

Interactive comment on “Winter 2018 major sudden stratospheric warming impact on midlatitude mesosphere from microwave radiometer measurements” by Yuke Wang et al.

Anonymous Referee #1

Received and published: 7 February 2019

GENERAL COMMENTS

The topic of ground-based mesospheric carbon dioxide observations is interesting and fits into the scope of ACP. The local microwave radiometer observations over Kharkiv during the major warming event in 2018 are valuable, but they need to be validated and explained adequately. In this sense I suggest the authors to add stratospheric carbon dioxide and mesospheric temperature data for a solid discussion of horizontal and vertical transports. If this information is provided in a concentrated form during a *major revision*, the paper would gain further value.

SPECIFIC COMMENTS

C1

1) Validation: A validation of the reported CO observations is required. For this purpose satellite observations could be used 1) to compare the CO in the 60-90 km range and 2) to extend the profiles will into the stratosphere. This would allow the qualification of downward transport during the 2018 major warming event in comparison with other events. Note, that the shown changes remain in the 70-80 km range while Funke et al. (2009) reports on effects down to 30 km for the 2004 major warming event. Such a three-dimensional picture would allow to place the local observations into a global context.

2) Explanation: The present explanation of the observed mesospheric CO profile in terms of horizontal and vertical transports is highly speculative. It uses analysis data for the stratosphere which does not directly imply a clear picture of the mesosphere. So you can not use the presence of stratospheric planetary waves to explain oscillations in the mesosphere on the daily basis. For such a link mesospheric data are required, which exist with satellites. In this sense, you give some information on MLS-derived temperatures in figures 2.a and 7, but the latter is very noisy and not very helpful. The presentation of maps at selected levels would considerably help the interpretation of local CO and T observations in terms of three-dimensional transports.

3) Concentration: In some points the discussion of stratospheric dynamics is distracting the reader. Given the aim of the paper to present and understand the local mesospheric CO behavior, the detailed presentation of stratospheric circulation patterns in figures 3, 5 and 6 and related texts does not help this understanding and should be erased in favor of a concise discussion of joint stratosphere-mesosphere data in the sense of the comment above.

TECHNICAL CORRECTIONS

L19: Change "was" to "is" for present tense.

L23: Change "have been" to "are".

C2

L42: Change "happened" to "happens".

L45: Change "The" to "A".

L51: Insert "is" after "database".

L56: Replace "waves" by "activity" and "propagate" by "propagates"

L58: What do you mean with "upward transfer of the momentum and heat"? The EP flux is the flux of wave activity, which is much upward and equatorward in the case of SSWs. Please, reformulate.

L61: Insert "its" after "is".

L65: Change "atmosphere" to "atmospheric".

L84: Replace "in" with "associated with", for example.

L143: Replace "are" with "is" because it refers to "data set" (singular).

L156: Insert a comma after "snow".

L160: Why not use "CO" for "carbon dioxide" (here and elsewhere)?

L161: Are these validation tests published and documented? Please, provide a reference.

L162: Why not use "MWR" for "microwave radiometer" (here and elsewhere)?

L166: Above you wrote "sideband" - please, unify.

L167: Replace "The first" with "At first".

L169: Replace "The second" with "At second".

L175: Which of the two methods were used for this article?

L178: What do you mean with "similar"? Rügenachts instrument is for ozone at 30-79 km - please, specify yours.

C3

L185: Insert "and" before "have".

L200: Shorten subtitle to "3 Northern hemisphere SSW effects" in the same style as for section 4.

L202: Begin with "The general" and insert "a" after "is".

L204: Insert "a" before "sequence".

L212: Why not use "SSW" for "sudden stratospheric warming" (here and elsewhere)?

L225: Replace "in the" with "into".

L233: See comment for L58.

L238: Replace "since" with "after".

L242: "QBO" appears only once in the text, so it doesn't need to be abbreviated.

L244: Insert "less likely" after "latitudes".

L256: Correct "WMR" to "VMR".

L376: Insert "The" before "Elevation".

L377: Insert "A" before "Similar".

L437: The paragraph should be shifted to where first reference to Fig. 4 is made.

Fig.2: Please, mark "10 Feb" in (a) as in (b),(c), and (d).

Fig. 4: Please, indicate height ranges in (a) and (b) as in (c) and (d).

Fig. 7: Please, indicate "10 Feb" as in Fig. 2.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-1361>, 2019.

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