Response to Reviewer #1

We would like to thank the anonymous referee for his/her interest and the comments on our manuscript. Below, reviewer comments are in italic font and our replies are in plain blue font.

The authors present an interesting new hydrologic modelling toolbox in Python. The toolbox itself is very interesting and the publication is appropriate for GMD. I have a few points that the authors might want to address to improve their manuscript.

We thank the reviewer for his/her helpful comments.

(1) The toolbox itself is interesting and is mostly well described. What took me a while to understands though, is whether the toolbox models only described 1-D soil processes or whether they can present a grid with spatial variability. As well as how this raster would be connected. My suggestion is that the authors expand Figure 1 to also include spatial and temporal discretization, as well the inputs to the model. I think it would help the reader to have such a conceptual figure regarding the possible model architectures.

We expanded Figure 1 and added the input(s), temporal and spatial discretization to the figure. Currently, the toolbox describes only 1-D processes. The implementation of the lateral fluxes between the grid cell is planned for the future as already mentioned in lines 295 ff.

(2) A related aspect is the very specific input requirements for the model discussed in lines 112ff. I am a bit confused why this is so specific when the model architecture is meant to be modular. Should the model not be adjustable to the data available? Precipitation of 10 minute time steps or less will limit available datasets very much. Why can the model not be run with hourly time steps? Especially given that other inputs are daily. I think the authors should provide some justification here, rather than just stating this as a fact.

The 10 minutes time step is required for the detailed representation of the runoff generation processes (i.e. infiltration, surface runoff and lateral subsurface runoff). Especially high rainfall intensities may cause infiltration excess which leads to Hortonian surface runoff that cannot be adequately represented by hourly time steps. Hourly precipitation or daily precipitation datasets can be resampled to 10 minutes. We added the justification for the input requirements to section 2.1.3.

(3) Another part where I would expect a bit more discussion is section 2.2. Much has been published on the issue of modular hydrologic models over the last 20 years, but hardly anything from this discussion is mentioned here (e.g. https://gmd.copernicus.org/articles/12/2463/2019/gmd-12-2463-2019.pdf). This discussion should also include how a certain process module (e.g. transpiration or surface runoff) could be represented using different process complexities. I assume this is included here.

The main reason for using a modular structure was to improve the readability of the code. Of course, the different processes can be represented by different degrees of complexity but this would lead to multiple modules for a single process and increase the choice of modules. Modular means that certain processes (e.g. lateral subsurface runoff, capillary rise from groundwater, etc.) can be activated/deactivated. Although this provides a high flexibility, the combination of multiple modules into a process consistent model can be challenging for model users. Therefore, we provide the processes with a certain complexity and hence limit the flexibility of the model. However, by providing pre-defined models we intend to guarantee process consistent combination of the modules. We include the mentioned reference and further discuss the modular usage in the context of the mentioned reference in section 2.2.

(4) Could the authors expand a bit on the numerical implementation of the models and how this links to previous discussions on the topic (https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2009WR008894)?

In order to calculate the soil hydrological fluxes and soil water content, we use analytical solutions of the infiltration into soil matrix and macropores (see Steinbrich et al., 2016 and Weiler, 2003) and variable time stepping which

depends on the rainfall intensity, but numerical implementations are not necessary. For the solute transport, three different numerical schemes are available and described in section 2.3. We add the information about the numerical implementation to section 2.2 and discuss it in the context of the mentioned reference.

(5) In line 248, the authors mention that parameters are randomly generated, but do not explain more. I assume the authors sampled from independent uniform distributions. Are there other options than this approach? Here the link to other toolboxes might be particularly useful to further explore the model outputs given that more and more analysis algorithms can be run with generic input samples (e.g. https://www.sciencedirect.com/science/article/abs/pii/S1364815218303220).

We modified Chapter 4 and run the simulations for a real-world catchment rather than using randomly generated data. The mentioned toolbox might be interesting for a more advanced analysis of the simulations. Generally, the toolbox can be used with other toolboxes. For this study, such an advanced analysis is beyond the scope of a model description paper.

(6) If the model is represented as a grid, is there a possibility for river flow actually occurring? Or is the domain limited to plot scales where channelized flow might not occur?

Currently, river/channel flow has not been implemented, yet. The implementation of river/channel flow is planned for the future as already mentioned in lines 295 ff.

(7) A hydrologic modelling toolbox like the one presented here can (and probably should) link to a wider range of Python toolboxes that assess and attribute uncertainties (e.g. https://safetoolbox.github.io/) or estimate parameters (e.g. https://pymoo.org/). Discussing how one might use existing toolboxes with RoGeR would be interesting for users I believe.

In the GitHub-Repository of the toolbox, we provide some examples how RoGeR can be used with other toolboxes. We provide examples that estimate parameters using a Monte Carlo approach or analyses the parameter sensitivities (https://salib.readthedocs.io/en/latest/index.html).

(8) There are a few issues with the writing. E.g. "measurements for their states" should be measurements of, the last sentence in the abstracts includes and twice and is too long, ... So please have another read through just for grammar.

We had another read and improved the grammar.