COUPLED SOIL CARBON MEASUREMENTS AND REMOTE SENSING TO QUANTIFY ABOVE AND BELOWGROUND CARBON STOCKS IN MANGROVE FOREST OF THE TEN THOUSAND ISLANDS REGION OF SOUTHWEST FLORIDA, USA

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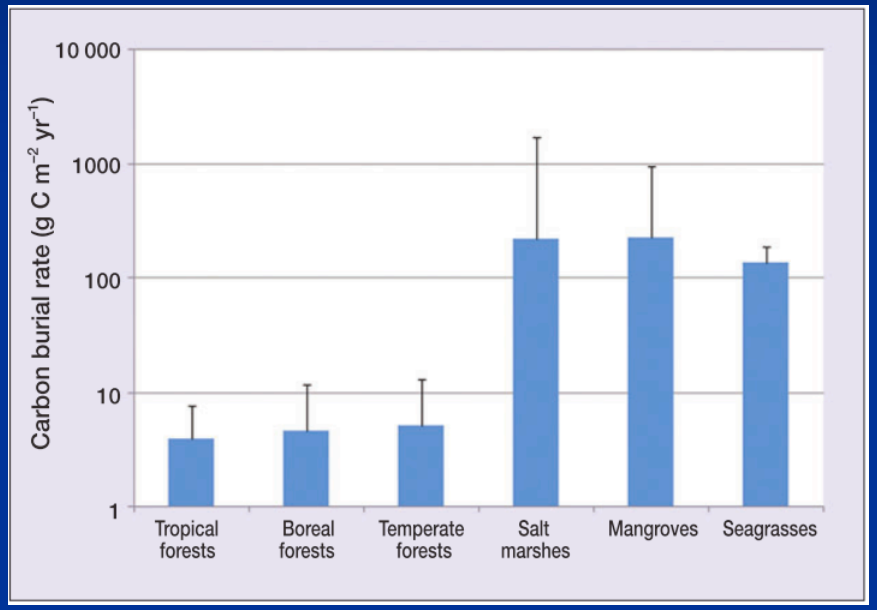
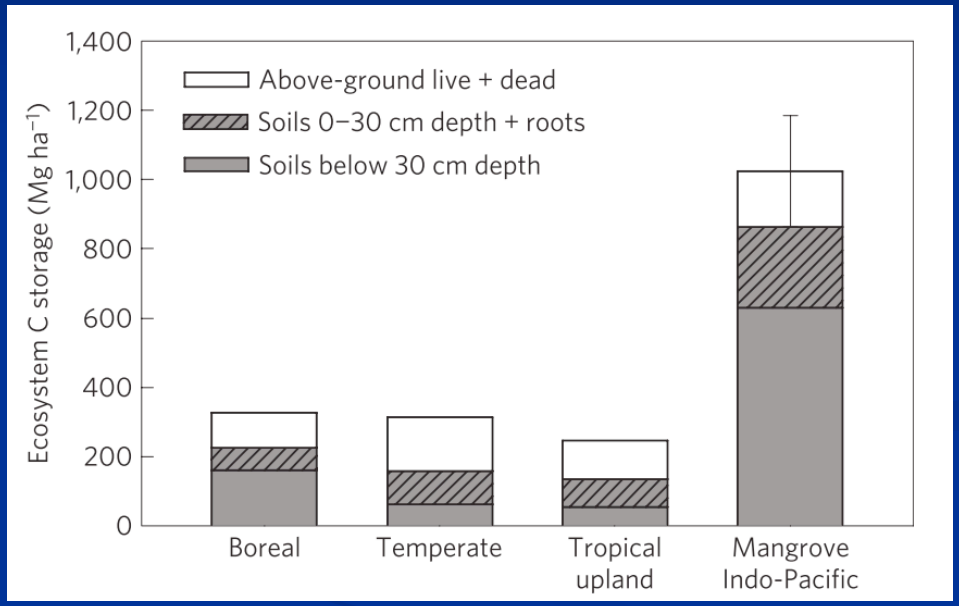
Burial and Storage of Carbon "Blue Carbon"



