Regional Process and Analysis Tool (RPAT)
Geoprocessing Tool

User's Guide

Introduction

In order to model a regional sediment budget for a coastal zone, a number of variables are required. One of these variables is volume change. In the GIS environment, volume change can be computed by comparing two raster grid surfaces over a time period. However, while the calculation is quick, it is often difficult to locate datasets with the appropriate resolution and data formats to compute the volume difference.

Profile data, or XYZ point data collected along the shoreline, is a common dataset that is widely available for a number of geographic regions. XYZ data is collected in a linear orientation from the shore towards the water. Although this profile data is widely available, coverage is not consistent. Many areas along a shoreline have been found to have no data coverage. This is not ideal when attempting to calculate a volume change.

The Regional Process and Analysis Tool (RPAT) Geoprocessing Tool solves this problem by using the elevation values that are reported for each point in the original profile and casting new points along a shoreline to "fill" an area of interest with data points. These data points serve as input into the interpolation routine that generates a raster surface. Once the raster surface is available, it can be paired with another surface (from a different time period) residing in the same geographic location, and the two surfaces can be used as input to compute a volume difference over the time period.

Installing the RPAT Geoprocessing Tool

The RPAT Geoprocessing Tool consists of a series of Python scripts which, in turn, are assembled into a Python toolbox that can be used with ArcMap.

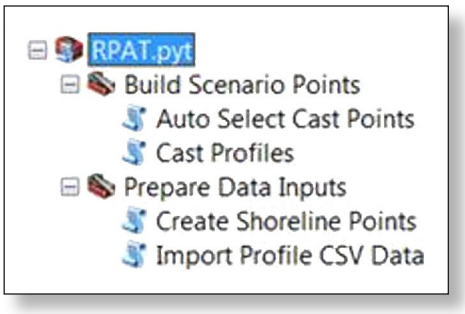
Use the following procedure to download and install the toolbox.

1. Download the RPATToolbox.zip file to your workstation's hard disk.
    a. Open the RPAT Geoprocessing Desktop Tools webpage on the USACE Geospatial Platform (http://geoplatform.usace.army.mil/home/item.html?id=0512eb62a0034940b770a73003f52193).
    b. Select Open>Download.
    c. Select Save>Save As.
    d. Browse to the appropriate directory and click Save.
    e. Close the USACE Geospatial Platform webpage.
2. Browse to and unzip the RPATToolbox.zip file.
3. Open ArcMap.
4. Within ArcMap, open ArcCatalog.

5. Browse to the unzipped files, and locate the RPAT toolbox (RPAT.pyt).

   The Python scripts are grouped into two categories within the toolbox:

   - Build Scenario Points
   - Prepare Data Inputs

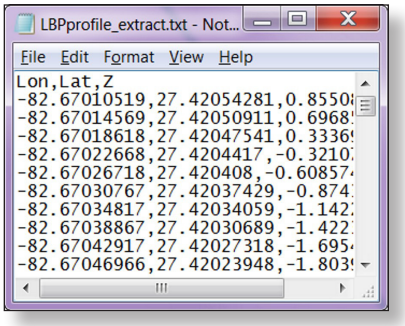


6. Expand each category, as necessary, to access the appropriate script.

Understanding the Required Data Inputs

The RPAT Geoprocessing Tool requires the following types of data:

- XYZ text file representing a single profile line
  - This file must be comma-separated.
  - Coordinates must be represented in decimal degrees.



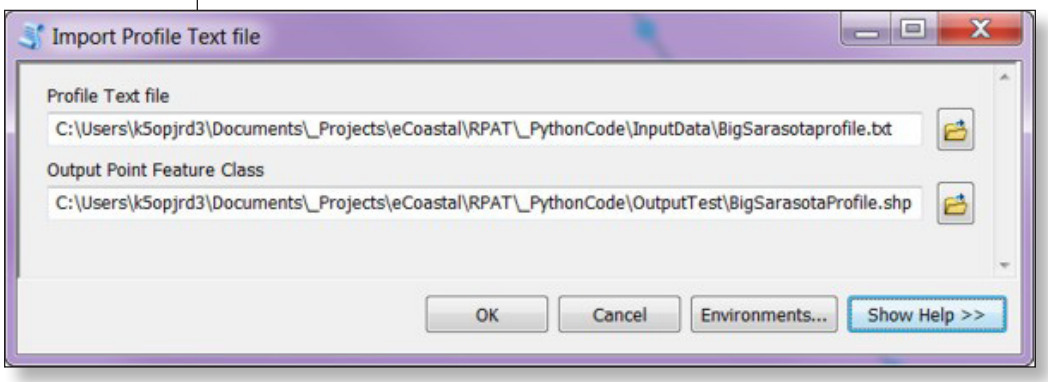
- Shoreline polyline with a defined coordinate system
  - If a coordinate system is not defined, use the Define Projection tool within ArcToolbox.

