Respond to the comments of RC2 (Christoph Kittel)

Review of The AntAWS dataset: a compilation of Antarctic automatic weather station observations by Wang et al., 2022

Wang and al. present a dataset of compiled AWS data over the Antarctic Ice Sheet. Data include near-surface temperature, humidity, wind speed and pressure. Quality checks have been performed on the data to remove outliers. In general, the original data set (3h) was already directly accessible in open access (https://amrc.ssec.wisc.edu/data/ftp/pub/aws/antrdr/) with for some already remarks on the quality of the measurements. The addition here then consists in a more thorough treatment of the reliability of the data.

Response:

We would like to thank Christoph Kittel (the reviewer) for doing the thorough review, and for the thoughtful and constructive comments and suggestions that improved the quality of our manuscript. All your comments have been considered and the manuscript has been revised accordingly. Please see our point-by-point responses on the major and specific comments.

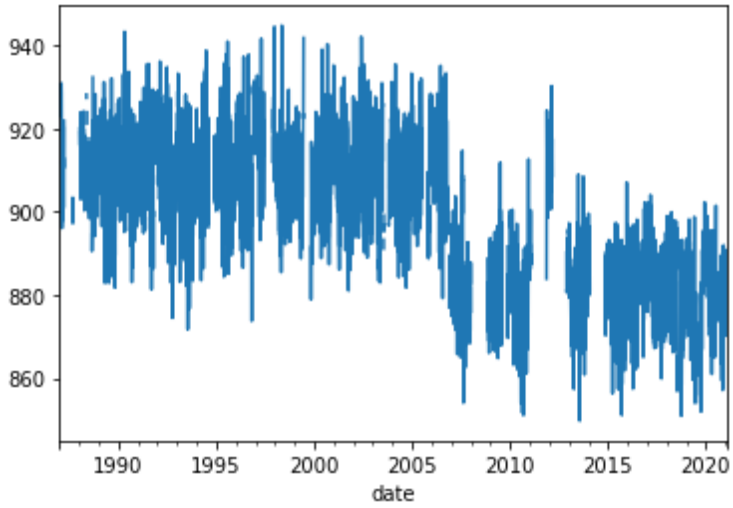
Major comment

1. I have already used the original raw dataset to evaluate climate models (see remark further about the introduction) and create a compiled dataset. The quality controls I made were only visual when the comparison with both RACMO and MAR (often-used regional climate models) revealed strong disagreement with the data. If nothing looked wrong, I concluded that it was simply the models that were wrong. However, this simple method allowed me to detect many outliers and remove data while giving greater confidence in the observations. Therefore, a better outlier evaluation technique applied to these data could allow to build a very useful dataset. This is what I expected from the data. I didn't take the time to double check every data, but only a few stations for which outliers seemed to be present when I firstly used these data. I then did a quick comparison with the latest MAR results.

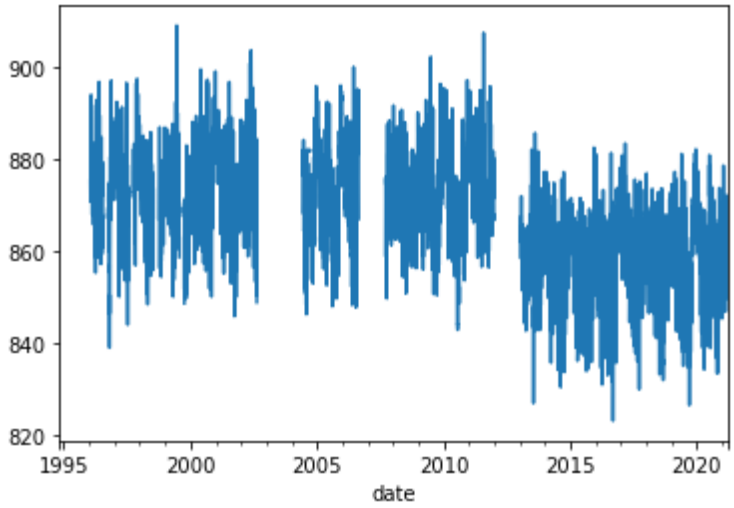
These values do not seem to have been removed in the AntAWS dataset. Here are some

