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The groundwater budget: a tool for preliminary estimation of the hydraulic connection between neighboring aquifers

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Abstract

Groundwater management authorities usually use groundwater budget calculations to evaluate the sustainability of withdrawals for different purposes. The groundwater budget calculation does not always provide reliable information, and it must often be supported by further aquifer monitoring in the case of hydraulic connections between neighboring aquifers.

The Riardo Plain aquifer is a strategic drinking resource for more than 100,000 people, water storage for 60 km² of irrigated land, and the source of a mineral water bottling plant. Over a long period, the comparison between the direct recharge and the estimated natural outflow and withdrawals highlights a severe water deficit of approximately 40% of the total groundwater outflow. A groundwater budget deficit should be a clue to the aquifer depletion, but the results of long-term water level monitoring allowed the observation of the good condition of this aquifer. In fact, in the Riardo Plain, the calculated deficit is not comparable to the aquifer monitoring data acquired in the same period (1992-2014). The small oscillations of the groundwater level and the almost stable streambed spring discharge allows the presumption of an additional aquifer recharge source.

The confined carbonate aquifer locally mixes with the above volcanic aquifer, providing an externally stable recharge that reduces the effects of the local rainfall variability.

The combined approach of the groundwater budget results and long-term aquifer monitoring (spring discharge and/or hydraulic head oscillation) provides information about significant external groundwater exchanges, even if unidentified by field measurements, and supports the stakeholders in groundwater resource management.

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