

Interactive comment on “How downstream sub-basins depend on upstream inflows to avoid scarcity: typology and global analysis of transboundary rivers” by Hafsa Ahmed Munia et al.

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The paper analyses the different types of dependency of downstream sub-basin areas (SBAs) on upstream SBAs, and provides a global overview of the types of dependency in 2792 SBAs. That is potentially interesting. However, the concepts used are not completely convincing and they are not always used consistently. Moreover, parts of the paper are overly complex.

1. The paper distinguishes three types of dependency of downstream SBAs on up-

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stream SBAs: no dependency, continuous dependency, and intervened dependency. According to the definition in table 1, no dependency means that for the SBA local runoff is sufficient. Yet, in table 3 and elsewhere other cases are qualified as "no dependency" as well: SBAs that experience occasional or persistent scarcity even if they were to receive all natural runoff from upstream. That is not consistent. Moreover, in the latter cases dependency on upstream SBAs is actually high: there is already little water, and every extra drop that is used upstream results in even less water for the downstream SBA. For these cases I would introduce a fourth type of dependency, which might be called "absolute dependency".

2. Continuous dependency is defined in two slightly different ways: on p. 2 as scarcity that is avoided thanks to upstream inflow, and in table 1 as a region that would experience scarcity if it did not have access to upstream inflows. The latter formulation seems to include actual water scarcity as a result of upstream water withdrawals ("intervened dependency"). This is probably an inaccuracy. More problematic is that "continuous dependency" covers very different cases: cases where upstream inflow is so big that downstream scarcity is just a theoretical possibility, and cases where downstream scarcity is a serious threat because of concrete plans to increase upstream withdrawals (or plans to increase water use downstream or the effects of climate change). It would be good to distinguish between these situations, at least in the discussion. In addition, I would replace the term "continuous dependency" by for instance "potential dependency" because there is no dependency if scarcity is just a theoretical possibility. "Intervened dependency" could then become "actual dependency."

3. To calculate water availability in the different SBAs, the paper uses the PCR-GLOBWB model. It is not clear to me whether and how return flows were taken into account. Especially for industrial and domestic water withdrawals these can be significant.

4. The authors distinguish between occasional scarcity - scarcity that occurs only in a dry year - and persistent scarcity - scarcity that also occurs in a wet year. They do not

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define wet year and dry year. What return period is used? And why not use instead of wet year average year? Wet year water availability seems to me a very shaky basis for water scarcity management. Please reflect on this.

5. My most important concern is that the typology of possible transitions in dependency category is very complex and it is not clear to me how useful this typology is. What downstream SBAs need to know is how total water availability may change as a result of climate change, how water use upstream may develop, and what their own plans and expectations are concerning water use in their own SBA. On that basis they can anticipate (an increase in) water scarcity and decide to enter into negotiations with upstream SBAs. They do not need and probably would not benefit from a full overview of groups and orders of possible transitions in dependency category.

6. Finally three suggestions for the presentation. First, the different formulation in line 255 can be simplified and made more uniform by removing "reliable" and "less reliable" and putting "dry year" and "wet year" (or "average year") always at the same place. Secondly, if no scarcity is N, occasional scarcity is O, why not use P for persistent scarcity? And thirdly, in table 4 the order in every column could be the same, e.g. always first no scarcity, then occasional scarcity, and then persistent scarcity.

In conclusion, I can see a publishable paper on different types of dependency that analyses the global situation, but it still needs a lot of work. I am not convinced of the relevance of the complex typology of possible transitions.

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