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Comment on egusphere-2022-164

Anonymous Referee #1

Referee comment on "Geophysical analysis of an area affected by subsurface dissolution – case study of an inland salt marsh in northern Thuringia, Germany" by Sonja H. Wadas et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-164-RC1, 2022

The manuscript deals with geophysical surveys and interpretation in an area affected by sinkhole processes in Germania. The topic is certainly of interest to Solid Earth, and the article is worth to be published, being an interesting piece of work; I was particularly happy to have the chance to read it.

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 my comments on the pdf file. Here, I just summarize the main points where the Authors should make an effort to further improve the quality and clarity of the paper, in my opinion.

The main problem with the manuscript is the extensive use throughout the article of the term "subrosion", which I strongly discourage. This because the term is not established in the scientific literature about sinkholes, and represents a potential source of confusion. I would suggest to use, as in the first line of the article, subsurface dissolution (which in many cases include also the leaching process).

At a greater detail, the existence of a well-established classification (proposed by Gutierrez et al., 2014, with recent developments by Parise, 2019, 2022) should be considered as reference point, and the interpretation of the geophysical surveys including the attribution to mechanism of origin, should be done in accordance with the categories of the classification above. In many parts of the manuscript I pointed out the confusion deriving from using the term subrosion, I really hope the Authors could take into account such observations and comments.

As for the sinkhole classification, as mentioned above there have been in the last years some updates published in the Encyclopedia of Caves (3rd edition) and in the Treatise on Geomorphology (2nd edition). I would suggest to quote also these recent developments. Below the complete references:

Parise M., 2019, *Sinkholes.* In: White W.B., Culver D.C. & Pipan T. (Eds.), *Encyclopedia of Caves*. Academic Press, Elsevier, 3rd edition, ISBN ISBN 978-0-12-814124-3, p. 934-942.

Parise M., 2022, *Sinkholes, Subsidence and Related Mass Movements*. In: Shroder J.J.F. (Ed.), *Treatise on Geomorphology, vol. 5*. Elsevier, Academic Press, pp. 200–220. https://dx.doi.org/10.1016/B978-0-12-818234- 5.00029-8. ISBN: 9780128182345.

The issue of salt springs in the Khyffauser hills (line 73) is very interesting, and might deserve some additional detail. Is there any reference to hydrogeological works in this area? Could these (if existing) could be useful for a deeper understanding of the sinkhole problems?

Comment on Figure 1: do we need so many different colors if you then summarize them in single formations?The map is quite complex and not easily readable, I suggest to simplify it in 6 colours (the 6 groups listed in the legend) to improve readability.

There is inconsistency among the initial figures as regards the formations shown. Figure 1 groups them in a way different from figure 2, and this makes difficult for the reader to understand the link among different figures and what is stated in the text. Author should decide which grouping is the best for their manuscript and adapt to that subdivision all the figures and the text.

Lines 241-216:

Authors are here describing their interpretation of a sinkhole identified by sinkhole profiles. In line 216, they state it is a collapse sinkhole. This is just an example to outline how misleading is the use of the term "subrosion" (used few lines before by the Authors) that, on the other hand, would let the reader think to a completely different mechanism of origin, that is dissolution or suffosion. I once more insist on not using such a misleading term.

Risk: the term risk is not used in the proper way, in my opinion. In natural hazards, risk comprises all damage caused by natural processes, and include the economical and societal costs. These are not dealt with in the present manuscript, and the term risk is used with a meaning that should be (in my interpretation) corresponding to susceptibility, or, if including also temporal information, on hazard. I suggest therefore to change in the manuscript, and in the abstract as well, the word risk.

Reference list: please check the reference Schriel & Bulow (1926). It is exactly the same, and repeated as 1926a and 1926b.

In relation to the comments above, and to those in the attached pdf, I suggest to add the following references:

Abou Karaki N., Fiaschi S., Paenen K., Al-Awabdeh M. and Closson D., 2019, Exposure of tourism development to salt karst hazards along the Jordanian Dead Sea shore. Hydrol. Earth Syst. Sci., 2323, 2111-2127.

