Going Old School: Using raw surface observations and objective analysis to accurately forecast a tornado environment.

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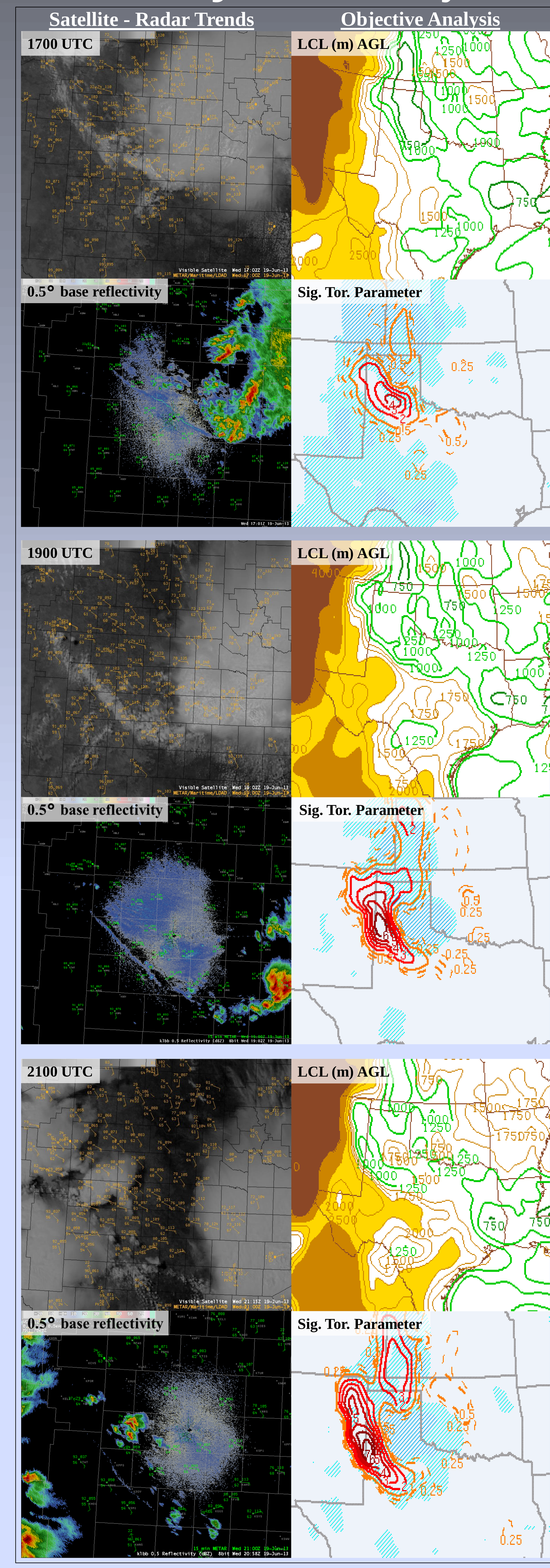
Introduction

- A mesoscale convective system (MCS) moved through the Rolling Plains region of West Texas during the morning hours of June 19, 2013.
- The MCS caused flash flooding in Caprock Canyons State Park and generated a southwestward propagating outflow boundary that moved into the South Plains region of West Texas and eastern plains of New Mexico.
- The outflow boundary modified existing air mass to support a tornado environment.
- Deterministic runs of the Texas Tech U. Weather Research and Forecast (TTU-WRF) model struggled to identify the tornado environment while the High Resolution Rapid Refresh (HRRR) model performed closer to reality.
- Subjective examination of raw and objective analysis data out-performed deterministic runs of the TTU-WRF and validated the HRRR.
- A comparison of raw surface observations, objective analysis products, and model data will be shown as it related to the short-term forecast problem.

