

2. Abstract

The North American Multi-Model Ensemble (NMME) forecasting project has been continuously producing seasonal forecasts since August 2011. Forecasts from the NMME, which brings together all the major U.S. climate forecasting institutions, as well as Environment Canada, have been extensively accessed by users in the broader community, and contribute to NOAA official climate forecasts. Currently, NMME forecasts are issued in a deterministic format, with experimental probabilistic forecasts. The proposed project will improve the NMME probabilistic forecasts through addressing systematic biases, allowing for more precise calibration of the forecast anomalies and probabilities. The final product of this project is expected to have greater reliability and accuracy, with the result of higher-quality NMME monthly and seasonal probability forecasts issued each month.

Improvements to the probabilistic forecasts will come from spatial calibrations and local probability anomaly calibrations. Spatial biases, i.e. errors in the positions of the patterns of the positive and negative anomalies being forecast, will be treated using a multivariate statistical method developed using the model's hindcasts, prior to the local calibrations, making possible more skillful forecasts. Probability anomalies – the departure from climatological probabilities – may be too large for the skill that the forecasts possess. The probability anomalies will be tuned using a damping factor derived from the probability anomaly correlation. This calibration of the probability anomalies will be applied to both the individual model probabilities and to the overall NMME forecast probability.

The spatial and local calibrations will be applied individually and in combination, and the resulting probabilistic forecasts will be verified against observations for cross-validated skill using the Brier skill score and RPSS. While it is anticipated that the full set of calibrations will result in the most skillful forecast, this will be tested and quantified empirically.

The proposed project targets the Climate Test Bed, Research to Advance NOAA's Operational Systems for Climate Prediction. The project will improve NOAA's operational climate prediction by enhancing the utility and skill of the NMME forecasts. Without an accurate probability forecast, the ability of forecasters to assess confidence and uncertainty in the NMME is limited. This project will perform corrections to systematic biases, calibrate forecast anomalies, assess reliability and probabilistic skill, and transition the experimental probability forecast product into operations.

The proposed project supports the objectives of NOAA's long-term climate goal by improving climate services. More accurate and reliable monthly and seasonal probabilistic climate forecasts are of benefit to the general public because they help alert businesses and individuals to the probabilities of anomalous climate for the immediately forthcoming seasons. Climate anomaly forecasts can result in the protection of life and property due to alertness and timely preparations, and probabilistic forecasts allow for users to react to forecasts within their own risk tolerance levels.