Abstract View

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Solution of Nonlinear Finite Difference Ocean Models by Optimization Methods with Sensitivity and Observational Strategy Analysis

Jens Schröter

Max-Planck Institut für Meteorologie, 2000 Hamburg 13, FRG

Carl Wunsch

center for Meteorology and Physical Oceanography, Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA 02139

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ABSTRACT

Dynamical models driven by “observed” forcing fields (e.g., the wind) have a true solution uncertainty owing to observational errors in the driving. This uncertainty is usually hidden from view because conventional numerical methods do not easily calculate it. We explore with finite difference, nonlinear circulation models (one and two layer) the uncertainties in interesting flow properties, such as western boundary current trandport, potential and kinetic energy, owing to the uncertainty in the driving surface boundary condition. The procedure is based upon nonlinear optimization methods. The same calculations permit quantitative study of the importance of new information as a function of type, region of measurement and accuracy, providing a method to study various observing strategies.

Uncertainty in a model parameter, the bottom friction coefficient, is studied in conjunction with uncertain measurements. The model is free to adjust the bottom friction coefficient such that an objective function is minimized while fitting a set of data to within prescribed bounds. The relative importance of the accuracy of the knowledge about the friction coefficient with respect to various kinds of observations is then quantified, and the possible range of the friction coefficients is calculated.

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Headquarters: 45 Beacon Street Boston, MA 02108-3693
DC Office: 1120 G Street, NW, Suite 800 Washington DC, 20005-3826
amsinfo@ametsoc.org Phone: 617-227-2425 Fax: 617-742-8718
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