Model Error in Weather Forecasting

D Orrell, LA Smith, T Palmer & J Barkmeijer

Nonlinear Processes in Geophysics 8: 357-371, 2001

Abstract

Operational forecasting is hampered both by the rapid divergence of nearby initial conditions and by error in the underlying model. Interest in chaos has fuelled much work on the first of these two issues; this paper focuses on the second. A new approach to quantifying state-dependent model error, the local model drift, is derived and deployed both in examples and in operational numerical weather prediction models. A simple law is derived to relate model error to likely shadowing performance (how long the model can stay close to the observations). Imperfect model experiments are used to contrast the performance of truncated models relative to a high resolution run, and the operational model relative to the analysis. In both cases the component of forecast error due to state-dependent model error tends to grow as the square-root of forecast time, and provides a major source of error out to three days. These initial results suggest that model error plays a major role and calls for further research in quantifying both the local model drift and expected shadowing times.