

# **Convection Nowcasting Products Available at the Army Test and Evaluation Command (ATEC) Ranges**

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with contributions from:

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Yuma Proving  
Ground, AZ

Dugway Proving  
Ground, UT

Aberdeen Test  
Center, MD

Night Vision  
and Electronic  
Sensor  
Directorate, VA

Redstone Test  
Center, AL

White Sands  
Missile Range,  
NM

Cold Regions  
Test Center, AK

Electronic Proving  
Ground, AZ

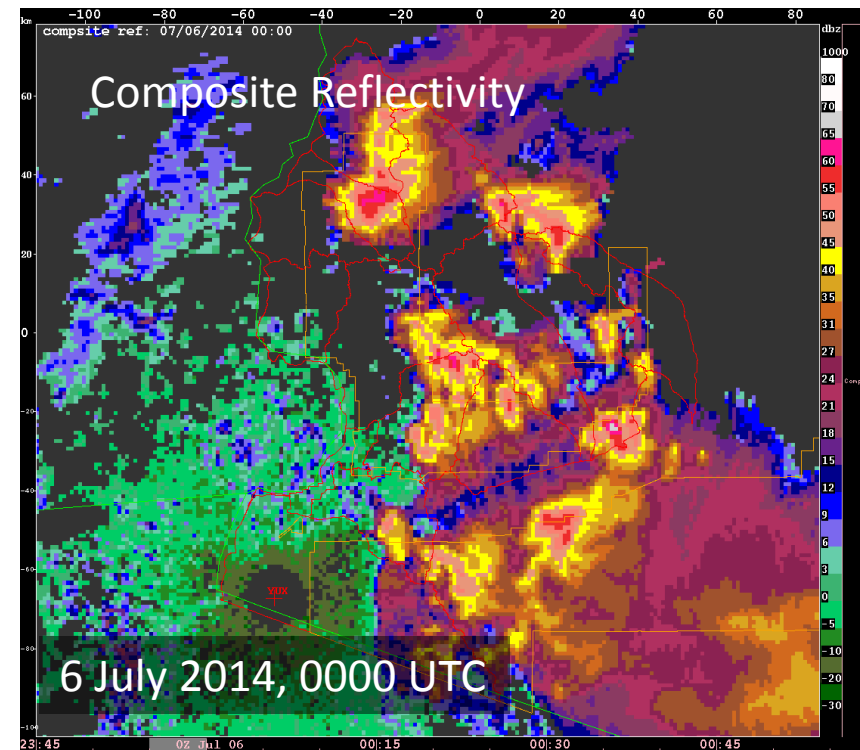


- Each range has a staff of meteorologists to deal with specific forecast challenges. Forecaster duties include:
  - **Tactical Support 0-1 hr:**
    - Warn of potentially hazardous thunderstorms/lightning throughout region
      - Ensure personnel safety
      - Protect expensive test equipment and matériel
    - During test operations, provide guidance on weather conditions
  - **Strategic Support >1 hr:**
    - Before test operations, provide guidance on expected weather conditions
    - Advise range customers about test scheduling, up to months in advance
- NCAR provides tools for thunderstorm and lightning nowcasting
  - AutoNowcaster (ANC): 30, 60 min initiation, extrapolation, growth/decay
  - AutoNowcaster-Lite (AN-Lite): 30, 60 min extrapolation only
- Both ANC and AN-Lite can add modular components for specialized tasks
  - Trident, tactical predictions of heavy rain potential
  - Lightning, tactical and strategic predictions of lighting occurrence

# Trident

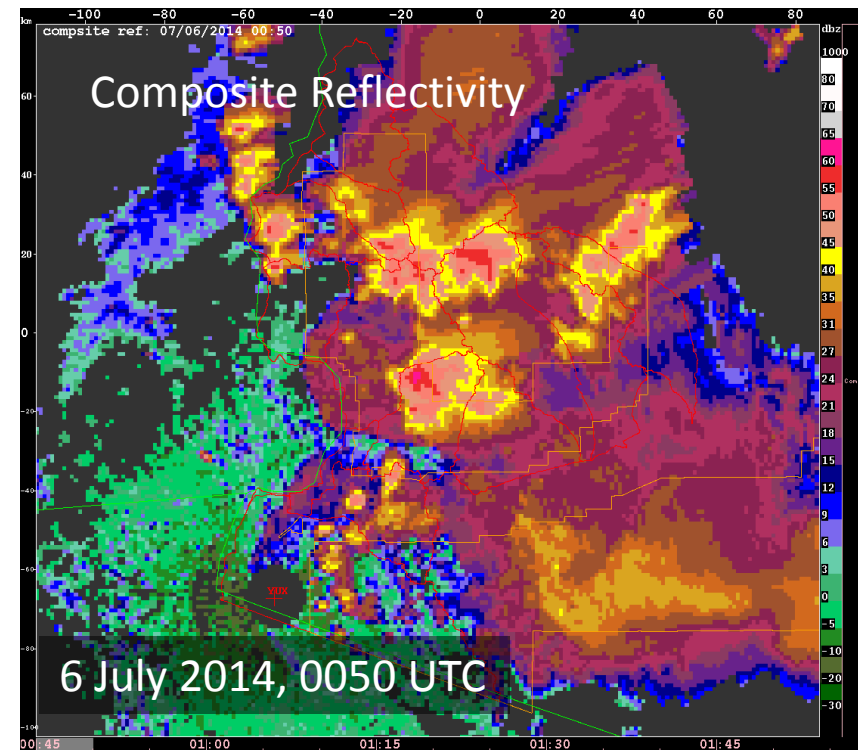
## An Algorithm for Predicting Heavy Rain Potential

- Flash floods are safety concern at some ranges, especially in remote locations
- Trident is not a flash-flood prediction per se but gives a heads-up to the forecaster where significant rainfall may be occurring
- Trident algorithm makes nowcasts of radar-derived precipitation accum.
  - Predictions at 10 min intervals to 1 hr
  - Z-R relation (upgrade to dual-pol QPE underway)
  - Rain gauge data not used for calibration
- Key it to a map file (such as drainage basins) with appropriate thresholds to give visual warnings