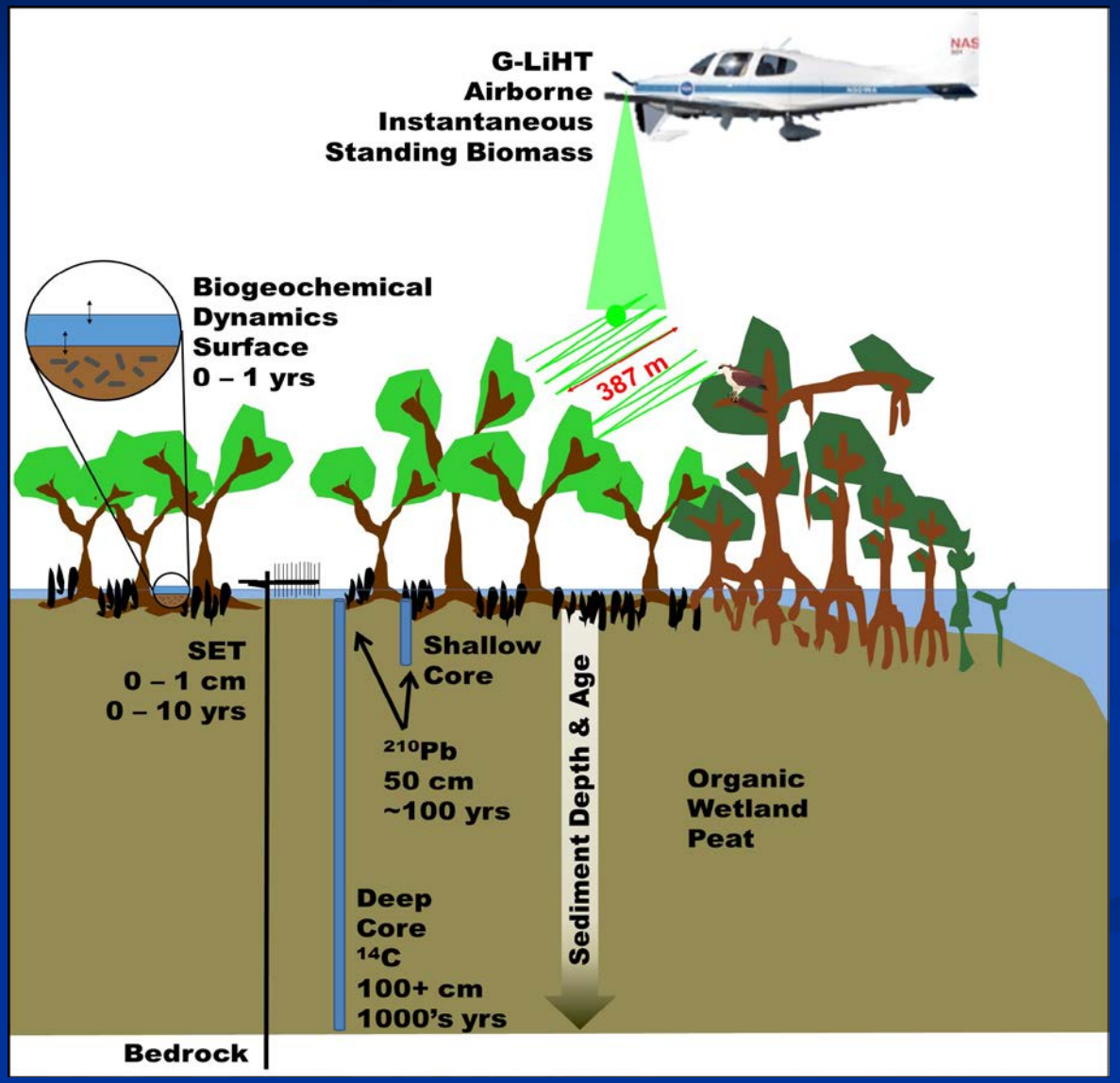
McLeod et al. 2011



Donato et al. 2011

Mapping and Predicting Future Storage

Remote Sensing, Soil Coring and Biogeochemisty

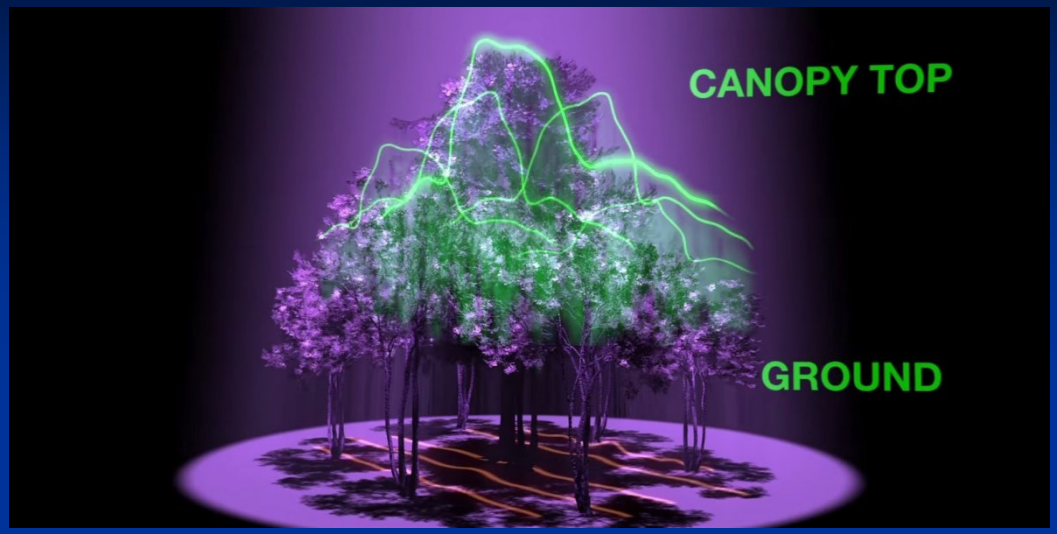


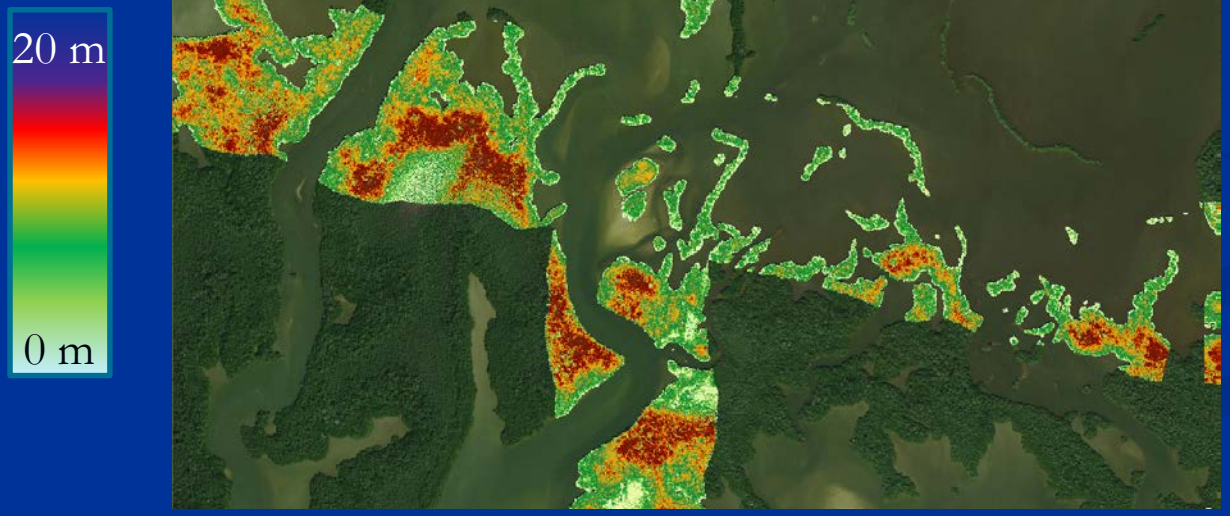
Ten Thousand Islands

Aboveground Vegetation

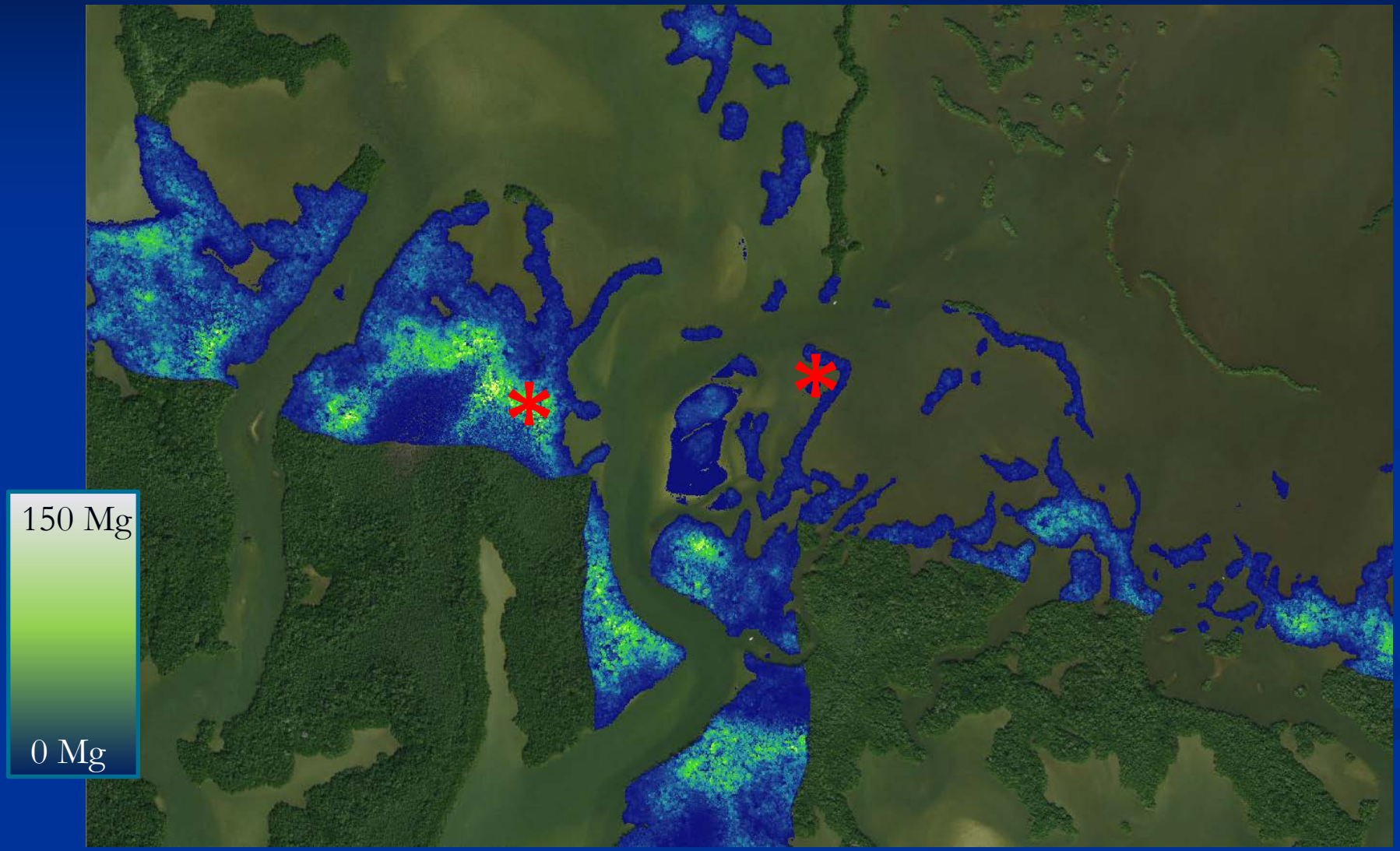
- G-LiHT and Ground-truthing sites selected under G-LiHT flight path
- 10 x 10-m plots
  - Tree height
  - Trunk diameter

