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# Ensuring the consistancy of Flow Direction Curve reconstructions: the 'quantile solidarity' approach

Carine Poncelet (1), Vazken Andreassian (1), and Ludovic Oudin (2)

(1) National Research Institute of Science and Technology for Environment and Agriculture, Irstea (HBAN Research Unit, Antony), France, (2) University of Paris VI, UMR Metis, Paris , France

Flow Duration Curves (FDCs) are a hydrologic tool describing the distribution of streamflows at a catchment outlet. FDCs are usually used for calibration of hydrological models, managing water quality and classifying catchments, among others. For gauged catchments, empirical FDCs can be computed from streamflow records. For ungauged catchments, on the other hand, FDCs cannot be obtained from streamflow records and must therefore be obtained in another manner, for example through reconstructions.
Regression-based reconstructions are methods relying on the evaluation of quantiles separately from catchments' attributes (climatic or physical features).The advantage of this category of methods is that it is informative about the processes and it is non-parametric. However, the large number of parameters required can cause unwanted artifacts, typically reconstructions that do not always produce increasing quantiles.
In this paper we propose a new approach named Quantile Solidarity (QS), which is applied under strict proxy-basin test conditions (Klemes, 1986) to a set of 600 French catchments. Half of the catchments are considered as gauged and used to calibrate the regression and compute residuals of the regression. The QS approach consists in a three-step regionalization scheme, which first links quantile values to physical descriptors, then reduces the number of regression parameters and finally exploits the spatial correlation of the residuals. The innovation is the utilisation of the parameters continuity across the quantiles to dramatically reduce the number of parameters. The second half of catchment is used as an independent validation set over which we show that the QS approach ensures strictly growing FDC reconstructions in ungauged conditions.

Reference:
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