

Interactive comment on “Is the groundwater reservoir linear? Learning from data in hydrological modelling” by F. Fenicia et al.

F. Fenicia et al.

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Referee 1 in the general comment section of his review, clearly summarizes the intentions of our paper. In the revised version we tried to emphasize those intentions, hoping that they will become clearer for the readers.

Detailed answers to the comments of the reviewer explaining the modifications to the paper are included below.

- Section 1 and 2 should be combined and shortened, the discussion was not adequately referenced

Section 1 has been rewritten, section 2 eliminated, the discussion has been rewritten and better referenced.

- The discussion regarding top down and bottom up methodologies should be improved

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We give some more references for this definition. In the introduction and conclusion sections we explain that the top down aspect of this study lies in the fact that we infer the behaviour of the groundwater reservoir of a conceptual model from discharge data. We make it clear that we are demonstrating an iterative process of model improvement.

- The methodology chosen should be contrasted with those already published. For example is the methodology used really “top-down” compared to that used in the derivation of Data Based Mechanistic (DBM) models [1, 2] or more of an iterative process of model improvement [3, 4].

We thank for the references to other works. The methodology is in fact more an iterative process of model improvement, and we made this point explicit in the new version, especially in the abstract and introduction sections. However, we still think we can state that the methodology follows a “top-down” approach, at least with respect to the determination of the storage-discharge relation for the model reservoir.

- The MACS should be referenced

In section 1 (introduction) and in section 4 (calibration of low flows) and in section 4.3 (calibration of high flows) we now reference to this procedure, which was in fact what we followed.

- The final storage-discharge relation is dependent on the model structure used.

We made this point more explicit throughout the paper, and in particular in section 4.4 (Recalculation of the storage-discharge relation) in the discussion section (Section 7).

- The derivation of the MRC should be improved, particularly when the input to the slow reacting reservoir is included

The derivation of the MRC is well described in the paper of Lamb and Beven that we reference in the paper; however, we added more details. The description of the calculation of the storage-discharge relation from the MRC has been improved, in particular when the input to the slow reacting reservoir is included.

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- The sensitivity of the MRC to the selection of an appropriate time period requires comments

We added comments to it in section 4.1. In the case of our paper, this relation did not appear to be very sensitive to variations of the selected time period. Also Lamb and Beven conclude the same in their work.

- The method used for fitting the storage-discharge relation requires comments

We added comments in Section 4.2 (Initial estimate of the storage-discharge relation). We explain that the choice of an appropriate trend line is a subjective assessment, and can be regarded as the choice of a particular model to represent the groundwater reservoir.

- No comment is made about how the iterative procedure affects the hydrograph

Figures 6 and 8 are supposed to show the effect of the iterative procedure on flow recession

- A simple graphical presentation of the respective contribution to flow from the slow and fast reservoirs would clarify the situation

We added a figure showing the relative contributions of the reservoirs

- Comments regarding section 8

Section 8 has been completely rewritten, also keeping in mind the suggestions of those comments.

- The conclusion (Section 9) does not offer anything further to the paper, such as suggestions for further work

The conclusion session has been rewritten, taking into account the suggestions of the comments.

- The length of three years appears short

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See comments to referee 2

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 1717, 2005.

HESSD

2, S1025–S1028, 2005

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