Hydrol. Earth Syst. Sci. Discuss., 8, C2990–C2993, 2011
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Hydrology and Earth System Sciences Discussions

Interactive comment on "Estimation of baseflow parameters of variable infiltration capacity model with soil and topography properties for predictions in ungauged basins" *by* Z. Bao et al.

J. Seibert (Referee)

jan.seibert@geo.uzh.ch

Received and published: 22 July 2011

This manuscript addresses the question on how to estimate at least some of the parameters of a conceptual model using other approaches than calibration against runoff. While this is an important issue and certainly worth studying, I have to admit that I have some serious concerns with the manuscript in its current form.

How are physical characteristics estimated at the grid scale?

As I understand one grid cell is about 30 x 30 km2. How do you get values for Ksat and other soil characteristics at this scale? Several previous studies have shown that

measured point values do not agree with effective values at larger scales. Therefore I would argue that the model parameter values you estimate at best might be indicative, but not really physically based. Furthermore, the average subgrid slope seems, at this scale, a poor proxy for the hydraulic gradient (note also that the subgrid slope depends largely on the resolution of the DEM being used!). Please describe in more detail which data sources were used and how as well as discuss the limitations.

Equation 8 is not correct

While the units might look ok, I do not think the equation is correct. In the Darcy law you need to multiply by the area through which the flow occurs. This should here be the width of a grid cell multiplied by the depth of the saturated zone (i.e. area in the xz-direction). The reason Dm has the unit length per time, as the right side of the equation has, is that the water flow is seen over the area of the grid cell in xy directions.

Test of model performance

Given that there is a considerable equifinality it is not surprising that model performances are about the same when the three less sensitive parameters were not calibrated but fixed before the calibration. This is because you can find good fits all over the parameter space. It is also expectable that parameter uncertainties decrease once you have fixed some parameters. The interesting question is more whether fixing these parameter values in the way presented here is any better than fixing the values to other values. This could be addressed by using some average values for all 24 catchments (=1 test) and/or using parameter values derived for another (i.e., wrong) catchment (=23 tests). It would also be interesting to see whether the parameter sets which partly have been derived based on other data than runoff would perform better or worse during conditions outside the calibration conditions (see Seibert, 2003).

Minor comments:

I find the structure of the manuscript rather confusing. Some of the methods are men-

tioned first in the result section and a discussion section is missing. In the end I would prefer conclusions rather than a summary. The manuscript would also benefit from improving the language.

The Mnc criteria (Eq 6) is a suitable approach to ensure a better fit in terms of the water balance than using just Nash-Sutcliffe. However, I wonder whether the volume error does not become to dominating. It certainly does if Re is used as defined in Eq 5 (multiplied by 100%), but even otherwise. Lindström et al. found a weighing factor of 0.1 to provide best results.

Several times the term sub-catchments is used. As (most or even all?) of the catchments are not nested I would recommend to just use catchment Please provide the units of all variables and parameters used in the manuscript. This is not the case at the moment.

P 7023, 19. Please provide rather a real reference than a website link

What do you mean by 'bulk water'? (p7025, 19)

In Eq 9 W is used with different subscripts and the different W have different units, which is confusing.

P 7029, 21/22. Do not provide too many digits.

Table 1: for three parameters for the unit N/A is written, should be [-]

Figure 11: What is the unit on the y-axis

Lindström, G., B. Johansson, M. Persson, M. Gardelin, and S. Bergström. 1997. Development and test of the distributed HBV-96 hydrological model. Journal of Hydrology 201(1-4):272-288.

Seibert, J., 2003. Reliability of model predictions outside calibration conditions, Nordic Hydrology, 34: 477-492.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 7017, 2011.