

The Cryosphere Discuss., author comment AC1
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Reply on RC1

Minghu Ding et al.

Author comment on "Brief communication: Evaluation of multiple density-dependent empirical snow conductivity relationships in East Antarctica" by Minghu Ding et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-70-AC1>, 2021

Reply to RC 1

This study presents a reliable evaluation on multiple empirical, density-dependent snow conductivity model/schemes, with three automatic weather station records. Although the subsurface heat flux is relatively low compared with the other components of air-snow/ice interaction, but it is essential for controlling the upper thermal boundary condition of ice sheets. As I know, there is urgent needs on the studies with in situ measurements in Antarctica. The sites the authors chosen can represents typical climatical regions of Antarctica, and they also presented a clear vision for further study, thus the result is effective and have a wide appeal. Several issues should be addressed prior to publication.

Line 15: "appears" should be "appeared".

Authors: It has been modified.

Line 27: Oldroyd et al., 2013?

Authors: It has been modified.

Line 27: histories or history?

Authors: It is histories, as it is now.

Line 37-39: "For example, the land model CLM and snow model SNTHERM use the empirical relationship developed by Jordan (1991), and is also adopted in other land surface energy balance and model studies, e.g., Wang et al. (2017)." This words should be rewritten.

Authors: It has been modified into "For example, the empirical relationship developed by Jordan (1991) was adopted by the land model CLM, snow model SNTHERM, and many land surface energy balance studies, e.g., Wang et al. (2017)."

Line 46-49: The paragraph can be simplified and merged with the previous part.

Authors: A separate paragraph would better to illustrate the structure of the paper, we think.

Line 60: delete "figure 1".

Authors: It has been modified.

Line 66: what is the lowest air temperature at Dome A? is it colder than Vostok?

Authors: The lowest air temperature at Dome A was -82.3 °C, which was recorded by an AWS at 10th July 2017. This is obviously higher than the lowest records of 89.2 at Vostok. However, the Landsat 8 has recorded a -93.2 value by remote sensing (<https://www.nasa.gov/content/goddard/nasa-usgs-landsat-8-satellite-pinpoints-coldest-spots-on-earth>). The Landsat 8 record still need a verification, I think.

Line 66: you may mean "specific humidity" rather "humidity"?

Authors: either "specific humidity" or "humidity" is ok here. It has been modified into specific humidity to avoid misleading.

Line 67: "There were no radiation measurements at the site".

Authors: It has been modified.

Line 75: I noticed that Figure S4-S6 showed before Figure S1 and suggested modification.

Authors: All figures and tables have been reordered.

Line 103: "relationships".

Authors: It is relationship for we only refer to Lan relationship.

Line 144-145: it is unexpected that Ca2 performed much worse than Ca1, what is the reason in your opinion?

Authors: As pointed by Reviewer 2, the Ca₂ relationship is only suitable for deeply buried firn with densities from 550 to 917 kg/m³, which is not the case for the Dome A, LGB69 and Eagle station (density approximately ranges from 380 to 550 kg/m³). We now use another relationship for Ca₂ as given by Calonne et al. (2019) and the new Ca₂ relationship has a greatly improved performance.

Line 148-149: "The 3 AWS sites in different locations in East Antarctica that we have used for our validation cover a large range of elevation and distance from coast" can be "the 3 AWS sites in the paper cover a large range of elevation and distance from coast."

Authors: It has been modified.

Line 150-152: "We also urge for similar evaluations to be conducted at more geographic locations (e.g., west Antarctica Ice Sheet) where snow temperature and density observations are available." Should be deleted.

Authors: It has been deleted.

Line 168-216, Ensure the references format are consistent, such as line 194, 210, the publication years are different.

Line 216, check the name of author, "Yen Y C" instead

Authors: It has been modified. We also checked the reference through the context.

Figure 2: the results of figure 2 is duplicated with Table 2, thus I suggest to move one of them into supplementary material.

Authors: The Table 2 has been moved into supplementary.

Table 2: It is better to adjust the order of sites as "Dome A, Eagle and LGB69", or "LGB69, Eagle and Dome A", which is similar with the figure 1. And this order is same with the introduction in "Results and discussions".

Authors: It has been modified.