

Weather Prediction for the Energy Sector



*Verification of 15 day
heat/cold wave forecasts
for 2019*

Climate Forecast Applications Network

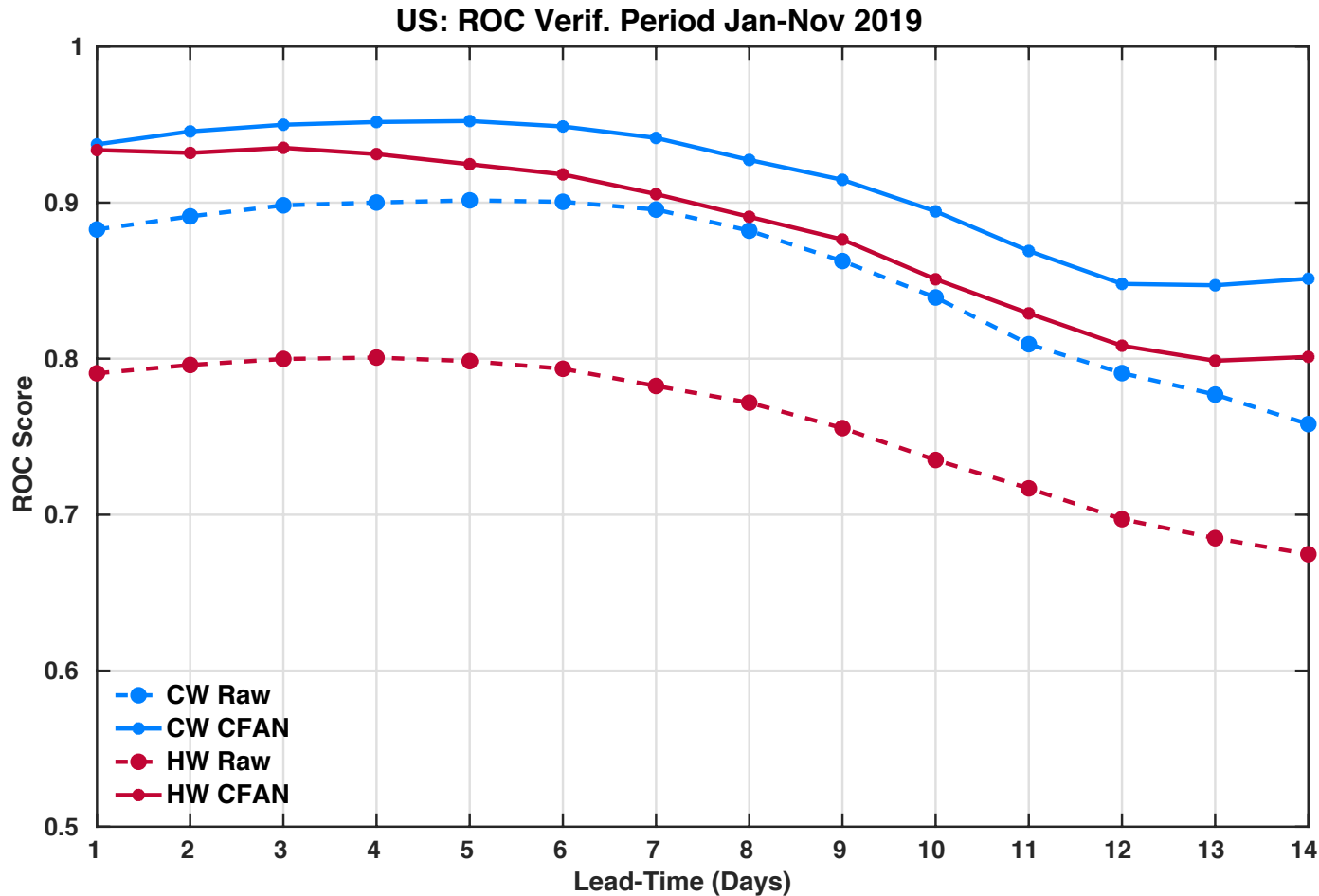
www.cfanclimate.net



Definitions

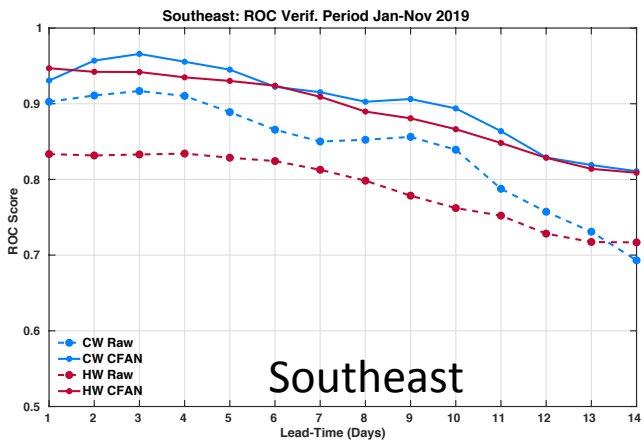
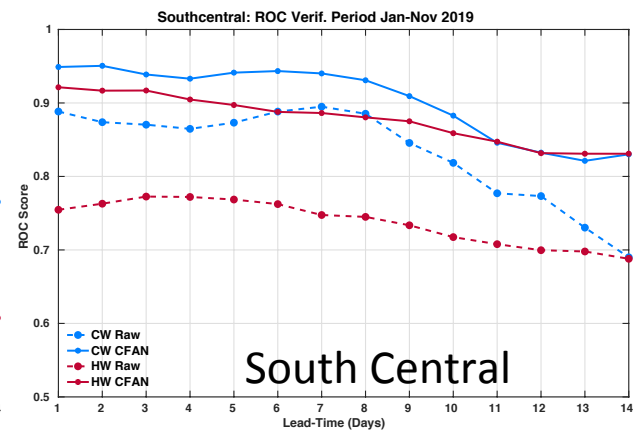
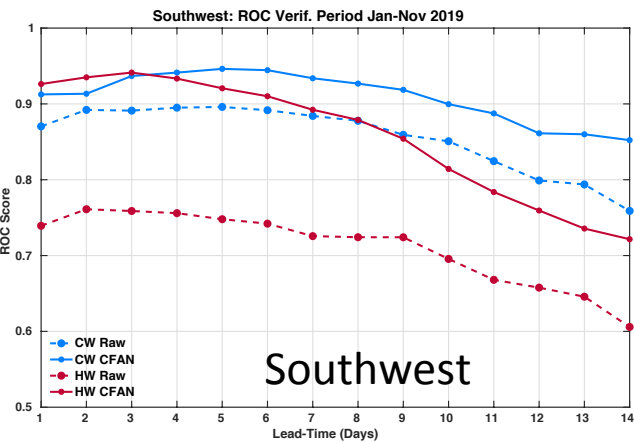
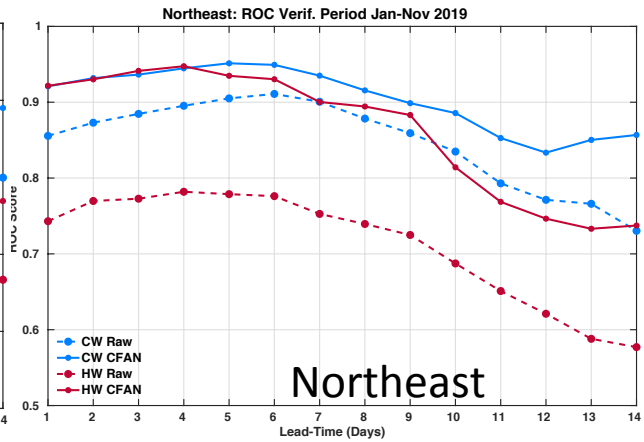
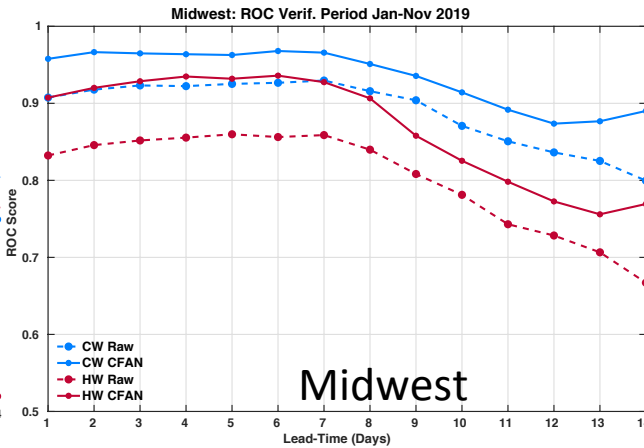
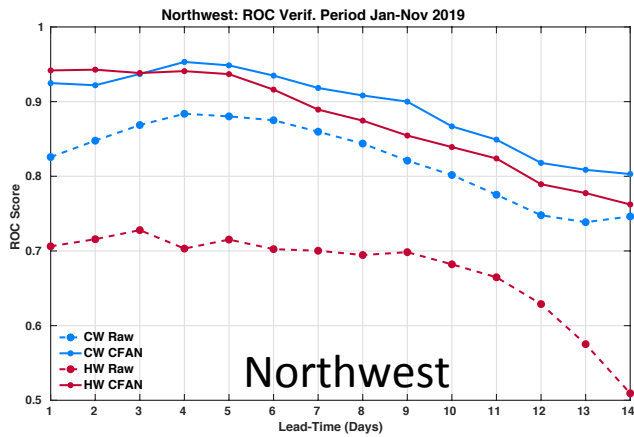
- **Probability of heat/cold wave:** % of ensemble members **exceeding/below** the 80th quantile of observed historical distribution for at least three consecutive days
- **ROC (Relative Operating Characteristic):** Skill score for probabilistic forecasts, discriminating between events and non events. 1 is a perfect score; 0-0.5 indicates no skill.
- **Probability of Detection (POD; Hit Rate):** Fraction of 'yes' events that were correctly forecast.
- **Miss Rate:** $1 - \text{POD}$
- **False Alarm Rate:** Fraction of predicted 'yes' events that did not actually occur

