

## ***Interactive comment on “Variability of subtropical upper tropospheric humidity” by J.-M. Ryoo et al.***

### **Anonymous Referee #2**

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#### General comments:

The paper discusses the climatology and variability of tropospheric water vapor in the subtropics and tropics based on AIRS data and links general features of these observations to dynamical processes. The paper provides interesting observations and analyses, but suffers from a presentation, which needs to be refined. I would also suggest extending the scope to include the southern subtropics, to provide a better understanding of the tropical RH variability. I would recommend publication of this paper only after some major revisions.

The discussion of the connection between MJO and variations in RH is interesting and contains much of the material that makes this paper worth publishing. However, following the paper by Waugh (2005) the authors limit themselves to the northern winter and northern subtropics, leaving out the questions opened by Waugh and Polvani

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(2000): How is RH in the southern subtropics modulated and is there the same connection between tropical convection and the MJO as the authors show for the northern subtropics? Waugh and Polvani (2000) show that PV intrusions from the southern subtropics into the tropics are as frequent as those from the northern subtropics and that the seasonal maximum of intrusions from the southern subtropics leads that from the northern subtropics by about 2 months. It would have been nice to see, how the southern intrusions contribute to the variability of tropical RH. This would make a nice extension of Waugh (2005). Furthermore, what is the variability of RH during the other seasons, when the intrusions are less frequent?

The introduction is in large parts a near verbatim copy of the earlier paper by Waugh (2005). This should be changed to emphasize the new results that are being addressed in the current manuscript. Some of the results are a repeat of the paper by Waugh (2005) using AIRS data (section 4.1) and could be shortened.

All figures are too small and very difficult to read. The contour figures carry too much information, much of which gets lost in the information density. These figures need to be improved. The authors might consider a way that separates one or two pieces of information in these very dense figures and place it in different figures.

The contours in figure 1 are impossible to identify.

The legend in figure 2 differs from the figure header.

The vertical scale on figure 3 is too small and misleading. It would be better to clearly indicate that four separated winter seasons are being shown. The contours in the right panels get lost. The variation between the four seasons isn't discussed in the text. Is it even relevant?

The vectors in figure 4 are unidentifiable and the geographical information gets lost in the contours and shadings.

What is the meaning of the thick solid horizontal line in figure 7?

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Figure 8 needs to be made easier to follow.

Page 1053, Line 4ff: How are these RH values calculated? Is zonally averaged RH compared to the MJO indices at 120E and 140E? Is RH averaged in a box centered around these longitudes? Why would the zonally averaged RH correlate with these MJO indices? In the composite RH calculation, what is the significance of MJO index  $< -1$ ? Why not  $< 0$ ? What impact has the Lanczos filter? The correlation between increased RH and decreased OLR in the tropics coming out of figure 8 is no surprised at all. The interesting result is the correlation between tropical OLR and subtropical RH through the dynamical coupling caused by the MJO. This discussion could be emphasized. The statements made here are not obvious in figure 8. Does the same hold true for southern subtropical RH, or is this particular to the northern hemisphere?

Page 1054, Lines 9-21: That the eastern Pacific region is very different compared to the western Pacific region is a very interesting result, but not necessarily surprising. Sea surface temperatures are lower and show different latitudinal variations compared to the western Pacific, thus enabling a different distribution of convection. This might play a role and could be discussed.

Other minor points:

There is a mix of longitude notations using either E and W notation or pure E. This makes it difficult to keep track of the regions that are being discussed.

The regions discussed in the text do not always match the regions shown in the figures. Text and figures should be harmonized.

Page 1049, Line 7: The largest variability seems to be well below the tropopause, more like at the bottom of the TTL. Furthermore, AIRS RH data don't reach the tropopause and have a coarse resolution.

Page 1049, Line 7: What does it mean that the NH tropopause is furthest south? Probably not the tropopause, but rather a PV contour. Can it still approximate the

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tropopause? What is the significance of that particular PV contour?

The language should be checked more carefully. Here are issues I noted.

Page 1043, Line 13: Word duplicate "winter"

Page 1044, Line 15: Word "Prediction" missing

Page 1047, Line 3: misplaced word "with"

Page 1050, Line 23: What means ahead? Better use east of or west of the intrusion.

Page 1051, Line 29: Should this have been "This lack of correlation ..."?

Page 1056, Line 9: extra "of" and extra "the"

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