SPC Calibrated Severe Hazards Guidance: Current Status and Future Plans

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Background/Motivation

- **Proliferation of Convection Allowing Models (CAMs) led to**:
  - SPC Storm-Scale Ensemble of Opportunity (SSEO)
  - Replaced by the High-Resolution Ensemble Forecast (HREF) system
- **Leverage coarser and larger-member Short-Range Ensemble Forecast (SREF) system for environmental fields**
  - Less potential for convective feedback/contamination of environment with perhaps better characterization of forecast uncertainty
- **Combine with Local Storm Report (LSR) frequency to produce Calibrated Probabilistic Guidance**
  - *Ability to supplement traditional ingredients-based forecast assessments of the environment with explicitly simulated storm-scale attributes in a manner consistent with SPC forecasters' approach.*
- **Initial Goal: Probabilistic guidance for tornado/wind/hail forecasts**

2017 – 2021:

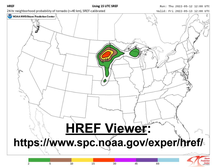
Local implementation of HREF/SREF calibrated severe guidance.

Probabilistic Guidance for Tornado, Wind, and Hail Hazards

May 2021:

HREF/SREF calibrated severe guidance became operational

Concurrent with HREFv3 implementation



Current Goal: Update Calibration

- **Operational SREF Scheduled for Retirement (~2024)**
  - New Sources of Environmental Information Considered:
    1. Global Ensemble Forecast System (GEFS)
    2. High-Resolution Ensemble Forecast (HREF) system
    3. Short-Range Ensemble Forecast (SREF) system - Parallel Version
- **Update to Current HREF Membership**
  - HREF Version 3 (2021 - Present)
- **Day 2 Individual Hazards Guidance**
  - HREFv3 members extend to forecast hour 48-60.
- **Consider Alternative Truth Data**
  - Traditional: Local Storm Reports (LSRs)
  - Alternative: MRMS MESH (Hail only)

Technique: *Maximum Neighborhood Probabilities within 25 miles of a point*

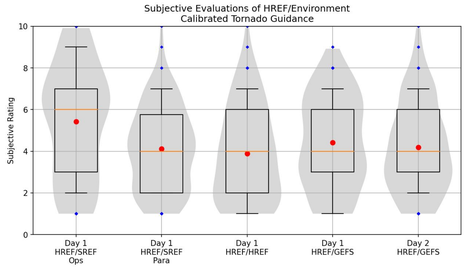
Operational HREF/SREF

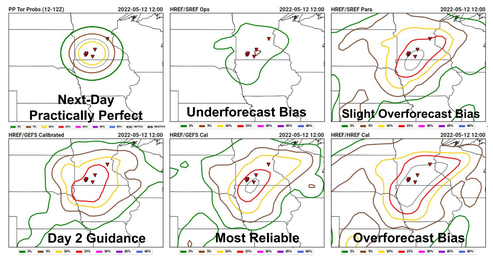
Hazard	HREF Storm-Attribute Variables	SREF Environmental Variables
Tornado	Updraft Helicity ≥ Model/Core Threshold	STP ≥ 1
Hail	Updraft Helicity ≥ Model/Core Threshold	MUCAPE ≥ 1000 J/kg, Eff. Shear ≥ 20 kt
Wind	Updraft Helicity ≥ Model/Core Threshold	MUCAPE ≥ 250 J/kg, Eff. Shear ≥ 20 kt

Experimental Guidance

Hazard	HREF Storm-Attribute Variables	SREF/GEFS/HREF Environmental Variables
Tornado	Updraft Helicity ≥ Model/Core Threshold	STP ≥ 1
Hail	Updraft Helicity ≥ Model/Core Threshold	MUCAPE ≥ 1000 J/kg, Eff. Shear ≥ 20 kt
Wind (Max of 3 approaches)	1. Updraft Helicity ≥ Model/Core Threshold 2. Calibrated Thunder (UH ≥ 5% mask) 3. 10 m AGL Wind ≥ 30 kt (UH ≥ 5% mask)	1. MUCAPE ≥ 1000 J/kg, Eff. Shear ≥ 20 kt 2. MUCAPE ≥ 250 J/kg, Eff. Shear ≥ 20 kt 3. MUCAPE ≥ 1000 J/kg, Eff. Shear ≥ 20 kt