ROC Verification for U.S. heat/cold wave forecasts



- Overall skill is higher for cold waves (blue)
- Substantial value added from CFAN's calibrations (solid relative to dash), esp for heat waves (red)

Regional ROC scores



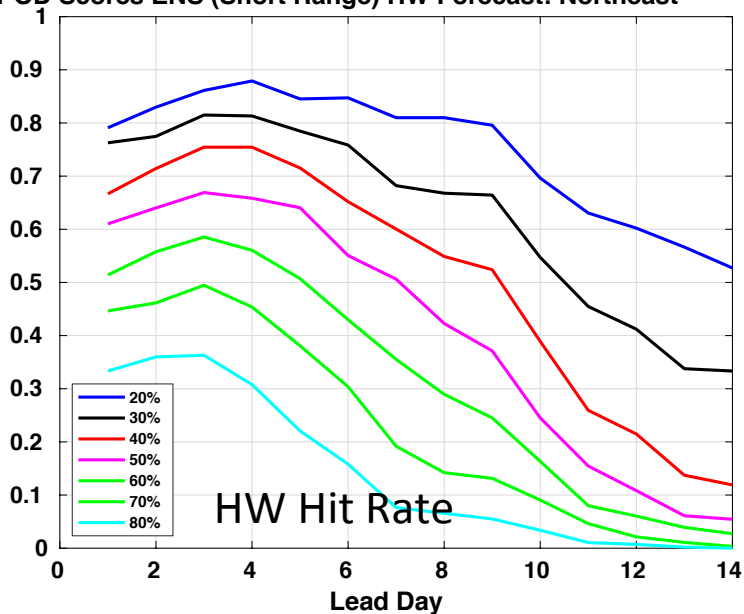
- Substantial regional variations, especially in week 2
- Degradation of week 2 HW skill in NE, MW, SW

HW/CW skill summary

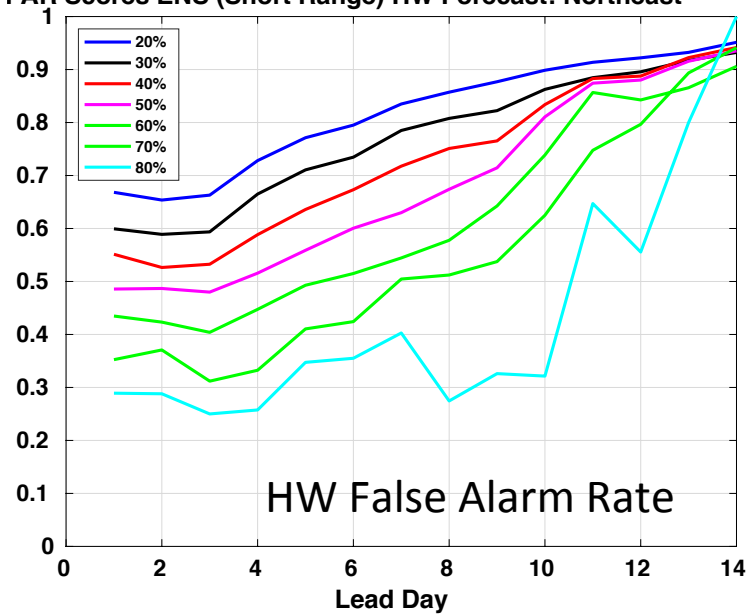
- Substantial value add from CFAN's calibrations, especially for HW
- Overall skill is higher for CW than for HW
- Skill is high for week 1 in all regions, for both HW and CW
- CW skill in week 2: skill remains high in MW, NE, SW, with lowest skill in NW, SE
- HW skill in week 2: comparable high skill to CW for NW, SC, SE; lowest skill in SW, NE beyond day 10

