Reviewer #1 (Arnauld Malard)

This paper intends to provide an approach for reducing uncertainties in the Varkarst simulation model (= lumped model divided in compartments). 500'000 parameters sets have been confined using discharge, NO3- and SO42- measurements, (i) together or in a separate way and (i) applied on the whole time series or in sub-series corresponding to expected flow processes (floods, recession, mid-stages). Besides, datasets have been resampled in the range of the 25th to 75th percentiles using soft rules in order to assess how the observations contribute to describe the parameter. Finally, repeated simulations using the reduced 250'000 sets of parameters make it possible for the authors to identify that: - "NO3- provides most information to identify the model parameters controlling soil and epikarst dynamics for unsaturated -flow state (i.e. flood events" - "SO42- and discharge data provides most information to identify the model parameters for saturated-flow state (i.e. recession periods).

The approach sounds coherent but authors might provide more information on the model timestep and the timestep used for applying the Kling-Gupta coefficient. Indeed, measurements are of lower resolution and it is not mentioned how the authors managed that.

A few other comments - and minor corrections in the attached .pdf

Few more words on the soft rules would also be appreciated

Our response: We thank Dr Malard for his valuable recommendations. In the revised manuscript, we will provide a more detailed model description (as also recommended by Dr Mazzilli in her review) including more information about the temporal resolution of the model and the observations and how they were linked within the parameter estimation. Also, some more elaboration on the soft rules will be provided in the methods section. Both issues, the impact of lower resolution of the measurements, as well as the impact of variations in the soft rules will be discussed in more detail in the discussion section of the revised manuscript.

Specific and technical comments from commented pdf

P5L3: For some event spring's peaks discharge seem to be comcomitant with EC depletion...

The resolution of the flow measurements (1 measure/week) reveals insufficient to ensure the supposed concomittancy...

Our response: True, we will rephrase this statement and add some discussion on the uncertainties that go along with such resolution discrepancies.

P5L17: From where? Epikarst, Unsaturated zones or drainage of the phreatic zone?

Our response: The phreatic zone. We will clarify this in the revised manuscript.

P5L18: "Seepage" from the epikarst should not be disregarded...

Our response: We agree that seepage from the epikarst will still be abundant during this stage. We will clarify this and add some elaboration why we believe that our distinction of flow states still makes sense.

P6L10: daily timescale?

Our response: Yes, daily time scale. We will provide this information in the revised version of the paper.

P8L15: How did you manage the differences in time step between model (daily) vs. measurements (biweekli)?

Our response: Simulations and observations are only compared by KGE at times when observations are available. If the resolution of observations were higher, more parameter sets could have been discarded by our soft rules and the precision of the simulation with the remaining parameter sets would have been higher. We will add this important information to the methods and discussion section.

P9L26: The "combined" state should be explicitly mentioned in Figure 1.

Our response: We will update Figure 1 accordingly.

P10L14: replace: "saturated"

Our response: Yes, the word will be replaced.

P11: marked areas in Fig 5

Our response: Unfortunately, there is no comment explaining the marked areas in Fig 5. For the revisions, we will assume that they were only included to facilitate the review but do not require any modification to the manuscript.

P11L10: Use "SO42-"

Our response: We will correct all hydrochemical variables accordingly.

P12L10: typo

Our response: Typo will be corrected.

P12L10: typo

Our response: Typo will be corrected.

P13L8: clarify

Our response: We refer to the entire time period that also includes the periods of river influence. The statement will be clarified accordingly.

P13: Please Make this figure bigger...(Fig 7)

Our response: The figure will be enlarged in the new version of the manuscript.

P13L25: typo

Our response: Typo will be corrected.

P16L13: ...; one being a known period...

Our response: The sentence will be changed accordingly.