Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-737-RC2, 2018

Hydrology and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "Comparing hydrological modelling, linear and multilevel regression approaches for predicting baseflow index for 596 catchments across Australia" *by* Junlong Zhang et al.

Anonymous Referee #2

Received and published: 17 April 2018

Summary:

This study compares two hydrologic models to two regression approaches for estimating base flow index (BFI) index at a large number of catchments across different climatic regions in Australia. The benchmark BFI is the mean of four recession flow approaches to estimating BFI. The study focuses on the important topic of estimating BFI at ungaged sites and provides a contribution to the literature in introducing a new approach to BFI estimationâĂŤmulti-level regression approaches, which are common in other fields but less often applied in hydrology.

Printer-friendly version

Discussion paper

General comments:

The manuscript is has appealing and informative figures and includes a thoughtful cross validation of the approaches. My first main comment is that the clarity and presentation could be improved, both in terms of the writing and language of the paper, as well as the comparisons between models. More explanation for which comparisons are made and why, as well as some general editing would help make the study more clear (see specific comments for some suggestions). One important language clarification is the use of “cross-level interactions”. It does not seem that interactions are used in the regression models based on the equations and I suspect this is a terminology issue. Perhaps “correlation” is a more appropriate term?

Clarification of the motivation between the approach for comparing the hydrologic and regression models would be helpful. Based on figure 5, it appears that the hydrologic models selected were not at all useful for predicting BFI. Are these models frequently used for this estimation of BFI? If not, might there be more appropriate models to provide a comparison to the regression approaches? Also, it would be good to introduce BFI duration curves before showing them as a way to compare approaches in Figure 4. I also wondered why the multilevel regression wasn’t included in Figure 4. It would be helpful to the reader also to have figure 5 to match the structure of Figures 6 and 7.

Next, in the comparison of traditional to multi-level regression models, it would be helpful to directly state more explicitly that the approach from equation (1) isn’t used in the comparison in the study. (Though it might be worth doing that just to see it as a comparison, especially given the similarity of the regional coefficients shown in figure 8?) It was surprising that, for the multi-level model, NSE and bias was almost identical in the leave-one-out cross validation as when the model was fit for the whole set of catchments. Can you provide some possible explanations for this, especially given the large degradation for the traditional model?

My second main comment is regarding the development of the regression questions.

Printer-friendly version

Discussion paper

How were these models fit? It was interesting, as noted in the paper, that a number of the parameters appear very close to zero (Figure 8). Did you check to see if the variables included in the regression were statistically significant? In the discussion it is noted that "P and ETP have the most significant effects on BFI" but was this was not reported in the results.

It would be a good idea to check that regression assumptions (normality, constant variance and independence of model residuals) are met for both models and report how well these assumptions are met. Also checking for influential observations could be good. It seems as though a few outliers in the traditional regression might have a lot of influence and be related to the reduced performance for these models.

Finally, it might be helpful to add a table comparing NSE and bias for the regression approaches across regions and for full sample vs leave-one-out cross validation (to make it easier than trying to compare across the figures). Also, calculation of % bias relative to the BFI index could provide useful context for what the bias reflects relative to the value of BFI itself.

Specific comments:

Title: Possible to make it more informative?

Abstract: Line 37-39 "Our study indicates the multilevel regression approach should be used for predicting large-scale baseflow index such as Australian continent where sufficient catchment predictors are available." The word "should" makes it a very strong statement. It might be best to tone it down some, such as: "could improve upon predictions of large-scale baseflow index compared to the other methods studied"

Line 43-47 These are very helpful. Maybe add in more of the information to the abstract?

Line 51: "important indicator of catchment hydrogeological characteristic" a bit unclear. Removing "important indicator of" might make it more clear: "catchment hydrogeologi-

cal characteristic".

Line 71: where do ensembles come in? "ensemble estimates from the non-tracer methods at gauged catchments"

Line 81: probably "literature" rather than "literatures"

Line 84: A little confused about the ensemble piece and the non-tracer designation

Line 111 "studies" rather than "literatures"

Line 118: remove the word "the"

Line 131 Grammar: "There are 596 catchments selected across Australia for assessing the three methods"

Line 191: More detail here about how "Figure 2 demonstrates how the recession constant is estimated" would be helpful.

Line 192: perhaps "empirical BFI" or "benchmark BFI" would be more appropriate as it is not an observed quantity

Line 194-195: "either to evaluate the two hydrological models for BFI prediction, or to build" I think you mean to both evaluate and to build?

Line 231: missing the word "of"

Line 234: "slope", "X represents the"

Line 239 confusing "one level reflects hydrological background should be introduced"

Line 252 define n; do you mean i here? "j is catchment in each climate zone"

Line 294: more details about how leave-one-out cross validation works would be helpful (ie, one of the catchments was omitted from fitting of the regressions and then those models used to predict at that catchment, as if the catchment was ungaged"

Line 315: might be good to add what a NSE of 0 means or that below 0 indicates that

the mean value would provide a better prediction

Line 380 Grammar “large biases to use hydrological models”

Line 387 Fragment. “This suggests that better estimate streamflow.”

Line 402 Grammar “As studies by Santhi et al. (2008) and PenÌČa-Arancibia et al. (2010), they”

Line 436 What does this mean? The models don’t have interaction terms so this is somewhat confusing. “When interactions crossing level have been implemented, adding those two factors can greatly improve performance of multilevel regression approach.”

Figure 9 appears to be missing

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-737, 2017.