Respond to the comments of CC1 (Ian Allison)

This is a very useful paper, bringing disparate Antarctic AWS data sources together to one accessible point. I think that it should be published, although I do recommend some changes and improvements as follows.

Response:

We would like to thank you for doing this review, and for the useful comments and suggestions that improved our manuscript. All your comments have been considered and the manuscript has been revised accordingly. Please see our point-by-point responses on the specific comments.

General comments:

1. There is another paper also in discussion in ESSD at the moment that provides more details of one of the Antarctic AWS networks included in this compilation. That paper is ESSD-2022-188, "The PANDA automatic weather station network from coast to Dome A, East Antarctica", Ding et al. If both papers are accepted for publication, then it would be useful if they referenced each other.

Response:

Thanks for your good advice, we have referenced the paper ESSD-2022-188 in the introduction, section 2 and section 4.4 of the revised version.

Reference:

Ding, M., Zou, X., Sun, Q., Yang, D., Zhang, W., Bian, L., Lu, C., Allison, I., Heil, P., and Xiao, C.: The PANDA automatic weather station network between the coast and Dome A, East Antarctica, Earth Syst. Sci. Data Discuss. [preprint], https://doi.org/10.5194/essd-2022-188, in review, 2022.

2. In the tables and graphs, the AWS are ordered firstly by the deploying institution and then alphabetically by name. It would be much more logical if they were sorted geographically, for example by elevation (from 0 to 4000+ m).

Response:

Followed your advices, we have modified the tables and graphs and sorted them according to station elevation changes, as follows.

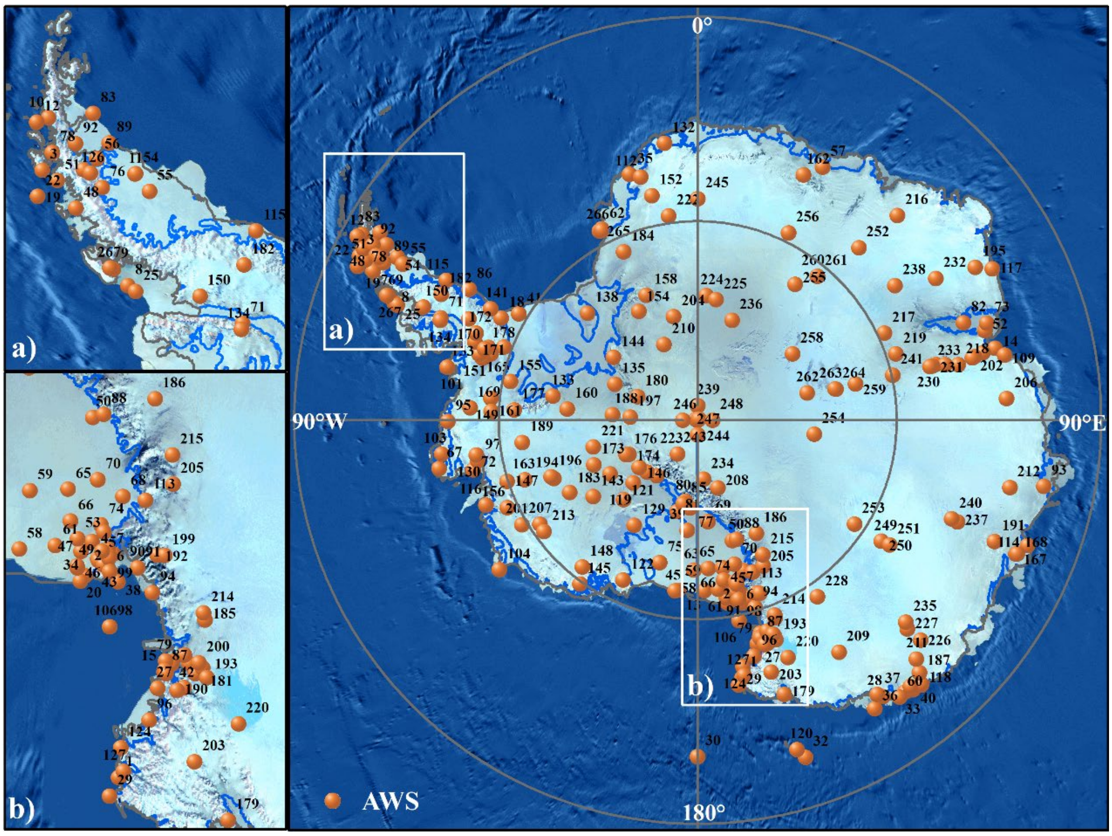

Fig.3. Mapping the sites of 267 Automatic Weather Stations (AWSs), the numbers (1-267) corresponds to NO. in Table S1.

