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Comment on hess-2021-37

Anonymous Referee #2

Referee comment on "Dynamics of hydrological and geomorphological processes in evaporite karst at the eastern Dead Sea – a multidisciplinary study" by Djamil Al-Halbouni et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-37-RC2, 2021

This is a highly valuable and interesting paper linking hydrology and sinkhole development and evolution in the evaporite environment of the Dead Sea, probably the most well known area in the world for this type of processes. Therefore, the article is worth to be published, and is an interesting piece of work, quite well written and full of data. I have listed in the accompanying file a number of small edits, and requests of clarification on some issues that are not clear to me. Overall, I therefore require minor revisions and invite the Authors to carefully read the comments, suggestions, and requests of clarification provided in the attached file. Here, I just summarize the main points where the Authors should make an effort to further improve the quality of the paper, in my opinion.

The main point is the length of the manuscript, which seems to be excessive, and even with many repetitions of terms in the same paragraphs. These repetitions should be avoided, by using other terms and making efforts to vary the text.

I suggest reducing the text especially as regards the explanation of the different geophysical techniques, which are well known in the scientific literature, and do not need lengthy descriptions. At the same time, many details about the methods used for the study could be moved in the supplementary materials, in order to not make the reading too heavy.

Hydrogeological modelling: this part is very interesting, but my feeling is that more details should be provided as concerns some of the constraints of the model. In particular, it is stated that "Vertical hydraulic conductivities are assumed to be 10 times less the horizontal ones, to represent anisotropy imparted from sedimentological layering". This assumption makes bedding as the main feature favouring conductivity, limiting very much the likely role of tectonics, which I believe is significant as well, as also documented in many articles. It would be therefore necessary to present some evidence to support this assumption, which should be presented in the section about hydrogeological modelling, and also in the conclusions.

When quoting more than one reference, the list should be organized following the chronological order. In many places throughout the article this has not been followed. Please format the text strictly following the journal guidelines.

Some figures show some problems, mostly as concerns inner writings. These are often too small to be easily read, and should therefore be increased to facilitate the comprehension of the figures.

As regards references, I suggest here some additional references about karst evaporites and sinkhole development, which could be useful especially in the introductory part of the article, also to put it in a broader international context of evaporite karst:

Bruthans J., Asadi N., Filippi M., Vilhelm Z. & Zare M., 2008.*Erosion rates of salt diapirs surfaces: An important factor for development of morphology of salt diapirs and environmental consequences (Zagros Mts., SE Iran)*. Environmental Geology, 53 (5): 1091-1098.

Bruthans J., Filippi M., Zare M., ChurÃiÄkovÃi Z., Asadi N., Fuchs M. & AdamoviÄ J., 2010. *Evolution of salt diapir and karst morphology during the last glacial cycle: effects of sea-level oscillation, diapir and regional uplift, and erosion (Persian Gulf, Iran)*.

Geomorphology, 121: 291-304.

De Waele J., Piccini L., Columbu A., Madonia G., Vattano M., Calligaris C., D'Angeli I.M., Parise M., Chiesi M., Sivelli M., Vigna B., Zini L., Chiarini V., Sauro F., Drysdale R. and Forti P., 2017. *Evaporite karst in Italy: a review*. International Journal of Speleology, vol. 46 (2), p. 137-168.

Dreybrodt, W., 2004. *Dissolution: evaporite and carbonate rocks.* In: Gunn, J. (Ed.), *Encyclopedia of Caves and Karst Science.* Fitzroy Dearborn, New York, pp. 295–300.

Filippi M., Bruthans J., Palatinus L., Zare M. and Asadi N. 2011. *Secondary halite deposits in the Iranian salt karst: general description and origin.* International Journal of Speleology, 40 (2), 141-162.

Gutiérrez, F., Cooper, A.H., Johnson, K.S., 2008. *Identification, prediction and mitigation of sinkhole hazards in evaporite karst areas.* Environ. Geol. 53, 1007–1022.

Gutiérrez, F., Linares, R., Roqué, C., Zarroca, M., Rosell, J., Galve, J.P., Carbonell, D., 2012. *Investigating gravitational grabens related to lateral spreading and evaporite dissolution subsidence by means of detailed mapping, trenching, and electrical resistivity tomography (Spanish Pyrenees).* Lithosphere 4, 331–353.

Iovine G., Parise M. & Trocino A., 2010. *Breakdown mechanisms in gypsum caves of southern Italy, and the related effects at the surface.* Zeitschrift fur Geomorphologie, vol. 54 (suppl. 2), p. 153-178.

Shaquor, F., 1994. *Hydrogeologic role in sinkhole development in the desert of Kuwait.* Environ. Geol. 23, 201–208.

For all the considerations above, I recommend minor revision.

Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2021-37/hess-2021-37-RC2-supplement.pdf