Dear Editor,

Thank you for reading our manuscript and providing your comments. In general, we tried to increase the consistency in the use of the acronyms as requested to improve readability of the manuscript.

Please, find below our response to the specific comments.

Dear authors,

This manuscript was reviewed by two referees who requested a major revision. The revised version was reviewed by one referee who judged that the revised version addressed their concerns adequately. However, I would like to request another revision to improve clarity and readability of the manuscript. Surface melt of Greenland is a highly interesting topic for a broad range of scientists, and satellite remote sensing examined in this manuscript is one of the key observational tools over the entire ice sheet for a historic period with a high temporal resolutions.

I would like to use Table 5 as an example to explain my point. This table includes M (most left column), T, LWC1m and LWC5 cm (second column from left), and C+O on the top row. This table is cited at p.12, whereas M is defined as the January-February mean brightness temperature at p.6 (why "M", by the way, and is it different from Twinter) and it is not cited in the main text where Table 5 is cited. T is not defined, and AWS-measured temperature is defined as Tair at P12L356. LWC is not defined but used many times. I guess "C+O" refers "total error including commission and omission" but it is not defined in the manuscript. I would add headers such as "satellite threshold" and "AWS threshold". In this way, even if M for example is not defined in the text where this table is cited, the readers can develop good understanding of this table. And I would expand the caption to something like "Performance of surface melt detection examined with AWS data. Six thresholds (rows) are used to determine satellite-detected surface melt. For each case, algorithm performance was examined using AWS data with five thresholds to determine surface melt. Commission and omission errors are shown in percentage of the total number of days considered averaged over all the selected AWS. [add explanations for C+O and C+O mean]" For the broad TC's readership, this level of description is necessary.

I echo reviewers' view; this manuscript presents highly interesting and valuable science. However, my own evaluation is that readability and clarify of this manuscript should be improved otherwise the broad readership of TC cannot get the valuable science that you are presenting here.

In general, I request following changes.

1. Remove most of acronyms that do not use so often. Such terms include GrIS, SLR, CDRs, MRF, T-B, E-D, and LTOD (this is not a comprehensive list, and I request the authors to check the entire manuscript carefully).

R: Thank you for pointing this out. I read through the whole manuscript and removed the least relevant and not often used acronyms (all the acronyms mentioned here and others, e.g. SISVAT, E and M for evening and morning).

2. When defined, use acronyms consistently and do not define other acronyms for the same term. Such terms include MAR5cm vs. LWC5cm, M vs. Twinter, and Tair vs T. These terms may refer different values; if it is the case define them more clearly and use them consistently.

R: Thank you for this important comment. I checked the manuscript and corrected all the double acronyms referring to the same term. This should improve the readability of the manuscript.

3. Add definitions of all acronyms. For example, LWC, C+O.

R: Checked the acronyms and added the definitions.

4. Section 3.3 define many acronyms, such as MD, MMD, MMS, MI, MOD, MED, and MMS. If these acronyms are widely used in passive microwave remote sensing and use of these acronyms improves the clarify of this paper for specialists, you can keep using them in the tables and figures, but define them in the captions and minimize their use in the main text.

R: Yes, these acronyms are widely used in passive microwave remote sensing of surface melting and I think that using them is important to keep the same notation of previous works. I defined them in the captions (specifically Figures 9 and 10).

I made some notes below, but please carefully check the entire manuscript to fully improve the manuscript in this round. I expect comprehensive revision to improve readability, and just responding to following specific points does not constitute adequate revision that warrants the acceptance of this manuscript.

All page/line numbers refer those in the mark-up version.

Title: change to "derived from"

R: Agree, changed

P1L12 and L14: do you need to define PMW? Is it better to define PMW as passive microwave at 37GHz vertical polarization?

R: I would prefer to keep this acronym since it has been historically used in the passive microwave notation.

P1L22-L24: present these numbers in a consistent manner. If you indicate the number of days to the first decimal point (e.g. 2.5 days), please do so for the both cases, instead of about 4 days and 2.5 days.

R: Corrected. Thanks

P2L2: Unit for the ice volume in Greenland is km3, not m3.

R: Thank you, it was a typo. Corrected.

P2: Many acronyms are defined in an inefficient manner in this paper. Defined acronyms in the first few pages are GrIS, SLR, SMB, PMW,–rSIR, CDRs,–MRF, GC-Net. Please critically review the manuscript and remove unnecessary acronyms. For example, I don't think following acronyms are necessary: GrIS, SLR, CDRs. Also, once it is defined please use it consistently. I see many sentences that do not use these acronyms (e.g. P3L94, P3L97, P5L141).

R: Thank you for this precious suggestion. I agree that some of the acronyms are not necessary. I removed GrIS, SLR, rSIR, SMB, MRF. I would like to keep PMW and Tb as separate acronyms, as generally done in passive microwave literature. Also, the main melting parameters, widely used in literature, are left in the manuscript (MMD, MOD, MED etc.). I checked the entire manuscript in order to make a better and consistent use of them.

P3L75: Spellout MeASURes (like you did in Abstract).

R: Corrected

P3L94-95: Revise. I cannot get the point.

R: Revised as "However, when considering higher values of T_b, the difference of the atmospheric effect between 37 GHz and 19 GHz T_b decreases (Tedesco and Wang, 2009)."

P4L100: Does "estimates of surface melting" refer melting timing, duration and/or amount?

R: Specified as "We compare results from these algorithms with estimates of surface melting obtained from data collected by automatic weather stations (AWS) in terms of melting timing and with the outputs of the regional climate model Modèle Atmosphérique Régional (MAR; Fettweis et al., 2017) in terms of melting timing and extent."

P5L130: remove coordinates of the Swiss Camp. It appears here and also Fig. 2 caption, while it is shown in Table 1.

