

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

Anonymous Referee #1

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General comments:

The paper describes possible consequences of anthropogenic climate change for the hydrology of the German area of Thuringia. Using two emission scenarios (A1, B2) they derive for a number of stations meteorological records that are consistent with the altered climate, as simulated by a GCM. These records are fed into a simplified hydrologic model to generate streamflow for the river Ilm at three selected gauges.

The general result is, besides the overall warming, a strong seasonal shift in precipitation under both scenarios, with increases in winter and decreases in summer. This

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seasonality pattern is transmitted to streamflow only for the mountainous gauge, with large increases in wintery streamflow and lower flows in summer. For the other two gauges streamflow is mostly reduced. The effect of reduced snow accumulation is visible as well.

While the result seems to reflect the current wisdom about European precipitation trends under global warming - wet winters, dry summers - that wisdom is much too uncertain and premature to just let it pass without thorough validation; this applies even more when results are being based on new models and techniques. Two out of the three model components in this study, WETTREG for the downscaling and J2000g for the hydrology, do not appear to have undergone thorough validation for the area in question, at least not in the peer reviewed literature.

Until this validation is done I think the study cannot be published. Although this will certainly produce considerable additional work I really encourage the authors to not refrain from doing so, as one can expect a much better paper from it.

If the manuscript should be rewritten I strongly suggest, as the current English is very poor, to consult a native English speaker for a final check.

Specific comments:

WETTREG is supposed to be build on empirical relations between weather-types and local weather, plus an additional stochastic component. The given references UBA 2007a/b do not provide any validation, and further references therein (Enke et al.) merely report summary statistics. I have not seen any real verification of the claimed empirical relations, that is, verifying simulated time series for independent data (for the timescales of the weather types). Moreover, how are the dominant weather types represented by the GCM? - It is, moreover, unclear how the reported results would generalize to the Thuringia area.

J2000g was derived from the J2000 hydrologic model as a simplification suitable for

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the current context, and it seems that J2000g has been applied for the first time here. I would think that this needs at least a bit of validation. Although the authors provide some calibration statistics (Nash-Sutcliffe) it is, first, not clear for which time period these were calculated and, second, how stable they are when applied to independent data.

There was mention of the method's capability to simulate extremes, but this was not followed by an actual assessment. It thus remains unknown if more severe weather, resulting in floods and droughts, from a changed climate is actually to be expected for Thuringia, at least within the current context.

The Abstract is much too long and specific.

The introduction does not reflect the status quo of the research.

No account was given regarding the significance of the findings. Especially for the highly fluctuating hydrological quantities it remains unknown whether the reported "signals" are real or simply reflecting sampling properties.

Conclusions are merely summarizing the previous sections, instead of discussing the added value of the study in the context of current and in view of future research.

Technical corrections:

The English is very poor and some paragraphs need a full rewrite. For those cases I did not indicate every single error.

p4038:

3: repl. "state Thuringia" by "state of Thuringia"

4: del. "For this study"

6: repl. "This regional climate model" by "WETTREG".

7: "... for the existent precipitation ..." is awkward.

8: repl. "this" by "these".

13: "(IPCC), and"

12: Sentence much too long. Split into two. e.g., remove "the entire area of the German state of".

16: simulations with ...

p4039:

2: anthropogenically caused.

4: "discountable"? - repl. (e.g.) by "numerous research projects".

10-14: remove.

24: del. "to deal with...".

28: They found out that...

p4040:

12: I doubt that HESS, by publishing "original research", is an appropriate address to provide the supporting information for political bodies. If this is intended the authors may consider, e.g., a German research report.

25: Incorrect. By "GCM" one usually refers to a "General Circulation Model" (sometimes also Global Climate model) and means an atmospheric model. But a global coupled model is nothing else than an AOGCM.

p4041:

11: repl. "The vertical ..." by "It has 31 pressure levels."

13-23: Awkward description. Control runs are usually defined as being unforced (as suggested also by the UBA reference), and should be distinguished from forced transient simulations.

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25: del. "German state of"

p4042:

10: So why not use mean values of 10yrs and more right from the start? In other words: Why use WETTREG at all? - This point should be explained.

12-18: For the evaluation it is important to know how much of the WETTREG skill is simply calibrated. For example, was WETTREG fitted to analyses, and how are these related to the control run.

p4043:

14: Which analysis?

15: inter-annual

21-26: Style: At several places one finds duplications of the following kind: The new modeling tool ... was developed within the following constraints: ... To meet these constraints, the hydrological model J2000g was developed.

p4044:

15: It seems that "regionalization" is used differently wrt. J2000g and WETTREG. This should be clarified.

21,22: explain "FAO" and "ET".

25: This paragraph should significantly be shortened. Instead of giving a detailed description of J2000g the authors might consider to set out only the main points where that model deviates from more standard approaches. For the details, the reader should be referred to the manual of the model, if that exists.

p4046:

10: It is completely unclear how the calibration is done. What is the meteorological input? If from WETTREG (as suggested above), from which atmospheric fields (sim-

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ulated, observed/analyzed)? Or does WETTREG output direct station observations, too. Then which/how many stations, etc.

16: Perhaps "man-made" should be preferred to "anthropogenic", as the latter already refers to climate influence in this manuscript.

28: "degree of variability for each parameter among the eight catchments varies for each parameter" (see above).

p4047:

17: I understand that using NSE(avg) gives "some" validation, but that is certainly not enough as it applies to the same data. Introducing a new model without genuine validation (and relation to other models) is not acceptable.

p4048:

13: explain "distributed manner".

17: How are the reported results distinguished from those described in the UBA reference, e.g. UBA 2007b, section 5 (other than the latter applies to the whole of Germany)?

p4049:

12: Why is it so much higher than current IPCC projections (of about +10%).

25: Can this conclusion be supported?

p4050:

13: "The absolute amount..." is too long.

22: "spatially averaged".

23: Runoff units are not specified (what is -47mm?).

p4051:

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12: "significant decrease": What is significant here? Precipitation and runoff show very large natural variability, and it is not at all clear how much of the "signals" are simply due to sampling.

p4052:

3: "not too problematic".

6: explain the abbreviations

13: The increase in runoff is 100%! Can this be put into perspective by citing, for example, streamflow projections for other catchments/scenarios.

p4053:

2: "depression"?

14: "precise predictions": What else then?

p4054:

1-8: Does uncertainty in the climate models really affect the regionalization? Maybe the predictor fields/weather types are pretty stable - which is why they were used in the first place, weren't they? Uncertainty from WETTREG itself, on the other hand, could have been estimated from conducting verification experiments, using the fairly long weather observations that exist in Germany.

22: That sensitivity study should have preceded this one.

p4057:

11: It is Schwandt, D.

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