G-LiHT Canopy Height

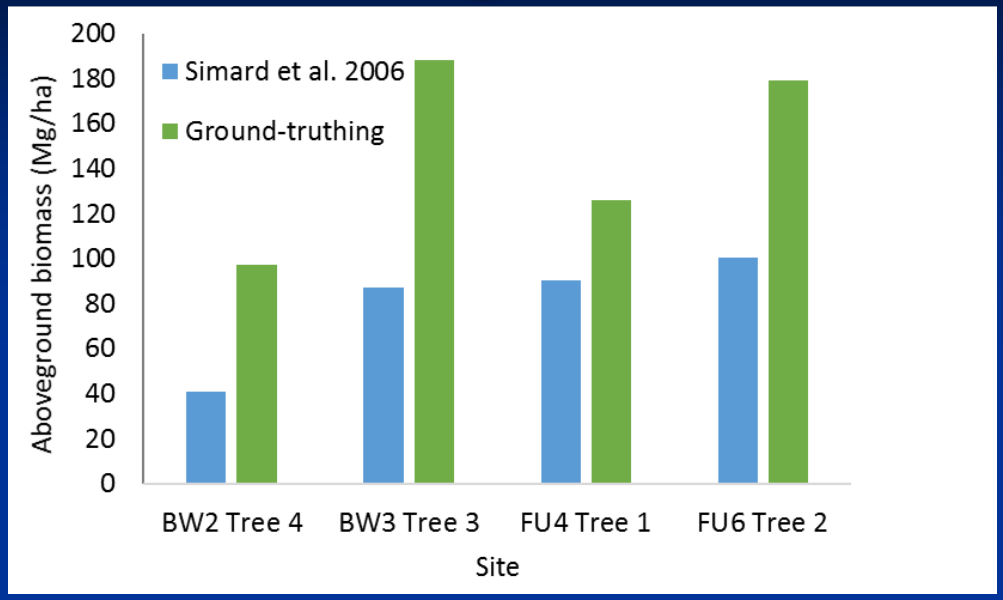




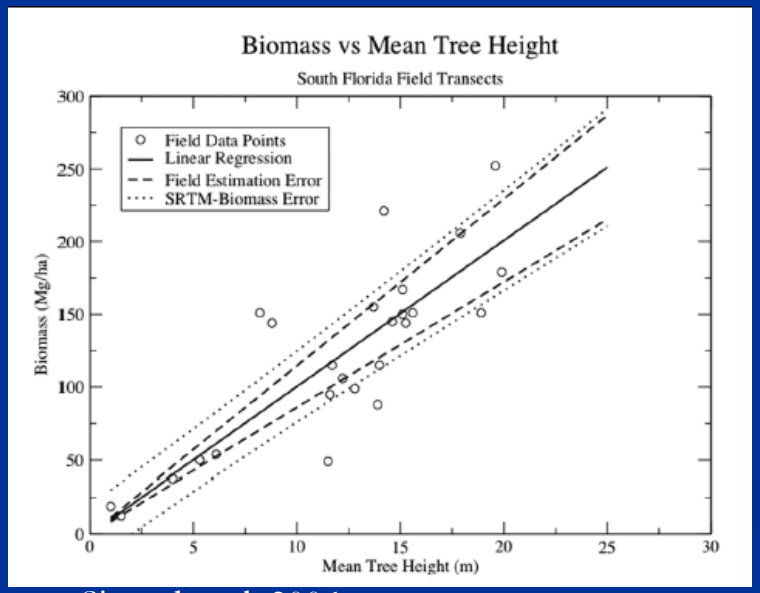
G-LiHT Aboverground Biomass



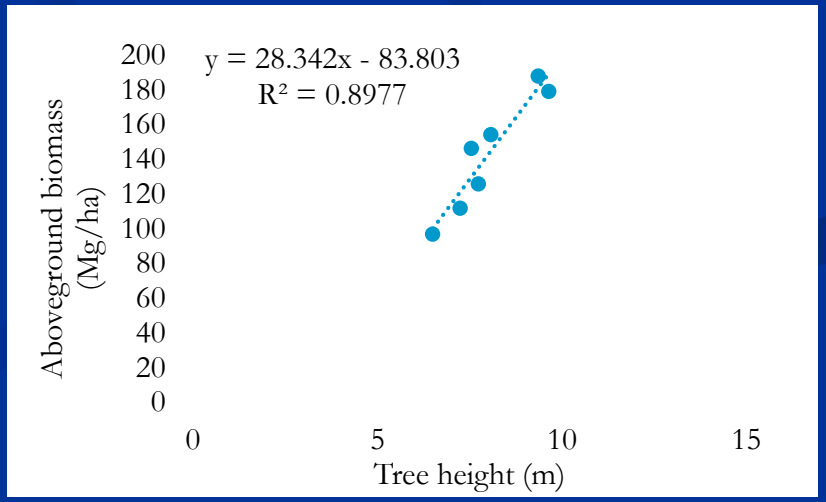
Aboveground Biomass (AGB)



- AGB calculated in two ways:
  - G-LiHT data and Simard et al. 2006
  - Tree density and trunk diameter calculations (ground-truthing data)
- Large differences indicate need for region-specific equation for small trees (5-10 m)
  - Most published AGB vs. height equations are for tall mangroves
  - Need to expand range of heights & create robust local equation



Simard et al. 2006



Belowground Carbon Stock

Preliminary Estimates

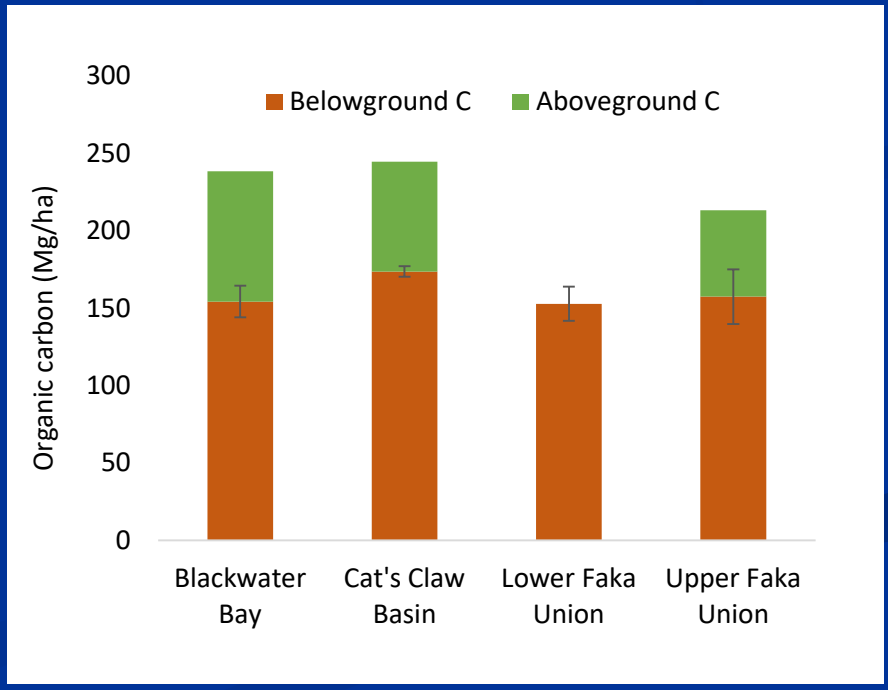
Loss-on-ignition to determine sedimentary organic matter content