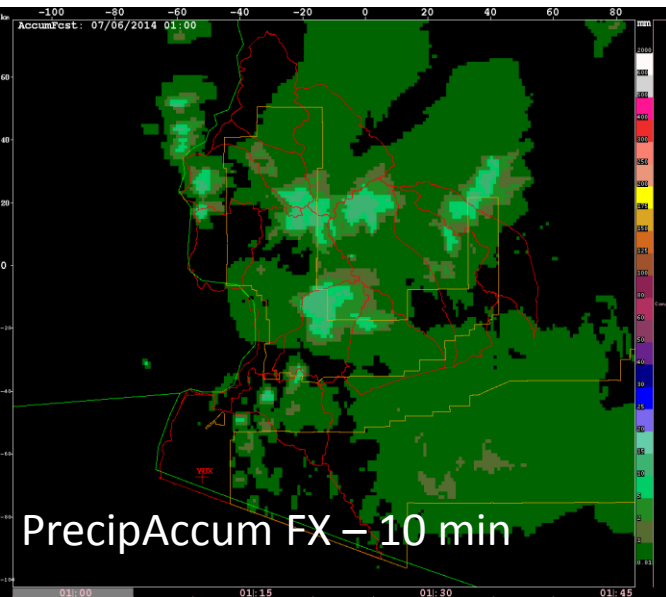




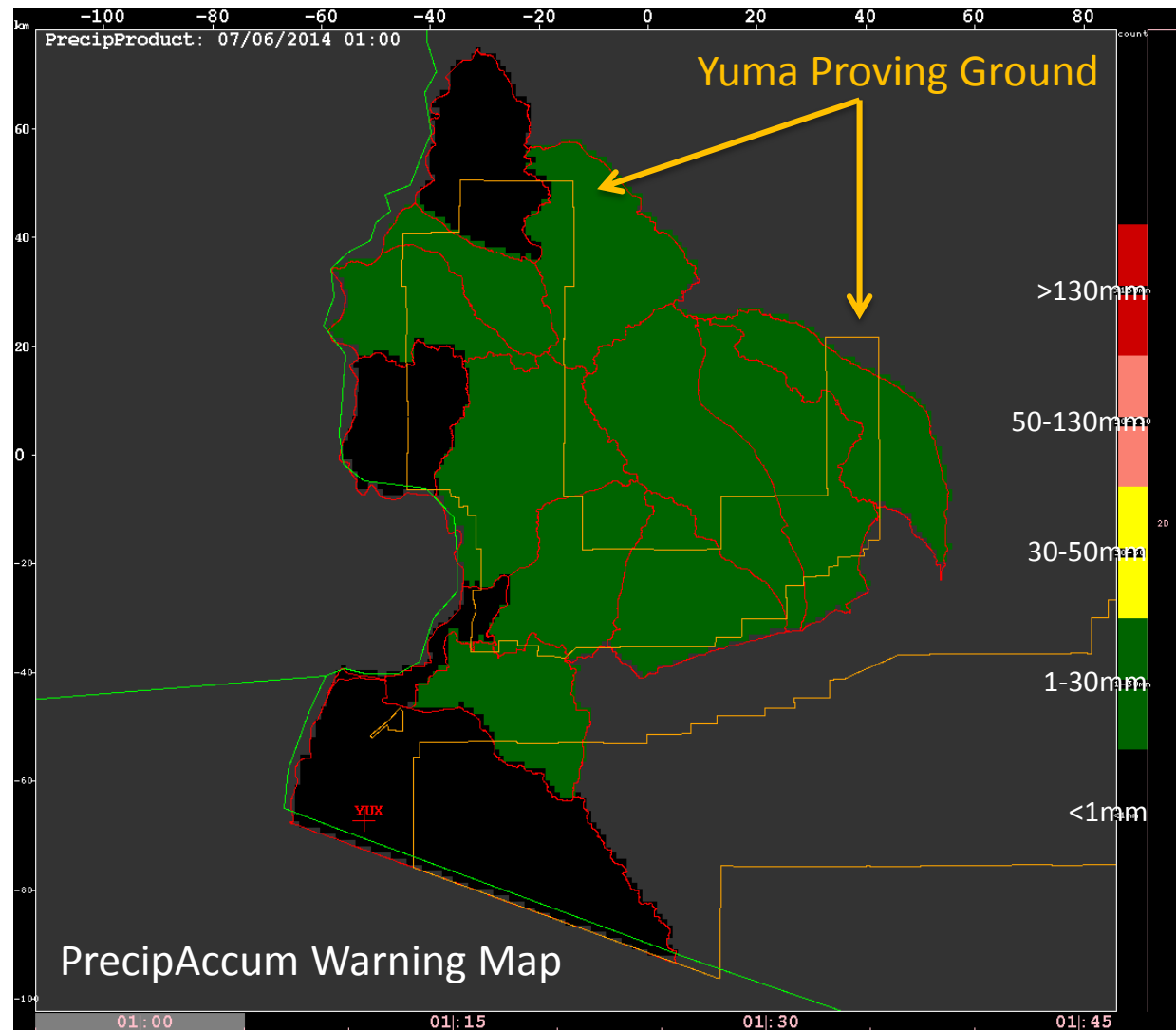
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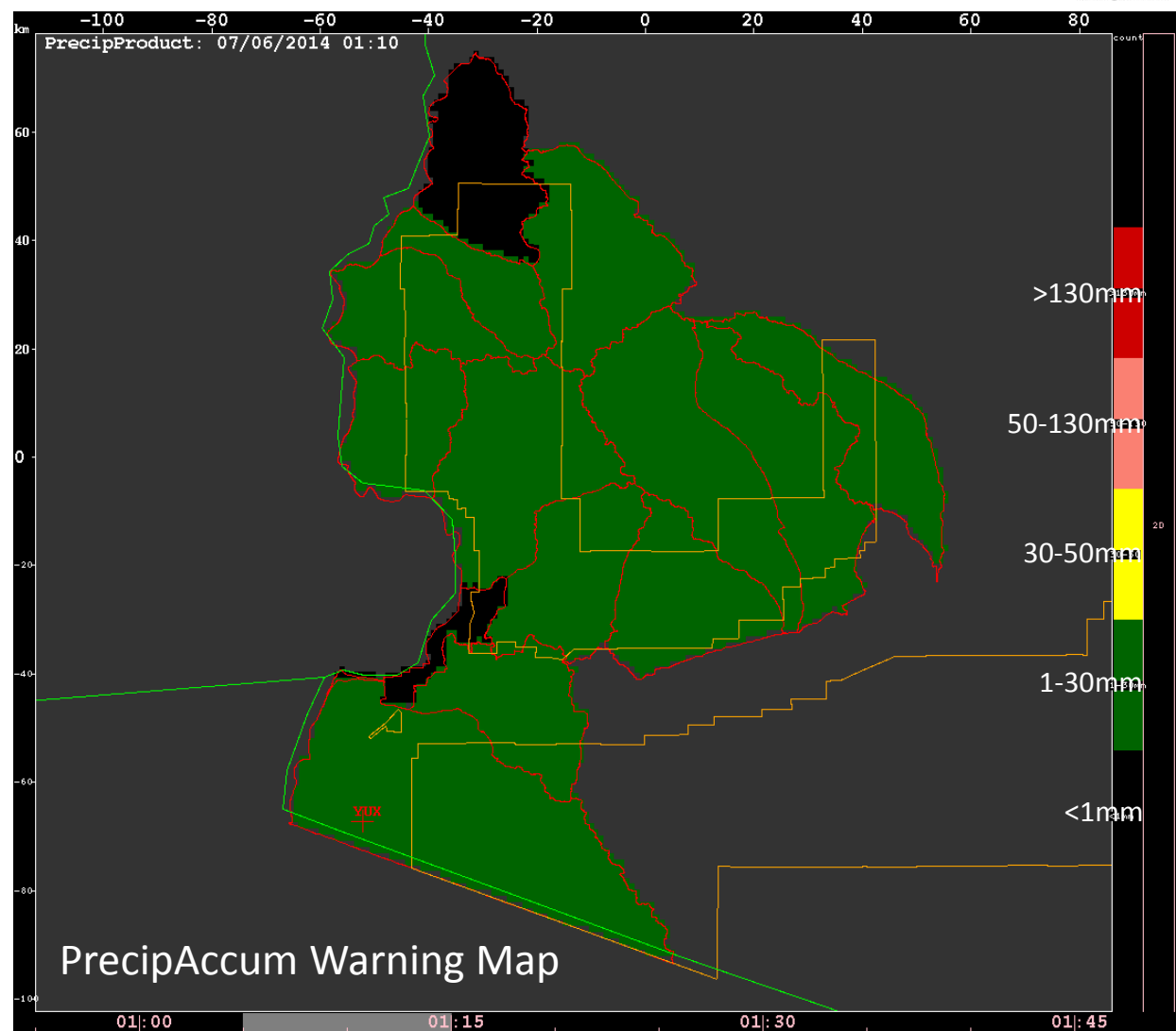
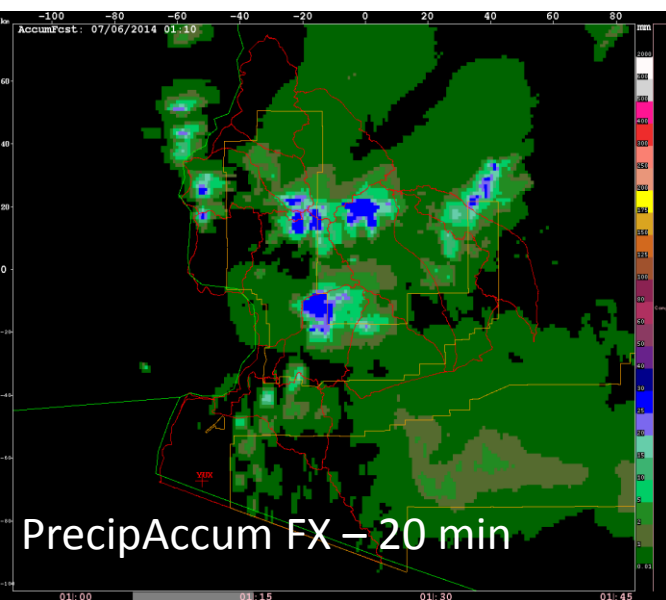
Yuma Proving Ground



