

WoF: SPC Update

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NOAA NWS Storm Prediction Center

- Forecast tornadoes, thunderstorms, and wildfires nationwide
- Forecast information from 8 days to a few minutes in advance
- World class team engaged with the research community
- Partner with over 120 local National Weather Service offices

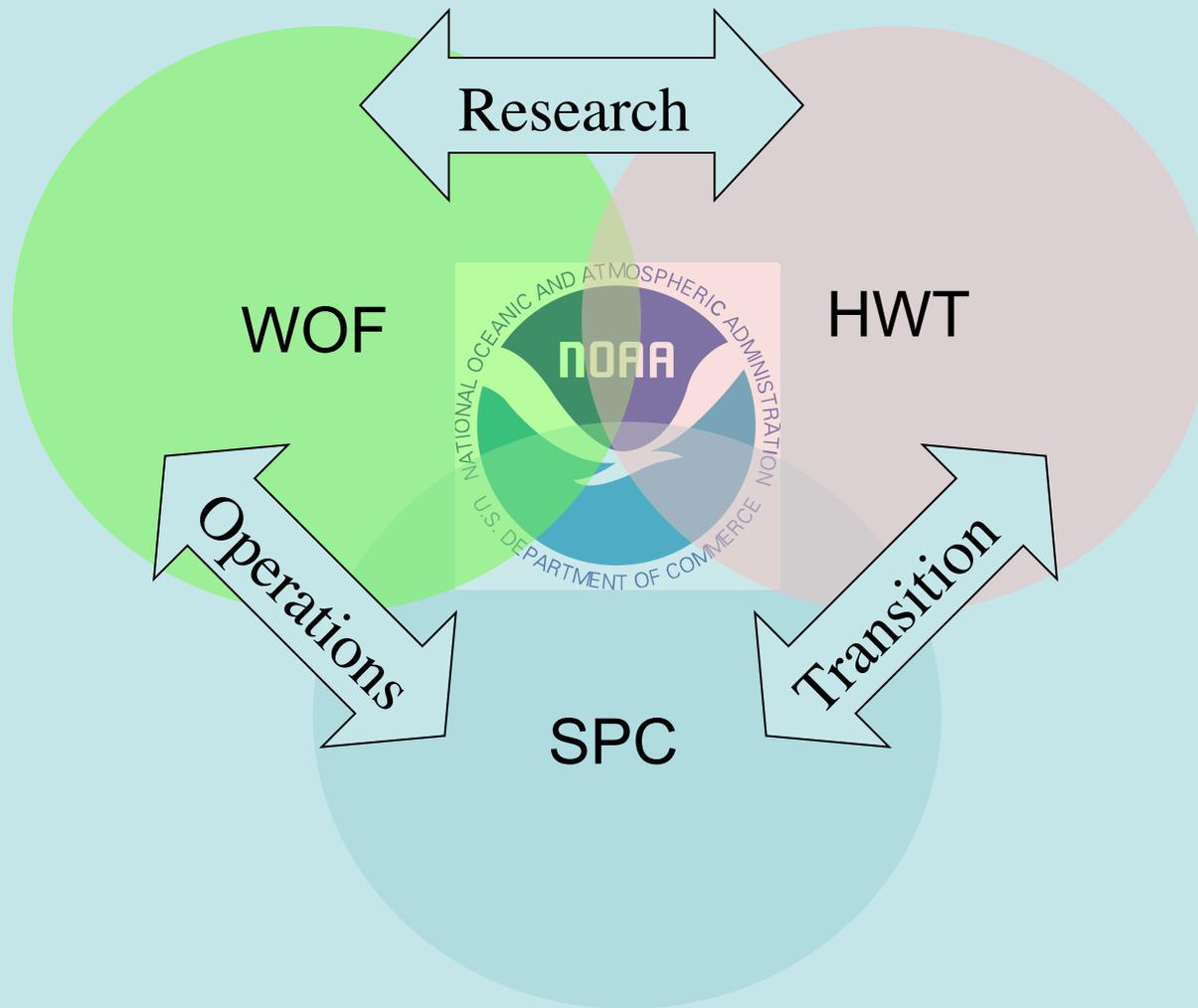




Deliverables

- Research Scientist hire
- Hazardous Weather Testbed
 - Experimental Forecast Program
- Social Sciences Group
 - End user issues in common with SPC and WoF





Research

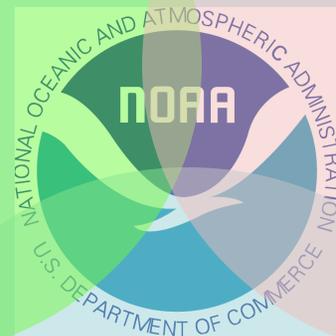
WOF

HWT

SPC

Operations

Transition





HWT EFP

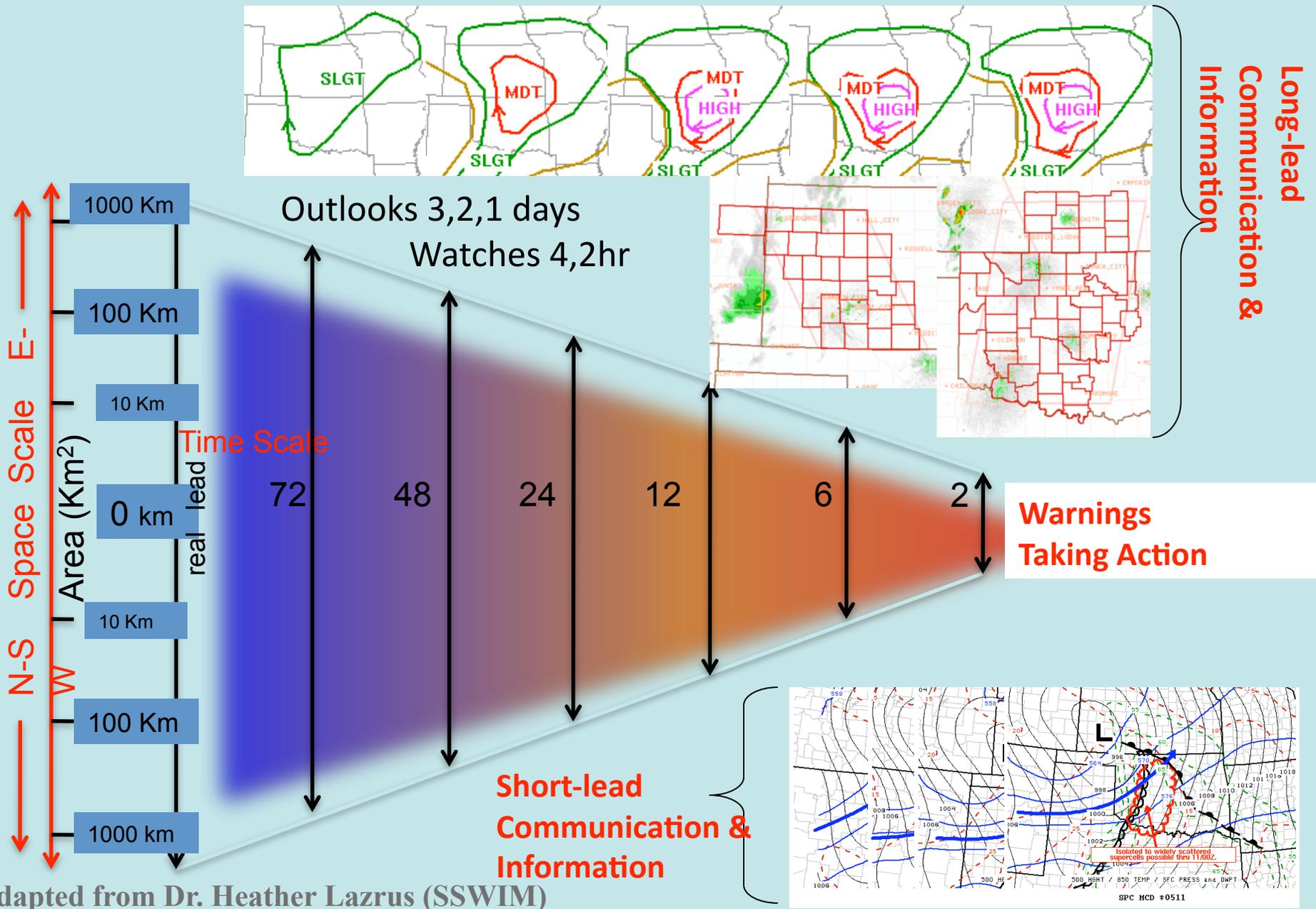
- Focused on model evaluation/utility
 - Ensemble design and spread
 - Merging subjective & objective measures of skill
 - Understanding & documenting strengths/weaknesses
- Data Visualization and Interpretation
 - Addressing the data overload problem [and the forecasters who seek it out] and Maximizing Interpretation Time
 - Information summary and extraction methods
 - How useful and/or valuable are these methods?
 - Ensemble based probabilities of storms and threats



HWT EFP

- The activities in HWT are very closely related to WoF
 - Radar data assimilation value (cold vs hot start)
 - Design and use of probabilistic information for rare type events
 - On the order of hourly and sub-hourly forecast data:
 - Information extraction
 - Model field interrogation
 - Rapid threat assessment
 - Piecing together the new forecast funnel

Situational Awareness, Perspective, forecast refinement, observations



Adapted from Dr. Heather Lazrus (SSWIM)

