Benthic Terrain Modeler (BTM)

Rationale:

Analyses benthic terrain for the purposes of classifying surficial seafloor characteristics that may be used in studies of benthic habitat, geomorphology, prediction of benthic fish species distribution, marine protected area design, and more

Benthic Terrain Modeler (BTM) is an application originally developed in 2005 at Oregon State University under a cooperative agreement with the NOAA Coastal Services Centre's (CSC) GIS Integration and Development program (Wright et al., 2005). The application provides a set of geoprocessing tools to analyse benthic terrain for the purposes of classifying surficial seafloor characteristics that may be used in studies of benthic habitat, geomorphology, prediction of benthic fish species distribution, marine protected area design, and more. From an input grid of multibeam bathymetry the user may create additional grids of slope, bathymetric position index or BPI (a variation on the topographic position index approach of Guisan et al. 1999 and Weiss, 2001), and seafloor rugosity (after Jenness, 2003 and Iampietro and Kvitek, 2002).

The Benthic Terrain Modeller contains a set of customized scripts that automatically creates grids of broad and fine scale standardized BPIs, and slope from an input bathymetric data set. Using these data and a defined dictionary of characteristics, the tool classifies the bathymetric structures into feature classes. If no dictionary exists yet, the tool will create a dictionary based on standard definitions and can be subsequently edited and the tool re-run.

Usage:

The input raster file will output two files: first an output raster file of the classes file and secondly a vector polygon file of the classes. Default names are suggested, being in the same directory but with an additional "_zones.img" added to the filename for the raster output and "_BTM.shp" for the vector polygon output file. These can be edited by the user if desired.

Four variables are required for the tool:

- The broad scale BPI inner radius – for pixel size of smaller features to be ignored when large scale features are being measured
- The broad scale BPI outer radius – for pixel size of large-scale features
- The fine scale BPI inner radius– for pixel size of very small features (noise) to be ignored when smaller scale features are being measured
- The fine scale BPI outer radius – for pixel size of small-scale features

Default values are given for initial use but can be changed by the user for possible later runs of the tool.

Two tick boxes are provided:

- To delete as many intermediate files as possible (held in a subdirectory called "tempMT").
- To make depth data positive values (depth data is often held as negative values). This BTM tool requires positive values

A default classification dictionary is created which defines the criteria for the different classes. This file is called “Dictionary.csv” and can be edited by the user if desired. An example is shown below where the depth boundary between shallow and deep is 5.8m and slope boundary of 11.8º.

Class	Zone	BroadBPI_	BroadBPI_	FineBPI_Lo	FineBPI_U	Slope_Low	Slope_Upp	Depth_Lov	Depth_Upper
1	Peak	-10000	-100	-10000	-100	0	90	0	12000
2	Ridge	-10000	-100	-100	100	0	90	0	12000
3	Ridge Trough	-10000	-100	100	10000	0	90	0	12000
4	Flat with Ridge	-100	100	-10000	-100	0	90	0	12000
5	Flat with Trough	-100	100	100	10000	0	90	0	12000
6	Flat (Deeper)	-100	100	-100	100	0	11.81052	5.856267	12000
7	Flat (Shallower)	-100	100	-100	100	0	11.81052	0	5.856267
8	Steep (Deeper)	-100	100	-100	100	11.81052	90	5.856267	12000
9	Steep (Shallower)	-100	100	-100	100	11.81052	90	0	5.856267
10	Depression with Ridge	100	10000	-10000	-100	0	90	0	12000
11	Depression	100	10000	-100	100	0	90	0	12000
12	Depression with Trough	100	10000	100	10000	0	90	0	12000

Graphically this equates to:

Zone	Profile
Peak	
Ridge	
Ridge Trough	
Flat with Ridge	
Flat with Trough	
Flat (Deeper)	
Flat (Shallower)	
Steep (Deeper)	
Steep (Shallower)	
Depression with Ridge	
Depression	
Depression with Trough	

The program is complex and requires many intermediate steps. It produces many intermediate files and can take many minutes to complete and create the final output.

Example: Bathymetry and Classified features