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Comparing ADCP inter-comparison results using an automated post-processing tool

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The moving-boat Acoustic Doppler Current Profiler (ADCP) gauging method is extensively used to measure the discharge of rivers and canals. Inter-comparison of ADCP measurements are necessary not only to validate the instruments and their deployment, but also to study the discharge measurement uncertainty. Uncertainty estimates provided by the propagation methods cannot be validated for in situ conditions because of the complexity of the ADCP data workflow and the uncertainty of discharge references in rivers and canals. To solve this issue, a complementary approach to uncertainty propagation methods is the repeated measures experiments, also known as inter-laboratory comparisons. ADCP inter-comparisons have been done for decades and with very different conditions. These data sets are precious in order to test and validate uncertainty propagation methods.

The OURSIN ADCP uncertainty analysis is validated using empirical uncertainty estimates on inter-comparison experiment. This propagation method has been implemented in the QRevInt software which provides an ADCP data quality review. QRevInt is developed by Genesis HydroTech LLC (Mueller, 2021) with the guidance and contributions from an international board of hydrological agencies. QRevInt helps to clean ADCP measurements from avoidable errors and to homogenize the discharge computations irrespective of the instrument manufacturer and model.

However, post-processing inter-comparison results is a long and complicated process particularly if users want to determine and quantify uncertainty sources. There are as many practices as there are hydrometric services. Uncertainty is an indispensable component of discharge measurement and should be estimated for as many measurements as possible. To popularize these practices and homogenize them, a user-friendly tool has been developed.

From raw ADCP measurements, it applies QRevInt post-process quality analysis, the OURSIN uncertainty propagation method, and the empirical uncertainty computation based on the repeated-measures experiment. The tool applies Grubbs and Cochran statistical tests to validate the measurement selection. It returns tables with a row for each measurement with information, such as, discharge and uncertainty decomposition from QRevInt. It also returns an overview of the inter-comparison with graphs of the discharge and its uncertainty among measurements,

computed uncertainty, and empirical uncertainty. The tool allows replaying data with homogeneous parameters and users can manually exclude a measurement if it does not seem consistent. The tool will be open source and freely available.

Beyond the operational application, it could be used to replay historical inter-comparisons. With an inter-comparison database, it will be possible to study diverse types of rivers to improve and validate uncertainty estimation in various conditions. A first synthesis is proposed from one inter-comparison data set and will be extended to as much data as possible in the future.