GEO TUTORIAL

DERIVING A VECTOR SHORELINE FROM A DIGITAL ELEVATION MODEL

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The Geospatial Education and Outreach Project (GEO Project) is a collaborative effort among the Geosystems Research Institute (GRI), the Northern Gulf Institute (a NOAA Cooperative Institute), and the Mississippi State University Extension Service. The purpose of the project is to serve as the primary source for geospatial education and technical information for Mississippi.

The GEO Project provides training and technical assistance in the use, application, and implementation of geographic information systems (GIS), remote sensing, and global positioning systems for the geospatial community of Mississippi. The purpose of the GEO Tutorial series is to support educational project activities and enhance geospatial workshops offered by the GEO Project. Each tutorial provides practical solutions and instructions to solve a particular GIS challenge.

DERIVING A VECTOR SHORELINE FROM A DIGITAL ELEVATION MODEL

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REQUIRED RESOURCES

- ArcGIS Pro (v. 3.1 or higher) with the Spatial Analyst Extension
- Internet access

FEATURED DATA SOURCES

- NOAA Digital Coast Data Access Viewer: https://coast.noaa.gov/dataviewer/#/
- 2020 USACE NCMP Post-Sally Topobathy Lidar DEM: Gulf Coast (AL, FL, MS)

OVERVIEW

Tracking temporal shoreline changes is a vital task for the coastal science community. Shoreline indicators, which serve as proxy lines to represent the dynamic position of the true shoreline, are frequently used by coastal managers for various projects and analyses. In this tutorial, elevation is used as the shoreline indicator due to its suitability for representing the shoreline in a dynamic environment.

The data utilized in this tutorial consists of topobathymetric lidar for the Mississippi-Alabama Barrier Islands. This type of data provides a seamless transition between terrestrial and underwater environments, making it ideal for shoreline analysis.

In this tutorial, you will learn how to derive a contour line representing zero elevation from a lidar-derived Digital Elevation Model (DEM) of a barrier island. Familiarity with ArcGIS Pro is recommended and access to the *Spatial Analyst Extension* is required.

The objective of this tutorial is to guide users through the process of extracting a shoreline from a DEM using the Contour List tool in ArcGIS Pro.

STEP 1. DATA ACQUISITION

To complete this tutorial, you will use the featured lidar-derived DEM, but any available lidar-derived DEM can be used. In this step, you will access and download the data for the islands in the Gulf Islands National Seashore.

A. Access the link provided in the **Featured Data Sources** section. Search for "Deer Island, Biloxi, Mississippi" and add the data to the **Cart** (see image).

B. Proceed to the **Cart** and follow the steps to download the data. *Note: this step may take some time.*

C. Save the downloaded data to a memorable location and unzip the file.

STEP 2. DATA PROCESSING

In this step, you will add the downloaded data to an ArcGIS Pro project and focus on a single barrier island as your area of interest. Note that if the island you choose spans multiple DEM files, create a mosaic dataset, and add the relevant images to it before continuing.

A. Open **ArcGIS Pro** and add the downloaded data to a new or existing project. If prompted to build pyramids and calculate statistics, click **OK**.

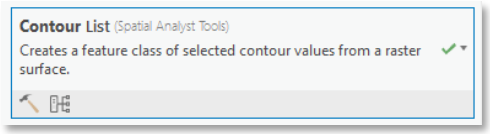
B. Navigate to the barrier island of your choice and create a bookmark for it.

STEP 3. CONTOURING USING CONTOUR LIST TOOL

The Contour List tool generates a feature class of user-specified contours from the raster surface. In this step, you will create a contour line representing zero elevation.

A. On the **Analysis** tab, in the **Geoprocessing** group, select the **Tools** button to open the **Geoprocessing** pane.

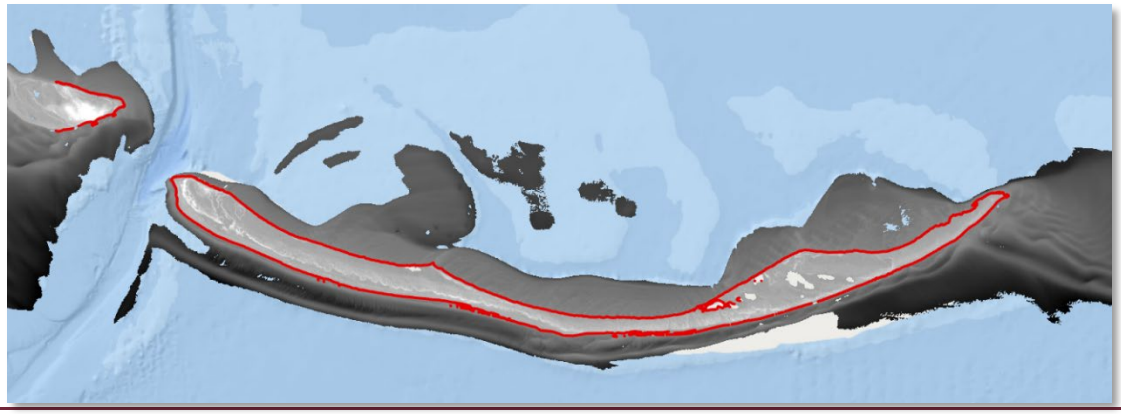
B. In the search bar, type **Contour** and select the **Contour List** tool from the **Spatial Analyst Tools** toolbox.



