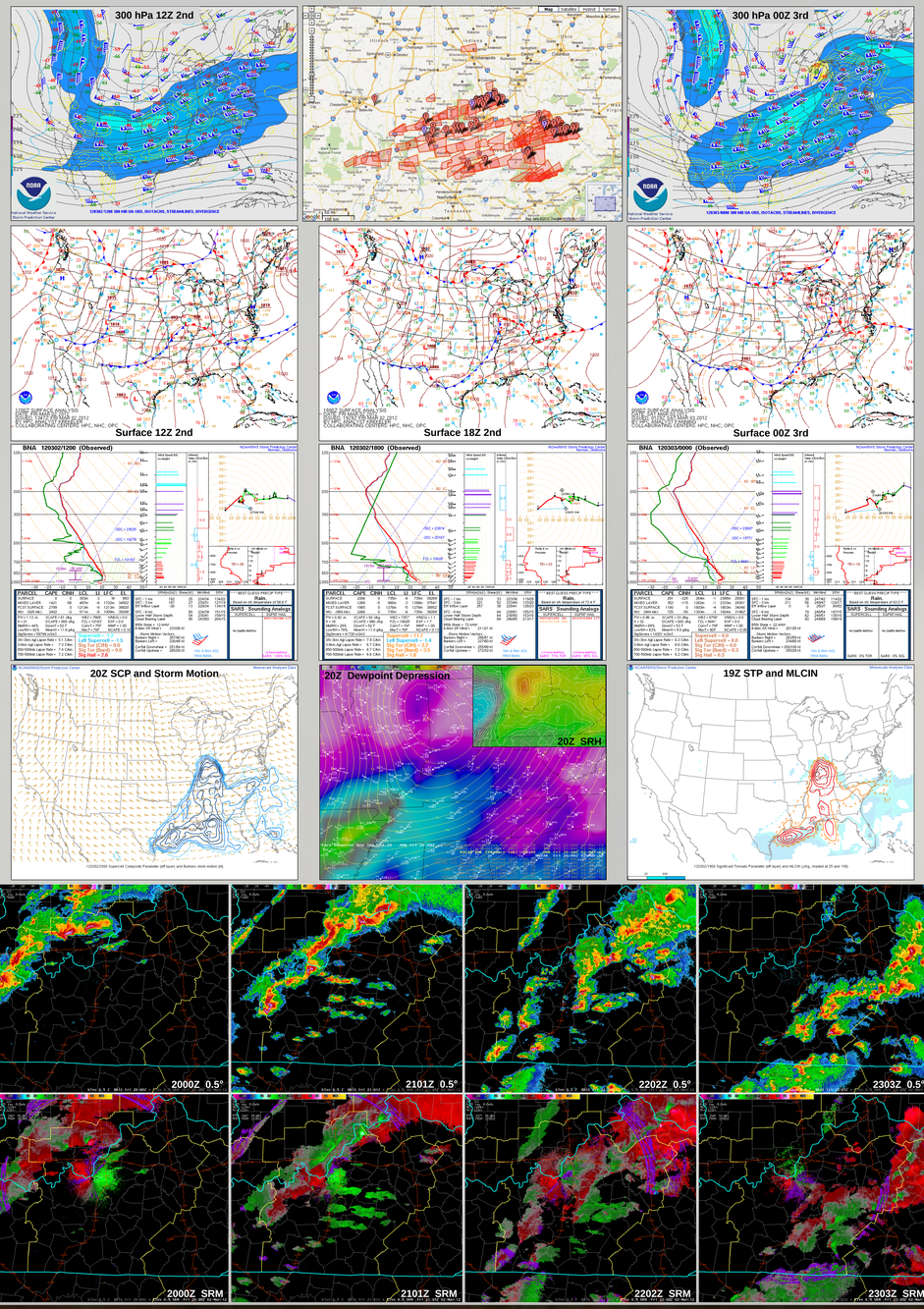
Storms continued to erupt throughout the region and easily attained rotating updrafts, resulting in eight tornadoes across south-central Indiana and north-central Kentucky, along with numerous reports of large hail. One supercell produced a tornado that was rated an EF-4 on the Enhanced Fujita scale, which stayed on the ground for 49 miles through portions of southern Indiana and into north-central Kentucky.

As the afternoon and early evening hours progressed, additional supercell storms tracked across central and south-central Kentucky within this very unstable atmosphere. However, tornadic development was practically nonexistent, with baseball to softball size hail being the main hazard associated with these supercells. Upon further investigation, there were several subtle atmospheric indicators that depicted potential tornado formation would be less likely across central and south-central Kentucky.

Methodology and Objective

With such an unstable and highly sheared environment, the tornado probability was too great not to warn on supercellular storms across central and south-central Kentucky. However, most storms only produced large hail. In addition to the supercell structures, the knowledge of a destructive EF-4 tornado earlier in the day could have augmented the warning mindset of meteorologists. This resulted in a high false alarm rate. A reanalysis of the data was undertaken to determine if we could have vastly reduced the tornado false alarm rate. Ongoing situational awareness via enhanced mesoscale analysis could have discovered certain atmospheric parameters or a combination of parameters were present that would have indicated possibly less tornadic activity.

Synoptic Overview



Summary and Conclusions

The overall environmental conditions across the Ohio Valley were supportive of strong supercells. The question remained if these storms, particularly across central and south-central Kentucky, would produce tornadoes. After reanalyzing the data, the environment across this area was quite different than that of south-central Indiana and north-central Kentucky. Additionally, the southern environment continued to change throughout the afternoon. Below are some key distinctions between the supercell storms across northern portions of the forecast area and storms that developed further south.

- Storms across south-central Indiana and north-central Kentucky formed within the vicinity of the warm front, where greater moisture and system-relative helicity were located.
- Storms further south were removed from the pooling moisture and enhanced system-relative helicity, as surface winds veered through the day becoming southwesterly.
- Storms across central and south-central Kentucky also formed within a well-mixed environment, with dry air mixing down to the surface and temperatures increasing through the afternoon.
- Lowering dewpoints and increasing temperatures resulting in greater dewpoint depressions across the south, which indicated lifted condensation levels would be higher than what was experienced across the northern forecast area, where moisture pooled along the warm front.
- Higher lifted condensation levels across portions of central and south-central Kentucky resulted in more outflow-dominated storms.
- With surface winds veering through the day, the hodograph depicted an environment more conducive to splitting supercells.
- One such split generated a weak EF-1 tornado in southeastern Warren County that traveled one half of a mile, was approximately 60 yards wide, and lasted about one minute.

While the environment was clearly supportive of supercell development, tornadic formation became less likely across portions of central and south-central Kentucky as the day progressed. The mindset associated with a devastating EF-4 tornado earlier in the day should not augment warning decisions when the environmental conditions are different or have changed.

Contact Information

Michael J. Paddock, Ph.D.

Michael.Paddock@noaa.gov

Website Information

http://www.crh.noaa.gov/lmk/?n=march22012tornadooutbreak