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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "A percentile approach to evaluate simulated groundwater levels and frequencies in a Chalk catchment in Southwest England" *by* Simon Brenner et al.

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This manuscript describes the application of an existing hydrologic model for karst aquifers. The approach of evaluating the model calibration in terms of hydrologic exceedance rates appears to be a new and useful approach. Exceedance rates of projected hydrologic simulations are evaluated for human safety or the needs of species (e.g., https://pubs.er.usgs.gov/publication/sir20145089). Therefore, if a model is to be used for this purpose, it makes good sense to evaluate the model directly on the basis of exceedance frequencies.

Main comments:

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The abstract explains that the approach to simulate groundwater level frequency is novel. I would say that this is not the novel part, because the time-series records were simulated and simply converted into frequency distributions, which is a common way to summarize hydrologic time-series records. However, the novel part is that the model calibration is evaluated on the basis of frequency distributions, which I have not seen before, and I suggest presenting it that way. The tile is more accurate: "A percentile approach to evaluate simulated groundwater levels and frequencies. . ."

Section 5.2 discusses the possibility of focusing the calibration on high percentiles. I don't totally agree that longer time-series records would be needed to do this, and this section could benefit from further discussion of this idea. For example, an approach could be developed to evaluate the usefulness and data adequacy of such an endeavor. You could vary the weights within the observed time-series record for individual observations at different exceedances to tailor the calibration to a target percentile. It would be possible to calibrate to a different weighting scheme for each percentile. Further, an uncertainty analysis could be applied on each separate calibration run, and quantifying the presumed decrease in uncertainty as the percentile increases could be useful. Then, when you make predictions for different percentiles, you can also report the differences in uncertainty. This idea also applies to section 5.3, which discusses the prediction of increased drought.

The Introduction discusses risks to events such as groundwater flooding and drought. I suggest adding a short statement to this effect in the Abstract to emphasize the need for this study in terms of natural hazards.

Other comments:

1. p. 2, lines 24-26: indicates that karst groundwater levels were simulated by lumped models only in a few instances, but see also Long and Derickson (1999), Long and Mahler (2013), and Pinault et al. (2001). 2. p. 3, lines 22-23: describes a new approach to show groundwater levels as frequency distributions. Showing hydrologic

time-series data as frequency distributions is a common method. Please explain how this is new, or describe it differently. 3. p. 3, line 35: “PET” should be defined. 4. p. 4, line 34: discusses a “weighting scheme.” I think the calibration weights are applied to observations, but that should be explained here for clarity. 5. figure 7: what is the meaning of “manipulated” in the caption? 6. table 5: I think these result apply to a particular model time step (e.g., daily), but I’m not sure. Please clarify.

References:

Long, A.J., Derickson, R.G., 1999. Linear systems analysis in a karst aquifer. J. Hydrol. 219, 206-217.

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