Northeast heat/cold wave probabilities

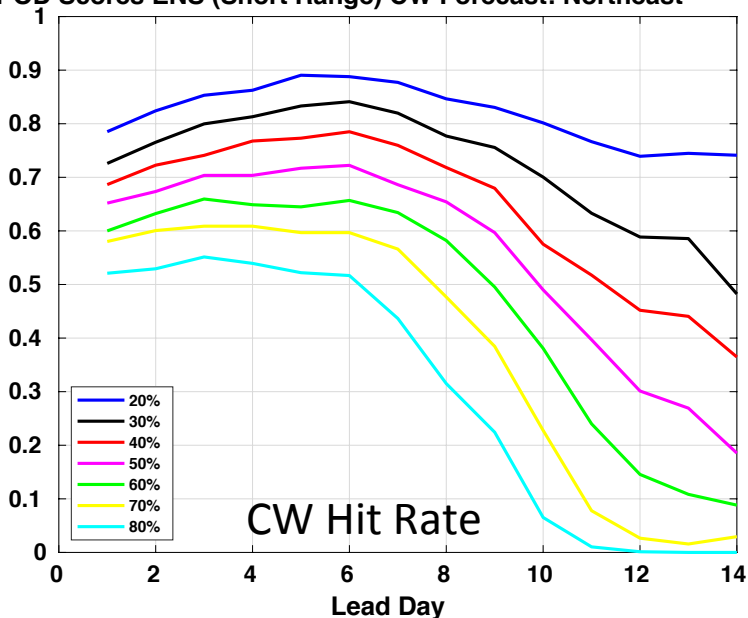
POD Scores ENS (Short Range) HW Forecast: Northeast



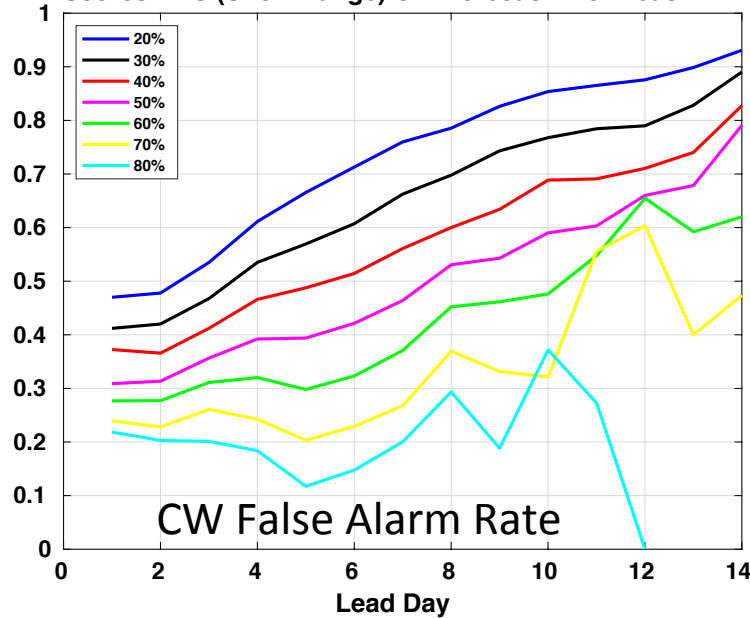
FAR Scores ENS (Short Range) HW Forecast: Northeast



POD Scores ENS (Short Range) CW Forecast: Northeast

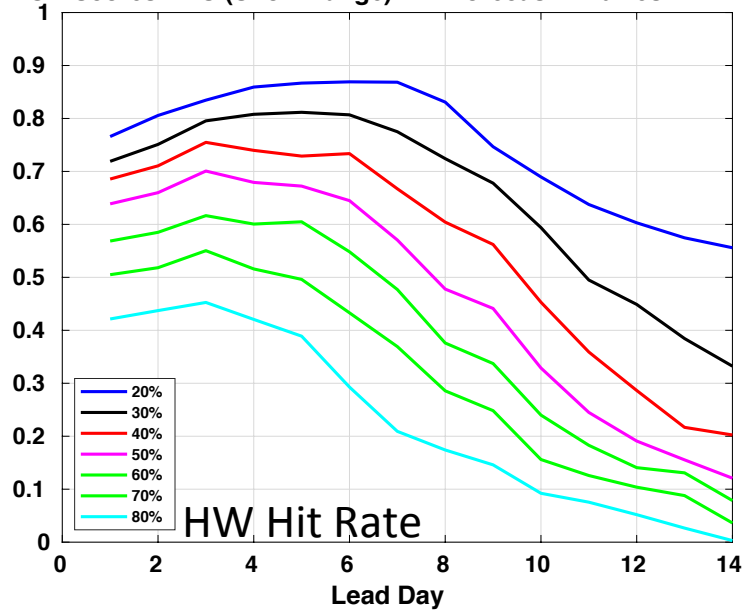


FAR Scores ENS (Short Range) CW Forecast: Northeast

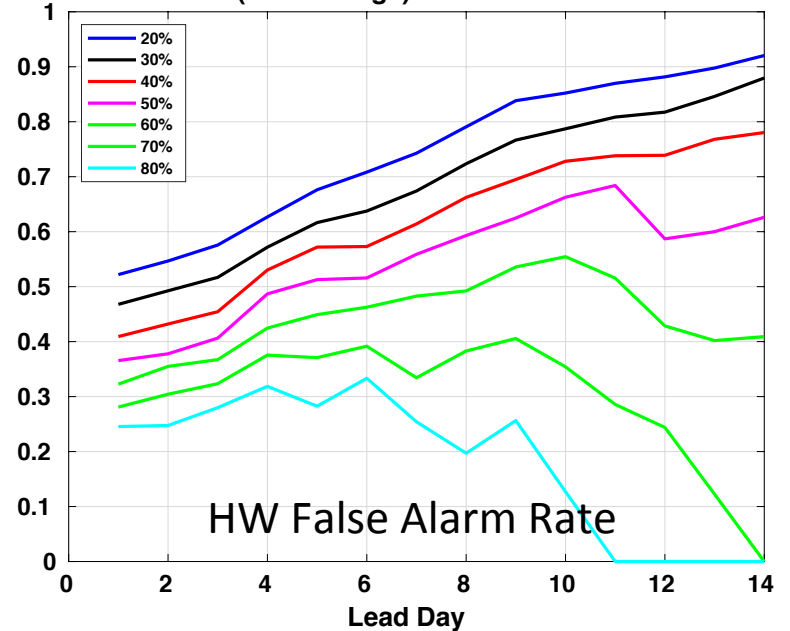


Midwest heat/cold wave probabilities

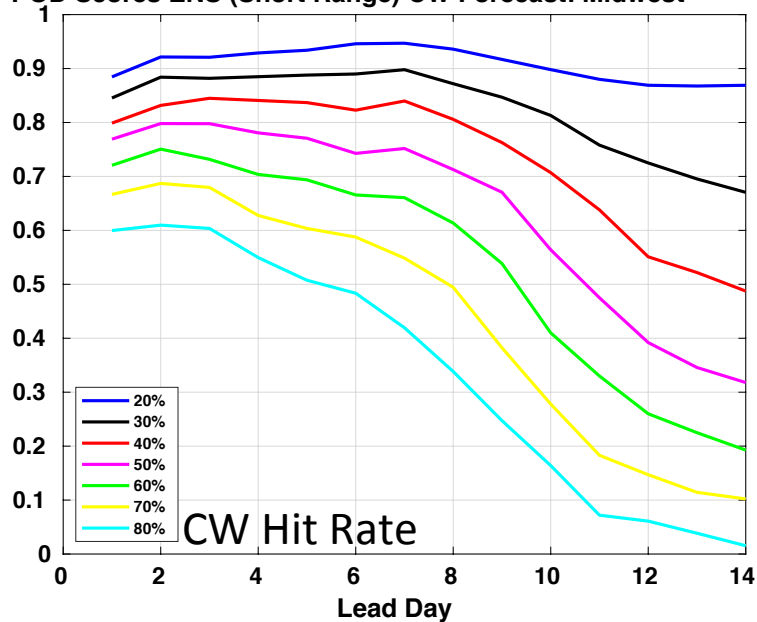
POD Scores ENS (Short Range) HW Forecast: Midwest



