The importance of heavy rainfall to groundwater recharge in the southwestern Chad basin- evidence from isotopic observations
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The southwestern Chad basin is situated within the Sahelian belt of Africa where annual rainfall is generally less than 500 mm and evapotranspiration exceeds 2000 mm. Surface water in rivers is seasonal so groundwater is the only perennial source of water for domestic and other purposes such as irrigation. Understanding groundwater recharge is therefore fundamental to assessing the sustainability of groundwater use, especially in the context of climate change. Stable-isotope ratios of O and H together with carbon-14 data demonstrate that active recharge of groundwater is taking place regionally. δ18O values observed in shallow groundwaters near river channels range from -2‰ to +2‰ (relative to Vienna-SMOW), which may reflect the impact of evaporation as these values exceed the weighted mean average δ18O for precipitation. Stable-isotope data are considered to trace focused recharge via river channels. Groundwater remote from the river channels is characterized by more depleted δvalues of -4‰ and -7‰, similar to that of heavy rainfalls and reflect direct, diffuse recharge through the deep unsaturated zone. Therefore, in this region, groundwater recharge is dominantly from heavy rainfalls. Carbon-14 data sampled from some of these wells are consistent with 'modern' water with average percent modern carbon of over 100 pmC. The dominance of heavy rainfall in recharging the groundwater in this region has implication, especially in view of the climate change projections that global warming will lead to intensification of rainfall and thus will probably result in increased groundwater recharge.