We would like to thank Referee #2 for appreciating our efforts and for the very helpful comments and suggestions that will definitively improve the manuscript!

Please find below our point-by-point reply to the reviewer concerns. Comments by Reviewer #2 are given in red, our reply is given in black, and changes in the manuscript are indicated in blue.

Reply to the Minor Comments by Reviewer # 2:

(Minor Comment 1) L3: 'effect' of what ?

For clarification, this sentence has been reworded to:
"One important, but often neglected characteristic of the gravity wave distribution is the fact that..."

(Minor Comment 2) Eqs. (4)-(5): Would this part be fit more in Section 3.2 than here ?

As recommended, Eqs. (4) and (5) have been moved to Section 3.2.

(Minor Comment 3) L122: 'every about 60 days for about 60 days': Would the second part be removable ?

Removed as recommended.

(Minor Comment 4) L134: One of the two 'instrument' should be removed.

Removed as recommended.

(Minor Comment 5) L146: 'location': Would it be replaced with 'latitude, height' ? (if I understand correclty)

Here the "location" includes not only latitude and height, but also longitude. This has now been clarified in the revised manuscript as follows:
location (i.e., longitude, latitude, and height)

(Minor Comment 6) L156: 'different': between what ?

The sentence has been reworded for clarification:

"The reason is that during these short time intervals the respective local solar times of the ascending and descending parts of the satellite orbit are about constant."

(Minor Comment 7) * L198: What are the displacements between overlapping bins ? (i.e., spacings of final estimates in the map)

This has now been clarified by adding:

"... each bin slid 5° in longitude and 2.5° in latitude to yield a final 5° × 2.5° longitude × latitude grid."
Further, we have also given the grid spacings for the other bin sizes used.

(Minor Comment 8) L201: 'and' must be removed.

As recommended by Reviewer #1, this text has been reworded for clarification:

"... values are multi-year means of medians, and not multi-year means of arithmetic mean values."

(Minor Comment 9) L240: 'single' values: What does this mean ?

The expression "single values" is misleading. Sorry for that. We have reworded this sentence:

"... the PDFs should be created by normalizing all values by, for example, ..."

(Minor Comment 10) * 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).

This point is related to Reviewer # 1, Main Comments 2 and 3, and Minor Comment (10), as well as Reviewer # 3, Minor Comment 2.

As recommended, for clarification we have used the expression "spatially and temporally varying medians". Further, in the revised manuscript, after former l.240, we have added some more reasoning why we apply normalization, and the normalization procedure is described in detail. The importance of normalization is now also demonstrated in an Appendix where global distributions of Gini coefficients are shown that are calculated for SABER gravity wave absolute momentum fluxes without normalization. In these distributions spurious enhancements of intermittency can be seen that are introduced by strong horizontal gradients of the global distribution of momentum fluxes.

(Minor Comment 11) L245: 'sensitivities': instrumental sensitivities ?

The expression "sensitivities" here is meant to include both instrumental sensitivities and the effect that models may resolve only a certain portion of the gravity wave spectrum. For clarification, we have reworded this statement as follows:

"Normalization of the PDFs makes also sense if only the shapes of the PDFs of different data sets shall be compared, but magnitudes are different. In the case of observations, this could happen if instruments have different observational filters for observing gravity waves. In the case of model data, differences in magnitude could arise from different model resolutions, or from different model setups. Using normalization, it is even possible to compare completely different physical parameters that have different physical units."

(Minor Comment 12) 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 ?

Indeed, this could hint at the statistical nature of the gravity wave distribution. The shape of the distribution seems to not change much from year to year.

No changes required.

(Minor Comment 13) L253: 'contribute to ... for the unnormalized values': It would be more clear to say 'cause an overestimation of ... when the unnormalized values are used.'

Modified as requested.

(Minor Comment 14) L256: 'very close to unity': Why not exactly the unity ?

Since we are using "local" medians for normalization, and not the median of all data points in a considered region, it is not expected that the overall median of the normalized PDF in that region is exactly unity. For example, one effect of our method to obtain time-varying global distributions of medians, which uses overlapping lon/lat bins, is that at the boundaries of these larger regions there will always be lon/lat bins that are not completely contained in the larger PDF-region. This means that also information from data points outside the larger PDF-region is used for normalizing the data points inside the larger region, which can lead to minor deviations of the median of the normalized PDF inside the larger region from unity.
We consider this a very minor effect that is almost negligible, and therefore we just add a short statement in the text as follows:

"Since we are using local medians for normalization, and not the overall median of all data points used for a PDF, it is not expected that the overall median of a normalized PDF is exactly unity."

(Minor Comment 15) L256: 'the reciprocal of': This might be removable in the context.

Removed as recommended.

(Minor Comment 16) 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.

