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Water losses from irrigation canals evaluation: comparison among different methodologies

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The research investigates the field methodologies to evaluate water losses from canals, in order to find a reliable method to identify and quantify them. This study was conducted in five canal lines in Piedmont, north-western Italy, different for hydraulic, morphological, geological and hydrogeological contexts (De Luca et alii, 2012).
At a regional scale, Piedmont network consists of several tens of thousands km of irrigation canals. The loss of water due to seepage from irrigation canals constitutes a substantial part of the usable water. Irrigation canals placed in natural soil or fine and coarse sediments are characterized by water losses ranging from 20 % to more than 50 %. These losses cause economic, hydrogeological and environmental consequences: water losses evaluation from irrigation canals in the basis for the sustainable water resource use and management.
First, hydrogeological and hydrological characterisation of the study area and of the bottom of the irrigation canals was carried out for every investigated canal, in order to evaluate the relationships between groundwater and stream water (eg. piezometric and hydrogeochemical survey campaigns, infiltrometry tests, penetrometric tests and electrical tomographies, soil characterizations from the bottom of investigated canals).
The canals seepage rates were subsequently estimated using different methodologies: empirical formulas, inflow-outflow tests and double tracer tests.
The empirical formulas applied for the study underestimated the real amount of the losses probably due to the scarce number of the considered variables.
Then the canals seepage rates were evaluated employing inflow–outflow tests, considered the best tool by several authors. This method allows the determination of seepage quantities measuring inflow and outflow of a canal test reach either by instruments. The canal discharge was evaluated using a current meter. This method, even if easy to apply and practical, is not efficient, especially for low canal discharge, because of the high instrumental error.
A more rigorous method, based on the quantification of artificial tracers mass losses through exfiltration, was tested. This methodology is based on QUEST method (Rieckermann J. & Guier W., 2002; De Luca et alii, 2012). The used tracers were sodium chloride (NaCl), uranine and rhodamine WT. Uranine and rhodamine were detected by means of a fluorometer and NaCl thanks to a conductivimeter. In order to reduce the error of the NaCl detection, a multistage sampling in different parts of the cross section was applied, guaranteeing the contemporary water picking up. The results of these last tests were more accurate and in accordance with the aim of the research.

References

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