# Knickzone Extraction Tool

A brief tutorial

26th February 26, 2016

Tutorial for the use of Knickzone Extraction Tool (KET)

This tool was created to identify knickzones along the longitudinal river profile using user specified constraints. It also calculates the, height and length of the kniczones.

References:

- Hayakawa, Y.S., Oguchi, T., 2009: GIS analysis of fluvial knickzone distribution in Japanese mountain watersheds. Geomorphology 111, 27–37.
- Hayakawa, Y.S., Oguchi, T., 2006: DEM-based identification of fluvial knickzones and its application to Japanese mountain rivers. Geomorphology 78, 90–106.
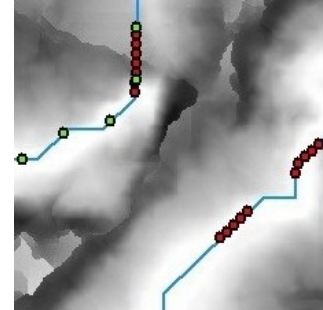
Requirements:

- Installation of the TauDEM.
- ArcGIS (10 or higher) with license to Spatial Analyst.

Installation instructions

TauDEM 5.1.1 (For ArcGIS 10, 10.1, and 10.2)

1. Click the link below to go to the Utah State University's TauDEM download link

   TauDEM 5.1.1 Self extracting zip file install package

   (http://hydrology.usu.edu/taudem/taudem5/taudem511exe.html)

2. Fill in the details or just leave it blank and click Download to download TauDEM511.exe

3. Follow the on-screen instructions to complete the setup of TauDEM511.exe. The installer will install following four packages:

| Name	Publisher
TauDEM 5.1	Utah State University
Microsoft HPC Pack 2012 MS-MPI Redistributable Pack	Microsoft Corporation
Microsoft Visual C++ 2010 x86 Redistributable - 10.0.40219	Microsoft Corporation
Microsoft Visual C++ 2010 x64 Redistributable - 10.0.40219	Microsoft Corporation

4. To activate the TauDEM Toolbox in ArcGIS (not required for KET):

   a) Open ArcMap. If the ArcToolbox Window is not open, click on the "Show/Hide ArcToolbox Window" icon in the Standard Toolbar.

   b) Right click on ArcToolbox at the top of the window. Select Add Toolbox... .

   c) Browse to the TauDEM install directory (C:\Program Files\TauDEM\TauDEM5Arc\).

   d) Click on the TauDEM_Tools.tbx file, and click Open.

   e) The TauDEM Toolbox should now be visible in the list of toolboxes.

   f) If you wish to save this configuration, right click on ArcToolbox, select Save to Default.

5. A system restart might be required before you start using the tool.

The installation of **TauDEM 5.0**, compatible for **ArcGIS 9.3** is still the same complicated step.

