



# Engagement of Customers, Stakeholders, and Users

## Collaborative Research Environments

Alan Gerard, Chief, WRDD





# Collaborative Research Environments enable...

Dynamic interactions between researchers and practitioners that support a true iterative R&D environment





# Various Efforts



- Lead and operate NOAA's Hazardous Weather Testbed (in partnership with NWS)
- Strong partnerships and relationships with other NOAA testbeds (AWC, HMT, OPG)
- Collaborative relationships with NWS at all levels of the organization (NWSH, regions, field offices)



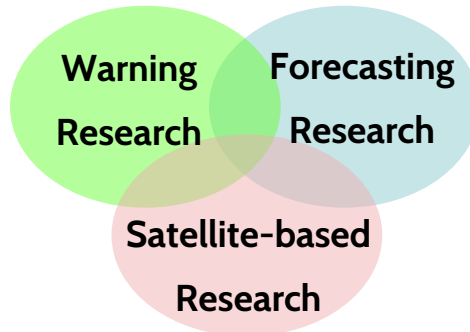


# NOAA's Hazardous Weather Testbed



**Experimental  
Warning  
Program**

*Detection/prediction of  
hazardous weather events **up to  
several hours in advance***



**Experimental  
Forecast  
Program**

*Prediction of hazardous weather  
events from a few hours to a  
**week in advance***



# HWT in the Literature



## THE COMMUNITY LEVERAGED UNIFIED ENSEMBLE (CLUE) IN THE 2016 NOAA/HAZARDOUS WEATHER TESTBED SPRING FORECASTING EXPERIMENT

Adam J. Clark, Israel L. Jirak, Scott R. Dembek, Brett J. Roberts, Fawcett Krocak, Keith H. Knopfmeier, Louis J. Wicker, Makenzie Krocak, Patrick S. Skinner, Pamela L. Heinselman, Katie A. Wilson, Jake Vancil, Kimberly A. Hoogewind, Nathan A. Dahl, Gerald J. Creager, Thomas A. Jones, Jidong Gao, Yunheng Wang, Eric D. Loken, Montgomery Flora, Christopher A. Kerr, Nusrat Yusouf, Scott R. Dembek, William Miller, Joshua Martin, Jorge Guerra, Brian Matilla, David Jahn, David Harrison, David Imy, and Michael C. Coniglio

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The National Severe Storms Laboratory (NSSL) and Storm Prediction Center (SPC) inaugurated annual Spring Forecasting Experiments (SFEs), which are conducted in NOAA's Hazardous Weather Testbed (HWT) at the National Weather Center in Norman, Oklahoma, for five weeks during the climatological peak of the severe weather season. The SFEs are designed to test emerging concepts and technologies for improving the prediction of hazardous convective weather with the primary goal of accelerating the transfer of promising new tools and concepts from research to operations, inspiring new initiatives for operationally relevant research, and identifying and documenting sensitivities and performance characteristics of state-of-the-art experimental convection-allowing

modeling (CAM) systems. Over the last decade, the SFEs have emerged as an international resource for developing and evaluating the performance of new CAM systems, and major advances have been made in creating, importing, processing, verifying, and extracting unique hazardous weather fields while providing analysis and visualization tools including probabilistic information, for those large and complex datasets. For example, during the 2010 experiment (Clark et al. 2012), in addition to providing a 26-member, 4-hm grid-spacing CAM-based ensemble, the Center for Analysis and Prediction Studies (CAPS) at the University of Oklahoma provided a 1-hm convection-permitting domain forecast that required over 10,000 computing cores in the 2015 SFE (Gallo et al. 2017), an unique and

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Kristin M. Calhoun<sup>1</sup>, Kodi L. Berry<sup>1</sup>, Darrel M. Kingfield<sup>2</sup>, Tiff...

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### Forecasters' Cognitive Task Analysis and Mental Workload Analysis of Issuing Probabilistic Hazard Information (PHI) during FACETS PHI Prototype Experiment

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University of Akron, Akron, Ohio

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JAMES CORREIA JR.  
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KRISTIN CALHOUN, TEFANY MEYER, AND DAPHNE LADUE  
NOAA/OAR/National Severe Storms Laboratory, Norman, Oklahoma

(Manuscript received 7 October 2019, in final form 12 May 2020)

