



EGUsphere, referee comment RC2  
<https://doi.org/10.5194/egusphere-2022-745-RC2>, 2022  
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## **Comment on egusphere-2022-745**

Anonymous Referee #2

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Referee comment on "Improving modelled albedo over the Greenland ice sheet through parameter optimisation and MODIS snow albedo retrievals" by Nina Raoult et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-745-RC2>, 2022

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This article presents the calibration of the ORCHIDEE model against the MODIS derived snow albedo dataset. While the overall objective of improving albedo is very relevant, this particular study, in my opinion, is very limited. My specific concerns are outlined below.

The article reads like a description of the research in the way it was conducted. The authors describe all the methodologies the authors tried, which are sometimes distracting from the main objective of the paper. For example, Section 3.2. describes the results with two different optimization algorithms. As shown here (and as well known), gradient search methods have limitations in exploring complex decision spaces within an optimization context. The results presented here are not adding anything new to the key focus of this paper, and it is distracting. In Section 2.4.2 – It is not clear (at this point) in the manuscript what is meant by 'performing a sensitivity analysis of the model'. Typically, this is done ahead of the calibration step to reduce the number of parameters being optimized (as the authors acknowledge in Section 3.4.3). If that's the same context, it'll be good to describe that and present this section before 2.4.1. Similarly, Section 3.4.3 should be presented earlier (even though that's not how this work evolved). I appreciate the value of explaining all the steps, but there are lots of 'preliminary' setups (section 3.2, line 207) in this paper. A major recommendation is to restructure the paper so that it focuses on the finalized results, while presenting the intermediate results and steps only to support the main findings.

As the authors note in the summary, calibration has its problems in that adjusting certain model parameters may improve some parts of the model, while degrading others. The main objective of improving albedo is to improve the changes in the snow pack over GrIS,

as noted in the intro. The paper needs to describe what the impact of the improved snow albedo formulation is on the snow simulations (and other model states). Does the improved albedo lead to better snow states?

The modeling setups use forcing data from MAR, which is a modeled estimate, presumably with its own associated biases and errors. In a calibration setup, the tuned parameters are then used as an error sink to 'hide' these boundary condition errors. This needs to be discussed in the article. Is there an evaluation of MAR data over GrIS? Are other 'observational' datasets available?

Since ORCHIDEE is used in global setups, how are the results over this domain applicable in a general sense? Are these calibrated parameters limited to GrIS?

Minor comments:

Line 51. Need brackets around Krinner et al. (2005).

Line 67: Change to 'the' instead of 'our'?

Section 2.3 – It is important to clarify (here, early on in the paper, abstract, and title) that the snow albedo is being calibrated instead of the total albedo. MODIS has several different albedo products (blue-sky, black-sky etc.) Please clarify.

Line 146: change to 'output' instead of 'writing'

Line 151: remove 'However'

How do the calibrated values influence the peak winter month simulations?

Figure 1 – this is the snow covered albedo? Is this average computed by excluding Nov-Feb?

Section 3.1 – This is a very hand-wavy section. The authors need to spell out exactly what was changed in this manual calibration procedure. What parameters/physics were changed?

Section 3.2: How many iterations of GA were used here? Are these the results from the 'Both' approach (results in Figure 2)?

Table 2: How are the albedo evaluated for 'All months'? If you don't trust the MODIS albedo during the winter months, how do you justify comparing back to them?

Line 220: Why were these three years chosen? How do you do these calibrations (separately for each year and somehow harmonize the calibrated parameters? Or are they calibrated from a single run, but the calibration data is withheld during all years except 2000, 2010, and 2012)?

Line 223: Add a comma after 'Indeed'.

Line 232: Why is it that 'We would not expect to lower the RMSD of the edges any further'?