# EROSION OR ERROR: ARE BEACH PROFILES AND THE MEAN HIGH WATER SHORELINE APPROPRIATE PROXIES FOR MEASURING SUBAERIAL VOLUME CHANGE?

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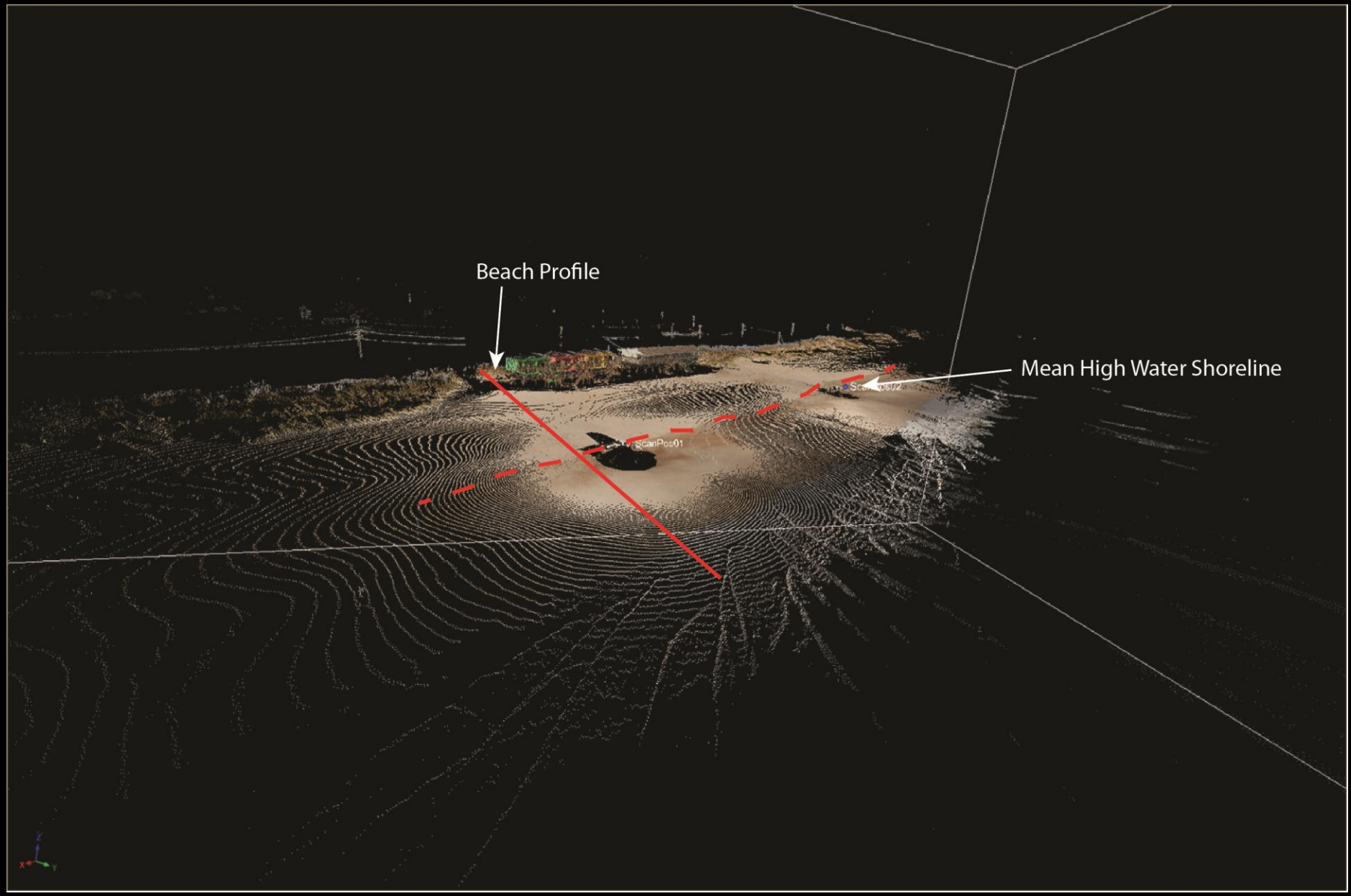
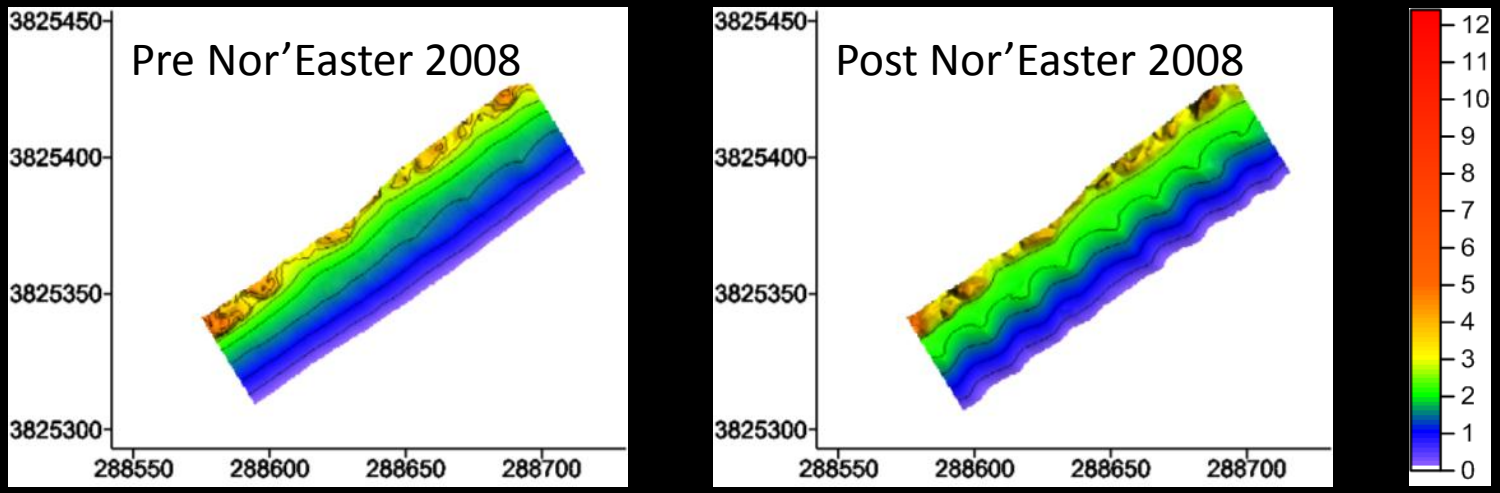
# Subaerial volume change measurements

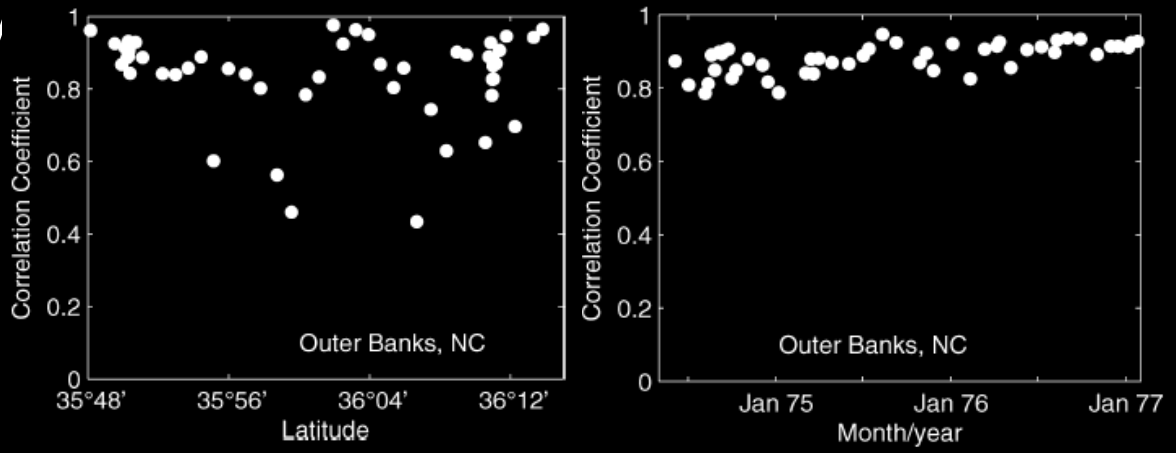


# Short-term beach volume changes

- Beach profiles do not work well on short time scales at beaches with morphologic variability (e.g. beach cusps)



