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Hydrology and Earth System Sciences Discussions

Interactive comment on "Climate change and hydrological extremes in Belgian catchments" *by* P. Baguis et al.

P. Baguis et al.

pierre.baguis@oma.be

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We would like first to thank the Referee #3 for his/her detailed comments and constructive suggestions.

The first part of the reply to the referee #1 report addresses the fundamental critique on our methodology and will not be repeated here.

Q: 1. It is not clear, without returning to the TAC paper, how the climate change scenarios used in this paper were constructed. This should be made clear as the method used is very simple and can be clearly explained in a concise way.
A: The description of climate change scenarios used in the paper (page 5042, lines

2-9) will be revised and completed with the description of the quantile perturbation approach.

Q: 2. In the comparison of the baseline and observed flows section - is there any reason why a shorter validation period cannot be used for the Gete? That way you can properly compare the time series and whether the model is able to reproduce the observations correctly. This must be established before it can be used predictively.
A: On page 5040, line 8-11 it is stated that seven years are missing from the Gete observed streamflow series. That's why results in Table 3 include – as described on page 5045, line 19-21 – values calculated with both the complete simulation series and its part that corresponds to the period of observations availability. Thus, the model is compared against the observations on the period of their availability, although simulation data are available for the whole 30-year period. Statistics for both the complete period and the period of observations availability are presented.

Q: 3. The most major flaw in this paper is the use of the very simple delta change method in downscaling the climate change projections from the RCMs. ... Changing the mean only is fatally flawed if you are interested in changes to the extremes: at the least you must show that only the mean changes in the RCM data.
A: See "Response concerning the referees' comment on methodology" found in our reply to the referee 1 report.

Q: 4. Why is gamma used as a distribution to describe the extremes - this is not normal. Gamma is commonly used as a distribution to describe daily rainfall properties – but not it's extremes? I would like to see some objective goodness of fits done and one distribution chosen. Which fitted best to the observations - you cannot tell from your figures.
A: The Gamma distribution (as well as the Pearson type 3 from the same family) is often used in order to describe hydrological extremes (see for example Rao, 2000, and Maidment, 1993 – references in the end of this document). The Gamma distribution was also required for compatibility reasons with other studies in Belgium. Of course

the GEV distribution is in theory a better choice for analyzing extremes. In our case an L-moment test indicated that both the Gamma and the GEV probability distributions are good candidates.

Q: 5. p5047: this study is very limited by the downscaling method is has chosen.
A: In the context of the present study the spatial downscaling is implicitly included in the perturbation of the interpolated observed fields. See also “Response concerning the referees’ comment on methodology” found in our reply to the referee 1 report.

Q: 6. p5050: it is not clear how the different methods are used. How, for example, is the control climate 61-90 produced if you are using the delta change method - surely this is just observations? What are you comparing? - this is not obvious. When you use a "mean" scenario does this just lump all the A2 and B2 emission scenarios together? If so, this is flawed as there are many more A2 than B2? Does this then mean anything?
A: The control climate (interpolated meteorological fields from observations) is used as input in the hydrological model in order to obtain what we call “control simulation”. “Mean” scenario means indeed that all the A2 and B2 simulations are taken into account. This is done at two levels, before and after the hydrological runs as explained in lines 9-14 of page 5050. The goal is to measure the commutativity of these two paths in the calculation of the mean using at the same time the largest possible ensemble. From a physical point of view it would certainly be more meaningful to distinguish between “mean A2” and “mean B2” scenario. But from our previous experience with the PRUDENCE simulations and as far as Belgium is concerned, the B2 precipitation and temperature ensembles look like subsets of the corresponding A2 ensembles. This can be seen even in the figures 6-11 of the article in terms of hydrological results. We will improve this point in a revised version of the article.

Q: 7. p5054/5055: The climate change signal of the RCMs should be discussed – this would be extremely simple to do - especially as you have already calculated the deltas for each month. This is needed to try to explain your results.
8. You need to talk about downscaling methods in your discussion section as this is

critical to your results.
A: The climate change signal has already been used in order to interpret the results (page 5049, line 24 – page 5050, line 1). But we will try to improve on both points in a revised version of the paper.

References

Rao, R.A., Hamed, K.H.: Flood frequency analysis, CRC Press LLC, 350 pages, 2000.
Maidment, D.R.: Handbook of Hydrology, McGraw-Hill Inc., 1993.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 5033, 2010.