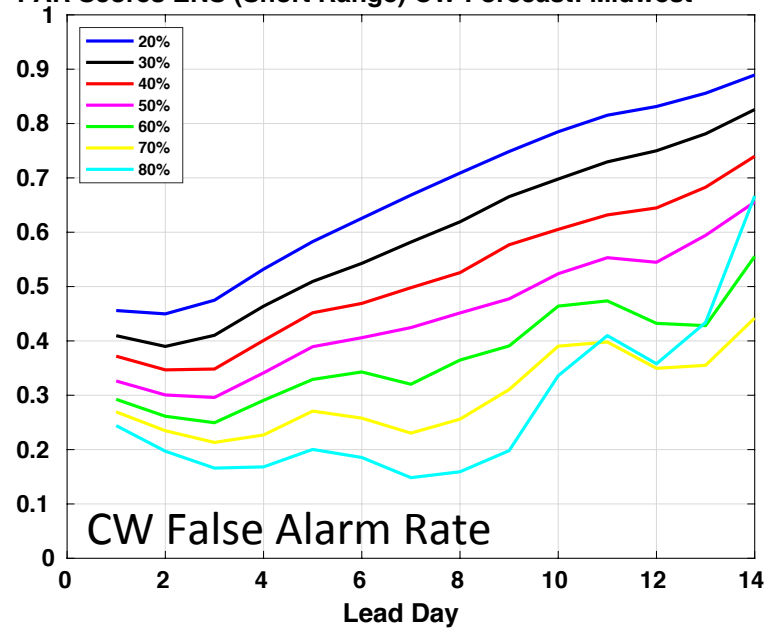
FAR Scores ENS (Short Range) HW Forecast: Midwest



POD Scores ENS (Short Range) CW Forecast: Midwest

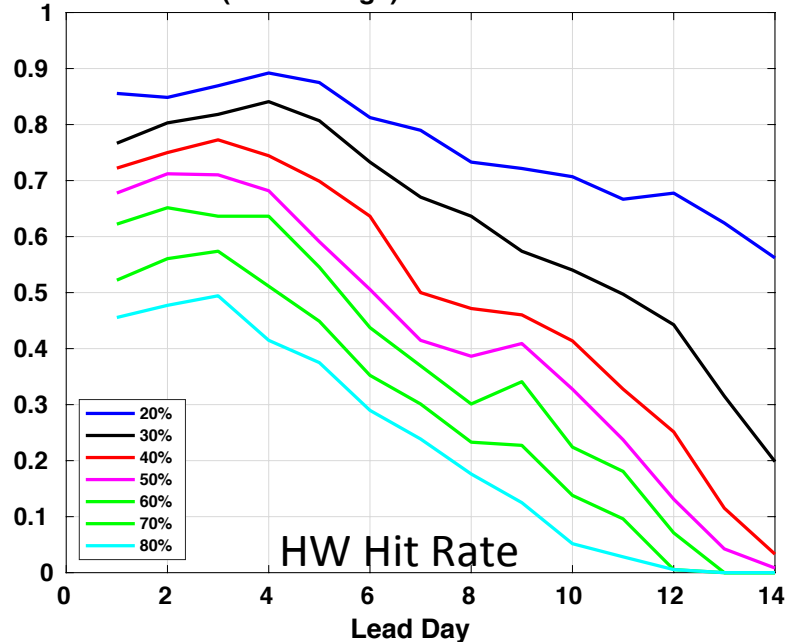


FAR Scores ENS (Short Range) CW Forecast: Midwest

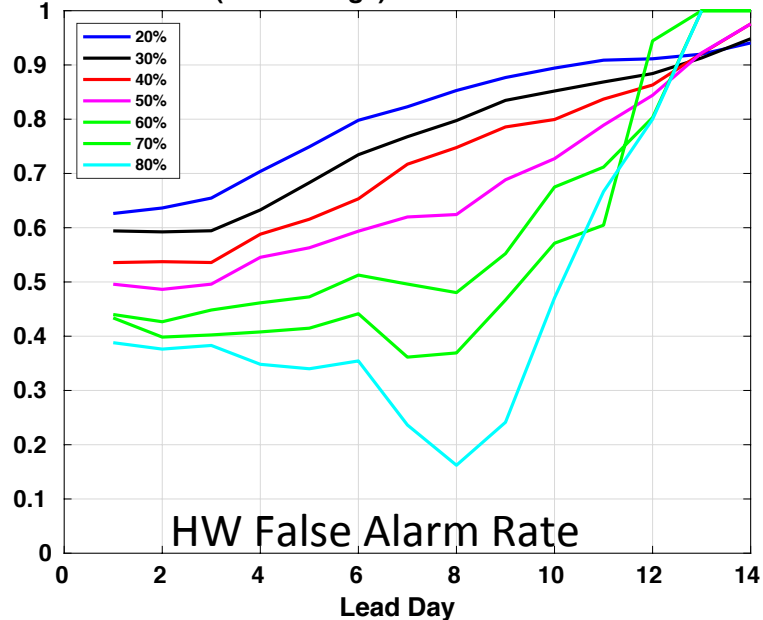


Northwest heat/cold wave probabilities

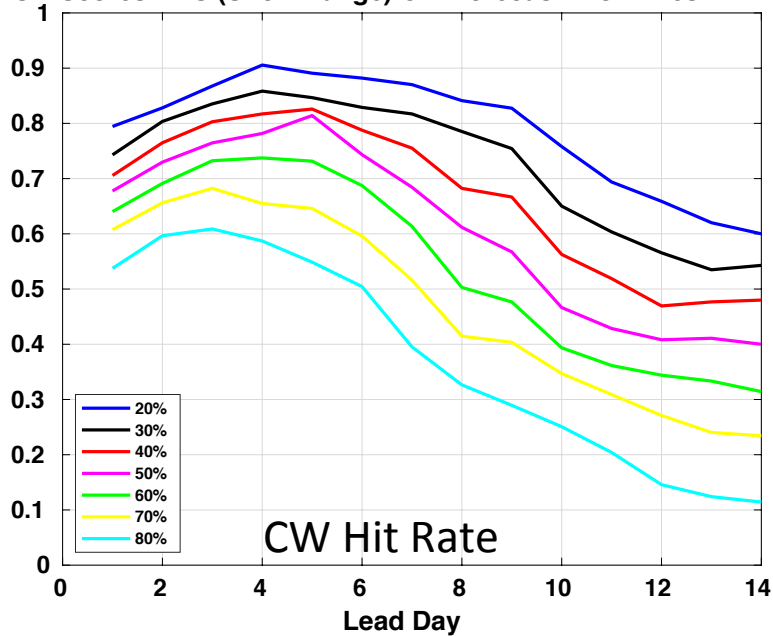
POD Scores ENS (Short Range) HW Forecast: Northwest



