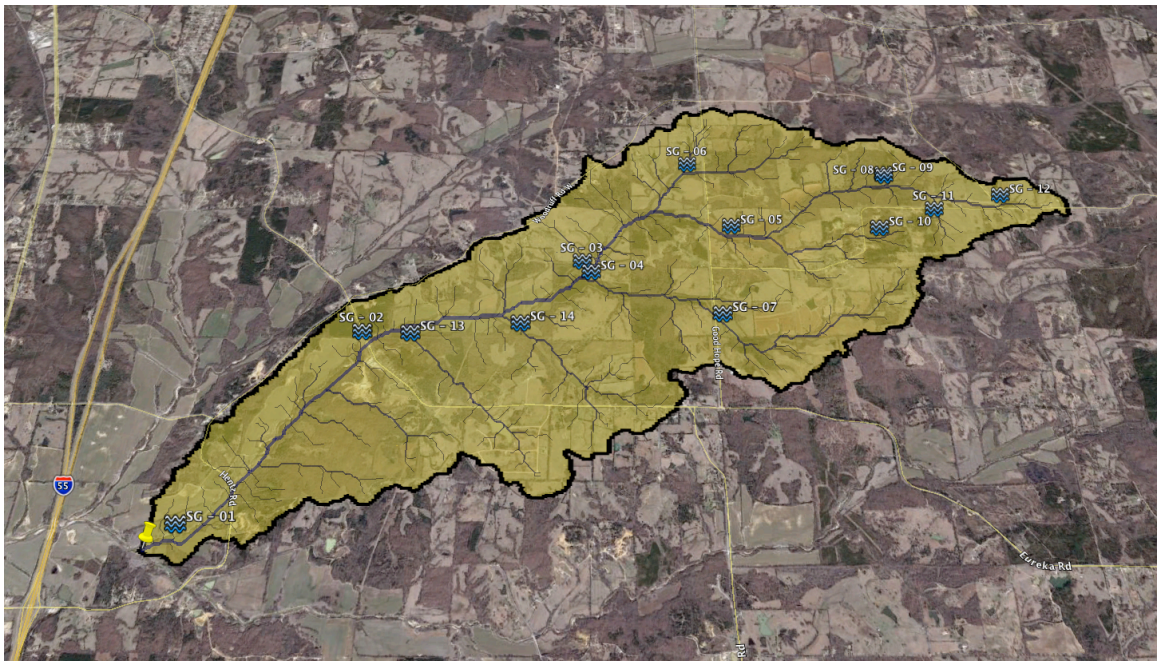
HW#9 (Lectures 20, 21,22, 23) (Due December 2, 2010)

Follow the steps to do this data analysis and simulation on GCEW homework. Questions are highlighted in text below.

1. Download the data needed for the first part of this homework form: http://cires.colorado.edu/~ricardo/temp/Homework9-Data.zip
   You may need to copy paste this url to your browser to get the data.

2. Uncompress the ZIP file and open the file Goodwin Creek Mississippi.kmz using Google Earth (if available) and familiarize yourself with the region and the location of the outlet gauge and the internal gauged sites at the Goodwin Creek Experimental Watershed (GCEW). The yellow polygon indicates the area of the river basin and the blue lines are the river-network extracted from a 30m Digital Elevation Map. How well does it compare to the actual channels in the terrain?



3. The second file is a spreadsheed named "Homework 9 - Data.xlsx". Data is organized in two sheets of data, one for each of two rainfall-runoff events. The first three rows of data contain upstream area and peak flows observed during for two rainfall-runoff events. The following rows contain time and streamflow value recorded at the internal gauged locations.

Q.1 Plot peak flows versus upstream drainage areas on a log-log plot, and compute the scaling slopes and intercepts. Use Excel's "Trendline tool" and select the power law option. (4)

Q.2 You are given the stream flow hydrograph at the outlet for the two events. Also the observed rainfall intensities are given for the same events. Rainfall (Mean areal precipitation) is given at the far right column of the data sheet. Carry out a water balance analysis and calculate the φ-index infiltration threshold (mm/hr) for the two events. Recall that φ is the value that satisfies the equation

$$V_Q = A\sum_T \left(p(t) - \varphi\right)\Delta t$$

where V_Q is the total runoff volume, A is the basin area, $p(t)$ is the rainfall at time t and Δt is the rainfall time interval. (8)

