



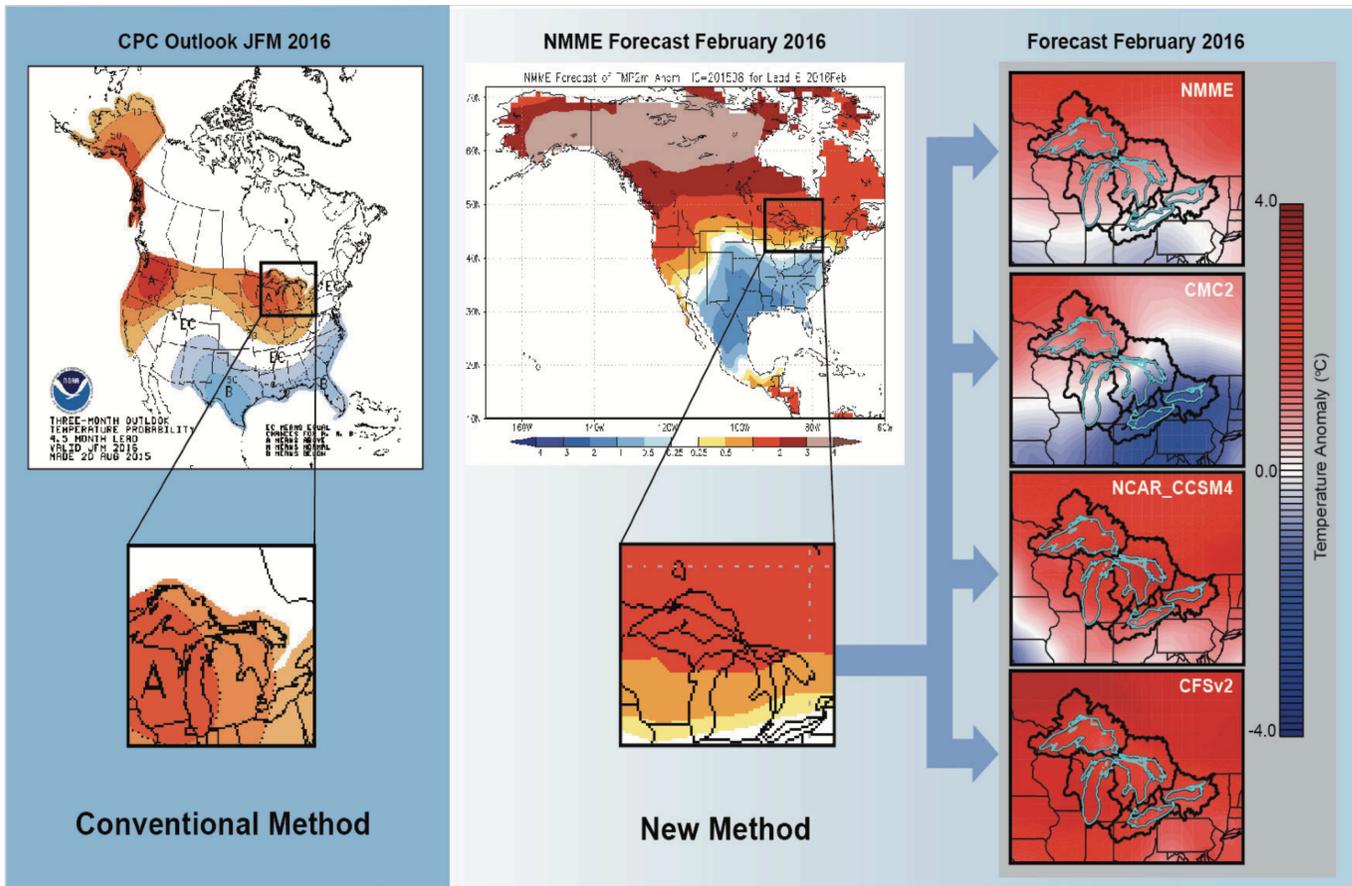
# Improving Great Lakes Seasonal Climate Forecasts



R.A. Bolinger<sup>1,2</sup>, A.D. Gronewold<sup>1,3</sup>, L.M. Fry<sup>4</sup>, and K.W. Kompoltowicz<sup>4</sup>

<sup>1</sup>NOAA Great Lakes Environmental Research Laboratory, <sup>2</sup>University Corporation for Atmospheric Research, <sup>3</sup>Univ. of Michigan, Dept. of Civil and Environmental Engineering, <sup>4</sup>U.S. Army Corps of Engineers, Detroit District

