

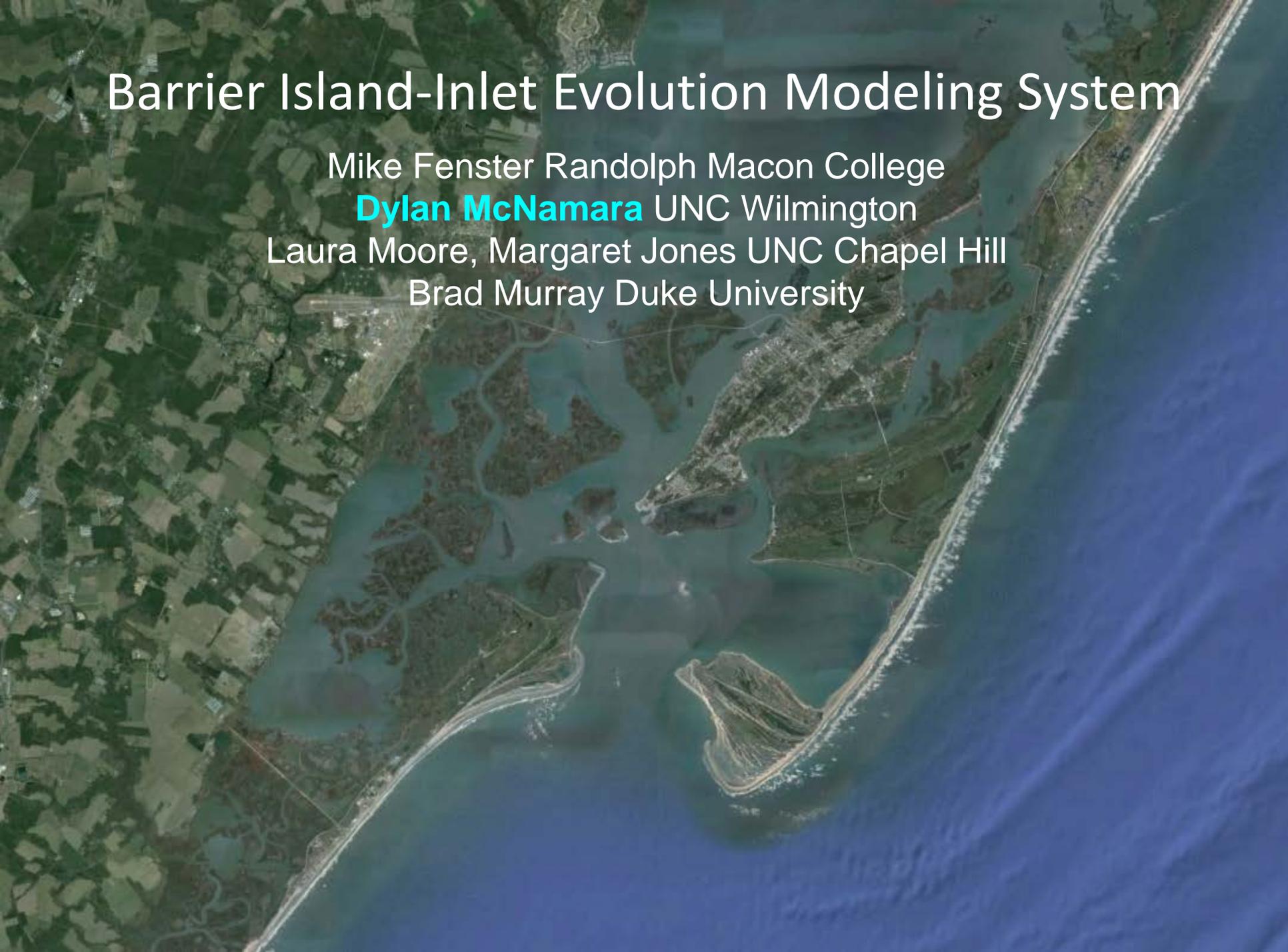
Barrier Island-Inlet Evolution Modeling System

Mike Fenster Randolph Macon College

Dylan McNamara UNC Wilmington

Laura Moore, Margaret Jones UNC Chapel Hill

Brad Murray Duke University



Dylan McNamara UNC Wilmington
Born and raised on the Eastern Shore

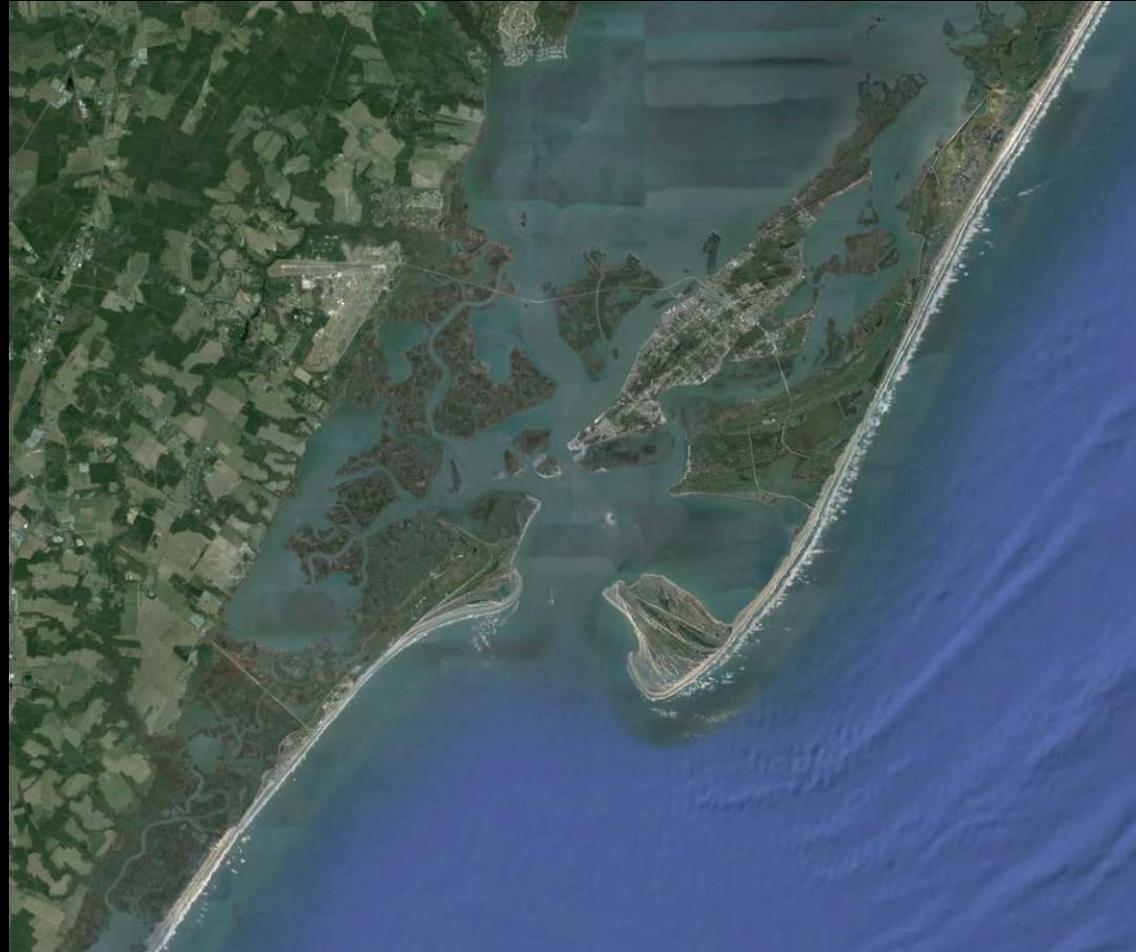


Dylan McNamara UNC Wilmington
Born and raised on the Eastern Shore



Modeling the Coastal System

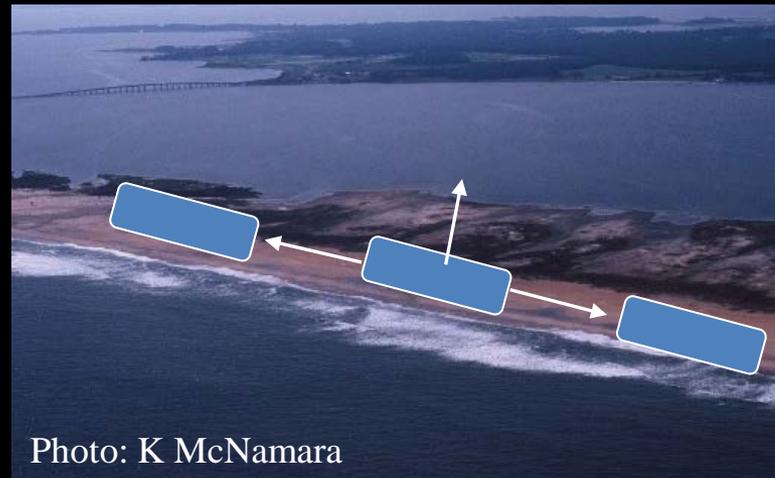
- What to model?
- Where have we modeled?
- What to forecast?



Modeling Approach

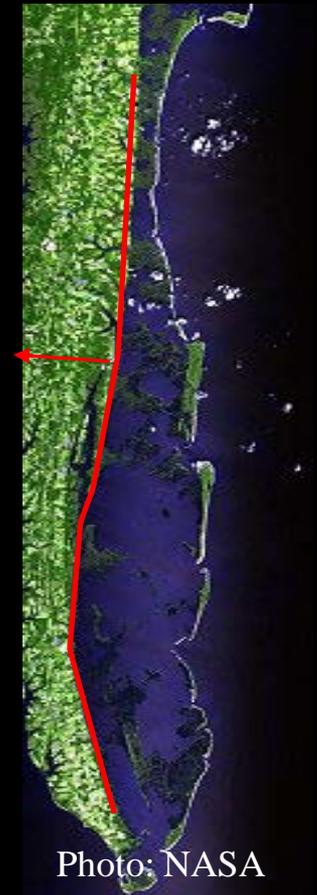


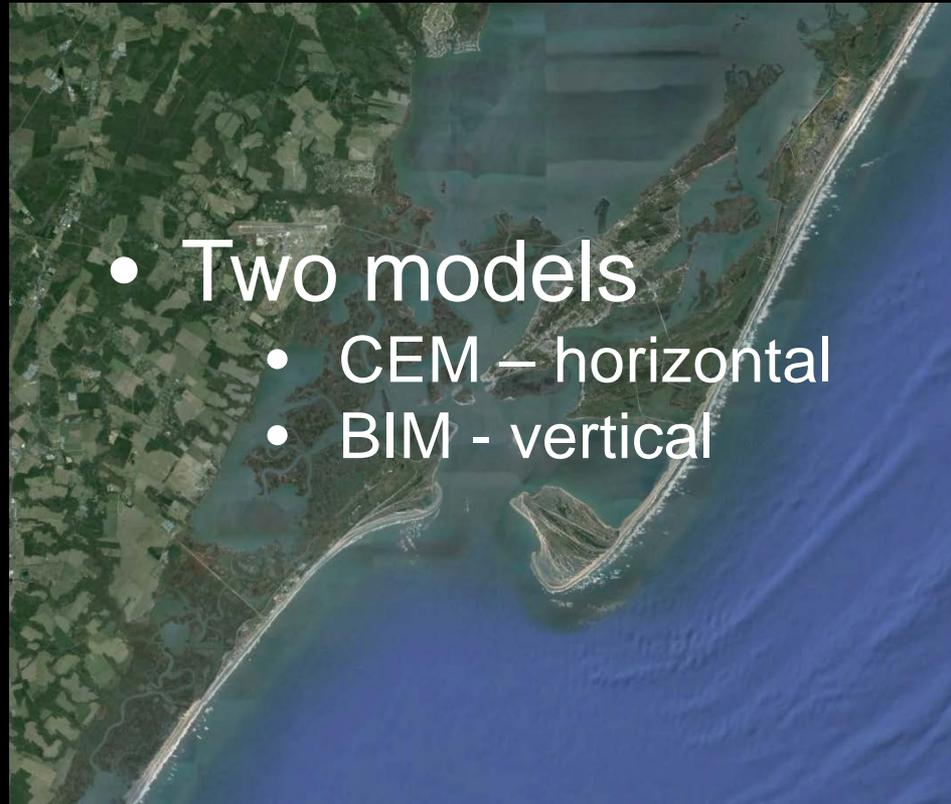
Fluid Parcels/
Sand Grains
(seconds)



Sediment Transport
Pathways
(years)

Coastal Margin
(centuries)



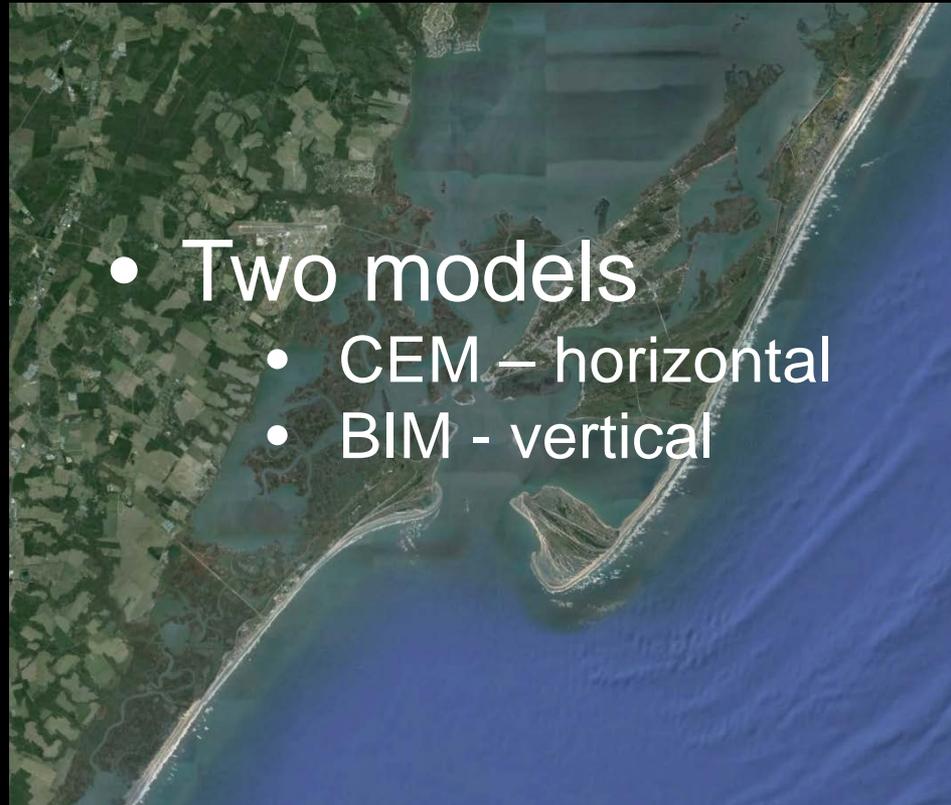


- Two models
 - CEM – horizontal
 - BIM - vertical

How does the system respond to changes in "forcing"

Changing storm climates

Sea level rise



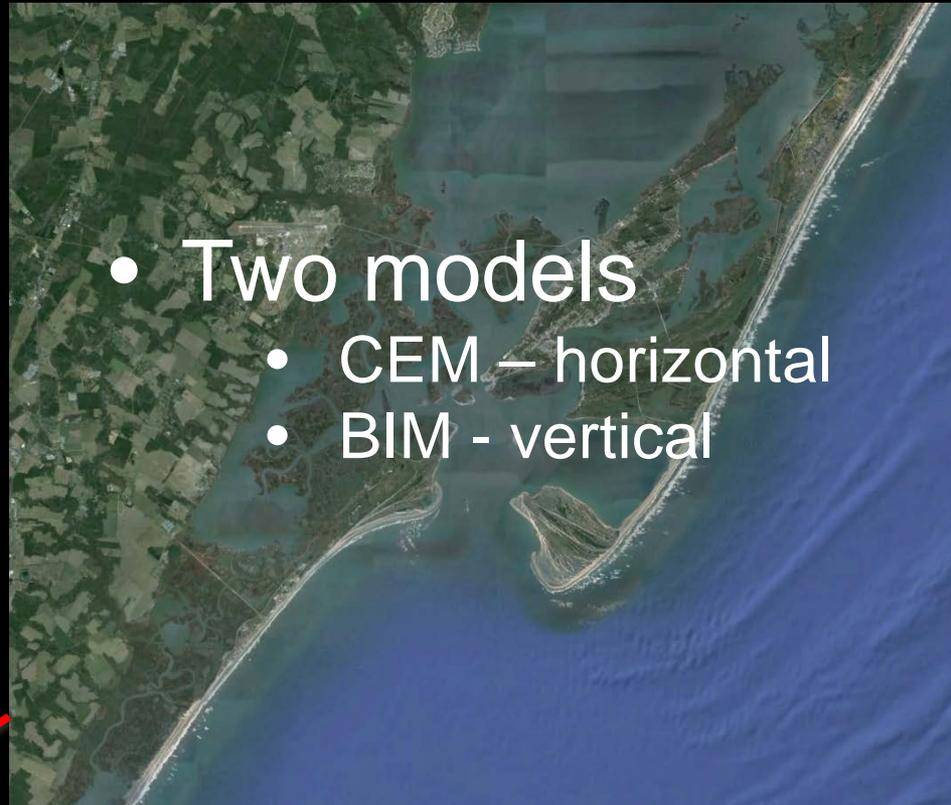
- Two models
 - CEM – horizontal
 - BIM - vertical

Human modifications

How does the system respond to changes in "forcing"

