Calculating outflow hydrographs from storm drainage units using the hydRopUrban tool

Application of the modified rational method

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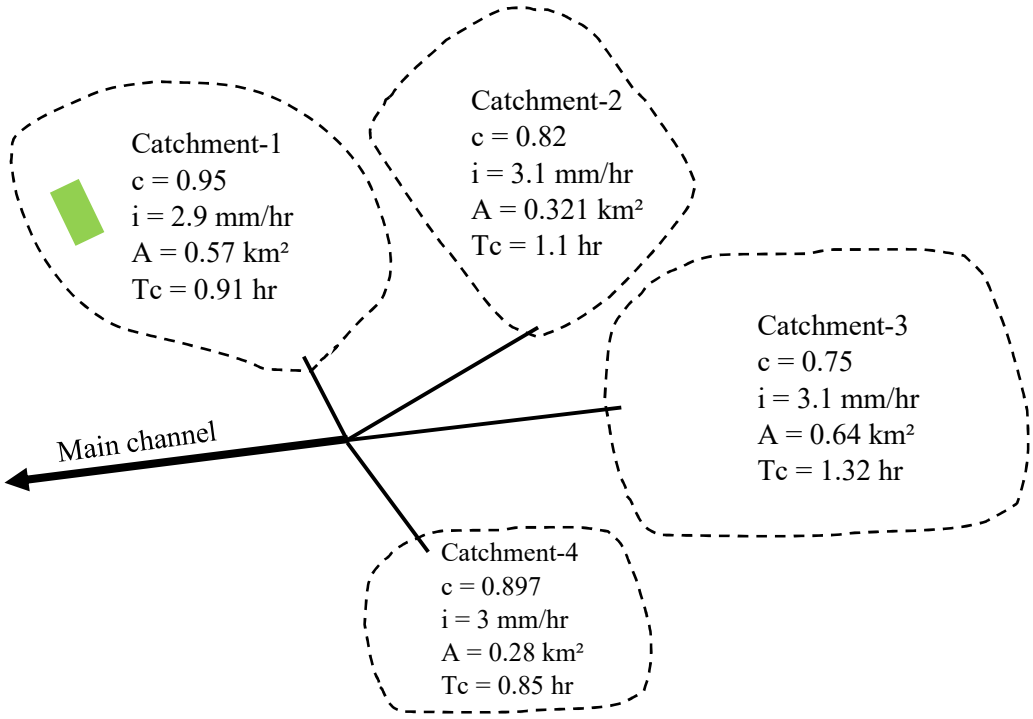
There are the following storm drainage units that bring to a main channel. The data are the runoff coefficient (c), precipitation intensity (i), area(A) and the time of concentration (Tc) by each drainage unit.



Check the reduction in the hydrograph after the installation of a sustainable drainage system in Catchment-1, by reducing its runoff coefficient from 0.95 to 0.7. Consider a storm duration of 2 hours.

Step 1: Install the **hydRopUrban** package on Rstudio, RstudioCloud or another user-defined IDE. First install the **devtools** package and then write in the code console.

```
devtools::install_github("hydrocodes/hydRopUrban")
```

This step only executes once. If the package is already installed, start with step 2.

Step 2: hydRopUrban works with txt files. Create a file with the initial data **input.txt** with the following format with the names of the headers: c, i, A and Tc.

Name	c	i	A	Tc
Catchment-1	0.95	2.9	0.57	0.91
Catchment-2	0.82	3.1	0.321	1.1
Catchment-3	0.75	3.1	0.64	1.32
Catchment-4	0.897	3	0.28	0.85

Step 3: Read the created file input.txt with the variable name "**data**". Write the path of the output file to be generated **output.txt** with the variable name **"output**". Define a time interval

for the hydrograph plotting with the variable name "**dt**" (it is suggested to use 3 minutes or 0.05 equivalent hours). Use D for storm duration. Edit the following code in the code console.

```
library(hydRopUrban)
data <- read.table(file.choose(), header=T)
output <- "C:/output.txt"
D <- 2
dt <- 0.05
rationalm(data, D, dt)
```

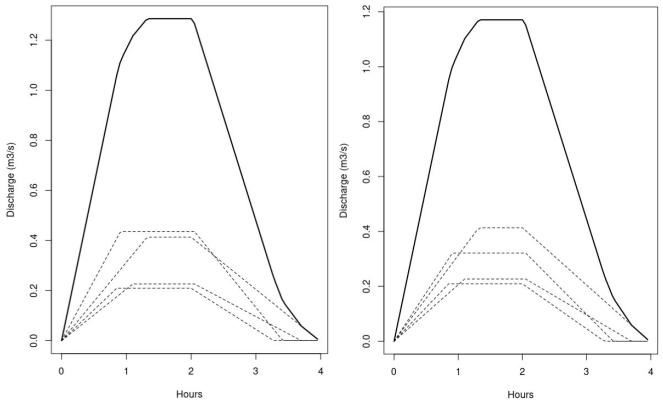
Step 4: Run the previous code with the option ***Run*** in the code console.

Step 5: Check the results, they will be displayed the maximum flow rates obtained in each drainage unit with the order specified in the input file, the maximum flow rate (Qpeak) and the volume (Volume) resulting from the aggregation of the hydrographs, as well as the plotting of the resulting hydrograph and its values saved in the path of the output.txt file.

```
[1] 0.4362083
[1] 0.2266617
[1] 0.4133333
[1] 0.2093
[1] "Qpeak = 1.285503 m3/s, Volume = 10607.773583 m3"
```

Step 6: Repeat the steps from step 2, now changing the runoff coefficient (c) of Catchment-1 equal to 0.7.

```
[1] 0.3214167
[1] 0.2266617
[1] 0.4133333
[1] 0.2093
[1] "Qpeak = 1.170712 m3/s, Volume = 9666.608061 m3"
```



"Hours"	"Discharge"
0	0
0.05	0.0622386242352419
0.1	0.124477248470484
0.15	0.186715872705726
0.2	0.248954496940968
0.25	0.311193121176209
0.3	0.373431745411451
0.35	0.435670369646693
0.4	0.497908993881935
0.45	0.560147618117177

Fig. hydRopUrban outputs. Aggregation of hydrographs (*left* for the original case; *center* with the sustainable urban drainage in Catchment-1) and output file view (*right*).

A decrease in the peak flow can be observed from 1.286 to 1.171 m^3/s.

There is a decrease in the generated volume from 10607.8 to 9666.6 m^3.

More information: https://github.com/hydrocodes/hydRopUrban