Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-216-AC1, 2017

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Dynamics of water fluxes and storages in an Alpine karst catchment under current and potential future climate conditions" *by* Zhao Chen et al.

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Received and published: 30 October 2017

Reply to comments by an anonymous referee (Reviewer 1) on the manuscript "Dynamics of water fluxes and storages in an Alpine karst catchment under current and potential future climate conditions" by Zhao Chen et al.

Summary of the reviewer: The subject paper presents a model based on a previous model (Chen et al., 2014) for the northern Alps on the Germany-Austria border, adding new developments as the presence of the non-karst area and the surface runoff, the slow flow and the snow accumulation and melting. The work seems fine for me but, however, the manuscript is hard to read itself and it looks very focused on the study

area, that is why I must say that the manuscript is not suitable for publication unless it was revised in some aspects.

Reply: We thank the reviewer for her/his useful and valuable comments that will help to improve the manuscript, in particular its readability. We will carefully rework the entire text in order to improve its structure and intelligibility, also with the help of a native speaker. All suggestions will be taken into account. According to her/his comments, we will perform the following changes.

Comments:

The model is based on the one developed by Chen et al., 2014 but, are there more differences between both models apart of the new developments? The basic setting of the model should be explained in the manuscript: what boundary conditions do the authors use and why? What are the equations that are solved? I miss also a brief discussion about the differences between both models in terms of hydrodynamics (how the new developments change the results and why they should be included). In fact, it looks like the new model fits the discharges considerably worse than in the previous one.

Reply: We will add a brief discussion about the differences between the model developed by Chen & Goldscheider 2014 and the model used in this study. Also, we will include a more detailed description about of the model in this revised manuscript regarding its basic setting, boundary conditions and the underlying equations.

The authors also present some climate scenarios in order to evaluate the behavior of the system and the connections between climate change and subsurface dynamics in karst aquifers. This could be a research of broad interest however, again, the discussion is hard to follow without going through literature and the conclusions are very focused on the study area. May be it would be interesting to compare this work with some other studies of karst aquifers dynamics.

Reply: We thank the reviewer for this valuable suggestion. We will go through the literature and extent the comparison of our results with other karst studies to generalize the discussion and conclusions.

Talking about the “extremely dry conditions” in 2070, it is not clear to me how the authors introduce the base flow, is it a constant value as in the work of Chen et al., 2014 or is it different now? Please, explain.

Reply: We thank the reviewer for pointing this out. This is different to the work by Chen & Goldscheider 2014. We used the linear reservoir approach by Hartmann et al 2011 to simulate base flow (also mentioned as slow flow in this manuscript), which is depending on the recharge process and influenced by the chanced climate conditions. We will explain this by comparing the differences between the model developed by Chen & Goldscheider 2014 and the model used in this study (see our answer above: the existing model and the new developments will be more clearly explained).

Regarding the conclusions, the authors claim that “the results demonstrate that the spatiotemporal distribution of water fluxes and storages is controlled by surface hydrological setting” but also that “the results should only be applied to understand the relationship between the hydrological processes within the studied catchment and potential climate change patterns”. The conclusions are valid but they do not seem to be relevant for the general hydrogeological knowledge. The authors should try to generalize them. It would be interesting to evaluate how a karst system could be affected by climate change, why it is different the affection of climate change over a karst aquifer, are karst aquifers more vulnerable than no karstified ones?

Reply: We thank the reviewer for this valuable suggestion. We will expand the literature review and compare the climate change impact on karst aquifer system with other aquifer types in order to generalize the conclusions and increase the relevance of this study for the general hydrogeological knowledge. In fact, it is true that every karst aquifer system has its unique setting and behavior; therefore, detailed projec-

tions cannot be transferred to other karst catchments. However, our general modeling approach and some general conclusions can be transferred to other regions. We will try to show this more clearly and carefully in the revised version of our manuscript, e.g. by differentiating between “local” and “general” conclusions.

References

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