



The Use of Objective Analyses in the National Weather Service's Graphical Forecast Editor (GFE) to Anticipate a Localized Tornado Outbreak

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Tornado Outbreak

- April 3, 2012
- 20 tornadoes in north and northeast Texas
 - 3 EF-2 and 1 EF-3 affected DFW Metroplex
 - 0 fatalities; 29 injured
 - \$800 million in damage
 - Tornadoes were tracked live on TV from helicopters



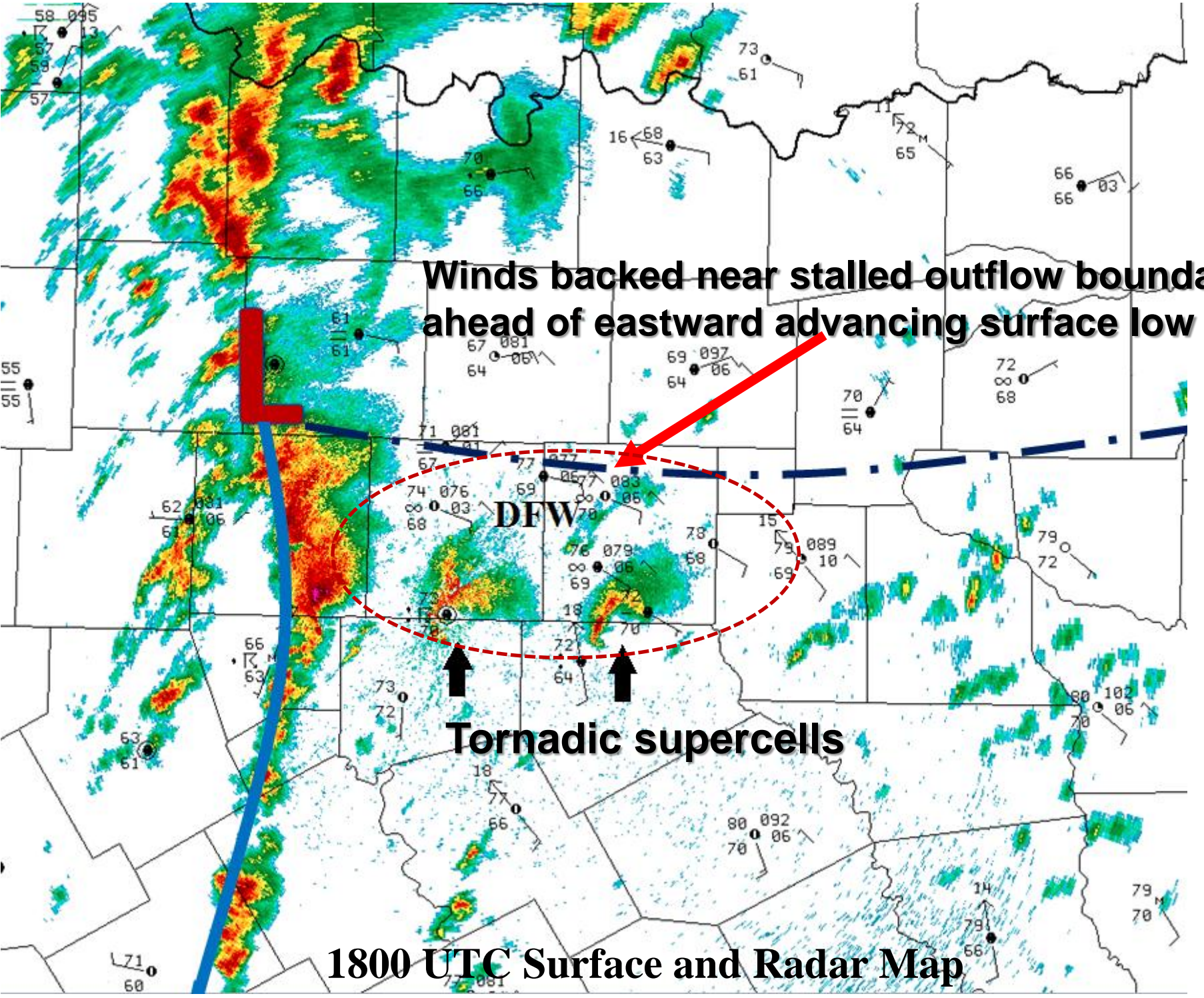
A Poor Forecast

Tornadic event was not anticipated until an hour or two before first tornado.

