RESULTS OF A RESEARCH REGARDING THE VARIABILITY OF SPRING DEPLETION CURVES

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In most cases, the discharge process of springs during no recharge periods - or depletion curve (DC) - is described by three well-known functions (or by a combination of them): a) Maillet or Exponential (EF); b) Tison or Hyperbolic (HF); c) Linear (LF). Each of the three functions can be obtained as a solution of a differential equation, assuming some simplifying assumptions. Each of the three equations, according to theoretical considerations, should correspond to a different hydrogeological setup, so that, for the same spring, the type of function and its depletion coefficient should remain constant from one year to the other. However, in many cases, this does not occur: often for the same spring, the depletion coefficient can change notably from one year to the other. Furthermore, even the type of DC can change. To understand the possible reasons for such discrepancies, we carried out an investigation on both theoretical and actual data sets. In this work, we present the results regarding the influence of measurement errors on the DC.
The first part of the research was carried out on a set of theoretical DCs. The theoretical data have been corrupted adding three sets of random errors (5%, 2%, and 1%), generated by a Monte Carlo procedure. In a non-negligible number of cases, the statistical analyses of results have shown that not only the depletion constant changed notably, but even the type of function was different from the original. These results were confirmed by the analyses of actual spring data.
The findings confirm the need for high-quality data. Furthermore, as there is no measurement without error, the research stresses the importance of taking into consideration the uncertainty coming from measurement errors and the need to interpretate the theoretical results in the light of the known hydrogeological setup of the spring.