Review of the manuscript hess-2014-489

"Water vapor mapping by fusing InSAR and GNSS remote sensing data and atmospheric simulations"

by

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The paper introduces a methodology to fuse remote sensing data from InSAR and GNSS with atmospheric model data from the WRF model to derive more accurate maps of vertically integrated water vapor than the single data sets can provide.

The general idea to merge different data sets into a product that might contain more information than the single source data sets provide is interesting and the outcome may be beneficial for meteorological research on different scales. The manuscript is furthermore well written.

However, with the results presented, the value of the methodology cannot be shown. Although the manuscript is worthwhile to be published in HESS, **major revisions** are necessary before publication.

Major points:

1.) I do not understand the plots (negative values for PWV???) Either explain more precisely what we see on the images or stick for all plots to what you did in Figure 1 – which is in my understanding the best way to plot PWV.

2.) Driving model resolution – why ERA Interim when higher resolution ECMWF analyses are available? I think that it might be better to use shorter simulations driven by higher resolution analyses to show the benefits of your procedure for single cases. Then it is also necessary to use more than 42 vertical levels to better represent the tropospheric structure and especially the lower troposphere where most of the water vapor is.

3.) When you merge model data with observations to create a "new" observation, it is necessary to make sure that the model provides the best possible result. This is only possible when you also use data assimilation to initialize the model. ERA Interim contains data assimilation – but I am sure that the WRF simulation would highly benefit from doing a re-assimilation of observations in the nests.

4.) Is it necessary to do such long simulations when you focus on single days? True – the deeper layer soil moisture needs long spin-up times – but how large is their influence on the daily evolving weather? The topmost layer directly influenced by the atmosphere reacts faster. And only this layer influences PWV.

5.) Model results are clearly dependent on resolution, physics, and driving model – and therefore lead to clearly different results for different synoptic situations. This is the more

the problem when you drive the model with such a coarse resolution analysis and then look to single cases.

6.) The results do not show the benefit of the methodology – the region you selected for the results is by far too small. I guess if you enlarge the region to e.g. at least Germany you might be able to find systematic pros and cons of the methodology

7.) Some of the plots are too small (labels in figure 1, Figures 10, 12 and 13)

Minor points:

1.) Give some information in the introduction what you think are the target groups that will work with your data.
2.) Page 2, line 19: Why do you introduce the term “neutrosphere”?
3.) Page 3, line 9: Replace “want to” by “would like to”
4.) Page 4, line 22: Delete one “the”. What you describe in this sentence is exactly what you improve (optimize as well as possible) when data assimilation is applied.
5.) Page 5, line 1: I would delete “redundant” – you never know whether a data set is redundant – this might change from case to case.
6.) Page 5, line 23: “space-bourne” instead of “space-based”?
7.) Page 6, line 3: “Rhine valley” instead of “Rhine Graben”
8.) Page 6, line 17: “In cloudy conditions” instead of “Under cloud cover”
9.) Page 8, line 14: “Rhine valley” instead of “Rhine Graben”