**Geoscientific
Model Development
Discussions**

Interactive comment on "Physically-based data assimilation" by G. Levy et al.

Anonymous Referee #2

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I consider this a good paper, which requires some minor revisions for clarity. Barring major surprises from those figures, it should be published.

Main comments: Regarding a point raised by another reviewer: I think the discussion of the sea ice model in this paper is appropriate, and required. The model itself is fairly novel with these authors, and the novelty makes it quite distinct in its character as compared to other sea ice models, such as the much more common Hibler and Hibler-descended ice rheologies. That novelty is essential to understanding the assimilation that is being discussed.

The clarity of the assimilation discussion could be improved by the addition of a figure. While the text is sufficient to provide a qualitative understanding of what changes are made in the assimilation process, a figure showing the RGPS analysis, the model's pre-assimilation state, and the model's post-assimilation state would be helpful.

In similar vein, an illustration of an unrealizable model state that another assimilation method would lead to would be helpful.

minor writing points:

a priori should be italicized. (Maybe this is a US vs. EU issue?)

Why was the model initialized to 3m? That seems thick for a 2004 simulation, when 2 meters seems like a better round number. I'm concerned that this thickness might have driven some of the results – overly thick ice necessitating more cracking?

McCauley bracket may not be an obvious term to glaciologists and oceanographers. Inserting <x> after the term should make it clear that the reference is to that component of equation A1.

'Griffiths Model' deserves a citation.

table 1: 105N/mˆ2, should be 10ˆ5.

The extraordinary number of digits precision for the decohesive parameter deserves mention. Is the model/assmilation exceedingly sensitive to this number?

Interactive comment on Geosci. Model Dev. Discuss., 3, 517, 2010.