

Interactive comment on “A new sub-grid surface mass balance and flux model for continental-scale ice sheet modelling: validation and last glacial cycle” by K. Le Morzadec et al.

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We would like to thank Dr. Fuyuki Saito for making thoughtful comments and constructive suggestions. These will be followed in the preparation of the revised version of the paper.

This schematic diagram will also be added to clarify the coupling between the GSM and the SG model.

p3049 L26. Does it mean that CG ice volume is replaced by sum of the volume of SG levels below the lowest unfilled level? On L20 above it is said that CG ice is added

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to the SG levels. I am afraid that this loop makes the SG ice volume infinite by this procedure.

This issue will be clarified in the text. Ice in a CG cell is added to the SG level only for one time step when the SG model switches from deactivated to activated. Then, the coarse grid ice volume is updated at every time step.

p3050 L15, adjacent CG flux into SG model. Is this procedure done after the computation of equation (6)?

We will clarify that eq.6 is not used at the lowest level of the sub-grid level. Instead, the CG fluxes are used to remove ice at the lowest levels.

p3051 comparison. I am curious how much is the difference in the computation time between SG and ISSM, just for information.

For 3000 years simulation, the SG model using 10 hypsometric levels computation time is about 0.02 seconds. ISSM takes 2 to 5 hours (depending of the topographic region used) using 10 cpus at a resolution of 1km. The sub-grid model adds 3 to 6 hours (depending of the parameter vector used) to the glacial cycle run-time.