

Comment on **essd-2022-49**

Neil Ross (Referee)

Referee comment on "British Antarctic Survey's aerogeophysical data: releasing 25 years of airborne gravity, magnetic, and radar datasets over Antarctica" by Alice C. Frémand et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-49-RC2>, 2022

This is a very welcome paper/manual/documentation of the BAS aerogeophysical system & the open release of an astonishing amount of aerogeophysical data acquired over multiple decades. On behalf of the scientific community I would like to say thank you, and pay testimony to the considerable work and effort that is represented by, and outlined in, this paper. This important paper and data release are vitally important for understanding ice sheet dynamics and change, and the scientific community can now use these data. I found it particularly useful to see all the different surveys reviewed, and key references provided for those surveys, in one single document. It is also very useful to see the technical aspects and set up of the PASIN radar system so comprehensively documented formally for the first time (aside from the slightly difficult to access 'Terra Antarctica' report from 2006). Documentation of the evolution of the BAS aerogeophysical system since 1994 is also useful.

Major comments

- This 'data paper' is all encompassing and highly informative, and thereby provides a very useful 'one-stop-shop' for those working with and analysing BAS aerogeophysical datasets. At times, this all-encompassing nature has its disadvantages however, resulting in a very long and at times slightly unwieldy manuscript. I therefore wonder whether there were ways to streamline it a little. Perhaps sections 4 & 5 could be reduced in length? Section 5 presents an interesting case study/exemplar of the use of the data facilitated by the open data release, but it does tend to imbalance the closing stages of the paper towards the radar dataset, particularly since magnetic and gravity examples are not given.
- There is a need to be consistent with recognition/acknowledgement of external partners when reviewing all the surveys. There is somewhat strange non-UK bias when detailing external collaborations (e.g. contrast the description of the IMAFI survey in lines 261-276 with ICEGRAV and PolarGAP surveys in 277-282 & 284-289). I think it would be good to acknowledge the involvement of UK non-BAS institutions a little more. Even

if individual collaborators/PIs are not referred to by name, then there should be parity of acknowledgement (e.g. why UTIG, Technical University of Denmark, but not the University of Edinburgh, Bristol etc.?). This suggestion is about consistency of approach really. It may also be appropriate and fitting to recognise Richard Hindmarsh's scientific contribution to the IMAGE-GRADES survey.

- Picking uncertainty: the section on radar bed picking might need to be a bit more open about potential errors associated with different pickers. Different people, often not radar experts, picked radar data using standard protocols and systems. Individual calls need to be made however, and these can be difficult to make (as I picked the IMAFI dataset whilst a postdoc I should know!). My understanding is that some pickers were not experienced radar users or researchers so different surveys may have different errors.
- Are small-scale opportunistic/targeted surveys missing from the data release? I'm thinking of surveys like that of Flask Glacier (<https://doi.org/10.3189/2013AoG63A603>) and surveys over the ice rises of the Weddell Sea (I'm aware of ice rise survey flights undertaken in the 2010/11 season on behalf of Richard Hindmarsh). It might be worth a 'mopping up' paragraph in section 2.2 to capture opportunistic/targeted surveys.
- Section 5: I think it is important to re-frame section 5 to make it clear that it is an exemplar case study to avoid radar-dataset bias. I also think that section 5 could be considerably condensed. The whole point of section 5 is to demonstrate the validity/usefulness of releasing the data openly. What is the 'added-value' provided by the release? This is the priority of this section, rather than the admittedly interesting findings etc. of the ILCI analysis. I therefore suggest that section 5 be reworked to make this demonstration clearer (see minor comments relating to section 5 below for more details). It may also be worthwhile flagging the potential application of AI on this 'big data' dataset in section 5.

Minor Comments

Line 36 – “not openly available” rather than “unpublished in full”?

Line 37 – how about more generic language? i.e. rather than “gravity inversions, bed-reflectivity....”, what about “geological and glaciological applications”?

Line 52 – rather than “fully processed”, “online radar dataset”?

Line 67 – it is not just bedrock beneath the ice. Could be sediment or water.

Line 68 – ice sheet 'bed' is not necessarily an accessible term to non-glaciologists. Define this term?

Line 72 – Napoleoni et al 2020 would be an appropriate recent reference here as it used

BBAS data. I note it is referenced elsewhere in the manuscript, so is not an additional reference.

Line 87 – “modern digital aerogeophysical surveying”?

Line 89 – typo “aerogeophysics”

Line 91 – “...have played a vital role....”

Lines 97-103 – a very long sentence. Split in two?

Line 115 – “...for understanding...”?

Line 117 – no need for “As a result,....”. Start sentence with “This lack...”?

Section 2.1 – it might be useful to make it clear at the start of this section that the data release for 1994-2004 does not include processed RES data.

