Never expect the expectation: on the misapplication, and ultimately limited precision, of probability forecasts

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Abstract

Probability forecasts abound, in weather, sports, anticipative disaster risk reduction and the IPCC. Uncertainty Quantification (UQ) now has its own SIAM journal. But UQ is often restricted to model-land, and uncertainty guidance for real world decision making is rarely available. The probability of an outcome conditioned on having a perfect model is an expensive but achievable aim. It is also irrelevant to decision support without quantitative acknowledgement of the impact of the fact that the model used is imperfect. The $P(x|$ FALSE) can still have value, as long as the details of FALSE are considered, or it may not.

The evaluation of weather-like probabilistic forecasting will be discussed both in terms of the mathematical properties of various skill scores and in terms of valuing those scores in practice for the insurance sector. Applications of Anticipatory Disaster Risk Reduction will also be noted, in particular using the (single case) success of the START-CATS joint work saving lives in the Pakistan heatwave earlier in 2018. Uncertainty Guidance aims to clarify when the best available forecast is adequate for a particular application, and take it off the table when it is not. The value to decision makers of taking the best available model-based forecast off the table is documented; uncertainty guidance provides an indication of when to do this, and how to use imperfect probability forecasts when we have evidence that they are informative.

Berger and Smith (2019) "On the Statistical Formalism of Uncertainty Quantification", Annual Reviews of Statistics (in press)

Smith et al (2018) EPSIS White Paper I

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