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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Identifying a Transition Climate Zone in an Arid River Basin using a Hydrological Drought Index" *by* Libo Zhang et al.

Anonymous Referee #2

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In the manuscript entitled "Identifying a Transition Climate Zone in an Arid River Basin using a Hydrological Drought Index", Zhang et. al., analyzed meteorological and hydrological drought indices to identify transitional climate zone in a Heihe River Basin (HRB) in the arid northwestern China. The authors used simulations from a Regional Integrated Environmental Model System (RIEMS 2.0). Based on their analyses, the authors found the hydrologic based drought index being more suitable for the characterizing the transitional climate zone in the study basin, compared to meteorological based drought index. While the study might fall within the scope of this Journal, there are several limitations, in my opinion the work performed here is not adequate for the publication in this Journal. Major issues with this study is detailed below.

1. I find the narration as authors put up that drought indices are used for climate

classification a bit strange. The aridity index as used by the authors as drought index is also strange as this is generally used as climate characteristics (starting from the Budyko's classical work). Also what I have hard time to understand is that the authors are using the full range of aridity index – which considers both wet and dry phase – in their analyses. So where is the perspective of droughts here? In order to consider droughts the authors must focus of one end of the drought indices (drier parts) and not the entire range. The similar is the case with the author's analyses for the hydrological drought index. So, if I did not get it wrong – the whole perspective of the author's analyses revolving around the drought indices are misleading.

2. The authors must provide argument and reasoning for the choice of selected drought indices. Why do not authors choose conventional and commonly used drought index – Standardized precipitation index (SPI) or the Standardized Precipitation-Evapotranspiration Index (SPEI) for meteorological droughts; and runoff based drought index for hydrological droughts.

3. Related to the above one, why are the drought indices analyzed at annual time scale and not monthly or moving average estimates as commonly used in drought studies?

4. To a certain degree I understand the choice of using the regional climate model in their analyses, but what I miss is the thorough comparison of the RIEMS model to observations – in the sense that it could provide meaning conclusion for drought analysis. The authors must demonstrate that the selected model is able to capture the observed behavior of meteorological and hydrological droughts (say SPI or standardized runoff index). Here I mean skill of the model for drought index and not the variable itself.

5. To my understanding the RIEMS model provide estimates of net radiation (Rn) through their numerical parameterization of the mass, momentum and energy conservations schemes – so why do not the authors use Rn variable instead of PET – which is just the proxy of available energy? Please elaborate.

6. As stated by the Abstract and Discussion sections point towards "human distur-

bance" affecting the hydrological drought conditions. Do these statements are supported by their analyses or this is just the speculation? Do the selected model (RIEMS) considers the process affected by human disturbances (irrigation, farming, urbanization, grazing activities) and in which way those disturbances affect the hydrological processes? Please consider elaborating on the RIEMS parameterization and provide some modeling results in this direction.

7. All you describe in Section 3.2 is hydro-climatic characteristics and not the spatial pattern of drought indices – as the section heading indicates and explained in text. See the point 1 of my comment.

8. The starting paragraph in the Introduction section does not flow - instead of making a case (motivation) for the current study, it starts with describing the study catchment (Heihe river) and then jumping to other region (Colorado river in US). Please reformulate.

9. The results section starts with detailing supplement plots – I would have expected to see first the main plots and then the supporting plots and not other way around.

10. Figure 1: Quality is too poor – I could not read any of the subplot's legend.

11. Figures 2-7: What is the point of making these figures up to 43oN, when the whole study area ends at 42oN? Also please consider improving these figures and limit them to just show the study basin region.

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