

Assessing the Role of Framework Geology on Barrier Island Geomorphology

Phillipe Wernette^{1*}, Chris Houser², Bradley Weymer³, Mark Everett⁴,
Michael P. Bishop¹, and Bobby Reece⁴

¹Texas A&M University, Department of Geography, College Station, TX, USA

²University of Windsor, Department of Earth and Environmental Sciences, Windsor, ON, Canada

³GEOMAR Helmholtz Center for Ocean Research Kiel, Kiel, Germany

⁴Texas A&M University, Department of Geology and Geophysics, College Station, TX, USA

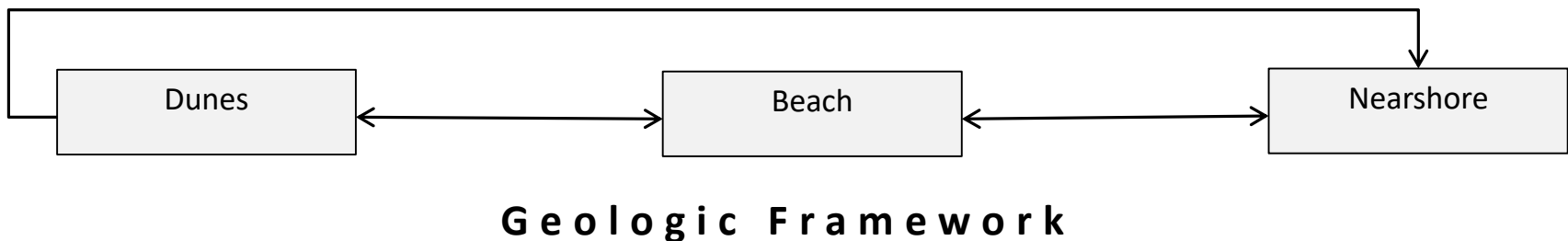
GSA South-Central Meeting 2017
San Antonio, TX



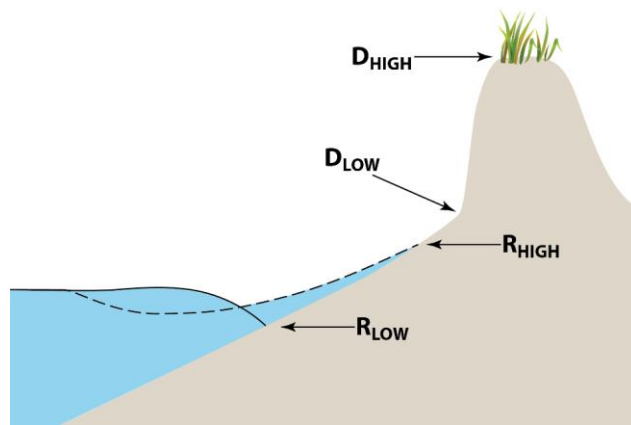
Coastal Geomorphology

“It is essential to understand this geologic framework before attempting to model the large-scale behavior of these types of coastal systems.”

(Riggs et al, 1995)

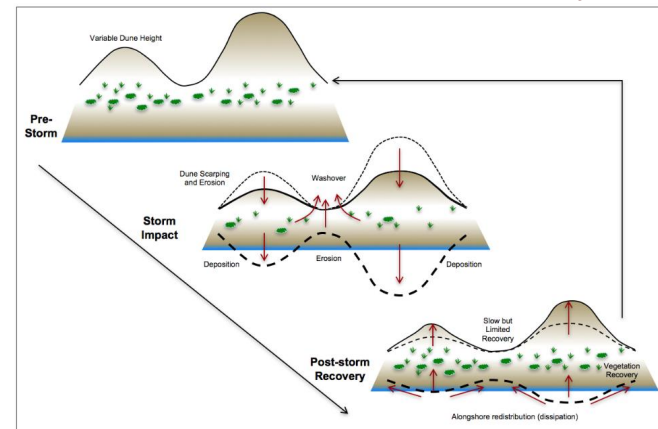


Storm-impact Model



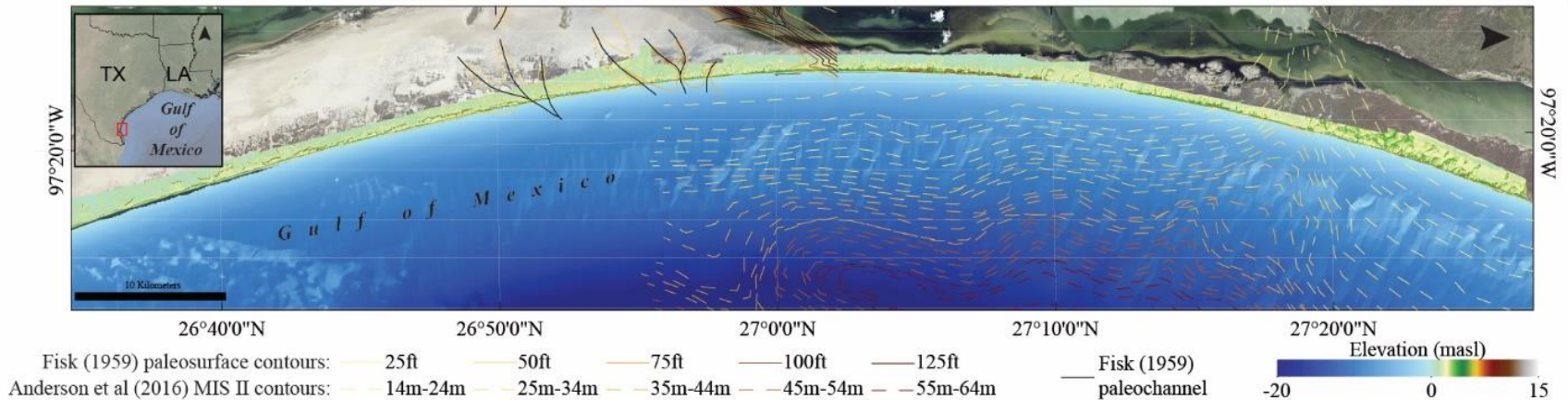
(Sallenger, 2000)

