

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2  
<https://doi.org/10.5194/hess-2022-95-RC2>, 2022  
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## **Comment on hess-2022-95**

Anonymous Referee #2

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Referee comment on "Advancing measurements and representations of subsurface heterogeneity and dynamic processes: towards 4D hydrogeology" by Thomas Hermans et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-95-RC2>, 2022

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I was quite excited when I started to read Hermans et al especially with their stated objective "to identify and discuss when, why, and for which processes and applications the characterization of dynamic hydrogeological processes is crucial."

The authors provide a massive amount of detail on groundwater fluxes, transport, mixing and reactions processes, soil moisture dynamics in the vadose zone and surface-subsurface water interactions which was interesting and useful but very little synthesis of simplified messages. I think a third to a half of the details could be striped away without losing much. They promise to provide opinions on where and when these groundwater processes can reasonably be simplified or not but fail to deliver on this. I suggest significantly expanding this with a table that suggests criteria for when, why and what scale each of these processes can be simplified or not.

Instead of such useful synthesis in the modeling section they just suggest more computing power in this text:

Cloud computing combined with increasing computational power should allow to model the subsurface at a higher 4D resolution for an increasing number of applications in the future, including for (small) consulting companies and field practitioners (Hayley, 2017; Kurtz et al., 2017).

Another overall observation and critique is that scale is of outmost importance but not clearly and consistently defined and discussed in this manuscript. I think every element of the mansucirpt should clarify how scale plays in and I would suggest putting the processes

and methods on a time-space graph like this: [https://www.researchgate.net/figure/Spatial-and-temporal-scales-of-measurement-black-and-modeling-red-methods-GCM\\_fig1\\_255586996](https://www.researchgate.net/figure/Spatial-and-temporal-scales-of-measurement-black-and-modeling-red-methods-GCM_fig1_255586996)

In sum I think this manuscript would benefit from significant re-think and re-write as a major revision.