**BAE587 – Homework# 5**

The entire code for the homework is in the “BAE204-QClab-2020.Rmd”.

The goal of this homework is to manipulate some very useful tools to derive important hydrology and water quality indicators. For this, I am asking you to use R and R Markdown codes to write and illustrate your homework/report. I am giving you quite a bit of code such that you have a head start and you do not have to invent the wheel again.

I am asking you to of hydrologcommonly used in hydrology and water qualityconcepts of hydrographs and chemistry be able to apply the tools provided and apply them to another watershed, and derive indicators of hydrographs, chemographs, concentrations, and loads as explained in “BAE204-QClab-2020.Rmd”.

The study watershed for this homework is the Chickasaw River at Franklin, Ohio (lat:40.487038, long:-84.481683). The watershed is 42.5 square kilometers in surface area, draining a predominantly flat, tile drained, agricultural watershed.

The data is available at

<https://raw.githubusercontent.com/francoisbirgand/BAE204-Qlab/master/Lin_1h_cuyahoga_all_2008-2009_SI_ref.csv>

Exercise 1 (10 points):

Plot the yearly 2012-2013 hydrograph for the Chickasaw River at Franklin, Ohio. For this go into the “BAE587-Hmk5.Rmd” document, and modify the code available <https://francoisbirgand.github.io/BAE-587/introduction-to-hydrographs-chemographs-concentrations-and-loads.html#actual-hydrograph-over-an-entire-year> into the first chunk to obtain your result. Do not forget to introduce what you are doing before the figure. After the figure, discuss what you are observing. Think about potential seasonality (or lack thereof) of baseflow, of the magnitude of flow peaks, etc. Propose possible reasons for your observations.

Exercise 2 (20 points):

Calculate the lowest, highest, mean, and median flow rates, as well as the 10th percentile, and the 90th percentile. For this, there is the quantile function, which works as quantile(Q,percentile value).

Report them in a bullet list using embedded code.

Exercise 3 (20 points):

Calculate and report the arithmetic average and medium concentrations for nitrate, TP, SRP, and TSS over the entire year of record.

List reference concentration values seen in lecture and compare your results to these reference values.

Exercise 4 (20 points):

Plot the hydrograph and nitrate, TP, SRP, and TSS chemographs for the Chickasaw River at Franklin, Ohio, from 2013-02-25 12:00 to 2013-03-05 12:00. You may use code available at <https://francoisbirgand.github.io/BAE-587/introduction-to-hydrographs-chemographs-concentrations-and-loads.html#chemographs-and-concentration-levels>

For each, report whether the chemographs exhibit a concentration or a dilution effect.

Exercise 5 (15 points):

Over the same 10 day period, for each of the nitrate, TP, SRP, and TSS, plot the cumulative load expressed in kg/km²/10 days as a function of the cumulative volume expressed in mm. Add a line connecting the first to the last point of the curve.

A nice code to calculate cumulative volume or load is give in the same book section given above.

Report either on the graph or in the text below the arithmetic average and the EMC concentrations, and calculate and report their percentage difference. Make sure you use embedded code to make all your calculations and display in the text. Discuss the differences between the two.

Exercise 6 (15 points):

Over the entire 2012-2013 hydrological year, for each of the nitrate, TP, SRP, and TSS, plot the cumulative load expressed in kg/km²/year as a function of the cumulative volume expressed in mm. Add a line connecting the first to the last point of the curve. Report either on the graph or in the text below the arithmetic average and the EMC concentrations, and calculate and report their percentage difference. Make sure you use embedded code to make all your calculations and display in the text. Discuss the differences between the two.