Guidance Information or Probability Forecast: Where do Ensembles Aim?

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Abstract

It is widely held that ensembles of simulations can provide a probability distribution of quantities of interest useful in decision support. This claim is challenged. It is suggested that while an ensemble of simulations provides information regarding the future, it is neither designed to nor best interpreted as providing a probability distributions reflecting future weather per se. The seductive image of the output of an ensemble prediction system as a probability forecast, used to update a prior probability distribution (either from climatology or from yesterday's probability forecast) is inconsistent with actual practice, and arguably with the highest scoring probability forecasts. In practice, alternative procedures are applied, procedures believed to yield both more skill and more value to the probabilistic forecast eventually produced. The ability of ensemble interpretations schemes to capture the information in the ensemble of simulations (contrasting Bayesian Model Averaging with kernel dressing) is explored, and sensible ways to use the ensemble forecast (probability updating vs blending) are contrasted. Each point holds implications for ensemble formation and resource allocation between observations, data assimilation and model complexity. The role of "sharpness" when we do not have "calibration" is clarified, and the question of whether or not post-processing ensemble prediction systems can ever yield sustainable odds (probabilities which could rationally be used as probabilities) is shown to impact the interpretation of ensemble systems. Although focused on weather-like scenarios, where one has a large forecast-outcome archive and the model-lifetime is long compared to the forecast lead-time, these ideas also cast some light on the controversies regarding climate-like scenarios which do not have these properties. In particular, shortcoming in some of the criticisms of climate forecasts made by statisticians become clear when the aim and information content of ensembles is clarified. The recognition that the best available initial condition was less useful than an ensemble of good initial conditions changed the nature of weather forecasting from point forecasting to probability forecasting. How might the nature of forecasting shift if model-based probability forecasts are recognised as a target we do not possess and arguably can never obtain.