Using NMME in Region-Specific Operational Seasonal Climate Forecasts

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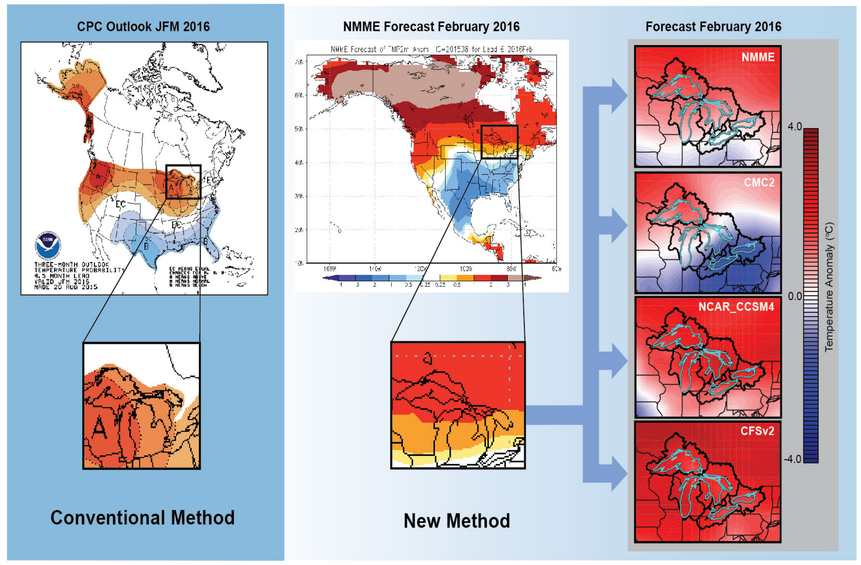
Introduction

Recent regional climate extremes, including the ongoing drought in California (Seager et al. 2015) and extreme cold outbreaks across the northeast United States (Clites et al. 2014), have directed national attention to the importance of understanding and anticipating climate variability (Herring et al. 2014). Decision-making processes adopted by various sectors require reliable climate prediction resources to better anticipate, adapt to, and respond to changes and extremes in climate (Kerr 2011).

The National Oceanic and Atmospheric Administration's Climate Prediction Center (NOAA – CPC) has been the leader in providing seasonal climate outlooks for the U.S. (O'Lenic et al. 2008). A recent multi-agency effort to provide an operational ensemble of global climate model predictions, known as the North American Multi-Model Ensemble (NMME, Kirtman et al. 2014), has the potential to fill some gaps in regional seasonal climate forecasting. The NMME is still very much in a research and testing phase, with limited examples of regional applications. For many regions of the country, the NMME has not been employed by regional decision makers.

Here, we leverage the NMME to advance current regional climate forecasting methods with the development of a region-specific seasonal climate forecast tool over the North American Great Lakes region. We present the application of the regional forecast tool specifically for use by the U.S. Army Corps of Engineers, Detroit District (USACE-Detroit), a regional agency responsible for the operational production and release of seasonal water level projections.