Details are given at http://hydrology.usu.edu/taudem/taudem5/downloads5.0.html
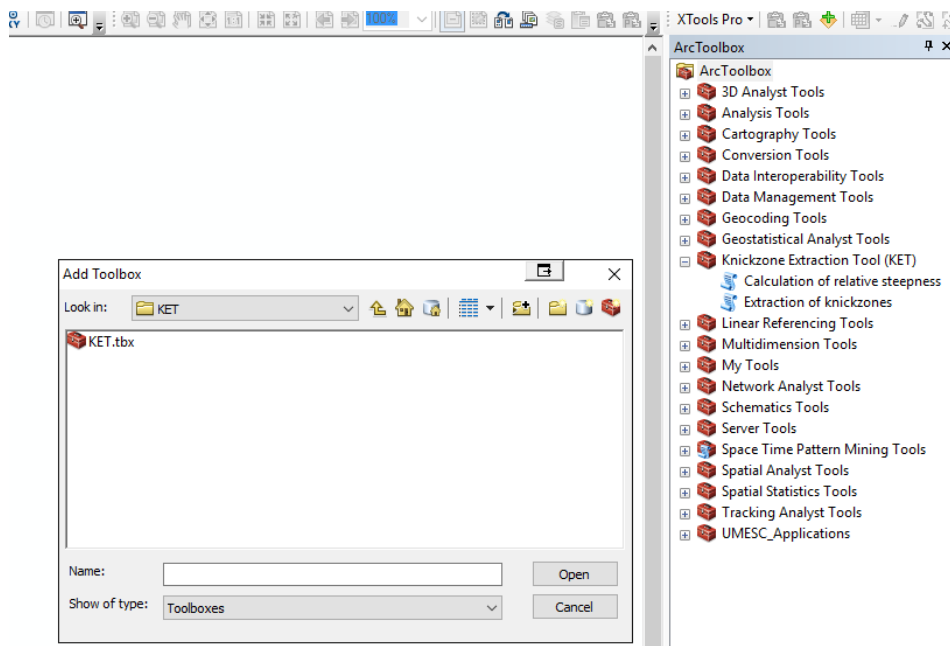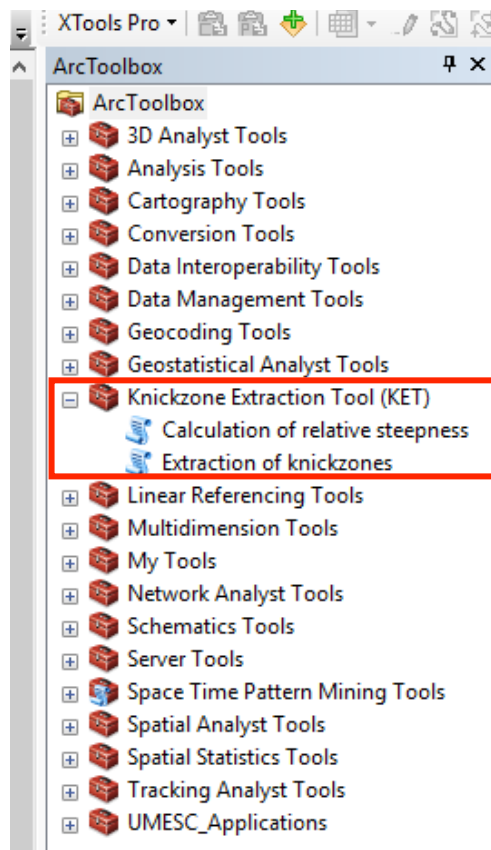
Importing the tool into ArcToolbox:

1. Right click the ArcToolbox and click add Toolbox
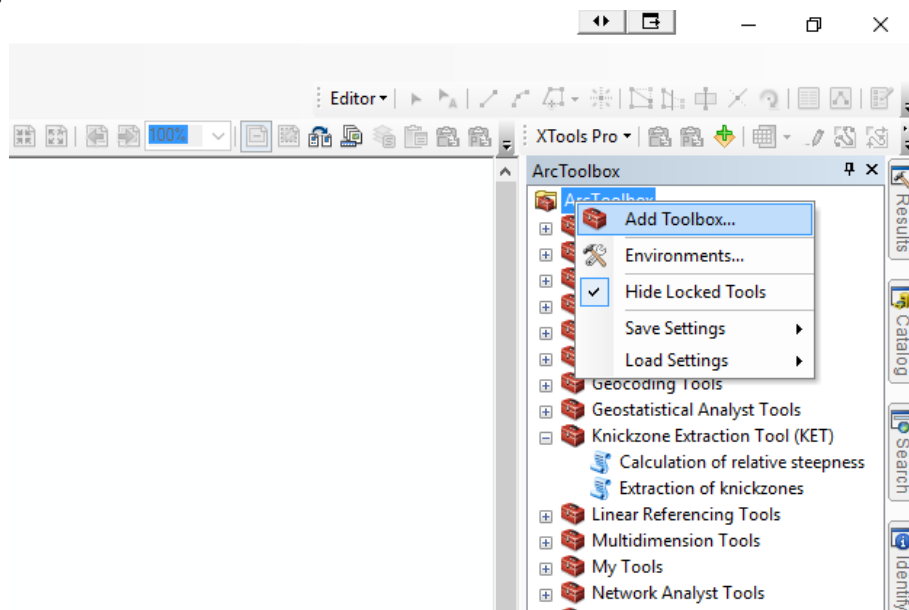
2. Browse to the KET downloaded from website and select KET.tbx to open.

