GROUNDWATER LEVEL SENSITIVITY TO THE RAINFALL EVENTS IN THE COASTAL SEDIMENTARY BASIN OF BENIN (WEST AFRICA)

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Abstract

Rainfall volume and intensity play a fundamental role in determining groundwater recharge yet their influence is moderated by characteristics of the terrestrial environment including land use as well as soil and aquifer lithlologies. To investigate these influences, we analysed observations of daily rainfall and groundwater levels from 1991 to 2012 in the coastal sedimentary basin of Benin under contrasting geomorphological conditions: the coastal area and upslope plateaux. Substantial differences were observed in the lag time between rainfall and observed rises in groundwater levels as well as the magnitude of responses to rainf-fed recharge. Heavy seasonal rainfall of between 100 and 300 mm induces a rise in groundwater levels of approximately 1 to 3 m in the coastal area but only 1 m in the upslope plateaux. The lag times of groundwater levels to observed rainfall events is comparatively short (1 to 2 months) in the coastal region but substantially longer (3 to 5 months) in the plateaux region. Further research is required to ascertain whether these differences derive from different recharge pathways (e.g. vadose-zone velocities) or different soil conditions (e.g. soil saturation) that are required for recharge to occur. Understanding these recharge processes is not only important for predicting the impacts of climate change including projected changes in rainfall intensities but also adaptive strategies for enhancing recharge (e.g. managed aquifer recharge).

Key words sedimentary coastal Basin, groundwater, heavy rainfall, water level fluctuation, hydrographs analysis