

Interactive comment on “The El Niño event of 2015–16: Climate anomalies and their impact on groundwater resources in East and Southern Africa” by Seshagiri Rao Kolusu et al.

Reviewers’ comments in BLACK

Our responses to comments in BLUE

Reply to Anonymous Referee 1:

We would like to thank the reviewer for taking time to review this manuscript thoroughly and for their comprehensive comments received. We have addressed all comments in turn below: We have made all suggested changes in the revised MS. (Please see them in blue color text)

This paper compares a leading agro climatic indicator (the SPEI) with other estimates of water availability, over two regions of Africa and specifically focusing on the 2015-16 Southern Africa drought. Overall I found this paper to be very well-written and focused, and using some interesting analysis and data products to characterize the 2015-16 season. I especially liked the use of the IAF curves. I recommend this article for publication.

We thank the reviewer for his/her positive comment and finding our study very interesting.

I have two minor points that I think would help the paper, but I will leave it to the discretion of the authors how to respond to these issues.

First, there are many potential data inputs which could be used for the calculation of SPEI. While these are mentioned in the S2 supplemental material, I think that the manuscript would benefit from moving the first paragraph of the S2 section to the manuscript proper. Stating upfront which precipitation and PET estimates are used will help the manuscript by letting people better understand the historical record being used and the flavor(s) of PET calculation.

We understand the reviewer’s comment here. The main paper was deliberately written to be as short as possible, with much of the detail in the supplementary material (SM), increasingly popular in many journals. Of course there is a trade-off between brevity and detail in the main paper. Given this comment and comment 1 of reviewer 2 we agree that the methods section should include more detail, and have accordingly moved important components from the SM to the main methods section, as advised.

Secondly, I think the identification of the discrepancies between the GRACE data and the SPEI and GLDAS is quite interesting. While this paper is not meant to be a criticism of those other products, I think it should be noted that they are dramatically different in some locations, and that (typically) the GRACE does not match up with the SPEI. I think if this paper is proposing to use the SPEI to characterize drought events that this might be a useful opportunity to clarify

these discrepancies, and where to put the confidence. This is touched on in the closing of section 3.2.2, by comparing to the piezometry, but I think that this is an important and relevant finding of this paper, and definitely calls into question the use of GRACE for monitoring groundwater.

We agree that the comparison of the SPEI values with GRACE water storage components (and the contributing GLDAS components) is interesting. Indeed our analysis of the structure of apparent qualitative agreement and discrepancy forms Section 3.2.1 in its entirety. We made informed speculation about the potential sources of the discrepancies, supported by our comprehensive analysis of the uncertainties in the estimation of all the quantities considered. To this we have now added additional clarify on the nature of potential errors in GRACE retrievals of dTWS and cite the most recent approaches to address this. Further, as the reviewer notes our comparison of GRACE dGWS with piezometric observations in Section 3.2.2 provides further insight into GRACE TWS errors (see a new plot, Figure S3, in the supplementary material showing individual TWS time-series data from 3 GRACE solutions). We return to the issue in the Conclusion (lines 525-540) and have now strengthened our cautionary inference as suggested by the reviews (line 538-40).