

## ***Interactive comment on “Seasonality of hydrological model spin-up time: a case study using the Xinanjiang model” by Mohammad M. Rahman et al.***

**Anonymous Referee #1**

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Authors estimated spin-up time of a conceptual hydrologic model by initializing the model from two extreme initial conditions (wet and dry states) at different times of a year, and defining the equilibrium state by computing the Mahalanobis distance between the soil moisture states of two model runs. By initializing the model at different times of a year, authors were able to present variability of spin-up time from models started from different seasons. While model initialization is an important issue in hydrologic modelling and erroneous initial conditions lead to bias on simulated model output(s), there are a few issues with the current study as highlighted below.

1) The choice of a modelling application by the authors does not seem to be relevant for a spin-up study. As it is shown in the results, spin-up time of a conceptual lumped

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hydrologic model is quite short in the study catchments. In fact, the impact of initial condition is mostly disappeared in less than a year or two. In the conceptual hydrologic modelling literature, we often see that the first 2 or 3 years of simulation is considered as the warm-up period and removed from the rest of the analysis including model calibration. Therefore, it is not clear what are the implications of estimating spin-up time in conceptual hydrologic models considering their short spin-up times? Can we just remove the first two years of simulation as it is commonly performed? I agree with the authors that initialization is an important issue in hydrologic modelling. However, proper initialization of hydrologic models becomes more relevant in integrated hydrologic models where sub-surface and land surface processes are coupled and computational time is an important issue.

2) Another issue with the approach in the paper is that it seems model calibrations are performed at the same time to explore the impact of initial condition. Therefore, one would expect that the impact of initial condition is reduced through parameter adjustment during calibration. It will be very useful if authors can present possible differences in model parameters and performance between the various initializations as the model reaches equilibrium.

3) Why authors only used snow free catchments in their modelling study. The conceptual model used here runs quite fast and it is not clear why not all the MOPEX data is used in this study. At least this way, authors could expand their analysis and provide useful and informative discussion that will be useful for readers.

4) As authors have stated in their Introduction, Rahman and Lu (2015) have already estimated the maximum spin-up period of the Xinanjiang model using basin aridity index. Similarly seasonality of soil moisture memory (SMM) is already discussed in Rahman et al. (2015). Therefore, the novelty of this manuscript is not clear.

5) No information is provided about the seasonal characteristics of precipitation in the study basins. I suspect that seasonality of spin-up time is similar to the seasonality of

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precipitation patterns. Can authors discuss this?

6) It will be very important that authors discuss their results and explain the factors impacting observed behaviour here. More importantly, authors should discuss the implications of their study and its broader impact for hydrologic modelling community.

7) Regarding the calibration, no information is provided about the calibration approach and the length of calibration and evaluation periods.

8) Why spin-up time is longer if the start time of a simulation is in spring? Can authors provide further details.

9) In Page 2 –Line 4: authors state “These techniques of reducing spin-up errors hold certain limitations”. Can authors discuss these limitations? There are multiple papers that examined the use of various spin-up criteria in both land surface and integrated hydrologic models and it is not clear what authors are referring to it here.

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