LOI converted to Organic Carbon from existing equations

Sediment analyzed in 1- to 2-cm intervals to 40 cm depth

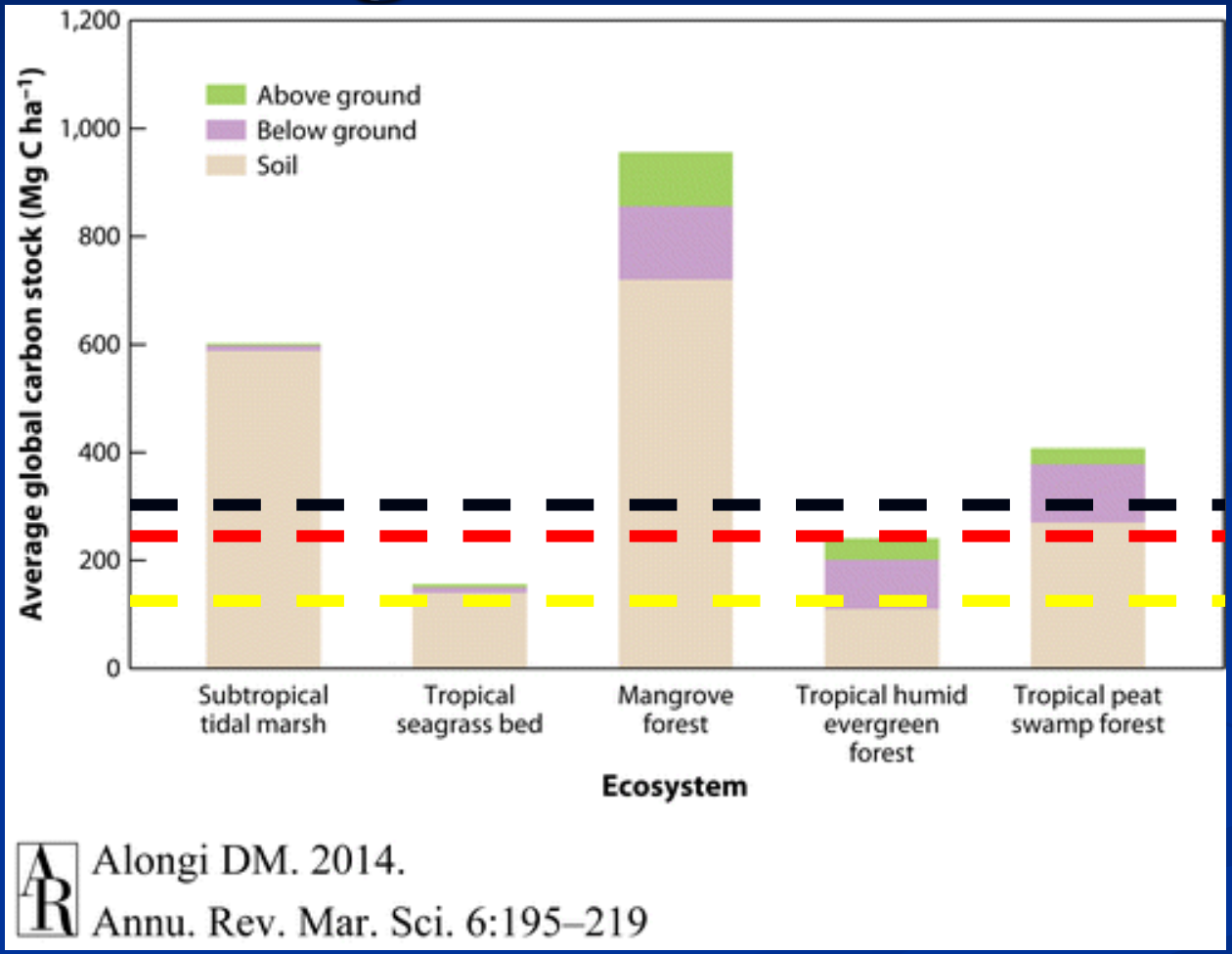
Total Organic Carbon Stocks

- Total carbon 213 – 244 Mg/ha
  - Belowground organic C 152 – 173 Mg/ha (n = 4)
  - Aboveground organic C 42 – 84 Mg/ha (n = 7)



*No vegetation plot or G-LiHT flight path near site

Comparing Mangrove Forest Organic Carbon Stocks



Shark River*

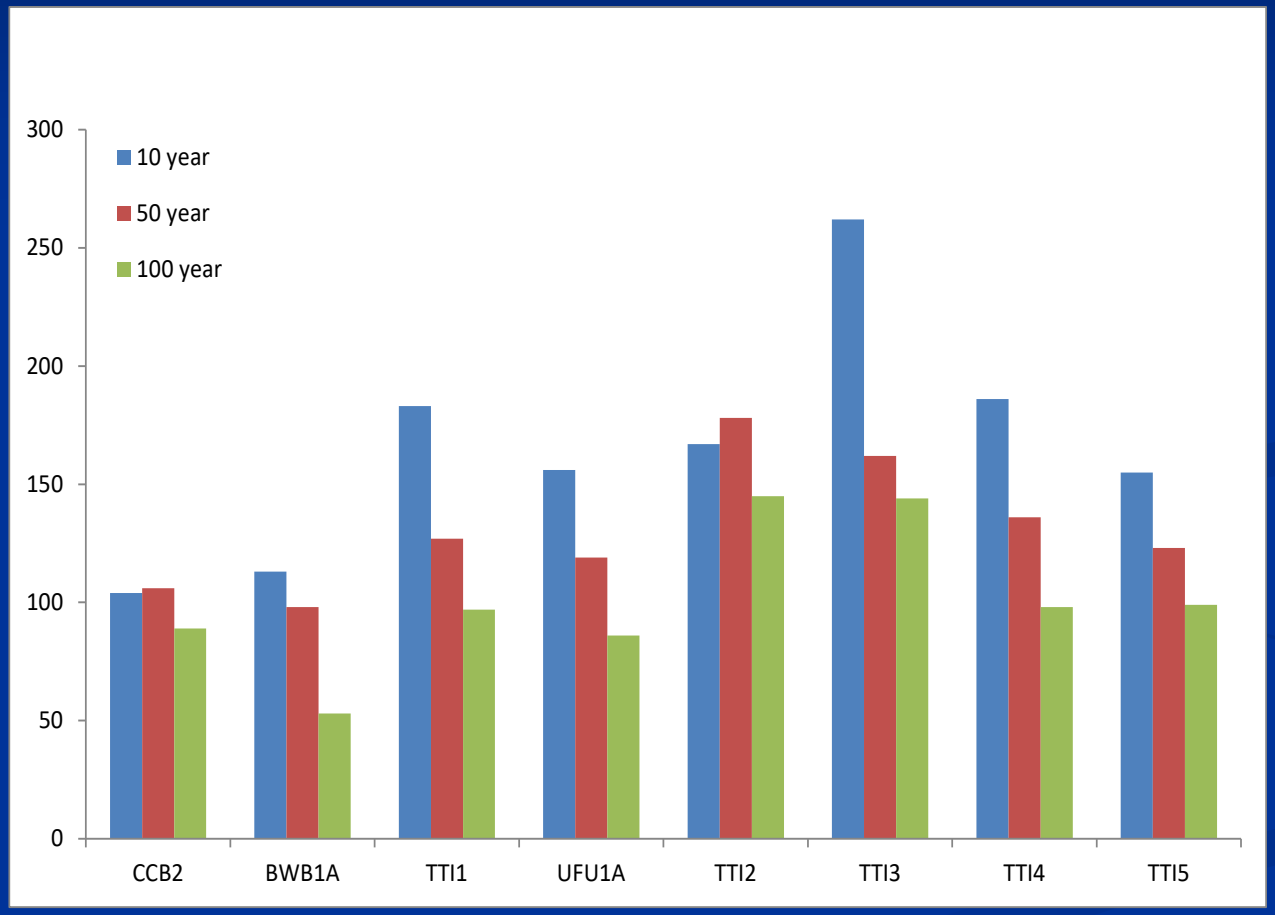
10K Islands

Tampa Bay**

*Castaneda-Moya et al (in prep)

**Radabaugh et al. 2017

Ten Thousand Islands Organic Carbon Burial Rates (g m^{-2} yr^{-1})



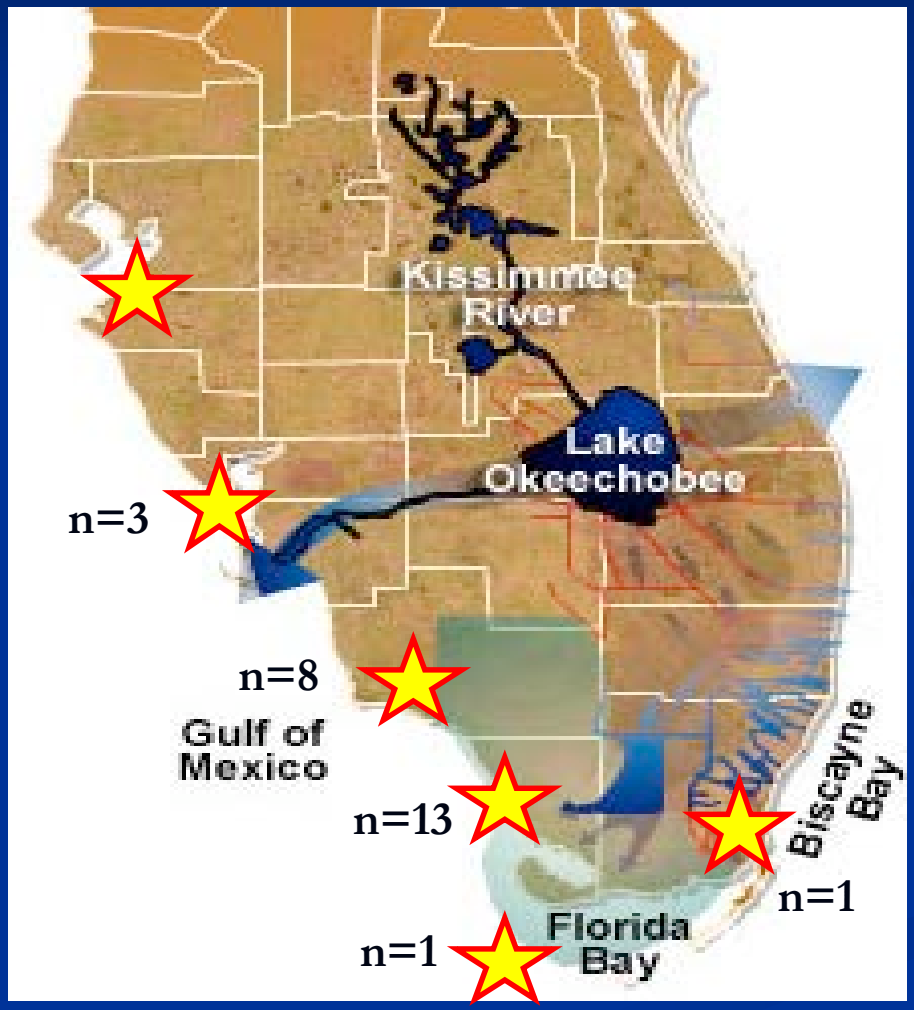
Regional 90% C.I.

