HESSD

Interactive
comment

Interactive comment on "Land surface albedo and vegetation feedbacks enhanced the Millennium drought in south-east Australia" *by* J. P. Evans et al.

Anonymous Referee #2

Received and published: 26 September 2016

Summary: The authors present an RCM study of the Millennium Drought that builds logically from their previous work on the subject. Here they examine interactions between albedo and green vegetation fraction in RCM simulations that include the two peaks of the drought, 2002 and 2006. The paper is well written and both experimental design and results are presented in a clear and logical manner. I believe that the manuscript is appropriate for publication in HESS.

However, I do have two major comments that I would like to see addressed prior to final publication:

1. Methodology: I recognize that AVHRR is a default option for albedo and vegetation fraction in WRF. But the authors clearly have the capability to replace these defaults

with MODIS data, since that is how they are performing their variable albedo and GVF simulations. That being the case, wouldn't the appropriate climatological comparator be a simulation that uses MODIS climatology for these fields? Using AVHRR for the baseline experiments means that differences between the simulations could stem either from interannual variability in MODIS or from differences between the AVHRR and MODIS datasets. Time mean statistics like those presented in Table 1 seem likely to represent changes in dataset rather than the introduction of interannual variability, which is confusing since variability is the topic of the paper. I do not insist that the authors perform new simulations at this point, as the results are sufficiently interesting as they stand. But I would like to understand the choice of design, and I would encourage the authors to distinguish between dataset effects and variability effects throughout their Results and Discussion sections.

2. Mechanism: The manuscript is light on mechanistic interpretation, though members of the authorship team have numerous publications that explore mechanisms associated with these kinds of drought feedbacks. The manuscript would be stronger if it contained a distinct section within the Discussion that addressed mechanism. This would likely require the addition of some results figures or tables, since the manuscript currently doesn't include any results on the surface energy balance or PBL conditions. But I'd expect that such analysis could be added without too much difficulty and could, potentially, substantially elevate interest in this paper.

Minor comments:

1. Abstract: the statement "These results suggest that in terms of drought development, capturing the feedbacks related to vegetation and albedo changes may be as important as capturing the soil moisture-precipitation feedback" seems to come out of nowhere, since the magnitude of the soil moisture feedback has not been mentioned yet. I suggest rephrasing or removing this sentence.

2. Section 3: What meteorological data were used for the offline spinup?

3. Figures 5 & 6: The authors emphasize the fact that WRF_ALB and, in particular, WRF_BOTH show greater differences from WRF_CTL in 2002 than 2000 and in 2006 than 2005. This is clearly supported by the results shown in these figures. But the simulations actually show the greatest difference in 2007. Why was this? Does it fit into a delayed response hypotheses and, if so, does this make the year-after-a-drought response as or more interesting than the results for the drought year? It's also notable that WRF_ALB is low in 2000 and 2001 as well as in 2002. This is not discussed in the text.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-439, 2016.