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Hydrology and Earth System Sciences Discussions

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 #3

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General comments: Unfortunately, the article is clearly not in a shape that allows its publication in an international hydrological journal. Many passages in the text read like a technical, internal report, and the English is often poor. Several descriptions are lacking some detail (e.g., the specification of methods) while others are too voluminous (e.g., more general information that is not imperative for the understanding of the contents and aims). There are many shortcomings in the text, some of them are listed below (except the many linguistic errors).

Specific comments: The title includes the expression 'hydrological dynamics'. It there-

fore suggests that the article investigates short-term and highly dynamic hydrological processes such as floods and the related impact of climate change. The study however deals with the long-term analysis of mean seasonal or mean monthly hydrological conditions, such as evapotranspiration or discharge. The possible change in the frequency of floods or droughts (e.g., through a statistical analysis) is not included in this study. The paper also delivers no indication about future changes in precipitation intensities. Nevertheless, both in the abstract and in the conclusions the authors write that 'it is likely that the extremes of flooding in winter and dry spells in summer might occur more often' (p 4038, lines 26-28) and that there is 'a likely intensification of the extremes' (p 4056/4057, lines 29 and 1), which needs to be termed as highly speculative.

The authors frequently use the expressions 'predict' or 'prediction' when they discuss results from their climate change analysis. It should be clearly stated however that all scenarios include a large number of assumptions and that they just represent possible futures. Therefore, the expression 'projection' instead of 'prediction' would be more useful in this context. The results from the climate change analysis frequently read as if they would certainly occur. The authors should therefore stress that they deal with scenarios and that their analysis is just an implementation of two different IPCC emission scenarios, coupled to a statistical downscaling and a hydrological model. The authors correctly discuss some issues of uncertainty (short paragraphs in section 2 (p 4041, lines 13-20) and in the conclusions (p 4056, lines 17-24)), this is however not sufficient to explain the limitations when dealing with scenarios.

The Introduction appears too voluminous, containing a lot of general information (for example, regarding the IPCC and its latest report, or what follows from climate change). There is also a short description of regional climate impact investigations in Germany, however, without giving any reference to the projects KLIWA and GLOWA. A clear and understandable introduction to the underlying problems of regional impact analysis (with focus to German conditions) and to the aim of the investigations is however

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missing.

In section 2 (Climate modelling), the regional climate model WETTREG is shortly described, however no reference is given. Instead, two references are given ('UBA') to technical (and thus not publicly accessible) reports written in German. This is a very rough specification of a major approach applied in the study, and it therefore requires more explanation and a clear and referenced description of the method. - Page 4042, lines 7/8: 'estimated by regression analysis': This clearly requires a thorough description. - Page 4042, line 9: which uncertainties do you mean? - Page 4042, lines 12-18: explain in more detail the results and related uncertainty considerations.

Section 3: Page 4043, line 12: do you mean temporal or spatial resolution? What was the temporal resolution of the approach? - p 4043, line 14: what do you mean with 'predictive climate data'? Description of the hydrological model J2000g: Requires more detail, references and some clarifications. Examples: - p 4044, line 7: what are 'the important hydrologic behaviours'? - How is potential ET calculated in the model? - p 4044, line 28: 'potential snow melt moves to the soil' is not a correct description of a hydrological process - p 4045, line 19: how do you explain the relative simplicity of your model with the subdivision of an area of ca. 16,000 km^2 into more than 220,000 modelling units? - p 4047, line 6: The reasons for the high spatial variability of TMF, FCA and ETA require more description Most of the calibration catchments are at relatively high altitudes and are spatially clustered (catchments nr. 1,2,3,4,8 as well as nr. 6 and 7). 3 of the 5 clustered catchments show the expression 'Gera' in their names. Does this mean that they represent subcatchments of one larger basin? If yes, discuss the consequences for the whole calibration procedure. Also discuss the representativeness of the calibration procedure regarding the spatial clustering of the calibration basins in general and their representativeness regarding the lowlands of the investigated area. Page 4047, lines 17-25: Application of an average of the parameter values from the 5 calibration basins delivers reasonable estimates for the uncalibrated areas. What do these findings mean regarding parameter sensitivity and

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the reliability of the calibration procedure? Table 1: Tbase: Does this mean that snow accumulation starts only at a temperature of below at least -3.9°C ? Is this realistic? Discuss the physical meaning of this parameter (page 4047, line 1 says that Tbase is the 'most physically based'). Explain the extreme high variability of TMF - does this still have any physical meaning? Explain also the very high TMF's for the two mountainous catchments Wilde Gera and Hasel. Explain also the high variability of FCA. There are quite low ETR-values for some basins. Does this mean that they are close to potential evaporation? Explain the high ETR differences between the spatially clustered basins 1,2,3,4 and 8.

Section 4: Page 4048, lines 6-7: Please explain in more detail why a 10yr average and a 30yr average have been applied. - p 4048, lines 15-16: why can the Ilm be considered as representative? - p 4049, line 3 ('the latter will have significant impact on the runoff'): please demonstrate - p 4049, lines 23-26: as long as this is not clearly proven it appears to be highly speculative (see discussion above) - p 4050, paragraph on evapotranspiration: please explain why simulated, actual evapotranspiration is projected to increase although precipitation is projected to clearly decrease during future summers - paragraph on streamflow: It is recommended to first give a comparison between observed and simulated discharge for the reference period (either as a graph or as a table) - It is seen very critical that the model is not able to reflect some properties of the Ilm catchment (the karstic processes), but the direction of change in streamflow through climate change is meant to be given properly. Again, why is the catchment seen as representative for Thuringia as a whole, and why is then the model not able to represent some of the major characteristics of this basin? - p 4053, line 5: 'shows that the predicted climate change will have...': This sounds too strong with regard to the issues discussed in the context of scenarios

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