

Response to the comments of Reviewer #2:

We'd like to thank the reviewer for the constructive feedback and help in improving the quality of this manuscript. Below are detailed responses to the comments. All changes and clarifications are included in the revised manuscript and highlighted

Thanks to the authors for their clear responses to my previous comments and suggestions. I think the paper is significantly improved, and now have a short set of comments below. Otherwise, I think this is an interesting paper and worthy of publication with minor revisions.

Major comment:

My initial comment regarding the detailed references to studies in the introduction seeming separate from the results and discussion of the study remains. In general, I think it would be valuable to discuss more findings related to precipitation shifts in the context of your actual results and make connections between the scales you analyze. This also goes along with a previous comment from Reviewer 1, who notes several connections that could be made between the cities versus regional trends, and notes that some of the content from the introduction could be useful. If the authors do not want to change this aspect, I would ask for a stronger rationale for such detailed introduction and methods sections and a relatively very brief exposition of the study findings. As it is, I felt like the paper was nearly over after the methods were described.

We thank the reviewer's insight in improving the overall structure of the paper, especially the seeming gap between the introduction (Section 1) and results and discussion (Section 3). In this revision, we strengthened the link by explicitly referencing Section 3 in the end of the introduction and added the justification of using different spatial (city, regional, and global) scales in Sections 3.1 and 3.2. See also our response below for detailed revision.

Minor comments:

Line 95: I think this section, or somewhere in the introduction, could use a little more detail on the actual study – for example mention the different scales analyzed and the reasoning for these scales (which can tie in to the background you have already provided).

This part is substantively revised as follows:

“In this paper, we aim to investigate critical transitions in hydrological processes, primarily precipitation, at various spatial, ranging from city to global, scales, using both conventional statistical and novel network measures. Detailed analyses at different scales demonstrate the versatility of the proposed method and will be of interest to locality-concerned researchers and policy makers. In particular, the analysis in individual U.S. cities (see Section 3.1 and Fig. 3 below) will enhance our understanding of the physics of urban hydroclimate via local land-atmosphere interactions (Song and Wang, 2015, 2016).

The remainder the paper is organized as follows: we present data sources of precipitation and potential evapotranspiration (PET) in Section 2, together with definition of early-warning signals and basic network analysis techniques. These methods are then applied to urban areas in CONUS with results presented in Section 3: statistical variance and autocorrelation in Section 3.1, and changes in network structure in Section 3.2. Specifically, the results of

Section 3.1 are on PET analysis at the global scale and the precipitation climatology at city and global scales. The network analysis in Section 3.2 is applied to the regional precipitation in CONUS. The choice of different scales in Section 3 is partly due to data availability (such as the inadequacy of precipitation data to construct precipitation network at individual city or global scales), and partly to avoid repetition of similar findings (such as the trend of statistical variance and autocorrelation of the CONUS precipitation closely resembles its urban-scale counterparts). We then conclude this study with main findings and future perspectives in Section 4.”

Line 174: The authors noted that they added the phrase “benchmark example” to make the harvesting example more clear here. However, I think this really deserves its own subsection (e.g. “Illustrative Example” to make it a separate part of the methods section that prepares the reader to understand the actual results.

We made this part a separate subsection 2.2.3 titled “Illustrative example of the autocorrelation process”.

Section 2.2.2: “Statistical” instead of statistic

Typo corrected.

Code/Data availability: I would recommend a stronger statement on data availability, as in general codes should be made available in a repository. However, this is a journal requirement so maybe this is fine for HESS.

Here we followed the standard language of the journal for code/data availability. We will make the code/metadata available through online data repository as mandated by our funding agencies.