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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Controllability, not chaos, key criterion for ocean state estimation" *by* Geoffrey Gebbie and Tsung-Lin Hsieh

Anonymous Referee #3

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This paper investigates the key criterion for ocean state estimate, which is commonly called data assimilation (DA) in the oceanography and meteorological communities. There have been a lot of theoretical research and development over the past 30 years, the number of literature is just too many to list. The Lagrange multiplier method is just another way to express the minimization problem presented in the traditional 4D-Var. This can be found out Andrew Bennett's 1992 book: Inverse Methods in Physical Oceanography. Cambridge Monographs on Mechanics and Applied Mathematics. Cambridge University Press.

The reviewer does not agree the statement: "the dimensionality of many million state variables is not a a fundamental problem". I think both high dimensionality and nonlinearity of ocean models are challenging issues for the ocean prediction and data assimilation. The controllability in this article is very vaguely defined. In fact the importance

of boundary condition in ocean state estimation has long been recognized.

My view is that the system the authors have employed for the study and the 'observations' are too simplified to draw valuable conclusions for the DA research and development communities. The reviewer recommends a major revision to include more realistic models.

The presentation also needs improvement, there are some sentences that are either not correct or clear to the reader. e.g.

Page 2, line 34-35 is not correct.

Page 3, equation (1). It is stated that omega_d = 2/3, so the right hand side forcing f(t) is just a cosine function of time, I cannot see two independent variables (omega, theta) in this equation.

Page 5, lines 26-27: Kalman filter equation is normally solved by in lower space with the covariance represented by ensembles, there is no need for explicit representation.

Page 14, equations (A1), (A2). Omega is the time derivative of theta. They are not completely independent.

Page 25, the 2nd to the last sentence in Figure 7 caption is clear not a correct sentence.

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