

## ***Interactive comment on “X Water Worlds and how to investigate them: A review and future perspective on *in situ* measurements of water stable isotopes in soils and plants” by Matthias Beyer and Maren Dubbert***

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We kindly thank reviewer#2 for this very positive review of our manuscript. We will try to further improve it during the revision process and appreciate the additional (technical) comments and suggestions.

[1] The title is slightly misleading however, as the manuscript barely deals with the “two or x water worlds” hypothesis. I suggest to remove all parts before and including the “:” from the title and just call it “A review and future perspective on *in situ* measurements

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of water stable isotopes in soils and plants”.

Reply: Thank you. Please also refer to our reply to reviewer#1. It is true that we do not refer extensively to the two water worlds hypothesis. However, the title ‘X water worlds’ was meant to relate to it in a slightly provocative way. We believe that it is important to clarify that this hypothesis which has certainly had impact on the community has been seen critically by large parts of the (European) community. It has been shown that it can be explained by simple soil hydraulic relationships that are used by soil scientists since decades. However, the hypothesis has had a very positive impact on the advancement of process understanding. The *in situ* methods fall exactly into this category. We believe that for a review paper it is important to put those aspects into a context and the title and Fig.1 are meant to expose that soil-plant water relationships are more complex than the hypothesis states. However, as both reviewers suggested to change the title, we kindly ask for a comment of the editor. As stated in the reply to reviewer#1 we would like to keep as is because of i) put the *in situ* measurements into a larger context and ii) approach a wider community to thing further than ‘two water worlds’. Perhaps a few text-additions might also help to clarify that.

I only have some minor comments for clarification or little bit more detail and suggestions for typos. Specific comments

[2] L38: the more easily accessible water would be soil water that eventually becomes stream water, currently the sentence sounds like stream water is directly sampled

Reply: Thank you, we will rephrase and clarify.

[3] L95: unclear if “leaf chamber” is a physical e.g. plastic chamber where leaves are studied or if stomatal openings, the sites of transpiration, are meant.

Reply: We refer to an actual physical chamber and will define this properly.

[4] L120: where’s the difference of fractionation factors and equilibrium fractionation factors? Be a bite more specific what is exactly meant with the first term

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Reply: Thank you. We will rephrase and clarify.

[5] L164: which other value was used to linearly correct the measured hydrogen isotope values in vapor in the study of Rothfuss et al. 2013? Further, how did Rothfuss et al (2015) proof that their isotope values were reliable? They must have compared it to something.

Reply: For the conversion of vapor to liquid values, Rothfuss et al. (2013) use only temperature. Rothfuss et al. (2015) are not completely clear on to what they compared their values to. We believe they compared the obtained values to the ones from water that was used to saturate their soil column. We will add this information in the revised version.

[6] L173: according to Line 128, the first in-situ study in semiarid areas was by Sodeberg et al (2012) and not Gaj et al. (2016). Please clarify.

Reply: This is true. They were the first even though it did not work very well. We will correct that in a revised version.

[7] L183: incomplete soil water extraction by which system?

Reply: We will add the missing information, the authors used a cryogenic vacuum extraction system.

[8] L200: since this system is the most complete, I am lacking a bit of information of what this system consists of exactly. Especially since later the authors of this manuscript suggest a more general, expanded approach to the cited study. The other methods were well described but here the description is a bit lacking. It seems to be a vapor-permeable membrane technique, but the advantage or difference to previously described methods is unclear.

Reply: Thank you. Indeed, the description of this section is not completely comprehensive. We will provide a better summary of the study in the revised manuscript.

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[9] L210: I would not call this “trueness” but “accuracy”. Since there is also a discussion ongoing of which water is exactly sampled by each method and which method can give “correct/true” values under which conditions.

Reply: I agree, but we used the phrase that was used in the cited publication and would stick with this to not confuse the readers.

[10] L408: method number 3 does not sound like a system to prevent condensation. The condensate between each flushing is just removed.

Reply: Correct, thanks. We will clarify.

[11] Also for the example of Figure 5, where is the data coming from? Did you conduct this experiment or is it from another study?

[12] Reply: This is our own data. We will add a brief explanation to clarify that.

[13] L445: the meaning of the sentence becomes unclear starting with “correction has mostly been applied [ . . . ]”

Reply: We will rephrase this part.

[14] L488: The description of carrier gas effects is very short compared to the rest

Reply: That is correct. In the revised version of the manuscript, we will extend that section.

[15] L545: does the proposed method have to be repeated for each individual study? I think that the final multiple regression results should be general and applicable for many studies. Please elaborate on this.

Reply: Ok, we will do so.

[16] L579: I do not see how the example of mobile water is related to the sentence before, that in situ methods overcome current method limitations.

Reply: The statement is meant in a way that by using destructive sampling and ex-

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traction methods, we do not really know which pool we extract (only the mobile water? Mobile plus a bit of tighter bond water? All water?). For example, using 105°C for extraction will extract different pools for sand, silt, or clay soils. With the in situ methods one always measures the mobile part.

Technical comments

[17] L61: citation: Hendry et al. 2015. As changes in citation style appears again in the manuscript, please keep it uniform everywhere.

Reply: Thank you, we will keep this consistent.

[18] L83: sentence “and this is where. . .” should be shifted, as it currently reads very confusing. For example, “The scientific community agrees that one of the most important steps to investigate, disentangle, quantify and incorporate. . .”

Reply: Thank you, we will reorganize the sentence.

[19] L87: delete the one “a” before “the same”

Reply: We will do so.

[20] L91: “kill the plant” please correct

Reply: We will do so.

[21] L92: Sentence sounds like time and costs of destructibe sampling result in larger sample amounts.

Reply: We will rephrase.

[22] L94: delete “of” L169: “O” for oxygen missing at the end of the sentence with “delta 18”. Also unclear what combined measurement is referred to? I assume d18O in water and carbondioxide?

Reply: This sentence is very confusing. We will improve that in the revised manuscript.

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[23] L188:delete either “of” or “for” L200: “applied” please correct

Reply: We will do so.

[24] L213: write already “isotopes” in the heading for 2.2

Reply: We will do so.

[25] L252: “Gordon” missing

Reply: We will correct this. Thank you.

[26] L304: delete “and” L375: delete one “now”

Reply: We will correct this. Thank you.

[27] L415: “disappears” spelling

Reply: We will correct this. Thank you.

[28] L454: use “positive correlation” instead of “positive effect”, as this sounds beneficial

Reply: We will correct this. Thank you.

[29] L465: “no” should be “not” Reply: We will correct this. Thank you.

[30] L472: “A” should be “As [stated above]” Reply: We will correct this. Thank you.

[31] L512: “is” should be “as” Reply: We will correct this. Thank you.

[32] L514: do you mean “previous” instead of “succeeding”?

Reply: Thank you! You are right! We will correct this.

[33] L671: Fig 7 instead of Fig 6

Reply: We will correct this. Thank you.

600, 2019.

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