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Interactive comment on “Prognostic simulation and analysis of the impact of climate change on the hydrological dynamics in Thuringia, Germany” by P. Krause and S. Hanisch

P. Krause and S. Hanisch

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First of all we like to thank the evaluator for his or her extensive, critical, and helpful review of our paper. We have considered the reviewer's suggestions thoroughly and will integrate most of them in the revised version of the paper. In particular the advices about the missing validation of J2000g are absolutely correct and we really apologise for not providing more information about model calibration and validation, which had of course been undertaken before.

Somewhat annoying was the fact that the reviewer was simply ignoring some of the most important results and findings of the paper. It is not clear for us why and how this

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happened; was it some kind of misunderstanding or misinterpretation? In the general comment section the reviewer completely ignores the fact that the hydrological model was used to compute potential and actual evapotranspiration and runoff generation for the entire area of Thuringia. These results (pages 4050, 4051, and fig. 4 and 5 on pages 4055 and 4065) are the actual results of the paper and were not mentioned at all in the review. From the evaluator's summary one could get the wrong idea that the only output of the study was the simulated runoff for the river Ilm. This case study was only provided to give one(!) possible example how the findings and results may translate into streamflow.

With some of the suggestions and question the evaluator is asking for too many details of WETTREG and the underlying method in our opinion. We cannot answer all questions of the reviewer because this would be beyond the scope of this paper which deals with an application using WETTREG data as drivers. Nevertheless, we did integrate a reference demonstrating the WETTREG method instead, to provide more information for interested readers.

Response to the general comments:

On page S1559 the reviewer argues about the fact that the results reflect "the current wisdom" about the likely changes of the interannual precipitation distribution and that these results had to be validated when they were being based on new models and techniques. The results we used for the study are actually based on ECHAM05 runs, which provide the basis for the downscaled climate projections of WETTREG. We are aware that ECHAM05 can only provide a more or less likely trend of the future conditions and in particular of the change in the interannual precipitation distribution, but we do not know how this trend should be validated. Further on the reviewer argues about the missing validation of WETTREG and J2000g. He or she is right about the missing validation of J2000g and we will integrate more information about calibration and validation in the revised version of the paper. His or her remarks about the missing WETTREG validation are not true.

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Response to the specific comments:

On page S1550 the author argues that the given references UBA2007a,b do not provide any information about validation. This is simply not true! In UBA2007b the validation of WETTREG is described in section 5 (Validierung). This section clearly describes how WETTREG was validated for the area of Germany. Anyway we did additional validation of the WETTREG data by the comparison of WETTREG results based on ECHAM05 control runs with measured data from 4 climate stations and 2 precipitation stations in or nearby Thuringia.

The sentence "The introduction does not reflect the status quo of the research" is not really helpful. We kindly ask the reviewer to specify more precisely what he or she is missing. Maybe he or she can point us to some relevant references. We will be more than happy to integrate them if appropriate.

The revised paper will be proofread by a native speaker to improve the English.

Response to the technical corrections:

S1562: Reviewer asks: "So why not use mean values of 10yrs and more right from the start?" Answer: This is exactly what we did! We did use 10yrs means to drive the hydrological model but we aggregated the results to 30yr mean value to provide robust trends.

Reviewer asks: "Why use WETTREG at all?" Answer: Because it is the only regional data set available for the area of Thuringia. Unfortunately, REMO cannot be used because the precipitation downscaling is not working very well for the mid-mountain areas which are crucial for the runoff generation in Thuringia.

Reviewer asks: "...how much of the WETTREG skill is simply calibrated" Answer: The principles of the WETTREG method are described in Enke et al. 2005 (Results of five regional climate studies applying a weather pattern based downscaling method to ECHAM4 climate simulation). In our opinion a more detailed description of the WET-

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TREG method would be beyond the scope of this paper.

Reviewer asks: "It seems that regionalisation is used differently wrt. J2000g and WET-TREG. This should be clarified." Answer: Actually the software delivered with WET-TREG data, called IDP2006, provides a method for the regionalisation of the data but we did not use it for this study. We used the values WETTREG provides for a number of climate and precipitation stations in Thuringia and nearby. This point values were distributed to spatial values with the regionalisation approach of J2000g. This regionalisation approach accounts for vertical and horizontal variation of climate data by regression analysis and inverse distance weighting.

S1562 and S1563: More information about calibration and validation of J2000g will be given in the revised version.

S1563: Reviewer ask: "Why is it so much higher than current IPCC projections" Answer: The reason is that IPCC uses mean values of 21 different models whereas the projection presented here is based on ECHAM05 only. Alas, we are not able to answer the question why ECHAM05 results are so much higher.

Reviewer asks: "Can the conclusion of a more likely occurrence of hydrological extremes in the future be supported" Answer: It is always hard to support future projections. What we already see in Thuringia is that floods and extreme dry conditions have occurred more often in the last 10 yrs or so. As floods mostly occur in winter it is likely that any increase of precipitation will result in more and higher floods. The same just the other way round is true for summer. An increase in ET and a decrease in precipitation will result in a decrease of runoff generation. The precipitation in Thuringia is already very low compared to other regions of Germany. Any further decrease will have impact on the water availability. Anyway, we will reformulate this statement in the revised version to make it clearer that it is only an assumption which cannot be substantiated by data.

Reviewer ask: "Runoff units are not specified (what it is -47mm?)" The units are mm

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(millimetre) but please notice that we are talking about runoff generation not streamflow! One mm of runoff generation equals one litre per square metre. Millimetres are a quite common unit in spatially distributed hydrological considerations.

S1564: Reviewer asks: "The increase in runoff is 100%! Can this be put into perspective by citing, for example, streamflow projections for other catchments/scenarios." Answer: We will try to do this for other basins.

Reviewer asks: "Does uncertainty in the climate models really affect regionalisation?" Answer: No, we don't think so and we didn't write something like this. Uncertainty of WettReg will be estimated to some extent by the validation which will be in the revised version.

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