Modeling Sediment Erosion in A Coastal Watershed

Using DSAS v5.0

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Introduction

- The tracking of erosion in coastal areas provides increased difficulty when compared to more conventional sediment models.
- Remote sensing and geographic information systems are always rising to meet demand in data collection and analysis.
- This project will produce such a model via a combination of ArcGIS software (primarily DSAS v5.0), drone imaging, and comparisons with historic aerial and LiDar data.
- A more localized section of coastline will be used for even more in-depth analysis on one of the fastest eroding beaches in Texas

Procedure

- Data was compiled from various sources including TNRIS Data Hub, Modeling Analysts, and Drone Collection.
- The drone used was the Phantom 4 Pro produced by DJI. The drone was set to gather aerial images at 2 cm spatial resolution along the research area of interest for a more in-depth analysis of a localized system.
- All images were then processed via projections into the correct spatial frame and georeferenced for accuracy.
- The raster files were stitched together into a mosaic and shoreline shapefiles created from the digitization of filtered aerial imagery.
- The images span from 1850-2020.
- The shapefiles were loaded into the DSAS v5.0 add-in and processed via linear and weighted linear regression rates.
- The calculation followed a simple formula:

$$y = mx + b$$

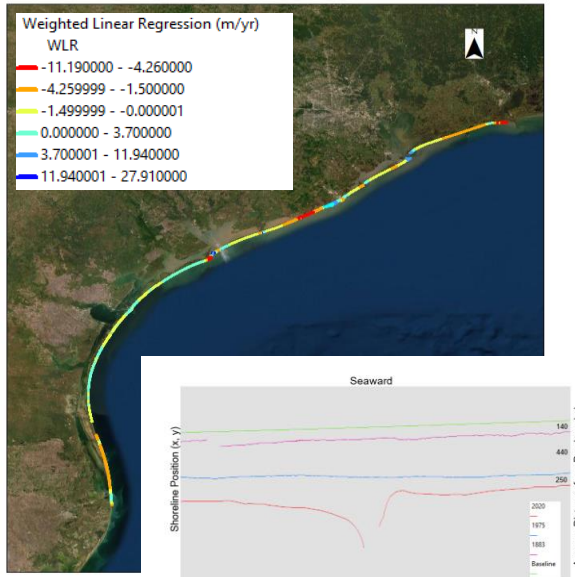
- That was fit to match a least squares regression line based on shoreline position from baseline and the date that shoreline pertains to.
- In the case of the weighted linear regression a weight was determined based on shoreline uncertainty according to the following formula:

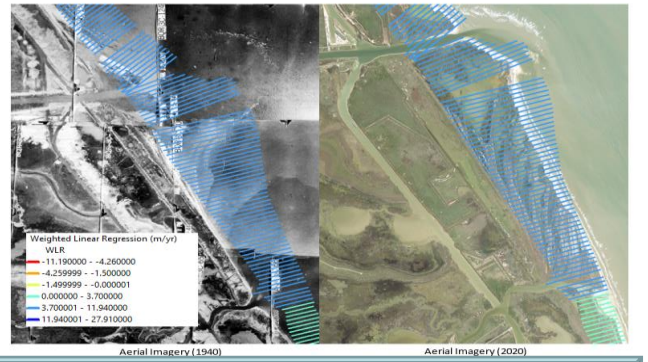
$$w = 1/e^2$$

- The results from that model were clipped to the shoreline change extent to provide images that indicated rates of erosion within the envelope of the net shoreline movement from baseline to most recent shoreline extent.

Results

- The model accurately predicted shoreline erosion at the regional level.
- The more localized and more in-depth processing also provided the most accurate aerial imagery of the site of interest. Additionally, useful erosion data for a portion of the Texas coast.
- The average erosion rate along the coast of Texas was calculated at 0.731229 m/yr and 0.685879 m/yr based on the weighted and linear regression rates, respectively.
- The net shoreline movement along the coast from 1850-2020 was on average 890 meters. This is the total extent of shoreline loss in between those years.
- The weighted linear regression far out-performed the linear regression with standard error values of 5.575171 m and 52.1582 m. respectively





Conclusions

- The DSASv5.0 tool can accurately predict shoreline erosion given the proper input parameters.
- The Texas coast is eroding at an alarming rate. With the exception of areas that have been influenced by human structures/features.
- The weighted linear regression method can provide much more realistic outputs when the proper uncertainty values are calculated.
- The use of drone imaging can provide a new level of accuracy and data integrity to GIS modelling systems, and is especially useful at a localized scale

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