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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Three parameter based Streamflow elasticity model: Application to MOPEX basins in USA at Annual and Seasonal Scale" *by* G. Konalapa and A. K. Mishra

W.R Berghuijs

wb14708@bristol.ac.uk

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Please note that this interactive comment is not intended as a full review of the paper. I just provide some comments that I think are worth considering and may strengthen the paper:

1. "Later, Dooge (1992) used a hortonian approach to quantify. . .' is a very vague description of what Dooge did. Essentially Dooge derived streamflow sensitivities based on different Budyko type equations (Ol'dekop, Schreiber, Budyko, etc etc). I think therefor this needs to be clarified compared to the current version of the text. He did something very similar to Arora (2002), but Dooge did not yet decomposed the role of climate into P and PET, and considered them as a lumped parameter (P/PET)

2. "All the elasticity-based models have shown that precipitation has a greater positive influence on streamflow" is not clearly formulated. Do you mean "All the elasticity-based models have shown that precipitation elasticity is positive"?

3. "Fu et al., (2007) suggested that an increase in precipitation along with a positive deviation in temperature would result in lesser impact in streamflow, whereas a negative temperature deviation would result in a higher impact in streamflow" is also unclear. If your formulate these influences in terms of elasticity values (see previous comment) your statement will get more clear.

4. "Yang and Yang (2011) has identified that relative humidity has a positive influence, whereas net radiation and wind speed have a negative influence on streamflow. More recently, Andréassian et al., (2015) has identified a negative influence of potential evapotranspiration on streamflow." Idem (see point 2&3)

5. "The hydrometeorological data (1948 to 2003) were collected from the Model parameter estimation experiment (MOPEX) basins located in USA, which are considered unaffected by human influence." What do you mean by "unaffected by human influence"; many of these catchments have land-surface conditions that are strongly affected by humans? I.e. catchment in the Midwest are mostly agricultural. Can you specify what you mean by "unaffected by human influences".

6. "Therefore, there is an opportunity to investigate the elasticity of streamflow at the seasonal scale to explore the seasonal control of climate on water resource availability." Please not that your concept of seasonal elasctity values is not per se novel. See e.g. Vano et al., 2015.

7. How does snow influence your study? Snow strongly affects your seasonal and annual water balances (Berghuijs et al., 2014, 2014). I suspect for example that snow links to your statement: "There appears to be a lag in the response of streamflow to rainfall with the high elasticity values starting in winter in the western part of USA. However, it also appears to follow a cycle similar to what we have seen in the eastern

part of USA. This clearly highlights the differential behavior of western and eastern USA streamflow elasticities due to precipitation."

8. One of the disadvantages of your approach is that the elasticity to water storage changes is derived from all residual (and uncertain) other data sources (Q, P, AET). Especially AET is uncertain as this cannot be directly measured. In the meanwhile there is also a way to calculate this metric using hydrograph recession analyses, see Berghuijs et al. (2016). Are you happy with your current approach or do you think that this method could actually make your results more robust?

9. I think the following statement is very specultive “We can see that during fall, the eastern region has a negative elasticity indicating a decrease in stream flow due to increase in potential evapotranspiration. But, in the south western watersheds we can see a positive elasticity value indicating an increase in stream flow due to potential evapotranspiration. This increase can be viewed as an increase in available moisture locally causing more rainfall and subsequently more rainfall within the same season. This contrasting behaviour might be due to higher temperatures in southern USA increasing the potential evapotranspiration and thus the capacity to withhold moisture. This might be similar to the precipitation recycling concept introduced by Eltahir and Bras [1998].” Do you have more evidence to support this?

10. Can you clarify your interpretation for: “Figure 8 illustrates the seasonal pattern of streamflow elasticities due to storage change. It was observed that the seasonal elasticities exhibit change in spatial clusters. For example, the eastern USA seems to exhibit a cycle of negative elasticities in fall, and then its intensity decreased in winter, becomes almost negligible in spring and exhibits positive elasticity in summer. However, the watersheds in south eastern coast seem to exhibit negative elasticities in summer followed by a decrease in negative elasticity values in fall and winter. This region exhibits positive elasticity values in spring whereas the rest of eastern USA exhibits positive elasticity in later season. S” Do you expect that this is the actual physical behavior of the catchment or can these seasonal changes also be induced

by the potential bias introduced in your result due to uncertaines in the components of water balances?

11. I do not think that the analysis of catchment properties influence on elasticity’s is done rigorously. Can you make this part of the analysis a bit more appealing and convincing? Also, why did you choose these catchment properties?

12. The discussion part of this paper is somewhat thin in my opinion.

13. Figure 1 & 5: can you please be accurate in what we are looking at, and specify the units (even if they’re dimensionless).

14. Figure 6: On the left side? Or on right side?

15. Figure 8: this colorbar makes it impossible to read the figure well

16. Figure 10-12: what do these blue thin lines resemble?

17. Are the following studies relevant to discuss or acknowledge: Renner et al, 2012, Sivapalan et al, 2011; Harman et al., 2011; Xu et al., 2013?

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