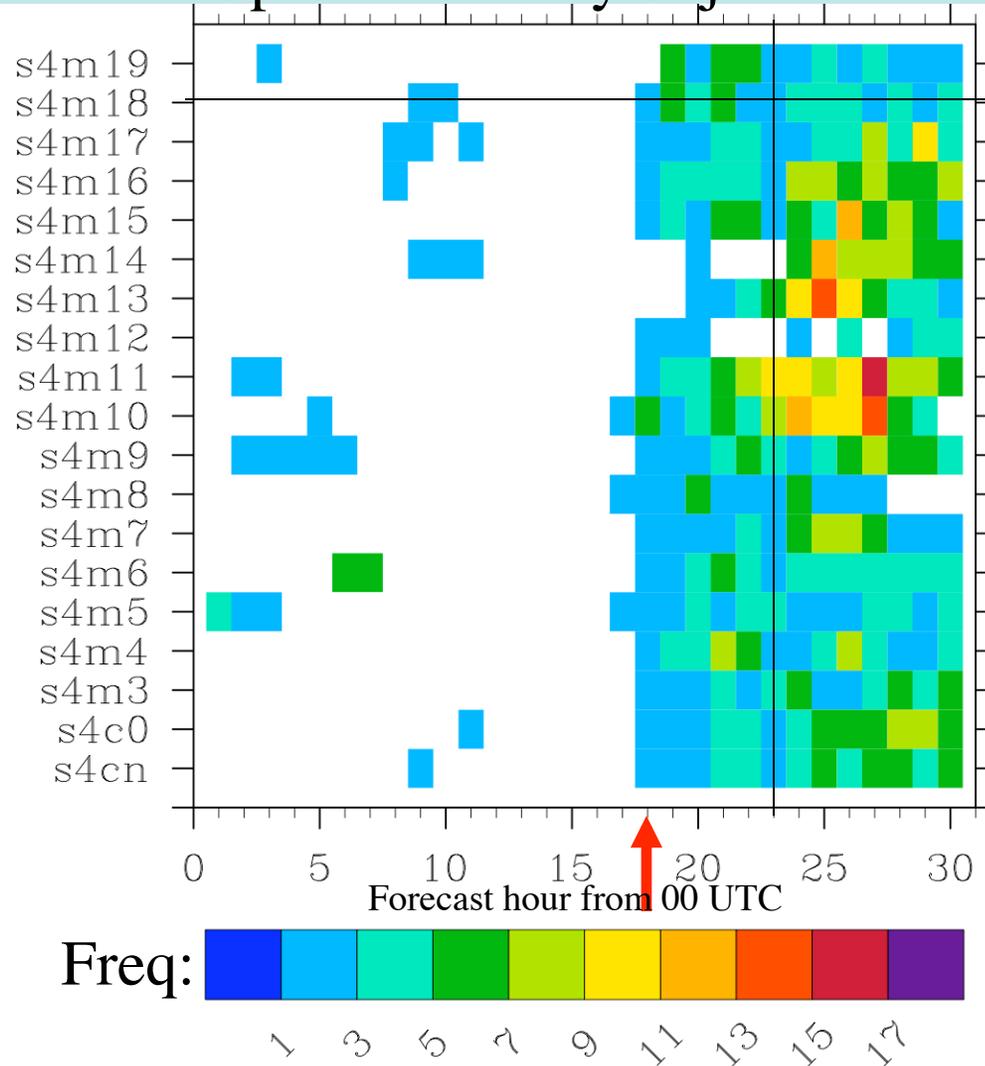


EFP: Shorter term goals

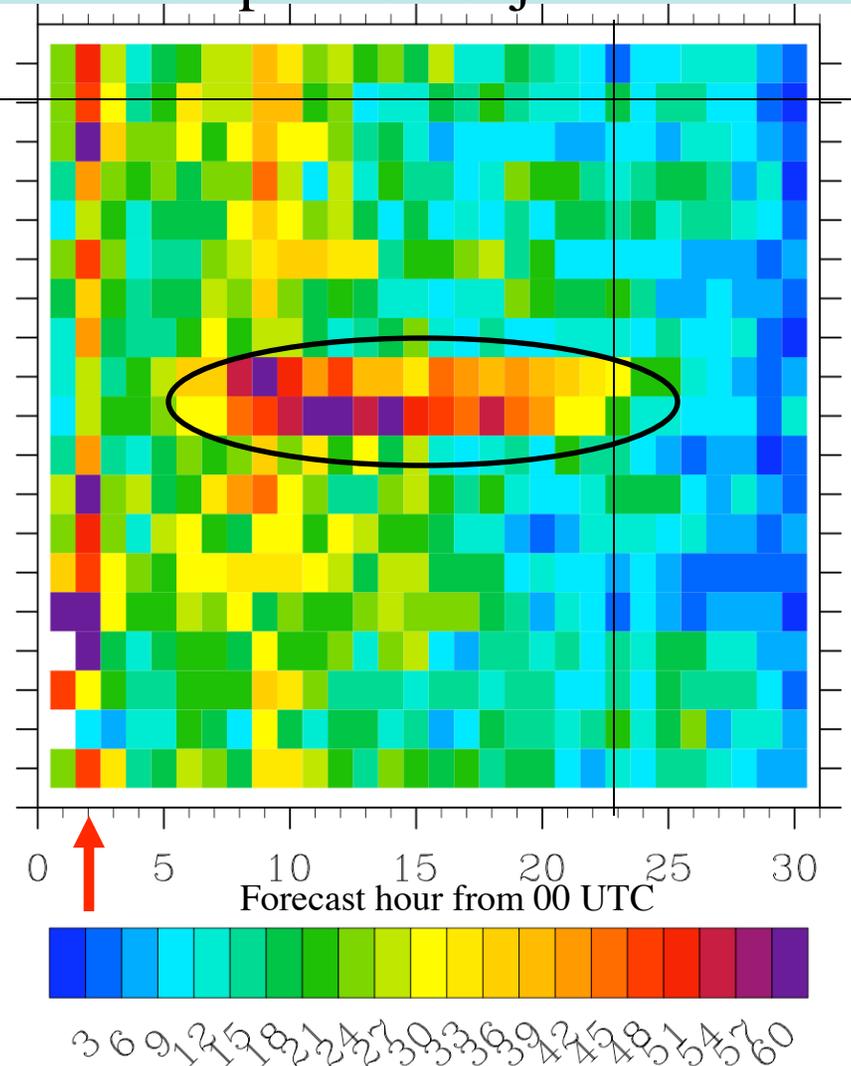
Severe Storms Desk

- Working toward meeting WoF in the 1-3 hour time frame
 - Developing finer spatial and temporal probabilistic guidance
- Exploring new ways of data visualization on specific storm properties and model summaries
 - Object based methods
 - Visualizing ensemble spread and pairing with ensemble evaluation tools (rank histograms)

Updraft Helicity objects

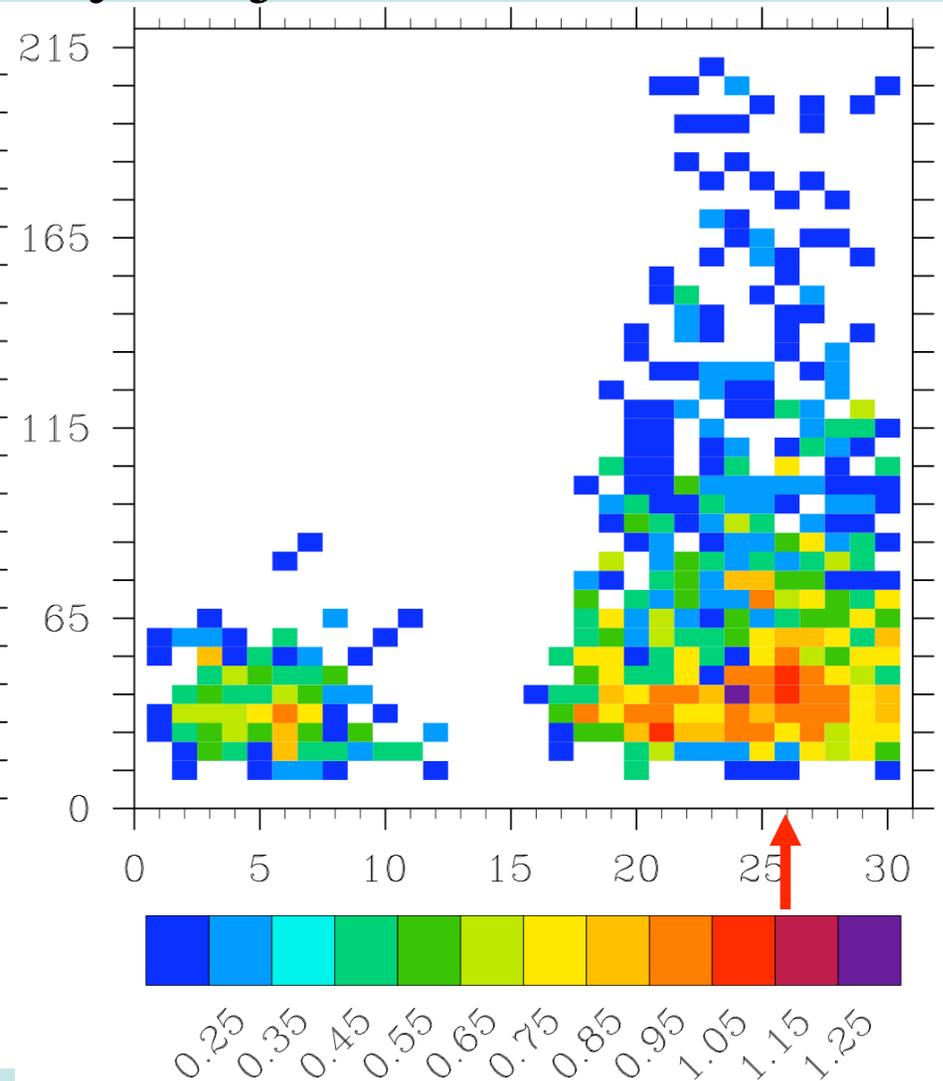
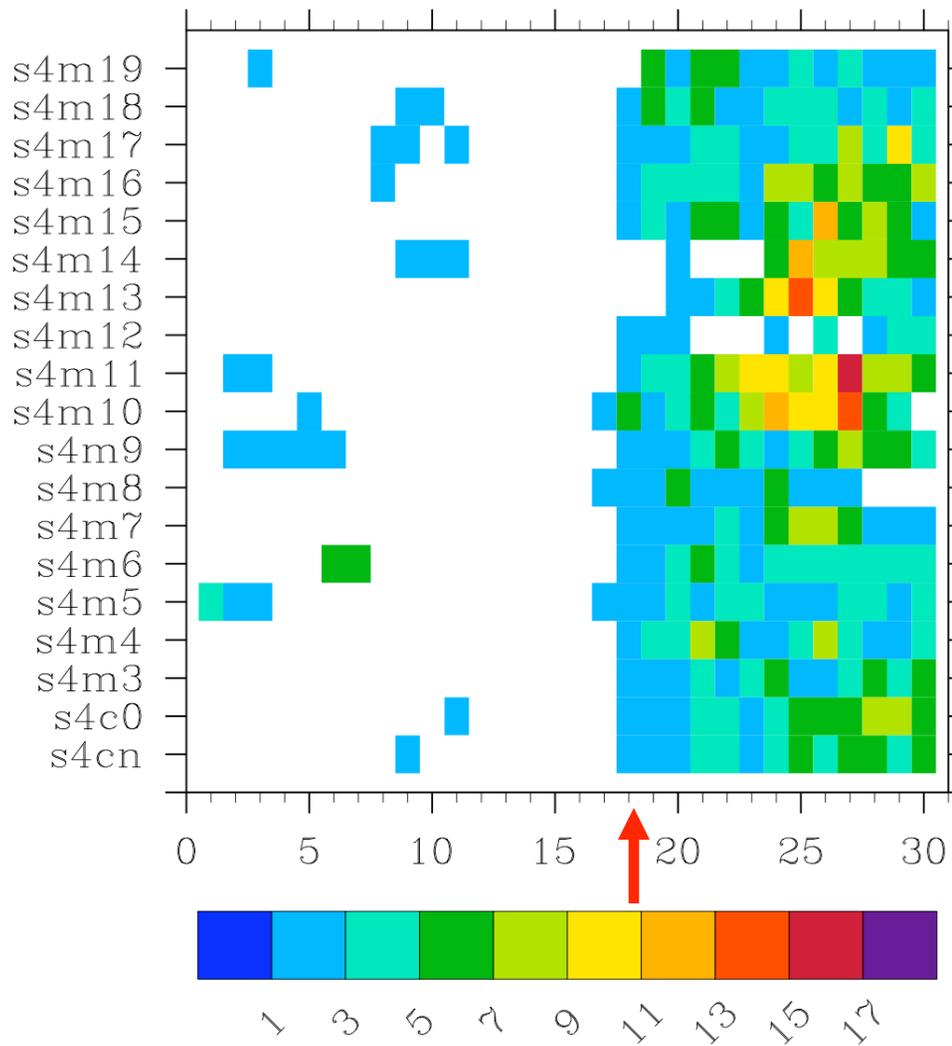


