Lab 8 - Investigating baseflow in HEC-HMS

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Learning Outcomes

The objective of this lab is to explore the baseflow functionality in HEC-HMS. By the end of this lab and related homework, students will be able to:

1) Use the recession method for incorporating baseflow in HEC-HMS simulations for individual storm events
2) Describe the role of parameters associated with the recession method for baseflow simulation

Student Time Required: 50 minutes during lab and additional 25-50 minutes for HW.

Instructions

Create a new HMS project and save it in a new folder with an appropriate name for the folder and the project.

1. **Create a new basin model in this project.**

Create sub-basin A (name=subbasin-A) with the following characteristics:

- Area = 100 km^2
- Use SCS method for computing rainfall losses with the following parameters: CN = 80, impervious cover = 0, Initial abstraction = 0
- Use SCS unit hydrograph for transformation with the lag time as 60 minutes.
- Use None for all other methods.
- Use the following precipitation data as input

ΔT (15 min)	Precip. (Inch)
1	0
2	0.3
3	0.1
4	0.1
5	0.1
6	0.1
7	0.1
8	0.1
9	0.1
10	0.1
11	0.1
12	0

- Run the model by using appropriate start date/time and end date/time. Use 10 minutes for time step.

Create a plot of total streamflow.

2. Computing Baseflow using a recession model.

In the HEC-HMS model that you created in (1), change the recession method from "None" to "Recession". Use initial discharge as 10 m3/s and the recession constant as 0.25. Use the threshold type as "Ratio to peak" and the ratio as 0.1. HEC-HMS uses the following equation in computing the baseflow: *Baseflow = Q_0K^t*, where Q_o is the initial discharge you specified, K is the recession constant defined as the ratio of current baseflow to the baseflow one day earlier, and t is the current cumulative time. The threshold defines the point on the recession curve where the direct runoff will stop and the total flow becomes equal to the baseflow.

- Run the model and copy the direct runoff, baseflow and total flow in an excel sheet. Also look at the total input, loss and output values.
- Run the model four more times by using K (Recession constant) = 0.1, 0.3, 0.6 and 0.9. Copy the direct runoff, baseflow and total flow after each run.
- Change the ratio to peak to 0.5, and run four more simulations by using "Recession Constant " = 0.1, 0.3, 0.6 and 0.9.
- Change the ratio to peak to 0.9, and run four more simulations by using "Recession Constant " = 0.1, 0.3, 0.6 and 0.9.
- Change the threshold type to "Threshold Discharge" and play with threshold flow values from 10 to 100 cfs to see how this option differs from the "Ratio to Peak" option.

Turn-in (By April 03, 2020)

1. A plot of total streamflow that shows direct runoff and baseflow (see Figure below) from all runs. Use Excel or any other plotting software. Do not include screenshots. Thirteen plots total, with first plot not involving any baseflow. Try to put at least four plots on one page.

Total Streamflow Hydrograph
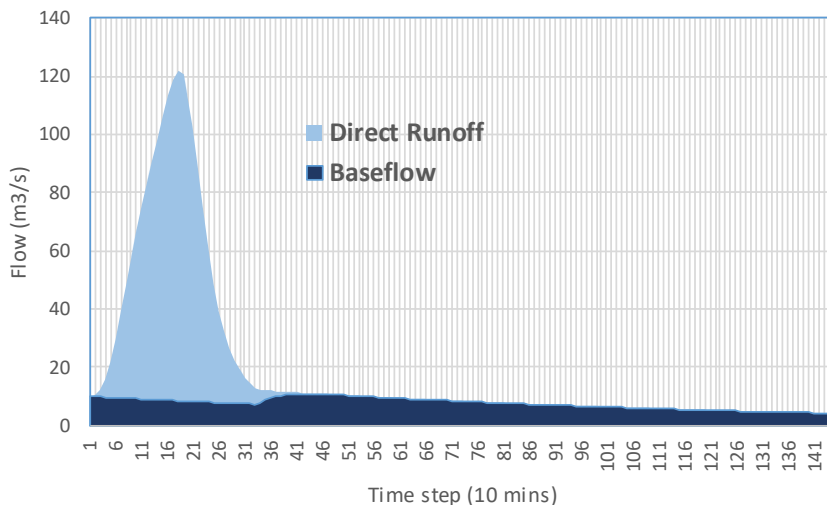
2. Provide a brief write-up covering the following points: (1) how does the recession baseflow model in HEC-HMS compares to the methods discussed in the class (straight line, fixed base and variable slope)?; (2) what is the role of K in the recession model in HEC-HMS; (3) what is the role of "ratio to

peak" in the recessing model. How does it affect the total streamflow hydrograph?; (4) which parameter (K or "ratio to peak") adds more flow volume to the total hydrograph. (5) How is "Threshold Discharge" option different than "Ratio to Peak" option? Can you accomplish same result by using any of these two options? How?. (6) Do you need to specify initial discharge to use the recession method? How will your results change if you provide zero initial discharge? <you may have to run few more simulations to answer this question>; (7) What happens if you use a value of zero for ratio to peak? What effect does this have on the hydrograph compared to when you use a nonzero value for the ratio? <you may have to run few more simulations to answer this question>