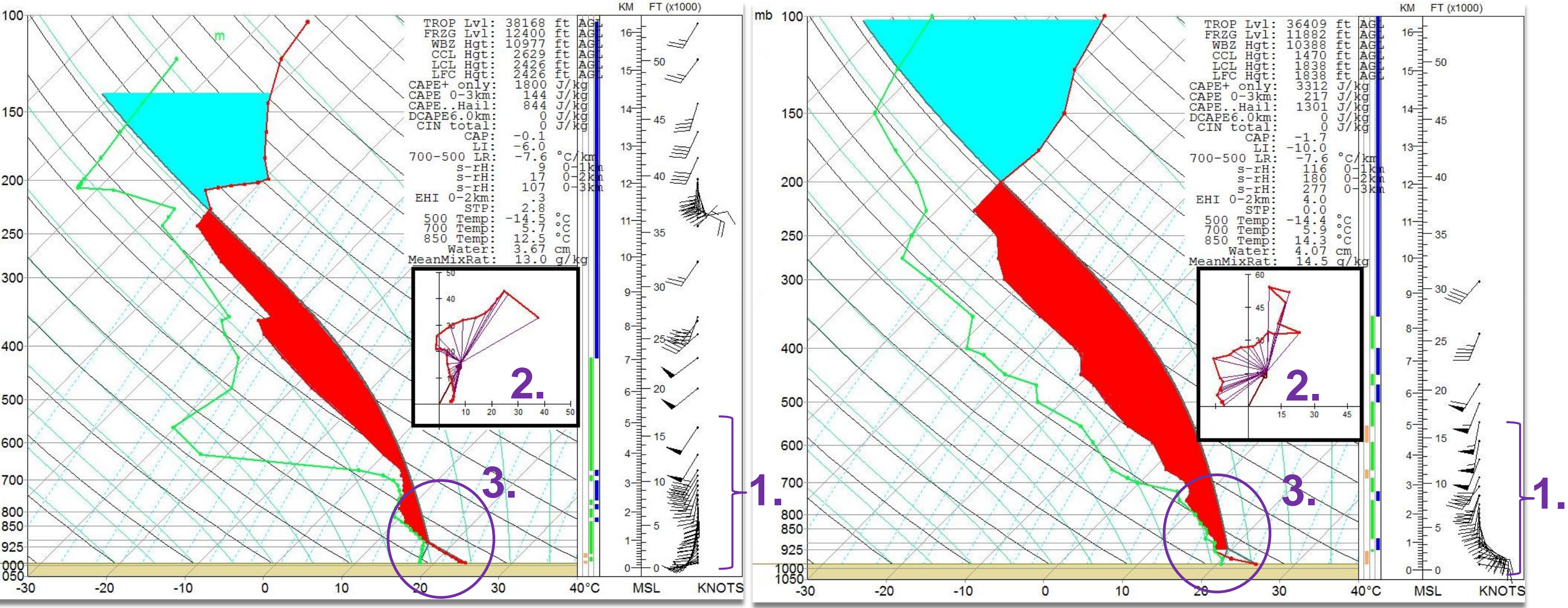
- Synoptic forecast data suggested large hail and damaging winds were the severe weather threats
- Tornado threat appeared to be low due to:
 - Weak/unidirectional low level wind fields
 - Linear convective forcing along front
- A mesoscale outflow boundary changed the atmospheric profile between 1400 and 1700 UTC
- Short-term RUC forecasts were not useful
 - Poorly resolved the outflow boundary
 - Surface temperature/dewpoints were too low
- SPC convective parameters objective mesoanalysis suffered due to poor RUC performance
 - Low level shear was higher than analyzed
 - Low level instability was higher than analyzed

Mesoscale Changes

An outflow boundary from earlier convection in Oklahoma moved south and stalled across the DFW Metroplex.



