Assessment of Time-Lagged, Medium-Range, High-Resolution Ensemble Forecasts of Extreme Precipitation: May 2023

Anastasia Tomanek[1, 2], Craig Schwartz[3]

1. University Corporation for Atmospheric Research, Boulder, CO | 2. University of Wisconsin-Madison, Madison, WI | 3. U.S. National Science Foundation National Center for Atmospheric Research, Boulder, CO

Purpose

- Examine medium-range ensemble forecast quality of 1-hour precipitation accumulation
- Assess time-lagged ensembles
- Identify point of diminishing returns for the contributing number of time-lagged members

Model Data

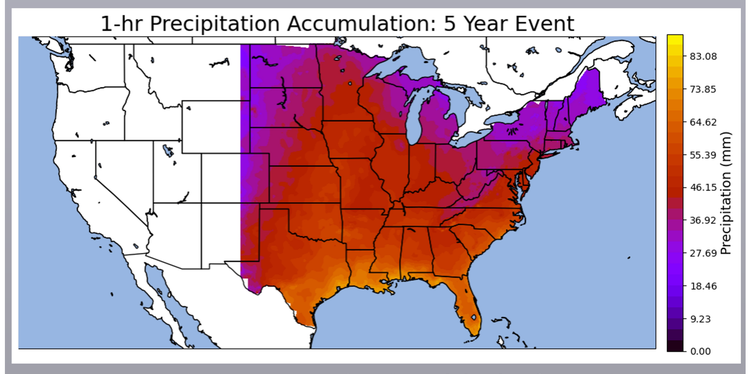
- FV3-based ensemble forecasts
  - 204 forecast hours (8.5 days)
  - 10-member ensemble with initial conditions from GEFS analysis
  - 38 valid forecasts (24 April – 31 May 2023)
  - 3-km horizontal grid spacing

Observational Data

- NCEP Stage IV analyses
  - ~4.8-km horizontal grid spacing

Event Definition

- NOAA ATLAS14 Data
- Average Recurrence Intervals (ARI)
  - ‘N-year event’
  - Average time between precipitation events exceeding specific magnitude and duration

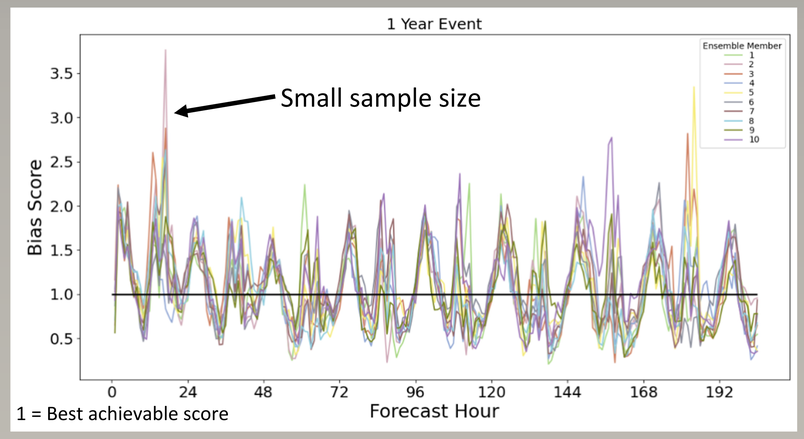


5-year event total 1-hour accumulated precipitation from NOAA ATLAS14 data across the verification region, east of the Rocky Mountain Range.