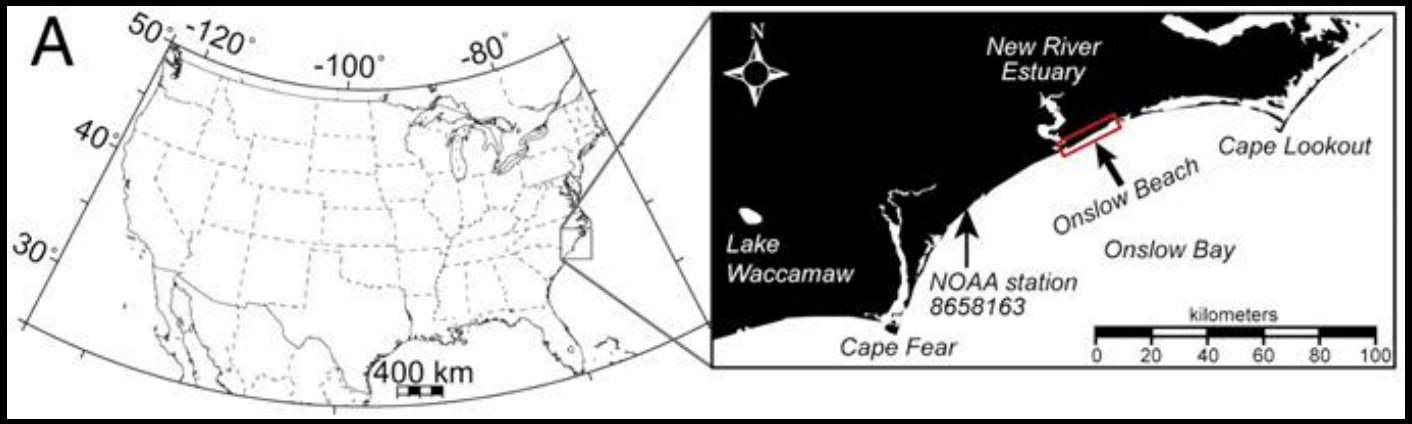

- Shoreline change proxy does not work well where profile shape is variable
  - Improves with time because magnitude of change exceeds profile variability (Farris and List, 2007)

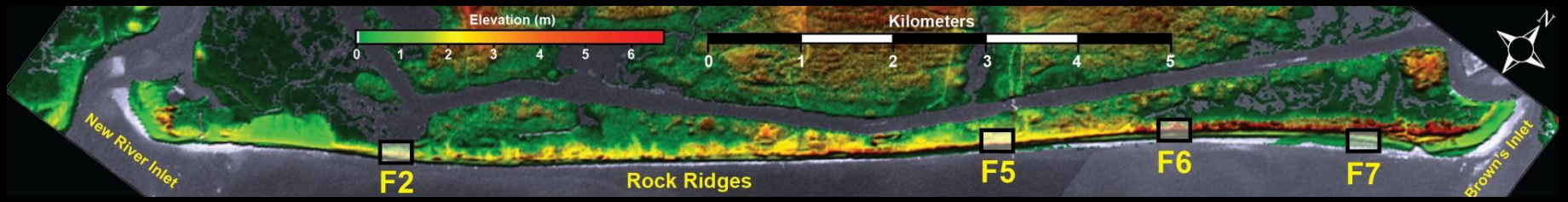


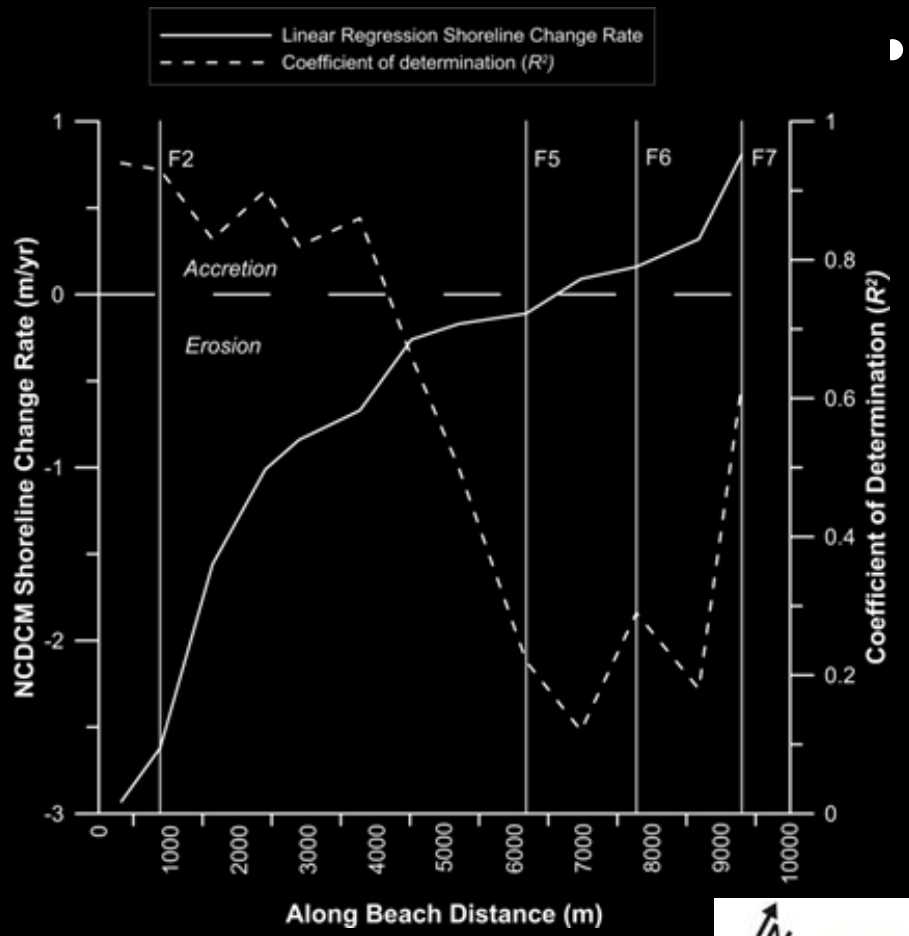
# Do estimates of volume change from beach profiles and the shoreline change proxy improve with time at beaches with varying morphologies and shoreline response?

- Consistent shoreline erosion + beach cusps
- Erosion one year, accretion the next + beach cusps