## How Using NMME Can Improve Regional Climate Forecasting Methods

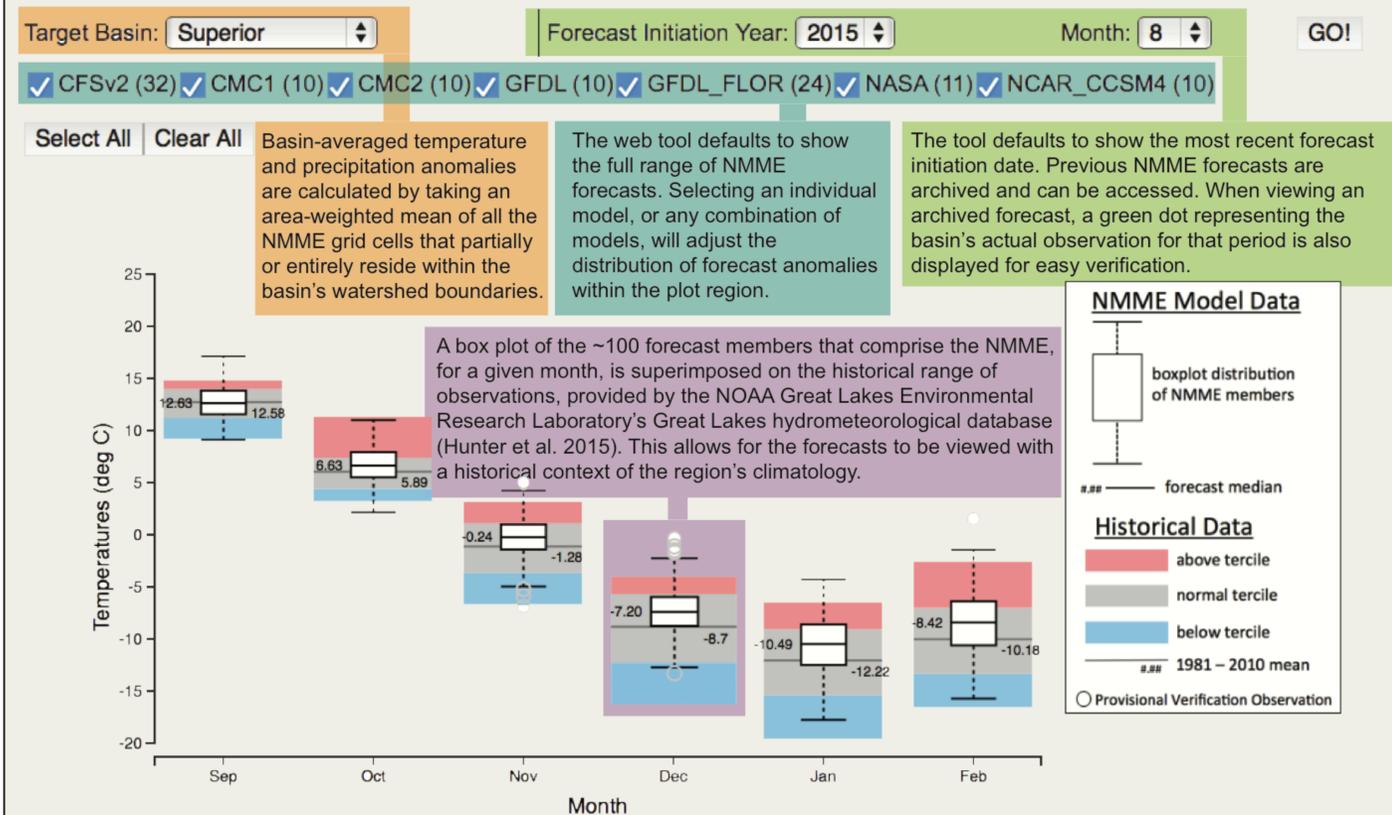


Current forecast procedures at USACE-Detroit are influenced by the seasonal climate outlooks provided by NOAA – CPC (shown as the Conventional Method on the left). One limitation of this method is that the outlook does not cross international borders, thus the part of the Great Lakes basin that extends into Canada, does not have a forecast.

A schematic depiction of the flow of information, when utilizing NMME within a regional context (shown as the New Method on the right), signifies a more complete representation of climate information for the entire Great Lakes region. In addition, the display of individual members of the NMME on the far right (an early fall forecast made for this coming winter) communicates the variability and uncertainty across the different models, in spite of the strong El Niño, which represents a prominent driving force in climate modeling. The new method gives a more comprehensive depiction on how climate signals may impact a region and is critical for decision-making and risk-based planning.

## Introducing a Web-based Seasonal Climate Forecasting Tool for the Great Lakes

### Great Lakes Seasonal Climate Forecast Tool (Version 2)



The region-specific seasonal climate forecast tool automatically updates every month and can be viewed at this website.

