We thank Kuo-Chin Hsu for the time spent in reviewing our manuscript and appreciate the positive and constructive criticism. Hopefully we have answered the questions satisfyingly, otherwise we are available for further clarifications.

This manuscript provided insight of the effects of downscaling methods on the response of a hydrological system to climate change. The dynamic-multimodel analysis was rigorously performed for a small catchment in Switzerland. First, precipitation data from the general circulation model (GCM) was downscaled to local-scale precipitation that serves as the driving force of the ground water system. Then, the downscaled precipitation was applied to a 3-D integrated surface water-groundwater hydrological model to explore its impacts on the projected groundwater water response. Results of three different downscaling methods were compared. The authors concluded that the downscaling methods serve as the important source of uncertainty of the hydrological studies.

The most striking result of the manuscript is the increasing groundwater level predicted by the integrated model for the future using the downscaled precipitation. The result is very different from previous studies. Previous studies predict a reduction in overall precipitation, an increased frequency of both extreme precipitation events and severe droughts. All these lead to a possible decline of groundwater table. However, the net precipitation projected by three downscaled precipitation shows increasing in the future and leads to an increase of groundwater level. The difference of predictions for present and previous studies in groundwater table variation is very possibly caused by the downscaling methods (as shown in Figure 8). This raises important questions that which projected trend (with and without downscaling) of groundwater level is correct and whether new downscaling method is required. Since 2000-2010 precipitation data are well bounded by all projected envelopes with and without downscaling methods (Figure 9), the verification of the downscaling method becomes a challenge task.

The authors argued that the performance of downscaling methods should be evaluated by average values, the variability but also the intra-annual distribution (P. 7540, Line 26 – P. 7541, Line 2). Alternatives may be to recognize the capability of the downscaling method such that the downscaling results match the main concerned characteristics of precipitation for specific management purpose (for example, disaster prevention or drought adaptation). Analyzing historical data did help us to understand how the hydrological system has reacted under the significant historical changes in climate conditions. However, prediction work is for better adaptation in the future. Risk assessment is still the main tool. Historical variation may not repeat in the future. Therefore, the pursuit of appropriate downscaling method and its validation seems more urgent for the climate change study.

Answer:

We fully agree with the reviewer that the verification of the downscaling method is a challenging task and we will thankfully add the proposed alternatives to the manuscript. It is also important to realize that these simulations were carried out with help of simulations from the ENSEMBLES project. Many of the documented declines of groundwater levels used simulations from PRUDENCE (Christensen et al., 2007) as input. This is a former generation of climate models. However, this also illustrates the uncertainty related with the precipitation prediction by climate models. Besides this, also other reasons summarized in the conclusion section (page 7540, l. 17-19) could cause the contradictions.

We also agree with reviewer that it is important to continue the pursuit of appropriate downscaling methods (page 7536, l. 23-page 7537, l.2.). The analysis of historical data should

not replace this. It should rather be an additional alternative to circumvent the uncertainty of the climate models and downscaling.

P. 7528, Line 20, “the eastern boundary is chosen parallel to groundwater flow line,: : :” . Does this mean a no flow boundary? With no flow boundaries around the numerical domain, the study area serves as isolated unit to response the climate change.

Answer:
Yes, that does mean that there is a no flow boundary. The western, northern and southern no flow boundaries are simply necessary to represent the geological setting. The aquifer is essentially a closed basin which is recharged by rainfall. The discharge is via the pumping wells and the springs on the southern and western boundary through which all excess water flows out. The aquifer continues some more kilometers to the east and is bounded there by a distortion. However, a streamline boundary is used to cut down the aquifer in size somewhat.

P. 7529, Line 4, Please explain why the SREE A1B emissions scenarios is chosen.

Answer:
Unfortunately, the ENSEMBLES database does not provide a significant number of climate models for all scenarios except the A1B scenario. Uncertainty would certainly increase if different emission scenarios would be considered. However, this was not the subject of this investigation.

P. 7529, Line 27, Which weather station is used? Effretikon or Zurich-Kloten airport?

Answer:
We used precipitation data from Effretikon and the data for the other meteorological variables were obtained from the station at Zurich-Kloten airport. We will clarify that in the revised version of the manuscript.

P. 7530, Lines 14-15, The monthly CDF correction downscaling method needs more detailed description. For example, how the previous methods were combined?

Answer:
We agree that this section is rather sketchy. The section will be rewritten, more information delivered.

P. 7530, Lines 23-25. Uncertainty sources may also include the validity of the coupled surface water and groundwater water model since the available observation wells and piezometers are sparse in the study domain.

Answer:
We agree that the uncertainty of the hydrological model is an important issue when doing impact studies (see page 7530, l.21-26). We are aware of the problem and that is why we are currently conducting studies especially focusing on this topic. Although we acknowledge in the manuscript

that there is still potential to improve the calibration, we think that for the focus of this study (uncertainty with respect to climate models and downscaling) the representation of the system is fair enough. The main aquifer parameter for the water balance is not the transmissivity and its heterogeneity. It is rather the porosity and thus the storage volume of the aquifer.

References:

Christensen, J. H., Carter, T. R., Rummukainen, M., and Amanatidis, G.: Evaluating the performance and utility of regional climate models: the PRUDENCE project, Climatic Change, 81(Suppl. 1), 1–6, 2007.