Changing storm climates

Sea level rise



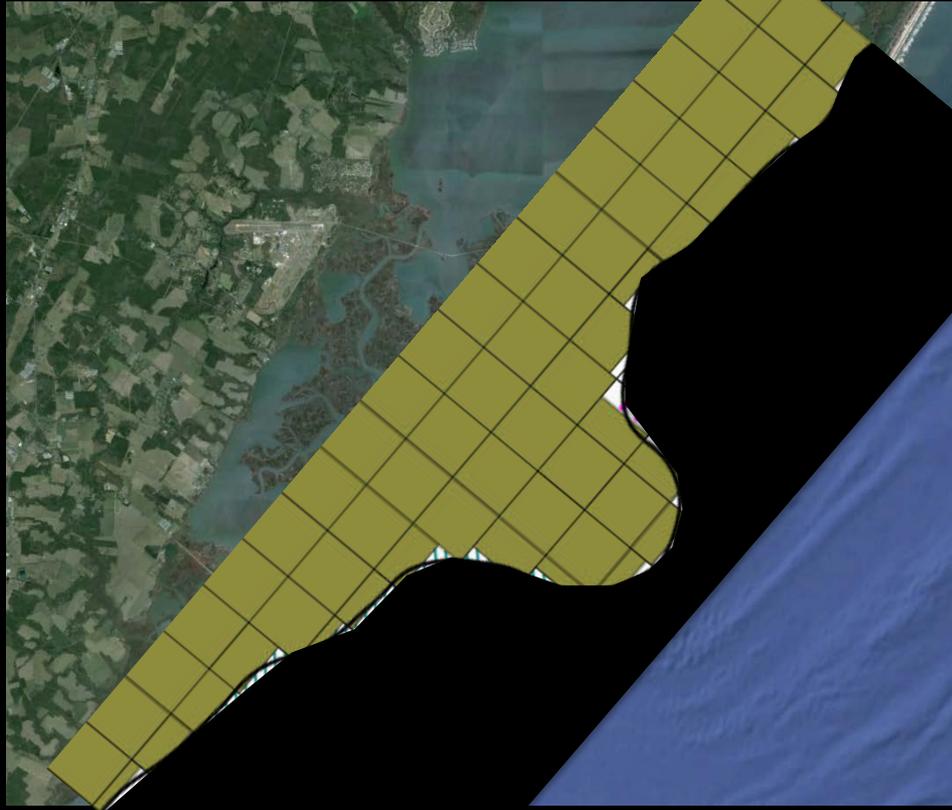
- Two models
 - CEM – horizontal
 - BIM - vertical

Human modifications

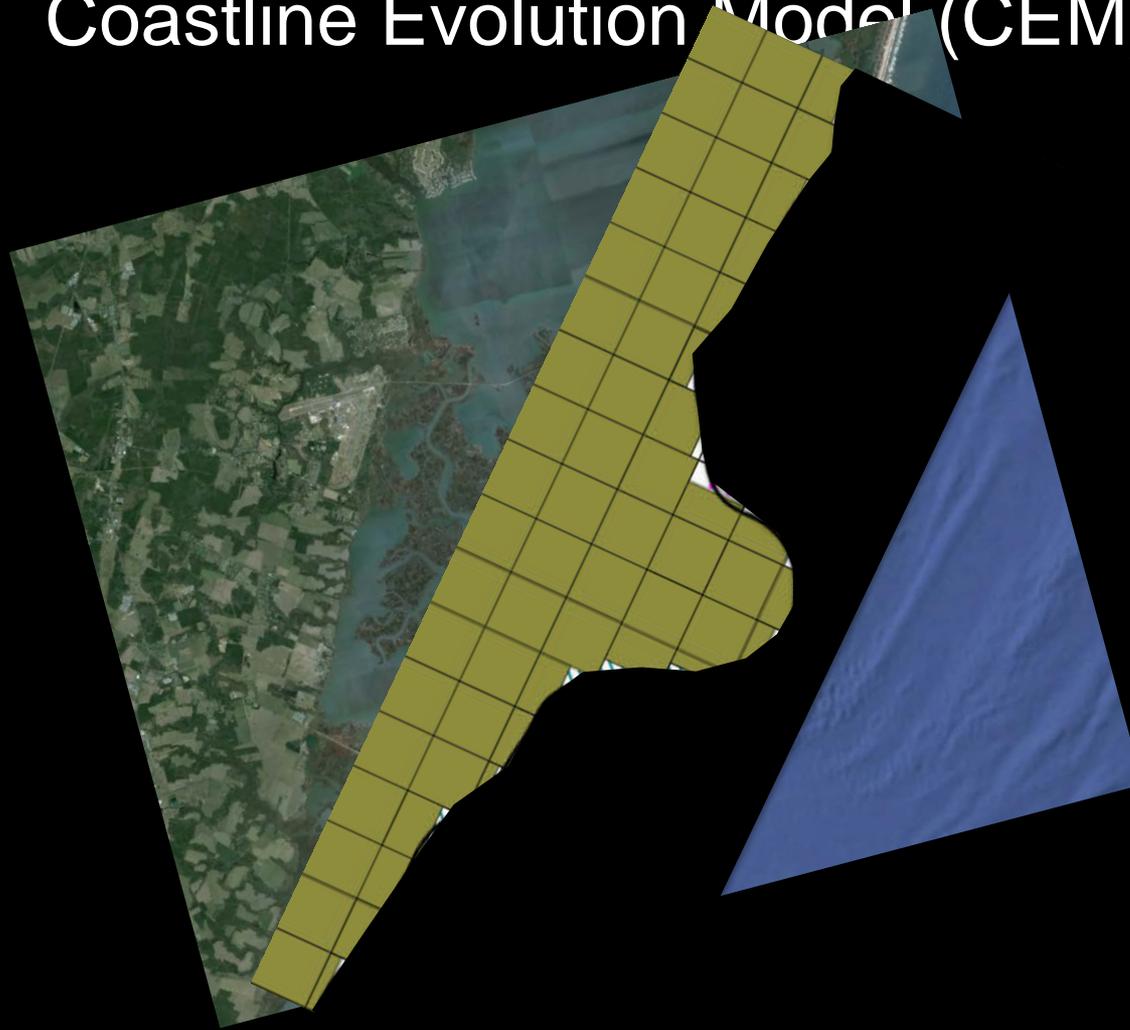
Coastline Evolution Model (CEM)



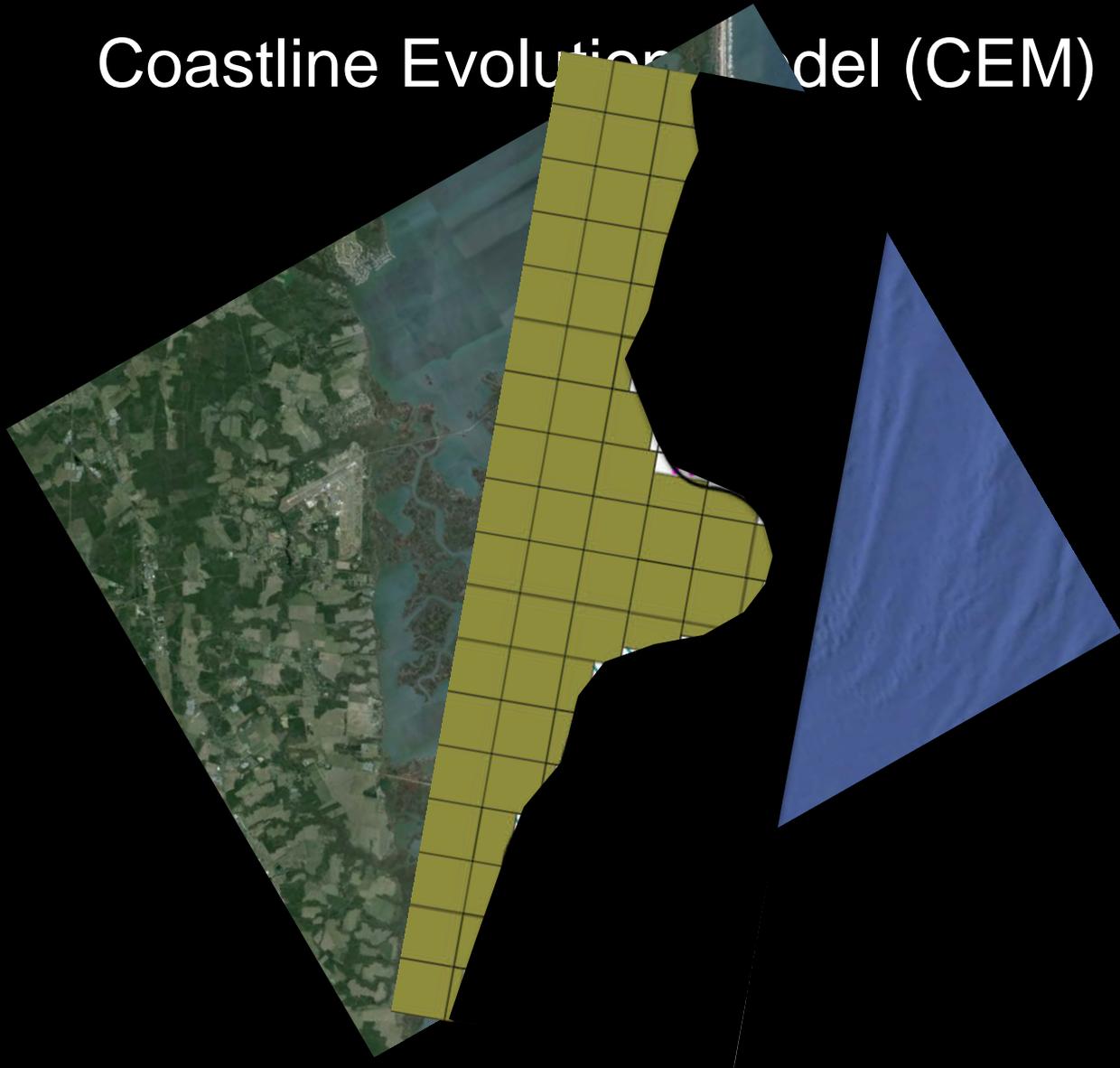
Coastline Evolution Model (CEM)



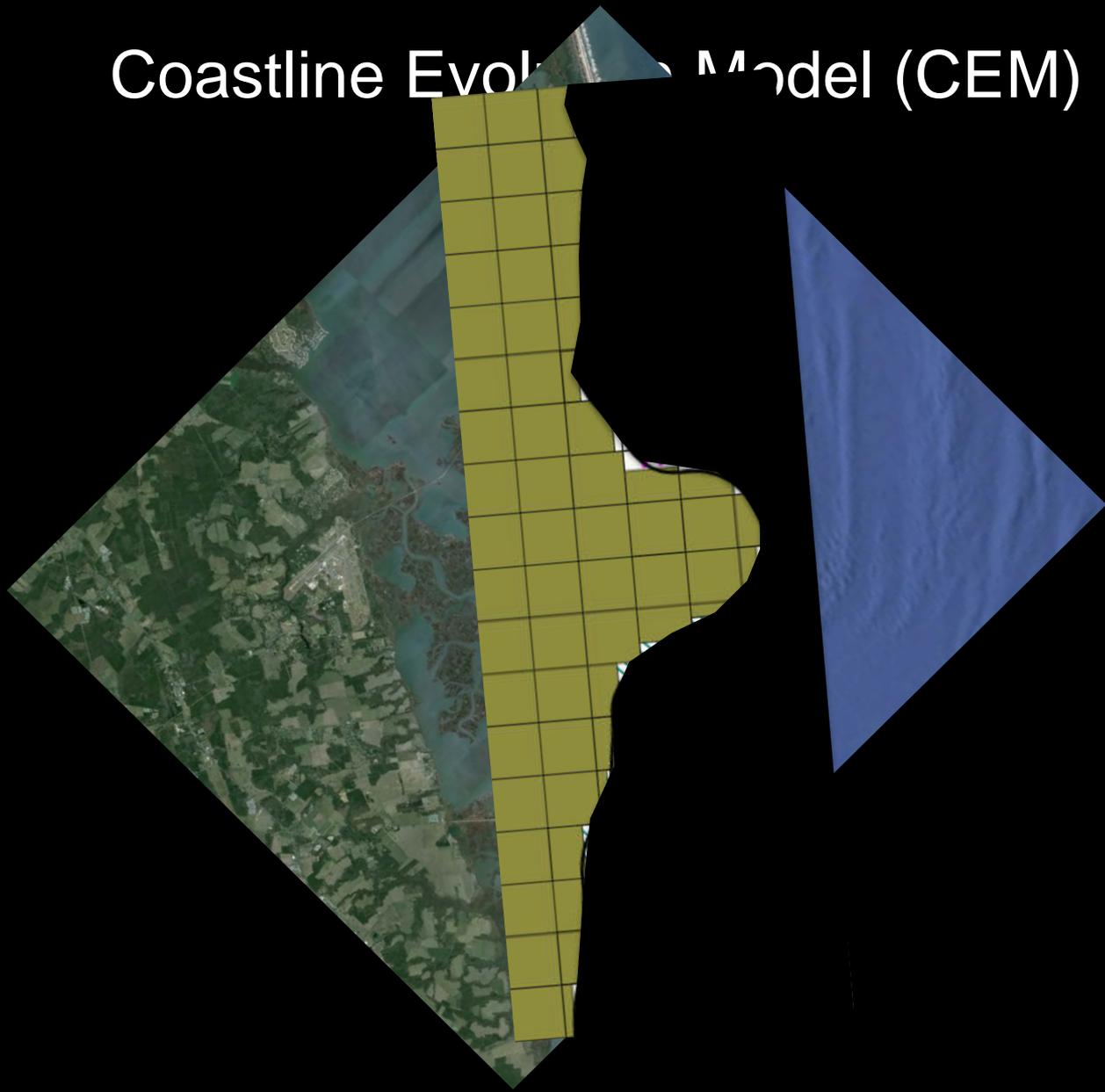
Coastline Evolution Model (CEM)



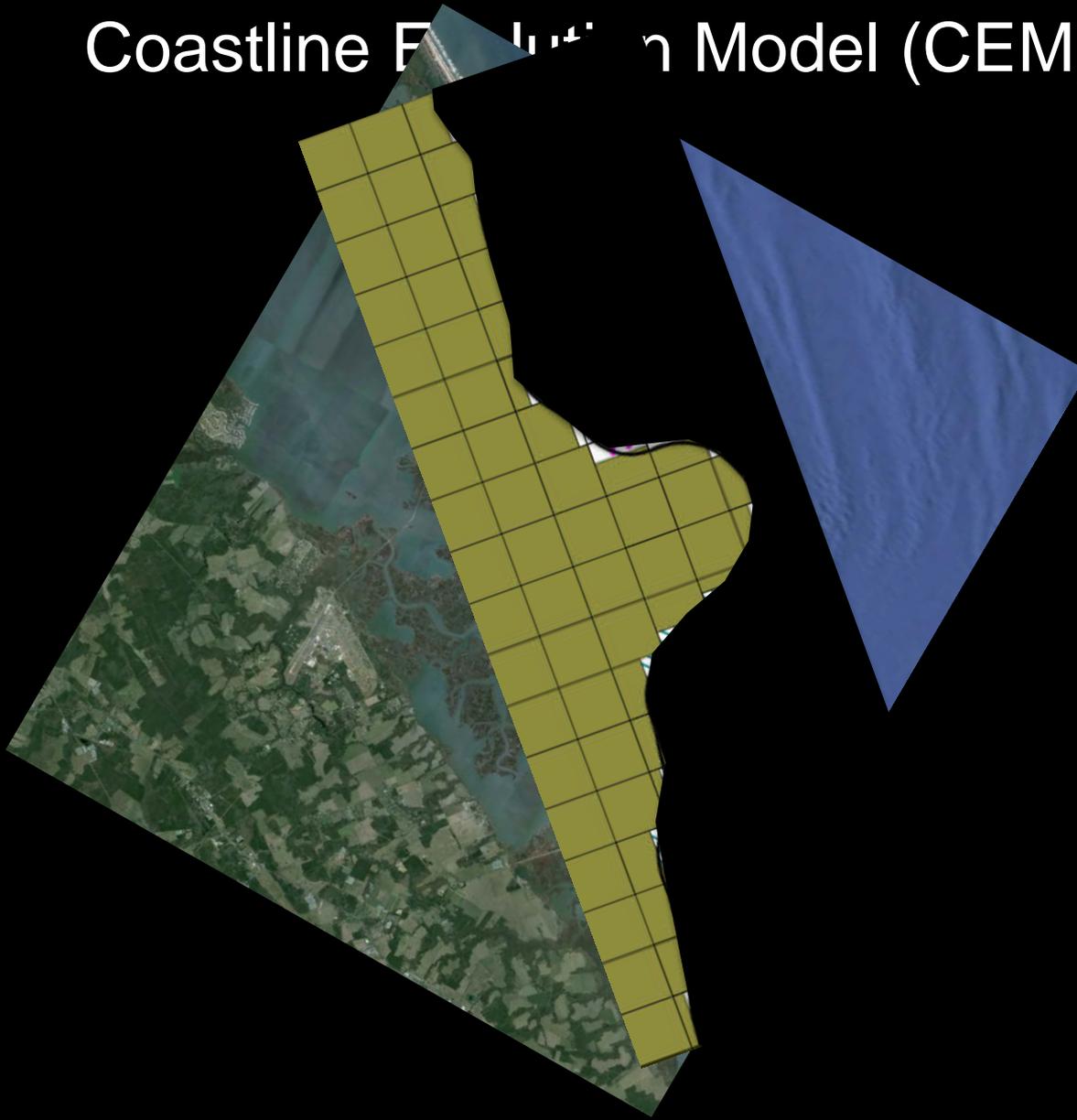
Coastline Evolution Model (CEM)