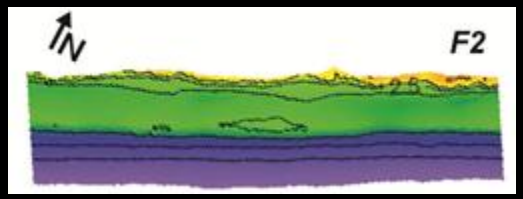
# Onslow Beach, Camp Lejeune, NC

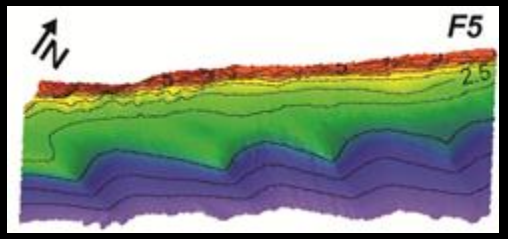


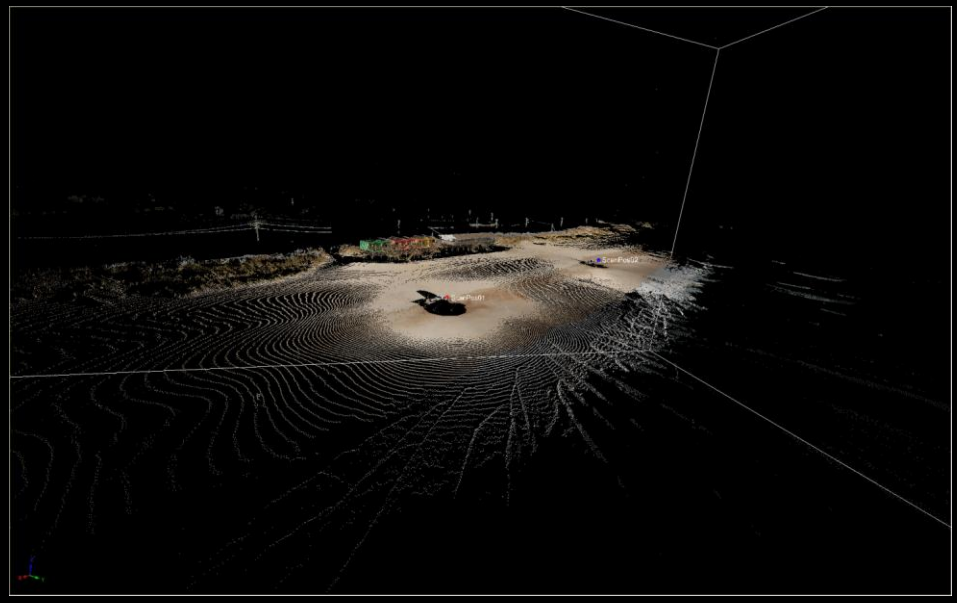



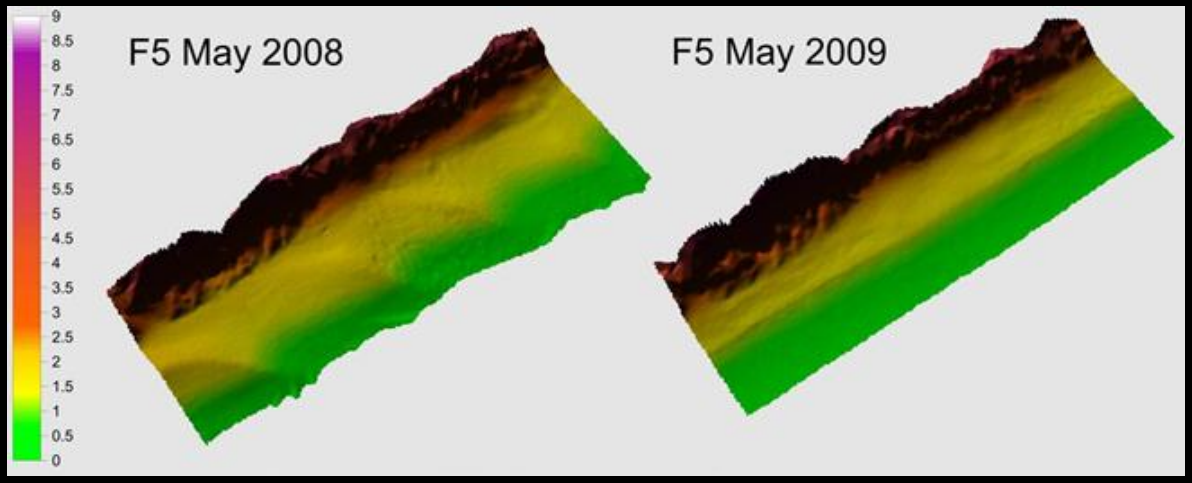

- Sites span range of morphologies
  - F2- Consistently eroding; ephemeral beach cusps
  - F5- Near-neutral change rate; high decadal variability in rate; ephemeral beach cusps

