Perturbation of an idealised coupled ocean-atmosphere model using breeding vectors

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Abstract

Breeding vectors (Toth and Kalnay, 1991a, 1993) provide a relatively simple method for generation of perturbation growth that approximates the singular modes of the system, all without the need for a tangent linear model. This method requires a small, random perturbation to initial conditions to generate a response over a typical eddy-growth timescale, and for this response to be normalised to small amplitude and reinserted as a perturbation, then the process is repeated. We calculate breeding vectors for the Quasi-Geostrophic Coupled Model (Q-GCM), configured with a periodic channel atmosphere and an ocean basin with a double-gyre circulation. Both atmosphere and ocean are eddy-resolving. We compare breeding vector perturbations with crude, pointwise perturbations and examine the relative rates of ensemble divergence and the relationship of the evolving perturbations with physical modes of the system.

Toth, Z., and E. Kalnay (1991a), Estimating the growing modes of the atmosphere: The breeding method, *Research highlights of the NMC Development Division: 1990-1991*, 439–443.

Toth, Z., and E. Kalnay (1993), Ensemble Forecasting at NMC: The Generation of Perturbations, *Bull. Am. Meteorol. Soc.*, *74*(12), 2317–2330.

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