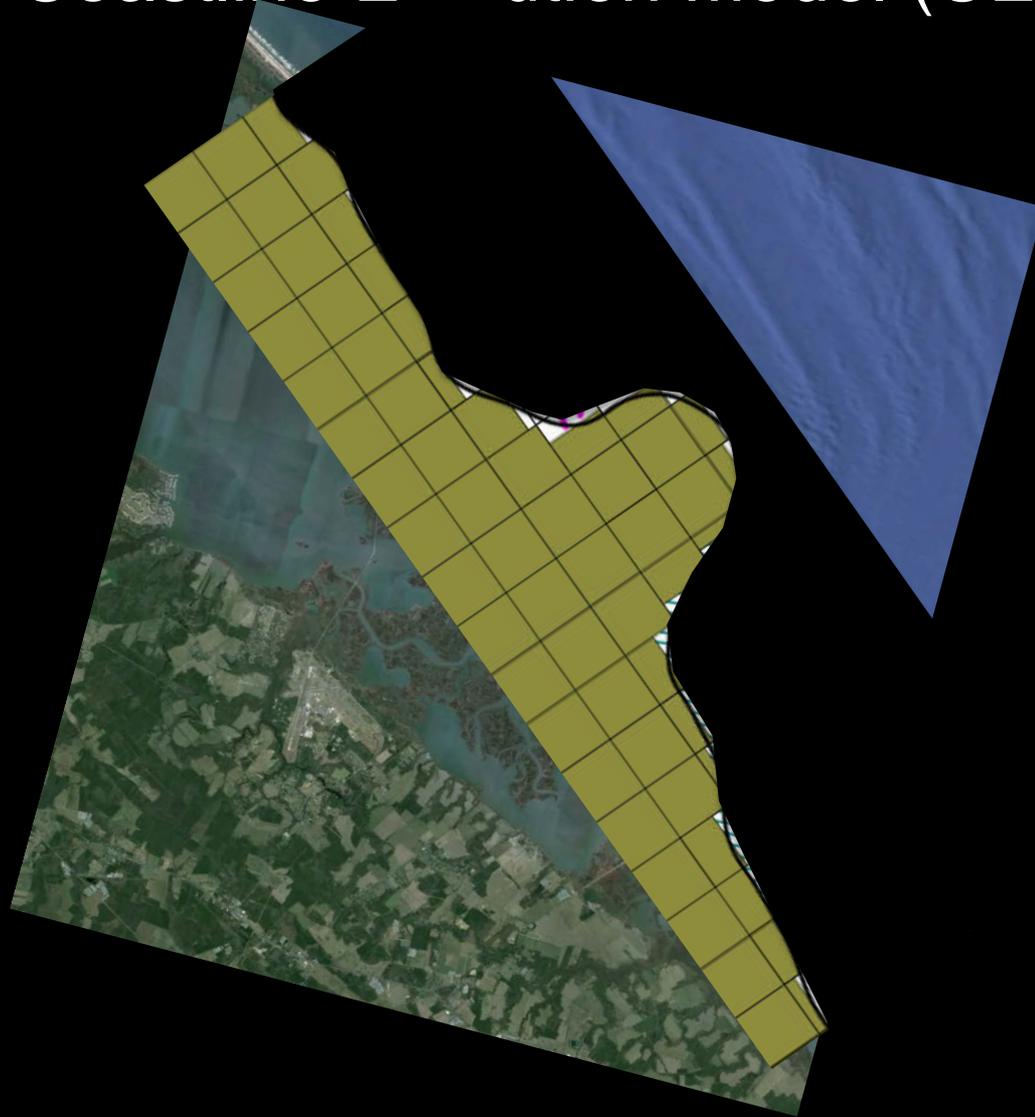
Coastline Evolution Model (CEM)



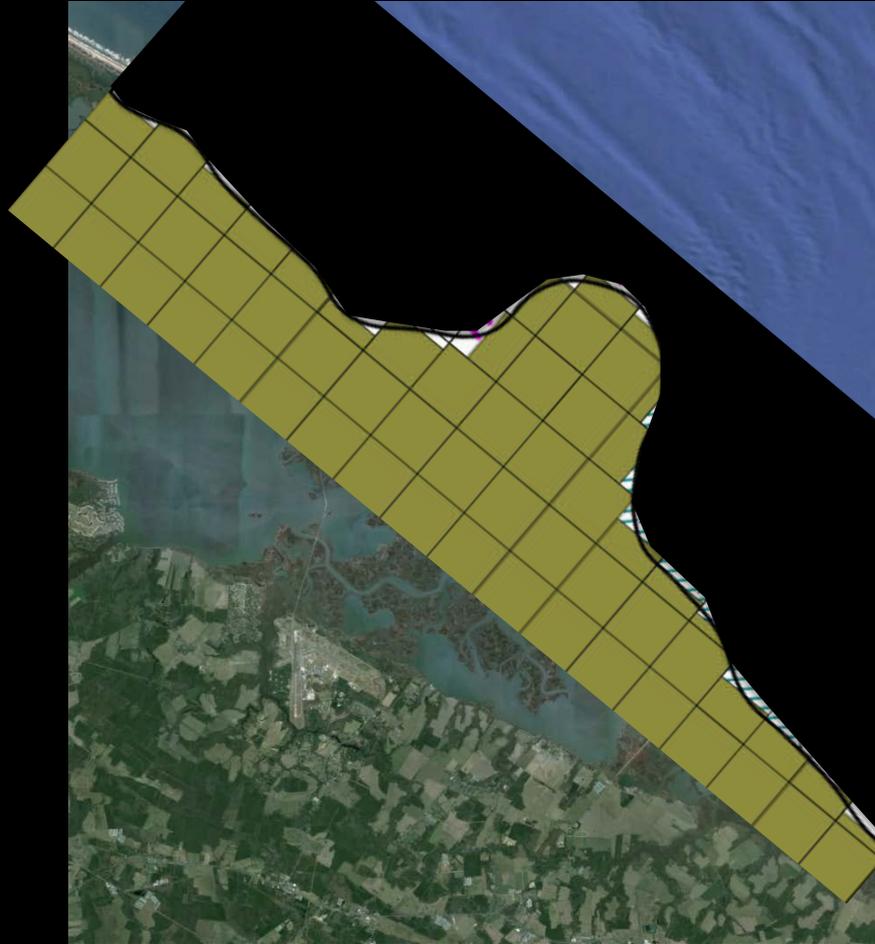
Coastline Evolution Model (CEM)



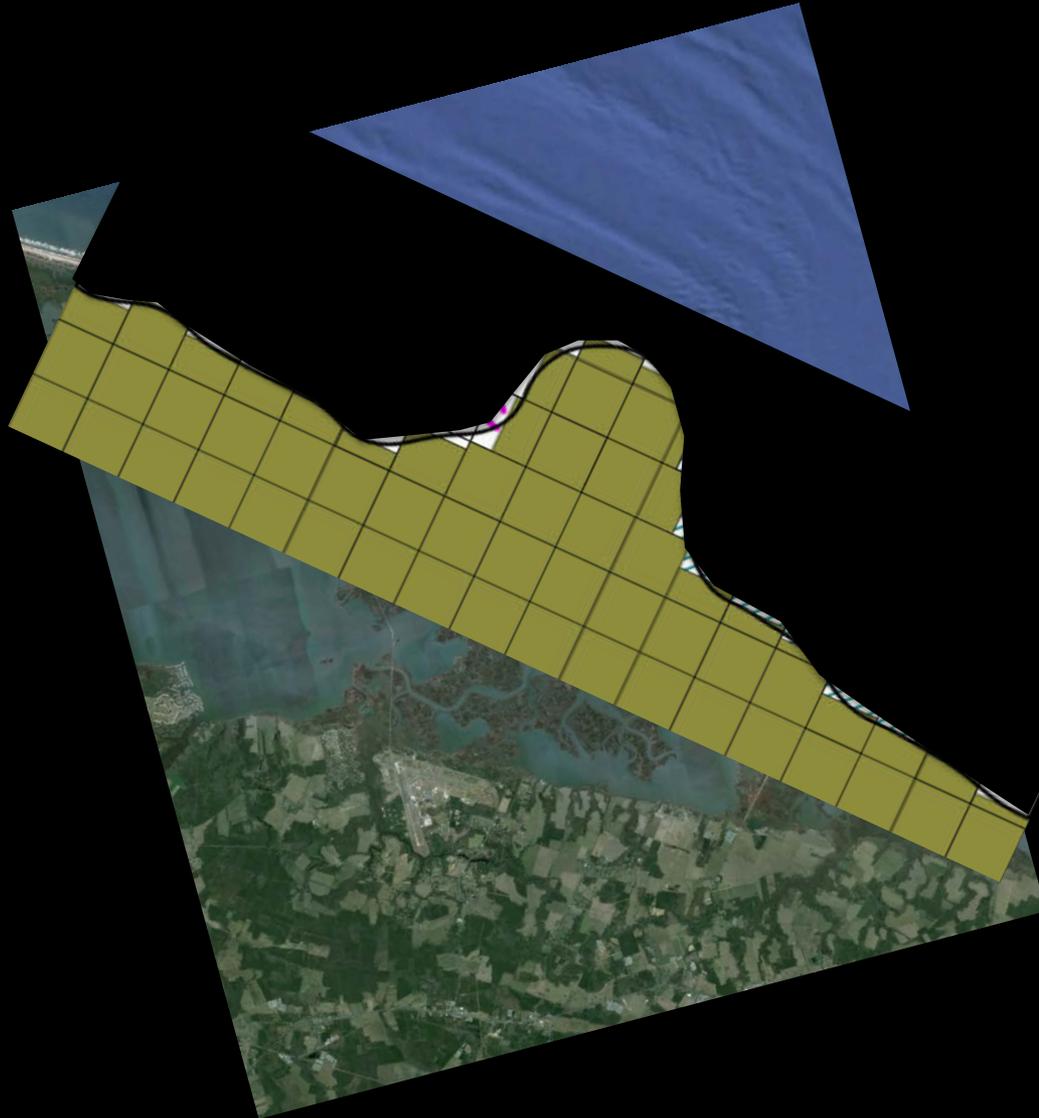
Coastline Evolution Model (CEM)



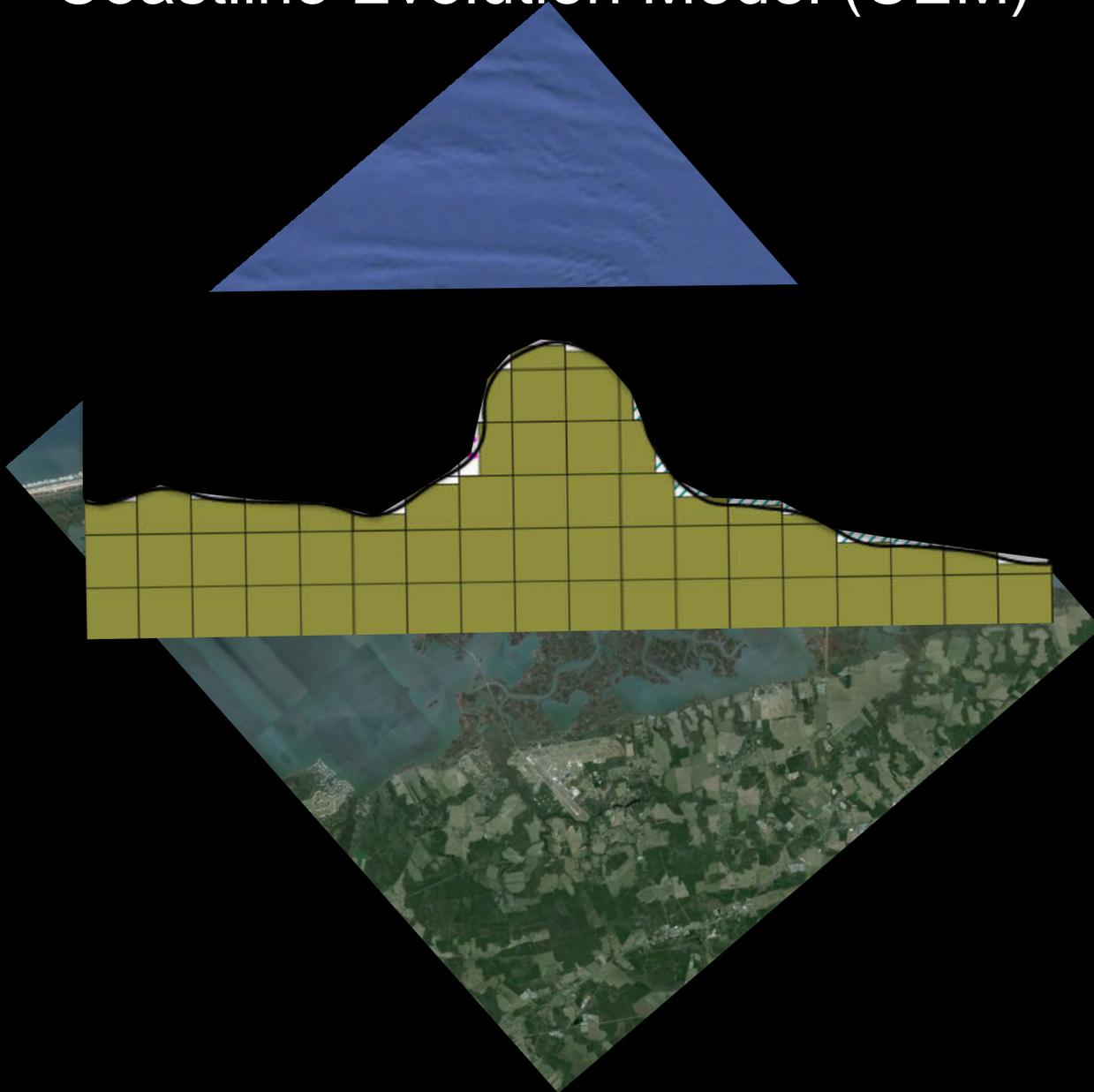
Coastline Evolution Model (CEM)



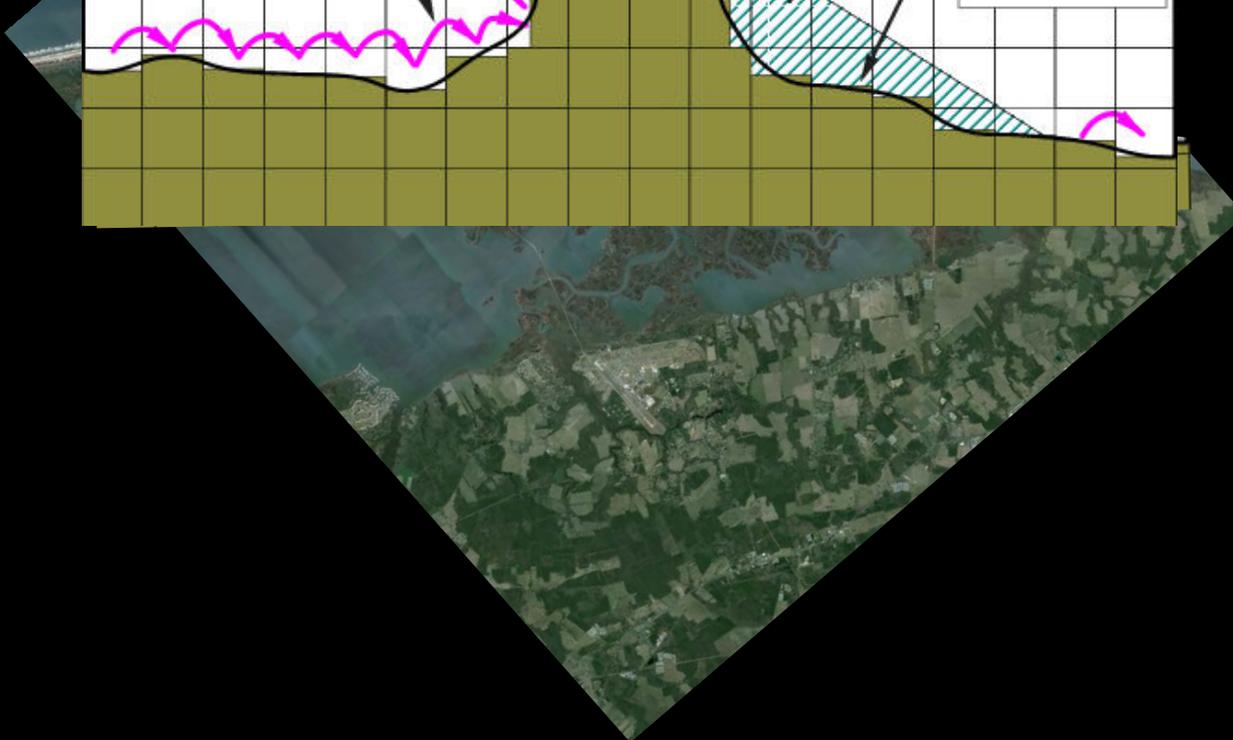
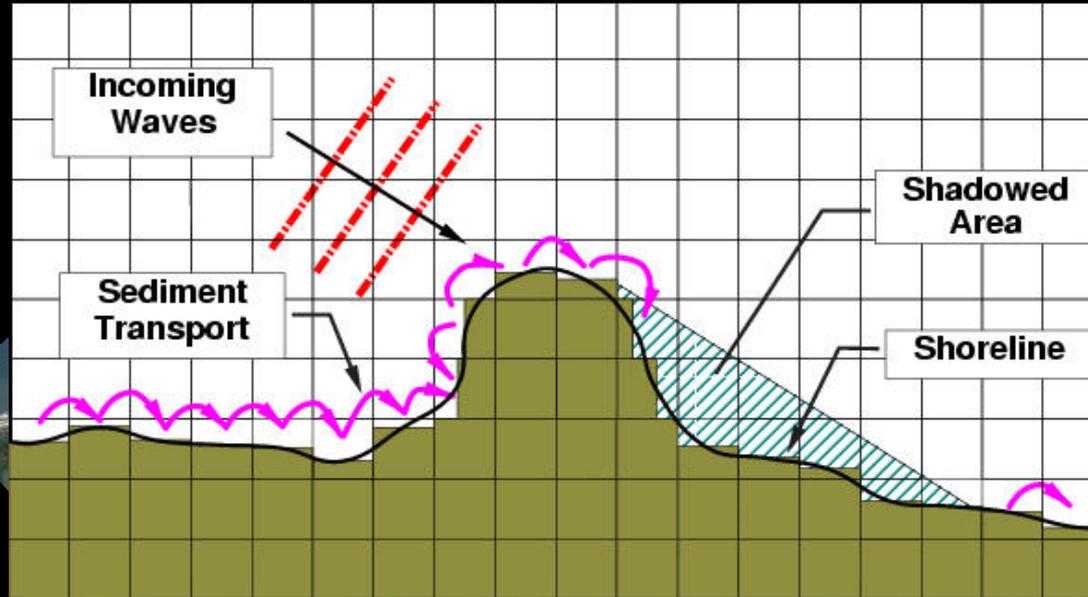
Coastline Evolution Model (CEM)



