

The Influence of Interannual Sea Level Changes on Shoreface Sand Volume and Sediment Budget Calculations

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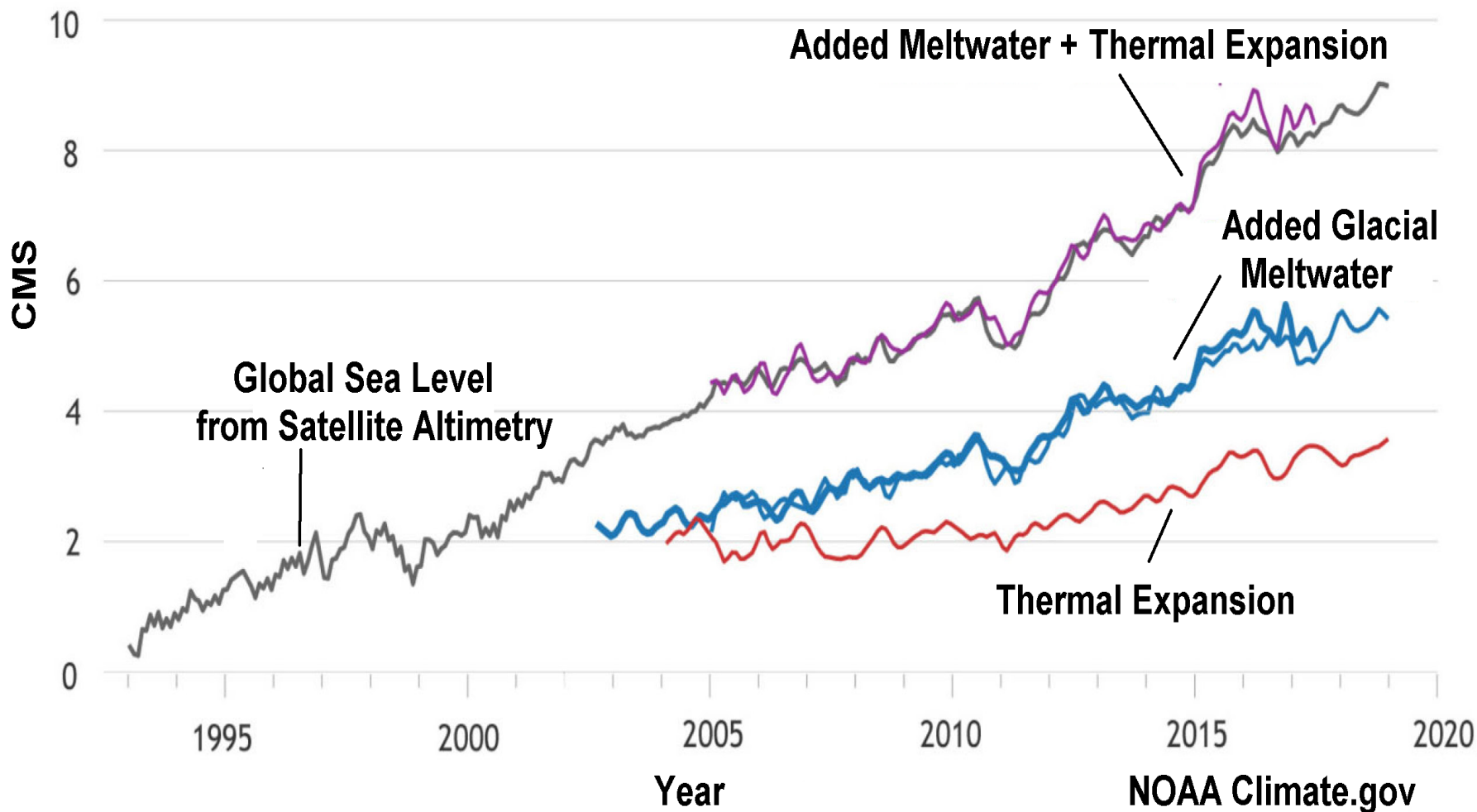


Sea Level and Sand Budget

Topics:

- **Global Sea Level**
- **Overview of Florida Sea Level**
- **Sea Level Facts: State of Our Knowledge**
- **Central Florida Coastal Sea Level Record**
- **Coastal Sea Level and Sand Reservoirs**
- **Sand Budget Calculations: Examples**
- **Conclusions**

