Review comments for “intraseasonal to interannual variability of Kelvin wave momentum fluxes as derived from high-resolution radiosonde data” by Sjoberg et al.

This manuscript seeks to derive the Kelvin wave momentum flux (KWMF) vertical profile from a series of radiosonde observations. The methodology is first developed and tested about its robustness against high-vertical-resolution, high-temporal-resolution, intensive radiosonde obs. During the DYNAMO campaign, and then applied to two low-vertical-resolution, low-temporal-resolution, long data record ARM radiosonde datasets for the sake of studying the intraseasonal and interannual variabilities. The authors focused on studying the QBO and MJO’s impacts on the KWMF. For QBO, the finding agrees qualitatively with many previous studies that KWMF plays a major role in the descent of the QBO westerly phase; for MJO, the authors found that there is a nontrivial (but statistically insignificant) increase in KWMF when MJO is in its active phase versus the inactive phase.

While the value of using high-resolution radiosonde data to study (and to separate out the Kelvin waves in the first sense) the KWMF and its interaction with other tropical variabilities is highly appreciated, the originality of this work is relatively weak. The methodology is refined from Sato and Dunkerton (1997) and Holton et al. (2001), and the major findings are mostly “qualitatively” agree with previous other findings. Of course the datasets employed here are unique. I think the novelest finding I appreciated the most as well is that the sensitivity of the magnitude of KWMF to the vertical and temporal intervals are investigated, which could greatly help us understand the discrepancies among the values calculated using different obs. or modeling techniques. The authors should pay extra effort in the revised manuscript to point out the uniqueness and importance of this work.

Overall the writing is OK, and the logic flow is natural. I found tiny inconsistencies from places to places that may confuse the readers though.

Now, since this review is for publication pending to ACPD, I’d point out some re-arranging suggestions first before raising my scientific concerns. I have no problem of publishing it on ACPD first after revising some of the awkward logics pointed below, and the authors can then prepare and think more about my further scientific comments.

Re-arrange some of the sentences/figures, and correct grammar errors.

1) Fig. 1: please consider at a panel of background wind contours so we know what the background wind looks like, and more importantly, we can see whether its varying slowly vertically.
2) Fig. 2: add the errorbar for each line for each resolution you picked to construct the lines. Since I’m not clear how many soundings were used, if only a few, you need to explain how robust Fig. 2’s results are to a large sample; if a lot of the soundings were used, you can comfortably plot the errorbars out.
3) Fig. 3: add the explanation of the bold grey line (zero wind line) or add the label in the figure.
4) P13, L4: it would be much straightforward if you can show a scatterplot of your comparison between the two datasets.

5) Fig. 7: since you stated that 8-20day Kelvin waves are representative of the total KWMF features of 5-20 day Kelvin waves, and there are a lot of missing data for 5-8 day Kelvin waves using your technique, why not revised Fig. 3, 4, 5, 6 with the 8-20 day Kelvin waves? I think it's very important to keep consistency throughout the paper of the variables you present. Otherwise, you don't know whether the differences are caused by other mechanisms or simply by the inconsistency. Move your explanation of P15, L11-15 to the second paragraph of Section 4.
6) It's very awkward to further extend your discussion about MJO's impact on KWMF in the conclusion section. Why not move this discussion to a subsection of Section 5 (also change the title of Section 5)?
7) You mentioned you used two indices to indicate the phase of MJO: RMM and OMI. Firstly, you need to clarify which datasets are used to construct these two indices; secondly, you don't even used RMM throughout the paper, if I didn't read too fast to miss that point. Please point the sentences about RMM out in the MJO section.

8) Fig. 9: I don't understand the meaning of the x-axis of Fig. 9b. Can't imaging the errorbar could be uniform throughout the layer. Can you add your spread (2*sigma or 3*sigma) to Fig. 9a for both solid and dashed lines (since you have a lot of sounding profiles to composite each of the line), so it would be much more straightforward to check whether they are statistically different.

9) minor grammar errors:
P1, L9: reveals -> reveal that
L10: add "in" before "boreal"
L11: add "the downward propagation of the" before "easterly".
L11: add "the" before "Madden".
L12: remove "the" before "MJO". Add "the" before "lowermost".
L16: remove "to".

P3, L6: add "the" before "reanalyses".
L22: add "the" before "collection".
L29: Since balloon ascent rate is ~ 5m/s, 2-sec resolution means the vertical resolution should be around 10 m? Why you indicated later that it ranges between 50 and 2000 km?

P4, L22: In the description of methodology section, you mentioned that the rationale of choosing the vertical resolution of 250m will be discussed in Section 3. Where in Section 3 did you discuss your motivation? I'm sorry I couldn't find it. Also, just as I said in the last comment, why not use even higher vert. resolution, or at least test the sensitivity to a smaller vertical interval of KWMF?

P9, L7: "the blue curve": which curve? Fig. 2 is black and white.

P11, L1: "removed" -> "away".

P18, L2: Since “OMI” has been mentioned long ago, it’s better to refresh the readers’ memory of re-spell out what the word stands for and the reference.
L1: move L5’s explanation of the dashed line here and combine it with the first sentence of this paragraph.
L17: “Fig. 6”: can you double check if you get the figure number correct?

P19, L29: add your funding source if there’s any.

Now, major comments (can be answered after the publication on ACPD):

1) How good is your assumption that the vertical wavenumber is constant for a given window of data? My understanding is that you still estimate the vertical wavenumber for each period of Kelvin wave (5-20 days) separately, is that correct? How to justify the impact if it is not the case? Can you assess how many cases in terms of percentage of total that violates the slow-varying-zonal-wind rule (is this the WKB assumption by the way)?

2) Please add a sentence or two to clarify that easterward propagating gravity waves (GWs) would not be included in your KWMF calculation, as you only constrain your horizontal wavelength to be > 100 km, fairly fall in the spectrum of internal and inertial GWs.

3) Fig.2: it would be the best to add a panel showing how your vertical wavelength (Lz) change with decreasing the vertical resolution for, e.g., 5-day, 10-day, 15-day, and 20-day waves.

4) P13, L2: I strongly suggest you to elaborate the reason to explain the discrepancies among different datasets here more thoroughly, e.g., SABER retrieved temperature profiles or ERAi might have too coarse vertical resolution, etc. Then briefly summarize this point in the conclusion section.

5) P15, L16: I don’t quite understand. KWMF plays a critical role in the descending of the QBO westerly phase, which shows a discernable enhancement along the zero-wind-line, as also shown in Fig. 4 and Fig. 5. Then, when you do the composite, it seems to me that the KWMF enhancement actually occurs when the QBO easterly starts to weaken. Why?

6) P17, L28 and onward about the MJO discussion: firstly, you need to give a reference or two suggesting that MJO likely impacts the KWMF. As you later on stated that some of the previous studies also found that Kelvin waves were also released when MJO was in the inactive phase: then why conduct such an investigation?

If you’d like to study whether convective activities are tied to KWMF strength, simply use the daily OLR index for a given grid box around the sounding site, and set up a threshold to separate active and inactive convective days to composite the KWMF.

7) Like I said in the beginning, add some sentences or paragraphs highlight the uniqueness and novelty of your work.