

Interactive comment on “River flow forecasting with Artificial Neural Networks using satellite observed precipitation pre-processed with flow length and travel time information: case study of the Ganges river basin” by M. K. Akhtar et al.

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We thank the reviewer for the valuable comments. Following his/her suggestions we will update the manuscript as follows:

The explanation about the physical considerations in the application of the lagged rainfall using the travel time rainfall approach is included in page 3389, lines 12-14, and 19 where the flow length is characterized. This might be complemented with the state-

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ment in 3390, line 9. In relation to the neural network, it is expected that these physical concepts reduce the number of physical processes that the network will require to encapsulate in its processing units. This expected reduction in complexity is expressed in a statement that was added to the end of section 3.

A SWAT model was calibrated to find out what is the relation with a hydrological conceptual model, however, the complexity of the basin is such that the results achieved were not satisfactory. The reference to this model was included in the new updated results. In addition, we refer to one of the error measures mentioned by reviewer 1; the PERS. The persistence index is useful in referencing the linearity of the process due to its relationship to the Naive model. This benchmark error measure is included in the updated version of the paper, and a comment is added to the results.

The formula used for the normalized root mean square error is added in the update, as well as the PERS index mentioned above.

The low flows were not considered since we wanted to evaluate the effect of precipitation, which is strongest in peak flows. On low flows it was not expected to have significant influence of this precipitation in the outlet discharges.

About the slope inclusion in the calculation, we have chosen to start from a representation of the differences in travel times, based only on flow path (determined also by elevation differences) and two different flow velocities. We believe that in a further study the inclusion of slope might be an important consideration that we would like to explore. For now, a discussion on this inclusion is added in the conclusions.

The 25 rainfall time series was based on different trial and error, where we noticed that with more time series no improvement was obtained, and instead, it would appear that the model performance deteriorates. A comment on this issue is added.

A short description of ANN models is included in the updated paper, and proper reference to complete and detailed descriptions added.

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Cluster area-average rainfall was calculated in the process, an explanatory sentence is included in section 4.3, p. 3394, line 23-25

With respect to the details mentioned, one figure of a sample rainfall event is included, with the regular grid cells of the TRMM and the processed rainfall per lag time area.

We have checked all the figures for clarity again, keeping in mind that it is colour published. We have made improvements where needed and added the basin area ($907 \times 10^3 \text{ km}^2$ in the description).

We include a reference to the TRMM project.

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