# Calculating outflow hydrographs from storm drainage units using hydRopUrban tool

Application of the standard rational method



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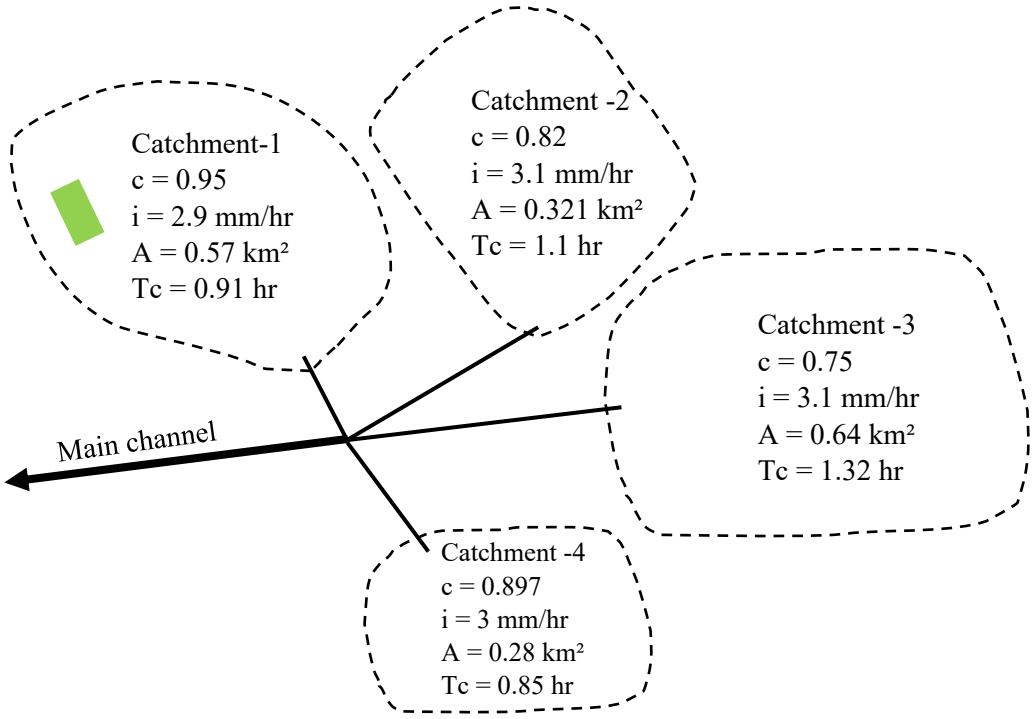
|---|---|---|---|



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.

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). Edit the following code in the code console.

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

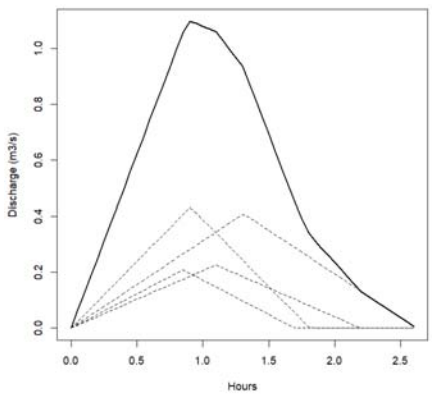
Step 4: Run the previous code with the option ***Run*** in the code console.

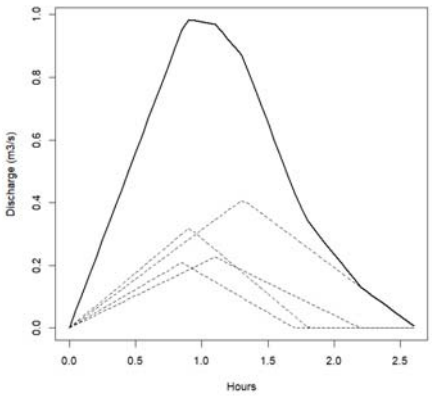
Step 5: Check the results, they will be displayed the maximum flow rates obtained in each drainage unit with the order specified in the input file, the maximum flow rate (Qpeak) and the volume (Volume) resulting from the aggregation of the hydrographs, as well as the plotting of the resulting hydrograph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

```
[1] 0.4314148
[1] 0.2266617
[1] 0.4070707
[1] 0.2093
[1] "Qpeak = 1.095672 m3/s, Volume = 4885.753200 m3"
```

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

```
[1] 0.3178846
[1] 0.2266617
[1] 0.4070707
[1] 0.2093
[1] "Qpeak = 0.982141 m3/s, Volume = 4513.828200 m3"
```




| "Hours" | "Discharge" |
|---|---|
| 0 | 0 |
| 0.05 | 0.0559313898030075 |
| 0.1 | 0.111862779606015 |
| 0.15 | 0.167794169409022 |
| 0.2 | 0.22372555921203 |
| 0.25 | 0.279656949015037 |
| 0.3 | 0.335588338818045 |
| 0.35 | 0.391519728621052 |
| 0.4 | 0.44745111842406 |
| 0.45 | 0.503382508227067 |
| 0.5 | 0.559313898030074 |

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 maximum flow can be observed from 1.096 to 0.982 m3 / s.

There is a decrease in the generated volume from 4885.8 to 4513.8 m3.

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