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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Identification and simulation of space-time variability of past hydrological drought events in the Limpopo river basin, Southern Africa" *by* P. Trambauer et al.

Anonymous Referee #2

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GENERAL COMMENTS The authors present an analysis of droughts in the Limpopo basin over the period 1979-2010. The analysis is based on the results of a global scale hydrological model run with spatial resolution of 0.05°. Model results were used to compute a set of drought indicators and to characterize drought occurrence, duration, intensity and severity in the Limpopo basin. Results show that simulated hydrological drought indicators are able to reconstruct the history of droughts in the basin. I found particularly interesting the graphs showing the compared time evolution of drought indicators for agricultural, hydrological, groundwater and extended groundwater drought in different stations.

The topic fits well within the scope of Hydrology and Earth System Science, the objectives are clear and well identified, the methodology for the analysis correctly described and the conclusions are relevant and adequately supported by the results and discussion. The uncalibrated model shows acceptable agreement with observations in downstream stations in the basin and the analysis performed on simulated flows is very interesting for drought characterization. Therefore, I believe the paper deserves publication in Hydrology and Earth System Science.

SPECIFIC COMMENTS I also think that there are a few points which I believe would improve the paper:

a) On page 5, line 27, the authors state that the Limpopo basin is heavily modified. There are significant differences between naturalised and observed runoff due to reservoir storage and water abstractions. However, while discussing hydrological model performance (page 11, lines 11-25) they do not offer information on how they accounted for water abstractions in their comparison with model results. What runoff data source was used for the comparison? Was runoff directly measured in the stations compared with naturalised runoff generated by the model? The fact that PBIAS was not considered for model evaluation suggest that this is the case. Were results compared on a daily, monthly or annual basis?. I think the methodology applied for model evaluation should be clarified. Perhaps a scatter plot of models results vs. observations in some stations would illustrate the results and help the reader evaluate model performance.

b) More information should be provided about hydrometric stations, in addition to Figure 1. Perhaps basin area and mean annual runoff (naturalised and observed) should be added to Table 2. What was the source of information on naturalised runoff coefficient? This would help the reader interpreting model evaluation results presented on Table 3.

c) I do not think I understand the symbols used in Figure 9. According to the legend, drought severity is represented twice, on the vertical axis and through bubble size. Perhaps the vertical axis corresponds to drought duration and it is just a typo. I sug-

gest redrawing the figure, trying to make it more clear. In my opinion, there are too many (14) drought indicators and many bubbles overlap. Bubble size prevents a clear identification of delays between successive types of drought (agricultural, hydrological, groundwater, etc.). I suggest selecting one indicator from each of the four groups shown in Figs 5-8, since there is a good overall agreement among indicators in each group. I also suggest using a different symbol for each drought severity (like, dot, triangle and star), but without changing size, to allow a clear visualization of delays from one group to the next.

TECHNICAL CORRECTION From the formal standpoint, the paper is very well written, correctly organized and adequately illustrated with tables and figures. Although I am not a native English speaker, I believe the following expression should be corrected:

On page 11, lines 23-24, "we use them as a simply test of concordance"..... (use them simply as a test...? or ..as a simple test of..?).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 2639, 2014.