Response to reviews of "A revised and expanded deep radiostratigraphy of the Greenland Ice Sheet from airborne radar sounding surveys between 1993–2019"

J. A. MacGregor et al.
15 April 2025

We thank the editor and referees for their careful and constructive comments on this submitted MS. We've addressed them all below as precisely as possible, with their comments in *italicized blue* followed by our response in black. We hope that a suitably revised MS and dataset would be satisfactory for publication in ESSD. Screenshots of the larger-scale tracked changes are given below. Note that the line numbers shown from the tracked changes document screenshot may be slightly different from those in the "clean" version of the revised MS.

Response to referee # 1 (J. Bodart)

> *Abstract: I agree with the Editors that sentences on Line 17-20 are perhaps too focused on the methods (which are useful, but perhaps not universally applicable and the sole focus of this paper), rather than the dataset (which is and should likely be the main focus of the paper and the journal). Perhaps these two sentences could be shortened, and more emphasis made in the abstract about the dataset itself. For example, specifying here the difference between V1 from M15 and V2 from this publication in terms of length of additional profiles traced, layers dated, coverage, etc (e.g. providing some numbers from Table 1; or highlighting the key results of Figures 6-7) would be useful. This would follow well from the sentences preceding Line 17 which describe the two studies and their key difference. As you state in Lines 368-374 and show in Figure 8, there isn't a great deal of difference between M15 and this v2 study (i.e. in terms of depth mismatches that could result from the specific methods used in M15 vs V2 here) apart from the greater amount of data, so these methods, whilst useful, are perhaps not the best take-home message of this study (in my opinion). I would also focus on the key figures provided in the Results section, particularly relating to areas with a relatively well (and poor) preserved age-depth profiles.*

We agree and have revised the abstract to better focus on the dataset changes and less on the methods. We will also expand the beginning of the Results section with a new paragraph to emphasize some of these points.

campaigns (1993–2013) and investigated its value for constraining the ice sheet's history and modern boundary conditions. Here we describe the second version of this radiostratigraphic dataset using all 26 campaigns, which includes substantial improvements in survey coverage and was mostly acquired with higher-fidelity systems. We improved quality control and accelerated reflection tracing and matching by including an automatic test for stratigraphic conformability, a thickness-normalized reprojection for radargrams, and automatic inter-segment reflection matching. We reviewed and augmented the 1993–2013 radiostratigraphy, and we applied an existing independently developed method for predicting radiostratigraphy to the previously untraced campaigns (2014–2019) to accelerate their semi-automatic tracing. The result is a more robust radiostratigraphy and age structure of the ice sheet that covers up to 65% of the ice sheet and includes >58 600 km of newly traced reflections from the 2014–2019 campaigns. This dataset can be used to validate the sensitivity of ice-sheet models to past major climate changes and constrain long-term boundary conditions (e.g., accumulation rate). Based on these results, we make several recommendations for how radiostratigraphy may be traced more efficiently and reliably in the future. This dataset is freely available at https://doi.org/10.5281/zenodo.15132763 (MacGregor et al., 2025). It includes all traced reflections at the spatial resolution of the radargrams and grids (5 km horizontal resolution) of the depths of isochrones between 3–115 ka and

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(a) Regarding the .MAT files: I also agree with the Editors that .MAT formats are not ideal; however, I note that the authors do suggest packages in Python that can be used to read such files (though with no guarantee that these might change in the future). I also note that the authors provide their gridded product in a NetCDF file format, which is much appreciated, particularly to the non-radar community (e.g. ice-sheet modellers). Personally, I would recommend that the .MAT files be converted to text file or CSV/tabular formats and in the same structure as described in Table 3. I don't think any information or ease-of-access will be lost as a result of this conversion and so would encourage the authors to consider this.

Based on our experience with the MATLAB to GeoPackage conversion and other knowledge of MATLAB, we know that we can do this (.mat to .csv conversion), but that it is unlikely to be useful as the file sizes will be prohibitively large and the tabular format will require naming compromises. All the wealth of information in the .mat files on the traced reflections (much more than just depth) is directly accessible via Python's mat73 package (as mentioned on the Zenodo page for the dataset) and for which there is no other known equivalent. We will also provide a simple Jupyter notebook for accessing the .mat file.

