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Hydrology and Earth System Sciences Discussions

Interactive comment on "How crucial is it to account for the Antecedent Moisture Conditions in flood forecasting? Comparison of event-based and continuous approaches on 178 catchments" *by* L. Berthet et al.

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Dear Mr. Berthet,

With interest I have read your article about event-based vs. continuous approaches for flood forecasting. I have worked in the flood-forecasting center for the rivers Iller, Lech, Wertach in Bavaria, Germany for the last six years. Based on the experience gained during that time, I want to add the following comments.

1) You state that a major drawback on using continuous simulation models for opera-

tional flood forecasting is that long term input timeseries (including a warm-up period) are difficult to provide. Hence the need for event-based runs which require initialization methods.

Comment 1: You can do short term runs and keep the benefits of continuous simulation by storing the complete model state (storage volumes etc.) at the end of the run. Prior to the next run (which has to connect seamlessly to the previous) the model states are re-read. Thus, the decision between continuous vs. short term simulation is bypassed, input timeseries are sufficiently short to ensure fast calculation, initial state influence is minimised. Example: flood forecasting in Baden-Württemberg, Germany (BW) and Bavaria (BY) is based on Larsim, a continuous, conceptual, semi-distributed waterbalance model operated in the described mode.

Comment 2: Especially floodforecasting, with events occurring only rarely, requires permanent operation, e.g. in a daily routine. This is to ensure that a) the model-users stay experienced, b) data transfer deficiencies and c) model malfunctions are detected and corrected timely and 'in times of peace'. Based on a routine application of the model, maybe even automated, the interrupted continuous simulation mentioned in comment 1 should be possible. Example: the flood forecasting centers BW and BY operate on a daily routine.

Comment 3: You explicitly exclude snow impact from your work. However, even in lowland catchments, snow-induced or snow-supported floods occur. Example: spring flood at the river Wörnitz (gauge Harburg, 1568 km2), Bavaria, in March 2005, where only snowmelt lead to a five- to ten-year flood, although the maximum catchment elevation is just 500 m.a.s.l. Cases as these can best be accounted for by continuous snowpack simulation, as the assimilation of pre-event snow observations remains a difficult task (availability, spatial interpolation etc.).

2) In your work, the last observed discharge observations are used for updating the models routing function, which improves model output quality considerably.

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Comment 1: From my experience with operational updating techniques used in Larsim and its event-based predecessor Fgmod, it is crucial to evaluate the quality of the observed data before using the for model state updating. In fact, some gauges are well suited for low flow cases but fail in cases of flood and vice versa. Example: In BW and BY, gauge applicability for assimilation is evaluated for three classes (low and medium flow, floods).

Comment 2: In low flow cases, the SMA store or rather its inflow to the routing function should have a clear impact on the resulting discharge. Therefore, it should also be altered by the assimiliation procedure. More generally speaking, assimiliation techniques should effect those model components that are responsible for the current mismatch between observation and simulation. Example: The Larsim assimilation technique changes, according to the current hydrological situation, one of three stores (Baseflow, Interflow, Direct Runoff). For more information, see attachment: Luce, A., Haag, I. and Bremicker, M., 2006. Einsatz von Wasserhaushaltsmodellen zur kontinuierlichen Abflussvorhersage in Baden-Württemberg. Hydrologie und Wasserbewirtschaftung, April 2006: 58-66.

Comment 3: As not stated otherwise, I assume each catchment in your study is represented by one pair of production and routing functions, with one gauge at the outlet, which means that all input and state variables are used in a catchment-averaged way. Clearly, when working with spatially distributed models, which can account for spatially distributed input and processes, antecedent soilmoisture patterns will occur and be considered. This will influence the resulting discharge. Neglecting this (by using spatial averages) is to the disadvantage of modeling and in favor of assimilation techniques and may explain why the assimilation procedure improves the results of your study so dramatically. Or, in other words, using distributed models might lessen the influence of data assimilation.

3) Final remarks: Beyond the reasons stated above, continuous modeling is advantageous because it allows application of the model for more than flood-forecasting, e.g.

low-flow forecasting, water temperature forecasting, long-term simulation etc. Furthermore, modeling as closely as possible to the natural hydrological processes instead of relying strongly on updating techniques improves the models predictability and might provide valuable insight in the catchment under consideration.

Yours sincerely, Uwe Ehret

Please also note the Supplement to this comment.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 1707, 2009.