10-Year: 166 ± 33

50-Year: 131 ± 18

100-Year: 103 ± 20

Organic Carbon Burial Rates ($g\ m^{-2}\ yr^{-1}$)



10K Islands 90% C.I.

10-Year: 166 ± 33

50-Year: 131 ± 18

100-Year: 103 ± 20

Florida 90% C.I.

10-Year: 188 ± 22

50-Year: 149 ± 15

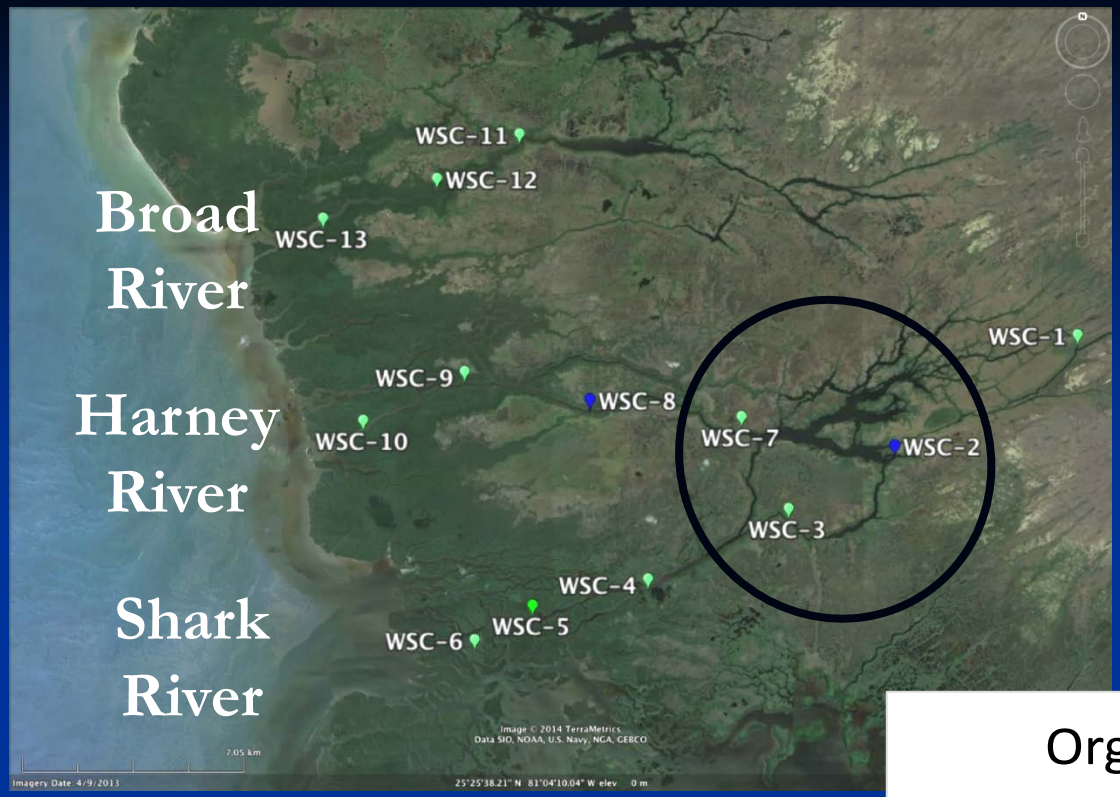
100-Year: 114 ± 12

Global*

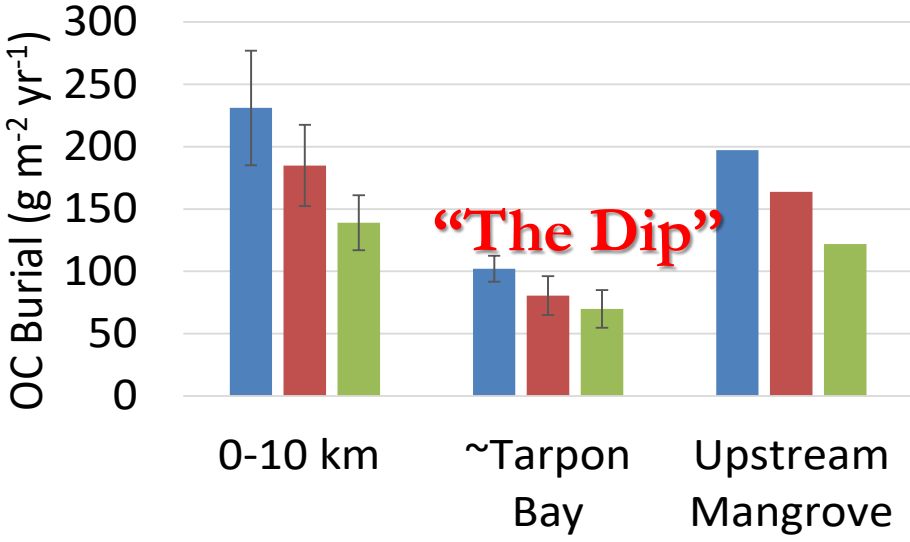
100-Year: 163

*Breithaupt et al., Global Biogeochemical Cycles, 26, 2012.

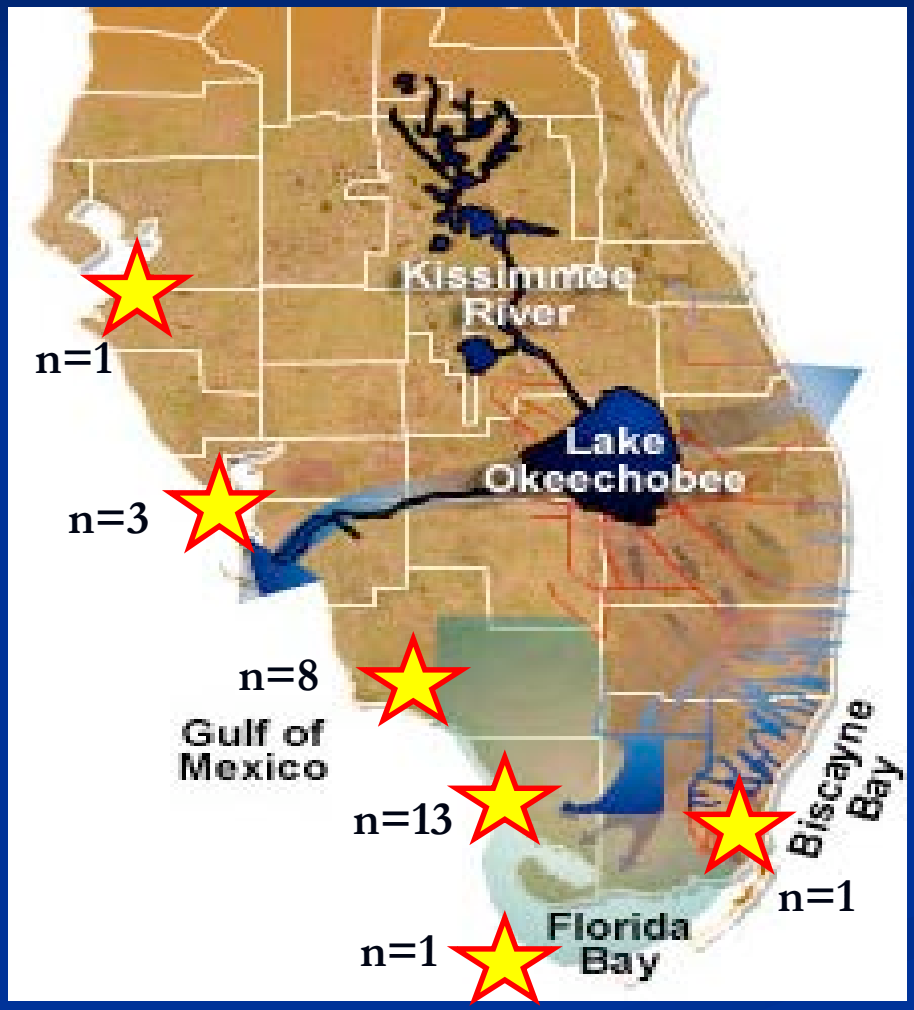
Everglades National Park



10-year
50-year
100-year



Accretion Rates (mm yr^{-1})



10K Islands 90% C.I.