Factors Contributing to Recent *Global* Sea Level Rise



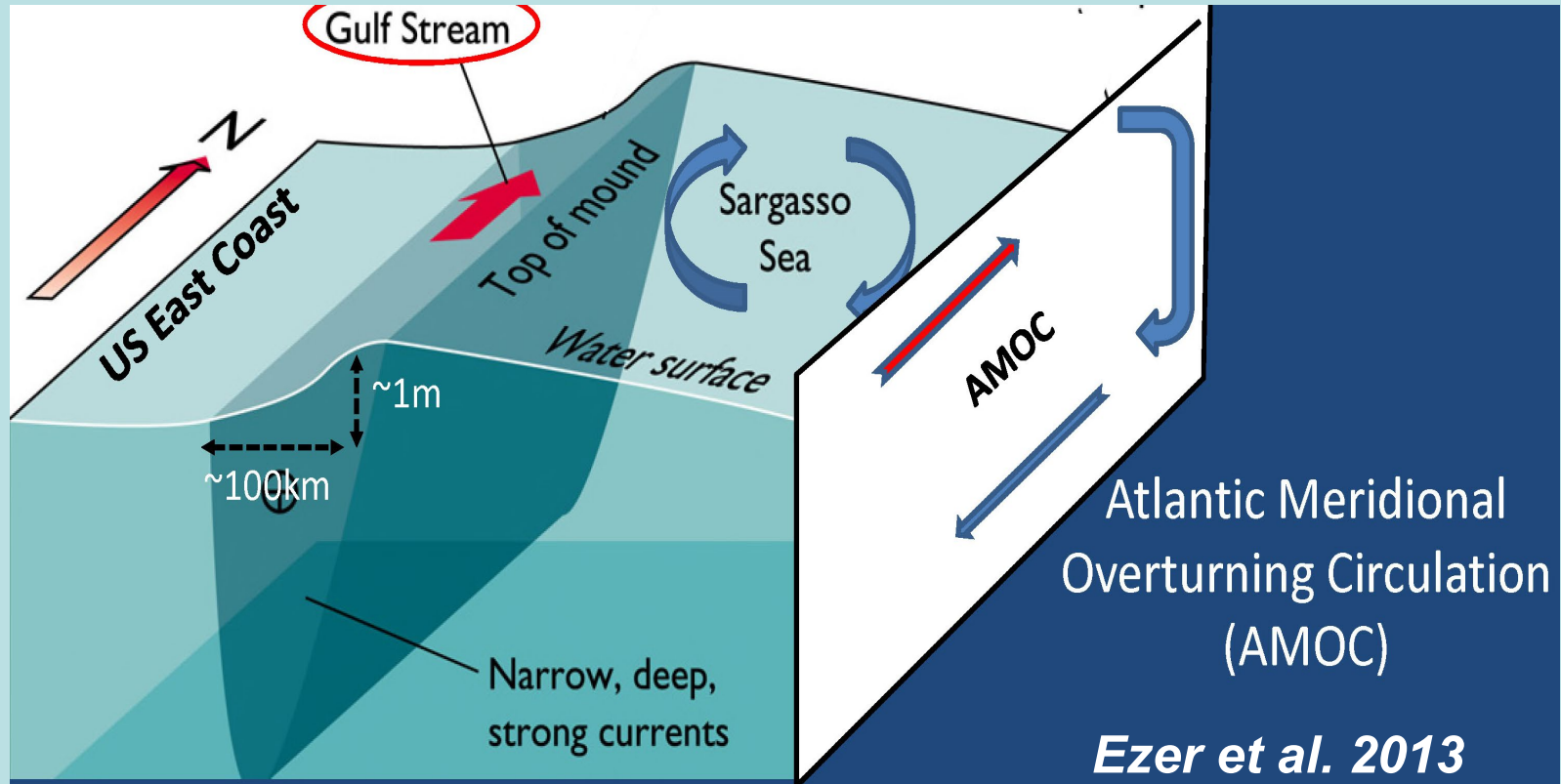
A Few Sea Level Facts

- At least 45% of the global sea level rise (SLR) over the past century is of anthropogenic origin (Bindoff et al. 2013)
- *Coastal ocean sea level* is influenced by basin-scale processes like Atlantic Meridional Overturning Circulation (AMOC) and the Gulf Stream (GS) variability (Han et al. 2017)
- Variations of Gulf Stream flow correlate with variability of coastal sea level (Ezer et al. (2013))

Gulf Stream Sea Level Facts

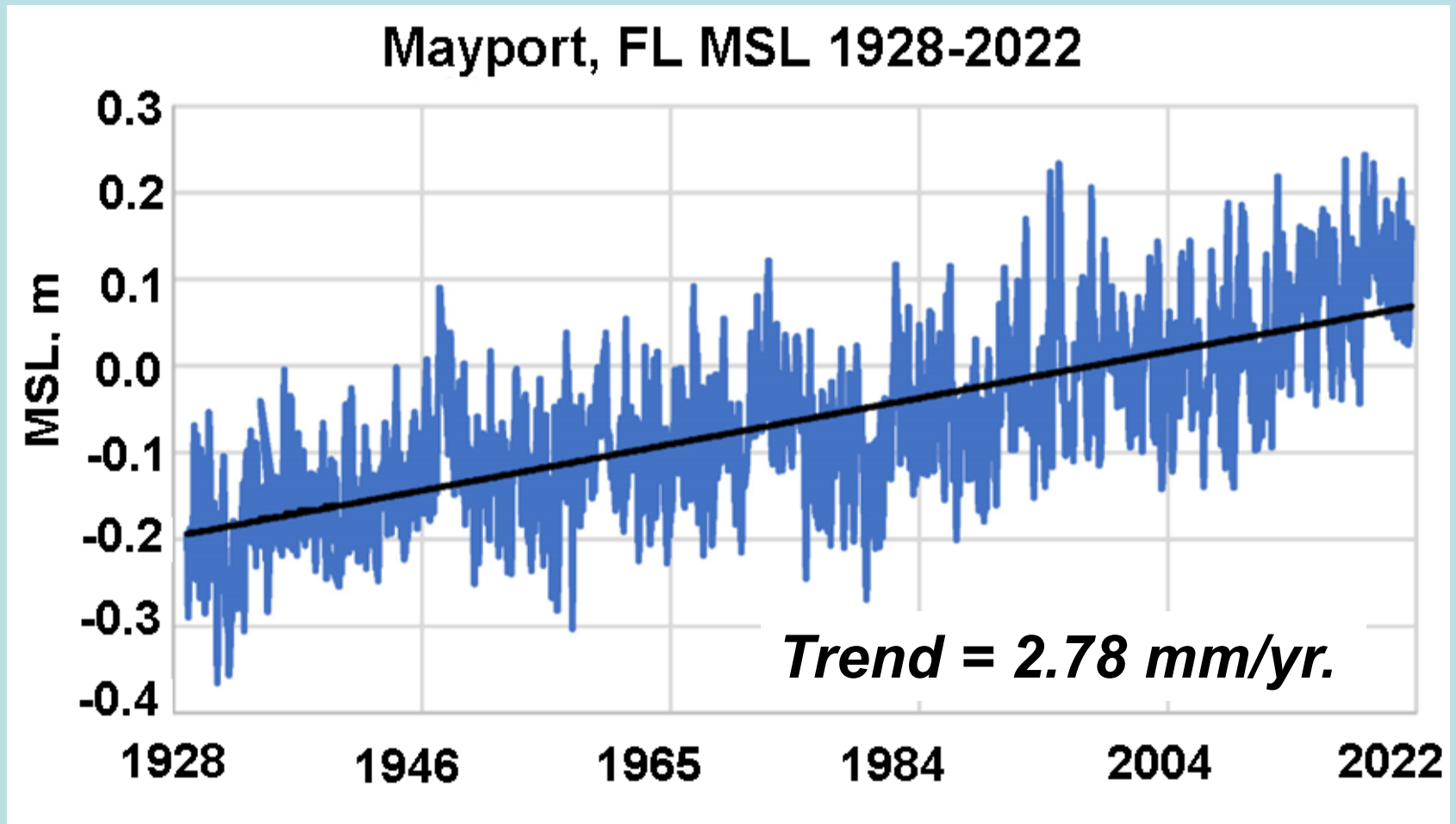
- **Mean sea level is lower on the inshore side and higher on the open-ocean side of the Gulf Stream (GS)**
- **Weakened cross-GS pressure gradient = rising coastal sea level**
- **Ocean Rossby waves influenced by wind stress weaken the GS transport by disturbing the cross- GS pressure gradient causing increase coastal sea levels (Dangendorf et al. 2022).**