3. I can see no rationale for plotting the data availability Figure 8 and Figures S1-S4 in rainbow colours. They would be simpler and clearer if they were just black and white.

Response:

We have changed the rainbow colors of Figure 8 and Figures S1-S4 to black and white. We will finish this when submitting the revised manuscript.

4. If there are missing values in Tables S2, S3 and S4 they are reported as NaN (not a number). They should just be shown blank.

Response:

The missing values in Table S2, S3 and S4 have been changed as blank.

5. Maximum and minimum wind directions (in Table S2, S3, S4) are physically meaningless concepts: a maximum of 360 is the same direction as a minimum of 0. Mean wind direction is also subject to calculation error: for example, the arithmetical average of a 90- and 270-degree wind is 180 degrees; but the direction could also be 0 degrees. A more useful statistic to show would be constancy of the wind direction

(defined as the ratio of the magnitude of the mean wind vector to the scalar average wind speed).

Response:

Thanks for your instructive suggestions. In revision, we have deleted the maximum and minimum wind directions, and changed the mean wind direction to the constancy of the wind direction in Tables S2, S3 and S4.

6. It would be useful if Table S5 also included a column giving the duration (in years) that each station provided data (up to the end of 2021).

Response:

Followed your advices, in Table S5, we have added a column giving the duration (in years) that each station provided data (up to the end of 2021).

7. The English language is generally reasonable although it could be improved. Several of the authors are native English-speakers and should review the text.

Response:

The English has been improved by Matthew A. Lazzara, Elizabeth R. Thomas, David Mikolajczyk, Lee J. Welhouse, and Linda M. Keller. Hopefully, the revised version is readable.

Specific comments by line number

1. 52-53 Remote AWS became practical with the introduction of the ARGOS data relay system. This is discussed later, but should be introduced here. The relevant satellites are not in "outer" space.

Response:

Following your advice, corresponding changes have been made accordingly, and now it is "*Remote AWS became practical with the introduction of the ARGOS data relay system on polar orbiting satellites in 1978, and thus real-time or near real-time meteorological data could be obtained in distant places.*"

2. 59-60 The first (successful) Australian AWS in Antarctica was deployed inland of Casey, not in the Lambert Basin. The early Australian AWS are reported in Allison, I. and Morrissy, J.V. (1983). Automatic weather stations in Antarctica. Australian Meteorological Magazine, 31(2),71-76. A network inland of Casey station was

deployed during the International Antarctic Glaciology Program: those are the stations discussed in the Allison et al. 1993 paper that is cited. Details of the Lambert Glacier Basin AWS are given in Allison, I. (1998) The surface climate of the interior of the Lambert Glacier basin: 5 years of automatic weather station data. Annals of Glaciology 27, 515-520.

Response:

Thank you for pointing out the problems in this section and providing the important reference. Corresponding changes have been made accordingly, and now it is "*In 1982, the AAD deployed its first AWS in Antarctic inland Casey (*Allison and Morrissy, 1983*). During the International Antarctic Glaciology Program, a network inland of Casey station was deployed (Allison et al., 1993). Later, the National Antarctic Research Expedition (ANARE) of Australia set up an AWS network with updated version of the stations in the Lambert Glacier drain of East Antarctica (Allison et al., 1998).*"

References:

Allison, I., and Morrissy, J.V.: Automatic weather stations in Antarctica, Australian Meteorological Magazine, 31, 71-76, 1983.

Allison, I.: The surface climate of the interior of the Lambert Glacier basin: 5 years of automatic weather station data, Annals of Glaciology, 27, 515-520, https://doi:10.3189/1998AoG27-1-515-520, 1998.

3. 83 "Southern Ocean island stations" NOT "South Pacific island stations"

Response:

It has been modified.

4. 113 Define what the acronym "PNRA" actually is

Response:

PNRA: the Italian National Programme of Antarctic Research. The introduce has been modified and added to the location where it firstly appeared.

5. 118 The supporting framework for AWS instruments differ greatly between models. They are not "mostly tripod".

Response:

Thank you for pointing out the problems and we have corrected the sentence as "*The supporting framework for AWS instruments varies between models. But in general, the*

AWS body is made up of a mast, usually with instrument arms fitted with different sensors."

6. 137 It would be better to give a height range. There is considerable difference between stations.