10-Year: 4.1 ± 0.8

50-Year: 3.2 ± 0.3

100-Year: 2.3 ± 0.3

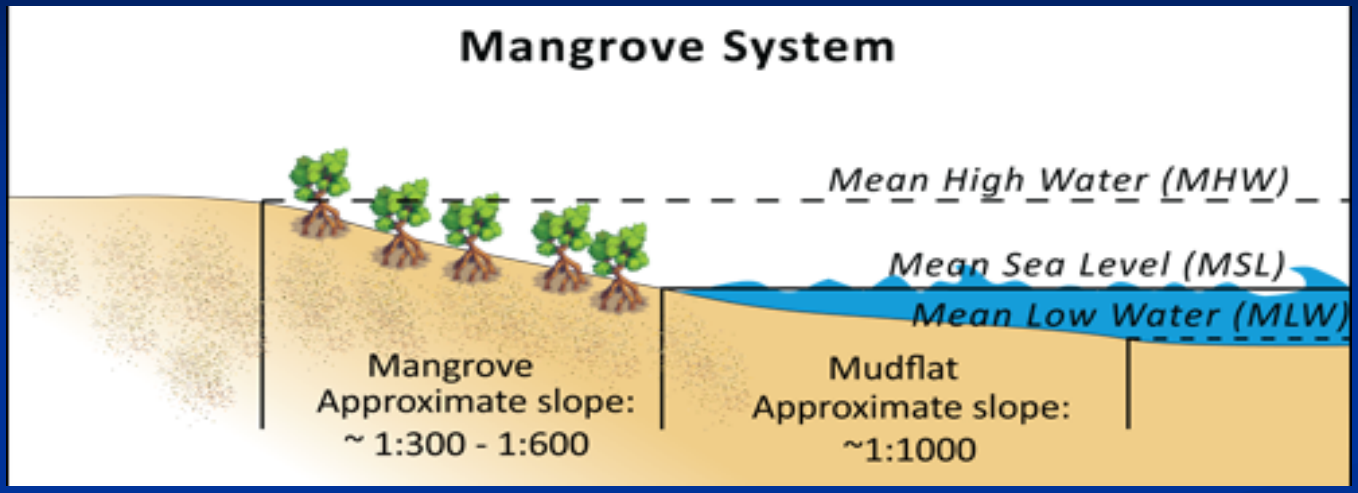
Florida 90% C.I.

