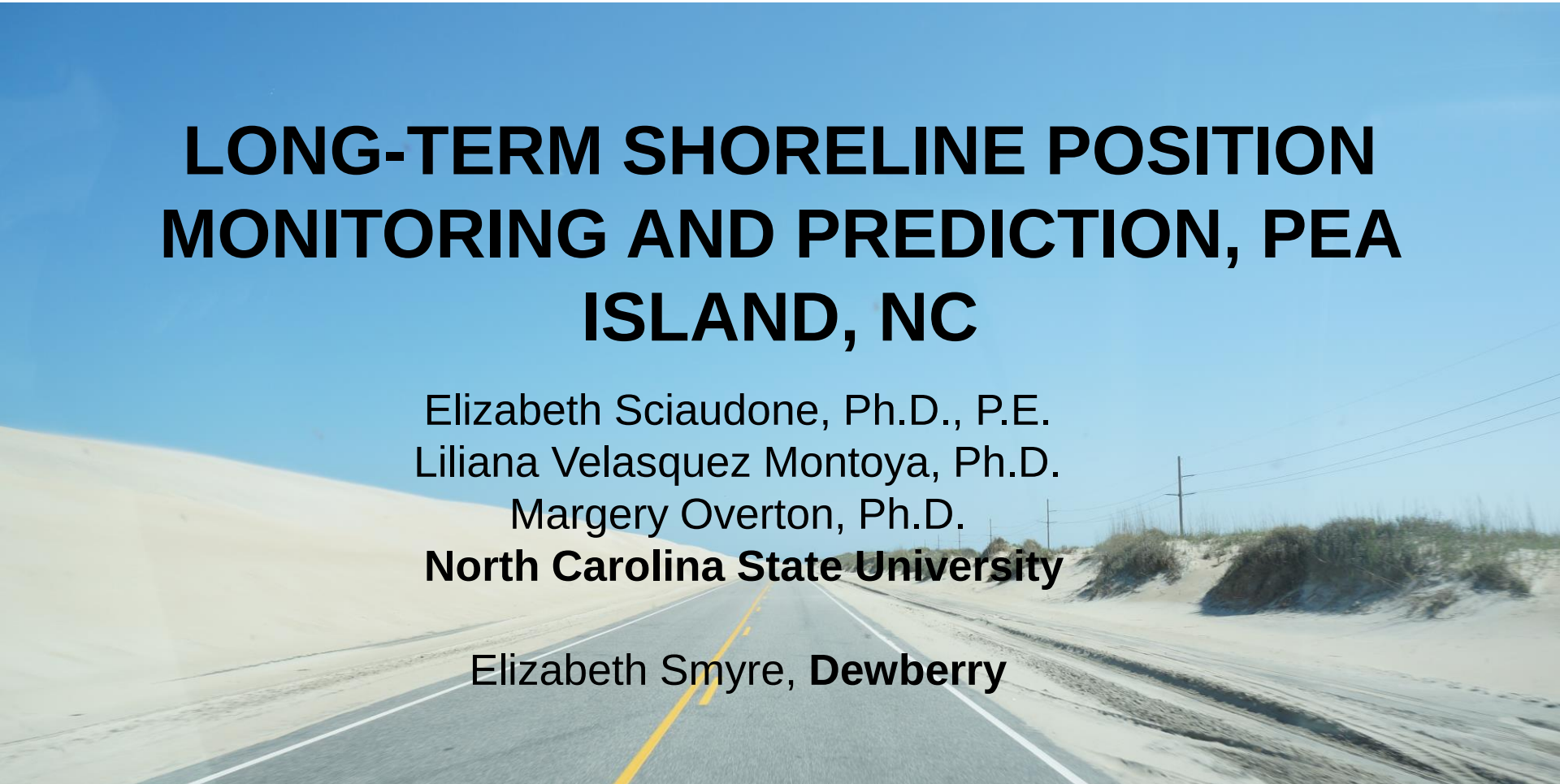

LONG-TERM SHORELINE POSITION MONITORING AND PREDICTION, PEA ISLAND, NC

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Liliana Velasquez Montoya, Ph.D.
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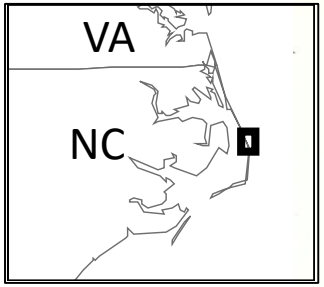