3. Once added, the KET will show up in the list of toolboxes with two tools inside the toolbox:
   a. Calculation of relative steepness
   b. Extraction of knickzones

Calculation of relative steepness

Included as the first part of KET, this tool uses an uncompressed DEM in TIFF format to calculate relative steepness of the supplied topography at multiple scales. The tool needs input for the scale. Input of "From value" and "To value", correspond to the first, the last scale of computation. "By value" determines the incremental scale for multiple scales in between the first and last scales. For details, please check the references.
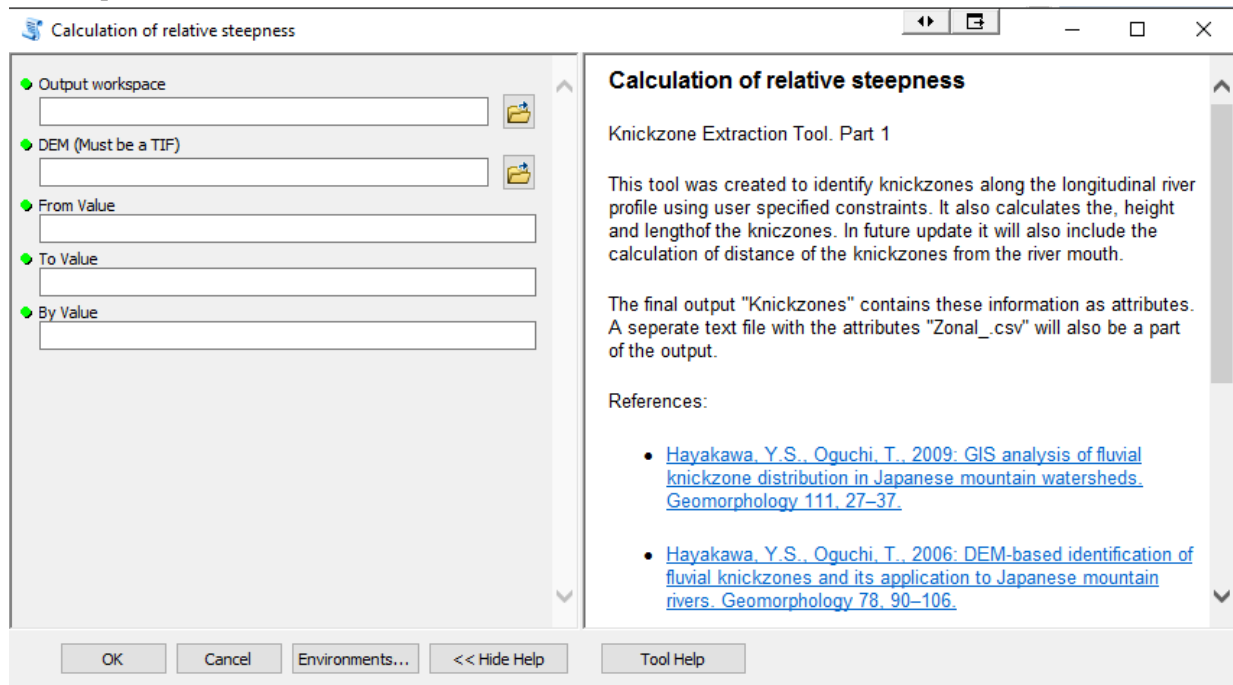
Tool help:

Output workspace : The folder where the files during the processing and output 'FinalRaster' will be placed.

