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 1

Major comments:

While the title of the manuscript suggests that it is a study of QTDWs, the introduction section may give the impression that the authors are primarily interested in the QBO and its effects on QTDWs. To better reflect the main aim of the study, the authors should revise the introduction section to focus on the investigation of QTDWs and their relationship to different phases of the QBO. In the revised introduction, the authors should clearly state the research question or hypothesis, provide a brief background of the topic, and explain the significance of the study.

The manuscript is revised thoroughly by considering the introduction.

The authors may consider providing a paragraph in the revised introduction briefing on previous works on QTDWs based on ground-based MF and meteor radars, particularly in equatorial regions where the QBO is stronger

More descriptions on the introduction parts are added in the revision. Lilienthal and Jacobi (2015), Gu et al. (2013) and Liu et al. (2019), have been added to the revision.

References

Gu, S.-Y., Li, T., Dou, X., Wang, N.-N., Riggin, D., and Fritts, D.: Long-term observations of the quasi two-day wave by Hawaii MF radar, Journal of Geophysical Research: Space Physics, 118, 7886-7894, https://doi.org/10.1002/2013JA018858, 2013.

Lilienthal, F. and Jacobi, C.: Meteor radar quasi 2-day wave observations over 10 years at Collm (51.3° N, 13.0° E), Atmos. Chem. Phys., 15, 9917-9927, 10.5194/acp-15-9917-2015, 2015.

Liu, G., England, S. L., and Janches, D.: Quasi Two-, Three-, and Six-Day Planetary-Scale Wave Oscillations in the Upper Atmosphere Observed by TIMED/SABER Over ~17 Years During 2002–2018, Journal of Geophysical Research: Space Physics, 124, 9462-9474, https://doi.org/10.1029/2019JA026918, 2019.

The title of the manuscript suggests that QTDWs are observed in the middle atmosphere. However, this term was not explicitly used in the manuscript. Therefore, to avoid confusion, the authors should provide a clear definition of the middle atmosphere in the introduction section. Furthermore, it is important to clarify that the QBO occurs in the stratosphere, while the QTDWs are observed in the mesosphere and lower thermosphere. This clarification will help readers to better understand the vertical location of the phenomena being studied and the relevance of the QBO to the study.

In the methodology section, the authors should explain the process of extracting the wavenumbers and why W3 and W4 are chosen. They should also provide a clear explanation of why W3 and W4 are obtained at different heights.

More descriptions are added in the revision.

The manuscript contains several technical terms, such as W3 and W4, easterly and westerly zonal winds, QBOW and QBOE, NH and SH, and GPH, which may make it challenging for some readers to follow the main focus of the results. To improve the readability and accessibility of the manuscript, the authors should consider defining these terms and providing sufficient context for their use. Additionally, they could consider simplifying the language where possible to help ensure that the main ideas are clearly conveyed.

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

The authors should highlight the main results of the study, and explain clearly what is new and what is already known. They should also explain the significance and implications of their findings.

The main results of the study are considered, the new results are clearly explained, the significance and implications of the findings are expounded, and the manuscript is thoroughly revised.

The authors should separate the results and discussion sections to make it easier for readers to understand what is already known and what is new. The summary and conclusion section should also provide a clear and concise overview of the main findings of the study and their implications

The results and discussion sections have been described separately, with a clear and concise exposition of the summary and conclusion sections.

By addressing these concerns, the manuscript should become clearer and more accessible to readers.

Minor corrections (not an extensive list, there are many)

Abstract: Please rewrite the abstract, and make sure to mention the most important results.

The abstract has been rewritten in the revison.

Introduction: Please rewrite the introduction, as it currently reads like a small review of QBO. Instead, focus on the QTDW and its variability, and explain why it is important to study it under different phases of QBO. This information is already present in the manuscript, but it needs some re-arrangement.

More descriptions on the introduction parts are added in the revision

Section 2: The authors mention that the SABER data is from 2002 to 2020 (lines:186-187), whereas the MERRA 2 data is from 2003 to 2020. It is recommended that the authors use the same period of data from the two datasets.

Revised in the revision.

Lines 150-151: There is a typo in the expansion of “MERRA 2”.

Revised in the revision.

Lines 233-236, Figure 1: The zonal winds vary from negative to positive, not the amplitude. The amplitude cannot be negative.

Revised in the revision.

Lines 246-247: The first sentence of the paragraph is incomplete and needs to be revised

for clarity.

Revised in the revision.

Lines: 247-250: It is important to explain why these specific heights were chosen for W3 and W4, and why different heights were used for each.

Revised in the revision.

Figure 3: The letter 'E' is missing for 'QBOE' in the titles of sub-plots B5, C5, and D5. Additionally, the figure caption should read 'A5-D5,' not '3A-D5' if I understand correctly.

Revised in the revision.

Lines 785-787: Figure 4 caption: The meaning of the sentence "The temperature amplitudes...data, respectively" in the Figure 4 caption is unclear. Please revise the caption to improve clarity. As currently written, it appears that the amplitudes of both W3 and W4 in both QBO phases were extracted from SABER data, but it is unclear if this is correct.

Revised in the revision.

Figure 5: The figure is difficult to understand. It is unclear what the color-scale represents, what its units are, and where the blue shaded region is located. Additionally, it is unclear why one horizontal line is drawn for the QBO phase, and why the green line is mentioned twice, as both the critical layer and critical layer E1 with the mean period are labeled green. The authors should revise the figure and its caption for clarity.

The shaded region represents instability. The green line represents critical layers. More descriptions on the analysis results are added in the revision.

Overall, the manuscript is very confusing and lacks clarity in presenting the important results. The text and figures also contain several typos. Therefore, the manuscript needs to be completely rewritten, with a focus on presenting the results clearly and discussing them in a way that highlights what is new compared to what is already known. Additionally, the introduction should clearly state what the authors want to study, and the manuscript should have a logical flow that leads the reader from the introduction to the conclusions.

We thank the reviewers and editors for their constructive comments on our manuscript. The manuscript is revised thoroughly by considering all the comments.

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 ZMZW or wind other than Q2DW-W3 and Q2DW-W4?
Revised in the revision.