

Interactive comment on “Anomaly in the rainfall-runoff behaviour of the Meuse catchment. Climate, land use, or land use management?” by F. Fenicia et al.

Anonymous Referee #1

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General comments

- This paper deals with the attribution of changes in hydrological behaviour of a middle-sized river basin in Belgium and France. This is done by dynamically calibrating time-varying parameters of a hydrological model and subsequently relating these calibrated parameter values to changes in hydrological behaviour. The paper is well written and structured and within the scope of HESS. The approach is interesting and possibly novel and can be useful for other attribution studies and for other study areas. However, the authors are sometimes too definitive and speculative in their conclusions and moreover some assumptions and data are not well founded. More general comments,

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specific comments and some technical comments are given below.

- The authors only focus on the Meuse basin and do not relate their work to other studies on attribution of trends/ fluctuations/ anomalies in discharges in other river basins. It would be great if the authors can refer to similar studies in other river basins in the Introduction and discuss their results in the context of these studies as well in the Discussion.

- The model description is not very clear. For instance; what is the temporal scale of the model? What is the time period? What is the spatial scale? Did the authors use a lumped model or a semi-distributed approach? Which discharge stations have been used in the DYNIA approach and is the number stations consistent with the spatial scale of the model? How are observed land use changes (e.g. from deciduous to coniferous forest) included in the model? Has any validation been done?

- Most important general comment is the attribution of changes in the hydrological response of the Meuse basin (the aim of the paper). The authors claim (see e.g. p. 1805, l. 4-6 and also the title) that both land use changes and changes in land management are likely causes of observed changes in the hydrological behaviour of the basin. Changes in land management (through ages of trees) have been investigated in some way although indirectly through the relation between calibrated parameters (with some very general objective function) and the discharge. Land use changes seem not to be included at all. Also changes in the hydrological response is a very relative term; changes with respect to what?

Specific comments

Abstract

- p. 1788, l. 2-4: These sentences suggest that the authors have done these simulations, what does not seem to be the case. Please reformulate.

Introduction

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- p. 1789, l. 12-18: Obviously, the causes of the extremity of these floods can also be a combination of these three groups.

- p. 1789, l. 26: Tu Min et al. looked at the flood peaks while others and also this study look at the hydrological behaviour in general. Please take these points into account when comparing and discussing different studies (for the same basin).

- p. 1790, l. 14-17: Which period did Ashagrie et al. use for calibration? The last 30 years? In that case it is logical that the period 1969-present is well simulated and it might be a coincidence that the period 1933-1968 is underestimated and the period 1911-1932 is relatively well simulated. It would be instructive to repeat the study of Ashagrie et al. by calibrating on other periods (also 1933-1968) and see the performance of the HBV model for the remaining periods. Is 1933-1968 overestimated or are other periods underestimated?

- p. 1791, l. 4 and further: The use of the term evaporation is a bit confusing throughout the paper. Does this term include transpiration by plants as well or is this process excluded (and not in the 41 %)? Another example where these terms seem to be mixed are lines 8-11 on page 1792.

- p. 1791, l. 23-26: What about the trend of the average age of trees in the Meuse basin upstream of Borgharen (not in the Netherlands)? Can you transfer the results from the Netherlands to Belgium and France?

- p. 1792, l1-6: Figure 3 is not really necessary in this paper, the authors may refer to it. Moreover, what is the meaning of mean annual water yield in this figure?

Study area and data description

- p. 1794, l. 13-16: What are the time period(s) and time step(s) of these hydrological and meteorological data?

- p. 1795, l. 4-6: Where is De Bilt in Figure 1? It is located far outside the Meuse basin? This is a weak point of the paper. The authors should clearly indicate and quantitatively

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show that the (meteorological) time series of De Bilt can be used as a substitute for the time series of stations within the Meuse basin upstream of Borgharen.

Methodology

- p. 1797, l. 1-2: Please explain clearly what is meant by a fully top-down approach?
- p. 1797, l. 26: What is the unit of I_{max} and I_{min} ?
- p. 1798, l. 4-5: What is the meaning of this sentence?
- p. 1799, l. 15-18: Please explain the rescaling more clearly.

Results

- p. 1800, l. 2-4: Which criteria have been used when determining the feasible ranges of parameters? Also provide a reference for the previous exploration.
- p. 1801, l. 1-3: What is the reason of choosing these 5 and 2 parameters to vary? Is this choice based on a sensitivity analysis? And how are the constant values of the other 5 and 8 parameters determined?
- p. 1801, l. 17: Why is it not very likely that these parameters changed over time? Please discuss, see also p. 1802, l. 7-8.

Discussion

- p. 1803, l. 11-16: Matching the trend of a parameter related to 35 % of the land use in a river basin with the hydrological response of that river basin (including quite distinct sub-basins, see the study area and data description) is very hypothetical and should be done with more care here.

Technical corrections

- p. 1788, l. 3: overestimation instead of underestimation
- p. 1789, l. 27-28: What is the definition of antecedent precipitation depth here?

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- p. 1791, l. 5: Which period has been used to calculate the number of 41 %?
- p. 1794, l. 16: from instead of form
- p. 1804, l. 11: or instead of of?

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