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RELIABILITY OF SPRING RECESSION CURVE ANALYSIS CONSIDERING DIFFERENT TIME RANGE MONITORING DATASETS

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ABSTRACT

The continuous expansion of urban areas has caused an increase interest in finding new potable water sources and led to consider the exploitation not only of alluvial aquifer but also of mountain aquifers as an increasingly strategic resource.

In Italy, 84,3% of the national clean water derives from groundwater where 48,0% results from well, 36,3% from spring, 15,6% from surface waters and the remaining 0,1% from marine water: springs represents therefore one of the largest and precious source of water, necessary to meet the water needs of the population (Istat, 2017).

As mountain aquifers can be particularly vulnerable from qualitative and quantitative point of view, they need a high degree of protection: it is important to understand their recharging system, from both geological and hydrogeological perspective, in order to protect and optimize its present and future management. Hydrograph analysis is one of the most common and effective ways to evaluate the properties of an aquifer supplying a spring, such as the type and quantity of its groundwater reserves.

Over the decades, many studies were made on recession curve: generally, such curves are still nowadays quantitatively analysed through methods derived from the work of Maillet (1905), who showed that the recession of a spring can be represented by an exponential formula and Boussinesq (1904), who reported that the discharge of aquifer systems is characterised by a non-linear behaviour. Continuous (hourly value) flow rate (Q) dataset are nevertheless needful for the application of these depletion curves analysis.

However, in remote settings, continuous monitoring of springs in wilderness is hampered by logistical problems for instrumentation and data collection, and monitoring all springs is both cost and labor prohibitive (Tobin and Schwartz, 2016). To understand if these equations can be valid also using a less dense monitoring dataset, starting from real complete hourly measuring recession curves, we simulated different weekly or biweekly monitoring datasets. Each monitoring series, obtained by this selective measuring range, have been analysed by Boussinesq and Maillet depletion curves methods. These values have then been compared with the ones obtained by hourly value monitoring set in order to understand the validity of these equations even in a realistic and common case characterised by a non-continuous monitoring.

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