

***Interactive comment on “A simple inverse method for the distribution of basal sliding coefficients under ice sheets, applied to Antarctica” by D. Pollard and R. M. DeConto***

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We thank both reviewers for their careful and constructive reviews and suggestions. We acknowledge and agree with nearly all their comments, and plan to revise the paper accordingly. The changes can be grouped into (1) reorganization, and (2) new analysis and runs.

1. Reorganization:

Both reviewers suggest the paper could be more concise, with some sections shortened or moved to appendices, and with some appendices moved to the main text. We agree, and plan to:

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- Streamline, shorten and combine some parts of sections 2 and 4 to avoid repetition in describing the "first inverse method". Even though that method does not work satisfactorily, we will still mention it briefly because it illustrates a pitfall that may be useful to others.

- Move the lengthy sensitivity exercise constraining the enhancement factor E (section 6, Fig. 2) to an Appendix (suggested by Reviewer 1).

- Reduce the comparisons with previous work in section 8 considerably, and remove the reference to figures only available on web sites (Revs. 1 and 2), which we agree are not very useful. And move Appendix C and Fig. C1 comparing with the Rignot et al. velocity dataset to section 8 (Revs 1 and 2).

- Although Reviewer 2 suggests moving Appendices A and B to the main text, we would prefer to keep them as they are, because they are not essential to the main flow. However, we acknowledge that uncertainties in bedrock elevations are important (see below).

## 2. New additions:

- We agree with both reviewers that reducing the spin-up time of  $\sim 200,000$  years required for the inverse procedure would be valuable. As Rev. 1 suggests, we will explore different choices of the spin-up interval between adjustments and the amplitude of adjustments, to try to accelerate the spin up, and briefly report on this in the paper.

- We agree fully with Rev. 2's caveats about uncertainty due to poorly known modern bedrock elevations. To some extent we think this is covered already in the discussion that emphasizes the possibility of canceling errors, which largely addresses the caveats in Rev. 2's specific comments 2nd paragraph (and which Rev. 1 points out also apply to other inverse methodologies). We will add some discussion explicitly on bedrock elevation uncertainties, and also perform and report on synthetic tests with imposed random perturbations as suggested by Rev. 2, to test the effect of this uncertainty on

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the results.

- As suggested by Rev. 2, we will compute a single metric for the surface elevation errors in all experiments shown (probably rms or mean absolute error), and report the values.

- We will add a second animation to the Supplementary Material, showing the variations of basal sliding coefficients during spin up (Rev. 2).

We agree with and will implement nearly all the minor corrections and comments of both reviewers.

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Interactive comment on The Cryosphere Discuss., 6, 1405, 2012.

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