

Interactive comment on “Surface water and groundwater: Unifying conceptualization and quantification of the two “water worlds”” by Brian Berkowitz and Erwin Zehe

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I thank Brian Berkowitz and Erwin Zehe for outlining their views on heterogeneous flow and transport of water and solutes in the subsurface. Their manuscript offers several interesting aspects and I especially like the emphasis of connecting different communities. However, I would like to ask Berkowitz and Zehe to reconsider their use of “Two Water Worlds” throughout the manuscript.

I highly recommend to not use this term for the following reason:

1. The term was introduced by McDonnell (2014) as “vegetation and streams returning different pools of water to the hydrosphere”. The term is quite exclusively

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used in this very specific context – mostly in isotope hydrology (see list of citing literature here: https://scholar.google.de/scholar?cites=9670915851738538320&as_sdt=5,34&scioldt=0,34&hl=de). Contrary to your introduction, I am not aware that the groundwater community uses the term “Two Water Worlds”. I do not see that groundwater hydrologists address the hypothesis posed by McDonnell nor do they use that term in a different way. (see: <https://imgtfy.com/?q=%22Two+Water+Worlds%22>)

2. Based on the definition from McDonnell, the term “water world” is not correctly used in this manuscript, when the authors state for example in L43: “. . .two systems – surface water and groundwater – using the (often distinct) terminology of each of these “water world” research communities.” The “Two Water Worlds” are not surface water vs. groundwater.

3. It is not correct that the term “Two Water Worlds” was used by Brooks et al. (2010) as you state in L576. Brooks et al. introduced “ecohydrological separation”.

4. Since it is stated in L579 that “We question the conceptualization of two (or more) separate, fully compartmentalized mobile and immobile regions of water and chemicals.”, why would one continue using the term “Two Water World”? Why promoting an oversimplified expression about which you acknowledge in your response to Markus Hrachowitz (page C15) that a “distinct separation is indeed a highly idealized interpretation”?

5. The “Two” in “Two Water World” resulted from the two different methods to sample the isotopic composition (2H and 18O) of subsurface water (as done in the early work on “ecohydrological separation” by Brooks et al. (2010) and Goldsmith et al. (2012)): One is either limited to the more “mobile soil” water when using suction lysimeters (often about 600 hPa) or one samples the entire pore water (“bulk soil water”; i.e., mobile and more tightly bound water) by using for example cryogenic extraction. I discussed these aspects in more detail in Sprenger et al. (2018) and Sprenger et al. (2019). Thus, the limitation to TWO separate subsurface pools is to a great extent a result of the methodological limitations, since we cannot simply sample stable isotopes along the water retention curve (but some attempts were done, see e.g. Figure 4 in

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Geris et al. (2015)).

I am concerned that the use of “Two Water Worlds” in this manuscript will cause confusion among the hydrological community and I hope that the points I raised here will encourage the authors to use a different terminology.

References

Brooks, J. R., Barnard, H. R., Coulombe, R., and McDonnell, J. J.: Ecohydrologic separation of water between trees and streams in a Mediterranean climate, *Nat. Geosci.*, 3, 100–104, doi:10.1038/NGEO722, 2010.

Geris, J., Tetzlaff, D., McDonnell, J., Anderson, J., Paton, G., and Soulsby, C.: Ecohydrological separation in wet, low energy northern environments? A preliminary assessment using different soil water extraction techniques, *Hydrol. Process.*, 29, 5139–5152, doi:10.1002/hyp.10603, 2015.

Goldsmith, G. R., Muñoz-Villers, L. E., Holwerda, F., McDonnell, J. J., Asbjornsen, H., and Dawson, T. E.: Stable isotopes reveal linkages among ecohydrological processes in a seasonally dry tropical montane cloud forest, *Ecohydrol.*, 5, 779–790, doi:10.1002/eco.268, 2012.

McDonnell, J. J.: The two water worlds hypothesis: ecohydrological separation of water between streams and trees?, *WIREs Water*, 1, 323–329, doi:10.1002/wat2.1027, 2014.

Sprenger, M., Llorens, P., Cayuela, C., Gallart, F., and Latron, J.: Mechanisms of consistently disjunct soil water pools over (pore) space and time, *Hydrol. Earth Syst. Sci.*, 23, 2751–2762, doi:10.5194/hess-23-2751-2019, 2019.

Sprenger, M., Tetzlaff, D., Buttle, J. M., Laudon, H., Leistert, H., Mitchell, C. P. J., Snelgrove, J., Weiler, M., and Soulsby, C.: Measuring and modelling stable isotopes of mobile and bulk soil water, *Vadose Zone J.*, 17, 170149, doi:10.2136/VZJ2017.08.0149, 2018.

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