
S1-09 Rainfall - recharge relationships observed from multi-decadal chronicles of groundwater levels across tropical Africa: implications for water security and climate change

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Résumé

Groundwater is of fundamental importance to strategies for poverty reduction in tropical Africa and understanding the sustainability of more widespread groundwater abstraction for improving water and food provision is a key challenge. However, the hydraulic processes governing groundwater recharge that sustain this resource, and their sensitivity to climatic change, are poorly constrained. Here we present results from the Chronicles Consortium initiative which has collated multi-decadal groundwater hydrographs and co-located rainfall records across tropical Africa to better understand climate controls, among others, on groundwater recharge. We find that recharge in more arid environments is generally highly dependent on infrequent large rainfall events causing focused recharge through losses during ephemeral overland flows. This process is not included in any large scale hydrological or land surface models, and these events are often driven by synoptic climate controls which are themselves poorly constrained in existing climate models. In more humid locations we find surprisingly linear relationships between rainfall and recharge indicating a lack of threshold behaviour that is embodied in most hydrological models and hypothesise this is due to prevalence of preferential flow processes in the soil zone. While aridity exerts a strong control on the predominant recharge process, geological variations can dominate the observed sensitivity of recharge to climate variability. Our results enable models used for water security and climate change assessments in the region to be improved and validated using in situ groundwater observations for the first time.

Mots-Clés: Groundwater, Climate Variability, Tropical Africa, Critical Zone, Water Resources

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