As requested, we will add the following statement:

"As will be shown later in Sect. 4.2.4, measurement noise only partly affects the PDFs at low values of normalized momentum fluxes. The meaningful range of the PDFs for normalized momentum fluxes starts from about -2 in most cases."

(Minor Comment 17) L272: 'the SABER PDFs in Figs. 6c and 6d': These panels are for HIRDLS.

Thank you very much for finding this mistake!

Correct is: "Figs. 6e and 6f"! This will be corrected in the revised manuscript!

(Minor Comment 18) L276: '90th and': This should be removed, as the 90th percentile shows a slight increase in SABER.

Corrected as requested.

(Minor Comment 19) L287: 'regions. The locations of ... are illustrated' can be shortened by 'regions illustrated'.

done

(Minor Comment 20) * L299-300: '... wider': How can they be compared with different units ?

Thank you very much for pointing this out! We have rephrased this sentence as follows:

The intermittency of unnormalized momentum fluxes is only generally somewhat stronger as can be seen from the percentages of momentum fluxes beyond the 90^{th} and 99^{th} percentiles.

(Minor Comment 21) * Table 3: '0.61 mPa' (1st row, 1st column): This value differs from Fig. 7a (0.51 mPa).

Thank you very much for finding this typo!

The value in Table 3 has been corrected to 0.51 mPa.

(Minor Comment 22) 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.

Thank you very much for pointing this out. We have included this fact in the revised manuscript:

"Together with the somewhat reduced width of the fitted lognormal distribution in the tropics, this means..."

(Minor Comment 23) L306: '90th percentiles': of unnormalized fluxes ?

Sorry, our statement was incomplete and therefore wrong. Correct is:

"Also the percentages of momentum fluxes beyond the 90^{th} percentiles are in good agreement ..."

(Minor Comment 24) L325: 'balloon' is missing.

added

(Minor Comment 25) 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) ?

Although gravity amplitudes are smaller on average in the Northern Hemisphere, gravity wave sources could still act more continuously. Main reason are the background winds that are weaker in the northern hemisphere polar vortex, which makes gravity wave propagation conditions less favorable and limits the maximum amplitudes that gravity waves can attain.

We have added this explanation as follows in the revised manuscript:

"Given the strong activity of jet-related gravity waves sources, it may appear counter-intuitive that gravity wave amplitudes in the Northern Hemisphere during boreal winter are much lower than in the Southern Hemisphere during austral winter. However, during the respective winter season, background winds are usually much weaker in the Northern Hemisphere than in the Southern Hemisphere. This makes gravity wave propagation conditions less favorable in the Northern Hemisphere during boreal winter and limits the maximum amplitudes that gravity waves can attain. Another effect that can lead to less pronounced hotspots of mountain wave activity in the Northern Hemisphere is that...

(Minor Comment 26) L390: 'the regional difference in the potential energy PDFs ... to the corresponding difference in ...' ?

In order to clarify our statement, we have reworded it as follows:

"the shapes of the potential energy PDFs in the different regions are very similar to the shapes of the corresponding momentum flux PDFs."

(Minor Comment 27) L408: 'HIRDLS and SABER' can be deleted (repetitive).

deleted

(Minor Comment 28) L457-458: Has the reason for this been mentioned before ?

No, so far we did not give any explanation for this similarity of the global distributions of Gini coefficients.
One possible reason for the similarity between median and mean normalization could be that the median differs from the mean by a factor that is approximately the same within any of the given lon/lat bins used for calculating the global maps, while this factor may vary from bin to bin. In this case, the Gini coefficient determined for this bin would be almost unaffected.
We have added this explanation in the revised manuscript as follows:

"One possible reason for this similarity could be that for every lon/lat bin used for calculating the global distributions of I_g, the median differs from the mean by a factor that does not vary much within this bin. If this is the case, the Gini coefficient for this bin would be almost the same for both kinds of normalization. Still, the factor between mean and median could vary from bin to bin without having much effect on the global distribution of I_g."

(Minor Comment 29) 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).

Thank you very much for this additional information! The text has been changed to:

"...alter intermittency (either increase or decrease, e.g., Kim et al., 2021)"

(Minor Comment 30) L580: '... with altitude, mainly in the mesosphere.' ? (In the stratosphere, the increase seems to be very small: 0.01–0.02?)

this information has been added in the revised manuscript

(Minor Comment 31) L614: 'We will ...': Section 6.1 also focussed on SABER. Please place this sentence to the earlier part.

As suggested, this statement has been moved to the introductory part of Sect. 6.

(Minor Comment 32) L620: 'seen'

corrected

(Minor Comment 33) L642: 'gravity wave' (the first-appearing one) can be deleted.

first appearance deleted

(Minor Comment 34) L734: 'flat' at around what value (could you please include this) ?

In the revised manuscript we have added "and displays only weak variations around a value of 0.5."