

Earth Syst. Sci. Data Discuss., referee comment RC2  
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## Comment on **essd-2021-204**

Anonymous Referee #2

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Referee comment on "10 years of temperature and wind observation on a 45□m tower at Dome C, East Antarctic plateau" by Christophe Genthon et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-204-RC2>, 2021

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### General

This paper describes temperature and wind data measured over ten years at six levels on a 42 m tower near Concordia station, which is located on the high interior plateau of the East Antarctic Ice Sheet. The dataset is unique – no other comparable measurements exist from this part of Antarctica – and is thus of immense value for validating the performance of climate and weather prediction models in this region and also for the development and validation of remote sensing techniques. Furthermore, the Dome C region provides an ideal “natural laboratory” for studying the atmospheric boundary layer (ABL) under conditions of strong static stability so these measurements also have application in the development of parametrisations of the ABL under such conditions, which occur widely across the polar regions and even in mid-latitudes. I am very pleased that the authors have chosen to make these data freely available and have documented them carefully in this paper. The paper provides users of the data with essentially all of the metadata that they would need to access and analyse the data. The description of the quality control procedures applied could possibly be a little more quantitative (see my detailed comments below) but this is not a major issue.

As well as providing a detailed description of the dataset, the paper also presents some basic climatological analysis of the data (section 3) and uses the data to validate the ERA5 reanalysis (section 4). These excellent studies are a substantial part of the paper and would be worthy of publication in their own right in an atmospheric science journal. It is, of course, useful to see examples of the use of the data in a dataset description paper but the Editors may wish to consider whether the balance is right for ESSD. This issue aside, I believe that the paper is suitable for publication following attention to the specific points raised below.

### Specific points

- Lines 54-56: You could also mention measurements made at Halley (King, 1990, 10.1002/qj.49711649208) and the Alexander Tall Tower! (Mateling et al., 2018, 10.1175/jamc-d-17-0017.1)
- Lines 92-93: I presume you mean "...upwind of the station in the prevailing wind direction."?
- Line 94: "extension" rather than "expansion"?
- Line 138: "mean" rather than "modulus"?
- Line 143: "power outages" rather than "blackouts"?
- Lines 151-152: These are reasonable limits for quality control purposes but I don't think that it is correct to say that temperature "cannot" be outside these limits.
- Lines 154-155: "Data outside of those ranges, or showing suspicious vertical variations or unrealistically steep changes, are eliminated." Did you apply objective criteria on vertical gradients or temporal changes? If so, state clearly what these are. If this was done subjectively, then make this clear.
- Line 155: "rapid" rather than "steep"? (I assume you are referring to temporal change here?)
- Lines 199-201: This sentence isn't very clear. Are you talking about elevated inversion layers? Not sure what you mean by "nonlinear turbulent diffusion" – turbulence is an inherently nonlinear phenomenon.
- Figure 3: Use symbols to mark the measurement levels and possibly add horizontal bars to indicate measurement uncertainty. Part (a) shows a suspiciously large superadiabatic temperature gradient between the 25 m and 33 m levels.
- Lines 229-230: You could establish how much of the difference between AWS and tower temperature was due to sensor height difference by extrapolating the tower measurements to AWS sensor height (either linearly or using a more sophisticated extrapolation).

12: Figure 6 (and other power spectra). Give units on the "Power" axis.

13: Figure 7 caption: "tower level", not "model level".

14: Figure 9: Y-axis caption needs correction.

15: Line 328-329, figure 10(a): It is interesting that you don't observe significant power at the inertial frequency.

16: Section 4: I think it would be useful to summarise the results (mean bias, rms bias, correlation coefficients) of this section in a table, maybe broken down by season?

17: Lines 373-374: I don't understand this sentence. Correlation coefficients don't tell you anything about the relative amplitudes of variations in the two series that are being correlated.

18: Line 380: The temperature profile has a log-linear form under stable conditions, with the linear component increasing with increasing stability.

19: Lines 391-392: It might be clearer to say "the reanalysis product has a cold bias at higher temperatures and a large cold bias at the lowest temperatures". Weidner et al. (QJRM 2021, 10.1002/qj.3901) give a striking example of the failure of ERA-Interim and ERA5 to accurately reproduce an extreme low temperature and associated extreme surface inversion over Greenland.

20: Line 493: Typo "to overestimate".

21: References, line 573: I don't think that the Ekman paper is referenced anywhere in the text.

### **A note on the datasets**

The datasets described in the paper can be easily downloaded from the Pangaea data centre as tab-delimited text files with some basic metadata provided in the file headers. Temperature and wind speed measurements are provided in separate files. However, wind direction measurements (which are described in the paper) are not made available. As wind direction is a cyclic variable there can be some ambiguity (alluded to in the paper) when calculating 30-minute means, but I would strongly encourage the authors to deposit a third file in Pangaea, containing either 30-minute vector mean wind directions or, alternatively, 30-minute mean u- and v-components of the wind.