Barrier Island Resiliency

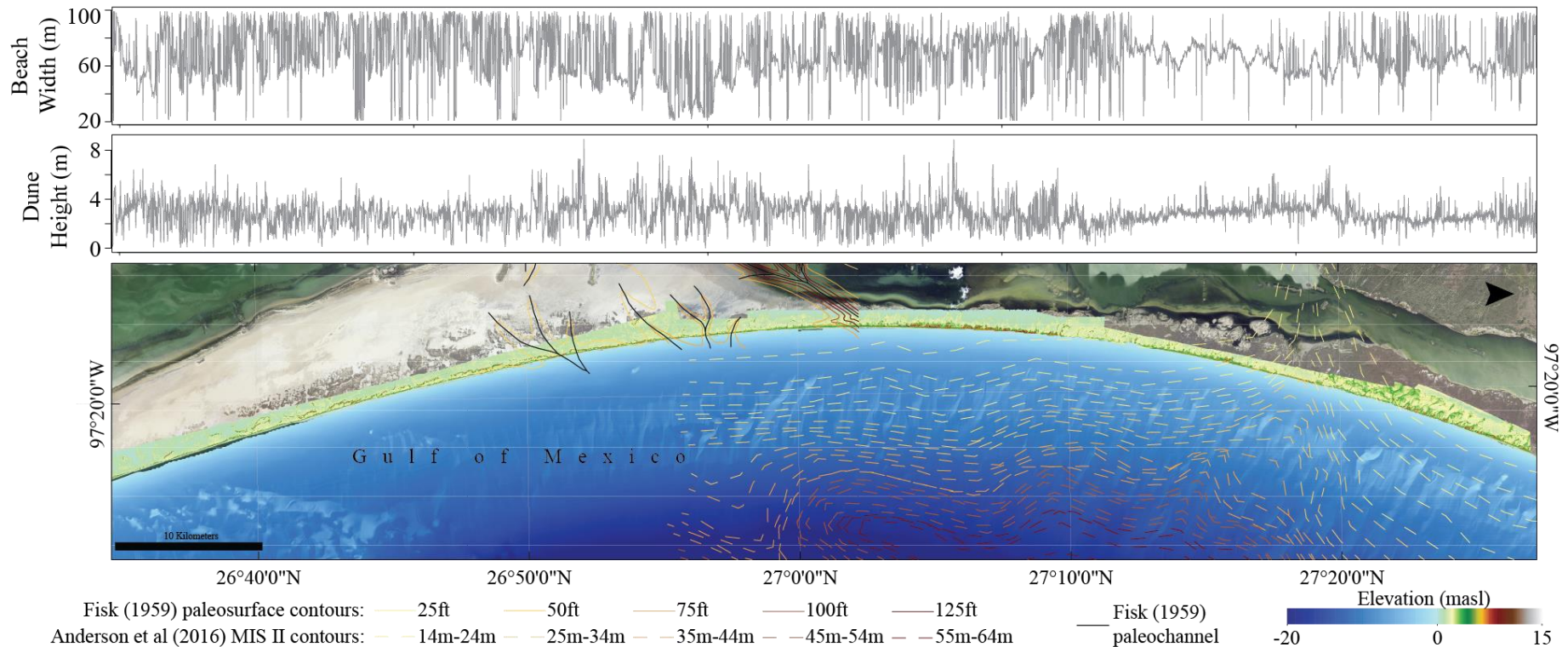


(Houser et al, 2015)

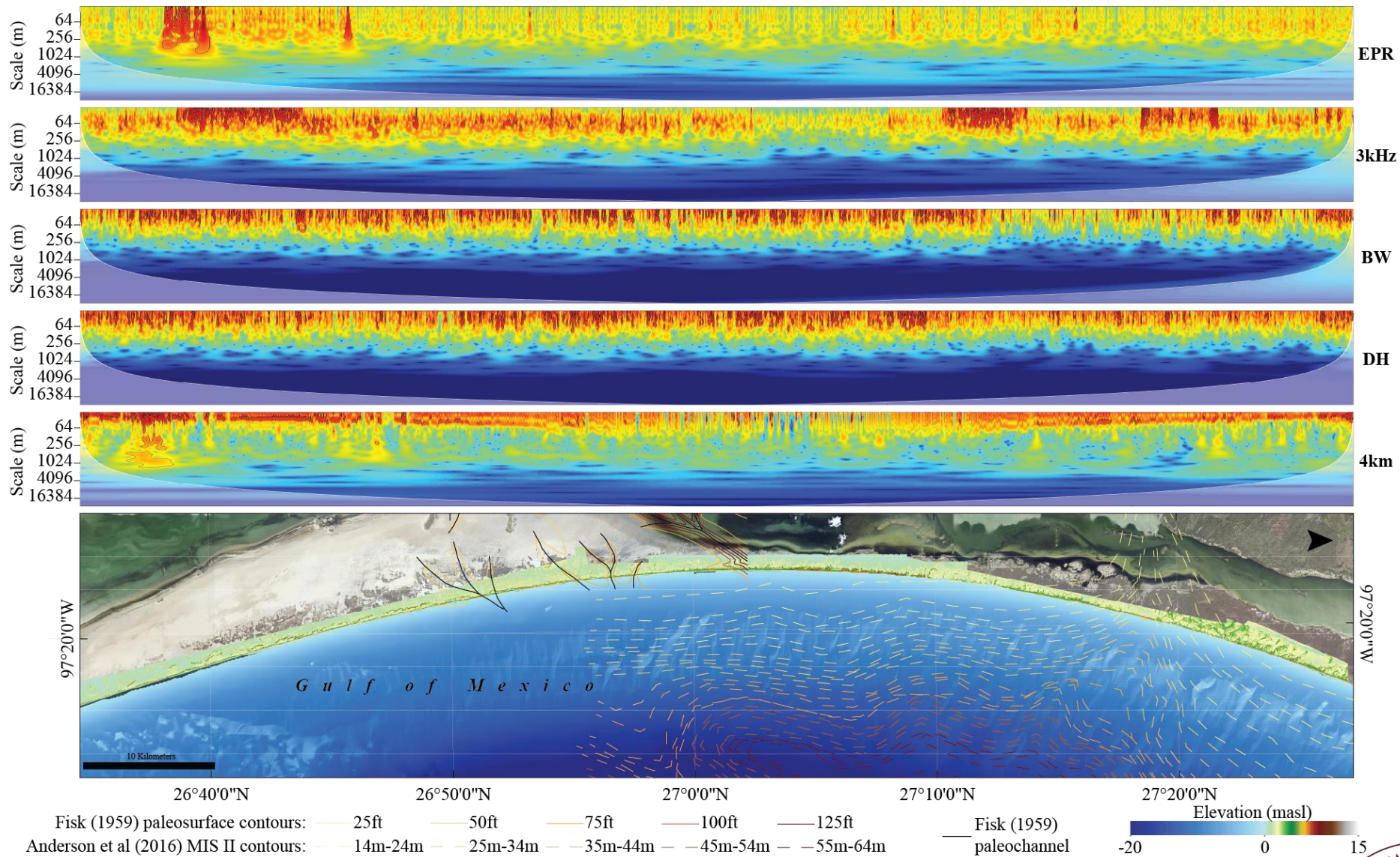
Padre Island National Seashore (PAIS)



