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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Pedological and hydrogeological setting and subsurface flow structure of the carbonate-rock CZE Hainich in western Thuringia, Germany" *by* Bernd Kohlhepp et al.

Anonymous Referee #1

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This paper reported a comprehensive investigation of subsurface carbonate-rock aquifer in western Germany, including stratigraphy, geochemistry, human factors, structure geology and karst heterogeneity. The authors did a lot of field works, collected many data and conducted a very nice statistic analysis. However, I think current manuscript still needs lots of works to be published on HESS, due to the reasons

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Discussion paper

as follow. I encourage the authors to address the scientific issues, restructure the manuscript and resubmit the paper.

1) Generally speaking, the structure of this manuscript is more like a hydrogeological survey report or groundwater resource summary, not a research article. Why did you do this study? What scientific questions are answered in this paper? The author listed three aims in the introduction part, but it seems the authors are trying to address so many issues in one manuscript, and bring difficulties for readers to follow up. The first aim is obviously not a science question but more like a geological background by the survey. The second and third aims are significantly different. Therefore, the detail demonstration of the connections between these two aims is highly expected. I actually suggest the authors to focus on one aim only in the paper. Also, it's very important to highlight the research purposes and the novelties in the title, abstract and conclusion parts.

2) Because it is a research article instead of report, the authors are expected to explain why Hainich CZE is important and interesting to study. Are there any special geological characteristics? I'm not familiar to the hydrogeological setting in Germany, but I assume that carbonate-rock structures are widely distributed. Is Hainich CZE a typical karst aquifer in Germany? All of those are necessary to be fully illustrated in the manuscript.

3) The authors used more than half of the words in this manuscript to introduce and describe the field works and data collections. Again, I would recommend the authors to focus on the discussion of statistic analysis (PCA and cluster analysis) of geochemistry data, and address the effect of karstification and hydrological stratigraphy on groundwater quality/hydrogeocemistry (section 4.2).

4) The authors mentioned the effects of fault zones on groundwater chemistry with dissolution-enlarged fractures. Hydraulic conductivity through the faults in karst aquifer can be larger in several magnitudes, due to the dissolution of carbonate-rock dissolution. Does dissolution play a more important role rather than faults? More explanations

are expected. On the other hand, dual-permeability hydrological characteristics are commonly observed in karst aquifers. The authors should address some literature citations of flow properties in karst aquifer in the introduction. 5) The authors might not have enough data, especially the historical data before the beginning of sampling. But it is interesting to see any trends of geochemistry data variation along time, with changes of land use type and anthropogenic factors. And a discussion of the effect of contamination/pollution/human factors to data is desired.

6) In the end of section 4.2, the authors classify three modes of subsurface water flow in the karst aquifer. I would say the lineaments of sinkholes are not necessarily due to flow through open faults. Is there a possibility that bedding parallel in either unconfined and confined aquifer can cause lineaments of sinkholes as well? Probably just track the faults/fracture zones from geological map/structure survey.

7) Discussion 4.3 has weak relevant to the statistics analysis result. I don't think the authors have enough data to discuss karstification dissolution, so I recommend removing it.

8) To be honest, I didn't get the key points in the conclusion part. The authors do not need to mention the results of mapping and survey in the conclusion part. I suggest the authors to summarize the results of data analysis and emphasize the relationships. It might be better to make the statements by bullet points.

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