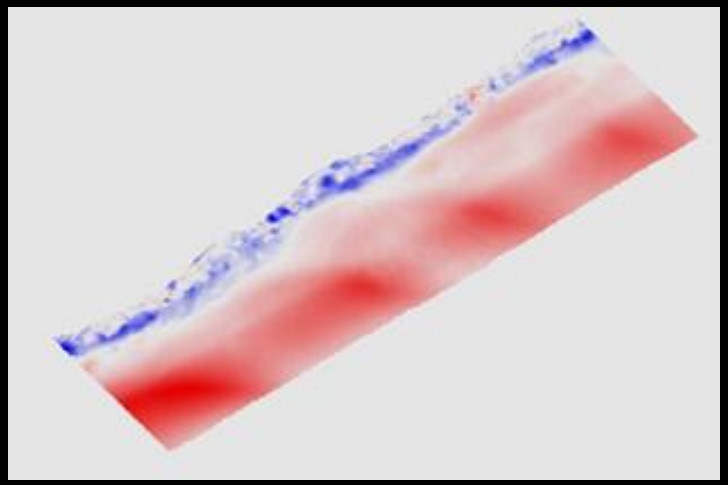


# Terrestrial Laser Scanning (TLS)

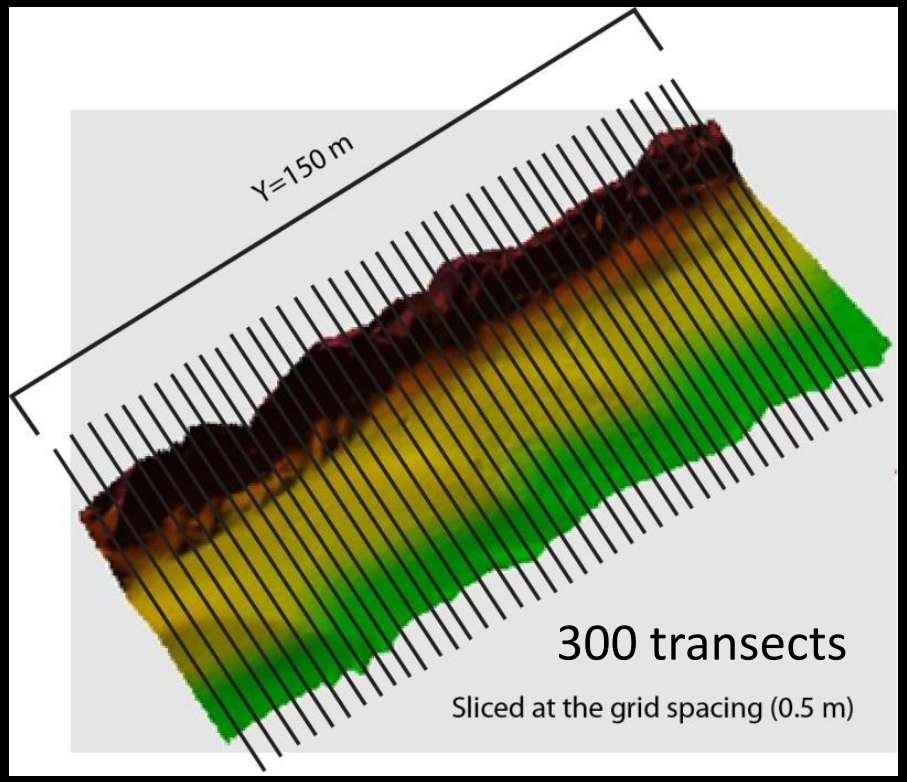


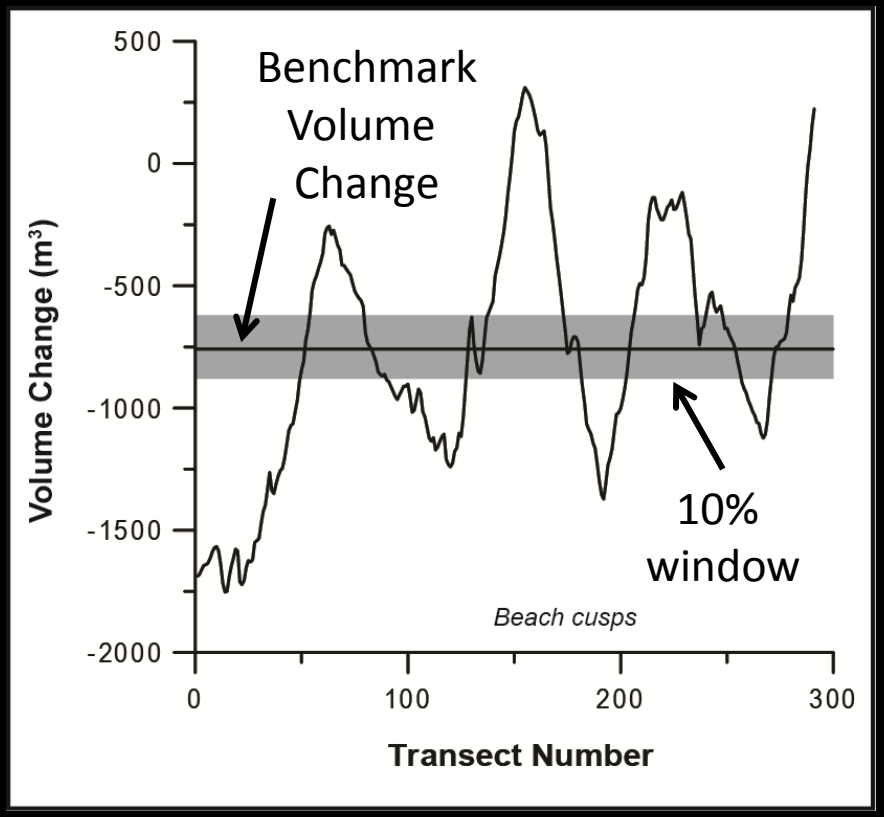


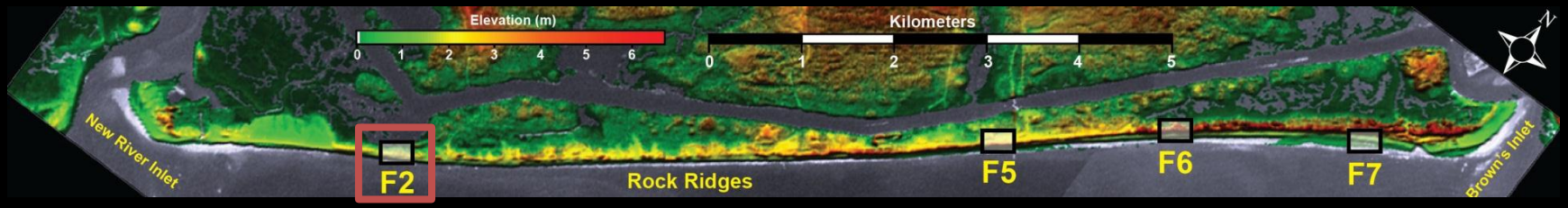
- Biannual monitoring surveys (May and September since 2007)
- TLS data used as benchmark to compare against profile and shoreline change data

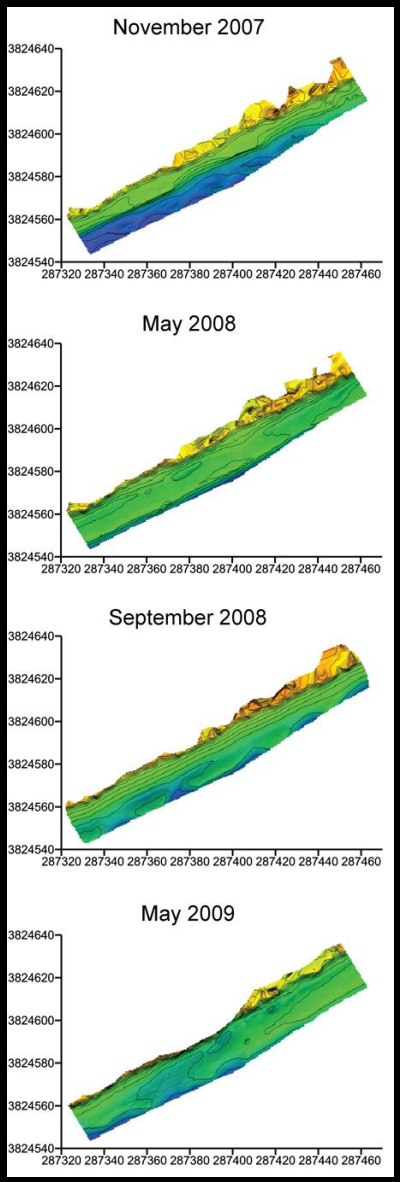
# Profile-Derived Volume Change




- Sliced transects for each survey (e.g. May 2008)
- Assumed each transect was only transect for that site---calculated volume change between surveys