10-Year: 4.0 ± 0.4

50-Year: 3.2 ± 0.2

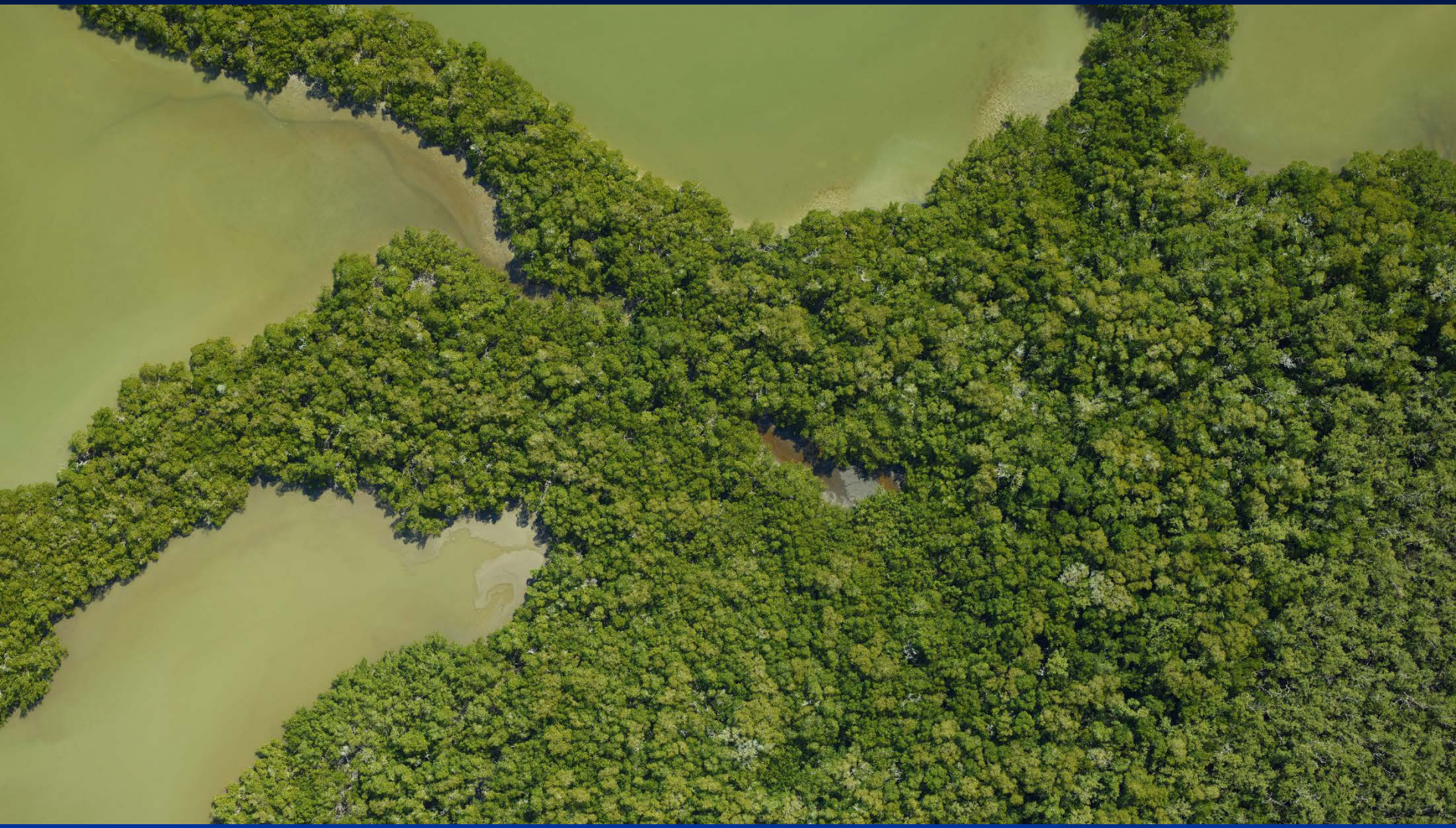
100-Year: 2.3 ± 0.2

Timeframes of vulnerability to sea-level rise

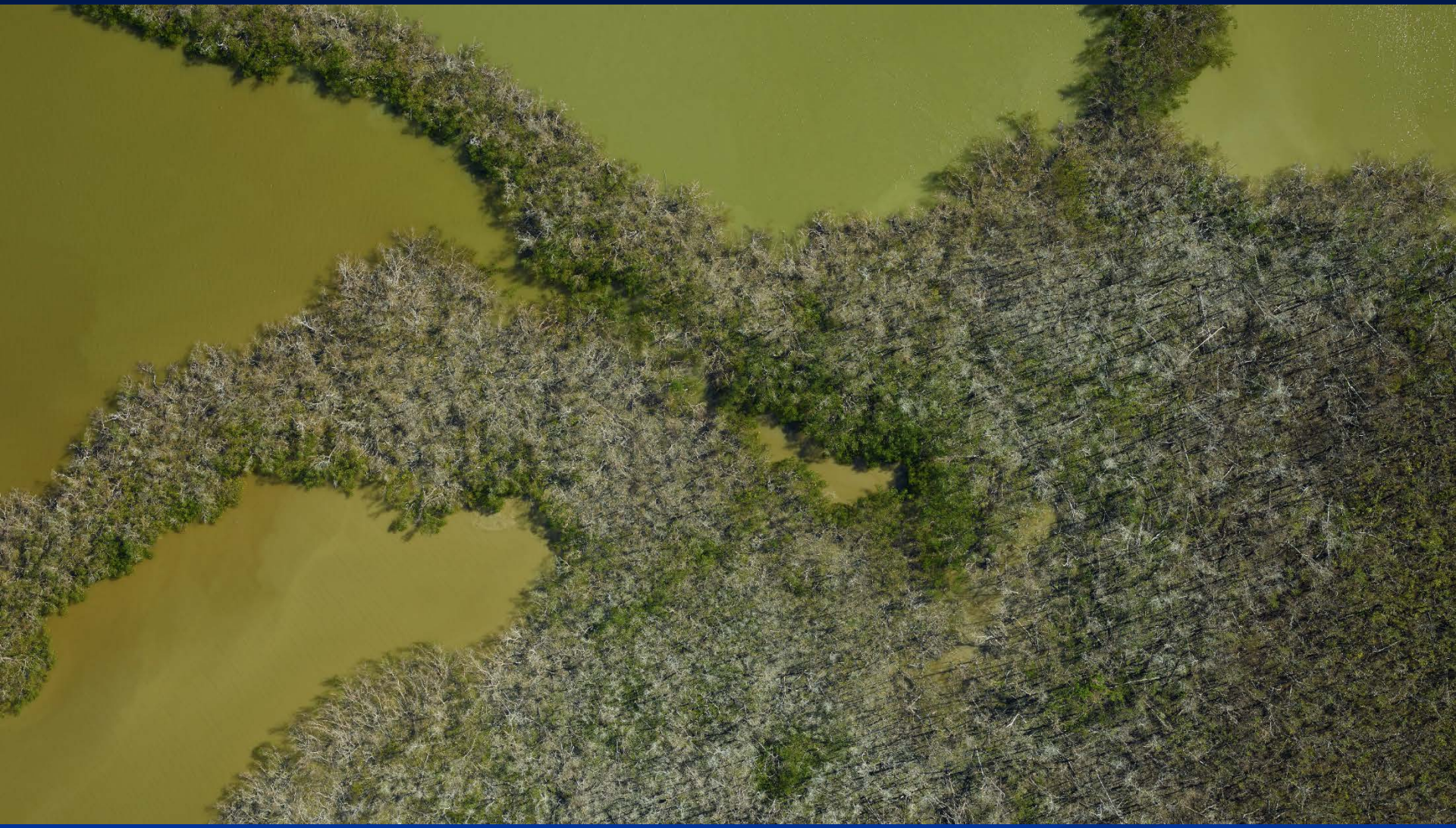


- With Accretion at 4.6 mm yr^{-1}
- Under 6.9 mm yr^{-1} SLR Scenario
  - Loss occurs in about 200 years
- Under 12.7 mm yr^{-1} SLR Scenario
  - loss occurs in less than 70 years

G-LiHT Aerial Photo 3/29/2017



G-LiHT Post Irma Aerial Photo 11/30/2017



Summary

- Total Organic Carbon Stocks: 213-244 Mg ha^{-1} (minimum)
- Organic Carbon Burial Rates: 103 ± 20 g m^{-2} yr^{-1} (100 year)
- Mangrove forest accretion has been keeping pace with SLR on the 100 and 50 year time scale. However, some sites may be submerged in ~70 years.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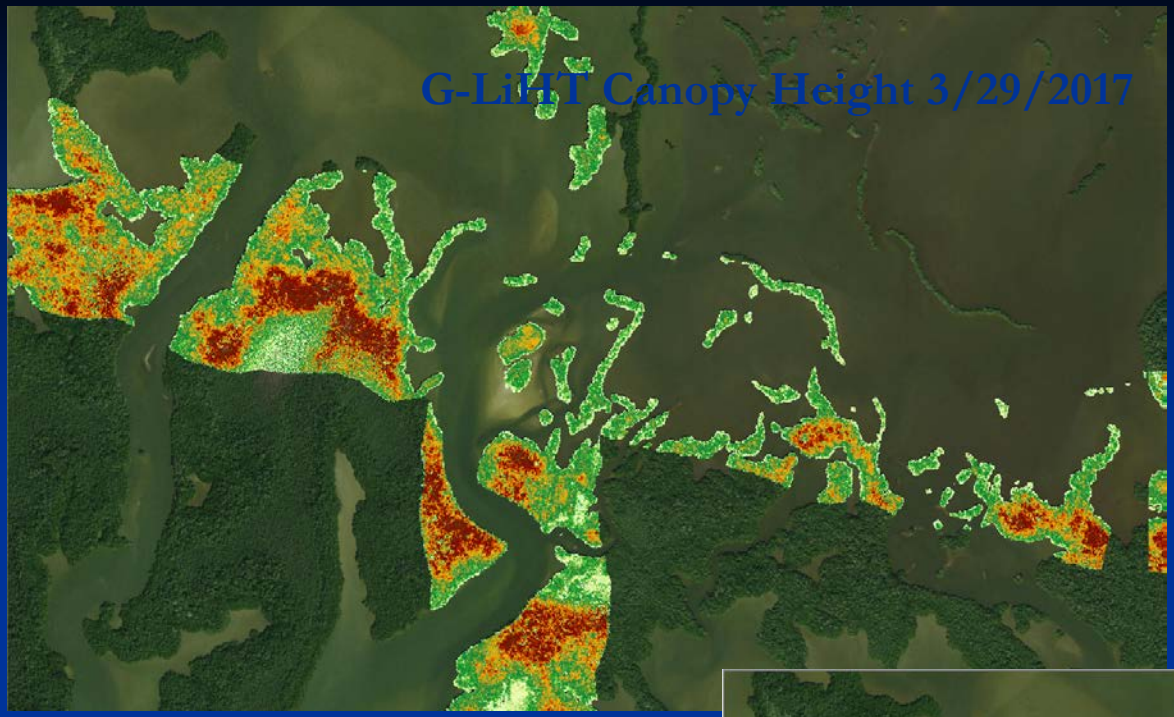
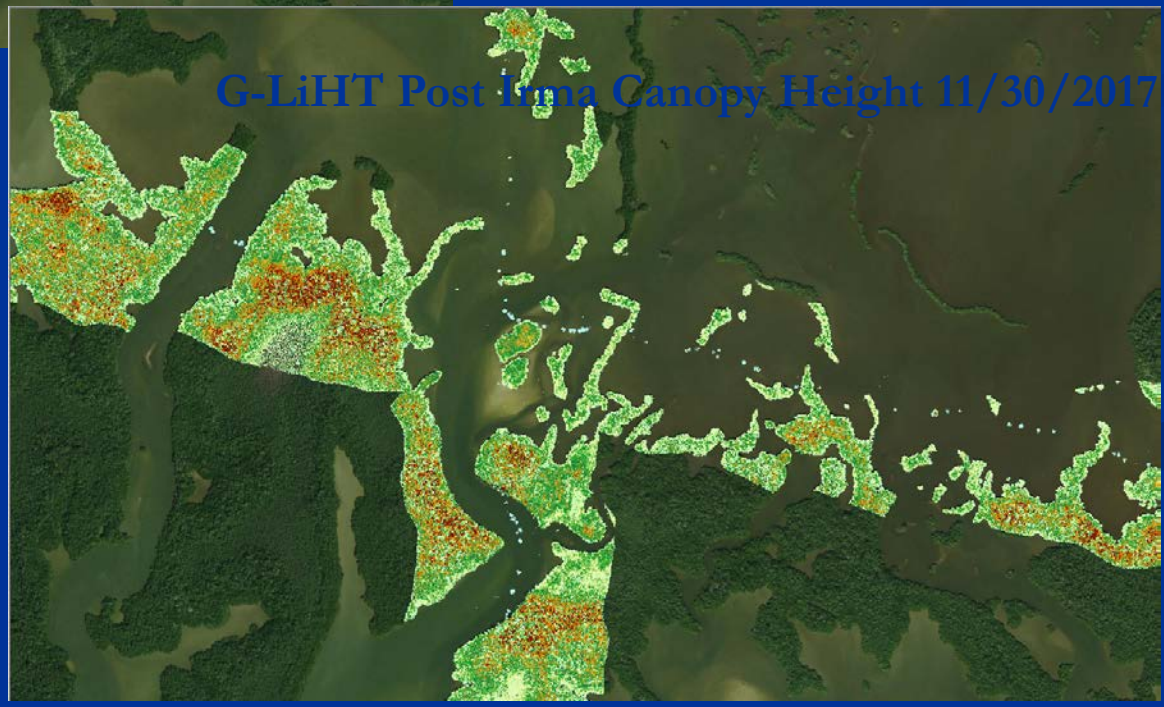
Thank you.