C. Select the DEM covering your area of interest for **Input Raster** and provide a name for the resulting feature class under **Output Polyline Features**.

D. Set the Contour Values to 0 and click **Run**.

The result will be a vector line that delineates land from water, representing the zero-elevation contour. *Note: If null values are present in the data, the contour may not be contiguous.*



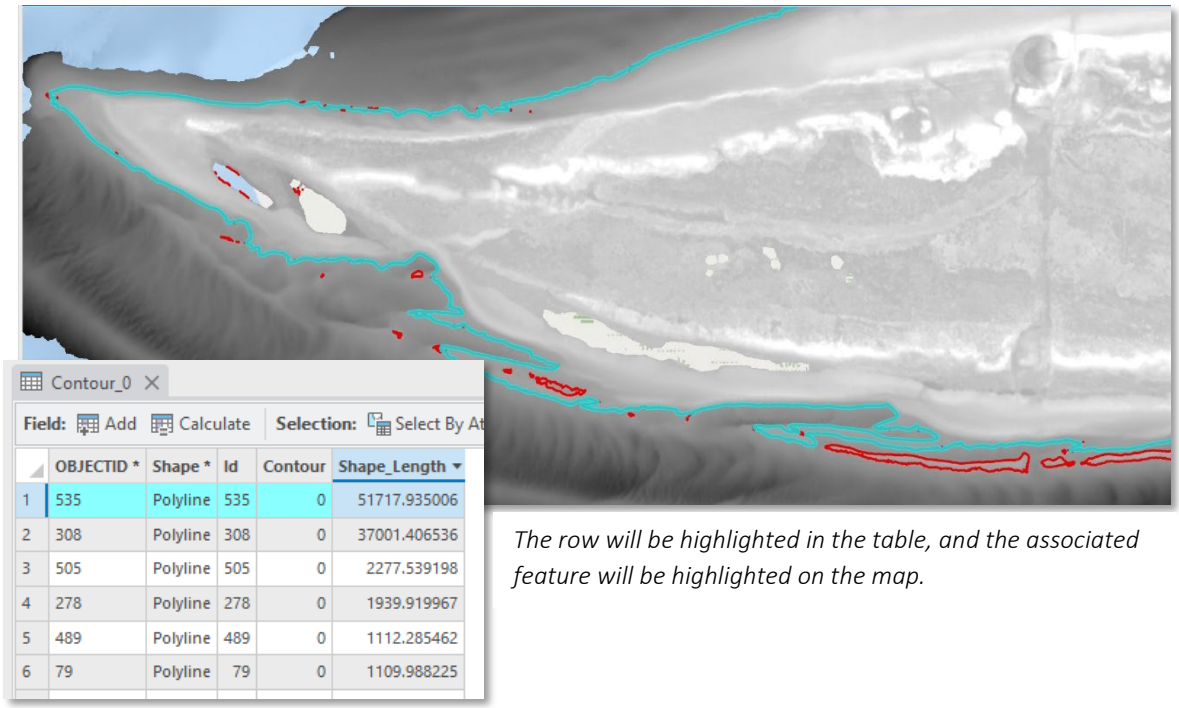
STEP 4. SELECT & MERGE ATTRIBUTES

Examine the generated contour line. Ideally, it should form a fully enclosed perimeter around the island. However, smaller zero-elevation contour lines may also appear. In some cases, you may need to combine multiple segments into a single line to accurately represent the shoreline. In this step, you will select the longest feature, or if necessary, merge multiple segments to create a continuous shoreline layer.

This process is site-specific and may require verifying the selected features for accuracy. For mainland environments, the selection process may involve additional considerations, such as setting a length threshold to filter out smaller, less relevant contour lines.

A. Open the **Attribute Table** for the contour layer and sort the table by **Shape_length** in **Descending Order**.

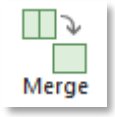
B. From the sorted list, select the *longest feature* by clicking in the space next to the **Object ID** of the feature.



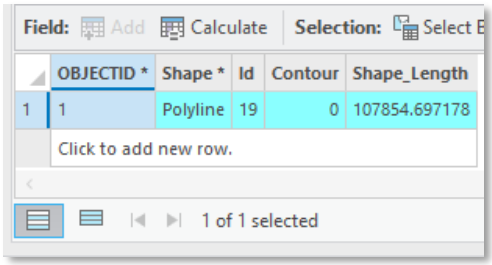
The row will be highlighted in the table, and the associated feature will be highlighted on the map.