- Performance = percentage of transects within 10% of benchmark


Elevation (m)
0 1 2 3 4 5 6
Kilometers
0 1 2 3 4 5
New River Inlet
F2
Rock Ridges
F5
F6
F7
Brown's Inlet


November 2007
May 2008
September 2008
May 2009
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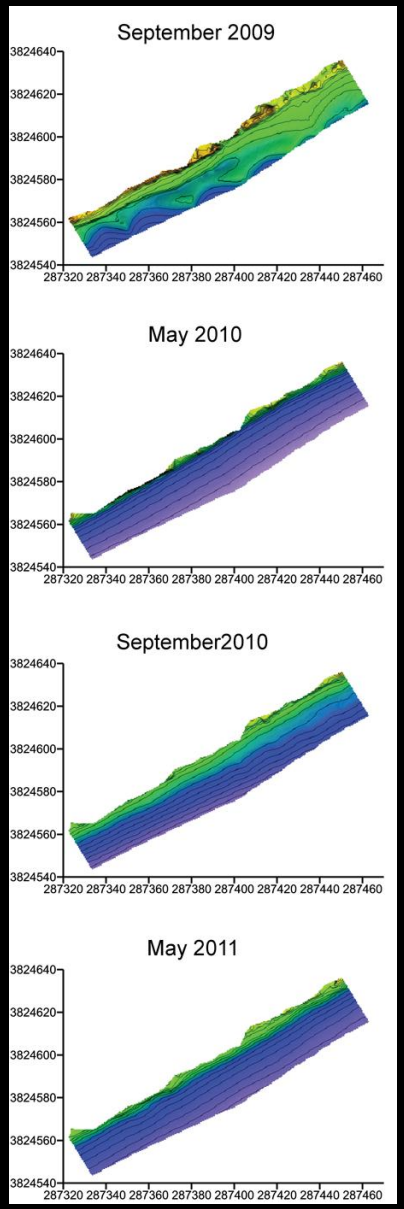
September 2009
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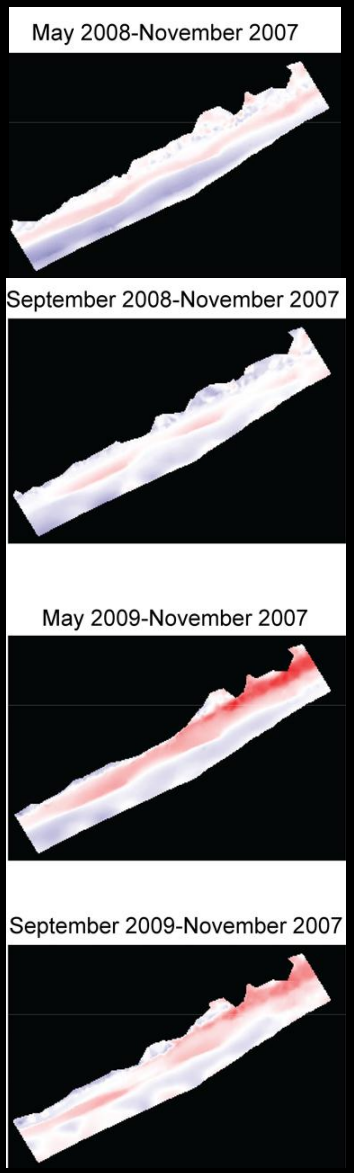
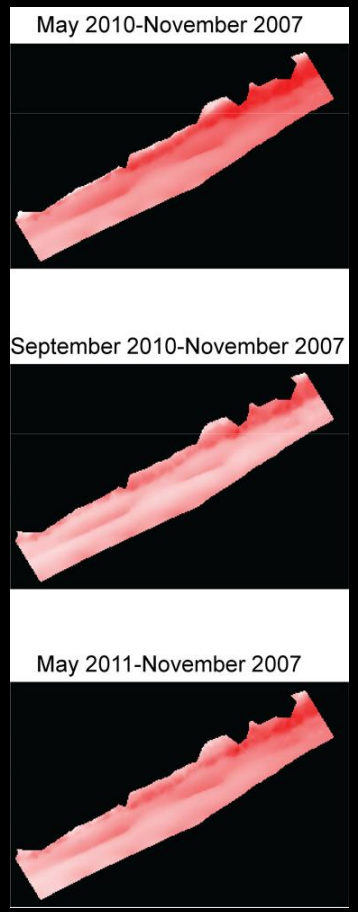
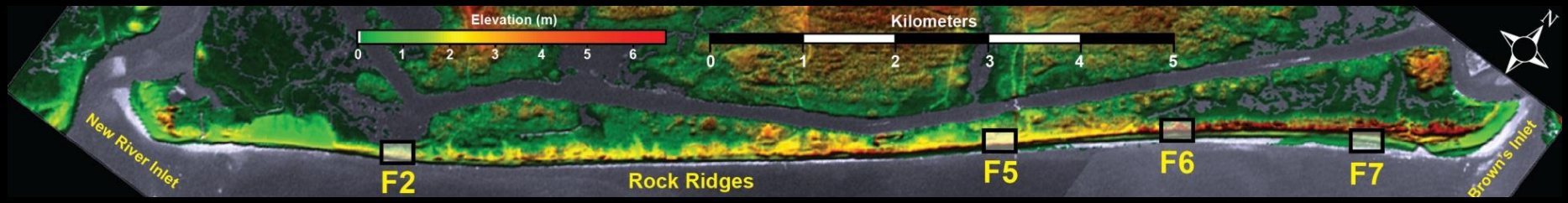
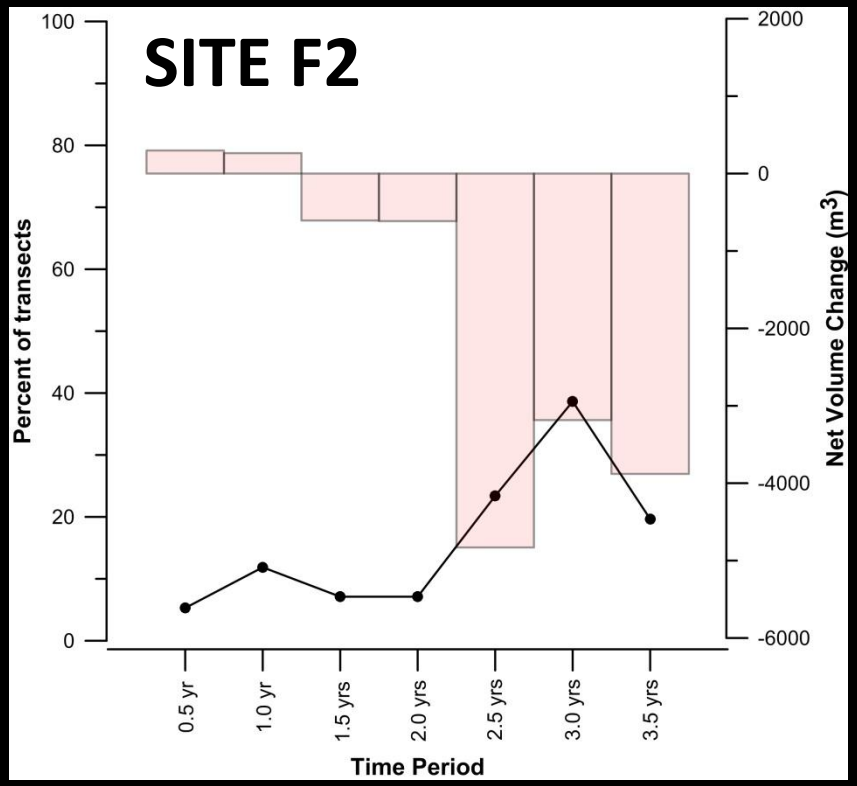
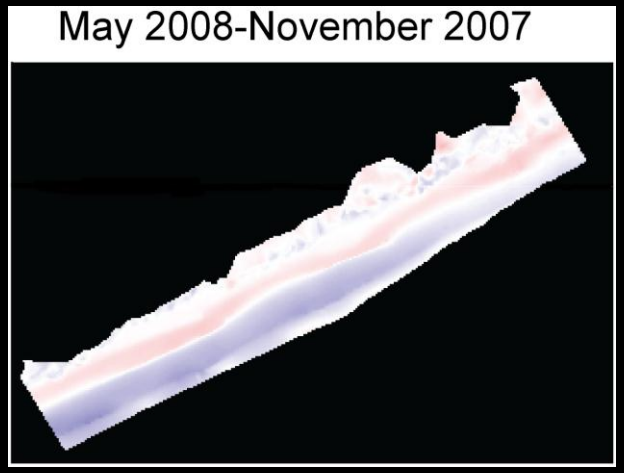