Preparing the Data Inputs for Geoprocessing

1. Import the profile text file, and convert the profile points to a point shape file.

   a. From the RPAT toolbox's Prepare Data Inputs category, double-click Import Profile CSV Data.

      An Import Profile Text File dialog displays.



b. In the Profile Text File field, browse to and select the comma-separated text file that contains the profile data.

c. In the Output Point Feature Class field, browse to a location and name the new feature class that will hold the profile points.

d. Click OK to run the script.

e. Close the geoprocessing window.

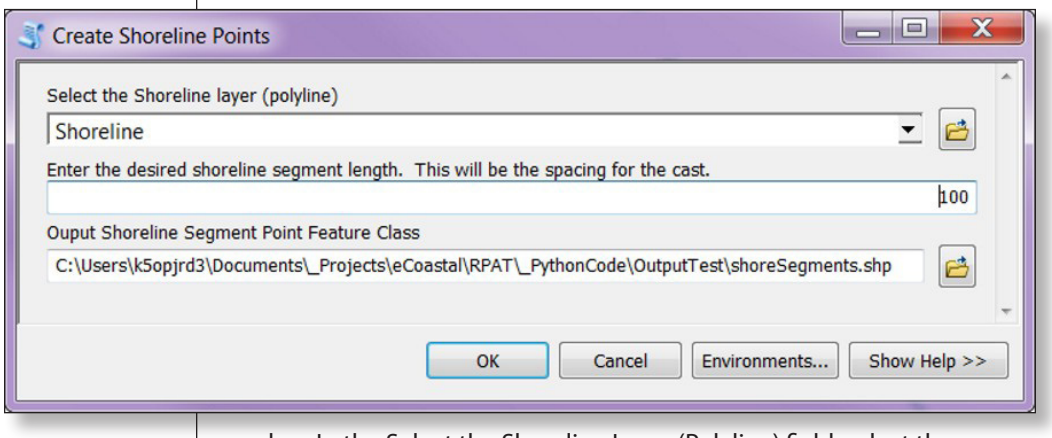
When the geoprocessing is complete, the point shapefile is added to the Table of Contents.

2. Divide the input shoreline into a segment.

Each segment is represented by a point. These point locations serve as the starting point for the casted profile lines.

a. From the RPAT toolbox's Prepare Data Inputs category, double-click Create Shoreline Points.

A Create Shoreline Points dialog displays.



b. In the Select the Shoreline Layer (Polyline) field, select the Shoreline layer.

c. In the Enter the Desired Shoreline Segment Length field, enter a number for the shoreline segment length.

Note: The units for the value *must* match the units of the map frame.

Note: It is helpful to reproject the shoreline feature class into a planar coordinate system, like State Plane, so the value needs no conversion into feet or meters. If the coordinate system is a geographic coordinate system, the segment length value must be reported in degrees.

d. Browse to a location and name the new feature class that will hold the shoreline segment points.

e. Click OK to run the script.

A point is placed at the distance specified and at each change in line direction. This causes the points to look unequally spaced.