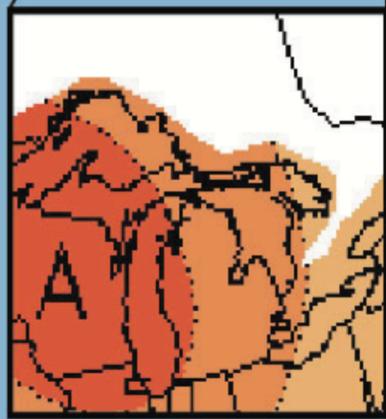
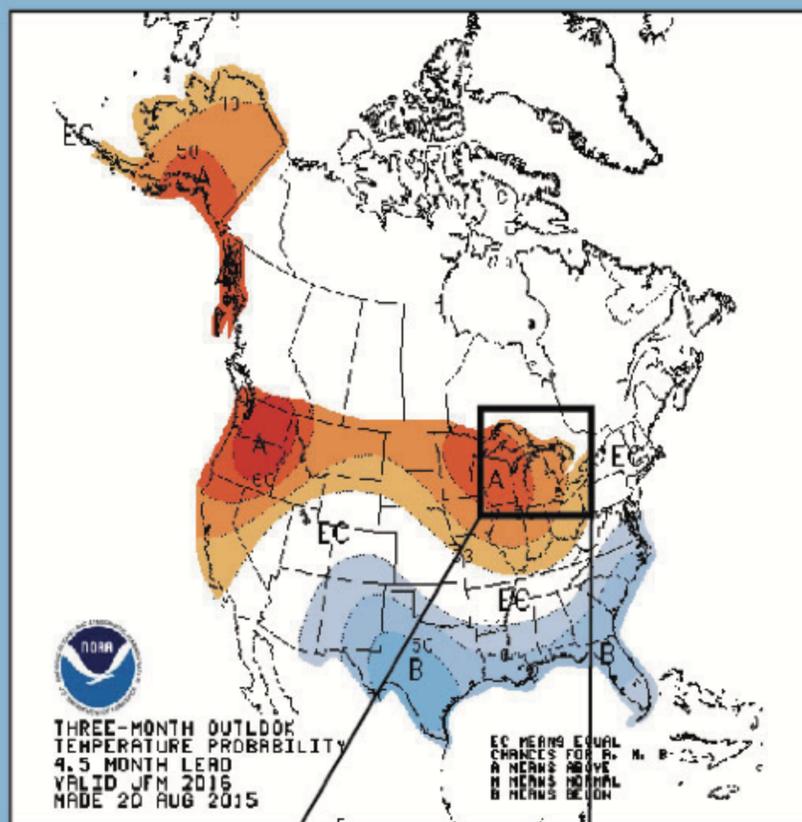
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## Discussion

1. Use of the NMME represents a step forward in seasonal climate forecasting, in part because its forecasts don't follow the restrictive framework of the NOAA – CPC climate outlooks.
2. This project is one of the first of its kind to integrate the NMME into an operational region-specific seasonal climate forecast tool.
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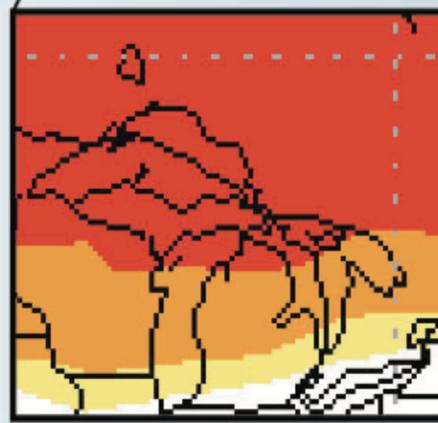
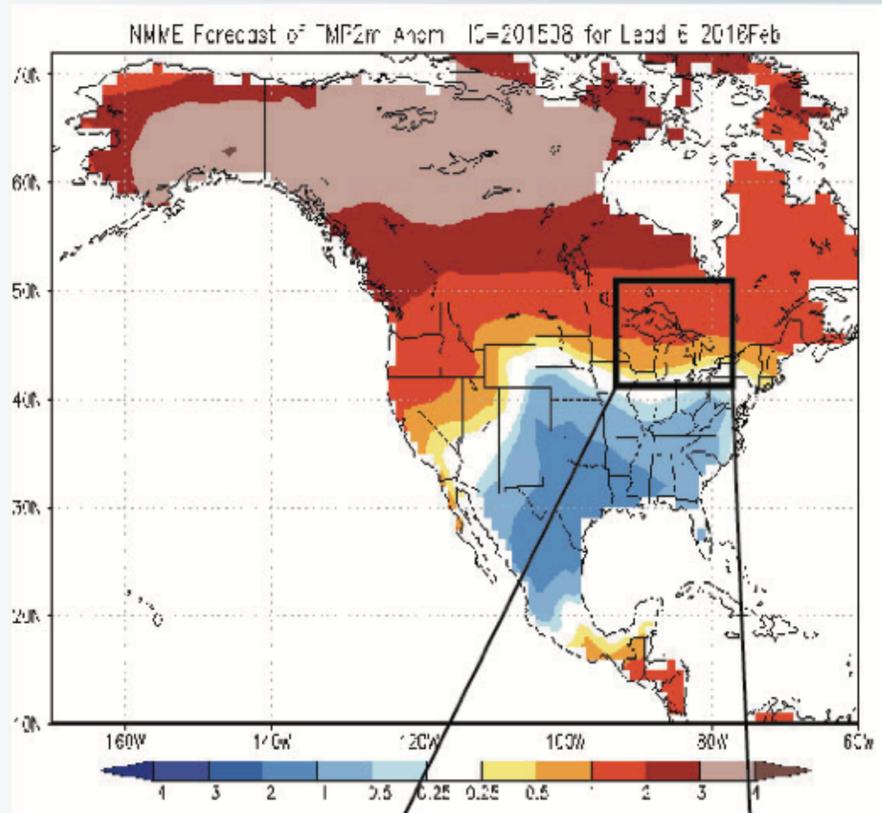
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CPC Outlook JFM 2016



