

Calculation of the Topographic Index

Required:

Digital elevation model, having metric coordinate system (e.g. UTM)

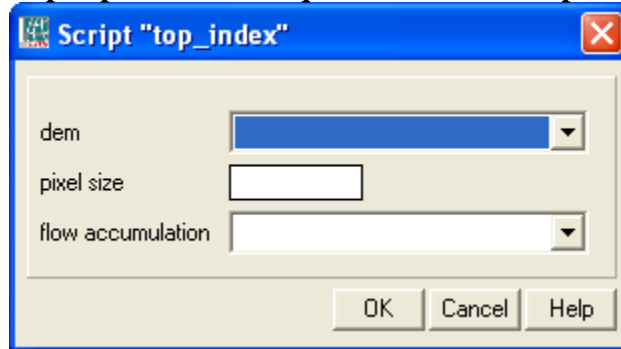
Pixel size (in meters)

Flow Accumulation Map

The Flow Accumulation map can be produced using the ILWIS DemHydro Processing module, select first the options Fill, Flow Direction and subsequently Flow Accumulation.

Copy the script files in the ILWIS \Scripts sub-directory. Start ILWIS and from the menu select “Operations” > “Scripts” and select the script “top_index”.

Figure 1: input parameters required to run the top_index script



Short description and Script Listing:

Calculate the topographic index: $TI = \ln(a / \tan \beta)$

TI=topographic index, as defined by Kirkby and Beven

where:

ln: natural logarithm

a = the upslope area per unit contour contributing flow to a pixel

$\tan \beta$ = the local slope angle acting on a cell (approximately taken as the local hydraulic gradient under steady state conditions)

(Once the single flow direction is determined for each cell, flow accumulation area (or upslope area) (A) is calculated using a recursive procedure [e.g., Tarboton, 1997]. The specific flow accumulation area (a) is (A) divided by a contour length, which is equal to the grid size or horizontal resolution of the DEM. The slope is set to be the maximum downward elevation gradient).

ILWIS SCRIPT (3 variables, %1=dem, %2=pixel size, %3=flow accu map, unit is no of contributing pixels)

```

dfdy_1.mpr{ dom=value;vr=-1000:1000:0.1 }:= MapFilter(%1,DFDY.fil,value)
calc dfdy_1.mpr

dfdx_1.mpr{ dom=value;vr=-1000:1000.7:0.1 }:= MapFilter(%1,DFDX.fil,value)
calc dfdx_1.mpr

// slope map in percentage
slp_perc:=100*(hyp(dfdx_1,dfdy_1)/PIXSIZE(%1))
calc slp_perc.mpr

// slope map in degrees
slp_deg:=RADDEG(ATAN(slp_perc/100))
calc slp_deg.mpr

//Calculate the flow accumulation area or upslope area (A)
flowacc_area{ dom=value;vr=-1000:10000000000000000000000000:1 }:=3*%2^2
calc flowacc_area.mpr

// ln(a/tan(slope in degree))
//a = (flowacc_area/gridsizesize or horizontal resolution of the DEM)

// Calculate the topographic index map
topographic_index{ dom=value;vr=-
1000:1000:0.001 }=LN((flowacc_area/%2)/(TAN(DEGRAD(slp_deg))))
calc topographic_index.mpr

```