Alongshore Morphometrics



Time-series vs. Spatial-series



Peak Spectral Density

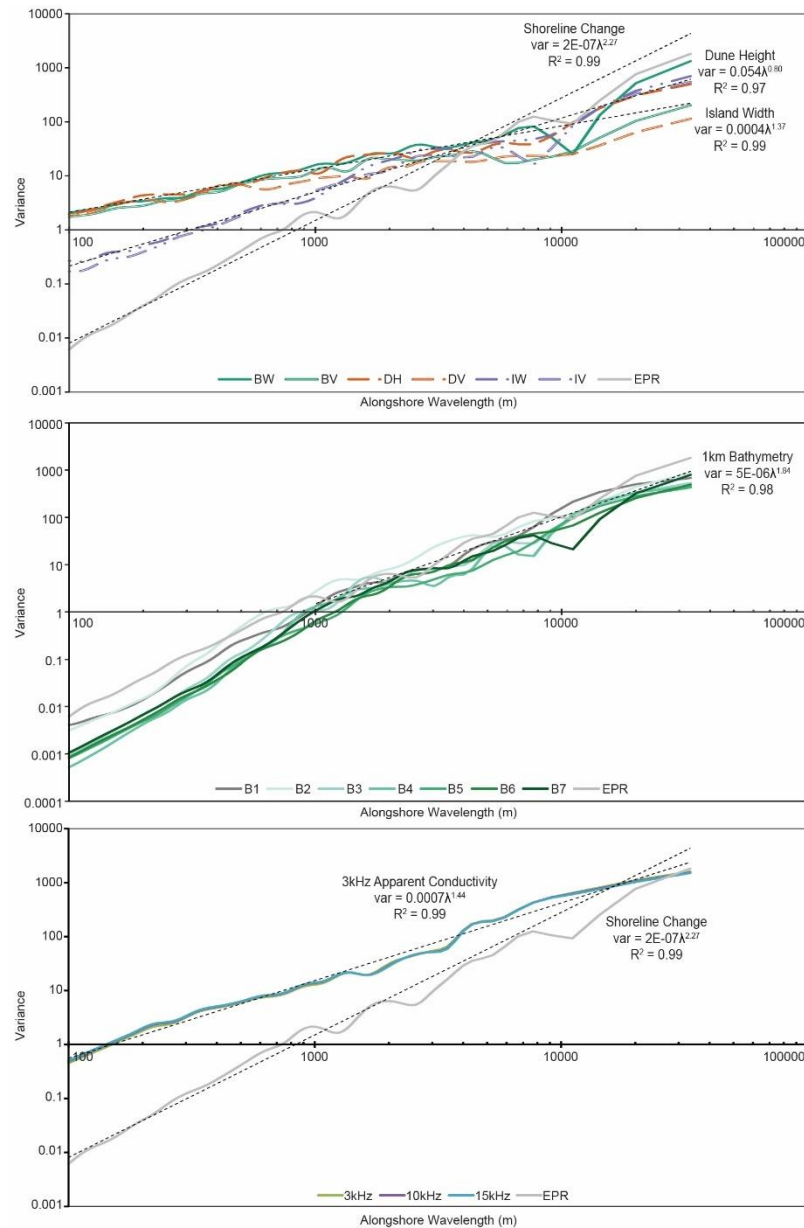
White noise (slope ~ 0)

Pink noise (slope ~ 1)

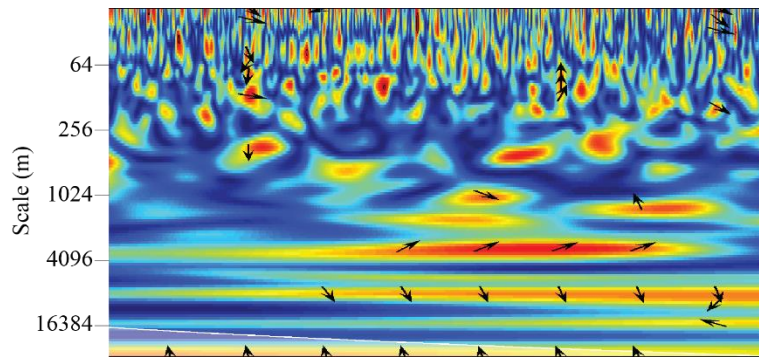
Red noise (slope ~ 2)

Shoreline change (long-term)
slope = 2.27

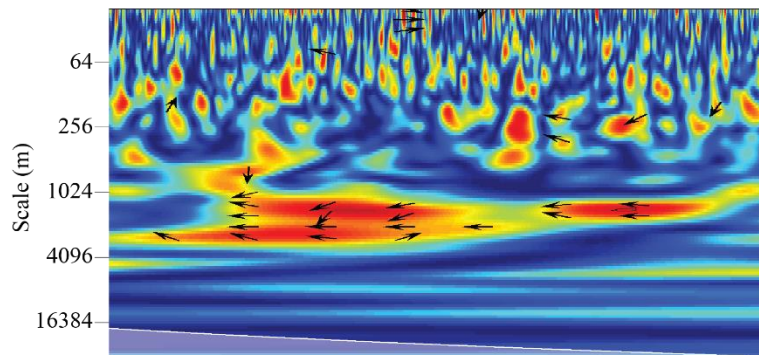
Surface morphometrics
slope ~ 1



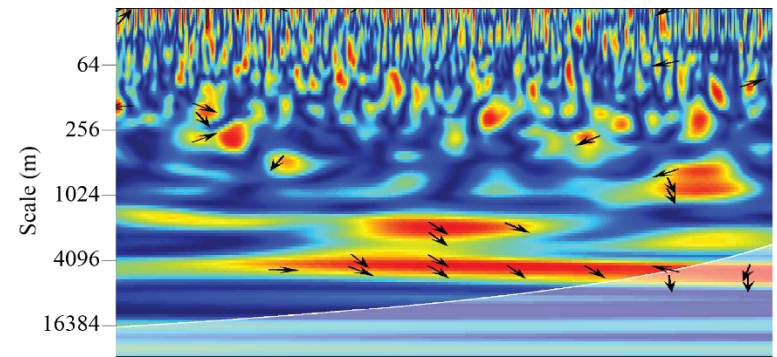
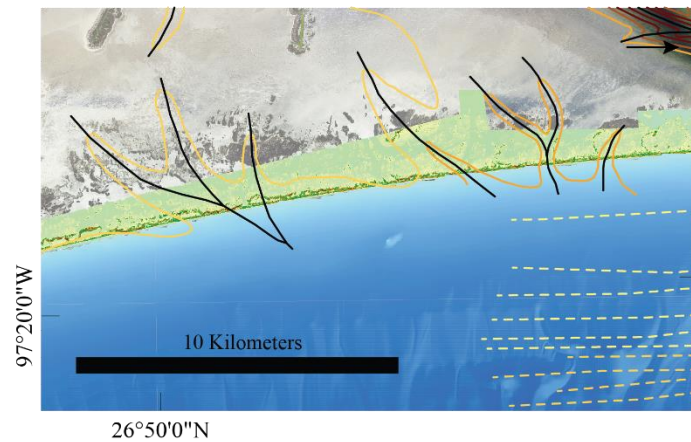