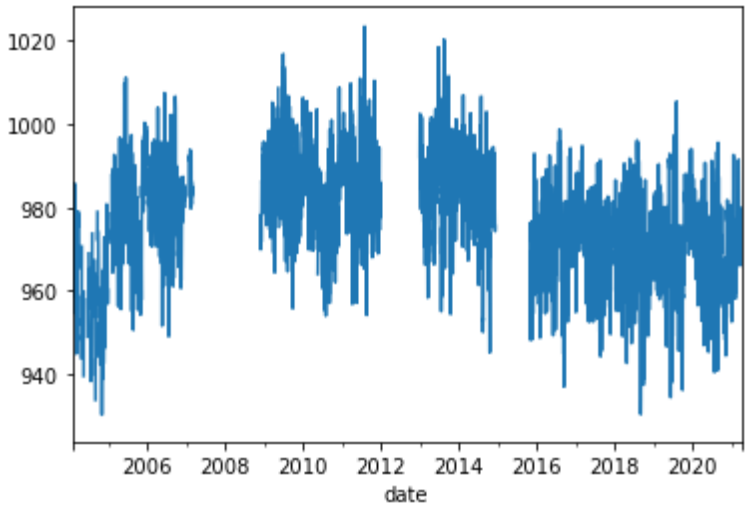
examples:

Zoraida, after 2007 the pressure decreases which seems unrealistic.



For instance, while RCM like MAR represent very well the pressure (eg., Motram et al., 2021, Kittel et al., 2021; Kittel 2021), the temporal correlation is very bad for the whole series (r=0.55). If I cross-check before 2007, the statistics become better (r>0.9). Similarly, Erin and Emilia's measurements of surface pressure does not seem reliable which spurious trends.





I refer to Kittel, 2021 Appendix A, Table A.1 (https://orbi.uliege.be/handle/2268/258491) for the list of AWS I found.

I strongly recommend the authors to visually inspect each time series of each data before considering any publication of this database even after their statistical check. I hope that combination of several methods (statistically, physically-based methods from Wang et al., with crossed comparisons with models) would improve the reliability of the dataset.

Response:

Thank you for your constructive comments. After our quality control, we have visually inspected each time series of each data, and cross-compared with ERA5 to remove outliers. When the MAR outputs are available, we will visually check and perform cross-comparison with MAR data.

In addition, we are investigating the error of Emilia's pressure change – there is an error, and we are working on finding out what happened, and when, and if we cannot find out a why, we will explore fixing it if we can or if we can't fix it, at least remove what is determined to be bad data. This investigation will not be complete in time for this revision of our manuscript. This investigation was underway before it was pointed out by this reviewer.

We are not clear on why Erin AWS has errors in its pressure measurement. We thank the reviewer for pointing this out and we will launch an investigation into that. The

investigation will not be complete before the revision of this manuscript is complete.

I would also suggest the authors to rewrite their introduction P1L94-96, as the same dataset has been already checked, compiled and used in several studies (eg., Mottram et al., 2021; Kittel et al., 2021; Kittel, 2021; Donat-Magnin et al., 2020; Wille et al., 2021). Consider to only insist on the availability of quality-controlled data?

Response:

We have rewritten the introduction P1L94-96 and now is "*These AWS observation compilations generally suffer from part or all of the following limitations: the duration of datasets, single meteorological parameter, low temporal resolution, limited spatial coverage, no rigorous quality control and in some cases limited availability for the public. Most recently, Kittel compiled a near-surface weather observation database at a high temporal resolution, which to a great extent remedied the deficiency of the previous database (Kittel, 2021), and has already been used in the studies of the ice sheet surface processes, climate model validation or atmospheric diagnoses (e.g., Donat-Magnin et al., 2020; Mottram et al., 2021; Kittel et al., 2021; Kittel, 2021; Wille et al., 2021). However, this database were only visual crossed comparisons with models to detect many outliers and then remove them, and it is still not available for the public. Thus, better quality control could allow to build a more reliable dataset.*"

References:

Donat-Magnin, M., Jourdain, N. C., Gallée, H., Amory, C., Kittel, C., Fettweis, X., Wille, J. D., Favier, V., Drira, A., and Agosta, C.: Interannual variability of summer surface mass balance and surface melting in the Amundsen sector, West Antarctica, The Cryosphere, 14, 229–249, https://doi.org/10.5194/tc-14-229-2020, 2020.

Kittel, C.: Present and future sensitivity of the Antarctic surface mass balance to oceanic and atmospheric forcings: insights with the regional climate model MAR, PhD thesis, University of Liège, Liège, http://hdl.handle.net/2268/258491 (last access: 28 May 2022), 2021

Kittel, C., Amory, C., Agosta, C., Jourdain, N. C., Hofer, S., Delhasse, A., Doutreloup, S., Huot, P.-V., Lang, C., Fichefet, T., and Fettweis, X.: Diverging future surface mass balance between the Antarctic ice shelves and grounded ice sheet, The

Cryosphere, 15, 1215–1236, https://doi.org/10.5194/tc-15-1215-2021, 2021.

