Lab 3: Hydrology lab

This week's lab will look at how the hydrograph for water leaving a stretch of river differs from the hydrograph of water entering a stretch of river. Sort of like lag to peak between precipitation and discharge but for discharge in and discharge out. This is partly because we don't have a good way to rain on the EmRiver model right now.

Turn in: Lab report, edits to lab report, or a concept sketch.

Due date: 6 March at 11:59 pm (lab report and edits) or 7 March in lab (concept sketches)

Obective: To determine how different channel forms affect the hydrograph of a reach of river when it receives a pulse of water (say from a dam release or burst).

Methods:

A lot of this is going to be totally up to you with how you do it. Basically we need to add water in to the top of the stream table at a known rate (or known hydrograph) and then measure how the water comes out of the stream table. We'll repeat the experiment for multiple channels and multiple hydrographs. At a minimum you should consider three channel types: a concrete channel (move all the sediment out of the way for a straight channel), no channel (smooth the sediment out), and some kind of meandering channel in the sediment.

Supplies

- 2 stop watches
- Graduated cylinders and beakers
- EmRiver Em2 model

Lab methods

1. Determine what hydrograph inputs will be. Practice getting them correct (or correct enough) using the graduated cylinders and stop watch.
2. Determine what your channel forms will be.
3. For each channel and hydrograph combination you will:
    a. Create the channel
    b. Start both stop watches
    c. Pour water in the top of the channel, noting start and stop times for water going in, and how much water goes in.
    d. Collect the water coming out the bottom of the channel, noting when water starts to come out, how much comes out in each unit time, and how long it takes for all the water to come out.
4. Repeat step 3 for each channel/hydrograph combination (so with 3 channels and two hydrographs, you'll do this 6 times).
5. Be sure to describe the channels in your methods section. Pictures would be helpful.

Analytical methods

1. Create all your input and output hydrographs (twice as many as your number of trials, but you can plot input and output on the same plot for each pair). Plot these using bar (or column) plots.
2. Calculate travel times.
    a. Calculate the travel time between starting to put water in and starting to get water out for each pair of hydrographs.
    b. Calculate the travel time for peak discharge for each trial.
    c. Calculate the total time you put water in and that water came out for each trial
    d. Calculate the travel time for the last bit of water put in (when you stopped putting in water) and when it stopped coming out. Remember that water in should equal water out.
    e. You'll probably want to put all these into a table

Results: In your results section, describe the different hydrograph pairs and report the travel times. Be sure to include both quantitative and qualitative observations. You should use a bar plot for your results figures (or a column plot). Try to get all three trials on the same figure so you can compare them easily.

Discussion

In your discussion, think about the following questions:

1) What do the results tell you about the lab objective?
2) Compare the hydrographs for different trials. Compare across channel types for one input hydrograph and across hydrographs for one channel type. You're controlling for two different variables, so don't mix comparisons between them.
3) How does this scale up to a real river system? What can you learn about water transport in the real world? Some examples of a real world connection are a dam release or outburst flood.

Concept Sketch Ideas

Here are some ideas for the concept sketch this week. Remember that you don't need to do everything, you just need to include a few points for each. I want to see more drawings and less text. Be sure to include actual lab results, but you can focus on just one of the questions if that helps you simplify things.

Identification: What are your input/output hydrographs? What channel shapes did you use? What qualitative observations do you make? How do travel times vary?

Process: Why do you think the things you identified are happening? What is it about the different channels or different hydrographs that makes thing change or not change?

Interactions: How does this compare to the real world? What real life stream systems are you modeling?

Predictions: Draw a different channel form or different hydrograph and predict how the travel times and/or output hydrograph would look.