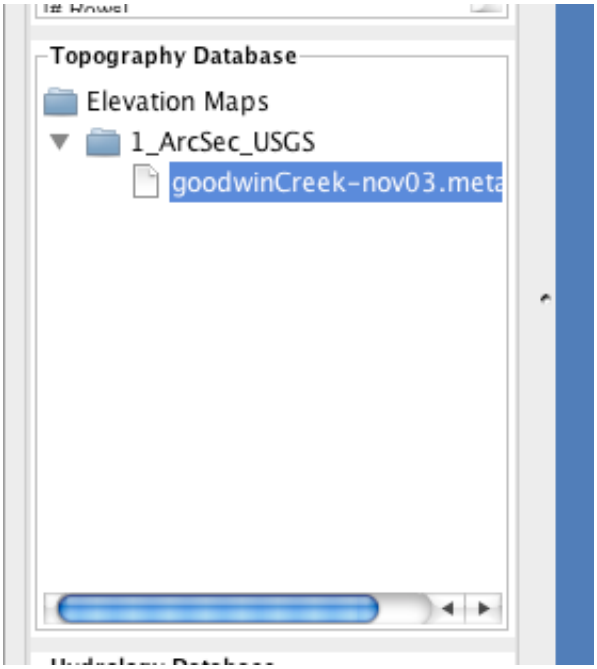
4. Simulate peak flows for the two rainfall-runoff events using CUENCAS, use the φ-index infiltration threshold calculated in the previous step. Follow the steps below.

- Download a CUENCAS database for the Goodwin Creek basin from http://cires.colorado.edu/~ricardo/temp/Goodwin_Creek_MS_database.zip. Uncompress the file to your desktop.

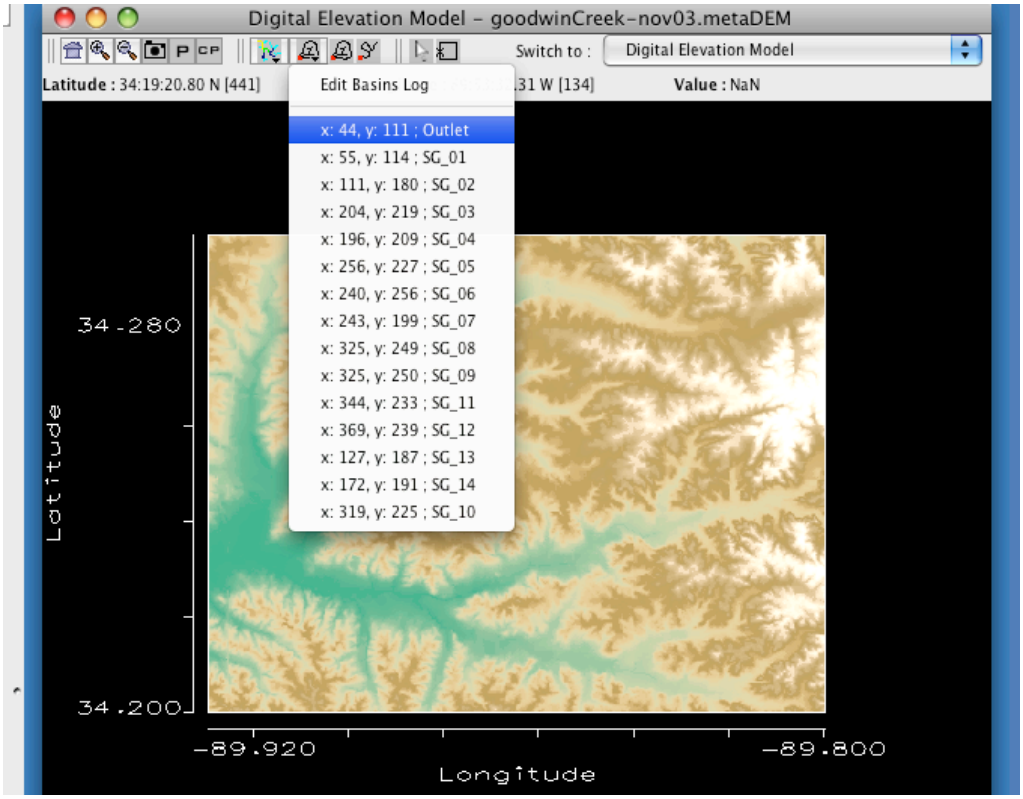
- Open CUENCAS by clicking the "Run CUENCAS" link at the CUENCAS webpage http://www.iihr.uiowa.edu/~ricardo/cuencas/cuencas-download.htm

- On the CUENCAS menu select "File -> Open Database". Find the directory "Goodwin_Creek_MS_database" that you uncompress with the data for Goodwin Creek.