(b) Regarding the NetCDF file: I believe that more metadata information should be available, including notes of pre-processing and a more complete description of each variable (using NetCDF's "long_name" for example, but with much more information that currently provided i.e. "long_name = depth"). For instance, it is not immediately obvious what "depth_norm" is in the NetCDF file, and one has to go into the paper to find this out. I would encourage the authors to add more information in the file (e.g. use the information provided in the Description column of Table 5), and if possible, make as much of the variables machine readable following the CF convention (http://cfconventions.org/cf-conventions/cf-conventions.html)

We are confused by this comment as we already had descriptive values for the long_name attribute for all variables in the NetCDF file, and the linked reference page does not clarify what is meant by "machine readable". We already undertook significant effort to make our NetCDF compliant with current standards and tested it following guidance from the previous ESSD editor (K. Mankoff). While it is true that some of the variables we provide do not clearly align with existing NetCDF conventions by their very nature, we attempted to reconcile them where possible. Nevertheless, we will adjust the long_name values of several of the variables to address this concern. We have opted not to include further pre-processing details in the NetCDF file, as any useful exposition thereof would be too long to include as metadata, and the MS is already referenced therein.

(c) Regarding the Geopackage files: I appreciate that these are exported into open-access format and understand that there are limitations (mainly size) with this format which means some information is lost (hence the need to provide also the .MAT files you produced – although as highlighted above, it would be beneficial to convert these to tabular format); however, I would make a small adjustment to the name of the depth_x variables. Instead of having "depth_1", "depth_2", etc., why not provide the age of the isochrone directly into the variable name (e.g. "depth_3.0", "depth_11.7", etc?). Right now, if I open these files, the number following "depth_" means very little to me, and I would benefit more from uploading the tabular data (which I can't in, say, QGIS as it doesn't accept .MAT files), but then this defeats the purpose of the Geopackages and also requires more computing resource (i.e. loading the files, opening the projects, etc). I would recommend making this small adjustment to further enhance their use.

As suggested, we will change the GeoPackage depth variable names to include the reflection age (if available).

depth_XY.Z	Depth below ice surface (not corrected for firn) to reflection whose age is X ka. If undated, the age is given as U. If more than one reflection is dated to that age (or undated), then the variable name is hyphenated with -0, -1 and so forth.	m

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Release of codes: Regarding the MATLAB GUI and tools developed as part of this paper: I believe it to be beyond the scope of the paper to convert/translate these into Python or similar open-access programming platforms. Whilst I feel strongly about making data and codes as open-access as possible in all instances, the value of this dataset and the willingness of the authors to share their codes in the way they have done here is for me enough in this particular case, and I believe that converting these to a more open-access format would undoubtedly delay and complicate the release of this data. Most radar experts have a picker or tool of their own to extract isochrones from radar images, be it in MATLAB, Python, or any proprietary geophysical software such as Paradigm, Petrel, Landmark, or OpendTect. This means there are no "set" or "default" GUI or application used by all, but importantly, they all do the same thing (e.g. all have semi-automatic pickers that follow the peak amplitude within a pre-determined window, with the ability to match isochrones at intersections in 2-D or 3-D view). I appreciate that the authors release the codes associated with their own picker, and in my opinion believe that it is already much more than what most papers provide in terms of software and associated codes. It would, of course, be more beneficial to the wider scientific community for these to be translated into an open-source software, but I believe that the release of the dataset (with improvements, as suggested here in my review) would be sufficient for the purpose of this study.

We agree that, ideally, all products and codes should be open-source and free to use. In the case of our MATLAB codes and products, they are effectively open source and freely distributed, but they are not free to use given the MATLAB license required. The primary GUI alone is nearly 5000 lines of code that relies on existing MATLAB functionality, and translating this into Python is presently not feasible. The data analysis codes could almost certainly be translated. The main reason this has not yet been done is resource and time availability.