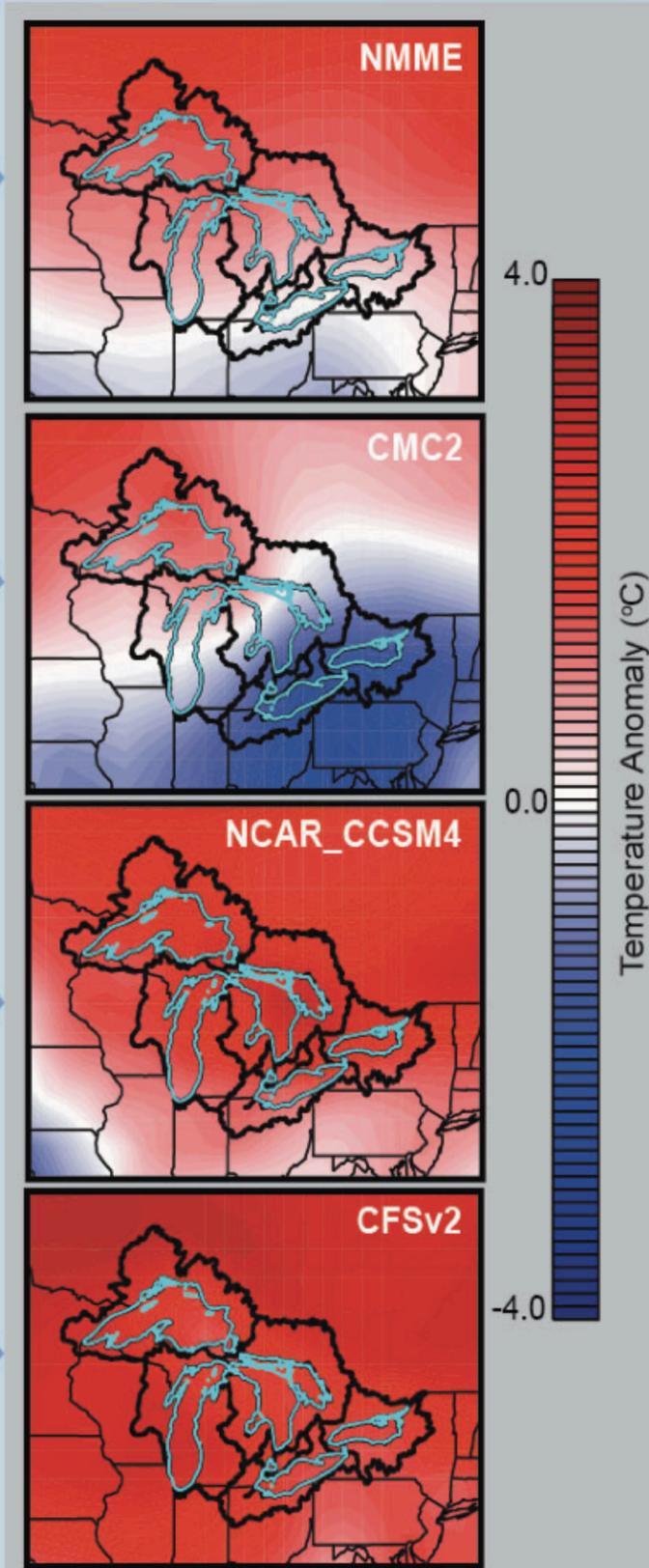
Conventional Method

NMME Forecast February 2016



New Method

Forecast February 2016





