Data-based information gain on the response behaviour of hydrological models at catchment scale

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A data-based approach is presented to analyse the response behaviour of hydrological models at the catchment scale. The approach starts with a number of sequential time series processing steps, applied to available rainfall, ETo and river flow observation series. These include separation of the high frequency (e.g., hourly, daily) river flow series into subflows, split of the series in nearly independent quick and slow flow hydrograph periods, and the extraction of nearly independent peak and low flows. Quick-, inter- and slow-subflow recession behaviour, sub-responses to rainfall and soil water storage are derived from the time series data.

This data-based information on the catchment response behaviour can be applied on the basis of:
- Model-structure identification and case-specific construction of lumped conceptual models for gauged catchments; or diagnostic evaluation of existing model structures;
- Intercomparison of runoff responses for gauged catchments in a river basin, in order to identify similarity or significant differences between stations or between time periods, and relate these differences to spatial differences or temporal changes in catchment characteristics;
- (based on the evaluation of the temporal changes in previous point:) Detection of temporal changes/trends and identification of its causes: climate trends, or land use changes;
- Identification of asymptotic properties of the rainfall-runoff behaviour towards extreme peak or low flow conditions (for a given catchment) or towards extreme catchment conditions (for regionalization, ungauged basin prediction purposes); hence evaluating the performance of the model in making extrapolations beyond the range of available stations' data;
- (based on the evaluation in previous point:) Evaluation of the usefulness of the model for making extrapolations to more extreme climate conditions projected by for instance climate models.

Examples are provided for river basins in Belgium, Ethiopia, Kenya, Ecuador, Bolivia and China.

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