May 2008-November 2007
September 2008-November 2007
May 2009-November 2007
September 2009-November 2007

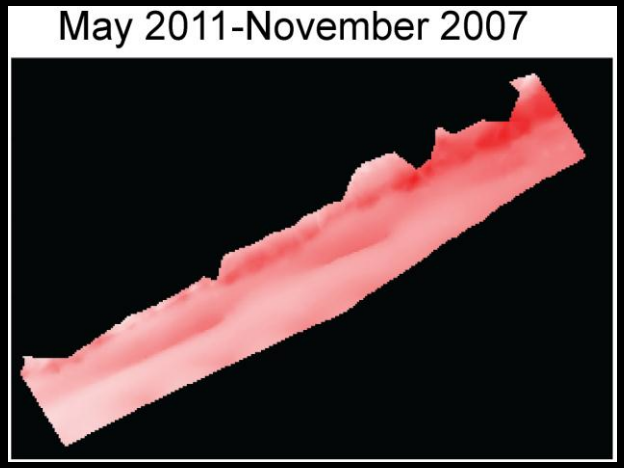

May 2010-November 2007
September 2010-November 2007
May 2011-November 2007

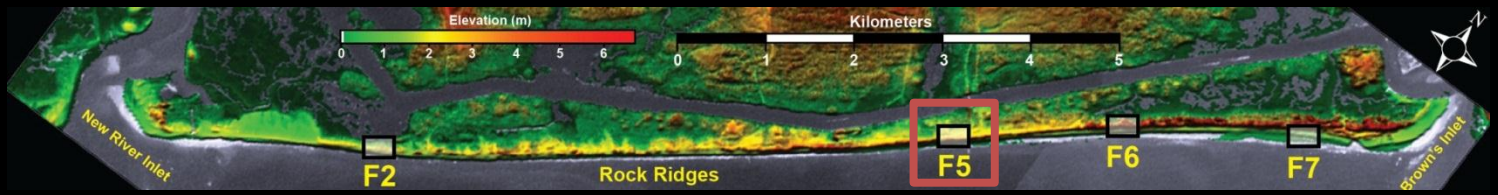
# Does profile performance improve with time?



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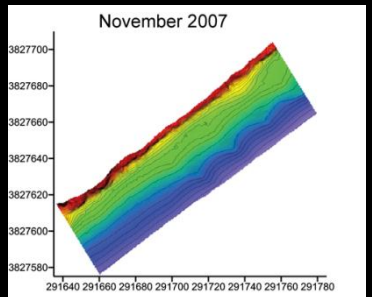

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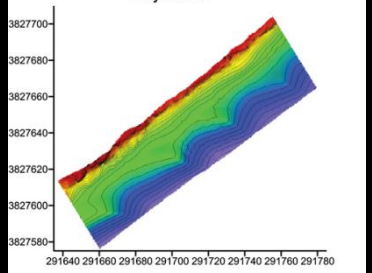

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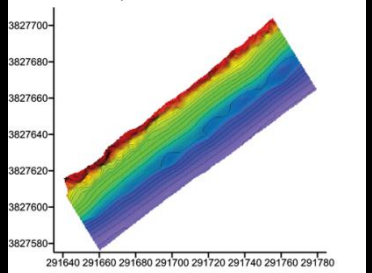

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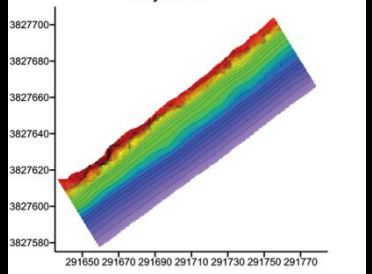

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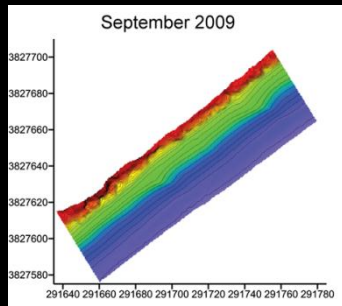

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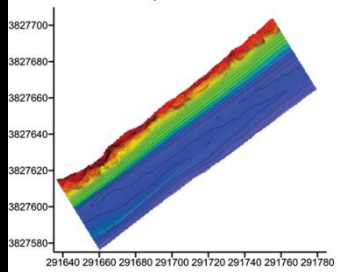