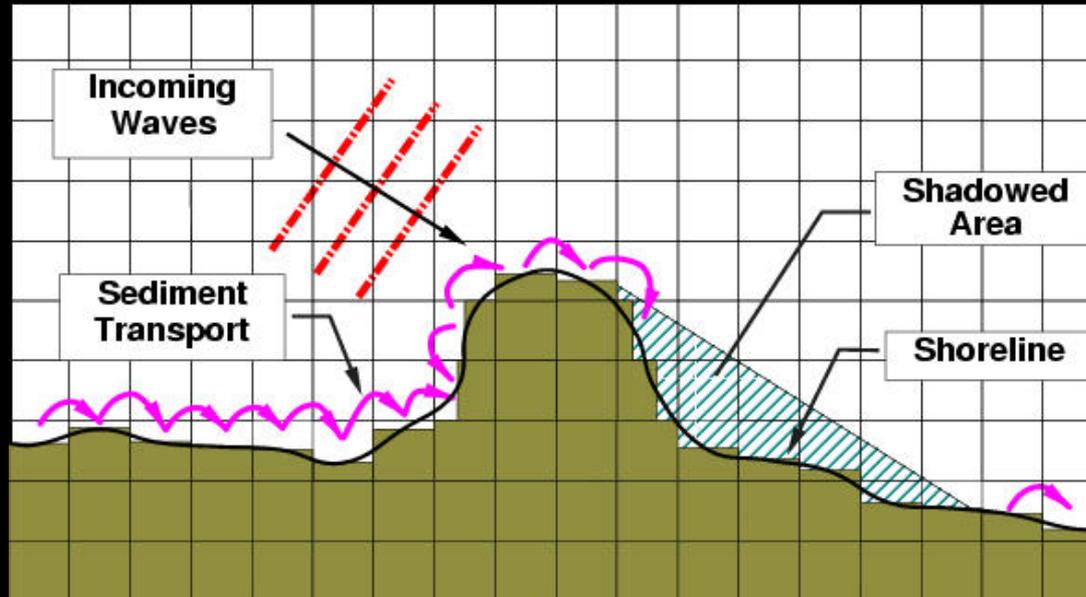
Coastline Evolution Model (CEM)



Coastline Evolution Model (CEM)

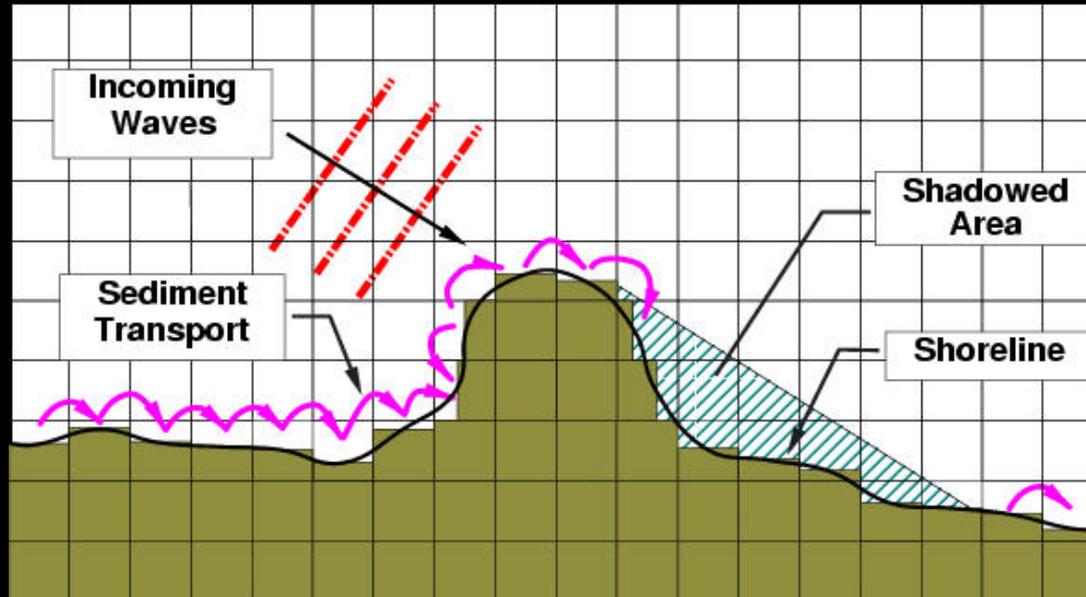


Coastline Evolution Model (CEM)



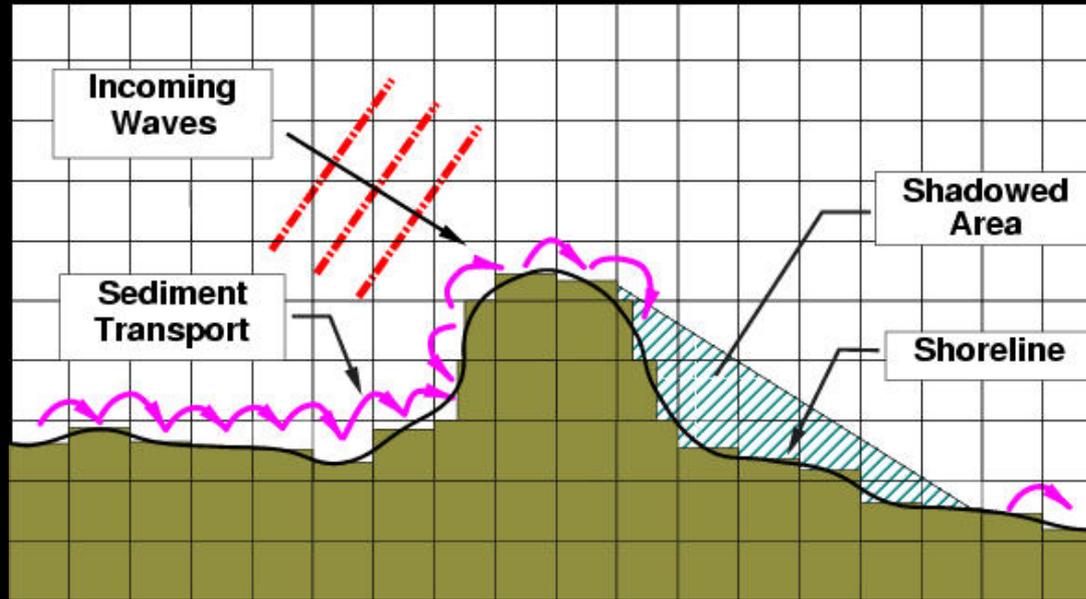
- Simulate alongshore transport
 - shoreline erosion or accretion where differences

Coastline Evolution Model (CEM)



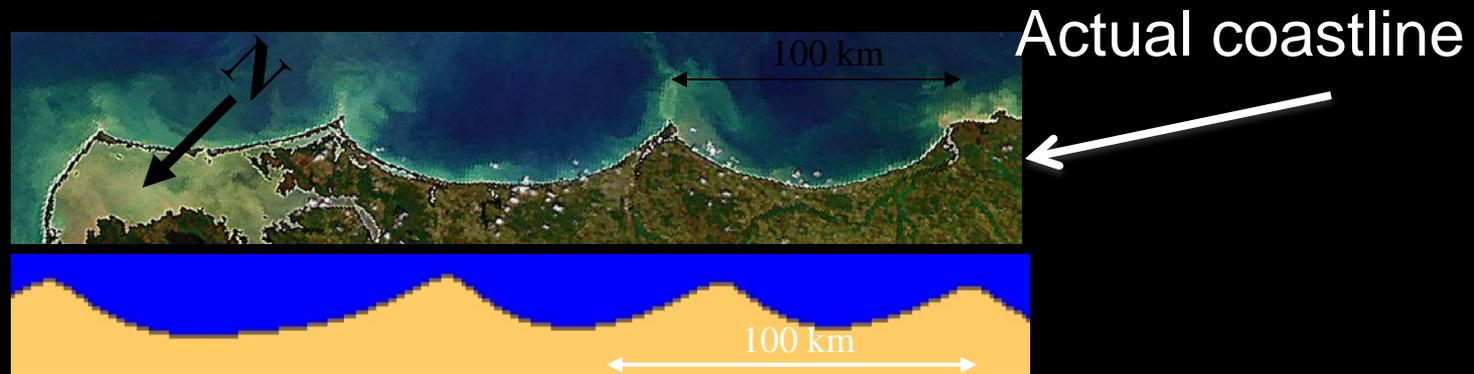
- Simulate alongshore transport
 - shoreline erosion or accretion where differences
- Simulate waves approaching shoreline
 - causes alongshore transport
 - uses a mix of wave-approach angles

Coastline Evolution Model – Application to N.C.



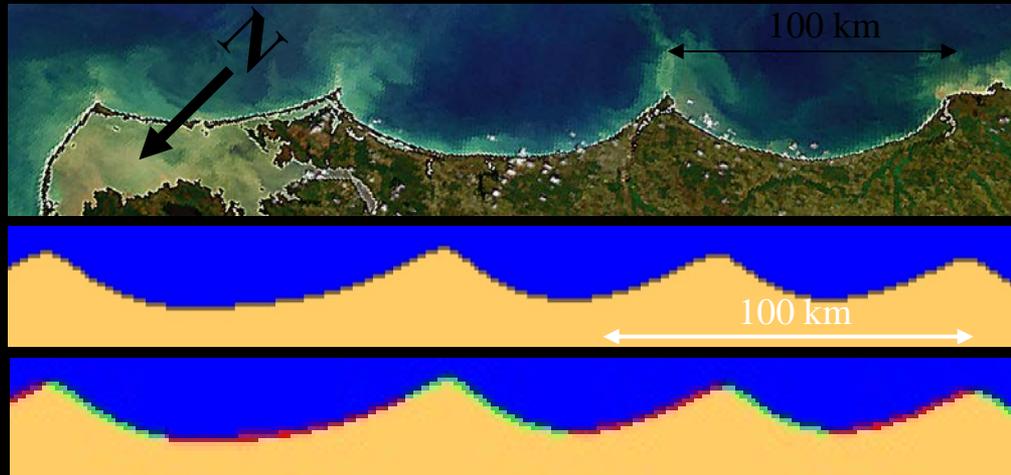
Use wave record off of
North Carolina Coast

Coastline Evolution Model – Application to N.C.

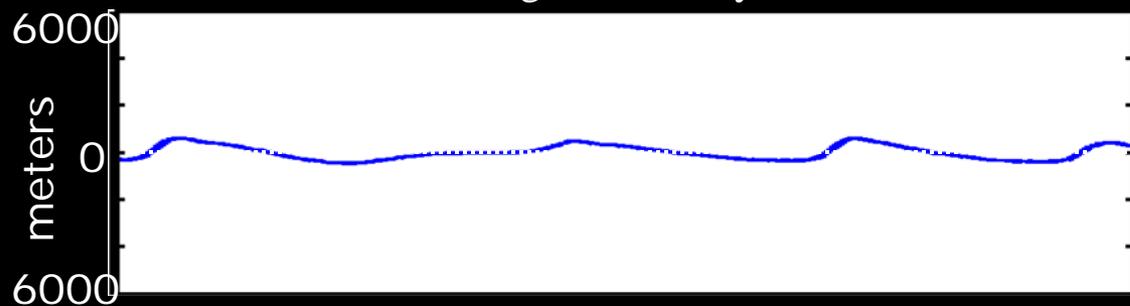


Model

Coastline Evolution Model – Application to N.C.

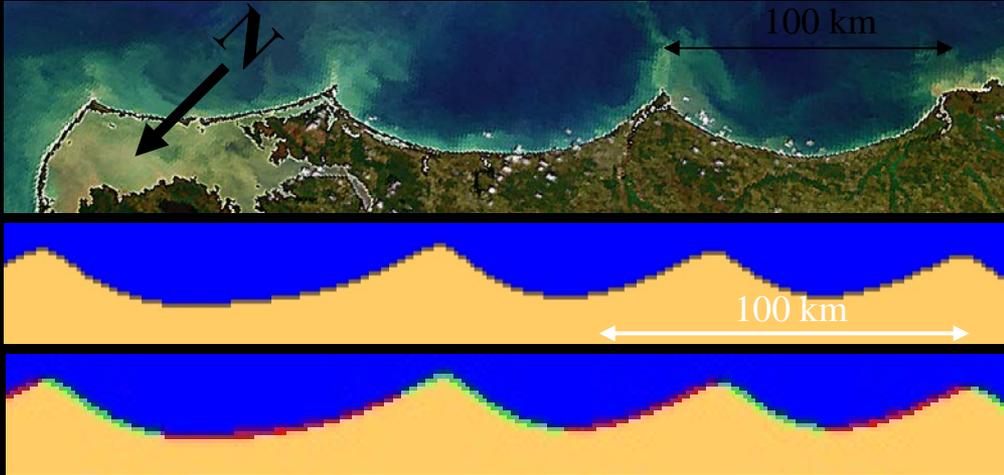


Change over 200 years

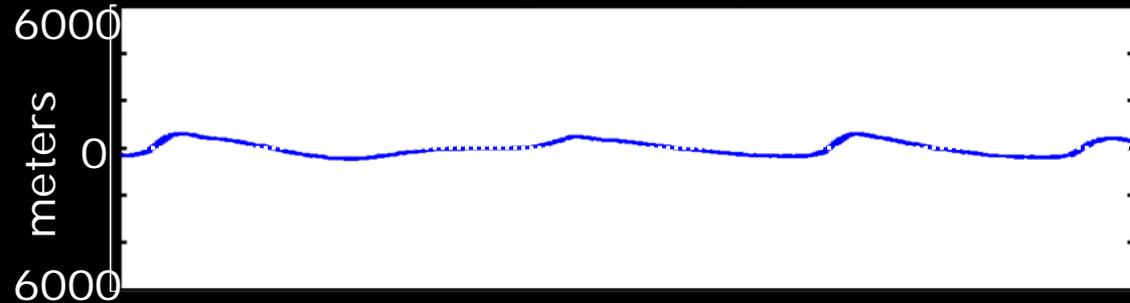


ave. magnitude of shoreline change = 1.1 m/year

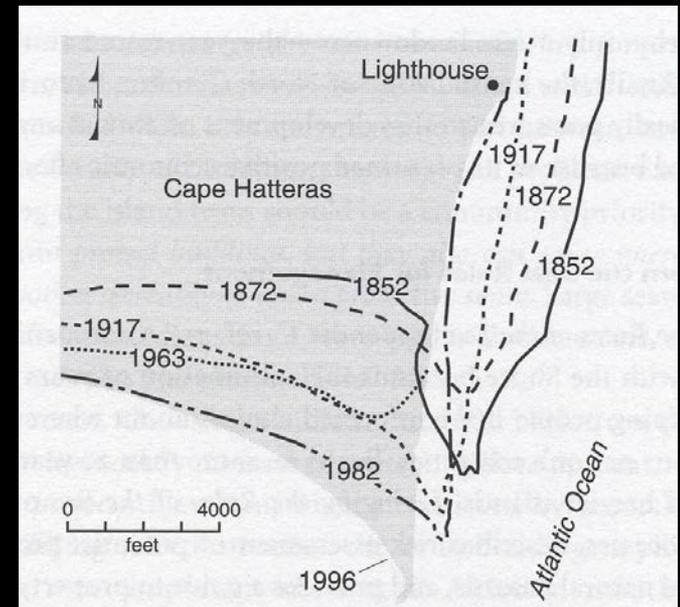
Coastline Evolution Model – Application to N.C.



Change over 200 years



ave. magnitude of shoreline change = 1.1 m/year



Observed Wave Climate Change on NC Capes

In recent decades - more hurricanes impacting NC coastline



Observed Wave Climate Change on NC Capes

In recent decades - more hurricanes impacting NC coastline



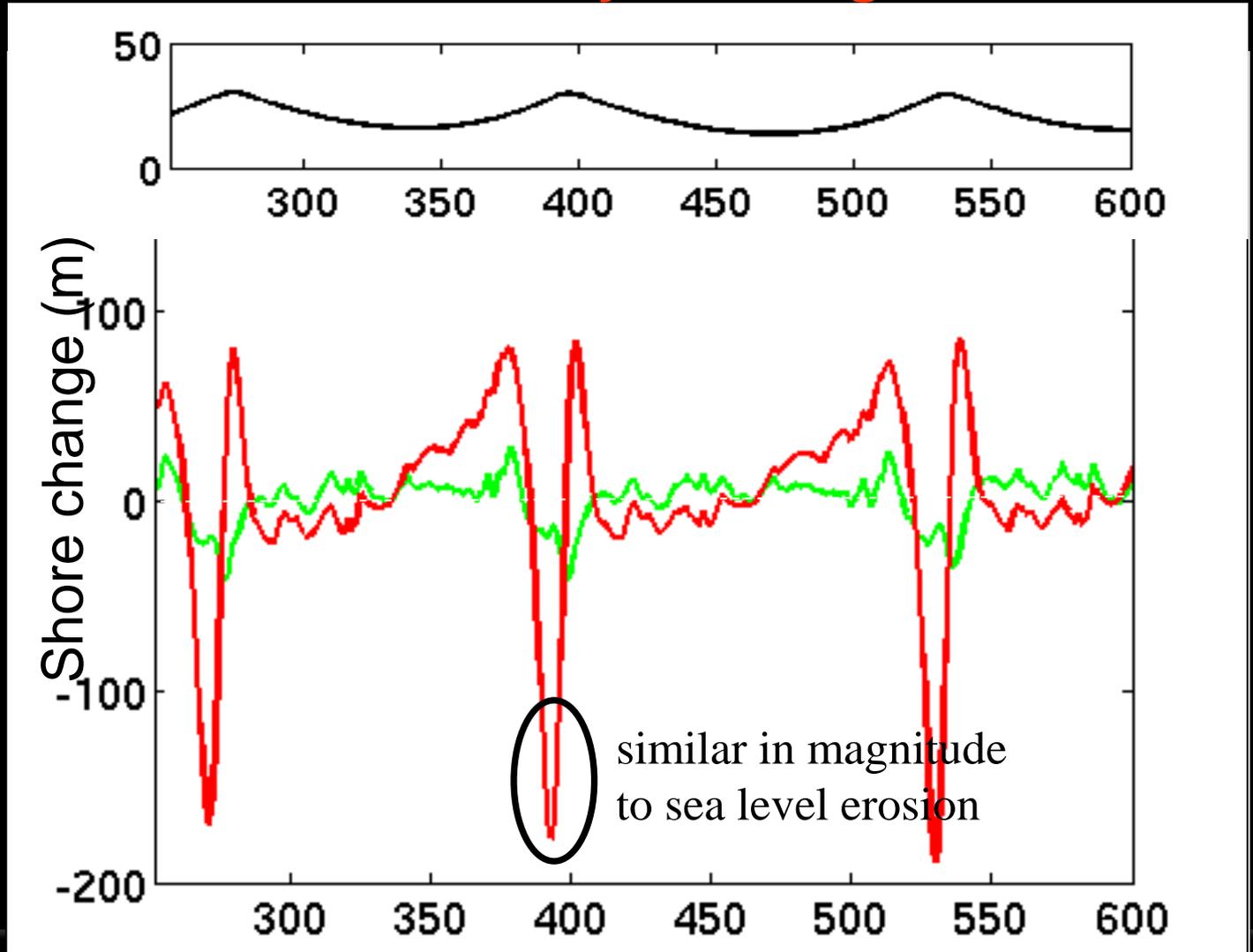
this leads to changes in coastline shape

