Groundwater recharge in Africa- identifying critical thresholds
Abstract n°1896

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KEYWORDS: RECHARGE+ thresholds, field studies Africa

Increasing access to groundwater is fundamental for improving health, reducing poverty and increasing food security for the rapidly growing African population. Recent assessments of groundwater storage and expected borehole yields highlight the potential of groundwater storage to meeting domestic needs and also in some areas supporting extensive irrigation [1]. However, groundwater recharge remains one of the most difficult parameters to estimate, particularly on a regional scale [3], and there are key uncertainties around the magnitude and nature of groundwater recharge, and the relationship between rainfall and diffuse or focused recharge across different climate and hydrogeological zones. There is emerging evidence that the relationships are non linear, controlled by critical recharge thresholds based on rainfall intensity [4]. This observation is of particular importance given climate change projections which suggest a move towards increasingly intense rainfall events in Africa [5]. In this study we analyse data from 200 groundwater recharge field studies published from across Africa. Estimated values from these studies vary from 0–940 mm yr with an interquartile range of 6–82 mm. We find a direct relationship between long term total annual average rainfall and estimated recharge from the field studies, which describes approximately 50% of the variance. Further analysis of the individual field studies demonstrate that much of the remaining variance can be explained by the patterns of rainfall (such as intensity) and also land use. Long term average recharge is rarely >10 mm yr where annual rainfall is <250 mm, or <10 mm when rainfall is >500 mm. Reliable long term recharge of >50 mm yr is observed for nearly all field studies where long term annual rainfall is >1000 mm. [1] MacDonald AM et al. (2012) Environ. Res. Lett. 7, 024009 [2] Edmunds WM (2012) Environ. Res. Lett. 7, 021003 [3] Healy RW and Scanlon BR (2010). Estimating groundwater recharge. Cambridge Univ Press. [4] Jasechko S and Taylor RG (2015) Environ.Res.Lett. 10, 124015 [5] Allan RP and Soden BJ (2008) Science 321, 1481 1484