Can also add a 2, 3, 4 hr accumulation to current prediction for turning on the PrecipAccum Warning Map

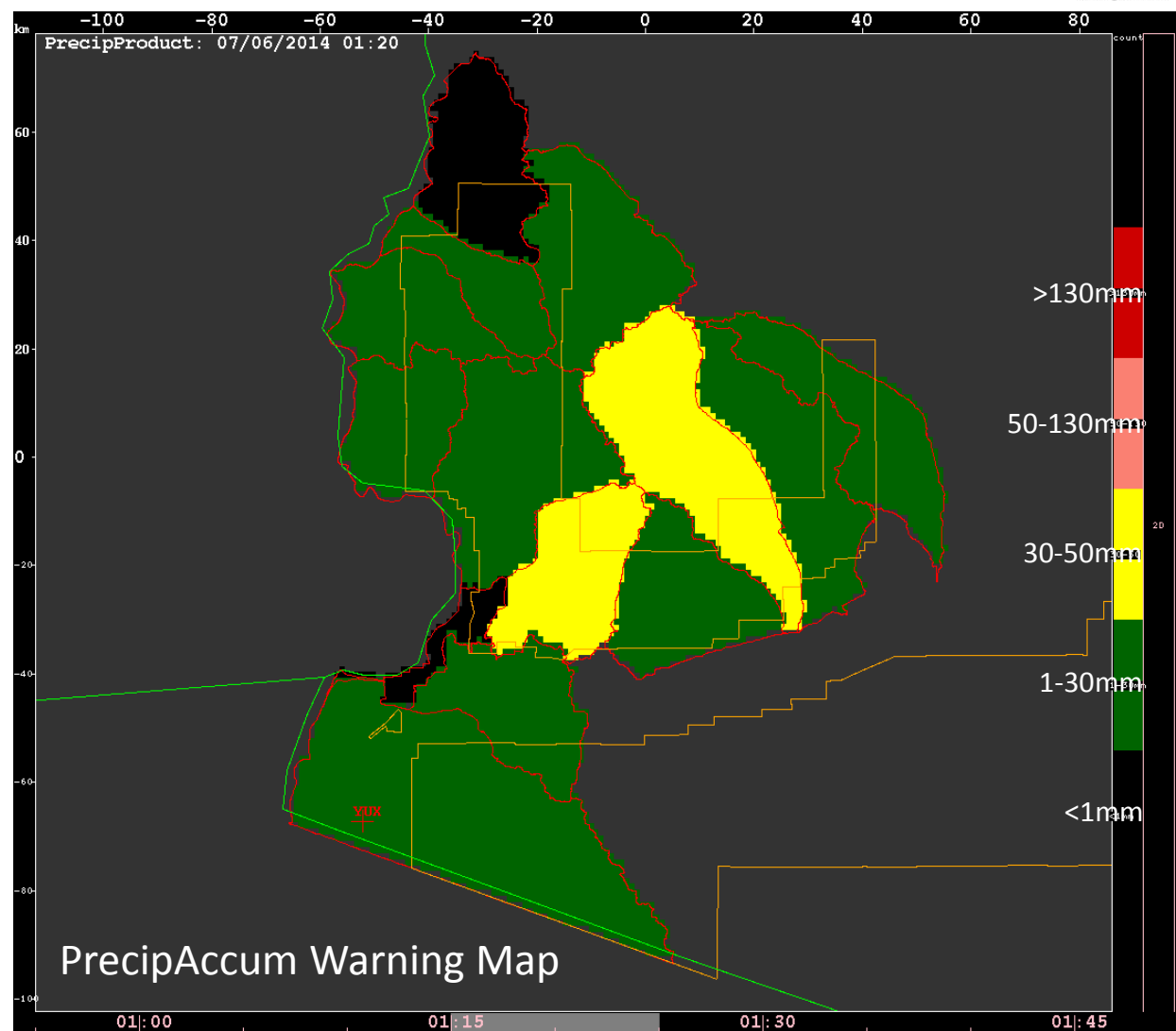
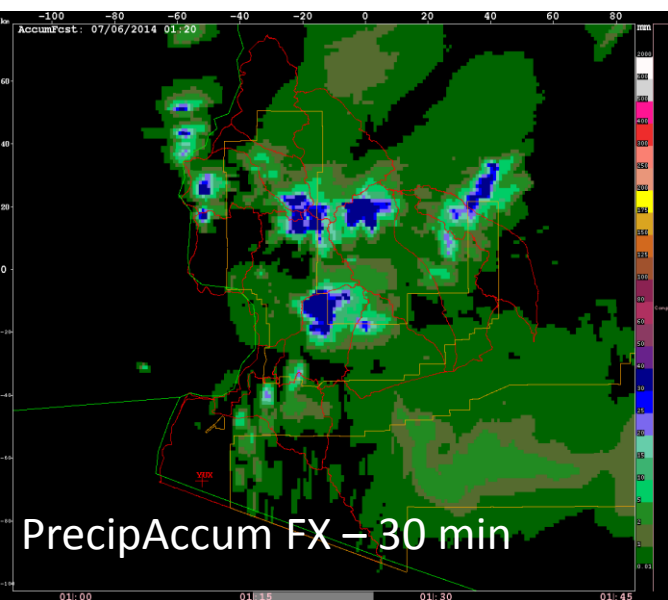