Precipitation objects



Summary which indicates threat onset time (UH), precipitation behavior leading up to the event (outliers identified).

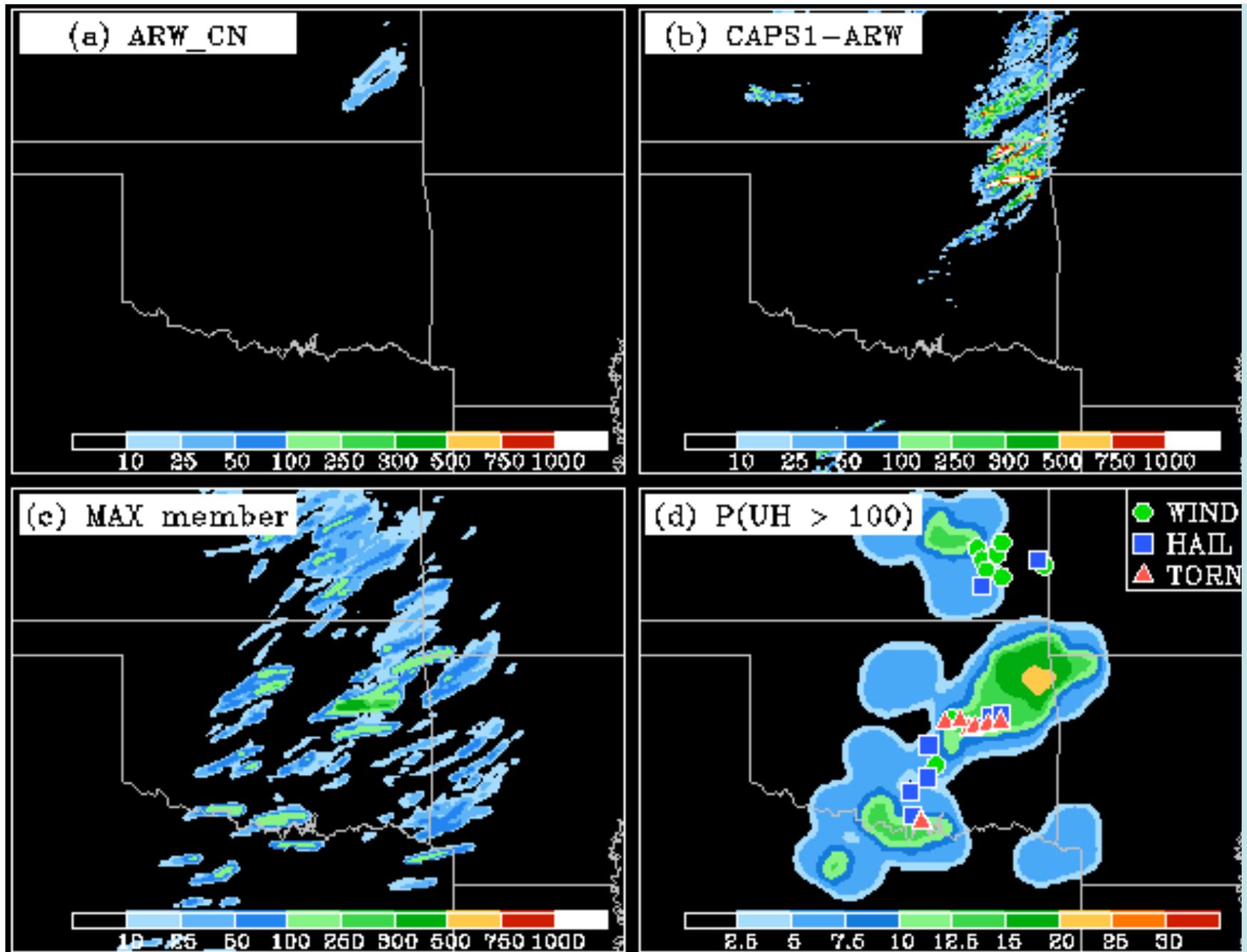
Updraft Helicity Objects



OK area object count

UH object 90th % intensity
whole domain - all members

Clark et al. (2011): 25 hr forecast UH





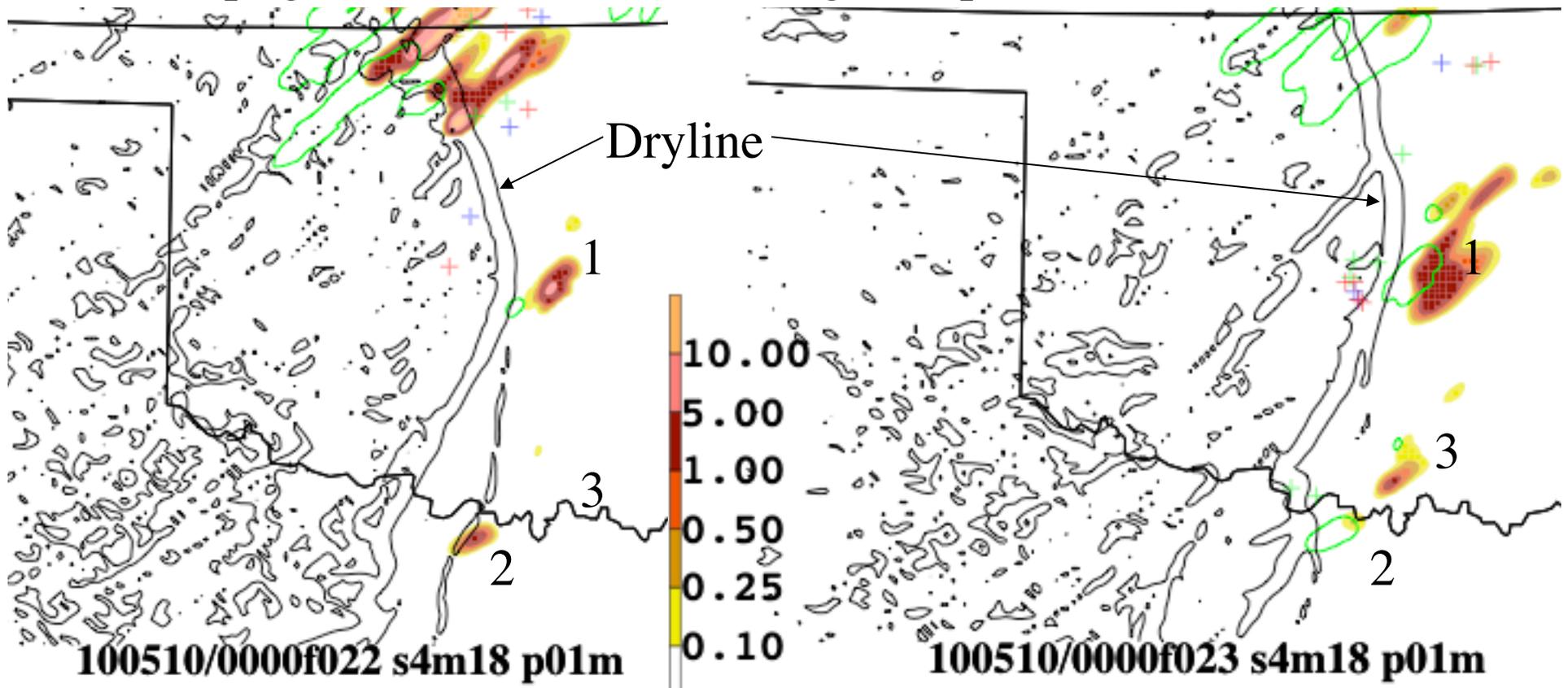
EFP: Shorter term goals

Convection Initiation Desk

- Need to understand the physical processes which precede and result in CI; CI failure or early demise.
- What are the environmental changes in unique environments (weak vs strong forcing)?
- What is the length of time between CI and “hazard initiation” or severe storm onset?
- Define the value in CI forecasts (if any) and if this helps in severe storm mode and thus hazard assessment.
- Comparison between satellite and synthetic satellite

Closeup of CI

1 hr Precip (green and shaded) and mag $\nabla dwpf$ (contoured $.75 \times 10^{-3}$)



1. CI close to analysis time and continues 1 hour later
2. Apparent CI ... failure 1 hour later
3. Note that fine scale precip structure distorts “storm” objects



EFP: Shorter term goals

Social Science Components

- What does a SVR or TOR Watch provide to end users? Continuously updating products too...
- Can we get the public to understand probabilities of rare events? 2-30% tornado probabilities can be 1000 times greater than normal.
- Communicating the forecast in terms of confidence and uncertainty. How to represent that information in graphical and other products? Can we really distinguish between events with 40 and 60% uncertainty? How will public react to numerical specificity when forecasters struggle with quantifying uncertainty/confidence?