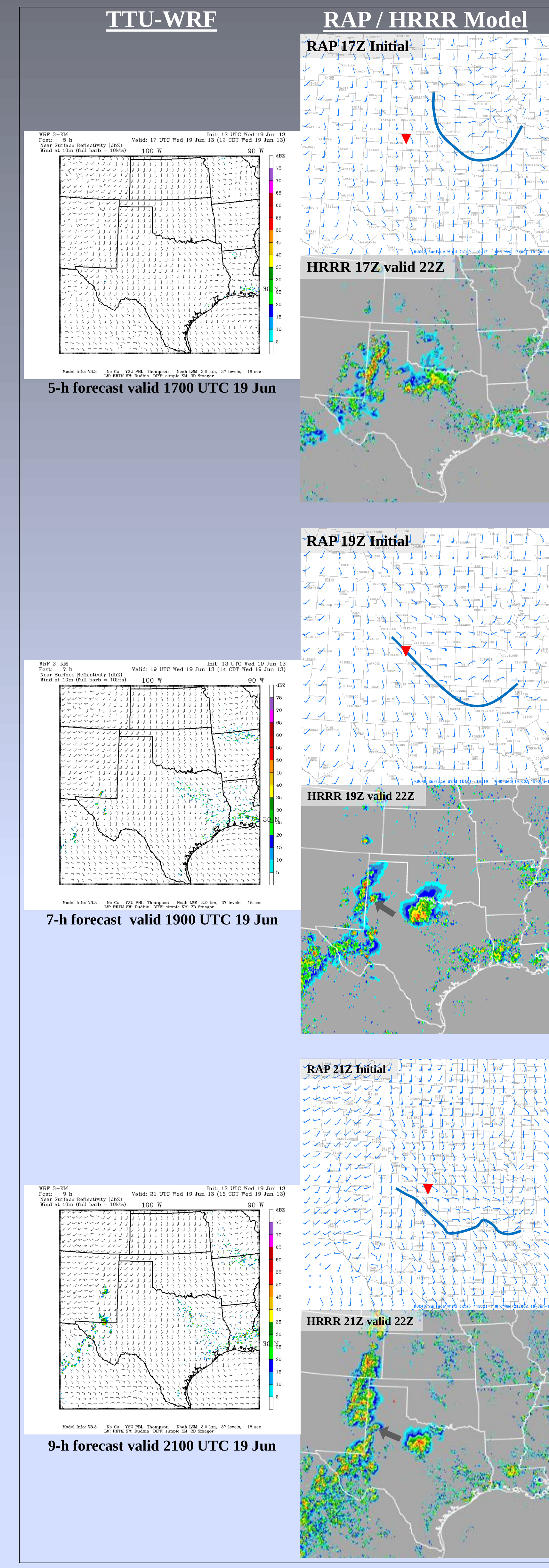
Photo of supercell thunderstorm and visible meso-cyclone near Sundown, TX. 19 June 2013 @ 2227 UTC.

Rain-wrapped tornado, rated EF2, near Sundown, TX moving north across FM 1585. 19 June 2013 @ 2240 UTC.

Obs./Objective Analysis vs. Meso-scale Models



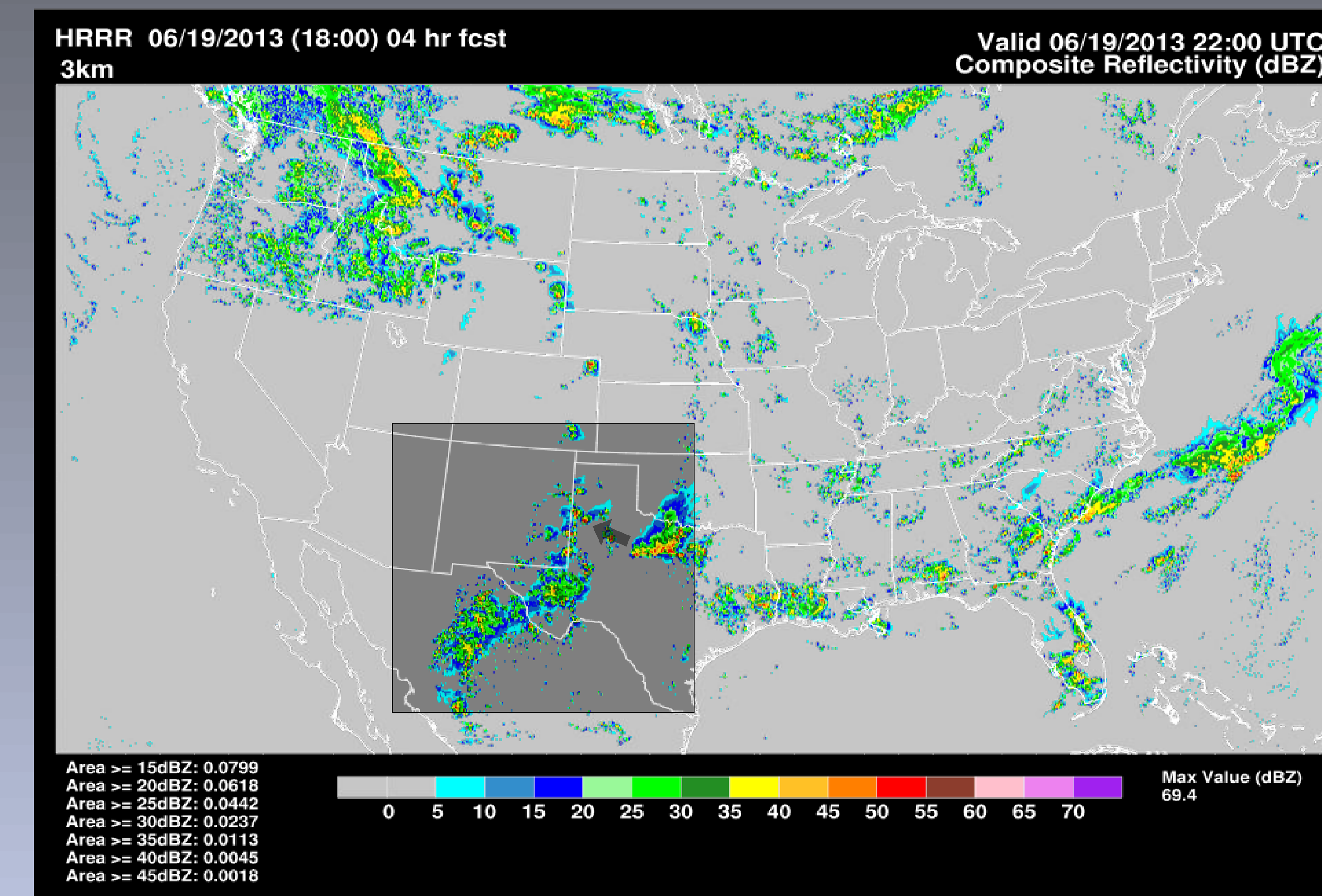
Visible satellite and radar images with surface observations, SPC LCL heights (m) AGL, and SPC significant tornado parameter charts at 17 UTC, 19 UTC, and 21 UTC respectively.



