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Hydrograph separation using recursive filters and causal objective functions

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Hydrograph separation consists in partitioning streamflow into its quickflow and baseflow components. These components represent water incoming to the stream respectively by surface/subsurface processes and by aquifer discharge. Among the methods used to separate the components, recursive digital filters are straightforward parametric methods. However, estimating the filter parameters is either subjective or requires investigation efforts jeopardizing the initial simplicity of the method.

In this research, we investigate the Eckhardt 2-parameters recursive filter method and the Convergent Cross Mapping (CCM) based method for hydrograph separation. The latter method is a new method that promises to identify causal relationships between time series belonging to the same dynamical systems. The method is based on phase space reconstruction and is suitable for nonlinear dynamics. As the base flow and quick flow are induced by different processes and dynamics, we assume that a proper separation would minimize CCM between the two components. This hypothesis is tested using virtual reservoir modelling. We further investigate the causal relationships within the model time series using CCM with the general purpose of investigating how empirical causality could be used to objectify Eckhardt's filter parameters.