

HW #5 (Lectures 9 and 10, 5333) (Due on October 7)

Start up CUENCAS. Download and display the GCEW DEM. Click on the outlet coordinates to display the basin outlet and drainage divide. Next, press control-option (Mac) and click, or right click (pc), on the basin outlet (shown as a red dot) and then on 'Geomorphology Analysis'. These steps were shown and explained in Lecture 10.

Part A: Horton Laws

You will see several types of geomorphologic analysis that CUENCAS performs on GCEW. On top of the window click on the tab "Horton Laws". Many different types of analyses are listed on the right. We will select two that have been covered in Lecture 9.

1. Click on branching relation, or the Horton law of stream numbers. Calculate Horton bifurcation ratio from the plot. Use Eq. (9.3). Show your calculations. (2)

2. Click on areas relation, or the Horton law of stream areas given by Eq. (9.4).

(i) Obtain a relationship between mean area $E[A_{\omega,\Omega}]$ and R_A , $1 \leq \omega \leq \Omega$, using Eq. (9.4). It will look similar in form to Eq. (9.2) but not the same. Show your steps. (3)

(ii) Calculate Horton area ratio from the plot in CUENCAS and the equation in part (i). Show your calculations. (1)

Part B. Link-based Analysis

Definition: Magnitude is the total number of external links upstream of a given location in a basin; in CUENCAS, the location is given as a link. The n_L in a basin, is related to magnitude, m , as $n_L = 2m - 1$. To get a feel for this expression, consider a river network that looks like the letter Y. Here, $m = 2$ and the equation indicates that $n_L = 3$ (which is true).

Click on the tab 'Link Based Analysis' that is second to the right of the Horton laws. "Buttons" for XY-Plot Mode, X-log, Y-log, Interiors, and Exteriors are located near the top of the window. A column of link properties (e.g. Upstream Drainage Area) appears on the right side of the window. The column is divided into two parts: x-axis and y-axis. You will work with these features for the problems below.

3. Turn **on** XY-Plot Mode (i.e. fill the empty circle). Turn **on** the Interiors and Exteriors buttons (i.e. check-mark the square). Turn **off** the X-log and Y-log buttons. Next, highlight 'Link's Magnitude' for the x-axis (top right column), and 'Link's Magnitude' for the y-axis (bottom right column).

(i) Estimate the magnitude of GCEW from the plot, and Calculate total number of links. (1)

4. highlight 'Link's hillslope area' for the x-axis (top right column), and 'Link's hillslope area' for the y-axis (bottom right column). Notice from the plot the hillslope areas draining into links vary through out the basin.

(i) What is the smallest and the largest areas of the hillslopes? (1)

(ii) Total area of GCEW is 21.2 km^2 . Calculate the mean hillslope area. (2)