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TCD

2, S59–S65, 2008

Interactive  
Comment

## ***Interactive comment on “The ISMIP-HOM benchmark experiments performed using the Finite-Element code Elmer” by O. Gagliardini and T. Zwinger***

**O. Gagliardini and T. Zwinger**

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O. Gagliardini and T. Zwinger

4 May 2008

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Dear Scientific Editor,

We would like to thank both referees for their positive and useful comments on our paper. The modifications suggested by the referees have been taken into account in the new proposed version of our paper. Below, we answer each point that was raised and indicate corrections made in the new version of the manuscript.

**Referee #1** (M. Lüthi)

### Major Points

- The description of the algorithms used to calculate the evolution of the free surface geometry, as well as the choice of the solver for the nonlinearity have been added in the revised version of the paper. Basically, the non-linear solution is approximated using fixed point iteration, leading to a linear Stokes problem to be solved for every iteration step. The evolving surface geometry is treated by solving a fictitious elastic problem for the mesh, using the free surface displacement as a Dirichlet boundary condition, as explained in detail in the new version of the paper.
- We agree that the wording "accuracy" is not suited for the comparison of result from different models. "Accuracy" has been changed by "quality" in the introduction, because it refers to the comparison of the same model but using different settings. The comparison is then done relative to a reference run using the *best* setting (*i.e.* that one which should give the best results).

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- The English of the paper has been improved (we hope).

### Minor Points

- p78, l5 the definition of the Cauchy stress has been added.
- p80, l15 The general wording "Taylor-Hood" has been introduced
- p81, l6 Yes, Equation (10) is solved on the 2D top surface only (for a 3D flow problem). This has been stated explicitly in the new version of the paper.
- p82, l6 done
- p82, l15 As explained above, the non-linear solution is approximated using fixed point iterations. For the preconditioning of the linear system, we used the well established ILU method as explained in Section 2.4.1.
- p83, l1 done
- p84, l15 We agree that the CPU consumption depends also on the choice of the elements and pre-conditioner. The point in this part was that for fixed parameters (mesh size, numerical methods), we obtained significant differences for the same test with different lengths  $L$ .
- p84, l19 done

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- p85, l25 The definition of the convergence criteria for the non-linear solution was incorrect. Equation (11) has been modified. The norm of the relative change is used to check the convergence of both the non-linear and coupled solutions.

- p86, l25 done

## Referee #2 (Anonymous)

### Major Point

- The quality and the caption of the figures have been improved both in the paper and in the complementary material. See detail for each figure in the technical corrections section.
- Some conclusions summarising the main results obtained in the paper have been added.
- An introducing part has been added to the complementary material, which explain the notation used for the output data files. In the paper, the test notation has been rewritten accordingly to the reviewer suggestions using the longer description. The description of the ISMIP-HOM tests (reference Pattyn and Payne, 2006) will be included in the complementary material of the submitted paper Pattyn et al., (2008) so that this reference will always be available.

### Technical corrections

- p77, l20 The sentence has been reformulated.

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- p78, l20 Yes, the sign is correct, we have added the decomposition of the Cauchy stress into its deviatoric and isotropic parts to clarify this point.
- p78, l21 done
- Sec. 2.4.4 The paragraph concerning the mesh generation for experiments E000 and E001 has been rewritten and is hopefully now more to the point
- p84, l19 done
- p85, l7 done
- p85, l10 done
- p85, l10 done
- p86, l4 done for all the paper
- p86, l4 Yes, we have modified the sentence
- p86, l22 done
- p86, l23 done

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- Section 4 Yes, the reviewer is right, this has been corrected now.
- p88, l2 done
- p88, l5 The caption of the complementary material have been expanded such that they are now self-consistent.
- p88, l13-16 Yes, we have added the link to Fig. 7 of the complementary material
- p89, l14 done
- p90, l10 done
- p90, l11-14 done as suggested by the reviewer
- p91, l10 done
- p91, l26 done
- p92, l12 done
- Fig. 1 The quality of the figure has been improved.

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- Fig. 2 The caption has been changed to be consistent with the figure.

- Fig. 4 done

- Figs. 6, 8, 10 the mesh names in the caption have been renamed to be consistent with the test notations.

- Figs. 7, 9 The caption has been extended and all the plotted variables are now explicitly defined in the caption. The dashed grid has been re-coloured, such that the results clearly can be distinguished from the grid.

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