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Lessons learnt by applying an EnOI system to a gridded observational product

Ensemble Optimal Interpolation (EnOI) is used by several groups for ocean forecasting and reanalysis. Here, EnOI is applied to a gridded observational product –mapping Argo and satellite data to produce weekly analyses on a global 1/10 degree grid. Starting with a configuration that has long been applied under Bluelink for forecasting and reanalysis, many shortcomings quickly became evident. Analyses included small-scale noise, unresolved by observations. The locations of observations were clearly evident, particularly altimeter tracks, indicating over-fitting. Background and analysis innovations were larger than expected, and grew with time, signally poor constraint. When such analyses are used to initialise a dynamical model, the model seems to "hide"many of these characteristics –and in the resulting daily-mean fields that most practitioners analyse to assess performance, most of the problems are not evident. But in the absence of a model, these features are disturbingly obvious. What was the cause? The ensembles all included noisy anomalies and did not include the necessary scales of interest. The localising length-scales were too short for the observing system, and there was insufficient data to really constrain the resolved scales. The solution was to use a much larger ensemble (˜400 members compared to ˜100), longer localising length-scales (˜1000 km instead of ˜200 km), and damping towards climatology (to make up for insufficient observations). The resulting analysis system seems to out-performs most dynamical forecast systems –both in terms of analysis innovations (i.e., it fits the observations more closely), and persistence forecasting (i.e., a persisted analysis seems to "beat"most dynamical forecasts). Most EnOI-based studies use a modest ensemble size (typically 100 members), poorly considered ensemble generation, and localisation that is too short. Perhaps our EnOI-based systems can do much better, if configured with care.

Which theme does your abstract refer to?

Development and assessment of data assimilation in forecasting applications (global and regional)

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