Dynamics of groundwater recharge near a wadi in the semiarid piedmont of the High-Atlas of Marrakech (Morocco)

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In arid to semiarid basins, mountain front recharge (MFR) linked to streamflow losses is often considered the primary source of groundwater recharge of the subjacent alluvial aquifers. This MFR was described as episodic, generating a dynamic of alternating episodes of recharge and discharge. The present study is curried out at the semiarid piedmont of the High-Atlas of Marrakech, near the Rheraya wadi that is one of the main streams of the Tensift basin (Central Morocco). The objective is to analyze the processes of groundwater recharge and its temporal variability during two hydrological years, one with an extremely wet climate (2014–2015) and the other with a typical semiarid climate (2015–2016). To this aim, the water table fluctuation was measured from a well located at 10 m from the active channel of the Rheraya Wadi. The groundwater recharge was assessed by the water table fluctuation (WTF) method using the Episodic Master Recession (EMR) algorithm.

The results have shown that in the normal year, the recharge was effectively episodic. In the wet year an exceptional high recharge was recorded following an extreme flood, which has deeply replenished groundwater. In addition, a steady state of groundwater took place induced by a steady recharge rate, a dynamic rarely observed in such a context. For several recharge events during the study period, the assessed recharge seemed not to be from an individual water source. It is rather multisource, mainly from streamflow, but possibly from precipitation, underflow, or irrigation return. Consequently, the used EMR algorithm in this context estimated the general recharge that could encompass various sources. Therefore, in semiarid stream-dominated systems, different recharge patterns (unsteady and steady), various potential sources of recharge and effects of extreme hydrological events are to consider when assessing and predicting groundwater recharge.