



Methods for the inclusion of parameter uncertainty in weather and climate forecasts

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Numerical model based weather, seasonal and climate forecasts are all influenced by parameter uncertainty, whether in the numerical model itself or in the statistical downscaling. Fortunately, Bayesian statistics provides a mathematical framework for dealing with parameter uncertainty, although there are pitfalls waiting for the unwary which can lead to nonsensical probabilities. We describe the "Objective Bayesian" and "Subjective Bayesian" paradigms for dealing with parameter uncertainty, and their pros and cons.

We describe how the objective paradigm has been applied in simple statistical predictions of future climate and estimates of climate sensitivity (leading to lower estimates of climate sensitivity than in many previous studies, for good statistical reasons) and give an overview of our own work which attempts to work out how it could be applied in more complex numerical model predictions. We also explain why we don't think the subjective paradigm, which involves the inclusion of subjective judgment of parameter ranges, is relevant to public weather and climate prediction. Finally we briefly mention studies that have been caught in some of the pitfalls, rendering their probabilistic predictions more or less meaningless, including parts of the IPCC report and several of the papers cited therein. We explain how those studies could be corrected so that they do produce sensible (reliable) probabilities.