Hydrology and Earth System Sciences Discussions

Interactive comment on "An ensemble approach to assess hydrological models' contribution to uncertainties in the analysis of climate change impact on water resources" *by* J. A. Velázquez et al.

Anonymous Referee #1

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General appreciation:

Climate change impact investigation on hydrology is typically conducted based on an ensemble approach where different global and/or regional climate models and climate forcing scenarios are considered to address the uncertainty in the future climate projections. In most cases, the impact analysis is based on one hydrological model and the assumption is made that the uncertainty induced by the model is small in comparison with the uncertainty due to the ensemble climate projections. This is, however,

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seldom tested.

The paper therefore presents an interesting analysis on the use of different models with various types of model structures ranging from lumped conceptual to more detailed, spatially semi- and fully distributed hydrological models.

Main comments:

p.7447 lines 17-22: The climate-simulation ensembles considered by the authors are very limited. For both the Quebec and the Bavaria case, only one GCM, one RCM and one emission scenario are considered. This is very limited to draw general conclusions. State-of-the-art climate change impact investigations nowadays make use of a range of GCMs, RCMs and emission scenarios. The climate simulation ensembles in this paper are limited to changes in the initial conditions (five runs for the Quebec case and three runs for the Bavaria case).

p.7448 lines 12-13: it is unclear at which time scale the LOCI scaling method was applied. At daily scale? The models appear to run with daily or hourly time steps (p.7449 line 14).

p.7452 lines 8-14: The Wilcoxon rank sum test assumes independency between the hydrological model results. I assume this independency condition is not met for results obtained by the same model. Can the authors comment on this?

p.7443 lines 11-20: It surprises me that the authors do not mention the influence of the climate forcing (e.g. emission scenarios). They limit the review to the uncertainty in the climate projections due to different GCMs and RCMs.

p.7450 lines 6-20: The hydrological models were not explicitly validated for their performance in describing high and low flows, and their performance in terms of flood or low flow frequency distribution. This is very surprising to me given that the models were applied for studying the impact on high and low flows (indicators HF2 and 7LF2) and because the most interesting/important conclusions drawn from this study are related

to these extreme flow conditions.

If the authors revise their manuscript, better highlighting these and other weak parts of their work, and after meeting the other comments, this paper can in my opinion be considered for publication in HESS.

Other comments:

p.7450 lines 11-12: for the HSAMI model the "sum of squares error" is considered whereas for the HYDROTEL model the "root mean squares error" is considered as objective function for the optimization. Does that make a difference? I assume optimization of the two objective functions leads to the same results given that there is only a scaling factor difference.

p.7450 line 13: That these objective functions favour high flows to the detriment of low flows: I am not convinced of that, because another factor that plays an important role is the autocorrelation: dry spell periods typically have much longer durations than high flow periods; as such the low flows will receive more weight in the objective function. It is not clear whether the "square" in the objective function equation has a stronger effect than the autocorrelation effect.

p.7451 lines 1 & 7: which calibration method is used for the distributions? Does the DVWK approach considers a log Pearson III probability density function for the annual maximum and minimum flows? This is not fully clear from the text.

Minor comments:

p.7442 line 13: change "a reference ... and a future ... periods" to "a reference ... and a future ... period" or to "reference ... and future ... periods". Same comment for p.7445 line 17.

p.7442 lines 24-26: add "rainfall" to the list of variables affected by the uncertainty associated to climate scenarios

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p.7443 line 20 change "GCM" to "GCMs"

p.7443 line 28: I suggest to replace "GCMs" by "GCM runs" or "GCM simulations" because the differences are not only due to different GCMs but also different initializations and climate forcing (emission scenarios)

p.7444 line 5: replace "model" by "models"

p.7444 line 11: replace "China catchment" by "Chinese catchment"

p.7444 lines 18-19: I suggest to replace "the Canadian Regional Climate Model following the IPCC SRES-A2 scenario" by "one RCM run" because also for the other cited references no details were provided on the RCM model or the emission scenario. Why making an exception for this reference?

p.7445 lines 11-12: there is a sudden jump from the cited references to the introduction of the research work by the authors. Please provide a more smooth transition.

p.7446 line 7-8: change "water systems" to "river basins"

p.7446 line 12: change "a managed river systems" to "managed river systems"

p.7446 line 23: change "sits"

p.7449 line 19: "empirical formulation developed by Hydro-Quebec" & "Thornthwaite formulation": please add references

p.7452 line 16: change "model's" to "models"

p.7452 line 22: change "climate models" to "climate model projections"

p.7452 line 24: change "climate simulations" to "climate change signals obtained"

p.7457 line 27: change "model's" to "model"

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