CATS CENTRE FOR THE ANALYSIS OF TIME SERIES

Prediction, Predictability, and Insight: from the Lab to the Globe

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Special MEAS/Physics Seminar, NC State University

30 May 2017

Abstract

What does it mean to forecast an imperfectly observed system well? Real physical systems can be difficult, perhaps impossible, to predict, but advances in our understanding of nonlinear dynamical systems suggest novel ways of improving and interpreting the use of forecast systems based on ensemble simulations.

New metrics for evaluating model fidelity will be discussed, as well as the improvement of forecasting by assimilating information regarding the future.

Nonlinearity breaks the traditional connection between accuracy and small errors in a Root-Mean-Square sense; it is more relevant to focus on determining where the information is. That this is so will be discussed in the context of parameter selection, data assimilation, and forecast system evaluation. Forecasting laboratory-scale physical systems can clarify, and sometimes resolve longstanding issues in operational "weather" models on scales from days to decades. Further, insights from surrogate (mathematical) forecast systems are argued to be informative in the design of large-scale operational systems.

Chaos is a tractable, if expensive, challenge; model inadequacy (structural model error, without structural stability) appears to be an intractable challenge, calling into question many so-called “Bayesian” tools and even the relevance of the probability calculus.

In short, this talk will provide an introduction to using simulation models to understand and/or predict the future of physical systems; both weather-like tasks (where many forecasts are made and evaluated) and climate-like tasks (as in climate services and nuclear stewardship, where the lead time of the forecast may be longer than the lifetime of the model) will be considered.

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