

Comment on acp-2022-389

Anonymous Referee #2

Referee comment on "Intermittency of gravity wave potential energies and absolute momentum fluxes derived from infrared limb sounding satellite observations" by Manfred Ern et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-389-RC2>, 2022

The manuscript investigates the global distribution of intermittency of gravity waves and its change with altitude using two limb sounding satellite measurements. The analysis is based on the probability distributions (and their fitting functions) and the Gini coefficient for the wave potential energy and momentum flux. An obvious strength of the analysis in this study is its broad spatial coverage (nearly global in the stratosphere and mesosphere). The author also introduced the importance of a proper normalization in the methodology for deriving the intermittency estimates. The results of the analysis are well presented with reasonable interpretations and with useful comparisons to previous observational and/or high-resolution modeling studies. The manuscript is also clarifying some limitations of the investigation due to characters of measurements (e.g., sampling issue; spectral coverage; noise range). I can strongly recommend this paper for publication after a minor revision (which will be rather technical). The following list includes only minor comments. Particularly the comments with '*' may be considered.

[Specific Comments]

L3: 'effect' of what ?

Eqs. (4)-(5): Would this part be fit more in Section 3.2 than here ?

L122: 'every about 60 days for about 60 days': Would the second part be removable ?

L134: One of the two 'instrument' should be removed.

L146: 'location': Would it be replaced with 'latitude, height' ? (if I understand correctly)

L156: 'different': between what ?

* L198: What are the displacements between overlapping bins ? (i.e., spacings of final estimates in the map)

L201: 'and' must be removed.

L240: 'single' values: What does this mean ?

* L240: 'normalized by the global distribution of median values': I would suggest clarifying more, with (for instance) 'spatially and temporally varying medians'. Moreover, given the context, it seems that this median field varies even within a bin of single estimation (so that the local gradient of median is taken into account). However it is not clear how this inner-bin field is made. Later in L456, it is first mentioned that an interpolation has been used. I suggest introducing this method around here (or earlier).

L245: 'sensitivities': instrumental sensitivities ?

L247-250: (just a question) In other words, momentum flux distributions show an interannual difference only in their overall magnitudes but not in the shapes of distributions. What would this mean ? Is this a statistical nature of gravity waves ?

L253: 'contribute to ... for the unnormalized values': It would be more clear to say 'cause an overestimation of ... when the unnormalized values are used.'

L256: 'very close to unity': Why not exactly the unity ?

L256: 'the reciprocal of': This might be removable in the context.

L270: Here I had wondered about what the meaningful range in the left-end of the

distribution would be, considering some measurement noises. Then later this information was found in Section 4.2.4 (it is so nice to have this).

I would suggest referring to that section here and, in case it is possible, providing the meaningful range in values (from about -2 in most cases ?) briefly.

L272: 'the SABER PDFs in Figs. 6c and 6d': These panels are for HIRDLS.

L276: '90th and': This should be removed, as the 90th percentile shows a slight increase in SABER.

L287: 'regions. The locations of ... are illustrated' can be shortened by 'regions illustrated'.

* L299-300: '... wider': How can they be compared with different units ?

* Table 3: '0.61 mPa' (1st row, 1st column): This value differs from Fig. 7a (0.51 mPa).

L302-305: Here the heights of the distribution tails relative to the lognormal functions (fitted for each distribution) are used for the comparison of the intermittency in the tropics and that in winter high latitudes. However, it should also be considered that the fitted lognormal function in the tropics has a width (~ 2 at 10^{-5}) that is not larger than that in the high latitudes (~ 2.4 at 10^{-5}). If this were not the case, the statement L302-305 would not simply hold.

L306: '90th percentiles': of unnormalized fluxes ?

L325: 'balloon' is missing.

L366: 'jet-related gravity source processes act more continuously' (in the northern hemisphere): Would this be contradictory to the fact that the mean momentum flux (unnormalized) is only less than half that in Southern Ocean in austral winter (Table 3) ?

L390: 'the regional difference in the potential energy PDFs ... to the corresponding difference in ...' ?

L408: 'HIRDLS and SABER' can be deleted (repetitive).

L457-458: Has the reason for this been mentioned before ?

L567: 'introduce additional': I would suggest changing this to 'alter' (or 'increase/decrease'), as the temporal changes of the atmosphere can also reduce the intermittency depending on the situation (Kim et al., 2021, JAS).

L580: '... with altitude, mainly in the mesosphere.' ? (In the stratosphere, the increase seems to be very small: 0.01--0.02?)

L614: 'We will ...': Section 6.1 also focussed on SABER. Please place this sentence to the earlier part.

L620: 'seen'

L642: 'gravity wave' (the first-appearing one) can be deleted.

L734: 'flat' at around what value (could you please include this) ?