**Assignment#7 Soil Water Balance and Watershed Modeling I** (due 4/14)

There are three distinct objectives to this assignment: (1) to gain perspective on how Northeastern U.S. soil moisture oscillates; (2) to get a little experience modeling a watershed; and (3) and to tie together several of the processes that we have discussed over the past several weeks.

1) I have provided *monthly* precipitation (+ snowmelt) and PET\(^1\) for 1994-1996 in a file available at the class website. Also included is monthly streamflow for our old friend Fall Cr. Apply the Thornthwaite-Mather soil-water budget to a typical upstate New York soil, i.e., sand loam with a depth \(\approx 25\) cm. Keep track of the surplus and play with the reservoir coefficient such that monthly “modeled” streamflows are similar to the observed Sixmile Creek streamflows. Assume the initial available water is equal to the available water capacity and that the initial storage is about 5 cm.

Questions:

- What is your average annual actual ET and how does it compare to previous estimates from this semester? Compare it to the average annual PET. Make a graph of precipitation, PET, and actual ET (on the same graph) and note the parts of the year where there is a deficit in the soil water budget (more PET than precipitation)
- In which month is the soil, on average, the driest? How dry? Turn in a graph of monthly available water, precipitation, and PET for 1994-1996
- What reservoir coefficient did you use? Attach a graph of modeled streamflow (represented with a line) and observed stream flow (represented with symbols and no line). How well did your “modeled” streamflow match the observed streamflow? Note some specific problem months and hypothesize on the discrepancies.

2) In the same Excel workbook I have provided *daily* precipitation, snowmelt, and information for calculating PET for one year. Perform a daily soil water budget for this year and keep track of how much surplus water drains from the soil and how much generates saturation excess overland flow. What month(s) experience the highest overland flow? Based on your results, when does groundwater recharge mostly occur? Graph daily precipitation, ET, available soil water, and runoff (overland flow).

ALSO: I have included some pan evaporation data from the summer. What is the average ratio of your calculated PET to the pan evaporation

You’ll want to use some sort of computational tool to do this assignment and I have no preference, although, in something like MATLAB or a basic programming platform is probably easiest if you are comfortable with one. If you choose Microsoft Excel, you’ll want to use the “if()” function. If you aren’t familiar with this tool either see me or someone else who can show you how to use it... it’ll make this assignment much easier.

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\(^1\) I used a combination of Pan Evaporation and the Priestly-Taylor method; to account for lost leaves I halved the PET for the Oct.-Apr.; it would have been better to reduce the effective soil depth. Feel free to modify this as you’d like.