

Interactive comment on “ADISM v.1.0: an adjoint of a thermomechanical ice-sheet model obtained using an algorithmic differentiation tool” by J. McGovern et al.

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Received and published: 6 January 2014

The main point the reviewer makes is that he acknowledges the adjoint is a large task and has been achieved successfully. He says, though, the manuscript, as is, is not worthy of publication.

We acknowledge the material in section 3 is of textbook standard. If it were a geoscience paper other than GMD, this material would definitely be irrelevant and should not be included. The section does include physics that can be found in other reference text books. However, in the context of a GMD paper, we feel it can be included. This is to properly describe the model, even though it does use established ice sheet model

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equations.

Section 2 describes the framework of AD. The reviewer says one section is too long, another too brief. Section 2 is not intended to describe the complete theoretical framework of AD in detail; rather to describe AD with reference to the models in this paper. While one section may be too long and another too short, the section does give a reference (Heimbach2009) to which the reader can refer for further information/ clarity. Nevertheless certain clarifications in the sections mentioned by the reviewer will be made in the revised paper.

Section 4 presents the adjoint model and the way the OpenAD tool is implemented. We acknowledge it is quite a structured section, and that it contains quite a bit of technical material. The reviewer says some of this technical material is uninteresting. We acknowledge this section is indeed more technical and more 'manual-like'. However we feel it is relevant to properly describe the process of, and difficulties in, obtaining the adjoint model.

The reviewer mentions the reader may find it hard to follow the material presented if the reader is not familiar with the adjoint method. In the final revised paper it will be explicitly stated that further information regarding the use of the OpenAD tool may be found in the reference for the tool. The adjoint method is described in Section 2, which also states that further theory of AD is found in Heimbach 2009, for the interested reader.

Specific comments.

Experiment A and H. Repetition of experiment A and H. The setup for the EISMINT 2 is described for both A and H. There is one sentence giving the difference between these, the rest of the generic description of EISMINT 2 benchmark. That said, the description of the EISMINT2 could indeed be removed, and a reference to it could simply be made.

Figure 2 is indeed similar to the original EISMINT figures. Figure 2 will be removed.

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EISMINT3 section. This benchmark is indeed established and perhaps outdated. It is worth, however, keeping it.

Fig. 3 The adjoint sensitivities over most of the domain of the ice sheet are uniform, except at the very edge. This is why the plots in Figure 3 appear to not give detail. It is because of the mostly uniform sensitivity, apart at the very edge.

Fig. 5 a,b the land mass in the north west is else mere island. This will be noted in caption. Data set which is used will be mentioned.

Fig. 4 a,b yes, the point is to show the adjoint and forward sensitivities are similar and match well. This will be stated clearly.

A small perturbation factor was used to get minimal effects from perturbation factors. Examining the effect of perturbation factors on the forward sensitivity would be interesting to explore. However the paper focuses on an adjoint model, rather than the exploration of effects of perturbation factors on sensitivities. Thus looking at the perturbation factors on the forward sensitivity would not be relevant in the context for this paper.

Adjoint sensitivities are exact solutions. These are not affected by either perturbation factor or grid.

Interactive comment on Geosci. Model Dev. Discuss., 6, 5251, 2013.