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Geoscientific Model Development Discussions

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.

Anonymous Referee #1

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The aim of this manuscript is to present the adjoint code of a thermo-mechanical ice-sheet model (Shallow-Ice Approximation, SIA) obtained using Automatic Differentiation (OpenAD, source-to-source transformation). The computational software (forward and adjoint codes) may be a useful tool for the glaciological community. Indeed the manuscript contains useful basic technical information, but it does not meet internationally recognized standards for research publications. The manuscript presents classical knowledge only, the code does not presents any new feature compared to the existing softwares (even the open-source ones). Moreover the bibliography is not worthy of a research article. The benchmarks used to validate the code (both the forward and the adjoint ones) are far from being satisfactory, it is therefore difficult to conclude on

the validity of the code. This manuscript could be useful along with the open-source code distribution in view to help users or co-developers. But it cannot be published in a scientific research journal since it does not bring any original contribution to knowledge/understanding in the field of interest.

* Some references (with corresponding computational softwares) the authors should address. M. Morlighem, E. Rignot, H. Seroussi, E. Larour, H. Ben Dhia, and D. Aubry. Spatial patterns of basal drag inferred using control methods from a full-stokes and simpler models for Pine Is- land glacier, west Antarctica. Geophysical Research Letters, 37(14) 14 502, 2010 N. Petra, H. Zhu, G. Stadler, T. J. R. Hughes, and O. Ghattas. An inexact Gauss-Newton method for in- version of basal sliding and rheology parameters in a nonlin- ear Stokes ice sheet model. Journal of Glaciology, 58:889–903, 2012 M. Morlighem, H. Seroussi, E. Larour, E. Rignot. Inversion of basal friction in Antarctica using exact and incomplete adjoints of a higher-order model. 118 (3) 1746. 2013 N. Martin, J. Monnier. Of the gradient accuracy in full-Stokes ice flow model: basal slipperiness inference. J Cryos Disc, 7, 3853-3897, 2013

* Few extra comments *

Section 2 "A.D.": it is classical, see any course on-line (see eg autodiff.org website, OpenAD website, Tapenade website).

Section 3 "Forward ice-sheet model" is a detailed description of the 3D Finite Difference SIA model - thermal field. There is nothing new since all the material is available elsewhere.

Section 4 "Adjoint model" only contains pure technical remarks. It may be useful information for co-developers. It should, therefore appear in a "technical note" along with the open-source code.

Section 5 "Forward model verification". This section is supposed to prove the validity of the code. The benchmarks considered are the EISMINT 2 and EISMINT3 Greenland

benchmarks. Again, this section does not present any additional scientific value. In this section which aims at "validating" the forward code, no error quantification is presented, only appraisal like "ADISM was seen to perform satisfactorily". (From this section an assertion is repeated in the conclusion: "The forward model was verified and performed well against the EISMINT3 benchmark" while no real assessment is presented).

Section 7 "Discussion" The authors highlight a "500" CPU time factor. On one hand the remark is classical since it is the goal of the adjoint method compared to finite-difference sensitivities computations. On the other, the number "500" is grid size dependent (it is proportional to the variable number) hence such ratio cannot be highlighted without extra explanation.

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