

Review: Remote land use impacts on river flows through atmospheric Teleconnections

The paper studies the interaction between land use changes inside and outside of a basin on the river flow by coupling of a hydrological model (STEAM) with an atmospheric moisture tracking model (WAM-2layers). The study comes to the conclusion that depending on the region extra-basin land use changes can strongly affect river flow inside a basin.

The topic of land use change impact through atmospheric teleconnection is very interesting and important to the hydrological science community as well as for water governance. The method of coupling an atmospheric model with a hydrological model in both directions (not as usual in one direction) is very promising.

Main suggestions:

- Some of the descriptions, figures in the supplement should be moved to the main paper.
- The focus of basins should be moved from basins with high absolute delta Q (Amazon, Congo, Ob etc.) to basins with high % change (Indus, Zambezi, Odra)
- The role of TMR should be addressed regionally. To refer to the title the differences between having the teleconnection in or not should be pointed out. What are the basins affected by TMR most and why?

Some other aspects have to be addressed:

P2 L31: “.. no studies ..” about P I do not know, but LUC on Q a lot: See the <https://www.isimip.org/> project deals also with impact of human interactions on water balance variables.

P3 L14: on long term: $q = P - ET_{act}$; where ET_{act} is actual evapotranspiration with the parts mentioned before. Further on we talk about actual ET?

P4 L15 and S8: GRDC runoff data are used for verification. GRDC data are not referred and not explained see: http://www.bafg.de/GRDC/EN/03_dtprdccts/33_CmpR/unh_grdc_node.html). Also the data source is from 2002 (and not really “observed” runoff). Maybe a comparison with recent modelling results is more appropriated (see: <https://www.isimip.org/outputdata/>), also because the MSWEP precipitation data is more inline with the WATCH WDFEI dataset than the one used in 2002. But here the important part is to show that the hydrological model is more or less ok. Therefore a rough comparison might be ok. Maybe adding the explanation of the supplement is enough.

P4 L20: E,pot might be misleading because it is normally used for potential Evaporation

P4 L22: Why Fig S8 as reference?

P6 Figure 1a: Irrigated crop (orange) is hard to distinguish from rainfed crops (red). From this map there is hardly any irrigation in Spain or Italy (even if it is the main land cover change). What are the green dots?. A land use change map which indicated from with land cover to which would be helpful e.g.

Forest – pasture. Because it makes a difference if you change from Forest – pasture or from shrubland - pasture

P6 Figure 1b-d: Quite a drastic change. E.g. for Zambezi that is more than 100% (more than indicated in S1). Fig 1a-c are cell values.

Figure 1d are summed up for the catchment at the outlet and then again put on the whole catchment. Maybe choose another way to show this, e.g. as points. Or show this as percentage as in S1h. Also because a change of 1000 m³/s in the Amazonas (or Congo) is close to nothing while for the Elbe River it is a lot.

P6 L1-8: This part is also interesting. But it would be good to have a global map here instead only a description of some basins to see the region differences. Maybe a map of absolute delta Q and delta Q/Q. Fig S1h shows the interesting basins like Odra, Indus, Colorado, Niger, Zambezi

P7 Figure 2: This is a necessary figure to show that the high values in fig 1 are well based inside other literature. Please put a table or part of it or another way of displaying results here in order to make it independent from the supplementary.

P8 Much more interesting than the Congo (less than 5% change) is the Zambezi with almost 100% change.

P8 Fig3: The y-axis is not only hydrological flow [m³/s]

P10 L 21ff:

- Precipitation and evaporation over the sea is not in
- Changes in atmospheric circulation is not in. it seems the model assumes the same patterns (see S1e)?
- Are you sure that dams are not indirectly in. e.g. Zambezi big dams as major land cover change from shrubland to open water?