EFP: Shorter term goals

Social Science Components

- The need to balance perceptions and expectations with any forecast system. Surveys with context will be needed to gauge the response of the public. Open ended questions may not serve our ability to frame the end product we envision.
- What is envisioned as the role of the human in the forecast process?
 - Try to understand how to **maximize** human forecaster skill/contributions versus computer forecast skill/contributions. Requires understanding how forecasters make decisions (incorporate uncertainty/confidence into forecasts)
 - Communicating the threat to people



Challenges

- SPC and WoF type operations are very similar with respect to Models (NWP design [ensembles], Data assimilation approaches), data mining and interrogation (probabilities), and forecast implementation (watch - warning)
- We are approaching it from longer lead times and currently exploring finer temporal windows down towards 3 hours.
- But the lines become rather fuzzy between 1-3 hours. SPC will approach the 1-3 hour window and we believe a **seamless transition** will be required to be **consistent** between “forecast” and “warning forecast”
- We are beginning to dream up a paradigm test for how we all work together and **Bridge The Gap**. The testing of any approach may need to start outside of HWT and worked in.

**The Weather Challenge:
HRRR Forecasts of the
Multiple MCSs on 18 June**

Comparison of 14z, 16z, and 18z
Model Runs Valid 14-00z

HRRR Simulated Reflectivity (1 km AGL)

Forecasts valid 14z 18 June 2010

14z
00-hr

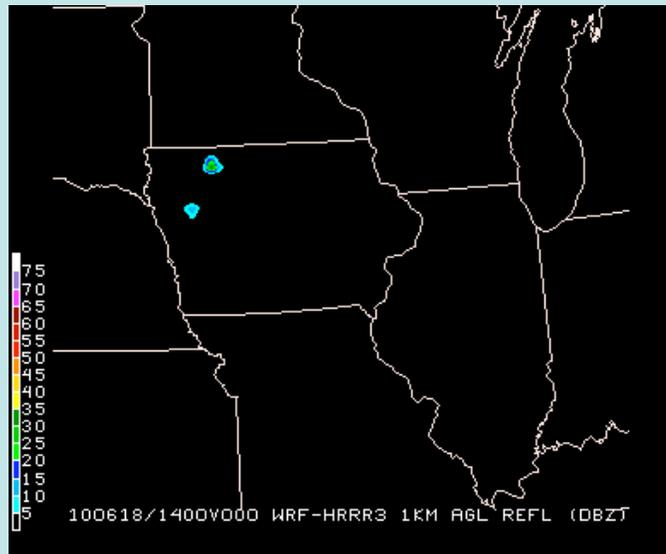
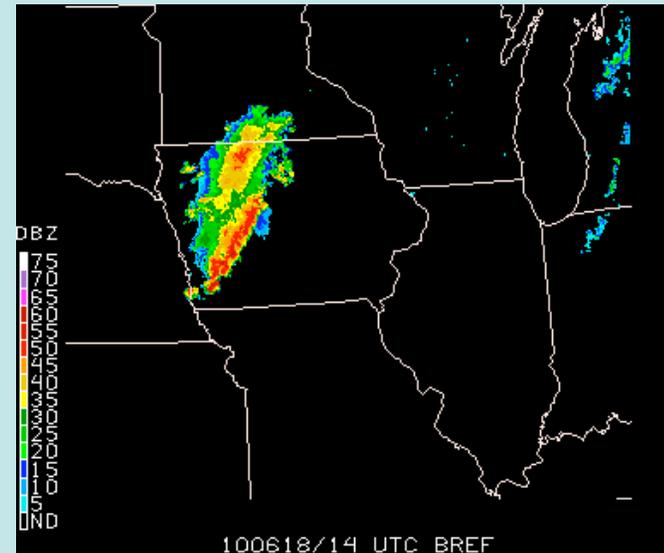


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16z (NA)

18z (NA)

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Observed
Radar

HRRR Simulated Reflectivity (1 km AGL)

Forecasts valid 15z 18 June 2010

14z
01-hr

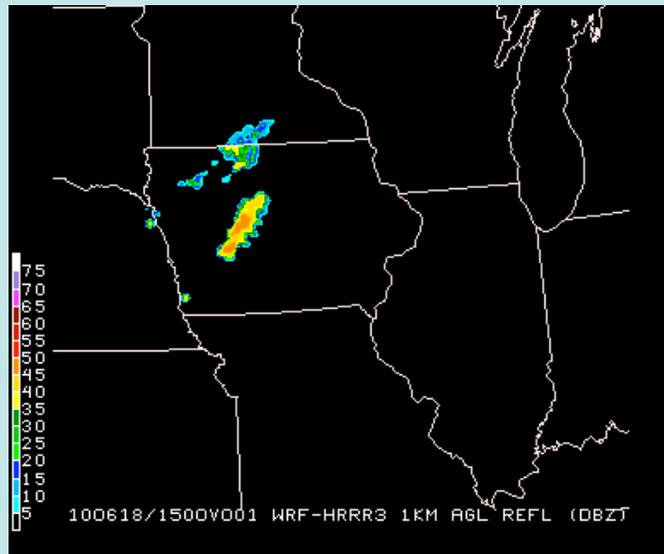
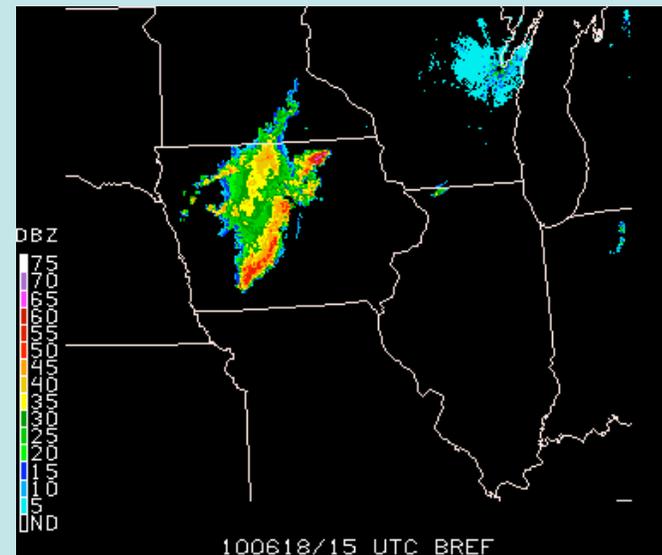


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16z (NA)

18z (NA)

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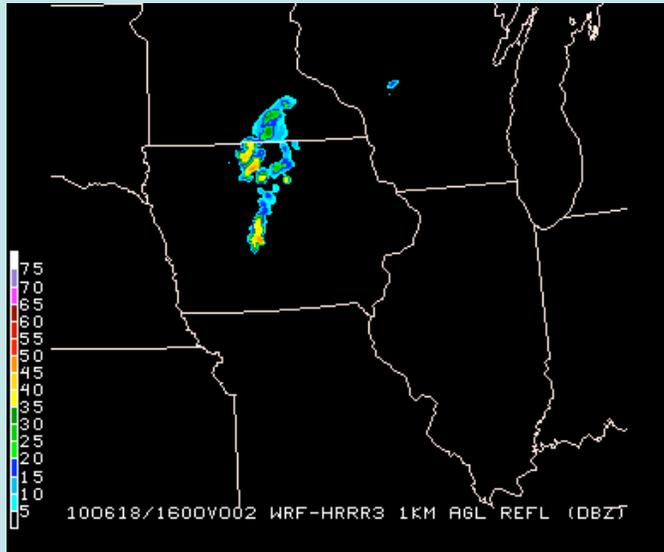


Observed
Radar

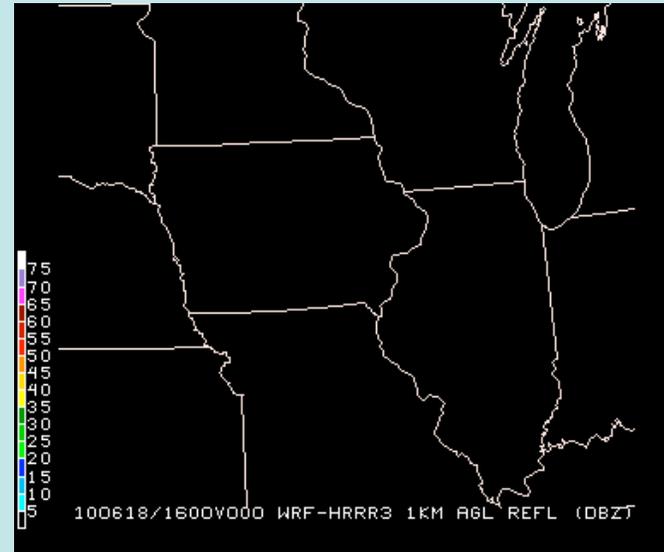
HRRR Simulated Reflectivity (1 km AGL)

