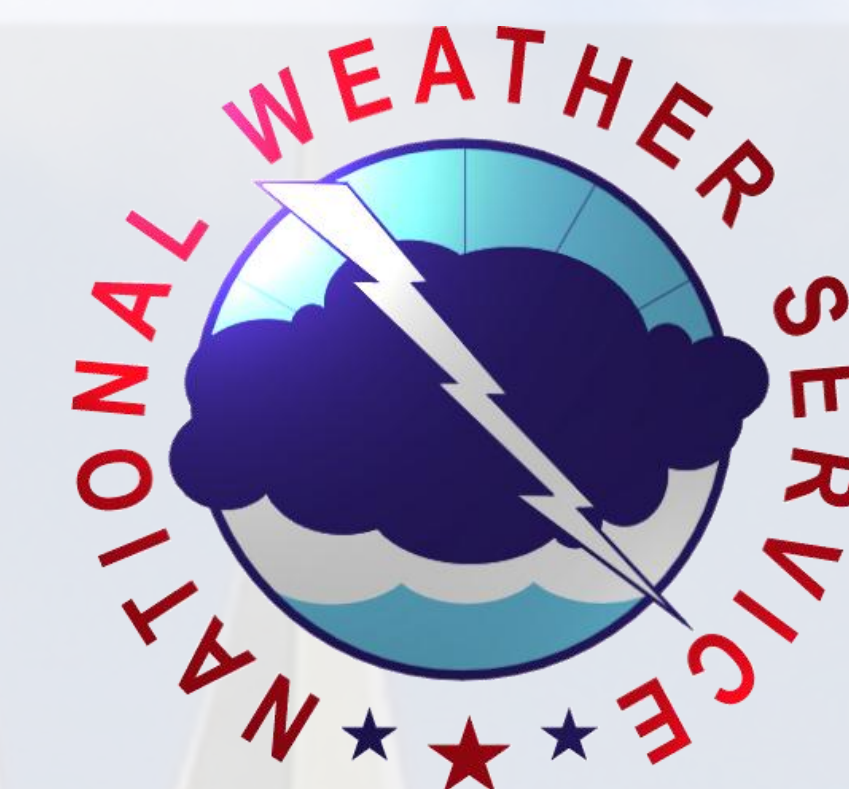


The 22 June 2011 Churchill Downs Tornado: A Science and Impact-Based Study

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Introduction

On the morning of June 22, 2011 surface low pressure was centered across the Upper Mississippi Valley, with a cold front extending southward through the Middle Mississippi Valley. As the day progressed, the low pressure system pushed into the Great Lakes while the cold front edged into the Ohio Valley. At the same time, an upper-level jet streak of 100+ knots at 250 hPa was advancing eastward, directly over the Ohio River. The overall eastward advancement of this system increased vertical wind shear and moisture across the Ohio Valley. The orientation of the upper-level jet streak placed the Ohio Valley within the right entrance region, favorable for upward vertical motion. Additionally, dew points in the upper 60s °F pushed into the Louisville, Kentucky Weather Forecast Office's County Warning Area from the south.

The atmosphere became increasingly unstable through the afternoon hours. Morning low stratus clouds gave way to stratocumulus clouds and horizontal convective rolls. Clusters of convection began to develop and increase in coverage along the Ohio River, particularly in the vicinity of metropolitan Louisville. Three cells in particular tracked over nearly the same metropolitan areas, with one noticeable feature being essentially nonexistent. Minimal cloud-to-ground lightning accompanied these cells, and radar analysis indicated the greatest reflectivity was concentrated within the lowest levels of the atmosphere. However, these were no ordinary convective cells, as three low-topped tornadic supercells tracked across metropolitan Louisville, with one tornado impacting the iconic venue Churchill Downs.

This event posed several forecast challenges:

- Determining if widespread or localized convection would develop during the afternoon and early evening hours.
- Convective mode.
- Potential impacts associated with the assumed convective mode.

