# Better Forecast/Warning Tools and Techniques

Observation-based Severe Convective Tools Overview

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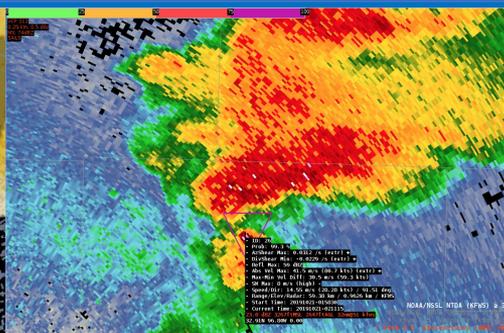
NOAA long-term goal: Weather Ready Nation

"Essential components of a weather-ready nation are integrated, impact-based information and decision-support services so that citizens, businesses, communities, governments, and first responders are prepared, ready to act, and able to minimize risk. Impact-based information means NOAA understands the information needed, how it will be used to make decisions, and the value such information brings to minimizing risk and impact."

Probabilistic Hazard Information (60-minute threat)

Lightning				
>0%	20%	40%	60%	80%

Severe				
>0%	20%	40%	60%	80%
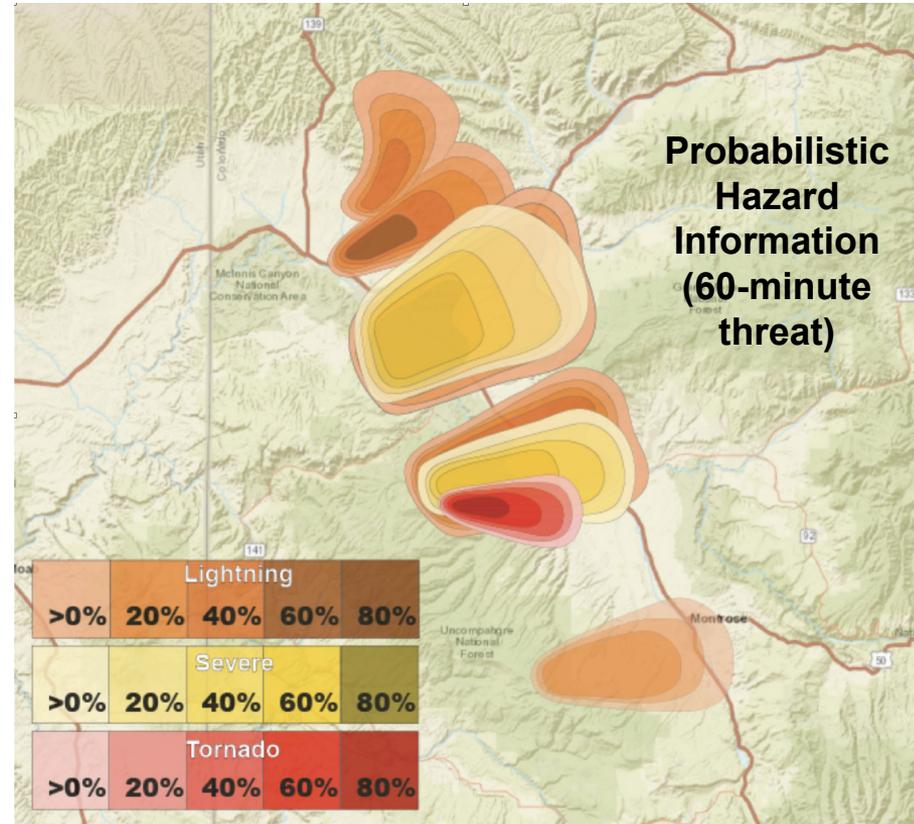
Tornado				
>0%	20%	40%	60%	80%

OAR Goal 3: make forecasts/predictions better
# OAR Goal 4: drive innovative science

Machine learning - detection and short-term prediction of:

- Tornadoes
- Hail
- Damaging Convective Wind
- Flash Flooding

How do humans use these tools?

