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Interactive comment on "A line integral-based method to partition climate and catchment effects on runoff" *by* Mingguo Zheng

Anonymous Referee #2

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The paper describes a mathematical method to attribute a discrete change in runoff to changes in climate and catchment characteristics. The method is directly applicable to common data and yields quite similar results when compared to existing methods. However, it remains open which of these methods is more accurate because there is no data to verify.

Still, there are two interesting and valuable aspects of the manuscript: a) The role of the evolution over time b) Reconciling the existing methods and their assumptions on this evolution

To consider the path of changes is an important aspect and, as the author illustrates, may thus alter the resultant sensitivity to a change. This is important, since this may allow to better assess the vulnerability of a given catchment to global change. The

problem is, that there is usually not sufficient data to constrain the evolution of disturbances. The author uses subperiods of 7 years, where at least the meteorological data provides some constraints. However, the use of shorter periods comes at the cost of potential changes in the catchment water storage, which can then be misinterpreted as changes in catchment characteristics. Figure 6 shows that the temporal variation of the catchment property sensitivity is largest. This might actually be caused by water storage changes, rather than actual changes in the catchment properties. This aspect is not sufficiently discussed in the manuscript.

Although I like that the existing methods are discussed in detail, I strongly recommend that the author better visualizes these methods. An attempt is done in Figure 1, but this must be extended and linked to the other methods.

Recommendation: Major Revisions. The relevance/significance of the paper must be better highlighted. This requires major changes throughout.

Further comments: Overall, the notation should be more consistent (for example indices) and streamlined.

I think that some parts of the paper can be cut. Figure 2b is trivial and can be removed. It would be better to describe the decomposition method in a conceptual Figure, similar to Fig.1.

The catchments with the largest changes in n have a reference period of only 3 years. This is quite short for a reference period.

Figure 6: It is unclear what is shown here.

The motivation of the figures 7,8 and 9 is not really clear to me. Please explain or remove.

At Line 311-312 it is argued that the timing of precipitation change is important. I did not see this aspect in the results.

The discussion of Berghuijs and Woods (2016) at lines 312ff is not clear to me. Please explain.

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