Hydrol. Earth Syst. Sci. Discuss., 5, S751–S754, 2008
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Hydrology and Earth System Sciences Discussions

Interactive comment on "Robust estimation of hydrological model parameters" *by* A. Bárdossy and S. K. Singh

Anonymous Referee #1

Received and published: 23 July 2008

General comments:

The article presents the use of geometrical depth to characterize parameter vectors that can yield good model performances. After explaining the concepts, an application is shown on a few catchments in Germany. The article is generally clear and well-written. It is of acceptable length. The article could be published after minor revision (see detailed comments below).

Specific comments:

1. p.1643, line 18: Clarify what you mean by "well-structured". Is this structure not determined by the mathematical formulation of the model and the possible interactions between parameters?

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2. p. 1644, line 10: high model parameter sensitivity is generally thought as a desirable property: one wishes sensitive parameters as the corresponding optimum is generally well defined. Insensitive parameters create flat areas in the response hypersurface and problems of identifiability. Please further explain what you mean.

3. p. 1646, lines 10 and 11: give the meaning of parameters and variables used in Eqs. (1) and (2)

4. p. 1646, line 21: it is probably PWP that is the limit for evapotranspiration decrease rather than SM/PWP

5. p. 1647: at the end of section 2.2, please indicate the total number of free parameters used in this application. A table could be introduced summarizing the typical range of variation for each of them.

6. p. 1648, line 13: please indicate what you mean by "erratic" objective function

7. p. 1648, lines23-25: the assumption of random and independent errors in flow data is quite unlikely. Generally errors on flow data are auto-correlated and systematic on some periods. Please comment on this in the text.

8. p. 1649, line 1: which algorithm was used to maximize the Nash-Sutcliffe objective function?

9. p. 1649, line 3: it is difficult to say whether the scatter is "considerable" from the graph. The values do not change by 50%. How this scatter compares to the possible parameter ranges? Please also indicate the values of parameters (and corresponding performance) obtained when there is no data corruption. This could be used as a reference to which the scatter could be compared (is the scatter more than 10% of the reference value?)

10. p. 1650, line 16: which are the nine parameters considered here? (see also comment #5)

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11. p. 1650, line 17: what are the "reasonable limits"? (see also comment #5)

12. p. 1651, line 26: is the assumption of continuity of the objective function realistic? The work by S. Sorooshian in the 1980s showed that for some models, discontinuities in the hypersurface could happen due to the model formulation itself. Please comment on this aspect.

13. p. 1652, section 4.2: the apparent stability of parameters from one period to another may simply come from the fact that periods are quite long (10 years) and therefore are likely to be quite similar in terms of hydro-climatic characteristics. Please add the characteristics of the periods (mean rainfall and flow for example), and discuss this point while commenting result stability.

14. p. 1657, lines 9-10: The proposed algorithm still requires flow observations to estimate model parameters. Please further explain how it could be useful in the case of ungauged catchments.

15. p. 1660, Table 1: Giving mean annual precipitation with two decimals is excessive. Mean discharge could also be provided in mm/y, so the reader can have a quick idea of mean catchment yield

16. p.1661 and 1662, Tables 2 and 3: The performance of the parameter set without perturbation could be added as a reference

17. p. 1667, Fig. 2: The (k0,k1) parameter set corresponding to the optimization with uncorrupted data could be added.

Typo:

p.1642 l.4 write: "gives a unique" instead of: "gives an unique"

p.1643 l.15 write: "value" instead of: "values"

p.1643 l.16 write: "a parameter vector" instead of: "a parameter vectors"

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p.1643 l.24 write: "although" instead of: "Although"

p.1644 l.24 write: "control by Liu (1995) and Hamurkaroglu et al. (2004)." instead of: "control Liu (1995) Hamurkaroglu et al. (2004)."

p.1645 l.17 write: "238 m a.s.l to 1010 m a.s.l" instead of: "238 m m.a.s.l to 1010 m m.a.s.l"

p.1646 l.2 write: "early 1970s. It has been" instead of: "early 1970's has been"

p.1647 l.22 write: "of model parameters" instead of: "of a model's parameters"

p.1648 l.28 write: "higher than this" instead of: "higher then this"

p.1649 l.13 write: "Tables 2 and 3 show" instead of: "Tables 2 and 3 shows"

p.1649 l.15 write: "with more than two parameters" instead of: "with $>$2 parameters"
p.1653 l.4 write: "(with depth $>$ 5) for" instead of: "(with depth $>$ 5 for"

p.1656 l.6 write: "may not necessarily be the case" instead of: "may not necessarily the case"

p.1660 Table 1 write: "Slope" instead of: "Slop"

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