Response:

It has been modified and now it is "*Each AWS measures air temperature, pressure, relative humidity and other meteorological elements within an initial height range of 1~4 m and/or 6 m above the ground (reference to the initial height from build stations, snow accumulation and site tilt were not part of the monitored variables), except for Zhongshan Station, which measures wind speed and wind direction at a height of 10 m.*"

7. 159 Table 1. The pressure range of the AAD stations is NOT 530-791hPa: this would be useless for an AWS near sea level. The Paroscientific sensor covers a full range of atmospheric pressure, but the structure of the data transmitted from the stations is truncated to give a shorter message. The range is set for each AWS to cover the likely pressure range at the deployment site. The 530-791hPa range applies only to Dome A (4000+ m). Similarly, under the CHINARE stations, the range 530-791hPa is also only for the Dome A station.

Response:

They have been modified in Table 1. The Paroscientific Digiquartz 6015A covers 0 to 1100 hPa; The ranges set for the Dome A, Eagle, LGB69 AWSs are 530 to 610 hPa, 635 to 735 hPa, and 691 to 791 hPa, respectively.

8. 160 The image of the Eagle AWS (Fig 1f) is a very poor picture of a partly buried station. I can, if requested, supply a much better image of an AAD AWS (as also deployed at Eagle and Dome A).

Response:

Thank you for providing the picture. We have used one to replace the image of the Eagle AWS (Fig 1f), as follows.