Source: FRF website

N

Oregon Inlet

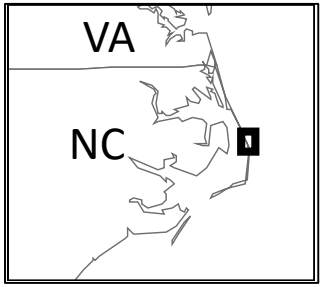
Predominant Sediment Transport

NC 12 tie-in

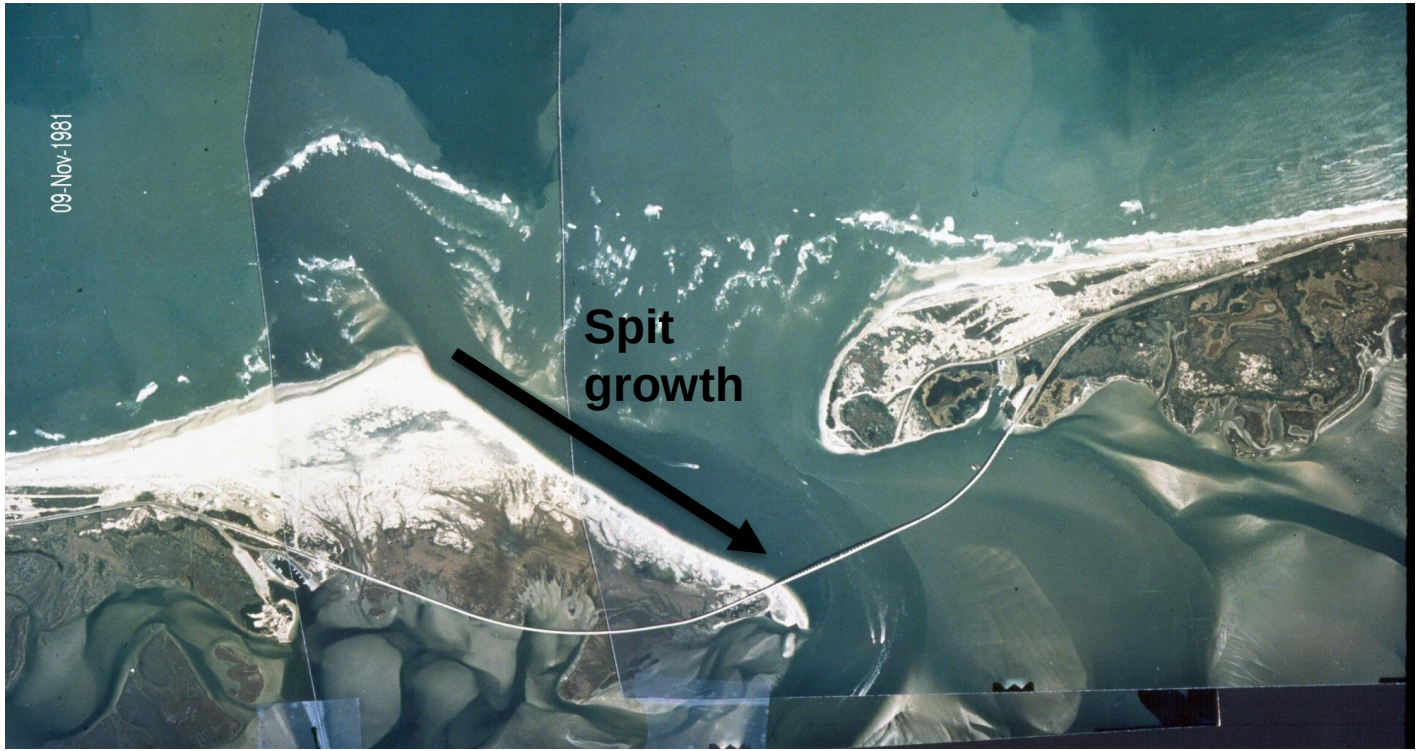
Bonner Bridge
under construction

05-Dec-1962

