Comments on the ACPD manuscript entitled “Signatures of the two day wave and sudden stratospheric warming in Arctic water vapour observed by ground-based microwave radiometry” by Brigitte Tschanz and Niklaus Kämpfer.

The present paper describes the analysis of ground-based radiometer observations of water vapour at Sodankylä/Finland, covering the time period between June 2011 and March 2013. The analyses focus on signatures of dynamical features as sudden stratospheric warmings (SSWs) and the quasi two day wave (Q2DW).

In general the paper is well written. It is easy to follow and leaves very little questions. Yet, I have to admit that upon first readings I did not know how to judge the manuscript. An immediate thought was “Yet another SSW manuscript”. This phenomena has been covered quite a lot in all kind of facets in recent years. In that regard the manuscript provides no surprises besides the mere report of the observations. The more interesting part, and also the real scientific value of this manuscript, is the analysis the Q2DW signatures in water vapour. So far there are very few observations reported in the literature. In that sense I think the manuscript can be tweaked a bit to build on this strength, like indicated in the title where the Q2DW is mentioned first. In the text however the SSWs come first, forming my initial impression.

Comments:

- page 373, lines 12 & 13: This sentence sounds somehow strange. Substituting “entering” with “the transport of this trace gas” could help. Besides that I would argue this transport is not the “main” source. For the middle atmosphere as a whole it is more like a 50-50 thing with the water vapour production from CH_4 and H_2 providing the other half.

- page 373, line 14: I suggest to use the term “freeze-drying” instead of “dry-freezing”. It is simply more common.

- page 373, line 20: The horizontal gradients are sustained by the vortex edge. Otherwise the descending air would mix with mid-latitude air.

- page 374, line 8: It should be “two days, … ” instead of of “two day, …”. And so on.

- page 374, lines 25 - 28 & page 375, lines 1 - 3: There is a lot of doubling in these two sentences, like “this paper”, “ground-based” or “radiometer”, which makes a bit confusing. In addition, the phrase “illustrate the capability” appears to be too shy for the potential of such observations.

- page 378, lines 27 - 18 & page 379, lines 1 - 3: I think the water vapour development here is even more complex than described. If you look at the lowermost mesosphere there appears to be a brief influx of former vortex air above Sodankylä just after the central SSW date. Shortly afterwards water vapour volume mixing ratios jump up again before a second weaker influx of former vortex air occurs. This happens within roughly 10 to 14 days after the central date of the SSW. Just at the 3 ppmv or 4 ppmv isopleth higher up in the middle mesosphere you see the steady descent in the aftermath of the SSW. Can you elaborate on that a bit? In that regard I think there are some inconsistencies to the message conveyed by the sentence in lines 18 - 20 on page 379.

- page 379, lines 5 - 6: I would be a little bit more careful here. In the uppermost stratosphere the vortex air could already be dryer than non-vortex air. Some nice examples of this are shown in Nassar et al. (2005) and Lossow et al. (2009).

- page 380, lines 14 - 16: Something is fishy with the second part of the sentence. Should it be something like this: "… and only at high latitudes the Q2DW has been observed near winter solstice"?

- page 381, line 3: I would put here already a reference to Figure 6.

- page 381, lines 11 & 12: There is certainly no amplitude peak at 2 days at 0.05 hPa in November. But there is one close by with a period of little less than 2 days that very likely can be attributed as Q2DW. The amplitude is just a little smaller than in the uppermost stratosphere. So, the message that there is no Q2DW in the upper mesosphere I would not support.

- page 381, lines 15 & 16: Here you could add a reference to Merkel et al. (2003) and Sonnemann et al. (2008).

- page 381, discussion of Figures 5 - 7: The figures are discussed to discern differences in the Q2DW in the mesosphere and stratosphere. I feel that this is a bit misleading. From Figure 4 I would make a separation between above and below 0.1 hPa, roughly.

- page 387, Figure 2 & page 388, Figure 3: I did bother a bit with the upper panel of these figures. I found that the overlaid distance to the vortex edge is covering up some details that I liked to look on. Could that be an idea to move the information to a separate panel?

Technical corrections:

- page 377, line 21:"cause" should read "course". This happens again on page 379, line 24.

- page 380, line 15: "hight" should read "high".

References:

- Nassar et al.: "ACE-FTS measurements across the edge of the winter 2004 Arctic vortex", *Geophysical Research Letters*, 32, L15S04, doi:10.1029/2005GL022671, 2005.

- Lossow et al.: "Middle atmospheric water vapour and dynamics in the vicinity of the polar vortex during the Hygrosonde-2 campaign", *Atmospheric Chemistry & Physics*, 9, 4407 – 4417, doi:10.5194/acp-9-4407-2009, 2009.

- Merkel et al.: "Observations of the 5-day planetary wave in PMC measurements from the Student Nitric Oxide Explorer Satellite", *Geophysical Research Letters*, 30, 1196, doi: 10.1029/2002GL016524, 2003.

- Sonnemann et al., "The quasi 5-day signal in the mesospheric water vapor concentration at high latitudes in 2003 - A comparison between observations at ALOMAR and calculations", *Journal of Geophysical Research*, Volume 113, doi:10.1029/2007JD008875, 2008.