Interactive comment on "Catchment-scale drought: capturing the whole drought cycle using multiple indicator" *by* A. J. Gibson et al.

Anonymous Referee #2

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This study provides analysis on droughts propagation from atmosphere to different terrestrial compartments in two (east) Australian catchments since the beginning of the 20th Century. The analysis performed is quite comprehensive and detailed for the recent (Millenium) drought event - touching the different aspects of the droughts including the atmospheric drivers. This is a very valuable contribution and I would recommend for its publication in HESS. I have some minor comments/clarifications, which I assume the authors would easily handle.

1. Somehow I missed the information on how the authors have objectively defined the criteria for the drought onset and termination.

2. While there appears to be two study catchments analyzed in this study – but the hydrological droughts (SWSI6) and NDVI anomaly (in Figures 3, 4, 9 and 12) is just a

single plot. For which catchments these data refer to? Or these plots use data combined for both basins – in this case how the underlying drought indices were aggregated into single values?

3. I understand that the authors used the AWAP simulated streamflows in their analyses. Since the following hydrological analysis is based on this modeled dataset, I would recommend the authors to make a quality check (skill assessment) against the available observed streamflow – though it might be the short time series – in my opinion the analysis will provide good foundation.

Related to the above – I would also recommend the authors to check the differences between the precipitation datasets (and the resulting meteorological drought index) i.e., one use as forcing in the AWAP product and the one the authors used in their analysis (i.e., BoM-Roscommon). This is really important to check in light of the author's discussion/conclusion on Page 10: "Not all meteorological droughts were found to progress to hydrological drought for our study catchment. The best example of this is the absence of a hydrological drought with the 1982– 83 meteorological event. This was the most severe meteorological drought, with an average SPI6 of -2.32, and had a rapid rate of onset (outlier in Fig. 3), however, there was no associated hydrological drought."

4. Could the authors explicitly specify the motivation as well the settings (parameters) they used in the Box-Cox transformation of discharge. What is the unit of Q (Y-axis) in Figure 9.

5. It is not clear which line on the Figure 4 corresponds to drought #4 or #9 (as mentioned many times in the manuscript). I can only guess.

6. Line 224: Please explain how did you identify the specific season from information provided in Figure 5.

7. I do not concur with the author's interpretation (Lines 270, 280, and 347) "the propagation from meteorological drought to agricultural drought is rapid. . . " Just because

the lag is zero it does not mean a rapid propagation. Note that you have taken SPI6, which accounts for the past 6 months of (accumulated) precipitation anomaly – which inherently account for the antecedent conditions (and create a memory effect). I would like to hear the authors opinion on this issue.

8. Since soil moisture also exhibits strong seasonality, I would have expected that authors to remove those seasonal effect (as they consider in case of NDVI) and consider the anomaly term in their analysis. Please comment on this.

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