Authors' Response hess-2014-549

Dear Dr. Bronstert,

Thank you very much for your comments and suggestions. We are also thankful for the extension you gave us to reply to the comments. We understand that the paper still has some open questions that need clarification. Please see below our response to the questions:

1. First open question concerns mainly to your conclusion that you detected a "shallow groundwater" contribution in your hydrograph analysis. You derive this conclusion on the increased potassium concentrations. Thus, the question is: how can you discriminate between surface runoff and shallow groundwater runoff. Potassium can be termed a trace for quickflow, including surface flow.

   We agree with this point. This component could be a mix of shallow groundwater and surface runoff. We agree that this has to be clarified along the paper and the conclusion should reflect this possibility and the potential for further research on separating the surface runoff and shallow groundwater component. We have gone through the manuscript to include this point accordingly.

2. It would help a lot if you can add some more explanations on the groundwater situation there, both deep (or "normal") groundwater and shallow (alluvial, perched?) groundwater. Do you have any data from gw-observation wells? If yes, please include such data in the paper. If no, you need to consider the possibility that the K-concentrations may be due to surface runoff.

We have borehole data from the different geological regions of the catchment. From the geological knowledge of the region, we observed that this data (presented in the manuscript in figure 6) reflects the differences between shallow and deep groundwater which are found mainly in the granite (deep groundwater) and gneiss regions (shallow groundwater). The differences in electrical conductivities and chloride concentrations are evident and the hypothesis of two groundwater systems in the region is further supported by Hughes (2010) that describes most aquifers systems in South Africa as two-reservoir systems. However, we cannot make the distinction from shallow groundwater and surface runoff from this data. Therefore we made it clear in the manuscript that the shallow groundwater could also include surface runoff water.

3. Finally, If groundwater contributions (both deep and shallow) are that important, it would help the better understanding of the regional conditions, if you discuss and discriminate the different processes during the wet and dry periods of the annuals cycle. If I understood your study correctly, your tracing was performed (only ?) in wet season events. E.g. these processes would be rather similar to the ones in humid regions (as rev. # 2 pointed in his comments). This would require that you make this clear in the conclusions (e.g. you analyse rainy season hydrology in a semi-arid climate, etc.) and that you may discuss (or speculate?) what processes might be of importance for dry runoff generation. Obviously there is runoff in the dry seasons, even if this is small.

We agree it would be good to have a hydrograph separation study during the dry weather. However, more importantly, the Kaap catchment during the wet season is considerably different from humid

environments due to the different characteristics such as the high rainfall and flow variability. We agree that we have to make clear in the paper that this study was carried out during the wet season. Therefore, we emphasized both this in the conclusion and suggested gaining a better understanding of the catchment during the dry season.

Moreover, in section 5.3 in the manuscript, we aim to explore these processes briefly and challenge further research into the dry hydrology of the region. We believe that additional monitoring of groundwater levels and aquifers is required in order to bridge this gap, such as in the study conducted by Van Wyk et al. (2012). Other considerations to take into account during the dry season include the runoff generation dependency on soil moisture and vegetation type. Evaporation and transpiration are the major components of the water balance during the dry season. Evaporation occurs from the unsaturated zone, from alluvial aquifers, from riparian zones; Transpiration from plants can tap into deeper layers of soil moisture, and in some cases even to groundwater (e.g. eucalyptus trees). When rainfall events occur during the dry season, runoff can be generated only when rainfall intensity is very high or when the soil moisture is quite high (Van Wyk et al. 2012), mainly on the beginning of the dry season. From previous research (Hughes et al. 2003, Hughes 2010) there is evidence that baseflow constitutes and important component of runoff in the region. The soil actually works as a buffer for the runoff, a lot of recharge occurring in the rainy season is slowly discharged in the dry season, as baseflow.

These points have been suggested in section 5.3. However, we agree that there is limited data in our study and further research is still needed.

Thank you again for the effort you put into reviewing our manuscript. Your questions and comments have undoubtedly led to a stronger paper. We look forward to addressing the remaining research questions in future publications.

Kind Regards

Vivian Camacho, on behalf of all the authors

References

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