Lines 38-41: Perhaps it would be relevant to cite the AntArchitecture paper (Bingham et al., 2024; in review) here to guide readers early to a review paper of isochronal stratigraphy and its uses/benefits. Sure, it's based on Antarctica mainly but would fit in well nonetheless here.

Good point and we will add that in.

of the present-day GrIS in a manner not achieved by other spatially distributed observations; it is also potentially valuable for identifying well-initialized instances of ice-sheet models (e.g., Bingham et al., in review).

Line 47: Citation to Rodriguez-Morales et al., 2014 is missing in the reference list. Do you mean Rodriguez-Morales et al., 2013 (IEEE)? I have not checked the other references, but I would encourage the authors to do so just in case.

IEEE publication dates are quite confusing: https://ieeexplore.ieee.org/document/6557071. We and the referee are likely referring to the same article, but 2014 seems like the better publication year. Regardless, the referee is correct that this citation was missing from the reference list and will be added in.

Rodríguez-Morales, F., Byers, K., Crowe, R., Player, K., Hale, R. D., Arnold, E. J., Smith, L., Gifford, C. M., Braaten, D., Panton, C., Gogineni, S., Leuschen, C. J., Paden, J. D., Li, J., Lewis, C. C., Panzer, B., Alvestegui, D. Gomez-García, and Patel, A.: Advanced Multifrequency Radar Instrumentation for Polar Research, IEEE Trans. Geosci. Remote Sens., 52, 2824–2842, https://doi.org/10.1109/tgrs.2013.2266415, 2014.

Line 86: Sure, but the reason is because they had not been acquired yet when M15 was published. So, it is perhaps more accurate to say: "Values in parentheses for v1 are surveys that had not yet been flown and therefore traced by M15", or similar.

We will reword this statement for clarity roughly following the referee's suggestion to: "Values in parentheses for v1 are campaigns that were not traced by M15 because they were either not yet available (2014) or had not been flown at the time (2015–2019)."

lower values for those earlier campaigns than reported by M15. Values in parentheses for v1 are campaigns that were not traced by M15 because they were either not yet available (2014) or had not been flown at the time (2015–2019). For this study (v2), the total length of the reduced set for each campaign is reported.

Lines 107-110: This is more for my own understanding, but I don't understand why having repeat tracks in the dataset is an issue. Maybe it is clear to the authors who "see it" when they process the data and grid, but to me it sounds like a good thing: if it is a repeat flight with the same xy, the layers should be the same across both profiles and thus be an advantage rather than an inconvenience? Why would this be an issue for producing an "ice-sheet-wide radiostratigraphy"? Perhaps just a few words to explain this would help.

We will clarify this issue in the text as: "For example, minor variations in flight track can lead to numerous intersections of two slightly different flights to evaluate, which increases the potential for incorrect matches, and having numerous closely spaced reflections can unduly bias subsequent 2-D gridding at the ice sheet scale."

> ice-sheet-wide radiostratigraphy. For example, minor variations in flight track can lead to numerous intersections of two slightly different flights, which increases the potential for incorrect matches, and having numerous closely spaced reflections can bias subsequent 2-D gridding at the ice-sheet scale. In this study, we explicitly avoid tracing repeat tracks by first collating
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Line 130 and Figure 2: You mention the word "set" – is this the same as "segments" in Line 70? If so, use a common word throughout (I personally prefer "segment")

We will clarify this parenthetically in the text as "portions of segments", because they are not necessarily whole segments and in fact rarely are.

> has remained the same. Here we simply concatenate contiguous sets of frames (portions of segments) as needed for the reduced

Lines 156-158: This sentence is a bit confusing – could you rephrase it please?

We agreed and will reword it to: "We selected this method for reflection prediction in previously untraced campaigns (2014–2019): 1. It does not require complex data; 2. It permits reflections to terminate; 3. It often generates realistic synthetic radiostratigraphy; and 4. The algorithm was publicly archived."