Newer web technologies

- Georeferenced data
- Modern databases

Quantifying and managing uncertainty at 0-60 minute scale
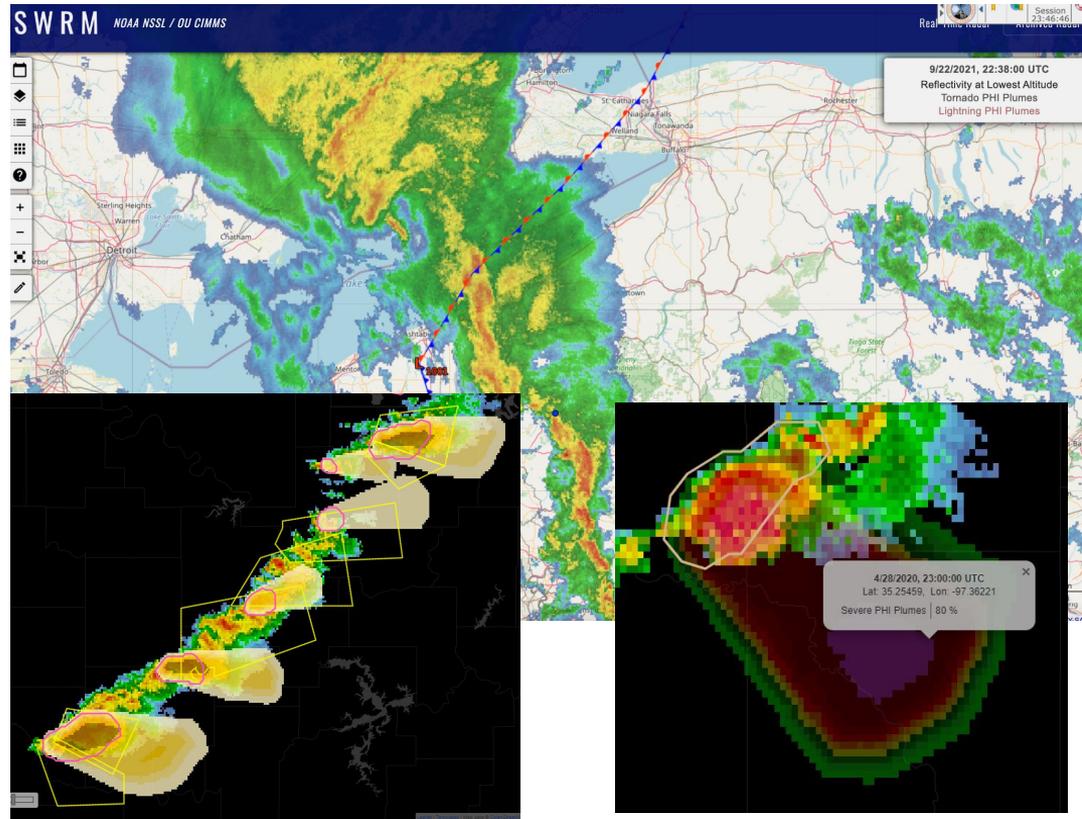
Large Radar Datasets, Machine Learning, and Storm-scale probabilistic hazard guidance

Over 2 decades worth of WSR-88D data covering the CONUS

Quality controlled CONUS data fro 1998-2011 (more to come)

- Range of storm behaviors
- Climatology
- Training machine learning applications
- Validation of NWP models
- Guidance for "strike" probabilities
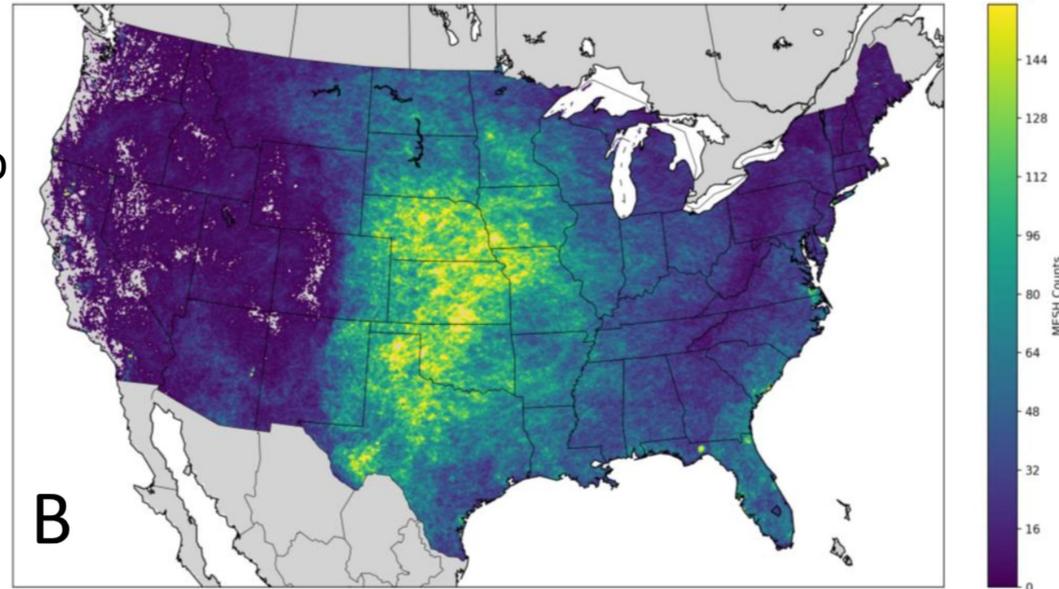
MYRORSS hail occurrence 1998-2011

Satellite, Lightning and Flash Flood Research

- Satellite R&D has greatly expanded with the new applicability to severe weather following the launch of the GOES-R series of satellites.

  - New products and algorithms

  - Data assimilation & machine learning

  - No longer dependent on radar data alone.

- Flash flood guidance change the paradigm of how flood threats are evaluated.

