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Managing the uncertainties of the streamflow data produced by the French national hydrological services

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The French national hydrological services (NHS) manage the production of streamflow time series throughout the national territory. The hydrological data are made available to end-users through different web applications and the national hydrological archive (Banque Hydro). Providing end-users with qualitative and quantitative information on the uncertainty of the hydrological data is key to allow them drawing relevant conclusions and making appropriate decisions. Due to technical and organisational issues that are specific to the field of hydrometry, quantifying the uncertainty of hydrological measurements is still challenging and not yet standardized.

The French NHS have made progress on building a consistent strategy to assess the uncertainty of their streamflow data. The strategy consists of addressing the uncertainties produced and propagated at each step of the data production with uncertainty analysis tools that are compatible with each other and compliant with international uncertainty guidance and standards. Beyond the necessary research and methodological developments, operational software tools and procedures are absolutely necessary to the data management and uncertainty analysis by field hydrologists.

A first challenge is to assess, and if possible reduce, the uncertainty of streamgauging data, i.e. direct stage-discharge measurements. Interlaboratory experiments proved to be a very efficient way to empirically measure the uncertainty of a given streamgauging technique in given measurement conditions. The Q+ method (Le Coz et al., 2012) was developed to improve the uncertainty propagation method proposed in the ISO748 standard for velocity-area gaugings. Both empirical or computed (with Q+) uncertainty values can now be assigned in BAREME, which is the software used by the French NHS for managing streamgauging measurements.

A second pivotal step is to quantify the uncertainty related to stage-discharge rating curves and their application to water level records to produce continuous discharge time series. The management of rating curves is also done using BAREME. The BaRatin method (Le Coz et al., 2014) was developed as a Bayesian approach of rating curve development and uncertainty analysis. Since BaRatin accounts for the individual uncertainties of gauging data used to build the rating curve, it was coupled with BAREME. The BaRatin method is still undergoing development and research, in particular to address non univocal or time-varying stage-discharge relations, due to hysteresis, variable backwater, rating shifts, etc. A new interface including new options is under development.

The next steps are now to propagate the uncertainties of water level records, through uncertain rating curves, up to discharge time series and derived variables (e.g. annual mean flow) and statistics (e.g. flood quantiles). Bayesian tools are already available for both tasks but further validation and development is necessary for their integration in the operational data workflow of the French NHS.

References

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