> to then propagating these candidate reflection peaks horizontally using Hough transforms for slope prediction. We selected this method for reflection prediction in previously untraced campaigns (2014–2019): 1. It does not require complex data; 2. It permits reflections to terminate; 3. It often generates realistic synthetic radiostratigraphy; and 4. The algorithm was publicly archived. We refactored the ARESELP algorithm (written in MATLAB™) to both accelerate it and improve QC of its output; we then applied it to the 2014–2019 campaigns (Figs. 2b, 3a). Despite our improvements, ARESELP is only used to predict
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> **Deleted:** Because their method does not require complex data, permits reflections to terminate, often generates realistic synthetic radiostratigraphy and was publicly archived, w…

Line 256: "the reduced set" – do you mean the "greater set"? (i.e. the opposite of reduced?). Your previous sentence says that you relaxed your search radius which increased the number of core intersections?

We do mean the reduced set, because it doesn't include any repeat tracks and so there are fewer Camp Century intersections. We will clarify this point parenthetically.

core from 3 to 5 km, increasing the number of core intersections from 53 to 65. The use of the reduced set (no repeat tracks)

Line 261: "near" – could you be more specific (e.g. how many samples below or above)?

We will clarify this as "(no more than the thickness of a dated layer pair or 20% of the ice thickness, whichever is less)".

interpolate the age of undated reflections that are either sandwiched between or are vertically near pairs of dated reflections (no more than the thickness of a dated layer pair or 20% of the ice thickness, whichever is less). This method seeks the best-fit vertical strain rate that can match the depth–age relationship of the two bounding reflections, and then uses this vertical

Line 270: "paleoclimatic interest" – could you provide some references or be more specific to justify why those specific ages were chosen?

We clarified this description and added a citation to Rasmussen et al. (2006).

ka) along with five more of additional paleoclimatic interest from the Late and Early Holocene, the bounds of the Bølling-Allerød period during the Last Glacial Period, and an approximate Last Glacial Maximum (3, 8, 12.8, 14.7, and 19 ka; Rasmussen and others, 2006).

Lines 307-308: Can you be a bit more specific as to how you account for the uncertainty associated with the interpolation/extrapolation of "age" here?

We will clarify this with: ", which is based on the age uncertainty of the existing dated reflection pair and the variance of the interpolated/extrapolated age across the overlapping section (Equation 12 in M15)."

interpolation/extrapolation of age, which is based on the age uncertainties of the existing dated reflection pair and the variance of the interpolated/extrapolated age across the overlapping section (Equation 12 in M15).

Line 317: Refer to Figure 2 (third panel) here.

We will add this figure reference.

core-dated reflections, and another 55.7% using quasi-Nye dating, leaving 22.8% of traced reflections undated (Fig. 2c). Direct

Line 429: You could consider adding Sutter et al. 2021 (https://doi.org/10.5194/tc-15-3839-2021) here too.

We agreed and will add this reference.

2021; Sutter et al., 2021). However, how to enable ML to perform a similar prioritization remains unclear. Third, as emphasized

Lines 436 or 443-444 (when mentioning Karlsson et al. 2024 dataset): One could also highlight the higher level of uncertainty in the geolocation of the radar profiles which could introduce errors when comparing with this v2 dataset.

That is a fair point and we will add a short statement to the end of this paragraph pointing out this issue: "For the older 1970's data, their greater geolocation uncertainty may also present an additional challenge in matching reflections with those from newer systems."

the newer AWI data operated in narrowband mode is comparable to most of the radar systems considered here. For the older 1970's data, their greater geolocation uncertainty may also present an additional challenge in matching reflections with those from newer systems.

Line 446: One could also add Bodart et al. 2021 (https://doi.org/10.1029/2020JF005927)
Line 458: Again here, I would add Sutter et al. 2021 (even if it's over Antarctica)

We agree and will add these references.

Further, there is precedent in Antarctica for similar multi-system reconciliation of radiostratigraphy (Bodart et al., 2021; Winter

Conclusion: Again, I would recommend that the authors add a bit more detail to this section, in a similar way than for the abstract. I found the conclusion a little underwhelming considering the achievement of this V2 dataset, and I believe it is worth highlighting again the key messages and figures shown in the paper. Perhaps this is also a further opportunity to encourage the modelling community to make use of this dataset to constrain their paleo simulations.