Forecasts valid 16z 18 June 2010

14z
02-hr



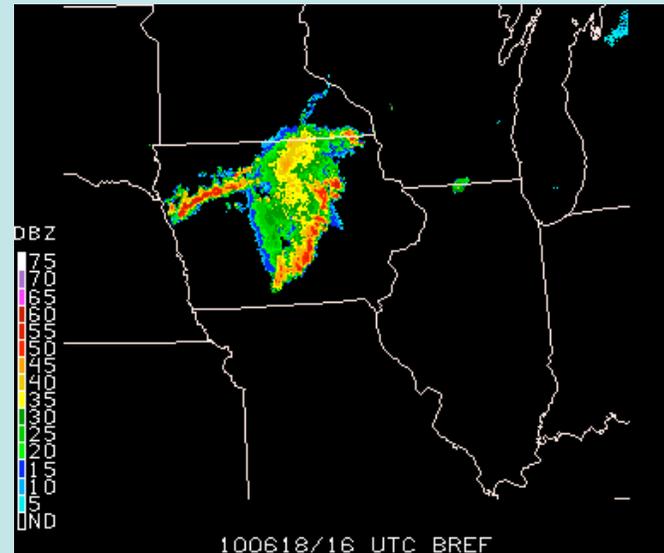
16z
00-hr



18z (NA)

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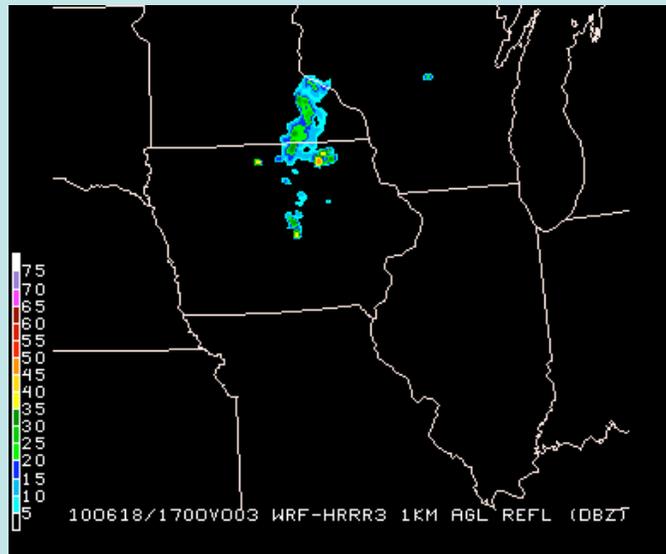
Observed
Radar



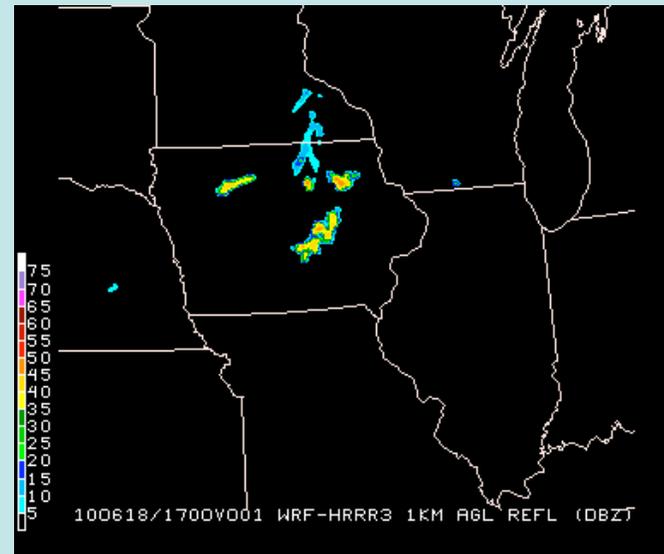
HRRR Simulated Reflectivity (1 km AGL)

Forecasts valid 17z 18 June 2010

14z
03-hr



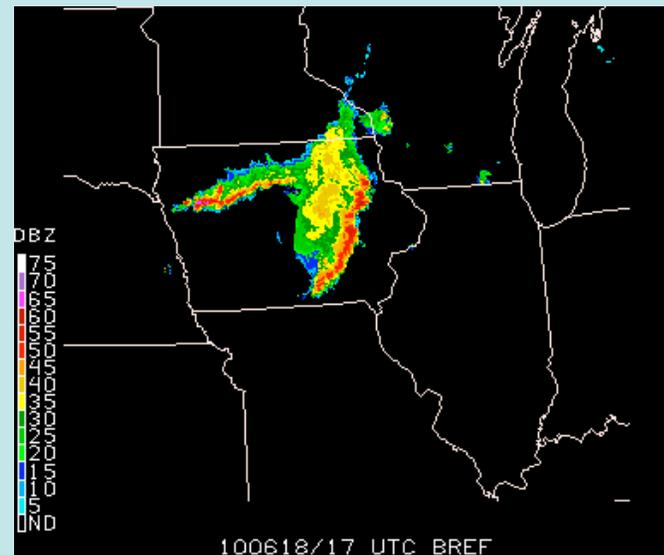
16z
01-hr



18z (NA)

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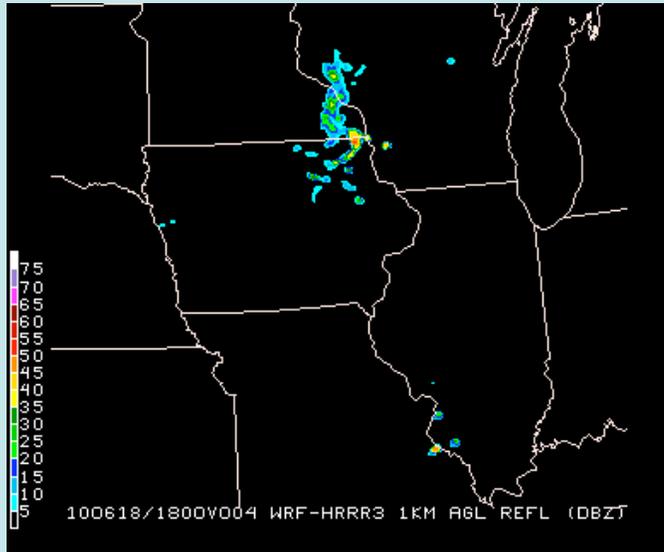
Observed
Radar



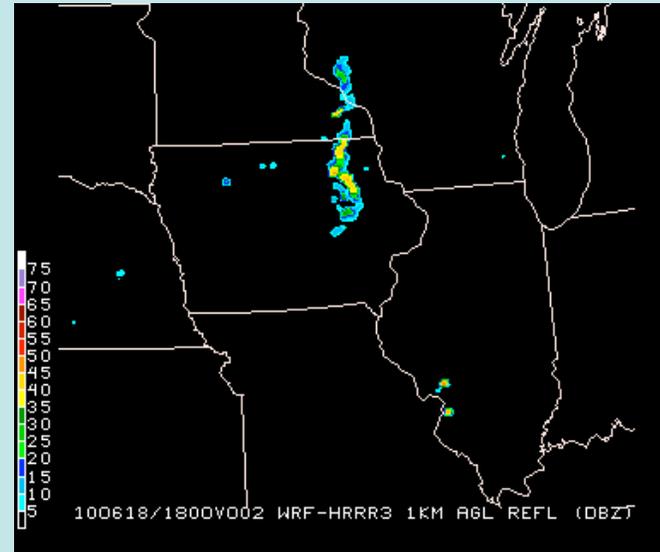
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Forecasts valid 18z 18 June 2010