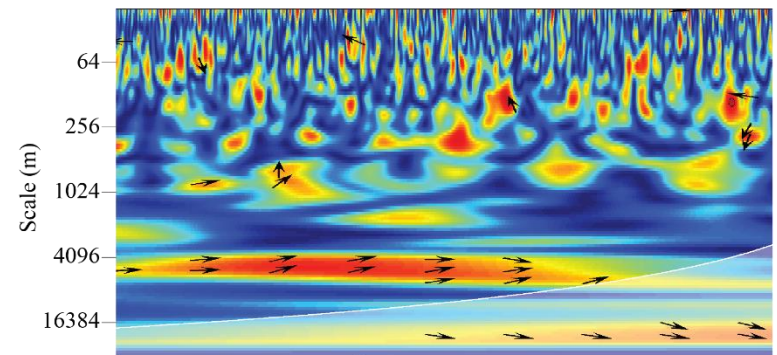
2km x DH



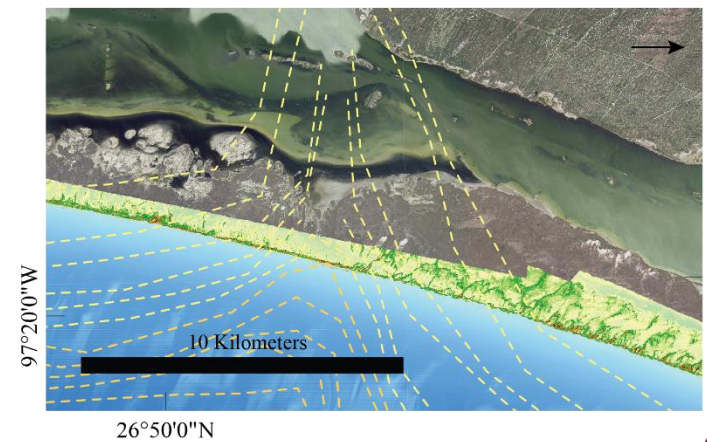
3kHz x DH



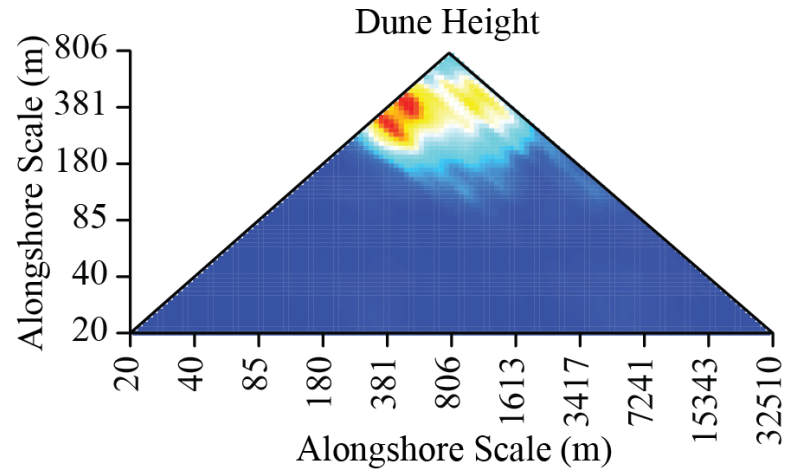
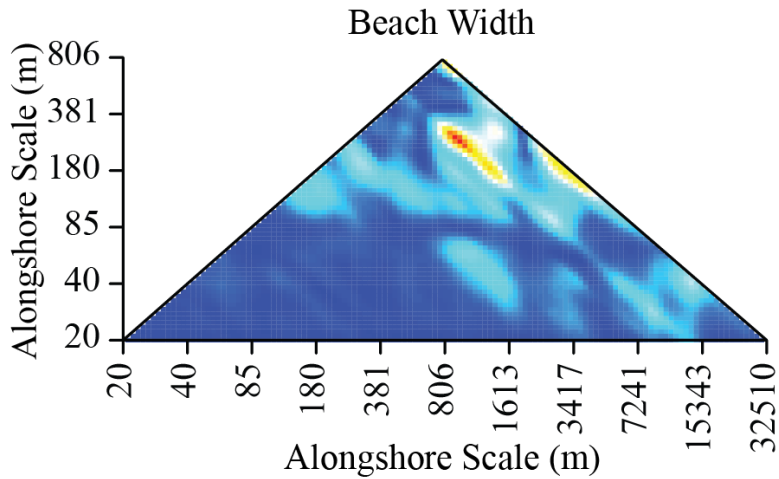
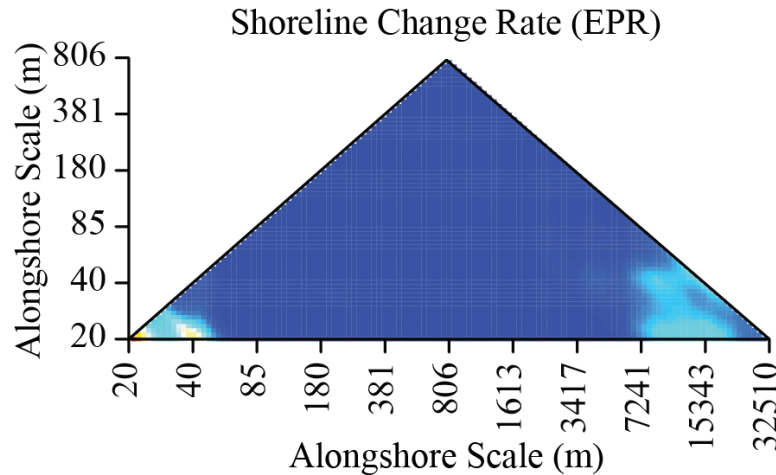
2km x DH



3kHz x DH



Bicoherence



ARFIMA Modelling

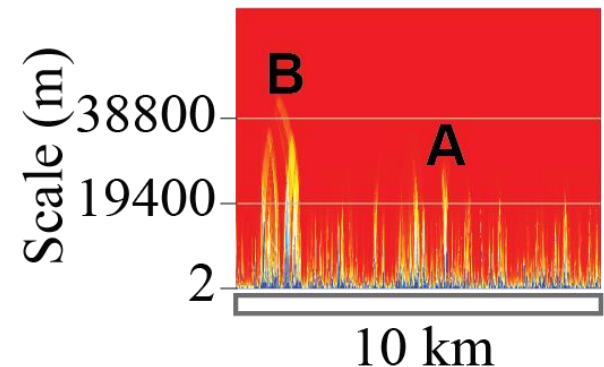
- Autoregressive fractionally-integrated moving average (ARFIMA) (Fraleley et al, 2012)
- Evaluate short- and long-range dependencies (SRD and LRD)