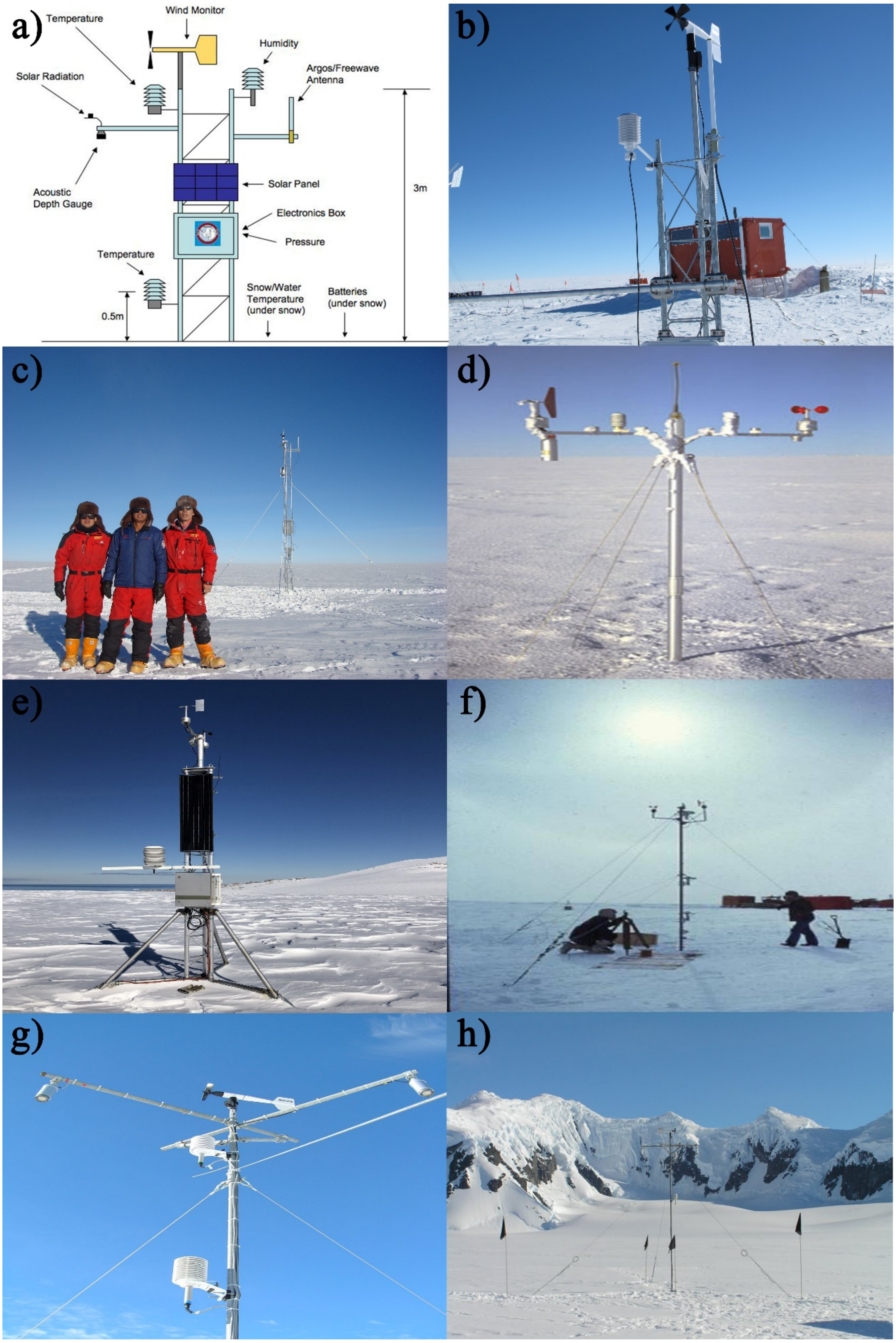

Fig.1. Typical AWSs of the six research institutions, but the sensors at other sites vary slightly depending on the local environment. a) AMRC-CR1000 device, b) AMRC-AGO-4, c) AMRC and CHINARE-Panda_South, d) IMAU-AWS10, e) PNRA-Maria, f) AAD-LGB00, g) BAS-the sensors used on Latady, h) BAS-Latady.

a) http://amrc.ssec.wisc.edu/news/2010-May-01.html
b) https://amrc.ssec.wisc.edu/aws/images/station_images/AGO_4.jpg
c) personal communication with Minghu Ding.
d) https://www.projects.science.uu.nl/iceclimate/aws/technical.php
e) https://www.climantartide.it/attivita/aws/index.php?lang=en
f) personal communication with Ian Allison
g) and h) https://ramadda.data.bas.ac.uk/repository/entry/show?entryid=synth%3A44d1a477-0852-4620-a1f4-63f559b44e94%3AL0RvY3VtZW50cy9waG90b3NfYXdz

9. 188-194 I found this description of cooperative links very hard to understand. I think it is incorrect in several cases.

Response:

Yes, you are right. The AMRC brings together data from several Antarctic research programs, not cooperative links. It has been modified and now it is "*The AMRC includes not only its own AWSs network but also brings together data from several Antarctic research programs, such as the Japanese Antarctic Research Expedition (JARE), the French Antarctic Program (Institut Polaire Francais-Paul Emile Victor, IPEV), the AAD, the BAS and the CHINARE. The JARE installed and maintained the JASE2007, Dome Fuji, Mizuho and the Relay Station on the East Antarctic Plateau. The IPEV installed and took charge of the AWSs from the Adélie Coast to Dome C II, including the Port Martin, D-10, D-17, D-47, D-85, Dome C and Dome C II. The cape Denison on the Adélie Coast belongs to AAD. The BAS installed and maintained the AWSs on the AP and the East Antarctic Plateau, including the Butler Island, Larsen Ice Shelf, Limbert, Sky-Blu, Fossil Bluff, Dismal Island and the Baldrick. The Panda South station, located on the East Antarctic Plateau, a cooperation between CHINARE and AMRC, which was installed, maintained and operated by CHINARE.*"

10. 206 Figure 4. This Figure make a lot more sense if it comes after the discussion in Section 3.2, not before. (There are also minor typographical errors in this Figure).

Response:

We have redrawn Figure 4 and put it after the discussion in Section 3.2, as follows.