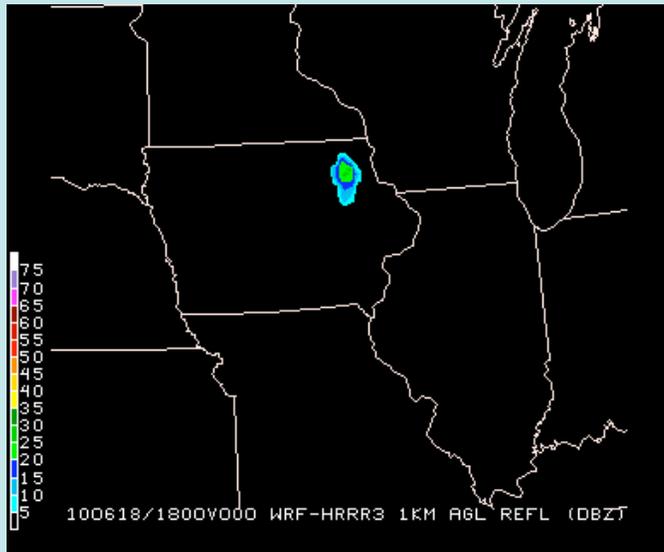
14z
04-hr



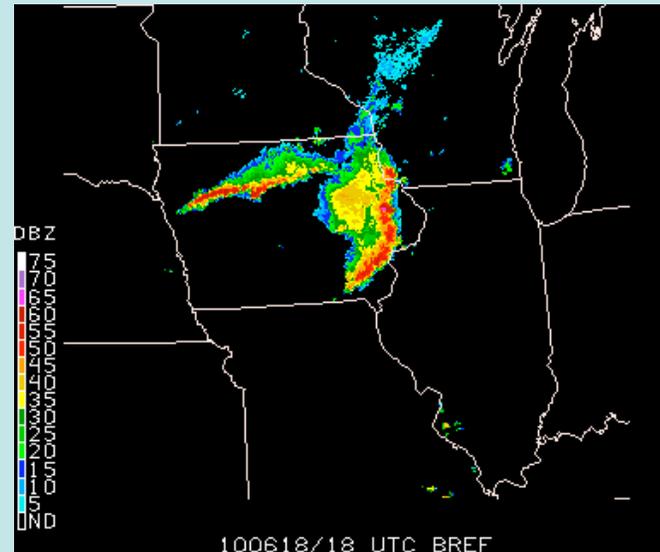
16z
02-hr



18z
00-hr



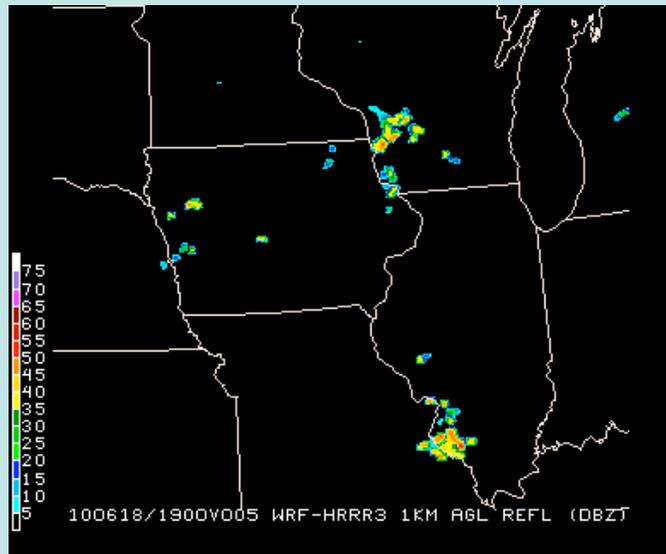
Observed
Radar



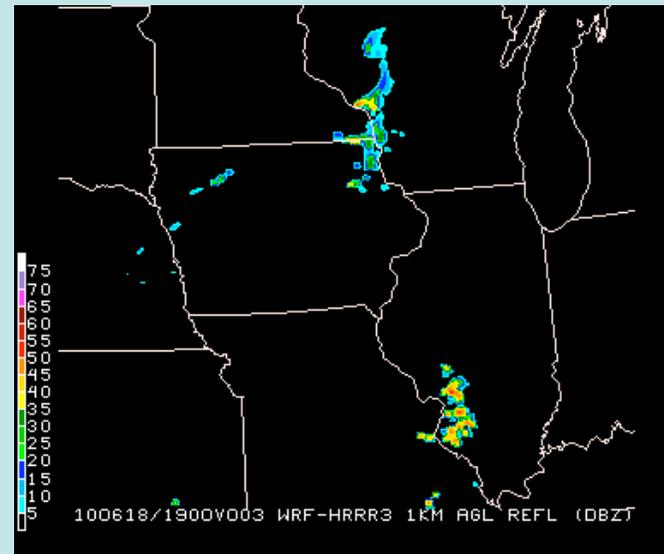
HRRR Simulated Reflectivity (1 km AGL)

Forecasts valid 19z 18 June 2010

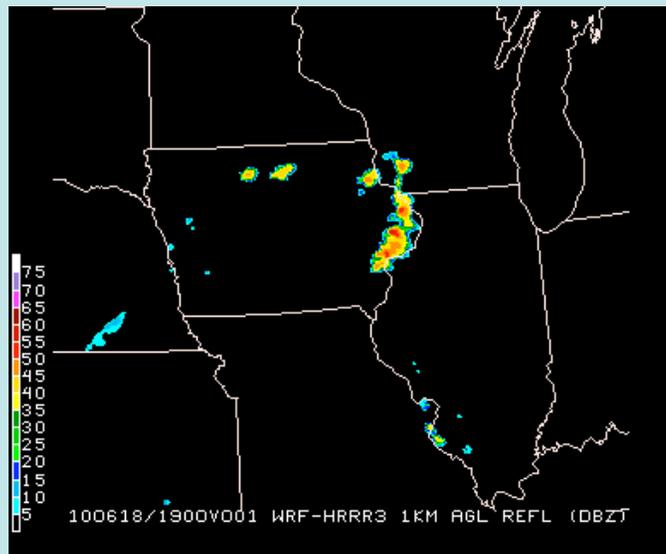
14z
05-hr



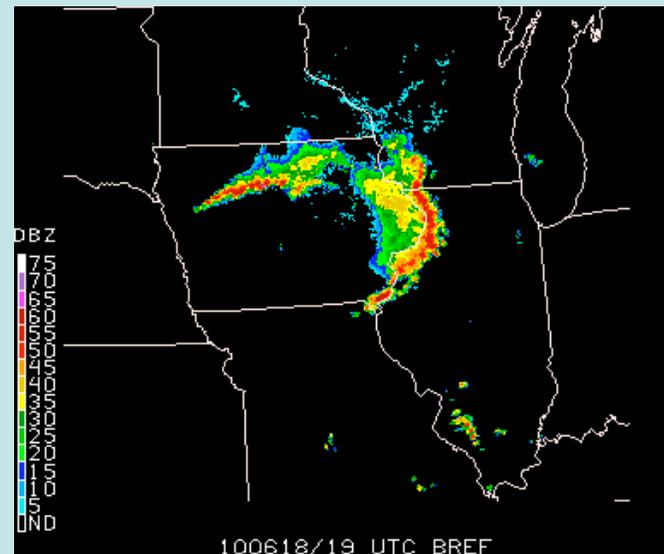
16z
03-hr



18z
01-hr



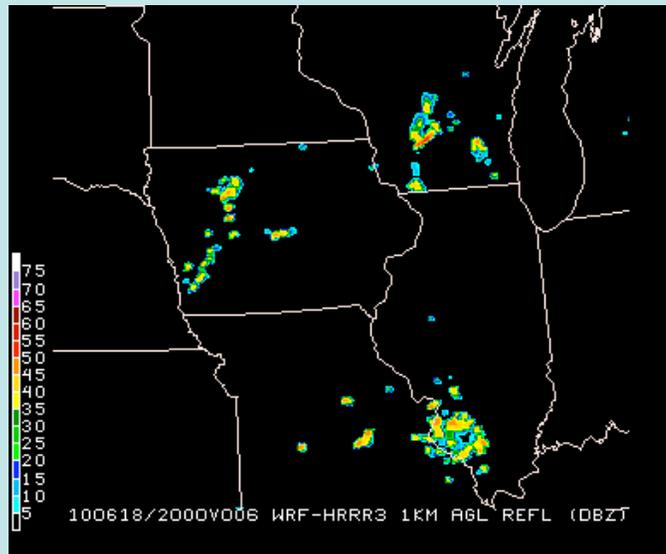
Observed
Radar



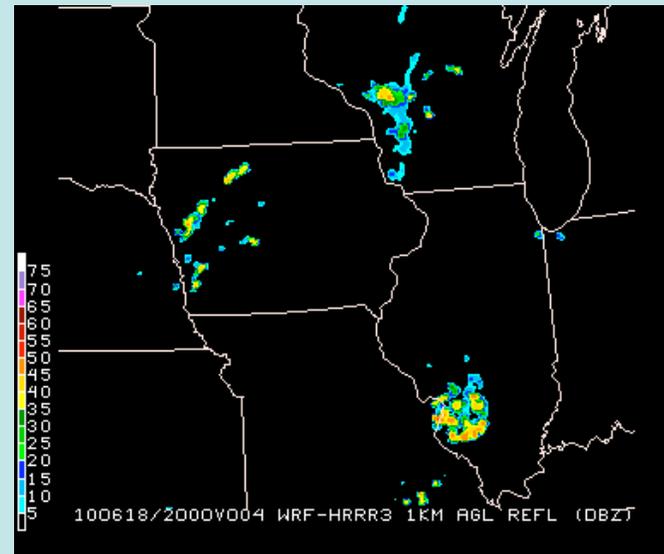
HRRR Simulated Reflectivity (1 km AGL)