0050 generate time; 0100 valid time

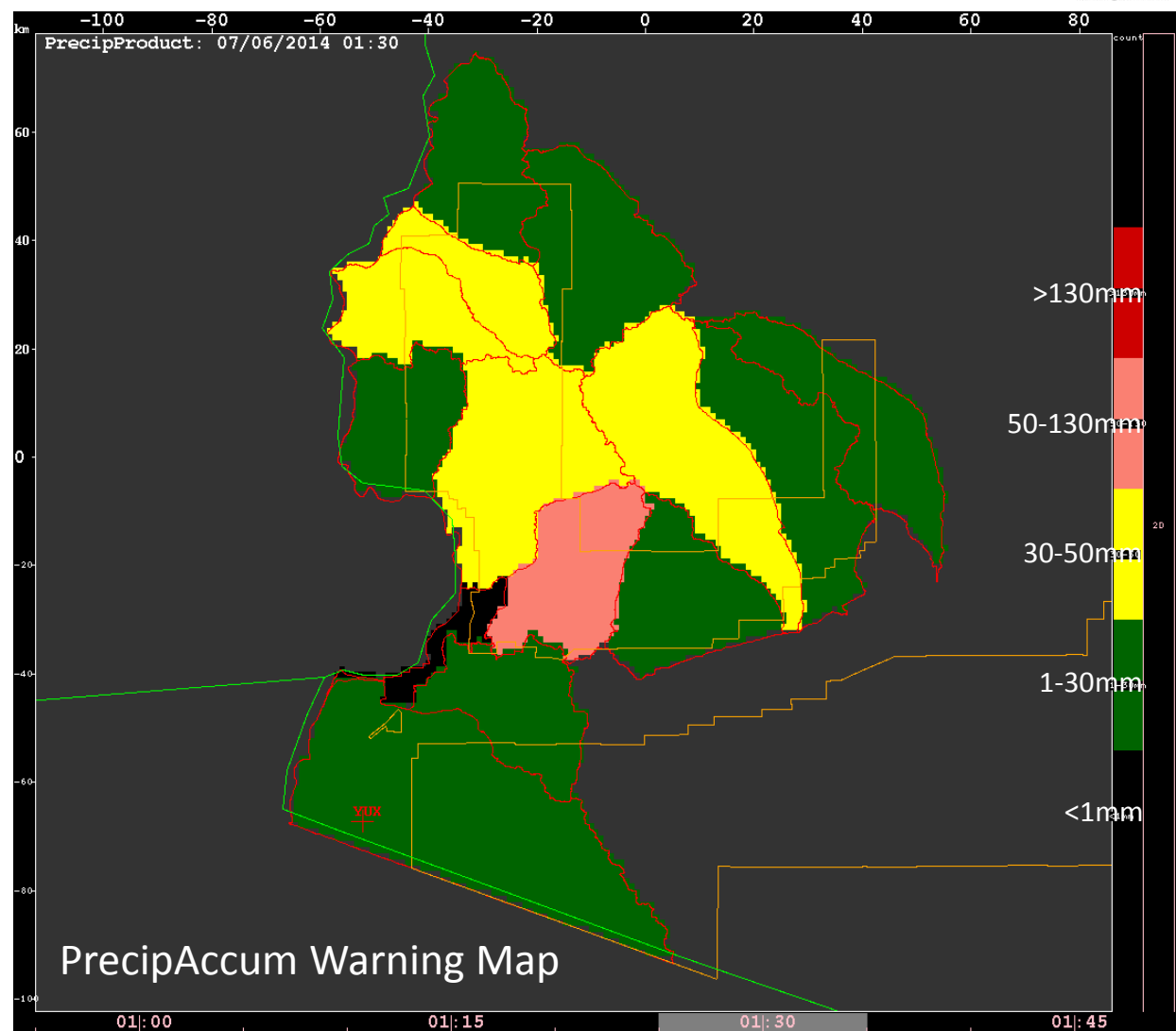
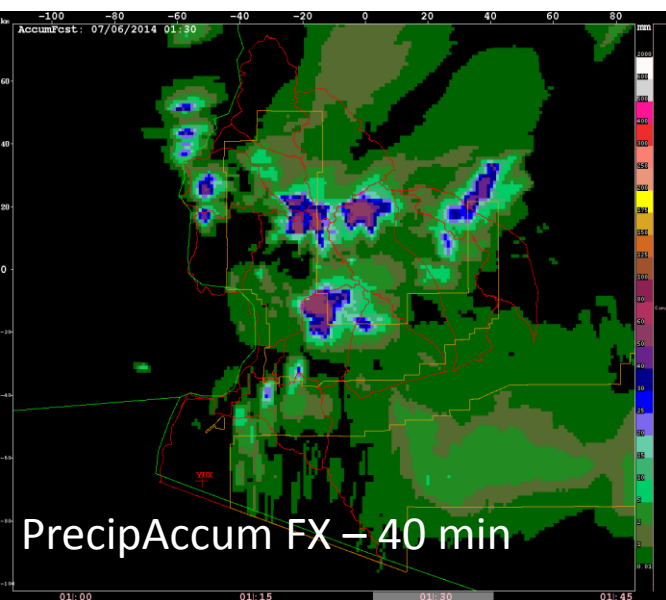


