Groundwater recharge and trends in seasonally humid tropics- comparative analysis of sedimentary and basement aquifers in Benin
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Groundwater is the primary source of water for domestic and agricultural water supplies throughout the tropics and much of Sub-Saharan Africa. The sustainability of current and projected groundwater withdrawals depends on groundwater recharge. In the seasonally humid area of Benin, we present new estimates of recharge using long-term (1991-2015) groundwater-level records in three aquifers that are found across Sub-Saharan Africa- quaternary unconsolidated sediments, Mio-Pliocene sediments, and weathered basement rocks. We compute annual recharge using the water-table fluctuation method in which specific yield values are constrained by Magnetic Resonance Sounding. Strong seasonality is observed each year in groundwater levels in all three geological contexts. Recharge correlates well to rainfall (mean = 1200 mm year) but varies substantially in magnitude from 460 mm year in shallow Quaternary sediments, to 260mm year in older sediments and 70 mm year in weathered crystalline basement rocks. High rainfall intensities between 10 and 60 mm day primarily contribute recharge in basement rocks, but no threshold in rainfall intensity is associated with recharge in sedimentary rocks. Rising trends in groundwater levels in Quaternary (8 cm year) and Mio-Pliocene (11 cm year) sediments are well explained by increases in rain-fed recharge. Since trend in recharge is mainly controlled by trend in rainfall, groundwater is very sensitive to any change in rainfall in all three geological contexts. However, substantial differences in recharge magnitude between geological contexts still have to be discussed.