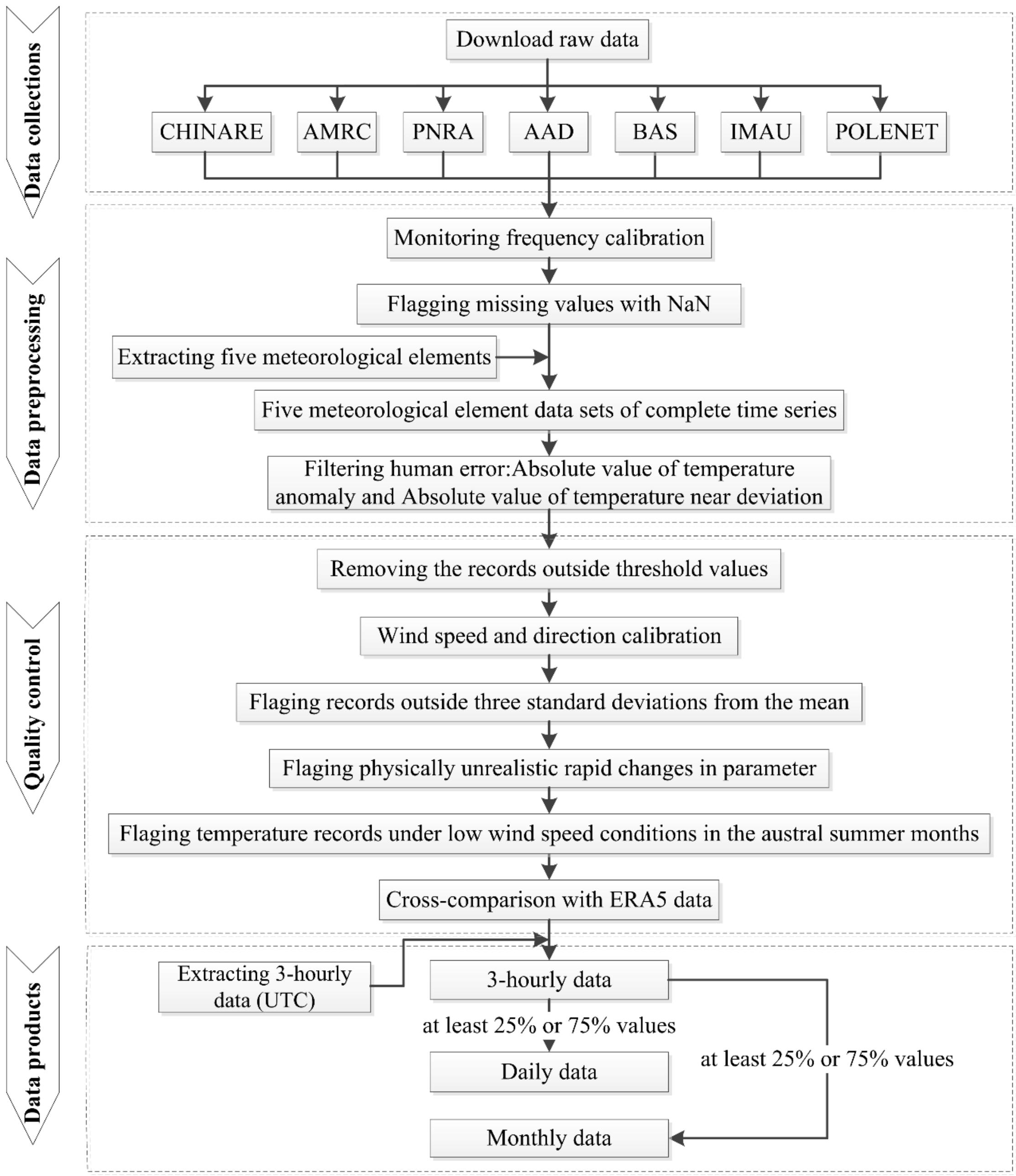

Fig.4. Description of AWSs data processing process.

11. 239 What does this mean? Surely, the purpose of an AWS is to be "unattended".

Response:

It means an AWS infrequent visits. It has been modified and now it is "*Unfortunately, a number of events that occur may result in data gaps because of only checked periodically.*"

12. 249 Not all AWS use a platinum resistor temperature probe.

Response:

It has been modified and now it is "*Air temperature is a sensitive indicator of the climate extremes experienced by the whole continent, which is measured at heights of* *approximately 3 m above the ground based on the thermistor (such as Apogee ST-110 Thermistor and FS23D thermistor in ratiometric circuit) or resistive platinum probe (such as PRT series and Vaisala HMP series).*"

13. 253-268 With the very strong surface inversions that occur over the Antarctic plateau, a small difference in sensor height (due to different AWS design or with from accumulation with time) can be very significant. It can lead to a measured temperature difference of a degree or more over 1 metre. There is also at least one error in Table S2: aws05 (at a near coastal elevation of only 150 m) has a 3-hourly minimum temperature of -87.7! A plot of temperature vs surface elevation would be more informative than the table (and would reveal any errors).

Response:

We agree with you. Especially due to snow accumulation, uncertainties of measuring temperatures occur in areas with the very strong surface inversions (high plateau in winter). The relevant descriptions have been added in the first paragraph of Section 4.1, and recommendations for reducing air temperature measurement uncertainties have been provided in Section 8, and they are as follows.