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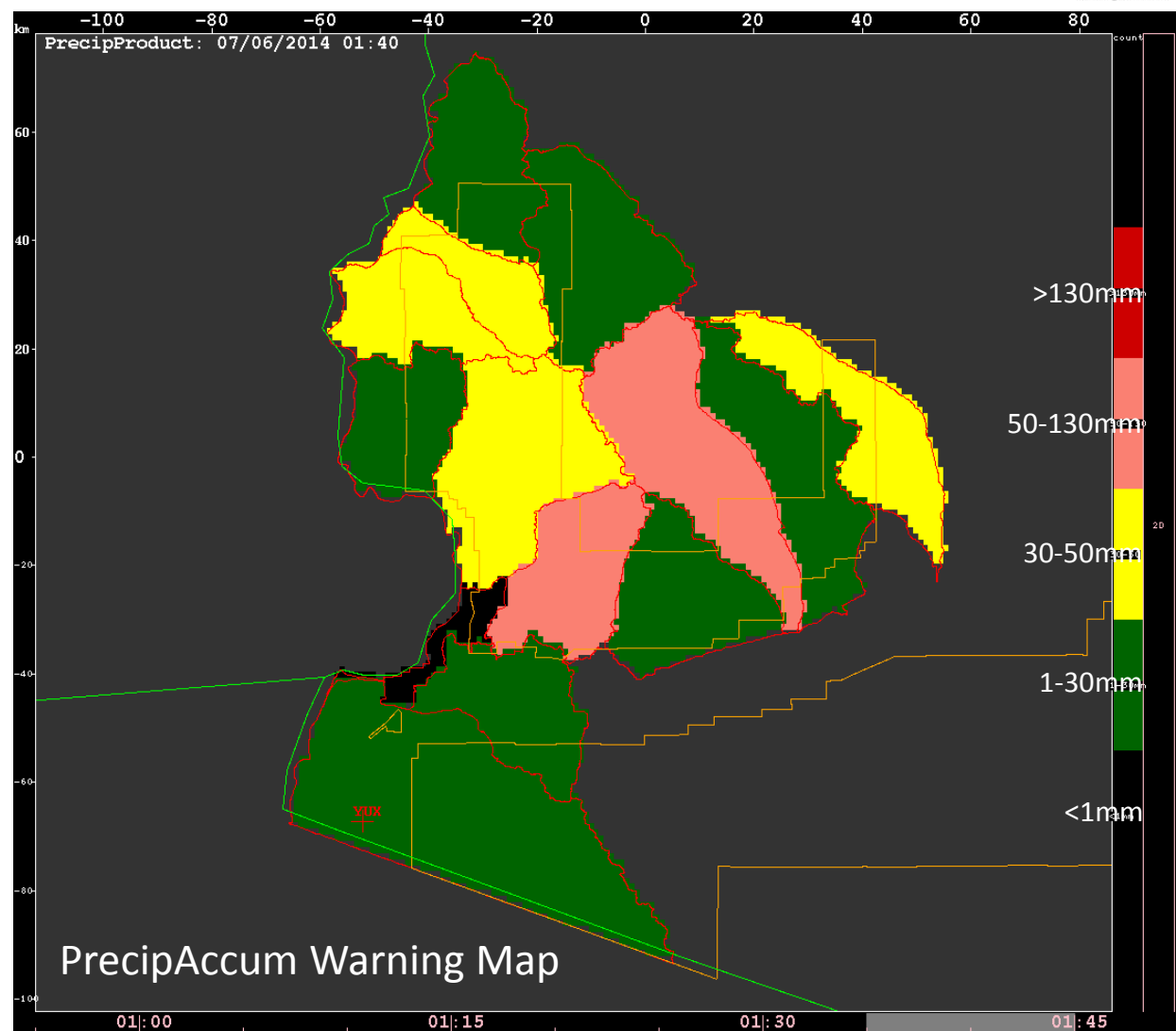
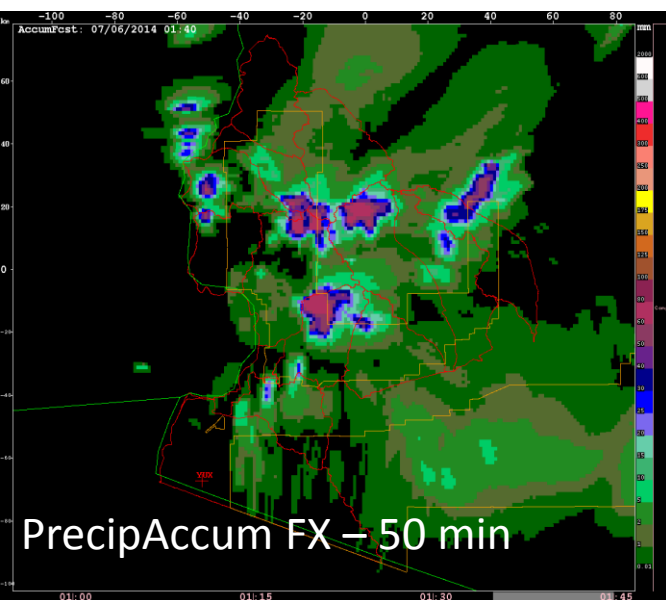