Time-Lagged Ensembles

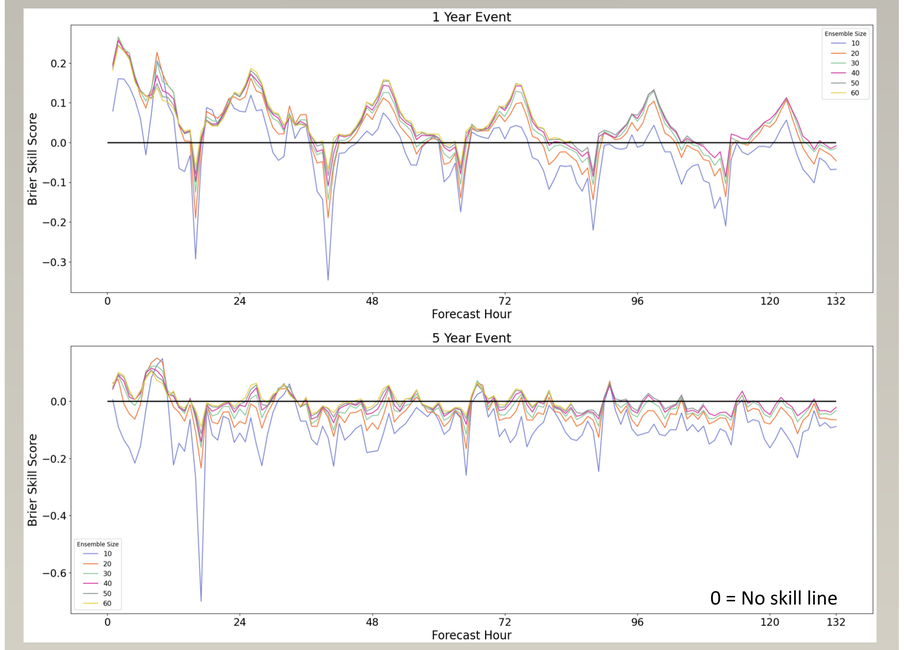
- Forecasts initialized at different times with common valid times
- Available number of time-lagged members determined by aligned forecast hours in the time period of interest

Multiplicative Bias



Multiplicative bias for each ensemble member, obtained by dividing the number of times an event was forecast by the number of observed events.

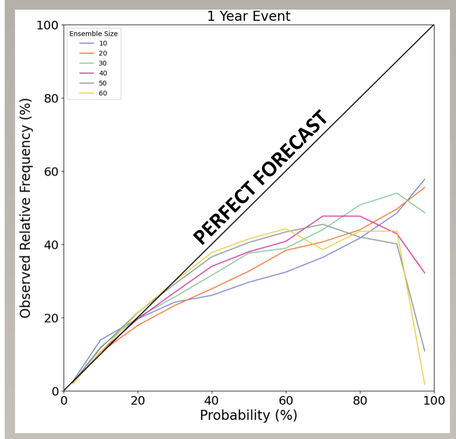
Brier Skill Scores



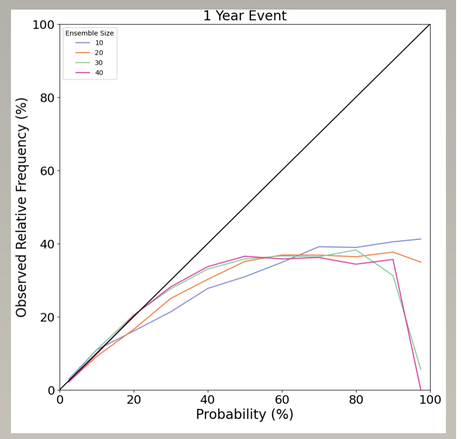
Brier skill scores (BSS) for 1-hour precipitation accumulation using a 200-km neighborhood. BSS measures the skill of probabilistic predictions.

200-km NMEP Reliability Statistics

60–84-h Forecasts



108–132-h Forecasts



Conclusions

- 20–40 member ensembles identified as the point of diminishing returns
- Rare events were forecast more often than observed
- BSSs exhibited minimal skill for 1-yr ARI events and almost no skill for 5-yr ARI events

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NOAA Award #NA22OAR4590533, NSF NCAR Mesoscale and Microscale Meteorology (MMM), NSF UCAR SOARS Leadership, Meghan Stell-Stewart, Russ Schumacher, and Tyler Moore.

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