Dear Editor Albrecht Weerts,

Thank you for sending me the revised manuscript "Calibrating 1D hydrodynamic river models in the absence of cross-sectional geometry [...]" by Liguang Jiang et al. for review. The authors have responded to my comments in detail and improved their manuscript accordingly. They suggest easing hydrodynamic model calibration through a reparametrization of the SWE. The authors seem to have experience in model calibration and they demonstrate their method on hand of a suitable dataset. The method is mostly an incremental improvement on existing ones, though the approach contains several interesting details, such as the regularization approach, which will be insightful for the readers of HESS. It is in particular insightful to see that hydrodynamic models can be reliably calibrated with remotely sensed channel-width alone, i.e. without reference depth, which is of importance for modelling ungauged basins.

While I commend the manuscript, its language should be thoroughly revised before publication. I provide an extensive list of suggestions below. It would be considerate when the Danish co-authors supported the first author with that respect before submitting future manuscripts.

Kind regards,

Reviewer

Minor

Structure: I recommend moving subsection 3.3 "Parameter calibration" forward at the end of section 2, as it is part of the methodology.

Appendix A: It is nice to see the parameter relations worked out. It would be insightful to show how the physical parameters are related, and thus could be recovered, from the calibration parameters. For example $\alpha = \log(w/d_0)$, where d_0 is a reference depth and $1 < \beta < 2$, which are the limits for a rectangular and triangular cross-sections. Similar simple relations exist for K. This is will be helpful for choosing suitable start values for the optimization and verifying the result.

Code and data availability: It would be considerate if the authors made their code publicly available so that others can easily apply the method in their studies.

Suggested clarifications

85 "two variables (Q and d) and three parameters (A, S_0, and S_f)"
→ Two variables (Q and d) and three unknown values (A, S_f and S_0), which are functions of further parameters as specified below.

95 "K(d) is much more sensitive than A(d)."
→ The calibration is much more sensitive to K than to A.

150 "parameters [...] in addition to bed slope S_0 (calculated from Z_0)"
→ "parameters [...] in addition to the bed level Z_0, from which the bed slope S_0 is calculated."

184 Some more information would be insightful here. Are the cross-sections of the hydrological model, or of the validation data? If they are of the model, are the parameters linearly interpolated between the sections? In which interval are the cross-sections placed?

215 Insert the missing sum signs in front of the brackets which are squared.

215 Is the value later reported as RMSE the "misfit" or only the standard deviation between the 10 calibration runs?

238-243 We use the LM: algorithm [...] to optimize the objective function.
→ We iteratively optimize the objective function (equation. 17) with the Levenberg-Marquardt (LM) algorithm (Marquardt, 1963) combined with Broyden's rank-one update to approximate the Jacobian (Broyden, 1965, Madsen et al. 2004). We use an implementation of the method provided by the Immoptibox toolbox (Nielsen and Völcker, 2010).

Suggested textual improvements

- All equations: End with dot or comma, as the equations are part of the sentence.

13 Scarcity/inaccessibility → Scarcity and inaccessibility

14 geometry has commonly been approximated using → geometry is commonly approximated by

15 Simultaneous [...] → Some explanation is missing before this sentence. For example: Hydrological model calibration requires both the determination of parameters for roughness and cross-section geometry.

18 ,20 power-law functions → power-laws

19 remove "and they are found to be linearly [...]", this is already implied by the power-law and thus an unnecessary tautology

30 has been → is

34 different → multiple

36 require detailed → require a detailed

37 by cross-sectional → by a cross-sectional

37 surveyed [...] geometry → the surveyed geometry

39 problem facing the scientific community → problem which the scientific community faces

38 used a uniform shape ... → used a cross-section geometry which did not vary along the channel.

55 Here → Here,

58 to simulate → for simulating

60 morphology → roughness

61 When calibrating [...] → Parameters of channel geometry and roughness are highly correlated during calibration.

63 will be effective, not only representing → effectively represent

64 compensating → compensate

72 remove "as observations"

80 (2) $S_f \to S_f(d)$

84 is chainage, i.e. the distance → is the distance

85 To effect solution → to solve for

86 bathymetry → the bathymetry

86 Friction slope → The friction slope

98 provide → are

105 power function relationships → power-laws

110 $Z \to Z_0$

115 different → several

115 having a wide range of river width (three orders of magnitude). The width ranges between the rivers over three orders of magnitude.

118 remove ”readily”

121 power-law function → power-law

122 ,123,124 Manning’s number → Manning’s coefficient

165 and representative of large rivers worldwide. → one of the largest rivers in the world.

169 two rivers merge into one, called Songhua → two tributaries merge to form the Songhua River

170 emptying → draining

171 remove ”main”

172 The reason we selected this reach is twofold → The reasons why we selected this reach are twofold:

175 drains → flows

176 at downstream → at the downstream end

183 set → set up

184 Daily → The daily

190 remove ”new”

191 entirely different → unique

195 derived → extracted

196 to avoid → avoiding

230 uncertainty → root mean square error?

268 log depth → log Depth

273 small depth → small depths

291 very wide range of RMSE → very large RMSE?

297 WSE → the WSE

298 RMSE → The RMSE

381 which is not new [. . .] → which goes back to Chow 1959.

383 and the relationship is generally independent of rivers → and applicable for a wide range of rivers.

385 no explicit consideration of roughness and channel geometry are needed to solve for WSE → the channel geometry and roughness do not have to be explicitly known to determine the WSE.

387 WSE → the WSE

387 remove the qualifier "fairly"

388 By referring [. . .] → Our method performs comparably to existing ones which use conventional parametrization and calibration approaches.

389 this approach → our approach

396 we can get → we get

405 Taking log transformation → Taking the logarithm

405 that leaves → we have