RUC 2 hour Forecast Sounding vs. Actual 1800 UTC Sounding

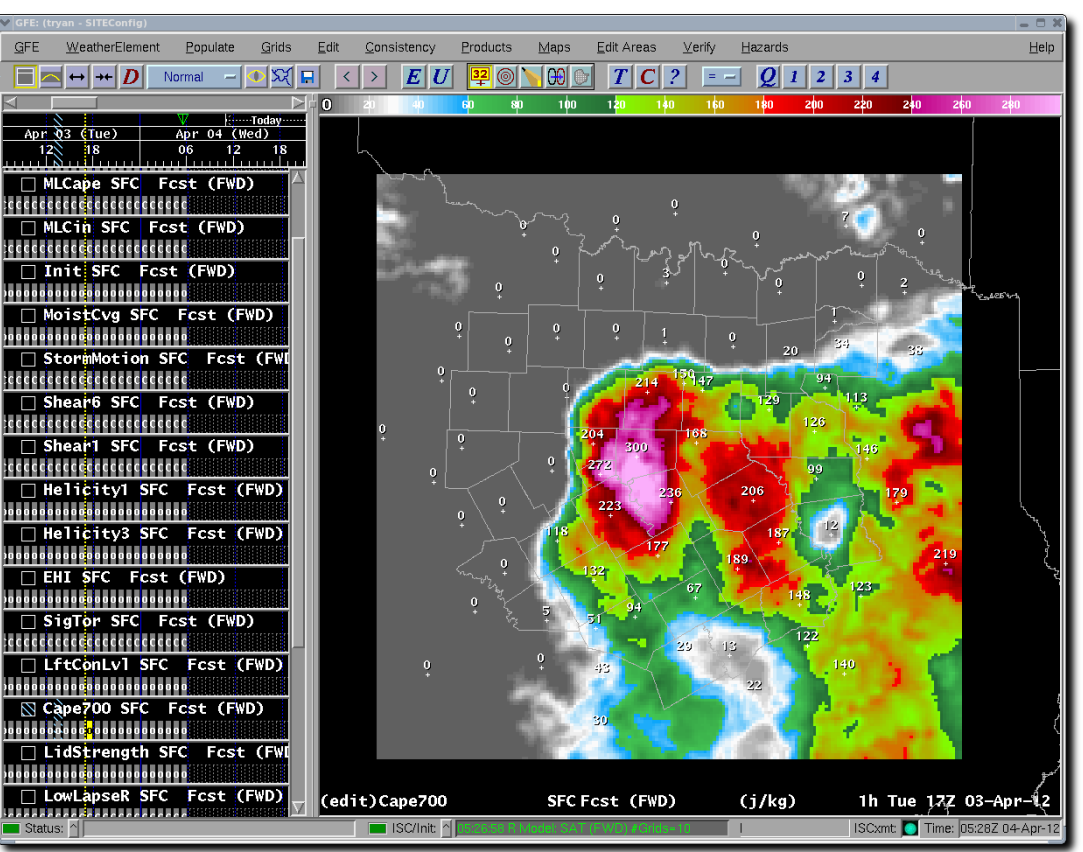


Important Differences Between Soundings:

1. Low level winds were stronger and more backed.
2. Hodograph acquired more curvature. 0-3 km SRH was over $100 \text{ m}^2\text{s}^{-2}$ greater.
3. Dewpoint was 5°F higher than RUC forecast, contributing to significantly more 0-3 km and total CAPE.

