

Response to the reviewer's comments

The article has been much improved and deserves to be published. I have only a few minor comments to make.

We are grateful to the reviewer for taking the time to review our manuscript a second time and for appreciating the work we have done to respond as well as possible to his initial comments. Below are our responses to the new comments (in blue). Excerpts from the text are italicized.

1/ You say "A likely hypothesis to explain this behaviour relies on the reduction in albedo, which leads to excessively high surface temperatures. Given this observation, it seems unlikely that accounting for solar absorption may improve our results." Here you're drawing conclusions from something you don't model. I'd prefer that last sentence to be deleted ("Given this observation, it seems...").

As recommended, we removed the sentence.

2/ You say that "Since metamorphism is not explicitly represented in the model, we think that ignoring solar absorption is justified." This sentence should be more measured and should be addressed with more cautions. Some model represents solar absorption without representing snow metamorphism (Decharme et al 2016 is a good example of this that is often cited in your study). Perhaps only say : "Since metamorphism is not explicitly represented in the model, we made the assumption that representing solar absorption was not a priority for our modeling, even if this choice is debatable."

The sentence cited by the reviewer has been changed in: *"Since metamorphism is not explicitly represented in the model, we assumed that representing solar absorption was not a priority in our modeling approach, even if this choice is debatable"*.

3/ And after you say "a more physically-based albedo scheme accounting for light-absorbing particles and snow grain size will be implemented in the ORCHIDEE-ICE model in the near future." So, if you use snow grain size for albedo, why not for deep solar absorption? In your discussion, you seem to separate the processes of solar absorption and albedo. But they're closely linked... and one doesn't go without the other in nature for materials like water, ice or snow...".

In light of the reviewer's comment, we realise that we were not clear enough in our explanations. To avoid any confusion, we modified the sentence: *"However, a more physically based albedo scheme accounting for light-absorbing particles and snow grain size (Kokhannovsky and Zege, 2004) will be implemented in the ORCHIDEE-ICE model in the near future"*.

The modified sentence now reads as: *"However, in the near future, a more sophisticated albedo scheme based on a transfer radiative model accounting for light-absorbing particles and snow grain size (Kokhannovsky and Zege, 2004) will be implemented in the ORCHIDEE-ICE model. This will allow to represent the backward and forward scattering processes as well as light absorption"*.