Data Paper

Masashi Niwano, Satoru Yamaguchi, Tetsuhide Yamasaki and Teruo Aoki. Near-surface snow physics data from a dog-sled traverse expedition in the northwest Greenland ice sheet during 2018 spring. Polar Data Journal. 2020, 4, p.133–144. http://doi.org/10.20575/00000019.

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1st submission

Editor Start Date: 9/3/2020

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Reviewer #1 (9/4/2020–9/17/2020)

Reviewer #2 (9/3/2020–9/25/2020)

Reviewer #1: Martin Schneebeli

Dear Authors

I found the paper quite clear. I suggest to add a small table, where the yearly accumulation (in mm SWE) is reported for all locations. This would it make easier to compare the differences in the profiles. I also suggest to indicate which snow profiles were below or above the equilbrium line (which I could not find in your paper).

Best regards

Reviewer #2: Takao Kameda

The manuscript summarizes the background, observation point, method, data, and accuracy of the density measurements of deposited snow in northwestern Greenland in 2018 in an easy-to-understand manner. In addition, I confirmed the data file (Excel) that has been uploaded for peer review, which was also summarized in an easy-to-understand manner. Therefore, I judge that this manuscript can be published as it is.

However, I noticed several points that should be revised. The author should revise these points if necessary.

Line 43 (ref.10) →10 (a superscript) The format of the citation is different only here.

Line 46 northern ice sheet → Greenland ice sheet

Line 49 northwest ice sheet → northwest Greenland ice sheet

Line 56 near-surface snow-physics data → near-surface snow physics data (If you match the title, you must take out a hyphen between snow and physics.)

Line 98 thin ice layer → thin ice layer (thickness: ○.○ mm and ○.○ mm) (Because it is an important ice plate, it

is better to add thickness of the thin ice layer.)

Line 98–99 It is better to describe how the age of the layers between 1 July 2017 and 1 January 2017 was determined.

Fig.14 I think it will be better to explain the figures by adding letters a to d in each four figures, and explain them in each order.

Fig.3

・Graph (a) "Surface air temperature" on the right axis in the figure above is written from top to bottom. I consider that it will be on the left axis in the figure from the bottom to the top.

・Graph (b) The place and the date are described in the figure, but I think it is easier to understand if they are written in the center above the figure. Especially the location and date in the graph at the top right are listed little below due to the space, and I thought for a moment whether this depth was related to Sigma A, 11 April 2018.

The font on the x-axis and the y-axis must be larger.

・Characters (a) and (b) are better to be expanded.

Authors Response:

Response to reviewer #1;

We sincerely appreciate the reviewer for taking the time to provide valuable comments and suggestions. Below we describe our responses (in red text) point-by-point to each comment (in black text). Revisions made in the updated manuscripts are highlighted in blue text. We have also uploaded a pdf in which our changes in the manuscript can be tracked. In our reply here, we indicate our revisions by referring to line numbers shown in the pdf for track-changes.

Dear Authors I found the paper quite clear.

Thank you for the positive evaluation.

I suggest to add a small table, where the yearly accumulation (in mm SWE) is reported for all locations. This would it make easier to compare the differences in the profiles.

Following the suggestion, we have added a Table (it is referred to as Table 2), where measured SMBs for the latest annual layers at ST2, ST3, SIGMA-A, and ST4 are indicated. Accordingly, the original Table 2 is now referred to as Table 3.

A relevant description of Table 2 can be found at L. 95 ~ 97:

With the information, measured SMBs of the latest annual layers as of the measurement dates are obtained (Table 2).

We have also indicated these SMB values in the dataset. This point is now explained in the text as follows:

SMB for the latest annual layer is indicated together. (L. 118)

I also suggest to indicate which snow profiles were below or above the equilibrium line (which I could not find in your paper).

In Section 2 (Location (or Observation)), we have added a description regarding this point as follows:

As seen in the annual SMB map presented by a recently conducted SMB model inter-comparison ST2, ST3, SIGMA-A, and ST4 are located above the equilibrium line. (L. 80 ~ 82)

The newly added reference #19 is as follows:

Fettweis, X. et al. GrSMBMIP: Intercomparison of the modelled 1980–2012 surface mass balance over the Greenland Ice sheet. The Cryosphere. 2020, in press, https://doi.org/10.5194/tc-2019-321.

Reponse to reviewer #2;

We would like to thank the reviewer for taking the time to review our manuscript. Below we describe our responses to the reviewer's comments (black text) in red text. Revisions made in the updated manuscripts are highlighted in blue text. We have also uploaded a pdf in which our changes in the manuscript can be tracked. In our reply here, we indicate our revisions by referring to line numbers shown in the pdf for track-changes.

