

The study investigates droughts occurred in the Crocodile River catchment, located in South Africa, during the past 60 years and explores the feasibility of abstracting groundwater for emergency water supply during a drought event. It is a useful study given the fact that groundwater has increasingly been tapped for irrigation and other purposes in many parts of the world and the impact of such practices has not been thoroughly studied. The paper is well organized. The authors have conducted many analyses but not all interesting results are shown. In particular, many statements and conclusions are not supported by appropriate figures. The paper also needs additional editing on word choices and sentence construction. My specific comments are:

Page 2720

- 1) Line 17: I believe you meant to say “the meteorological drought severity varies accordingly with mean precipitation”. If this statement is based on Fig.4, it is only true for the 92-95 drought. I don’t see any other results that show the correlation between mean annual precipitation and drought severity. SPIs are anomalies, relative to the temporal mean, and so are generally independent of mean precipitation. Fig. 4 may be an isolated case.
- 2) Line 25: This is the most important conclusion of the study and it needs more results than what has been presented. Specifically, I would have to see that groundwater can return to its natural state once abstraction stops to believe that it is a feasible strategy. I suggest you extend your groundwater simulation beyond the 4-year period, preferably to 2012, with groundwater abstraction turned off during non-drought years. If groundwater cannot recover to its natural state before the onset of the next drought, it is not sustainable to use groundwater for emergency water supply.

Page 2724

- 1) Line 20: what is “daily infilled precipitation”? Is it daily precipitation?
- 2) Line 25: Data gaps do not necessarily suggest lack of reliability. Use percentage of non-missing data instead of data reliability when needed.
- 3) Line 28: high percentage of reliability → less missing data

Page 2725

- 1) Line 1: time cover → time period
- 2) Line 9: “and the Lower Crocodile is even scarcer in terms of wells and well data” → “, especially in Lower Crocodile”.
- 3) Line 19: “are those presented in” → were provided by
- 4) Line 22: “(Nonner, 2010)” → Nonner (2010)

Page 2726

- 1) Line 21: what is the time scale of SPI and SRI you calculated in this study?

Page 2727:

1) section 2.3.2 “Water deficit during drought period”. It would help readers to get a bigger picture of water demand and water availability in the area if you provide a time series plot of annual water deficit/surplus for a relative longer time period, for instance the last 10 to 20 years. I think you have all the data needed.

3) Line 10 to 12: These two sentences can be combined into one. For instance, “The water deficit per sub-catchment during a drought was computed as the water availability minus the water requirements.” This section describes your methods in general and so there is no need to specify that the calculation is for the most severe drought event.

Page 2728

- 1) Section 2.3.3. Since you calibrated your model, I like to see a comparison of modeled estimates with in situ observations. Provide plots of monthly precipitation, groundwater storage (or levels) from MODFLOW and observation wells, stream flow from the model and gauges for the entire simulation period at selected well sites/gauge stations or as averages over the entire region. These graphs will provide background information on the hydro-meteorological conditions of the region and how difference processes interact with each other.
- 2) Line 28: “obtained from (DWAF, 2009) study” → provided by DWAF (2009)

Page 2729

- 1) Line 11: “which drains a large area (>65% of the sub-catchment area) were taken into account”. This sentence does not make sense to me.
- 2) equation (1): define what are T_{out} and T_{in} .

Page 2730

- 1) Line 20: provides time series plots of SPI and SRI averaged over all stations to accompany this sentence.

Page 2731

- 1) Line 3. “most severe” → “several severe”. Again if you have a time series plot of SPI12, it would be very easy for readers to see these severe droughts.
- 2) Line 9. What are “the graphs”?
- 3) Line 20. Was the annual precipitation in Fig. 4 calculated based on precipitation from 1992-1995 or the entire data period? As I indicated earlier, drought severity generally is independent of mean annual precipitation. Do you see similar correlation in other drought events?

Page 2732

- 1) Line 23: “are not only dependent on precipitation, they are highly affected” → “are not only affected by precipitation but also”

2) Line 25 & 28: "the most" → most

Page 2733

- 1) Line 3: The section title can be changed to "Water deficit and groundwater abstraction"; consequently, the sub-sections of 3.2.1 and 3.2.2 are not needed.

Page 2734

- 1) Line 24: Accompany this sentence with a graph comparing monthly modeled groundwater and in situ groundwater observations either at selected well sites or plotted as averages over all well sites. A graph is worth a thousand words!

Page 2735

- 1) Line 1: again show monthly time series of modeled base flow versus that of observed based flow. In addition, how do you derive base flow from stream flow data which include surface runoff and base flow?

Page 2736

- 1) Line 15. I don't understand "monthly stress period considering the longest consecutive drought in the history"?
- 2) Section 4.2: As I suggest at the beginning, you should extend your model simulations beyond the 1992-95 period to show if and how quickly groundwater can return to its natural state once abstraction stops. If groundwater cannot recover before the next drought, it is very questionable to implement such abstraction strategy.

Page 2737

- 1) Line 15-19: Once again, if this conclusion is based on Fig. 4 only, it is an isolated case and should be clearly indicated. If not, you need to show other results to back it up.
- 2) Line 19-22: Similarly, is this conclusion based on the 1992-95 drought only?

Page 2738

- 1) Line 10: revisit this conclusion after you extend your simulation beyond 1995.