C. If a *merge* is needed to make a complete contour line, **Select** the records relative to the main shoreline.

D. On the **Edit** tab, in the **Tools** group, select the **Merge** tool. This will open the **Modify Features** pane.



E. Verify the information and click **Merge**.

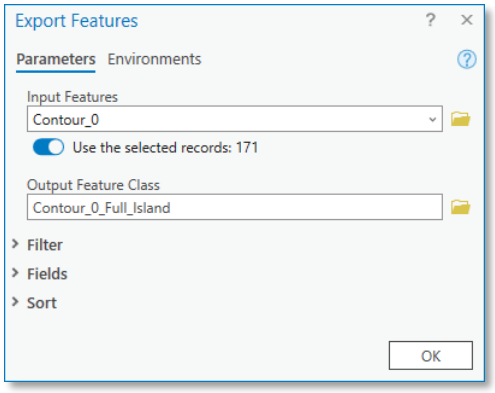


You will now have a single polyline feature that is representative of the zero elevation for the island.

STEP 5. EXPORT FEATURES

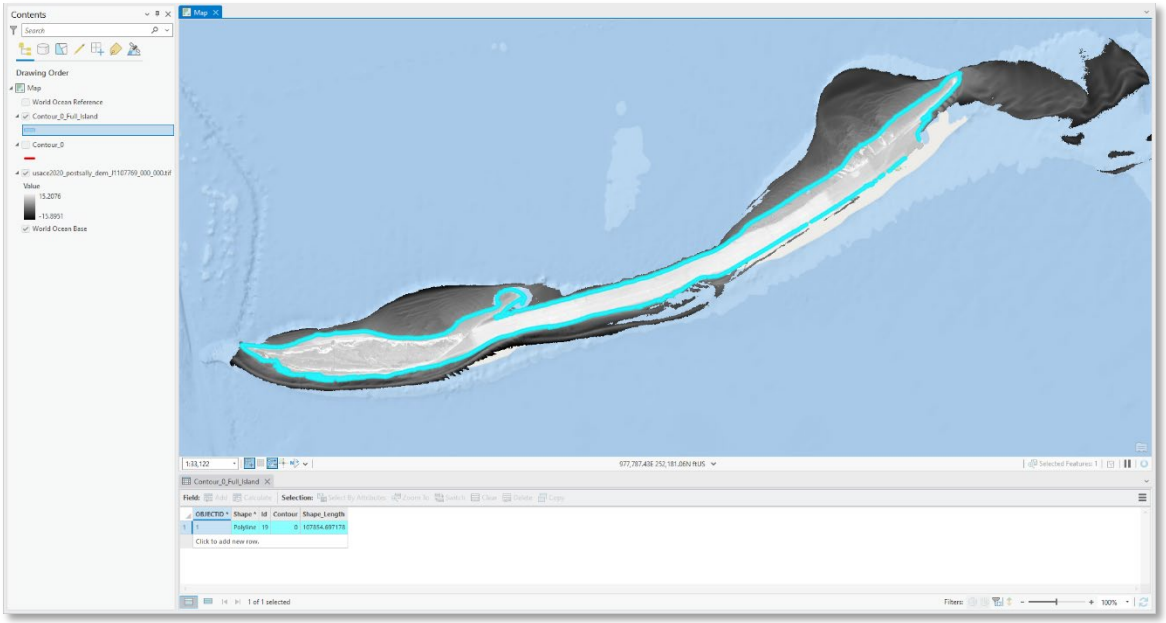
To utilize the shoreline contour in other projects or analyses, you will need to export the selected feature(s) as a new feature class or shapefile. Follow these steps to export the line feature:

A. Right-click on the layer containing the selected feature(s) and choose **Data**.
B. Select **Export Features** (only the selected features will be exported).
C. For **Output Feature Class**, choose the geodatabase or folder where you want to save the new feature class.
D. Name the new feature class appropriately and click **OK**.
E. Once the export process is complete, you will have a 0-elevation contour representing the shoreline of the island that you chose.
F. **Save** your project to preserve your work.



FINAL PRODUCT

This concludes the GEO Tutorial. You have successfully generated a 0-meter elevation shoreline using the Contour List tool. The final product should resemble the example image below, with the original DEM visible and the zero-elevation contour outlining the edge of the island. The attribute table should indicate only one selected feature, which is also highlighted in the map.



This process is particularly effective for island environments, where extracting a single, continuous shoreline is essential. For mainland environments, additional adjustments, such as setting length thresholds or merging multiple segments, may be necessary.

The resulting shoreline can be used in various applications, such as predictive modeling, future analyses, or tools like the USGS Digital Shoreline Analysis System (DSAS) to assess shoreline changes. This method supports informed decision-making for coastal management and planning efforts.