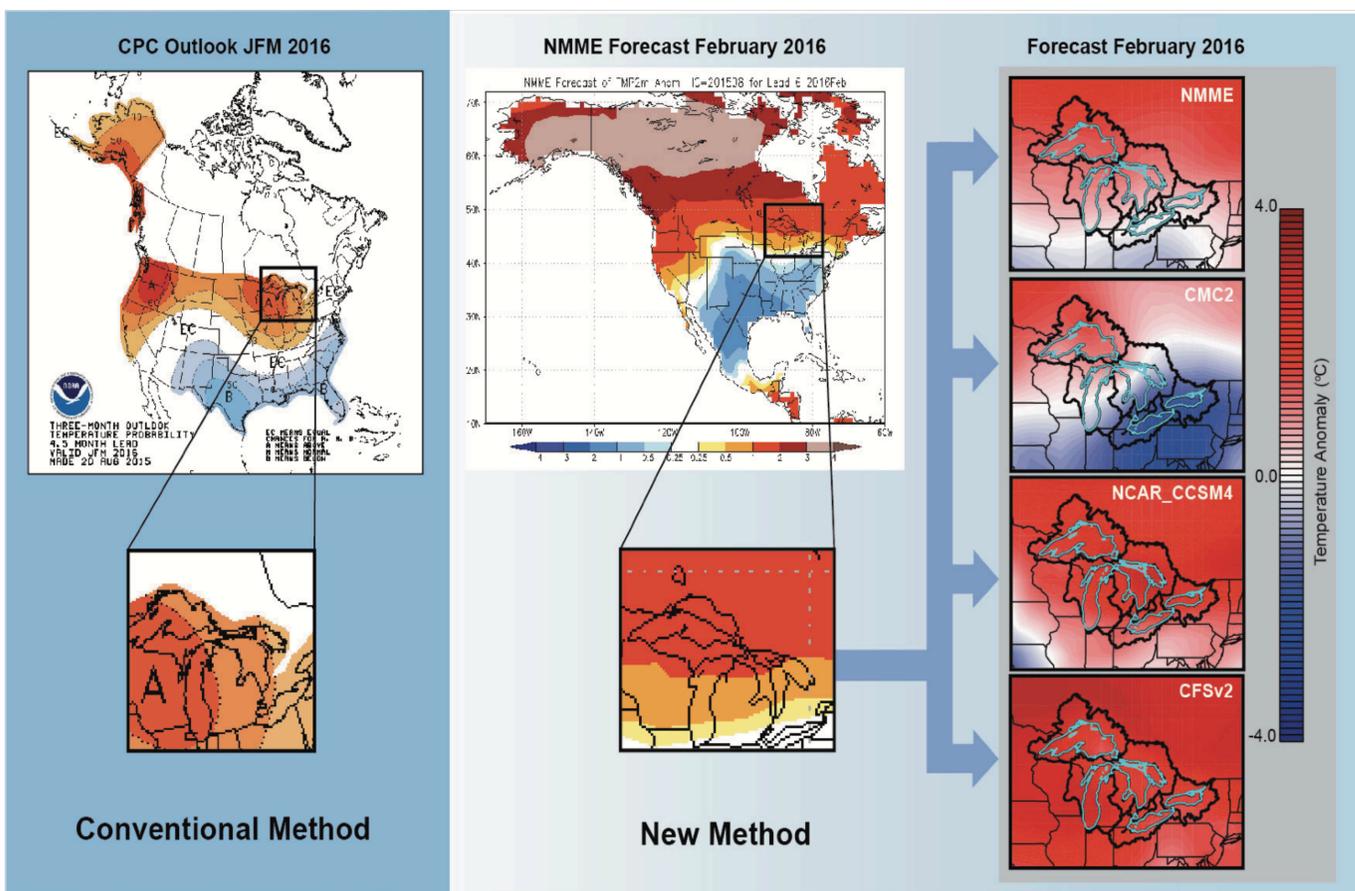
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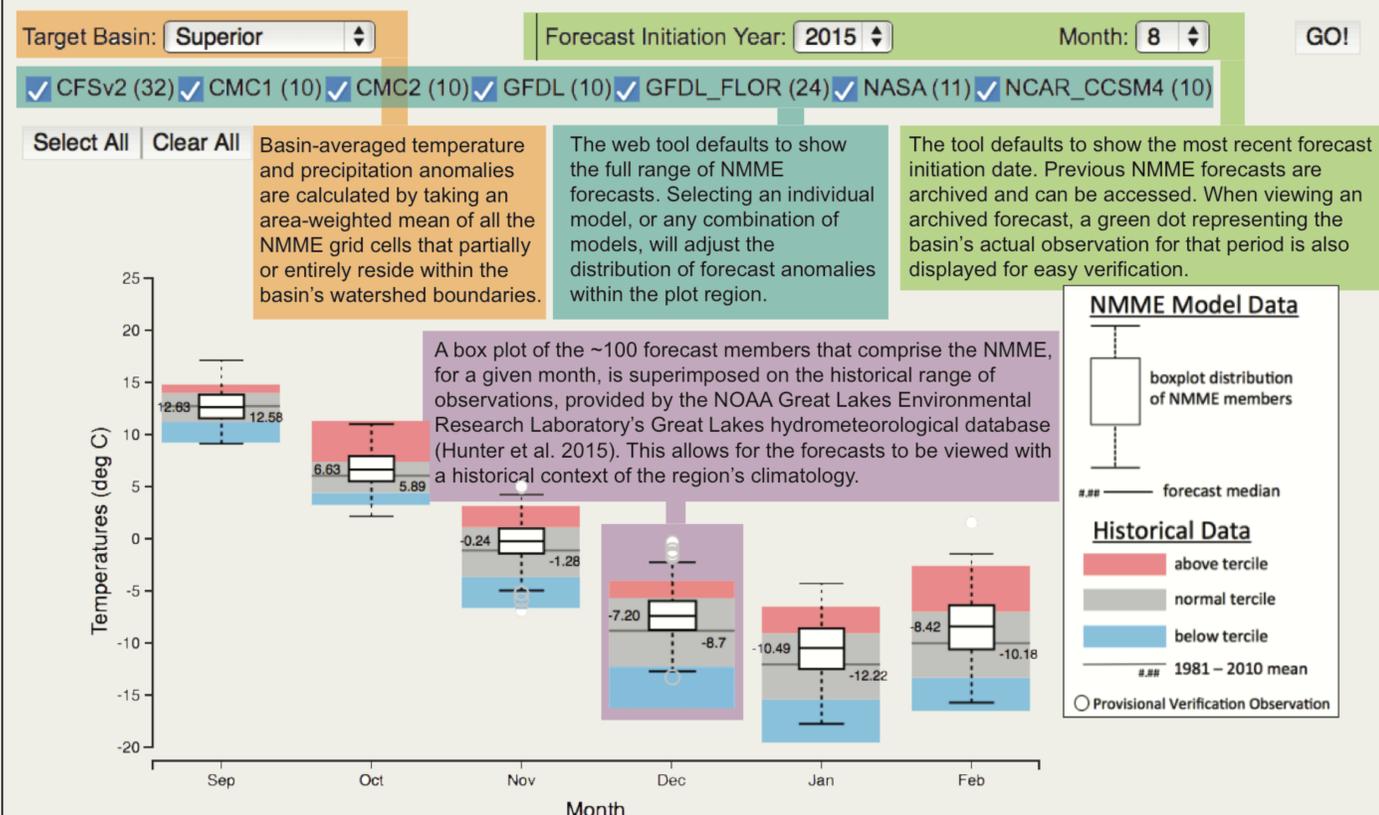


