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The Cryosphere Discussions

Interactive comment on "Parameter Optimization in Sea Ice Models with Elastic-Viscoplastic Rheology" *by* Gleb Panteleev et al.

Anonymous Referee #2

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Review of "Parameter Optimization in Sea Ice Models with Elastic-Viscoplastic Rheology" by Panteleev et al.

The manuscript presents parameter optimization of an EVP sea ice model using the tangent linear and adjoint method. Experiments in the manuscript generally show the capability of the inverse method to optimize the model initial states and also the parameters. Although current study is based on the ideal experiments, it does show promising future if it can be further extended to the real application with a long-term optimization.

The science is fine in current manuscript, and the authors reported that their tricky that adding Newtonian damping term in the adjoint equation stabilize the numerical performance, which should be highlighted but are missing in the text. Applying adjoint

methods especially in the sea ice model is a difficult work and the readers are keen to see if there really are some advances on this field. The analytic differentiation as reported by the authors, the damping term and even the codes should be publicly accessible at least from the appendix or the supplement materials, though there is something still not clear for me.

Apart from these points, I would like to say the manuscript is not well-prepared. It seems to be a draft on its first version. The context is little bit tedious on some unnecessary parts from my feeling and ignores too many details that, however, should be elaborated. I guess the co-authors even did not really go through the manuscript, let alone help to improve the text. Too many small grammar mistakes that, however, can be easily corrected by grammar check in MS word or spelling check if you use the Latex! All your citation styles in the text should be also taken care of. I would suggest the authors should really shoulder their own responsibility on their manuscript, not the reviewers! Overall, I suggest substantial revisions.

Comments:

L24: About abbreviations such as SIM, SI, LFI. . ., I indeed find it does not improve but reduce the readability of the text.

L33: As above, the citation style. Add '.' after 'al'.

L35: 'the sea ice rheology is defined by . . .' needs to be rephrased. I think the word 'defined' is not proper.

L56-58: Better to remove this paragraph. I did not find any connection with the context. The stochastic parameters are locally varied, but this is actually another story when stochastic effects are considered.

L66: spelling mistake: analyize

L90: what are the div and tr? Please state clearly in the text!

L95: det. the same as L90

L101: “SI rheology: for P:”. remove one of the colons

L110: “simulated (satellite) observations”. I did not really get the point what is the simulated observations. I believe you want to say ‘synthetic observations’.

L117: Please break this long sentence into shorter ones and elaborate how did you deal with the analytic differentiation of the equation in the appendix. I also wonder how is the Δ , which is highly non-linear, be processed.

L130: About the ‘TL code’, since the model is not such complicated, please make all your ‘TL code’ publicly accessible for better reproducibility for the community.

L144: Regarding the ‘spatial spectrum’, it’s not clear that what kind of spatial spectrum you refer to.

L148: Regarding the ‘Newtonian friction term’, please implicitly show the equation and the damping time scales that you used

Figure1: Please consider to use dotted line. it can obviously show how many experiments you did.

Section 2.3: I would significantly simplify this section, since only the observation errors are used. You do not need to introduce all these. When I read this section, I was thinking about the experiments are dealing with the real observations. But actually, I think for the ideal experiments, these observation errors only set a reference.

Table2: PIZ experiment. Spelling issue: ‘Truie’

L194: Spelling issue: ‘wass’ Line 206: remove the second ‘and’

L224: the assimilation window is really short. I just wonder if the experiment results show sensitivities on the assimilation window.

L232: what is ‘ω’?

L235: what is ‘DAS‘ ?!

Section 3.1: the configuration of the experiment is not clear. For example, is the initial SIC condition symmetric? It seems not from Figure 2a. How is the boundary condition? And in the text, the authors should explain why the spatial distribution of the polynya is not symmetric over the y-axis. Coriolis effects or the initial condition effects?

L253: spelling issue: ‘separting’

L275: GYRE-0/W. Elaborate the means of the abbreviations

L278: It’s not clear why you use such weird initial SIC distribution.

L292: time step

L293: Please say clearly how you mimic the realistic observations, just their magnitude?

L307: remove ‘is’

Figure 5: What is ‘SIH’????

Figure 6: In the caption, ‘t=3 d’ should be ‘t= 3 days’

L310: I wonder whether you optimize Crh first then the initial conditions, you could get the same conclusion.

L318: remove one ‘of the’

L338: ‘the western part agrees well with true e distribution’. Actually, only part of. I think the authors could just say something like “ show parts of agreement”. L343: “and therefore has a minor rheological impact of the sea ice dynamics”. That is not the case, as most parts in fig 5b still have SIC >= 0.95.

L368: Spelling, “maximuma”

L388: “Koning Beatty and Holland (2010)”??????????????????

L414: the authors never defined RMSE!

L431: I do not know why it is worth to address the realistic observation errors are used.

About the conclusions: it's currently too long. Please try to simplify what you really want to say.

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