Forecasts valid 20z 18 June 2010

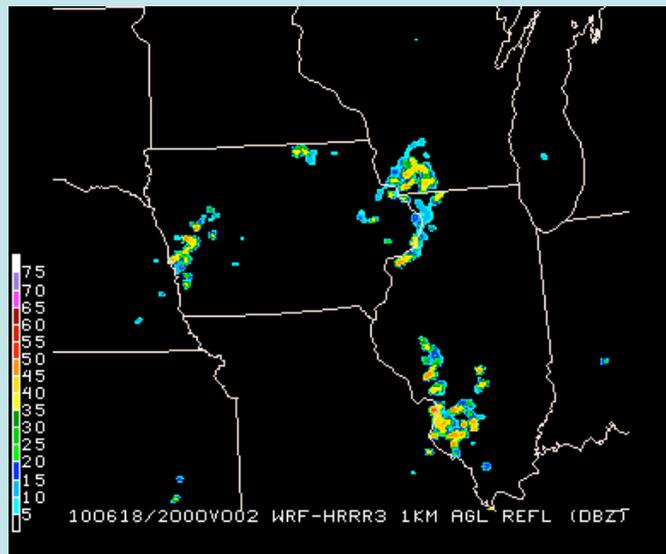
14z
06-hr



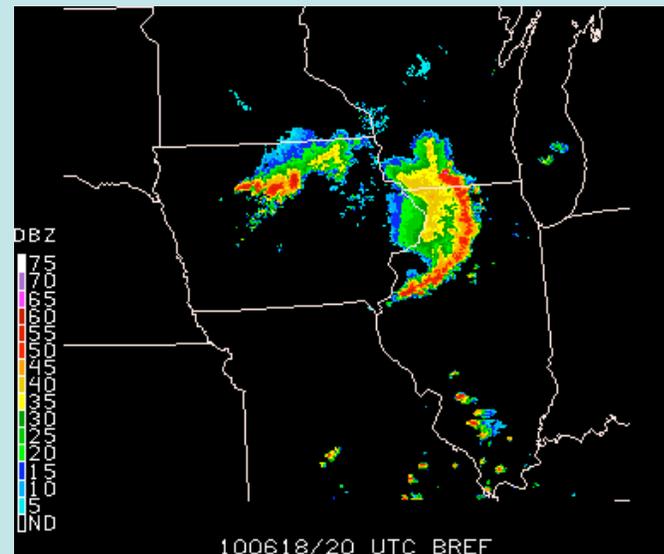
16z
04-hr



18z
02-hr



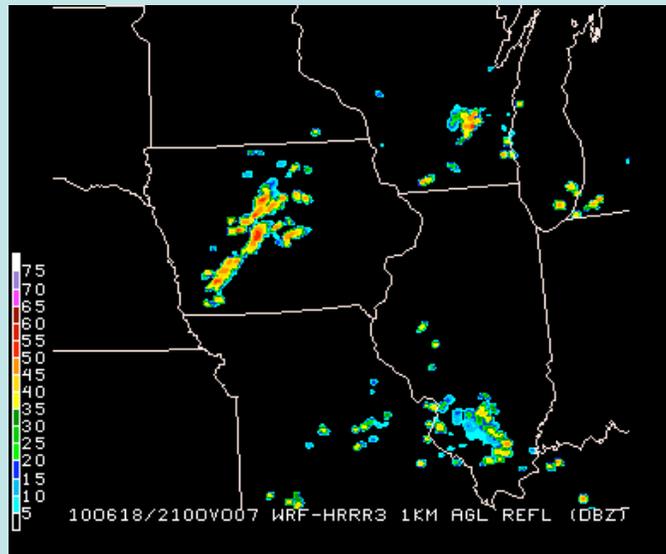
Observed
Radar



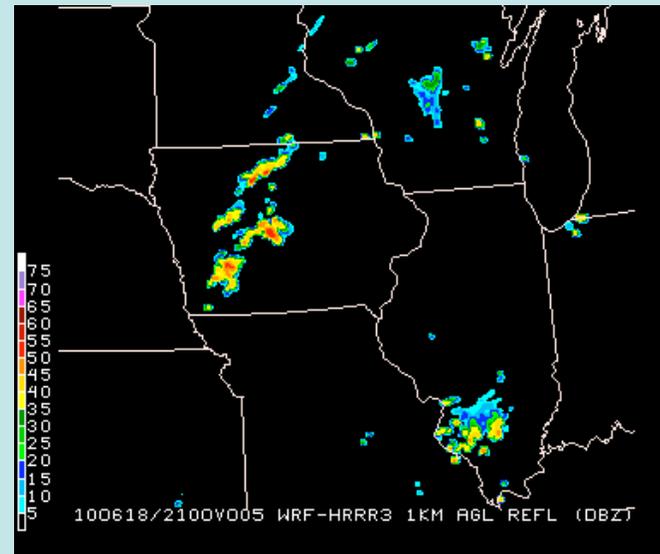
HRRR Simulated Reflectivity (1 km AGL)

Forecasts valid 21z 18 June 2010

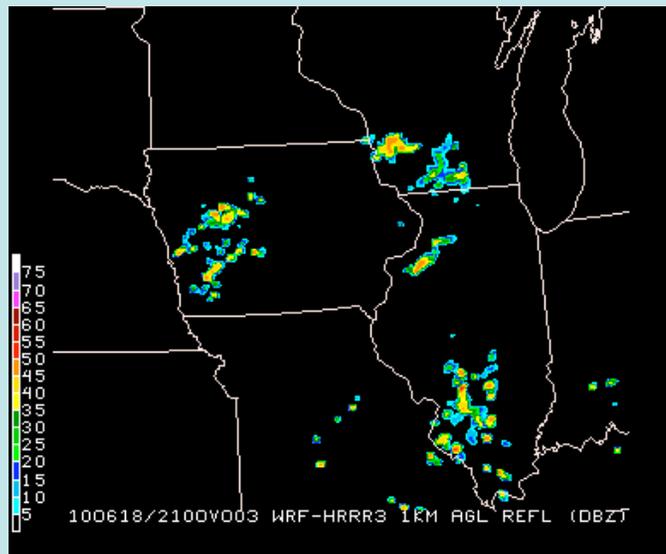
14z
07-hr



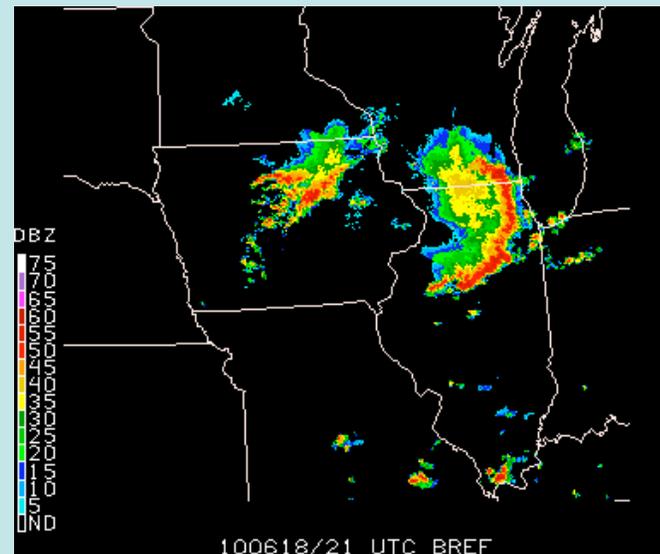
16z
05-hr



18z
03-hr



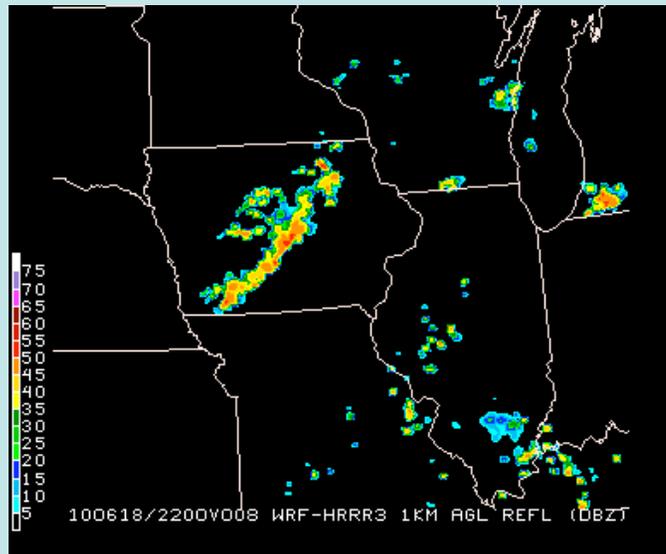
Observed
Radar



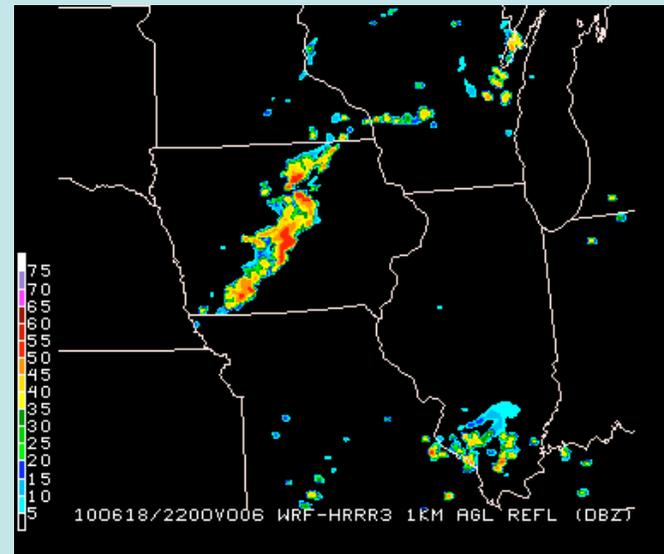
HRRR Simulated Reflectivity (1 km AGL)