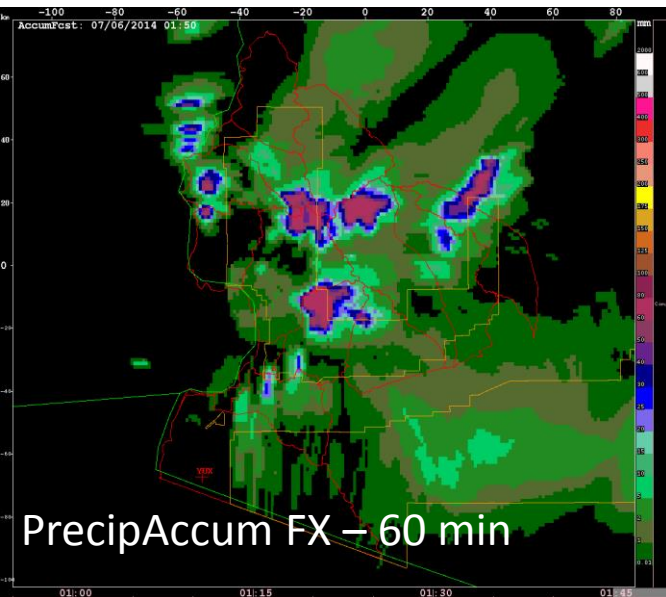
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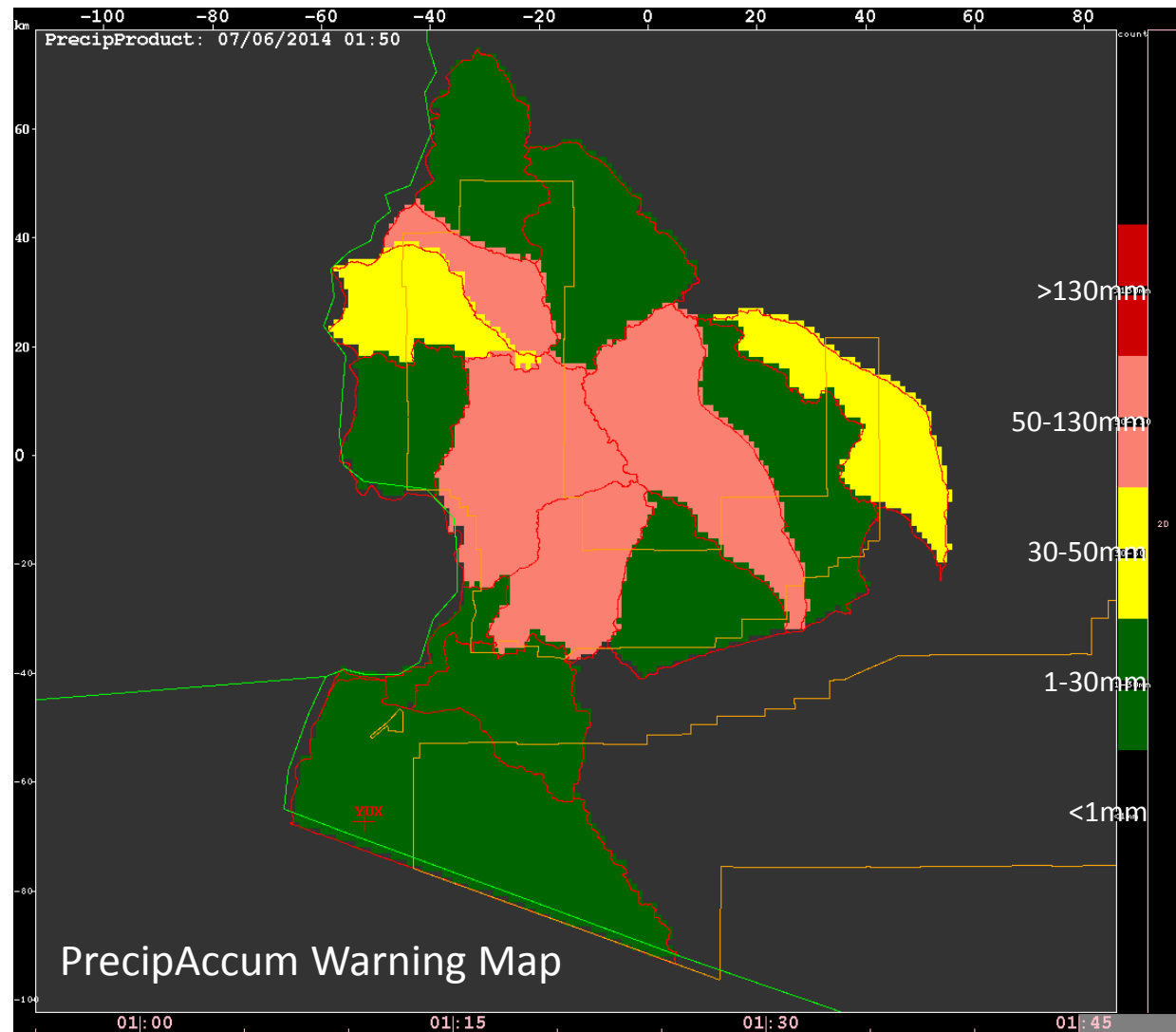


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Forecasters are very pleased with Trident and say it is the best algorithm that they have used so far.

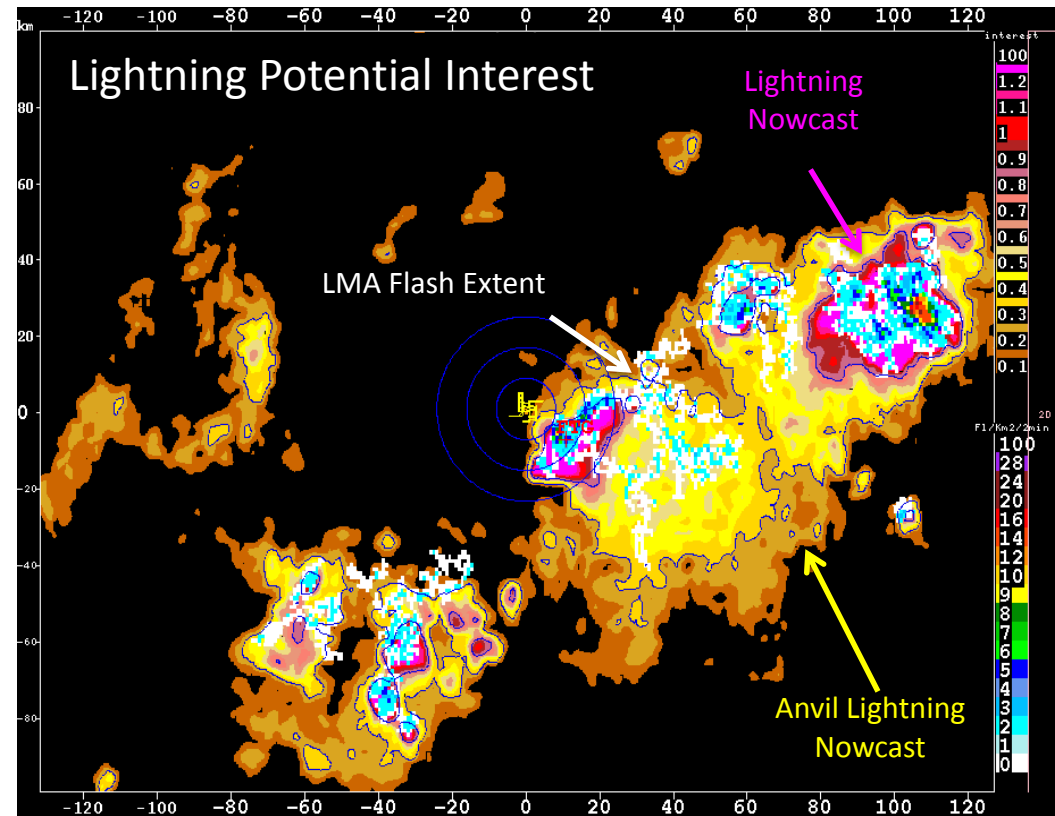
Limited experience, 1-2 storms, so we will continue to monitor its performance.