DEM (Must be a TIF) : A DEM representative of the topography. The supplied DEM must be an uncompressed TIFF file.
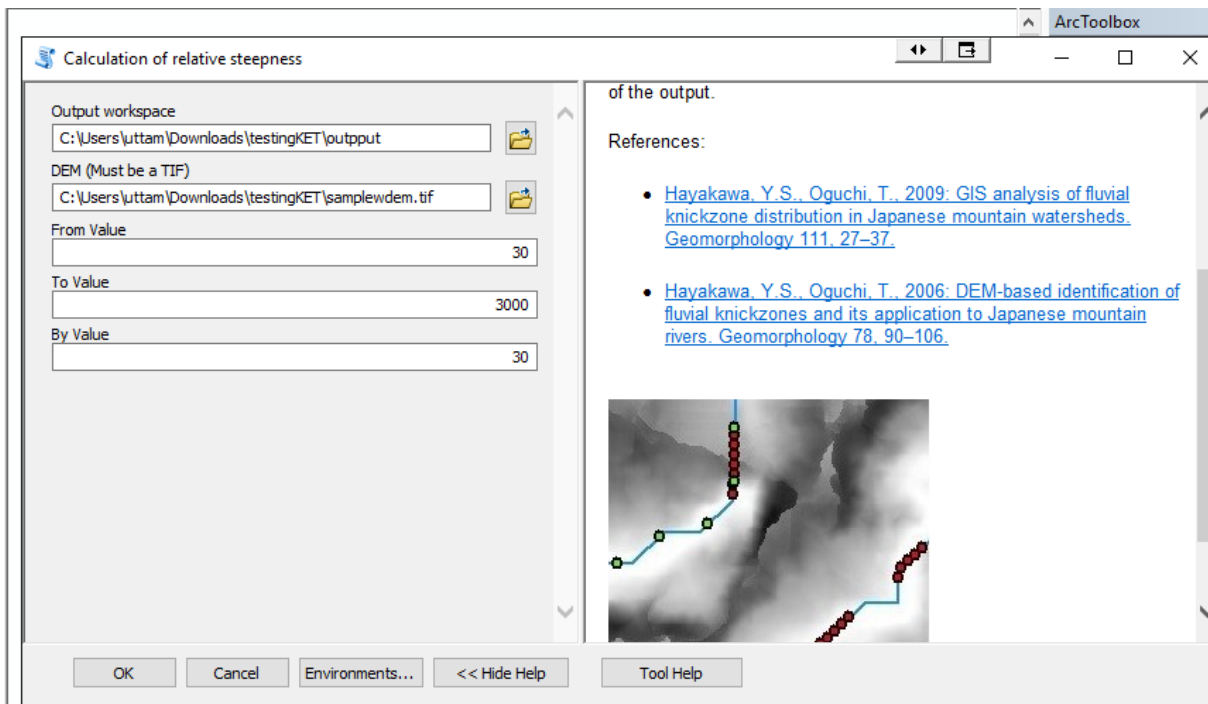
From Value : The starting d value.

To Value : The final d value.

By Value : The value by which the d is increased from 'From distance' to 'To distance'. (Step value)

*Output***:**

Finalraster.tif (the relative steepness raster) placed in the output workspace.

Change variables as required, supplied here for demonstration of KET (part1).

*Upon execution, the tool will start open a command window for computation using TauDEM and start populating the working directory at the same time. The progress will be displayed in a tool window in ArcGIS and this will several minutes. Be patient. The output of relative steepness will be a "**Finalraster.tif**" placed in the output folder.*
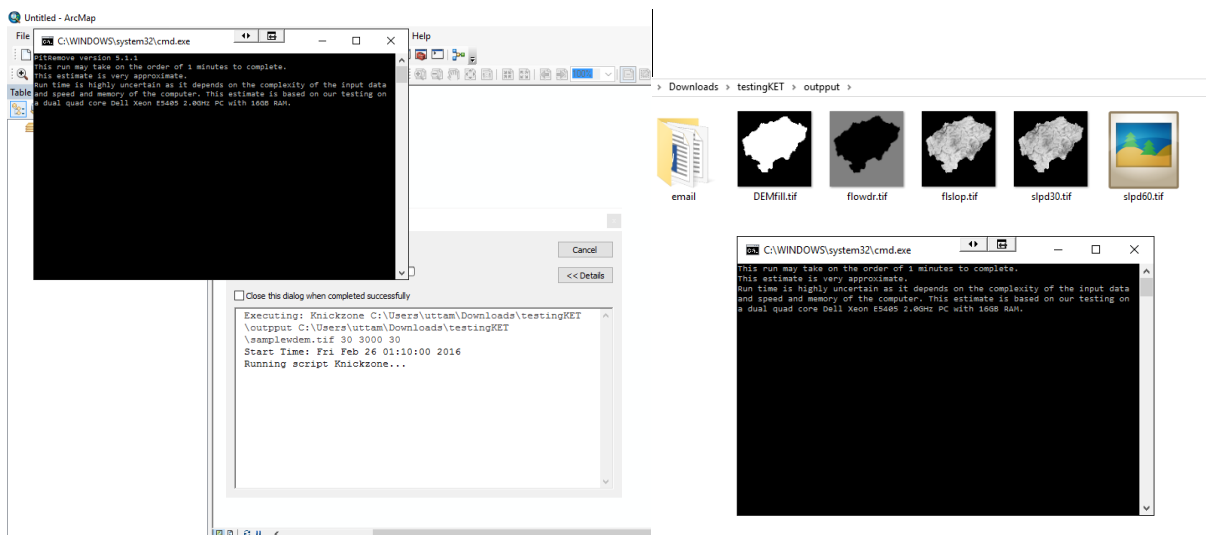
Extraction of knickzones

