

Review of “Global Balanced Wind Derived from SABER Temperature and Pressure Observations and its Validations”

BY X. LIU ET AL.

General remarks

This paper describes and validates a new dataset of the monthly mean zonal wind in the height range of 18-100 km at latitudes of 50°S-50°N from 2002 to 2019, which is based on data measured by the SABER instrument. This constitutes a valuable contribution to ESSD. However, the paper is not suitable for publication in ESSD in its present form.

I think the paper could be better in three main points

- The paper should convince the reader why the BU data set should be used. To play devil’s advocate, one might be tempted to conclude ‘let us just use MERRA’. I know there are arguments (like the altitude range of the various data sets) but these arguments could be made much clearer.
- There is an extensive comparison in the paper between BU and other data sets, which is very good and helpful. However, such comparisons are much more helpful if conducted in a more quantitative way, rather than saying ‘good agreement’ or ‘almost the same zero wind line’. I suggest analysing (and perhaps showing) actual difference plots and percentage differences.
- The theoretical basis for developing the BU data set is described in sect. 2.2. This description should be clear and straightforward to follow, which is not the case in its present form (see below).

I suggest to return the manuscript to the authors for major revisions.

Comments in detail

Section 2.2

The method of deriving the BU data set is discussed here; this is an important part of the paper. It needs to be clear and should be understandable (in principle) without going back to the cited literature. First Eq. (3) should be valid at the equator (as it can be simplified to Eq. (4) at the equator). Is this correct? But in line 131 you say 10° - 50° N/S for the BU data set – this seems to be a contradiction. Further, in l. 136, you say that Eq. (3) is valid from 8° S to 8° N as well as 70° - 90° N and 70° - 90° S. This is how I read your text. This is inconsistent with the given range of the BU data. I might not be correct here, but this discussion is not as clear as it should be.

Comparison with reanalyses

I would be helpful to know if any of the data used for BU are assimilated in MERRA2. Also be clearer about for which latitude range you compare MERRA2 and BU. Why do you not compare with ERA5? (And add the reference to Hersbach et al. (2020) for ERA5).

References

The citations are okay, but there could be a bit more recent references to scientific issues to which the data set could be applied. For example, Diallo et al. (2018) find that the QBO disruption in 2015-2016 reversed the lower stratosphere moistening triggered by the alignment of the warm ENSO event with westerly QBO in early boreal winter. Would the BU data set also be useful for ENSO?

Moreover, Ern et al. (2021) find that reanalyses reproduce some basic features of the SAO gravity wave driving and that higher-top models (ERA-5 and MERRA-2) show stronger gravity wave driving of the SAO eastward phase in the stratopause region and in the lower mesosphere. But reanalyses are limited by model-inherent damping in the upper model levels. Would such findings be relevant for the data set discussed here? You do not need to consider the specific papers/findings mentioned here, but they might be a starting point.

Presentation

Overall the paper is well written, but I suggest a revision to correct several small grammatical errors. In particular, get the difference between “well” (adverb) and “good” (adjective) correct.

Minor Points

- p 1, l. 20: ‘tide alias’ will not be clear to everyone, rephrase
- p. 1 l 23: make sure to clarify that (e.g.) the MERRA comparison is not only 53.3° to 29.7°. Also the data set is only 50°S-50°N, so how can you compare at 53.3°?
- p.1 l 25: I would not call the QBO in 2016 “anormal”, I am not even sure if this is proper English. See for example Diallo et al. (2018).
- p.2, l. 57: Be specific about ECMWF: do you mean ERA5 or ERA-Interim or both? I guess you mean ERA5. Add the reference to Hersbach et al. (2020) for ERA5.
- p 3, l. 80: justify the choice of these latitudes.
- p. 4, l 113: should be ‘Reimsberg’
- p. 4, l 117: The original profiles are from SABER – correct? Be specific here.
- p. 5, l 147: I suggest to refrain from such abbreviations in titles
- 11, l. 333: “tide alias” is not clear without further explanation.

References

Diallo, M., Riese, M., Birner, T., Konopka, P., Müller, R., Hegglin, M. I., Santee, M. L., Baldwin, M., Legras, B., and Ploeger, F.: Response of stratospheric water vapor and ozone to the unusual timing of El Niño and the QBO disruption in 2015–2016, *Atmos. Chem. Phys.*, 18, 13 055–13 073, <https://doi.org/10.5194/acp-18-13055-2018>, URL <https://www.atmos-chem-phys.net/18/13055/2018/>, 2018.

Ern, M., Diallo, M., Preusse, P., Mlynczak, M. G., Schwartz, M. J., Wu, Q., and Riese, M.: The semiannual oscillation (SAO) in the tropical middle atmosphere and its gravity wave driving in reanalyses and satellite observations, *Atmos. Chem. Phys. Discuss.*, <https://doi.org/https://doi.org/10.5194/acp-2021-190>, in review, 2021.

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