Observed Wave Climate Change on NC Capes

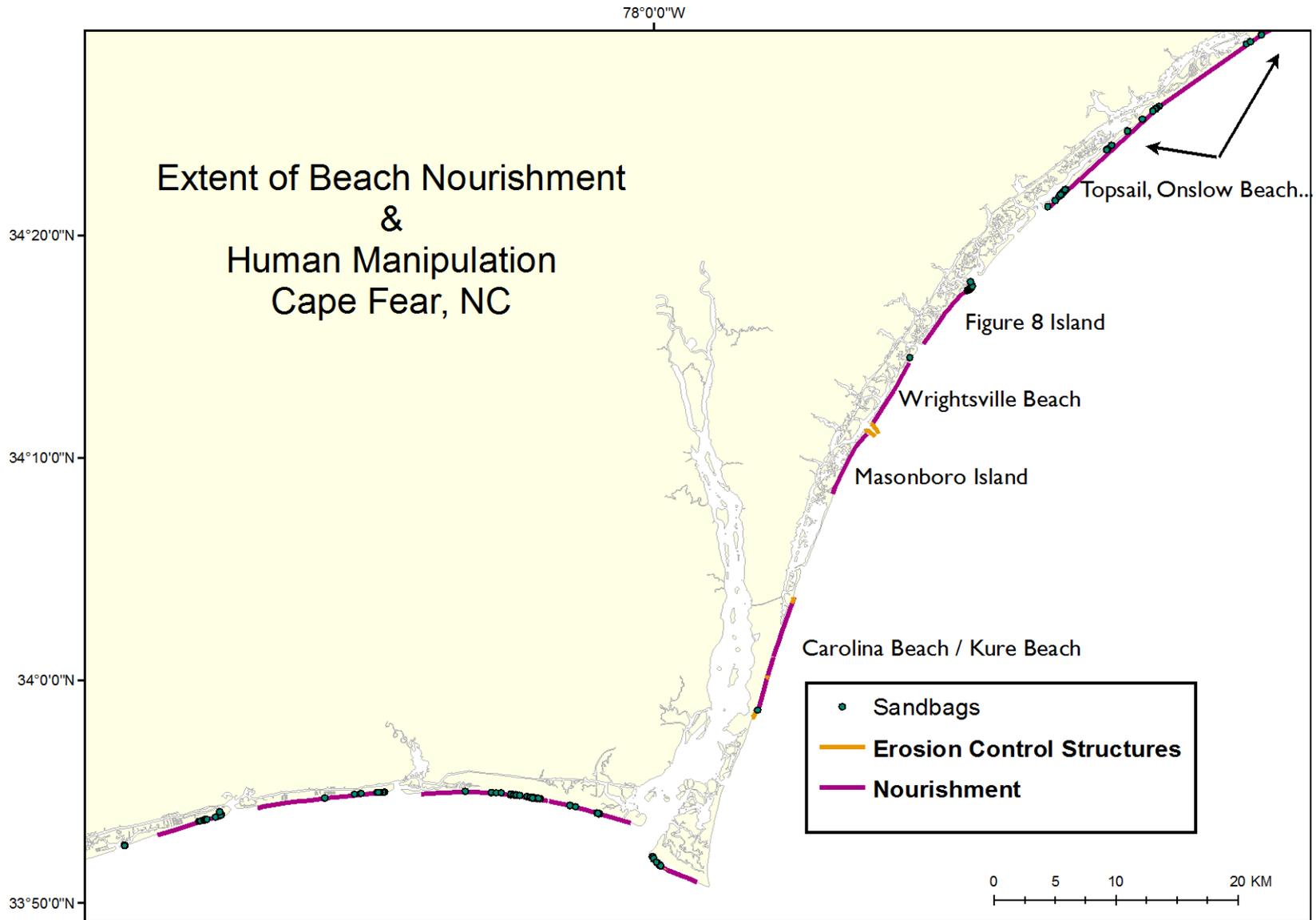
Observed Wave Climate Change on NC Capes

Green = 100 yrs, no change

Red = 100 yrs, changed climate



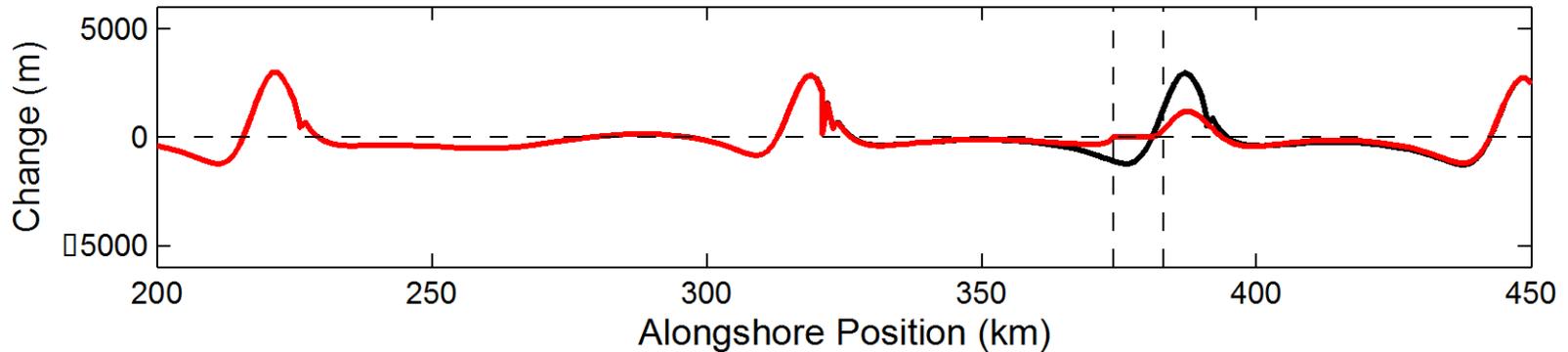
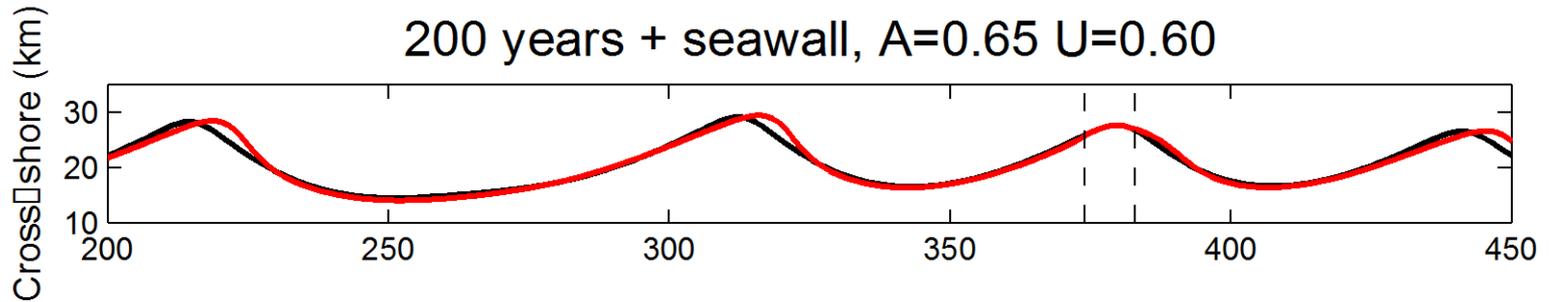
Heavily Manipulated



Change due to hard structures



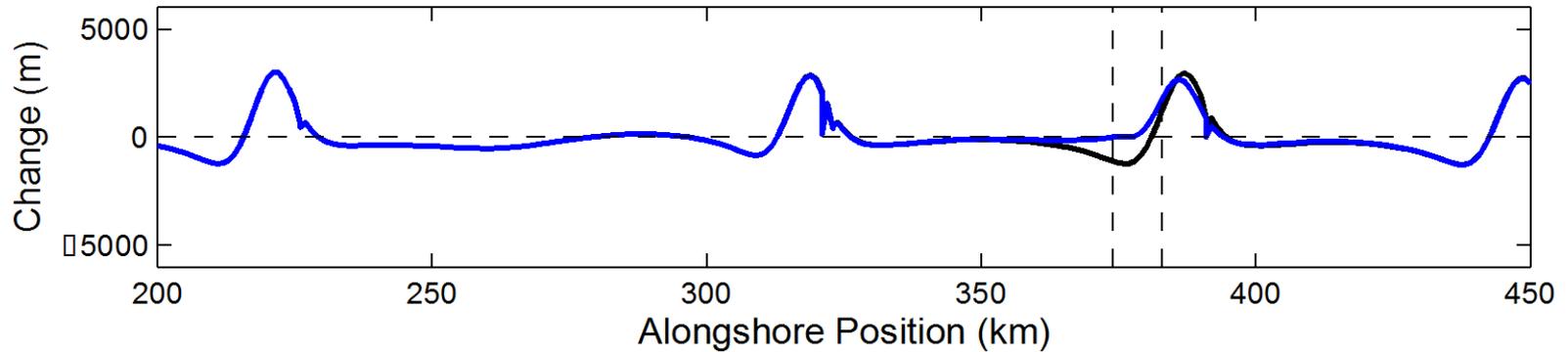
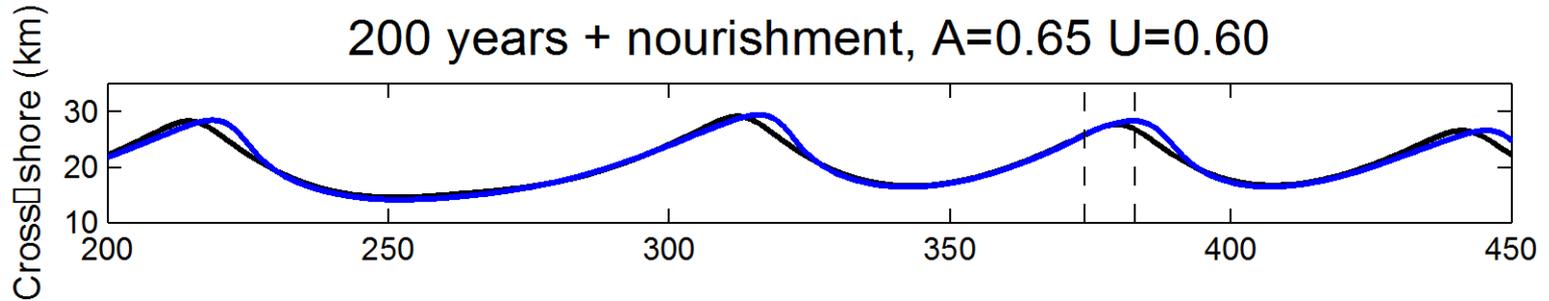
200 years + seawall, $A=0.65$ $U=0.60$



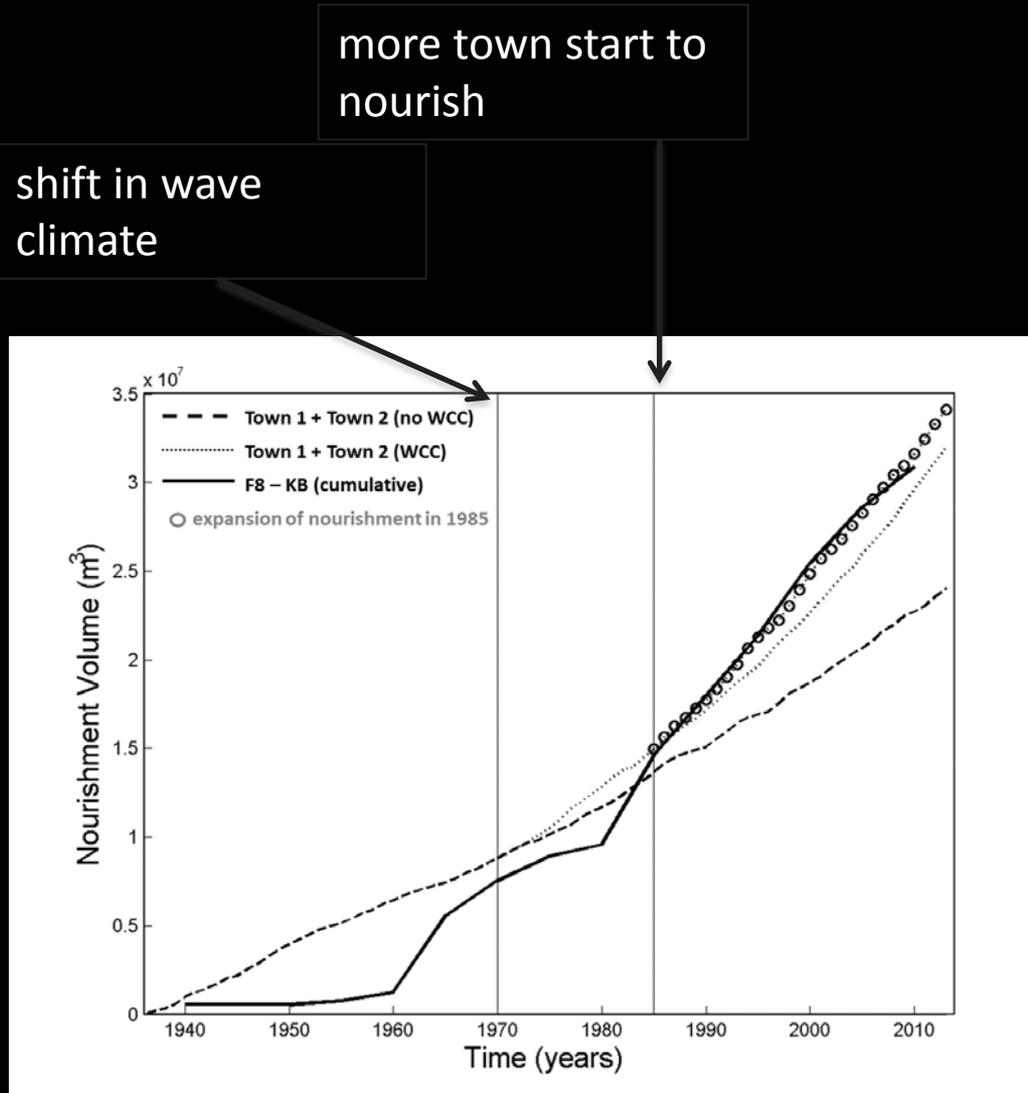
Change due to nourishment



200 years + nourishment, $A=0.65$ $U=0.60$



Change due to nourishment



Coastline Evolution Model (CEM)

- Reproduces Carolina coastline
- Reveals coastline changes due to storm climate change – CAN BE HUGE!!!
- Shows how nourishment impacts coast on 10-100's km scale
- Shows how armoring impacts coast on 10-100's km scale

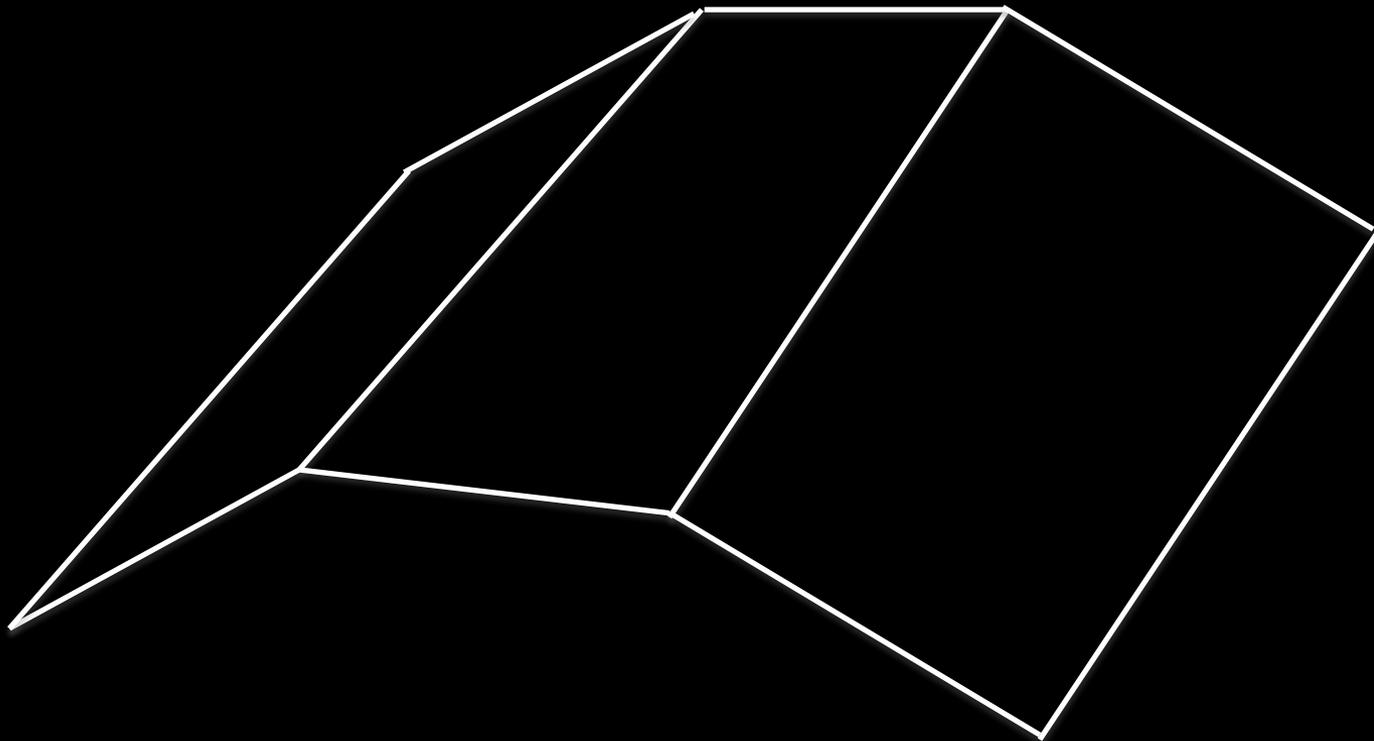
Barrier Island Model (BIM)



