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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Assessment of small-scale integrated water vapour variability during HOPE" *by* S. Steinke et al.

Anonymous Referee #2

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Most of my comments were properly addressed by the authors during the previous rewiev. The article presents the interesting results of a multi-instrument campaign with focus on short-term variability. Since the spatio-temporal variability of water vapour is not well known and measured yet, I recommend a publication in ACP.

I only see one point for improvement. The theory and the past research works about small-scale variability of water vapor are not well described in the ACPD article. Thus a reader can loose the orientation inside the article when the basic principles of IWV variability are not explained. As a consequence the reader don't get a comprehensive picture and may not see your research strategy or a need for high-resolution measurement campaigns.

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Interactive Discussion
Discussion Paper

It might be good to tackle this problem by starting from theoretical considerations, e.g., which atmospheric processes can induce a fast change of IWV over a small horizontal distance? Possibly you come to the sensitivity of IWV to convection cells. Generally it will be helpful for your research and for the readers if you add an half page about the theory and past works. In this context a recent PhD thesis by L. Fischer might be useful too:

http://edoc.ub.uni-muenchen.de/16208/1/Fischer_Lucas.pdf

L. Fischer, Statistical Characterisation of Water Vapour Variability in the Troposphere, Thesis , 2013

There were multi-instrument campaigns such as COPS and HyMex which are not mentioned yet. To some extent the statistical methods of the present article could be improved and the model data could be analyzed on a higher level (e.g. derivation of vertical water vapour flux). However this could be also realized in a follow-on-study.

Minor remarks:

abstract: line 9 "a good agreement in terms of standard deviation" do you mean the standard deviation of the diffences between coincident measurements of two instruments? I am asking since later standard deviation is used to characterize the temporal variability of water vapour.

actually one has to characterise the mean differences and their uncertainties

p.22839, line 6 "However, the interaction between atmospheric humidity and convection ..." How about the temporal and spatial scales of convection? What happens to IWV in convection cells? I think there are studies which can provide the reader with numbers, e.g. convection time scales: 10-30 min , horizontal scales < 2 km. It is your task to give such infos to the reader within the introduction.

section 2.1.4 how is the vertical resolution of the Raman lidar?

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p. 22851,line 28 what is a residual layer? I don't see the layer in Fig. 2

p.22860 "... the importance of the IWV variabilty associated with atmospheric turbulence." did you really show this? I have more the picture that IWV can suddenly increase if an updraft region moves through the MWR line of sight. That's not turbulence but convection. In your conclusions it is the second forcing (cloud, cell) which is larger than the third forcing (turbulence) of IWV variability.

For interpretation of the daily cycle of atmospheric water:

Linda Schlemmer, Cathy Hohenegger, Jürg Schmidli, Christopher S. Bretherton, and Christoph Schär, 2011: An Idealized Cloud-Resolving Framework for the Study of Midlatitude Diurnal Convection over Land. J. Atmos. Sci., 68, 1041–1057. doi: http://dx.doi.org/10.1175/2010JAS3640.1

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 22837, 2014.