December 5, 1962

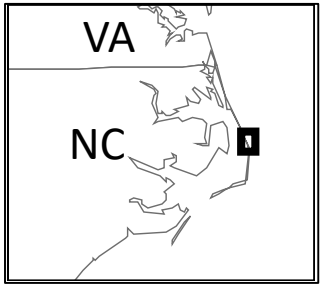


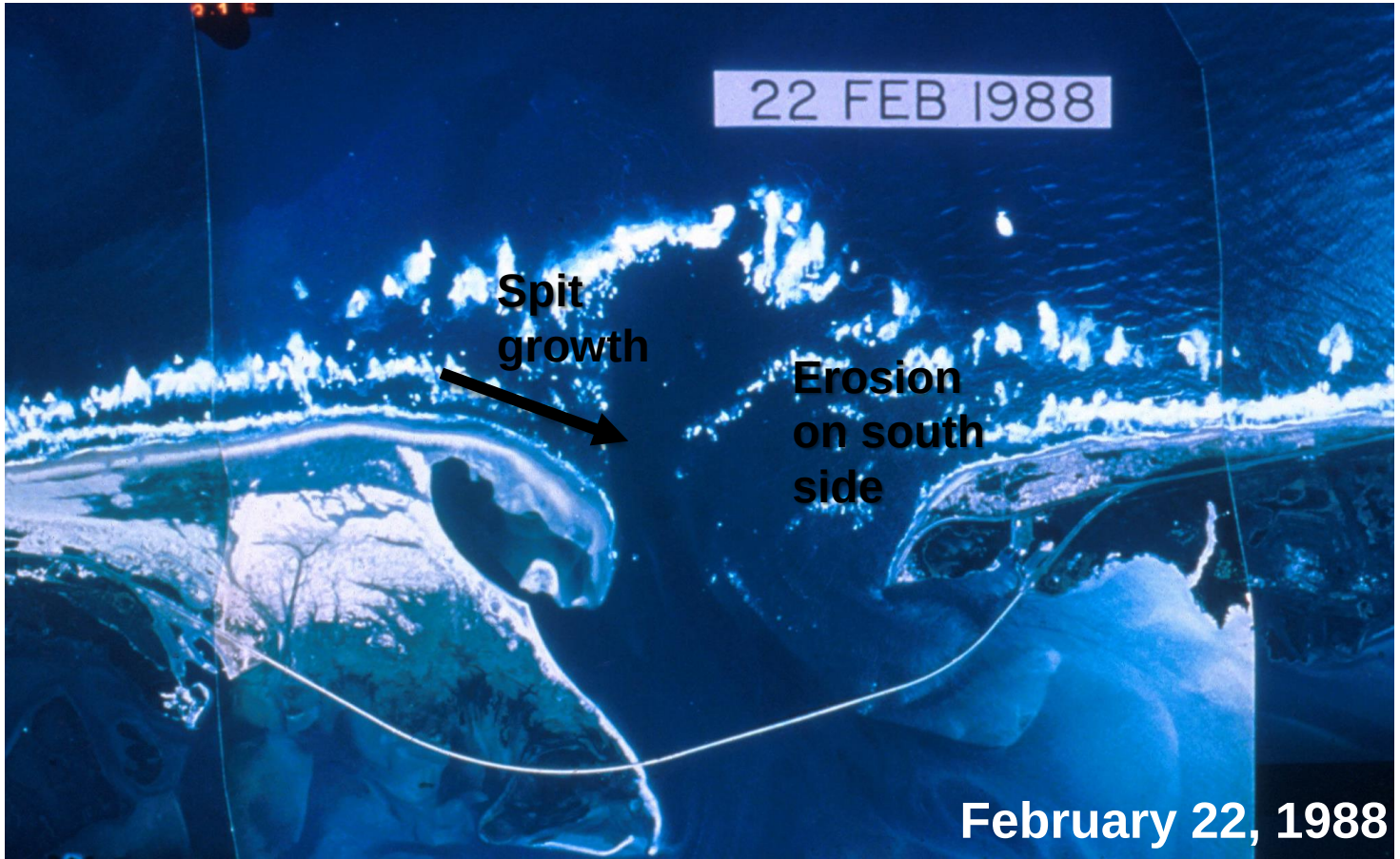
Source: FRF website

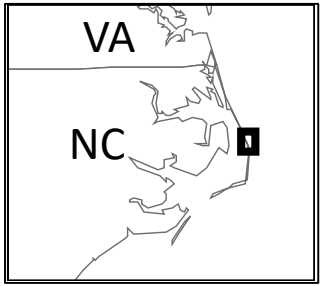


November 9, 1981

Source: FRF website

