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Using different piezometric heads distributions to reduce the uncertainty on the water budget evaluation of a phreatic aquifer model.

E. Romano (1), E. Preziosi (1) and A. Martinelli (2)

(1) National Research Council, Water Research Institute, via Reno 1, 00198 Roma, Italy (email: romano@irsa.cnr.it / Phone: +39 068841451), (2) ARPA Umbria, Regional Environment Agency (Perugia, Italy)

Assessing the vertical recharge due to rain infiltration, as well as exchanges between aquifer and surface water bodies, is one of the main problems in the estimation of the global mass balance of a regional aquifer. With this modelling study, we tried to reduce the uncertainty on the evaluation of the effective infiltration at the Petrignano plain area (Umbria, Italy) using several set of piezometric head data as target for solving inverse problems. The studied aquifer, whose surface is approximately 75 km2, is constituted by the alluvial deposits of the Chiascio River and is laterally limited by lacustrine and fluvio-lacustrine sediments, which can be considered as impervious boundaries; the bottom depth ranges from 20 to 80 m below the ground surface. The system is fed both by rain infiltration and losses from the upstream part of the Chiascio, while along its final part the river acts as a drain. Since the end of ’70, a large number of wells have been drilled in the central part of the plain, both for domestic and agricultural purposes, causing a significant change in flow direction. The model was calibrated, under stationary conditions, considering two different flow situations: an “undisturbed” situation, described by the piezometric field observed before the extensive aquifer exploitation, and the situation of 2004. For each of the two data set it was possible to find, for different values of the global recharge R, a distribution of the conductivity parameter k that led to a good calibration of the model. The calibrations were performed by means of the inversion technique known as “comparison method” (Ponzini and Lozej, 1982; Guo and Zhang, 2000). The comparison of the calibrations related to the two different piezometric distributions allowed us to identify the value of the recharge R and the k distribution that could correctly simulate both the reference

flow situations and estimate the global mass balance of the aquifer.