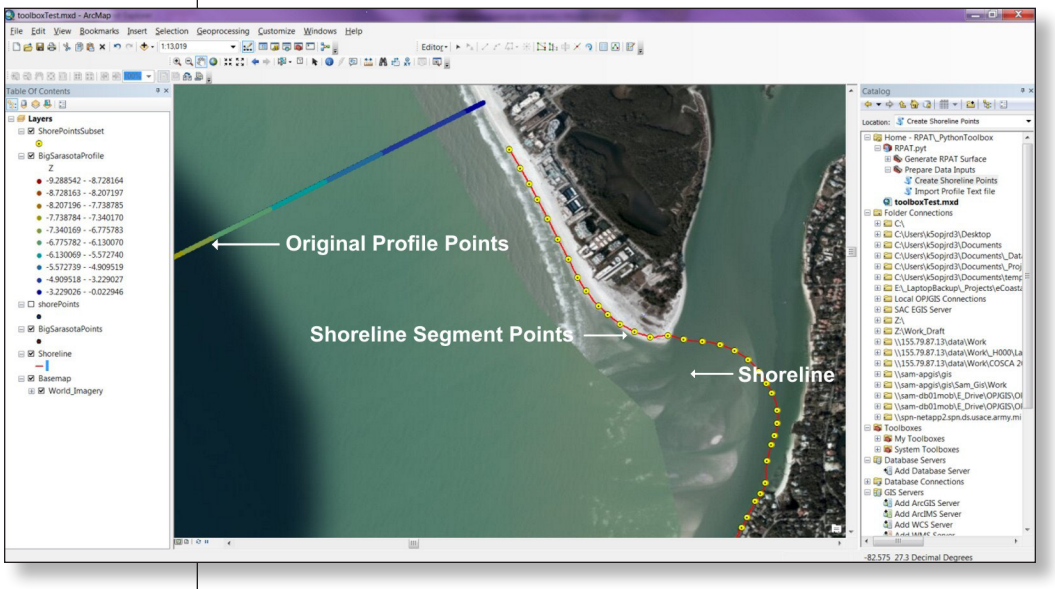
6. Close the geoprocessing window.

When the geoprocessing is complete, the point shapefile is added to the Table of Contents.

Note: If too many points are created, try running the Smooth Line (Data Management) tool on the shoreline first, and then use that as input into the script. (This tool requires a license to either ArcInfo or ArcEditor).

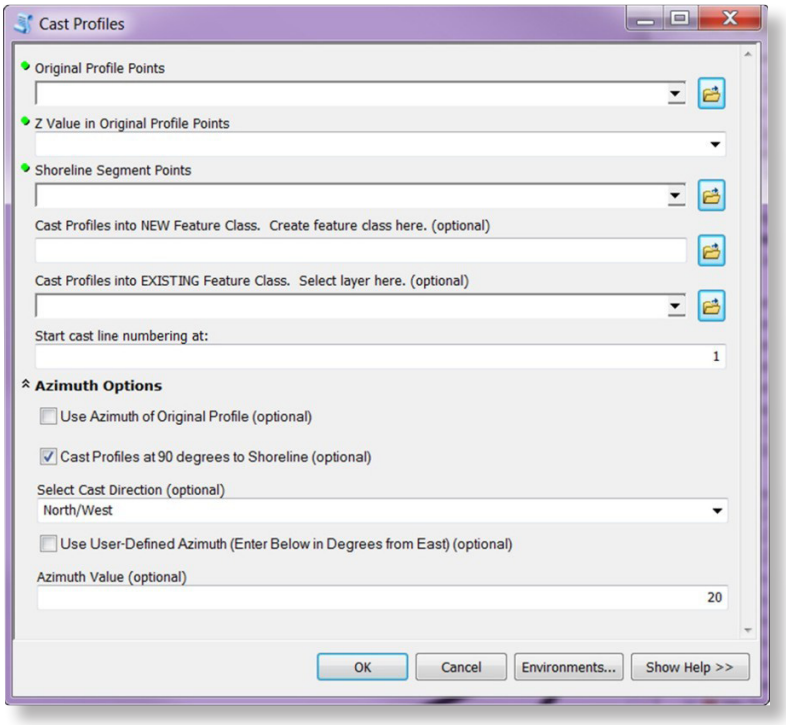
Casting Profiles along a Shoreline

Now that the data has been properly prepared, you are ready to generate the RPAT surface. This requires an XYZ point file as input. Prior to running an interpolation routine available under Spatial Analyst Tools, you must first cast the original profile points at each location defined by the shoreline segment points.



1. From the RPAT toolbox's Build Scenario Points category, double-click Cast Profiles.

   A Cast Profiles dialog displays.



