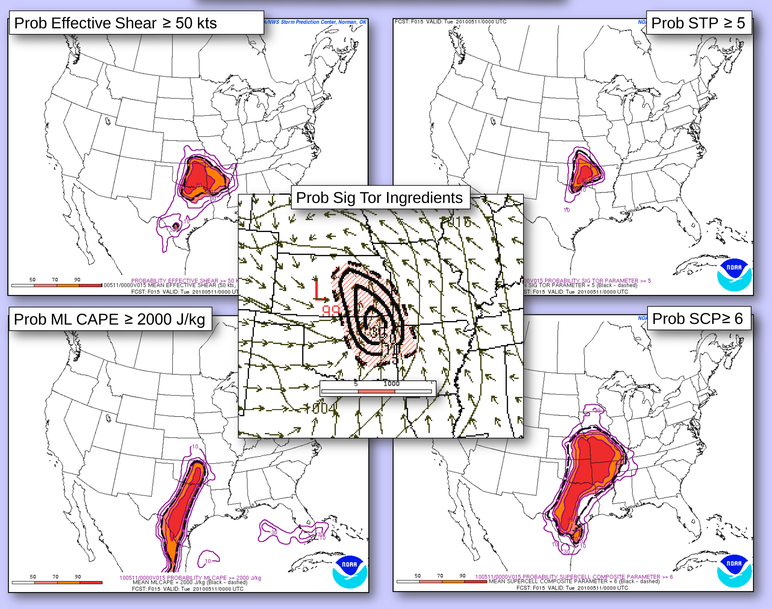
Using Short Range Ensemble Forecasts, Climate Anomalies, and High Resolution Model Guidance to Determine the Potential for a Tornado Outbreak across the Southern Plains on 10 May 2010

Josh Korotky (1) and R. H. Grumm (2)
(1) NOAA/NWS Pittsburgh, PA, (2) NOAA/NWS State College, PA

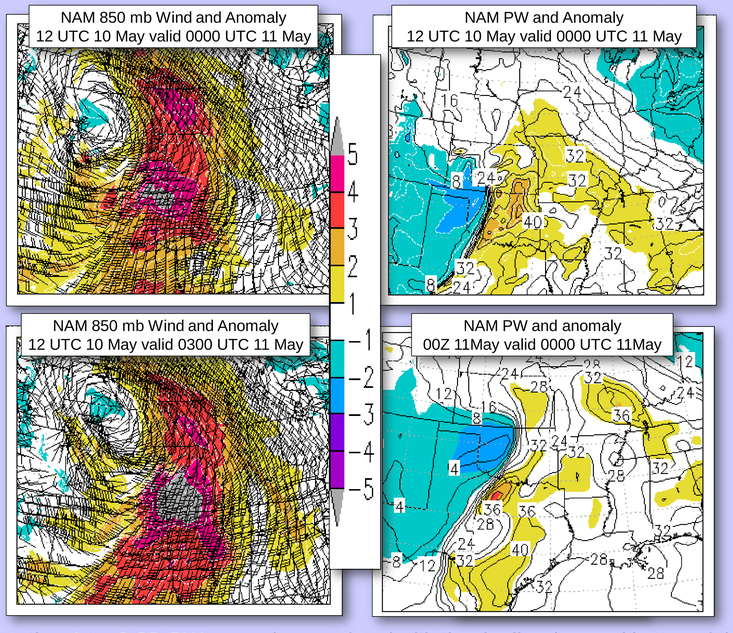
SREF Probabilities

0900 UTC 10 May SREF valid 0000 UTC 11 May



Note the probability of supercells (Prob Effective Shear ≥ 50 kts [top left], Prob SCP ≥ 6 [bottom right], Prob ML CAPE ≥ 2000 J/kg [bottom left]) and tornadoes (Prob STP ≥ 5 [top right], Prob Sig Tor Ingredients [center]) is high, indicating a high level of threat for a significant severe weather outbreak.