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., ChuraÌ□cÌ□kovaÌ□ Z., Asadi N., Fuchs M. & AdamovicÌ□ 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.

Fazio N.L., Perrotti M., Lollino P., Parise M., Vattano M., Madonia G., & Di Maggio C., 2017, A three-dimensional back analysis of the collapse of an underground cavity in soft rocks. Engineering Geology, vol. 238, p. 301-311.

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.

Goldscheider N. & Bechtel T.D., 2009, The housing crisis from underground—damage to a historic town by geothermal drillings through anhydrite, Staufen, Germany. Hydrogeology Journal, vol.17, p. 491-493.

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.

KAUFMANN, G. 2014. Geophysical mapping of solution and collapse sinkholes. Journal of Applied Geophysics, 111, 271–288.

KAUFMANN, G. & ROMANOV, D. 2016. Structure and evolution of collapse sinkholes:

combined interpretation from physico-chemical modelling and geophysical field work. Journal of Hydrology, 540, 688–698.

KAUFMANN, G., NIELBOCK, R. & ROMANOV, D. 2015b. The Unicorn Cave, Southern Harz Mountains, Germany: from known passages to unknown extensions with the help of geophysical surveys. Journal of Applied Geophysics, 123, 123–140.

Kaufmann, G., Romanov, D., Tippelt, T., Vienken, T., Werban, U., Dietrich, P., Mai, F., Börner, F., 2018. Mapping and modelling of collapse sinkholes in soluble rock: The MuÌnsterdorf site, northern Germany. Journal of Applied Geophysics 154, 64–80.

KAUFMANN, G. & ROMANOV, D, 2018, Geophysical observations and structural models of two shallow caves in gypsum/anhydrite-bearing rocks in Germany. In: Parise M., Gabrovsek F., Kaufmann G. & Ravbar N. (Eds.), Advances in Karst Research: Theory, Fieldwork and Applications. Geological Society, London, Special Publications, 466, p. 341-357.

Margiotta S., Negri S., Parise M. & Valloni R., 2012, Mapping the susceptibility to sinkholes in coastal areas, based on stratigraphy, geomorphology and geophysics. Natural Hazards, vol. 62 (2), p. 657-676, DOI 10.1007/s11069-012-0100-1.

Margiotta S., Negri S., Parise M. & Quarta T.A.M., 2016, Karst geosites at risk of collapse: the sinkholes at Nociglia (Apulia, SE Italy). Environmental Earth Sciences, vol. 75 (1), p. 1-10, DOI: 10.1007/s12665-015-4848-y.

Parise M., Closson D., Gutierrez F. & Stevanovic Z., 2015, Anticipating and managing engineering problems in the complex karst environment. Environmental Earth Sciences, vol. 74, p. 7823-7835.

Perrotti M., Lollino P., Fazio N.L. & Parise M., 2019, Stability charts based on the finite element method for underground cavities in soft carbonate rocks: validation through case-study applications. Natural Hazards and Earth System Sciences, vol. 19, p. 2079-2095.

Watson R.A., Holohan E.P., Al-Halbouni D., Saberi L., Sawarieh A., Closson D., Alrshdan H., Abou Karaki N., Siebert C., Walter T.R. and Dahm T., 2019, Sinkholes and uvalas in evaporite karst: spatio-temporal development with links to base-level fall on the eastern shore of the Dead Sea. Solid Earth, 10, 1451-1468.

White, W.B., 2002. Karst hydrology: recent developments and open questions. Eng. Geol. 65, 85–105.

Zumpano V., Pisano L. & Parise M., 2019, An integrated framework to identify and analyze karst sinkholes. Geomorphology, vol. 332, p. 213-225.

For all the considerations above, I recommend minor revision.

Please also note the supplement to this comment:
https://egusphere.copernicus.org/preprints/2022/egusphere-2022-164/egusphere-2022-164-RC1-supplement.pdf