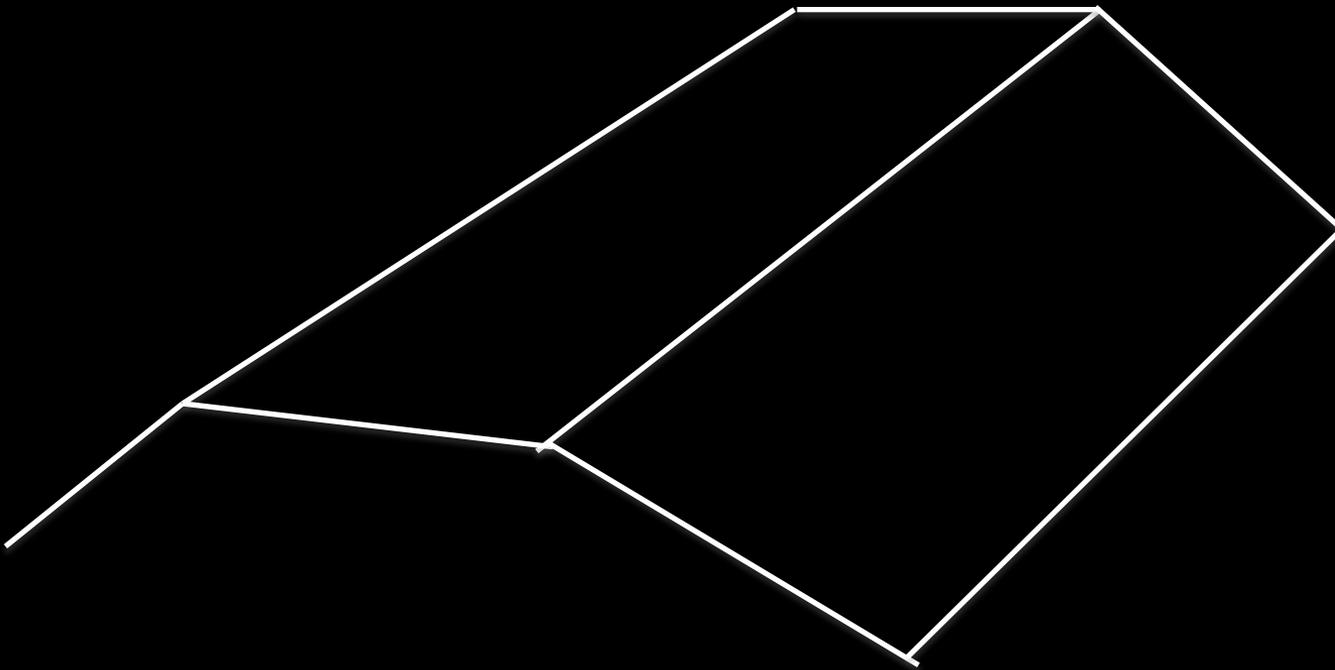
Barrier Island Model (BIM)



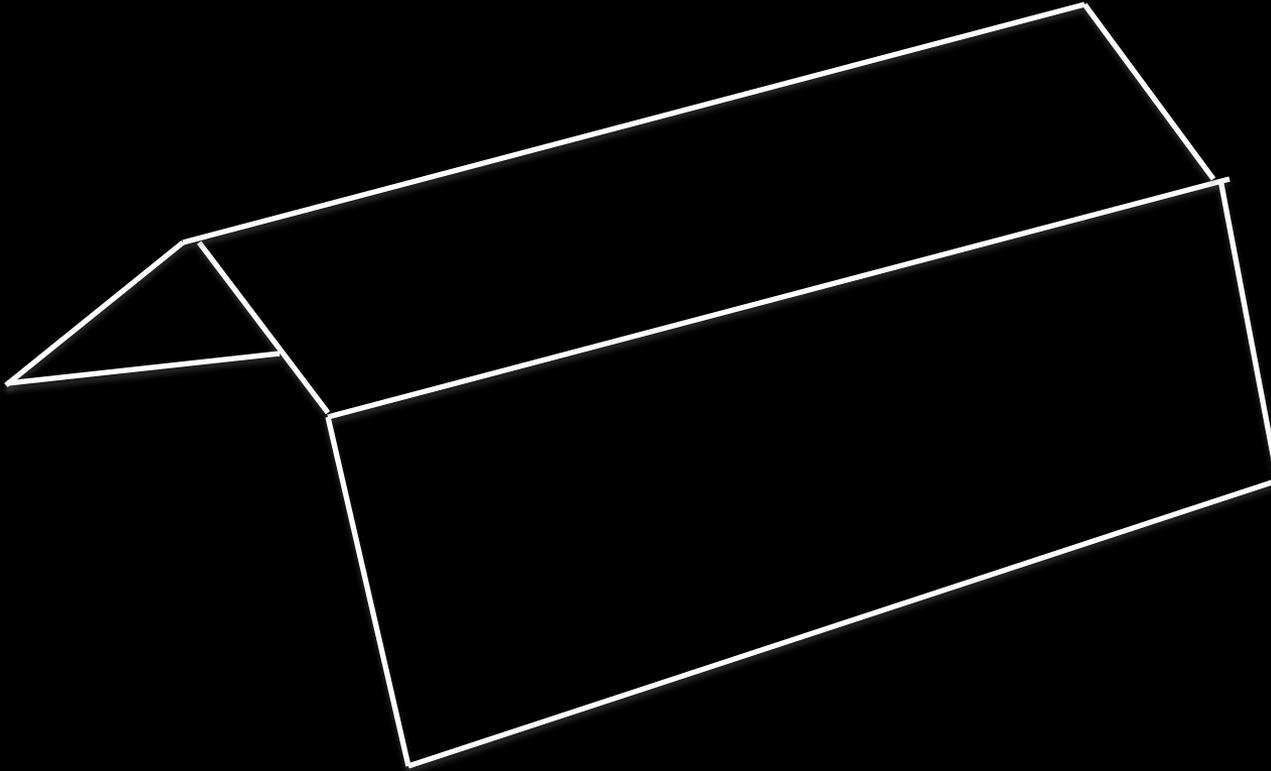
Barrier Island Model (BIM)



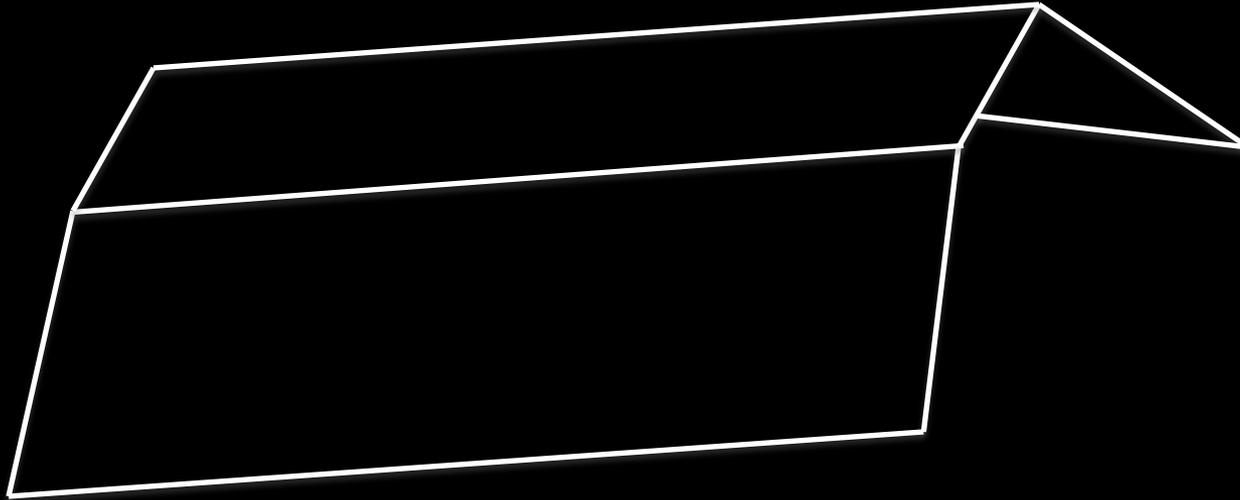
Barrier Island Model (BIM)



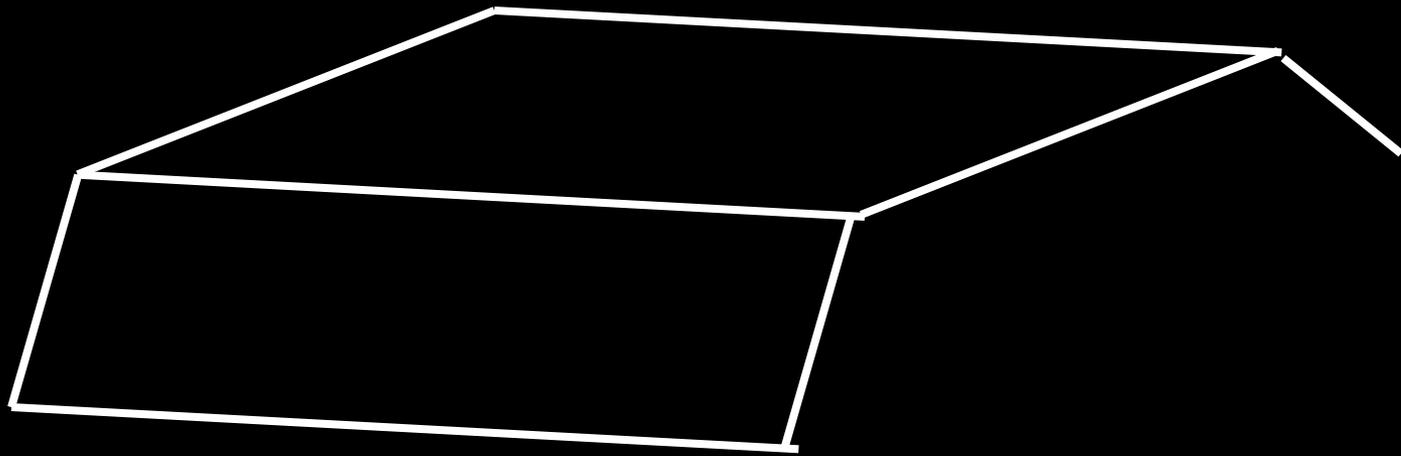
Barrier Island Model (BIM)



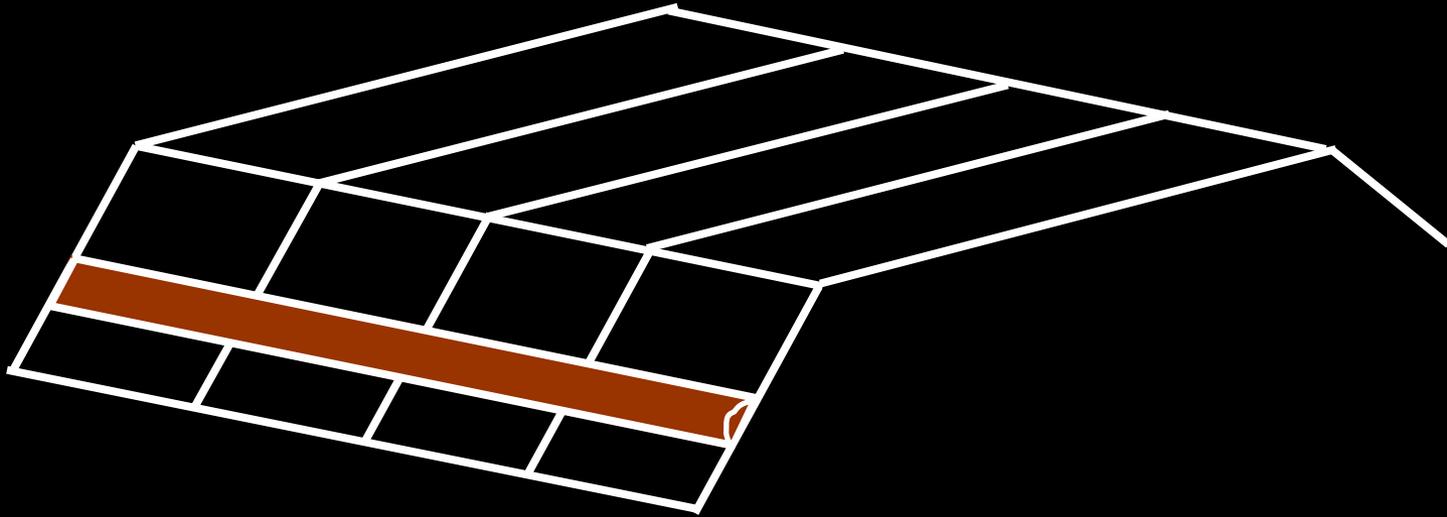
Barrier Island Model (BIM)



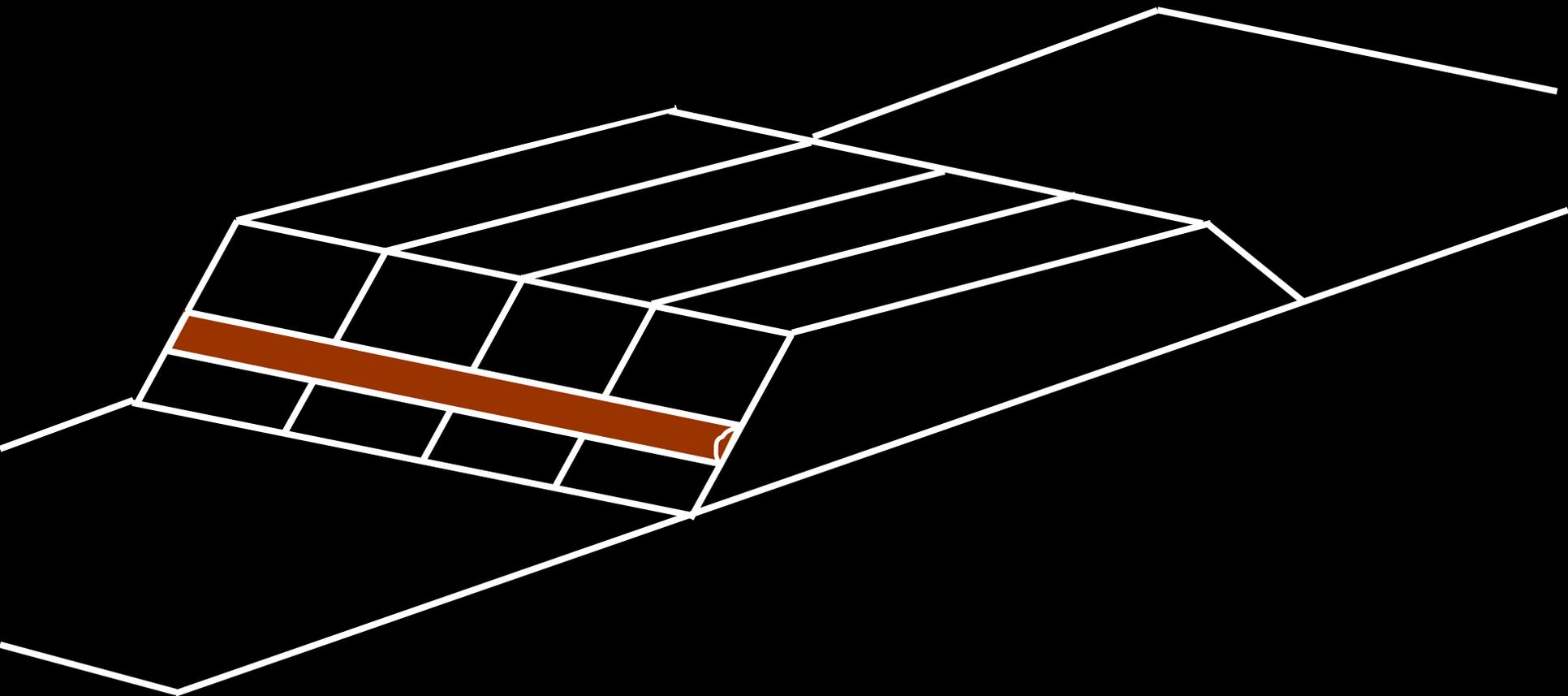
Barrier Island Model (BIM)



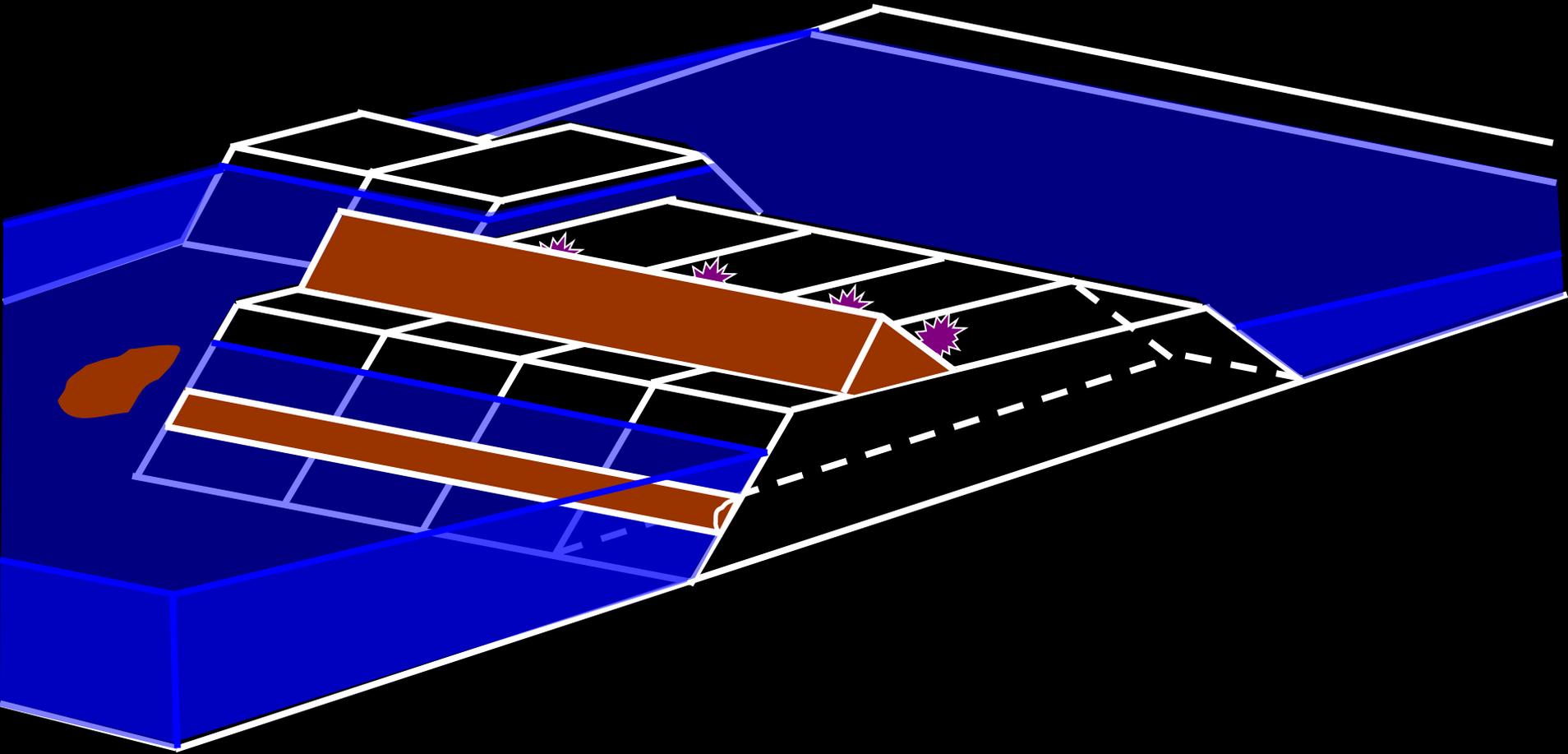
Barrier Island Model (BIM)



