

# ***Interactive comment on “Behavior of the iterative ensemble-based variational method in nonlinear problems” by Shin’ya Nakano***

**Anonymous Referee #2**

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The author proposed a new iterative ensemble variational method and investigated its behavior in the nonlinear problems. I suggest major revisions for publication, and I have some comments.

Major comments

1. I understand that the author investigated the new EnVar using the nonlinear settings for dynamical models. In this manuscript the author used the Lorenz 96 model with 40 variables. Is this model suitable for the geodynamical systems?
2. Line 357. Generally, in the data assimilation experiments spin-up is required, but I cannot find description about that in this manuscript. Please address the settings of the author’s experiment in detail.
3. Line 370. How did the author determine the  $\delta = 1.5$

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$\times 10^{-3}$  and  $1.5 \times 10^{-2}$  ?

4. Line 421. “This method could therefore be a promising tool for data assimilation and various inverse problems.” I think so, but I would like the author to compare the EnVar with some other methods such as 4DVar or EnKFs. The new method should be compared with the other methods. Also, I would like to see the time series of error such as RMSE using the EnVar and the other methods.

#### Minor comments

1. Line 342. “the full vector space if  $Q_m$  is taken to be full rank.” This sentence is incomplete. Please correct it.

2. Line 378. “when when” Please correct it.

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