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

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Army Test and Evaluation Command (ATEC) Ranges

- Yuma Proving Ground, AZ
- Dugway Proving Ground, UT
- Cold Regions Test Center, AK
- Electronic Proving Ground, AZ
- Aberdeen Test Center, MD
- Night Vision and Electronic Sensor Directorate, VA
- Redstone Test Center, AL
- White Sands Missile Range, NM
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 materiel
  - 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
Trident for Heavy Rain Potential

- Flash floods are a 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.

6 July 2014, 0000 UTC

Composite Reflectivity

Yuma Proving Ground
Trident for Heavy Rain Potential

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Fx Precip Accumulations + Precip Accum Warning Map

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

PrecipAccum FX – 10 min

PrecipAccum Warning Map

0050 generate time; 0100 valid time
Fx Precip Accumulations + Precip Accum Warning Map

PrecipAccum FX – 20 min

PrecipAccum Warning Map

0050 generate time; 0110 valid time
Fx Precip Accumulations + Precip Accum Warning Map

PrecipAccum FX – 30 min

PrecipAccum Warning Map

0050 generate time; 0120 valid time
Fx Precip Accumulations + Precip Accum Warning Map

PrecipAccum FX – 40 min

PrecipAccum Warning Map

0050 generate time; 0130 valid time

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Fx Precip Accumulations + Precip Accum Warning Map

PrecipAccum FX – 50 min

PrecipAccum Warning Map

0050 generate time; 0140 valid time
PrecipAccum FX – 60 min

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.

0050 generate time; 0150 valid time
Lightning Monitoring and Nowcasting
Lightning Monitoring and Nowcasting Capability

- **History:**
  - Developed for ATEC ranges
  - 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

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1 Saxen et al. 2008
Example of Lightning Initiation - WSMR

Updated Lightning Potential

High lightning potential threshold
~5 min leadtime

Low lightning potential threshold
~15 min leadtime

10 June 2013 20:05 UTC
Lightning indicator circle

10 June 2013 20:20 UTC
First LMA Lightning

10 June 2013 20:30 UTC
Updated Lightning Potential
Strategic Lightning Prediction

• 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
Strategic Lightning Prediction

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Summary

• 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!