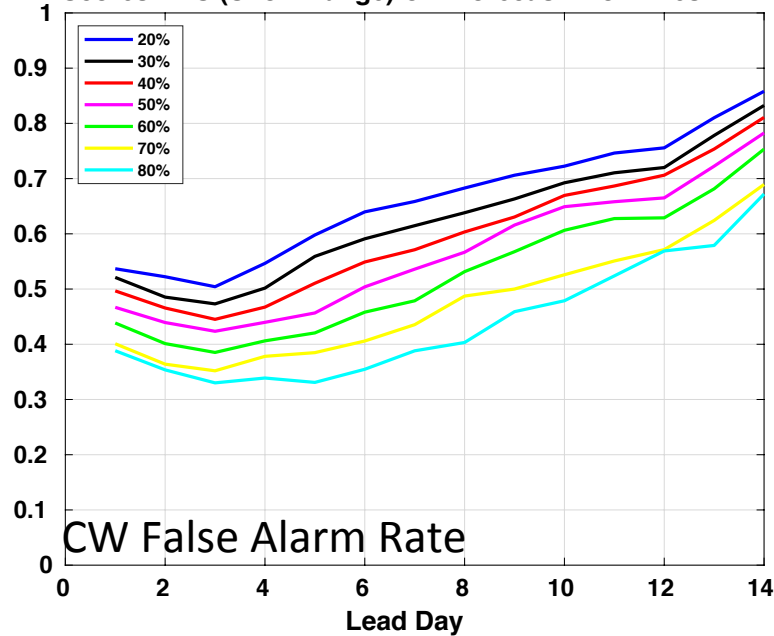
FAR Scores ENS (Short Range) HW Forecast: Northwest



POD Scores ENS (Short Range) CW Forecast: Northwest

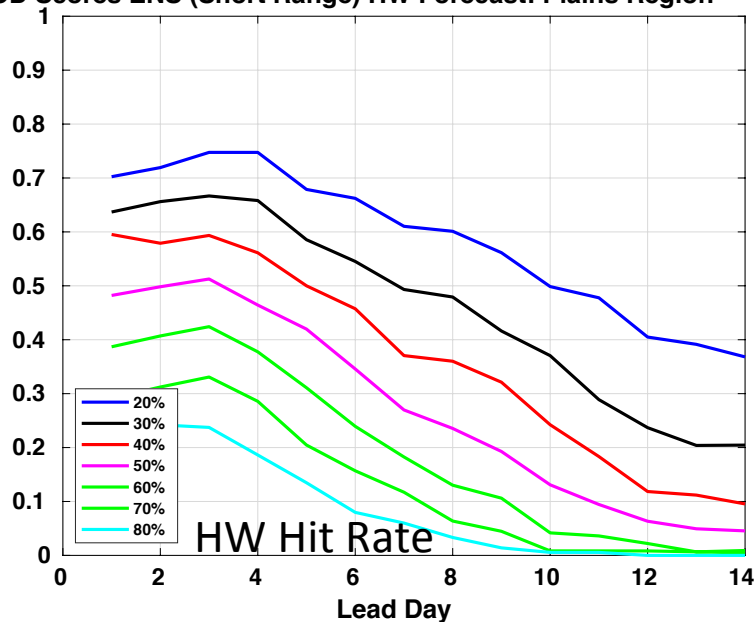


FAR Scores ENS (Short Range) CW Forecast: Northwest

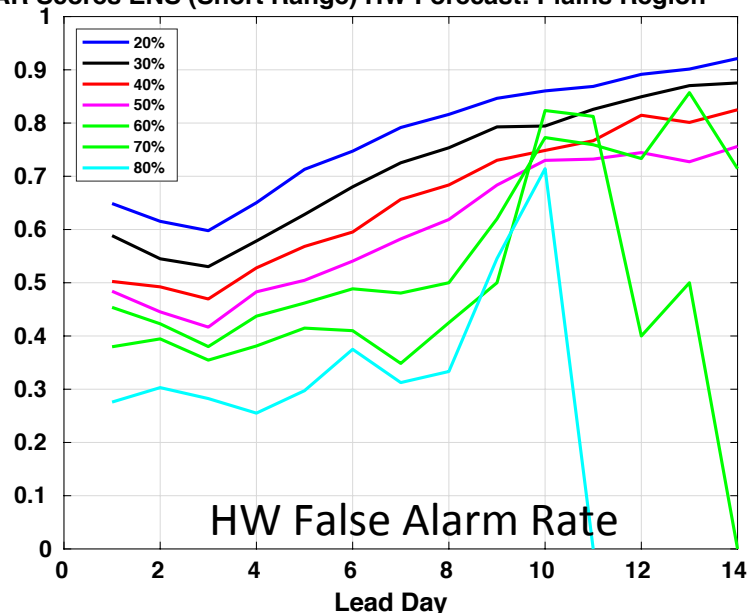


Plains/Rockies heat/cold wave probabilities

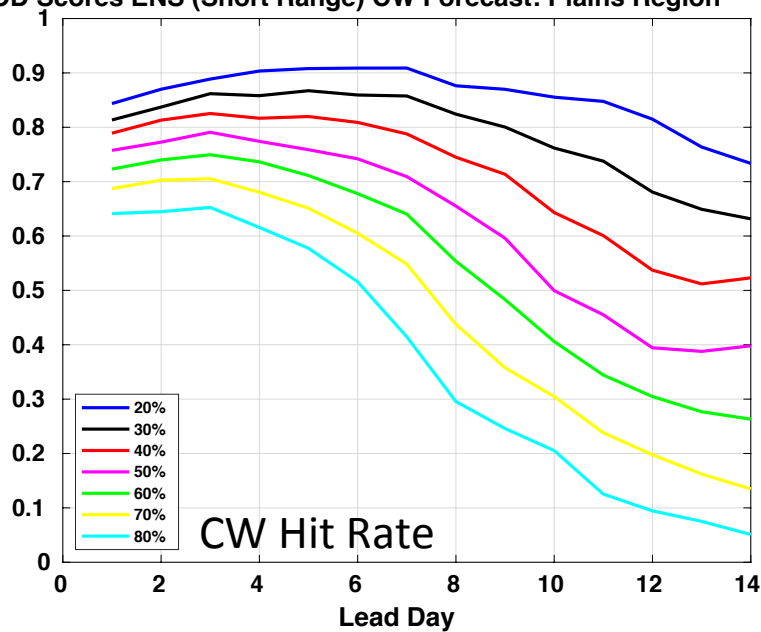
POD Scores ENS (Short Range) HW Forecast: Plains Region



