

Interactive comment on “Controls on hydrologic similarity: role of nearby gauged catchments for prediction at an ungauged catchment” by S. Patil and M. Stieglitz

Anonymous Referee #1

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This paper presents a methodology aimed at understanding the level of hydrological similarity between nearby catchments. This issue is particularly relevant for HESS and the paper is well written and referenced.

My main concern is on the model used in this study, which is a simple interpolation model of daily flow values. The implicit assumption made by the authors is that the success of the model results from a hydrological similarity between the donor and the receiver catchments. This, I think is rather plausible but the contrary is not true: two very hydrologically similar catchments in terms of hydrological processes but under

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different climate forcings will yield very different daily flow simulations. Therefore, the failure of the runoff-runoff model may stem from two causes: (1) different daily inputs (even a 1-day lag in precipitation might cause great damages on the NSE efficiency) and (2) different hydrological behaviours.

Thus, the problem with the proposed model is that it does not allow to differentiate explicitly those two causes. This is done implicitly by analyzing the climate settings of the catchments and their physiographic attributes but this approach is full of pitfalls. For instance, the result showing that streamflow similarity is higher in energy-limited region is probably due to the fact that rainfall intensity is more spatially variable in more arid catchments. Besides, the modelling framework precludes from finding those catchments that are hydrologically similar but not spatially close. Those problems are fairly recognized by the authors (p.9337 l.1-5) but to my opinion, those are methodological problems that do not allow the authors to reach significant conclusions on the issue of hydrologic similarity.

My suggestions to the authors on the paper would be to chose among two different paths:

1. Stick to the problem of prediction in ungauged basins and propose a more appropriate runoff-runoff model structure. The authors could refer to existing models (see e.g. Skoien et Bloschl, 2007; Archfield et Vogel, 2010; or more recently Andréassian et al., 2011)
2. Consider hydrological similarity through the correspondence of some hydrologic signatures (for instance those that are used in the paper), those flow statistics being much less influenced by climate forcings compared with daily flow values. The authors could refer to numerous recent studies on this issue (e.g. Sawicz et al., 2011).

References

Andréassian, V., Lerat, J., Le Moine, N. et Perrin, C., 2011. Neighbors: Nature's own

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hydrological models. *Journal of Hydrology*(in Press)

Archfield, S.A. et Vogel, R.M., 2010. Map correlation method: Selection of a reference streamgage to estimate daily streamflow at ungaged catchments. *Water Resources Research*, 46,

Sawicz, K., Wagener, T., Sivapalan, M., Troch, P.A. et Carrillo, G., 2011. Catchment classification: empirical analysis of hydrologic similarity based on catchment function in the eastern USA. *Hydrol. Earth Syst. Sci.*, 15(9): 2895-2911

Skoien, J.O. et Blöschl, G., 2007. Spatiotemporal topological kriging of runoff time series. *Water Resources Research*, 43(9),

Interactive comment on *Hydrol. Earth Syst. Sci. Discuss.*, 8, 9323, 2011.