

We thank the reviewers and editors for their constructive comments on our manuscript. The manuscript is revised thoroughly by considering all the comments. Besides, Figures 1-11 have been updated to make the results clearer. Our responses to every comment are listed below with blue.

Response to Anonymous Referee 2

This article has some important results, e.g., How the W3 and W4 components of Q2DW in winds and temperature differ during QBOE and QBOW phases. It discussed the role of interaction with mean flow and source variability of planetary waves in modulating the Q2DW variabilities. However, it is not well written and logically organized, which makes it very difficult to interpret and connect one paragraph to the next. It reads like the authors are making sudden jumps from one topic to another without connecting them with previous discussion. There are many flaws on the presentations. Also, many obvious/common knowledge results are presented as if they are new findings.

The manuscript is revised thoroughly by considering all the comments.

Some examples are:

Lines 15-17: “Mean...QBOW phase”. This is a characteristic of a QBO and it is very obvious.

Revised in the revision.

Lines 291-292. A sudden and unexpected jump in the description without any motivation or connection to earlier discussion.

We have adjusted the structure of the manuscript to make it easier to understand.

Revised in the revision.

No explanation or reasoning is provided on why different days are chosen from different years. For example, line 298, why 13-19 is chosen?

We chose the strongest events of each year, which occurred at different times between 2003 and 2020. Revised in the revision.

Line 367: No reference or description is given to what kind of diagnostic analysis has been performed here. The unit(s) of the diagnostic quantities in Figure 5 are not provided, which makes it difficult to guess it.

The event is analyzed using the method of Equation 2. Revised in the revision.

Lines 485-488: ‘... GPH W3 amplitude...’ What is the meaning of this? It is not clear what this quantity is. Is it some kind of filtered out Q2DW-W3 filtered out from the GPH data?

The fluctuation amplitude of Q2DW in the lower atmosphere was analyzed using GPH data. Revised in the revision.

Line 532: The mean zonal wind amplitude of what? W3 or W4?

Revised in the revision.

A physical explanation is missing: For each of the main finding listed in the summary and conclusion, a valid and proven physical mechanism or explanation should also be

provided.

More concise descriptions on the analysis results are added in the revision.

Minor comments:

Line 10: Define W3 and W4 here. Also, later in the introduction section define what direction they usually propagate.

Revised in the revision.

Line 14: Not clear, what do you mean by amplitude of zonal wind. Is it the zonal-wind due to Q2DW? W3 or W4 or of QBO?

Revised in the revision.

Line 233: same as line 14. 'amplitude of mean zonal wind' – how can wind have an amplitude. Do you mean amplitude of QBO in wind? Make this clear here and in later occurrences.

Revised in the revision.

Line 18: "background wind" define the background wind. Is it ZMW or wind other than Q2DW-W3 and Q2DW-W4?

Revised in the revision.