Mottram, R., Hansen, N., Kittel, C., van Wessem, J. M., Agosta, C., Amory, C., Boberg, F., van de Berg, W. J., Fettweis, X., Gossart, A., van Lipzig, N. P. M., van Meijgaard, E., Orr, A., Phillips, T., Webster, S., Simonsen, S. B., and Souverijns, N.: What is the surface mass balance of Antarctica? An intercomparison of regional climate model estimates, The Cryosphere, 15, 3751–3784, https://doi.org/10.5194/tc-15-3751-2021, 2021.

Wille, J.D., Favier, V., Jourdain, N.C. et al. Intense atmospheric rivers can weaken ice shelf stability at the Antarctic Peninsula. Commun Earth Environ 3, 90. https://doi.org/10.1038/s43247-022-00422-9. 2022

Minor comments

1. It is hard to find the station location. People, when downloading the data, don't start with checking the supplement. I'd suggest to add each station location directly in the files, as well as a file with all the locations that can be directly downloaded. Section 6: L394-L395: Unless I'm mistaken, I only found the .csv files in the download link.

Response:

Thanks for your constructive comments, we have added all the station locations that can be directly downloaded. However, in order to make it easier for users to batch process the data using programming software, we don't add each station location directly in the data product separately. If you insist, we will be glad to added it in each file.

You're not mistaken. The raw data we collected from different Antarctic AWS project databases are stored in different data forms, and we have unified them into CSV files. In the download link, we only provide our dataset (.csv format). It has been modified and now is "*The raw data we collected from different Antarctic AWS project include four different data storage formats: ASCII format (.dat), NetCDF format (.nc), TXT format (.txt) and Excel format (.xlsx).*"

2. Section 3.3 L237-245: 25% of data availability seems really low. What is the impact of different threshold (this could be tested with correlation and rmse between the

25%dataset and X%dataset). Turner et al., 2004 used 90% (rmse of 0.1%). What is the reliability of a monthly value based on only 25% of a month? In the worst case you presented, the monthly mean value would only represent the ~first week. It is much better to have fewer reliable values than a lot of non-consistent values.

Response:

Referring to the daily and monthly data processing method of the AMRC, we used a threshold of 25%, in order to provide as much data as possible. Considering the reliability of the data, we also provide daily data and monthly data products calculated using a 75% threshold, that is, at least six 3-hourly observed values are available, referring to Kittel (2021). This ensures the distribution during the day as much as possible and minimizes data errors.

We will be glad to modify again, if change didn't follow your intention.

3. Section 4.3 L286 – 297: Is the relatively humidity corrected for negative temperature? According to Amory (2020), the thermo-hygrometers are calibrated to measure relative humidity with respect to liquid water. Goff and Gratch (1945) formulae should then be used to convert it with respect to ice for temperature below 0°C.

Response:

We didn't consider the corrections of the RH data at the negative temperature. Most practical humidity sensors for AWS use Vaisala's Humicap capacitive sensor. The Vaisala humicap, which itself takes the conversion of ice and water form into account, is factory calibrated to provide RH with respect to liquid water even at below-freezing temperatures (Genthon et al., 2013). The relative humidity is only available at this point computed with respect to liquid water and not with respect to ice. We appreciate the interest and hope to accomplish this additional computed data value in the future, but not before this manuscript is ready for resubmission.

The relevant descriptions have been added to "4.3 Relative humidity".

Reference:

Genthon, C., Six, D., Gallée, H., Grigioni, P., and Pellegrini, A.: Two years of atmospheric boundary layer observations on a 45-m tower at Dome C on the Antarctic plateau, Journal of Geophysical Research: Atmospheres, 118, 3218–3232,

https://doi.org/10.1002/jgrd.50128, 2013.

Specific remarks

1. P1L29: replace estimating by evaluating

Response:

Done.

2. P1L35: impacts

Response:

It has been modified in the revision.

3. P1L100-101: Consider to document while /where you flagged and removed some data

Response:

Thanks for your constructive comments, we have generated one flagged subdataset of suspicious data in the raw dataset. See Section 6 for detailed flag instructions.

4. L137-139: 1cm is low considering the presence of moving sastrugi. Furthermore, strong temperature inversions have been found over the Antarctic Plateau (Genthon et al., 2013)

which highlights the importance of this parameter.

Response:

Thank you for pointing out the problems, and we fully agree with you.

Here our attempts are just to discuss the impact of sensor height changes due to snow accumulation on the meteorological measurements, not to discuss the uncertainty of snow height observations. Sorry for this mistake, and the corresponding corrections have been made, and they are as follow.