Gulf Stream Sea Level Facts



- **Gulf Stream inshore sea level 3 to 5 feet lower**
- **Variations in Gulf Stream strength affect sea level**
- **In a warmer climate, Gulf Stream slow-down will increase coastal sea levels**

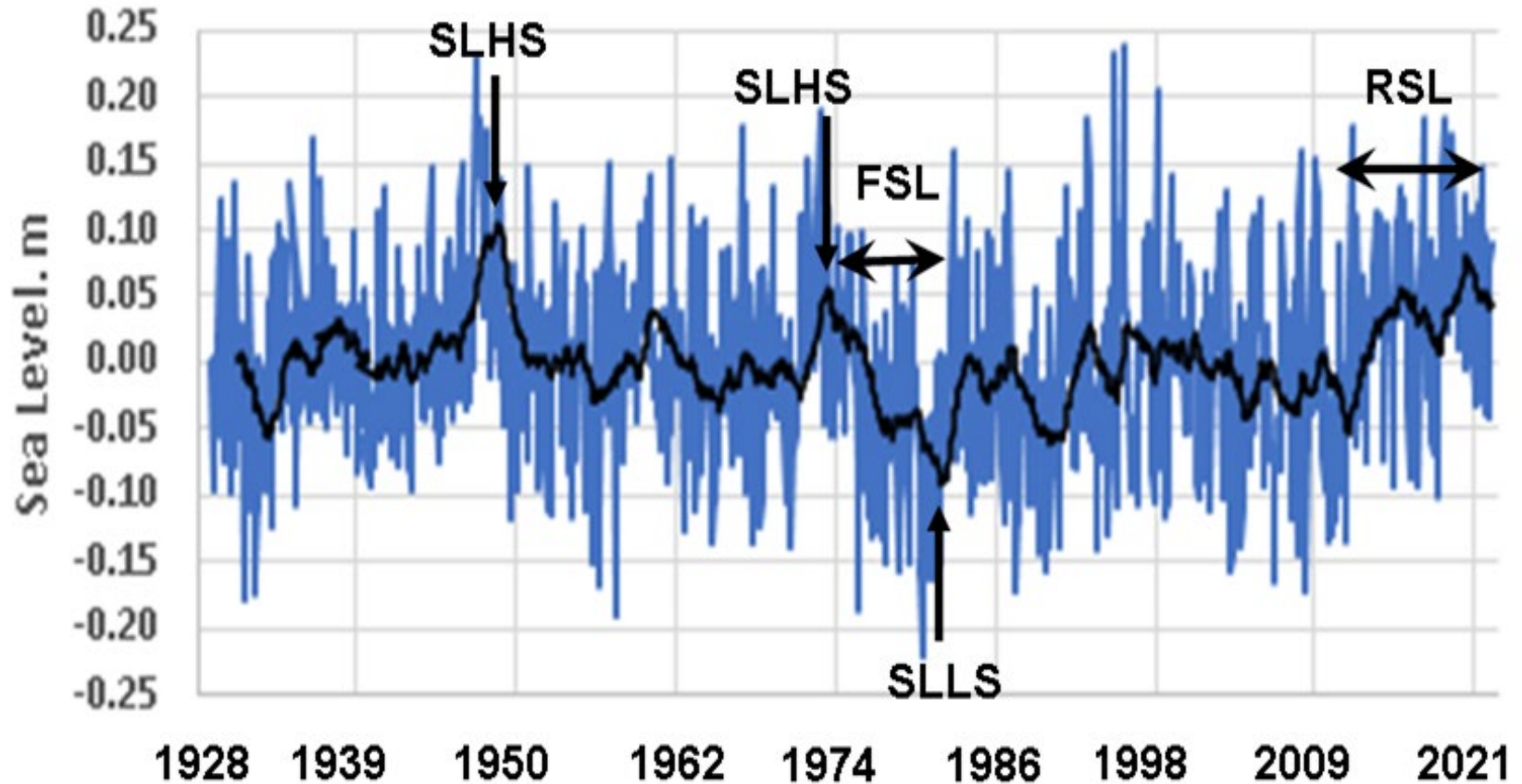
Florida Sea Level Record



Data from NOAA

Florida Sea Level Record