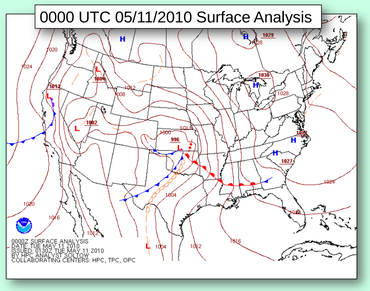
Forecast Departures from Climatology

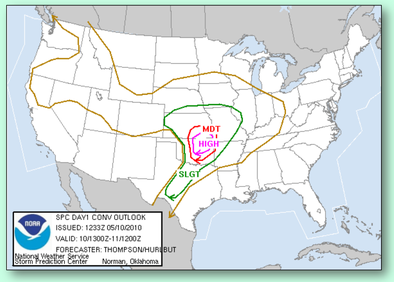


Note the -1 to -2 SD PW anomaly associated with the dry-line (top and bottom right) and anomalous surge of high PW (3-4 SD) air moving northward in the warm sector. Also note the expanding 5+ SD 850 mb total wind anomaly (top and bottom left). Anomalous low level jets are a primary consideration for significant severe weather.

Introduction

A well-predicted tornado outbreak spread across the southern plains during the afternoon and evening hours of 10 May 2010. The volatile pre-storm environment prompted the Storm Prediction Center to issue a high risk of severe weather for central Oklahoma and southeast Kansas preceding the event.





A Useful Forecast Strategy

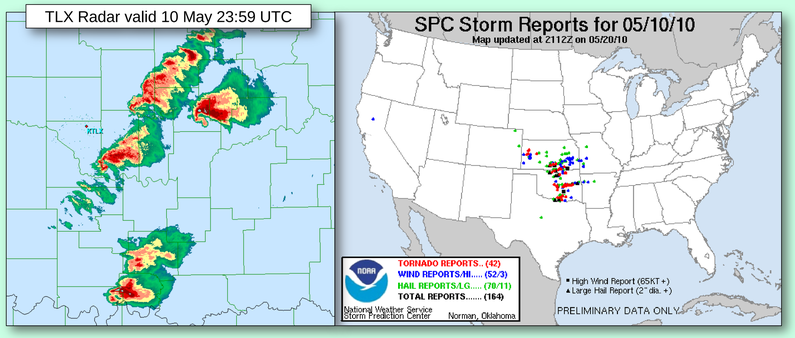
- The combined strengths of EFS and high resolution models can lead to greater awareness for the potential of severe weather impacts
- Use SREF probability forecasts and other Ensemble Prediction System (EFS) information to quantify the forecast uncertainty and predictability; to assess the likelihood and convective mode of an event
  - ✓ *It is far better to leverage the probabilities and determine ALL the forecast possibilities from an EFS than to persist in the delusional pursuit of a single model or model cycle or model solution, however satisfying and reassuring – Inspired by Rich Grumm, Jun Du, Carl Sagan*
- SREF/GEFS/NAM/GFS forecast departures from climatology help to frame and give context to a forecast
- Use high resolution model output (4.0 km NMM WRF, 3.0 km HRRR) to resolve important near storm scale details (e.g., convective mode/evolution).
  - ✓ *Don't expect perfection from a high resolution model…expect information!*