Section 4.1

"*It should be emphasized that over the areas with strong temperature inversions, especially high plateau in winter, near-surface air temperature is influenced by the changes in the height of sensors installed over the AWS (generally a relative "lowering") caused by snow accumulation (Genthon et al., 2021).*"

Section 8

"*However, the AWS network in the Antarctic is still incomplete and needs to be improved. In the future, it is hoped that more AWS will be deployed on the East Antarctic Plateau as a priority, especially on the summit of the East Antarctic Plateau. However, it is very challenging to install and maintain them in the extreme environment of the East Antarctic Plateau. Moreover, ultrasonic sounders are systematically implemented, to provide snow height data along with the meteorological data. And mechanically ventilated aspirated radiation shields should be considered to reduce radiation bias, especially in summer when solar power is available. In addition, the relative humidity supersaturated observation systems under extreme cold conditions described by Genthon et al. (2017) and Genthon et al. (2022) can be widely applied.*"

And, we have corrected the errors in Table S2, and visually inspected each time series of each data and cross-compared with ERA5 to remove the outliers.

A plot of temperature against surface elevation chart has been added in the manuscript.

Reference:

Genthon, C., Piard, L., Vignon, E., Madeleine, J.-B., Casado, M., and Gallée, H.: Atmospheric moisture supersaturation in the near-surface atmosphere at Dome C, Antarctic Plateau, Atmos. Chem. Phys., 17, 691–704, https://doi.org/10.5194/acp-17-691-2017, 2017.

Genthon, C., Veron, D., Vignon, E., Six, D., Dufresne, J.-L., Madeleine, J.-B., Sultan, E., and Forget, F.: 10 years of temperature and wind observation on a 45 m tower at Dome C, East Antarctic plateau, Earth Syst. Sci. Data, 13, 5731–5746, https://doi.org/10.5194/essd-13-5731-2021, 2021.

Genthon, C., Veron, D. E., Vignon, E., Madeleine, J.-B., and Piard, L.: Water vapor in cold and clean atmosphere: a 3-year data set in the boundary layer of Dome C, East Antarctic Plateau, Earth Syst. Sci. Data, 14, 1571–1580, https://doi.org/10.5194/essd-14-1571-2022, 2022.

14. 270-271 All the AAD AWS use Paroscientific digiquartz barometers

Response:

It has been modified and now it is "*All the AAD AWSs use Paroscientific digiquartz barometers, with an accuracy of ±0.2 hPa and a resolution of 0.1 hPa. AMRC AWSs also use Paroscientific digiquartz barometers (Paroscientific Model 215 A), which have an higher resolution of 0.04 hPa and accuracy of ±0.1 hPa.*"

15. 277 A plot of pressure against surface elevation would also be more informative than the tables

Response:

A plot of pressure against surface elevation chart has been added in the manuscript.

16. 289-292 The AAD AWS have included humidity measurements since about 1990. The Humicap sensor calibrations need to be corrected at very low temperatures – has this been done for all data?

Response:

Firstly, we have modified this mistake. And we don't consider the corrections of the

RH data at very low temperatures. Most practical humidity sensors for AWS use Vaisala's Humicap capacitive sensor. The Vaisala humicap, which itself accounts for the conversion of ice and water form, 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 description has been added to "4.3 Relative humidity".

The detail information with humidity and temperature probe, please see: https://www.vaisala.com/en/products/weather-environmental-sensors/humicap-humidity-temperature-probe-hmp155.

https://www.vaisala.com/sites/default/files/documents/HMP45AD-User-Guide-U274EN.pdf.

https://www.vaisala.com/sites/default/files/documents/WEA-MET-ProductSpotlight-HMP155-B212226EN-A.pdf.

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.

17. 329 What are the white circles in Fig. 5?

Response:

White circles represent missing data. We have added the description in the caption of Fig.5.

18. 360-363 It is the length of record from the site that is important, not the length of record from an individual AWS. For example, the stations named LGB00, LGB00-A, LGB00-B and LGB00-C are all at the same site, which has a total record of ~23 years. In the Australian program, a new AWS at the same site is given a different name

because it has a different calibration file: other programs may retain the same name for a replacement AWS.

Response:

Following your advice, we have intergraded records of AAD stations at the same nine sites, and then calculated their respective total record length. The nine sites are ①A028, A028-A and A028-B, ②DSS and DSS-A, ③GF08 and GF08-A, ④Lanyon and Lanyon-A, ⑤LawDome and LawDome-A, ⑥LGB00, LGB00-A, LGB00-B and LGB00-C, ⑦LGB10 and LGB10-A, ⑧LGB69 and LGB69-A, and ⑨MtBrown and MtBrown-A.

19. 409 "Antarctic AWSs" NOT "AIS AWSs". Not all stations are on the ice sheet.

Response:

It has been modified in the manuscript.