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.

Anonymous Referee #2

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Chen et al., Dynamics of water fluxes and storages in an Alpine karst catchment under current and potential future climate conditions, HESS-2017-216

Chen et al. simulate the water storages in a karst catchment using a distributed numerical model. The authors also predicted the hydrology changes under climate changes and stated the significant impacts on karst hydrogeological responses. Overall, this paper is novel and well written, so I would recommend HESS publish after a major revision.

Here are some of my comments:

P1L12: I suggest the authors to provide a brief introduction of distributed numerical

model when mentioned this term, since the readers might need some help to understand this word. If the authors do not want to have a description in the abstract, simply talked about the details of distributed numerical model later.

P1L19-27: I would expect a few sentences to specifically highlight that why the study of karst catchment is important, and the water resources in karst region is vulnerable under future climate change conditions. What is the difference of hydrological responses between karst and non-karst catchment? What it the scientific merit in this study?

P2L10-11: I would say the lack of input variables and model parameters in hydrology model is not only a challenge in Alpine, but also for the hydrological models in other regions. And, is "spatially-distributed model" equal to "distributed numerical model"? Just try to keep consistent and avoid misunderstanding.

P3L1-3: I doubt if it is appropriate to say the relationship between subsurface hydrology and climate has not been considered in detailed. Numerous papers have tried to addressed the relationship, if you simply google some keywords. I would recommend the authors take a look at the review paper by Taylor et al., 2013, Groundwater water and climate change, Nature Climate Change, DOI: 10.1038/NCLIMATE1744

P4L29: What is the source of meteorological data did the authors use? What parameters does the model need? It seems that the authors use the in-situ observational data from the meteorology stations. Since the authors mentioned the uncertainty issues of weather forcing at the very end of this paper, I suggest the authors take a look at the climatological/meteorological reanalysis dataset. I'm not familiar with the reanalysis product in Europe, but I'm sure there are some datasets (eg. ERA-Interim) or global datasets you can use.

P5Ln4-12: The authors mentioned that the melt factor and radiation coefficients were estimated by model calibration. What observational data did you use to calibrate the parameters? And also, I'm afraid the snow accumulation and melting equations are too simple, especially considering the importance of snow melt in this study. Could you

validate the accuracy of snow accumulation and melting?

P5Ln20: I'm not sure if the calibration strategy is an important part in this paper. I would recommend the authors address the physics of the distributed numerical model rather than the calibration.

P6Ln25-26: How did you include the infiltration in the storage calculation for the non-karst area? Please explain or consider to rewrite this sentence.

P7Ln20: It seems the authors use one year (water year 2014) simulation as the base to make future projection with the changing precipitation and ET forcing. Should you consider run the distributed numerical model in multiple years? The climatological average hydrological responses from the model should be used here, if long-term data are available.

P7Ln23: The total volume of mass water does not make sense to the readers who are not familiar to the study area. Is it better to use flux unit (m, or m/day, divided by the area of study domain) to represent the water mass? (I would say it's an open question for the the authors to think about). And also, I highly recommend the authors plot the mass budget of each component instead of using the time-series plot in Figure 5.

P8Ln14: The references of projected precipitation and ET are missing? Are these predictions estimated from an earth system model?

P8Ln20: How did you estimate the snowmelt and snow storage? Did you simply compute from the snowmelt equations in Sect. 3.3 or from an earth system model? Please explain and provide more information.

P9Ln19-20: The "spatial-temporal" distribution is one of the major finding and novel point in this study. I recommend the authors address this point more.

P10Ln17-18: What is the statistics of surface runoff responses to heavy rainfall events? Overestimation or underestimation? How did you compare? In general, I don't think you can directly compare the simulated surface runoff with streamflow measurement.

P10Ln27: Should be "hydrological process sensitivities"?

P11Ln7-9: The different hydrological responses at karst springs are interesting in this study. I recommend the authors highlight the importances of elevation dependency and the permeability of aquifer in water storage capacity and streamflow discharge.

Additional comments: Looking at the reviewer #1 comment, I argee that a more detailed description of the distributed numerical model should be included, and the difference between this model and the previous paper should be highlighted.