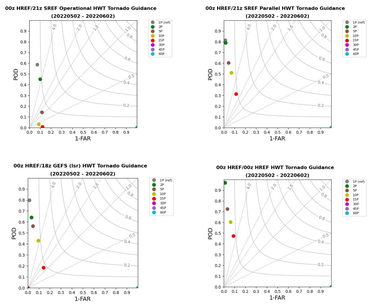
Tornado



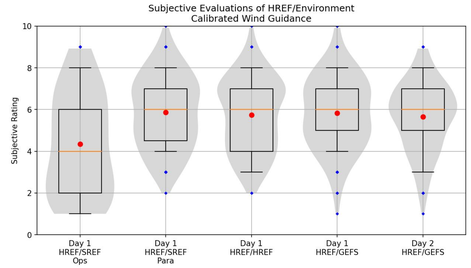


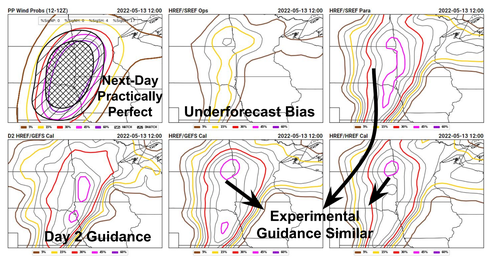
Objective Results

- **Operational HREF/SREF Better at 1% & 2%**
- **Similar Performance at 5%**
- **Experimental Guidance Better at 10% & 15%**



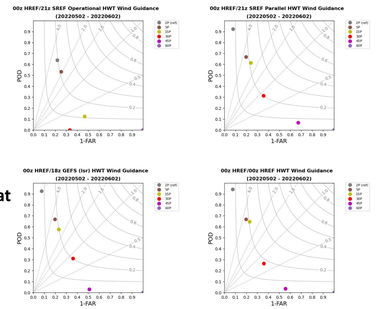
Wind



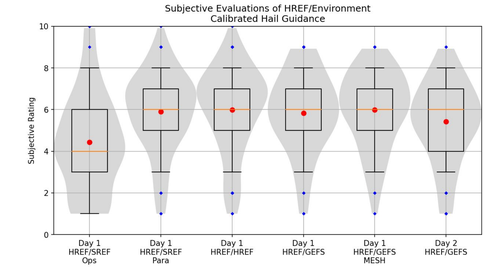


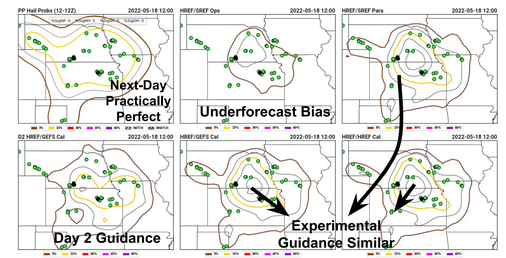
Objective Results

- **Similar Performance at 2%, 5%, and 15%**
- **Experimental Guidance Better at 30% and 45%**



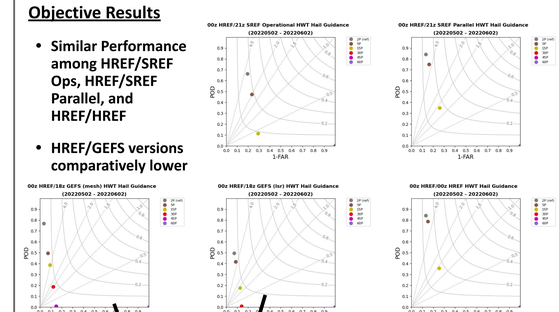
Hail



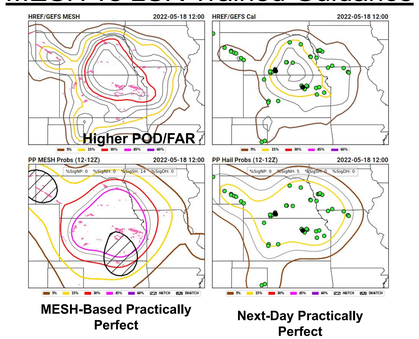


Objective Results

- **Similar Performance among HREF/SREF Ops, HREF/SREF Parallel, and HREF/HREF**
- **HREF/GEFS versions comparatively lower**



MESH vs LSR Trained Guidance



Results

- **Experimental HREF/GEFS**
  - Highest rated by HWT participants (overall)
  - Trends up from Day 2 to Day 1
  - Hail Guidance (LSR vs MESH) rated/verifies similarly
- **Experimental Guidance Outperforms Operational Version***
  - Operational HREF/SREF better at low thresholds
  - Experimental guidance better at high thresholds
  - Experimental guidance rated/verifies similarly
  - Less tolerance for FAR with increasing thresholds
  - *Operational HREF/SREF rated best Tornado Guidance by participants

Combined Subjective Evaluations