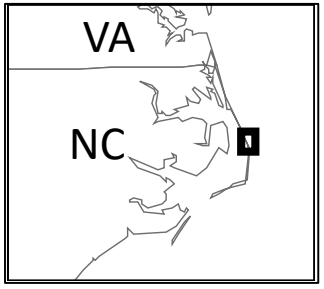


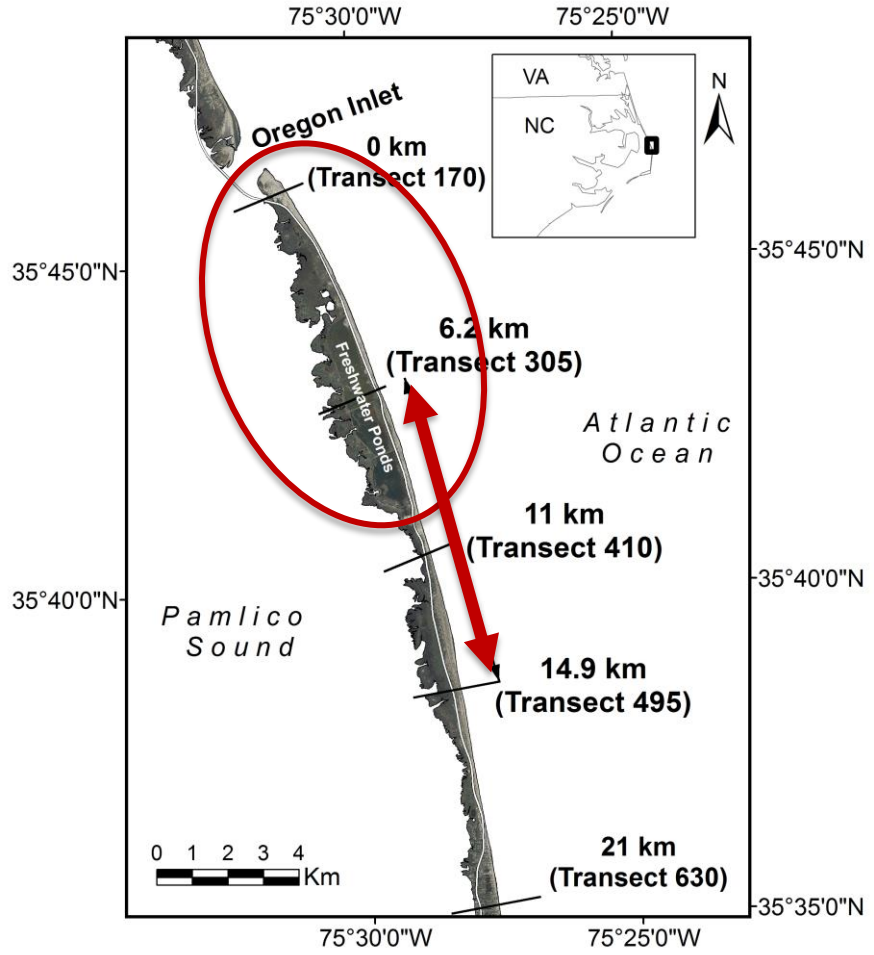




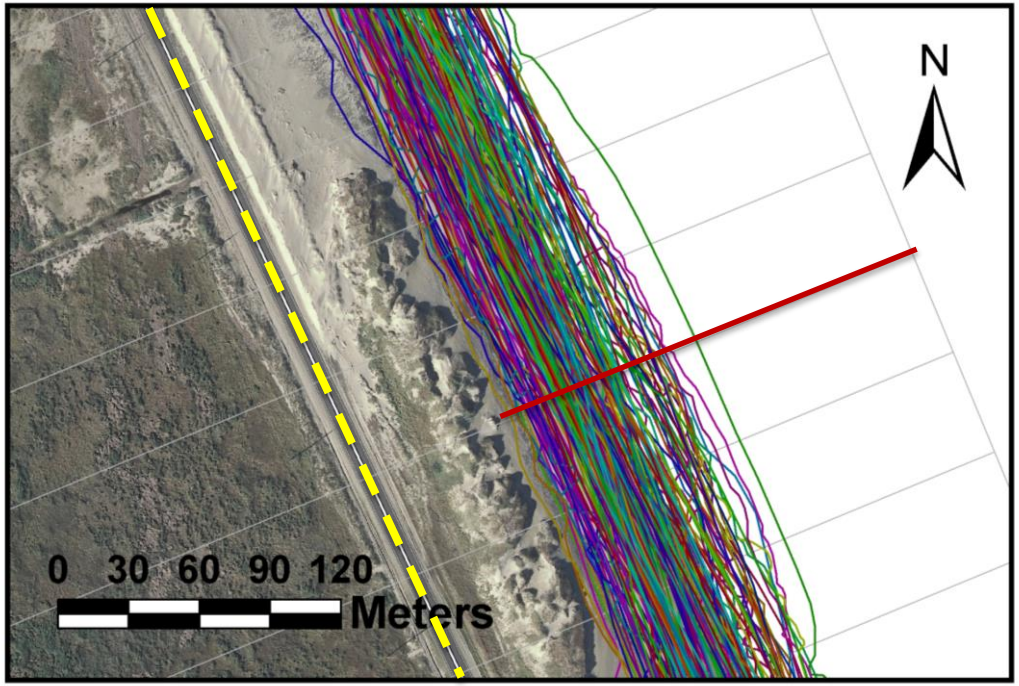
Source: M. Helminski photo

Source: Google Earth

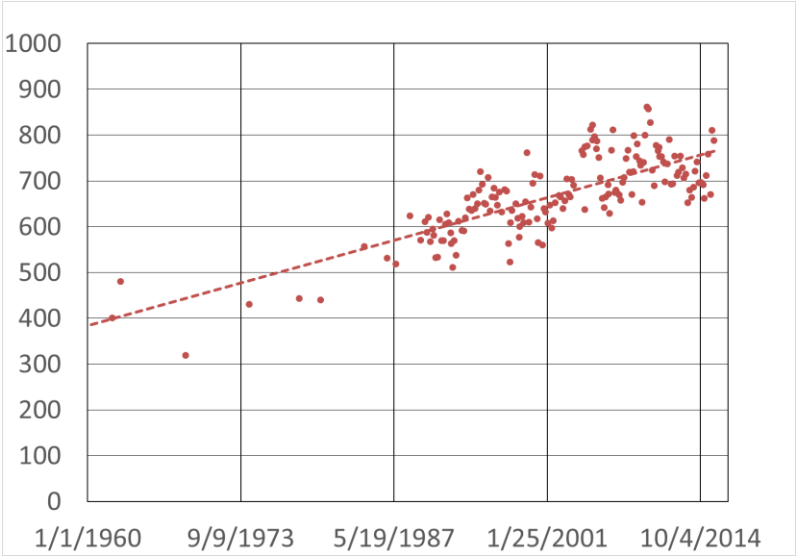




- Aerial photography every 2 months from 1989-present
- Additional historical data from R. Dolan
- Project study area initially 10 km, expanded in 2010 to 21 km.
- Shore-perpendicular transects at ~46 m spacing



