

User Introduction of HydRun Toolbox

Primary Functions	Description
<i>separatebaseflow.m</i>	separate streamflow into baseflow and stormflow (baseflow-free) hydrograph
<i>extractrunoff.m</i>	delineated runoff events on stormflow hydrograph
<i>extractprecipevent.m</i>	extract isolated rainfall events from hyetograph
<i>matchrainfallrunoff.m</i>	match the delineated runoff event with rainfall event(s)
<i>computeTC.m</i>	compute time characteristics for a given rainfall-runoff event
<i>computeRR.m</i>	compute runoff ratio for a given rainfall-runoff event
<i>computeRC.m</i>	compute recession constant for a given rainfall-runoff events, and also return the cut-out recession limb and simulation (in array)
<i>computeAP.m</i>	compute antecedent precipitation amount for a given rainfall-runoff event
<i>computeIA.m</i>	compute initial abstraction for a given rainfall-runoff event
<i>generalizerecession.m</i>	compute recession constant of master recession curve for a set of given recession limbs
Plot Functions	Description
<i>plotevent.m</i>	plot the runoff event and the corresponding rainfall together
<i>plotrunoffevent.m</i>	plot the delineated runoff event on the long-term hydrograph
<i>plotMRC.m</i>	plot the recession limbs along with the master recession curve (MRC)
Auxiliary Functions	Description
<i>computehydroITC.m</i>	identify the time instant (i.e. start, peak, centroid, and end) for a given runoff event
<i>computehyetoITC.m</i>	identify the time instant (i.e start, centroid, and end) for a given rainfall event
<i>findTP.m</i>	find the the turning points on hydrograph
<i>smoothcurve.m</i>	smooth the hydrograph (remove noise)
<i>batchprocessing.m</i>	apply a designated function to each event in a set of events.

Note:

- For more information of the function, please see the comments inside the function or type MATLAB command of `'help function_name'`.
- Before using the functions and HydRun GUI, it is require to add folder of *'HydRun_Functions'* to MATLAB search path (see `'addpath'` command).
- Functions of *'computeTC.m'*, *'computeRC.m'*, *'computeRR.m'*, *'computeAP.m'*, and *'computeIA.m'* deal with one event at a time. Therefore, *'batchprocessin.m'* provides a quickly to perform hydrometrics calculation on a batch of events in a cell array.

Input data:

The GUI has strict requirements for the data format and variable names. The data needs to be stored in a MATLAB data file (.mat). The time series of streamflow data needs to be named as *'streamflow'*, and precipitation needs to be named as *'precip'*. Both *'streamflow'* and *'precip'* should be a two-column array: the first column is the time step (in Julian Date), and the second column is the measured values. Please see the variables in *'BB_data.mat'* as a reference.

HydRun GUI:

The GUI (see Appendix) aims to facilitate calibrating input parameters for HydRun (e.g. filter coefficient, peak threshold, return ration, etc). It quickly plots the results of baseflow separation and runoff event delineation after the parameter are determined or adjusted. Also, it is able to generate and save the figures of the extracted rainfall-runoff events and simulated recession limbs to a designated folder. A table with selected hydrometrics will save to a designated path. It is highly recommended to save the table in .csv file (with an extension of .csv).

To open the GUI, simply run the script of *'HydRun.m'*. The GUI will pop up then.

Example Script:

The script of *'example_script.m'* allows users to perform more advanced analysis (e.g. MRC or event selection). It demonstrates the required input parameters for the primary functions and also the standard work flow of the event-based rainfall-runoff analysis using HydRun toolbox.

Appendix: HydRun GUI with Annotation

Specify the period of interest
If left blank, it will use full length of streamflow time series

show the basic information of streamflow and precip time series

filename (path) for the .mat file storing the streamflow and precip data

Baseflow Hydrograph

delineated runoff events on hydrograph

Calculate runoff ratio and antecedent precipitation need to provide additional parameters

the extracted runoff events can show on either the streamflow hydrograph or the baseflow-free hydrograph

the folder to save the graph of rainfall-runoff events

the folder to save the graph of observed and simulated recession limbs

Select hydrometrics to calculate

the file name to save the table of the hydrometrics. It is highly recommended to save in .csv file.

Input Data
 /users/weigangtang/google drive/hydro_toolkit/data/BB_data.mat
 Start Date: 2011 06 01 End Date: 2012 09 01
 Stream Flow: Start Date: 2011-Jun-01, End Date: 2012-Sep-01, Time Period: 457 (day), Time Step: 15 (min), Minimum: 0.009 (m³/s), 5-Quantile: 0.014 (m³/s), Average: 0.035 (m³/s), 95-Quantile: 0.166 (m³/s), Maximum: 2.256 (m³/s), Number of NAs: 0
 Precipitation: Start Date: 2011-Jun-01, End Date: 2012-Sep-01, Time Period: 457 (day), Time Step: 60 (min), Average: 0.093 (mm), Maximum: 12.4 (mm), Number of NAs: 0

Data Summary

Separate Baseflow
 Filter Coefficient: 0.995 Pass: 4 Go

Extract Runoff Events
 PK Threshold: 0.03 Return Ratio: 0.1 Runoff Event on: ☒ Streamflow ☐ Baseflow-Free
 Beginning Slope: 0.001 Ending Slope: 0.0001
 Smooth Coef: 4 Min Duration: Go

Match Rainfall-Runoff Events
 Max Resp. Time: 5 Rainfall-Runoff Plots: /users/weigangtang/temp/BB_ Go

Recession Analysis
 Recession Simulation Plots: /users/weigangtang/temp/BB_ Go

Compute Hydrometrics
☒ Time Charac. ☐ R / P Area (km): 3.6 ☐ Ant. Precip. Ant. Time (day): 3
☒ Rec. Constant ☒ Initial Abst.
 Output Table: /users/weigangtang/temp/BB_table_1.xlsx Go

Baseflow Hydrograph
 Discharge (m³/s) vs Time (Jul01 to Sep01). Legend: streamflow (blue), baseflow (red).

delineated runoff events on hydrograph
 Discharge (m³/s) vs Time (Jul01 to Sep01). Legend: streamflow (blue), runoff event (green).