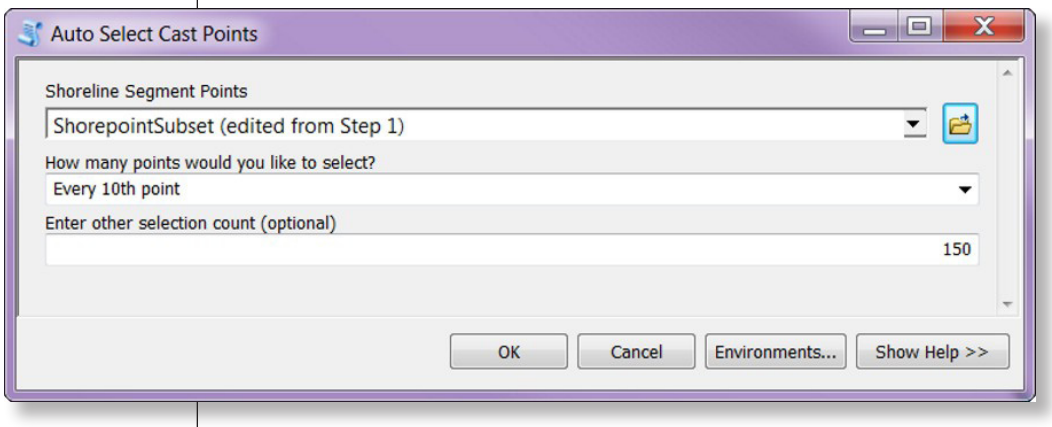
2. In the Original profile Points field, select the original profile points (those converted from the text file).

3. In the Z Value in Original Profile Points field, select the field that represents the elevations/Z values.

4. In the Shoreline Segment Points field, select the points that represent the shoreline segment points or the distance between each casted profile.

   Note: If a feature selection exists on the shoreline segment points, only those features are used for the casting of the scenario profile points.

   Note: To autoselect features to use in this cast step, from the RPAT toolbox's Build Scenario Points category, double-click Auto Select Cast Points. This allows you to select points along the shoreline at a defined feature interval.



5. Choose the appropriate output options.

   - If you want to use a new feature class, in the Cast Profiles into NEW Feature Class field, browse to and name the new feature class
   - If you want to append the points to an existing feature class, in the Cast Profiles into EXISTING Feature Class field, browse to or select an existing feature class.

     Note: This tool can be run multiple times. If a feature selection exists on the segment points, a profile is cast for only those locations at the requested azimuth.

6. In the Start Cast Line Numbering At field, enter a number for the starting cast line.

   Note: Each individual line is attributed with "CastLine*X*." Therefore, if you run this tool multiple times, you should change the starting cast line number. For example, if you select five points in run #1 and casted profiles are created, the lines are named CastLine1, CastLine2, CastLine3, CastLine4, CastLine5. Then if you run the tool again with two different points, change the starting cast line number to "6," so the subsequent casted profiles will be named CastLine6 and CastLine7.

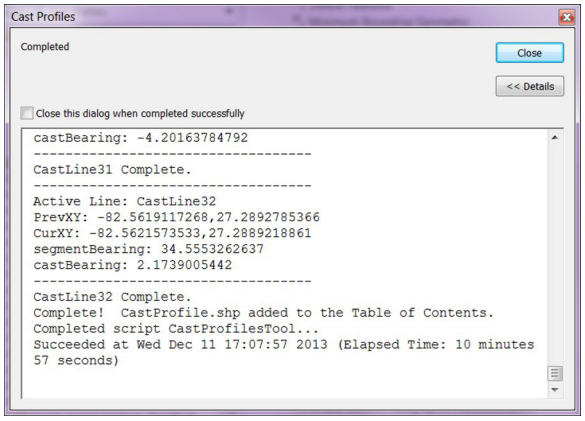
7. Select one of the Azimuth Options to calculate the azimuth, or bearing, of the line.

   - **Cast Profiles at 90 Degrees to Shoreline**—Select this option to calculate the line direction between the shoreline segments. For each selected shoreline segment point, a line is cast at 90 degrees. This is the default option.
   - **Use Azimuth of Original Profile**—Select this option to calculate the azimuth of the original profile points. This value is used to cast all points.

     Note: If you select this option, you must also select the direction in which to cast the scenario profile points. For example, if the water is to the west of the shoreline, you would want to cast in that direction. North/West = counterclockwise, and South/East = clockwise.
   - **Use User-Defined Azimuth**—Select this option if you want to use your own azimuth value for the calculation.

     Note: Enter the value in the Azimuth Value field.

