1. Motivation & Goals

- Since April 2017, The International Research Institute for Climate and Society (IRI), update the seasonal temperature and precipitation forecasts based on coupled ocean-atmosphere models from the NOAA’s North American Multi-Model Ensemble Project (NMME) project.
- IRI’s new calibration method is based on an extension of logistic regression (ELR), a nonlinear regression method where probability itself can be considered as the predictand rather than a measurable physical quantity, is an alternative model for the Gaussian approach, which allows deriving of full probability distributions by including the predictand threshold in the regression equation.
- Does this method works improve forecast??

2. Non-Gaussian Calibration: Extended Logistic Regression

- Logistic Regression is a Machine Learning algorithm which is used for the classification problems, it is a predictive analysis algorithm and based on the concept of probability. Unlike linear regression, no need to fulfill assumptions of linearity, normality and homoscedasticity.
- Limitation of Logistic regression: Probabilities of different categories estimated by fitting separate equations for selected predictand quantile thresholds (q), are not constrained to be mutually consistent.
- Extending Logistic regression: Extending LR by including the predictand threshold as an additional predictor (link function g itself function of the quantile q), allows the cumulative probability for a smaller predictand threshold cannot be larger than the probability for a larger threshold (Wilks, 2009).

Implementation

- We fit ELR between each NWME model’s ensemble mean and historical observed data.
- ELR has been applied to obtain calibrated tercile probabilities from each NMME model separately at each grid point; these forecast probabilities are then averaged together with equal weighting to obtain the final multi-model ensemble forecast. Final forecast probabilities are to be smoothed spatially using local kernel-function smoothing.

3. RPSS of ELR vs Ensemble Counting

- ELR removes strong negative skills of Ensemble counting and makes them milder (“climatology”). The areas of positive skill from counting retain in ELR but tend to be slightly weakened.
- The areas of positive skill from Ensemble counting retain in ELR but tend to be weakened, especially in tropics.

4. Temperature forecast: ELR vs Ensemble Counting

- In ELR, the AN probabilities tend to be very mild in tropics compared to counting.

5. Scopes in temperature forecast

- Other option; OLS = “Ordinary Least Square Method.
- First calibrated model with OLS and then convert to probability forecast based on Gaussian assumption.

6. Conclusions

- ELR is a more robust method compared to other calibration methods based on the Gaussian assumption for precipitation.
- This method might not be the best for Temperature forecast, however, temperature forecast has other challenges (trend?).

---

**Does Non-Gaussian Calibration Improve Multi-Model Seasonal Forecasts?**

Nachiketa Acharya1, Michael K Tippett2, Andrew W Robertson1 and Lisa Goddard1

1International Research Institute for Climate and Society, Earth Institute at Columbia University, Palisades, NY, USA

2Department of Applied Physics and Applied Mathematics, Columbia University, New York, New York, USA