"*Due to the accumulation of snow, the measurement height of each meteorological element varies over time, which may result in the notable meteorological measurement disparities such as temperature and wind speed due to instrument height differences.*"

5. Fig 3: What are the numbers on the map? (I guess the id of the station, but this is not mentioned in the caption)

Response:

The numbers (1-267) on the map correspond to NO. in Table S1. We have added this in the Fig 3 caption, as follows.

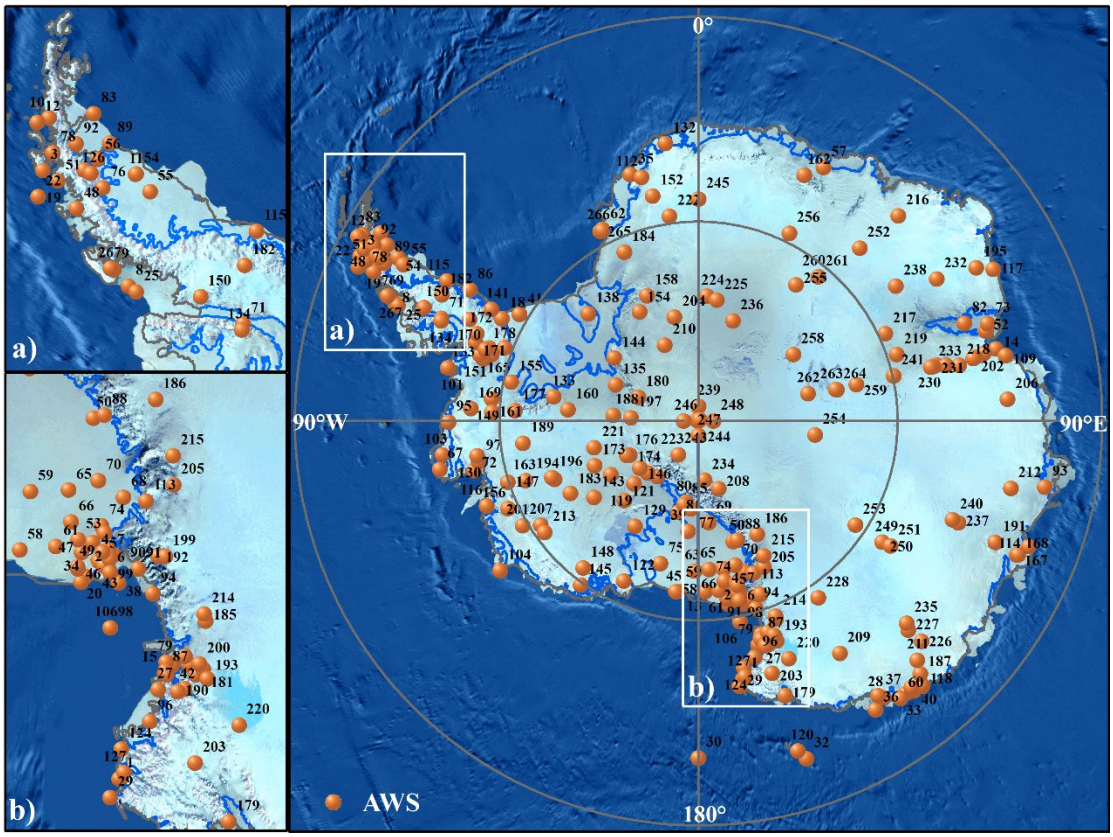


Fig.3. Mapping the sites of 267 Automatic Weather Stations (AWSs), the numbers (1-267) corresponds to NO. in Table S1.

6. Fig6: Why are AWS from permanent research stations like Amundsen-Scott, Dumont d'Urville, Vostok, Halley, Mc Murdo, …) not included in the data set? This strongly misleads the idea of Antarctic coverage in terms of weather stations. Furthermore, one could argue than permanent staffed stations could give more reliable data as people can check the instruments more frequently. These data could then be a significant contribution to the dataset.

Response:

We have added the AWSs from the POLENET program. In addition, this paper was about AWS– non-staffed stations. It was not about Vostok or McMurdo or South Pole that are staffed fully or staffed at least part of the year with people making or managing observational equipment. If the point of the work is to be complete of all surface observations, that will change things. A statement has been added to denote that this

work was not focused on staffed stations.

7. Fig 8: Why do they authors use a rainbow color map?

Response:

Rainbow color map are used to improve readability, but based on the feedback, it didn't work. Therefore, in the revision, we have changed the rainbow colors of Figure 8 and Figures S1-S4 to black and white for simplicity and clarity.

8. If authors would like, I would be happy to share MAR outputs to help with outlier scan.

Response:

Thank you very much. Indeed, we really need MAR outputs to help with the outlier scan and further improve the reliability of the dataset.