G-LiHT Canopy Height 3/29/2017

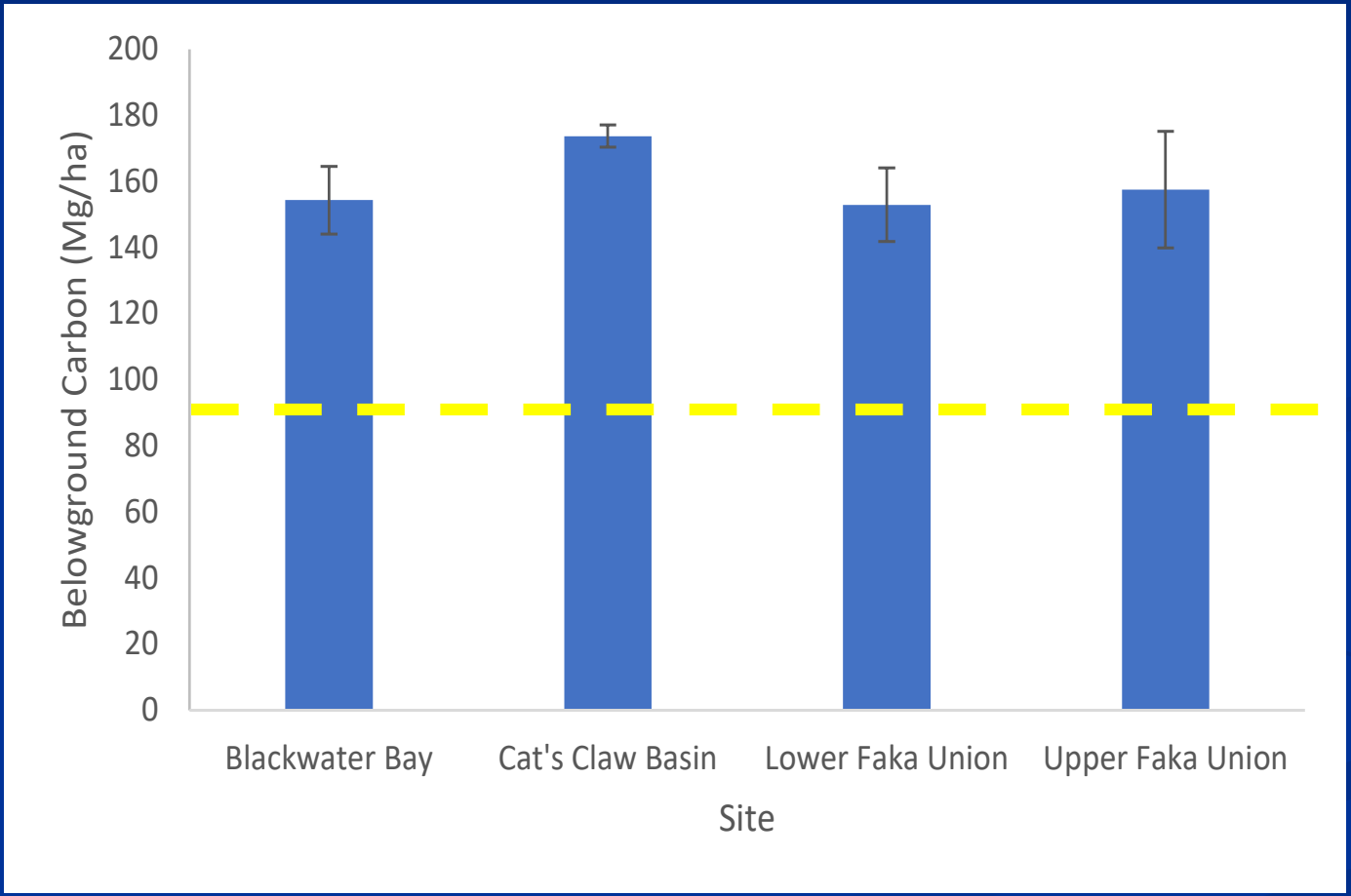

G-LiHT Post Irma Canopy Height 11/30/2017


20 m
0 m

Belowground Carbon Stock

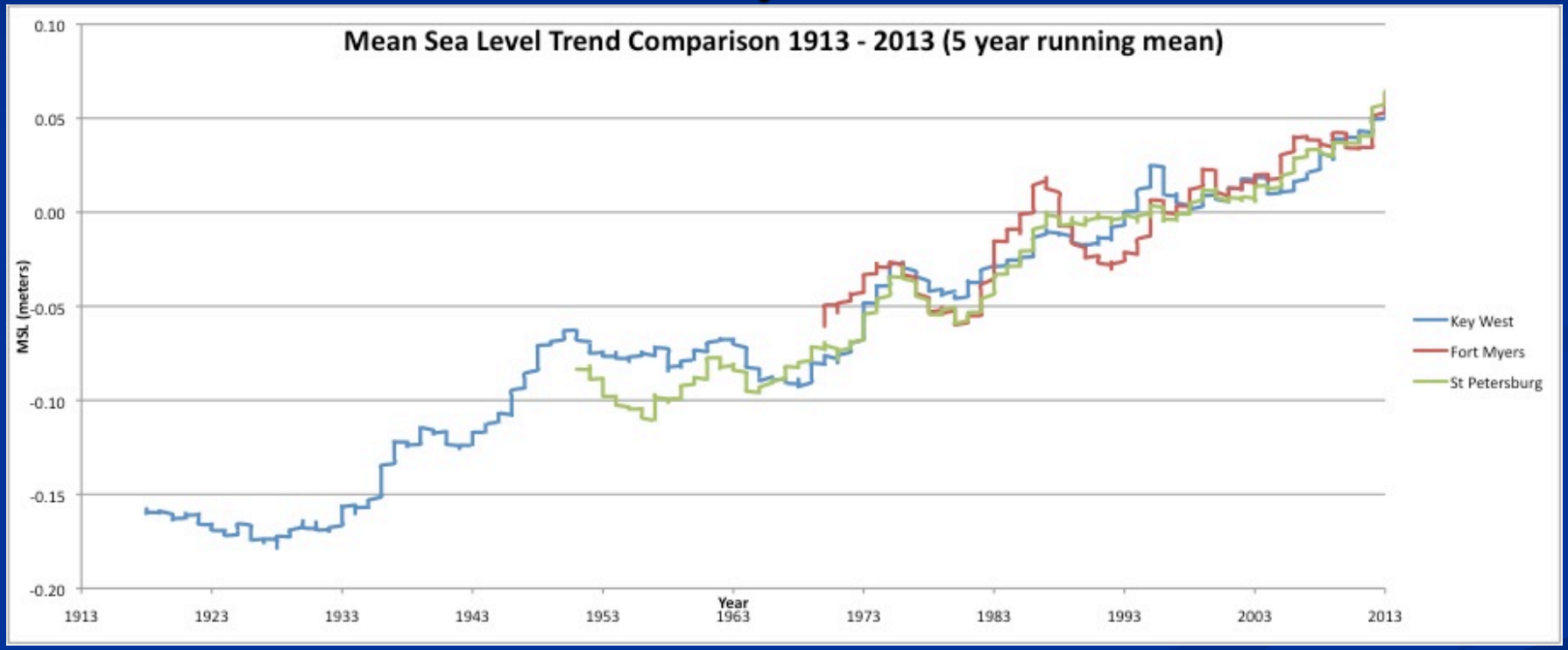
Need line for reference

40 cm potential to be much higher, use burial rate to estimate



Tide Gauge Data

Key West 1913
St. Petersburg 1947
Fort Myers 1965



100-Year Rate	50-Year Rate	10-Year Rate
2.2 mm/yr	2.8 mm/yr	6.9 mm/yr