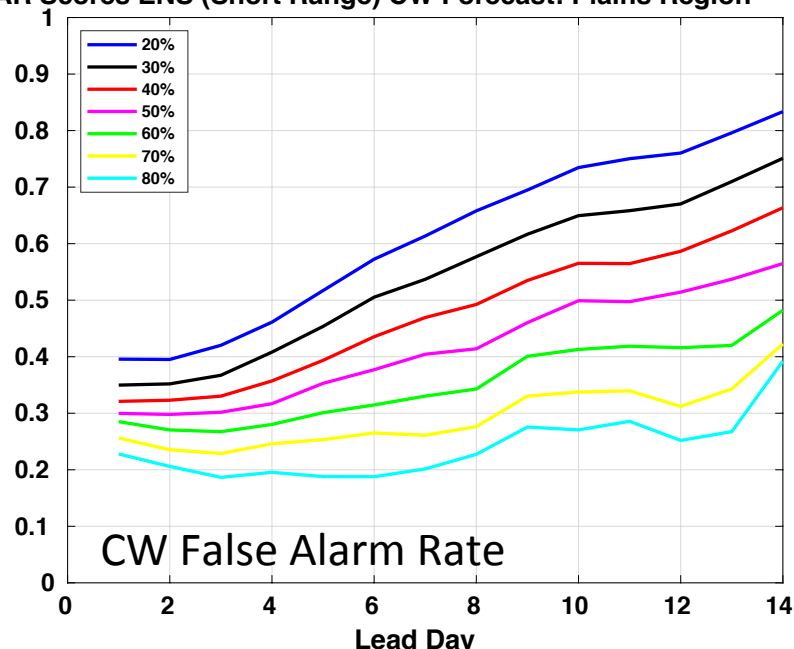
FAR Scores ENS (Short Range) HW Forecast: Plains Region



POD Scores ENS (Short Range) CW Forecast: Plains Region

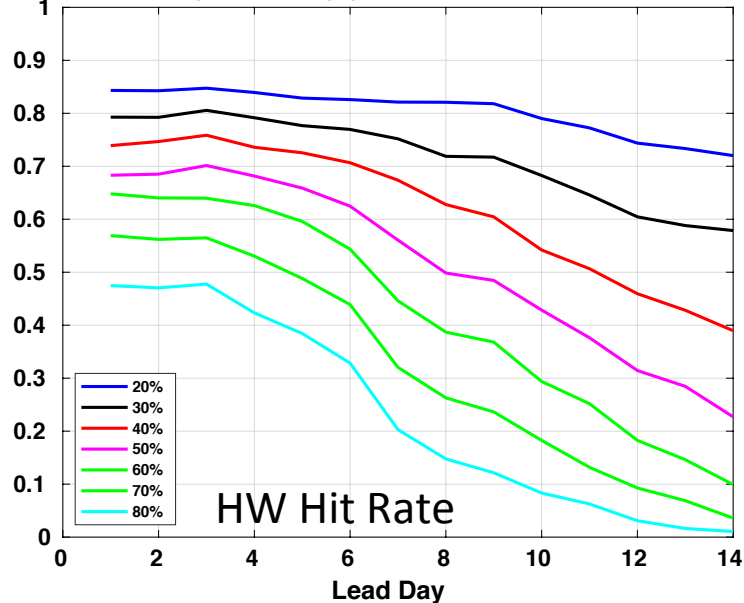


FAR Scores ENS (Short Range) CW Forecast: Plains Region

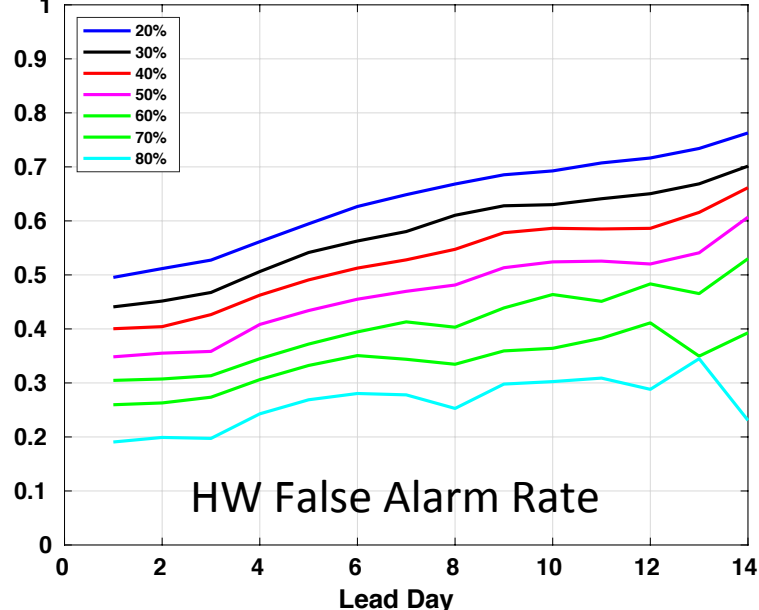


South Central heat/cold wave probabilities

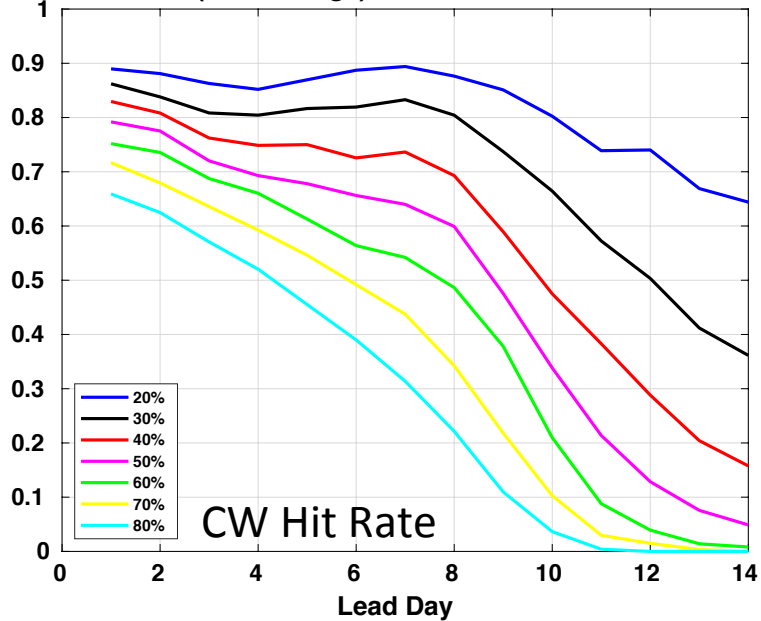
POD Scores ENS (Short Range) HW Forecast: Southcentral