Mayport, FL De-Trended Sea Level 1928-2022



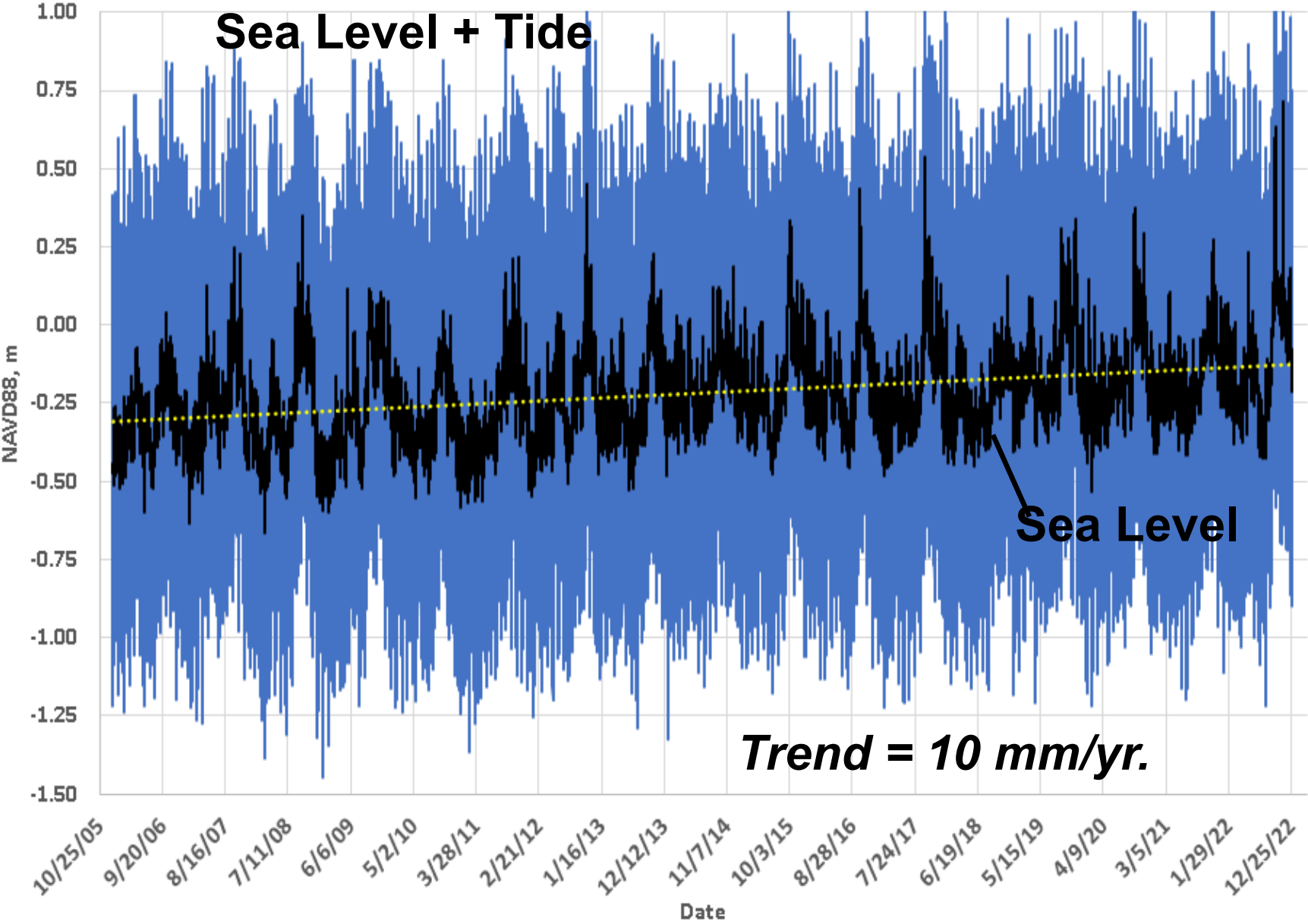
SLHS: *Sea level highstand*

SLLS: *Sea level lowstand*

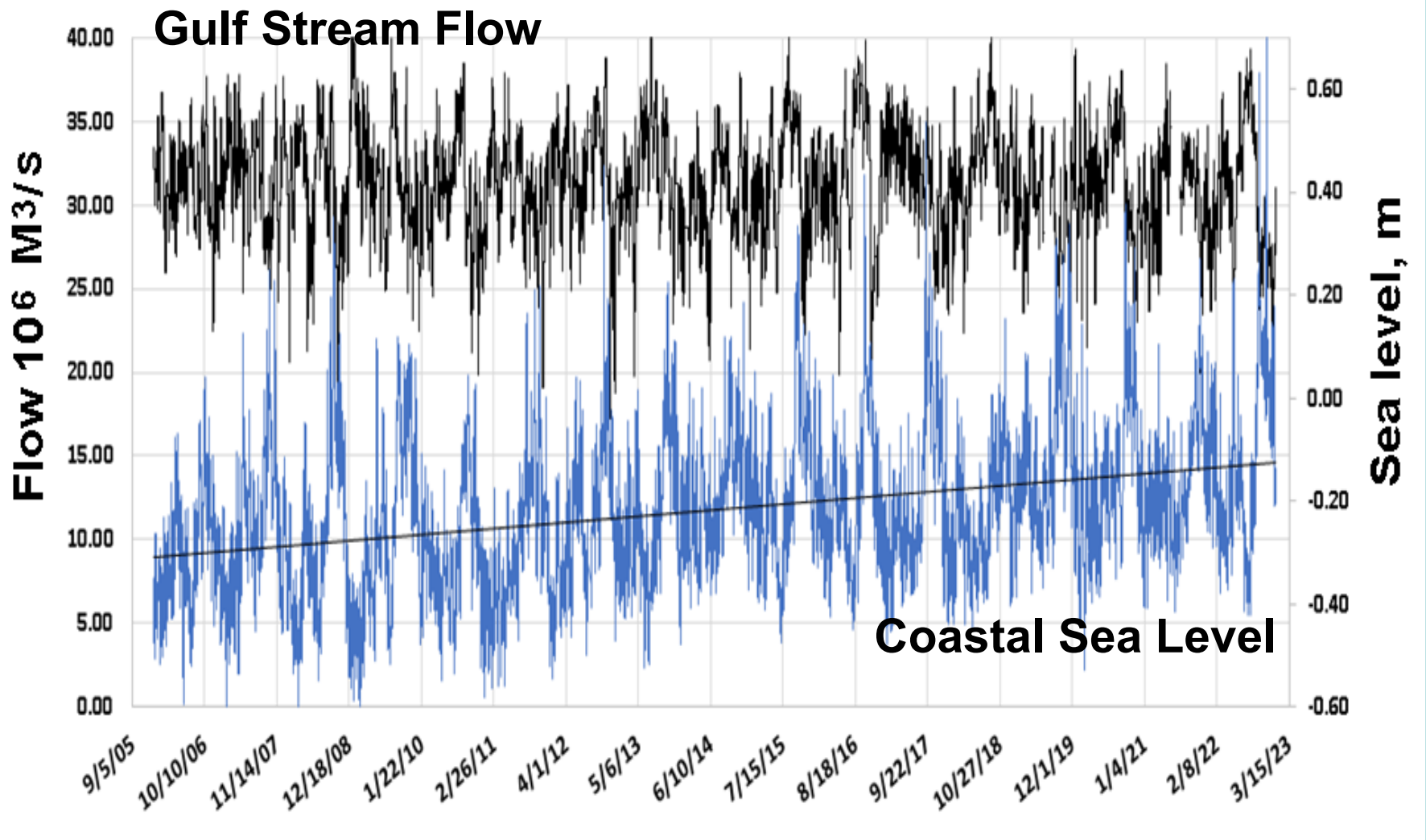
FSL: *Falling sea level*

RSL: *Rising sea level*

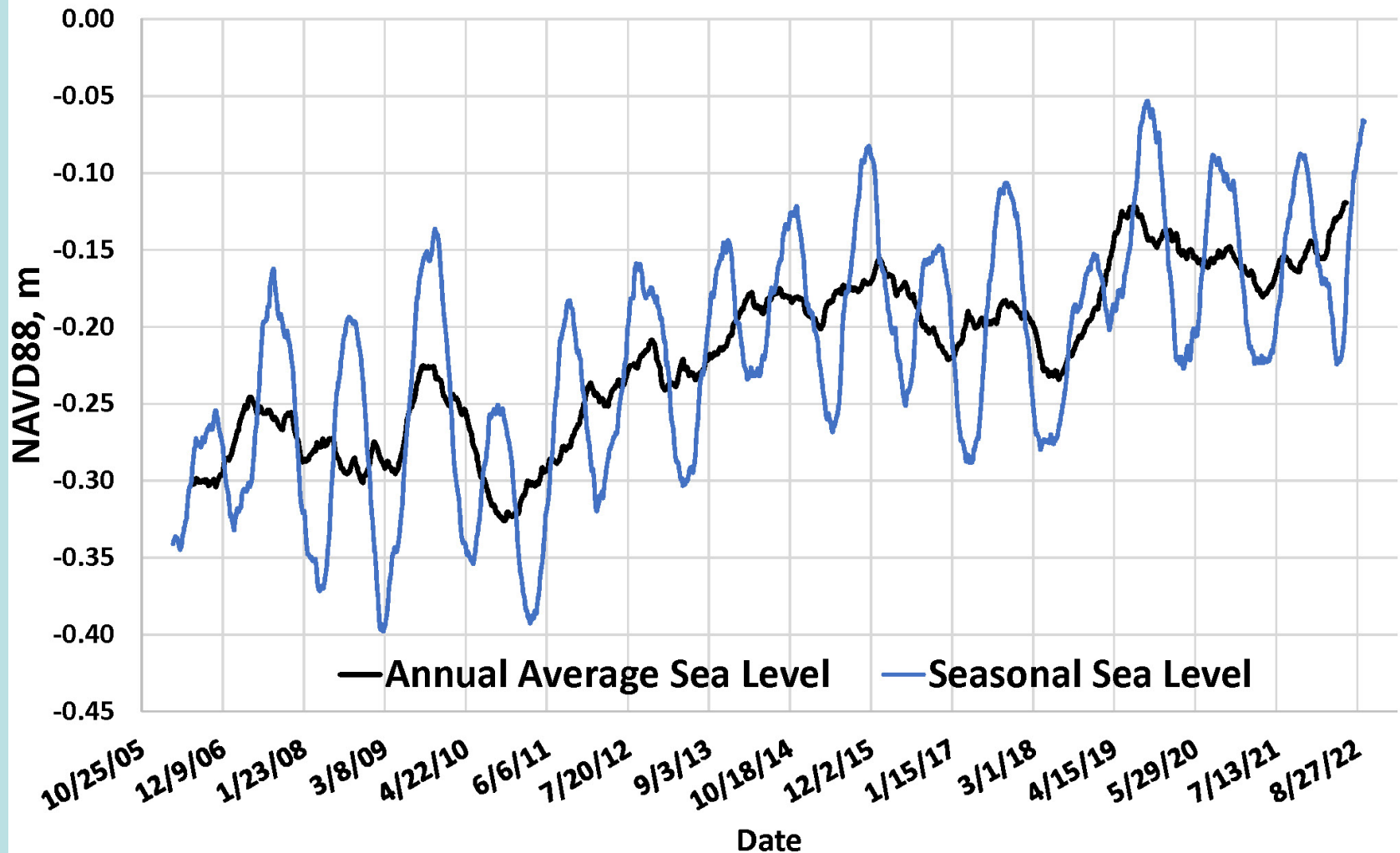
Central Florida Coastal Sea Level 2006-2022