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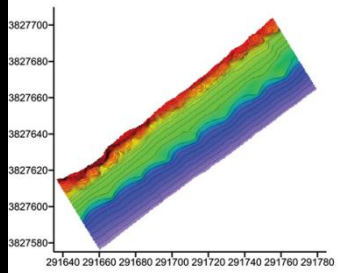

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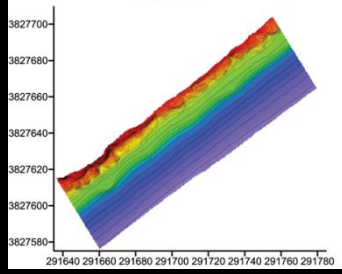

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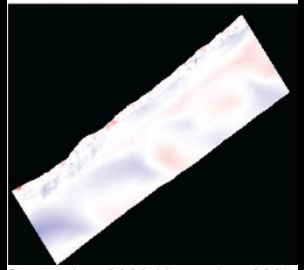

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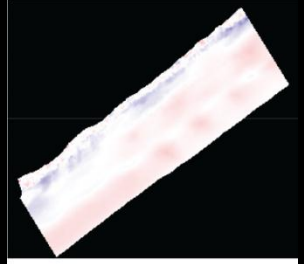

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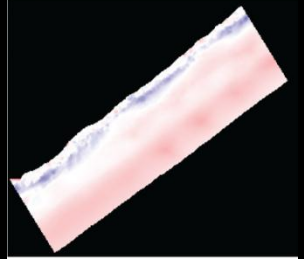

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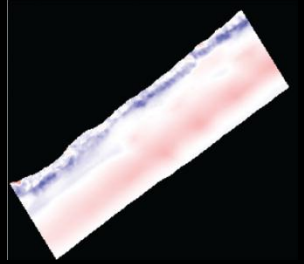

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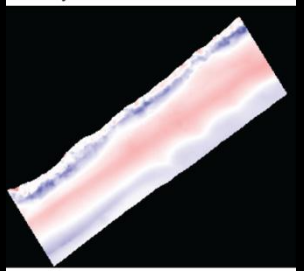

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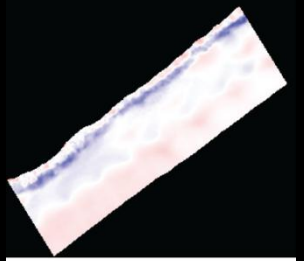

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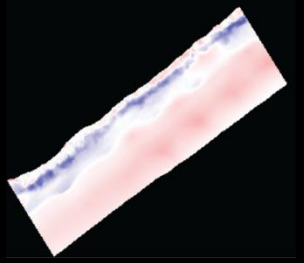
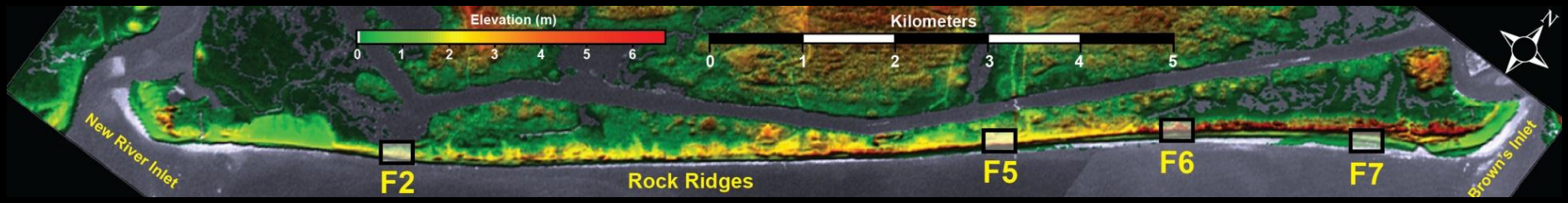
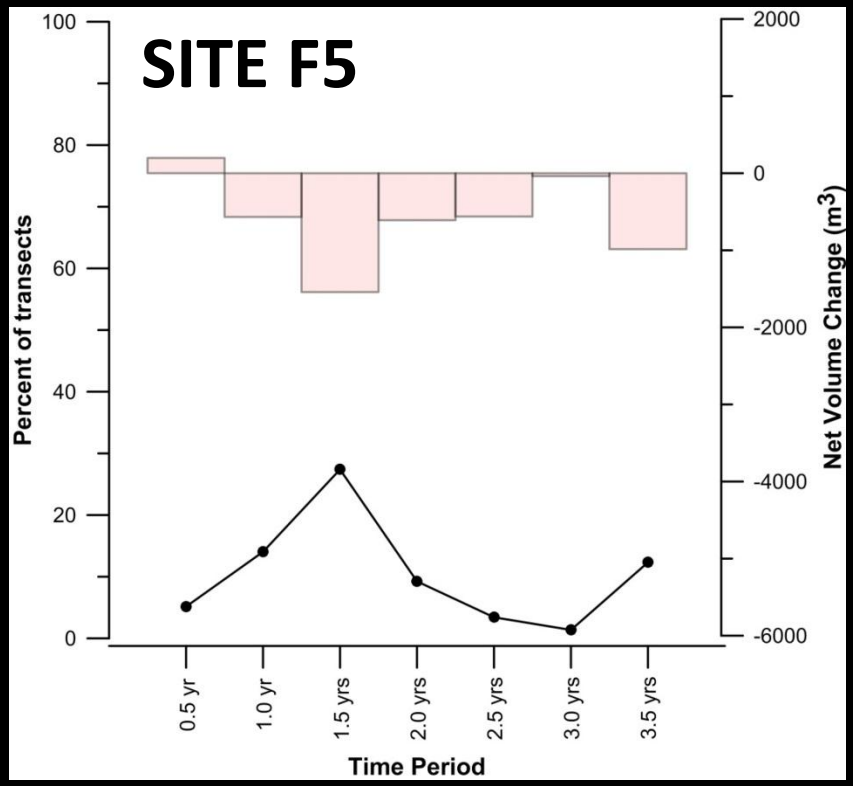
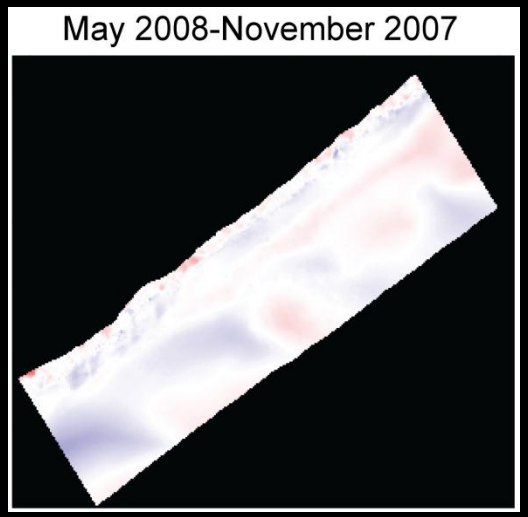
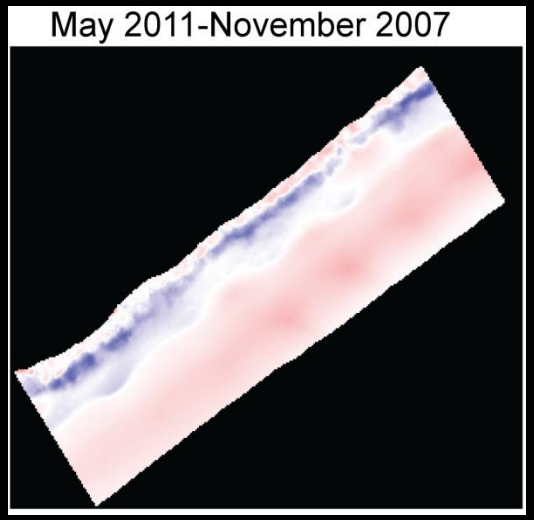


