From Ensemble Forecasts to Predictive Distribution Functions

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Abstract

The translation of an ensemble of model runs into a probability distribution is a common task in model based prediction. Common methods for such ensemble interpretations proceed as if verification and ensemble were draws from the same underlying distribution, an assumption not viable for most, if any, real–world ensembles. An alternative is to consider an ensemble as merely a source of information rather than possible scenarios of reality. This approach, which looks for maps between ensembles and probabilistic distributions, is investigated and extended. Common methods are revisited, and an improvement to standard kernel dressing, called "affine kernel dressing" (AKD), is introduced. AKD assumes an affine mapping between ensemble and verification; typically not acting on individual ensemble members but on the entire ensemble as a whole; the parameters of this mapping are determined in parallel with the other dressing parameters, including a weight assigned to the unconditioned (climatological) distribution. These amendments to standard kernel dressing, albeit simple, can improve performance significantly and are shown to be appropriate for both over– and under–dispersive ensembles, unlike standard kernel dressing which exacerbates over–dispersion. Studies are presented using operational numerical weather predictions for two locations and data from the Lorenz63 system, demonstrating both effectiveness given operational constraints and statistical significance given a large sample.