

Interactive comment on “Earth’s Critical Zone and hydrogeology: concepts, characteristics, and advances” by H. S. Lin

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I concur with Reviewer #2 that the paper is quite long and that it could be shortened to some extent without losing essential messages. Thereby I would prefer the second option mentioned by the reviewer: to shorten the first part on the definition of the CZ. I think the readers of HESS are well aware that the zone between the lower atmosphere including vegetation and the the lower boundary of the aquifer is an inherently complex system demanding for an interdisciplinary scientific approach. So that all these different definitions are not really required but of course (as also stated by the reviewer) there should be a clear definition what you refer to as the 'Critical Zone'. This is required for the further discussion of how hydrogeology fits into this concept. I really liked the

way how hydrogeology is introduced! In my perception there are some new inspiring aspects. On the other hand, there is no general agreement within the soil science community about the general aims and scopes of hydrogeology. Hence, this part of the manuscript is especially valuable. It could be argued that there have been other papers on hydrogeology already, however I recognize that with the present manuscript the notion of hydrogeology is becoming more clear, more focused, and better justified.

I have a few additional minor comments:

P2 L1: the increasing characteristic time for response and feed back with depth is motivated by the increasing density of the material (also later in the text). Isn't it more the increasing distance to the location of energy input (the soil surface) and the dampening of the dynamics of state variables with depth?

Section 2.1: As already mentioned above this could be shortened considerably.

Section 3.2.3: There is some redundancy in this section so that it could also be shortened to some extent.

4.1. Mapping: It could be emphasized more explicitly that we can use our knowledge of soil formation and the known interrelation of soils within landscapes to establish a mapping strategy which is supported by a sort of soil-landscape modeling. The latter can be developed from the answers to the two basic questions formulated in section 3.1.

4.3. Modeling: I agree that network structures are very common in terrestrial systems and that they are very likely to exist also in the subsurface. However I would expect that these structures are highly variable within the vadose zone and highly dependent on the hydraulic state of the system. Hence, a discrete representation of preferential flow networks within the subsurface can hardly be mapped and is probably not adequate. This phenomena could be reflected e.g. by appropriate travel time distributions in large scale models - but this is a matter of future inspiring discussions between the author

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