NOAA

Earth System Research Laboratory (ESRL)
Global Systems Division (GSD)
Putting tools in the hands of users
*Precise Weather Guidance for the Next Generation*

HRRR 9-hour forecast of thunderstorms for the April 27th, 2011 Southeastern U.S. tornado outbreak. Some individual tornadic storms (including the Tuscaloosa storm indicated by the white circle) are predicted with county-scale accuracy.

Observed thunderstorms at 5 PM CDT during the April 27th, 2011 Southeastern U.S. tornado outbreak. The Tuscaloosa tornadic storm cell is indicated by the white circle.
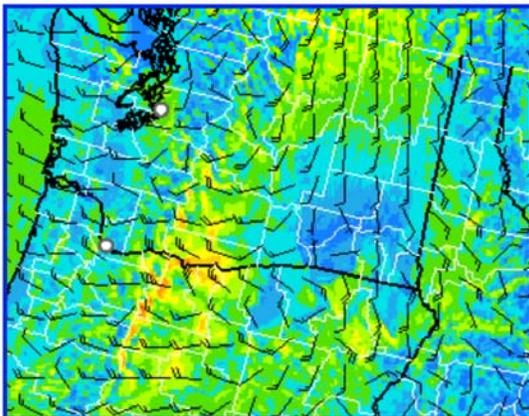
HRRR 12-h forecast 80-m wind speed and direction over Pacific Northwest region, showing strong winds through the Columbia River Gorge. HRRR 80-m wind forecast are potentially very helpful for anticipating wind energy ramp events.

High-Resolution Rapid Refresh (HRRR)

Our nation increasingly needs detailed, reliable weather guidance to enable the commerce and transportation that drive US economic activity and the warnings that save citizens' lives and increase public safety. With the High-Resolution Rapid Refresh (HRRR) Weather Prediction System, ESRL/GSD scientists have merged advances in weather prediction science and high-performance computing technology with a new breakthrough technique for using radar data to achieve a new standard process for up-to-the-minute weather forecasting. The HRRR went operational at the National Weather Service in September 2014. Further development continues at GSD.

Why Develop the HRRR?

The HRRR forecast system has already proven itself in a myriad of weather forecasting applications, such as:

- increasing efficiency and safety for aviation and other transportation sectors;
- helping to save lives in tornado and severe weather outbreaks, snowstorms, and flood events; and
- providing needed high-resolution forecasts to enable wider use of renewable energy sources.
- providing overall situational awareness to NOAA stakeholders.

HRRR Science and Technology Breakthroughs

The HRRR would not exist without a number of recent scientific advances and breakthroughs.

1. **Data Assimilation and Modeling:** a set of complex computer procedures that blend the latest weather observations, including high-resolution radar and satellite data, together, then predict future hazardous weather.

2. **High-Performance Computing:** ESRL/GSD's work to build extremely cost-effective large supercomputing systems and on-going work with graphical processing unit (GPU) technology.

3. **Use of Radar Data:** ESRL/GSD scientists found a new way to use NEXRAD radar data in the HRRR model, leading to further increase in forecast skill.

> *ESRL/GSD scientists are working with the NOAA's National Severe Storms Laboratory to add "Warn-on-Forecast" capabilities to the HRRR and to create accurate probabilistic forecasts from an ensemble of HRRRs. This work requires ongoing research and supercomputing support.*

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