To: Editor, Hydrology and Earth System Sciences
Subject: Revised manuscript (#hess-2017-6)
The Authors: Sang Y.F., et al.
Title: A discrete wavelet spectrum approach to identifying non-monotonic trend pattern of hydroclimate data

Response:

The authors appreciate the Editor and Reviewers for helpful and constructive comments that improved our original manuscript submitted to HESS.

Response to Reviwer#2's comments:

Comment 1. DWS is a well established approach and has been widely applied, especially in signal analysis. I simply cannot see the novelty despite the authors stated they developed a new DWS approach. The novelty should be further elaborated and highlighted should the authors consider to revise and resubmit to another journal.

Reply: Thanks for giving this helpful comment. We know that the discrete wavelet transform method has been widely used for trend identification; however, how to accurately assess the statistical significance of a trend pattern gotten from discrete wavelet decomposition results is a big challenge. To solve the problem, in the revised manuscript we mainly proposed the DWS approach for identifying the trend pattern in a hydroclimate time series. To be specific, we used the discrete wavelet decomposition method to separate the trend pattern in a time series, and more importantly, we then established the discrete wavelet spectrum to assess its statistical significance, which is the novelty of this study and is different from previous studies.

Following the helpful comments given by both the Reviewer 1 and 2, we have carefully rewritten and added many contents in the revised manuscript, and added some new references about the use of DWT for trend identification, mainly to more clearly explain the DWS approach proposed and emphasize the advantage of the approach.

Comment 2. Application of DWS is limited on time series trend identification. Data interpretation is indeed important to understand the hydro-climate system. However, it would be much practically useful if the application can be extended to trend/data forecasting.

Reply: Thanks for giving this favorable comment. Identification of trend is an important issue to understand the variability of hydroclimate process at long time scale, but it is not an easy task in practice. In the revised manuscript we mainly proposed the DWS approach for identifying the trend pattern in hydroclimate time series and assessing its significance.

Of course data simulation and forecasting is an important scientific issue and task to understand the future situations, and these have been many relevant studies, but in our opinion, accurate identification of the variability (including trend) of hydroclimate time series is the basic and primary task for the data interpretation and forecasting. Therefore, in the study we focused on the issue of trend identification, as an important basis of data forecasting at mid-to-long time scales.

Comment 3. The analyzed hydro-climate data are averaged time series over 740 meteorological stations over China, if I understand correctly. By averaging, the features related to different climatic regimes. geological characteristics and geographical locations, etc. will be filtered out. To analyze the time series with different features would be of more interest and revealing than just to analyze the averaged data. Also, I don't think a time series with 53 annual value is long enough to detect the reliable trend

Reply: Thanks very much. As explained above, in this study we mainly proposed the DWS approach for identifying the trend pattern in hydroclimate time series and assessing its statistical significance, but not investigating the variability of spatial-temporal variability of temperature and precipitation process over China. We used the TEM and PET time series mainly for verifying the applicability of proposed approach by analyzing the "warming" and the "warming hiatus" in temperature, and the reversed changes in potential evaporation, which cannot be described by a monotonic trend.

Besides, we consider that the identification of trend in a shorter time series would have more uncertainty, so in this study we proposed DWS approach just for assessing the statistical significance of trend pattern, which is described by a proper confidence interval in Figure 3 and 5. Those observed hydroclimate time series in China are usually about 50 years, by using which we can investigate their variability at decadal and multi-decadal time scales. Of course we know that a meaningful trend closely depends on the temporal scale concerned, and the proposed DWS approach can be used for identifying the trend pattern at different time scales. To clarify the point, we added some new contents in lines 129-133.

Thank you very much!

Best Regards!
Yan-Fang Sang