Transition to a New NMME-based Regional Climate Tool

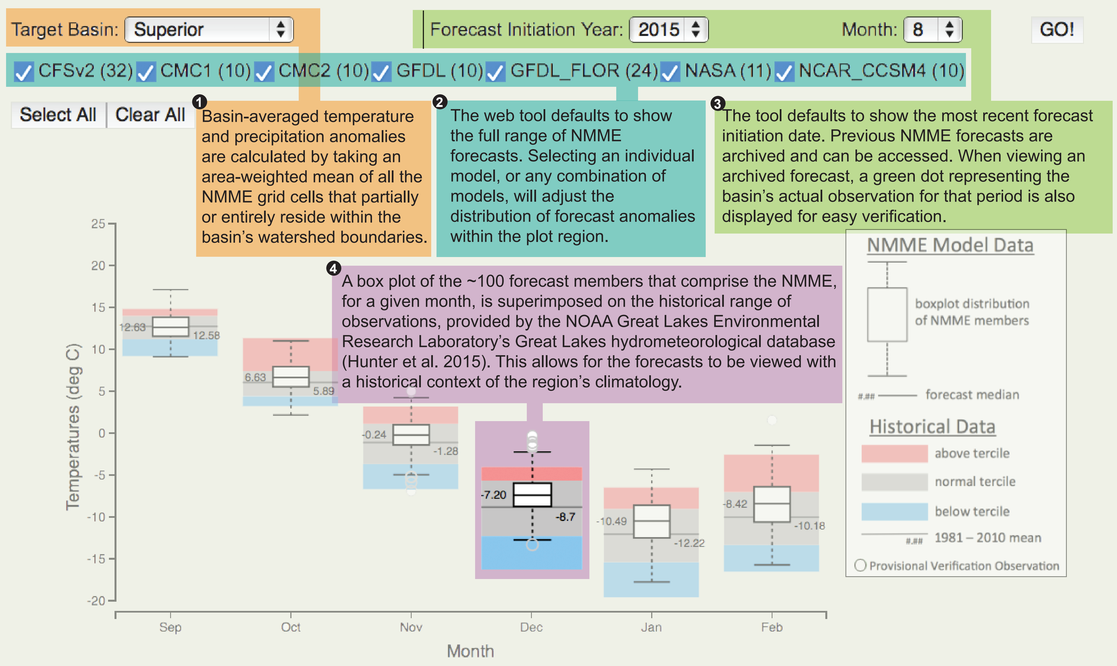


Current forecast procedures at USACE-Detroit are influenced by the seasonal climate outlooks provided by NOAA – CPC (shown as the Conventional Method on the left). One limitation of this method is that the outlook does not cross international borders, thus the part of the Great Lakes basin that extends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

Features of New Web-based Tool

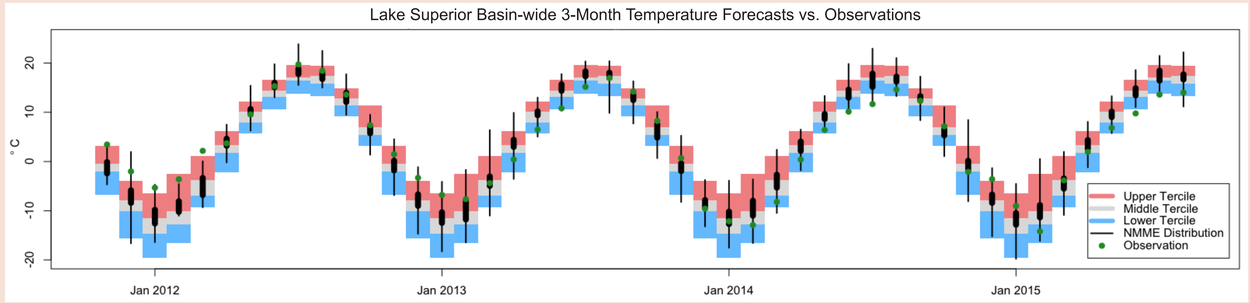
Great Lakes Seasonal Climate Forecast Tool (Version 2)



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

http://www.glerl.noaa.gov/data/now/wlevels/tpForecasts/testbed/

Skill Assessment



Distribution of archived three-month NMME temperature forecasts (black line, middle tercile in thick black) and verification observations (green dot) overlaid on historical observation range. Historical climatology range captures the observed temperature value 76% of the time. The NMME forecast range captures the observations 83% of the time, showing the NMME has improved predictability of capturing climate extremes when compared to climatology. This is important to note, because forecast protocols employed by USACE-Detroit depend upon NOAA – CPC outlooks, which are always constrained by a 30-year climatology.

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.
3. This tool has already been incorporated into USACE-Detroit's operational forecasting procedures and has proven beneficial in providing more detailed climate information for Great Lakes water level forecasts.

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