Included as the second part of KET, this tool uses the relative steepness raster (Finalraster.tif) computed previously to extract fluvial knickzones along the longitudinal river profile using some user input. It also calculates the, height and length of the knickzones. The final output "Knickzones" contains these information as attributes. A separate text file with the attributes "Zonal_.csv" will also be a part of the output in the workspace.
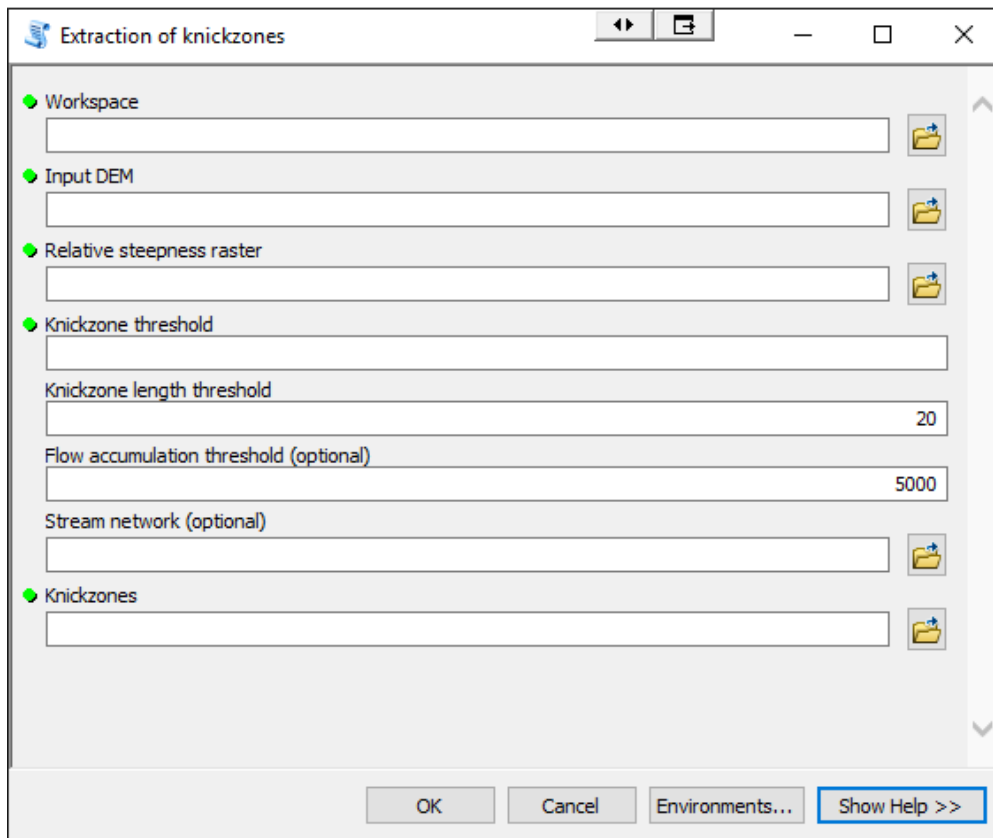
Tool help:

Workspace : The workspace that will be used for the analysis

Input DEM : The input raster representing a continuous surface.

Relative steepness raster : The relative steepness raster. (Output of the part1 of the KET: "Calculation of relative steepness")

Knickzone threshold : The value of gradient decrease Rd , below which the areas will be marked as knickzones.