Forecasts valid 22z 18 June 2010

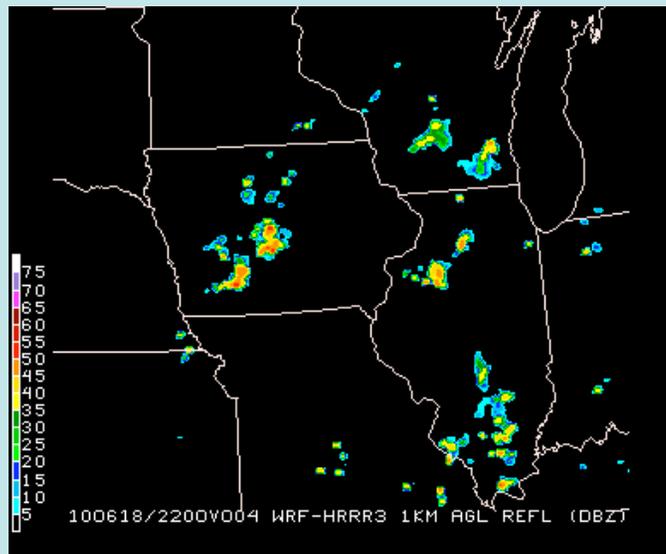
14z
08-hr



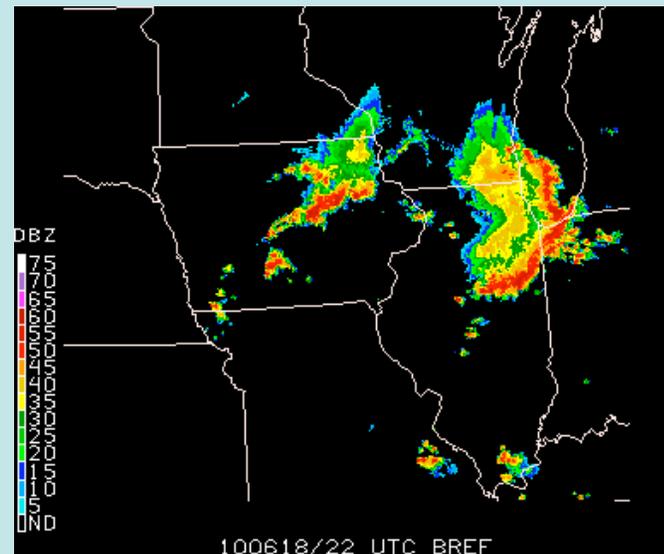
16z
06-hr



18z
04-hr



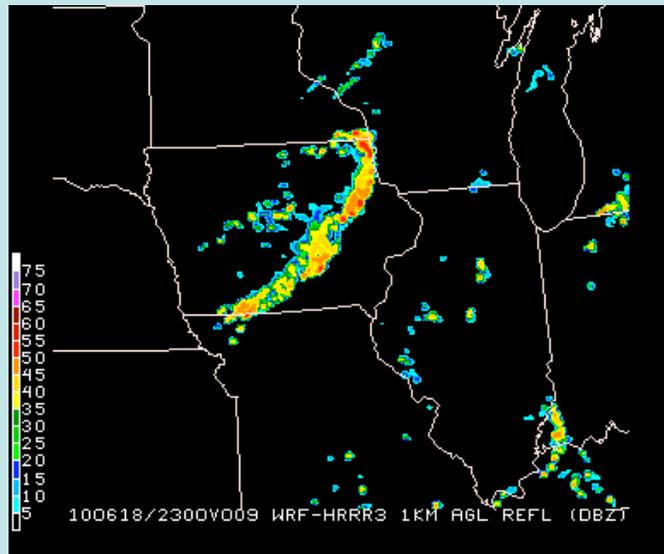
Observed
Radar



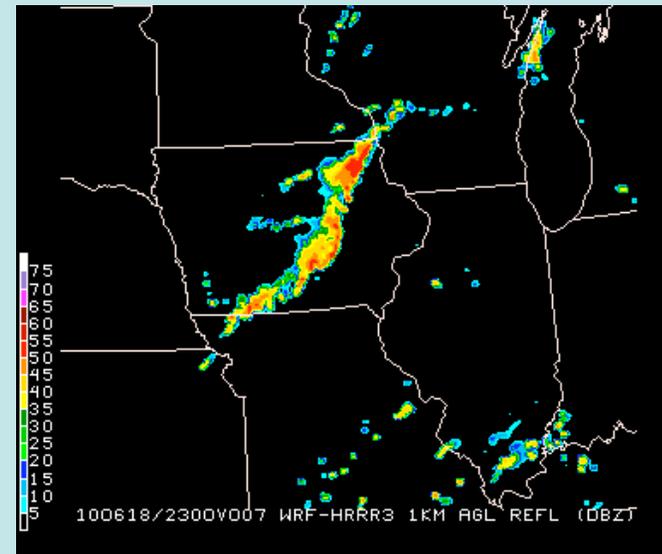
HRRR Simulated Reflectivity (1 km AGL)

Forecasts valid 23z 18 June 2010

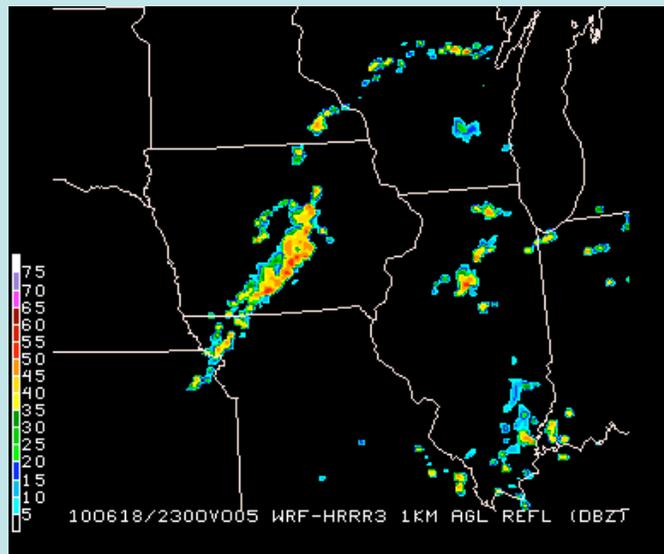
14z
09-hr



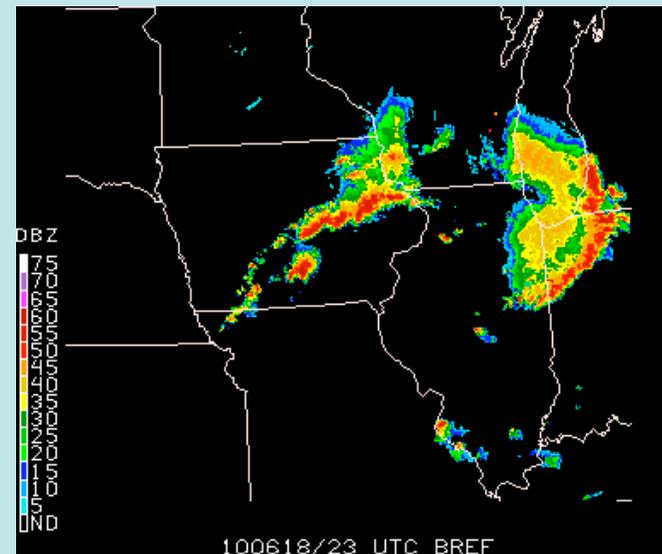
16z
07-hr



18z
05-hr



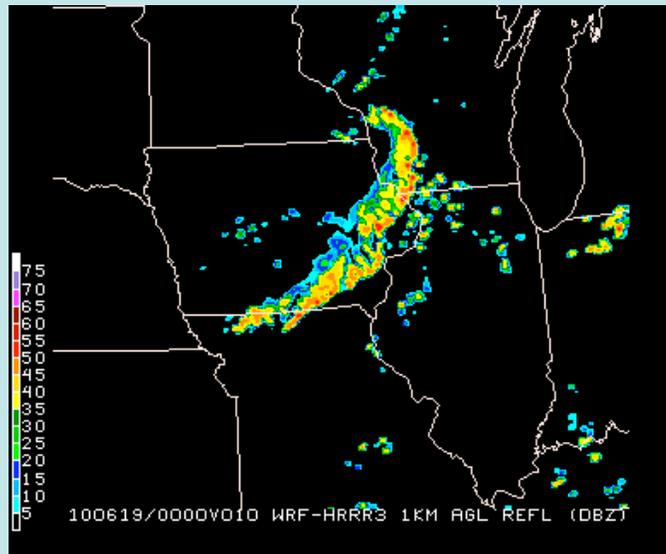
Observed
Radar



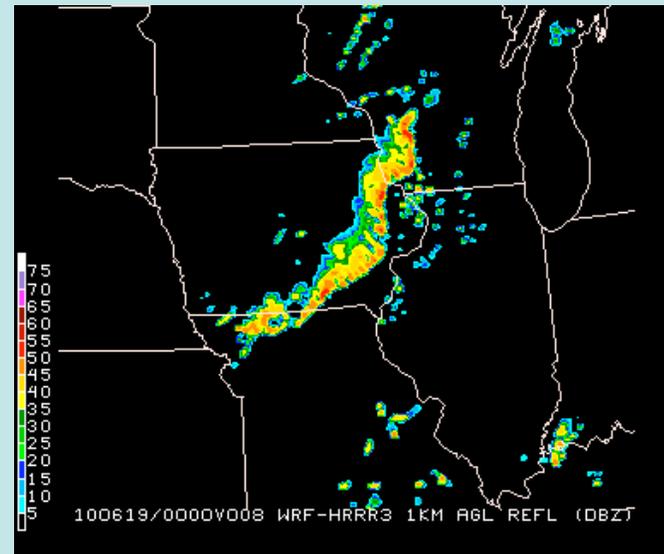
HRRR Simulated Reflectivity (1 km AGL)

Forecasts valid 00z 19 June 2010

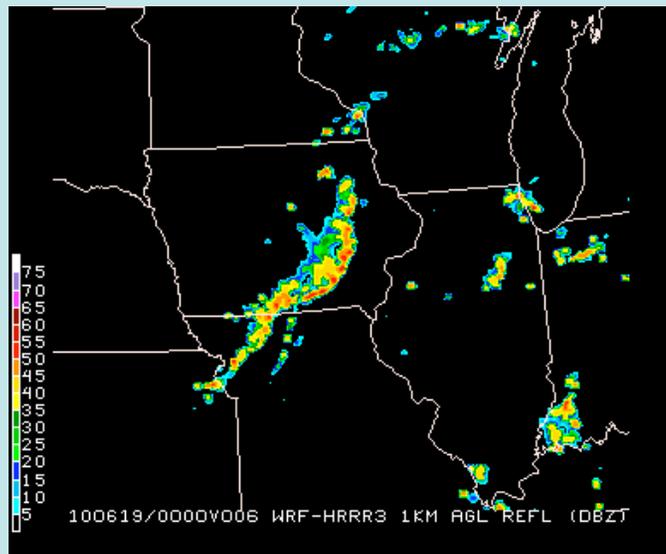
14z
10-hr



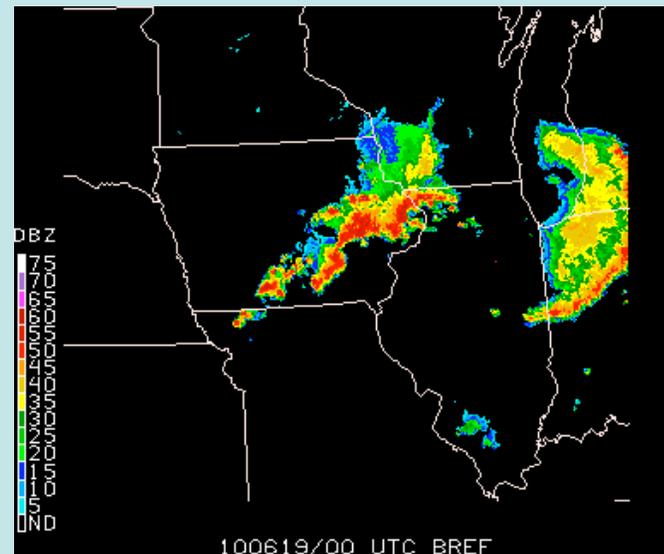
16z
08-hr



18z
06-hr



Observed
Radar





Wrap Up

- The weather challenge is still evolving on 1-3 hour time scales. It is still not **practical** to ask a forecaster to draw the reflectivity in 3 hours, and our models still struggle to do this.
- The data extraction paradigm and development of scientific forecasting is still evolving.
- SPC has been on the front lines and the HWT continues to be a significant resource with which to explore these challenges.