**Hydrology and
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Interactive comment on "Contrasts between chemical and physical estimates of baseflow help discern multiple sources of water contributing to rivers" *by* I. Cartwright et al.

Anonymous Referee #6

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Dear authors, dear editior,

I appreciate the responses of the author to the various referees concerns. If they are adequately dealt with in an updated version, this will have the potential to be a valuable contribution to HESS.

My reply is short and spontaneous due to my limited time. But since I feel that not all my comments have been addressed so far, I would like to respond to the authors once again and give some hints what I regard important for the revision:

1.)The issue of EC as a problematic tracer needs special attention. A simple CL-

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EC correlation with high r2 seems not enough, since this correlation could be weaker during periods of high flow. Do you have major ion data from low flow and high flow to prove a constant EC-CL relation? Also the issue of ET enrichment should be checked more thoroughly: Are the isotopic data really from low flow periods?

2.)As the authors admitted there are a number of processes that might contribute to the difference between chemical mass balance (CMB) and mathematical baseflow separation. Besides bank storage the contribution of other "transient" storage will be important (at least for hydrologists working in other climatic regions that want to use the same approach). The contribution of ALL storages need to be systematically evaluated and discussed. Also in the light of existing literature using tracer-based hydrograph separation. For this more information about the catchment is vital. How important are piston-flow contributions from shallow groundwater in the headwaters? I agree that riparian aquifers might be regarded similar as bank storage in terms of water quality but they might act differently in terms of dynamics. So how can these two processes be differentiated? This is one example for a systematic discussion of relevant processes. At the end clear evidence is needed that bank storage is the dominating one in this environment (if this is really true. . ..).

3.) The main source of uncertainty in the CMB is the uncertain definition of the two endmembers. This is less problematic for the event endmember (although +100 mikroS/cm might be not enough) than for the pre-event endmember. According to my experience the main source of CMB uncertainty comes from the use of one single EC-measurement as pre-event endmember. My proposal would be to systematically address uncertainty and to create uncertainty bands for both mathematical and chemical baseflow separation. For the mathematical you did this already when you used different approaches or different parameterization for these approaches. But do the same for the CMB: calculate total uncertainty (by error propagation) including variations in both endmembers. This variation should be based on real groundwater data or based on the use of different baseflow-EC values as pre-event endmembers from

different seasons (also including the rainy season!). Then finally you will get two error bands that you overlay. Finally you might get time periods when your difference is outside the shaded region and you can really state that there is something going on. But which type of process needs to be discussed, see 2 above.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 5943, 2013.

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