The manuscript summarizes the background, observation point, method, data, and accuracy of the density measurements of deposited snow in northwestern Greenland in 2018 in an easy-to-understand manner. In addition, I confirmed the data file (Excel) that has been uploaded for peer review, which was also summarized in an easy-to-understand manner. Therefore, I judge that this manuscript can be published as it is.

Thank you for the positive evaluation.

However, I noticed several points that should be revised. The author should revise these points if necessary.

Line 43 (ref.10) →10 (a superscript) The format of the citation is different only here.

If the end of a sentence is a figure "a" and the reference number "b" should be indicated there, readers will be confused because some readers can interpret the part as the power operator a^b. We checked some papers published in this journal and found this type of notations is employed there. An example can be found at:

http://doi.org/10.20575/00000001

Therefore, we think it is not necessary to correct the part.

Line 46 northern ice sheet → Greenland ice sheet

We think it is obvious that we talk about the Greenland ice sheet in this paper as seen from the title of the manuscript, therefore, we think it is not necessary to mention "Greenland" at each part indicating the ice sheet. But we understand the reviewer's concern and decide to use the abbreviation "GrIS" (Greenland ice sheet) throughout the manuscript. The

parts indicating “GrIS” are listed as follows:

L. 29, L 36, L. 39, L. 42, L. 43, L. 46, L. 49, L. 53, L. 54, L. 68, L. 73, L. 155, L. 208

Accordingly, we have revised the part as follows:

It has been demonstrated that increased early summer cloudiness in the northern GrIS enhances atmospheric warming through increased downwards longwave heating, which has triggered a rapid snowline retreat, causing early bare ice exposure, amplifying runoff (L. 45 ~ 48)

Line 49 northwest ice sheet → northwest Greenland ice sheet

See our answer above. We have updated the part as follows:

Herein, we attempted to collect near-surface snow- physics data in the northwest ice sheet GrIS during the spring of 2018. (L. 49 ~ 50)

Line 56 near-surface snow-physics data → near-surface snow physics data (If you match the title, you must take out a hyphen between snow and physics.)

Corrected as suggested. (L. 56)

Line 98 thin ice layer → thin ice layer (thickness: ○.○ mm and ○.○ mm) (Because it is an important ice plate, it is better to add thickness of the thin ice layer.)

The following description has been added:

At the four snow pits except for ST4, we found two evident thin ice layers less than 2 cm thick in the top 1.2 m snowpack. (L. 99 ~ 101)

Line 98–99 It is better to describe how the age of the layers between 1 July 2017 and 1 January 2017 was determined.

We think that the description before the part the reviewer pointed out "At the four snow pits exit for ST4, we found two immediate thin ice layers at 0.8 and 1.2 m below the surface." was not accurate and led to this question. The part that describes the explanation is slightly modified as follows:

At the four snow pits except for ST4, we found two evident thin ice layers less than 2 cm thick in the top 1.2 m snowpack. Around 1 July 2017, the measured surface height with respect to 1 January 2017 was approximately 0.3 m, whereas it became approximately 1.1 m in early April 2018 (indicated with two blue solid lines in Fig. 3a). In the SIGMA-A snow pit, an ice layer (upper one of the two ice layers) was found at 0.79 m below the surface; therefore, we determined the snow layer above the ice layer to be the latest annual layer at SIGMA-A. (L. 99 ~ 105)

Fig.14 I think it will be better to explain the figures by adding letters a to d in each four figures, and explain them in each order.

Corrected as suggested. The updated caption of the figure is now as follows:

Figure 1. Study area of the SIGMA-Traverse 2018. (a) A map showing entire Greenland, (b) northwest area (Domain-A) indicated in (a), (c) northwest GrIS (Domain-B) indicated in (b). In (b) and (c), accumulated SMB (mm w.e.) with respect to 1 August 2017 on 15 April obtained from the NHM-SMAP v1.00 calculation5 is depicted together to show regional characteristics of SMB from 2017 to 2018. Dashed lines in (b) indicate surface elevation at 1000 and 1500 m, and contour interval of dashed lines (surface elevation) in (c) is 50 m. (d) A scene of the expedition walking down near the termination of the GrIS (top of the Meehan Glacier) in the return trip.

Fig.3

・Graph (a)　"Surface air temperature" on the right axis in the figure above is written from top to bottom. I consider that it will be on the left axis in the figure from the bottom to the top.

Corrected as suggested.

・Graph (b)

The place and the date are described in the figure, but I think it is easier to understand if I they are written in the center above the figure. Especially the location and date in the graph at the top right are listed little below due to the space, and I thought for a moment whether this depth was related to Sigma A, 11 April 2018.

The font on the x-axis and the y-axis must be larger.

・Characters (a) and (b) are better to be expanded.

Corrected as suggested.

2nd submission

Editor Start Date: 10/13/2020

Editor Stop Date: 10/13/2020

Editorial Office's note

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