Gauging limitations of imperfect model prediction with sculpted ensembles (GLIMPSE)

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Abstract

Many processes in nature, such as the Earth's atmosphere, are believed to be chaotic, that is they show sensitive dependence to initial condition error. Since, in practice, observations of natural variables and phenomena will almost certainly be obscured by measurement error, a single point forecast will always, in time, diverge from the Truth. Ensemble methods, in which multiple model simulations are run with slightly differing conditions, have therefore been developed. Occasionally, one or more ensemble members will feature some extreme event, such as, in weather forecasting, a large storm, a heat wave or a flood. Whilst it is useful to predict the likelihood of such an event, it is also of interest to determine how it may pan out. For example, if a model simulation were to show a hurricane reaching the east coast of the USA, we may wish to try and determine its possible intensity or whether any model simulations show it hitting a major city. In theory, there is no limit to the number of model simulations that can be formed and, therefore, any number of different model scenarios can be examined. In practice, the size of the ensemble is usually severely limited by computational constraints. GLIMPSE uses data assimilation to attempt to find model simulations that lie close to one or more in which an event of interest occurs. Such model simulations are more likely to feature the event of interest and can thus give a better insight into how it may pan out. This talk will use dynamical systems to demonstrate GLIMPSE and discuss possible real world applications.

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