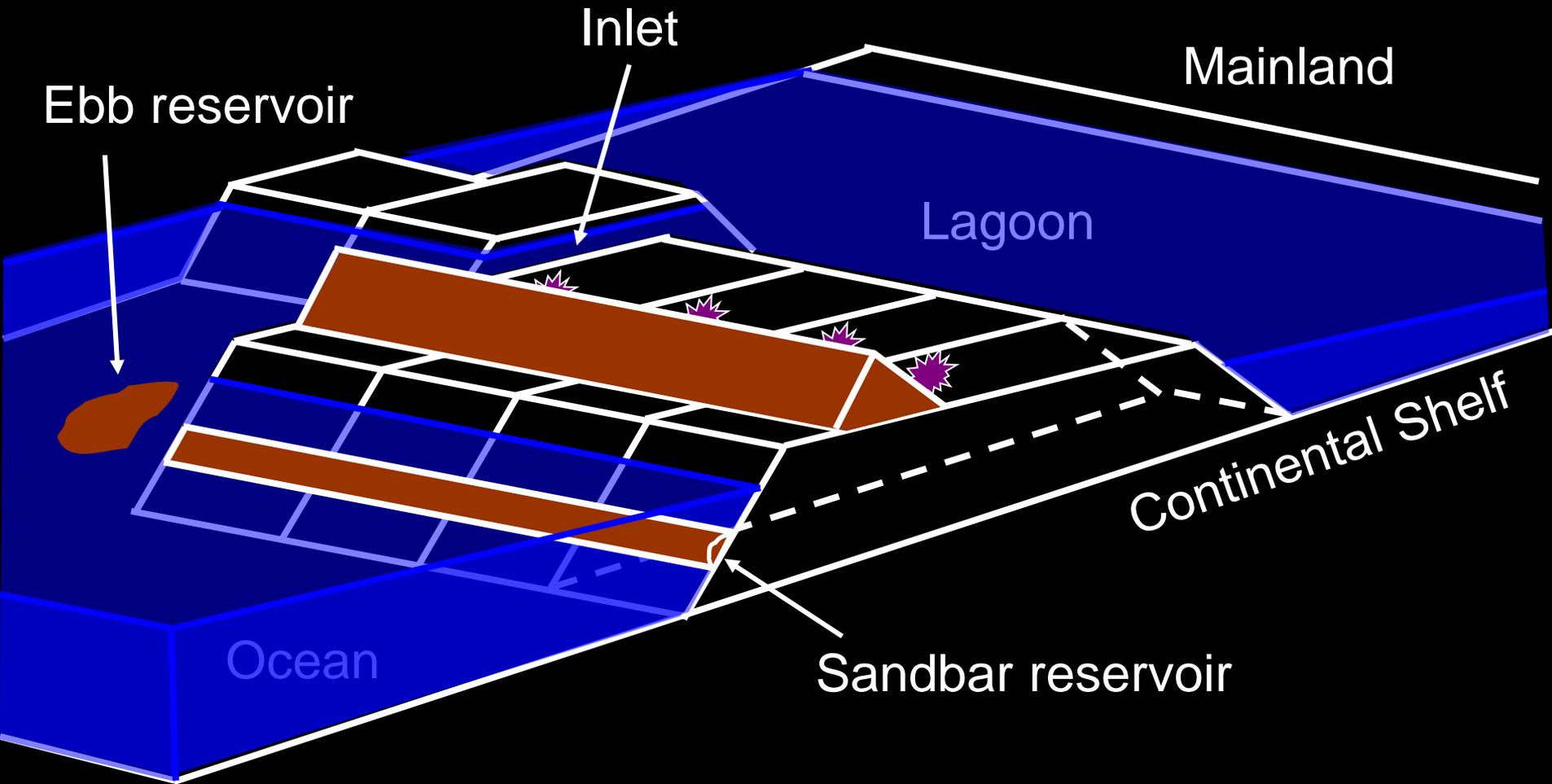
Barrier Island Model (BIM)



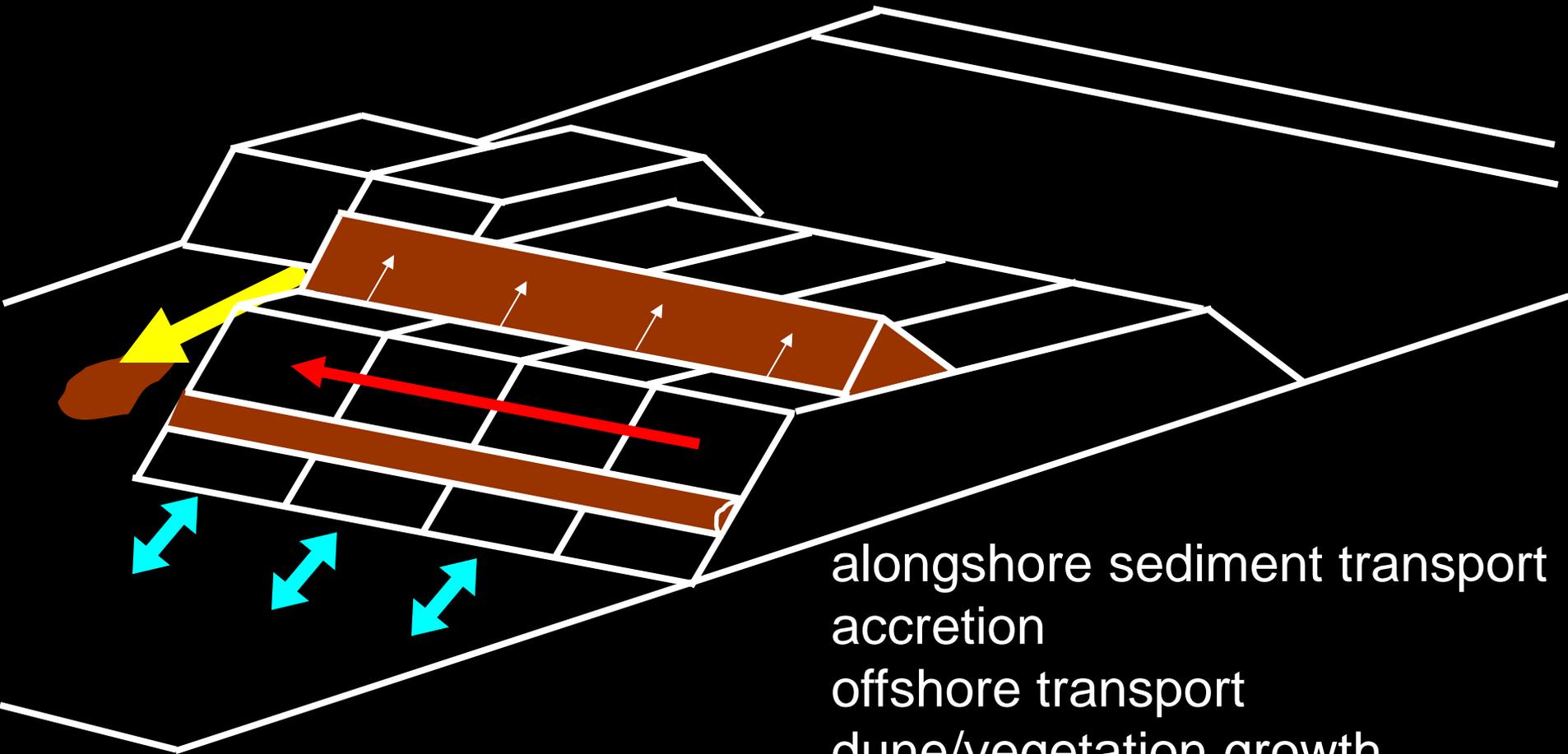
Barrier Island Model (BIM)



Barrier Island Model (BIM)

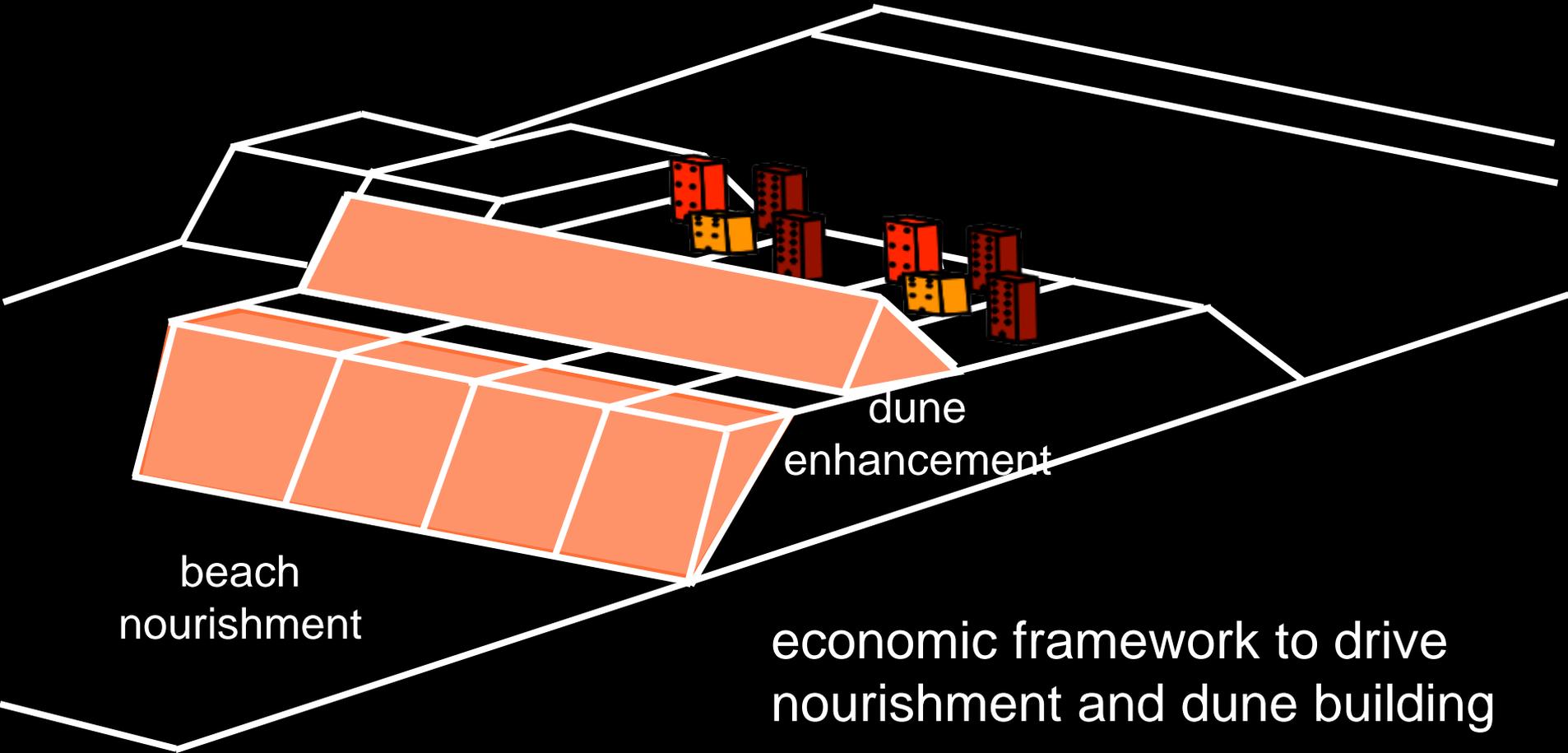


Barrier Island Model (BIM)



alongshore sediment transport
accretion
offshore transport
dune/vegetation growth
inlet transport

Barrier Island Model (BIM)

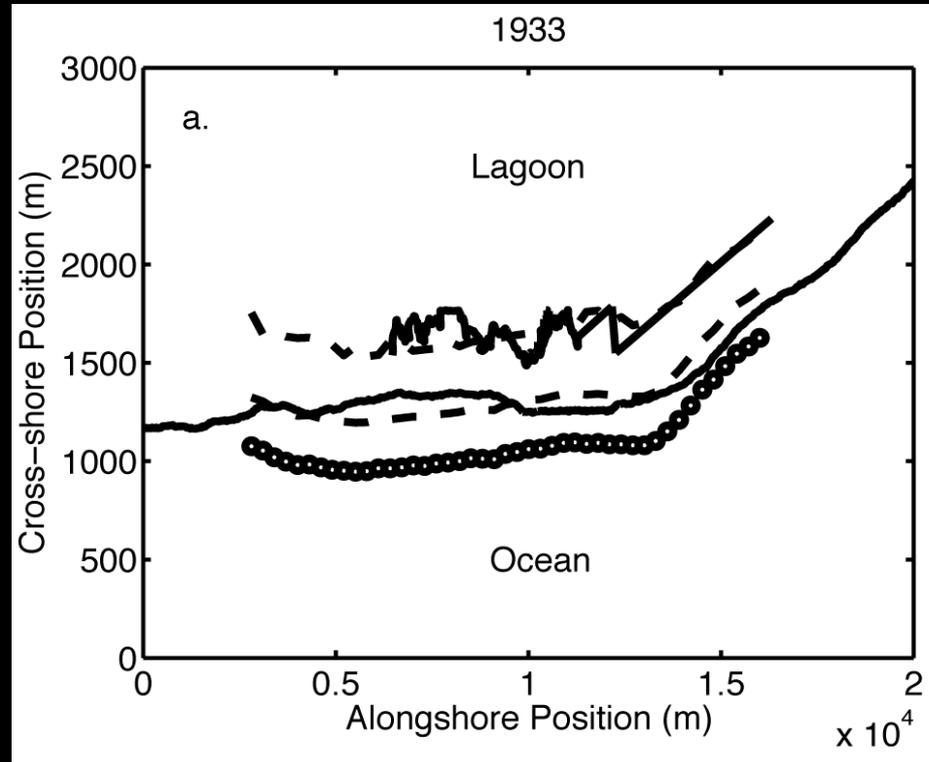


Barrier Island Model: Application Ocean City, MD



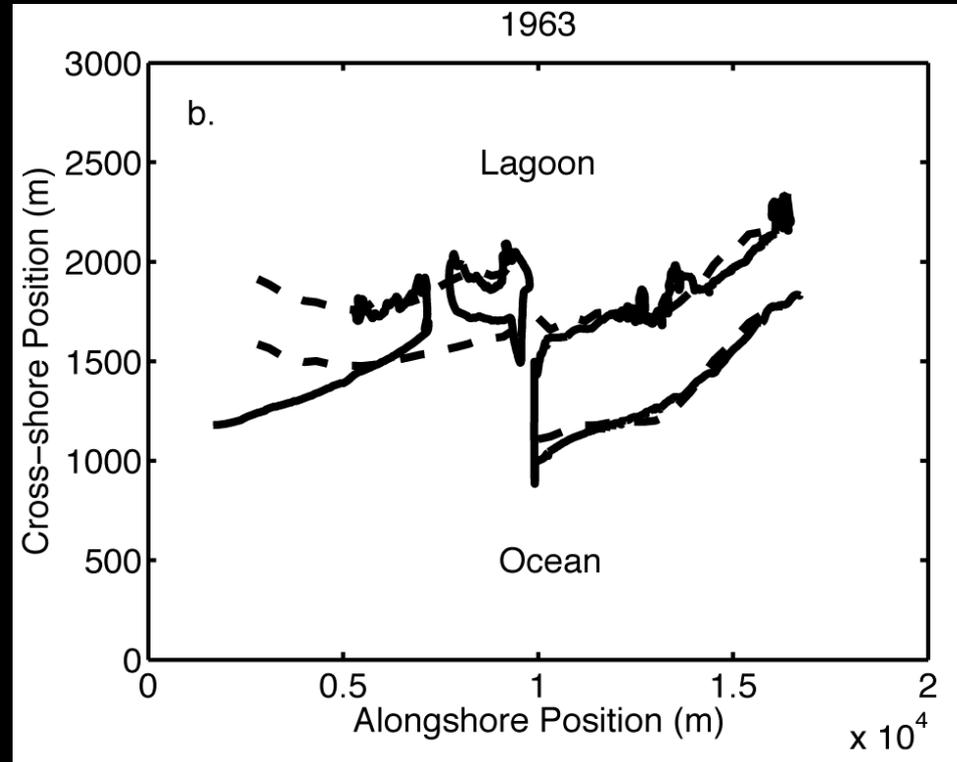
Barrier Island Model: Application Ocean City, MD