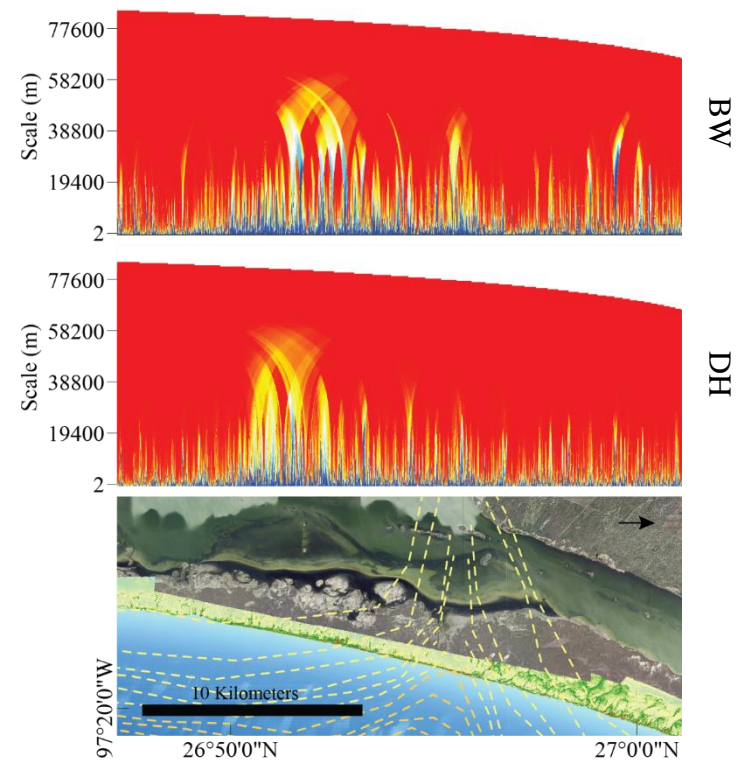
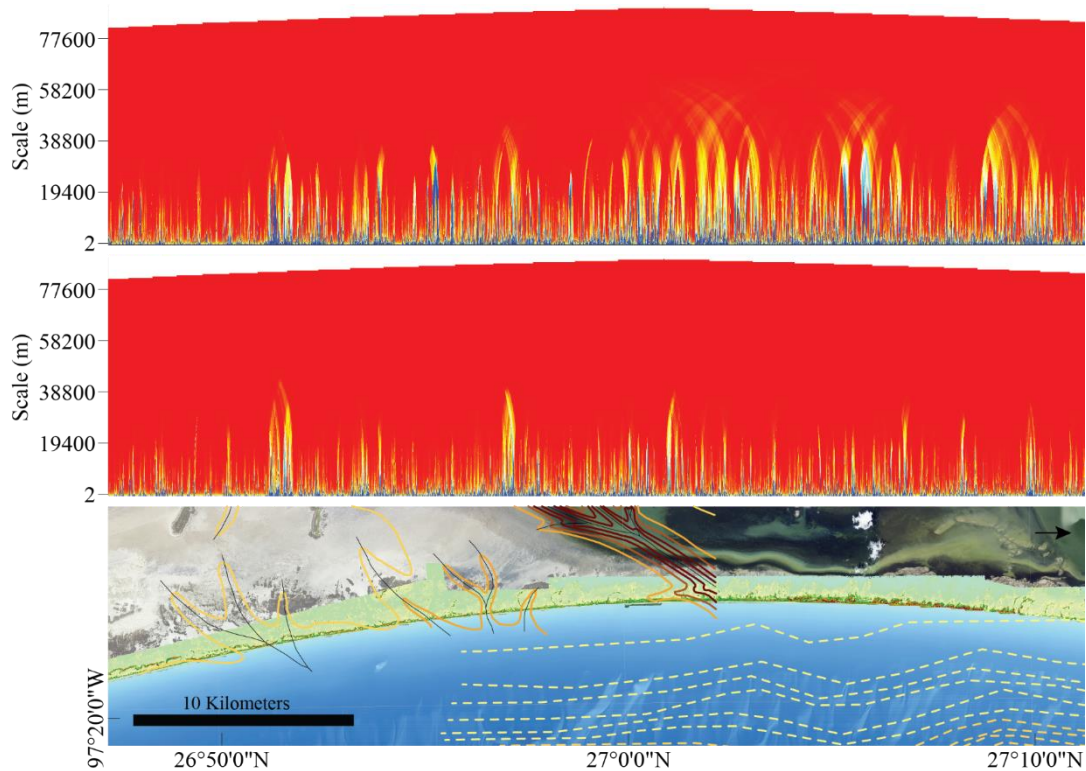
(p, d, q) model:

$p \rightarrow$ SRD (autoregressive)

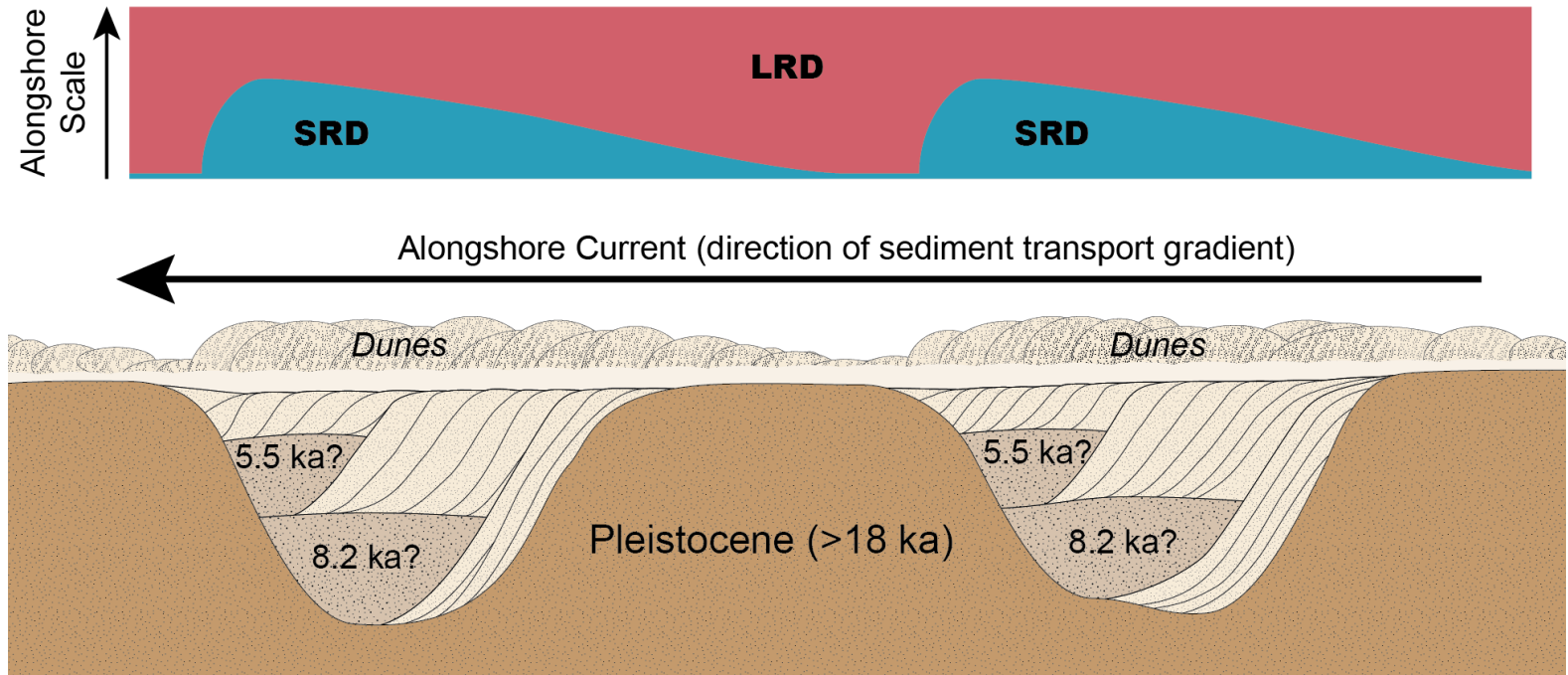
$d \rightarrow$ LRD

$q \rightarrow$ SRD (moving average)

