

## ***Interactive comment on “New insights into Rossby wave packet properties in the extratropical UTLS using GNSS radio occultations” by Robin Pilch Kedzierski et al.***

### **Anonymous Referee #2**

Received and published: 29 April 2020

This study investigates Rossby waves packets, their characteristics and evolution in the extratropical upper troposphere and lower stratosphere, based on observations from radio occultation. Rossby waves packets' structures are analyzed under normal conditions and compared to specific events such as periods of sudden stratospheric warming and heat waves. In connection to the SSW 2009, enhanced vertical propagation of Rossby wave activity is shown. During the Russian heatwave no distinct difference to normal conditions was found. Overall the paper is very informative. It adds new knowledge to the field and discusses ways forward.

Major comments:

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The analysis is based on temperature and pressure profiles from radio occultation and I have two major comments in this respect.

1) My first comment relates to the use of temperature from a moist air retrieval and the added value of pressure over temperature. I refer to and fully agree with the comment posted by Petr Sacha, which I do not repeat here.

(i) Dry temperature is recommended favorable for use in the UTLS as it is directly retrieved from refractivity, and does not contain background information from a moist-air retrieval.

(ii) Regarding the added value of pressure, I also strongly recommend to provide further evidence here.

2) Secondly, in your work, you used UCAR CDAAC data. Note, that from bending angle initialization the NCEP climatology might introduce some artefacts in mid to high latitude winter. There is some recent work of the radio occultation community comparing RO data from several processing centers, which discusses this, see Fig.5b to 7b, subpanels 60N –90N, at <https://doi.org/10.5194/amt-2019-358>).

In your work, however, you perform quality control of the radio occultation profiles (described in section 2.2 of your manuscript), which might get hold of this issue. You state that your QC removes about 10% of the profiles. It would be interesting to see, if there is a pattern in the removed profiles (latitude, time wise), and whether your QC preferably removes profiles in northern high-latitude winter.

Overall, the paper is well written with good discussions and explanations but has a lengthy style and gives repeating information at some places. There is potential for streamlining and shortening at several places to make it better readable without loss of information. I cannot point to each specific place but give examples in the list of minor comments below. I recommend that the authors thoroughly read through the manuscript and try to further streamline it (e.g., remove repeating statements). Re-

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garding the conclusions section: I recommend merging the summary given in section 3 with the conclusion section. I also recommend removing all citations in the conclusions section, all of them have been cited already during the discussions. Please find a list of minor comments below.

Minor comments:

The percentage signs looks strange, is it of different font than the other text?

Use “±” instead “+”

P3,I24: Suggest adding a more recent reference on the recent availability of RO data, e.g., Anthes et al. 2011 (<https://doi.org/10.5194/amt-4-1077-2011>), or Ho et al. 2019 (<https://doi.org/10.1175/BAMS-D-18-0290.1>)

P8, I1: Please state the time of the SSW, of onset and duration.

P13,I5: “Fig3f: Why is the correlation so high for wavenumbers larger than 8. Only low wave activity at wavenumber 8 is shown in Fig. 1 and 2).

P15, I7: Remove first sentence (it is repeating).

P16 Move the short summary and merge it with the conclusions section.

P16, I27: Remove: “After analyzing RWP activity from a zonally averaged perspective in Section 3, . . .”

P18, end of figure caption: Remove “on left side.”

P20, I1: Use “geopotential height tendencies” instead of “dphi”

P20, I3-6: Mover this paragraph up by two paragraphs and insert it in p19, I3, where you discuss the out of phase behavior.

P22, figure caption, end of I1: Remove “n” before “Fig.”

P29 &30: remove citations in conclusion section, will make it better readable

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P30: I15: “Mosow heat wave”: change to “Russian heat wave”

All figures: remove the underline in figure titles.

Figures 10 to 12: make the fonts consistent for x and y titles.

Figures 3, 4: remove “ $\text{Amp}(p')/p$ ” in legend

Figures 6,7: remove “ $p'/p$ ” in legend and in all other figures. You state it in caption and text.

Fig. 11: use smaller font for a), b), c), d)

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-124>, 2020.

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