Hydrology and
Earth System
Sciences

Discussions

Interactive comment on "Including Effects of Watershed Heterogeneity in the Curve Number Method Using Variable Initial Abstraction" *by* Vijay P. Santikari et al.

Anonymous Referee #1

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GENERAL COMMENTS The authors present a methodology to account for heterogeneity in the calibration of the curve number method (CN) from data. The focus of the study is understanding the variation of CN as a function of precipitation by analysing the variability of initial infiltration over the catchment. I particularly liked the analysis of the inconsistency of the theoretical definition of initial abstraction (Ia) and its value at the watershed scale. Based on their analysis, the authors propose a set of models with increasing complexity. They apply these models to synthetic basins with controlled heterogeneity following the CN behaviour and compare their performance with standard indices. By introducing additional parameters in the CN method they obtain a good fit of the precipitation-runoff relationship resulting from the application of the CN method

to heterogeneous basins.

The topic is relevant for the audience of Hydrology and Earth System Science, because the CN is the most widely used method to account for infiltration losses in professional applied hydrology. The objectives of the study are clearly identified, the methodology for the analysis is sound and the conclusions are relevant and correctly supported by the results and discussion. The proposed models perform well when reproducing the behaviour of heterogeneous basins and there are reasonable expectations that the method can be applied to natural basins. Therefore, I believe the paper deserves publication in Hydrology and Earth System Science.

SPECIFIC COMMENTS I also think that there are several aspects of the paper that deserve a deeper discussion, such as the following:

a) On page 2, lines 8-9, the authors state that, in addition to varying spatially due to watershed heterogeneity, CN also varies temporally due to changes in soil moisture or vegetation cover. However, in their synthetic experiments they did not account for temporal variation of CN or Ia. In my opinion, this is a significant limitation for the practical application of the proposed models, that were tested under steady conditions. The authors cite a forthcoming paper by themselves (Santikari and Murdoch, 2018) where several ways of dealing with temporal variation of CN are proposed. I was not able to locate such paper in HESSD. I think this issue should be briefly discussed in this paper, maybe in a section devoted to the limitations of the methodology presented here.

b) The promised paper (Santikari and Murdoch, 2018) will also deal with application to real watersheds, not synthetic data (lines 23-26). The argument given in favour of using synthetic watersheds (page 30, lines 12-16) is sound. However, the strength of the proposed CN-based methods lies on their practical applications. Since the authors have analysed applications to real watersheds, I think a brief discussed of this issue should also be included in this paper.

c) On page 11, lines 17 to 21, the authors report the standard professional practice of accounting for heterogeneity by obtaining the area-weighted average of the CN. The results presented in the paper clearly show that this practice can be improved. I think the authors should discuss this in the final part of the paper. This practice is routinely applied in ungauged basins, where CN is estimated from physiographic characteristics. Are there any better alternatives for computing an average CN in view of the research carried out? Can they propose a model for ungauged basins? I am aware this is not the main objective of the work, but I think the paper would benefit from a discussion of this issue.

d) The models were tested just for one synthetic watershed (described in table 2). This is a limitation of the methodology. The comparative results of model performance would certainly depend on the degree of heterogeneity of the tested basin. In suggest that a discussion of this issue be included in the paper and acknowledged in the conclusions.

TECHNICAL CORRECTION From the formal standpoint, the paper is very well written, correctly organized and adequately illustrated with tables and figures. Figures 8 and 9 could benefit from the use of colours, if possible. Although I am not a native English speaker, I believe the following expression should be corrected:

On page 32, line 12 and 14, . . . in both the cases...... ("the" should be removed?).