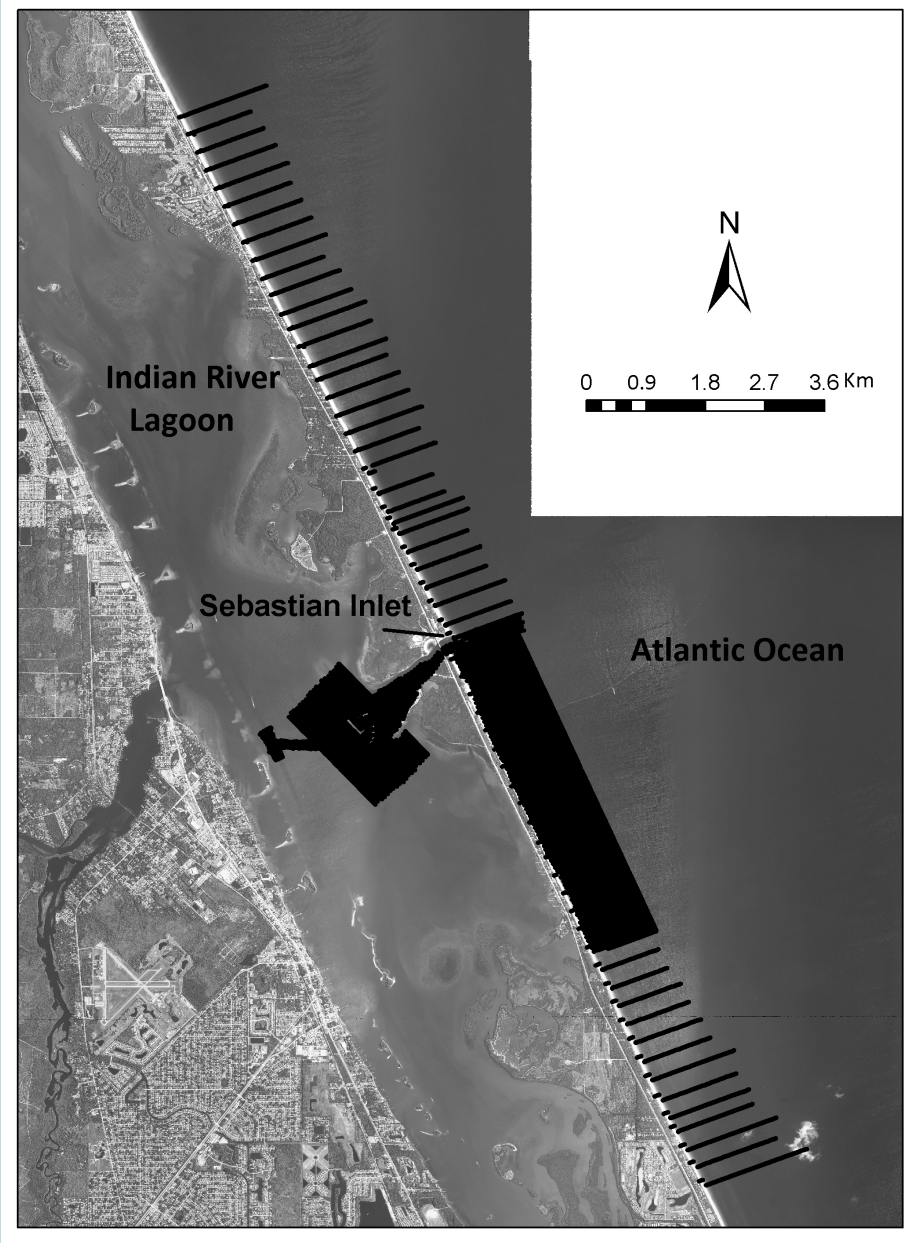


Gulf Stream and Coastal Sea Level 2006-2022



Central Florida Coastal