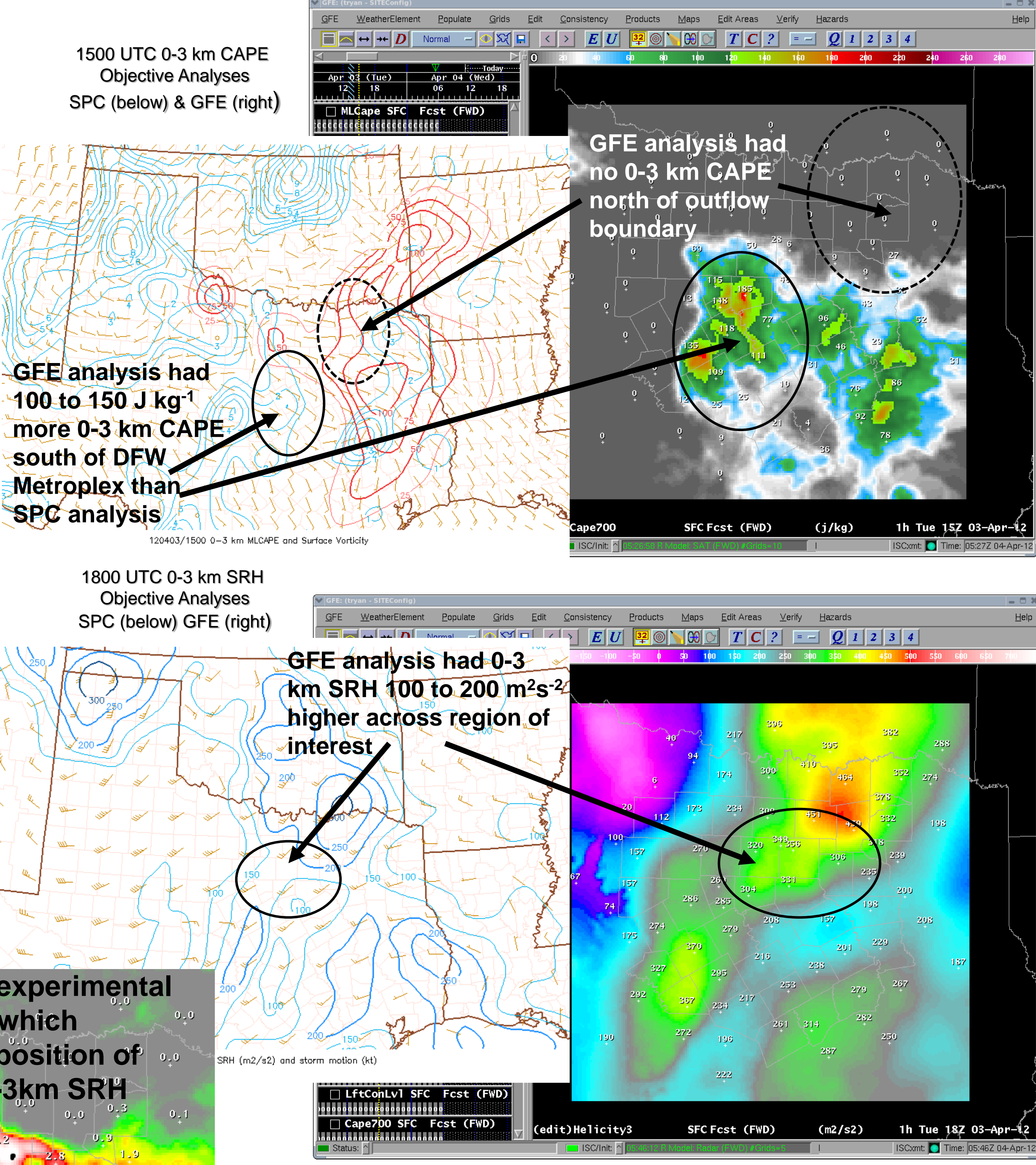
About GFE Objective Analyses

- Similar to SPC convective mesoanalyses
- GFE calculates convective indices over north Texas for short-term severe weather forecasting
- GFE analysis uses true surface observation data and merges it with all non-surface levels from the RUC 13km 1-hr forecast to generate a vertical profile
- Advantages to local GFE method:
 - 2.5 km resolution (a high spatial density observation network will show mesoscale features)
 - Available to NWS forecasters on AWIPS workstation 10 minutes after the hour
 - No smoothing or averaging of surface observation data in order to fit a "first guess" RUC forecast
- Disadvantage to local GFE method:
 - No automated observation quality control



An example (left) of GFE displaying 1 of 20 convective parameters available to forecasters. This shows 0-3 km CAPE at 1700 UTC, showing an area of over 250 J kg^{-1} across the DFW Metroplex. *Forecasters at WFO Fort Worth became alarmed by these high values.*

Comparing GFE & SPC Analyses on April 3rd



Conclusion

Real-time integration of GFE convective parameter objective analyses into warning operations allowed forecasters at WFO Fort Worth to better anticipate tornadic potential on April 3, 2012.