Response to reviewer #1

Explanation: *The reviewer' comments are shown in black, the author's replies and revises are shown in blue. The quoted line numbers and page numbers are the Marked manuscripts.*

Comments from Referee #1:

The ECK method and CMB method are two widely-used baseflow separation methods. The ECK method only requires the stream discharge data as input, which is one of the most readily available methods for baseflow separation in long term studies. However, the parameters for the ECK method are often subjectively determined, resulting in high uncertainties in the baseflow separation estimations. On the other hand, the CMB method is considered to be more objective because it is based on the direct measurements of streamflow conductivity. However, the data required for the CMB method may not be available for long periods. Using the baseflow data estimated with the CMB method to calibrate parameters for the ECK model can be a more accurate baseflow separation method.

Response: Thank you very much for reviewing our manuscript. Indeed, as you said, the CMB method is generally regarded as a relatively objective baseflow separation method. Many studies used the CMB method as a reference to correct the parameters of the Eckhardt method. We also discussed related research in detail in the manuscript **(Page 4, Lines: 75-84)**. However, some studies have pointed out that the separation results of the two methods may contain different transient water sources. These transient water sources may cause inherent deviations in the two baseflow separation results and cannot be truly corrected **(Pages 4-5, Lines: 84-95)**. These two types of views seem to be opposed and may cause confusion for researchers. The main purpose of this research is to try to solve this confusion by analyzing the correction effect of the CMB method on the Eckhardt method **(Page 5, Lines: 96-106)**.

The manuscript compared the differences between two baseflow separation methods (the conductivity mass balance method (CMB) and the two parameters filtering method (Eckhardt) constructed based on different theoretical assumptions. The manuscript examines the correction effect of the CMB method on the Eckhardt method by analyzing the deviation between the daily baseflow series. In addition, the effects of transient water sources on streamflow, conductivity, and baseflow separation results were discussed in detail. They attributed the difference between the two baseflow separation results to the inclusion of different transient water sources, which will provide future researchers with a reference when using and comparing different baseflow separation methods. In my opinion, there is no problem with the overall structure and content of this manuscript, and it can be published after some minor revisions:

Response: Thank you very much for your appreciation of our research. We have revised the manuscript based on your comments. See the following text for one by one reply.

1. The author mention many times that "surface runoff formed during the early stage of rainfall will flush out high-salinity wetland or depression water in the valley, forming a high-salinity pulse". However, not every region has such topographical conditions, but the rapid increase of baseflow is a very common phenomenon, so more conditions should be discussed.

Response: Indeed, we cannot be sure that there are wetlands or depressions water in every basin. However, many studies have pointed out the rapid increase of "baseflow" in flood events. The quotes are added because this phenomenon is part of an unresolved paradox: the "old" water paradox. The "old" water paradox refers to the phenomenon that a large amount of old water with water chemical or isotopic characteristics different from precipitation is contained in the streamflow in the early stage of flood event (Kirchner, 2003). Kirchner (2003) pointed out that the increase in hydraulic head gradient and baseflow fluxes caused by precipitation infiltration cannot explain the rapid mobilization of old water, that is, the old water is likely to come from other water sources besides precipitation and baseflow. Some researchers try to explain this paradox based on different theories, such as propagation of pressure waves, transmissivity feedback, soil water mobilization and wetlands water flushing, but no one theory has been universally recognized (Bishop et al., 2004; Kienzler and Naef, 2008; Kirchner, 2003; Cartwright and Morgenstern, 2018). In our opinion, a common understanding clarified by these studies is that the formation of old water is due to the rapid mobilization of a large amount of soil water, depressions or wetlands water by surface runoff, rather than an increase in baseflow. Considering that the original discussion may be relatively simple, we have added some discussion about the "old" water paradox, see **Pages:13-14, Lines: 250-256**.

2. Lines 104-106: "Section 2 introduces these*: : : : :*conclusions". This sentence is not necessary here, so suggest to rewrite or delete it.

Response: Thank you for your suggestion. We have deleted these sentences.

3. Lines 287-289: “These human activities … present study”. As you discussed, human activities (reservoir construction, irrigation, sewage discharge) could disturb streamflow and conductivity. In my opinion, these activities will obviously change the original negative power function relationship between conductivity and streamflow. Therefore, it is possible to determine whether it is affected by human activities by analyzing the correlation between conductivity and streamflow. In fact, you have explained in Lines 173-174 that the negative correlation between streamflow and conductivity of the basins used in this study is less than -0.5, in other words, you have excluded those basins that are obviously affected by human activities. Therefore, I suggest to rewrite the sentence of Lines 287-289 to clearly explain the impact of human activities.

Response: Thank you very much for your suggestion. When we selected the research basins, we have indeed excluded basins that are obviously affected by human activities. We have rewritten the related statements, see **Page 16: Lines: 292-296**.

4. Lines 332-336: “high-salinity deep circulating groundwater”, “low-salinity groundwater”, “high-salinity surface water”. What is the relationship between salinity and conductivity? There is no clear explanation in the article, may confuse readers. Therefore, I suggest that the “salinity” in the text should be replaced by “conductivity”, including the abstract, Figure 7, and conclusion. Or explain the relationship between conductivity and salinity in detail at an appropriate place.

Response: Thanks for your suggestion. Generally speaking, the conductivity of streamflow is positively related to the content of TDS or chloride, which means that the more salt in the water, the greater the conductivity. Considering that the word "salinity" may cause confusion, we have replaced all “salinity” in the manuscript with “conductivity”.

5. The Figures should be replaced by more clearer pictures.

Response: The original resolution of all pictures is greater than 600×600dpi, and we will upload these original pictures in subsequent submissions.

6. There are some problems in spelling, grammar, expression and format.

Response: The manuscript we submitted has been polished by a professional editor whose native language is English. If there are still problems, we can check it again later.

Reference

Bishop, K., Seibert, J., Köhler, S., and Laudon, H.: Resolving the Double Paradox of rapidly mobilized old water with highly variable responses in runoff chemistry, Hydrological Processes, 18, 185-189, 10.1002/hyp.5209, 2004.

Cartwright, I., and Morgenstern, U.: Using tritium and other geochemical tracers to address the "old water paradox" in headwater catchments, Journal of Hydrology, 563, 13-21, 10.1016/j.jhydrol.2018.05.060, 2018.

Kienzler, P. M., and Naef, F.: Subsurface storm flow formation at different hillslopes and implications for the 'old water paradox', Hydrological Processes, 22, 104-116, 10.1002/hyp.6687, 2008.

Kirchner, J. W.: A double paradox in catchment hydrology and geochemistry, Hydrological Processes, 17, 871-874, 10.1002/hyp.5108, 2003.