- Database of shoreline positions at each transect
- Distance from shoreline to shore-parallel baseline



Management Question

- Where/when will long-term erosion impact the coastal highway NC 12?
  - Current
  - 5-Year
  - 2030
  - 2060

March 7, 2018 NC DOT Photo

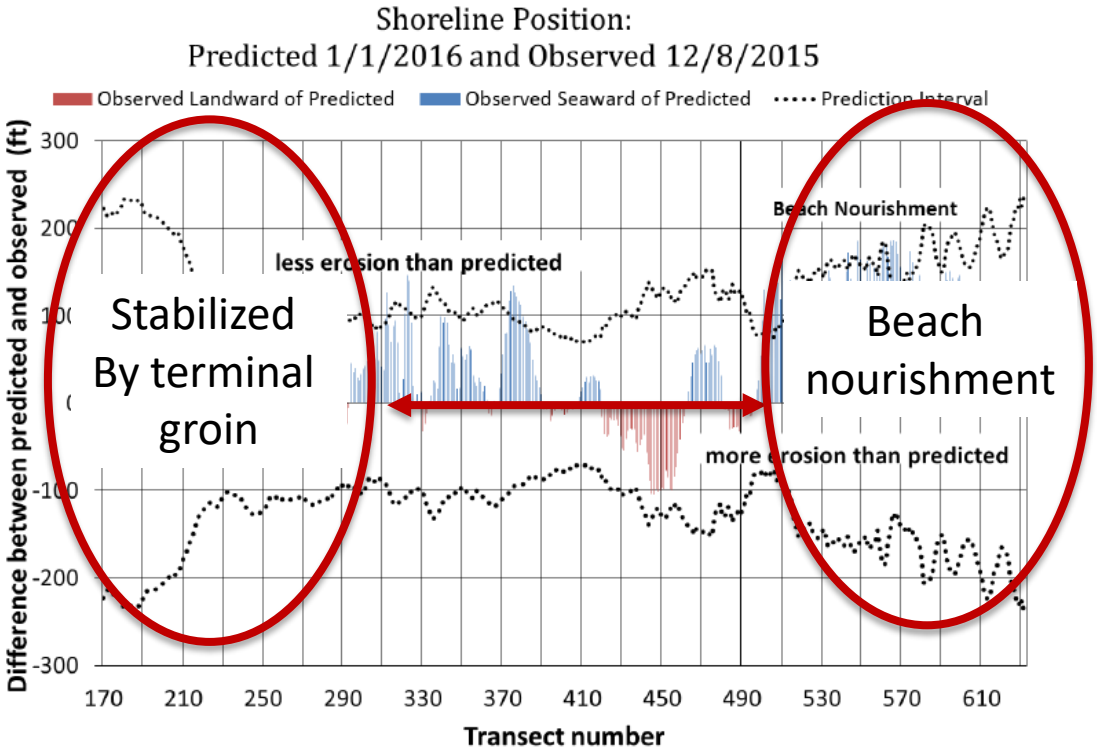
Shoreline Position Forecasting

- Linear regression with prediction Interval to forecast shoreline position at future time

