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Hydrology and Earth System Sciences
Discussions
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Interactive comment on "Calibration of a semi-distributed lumped karst system model and analysis of its sensitivity to climate conditions: the example of the Qachqouch karst spring (Lebanon)" *by* Emmanuel Dubois et al.

Anonymous Referee #2

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In the submitted manuscript, Dubois et al apply a karst simulation model at a large karst spring in the north of Beirut (Lebanon). The model is calibrated and evaluated with discharge observations at the spring supported by spring flow characterization methods. The model is then used to assess the impact of climate change of discharge using perturbations of the historic climate conditions that were derived from climate projections. A strong dependency of spring discharge on precipitation compared to a rather weak influence of increasing temperatures on spring discharge. The authors also find some indication for increased flood frequencies but acknowledge remaining

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uncertainties in the simulated recharge vernation processes.

This study presents an elegant new approach to use methods, originally developed for system characterization, to improve the setup of a karst simulation model. The paper is written well and concise. The results are plausible and are discussed with respect to the work of others. For all those reasons, I think it will make a valuable contribution to Hydrology and Earth System Sciences. However, in order to reach publication quality, the paper needs some minor to moderate revisions as elaborated below and in the attached pdf:

- A lot of important information is provided in the introduction but a clear research gap still needs to be defined, which the authors intent to fill with this particular work.

- Some clarification of the spatial discretization of the model is necessary. MIKE-SHE is a distributed model, which is here applied fully distrusted at the surface but it is operating completely lumped in the subsurface of a set of sub-catchments. Using a sub-catchment approach, this seems to be a semi-distributed application of the MIKE-SHE model using a fully distributed surface routine, right?

- Mangin's method and the decomposition of spring hydrographs are usually applied to hydrograph recessions. Please elaborate how recessions were defined/extracted for the entire time series.

- Please explain in more detail the model calibration procedure and how it is linked to the spring flow characterization.

- Some clarification on how and how many scenarios were derived from the IPCC projections for the climate change analysis. Mentioning table 2 already here might be helpful. In many regions, climate change is projected to have strongly different effects on P and T throughout the seasons. Why did this study choose a delta approach for entire years?

- In the results/discussion, the link between model structure and spring flow character-

ization is not very clear.

- Can you provide a sketch of the conceptual model of the system?

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2020-90/hess-2020-90-RC2-supplement.pdf

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