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Climate of the Past Discussions

Interactive comment on "Drought and vegetation change in the central Rocky Mountains: Potential climatic mechanisms associated with the mega drought at 4200 cal yr BP" *by* Vachel A. Carter and Jacqueline Shinker

Anonymous Referee #1

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The purpose of the paper is to investigate the mechanisms associated with a mega drought in the Rocky Mountains 4200 years ago. To this end the authors study the atmospheric conditions related to recent years with drought. Five years with drought are identified from a time-series of precipitation anomalies. Composites over these five years of atmospheric fields such as temperature, geopotential height, and winds are then calculated. The features of these composites for different seasons are discussed and used as analogues for the conditions during the mega drought.

I find the subject interesting, but unfortunately the analysis presented in the present

paper is not adequate and convincing. I have basically two major objections with the paper in its present form.

1) The composites are based on only five events. But there is no attempt anywhere in the paper to address the statistical significance or the robustness of the results. The features of the maps may easily in many cases be just results of chance. This should be investigated by calculating and showing the statistical significance. Also, it should be tested if the results are robust and if they depend on one or a few of the five events. It should also be tested if results depend on the threshold (-1.5 standard deviations).

2) The duration of the modern analogues are around a year, while the duration of the mega drought is more than 100 years. Is there any reason at all to believe that events on such different time-scales have the same or related mechanisms? Long lasting events tend, in general, to also be more spatially extended. See e.g. DOI: 10.1002/2016RG000521 for a review of how the number of spatial degrees of freedom depends on the temporal scale considered. The validity of the method of modern analogues should be investigated and discussed in detail.

There is a lot of available model experiments (e.g., CMIP5) where this could be investigated.

Minor comments:

p6, l13: Why are these years "suitable analogues". Are other conditions than the drought index used?

Figure 2: What is the value of the standard deviation?

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