Categorical Climate Forecasts through Regularization and Optimal Combination of Multiple GCM Ensembles

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Abstract
Two related issues are addressed in this paper. First, we develop a method to assess the information content of a categorical, probabilistic forecast of a specific variable, derived from a Global Circulation Model (GCM) ensemble. A Bayesian approach is used to combine a prior forecast (climatological probabilities of each category) with the sequence of historical GCM probabilistic forecasts to develop a sequence of posterior, or regularized categorical probabilities. The likelihood ratio of the posterior categorical probabilities to a climatology forecast is used as a measure of the information content of a candidate model. The weight given (or equivalent sample size ascribed) to a GCM forecast serves as another indicator of its information content. This weight is selected through the maximization of a posterior likelihood function estimated using the sequence of observed categorical outcomes. The skills of different models can be assessed in terms of their likelihood ratio. This procedure is then extended to the optimal combination of forecasts from multiple models (GCM as well as statistical ense0b3e f6recasts). An application of the method is presented for gridded precipitation and temperature forecasts for different seasons for the entire globe, using over 40 years of observational and model simulation data.