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Hydrology and Earth System Sciences Discussions

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Interactive Comment

Interactive comment on "Assessing rating-curve uncertainty and its effects on hydraulic model calibration" *by* A. Domeneghetti et al.

A. Domeneghetti et al.

alessio.domeneghetti@unibo.it

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We are very grateful to F. Dottori for his positive judgment about our work and also for the accurate and appropriate suggestions aimed to improve the quality of the paper. The authors' reply is structured as follows, we report all referee's comments (indicated by RC) together with our reply (denoted by AC, Authors' Comment).

RC:

1) Introduction: among the already mentioned uncertainty sources, the authors should also include the presence of unsteady flow conditions.

AC:

The Reviewer#2 is right, the impact of unsteady flow conditions was mentioned only briefly at page 10503, line 25. The presence and the importance of it will be highlighted further in the revised version of the manuscript.

RC:

2) Section 2.2: Di Baldassarre and Claps (2011) stated that hydraulic calibration is generally affected by uncertainty, given that roughness can vary according to flow conditions. Therefore, the use of low and medium discharge values to calibrate the 1D model for maximum discharge estimation could introduce a further relevant source of uncertainty in the rating curve. I think the authors should include such general consideration when presenting the constrained approach, although in this case the method indeed reduced overall uncertainty.

AC:

We agree with the Reviewer#2. The uncertainty related to the application of a model in flow conditions which are different respect the one used for its calibration could be considerable and should not be neglected. This point is also Reviewer#1's main concern, and we addressed it in our reply to Reviewer#1's main remark.

RC:

3)Discussion: as mentioned at point 2, the results in Figure 5 suggest that the uncertainty associated to the calibration of the 1D model is not so marked. Could the authors provide some explanation about this overall reduction of uncertainty? A possible reason could be that the use of hydraulic simulation data allows to take into account the cross section geometry at higher flows; on the contrary, such information is not retained when a standard extrapolation of the low flow rating curve is performed, thus increasing uncertainty. Similar considerations can be also found in Dottori et al. (2009,page 15).

AC:

This is a very good point and we totally agree with Reviewer#2 on his interpretation

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of the results (uncertainty controlled by explicitly taking geometry of riverbed into account). Also referring to high-flow conditions (and therefore range of flows for which Manning values do not vary, see previous point and Reviewer#1's main remark) reduces further the overall uncertainty. These considerations will be reported in the new version of the manuscript.

RC:

4) Conclusions: Despite the good results provided by the constrained approach, I think that the authors should clearly point out that the method is still relying on the steady state assumption. In particular, in Figures 6 and 7 both the standard and constrained approaches are evaluated referring to the optimal steady flow rating curve; a comparison against the "real" meaurements originated by unsteady flow simulation could be useful. Altohugh in this case the optimal rating curve seems to fit well the "observations" (that is, results coming from the 2D model), in other cases the error deriving from steady state assumptiom could be significant (Di Baldassarre and Montanari, 2009).As a result, the proposed method can reduce some, but not all, sources of errors related to the use of steady flow rating curves.

AC:

Figure 6 shows the bias of traditional and constrained median rating-curve relative to the “optimal” (or “normal”, as per Reviewer#1 suggestion) rating-curve, which provides the best possible steady state representation (i.e. a one-to-one relationship, blue line in Figs. 4 and 5) of unsteady flow conditions (grey dots in Figs 4 and 5). As suggested by Reviewer#2, the comparison of results of both approaches against the “real” measurements originated by unsteady flow simulations is already provided in Figure 5 (see blue line and grey dots). Reviewer's comment may arise from a lack of clarity in the manuscript, which will be revised accordingly. A clearer explanation of figures will also be included.

RC:

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Discussion Paper

Typo: p.10511 line 22 (Pontelagoscuro).

AC:

We will correct the text as suggested.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 10501, 2011.