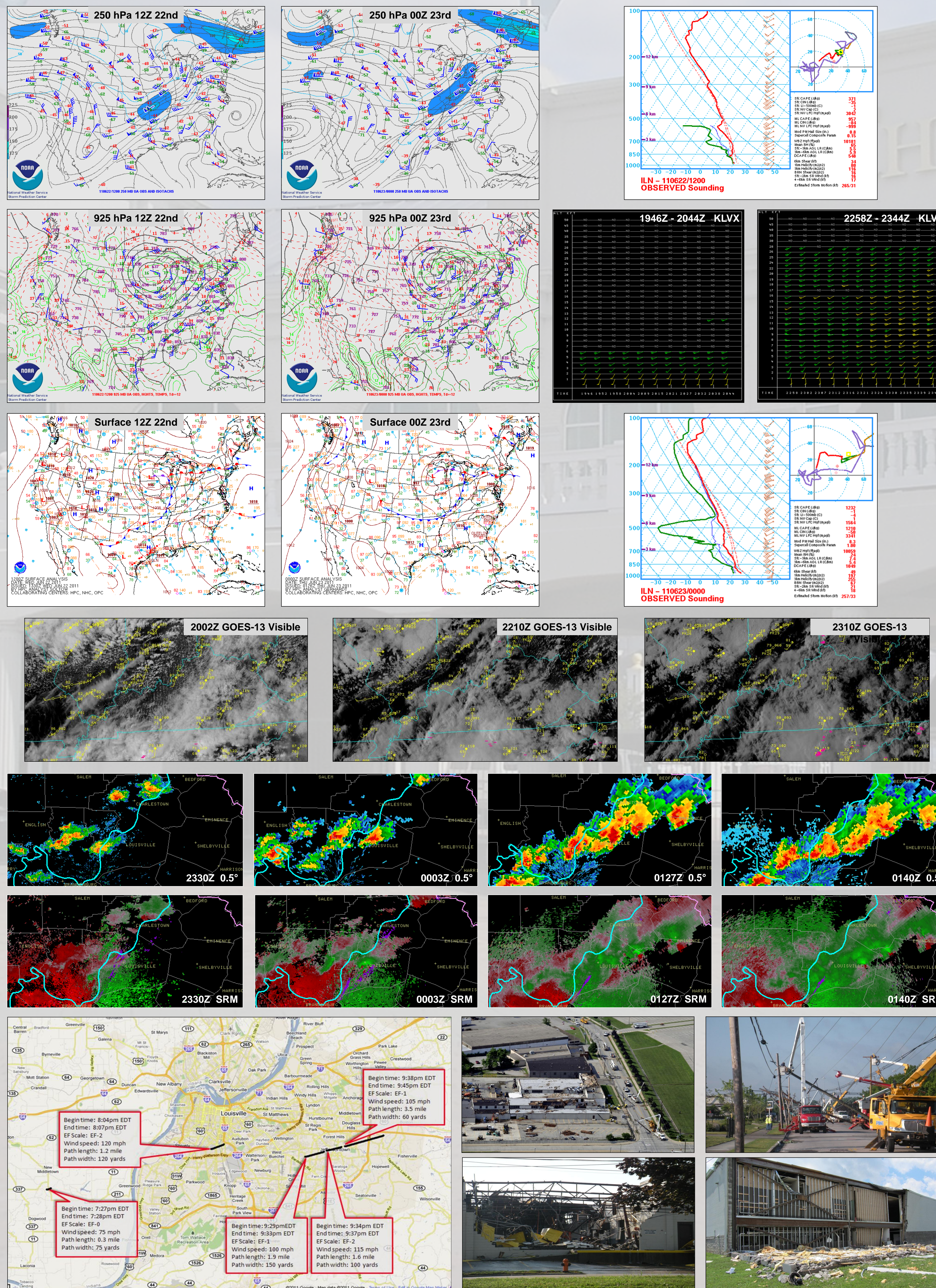
For several days prior to the event, numerical guidance and official forecasts were depicting thunderstorm development. However, supercell formation, particularly low-topped supercells were not anticipated.

Summary and Conclusions

An assessment revealed that these supercells developed under the following features:

- Within a dry slot aloft along a surface cold front.
- On the southern periphery of a deep upper low to the north.
- Within a lowered tropopause environment .
- Environmental low and mid-level shear remained significant, with a southwesterly mid- to upper-level jet streak .
- Greatest moisture and instability was located to the south and east, where higher equilibrium levels were located (deeper storm development).
- Areas north and west were essentially capped from deep convection, with low cloud-to-ground lightning count.
- Radar imagery clearly depicted the cells trained over the same area, so the hooks of the storms traveled parallel and along a boundary from a preceding storm, which locally enhanced low-level vorticity and helicity.

