Queuing the Wrong U?

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Just as there are many different types of uncertainty, there are many different types of models. The best technique for quantifying and communicating uncertainty will depend on the nature of that uncertainty: is it mere imprecision in a well-defined number (as with the square-root of two), intractability (as when we know how to compute the answer, but have not yet been able to carry out the calculation), indeterminacy (as when there is no well-defined target about which to be imprecise) or other. The relevance of UQ to a decision maker or scientist will also depend on the type of quantitative model that is considered: is the model intended to explain, or to forecast, or to provide a quantitative analysis of the past? When a perfect model is available, many of these distinctions collapse. In practice, attempting to quantify one type of uncertainty via a model which may not even display that kind of uncertainty is a nonsense. One must be careful not to confuse the diversity of our models for the uncertainty in our future. Or a well-defined probability forecast for what the next model simulation will report, with a probability forecast for the world. How is UQ to recognize the line between sensitivity analysis and probability forecasting? These questions will be addressed in the context of climate science, and more broadly that of science in support of decision making. The ways and means of UQ are shown to vary with type of model considered, the extent to which that model class is deemed adequate for purpose in a specific application, and whether or not the relevant dominant uncertainty (known from the science, but perhaps absent from the models) has been considered. Uncertainty Quantification may prove to be a very wide field, extending well beyond the bounds of the probability calculus.