8. Click OK to run the script.



When complete, this point layer can be used as the input for any interpolation method under Spatial Analyst.

Note: Prior to applying an interpolation, if may be necessary to use the following procedure to remove some of the casted points to account for the geomorphology of the local area.

a. Begin an ArcMap editing session (Editor>Start Editing).

b. Select the points of interest.

c. Click Delete.

d. Stop the editing session.

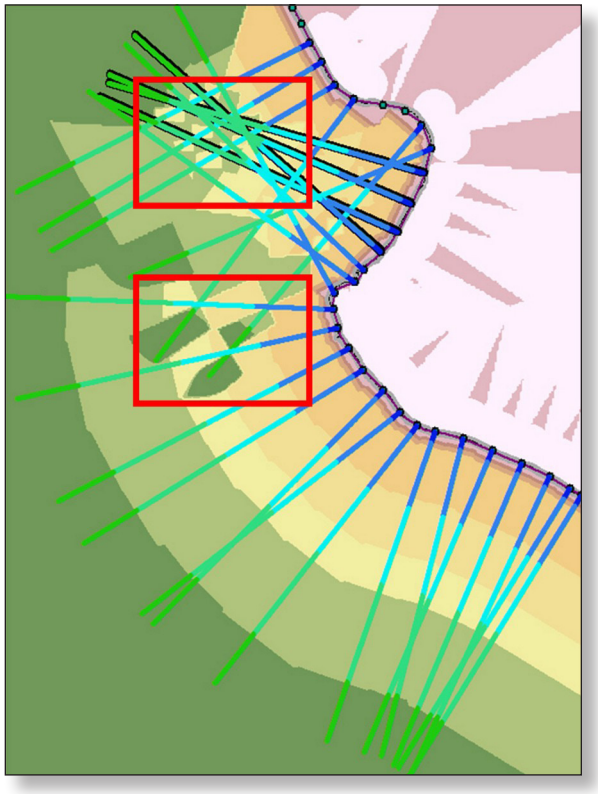
e. Save the changes.

Customizing Casted Scenario Profile Points

Grid A

The Cast Profiles default settings were used in this grid. Profile data was cast at 90 degrees to the shoreline segment.

Note: Areas outlined in red should be modified. Lines can be deleted and recast at different azimuths to build a better scenario surface.

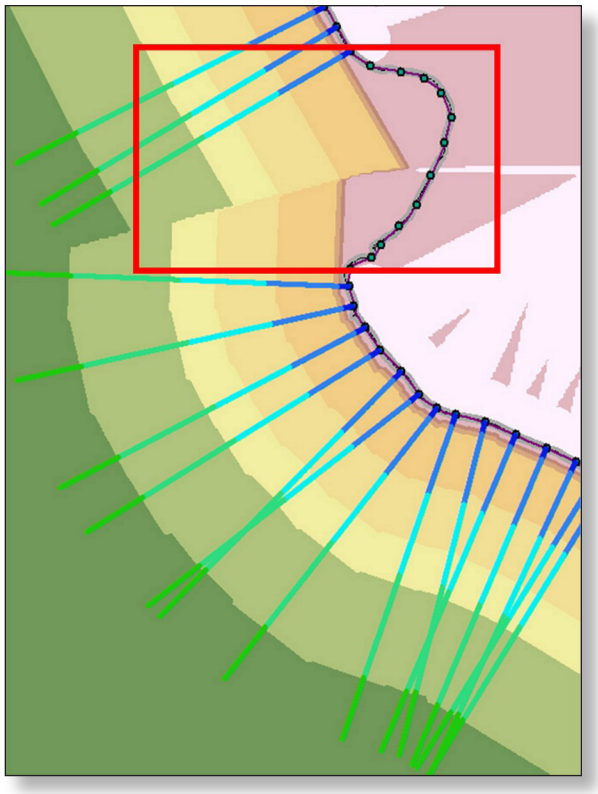


Grid B

Removing the profile lines and regenerating the grid results in this grid.

To build a more refined grid, additional customization per casted line can be performed.

In an ArcMap editing session, these profiles were first selected (via spatial query or attribute query where Line*ID*=CastLine*X*) and then deleted.



Grid C

This grid was created by using the RPAT. pyt's Cast Profiles script to recast lines into an existing feature class with a user-supplied azimuth of 200.

This grid is the result of an IDW interpolation on the casted profile points.