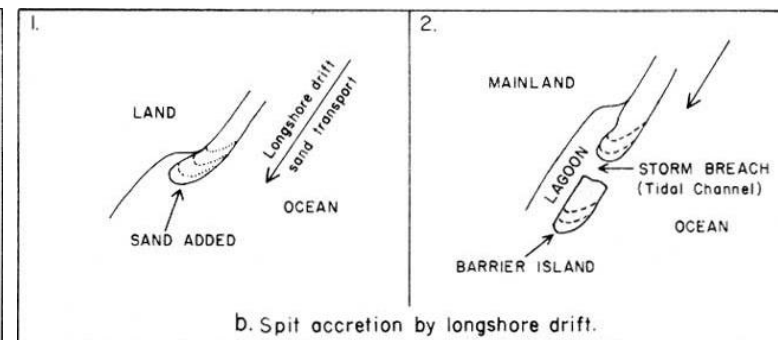
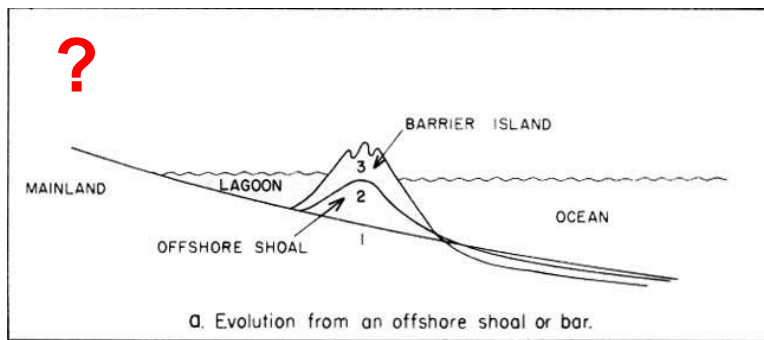
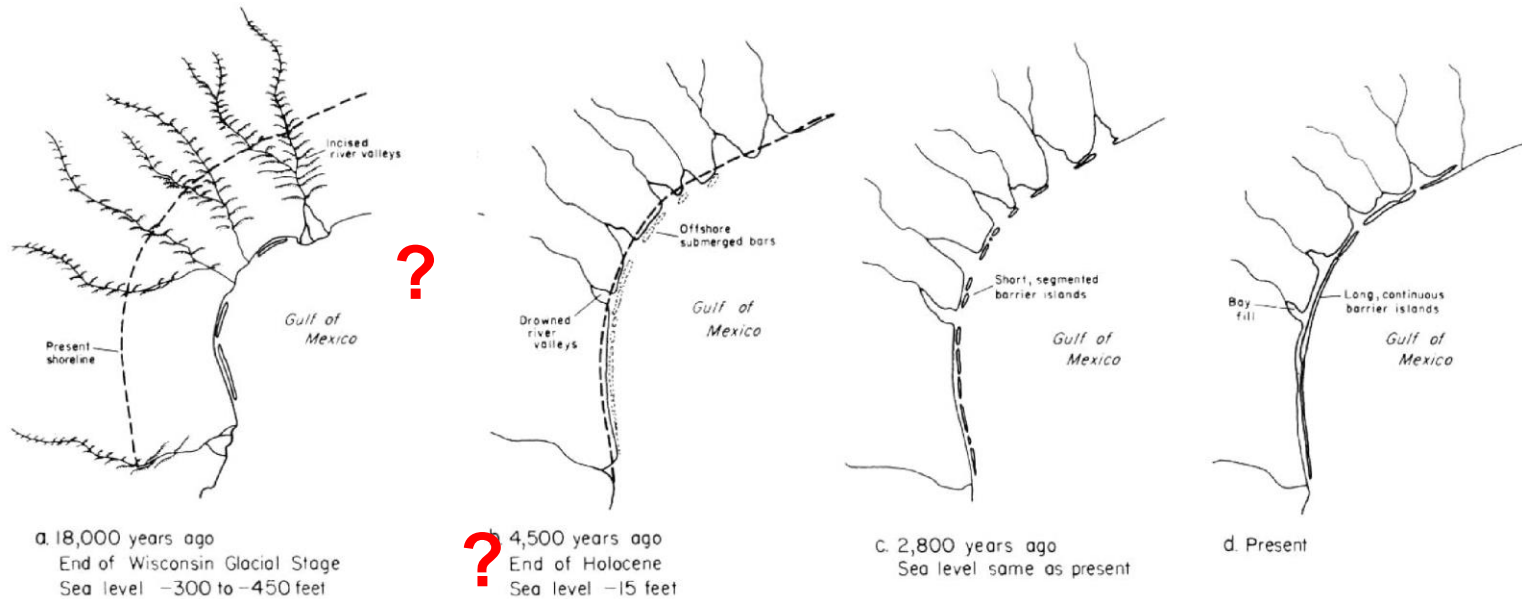