Sea Level 2006-2022

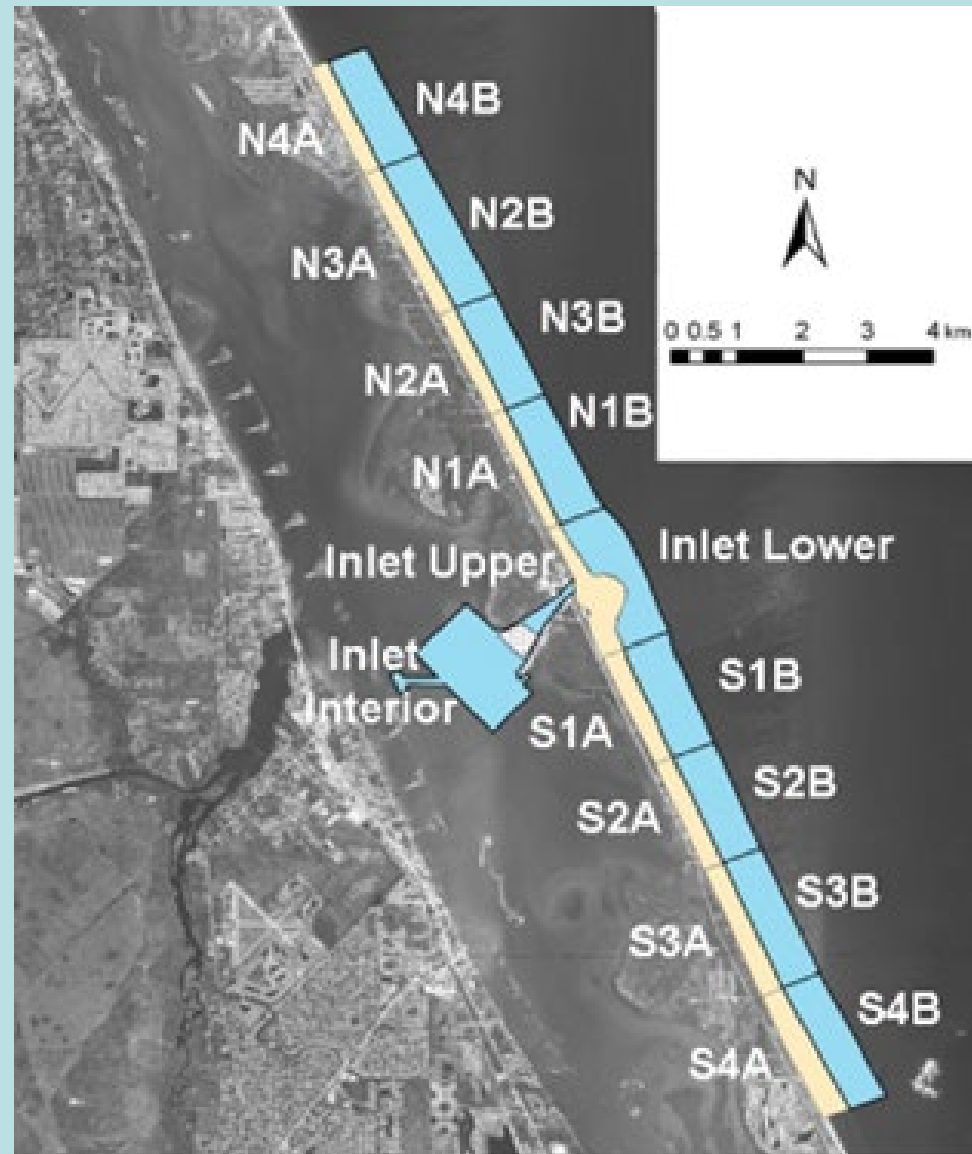
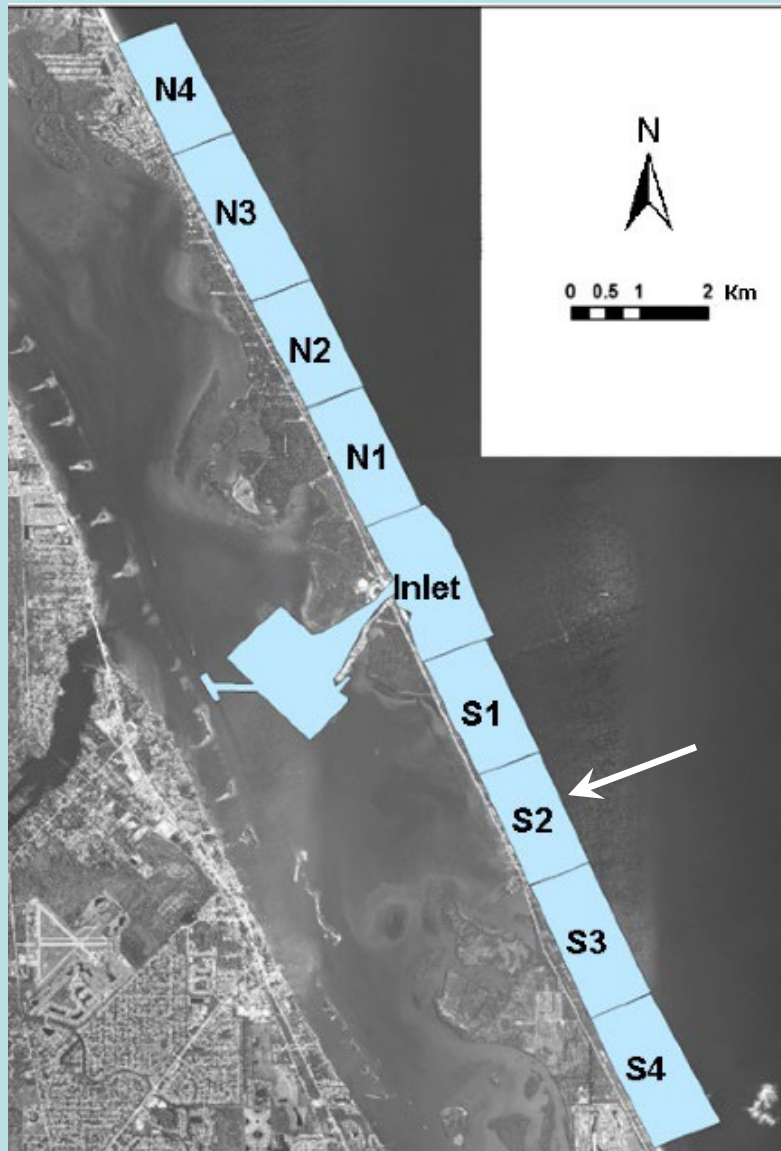