I find Figures 6 and particularly Figure 7 very well made and informative. They are definitely the key figures of the paper for me, and the statements made in and around these figures (e.g. Lines 342-345 and 355-366) could serve as a basis for an improved version of the existing abstract (and conclusion), as discussed above.

We will address this concern by further specifying what we consider to be some of the key results of this study and adding a sentence that revolves around the results shown in Figures 6/7, e.g., "This version of the dataset continues to indicate that the oldest ice in the Greenland is likely in northern central GrIS, that the ice sheet is significantly older in northeastern and far northern Greenland, and that the radiostratigraphy and age structure of the GrIS south of 65ºN remains challenging to map using presently available data and techniques."

substantially fewer tracing errors, is more self-consistent and is expected to be more robust for future modeling efforts. This version of the dataset continues to indicate that the oldest ice in the Greenland is likely in northern central GrIS, that the ice sheet is significantly older in northeastern and far northern Greenland, and that the radiostratigraphy and age structure of the GrIS south of 65ºN remains challenging to map using presently available data and techniques. Finally, we modernized and

Figure 1a: It is a bit difficult to see the difference between low and medium priority colours on Fig. 1a due to the white background. Could this background be grey, or could the colour scale be changed to something else (e.g. divergent)?

We will change this trio of colors to a diverging color scheme that is easier to distinguish.

Figure 2: Again, here for the "Date reflections" panel, it is a bit hard to distinguish on the radargram the different colours. Could you use a divergent colour scale? Also, perhaps it would be useful to name the sub-panels (a-d) and refer to each of these steps in the text. Finally, and still relating to panel 3 of this Figure, I find the information presented a bit confusing for several reasons: (a) I suspect that the numbers provided at the bottom of this sub-figure are for the whole GrIS, but it can be confusing as one might interpret that these numbers pertain to this specific segment; (b) a more complete caption would really help guide the reader, as it is not easy to understand what is meant by "overlapping reflections" and why there are two arrows between this step and "match to overlapping reflections", beyond the obvious fact that it's a closed loop. One of course can find this information in the text somewhere (or on Figure 5, which does help), but the figure and accompanying caption could help the reader more to get a quick sense of what is being presented without having to go find it in the text.

We will make numerous adjustments to this figure to address the referee's concerns, including adding panel lettering, expanding the caption, clarifying that the values given are for the entire dataset, changing the color scheme for the third panel (now c), and adding references to different panels in the text as appropriate. We will select a sequential scheme rather than diverging for the reflection colors, but will attempt to distinguish them more.

Figure 2: Flowchart illustrating the key steps involved in generating GrIS radiostratigraphy v2. Values given relate to the entire dataset, not just the radargrams shown. (a) Radargram preparation, including selection of the reduced set and concatenation (§2). (b) Typical tracing workflow and subsequent inter-segment reflection matching (§3.1, 3.2). (c) Reflection dating begins at ice cores, is sequentially propagated outward using reflections matched core-intersecting ones, and then any remaining reflections that horizontally overlap with already-dated ones are then dated where possible. The latter two steps are then repeated until no new reflections are dated. White reflections are undated

(§3.3) (d). Gridding isochrones begins by vertically interpolating the dated radiostratigraphy to pre-selected ages/depths, and then each of those ages/depths are gridded two-dimensionally using ordinary kriging (§3.3).

