Supporting Information

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SI Text

Glossary

This glossary contains definitions of new and uncommon terms, including references that document the definitions when available.

Aleatory Variability. Intrinsic randomness of the system (1). In the uncertainty hierarchy, it is the event frequency defined by the experimental concept.

Bayesian Model Checking. The part of Bayesian data analysis concerned with the fit of the model to the data and our substantive knowledge (2).

Epistemic Uncertainty. The lack of knowledge about a system (1). In the uncertainty hierarchy, it is the modeling uncertainty in the event frequency, where the latter is defined by the experimental concept.

Exceedance Probability. A value of the survival function. In probabilistic seismic hazard analysis, the probability that the ground shaking will be larger than some intensity value at a particular geographic site over a time interval of interest (3).

Exchangeability. A property that the joint probability distribution of a data set is invariant with respect to permutations in the data ordering (4).

Experimental Concept. The specification of collections of data, observed and not yet observed, that are judged to be exchangeable when conditioned on a set of explanatory variables. The experimental concept defines the uncertainty hierarchy.

Experts' Distribution. A discrete set of estimates of the event frequency defined by the experimental concept and the relative plausibilities of those estimates, based in part on expert (subjective) assessment.

Extended Experts' Distribution. The continuous probability distribution sampled by the discrete experts' distribution, used to set up the ontological hypothesis.

Forecasting Model Validation. The procedure by which we decide that a model forecasts the data-generating process well enough to be sufficiently reliable for some useful purpose.

Ontological Error. An error in a model's quantification of the aleatory variability and epistemic uncertainty, as defined by the experimental concept.

Ontological Hypothesis. A statistical null hypothesis that the event frequency defined by the experimental concept is a sample from the extended experts' distribution. The rejection of the ontological hypothesis exposes an ontological error.

Posterior Predictive Model Checking. Bayesian model checking that tests the posterior model distribution against the data (2).

Prior Predictive Model Checking. Bayesian model checking that tests the prior model distribution against the data (2).

Severe Test. Statistical test that, if the null hypothesis is false, has a high probability of yielding a bad fit to the data and a low probability of yielding a good fit (5).

Uncertainty Hierarchy. Levels of uncertainty, from aleatory variability to epistemic uncertainty to ontologic error, defined by the experimental concept.

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