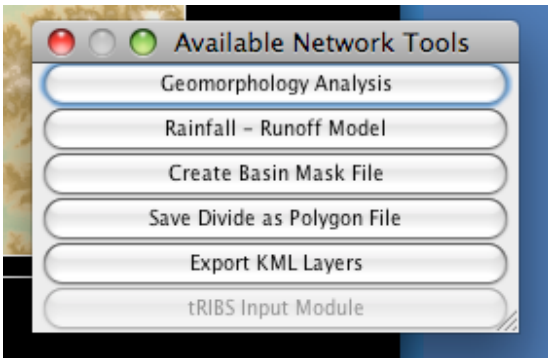
- Expand the Topography folder and open the DEM.



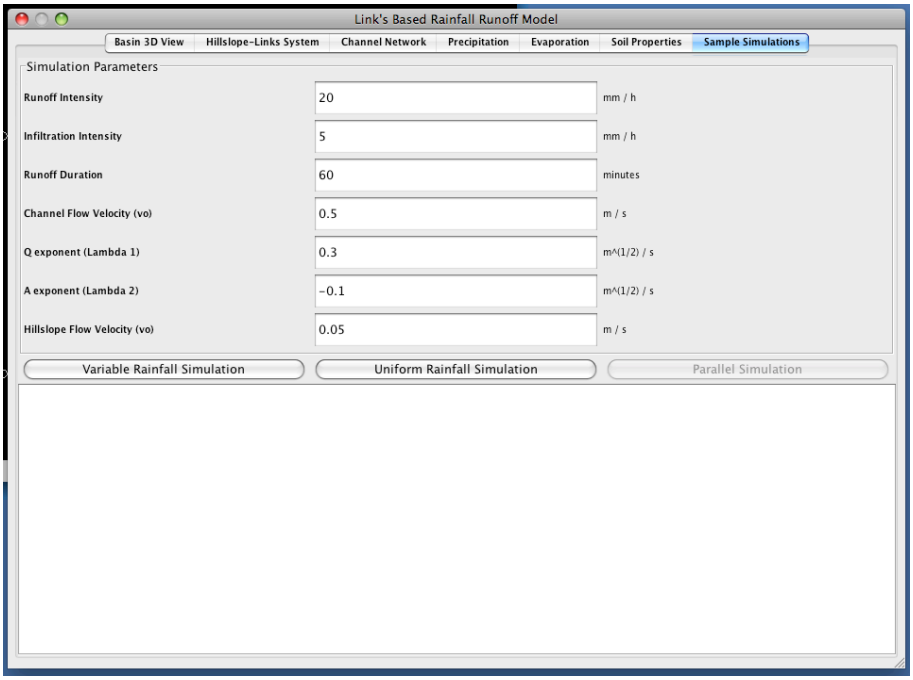
- Select the basin outlet, using the preselected outlets tool.