Directional Dependency

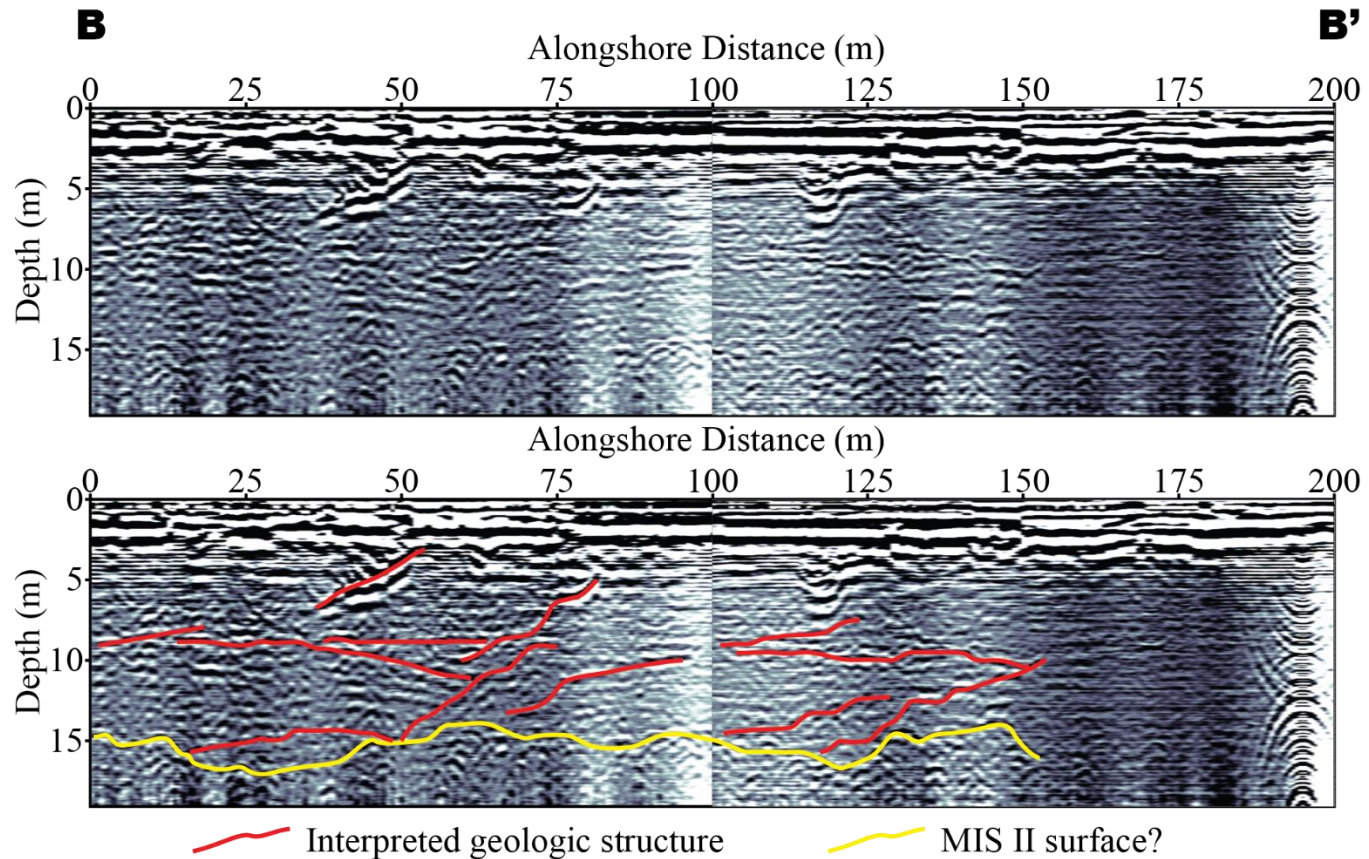
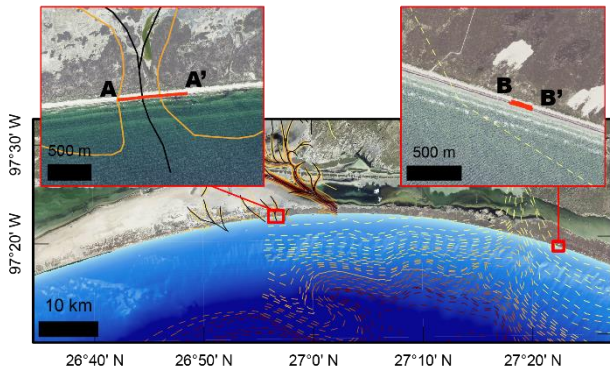


PAIS Development

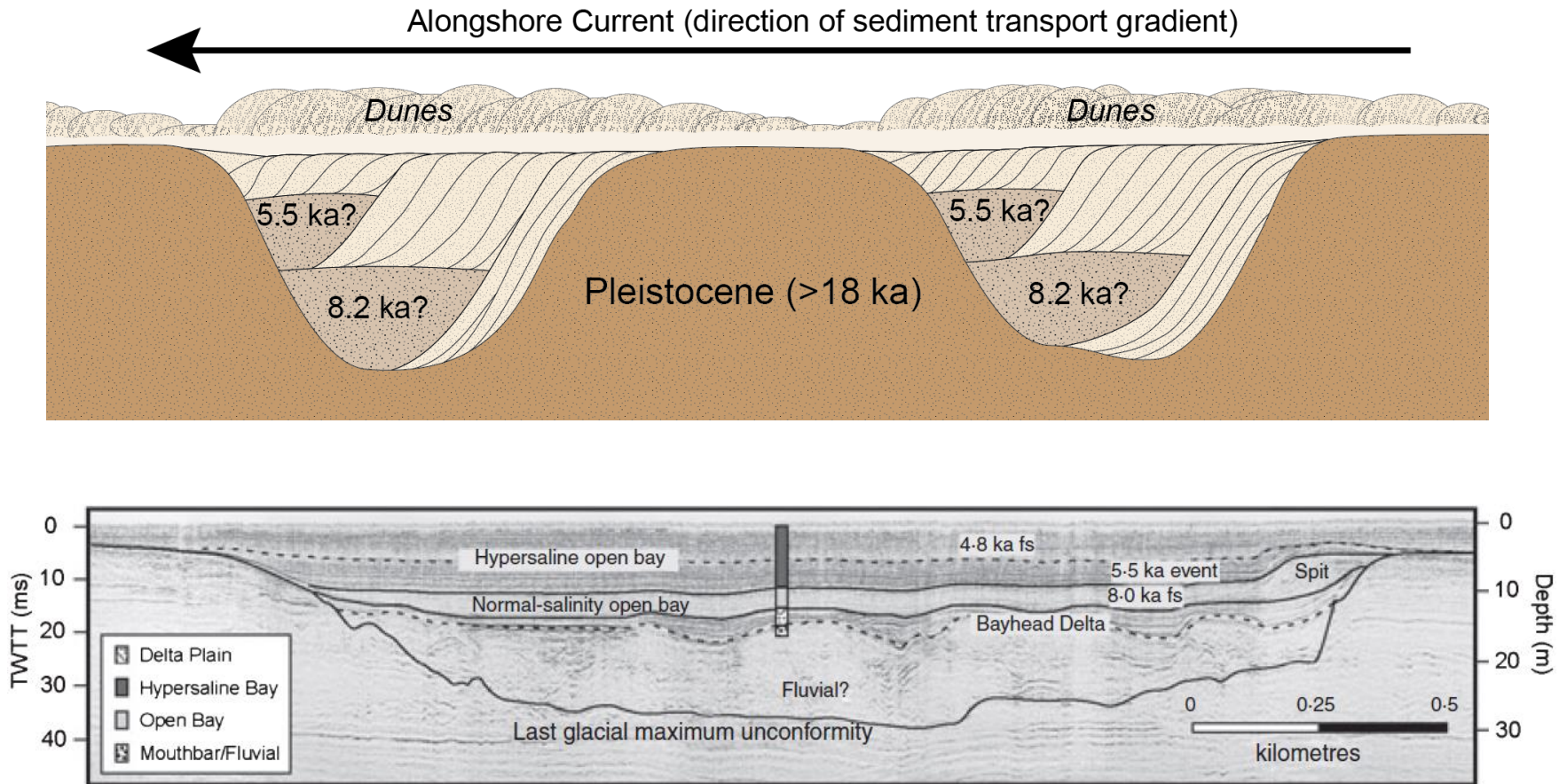


(Weise and White, 1980)

