

General comments:

The authors present a study which compares three rainfall-based drought indices for assessment of drought risks in Eastern Australia. Such assessment is vital to understanding the success and failures of ecosystem rehabilitation in post-mined landscapes which forms the focus of the study.

The study has potential to fill in several research gaps in drought studies involving the use of drought indices if adequate attention is given on discussing the results of drought simulation by the indices. There is no discussion on the seasonality of droughts simulated by the indices. This forms a big caveat in the current study given that the success and failures of ecosystem rehabilitation in post-mined landscapes is tied to the seasonality of droughts. There is limited discussion on how the drought indices compare against each other in terms of the time series. It is useful to know if aspects of droughts (e.g. duration) at a given time have been over- or under-estimated by one index over the other and/or to investigate how the indices simulate drought evolution. There is a flaw in the approach of comparing drought characteristics between a 3-month index and a 12-month index because different termination rules results in different drought characteristics with shorter, more frequent and less intense droughts usually associated with a shorter termination rule (e.g. 3-month). The authors should be looking to compare drought characteristics between indices using the same time scale.

The severity-duration-frequency (SDF) curves were used, but there is limited discussion of how the SDF curve can be used as a tool for early risk assessment. In particular, how consistent/different are the recurrence intervals simulated by the SDF from those by the intensity-duration-frequency (IDF)? The authors can enhance this by discussing the advantages and caveats of the SDF curve both in the context of the present study and elsewhere (given that there is a growing drought literature on the SDF curve).

I feel that the inclusion of management recommendations in section 4.3 is not necessary as it "dilutes" the study. I strongly recommend focusing just on discussing the drought indices and the SDF.

Major comments:

3:18-20 : The statement beginning with "As none of these indices apply universally to any climate region...". There is ample literature to show that certain indices work better in a given climatic region. The authors should refer to/cite the various drought index intercomparison studies.

3:22-24 : Why did the authors choose the SPI, SPEI and RDI instead of other indices? This needs to be explained. In addition, I feel that it is redundant for the authors to compare the SPI with the SPEI given that the SPEI is just another version of SPI but incorporating the

effects of evaporation (hence, more accurate) which is useful for assessment of droughts under climate change conditions. It is fine if the authors seek to compare the SPI and the SPEI to investigate if there are differences in drought characteristics simulated by both indices, but not to determine the "accuracy of using the SPI". Checks on accuracy of droughts simulated by an index should be compared against hydrological data (e.g. river flow).

4:17 : The statement containing "... and refer to this concept as severity-duration-frequency design drought" gives the impression that the authors are introducing a new drought characteristic. In the following statement the authors state that the SDF curve have been used elsewhere, citing the work of Shiau (2006) and Shiau et al (2012). The authors need to explain how their SDF curve is different from the SDF concept used in other studies. If this is not the case, the source of SDF concept needs to be appropriately referenced. Regardless, the concept of SDF needs to be elaborated.

4:18 : It is not clear what is meant by "drought variables".

4:24 : The statement beginning with "This approach contrasts current climate classification methods...". The SDF should be a complementary classification and not a competing one to those in Table 1. One provides a basic climatic state and is not meant to give an assessment of vulnerability, whereas the other provides the state of drought recurrence.

4:31 : Can the authors provide what methods have been utilized in the context of the phrase "... so far methods for quantifying the frequency of drought events have been rarely applied ..."?

5:9 : Why did the authors choose to use a 3-month timescale for RDI but 12-month for SPEI when the authors have acknowledged that "it is best to use a range of drought indices at various temporal scales" (3:19-20). Comparing the performance of RDI, SPEI and SPI at both 3- and 12- months could provide valuable information on the temporal consistency of these indices in simulating droughts at these timescales. Furthermore, studies have shown that drought characteristics are influenced by the n-month termination rules (see also comment 9:15-16).

6:1:2 : Out of the 11 sites, eight are what you would consider coastal locations. There may be a contrast between droughts generated at coastal sites and those in interior locations in terms their severity and timing due to the influence of maritime winds, weather types amongst others. In the later parts of the manuscript, results (Figure 5, Appendix E) suggest that this could be the case with the Quilpie and Bourke locations forming "outliers". The authors should conduct tests on rainfall data between sites within the same climate class to ascertain/reject locational influence.

6:4-5 : I would not label the SPI as "the simplest drought index" as there are other indices which are simpler to calculate than the SPI.

6:6-7 : The SPI is limited because it does not factor in other meteorological data, not because of the lack of them.

6:11-15 : The authors need to illustrate the merits and shortfalls of the 3-/6-month RDI and 12-month SPEI. In what ways are the RDI/SPEI better (e.g. better simulation of duration?) at the given timescale? In addition, to what extent are the findings from Banimahd and Khalili (2013) and Egidijus et al (2013) representative of climate conditions in Eastern Australia?

6:18 : Did the authors use the gamma distribution function for use in the drought indices, or did the authors explore other functions? If the latter is true, how are the results different?

9:6-10 : It would be useful to table the results (R^2 and p value) of all distributions and copula used.

9:12-14 : Given that only 11 sites are considered, it should not be difficult to incorporate the results of all sites instead of using selected examples.

9:15-16 : There is no basis to compare results of RDI3 and SPEI12 given that the characteristics of droughts change with different n-month termination rules. The authors should be comparing the results of RDI and SPEI using the same timescale i.e. RDI3 and SPEI3 and/or RDI12 and SPEI12.

Minor comments:

2:22 : The statement beginning with "In the past century..." - Can the authors comment on the temporal distribution of the periods of water deficits? For example, are these water deficits concentrated over a certain period e.g. late 20th century?

2:26 : Rephrase the statement "Ecosystem attributes are sensitive to the occurrence of drought events, for example the distribution of native tropical species are sensitive to the occurrence of drought events ..." to "Ecosystem attributes such as the distribution of native tropical species, the structure and functioning of forests... are sensitive to the occurrence of drought events".

2:31 : "... droughts also play a critical role for the early establishment of plants". I believe the role of droughts is as important as floods in this context (also shown in Table 1).

Can the authors briefly explain if post-mined landscapes are more sensitive to water deficits than excess?

3:6-7 : Please provide an indication of the duration of short, medium and long term droughts.

3:10 : The statement beginning with "Methods for characterizing droughts vary in complexity ...". My take is that there are two methods with which droughts can be characterized - through drought indices or hydrological models. Drought indices largely do not factor in the water budget, hence are much simpler in computation and data needs than hydrological models although indices such as the Palmer Drought Severity Index are much more difficult to compute and demands more data. I would recommend rephrasing the statement with "Droughts are usually characterized through the use of indices which vary in complexity and data needs".

3:15 : "... provide the foundation for quantifying the duration and severity ...". The term "foundation" is unsuitable given the context. I would recommend rephrasing to "... provide the means to quantifying the duration and severity ...".

3:17-18 : The statement citing Heim (2002) is the same as the statement citing Andregg et al (2013) on lines 11-13. I recommend omitting the latter.

3:29-32 : The examples of time scales used by those in different fields are not necessary.

7:20-23 : The examples of application of copulas in different fields are not necessary

9:28 : Change "P >0.05" to "p >0.05"

Fig. 4 : It makes an easier comparison of timeseries if the plots are arranged vertically, rather than horizontally, and making full use of the width of the paper. Similarly for Figs. C1 and C2.