Line 163 – is there a reference for TORUS? I understand that it is not a survey that was really worked up, but there is an AGU abstract that could potentially be referenced (<https://ui.adsabs.harvard.edu/abs/2003AGUFM.C31B0402J/abstract>). Possibly also <https://doi.org/10.3189/002214308784409125> ? Might also be worth inserting a line about the scientific aims of the TORUS survey to be consistent with the descriptions of the other surveys in this paragraph?

Line 178 – Is “coverage” the correct term here? How about “areal extent” instead?

Line 185 – I don’t think “techonomic” is the correct term here? “Tectonic”?

Lines 190-192 – is it worth inserting PASIN 1 and PASIN 2 in this sentence to explain the separation of 2004-2015 and 2015-2020?

Table 1 – is Evans Ice Stream 'WAIS'? Some might argue it is APIS. Same applies to Dufek, is it really WAIS or is it EAIS?

Table 1 & section 2.2.1 – made me wonder whether some 'opportunistically-acquired' PASIN datasets might be missing from table 1 and the data release. I'm thinking specifically about Crane/Flask Glacier (<https://doi.org/10.3189/2013AoG63A603>) and Weddell Sea ice rise surveys undertaken in 2010-11. There may be others. If these are not included in the data release then it might be useful to make it clear in this manuscript that the data release does not include occasional small-scale opportunistically-acquired datasets like these.

Table 1 – could table rows be colour filled to visually distinguish PASIN1 and PASIN2 surveys?

Lines 228-238 – it would be worth explaining here that the data released here is approximately one half of the overall AGAP project RES data. The US data AGAP data are archived and available elsewhere already (e.g. CReSIS data website).

Line 258 – "collaborative projects" – collaborative with who? Information is provided for the ICEGRAV survey, but not IMAFI.

Line 261 – "test" rather than "assess"? This project was definitely hypothesis-driven.

Line 284-289 – a rather long unwieldy sentence. I recommend splitting in two.

Lines 305-308 – Some detail on outlet glaciers/ice streams surveyed is missing here. Academy Glacier, Bailey and Slessor ice streams, and Support Force Glacier were surveyed. The survey lines over Bungenstock Ice Rise (whilst welcome) were opportunistic and a low priority target compared to the surveys of these outlet glaciers/ice streams.

Line 360 – "All BAS aerogeophysical..." (i.e. delete 'of').

Figure 5 – requires annotation of antennas and magnetometers on Figure 5a.

Figure 5 caption (and elsewhere in text body) – "antennae" or "antennas"? I'll leave that up to the authors and copy editors to decide on. I note lines 444-448 have a mixture of

usage.

Line 425-428 – I'm not sure "...acquire logarithmic detected waveforms to complex coherent acquisition." quite makes sense. Is there a missing word (e.g. "...to facilitate complex...")?

Line 432 – Typo "aiborne"

Line 435 – "...modern methods of digitisation..."?

Line 448 – "configured" not "configure"

Lines 439-452 – Quite a bit of this paragraph seems to be repetition of figure caption 5?

Line 458 and elsewhere in this section – Make it clear that the radar system is PASIN-2.

Line 462 – "Data" from PASIN-1 or PASIN-2 or both?

Line 466 – Missing MHz (x2) "10-MHz" and 13-MHz"

Line 469 – "The radar..." PASIN2?

Line 487 – "...of the PASIN 1 & 2 systems is..."

Line 487-492 – why are these parameters important enough to warrant text body description? Is this not simply repetition of the information provided in the table?

Line 497 – Trimble not Timble (x2)

Line 508-513 – I appreciate that these LiDAR data are 'released' as part of the along-track

measurements, but in at least 1 survey (IMAFI) & probably more, swath data were acquired. Are there plans to process and release these data in future?

Line 532-535 – This sentence is a bit complex. Perhaps split after “been applied” to read “...been applied. This includes the use of...”

Line 556 – “...important geophysical signatures...”?

Line 559 – “Magnetic data were then....”

Line 560 – “noises” or “noise”?

Line 566 – “shows” rather than “provides an insight of”?

Line 573 – “referred to as” rather than “just referred as”?

Line 588-590 – not strictly true as written as SAR techniques were later applied to a subset of the data (Heliere et al. 2007). Perhaps re-word to avoid confusion, explaining that the released data & Vaughan et al. 2006 not SAR processed? It would be useful to revisit the BBAS data and re-process with SAR techniques, followed by re-picking & release. The importance of the survey area (i.e. Pine Island Glacier/Thwaites) may warrant this, though admittedly it is a big job which is well outside the scope of this data release & manuscript.

Line 592-593 – Is this statement 100% correct? I didn't think that the 2006/7 IMAGE-Grades survey data were SAR processed (Maybe also the Wilkes Basin survey?). Perhaps I have this wrong however.