—
Measurements
- - -
Model



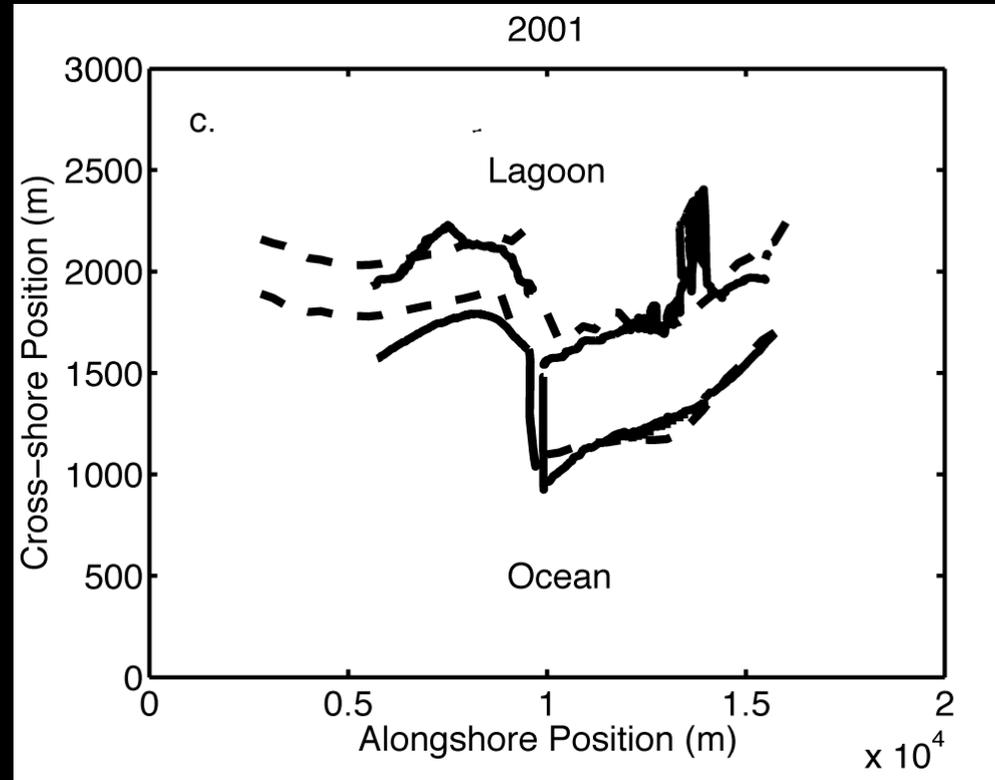
Barrier Island Model: Application Ocean City, MD

—
Measurements
- - -
Model

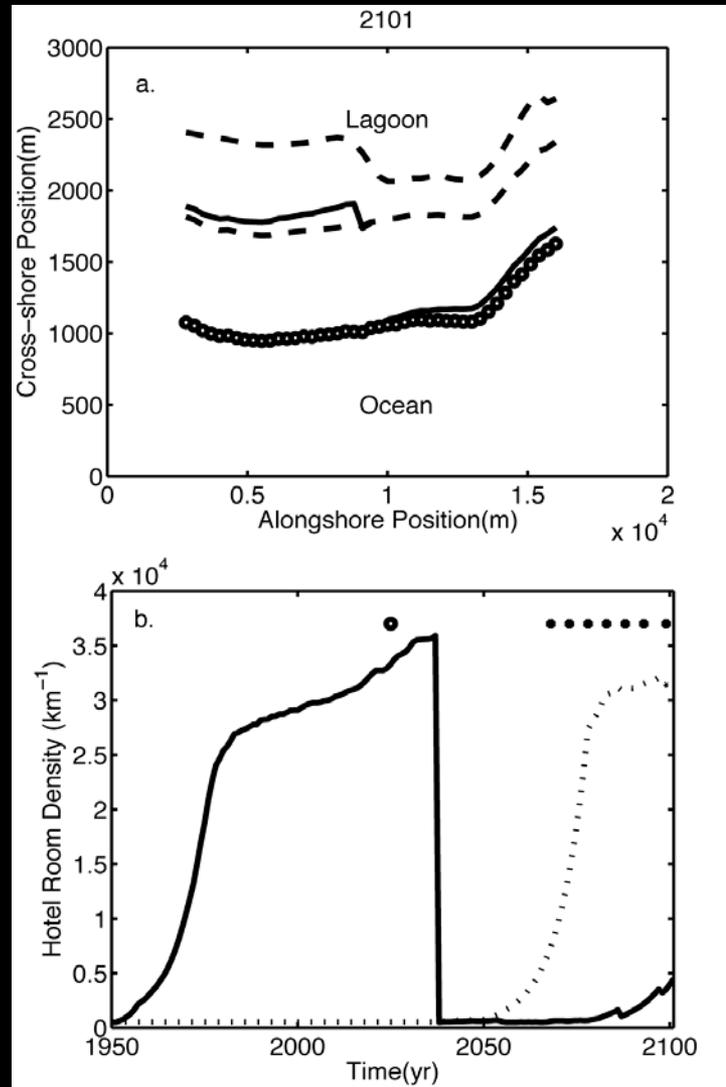


Barrier Island Model: Application Ocean City, MD

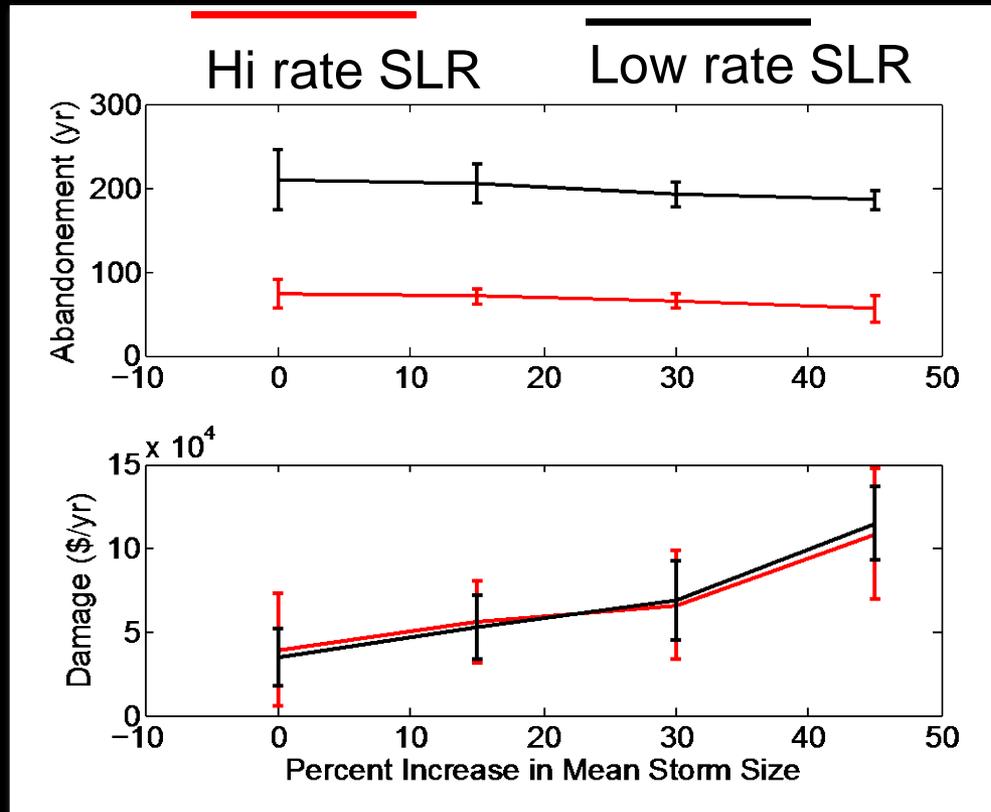
—
Measurements
- - -
Model



Barrier Island Model: Application Ocean City, MD

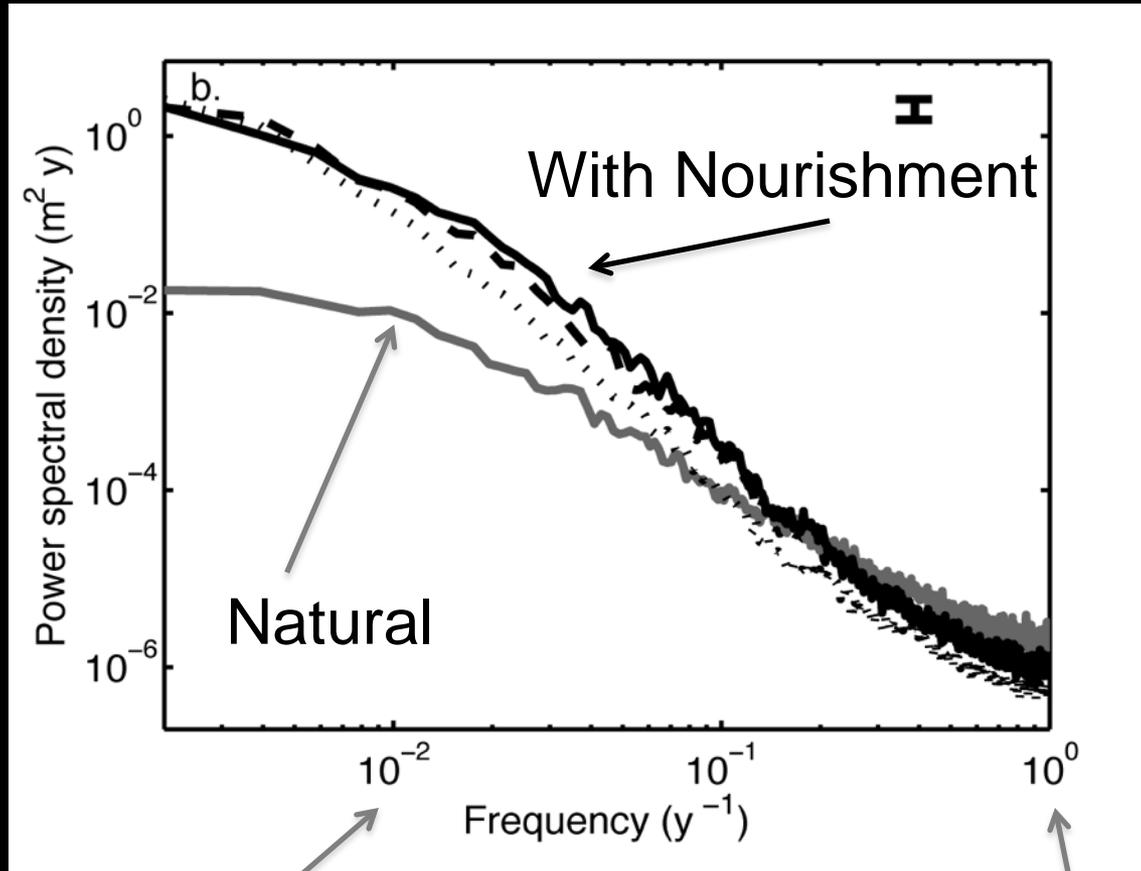


Barrier Island Model: Application Ocean City, MD



Barrier Island Model: Application Ocean City, MD

How Much Barrier Changes



Infrequent Storm

Frequent Storms

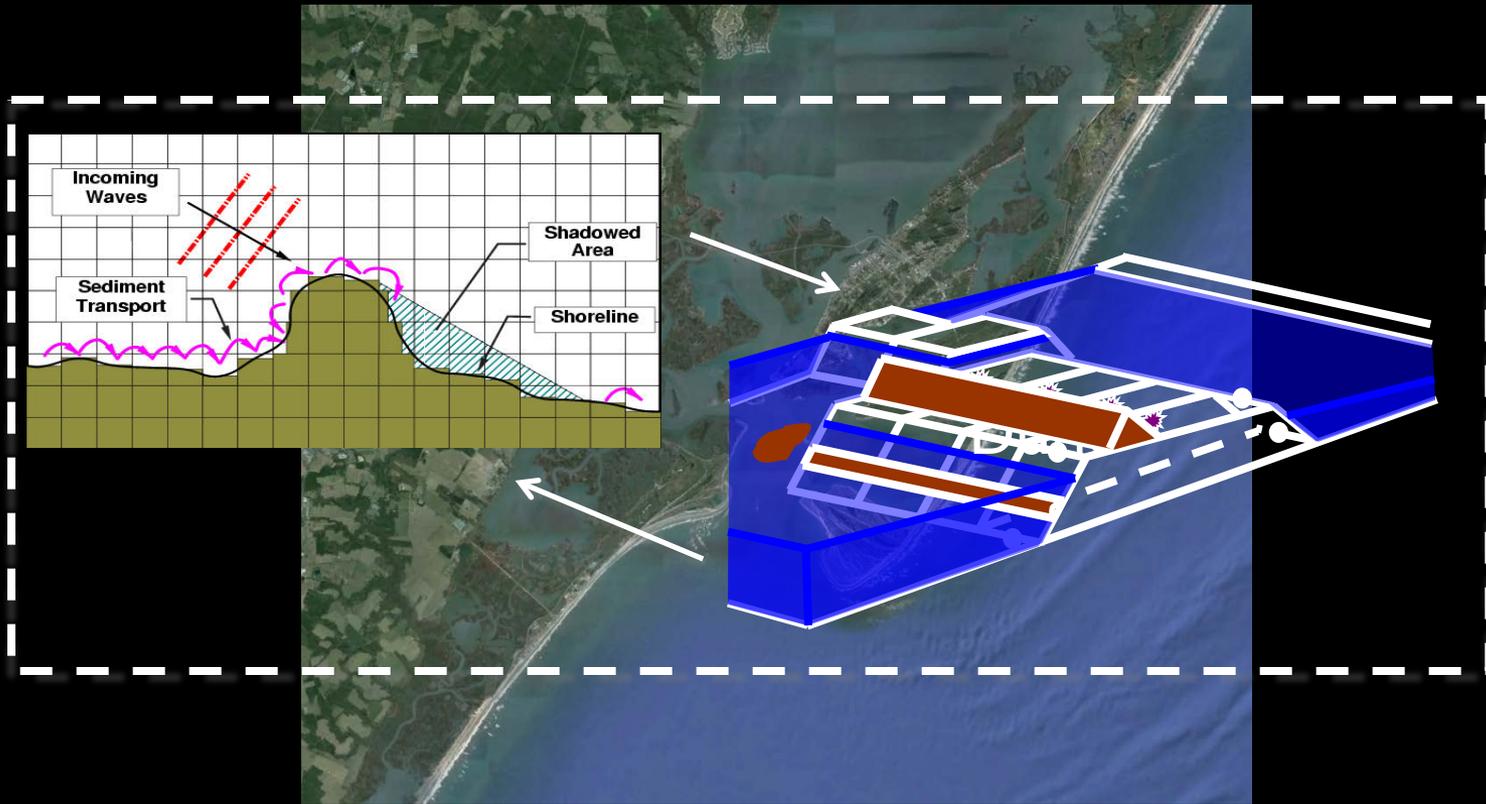
Barrier Island Model (BIM)

- Reproduces Ocean City coastline
- Abandonment
- Shows impact of overwash prevention

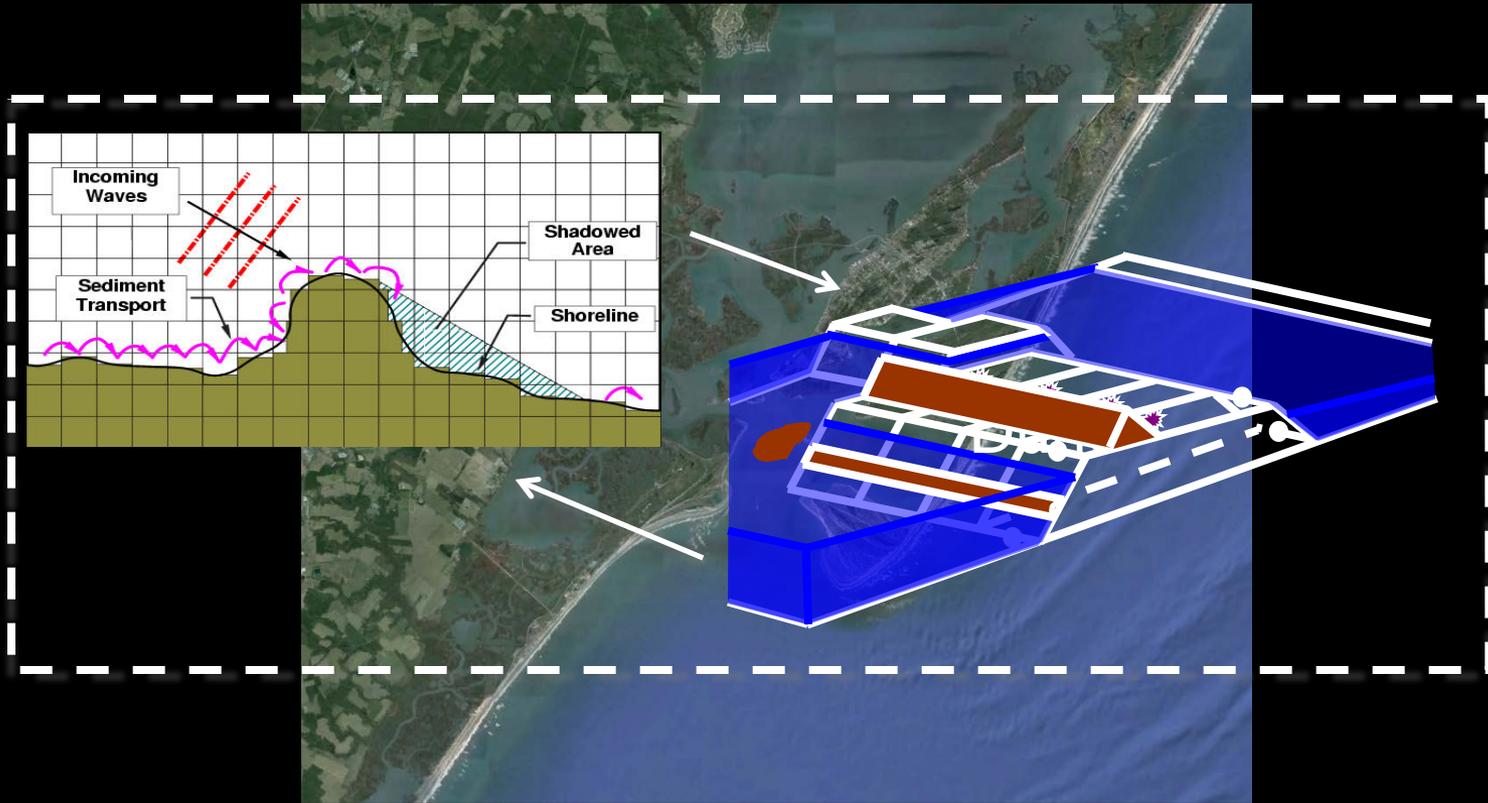
CEM + BIM



CEM + BIM



CEM + BIM



Address following issues:

- 1) Various management approaches (seawalls, nourishment, etc)
- 2) Various SLR and storm scenarios