Response to referee #2 (S. Franke)

MacGregor et al. describe a dataset of revised and expanded deep radiostratigraphy of the Greenland Ice Sheet (GrIS) from airborne radar soundings collected by KU/CReSIS/NASA/NSF between 1993 and 2019. The dataset is an improved version of the *initial version from MacGregor et al (2015). The authors describe the methods to generate the data, methodological improvements to the initial dataset version with the aim of developing a more complete radiostratigraphy of the GrIS with reduced uncertainties. Along to this manuscript, the authors publish the data as a gridded product for modelers and point data in different data formats.*

In my opinion, this dated radar stratigraphy dataset (along with the previous version by MacGregor et al., 2015), represents one of the most important and comprehensive datasets of the Greenland Ice Sheet (GrIS). It is particularly relevant for paleo ice sheet modeling and deciphering past dynamics of the GrIS and deformation history its englacial architecture. A homogeneous dataset of radiostratigraphic information of this scale is unique and demonstrates an immense amount of work and foresight in publishing it in such a consistent form as presented in this paper.

The improvements to the previous dataset are very useful, and I highly appreciate that they have been made. Additionally, the thorough documentation of these improvements (e.g., Table 2) is well-presented and well-justified. The description of the tracing philosophy, methodology, and procedure is detailed and very useful for anyone working with internal reflection horizons in radar data. The coverage, usability, and dating approaches are well-explained and demonstrate that the data have been sufficiently validated and are robust. I also find the discussion very useful, particularly, the part on machine learning methods for accelerating the tracing of radiostratigraphy.

I appreciate that this dataset has been submitted to ESSD and recommend its publication, taking into account a few minor comments and questions.

We appreciate the referee's kind words and appreciation of the structure of the MS and dataset, its aims and its ultimate value.

L375-381: I agree that your gridded data product is difficult to compare to those released in Franke et al. (2023). My additional remarks here are that they are particularly difficult to compare because the "FINEGIS" and "NEGIS" in northeast Greenland data sets are based on AWI radar data alone. Hence, in addition to the different ages of the AWI IRHs, the data basis is also different.

The Peterman and central Greenland datasets in Franke et al. (2023) are constructed from CReSIS data, however the segment-wise interpolation along fold anticlines and synclines to maintain fold orientation introduce also differences in the gridding products.

Thanks for the clarification on how the Petermann and central Greenland datasets were generated. They are unusually effective in conveying the internal structure and perhaps in the future the radiostratigraphy could be similarly interpolated but at the scale of the whole ice sheet.

L437-438: Consider citing rather the original studies of the AWI surveys (e.g., Franke et al., 2022 and Jansen et al., 2024) instead of the data description paper.

We agreed and will add these references.

surveys using newer CReSIS-built radar systems (e.g., Kjær et al., 2018; Franke et al., 2022, 2023; Jansen et al., 2024).

L438-444: Additionally, one could mention here that a large portion of the AWI radar data in Greenland have a similar range resolution as the CReSIS data: ~ 5 m for the EMR system with the 60 ns burst and ~ 4.3 m for the AWI MCoRDS 5 system in narrowband mode (180-210 MHz).

That's an excellent point and we will clarify this in the text as: "and the bandwidth of some of the older AWI data (short chirp mode) or the newer AWI data operated in narrowband mode is comparable to most of the radar systems considered here."

et al., 2017; Cavitte et al., 2021; Franke et al., 2025), and the bandwidth of some of the older AWI data (short chirp mode) or the newer AWI data operated in narrowband mode is comparable to most of the radar systems considered here. For the older

L467: Code and data availability:

Please provide the .mat file version, as for some non-Matlab programs or libraries this is important to know.

We agreed and will add clarification that they are version 7.3, because that is significant when it comes to which Python package to use to import them.

format of the HDF-5-compatible MATLAB™ (v7.3 .mat) files that contain each campaign's traced reflections for each

Table 3: Is somewhere documented that the stratigraphy.twtt in the mat files is two-way travel time below the surface reflection twtt? I can't remember finding this info in the text, but I might have overlooked it.

At least, when I tried to plot the stratigraphy.twtt on top of the radargrams (example: 19990507_01_001-003) they needed to be below surface twtt to appear correctly.

It was mentioned but only briefly, so we will further emphasize this point, as we agree that otherwise it would be confusing. The reason this was done is because we sometimes retraced the surface traveltime, so we concluded that reporting an englacial traveltime would be simpler, as the datasets natively come with a reported surface traveltime (and we included our revised ones in our dataset).

stratigraphy.twtt	Englacial traveltime to reflection	s

Regarding stratigraphy.int Reflection relative echo intensity: How is this determined? Is it the value in dB of the pixel where the pick is allocated or a cumulative value within a certain window around the pick?

