Nonlinear Processes
in Geophysics
Discussions

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Interactive comment on "Precision variational approximations in statistical data assimilation" *by* J. Ye et al.

Anonymous Referee #2

General comments The manuscript presents a very interest study with focus on transferring information from observations to physical models with a proposed annealing procedure. Though the new procedure is introduced and some results from twin experiments are presented, this research is not a mature research that can support a (new) publication. From the manuscript, it seems that one of the authors (Page. 1605 Lines 6-7) has published some work related to this topic. Thus, technical or/and scientific advance compared to the authors' previous work need to be clearly addressed in the manuscript, as the NPG required a manuscript contains new and significant results. Specific comments 1. Relation to 4DVAR method. The authors stated that variational methods seeking extrema of the "action" $A0(X)$, whereas, the authors proposed annealing method for locating the path $X0$ giving a consistent global minimum of the action $A0(X0)$. The relation between the authors proposed annealing method

and the 4DVAR method should be explained and discussed. Compared to the 4DVAR method, which has been widely used in geoscience field, what are merits of the annealing method? 2. Comparison of the proposed algorithm to current advanced data assimilation techniques such as 4D-Var and/or EnKF using a more complex model, e.g. two-dimensional show water model. Such comparison will make the research be solid and more attractive. Other comments: 1. Introduction: why need to introduce the new method? What technical or/and scientific advances are made compared to the authors' previous work? 2. Each term in equations should be well explained in Section 1 and Section 2. For example, what is the $A0(X)$ (Page.1605 Line 3), it will be easy to follow after given equation (1); is $X(0)$ (Page.1605 Line 6) same to $X0$ in the abstract? 3. Section 3 needs to be improved so that other researchers can repeat the author's work. 4. Page 1608 equation 6, needs to explain how the equation is derived or give a reference. 5. Suggest using a two or three-dimensional model.

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