  - very high resolution terrain

  - vegetation

  - MRMS precipitation estimates

GOES-16 EFD GLM Flash Extent Density (flashes/min) (1min)   Tue 18:48Z 15-Jun-21

GOES-16 EFD GLM Total Opti

DEV CREST Maximum Threshold Exceedance
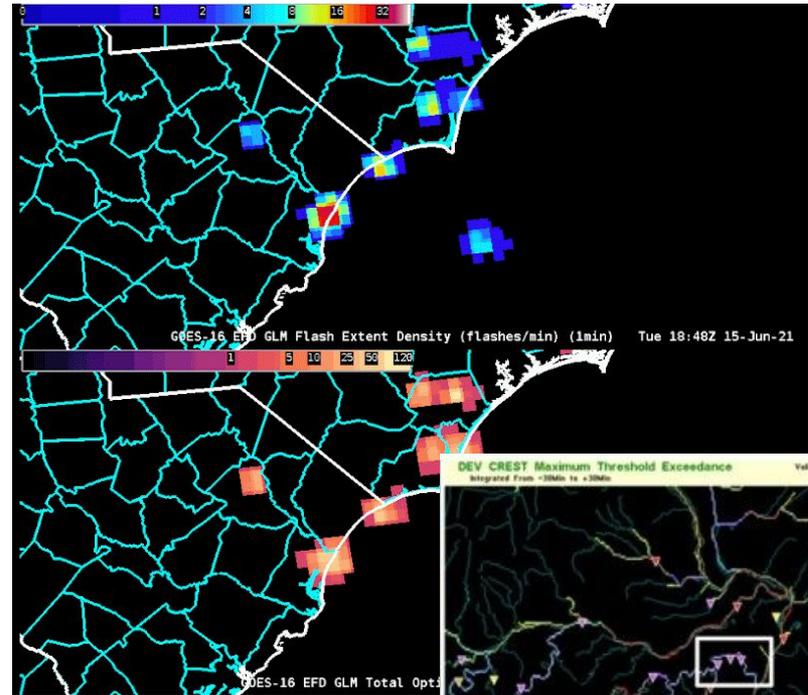
Working with partners

Forecasters, Emergency Managers, Broadcasters, Weather Enterprise

Collaborators

Research →→→ Operations & Users

Tornado Warning Improvement and Extension Program (TWIEP) Goals

3. "Implement a next-generation NWS warning paradigm to include probabilistic hazard information with extended lead times that empower effective decision-making."

5. "Define and implement optimal predictive information content and lead time for decision makers tailored to diverse user groups, with an overall focus on effective communication and response using social and behavioral science studies."

Quality & Performance

2016 & 2018 National Weather Association Larry R. Johnson Special Award - for the successful transition to operations of applications that assist forecasters with warning operations and observations (MRMS-Severe and mPING).

Over 70 refereed publications since 2015

Students mentored / degrees granted:

- Ph.D: 7

- MS: 8

- Undergraduates: 19 UGRAs,
  5 REU, 11 OU Meteorology Capstone

24 Hazardous Weather Testbed experiments led since 2015
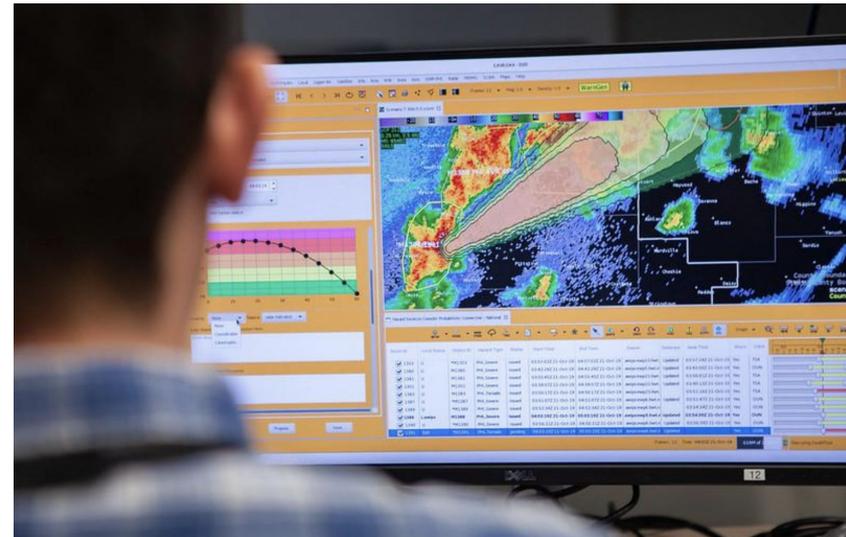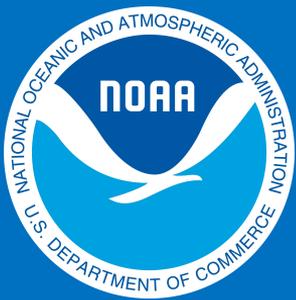
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Questions for the Observation-based Severe Convective Tools panel?