Line 600-601- this sentence would benefit from a reference. Would Castelletti et al. 2019 be appropriate here? <https://doi.org/10.1017/jog.2019.72>

Line 625 – Castelletti reference may be appropriate here too?

Line 628-630 – Which survey was the Flask Glacier from? This is perhaps an example of

the targeted/opportunistic surveys that I discuss in major comments above. Would be good to explain if this was part of one of the released survey datasets (Table 1) or is something else, even possibly not released here.

Line 632-635 – A sentence that is probably worth splitting in two. Also needs a little clarification by what is meant by “institutes”.

Line 636 – Opens with “we”, but I suspect that this is not appropriate here. “The BAS approach is to pick...” might be better. I’m aware that many people worked as ‘pickers’ (including myself) to pick the bed for these surveys, and at least some of these were not necessarily people with significant radioglaciology experience beforehand. It might be worth reflecting this in the text.

Line 638 – “...manual re-picking...”?

Line 659 – provide an example/reference for an ‘older survey’ like this.

Line 674-678 – provide a range of typical crossover errors from the surveys here? I’m aware that Ross et al. 2012 <https://www.nature.com/articles/ngeo1468> includes separate RMS errors for smooth and rough topography, so could be useful in this regard. Aside from crossover errors have BAS ever undertaken any other error assessment on picking of the bed from the radar datasets (e.g. comparison of picks by different pickers etc.)?

Table 3 caption – should the data held at CReSIS be linked to a DOI?

Line 739 – “...exported and made available...”?

Lines 765-776 – lots of repetition of figure caption information here (e.g. “highlighted in blue”). I recommend careful editing to remove unnecessary repetition.

Line 811-812 – “The portal interactively showcases...”?

Line 845-846 – I suggest swapping “geophysical data” in here, rather than “radar data”. The radar data are simply being used here as an exemplar on behalf of the entire dataset released and described. It would be good to reduce the potential view of section 5 being radar-biased, and instead be inclusive of all the data types (but without a case study

exemplar for each).

Lines 850-878 – Can this section be considerably shortened?

Line 852 – move “limited” to earlier in the sentence? E.g. “...suggest limited changes...”?
852-854 took me a while to fully comprehend so some form of rewording probably necessary.

Lines 879-883 – A lot of the text here can be reduced by simply inserting “between 2004-2020” in the first sentence, and referring to table 1. Then the second sentence listing all the surveys can be deleted?

Lines 904-907 – be specific about the differences between AGAP and BBAS surveys? i.e. one was SAR processed, the other was not.

Line 908 – The end of this paragraph presents an opportunity to reinforce the important message of section 5, i.e. to demonstrate the validity and usefulness of releasing the whole dataset openly (i.e. that this sort of metadata level analysis can be undertaken on a continent-scale, and that new and developing techniques and approaches (e.g. AI etc.) can be applied). That then mitigates the potential radar data bias that comes across with section 5 at present.

Lines 916-923 – lots of geographic locations referred to in this paragraph. These need annotated on a figure.

Line 939 – where it says “further exploited in the future” make the case that this is only possible because these data have now been so comprehensively and openly released. There’s an important argument and case to be made here as there is still work to be done across the scientific community (and funders) about the importance of undertaking and funding the work necessary to facilitate data release. The authors have an important and high-profile opportunity here and my recommendation is to reinforce this case here strongly.

Line 942 – at the risk of recommending citing my own work, an appropriate reference to cite here could be Ross et al. TC 2020
<https://tc.copernicus.org/articles/14/2103/2020/tc-14-2103-2020.html>

Lines 943-952 - I suggest these lines be removed. They are very radar data-/glaciology-

specific, and I think it dilutes the broader geophysical importance of the entire dataset a little. The ILCI analysis of the radar data should be a representative of the entire dataset demonstrating why open data is so important. It's an excellent example, it probably just needs to be presented in a slightly different way.

Line 956 – Napoleoni et al 2020

<https://tc.copernicus.org/articles/14/4507/2020/tc-14-4507-2020.html> would be appropriate here. It is referenced elsewhere in the manuscript so is not an additional reference.

Lines 991-995 – this sentence is unnecessary. Just insert appropriate references in line 989-991.

Line 1000-1005 – it wasn't totally clear that there is a current plan to release the 1994-2004 RES data from the text here. Is there one?

Line 1009 – reference Castelletti et al. again here?

Line 1008-1009 – it might be worth inserting a comment here that were data to be re-processed with new approaches then the aerogeophysical data platform could be used or adapted to release those data openly.

Line 1011 – Is there a plan to release these raw radar data files to the community?

Line 1025 – 2D radar data released 2004 onwards only.

Line 1044 – RINGS and AntArchitecture action groups: are there DOIs or references that can be linked to here? 10-20 years from now readers may wonder what these action groups were without this.

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