

Extracting maximum value from input observations in weather forecasting models

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Summary

Effective and timely use of observational data is vital for forecasting any environmental system, and particularly so for weather forecasting because of the chaotic nature of the atmosphere. Research undertaken within the Mathematics and Statistics Department at the University of Reading has led to better treatment of particular types of observational data in numerical weather prediction, resulting in significant improvements in operational analysis and forecast skill.

Background

The effective use of observational data in numerical weather prediction depends upon a good description of the uncertainty in the observations. For ease of computation it had been assumed that errors in observations were independent and uncorrelated, although it was recognised that this assumption was becoming unrealistic.

How is University of Reading research contributing?

Research at Reading showed that incorporating observational error correlations in data assimilation for numerical weather prediction was both computationally feasible and beneficial in terms of information content. A new approach developed at Reading used statistical diagnostic tools to demonstrate that significant error correlations were present in satellite data used for data assimilation at the UK's national weather forecasting agency, the Met Office. These techniques were subsequently taken up by the European Centre for Medium Range Weather Forecasts (ECMWF), who confirmed the significance of these results for data assimilation.

What impact has our research had?

The results establish that incorporation of observational error correlations in operational forecasting systems leads to better analyses and improved forecast skill. As a result, the Met Office plans to include approximate covariance matrices into their operational numerical weather prediction systems in the immediate future. Other centres, such as ECMWF and the US Naval Research Laboratory, are also planning to include these techniques into their forecasting models. The adoption of these methods leads directly to better use of expensively acquired earth observational data and to improved weather prediction techniques, with widespread benefits to users of forecasts such as civil aviation, energy providers, insurance companies, food suppliers and hazard response groups, as well as the general public.



“Through the PhD work undertaken ... methods were developed for the representation of correlated error in the assimilation of satellite radiance spectra in NWP. This work was followed up at the Met Office ... leading to operational improvements in our operational use of these data.”

Dr John Eyre

Met Office Fellow, Satellite Applications



Find out more...

- Department of Mathematics and Statistics, University of Reading, UK
- www.reading.ac.uk/maths-and-stats