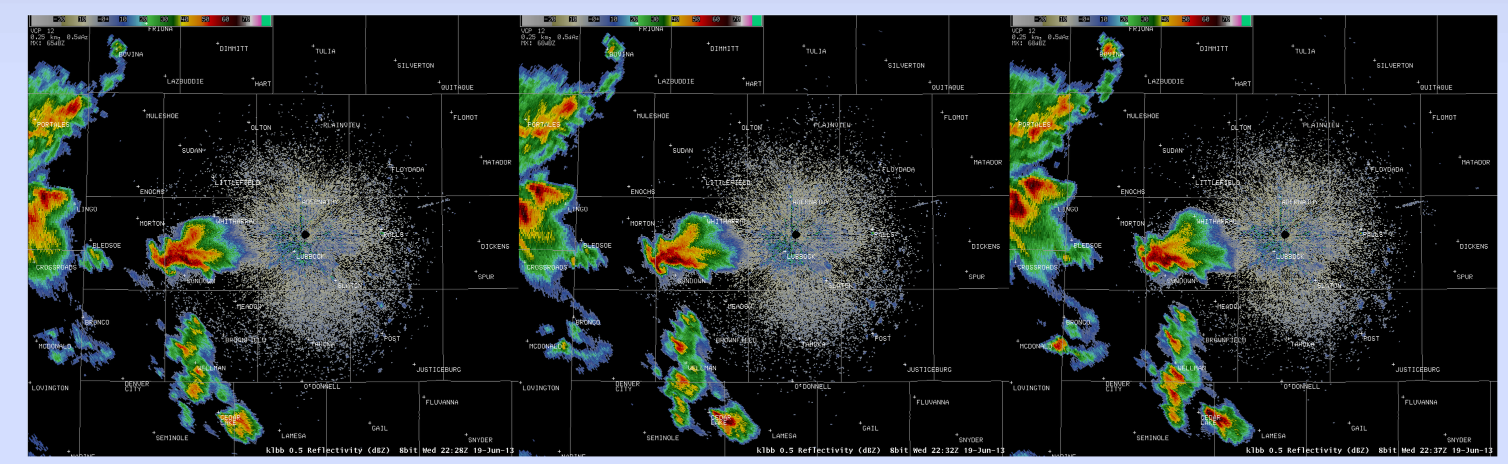
TTU-WRF, RAP and HRRR model output for 1700 UTC, 1900 UTC, and 2100 UTC. The solid blue line denotes an outflow boundary in the RAP output while the dark grey arrow points to a possible supercell, similar to radar images, in the HRRR output.

The MCS-generated outflow boundary was located near KLBB at 1700 UTC. Surface observations, visible satellite imagery, and radar data clearly indicated the outflow boundary moving through the WFO LUB CWA. Deterministic runs of the TTU-WRF never did show the MCS and subsequent outflow boundary, however the model did develop some weak convection in the 1200 UTC run valid for 2100 UTC. The RAP and HRRR models performed much better showing the MCS and outflow boundary as well as strength and coverage of convection; including what appears to be a supercell close to the location of where the Sundown, TX tornado occurred. A red triangle denotes location of tornado at 2240 UTC.

Best Model Performer?



Best model performer with respect to composite reflectivity output goes to the 1800 UTC run of the HRRR valid for 2200 UTC. The grey arrow points at what appears to be an isolated supercell displaced approximately 50 km too far north of actual supercell thunderstorm.



Base reflectivity radar images from KLBB WSR-88D showing evolution of supercell thunderstorm northwest of Sundown, TX. Note convection to the west also identified by various runs of the HRRR composite reflectivity images.

Conclusions

- **An MCS-generated a southwestward moving outflow boundary creating an environment suitable for tornadoes over the Texas South Plains.**
- **Storm initiated on boundary then produced a tornado on cool side of boundary as outflow continued to move southwest.**
- **Satellite, radar, and raw surface observations along with objective analysis products correctly identified the potential tornado environment.**
- **The TTU-WRF failed to identify the tornado environment while the RAP and HRRR eventually identified the tornado environment.**
- **A short-term forecast strategy should include raw observations, objective analysis products, and evaluation of short-term models to aid the forecaster in a successful short-term forecast.**

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