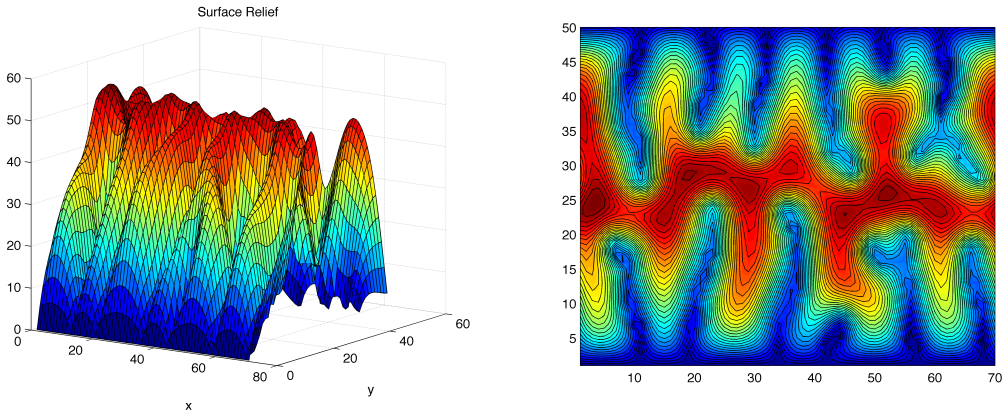
Computer Lab Assignment 9

Landscape Evolution Simulation

Please download all three Matlab files for lab 9 from bCourses. You will only need to edit the file *erosion_lab_start.m* This lab will guide you through a number of steps to obtain a working erosion code that follows the model by Perron *et al*. (see reading assignments). First you will need to add a few crucial lines of code and then you are asked run the code for different parameters and analyze their impact on the resulting landscape. Here is an example:



(1) Work out time step *dt* should be used. Assume *dx=5* meters, $D=5\times10^{-3}$ meters^2/year. I suggest using only half of the maximum stable value for this 2D problem! Enter you result on line 19.

(2) Compute the gradient $|\vec{\nabla}z|$ using the intermediate terms s_1,s_2,s_3, and s_4 as suggested in the Perron paper. Fill in lines 62-66.

(3) Now compute the resulting erosion term. It is the second term in equation 13 of Perron's paper, and we call it *Gz*. It is a function of the constants K, m, n, and θ_c as well as already computed drainage area *A(i,j)* and your gradient. Enter your formula in lines 69 and repeat it on line 85.

(4) Enter the mass diffusion term *phiz* on line 93 using the elevation *Z(i,j)* and diffusion constant *D*. You should check that your time step opn line 95 is not too large Perron's differential equation 13. Try running your code now! Hopefully it will work now.

(5) We want to perform 3 parameter modifications now and analyze the effects. Please increase the stream stress threshold, θ_c, by factors of 10 until you see a noticeable change in the final landscape. Describe the change in shape and give an explanation!

(6) Go back to the original value of θ_c and increase the gradient exponent *n* in steps of 0.5. Please reduce the time step by a factor of 5 for this and the following part! Keep increasing *n* until you see a drastic change, describe the effect, and give an explanation!

(7) Go back to the original value of n and instead increase the area exponent m in steps of 0.05 until you see a change. Again describe the effect and give an explanation!