### ABSTRACT

During spring 2016 the Probabilistic Hazard Information (PHI) prototype experiment was run in the National Oceanic and Atmospheric Administration (NOAA) Hazardous Weather Testbed (HWT) as part of the Forecasting a Convection of Environmental Threats (FACETS) program. Nine National Weather Service forecasters were invited to use the web-based PHI prototype tool to produce dynamic PHI for severe weather threats. Archived and real-time weather scenarios were used to test the new paradigm of issuing probabilistic information, rather than deterministic information. The forecasters' mental workload was evaluated for each scenario using the NASA-Task Load Index (TLX) questionnaire. This study summarizes the analysis results of mental workload experienced by forecasters while using the PHI prototype. Six subdimensions of mental workload: mental demand, physical demand, temporal demand, performance, effort, and frustration were analyzed to determine contributing factors to workload. Average mental workload was 46.6 (out of 100, standard deviation: 15, range 7–89). Top contributing factors to workload included using automated guidance, PHI object quantity, multiple displays, and formulating probabilities in the new paradigm. Automated guidance provided support to forecasters in maintaining situational awareness and managing increased question of threat. The results of this study provided understanding of forecaster mental workload and task strategies and developed insights to improve usability of the PHI prototype tool.

### 1. Introduction

The severe convective weather warning system in the United States has maintained the same weather warning paradigm since the first successful issuance of a tornado warning in 1948 (Meyer 2003), comprising watches, warnings, and advisories. The current warning system comprises 122 National Weather Service (NWS) offices, and their affiliated national centers, continuously analyzing radar, satellite, lightning, surface observations,

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The advancement of the weather warning methods requires a new means to graphically represent and communicate threat information to users. The Probabilistic

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# HWT in the Literature

102 peer reviewed publications since 2016



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# Why is Research in the Naturalistic Environment Important?

Testing and evaluation

Evaluate experimental product for many events and by many users

Develop longitudinal collaborations and deeper user engagement

## Research-to-Operations-to-Research

Real-time access to experimental products

A strong desire to incorporate available information into the forecast process

Observe operational challenges and limitations

Considerations for operationalization

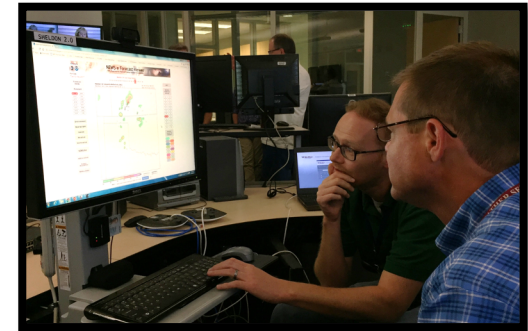
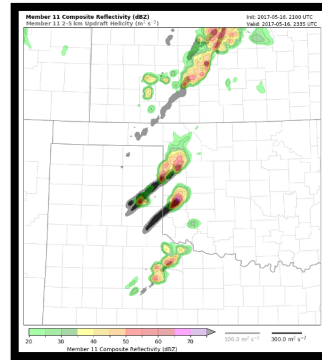




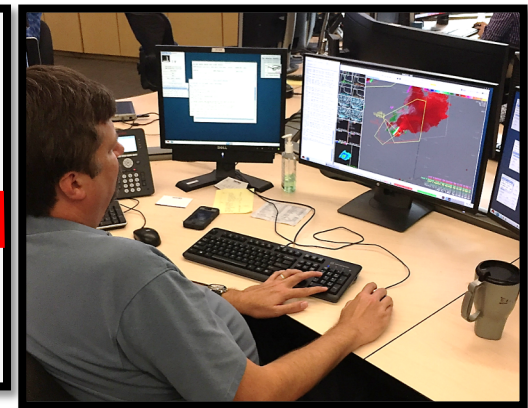


# An Example: Warn-on-Forecast in Operations

- Co-location of NSSL/OU CIWRO with the Norman Forecast Office
- Warn-on-Forecast guidance is available during the real-time run season
- Impromptu science support during weather events
- Learning *together* about the real-time applications of Warn-on-Forecast guidance