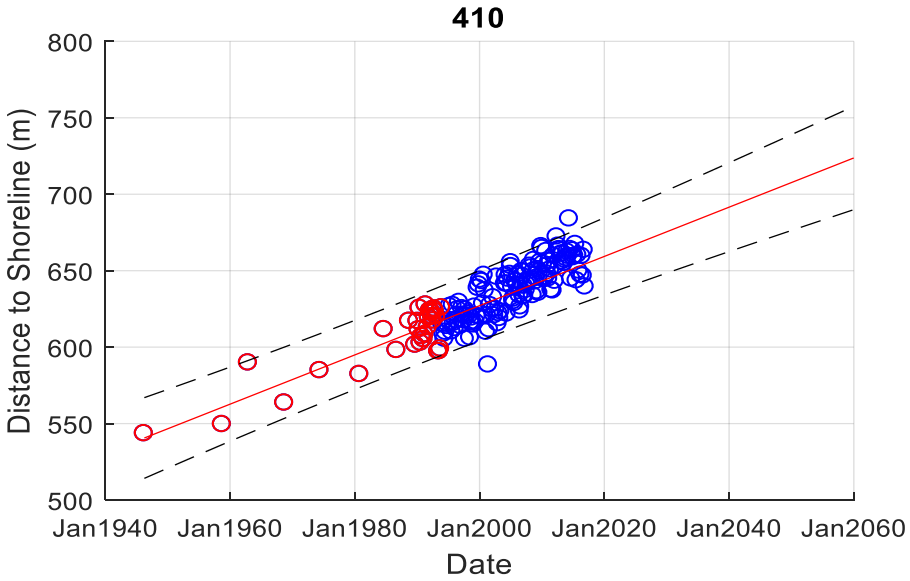
$$\hat{y}_h \pm t_{(\alpha/2,n-2)} \times \sqrt{MSE\left(1+\frac{1}{n}+\frac{(x_h-\bar{x})^2}{\sum(x_i-\bar{x})^2}\right)}$$

How successful are these forecasts?

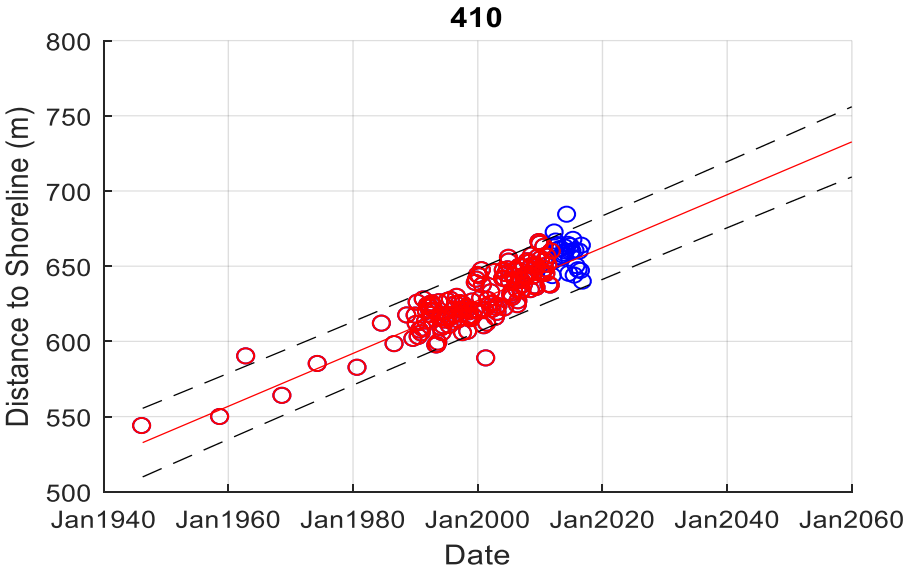
- Examine forecast success using historical data
- 2015: 5-year evaluation of methodology



April 1946-December 1993



April 1946-December 2011



- Used varying date ranges to forecast shoreline position, compared with measured shorelines

Date Range used to predict position	No. of shorelines available	Average width of prediction interval (m)	% of measured Dec. 2016 shoreline positions within prediction interval
April 1946-December 1993	~34	±50	90%
April 1946-December 2000	~76	±39	80%
April 1946-December 2006	~111	±36	81%
April 1946-December 2011	~145	±32	85%

Results

- More than 80% of observed shoreline positions fall within the prediction interval for all forecasts
- Method considered reasonable for planning and management applications
- Allows for capturing uncertainty of shoreline forecast

Maps with Vulnerable Roadway (70 m buffer)

NC DOT Planning Implications

PHOTOSIMULATION OF THE BRIDGE ON NEW LOCATION ALTERNATIVE | Figure 8

- NC DOT Transportation Management Plan
- Phased approach
- “Jug Handle” bridge

Thank you