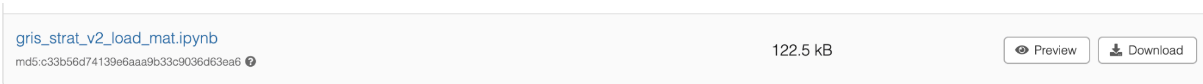
The echo intensity is only the dB value of the pixel, not a window around it as that naturally fell out of our tracing algorithm and also because we do not believe there is yet consensus in the community as to how to window the reflection to calculate its echo intensity in a cumulative manner.

stratigraphy.int	Reflection relative echo intensity (single sample, not window-integrated)	dB

I made a short test plotting the stratigraphy of one segment for Greenland_radiostratigraphy_v2_1999_Greenland_P3.mat – Segment: 19990507_01_001-003 and my impression was that working with the data was user-friendly and I find the information in the matfiles very useful and their structure very well organized. I think it is ok to have one file per season and not one huge file or hundreds of smaller files.
I have read Julien Bodarts review, and I agree that publishing the extensive data version as .mat files only (I am aware that you are also providing a GeoPackage version with reduced information) can be problematic for non-matlab users (or those without a license). For Matlab users, this is format and structure is wonderful. For Python users you mention the mat73 package, and it is probably the only python library (that I have found) that can easily read the matfiles provided here because it directly translates it into a python dictionary with nested lists and dictionaries and keeps most data types intact. I've tried to load the matfiles with h5py, which I believe is more common to read HDF5-based data formats in python, and which should work also, but here I experienced problems accessing the nested data structures and resolve the data types.

However, I admit that I have not invested an enormous amount of time in this, and therefore, this comment should be seen more as the perspective of a potential user who is trying to use the data. I also don't know how data access works for users who neither use matlab or python.

Considering this comment and referee #1's comments, and our brief mention on the dataset description page of the use of the mat73 package, we will generate a Jupyter notebook that loads the entirety of one of the campaigns' .mat datasets into a nested series of NumPy arrays that is as close as possible to the original .mat structure, and have now included that notebook with the revised dataset. In this manner, we believe that we will address the needs of the large majority of potential users of this dataset.



I have mixed feelings about the idea publishing the matfile information as tabular data and I understand the dilemma, because due to the nested structure it will probably end up either huge files with tens to hundreds of columns or in many many single files. I think one idea for a more universal access to the information provided in the matfiles could be to save them in the same or similar structure as netCDF files. However, I cannot say for certain whether I, as a reviewer, can demand that this format should be provided. This could and should probably be alongside the mat files and not replace them, as for Matlab users and for the CReSIS/KU community they are the most useful data format.

We looked into NetCDF for this purpose, but it is also an suboptimal data format for this dataset with strict conventions, as we learned during the generation of the 2-D grids, so ultimately it did not make sense in this case. We also earlier during the review process looked into conventional HDF5 (not MATLAB's version) and found it similarly unwieldy.

Regarding the Geopackage files: I was unable to retrieve the metadata on the ages of the different depths. Could you provide either an instruction how to access this metadata in the geopackage files or (as Julien suggested) add the ages to the "depth_*" variable names?

This is one of the riddles we discovered when generating the GeoPackages: We can write some metadata, but we could not figure out to *read* the metadata we wrote in any program that wasn't simply opening the XML-formatted GeoPackage in a text editor. This includes that package which we used to write the metadata (GeoPandas) and QGIS. It is perplexing. Nevertheless, in response to referee #1, we will change how the reflection depths are labeled to include their ages.

depth_XY.Z	Depth below ice surface (not corrected for firn) to reflection whose age is X ka. If undated, the age is given as U. If more than one reflection is dated to that age (or undated), then the variable name is hyphenated with -0, -1 and so forth.	m