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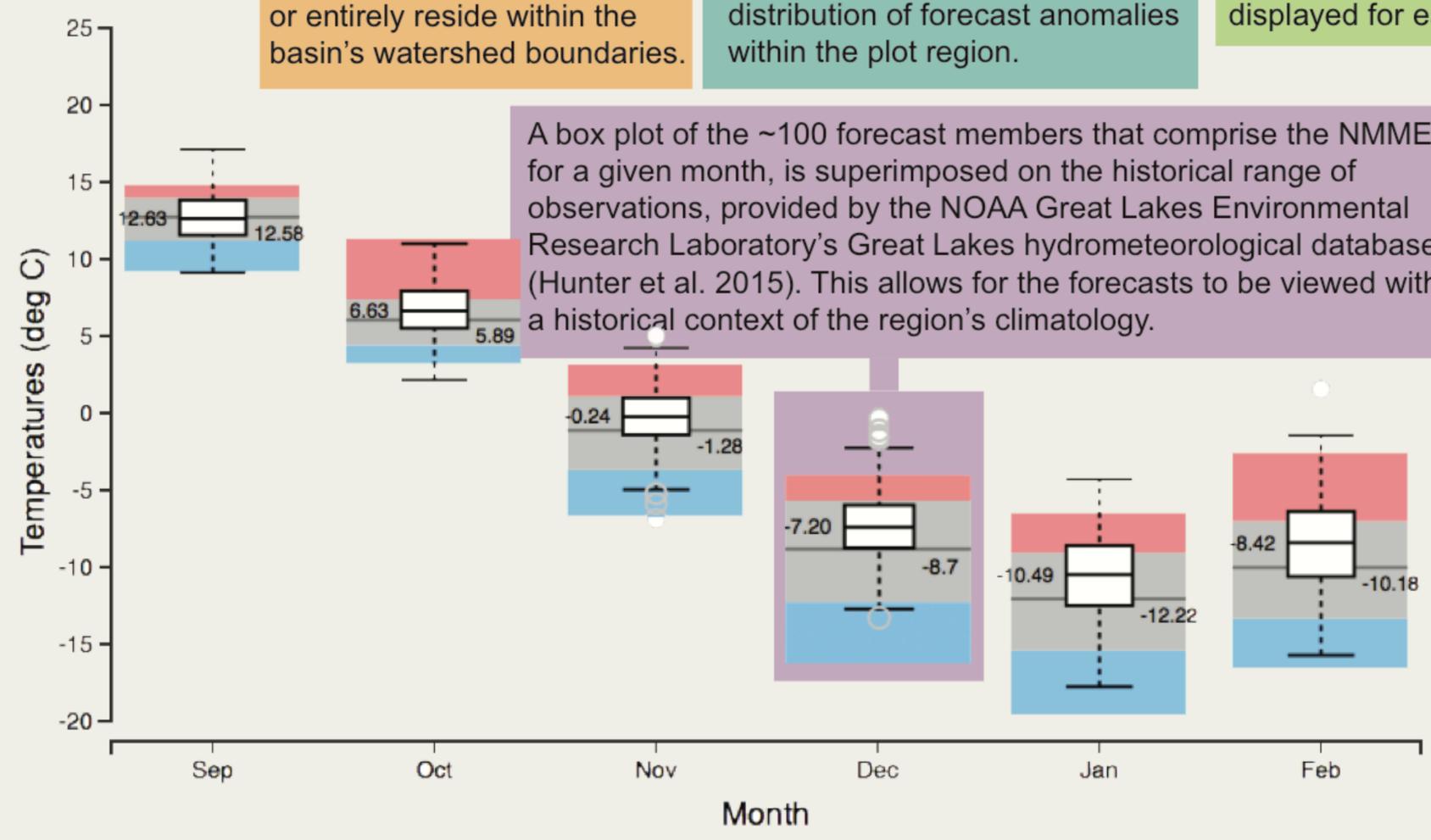
Target Basin:  Forecast Initiation Year:  Month:

- CFSv2 (32)
  CMC1 (10)
  CMC2 (10)
  GFDL (10)
  GFDL\_FLOR (24)
  NASA (11)
  NCAR\_CCISM4 (10)

Basin-averaged temperature and precipitation anomalies are calculated by taking an area-weighted mean of all the NMME grid cells that partially or entirely reside within the basin's watershed boundaries.

The web tool defaults to show the full range of NMME forecasts. Selecting an individual model, or any combination of models, will adjust the distribution of forecast anomalies within the plot region.

The tool defaults to show the most recent forecast initiation date. Previous NMME forecasts are archived and can be accessed. When viewing an archived forecast, a green dot representing the basin's actual observation for that period is also displayed for easy verification.



A box plot of the ~100 forecast members that comprise the NMME, for a given month, is superimposed on the historical range of observations, provided by the NOAA Great Lakes Environmental Research Laboratory's Great Lakes hydrometeorological database (Hunter et al. 2015). This allows for the forecasts to be viewed with a historical context of the region's climatology.

**NMME Model Data**

boxplot distribution of NMME members

### forecast median

**Historical Data**

- above tercile
- normal tercile
- below tercile
- ### 1981 - 2010 mean
- Provisional Verification Observation

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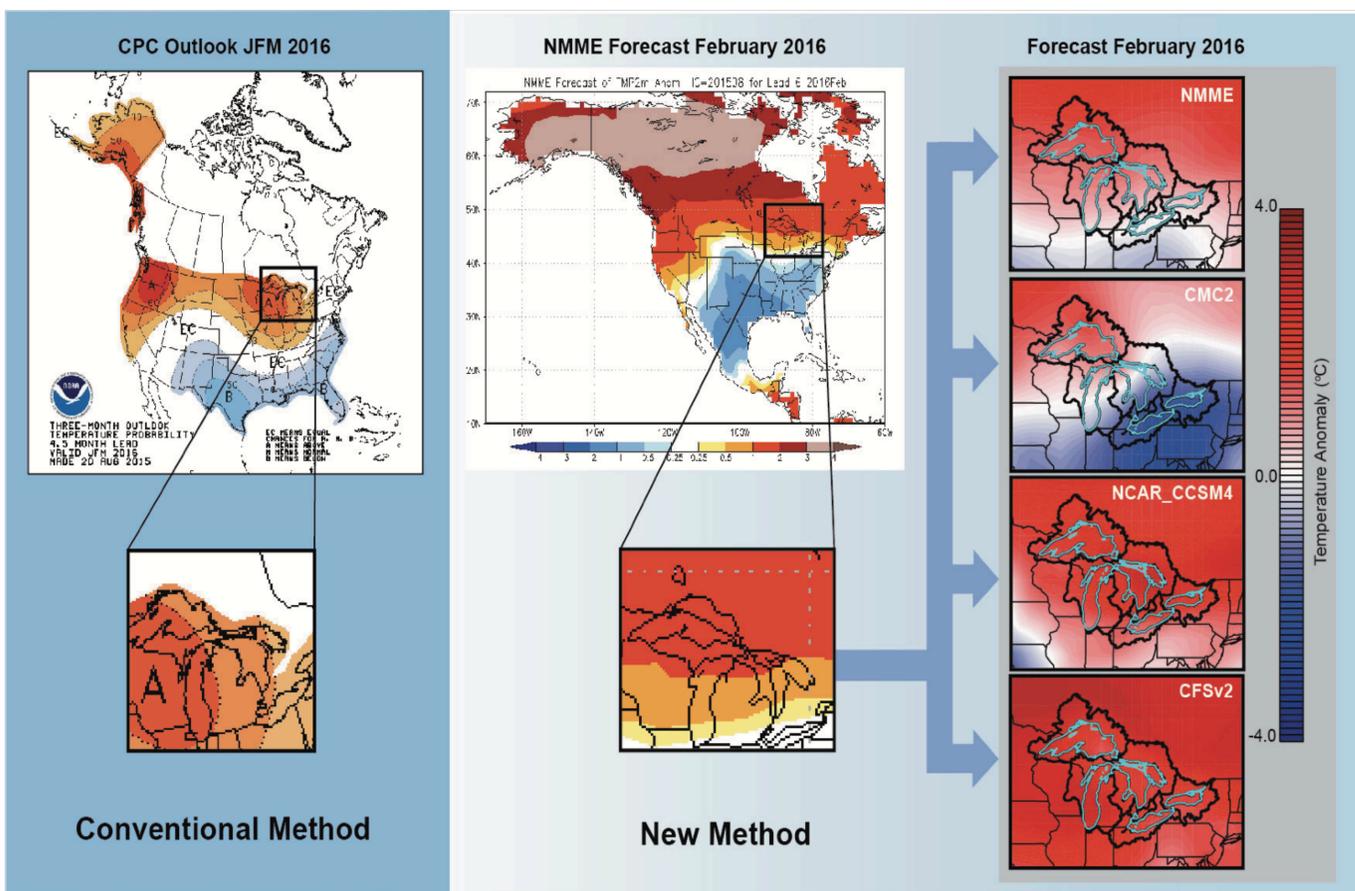
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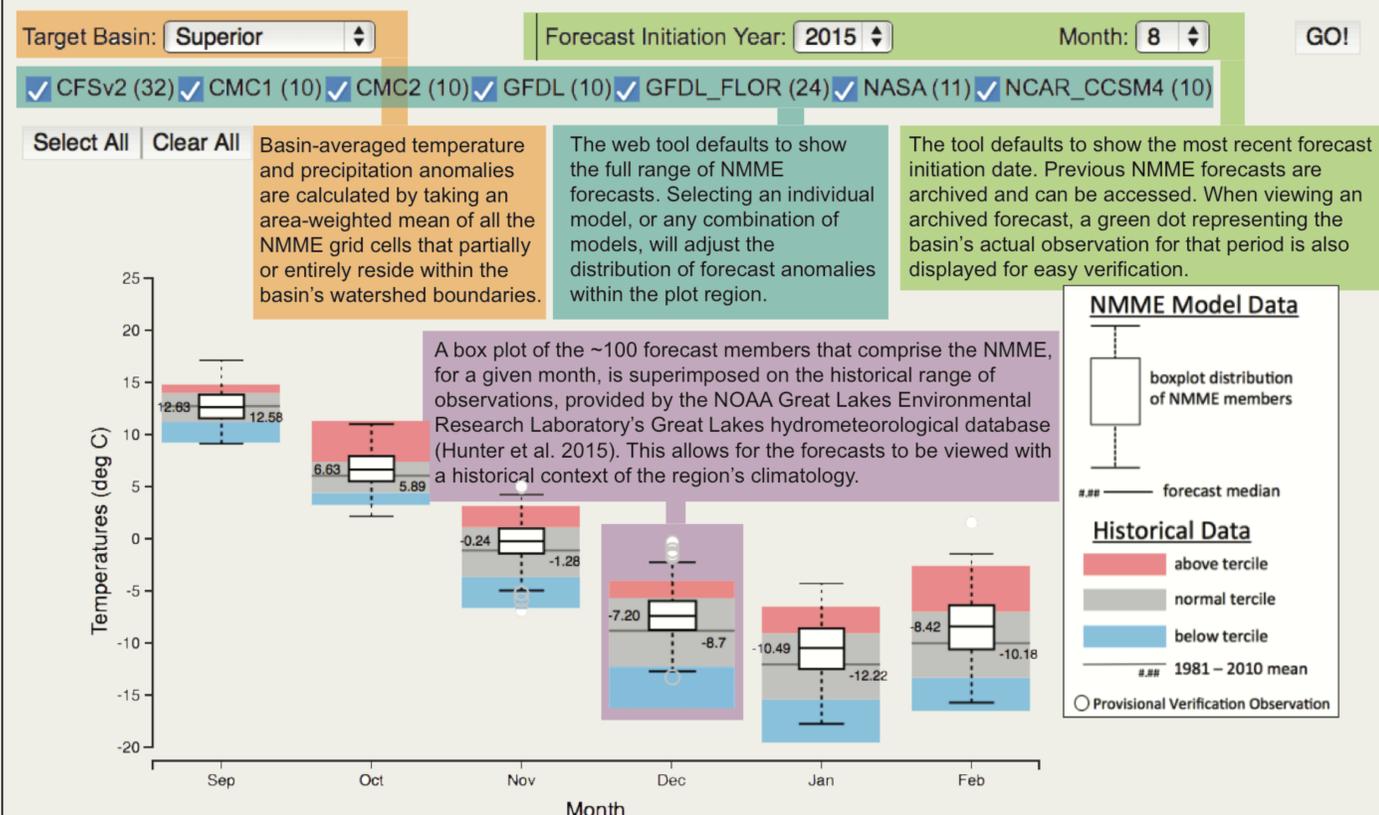


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