

## ***Interactive comment on “A system of conservative regridding for ice/atmosphere coupling in a GCM” by E. Fischer et al.***

### **Anonymous Referee #2**

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A system of conservative regridding for ice/atmosphere coupling in a GCM

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This paper discusses a method of conservative regridding for a two-way coupled GCM – ice sheet model with widely varying grid resolution and temporal resolution. This is a topic worth publishing in GMD. There are many technical details involved which are hard to understand and the justification of the work is not crystal clear to me.

### **General remarks**

There should be made a convincing case that there is a need for the use of an inter-

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mediate ice surface model. After reading the text this is not transparent to me. Line 26 page 6498 argues vaguely about important problems. Mapping and regridding in one step may well circumvent the addition of the ice surface model. If combined with coupling at low frequencies the two-way coupling may also be established.

I miss at several places the intuitive explanation of the formal maths. I think this paper would gain a lot if the basic concepts are explained more intuitively in addition. I have to admit that I did not convincingly understand the core of this work, and therefore my review is incomplete.

### **Specific comments**

Line 1, page 6494: The method of elevation classes is probably not familiar to everybody

Line 4-7, page 6494: Past ... downscaling to the ice model. Please rewrite.

Line 3, page 6495: the least to be mentioned is how this is treated in AR5 (even omit reference to AR4)

Line 20, page 6495 almost certainly arose is a bit a bold statement rephrase to feedbacks play an role in many events (e.g. ...)

Line 15, page 6496: replace "this" by e.g. "the latter"

Line 18, page 6496: What kind of surface flux fields are meant? I guess these are vertical fluxes?

Line 27, page 6497: replace "atmosphere" by "atmosphere model".

line 4-6, page 6498: remove, because it is repeated at line 11, page 6499.

line 7, page 6499: Should be ice SURFACE model.

Line 10-25, page 6500: I would suggest to replace the variable names (in Fig. 2 as well) as follows:

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current	suggested
height $R^A$	$F^A$
$R^E$	$F^{A \rightarrow E}$
$F^E$	$F^E$
$F^A$	$F^{E \rightarrow A}$
$Q^E$	$\bar{F}^E = \sum_{\text{time}=0}^{1 \text{ month}} F^E$
$Q^I$	$\bar{F}^{E \rightarrow I}$
$\Delta^I$	$\Delta F^I$
$\Delta^E$	$\Delta F^{I \rightarrow E}$
$\Delta^A$	$\Delta F^{I \rightarrow A}$
height	

Line 2, page 6501: Ambiguous definition of  $\Delta^I$ .

Line 3, page 6501: unclear

Line 7, page 6502: The practitioner ... grid cell. Unclear sentence.

Line 18, page 6502:  $f^E$  - SMB Do you mean  $f^E = \text{SMB}$  ?

Line 28 page 6502: You basically suggest that there is no ablation at all in the accumulation area, that does not seem to be necessarily true.

Line 20, page 6503: fundamentals IN SECT. 4 and projection issues IN SECT. 5.

Line 18, page 6504: In left hand side: f should be  $f^G$  I presume, and probably in line 15 as well.

Sect. 5.1: The use of an (optimal) oblique stereographic projection or the oblique Lambert Equal Area Projection projection, as used in OBLIMAP (Reerink et al., 2010, GMD), instead of a polar projection, reduces this error.

I suggest: Line 13–16, page 6508: Even ... 2008) can be moved in between line 5 and

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6 of page 6508. And the rest of Sect. 5.2 and Sect. 5.3, Fig. 5 and Fig. 6 can be omitted.

Line 10, page 6530: IS only required

Line 3, page 6535: transformations ARE linear

### Figures & Captions

The authors should carefully read and check all their caption texts.

line 1 caption Fig.3, page 6546: "bass" should be "mass".

Fig. 4 can be merged with Fig. 12.

Fig. 9 can be combined with Fig. 7 to one figure with two panels.

I do not understand Fig. 10 and its caption text.

Fig. 11 can be omitted or merged with Fig. 3.

The color bar in Fig. 13 misses a quantity-units caption. I do not really understand this part of the story. What is gray in Fig. 13, what the black lines, what the white lines (I guess the latter are the contour lines?).

There is a reference to Fig. 14 before Fig. 6 is cited.

Fig. 15 can be combined with Fig. 16 to one figure with two panels.

There are no references in the text to Fig. 17, 21 and 22. The latter two are only mentioned in the captions of Fig. 22-23. If Fig 21-22 are kept they can be placed in one figure with two panels.

Fig. 24 can be omitted or merged with Fig. 14.

Fig 25 can be omitted, refer to Fig. 2 instead at line 19 page 6529.