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Comment on acp-2022-393

Anonymous Referee #2

Referee comment on "A new methodology for measuring traveling quasi-5-day oscillations during sudden stratospheric warming events based on satellite observations" by Zheng Ma et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-393-RC2>, 2022

Comments on "A new methodology for measuring traveling quasi-5-day oscillations during SSWs based on satellite observations" by Ma et al.

Summary

Ma et al. (2022) tried to establish a possible new methods of identifying travelling planetary waves in the stratosphere during sudden stratospheric warmings by removing the possible interference of stationary planetary waves. Compared with the traditional method, the authors claim they have several improvements in the identification method. However, a significance test is lack in the paper, and readers might wonder to what extent the results are trustworthy. The difference between the new method and old is also not large, which is also shown for the synthetic (man-made) data from Figures 1-3. Further, this paper focuses more in the mesosphere and upper stratosphere. The largest improvement is very likely not in the lower stratosphere. The results from 100 hPa to 10 hPa should be shown if possible. I did not see any discussion on the origin of the enhanced planetary waves during SSWs. Do they come from the lower atmosphere like troposphere or generate in the middle atmosphere directly? Due to those issues, I would suggest a substantial revision before the paper can be considered.

Major comments

- The importance and significance of this study is not very persuasive. Only removing the interference of the stationary waves, I find it is hard to find any novelty of the results. The authors might add more discussion about the possible application of this new methods. Further, the stationary waves are much stronger than the travelling waves in their amplitudes. What is the ultimate aim of extracting the travelling the travelling wave amplitudes?

- The difference between the old method and the new method is not very evident, especially for the synthetic method. If the authors have to present an example, why not use the real observation? The example shows that the curves extracted have some sawteeth, which might be a problem.

- I am more concerned about the stratosphere. The amplitudes of the decomposed stationary waves and travelling waves in the stratosphere is more interesting, because SSWs occur in the stratosphere.

- The origins of the stationary waves and travelling waves are worth mentioning in the paper. After reading, I did not find any information about the possible generation mechanism of the travelling and stationary waves in the middle atmosphere. Do all of them come from the troposphere? Is there any other mechanism of generating the travelling and stationary waves in the stratosphere and mesosphere?

- The robustness of the results is a big problem. Can you provide any test for the composite difference?

Specific Comments

- L46: This review paper was published in 2021. Changed to "Baldwin et al., 2021"

- L47: two temperatures appear in this phrase, consider to rephrase this sentence.

- L54-56: There are too many publications discussion this point. Suggest to add more recent ones.

- Figure 1. Please add the axis title for the x-axis. There are some sawtooth-shaped points for the extracted curves in Figure 1c, 1d. Can you present some explanation. Is there any method to remove those sawteeth in those plots?

- L180: this criterion does not suitable for the ... => ...is not...

- Figure 2b, Figure 3c, 3d: Similar problem as for Figure 1.

- L310: The SSWs before 2013 were also studied in Liu et al. (2019; doi: 10.3390/atmos10110679) and Rao et al. 2019 (Table 1; doi: 10.1029/2019JD030900)

- L336: Because we did not have the observations of the decomposed wave amplitudes, it is not strictly true to regard the results from the new methods as the baseline. But there is possibility that the amplitude in the old method is overestimated.

- L352-353: If we use the old method as the baseline, the conclusion is reversed. The authors should be careful and cautious to summarize. I suggest to add more discussion. If there are some observed amplitudes for all waves, this comparison is more meaningful. Using the new method as the baseline, the old method is hypothesized to have problems. This bias might be not true.

- Figure 6: Because this is a composite picture, I suggest to add the significant test. The largest problem of the paper is lack of test.