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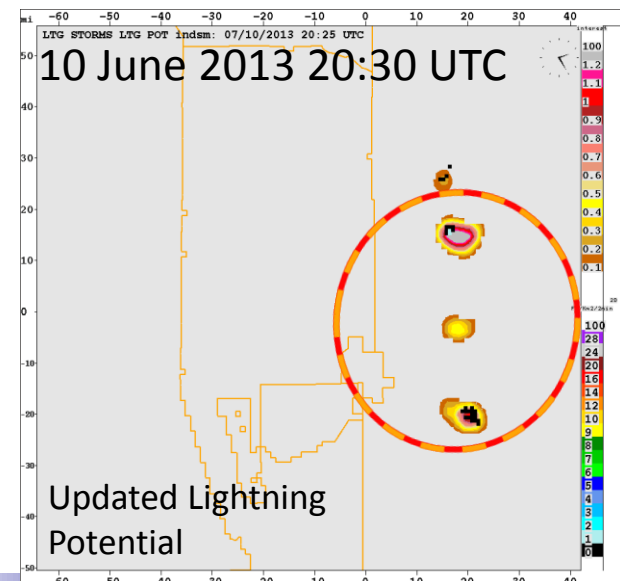
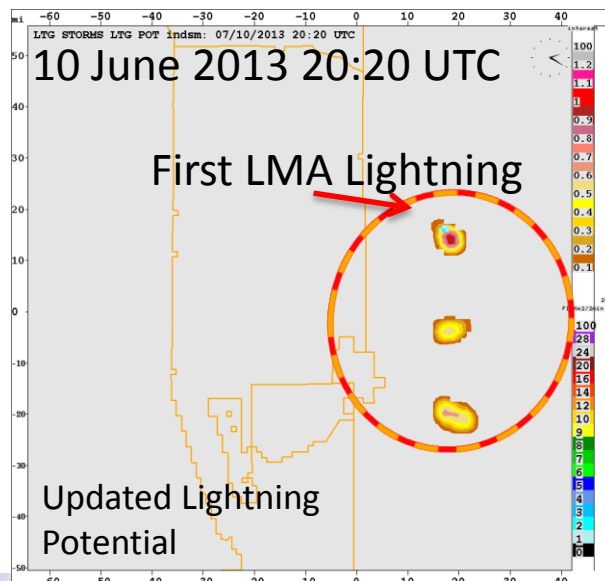
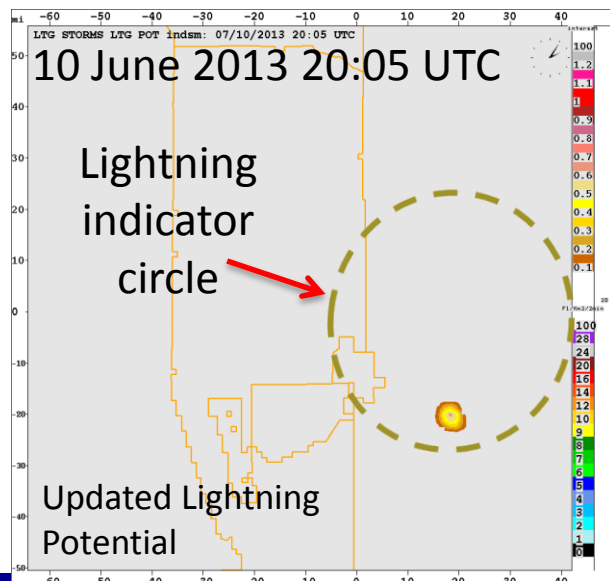
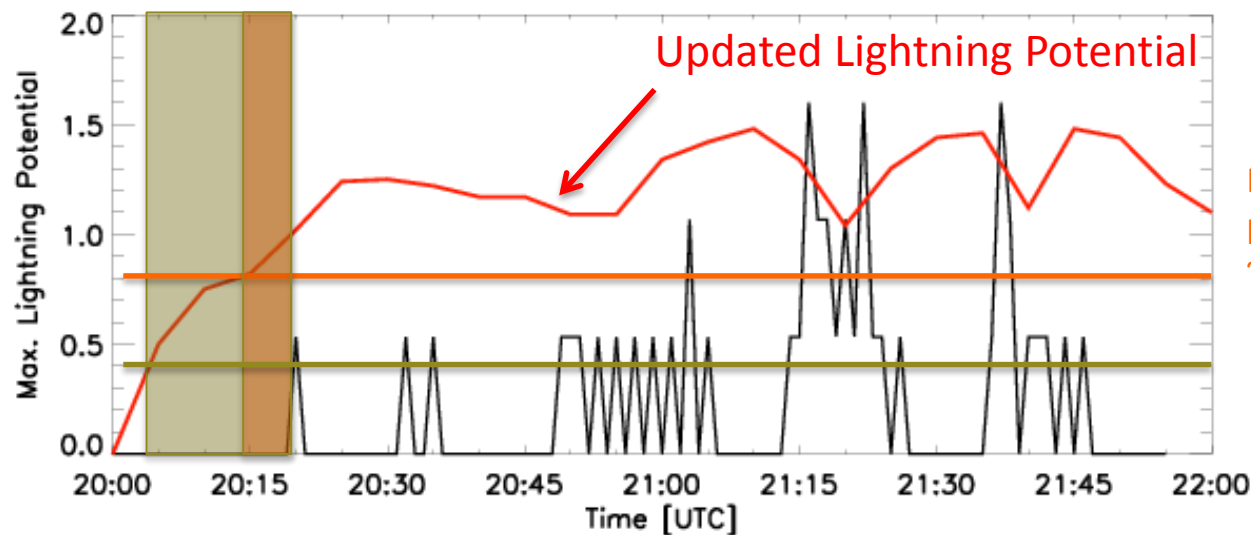
# Lightning Monitoring and Nowcasting

- History:
  - Developed for ATEC ranges<sup>1</sup>
  - Recent upgrade completed for airport ramp operations
- Captures lightning threats from:
  - Thunderstorm cores and anvil
  - Early stages of storm (initiation)
  - Late stages of storm (anvil)
  - Thundersnow
- Monitor thunderstorms with:
  - Radar and lightning data
  - Organization, 3D vertical structure, trends and evolution
  - Apply fuzzy logic membership functions to lightning predictors
- Pick/tune several thresholds:
  - Anvil lightning has a lower probability threshold
  - Core lightning has a higher probability threshold
- Communication of warnings
  - Lightning indicator circle turns on when threshold is reached



