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Hydrology and Earth System Sciences Discussions

Interactive comment on "Application of a model-based rainfall-runoff database as efficient tool for flood risk management" *by* L. Brocca et al.

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General evaluation:

The paper presents a very interesting approach in support of operational flood forecasting. It does not follow the traditional approach of real-time simulation of forecasted rainfall in a hydrological model. It is based on a database in which the results from a huge number of model simulations are stored after postprocessing and classification. (Flood) events are in the database classified based on the forecasted rainfall, initial catchment wetness index and initial river discharge (after k-means cluster analysis). The real-time operational forecasts then follow some type of "analogue" method where forecasts do not need new model simulations but are based on the simulation result available in the database, for the specific class to which the forecast belongs.

The paper is well written and presents an interesting new approach. Therefore, I recommend publication in HESS, after the authors have addressed the reviewers' comments.

Comments:

Abstract: It does not become clear from the abstract how the approach works. After reading the abstract, I did not understood yet that the database stores pre-simulated events and that the flood forecasting system does not require new model simulations to be conducted. This only became clear to me after reading section 2. Therefore, I recommend that the authors rewrite part of the abstract to make the general approach more clear from the abstract alone.

Rainfall generation: Can the authors explain why a time step of half an hour was selected (this depends on the concentration time of the quickest runoff component of the catchment) and why five days was selected as duration for the rainfall events (also that depends on the catchment characteristics)?

Can the authors add to the paper their motivation for using a stochastic rainfall generator instead of historical series? The main motivation is of course the limited time span covered by historical series. The rainfall generator allows to simulate extreme events, but question is how reliable this extrapolation is? Figure 2 shows slight underestimations of the hourly rainfall extremes and overestimations of the 6-hour and 12-hour rainfall extremes (the latter is not mentioned in the text). I am not sure they can say that the NSRP model represents "reliably" the extreme values!? (see page 2098 - line 23)

The authors checked the accuracy of the generation of the rainfall extremes in Figure 2, but did they also test the accuracy of the rainfall-runoff model in making extrapolations to extreme conditions? Approaches to test such performance have recently been proposed by:

Vaze, J., Post, D.A., Chiew, F.H.S., Perraud, J.M., Viney, N.R., Teng, J. (2010), 'Climate nonstationarity – Validity of calibrated rainfall-runoff models for use in climatic change studies', Journal of Hydrology, 394(3-4), 447-457

Van Steenbergen, N., Willems, P. (2012), 'Method for testing the accuracy of rainfall-runoff models in predicting peak flow changes due to rainfall changes, in a climate changing context', Journal of Hydrology, 414-415, 425-434

Coron, L., Andréassian, V., Perrin, C., Lerat, J., Vaxe, J., Bourqui, M., Hendrickx (2012), 'Crash testing hydrological models in contrasted climate conditions: An experiment on 216 Australian catchments', Water Resources Research, 48, W05552

The authors should at least discuss the need to test the performance of the model to reliably simulate extreme conditions, because their results will be used for flood forecasting, whereas the model calibration was based on historical series in which only three flood events occurred. The NSE provides a test on the overall performance, but does not focus on the extremes. The model results are shown for the four largest events in Figure 4, but it would be useful to test as well the tail of the flow extreme value distributions.

Was the correlation between rainfall and temperature accounted for in the stochastic temperature generation?

How important was it to include the initial discharge? I assume that the antecedent wetness state is far more important as initial condition than the initial discharge (which may strongly depend on the wetness state). Did the authors check this?

How was the initial time step selected, in a consistent way in both the historical and generated events?

Page 2095 - Lines 15-16: The authors refer to their previous papers for the baseflow model, but can they add in a few words what "simple" method they applied. Linear reservoir model or a more advanced approach?

I was surprised to read on page 2103 line 10 that one of the advantages of the approach presented by the authors is that it does not require hydrological modeling skills. I understand what the authors mean, but I suggest rephrasing this. Also in a traditional flood forecasting system, where the rainfall-runoff model has been prior calibrated, the system can be applied by operational users without good hydrological modeling skills (although such skills would be beneficial, not only for the developers of the system but also for the users. . .). I do not see the difference (in terms of modeling skills required) between prior FFS development activities where a rainfall-runoff is calibrated and set for operational use, versus the prior development of the RR-DB proposal by the authors.

In their future research prospects, the authors may consider applying a data assimilation method for real-time bias correction.

Some additional minor comments:

Abstract – line 14: "real flood events were appropriately captured by the database within an uncertainty range." This is quite trivial; model results are always captured within an uncertainty range . . .

Page 2091 – line 24: change "FFSs" to "FFS"

Title of section 2.4.1: typing error in "Precondition"

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 2089, 2013.