

## ***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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Received and published: 15 November 2016

We would like to thank everyone that has participated in this interactive discussion. Based on the reviews we have received from Kevin Trenberth, Jiangfeng Wei, Anonymous Referee #3 and Harald Sodemann, we intend to incorporate a number of changes into the manuscript (van der Ent and Tuinenburg (2016)). Below, we provide a bullet-wise summary:

- Add a non-exhaustive table to the introduction, listing the residence times (or other time scales) found in previous studies;
- More explicit statement of assumptions for the atmospheric moisture tracking models in Section 2.2;

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- Insert a more elaborative summary of the main points brought forward by Läderach and Sodemann (2016) against the use of Eqs. (2) and (3). And, of course, a summary of our counterarguments against it;
- Remove the speculative statement in Section 3 about irregularities in the method of Läderach and Sodemann (2016). Instead replace this with a more factual statement in the introduction regarding the assumptions made in that method and how that may bias their results towards lower residence times;
- Discuss what would be the result of assuming that water outside the troposphere does not participate in the hydrological cycle (Section 3);
- A more clear and in-depth explanation (Portugal example) of the differences between precipitation residence time, evaporation residence time and age of atmospheric water in Section 4;
- A more in-depth discussion of the difference between atmospheric moisture age in January and July;
- Discuss in Section 5 how the assumptions in the method and how ERA-Interim data could influence these results;
- Discussion of the differences in results for WAM-2layers and 3D-T in the Supplement;
- Add a section to the Supplement that extensively investigates, discusses and falsifies the arguments brought forward against the use of Eqs. (2) and (3), by Läderach and Sodemann (2016) and the comment of Sodemann SC1;
- Add a figure to the Supplement that gives atmospheric storage, precipitation and evaporation for January and July to help the interpretation of the seasonal variations in Fig. 3 and Fig. S2.

C2

## 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.
- van der Ent, R. J. and Tuinenburg, O. A.: The residence time of water in the atmosphere revisited, *Hydrol. Earth Syst. Sci. Discuss.*, in review, doi:10.5194/hess-2016-431, 2016.

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