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Interactive comment on “Spatio-temporal variability of water vapor investigated by lidar and FTIR vertical soundings above Mt. Zugspitze” by H. Vogelmann et al.

Anonymous Referee #2

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General comments:

The paper studies the temporal and spatial variability of atmospheric water vapor. First, column measurements performed with a sun-tracking FTIR and a water-vapor DIAL are compared as functions of horizontal and temporal displacement between both observations. Second, the variability of the DIAL water-vapor profile over time is discussed. Case studies are presented that illustrate different atmospheric mechanisms that affect the 4-dimensional humidity field.

The subject material falls within the scope of Atmos. Chem. Phys., and is of interest

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to the atmospheric dynamics and modeling communities. Qualitatively, the presented results are hardly surprising, but the authors manage to provide quantitative estimates of the spatio-temporal variability of water vapor, which is a significant contribution.

In summary, the manuscript is suited for publication in *Atmos. Chem. Phys.*, minor revisions should be considered.

Specific comments:

1. Provide defining equations for the statistical quantities used, and describe in more (mathematical) detail how they are determined. It is quite an effort to come up with a consistent set of equations, but it would take the guesswork out of the paper.
2. The authors use the center of gravity height of the vertical water-vapor distribution to define the reference plane in which the distance between FTIR measurement and DIAL measurement is computed. Further, they state that the FTIR measures (IWV of) the vertical water-vapor distribution, at least that's how the reviewer understands the caption of Fig. 1. That's confusing. The FTIR certainly does not measure vertical IWV but IWV along a slanted path. So is an air mass factor taken into account in the FTIR retrieval to provide IWV? Please clarify.
3. Running text (pp. 8,9) and caption of Fig. 3 are contradictory. Is the coincidence time interval 60 min for both winter and summer data sets (see caption), or only for the winter data set (and 30 min for summer, see text)? Please, check! If data shown in Fig. 3 are indeed for 60 min in both cases, why not show 60-min points in Fig. 2?
4. Measurements have errors. Some more comments on the robustness of the retrieval would be appreciated. At the very least include error bars in Figs. 8-11.
5. Are the backtrajectory computations reliable enough to trace back the origin of the air masses to the North-West Pacific Ocean? How many days backwards? The results are plausible, but. . .

Technical corrections:

Some typos:

1. P. 5, l. 9: 'information'
2. P. 15, l. 12: explain 'Alpine pumping'
3. P. 16, l. 16: 'these conditions'
4. P. 19, l. 20: 'relative short-term' or 'relatively short-term'?
5. P. 36, l. 2: unit 's' not in italic

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 28231, 2014.

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