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Interactive comment on "A hydrological framework for persistent river pools in semi-arid environments" *by* Sarah A. Bourke et al.

Gabriel Rau

gabriel.rau@kit.edu

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This discussion manuscript is a much needed contribution to the relatively small but slowly growing body of literature about dryland surface water-groundwater interactions. We wish to make a few recommendations that could further improve this contribution.

Section 5 (Susceptibility of persistent pools to changing hydrological regimes) considers changes to persistent river pools over time. It is well known that streams located in the most arid regions of the world receive runoff and can show significant streamflow after rainfall events. The dynamics of these are complicated but have been discussed, for example in Acworth et al. (2016). The hydrological regimes for through-flow pools following surface water flows were unraveled in detail in Rau et al. (2017). For an ex-

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ample please refer to their Figure 10. The sequence of events is generic for streams in unconsolidated sediments and some of the regimes would also apply to other types of pools. It would significantly improve this section with a better integration and discussion of the existing literature.

While the majority of persistent pools have their evapotranspirative water loss buffered by groundwater inflow, a better connection should be made to the existing dryland groundwater resource literature. For example groundwater recharge, surface water-groundwater interactions and environmental tracers in this context. Here, it would be beneficial to cite some key literature beyond what the authors have contributed (e.g., Scanlon et al., 2006; Herczeg and Leaney, 2011; Winter et al., 1998).

Great to see the concept of groundwater response times included. Our recent work has shown that longer response times are often associated with increased aridity (Cuthbert et al., 2019) so that may be worth adding in support of your arguments. Notably, that may also be the reason why groundwater fed pools were such an important resilient resource under fluctuating climates in the past in semi-arid areas during key periods for human evolution and dispersal (Cuthbert et al., 2017). The paleo-importance of persistent pools was likely very profound in many parts of the world so might be nice to add some discussion on this aspect as one more additional reason why such sites are important to understand.

The schematic cross section figures illustrate the paper really nicely.

Review comments were written by Gabriel C. Rau, Mark O. Cuthbert and Martin S. Andersen.

Recommended literature:

Acworth RI, Rau GC, Cuthbert MO, et al (2016) Long-term spatio-temporal precipitation variability in arid-zone Australia and implications for groundwater recharge. Hydrogeol J 24:905–921. doi: 10.1007/s10040-015-1358-7

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Cuthbert, M. O. et al. (2019). Global patterns and dynamics of climate-groundwater interactions. Nature Climate Change, 9, 137-141. DOI: 10.1038/s41558-018-0386-4

Cuthbert, M. O., et al. (2017). The role of groundwater hydro-refugia in hominin evolution and dispersal. Nature Communications 8, 15696, doi:10.1038/ncomms15696

Herczeg AL, Leaney FW (2011) Review: Environmental tracers in arid-zone hydrology. Hydrogeol J 19:17–29. doi: 10.1007/s10040-010-0652-7

Rau GC, Halloran LJS, Cuthbert MO, et al (2017) Characterising the dynamics of surface water-groundwater interactions in intermittent and ephemeral streams using streambed thermal signatures. Adv Water Resour 107:354–369. doi: 10.1016/j.advwatres.2017.07.005

Scanlon BR, Keese KE, Flint AL, et al (2006) Global synthesis of groundwater recharge in semiarid and arid regions. Hydrol Process 20:3335–3370. doi: 10.1002/hyp.6335

Winter TC, Harvey JW, Franke OL, Alley WM (1998) Ground Water and Surface Water - A Single Resource. US Geological Survey, Circular 1139.

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