**Central Florida
coastal sand volume
records based on
semi-annual surveys
since 1991:**

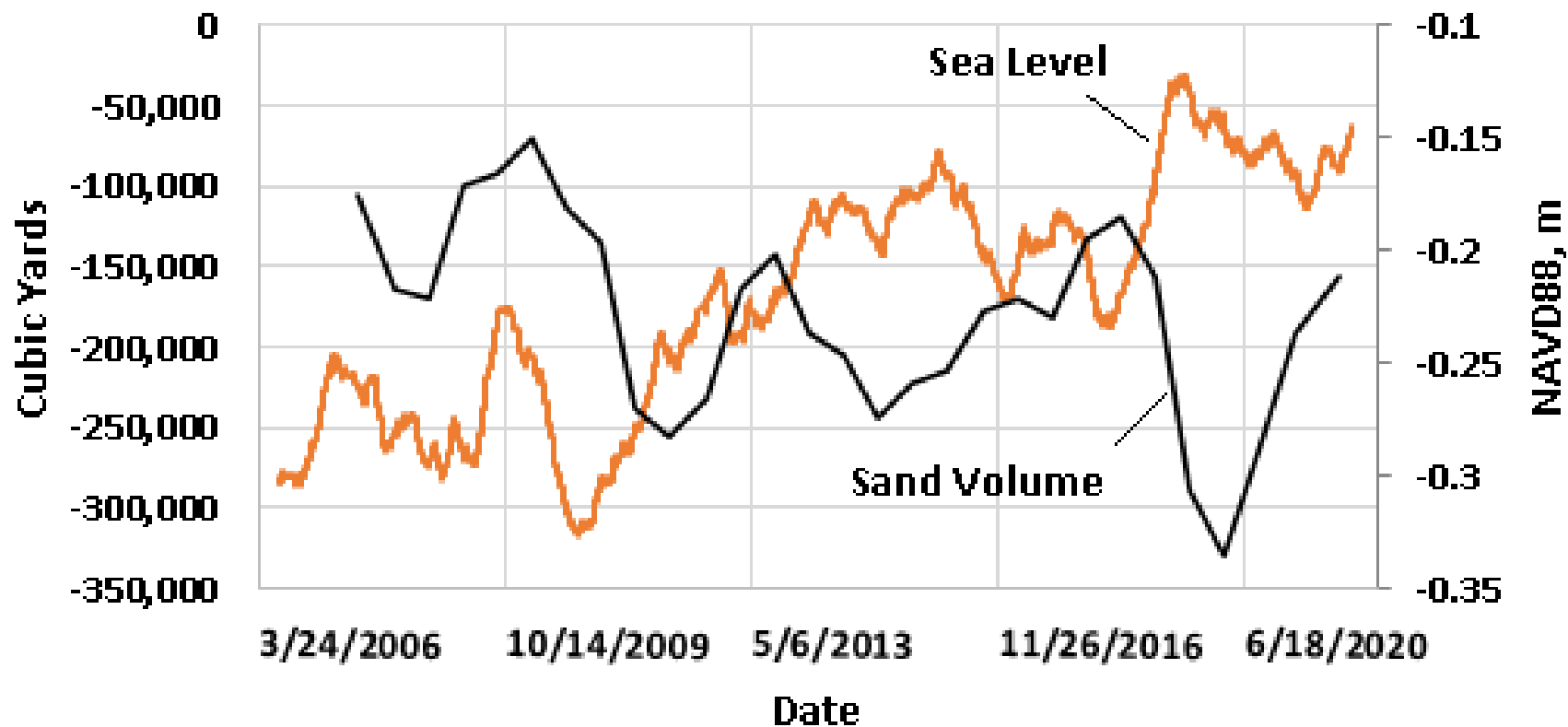
***(Zarillo et al, 2007-2022
Sebastian Inlet District)***

