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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Improving the Xin'anjiang Hydrological Model Based on Mass-Energy Balance" *by* Yuah-Hao Fang et al.

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The authors should be congratulated on production of an interesting paper that is easy to read and comprehend. There are a number of points, however, where the authors may wish to expand upon their current explanation. These include: 1 - Both the Abstract and the Introduction highlight the use of the model as a flood forecasting system. Hence only high flows are of interest with low flows being those between flood periods and of interest only for initializing the high flow periods. Nonetheless, calibration and validation of the models is focused on the capacity of the system to reproduce complete time-series of flows. Hence, this point is focused on whether reproduction of flow time-series is the appropriate metric for a flood forecasting modelling system.

The emphasis on reproduction of complete time-series of flows further complicates the

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calibration as there will be more high flows than low flows potentially resulting in a bias towards reproduction of low flow situations. It would be worthwhile to consider how the high flows were simulated in the absence of any low flows; in other words, if the flow time-series were censored to remove the low flows, would the calibration and validation statistics be changed.

It is worth noting that recent publications (see, for example, Sakal et al., 2016) have shown that, for many modelling systems, different parameter sets are needed for adequate reproduction of both high and low flow time-series. Use of alternative parameter sets and the selection between them becomes a question then of the belief in the suitability of the model for forecasting of flows in a given regime; this belief can be expressed as a probability if desired.

2 - A second issue related to the calibration and validation of the modelling system relates to the input data and the parameters. As outlined in the paper, the XAJ model assumes homogeneity of the element area. Variability within the element area for those processes associated with conversion of rainfall to runoff is considered as discussed in the paper. However, the variability in the rainfall over the full catchment area is not discussed and consequently, variability of rainfall over the element area is not discussed.

If, as suspected from interpretation of the paper, rainfall at the centroid of the element area was used as input to element, then there is a need to describe how the rainfall was estimated. This estimation of rainfall depth will introduce an error into the modelling system. The likely magnitude of the error in rainfall estimation was discussed by Ball and Luk (1998) who, for a smaller catchment, showed the likely magnitude of errors in rainfall estimation using a number of alternative spatial interpolation schemes. Subsequent studies by, for example Mandapaka et al. (2009) and Younger et al. (2009) have considered the effects of rainfall uncertainty on catchment modelling outcomes.

The relevant point here is the need to ensure that the enhanced XAJ model outcomes are better than the XAJ model outcomes and that the uncertainty arising from the

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rainfall inputs does not mask changes in the forecast errors.

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