

Interactive comment on “Tritium as hydrological tracer in Mediterranean precipitation events” by Tobias R. Juhlke et al.

Anonymous Referee #2

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The article by Juhlke et al introduces a novel tracer of moisture sources in precipitation that could be possibly used to identify present and past atmospheric circulation patterns to help us better constrain hydrological parameters in climatic models. I find the possibilities introduced by the article promising and worth publishing, however, being the “first of its kind”, the methodology and the implications must be better explained in a revised manuscript. I detail below some points of confusion and suggest possible ways of improvement.

Introductory first two paragraphs. This part sounds like a collection of statements on tritium, rather than a coherent introductory text that sets the background of the analysis. The links between different tritium sources and reservoirs are not clearly defined, nor how the constant decay of ${}^3\text{H}$ and lack of supply will impact futures studies. This entire

C1

section should have some more (specific) time dedicated to it.

Study site A brief paragraph on atmospheric dynamics at the study site would be most-welcome. Which are the main large-scale circulation pattern affecting moisture delivery in winter and summer? How does the NAO, AMO and MO affect moisture advection? These should be introduced here, before the discussion.

Methods The methodology seems to be somehow unclear. I understood that rain samples were collected on an event-basis (but it is not clear whether all events were sampled – please clarify) and than a methodology to understand the ${}^3\text{H}$ variability was devised – but the analysis seems to be rather confusing (confused?). HYSPLIT is a very useful tool, but it seems that its application here does not use the entire potential it provides. Several studies in different parts of the world have shown that moisture resulting in precipitation delivered to a given region is picked-up during the last 2-3 days before the rain event, hence the use of 10-days long trajectories seem useless (especially that these long trajectories were that truncated). Further it, is not clear how the trajectories for 10+ levels were used – perhaps sticking to 1-2 levels (or even one, based on previous data on cloud base to the site) would have resulted in a lower degree of uncertainty. Next, perhaps detailing the reasoning behind the combination of the three weights would be useful. It is only partly explained and than the reader is referred to the original publication. Being a paper that introduces a novel parameter, I find it useful that the entire methodology is clearly explained and self-sustained.

2.3 Tritium in moisture source regions This part is very confusing. It is not clear how the different regions were delineated> based on ${}^3\text{H}$ values in local precipitation from the IAEA database? Were the values calculated for overlapping periods of time? ${}^3\text{H}$ values change in time and if the analyzed periods were not similar, biases could occur. I suggest reorganize this part (and the subsequent results section) by replacing the examples in fig 1 with trajectories showing moisture pick-up regions independent of tritium measurements (something similar with present Fig. 7, but perhaps for one altitude only; see also Krkels et al., 2018). I would than use these maps to correlate moisture

C2

pick-up regions with a map of 3H in European precipitation and thus derive theoretical values of 3H, which could be than correlated with the measured values. While this seems to have been attempted, it was done in a very confusing way, bordering circularity in arguments. Separately, a discussion of the measured values in relation to atmospheric circulation during the analyzed period is required. This analysis could result in a potential link between large-scale atmospheric patterns and 3H values and these could be than analyzed against the HYSPLIT-based work to put weight behind "tritium as a hydrologic tracer".

I know these suggestions require a massif reorganization of the paper, but it is my opinion that like this the analyses would make a better use of the data gathered by the authors.

Krklec, K., Domínguez-Villar, D., and Lojen, S.: The impact of moisture sources on the oxygen isotope composition of precipitation at a continental site in central Europe, *Journal of Hydrology*, 561, 810-821, <https://doi.org/10.1016/j.jhydrol.2018.04.045>, 2018.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2019-725>, 2019.