

## ***Interactive comment on “Numerical modeling and sensitivity analysis of seawater intrusion in a dual-permeability coastal karst aquifer with conduit networks” by Zexuan Xu et al.***

**Anonymous Referee #2**

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The paper by Xu et al. presents the analysis of results with using local and global sensitivity analysis and different scenarios on a karst coastal aquifer system with seawater intrusion. The topic is potentially very interesting but to be useful to the reader, the paper needs significant improvements. The main concern is about the overall goal of the study. The abstract concentrate mainly on the comparison between local and global sensitivity results, but then a significant portion of the paper deals with scenarios. From a first reading, it is not clear the purpose of developing all these scenarios and how this connects to the previous sensitivity analysis. From my understanding, the scenarios are developed based on the most sensitive parameters and are expected to show how changes in those parameters can affect the results, but this needs to be

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more clearly explained. I have serious concerns about how the local sensitivity results are presented: the analysis lacks completely the presentation of the parameter correlation coefficients which are provided as output by UCODE, but are not presented here. CSS without parameter correlation coefficients is not informative and needs to be combined to the correlation analysis. Furthermore, there is not good explanation of which observations are used in this analysis. There should be heads and salinity field observations, but it is not clear how many, where and mostly which is the weight which is applied to each observation. How are the local sensitivity analysis results used to build the simulations for global sensitivity analysis? Are the same parameters included in both the analyses? Which are the key additional information that we are getting from this double analysis? Often local sensitivity results can be used to discriminate which parameters should be included in the global sensitivity analysis, but this does not seem to be the case in this paper. The two analyses seem to be performed exactly on the same set of parameters. The introduction is too long and does not get exactly to the point of the paper. Sensitivity analysis and calibration of similar models have already been performed and it would be good to point out where. The discussion of the sensitivity analysis results and of the different scenarios should be organized and made more concise. There are also some inconsistencies with the parameter names that should be checked. My suggestion would be to develop a summary table with all the results for both sensitivity and again for the scenarios to help the reader understanding which are the key findings of this analysis. Some more specific comments include: I. 48-49: are the parameters mentioned here calibrated parameters?

I. 132: Which are the issues with VDFST-CFP? Why cannot be used in this case? Without explanation it is not clear why this other method should be mentioned.

L. 207: please spell out EEs

I. 287: the goal here seems to be just performing sensitivity analysis and not calibration. But for running the scenarios, it should be clarified how the values of the parameters have been selected. After which type of calibration? Or the values calibrated in

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previous studies have been used?

I. 453: why the arithmetic mean of CSS?

I.470: this was already said at line 455. The discussion should be more compact and better organized.

I. 568: “groundwater seepage velocity” : are these used as observations?

I. 610: clarify which are the field observations and how they have been weighted

I. 619-621: check the English

I. 626: the DSP package was not mentioned earlier

I. 630: local sensitivity allows as well to understand interactions and correlations between parameters but it is not presented here

Chapter 5: how are the parameters for these scenarios defined? It would be useful to make a stronger link between the sensitivity analysis exercise presented above and these scenarios. What is the final goal?

I. 643: How “quantitatively”?

I. 684: “sensitivity analysis”: to which one do you refer? Global or local sensitivity analysis results? The distinction should be made more explicit for all the scenarios.

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