R: Removed.

P6L174: LWC is not defined

R: Defined in subsection 2.3 as: "…we average the liquid water content (LWC) simulated by MAR along the vertical profile..."

P6L177: T-B and E-D are defined but not used. I don't think you need to define them.

R: Removed

P6L189: What's the difference between M and Twinter? Also, Twinter is defined so please use it consistently (e.g. P7L198 says winter Tb).

R: It's the same, I corrected the manuscript keeping everywhere the same notation. I choose to keep M to identify the average winter brightness temperature as done in Tedesco (2009) (cited in this paper).

P7L214: MEMLS refers the microwave emission model of layered snowpack in general, so it is confusing if MEMLS is used in two different ways. Indeed, the authors write MEMLS (LWC = 0.2%) later, which is much better to refer MEMLS for a specific case. However, P7L219 uses MEMLS(0.2% LWC). Again, please use these terms consistently. The current manuscript is very hard to read and consistent use of terms will improve readability significantly.

R: Since the only specific case of MEMLS presented is the one with 0.2% of LWC, we refer to the algorithm simply as MEMLS. I corrected the double/inconsistent notetions and specified: "…the algorithm based on MEMLS in case of LWC=0.2% (referred simply as MEMLS from here on for brevity) and the 245 K fixed threshold (245K from here on)" to improve clarity.

P8L224 and P8L234: What do you mean with "novel nature" and "novelty"?

R: It refers to the enhancement in spatial resolution, a crucial novelty in passive microwave remote sensing. We specify now in the text as: "In view of the novelty of this PMW dataset introduced by the enhancement in spatial resolution thanks to the improvement of the gridding technique, .."

P12L367, P12L373, P13L380: air temperature or surface temperature?

R: Air temperature. Corrected.

P13L385 and L387: It was defined as Delta T, not Delta T_b (P6L189).

(I stop commenting editorial issues in the main text here, but request the authors to carefully review the current manuscript and make serious efforts to increase readability of the manuscript).

R: Corrected.

Table 1: change to "…. Used to validate the results in this study." If the table includes the sites not used in this work, remove such sites.

R: Corrected.

Table 2: Do you mean " the sensors used for this work."? "Selected" can be interpreted in many ways and thus confusing. Spell out IFOV in the table or at least define it in the caption.

R: Corrected as: "Instantaneous Field of View (IFOV) [km2]". I removed "Ka-band" in brackets since the frequency is already defined in another table line.

Figure 2: Add Tb after "Brightness temperature" in the y axis label in panel a. The label April 3rd 2012 points to more than 10 days. Use an arrow, instead of circle to specify the date. and are not used often, so I suggest removing them and spell out mean and standard deviation every time. If it is the case, remove these values from the panel and add them to the caption. Remove Swiss Camp coordinates.

R: I substituted brightness temperature with Tb, as it is an acronym already defined. Substituted the circle with the arrow and moved mean and standard deviation information in the caption. Removed Swiss Camp coordinates.

Figure 3: Is the data density (colorbar) normalized? A clarification is needed, what does the value 1 mean?

R: it is the relative frequency. Added in the caption.

Table 3: the left top cell says platforms, but they are sensors (keep Tables 2 and 3 consistent). Spell out PMW (or at least maintain the same style whether caption uses acronyms or spell-outed full terms). Clarify whether "the difference" is $T_{(high-ress)} - T_{(low-ress)}$ or vice versa.

R: Thank you, it's sensors. Corrected. The difference is indicated in the "Senrsors" (e.g. SMMR – SSMIF08)

Figure 4: clarify "Distance" in the caption.

R: Done.

Figure 5: M+DT should use symbol D. Do you need define epsilon to refer emissivity here? Also it is confusing that epsilon is used to define emissivity and the label has the upper bar to show that it is a mean value. Please minimize the use of acronyms. Remove one unnecessary arrow in panel a.

R: Corrected the DT. Removed the additional arrow. Corrected the upper bar epsilon in simply epsilon, typically used in passive microwave notation to denote the emissivity.

Figure 7: Add labels to all y axis. The labels show LWC in percent. If so, it is better to show y axis in percent too.

R: Corrected.

Table 6: What is "245K (MEMLS)" algorithm? Also, the table includes MAR1m MAR5cm, which should be changed to clearer acronyms. They are explained in the caption, but please use the acronyms consistently throughout the paper.

R: Corrected. Also added a sentence referring to the coarse resolution data (reported in table). I preferred to leave MAR5cm and MAR1m as acronyms, clearly defining in the text and using them consistently. In particular I removed the acronyms LWC1m and LWC5cm. I think that now the manuscript is more readable.

Figure 8: check the year collected these data. Caption says 1984 and 2006, but the table labels say 1983 and2005.

R: Yes, thanks. It's 1983 and 2005. Corrected.

Figure 9: Explain solid and dashed lines in the panel. Also consider spelling out all y label terms, or at least define them in the caption. Does panel b show the values in percentage? If so, clarify it in the y axis label.

R: The difference between solid and dashed lines is explained in the caption. I defined MMD, MMS (specifying that it is expressed as fraction of the surface area of the ice sheet), MI, MOD and MED in the caption.

The manuscript includes supplemental materials (5 figures and 4 tables), but none of them is cited in the main text. I have no objection to include them as supplement in this paper (if it is usefully cited), but it is also possible to archive a dataset reporting the values in these tables as well as the those reported in tables in the main text at a data center such as NSIDC or Pangaea.

R: I would like to keep the supplementary material. I think it can be interesting for the reader to have, for example, a graphical comparison for the coarse resolution dataset that might be on the other hand unnecessary in the main text. I added the reference to each supplementary figure in the main text.