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Dynamic rating curve assessment in hydrometric stations and calculation of the associated uncertainties : Quality and monitoring indicators

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Whether we talk about safety reasons, energy production or regulation, water resources management is one of EDF's (French hydropower company) main concerns. To meet these needs, since the fifties EDF-DTG operates a hydrometric network that includes more than 350 hydrometric stations. The data collected allow real time monitoring of rivers (hydro meteorological forecasts at points of interests), as well as hydrological studies and the sizing of structures. Ensuring the quality of stream flow data is a priority.

A rating curve is an indirect method of estimating the discharge in rivers based on water level measurements. The value of discharge obtained thanks to the rating curve is not entirely accurate due to the constant changes of the river bed morphology, to the precision of the gaugings (direct and punctual discharge measurements) and to the quality of the tracing. As time goes on, the uncertainty of the estimated discharge from a rating curve « gets older » and increases: therefore the final level of uncertainty remains particularly difficult to assess.

Moreover, the current EDF capacity to produce a rating curve is not suited to the frequency of change of the stage-discharge relationship. The actual method does not take into consideration the variation of the flow conditions and the modifications of the river bed which occur due to natural processes such as erosion, sedimentation and seasonal vegetation growth.

In order to get the most accurate stream flow data and to improve their reliability, this study undertakes an original « dynamic» method to compute rating curves based on historical gaugings from a hydrometric station. A curve is computed for each new gauging and a model of uncertainty is adjusted for each of them. The model of uncertainty takes into account the inaccuracies in the measurement of the water height, the quality of the tracing, the uncertainty of the gaugings and the aging of the confidence intervals calculated with a variographic analysis. These rating curves enable to provide values of stream flow taking into account the variability of flow conditions, while providing a model of uncertainties resulting from the aging of the rating curves.

By taking into account the variability of the flow conditions and the life of the hydrometric station, this original dynamic method can answer important questions in the field of hydrometry such as « How many gaugings a year have to be made so as to produce stream flow data with an average uncertainty of X% ? » and « When and in which range of water flow do we have to realize those gaugings ? ».

KEY WORDS : Uncertainty, Rating curve, Hydrometric station, Gauging, Variogram, Stream Flow