Data Assimilation: What is the Point?

Leonard Smith

Dynamic Days Europe Conference, Exeter

8 September 2015

Abstract

What defines successful data assimilation? Is the goal to obtain the most accurate analysis, a point in the model state space 'representative' of reality at the instant the forecast cast is launched? Or is the goal to construct an n_{ens} member ensemble, or better still a distribution from which an ensemble of any size can be drawn, which will yield the best probability forecast of future states of the system. Are either of those aims well-defined mathematically, when real-world forecasts are to be made and flaws in the structural formational of the model will exist? How are resources best balanced between accounting for nonlinearities of the model and coping with model inadequacy? Following Teller, it is argued that Perfect Model Model should be rejected at the outset, that the traditional aims of data assimilation are untenable outside the perfect model scenario, and a transparent data assimilation strategy that embraces model inadequacy from the outset is to be preferred, especially by those using the forecast for decision support. Illustrations outside the perfect model scenario are provided to support this argument. Pseudo-orbit Data Assimilation attempts to embrace model inadequacy form the beginning rather than perturbing off 'perfect model' schemes; its strengths and shortcomings are noted (Du, H. and Smith, L.A. (2014) 'Pseudo-orbit data assimilation part II', Journal of the Atmospheric Sciences, 71 (2), 483- 495. ISSN 0022-4928. DOI: 10.1175/JAS-D-13-033.1). This contribution follows the outline of a presentation of the same title given in North Carolina in SAMSI ten years ago. The formulation of the questions has improved significantly in the meantime.