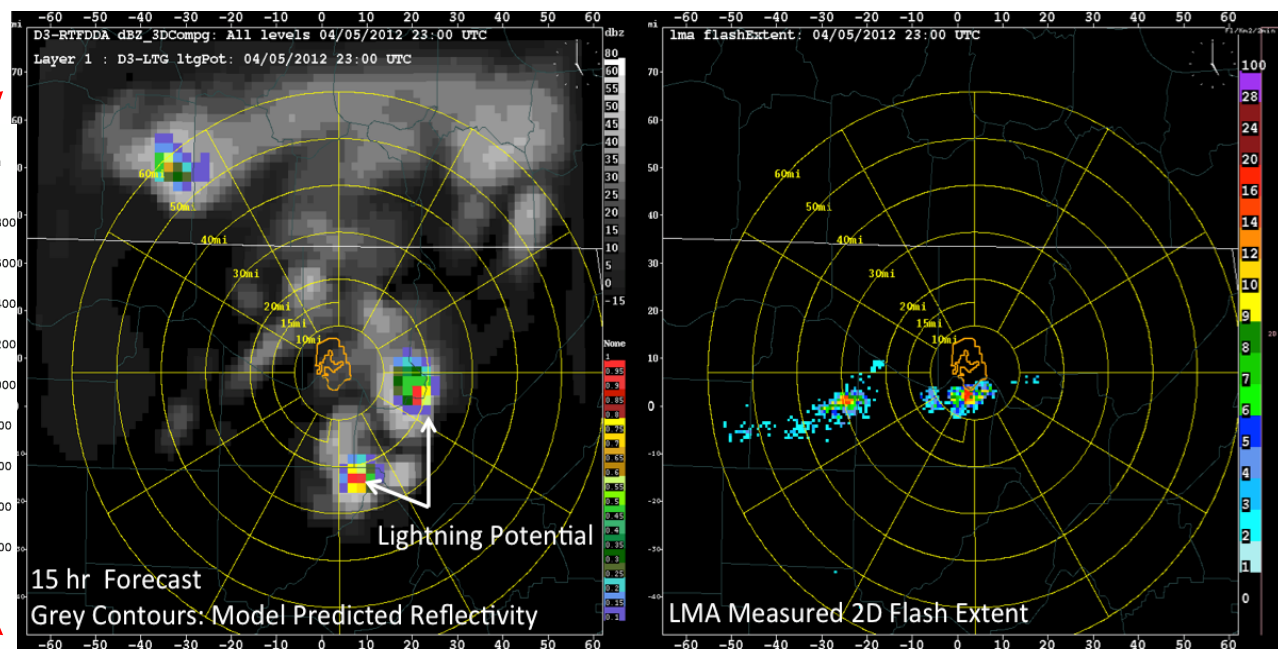
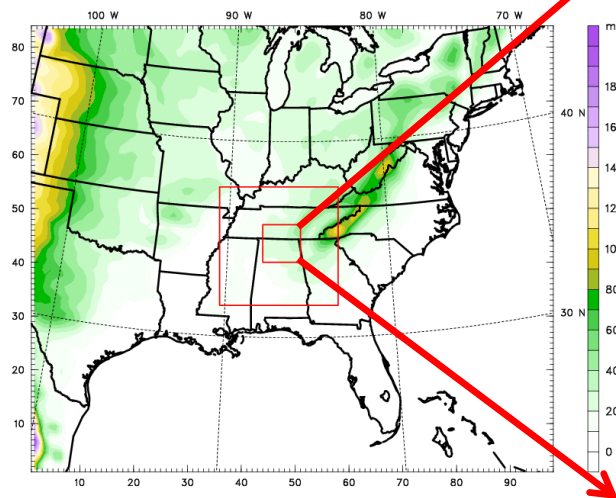
<sup>1</sup>Saxen et al. 2008





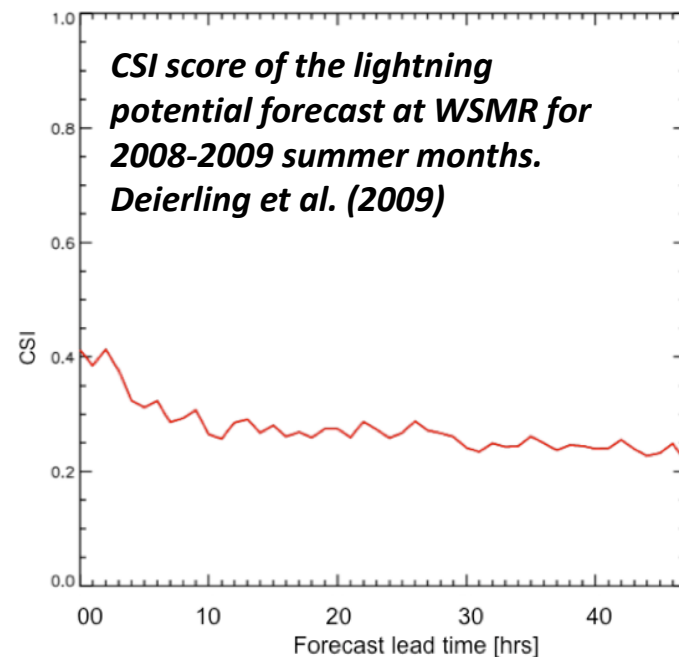
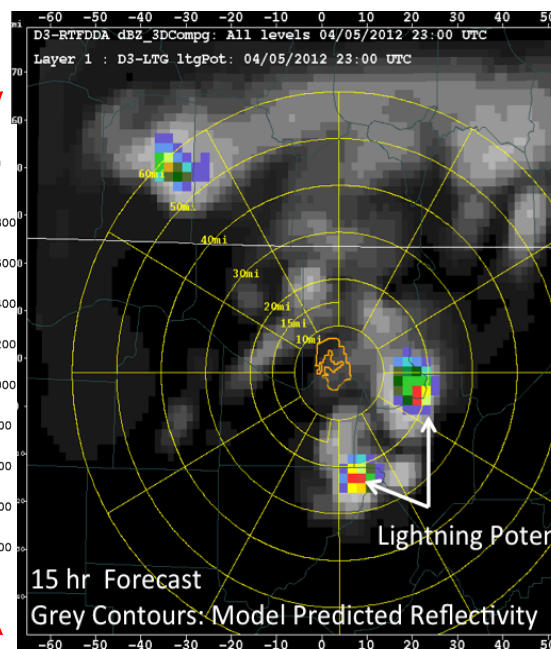
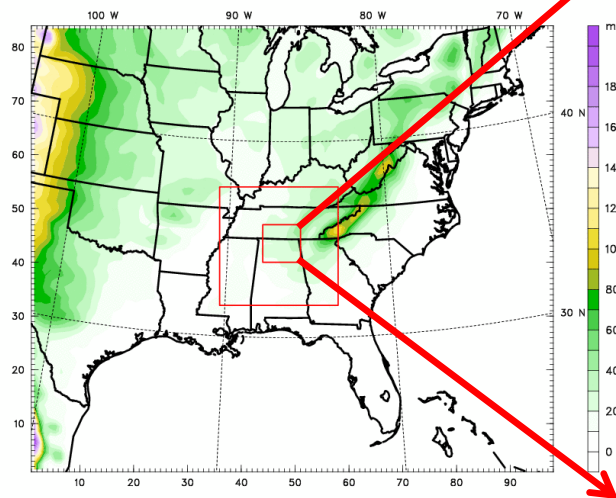
- 4DWX model (domain 3) analysis and forecast fields utilized
  - Deployed at WSMR since 2009, at RTC in 2011
- Microphysical and dynamical results from model output used to predict lightning potential to 48-72 hours (range dependent)
  - Fuzzy logic framework used to estimate lightning potential
  - Predictor fields are ice water path and updraft volume
- Forecasters use the results as guidance

4DWX at Redstone Test Range



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  - Predictor fields are ice water path and updraft volume
- Forecasters use the results as guidance

4DWX at Redstone Test Range



- ATEC forecast challenges from thunderstorms and lightning are being addressed by the NCAR ANC and AN-Lite systems
- Trident is a new algorithm for the ranges; deployed at YPG last fall
  - Performance looks good (limited to a few storms), continue to test/monitor
  - Upgrade to use dual polarization QPE is underway
- Lightning potential for tactical prediction (i.e., radar-based) has been recently upgraded and an increase in performance realized
  - Recently deployed at WSMR and RTC; no forecaster feedback yet
- Lightning potential for strategic prediction (i.e., 4DWX-based)
- Plan to deploy at other ranges, where needed

*Thank you!*