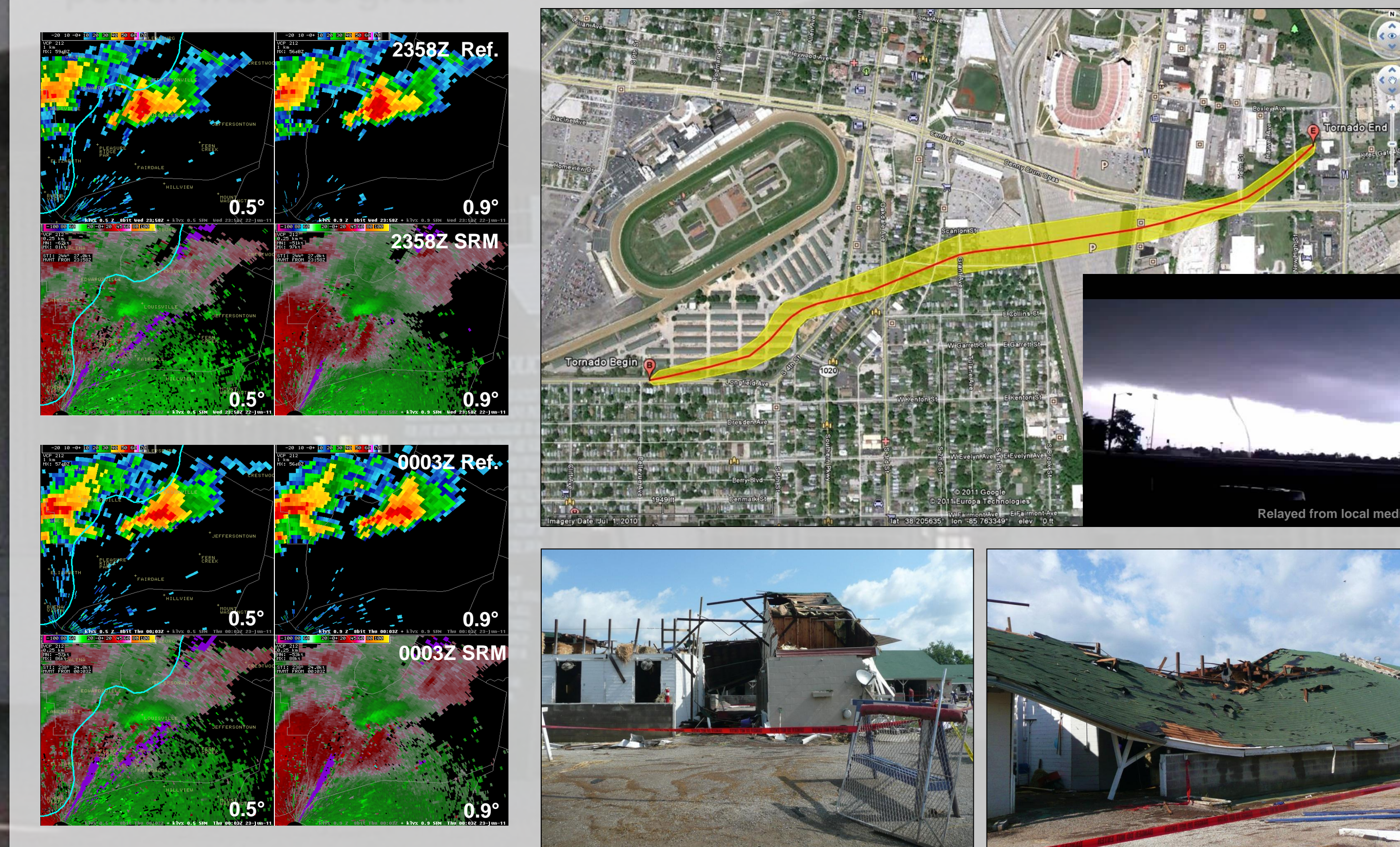
Atmospheric Conditions and Damage



Churchill Downs Impacts

An EF-1 tornado struck Churchill Downs causing extensive damage to facilities and disrupted daily operations for nearly three months. Below are some key aspects of this event, courtesy of Churchill Downs:

- Luckily, no races were held on Wednesday, 22 June, but facilities were open for simulcasting of races held elsewhere.
- Overall attendance, particularly outdoor spectators, was not as large as if there were live races, but the threat to life was a concern nonetheless.
- The tornado touched down on the south side of the property.
- There was major damage to six and one half barns, some built in the 1940s, causing \$1 to \$1.5 million in damage.
- The barns were composed of horse stables and staff living quarters, all of which were occupied at the time of the tornado.
- There were no deaths or injuries to humans or animals.
- The structural damage to the barns rendered the facilities uninhabitable.
- Horses and staff had to be relocated, many to Lexington, Kentucky.
- The relocation process, aided by countless volunteers, was conducted on the following day, as the potential for injuries at night with no utility power was too great.



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Website Information

http://www.crh.noaa.gov/lmk/?n=june22_2011

