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Discussions

Interactive comment on "Convective suppression before and during the United States Northern Great Plains Flash Drought of 2017" *by* Tobias Gerken et al.

Anonymous Referee #1

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General comments:

This is a nice paper that is a good fit for HESS. The authors demonstrate the importance of atmospheric humidity deficits just before the onset of the severe drought in the Northern Great Plains (NGP) of the United States during 2017. I do have a few suggestions that I believe will improve the analysis, and some minor comments to improve the flow and readability of the document. I believe these are minor suggestions, and I recommend publication after these issues are addressed.

1. Much of the interpretation of the figures is discussed in the text by referring to the month, but the figures use DOY on the x-axis. This forces the reader to do unnecessary

work. I recommend re-doing Figures 2, 4, 5, 6, S1, S2, S3, and S4 with the months clearly indicated on the x-axis.

2. Some of the analysis centers on the use of potential evaporation. Two papers by Milly and Dunne (Nature Climate Change 2016, Journal of the American Water Resources Association 2017) highlight the dangers and pitfalls of many empirical formulas for Ep. They show that the best method (particularly moving into the future) is the simplest: just 80% of net radiation. Given those results, I believe you should re-compute your Ep-based calculations. However, your discussion on page 8 about the impact of estimating Rn since there are no direct observations is still highly relevant, perhaps even more relevant. I do wonder how Figure 5 would change with better Ep estimates.

3. Figure 4 is a very nice figure! This figure really demonstrates how different the conditions at TFX are from the other stations. I would like to see more focus on the temporal relationship between the anomalous 2017 behavior shown in this plot and the period of peak climatological rainfall occurrence at each station, which can be deduced from Figure 2. BIS and GGW both show a lengthy run of atmospherically dry days (where the black line in Figure 4 exceeds climatological norms) prior to the onset of the rainiest period (the dramatic increase in the slope of the blue region in Figure 2). Thus, at these stations, drought onset begins and intensifies right away. At the other two stations, the climatologically rainiest time period gets underway prior to the intrusion of atmospherically controlled conditions indicated in June and July in Figure 3 and Figure 4, and the drought is not as severe (RAP) or begins much later (TFX). I think these differences between the stations should be brought forth more in this paper in order to more effectively make your point about the importance of convectively-unfavorable atmospheric conditions driving rapid drought onset.

Minor comments and edits:

1. Page 1, Line 21: "late May 2017": I think early June is more consistent with the Figure and Table.

2. Page 4, Line 3: You should explicitly mention the local time that is equivalent to 12 UTC.

3. Page 4, Line 31, “at all four soundings”: I noted here that TFX is not drier than climatology until day 200. This is the first indication that behavior at TFX is really quite different than at the other stations.

4. Page 5, Line 8, “in May”: at stations BIS and GGW (not all four).

5. Page 5, Line 19: include “climatological” before 75th percentile.

6. Figure 3: I had to look at this figure for a long time to sort out which months were anomalous at each station. I think this was simply because the many blue months were hard to distinguish from each other and because the July symbols sometimes got hidden under the August symbols and lines. Perhaps you can change your color choices to make it easier to quickly read these plots.

7. Page 8, line 1: “tall” should be “deep.”

8. Figure S1: I didn’t find this figure particularly helpful. It seems to me that the form is largely dictated by the nature of the denominator since Psum starts at zero and can only increase. I think the figure can be removed.

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