Flash drought onset over the Contiguous United States: Sensitivity of inventories and trends to quantitative definitions

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Author's response

We would like to thank the reviewers for the supportive and constructive comments. The original comments are noted in black and our responses are noted after each comment are in blue.

Anonymous Referee #1

The authors have adequately addressed my previous comments and I feel the paper is now ready for publication. I just recommend a few grammatical corrections to a new paragraph about the 2016 flash drought:

L342: change “southeast has been hit” to “southeast was hit”

Fixed in the revised manuscript as suggested.

L342: change “which has sparked” to “which sparked”

Fixed in the revised manuscript as suggested.

L347-349: I suggest rewriting this sentence as “The 2016 flash drought was expected to extend eastward towards the Carolinas, but heavy precipitation from the tropical storms and hurricanes (Hermine and Matthew) that hit the region ended the catastrophic event (Konrad II and Knox, 2018).”

Fixed in the revised manuscript as suggested.

L351: change “SESR definition has underestimated” to “The SESR definition underestimated”

Fixed in the revised manuscript as suggested.

Anonymous Referee #2

>Section 3.1 shows spatial distribution of flash droughts, I can see the spatial difference due to different definitions, however, I'm not sure which definition is better for application. The aim of this study is to evaluate the current diversity of flash drought definitions, so I think the contents in section 3.1 is not enough. I would prefer a specific presentation of a typical flash drought event than detailed case analysis of these events . Figure 2 well shows that the SMVI can capture flash drought, I suggest that the authors can add the analyses for this grid cell using other definition, which could illustrate the difference using the different definition. In addition, the variation in climate factors during this event can be illustrated.

We thank the reviewer for pointing out that the analysis presented in section 3.1 is not consistent with the aim of evaluating flash droughts against one another. While we indicate areas of agreement and disagreement between definitions and with the drought monitor, we do not demonstrate that one definition is "better for application." However, this is by design. The aim of the paper is to present the diversity of flash drought definitions and to compare in a manner that addresses the research questions stated in lines 65-70. We do not intend to rank the definitions based on the power for applications. Rather, we feel that the diversity of flash drought inventories presented by different definitions reflects the fact that the definitions are capturing different types of events; there may not be a "typical" flash drought across all credible definitions (see, for example our text on lines 53-57). Rather than restructure Section 3.1 into an argument for a single, best definition, then, we have clarified our intent by adding text to the final paragraph of the introduction (line 70): "We emphasize that the comparison of definitions is not designed to choose a single, "best" way to define flash droughts. Rather, cases of divergence between definitions can be used to examine different characteristics of rapidly intensifying drought events."

For the second part of the comment: *"Figure 2 well shows that the SMVI can capture flash drought, I suggest that the authors can add the analyses for this grid cell using other definition, which could illustrate the difference using the different definition. In addition, the variation in climate factors during this event can be illustrated."* We appreciate these suggestions. To address the question regarding how different definitions behaved at this specific grid cell, we have added a marker to indicate the location of the grid cell in the 2017 panels of Figure 6. This allows the reader to see how other definitions captured the flash drought at this location. For the climate factors, we note that Figure 7, bottom panel, presents the requested climate analysis, albeit over an average area rather than this specific grid point. The results for the single grid point have been added as Supplementary Figure S1, and is now referenced in line 89.

>Line 87, "Figure 2 shows an example for the proposed definition applied over Montana", Please revise this illustration, as Figure 2 only relies on a grid point within Montana.

The caption was updated to include the suggested edit in the first revised version of the manuscript.

>I think a full quantitative analysis of the response of NDVI to flash drought is not required, while showing the NDVI change during a flash drought can help to illustrate whether the definition can capture flash drought. Regarding this, I would like to suggest that the authors can add more sub temporal panels in Figure S2-3. In addition, the spatial extent (longitude and latitude) for sub figures need to be added.

Thanks for the suggestion. NDVI supplementary figures (S3 and S4) are now redrawn for better quality and updated with extra snapshot from the available MODIS NDVI anomaly data to show more temporal variation.

>Some of the figures are not clear enough to read, please improve them.

Thank you for noting that. All figures are generated in high quality, but this has most probably occurred in the reviewer's manuscript version due to conversion to pdf format. We will make sure to upload the original quality figures for publishing.