

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 #4

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General comments

The paper addresses some relevant scientific questions within the scope of HESS, but several improvements and corrections are needed. The paper deals with anomaly in the rainfall-runoff behavior of the Meuse catchment, which is studied by means of a numerical simulation model. The authors show that the model can only predict the observations when some model parameters are varied in time. From this some conclusions can be drawn. The authors imply that these results prove that the anomaly is due to land use management. However, land use management effects are not explicitly taken into account in the model. The authors term this a fully top-down approach.

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Hence, the conclusions remain speculative and it would be better to address this as a hypothesis. Given the fact that the anomaly consists of a different behavior of the catchment with respect to generation of runoff in the period 1930-1960 (less runoff for the same amount of rain), that the climate did not change and that the overall land use remained the same, one could obviously attribute this to a difference in land use management (more evaporation because of forest rotation) without running a model. Hence, this remains speculative as nothing is really proven with or without a model.

Specific comments

Title: the title does not reflect the real contents of the work, because climate, land use, or land use management are not explicitly taken into account.

Abstract: Page 1788, line 1: "An anomaly has been found in the ... Meuse" looks like the authors found this anomaly; better would be "This paper focuses on the anomaly ... " Page 1788, line 7 "This paper focuses on the possible ... Meuse catchment" is not correct because land use change is not explicitly modeled. Page 1788, Line 12: "It appears that the Land use ... Meuse catchment" is not correct, this is only a hypothesis.

Introduction: Page 1789, lines 2 to 4: this needs some more clarification because Garcier (2007) stated that there was considerable land use change in the basin, while later on the model is run assuming that the overall land use remained the same? Page 1789, lines 5 to 9: more references are needed here. Page 1789, line 29: "land cover remained relatively stable" contradicts Garcier (2007)? Page 1792, lines 8 and 9: interception seems to be important, however in their model application the authors do not find a difference in interception (C_i remains constant); this should be discussed.

Study area and data description: Page 1794, line 15: the location of De Bilt should be indicated on the map given in figure 1. This is one of the very weak points of the study. The Bilt is way out of the catchment, especially the part upstream of Borgharen. As stated in line 9, the catchment has three distinct zones. Hence, I am very doubtful that the meteorological data of De Bilt is representative for the study area. Page 1795,

line 4-6: real prove or references should be given that the data of de Bilt provide an acceptable agreement.

Model description: Pages 1797 and 1798: the description of the model is not very clear, especially the five land use types that are considered and their parameters. For instance, interception is simulated differently for each land use, but is this so for other parameters like the shape parameter 946;? What is the time step of the model? How did the authors deal with the difference in deciduous and coniferous forest if overall land use is constant but in the Meuse basin deciduous forest was gradually replaced by coniferous forest and their interception capacity is different in winter. Were different values of the stomatal resistance taken into account for deciduous and coniferous forest? Page 1797, line 22: why was scaling parameter C_i applied to all land use types. It would have been more appropriate to use this only for forest, because a significant difference in interception related to stand age is expected as indicated in the literature. Maybe the authors also expected a large difference in interception due to urbanisation? Possibly the mixing of all land use types neutralised the effect of this parameter. Why not use 2 scaling parameters for interception, one for build up area and one for forest? Page 1797, lines 23 and 24: for pasture interception can vary, but in Table 1 the min and max values are the same?

Model evaluation: The time period of the simulation is not clearly stated.

Results: Page 1801, lines 25 to 27: this outlier proves that the values of the model parameters are sensitive to other effects as for instance the amount rainfall. Hence, the conclusion that the changes in model parameters can be attributed to changes in forest stand should be taken with precaution.

Discussion: The most clear result of the model is that there is a significant change in the concentration time in the basin (actually this is already clear from the data because floods have become more severe). This can be clearly attributed to land use change (urbanization, drainage). Probably this also will have a strong effect on evapo-

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transpiration which is not considered in the model. The authors assume that changes in parameter α and parameter N_{lag} are unrelated and are respectively due to land use change and changed land use management. However, urbanisation and drainage have also important effect on evapotranspiration.

Conclusion: The conclusion should be more modest in line with the real results of the work. Page 1804, line 17: "the purpose of ... century" this was not really done in this study.

Technical corrections: Page 1792, lines 1 and 2: this is a little bit confusing because figure 3 is from another paper. Actually figure 3 is not really needed. Page 1797, line 27: the abbreviation PM is not needed. Page 1798, line 16: the sentence starting here is not good. Page 1798, line 17: 500 s/m Page 1798, lines 19 and 20: the symbols z_{om} and z_{oh} are not needed. Page 1804, line 11: or instead of of. Table 1: should there not be units? Table 3: is the equation for P_s correct?

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