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Title:
Detection of land surface induced atmospheric water vapor patterns

General Comments

I am not satisfied with the response to my review. A fair bit of cherry picking in the results is used to counter the issues I raised. Put together, these responses don't add up.

The goal is to look for the influence of the underlying landuse on observed water vapor in MWR scans. The scans are diagonal over 4.3km and reach upto 2.5km height above the surface. The authors also use a LES and MODIS images to evaluate the situation. Main comments on their approach were to do with

1) the question what the MWR ray actually sees of the underlying surface given the variable height reaching way above the boundary layer, weather conditions and the varying footprint and blending height and
2) what part is the water vapor signal is local and what part is advected. I proposed to study this using a simplified budget equation and use the LES to evaluate that.

All suggestions to bring MWR, satellite remote sensing product and LES closer together and more focused on the research question are ignored for various and contradictory reasons:

> ISSUE: Missing framework (budget equation) to guide the research and separate local vs non-local contributions from the humidity field observed with the MWR. The LES could be used to distinguish the relative contribution of sources as well.
>
> REPLY: "... in our opinion this would be a separate study on its own. The focus of the presented manuscript is on the unique long-term analysis of the MWR scans and its use to investigate land surface induced patterns."

RE-REPLY: I don't agree. This paper lacks a good framework to analyze the data for the goal as defined originally (link MWR to local landuse). In addition, it doesn't make sense to not use tools that you have available that are so valuable in answering your research question (use LES to separate local vs non-local contributions).
I now read that you define a second goal which is to highlight the unique long-term dataset available. This could also be an approach in analyzing the MWR dataset, but requires a redesign of the paper.

ISSUE: What is felt of the local surface at 2.5km height in light of the footprint of the measurements and the blending height concept?

REPLY (new txt in ms): "... The maximum height above ground, where changing the land use types has still a significant influence on model parameters, is around 2.3-2.5 km, which is visible for example in the domain averaged specific humidity difference (ICON1-ICON2) profile (Fig. 6).."

RE-REPLY: I am not convinced that the boundary layers in these particular LES runs are representative for the long term MWR dataset that you are analyzing. The LES runs are for the most extreme possible landuse signal (inversion of landuse), for one day in the hottest part of the year (end of July). Only then you see a signal upto 2.2km (not higher) in the humidity difference plot. But this is not the typical boundary layer for your long term dataset. Local conditions are not felt beyond the boundary layer height and the boundary layer height typically doesn't exceed ~1km as shown in Fig2a; so when integrating MWR signals upto 2.5m a large part of the signal will not be related to the underlying surface.

ISSUE: Why lumping all data over a season, as it is the seasonal change over time that will provide a strong change in moisture at the surface (crops growing, rain events, etc)?

REPLY: "The general idea of the study was to identify situations when the surface shows the strongest effect on the moisture field." .... "Different classifications (e.g. seasons) were applied, however, we did not succeed in identifying any significant changes in the patterns when sorting for these classes."

RE-REPLY: The fact that the widely spread agricultural fields in the area which undergo a transition from bare soil to highly evaporating green surfaces to dry ripened vegetation and back to bare soil doesn't leave a noticeable trace in the MWR signals seems to indicate that the MWR indeed doesn't see much of the surface when integrating the signals upto 2.5km

ISSUE: The LES results suggest that topography and advection are dominant over landuse in humidity signals

REPLY: " We agree that in general advection and topography are more important, but here the intention was to identify the impact of the land use for low advection cases. Drawing conclusions on local water vapor patterns as done for the long-term MWR analysis is difficult on the basis of a single simulated day as it was visible from Fig. 5. ...."

RE-REPLY: You are saying there is too much advection in the LES? I see that the wind speeds was 3m/s, well within your non-advection criterion. Also, you have full control over the LES, how can you say there is too much wind? You say one day is not enough to draw conclusions, so include more days. The main message I get, again, is that the local influence is relatively small.

ISSUE: to what extent do the MODIS images help to evaluate the identification of the landuse in the water vapour signals
REPLY: "The findings presented here could also be valuable for further studies using the MODIS products for assessing spatial IWV differences, which is especially valuable for larger areas."

RE-REPLY: Make up your mind about the goal is of this study. The MODIS part provides a nice inter-comparison but it is not related to the main research question.

The feeling I get when I read the paper is the following: from the start the hypothesis was that landuse leaves an imprint on the MWR signals. In my opinion, you bend the interpretation of your results too much to corroborate this hypothesis. Whereas your results indicate that the influence of landuse on the MWR signal is limited given the long MWR path that extends well beyond the boundary layer. Filtering the data for non-advection conditions doesn't help. Filtering the MWR data for conditions with known differences in landuse and soil moisture doesn't give a landuse signal. In an LES run with an extreme change in landuse advection and topography are dominant over landuse.

In all, I stick with the same verdict as the initial review: "This paper borders rejection in my view because it fails to orderly describe the processes at hand, come up with a good research strategy and presenting results that all lead to answering the research question."

The authors should either change the scope of their paper, i.e. change the research question or change the way they analyze the data. Right now they keep with the landuse imprint on the MWR data but all comments that question their approach are dismissed.