

Interactive comment on “A method for low flow estimation at ungauged sites, case study in Wallonia (Belgium)” by M. Grandry et al.

Anonymous Referee #3

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General comments

This paper presents a case study which combines frequency analysis and regression to estimate low flows for different return periods, in order to predict low flows at gauged and ungauged catchments in Wallonia. The method presented in the article is interesting and potentially very useful in low flow forecasting. However, there are parts that need further analysis, clarification and rephrasing. In particular the presented relationship between return period and regression coefficients that is based on 4 points make me wonder if the developed method as it is presented in this article is robust and meaningful.

Specific comments

Abstract

The abstract needs to become more concise and clear. Gap in knowledge and the goals/objective of the study do not become clear. The last sentence (11584, L19) is somehow unlinked to the rest of the abstract and should come before the final conclusion.

Introduction

The introduction needs some revision concerning structure and manipulative use of language. It is generally good to use the introduction as a “funnel” from a general issue to your specific field of interest. Hence, I would suggest introducing first the importance of knowing about low flow, and then come to what is your definition of low flow (MAM7). This can be nicely linked with the detailed interests of water management that you state in (11585, L3 – L11). Following your low flow definition using the MAM7, I would like to see a statement on why this is an extreme event (is it necessarily?) It is nice to see the review of studies that used different distributions (11585, L19 – L23). I miss here the further information of who did what. What are all the “possible techniques” in (111585, L24), please name them. 111585, L25/26: Do you have another argument than “the most widely used” for settling your study at the “regional regression approach”? Or can you state other reasons why you do not use another possible technique? 11586, L9 – L24: The way you formulate the review of studies closer to what you did in your study sounds manipulative (abundant use of “only”) and the concluding sentence (L23/24) strengthens this impression. It is clear that your intention is to place your own work and to show the existing research gap. I would be more careful in the formulation, though. This means remove the “only” (it is in most if not all parts possible. By naming what each study did and concluding that the combination of temporal and spatial was not often considered in the extend you planned, I guess the research gap becomes clear enough without sounding manipulative (which makes people wonder about the value of your own study).

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Material and methods

Generally I like the structure of this section that offers clarity and has a logical order. 11594/11595: Please, make your equations readable. “Area” e.g. could be read as 4 variables “A”, “r”, “e” and “a”. From the first look it is not clear that 10 is a multiplier and not part of the variable “AREA” that you chose.

11587, L12/13: Could you state which human influences are smoothed out? Did you see this effect with your data?

11589, L21 – 11590 L1: It would make it easier to read if you put the variables in a table instead of the continuous text.

11589, L26: I don’t know the soils of the hydrological groups. Please either refer to an article that describes the types of soils or state briefly what the main characteristics (especially regarding low flow processes) of A, B, C and D are.

11590, L8/9: On which equations does this model estimate P_e and PET? Please state.

11590, L10: Please, state briefly on what this method is based and where you had to adapt the method for Wallonia. This should logically follow the recession part in 11590, L5, please move up

11592, equation (2): Please state briefly what the adjustment is adjusting. What does it do effectively?

Results

Logic order ok. The results and especially the resulting relationship between return period and regression coefficients that is based on 4 points and could potentially change with a calibration based on an extended data set make me wonder if the developed method as presented is robust and meaningful.

11593, L7 – L23: Please indicate with numbers what you mean by “less precipitation”, “higher temperatures”, “good infiltration capacity”, “relatively low permeability”, “rather

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forested”, “not much urbanized” etc.

11595, L7: After showing the final equations of the regression methods it would be nice to see some comparing summary of which variables matter for which regression method. E.g. with the stepwise method the soil does not matter but with the other methods it does.

11595, L20: “the stepwise method minimizes the collinearity between variables” could you confirm this with your results (Did e.g. the VIFs change)?

11596, L8ff: The lack of calibration for extremes. . . isn’t the motivation of the study exactly those extremes (especially low flows)? Wouldn’t it be crucial for this purpose to reach a good/better calibration? I hence, would suggest trying to redo the calibration and to better include the extreme values. See also Anonymous referee #2.

11596, L12: “Fig. 3 shows that the constant and regression coefficients are linked to the return period by a logarithmic relationship. It is therefore possible to calculate AM7_T for any return period T with this formula“ The mentioned relationship is based on four points that with a different calibration maybe better suited to meet the extremes could look very different. Thus I find the statement to be able to calculate AM7_T for any return period a bit venturous.

11603, L9: I would disagree that the “method is very complete” because uncertainties of the model and sensitivity of the catchments is not considered. I would ask how robust the method really is and I do not see this question answered or even addressed in your paper. It would be good to see how uncertain your estimates are and these uncertainties could then be evaluated with other methods to see whether it is worthwhile to use your method or not.

Discussion/Conclusion

After the discussion the use of this new method compared to others (which?) does not become clear. Is it something more/better than “novel”? Uncertainty and sensitivity

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would be valuable attributes to the method but the two terms are barely discussed nor used to advertise the use of the presented new method.

Technical corrections

Reference missing for “Schwarz method” (11588, L27); “Wards algorithm” (11590, L18); Mallow coefficient (11591, L 11)

11589, L15: Clear reference to HYFRAN (some documentation, manual or similar?)

11584, L22: “depending of authors” -> depending on the definitions of authors

11585: “by numbers of scientists” -> by a number of scientists, by numerous scientists; “such as” -> as e.g.

11586, L3: “USA but only. . .” ->Break sentence: “USA. However . . .”

11586, L4: “temporal”, “spatial” remove quotes, remove the brackets in the sentence and merge the content of the brackets in the sentence

115787, L12: “Doing the average” -> Averaging

11587, L16: “Out of these stations, we selected those which fulfilled several criteria” -> From those, we selected the stations that fulfilled following criteria

11588, L4: “Fifty-nine gauging stations were eventually selected.” -> Finally, 59 gauging stations were selected.

11588, L7: -> The Data

11589, L14: “This selection” -> The selection

11589, L19: “admitted” -> acknowledged, accepted, . . .

11590, L21: Drop “indeed”

11590, L24: Drop, “Then”

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11591, L2: “catchment area is “ -> the catchment area was

11592, L15: “fits” -> fitted

11593, L2: “gave” -> “resulted in“

11593, L4: helped to understand; “it can be seen “ -> shown

11593, L7: the North

11597, L7: stepwise what? Word is missing. Or drop “by”

11598, L5: “on” -> in

11600, L1: “These two features are linked to geology: the more permeable the substratum is, the higher percolation is and the lower the recession coefficient is.”-> These two features are linked to geology: the more permeable the substratum is, the higher is the percolation and the lower the recession coefficient.”

11600, L27: “give” -> resulted in

Don't start sentences with “And”: 11585, L9; 11600, L14

Use a comma before "but" as a conjunction: 11585, L25; 11589, L3; 11595, L23; 11598, L6; 11601, L5

11607: columns T5, T10 and T20 are mixed up and the numbers of “Max R2 improv.” You write in the text that the maximum R2 improvement and the adjusted R2 resulted in the same final equations, but the table should be readable by itself.

11609: dots in a) are too small

11611: Do you base the logarithmic relationship on 4 points only?

11612: Labels too small, dots could be bigger as well

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