

Interactive comment on “From runoff to rainfall: inverse rainfall–runoff modelling in a high temporal resolution” by M. Herrnegger et al.

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Concerning size of catchments and the applicability of the model: As long as the spatial heterogeneity is not relevant in the hydrological modelling approach and the system can be represented by a lumped model setup both forward and inverse model can be applied: (1) The lumped model setup ignores spatial heterogeneity within a catchment. If the spatial heterogeneity cannot be reflected with a single parameter set, then a lumped model setup is not applicable. This applies to the forward and inverse model. (2) For the lumped model setup only a single rainfall value for the whole catchment is used as input. If a catchment is too large, the single mean catchment rainfall input will not be applicable. It will not be possible to obtain reasonable simulation results with

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the forward model. Therefore, the inverse model is also not applicable.

Your analysis is correct, that inverse rainfall can also be calculated if observed runoff is not increasing. This will happen, if the model does not simulate runoff correctly, e.g. the falling limb in non-driven periods. In the case that observed runoff stays constant (e.g. due to insufficient measurement accuracy), then again rainfall will be calculated by the inverse model. A constant runoff over several time steps cannot be simulated (without additional input), since this contradicts the model formulation of the conceptual model with linear reservoirs. The cumulative sums of the different rainfall realisations (Figure 10) however show that no significant systematic biases, which originate from this issues, is evident in the inverse rainfall.

If it rains and all rainfall is evapotranspired in the same time step (Effective rainfall=0, no signal in observed runoff) , then no inverse rainfall will be calculated. We do however not expect this to happen very often, since evapotranspiration rates are a magnitude lower, compared to rainfall. Therefore not only high intensities will be detected by the inverse model. Additionally consider that the model also includes actual evapotranspiration.

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