GPR

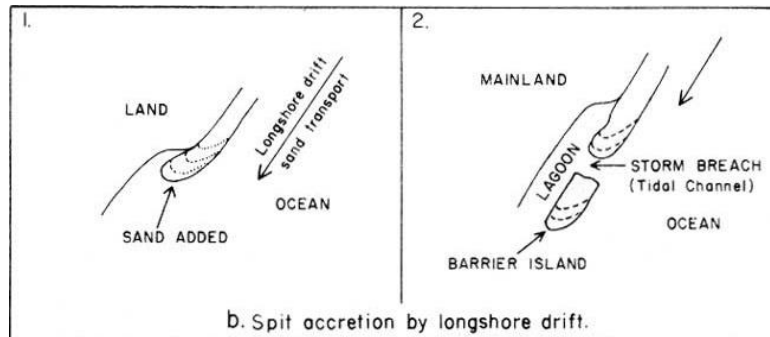
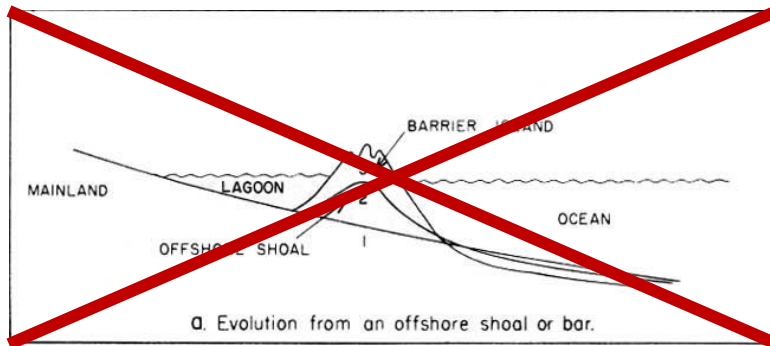
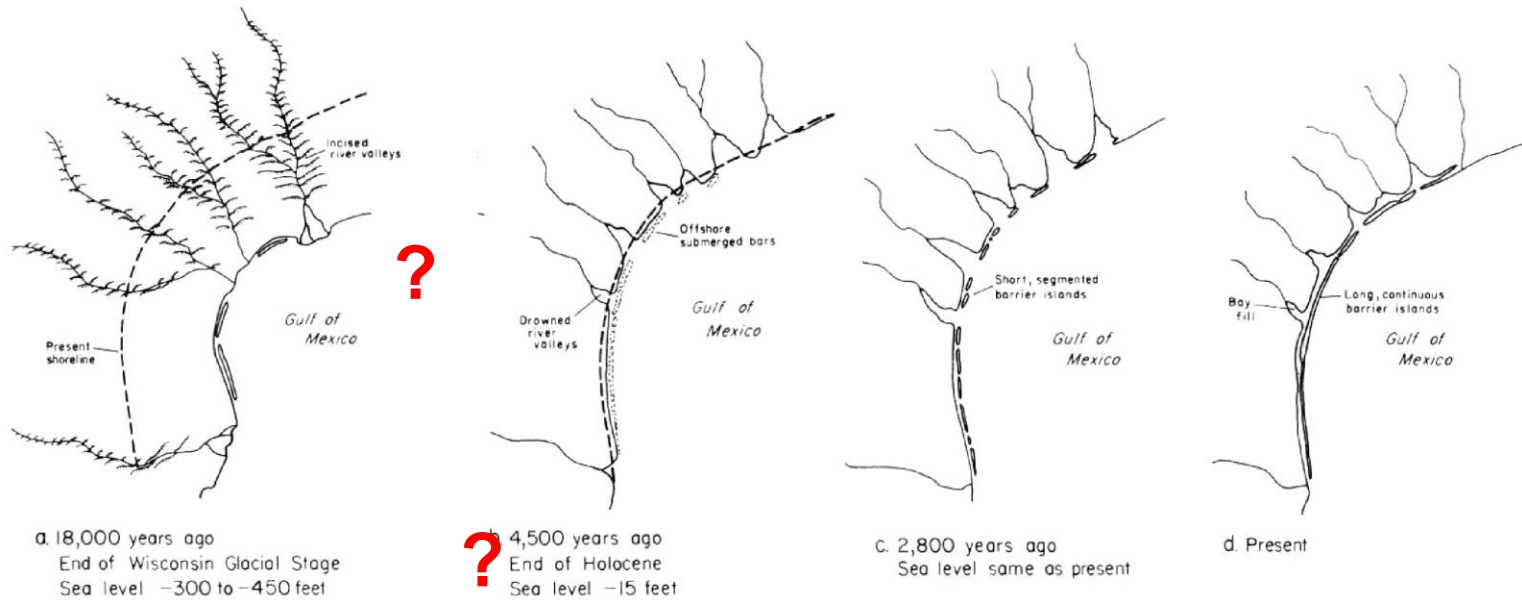


Framework Geology Context



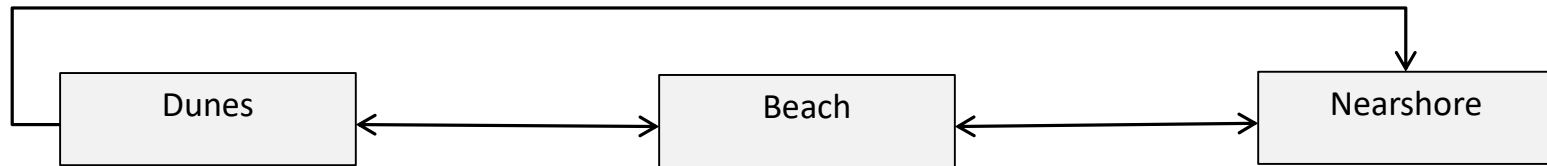
Baffin Bay seismic profile (Simms et al, 2010)

PAIS Development



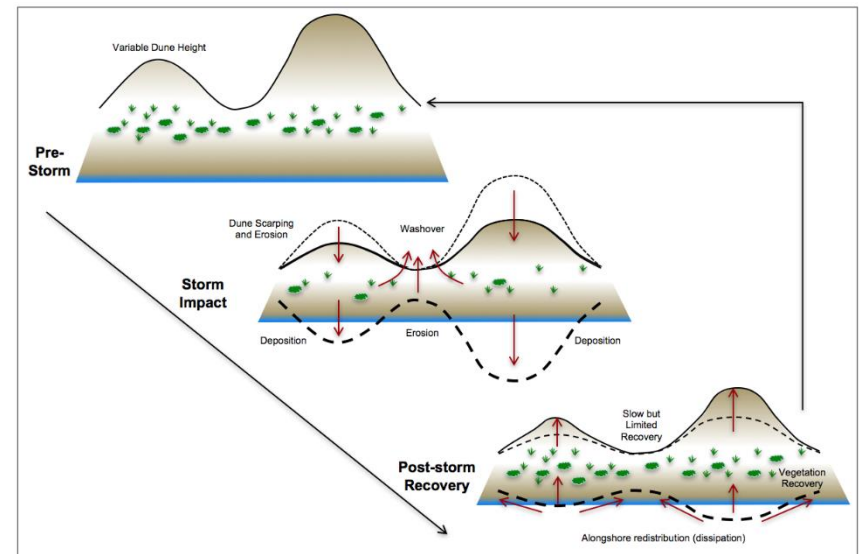
(Weise and White, 1980)

Barrier Island Geomorphology



Geologic Framework

- Spatial variations in framework geology affect dune morphology
 - Influence barrier island transgression
 - Persist through time
- Directional dependencies possible



(Houser et al, 2015)

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