# Does profile performance improve with time?



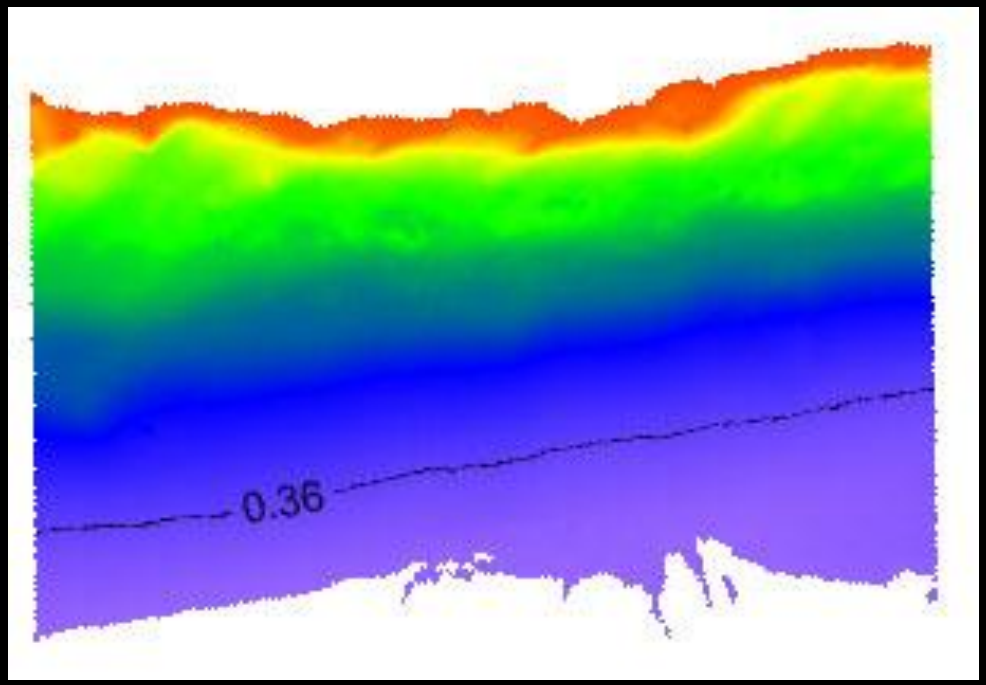



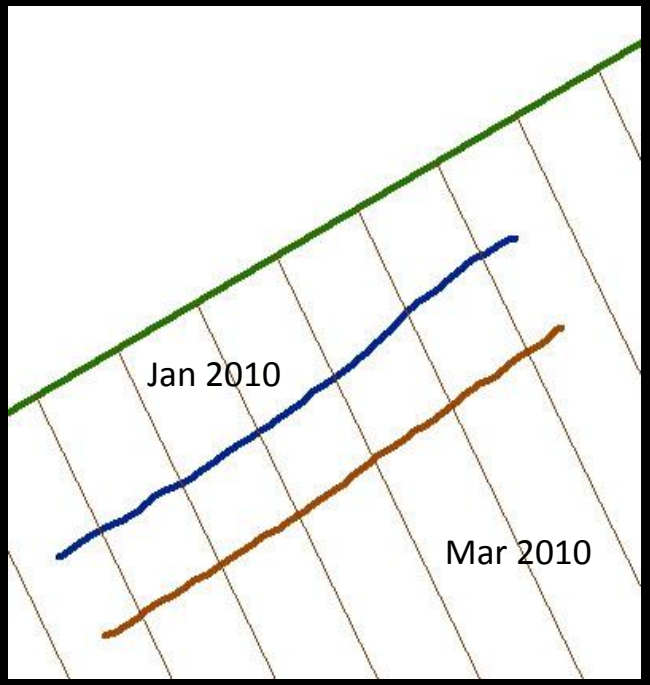



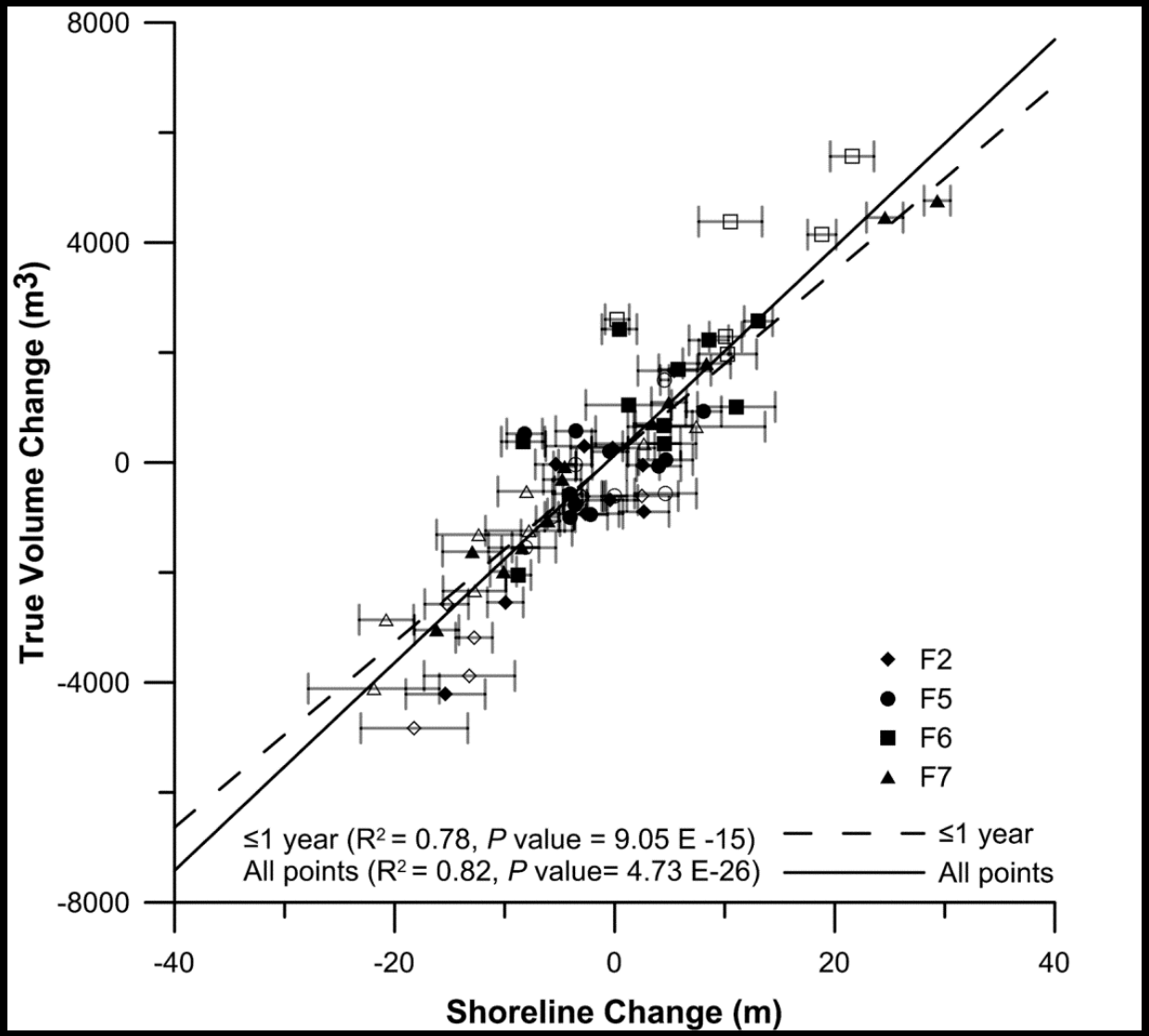

**Small-scale variability matters more with low net volume change**

# Shoreline Change Proxy



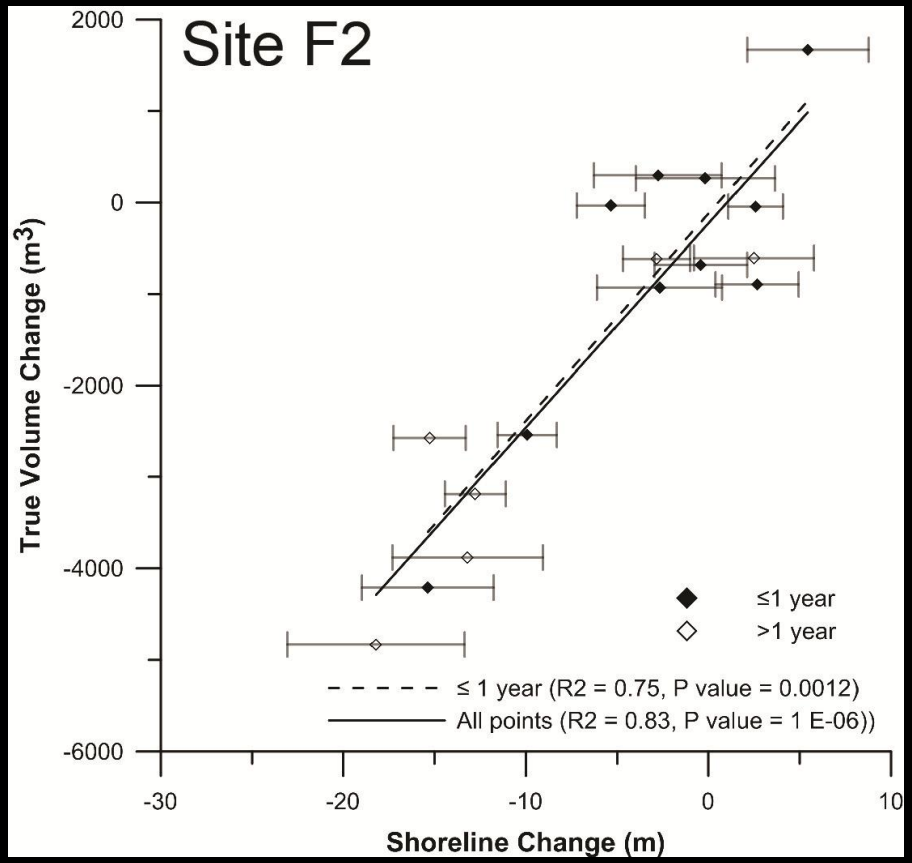



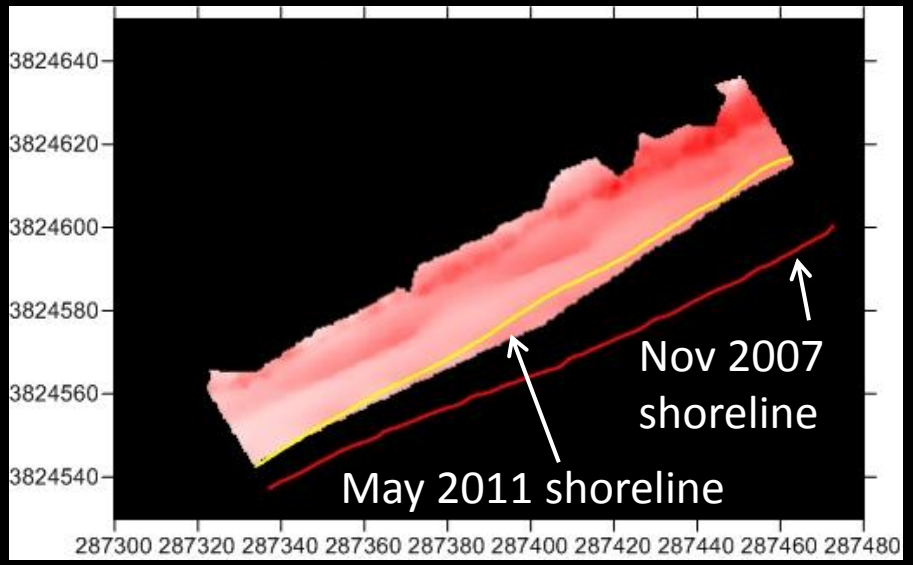

- Extracted MHW shoreline from DEMs
- Measured shoreline change using Digital Shoreline Analysis System (DSAS) (Thieler et al., 2009)




*How does the shoreline change proxy perform at sites with varying morphologic change?*

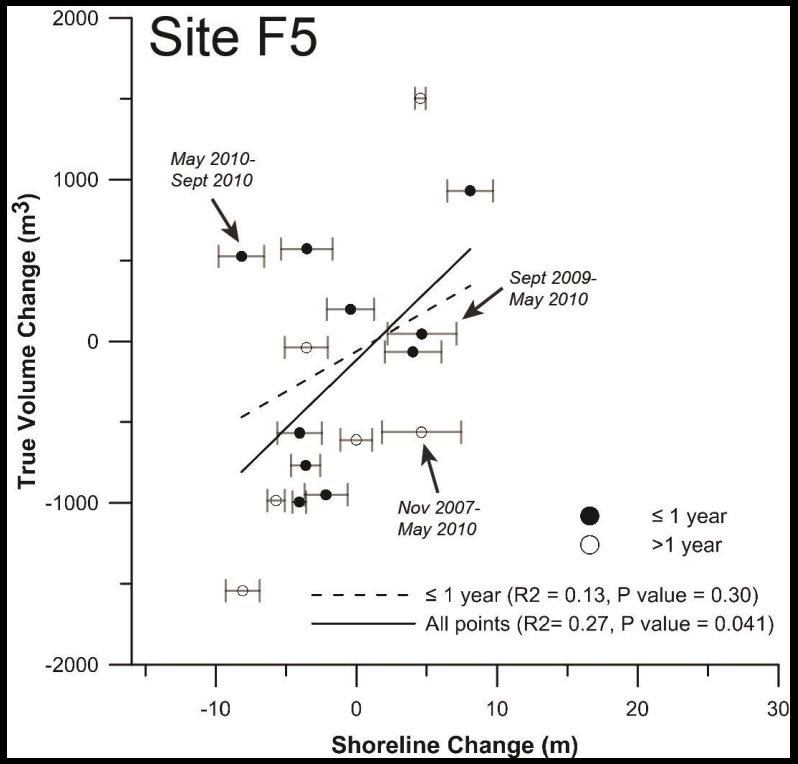
# Site F2: Consistent Erosion

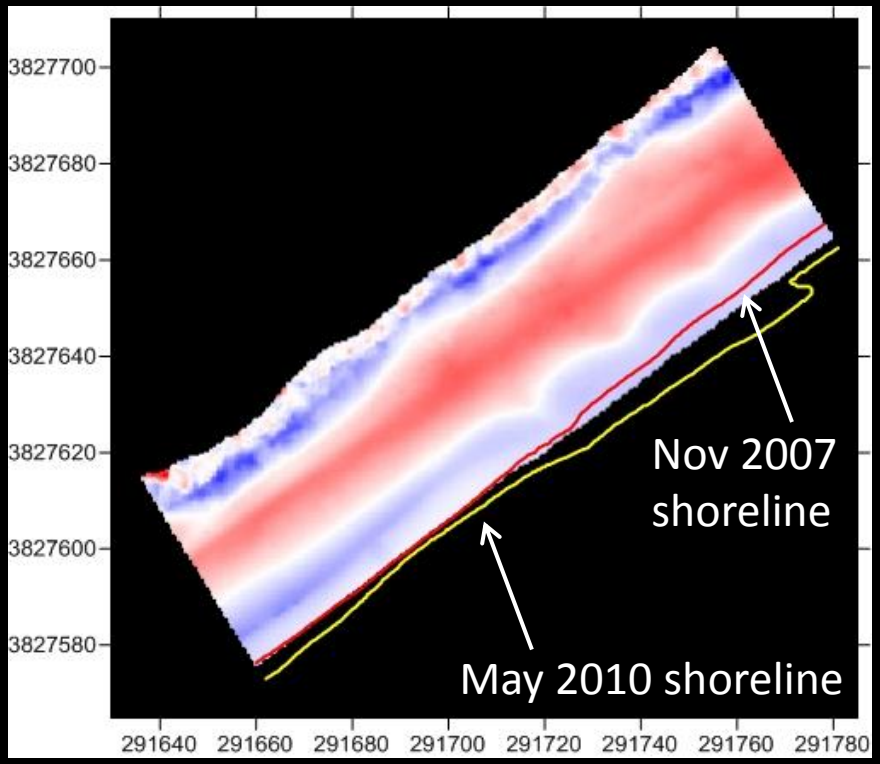



- Shoreline change correlates well with volumetric change
- Increasing time improves the proxy
  - Magnitude of change exceeds magnitude of variability

# Site F5: Low Volume Change; High Decadal Variability




- Shoreline change does not correlate with volume change
- MHW shoreline predicts erosion when volume change is positive
- Beach cusps form on backshore
- MHW line does not capture backshore response

# Conclusion

- Proxies do not accurately measure volume change at beaches with variable shoreline response
  - Short-term variability influences proxy performance on longer time scales