Central Florida Coast Sand Budget Cells

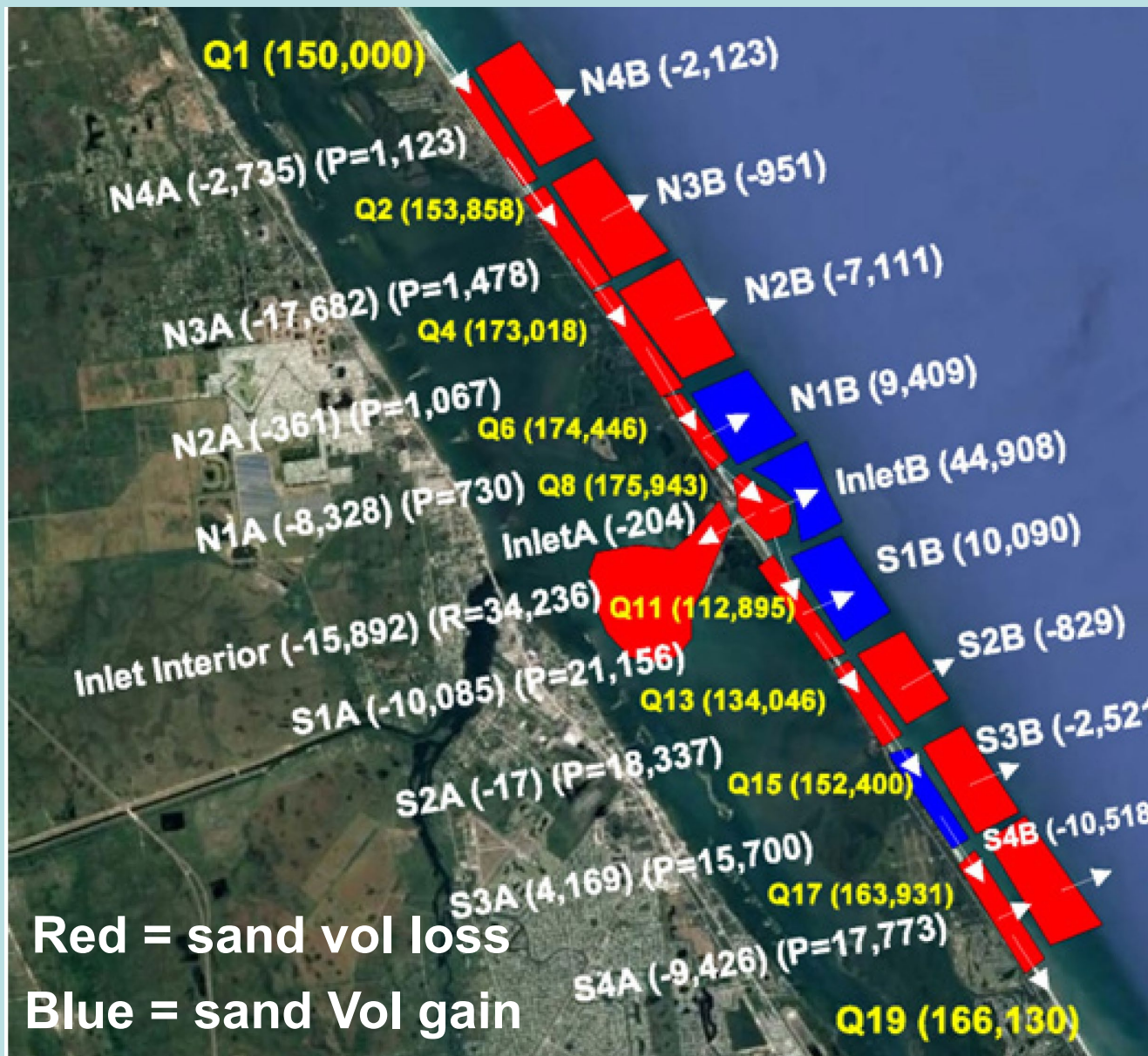


Coastal Sea Level and Sand Volume Records: 2006-2020

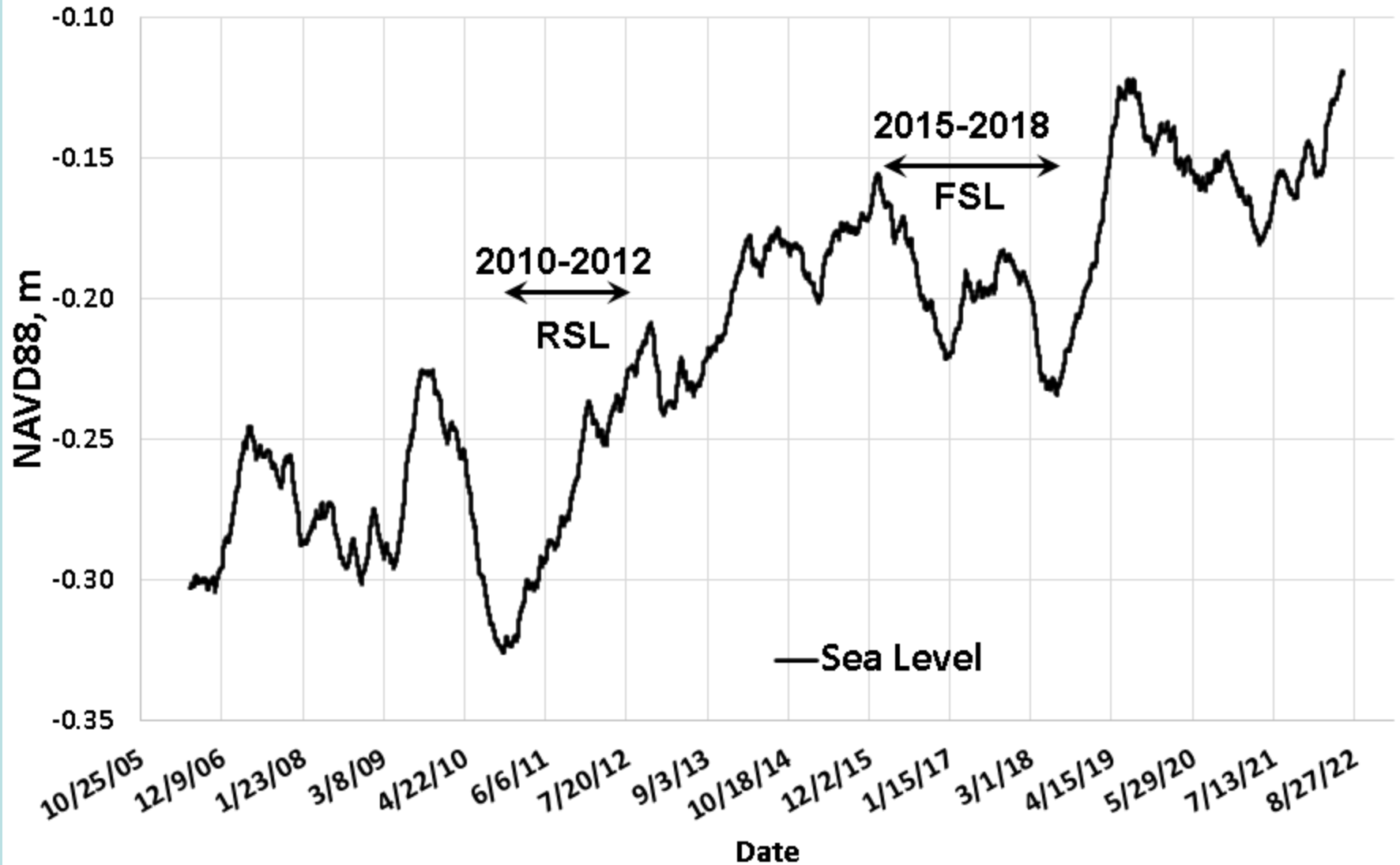
Sea Level vs. Sand Volume Change: S2 Cell



Rising Sea Level Sand Budget 2006-2022



Shorter-Term Sand Budgets



Rising Sea Level Sand Budget 2010-2012:



Falling Sea Level Sand Budget 2015-2018:



Conclusions

- **Observed coastal sea level variability is influenced by basin scale processes as well as global processes**
- **Plan for annual, interannual, and decadal scale sea level changes and correlated shoreface sand volume changes**
- **Plan for rapid and abrupt shifts in sand budgets in response to sea-level oscillations**
- **Rethink how to apply sea level data to shore protection and coastal resiliency plans**

Acknowledgements

Sebastian Inlet District Commissioners
James Gray, Executive Director



**SEBASTIAN
INLET DISTRICT**

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Dangendorf, N Hendricks, Sun,Q, Klinck,J and Ezer, T. 2022. Acceleration of US Southeast and Gulf Coast Sea-Level Rise Amplified by Internal Climate Variability. Research Square (in press: researchsquare.com)

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