Knickzone length threshold : The minimum length (in meters) of knickzones to be considered for analyses. This filters smaller artifacts.

Flow accumulation threshold (optional) : Number of cells draining into a cell along the stream network. Use larger values for sparse drainage networks and smaller values for denser stream networks. (If pre-calculated stream is provided, the tool will skip the stream generation)

Stream network (optional) : Supply, if previously calculated. Supplying a pre-determined stream network will skip the steps for stream calculation and considerably lessen the

calculation time. If not specified, a stream network file will be placed in the working directory in the first run for the supplied flow accumulation value.

Knickzones : The output knickzones.

Output

The knickzones as shapefile along with their length and height information as attributes. A separate text file with the attributes "Zonal_.csv" will also be a part of the output in the workspace
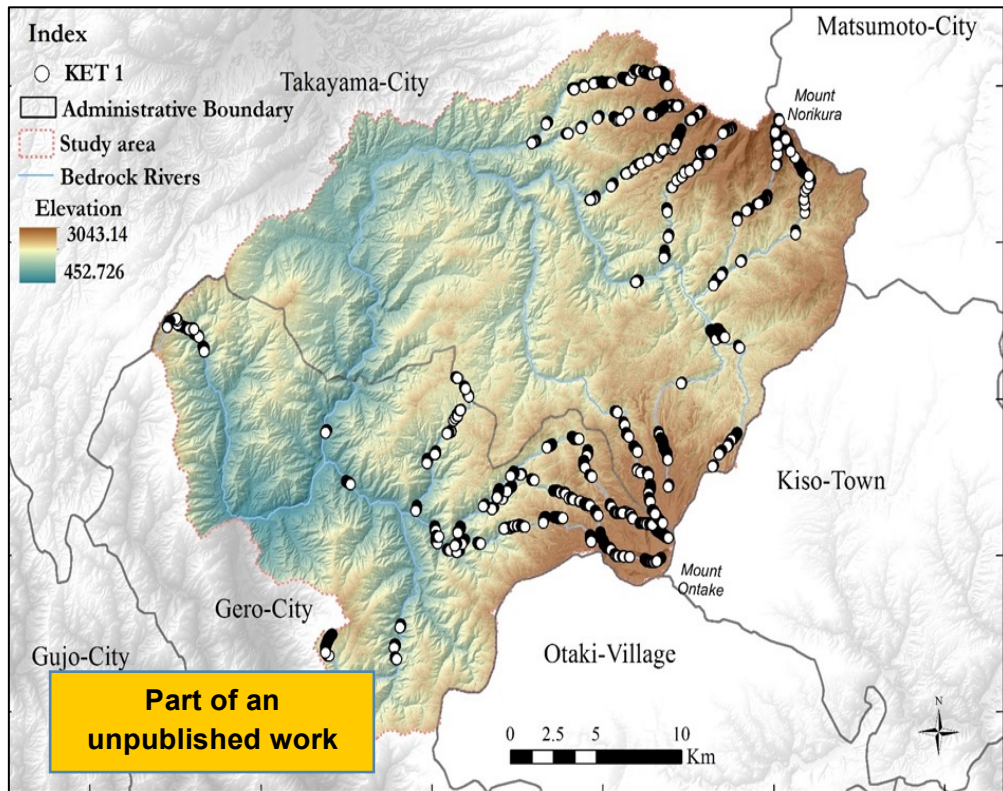
	FID	Shape *	Length	COUNT	MIN	MAX	RANGE	MEAN	STD
▶	0	Polyline	665	57	1263.303101	1401.780884	138.477783	1336.564198	41.081252
	1	Polyline	1206	102	1262.263794	1416.832397	154.568604	1336.316048	44.551093
	2	Polyline	629	54	1066.234375	1199.319824	133.085449	1142.001291	37.696276
	3	Polyline	1847	159	1066.022217	1260.605591	194.583374	1147.494777	58.423998
	4	Polyline	2676	228	1228.413696	1596.385254	367.971558	1409.342598	109.374166
	5	Polyline	3161	283	1228.51001	1674.244141	445.734131	1412.805936	126.715928

In the attribute table and the table generated, the length refers to the estimated length of knickzones while the range refers to the height of the knickzones.