

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 #2

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General comments

This paper provides interesting insights into an anomaly between rainfall and runoff in the Meuse basin between 1930 and 1965 and is firmly within HESS's scope. However, the paper needs several clarifications and improvements. To account for the anomaly between observed and predicted runoff (identified by Ashagrie and al., 2006), and in the absence of substantial historical data, the authors have used a "top-down" approach which specifies various parameters value for the FLEX model and most interestingly, tests the explanatory power of the age of forests on runoff decrease. The paper reaches the following conclusions: 1) The age of forests - a consequence of

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forest management practices - could be the main driving factor behind the lower than expected runoff, since younger forests tend to decrease runoff more than older ones. This is opposed to the prevailing theory that makes climate variations the main factor of runoff variations in the Meuse basin. 2) Accordingly, it is not so much land cover changes (in nature or surface) as land cover management (and especially forest management) that would explain the lower than expected runoff.

This is a stimulating methodological contribution, since little is known about the impacts of forest on runoff at a regional scale and the speculative approach used here is rather novel. The references to Ashagrie and al. (2006) are helpful, since this is very much a companion paper to Ashagrie's. However, the paper does not reach definitive conclusions because of shortcomings in the data that should be discussed if not addressed:

1) No historical land cover data is used and it is unclear what figures were used to specify the respective surfaces for each land use in the basin. The actual factual evidence on forest management changes in the basin is slim (restricted to some Dutch references). It would be helpful to have some more information on historical land cover changes and management practices to support the authors' hypothesis.

2) Other explanations for decreased runoff are not explored or mentioned. For example, decreased runoff began at the same time when mine works activities developed in the Meuse basin (modifying underground water circulation), canalisation works took place in the French section of the basin and war damage reconstruction came to an end (with increased net water consumption from various heavy industrial plants). These historical factors are not properly discussed, as they seem to imply considerable and complex changes in water circulation and consumption in the basin.

Generally speaking, it would be useful to have a native English speaker proof-read the paper, which is well structured but suffers from small language mistakes that sometimes impede proper understanding of specific points. I defer to the authors and the

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press for further corrections.

Specific comments:

Abstract: p. 1788 l.3: "overestimation" not "underestimation". The authors should be more cautious in stating what is fact or solid conclusion and what is hypothetical.

Introduction: The land use/cover changes analyzed by Garcier (2007) concerned the nearby Moselle catchment, not the Meuse. The authors do not state clearly whether similar changes occurred in the Meuse catchment. More generally, it is unclear whether the authors stand by their assumption that land cover changes were negligible over the course of the century.

p. 1791, l. 13: I don't understand the reference to FAO (1995) and a page reference would be helpful: "90 to 99% of forest in Europe is functional production forest". Does that mean that forests are actually exploited for wood? That there are artificial plantations? Since the figure is quite high, I suspect it incorporates the forested areas of Scandinavia and doubt it could apply to the Meuse catchment.

Study area and data description:

It would be helpful to have a better map that would show the extent of the Meuse basin, the sub-section area (21000 km²) investigated and the location of the meteorological station of de Bilt, the gauging station of Borgharen and the precipitation stations.

The spatial proxies used in the study (and notably the use of De Bilt as the sole source of meteorological information) introduce considerable uncertainty in the modelling outcome. It should be clearly stated/discussed.

p. 1795, l.22: It is unclear what is in decline: wood production? Forested areas (would contradict l. 17)? l. 26: it is unclear what the "remaining part, used for pasture" is.

Methodology

I don't quite see where the five land use categories fit in the model. Could figure 4 be

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modified to explain this point more clearly?

p.1797, l. 16-18: Review syntax as the point is not very clear.

p. 1797, l. 22: The role of the Ci factor is not clear.

p. 1798, l. 28: What proportions for each land use were selected? Were these proportions allowed to vary with time?

p.1799: what is the sampling rate for discharge measurements?

Results/discussion

The result section emphasizes the importance of parameters Nlagf and Alpha in explaining much of the variability. However, in the absence of a discussion on land use change assumptions, it is difficult to make much of the significance of alpha. The discussion section is rightfully careful when it comes to conclusions and it would be useful to indicate what further research could be conducted to overcome the hurdles identified in the paper.

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