

## ***Interactive comment on “The residence time of water in the atmosphere revisited” by Ruud J. van der Ent and Obbe A. Tuinenburg***

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The comment from the referee is in italic and our response is in normal text

*I thank the authors for carefully addressing my comments. There is one thing still not clear. As to the dramatically different results on moisture residence time from your estimates and those from Läderach and Sodemann (2016), what do you think is the main reason? Do they have some problems/errors in science or technology? For example, is there any problem with the FLEXPART model or data sets they used? Such large difference in results should not come from some trivial differences in model and data.*

The referee raises an important issue here. The large differences between the

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global average number – for atmospheric residence time – obtained with FLEXPART (Läderach and Sodemann, 2016) compared to our two tracking models (WAM-2layers and 3D-Trajectories) should not come from trivial differences between the models. We showed in our supplementary material that WAM-2layers and 3D-Trajectories also have small differences, but nowhere near the differences both models have with FLEXPART (in absolute terms, spatial patterns actually quite similar). Most importantly, the global average residence time computed with our models is close to the numbers computed from a simple global water balance, namely 8–10 days. We think that this is an indication of some sort of big error in the analysis with FLEXPART (Läderach and Sodemann, 2016). However, having not worked with the FLEXPART model and its input data ourselves it is difficult to pinpoint this error. We prefer to refrain from speculation at this point, but we have invited the Alexander Läderach and Harald Sodemann to join the discussion here and hopefully that will shed some light on the issue.

### **References**

Läderach, A. and Sodemann, H.: A revised picture of the atmospheric moisture residence time, *Geophys. Res. Lett.*, 43, 924–933, doi:10.1002/2015GL067449, 2016.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-431, 2016.