

# Report #1

Dear authors,

first I would like to acknowledge the impressive work you did to include all my remarks, especially on validating your approach with PROMICE in-situ measurements and on clarifying the purposes of your study. I believe that, in its current form, this paper forms a valuable contribution on albedo modelling and assimilation over Greenland. Therefore, and with great pleasure, I recommend the manuscript to be accepted subject to the following corrections/precisions:

[We would like to thank the reviewer for their appreciation of our efforts and their recommendation.](#)

Fig. 8 shows a negative sublimation for every version of ORCHIDEE during winter time. Does a negative sublimation make sense? If so, could the authors tell us more about that subject? If this does not make sense, this may have an impact on all the study linked to sublimation. Could the authors double-check what they consider as sublimation?

[Negative values for latent heat flux and therefore sublimation are indeed observed. These are linked to colder winter surface temperatures in the ORCHIDEE compared to the MAR model. We have added the following text:](#)

**["and no sublimation is simulated by ORCHIDEE outside the summer months. Indeed in winter, we even get negative values, i.e., condensation. This is likely due to the fact that surface temperatures are generally lower than those from MAR leading to a lower saturation humidity and thus to condensation."](#)**

L. 41: ... albedo data was also used by Wang et al. (2015) to calibrate ... [no need to put Wang et al. in parenthesis]

[Corrected](#)

L. 43: Crocus instead of Corcus

[Corrected](#)

L. 149- 150: Please rephrase "See Fausto et al (2021) ..." such as "Further information on ground measurements of snow albedo and associated methodology can be found in Fausto et al. (2021)".

[Done](#)

# Report #2

I appreciate all of the work that the authors have done to clarify the text and improve the figures. In particular, I appreciate the care taken in the new colour choices.

I think that the communication of the results has been improved. I have a few minor comments to make about this version, but I would accept the manuscript after these suggestions are addressed.

[We would like to thank the reviewer for their taking the time to reread the manuscripts and for the final comments.](#)

In 3 places the sub-subsection numbers are not incremented properly. Please recheck the section titles to ensure proper numbering.

["Impact of different parameter sets" is now under the "Results" section.](#)

Introduction:

L7 I would consider writing out the acronym RMSD.

[Expanded](#)

L11 I would explicitly say what you are optimising: "...for optimisation." Is this for optimisation of all a model's parameters or specifically for the albedo?  
Changed to "when optimisation these parameters"

Body:

L44 Crocus is misspelled as corcus

Corrected

L74 You already have defined LSM and DA so use the acronyms

Changed

L83 Earth system model should be Earth System Model

Changed

L97 Does "non-ice-free regions" mean "ice-covered land"? non-ice-free is a confusing way to put it, in my opinion.

Agreed we have corrected to ice-free

L109 What is "the latter term of  $f_{age}$ "? Is it the exponential in the second term of the numerator?

Missing comma when added - this statement refers to the previous equation, where  $f_{age}$  is the latter term

Table 1 Is  $\tau_{max}$  given in days? I think so, but need to add the units, please.

Unit added

L136 "further processed by Box" should be more like: "further processed by applying the techniques proposed by Box"

This line describes the processing done by Box et al - since we do not apply the technique but simply use their processed version of albedo we prefer to leave the text as it is.

L144 I think that the the dataset should be clarified. Is it the snow albedo dataset created by Box? I'm not sure.

Changed to "this dataset processed by Box et al."

L149, can use the acronym "GRIS"

Changed

L165 How was the Background error covariance matrix created? I don't mean to suggest that you write a new section or anything. It is just that B is very important, so some words to explain how it is defined would be helpful.

Added "For the B matrix, we define the prior distribution of each parameter to be 40% of the prior range"

L222 exceeds and not exceed.

Corrected

L230 "Performed Experiments" could just read "Experiments"

Changed

Figure 2 I suggest that the panels have labels like a, b, c and d. Then the caption will be easier to write. Then there is no need to specify reading the figure from left to right.

Added

L399-404. I am happy to see this paragraph included in the revised version. As a reader, it clarified what should be done next in this kind of study.

Thank you

L450. I would change "we get the most different results" to something like "the differences between SMB as determined by MAR and by ORCHIDEE are larger"

This paragraph is looking at sublimation. We have rephrased as follows: "the differences between each ORCHIDEE simulation are most marked"

L551 Should be "Further work will include"

Corrected

L558 Perhaps clearer to re-write as " discretising the snowpack vertically"

Done

L564 Perhaps be more explicit here and write: "the retrievals of the albedo from the observed quantity".

Changed

L594. This is not clear to me at all: "to distinguish nonlinearity from interactions" An interaction can be nonlinear. Do you mean to distinguish nonlinear interactions from linear interactions? What I mean is that nonlinearity is not clearer defined in opposition to interactions. Please could you clarify?

The input parameters can have linear or non-linear effects on the output. This can be can not be distinguished from the effect the parameters will have on each other. This has been clarified in the text: "it is not possible to distinguish the nonlinear effect individual parameters have on the model output from the effect of their interactions with other parameters"

Appendix B1 has a title "Parameter Values" but there is no text in this section. Should there be a single section Appendix B?

Section B1 contains Table B1. We have added the following text: "In Table B1, we list the different parameter values used and found in this study."