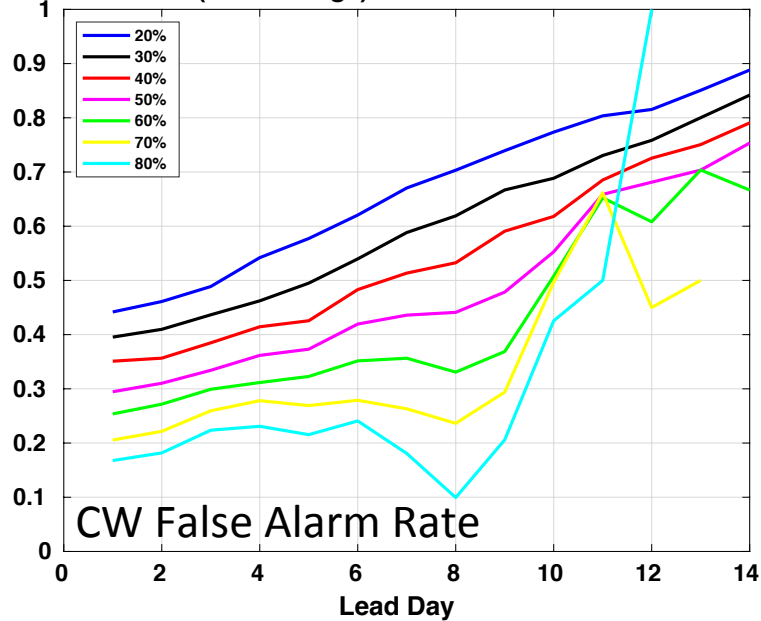
FAR Scores ENS (Short Range) HW Forecast: Southcentral



POD Scores ENS (Short Range) CW Forecast: Southcentral

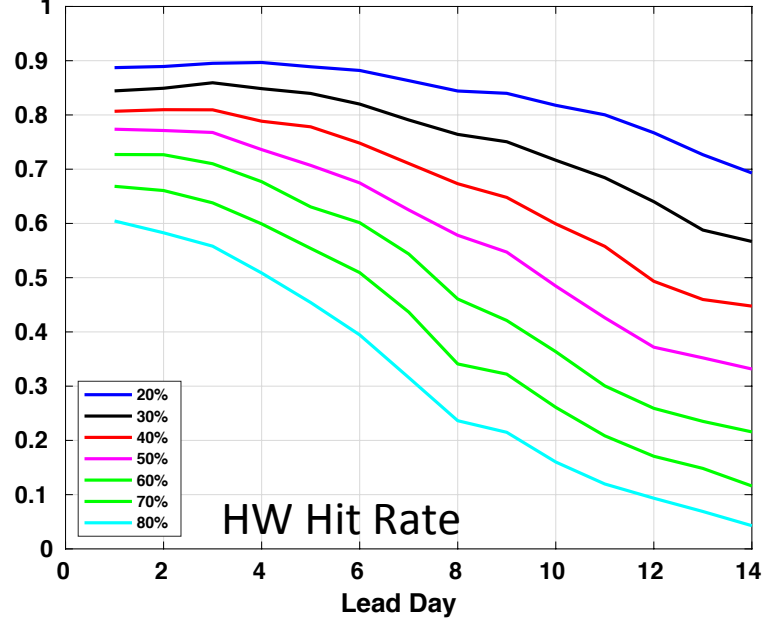


FAR Scores ENS (Short Range) CW Forecast: Southcentral

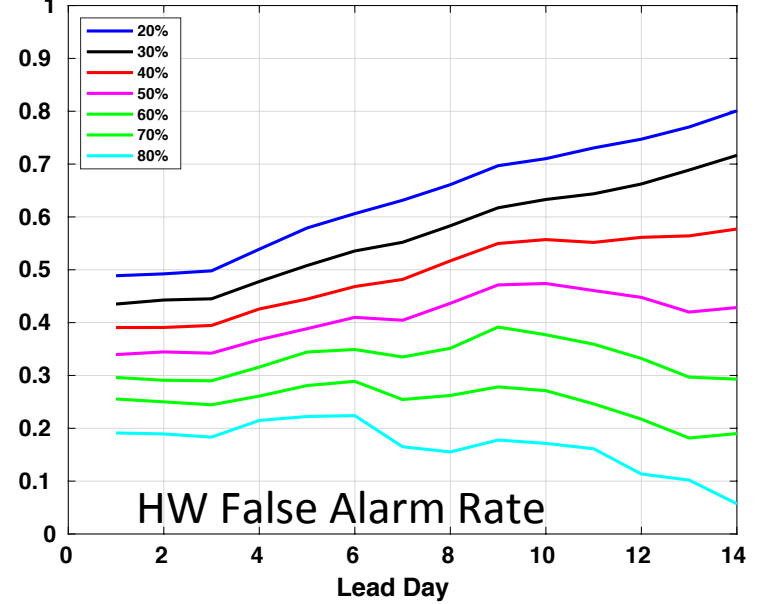


Southeast heat/cold wave probabilities

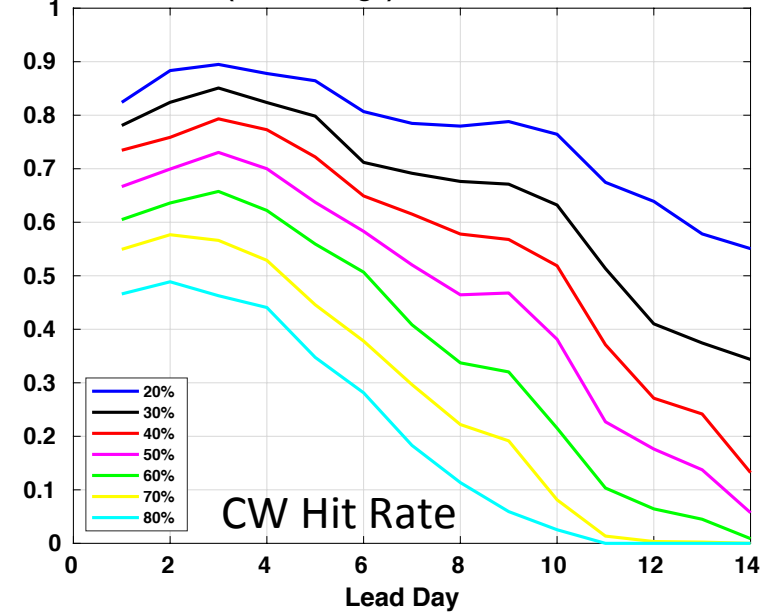
POD Scores ENS (Short Range) HW Forecast: Southeast



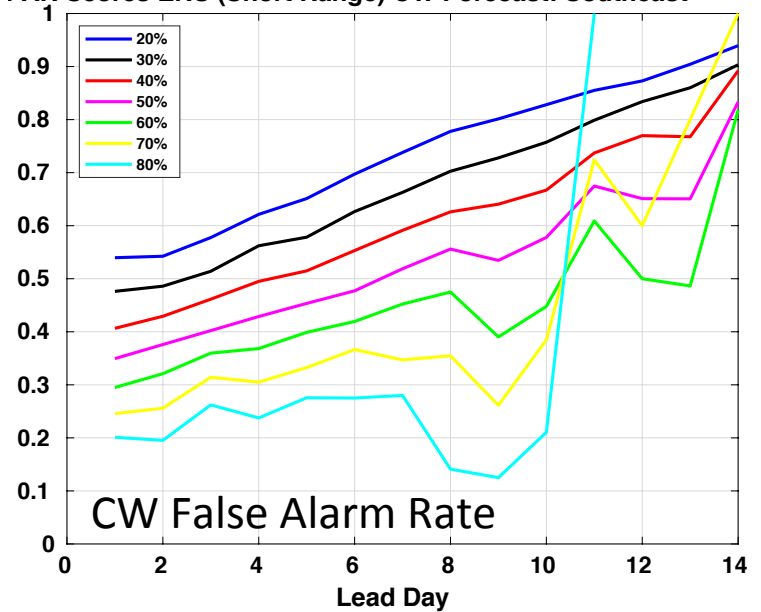
FAR Scores ENS (Short Range) HW Forecast: Southeast