Discussion

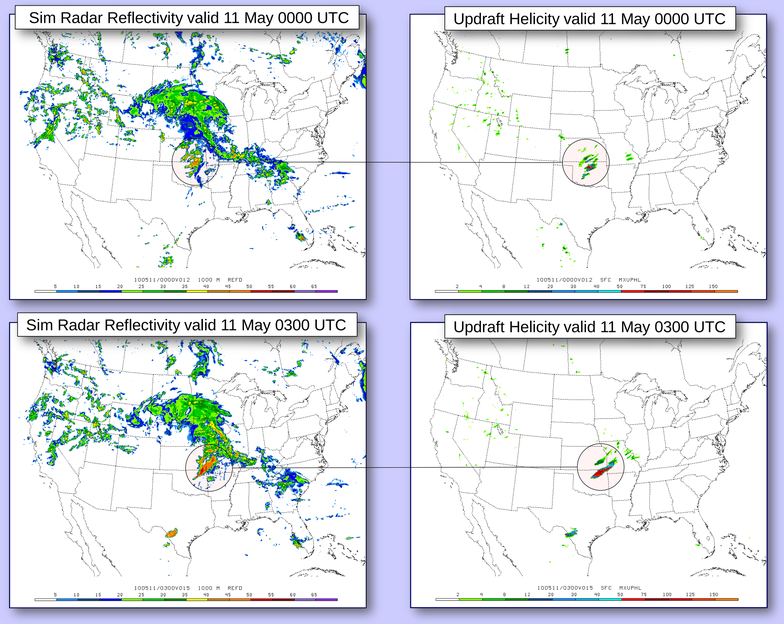
- High resolution models can resolve important near storm scale details, including the possible mesoscale evolution of convective systems
- Simulated Reflectivity can resolve convective initiation..mode..intensity..evolution
  - ✓ Computed from model predicted grid-resolved hydrometeor fields…can provide mesoscale and near storm scale details not resolved with operational models

Summary

Severe weather reports include 42 tornadoes in Oklahoma and Kansas and 164 reports of severe weather over the Southern Plains. High impact events included destructive tornadoes across parts of Oklahoma and Kansas, 4-5 inch hail over parts of Oklahoma, and wind gusts of 75-100 mph across parts of Kansas.

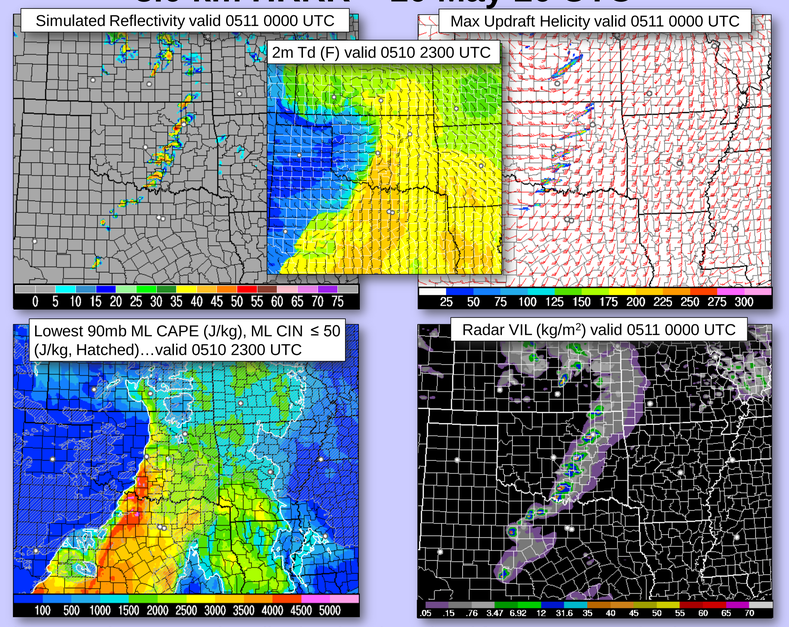


4.0 km SPC NMM WRF



Note the correlation between radar reflectivity signatures (left) and significant updraft helicity (right). This is a good indication of supercell potential and can increase situational awareness prior to convective development. Convection allowing models can produce a credible convective scale evolution for a particular environment.

3.0 km HRRR – 10 May 20 UTC



The HRRR is a convection allowing, hourly updated forecast system that ingests real time radar and many other types of data. At 3km resolution, the HRRR can reveal near storm scale details, including supercells. Note the association between radar reflectivity (top left), Max updraft helicity (top right), and radar VIL (bottom right). The dry line is indicated by the ML CAPE (lower left) and 2m Td (top center) gradients.