Biogeosciences Discuss.,
doi:10.5194/bg-2016-172-RC1, 2016

Biogeosciences Discussions
Open Access
EGU

Interactive comment on "Describing rainfall in northern Australia using multiple climate indices" *by* Cassandra Rogers and Jason Beringer

Anonymous Referee #1

Received and published: 19 May 2016

General comments This manuscript describes an interesting study designed to evaluate how well several climate indices correlated with the spatial and temporal patterns of rainfall along a severe rainfall gradient in the Northern Territory, Australia. The investigators used a rainfall record from 1900 to 2010 and correlated the climate indices to rainfall at 16 locations along a rainfall gradient from 1600 mm/y to 200 mm/y. They investigated the relationship at annual, seasonal and monthly scales. The sites used are known at the North Australian Tropical Transect (NATT). The study found that across the NATT the AUSMI index provided the best correlations at a monthly time step while the TSI index was the best predictor at an annual time step. The study only examined correlations, so no cause and effect relationships could be determined.

Specific comments Recommendations for improvements to the manuscript: 1. Revise the Introduction to focus more on the topic of this study rather than on the ancillary

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topics of climate change and vegetation dynamics. Of course, variability in rainfall can have important effects on vegetation and is likely to change under future climates, but the study did not examine those things.

2. The presentation of the results was generally clear, but the Australia-wide data presented in Figures 5 and 6 and Tables 4 and 5 seemed out of place. I recommend putting that information in a supplementary materials section, or perhaps at the end of the Results and Discussion section as a separate topic, or omitting it.

3. Similar to (2), if I correctly understood the time lag analyses mentioned briefly in sections 2.5 and 3.3.4, they were conducted at continental and Northern Territory scales and also do not fit well with the other analyses done using the NATT. I recommend either omitting the discussion of the time lag analysis or more fully incorporating it into the manuscript by providing additional information and data.

4. I think the Results and Discussion section would be improved by discussing the strength of the correlations between the climate indices and rainfall across the NATT. The authors pointed out that the correlations were highest at the northern end of the transect due to the dependability of the monsoon rainfall in that area, but did not address the low r2 of even the best-correlated index at the southern end of the transect, or that most of the climate indices were very poorly correlated with rainfall at all time scales across the entire NATT (see Figures 7 and 8). Discussing the reasons for this would be a useful addition to the manuscript.

Technical corrections p. 2, line 4, substitute effects for implications p. 3, line 19, “has been shown to feedback to affect. . .” is awkward p. 5, line 14 substitute in for is p. 5, line 20, mention where the rate change takes place along the transect p. 15, lines 13-14, mention that all of the correlations are low at the southern end of the transect p. 17, lines 23-24, this seems contradictory to Table 3 that shows an increase in rainfall over time for all points on the transect. p. 17, lines 25-29. This discussion is off topic. Please modify or omit. p. 18, lines 5-18. The first two paragraphs of the Conclusions

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did not describe much about the key findings of the study. Either revise or omit.

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