POD Scores ENS (Short Range) CW Forecast: Southeast

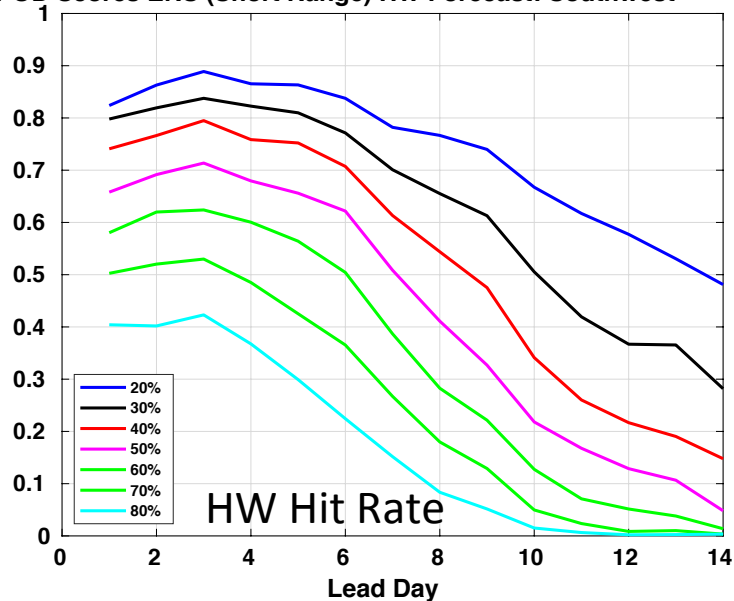


FAR Scores ENS (Short Range) CW Forecast: Southeast

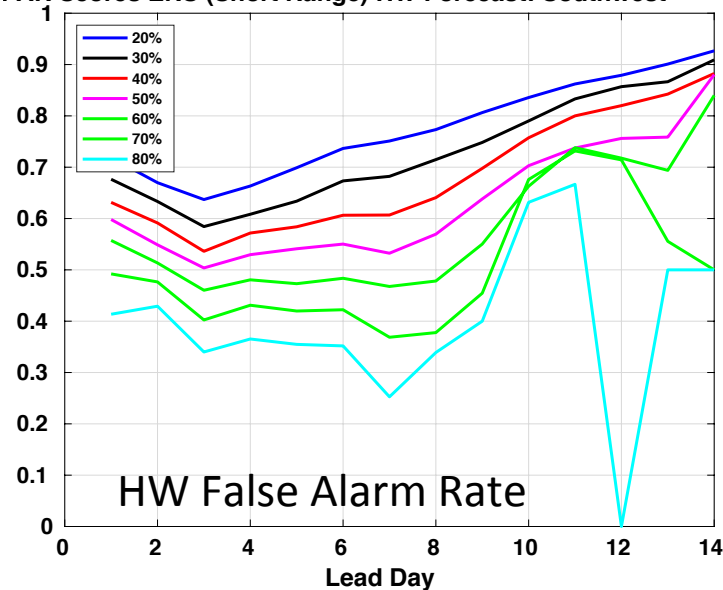


Southwest heat/cold wave probabilities

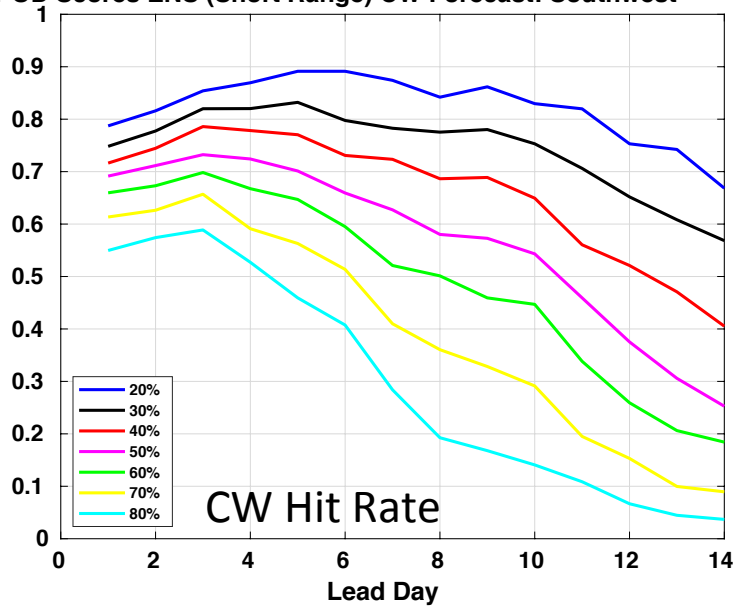
POD Scores ENS (Short Range) HW Forecast: Southwest



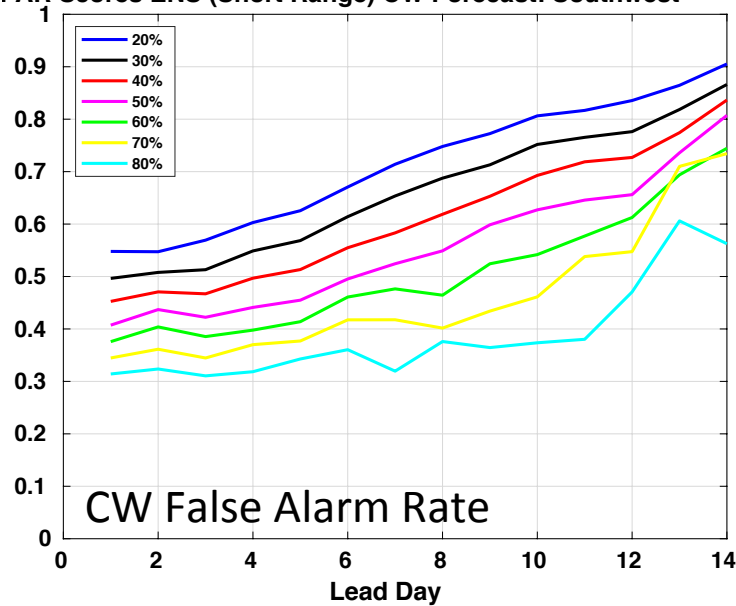
FAR Scores ENS (Short Range) HW Forecast: Southwest



POD Scores ENS (Short Range) CW Forecast: Southwest



FAR Scores ENS (Short Range) CW Forecast: Southwest



HW/CW forecast interpretation

- Hit rate and false alarm scale ~linearly with HW/CW probability in week 1.
- 20% HW/CW probability: high hit/low miss rate, but also high probability of false alarm especially in week 2
- 50% HW/CW probability: low hit rate >10 days for: HW (NE, MW, NW, PR, SW); CW (SC, SE)
- 80% HW/CW probability: low probability of false alarm, but rarely predicted > 10 days for HW (NE, NW, PR, SW); CW (NE, SC, SE)