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Interactive comment on "On the evaluation of the phase relation between temperature and wind tides based on ground-based measurements and reanalysis data in the middle atmosphere" *by* Kathrin Baumgarten and Gunter Stober

Anonymous Referee #2

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The paper by Baumgarten and Stober investigates the temporal variation of tides and their phases by applying constrained fits to a unique data set of continuous lidar data. With these they validate tidal signatures in MERRA-2 up to an altitude of somewhat below 60km altitude. MERRA data on the other hand are used to investigate the phase relations between the different variables. These findings are new and interesting, the evidence presented supports the conclusions and the paper is well to read. The paper is therefore recommended for publication in Annales Geophysicae. One result is surprising (at least to me): the phase of the diurnal tide is constant over an altitude of

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30km. I would like ask the authors at least to comment on this in the paper (see my minor comment below).

Minor comment:

The data analysis has been thoroughly performed, so we have to believe the phases as given in Figure 6 and Figure 7. The phase does not alter with altitude and for this there is also very little change in time. On the other hand you would expect a vertical wavelength of roughly 30km (cf. quotations in your text). That would mean that the phase runs one time over 360°=24 hours in that altitude range - similar as the semi-diurnal tide does. This is an unexpected behavior and should be commented on as such. And also the terdiurnal tide: There is phase variation with altitude, if you look into the time resolved data of Figure 9; this is also an interesting result that the expected phase variation with altitude from the temporally resolved data disappears in the mean profiles.

It would be nice, but may be exceeding the scope of this paper, if you could use MERRA data to reveal the global structure of the migrating tide. Where in the Hough mode structure is Kühlungsborn located? Probably close to a node of the Hough mode for temperature? This would explain the relatively small amplitudes in T compared to winds? How does vertical phase structure (in a zonal mean sense) at Kuehlungsborn-latitude compare to that at the equator? As said, maybe too much for the paper but it could help to understand things.

Specific comments and technical corrections:

P1L24 ... for semidiurnal component and so on are ...

P3L2 trapped tidal mode in SABER? in MERRA?

P3L3 please reformulate follow similiar as GWs poloarization relations?

P3L13 define s in k and motivate why is there a suffix s at the scale height

P3L19 Probably. The only one which I could think of is CORAL at Rio Grande. (just check, no action required, if still holds)

P3L28 as well as fluctuations/variations due to GWs

P5L5 ... but ?here?in that work? without ...

P5L14 variety -> variance

P5L19 somehow the assumption and the regularization seem to be described twice - choose the more precise formulation

P5L23 Studies such as ...

P5L27 if you filter them out that could be a self-fulfilling - but I think you are right

P5L29 It appears -> It turns out ??

P6L7 result section

P6L10 time resolved *what*

P6L29 For the left column this could be either coarser vertical resolution or MERRA's horizontal resolution which is filtering in a different dimension than the ones shown/discussed here.

P7L1 MERRA data are snap-shot data? Then only the temporal sampling is coarser, but the temporal resolution should be sufficient.

P7l6 damps

P8l6 as far as it makes sense to compare the values of different units - this becomes a meaningful result, if you set it in relation to the expected relations for the maxima of the Hough modes

P9L21 Why should the amplitude influence the phase? Is there a second mode competing? Are you just speculating about a higher uncertainty? -> P10L1 o.k., but you

have never discussed limits so far.

P10L3 My interpretation of the phase jump would have been that the phase cyclically continues in your fitting interval (the phase jumps are 12h = 360°). Whether the point around 12 UT is a real independent point may depend on your fitting technique. Would your technique allow the phase to continuously incerase even beyond 360°? O.k. the fact that the phase shifts with respect to the diurnal tide makes the semidiurnal tide visible in F4. The main point should be still the relative amplitude ratio.

F7-F9: Why are you using contour lines for the phases? That makes the plots very hard to read.

P16L18 in very good agreement

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