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ORIGINAL ARTICLE

Diffuse and concentrated recharge evaluation using physical and tracer techniques: results from a semiarid carbonate massif aquifer in southeastern Spain

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Abstract In the high-permeability, semiarid carbonate aquifer in the Sierra de Gádor Mountains (southeastern Spain), some local springs draining shallow perched aquifers were of assistance in assessing applicability of the atmospheric chloride mass balance (CMB) for quantifying total yearly recharge (R_T) by rainfall. Two contrasting hydrological years (October through September) were selected to evaluate the influence of climate on recharge: the average rainfall year 2003–2004, and the unusually dry 2004–2005. Results at small catchment scale were calibrated with estimated daily stand-scale R_T obtained by means of a soil water balance (SWB) of rainfall, using the actual evapotranspiration measured by the eddy covariance (EC) technique. R_T ranged from 0.35 to 0.40 of rainfall in the year, with less than a 5% difference between the CMB and SWB methods in 2003–2004. R_T varied from less than 0.05 of rainfall at mid-elevation to 0.20 at high elevation in 2004–2005, with a similar difference between the methods. Diffuse recharge (R_D) by rainfall was quantified from daily soil water content field data to split R_T into R_D and the expected concentrated recharge (R_C) at catchment scale in both hydrological years. R_D was 0.16 of rainfall in 2003–2004 and 0.01 in 2004–2005. Under common 1- to 3-day rainfall events, the hydraulic effect of R_D is delayed from

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