

We would like to thank the referees for their constructive comments and suggestions, that helped us improving the quality of our paper. Our detailed replies are included below.

## RC1

The Grieco manuscript presents the updated retrieval of water vapor and temperature from Odin/SMR by fixing the sideband leakage issue. Validation against other satellite datasets were carried out. Improvement of data in this new version has been achieved.

The paper is well written with significant results. I recommend its publication after a minor revision.

Major Comments:

1. page 3: line 10-line 14, References for other satellite measurements are not representative. For example, MLS, SABER, SOFIE and ACE-FTS have inappropriate citations. We have changed SABER reference to Dawkins et al. (2018) (<https://doi.org/10.1029/2018JD028742>) and SOFIE to Stevens et al. (2012) (<https://doi.org/10.1029/2012JD017689>). We believe MLS and ACE-FTS citations are correct, as they are relative to validation studies.
2. page 5, line 7: "The a priori for water vapour instead...." More information is needed. What kind of measurements at Bordeaux Observatory? This a priori data set was compiled a long time ago, in the beginning of the Odin mission and was not accurately documented. However, the corresponding data is provided for each profile in the v3.0 data files and available at <http://odin.rss.chalmers.se/level2>.
3. Figures should be described in sequence. For example, page 6, line 7 "Figures 12 and 13" are called too early. We need to call those figures early, because they also show the biases in the SMR v2.1 version (in addition to the relative differences between SMR v3.0 and other instruments) which we talk about in Section 2.2. An alternative to that would be to show very similar plots that only show v2.1 biases already in Section 2.2. We chose not to do this as these plots would be almost a duplicate of the ones in the Conclusions section.
4. Structure of the paper. Many figures are put in the appendix, but are discussed in the main text. For example, page 11, first paragraph. Need to rearrange. We indeed decided to include some of the discussed figures in the appendix instead of keeping all of them in the main paper in order to avoid having too many figures. We had to prioritize some figures over others of secondary importance. We think that such a structure is preferable for the sake of clarity.
5. page 12, line 5 "Regarding H<sub>2</sub>O, measurements are considered coincident...., while for temperature ....." the separation of time seems too long: 9 hours and 4 hours. Tides will be mixed in the comparison. Performing tests with stricter time coincidence criteria proved not to sensibly change the shape of the median difference profiles, suggesting that tides don't have a significant effect in the presented comparisons. This information has been added to the text.
6. Contours in the appendix need improvements. Figure A5-A6, A8-19, difficult to quantify the values. Use more color table or contour interval. The color table is already set to cover the highest difference values. Extending it would only result in lower values to be undistinguishable. The contours are already close to each other, therefore adding more of them would make the plots even harder to read.

7. Why SABER H<sub>2</sub>O and T are not used in the validation? We thank the reviewer for his/her suggestion to include the comparison with SABER. It could have indeed been done. However, we chose to include in our study only the instruments covering a similar altitude range as our instrument, i.e. the mesosphere and lower thermosphere. Contrary to MIPAS, ACE and MLS, SABER does not measure H<sub>2</sub>O in the lower thermosphere (Rong et al., 2019, <https://doi.org/10.1016/j.jastp.2019.105099>).

Minor comments:

1. Abstract: first line, "temperature is also important tracer" Not really. Temperature is also controlled by solar radiation and cooling. Not a dynamical tracer. Text changed to "Temperature observations are also critical to study middle atmospheric dynamics"
2. page 4, last line, "long wavelength" This has been changed in the updated version of the manuscript.
3. page 6, line 14, what are the physics behind these r<sub>0</sub> values? Or just empirically determined? Yes, they are empirically determined. As explained in the text, they are the values that minimize the differences with other instruments. This has now been clarified.
4. page 7, line 9 "and increased methane oxidation...."or sure about it. Any reference? The reference has been changed to Lossow et al.(2017) (see page 1117, Section 4.11, points 4 and 5).
5. page 7, line 14, "geostrophic balance" please double check its accuracy. The accuracy of this sentence has been checked.
6. page 12, line 3, "that is MIPAS", --->"such as" " This has been changed in the updated version of the manuscript.