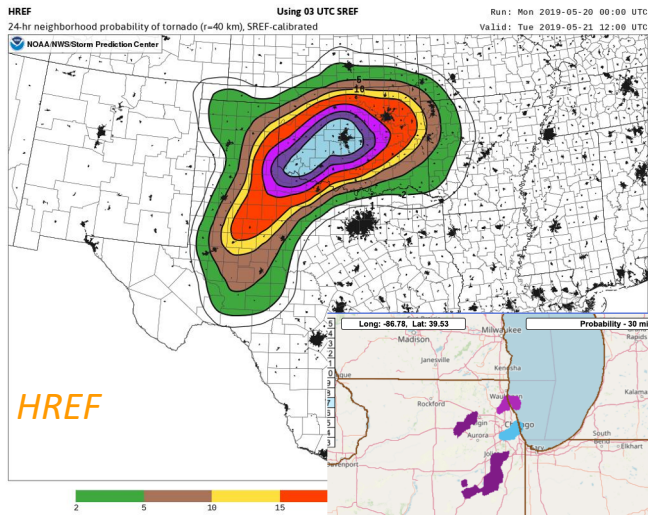


```
...SIGNIFICANT WEATHER ADVISORY FOR northwestern Harmon...  
southwestern Roger Mills...western Beckham and northwestern Greer  
Counties Until 545 PM CDT...  
  
Storms capable of producing tornadoes were located in the Texas  
panhandle. One storm was located southwest of Wheeler and the other  
located northwest of Wellington at 515 pm. The storms were moving  
northeast at 35 MPH. These storms will move into western Oklahoma  
before 6 PM. Severe weather is likely with these storms as they move  
into Oklahoma and there is a high probability that tornado warnings  
will be issued.  
  
PRECAUTIONARY/PREPAREDNESS ACTIONS...  
  
Monitor the situation closely. Be ready to act quickly if a warning  
is issued or if storms threaten you.
```



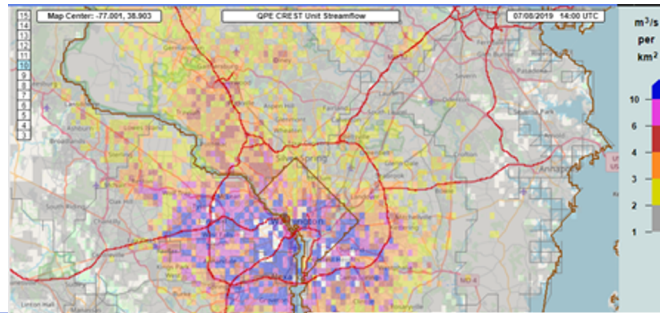


# Impacts and successes...

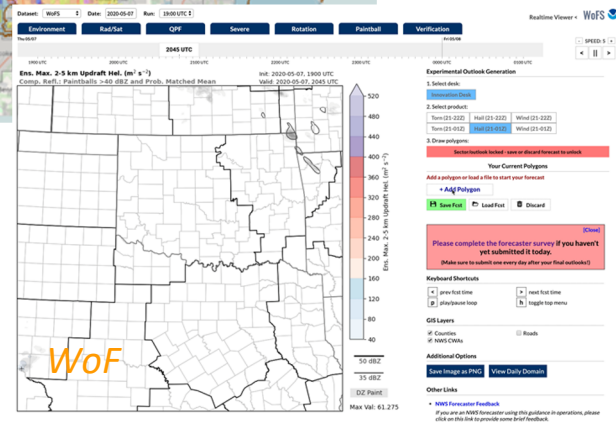
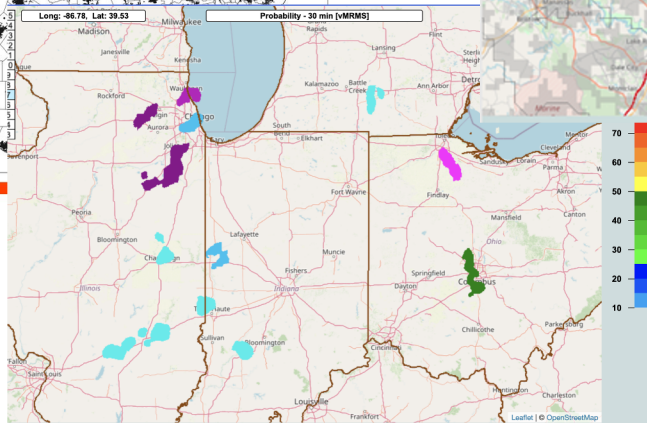


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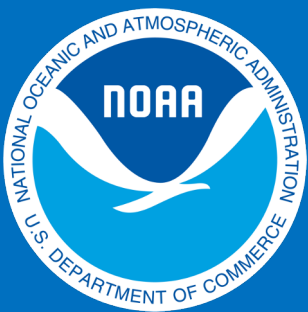


FLASH



WoF





Heather Reeves



Kodi Berry



Adam Clark



Katie Wilson



Pam Heinselman



Kristin Calhoun



Brett Roberts



Kim Klockow-McClain



Eric Loken

# Questions for the panel?