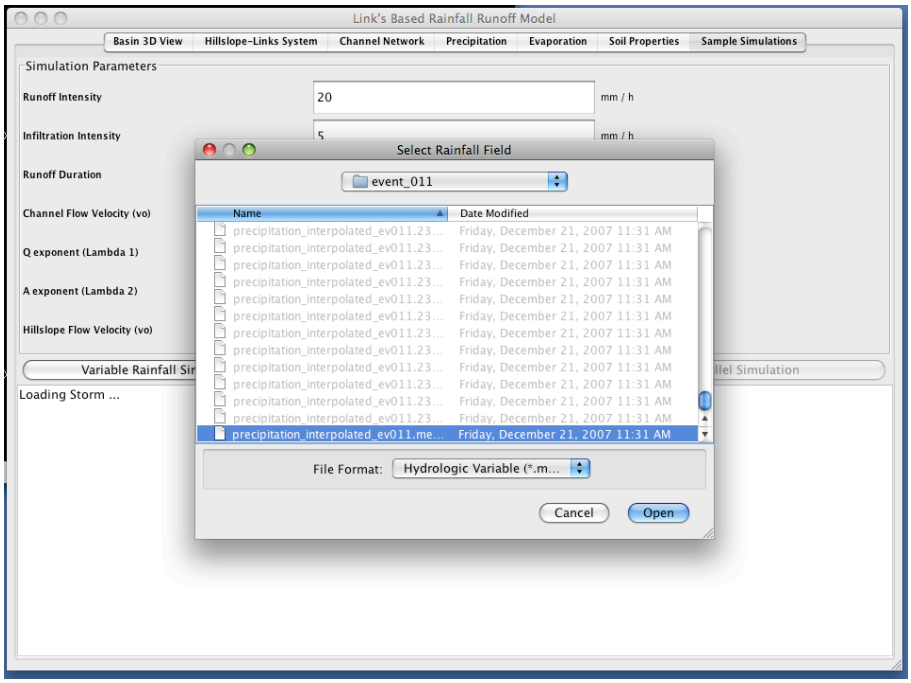
- Right-click on the red spot to expand the "network tools" and select Rainfall-Runoff Model.



- On the interface select "Sample Simulations" tab. Choose the appropriate parameters for your simulation (Infiltration Intensity = φ-index, Channel Flow Velocity = 1.0 m/s, lambda1 = 0, lambda2 = 0, Hillslope Flow Velocity = 0.05 m/s) and press the "Variable Rainfall Simulation" button.



- Use the directory search to find the rainfall data and select the output directory.



- A comma separated file is created in the selected directory. Open the "csv" file using Excel to visualize your simulation results.

Q.3 Plot simulated peak flows versus upstream drainage areas on a log-log plot, and (i) compute the scaling slopes and intercepts. (ii) Compare the scaling parameters for the two RF-RO events, and discuss the similarities and differences between them. (4)

Note: The observed exponent in Q.1 is to be estimated using 14 gauged locations in the network. For the simulated peakflows you are using peak flows at the bottom of all complete order streams in the river network

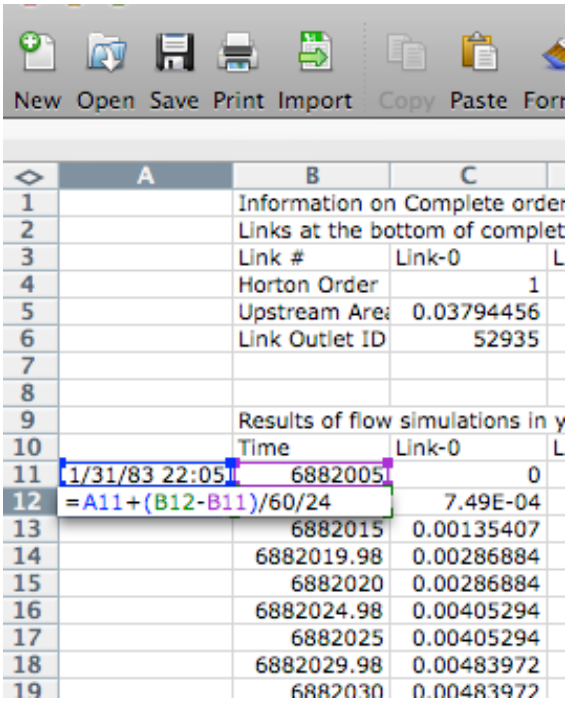
Q.4 Compare the simulated hydrograph at link-427 with the observed hydrograph at SG-01. Similarly, compare simulated hydrograph at link-314 with SG-04, and simulated hydrograph at Link-506 with SG-12. Discuss your results. (4)

Note: You will need to manipulate the time column of the simulated hydrographs to obtain time in excel format before you can put all the plots on the same chart. Follow these simple steps:

- Insert a column at the beginning of the simulation results data sheet.

- Write the initial date for the event (For event 011: 1/31/1983 10:05:00 PM, For event 020: 5/3/1983 12:20:00 AM) next to the first simulated time stamp

- Write the formula "=A11+(B12-B11)/60/24" and expand the formula to the entire column.



- Plot rainfall, observed flow and simulated flow in the same chart. A typical way to present the plot is with the rainfall using a secondary inverted axis. See the figure below for an example of the results.