Investigating the Roles of Wind Speed and Sediment Supply on Continental Shelf Dynamics

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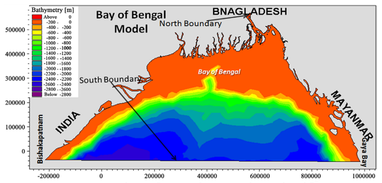
BACKGROUND

The processes of how continental shelves form is unclear. Most of the continental shelves that we see today have already been established since the Last Glacial Maximum[1].

There are some modern examples of constructional shelves forming, but the sediment composition is primarily silty and muddy, not sandy[2].

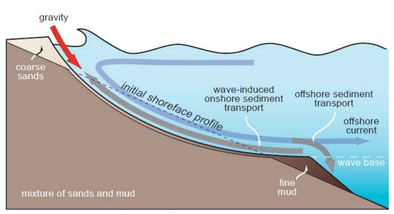


Example of modern silty shelf[3]

Stratigraphic records show that sand is a major component of the continental shelf[4].

Can we create a simple set up in which we can control the factors affecting shelf geometry in the lab?

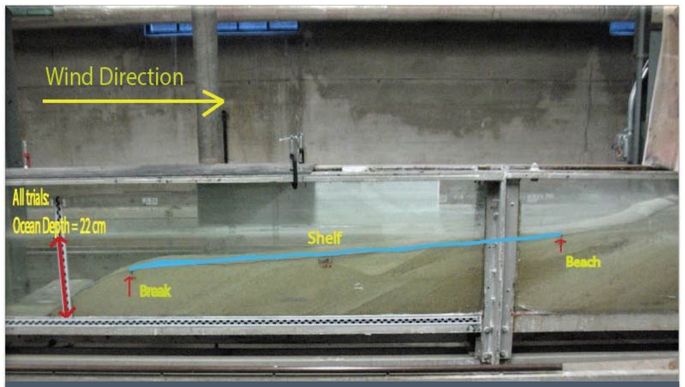
The goal of this project is use gravity-fed downwelling current[5] as the driving force of an evolving continental shelf sediment delivery system using sand.



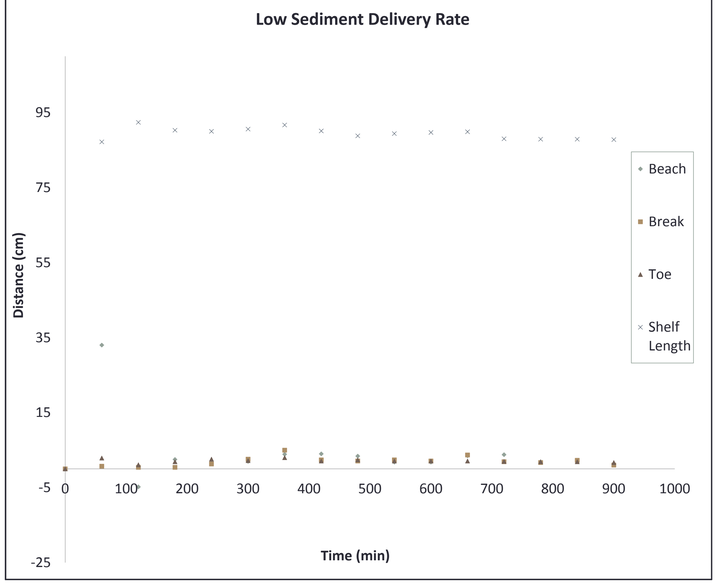
Pratson et. al. 2007

RESULTS

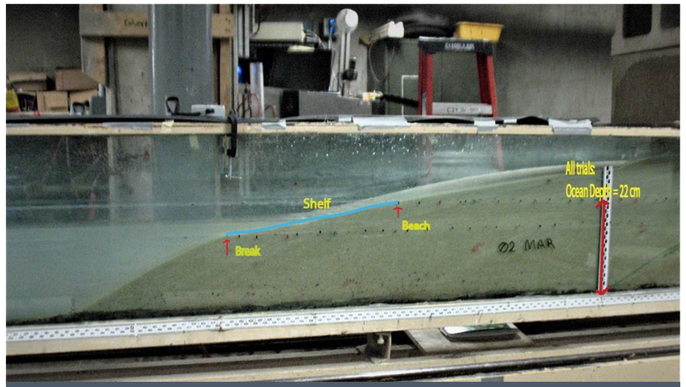
Low Sediment Delivery Rate



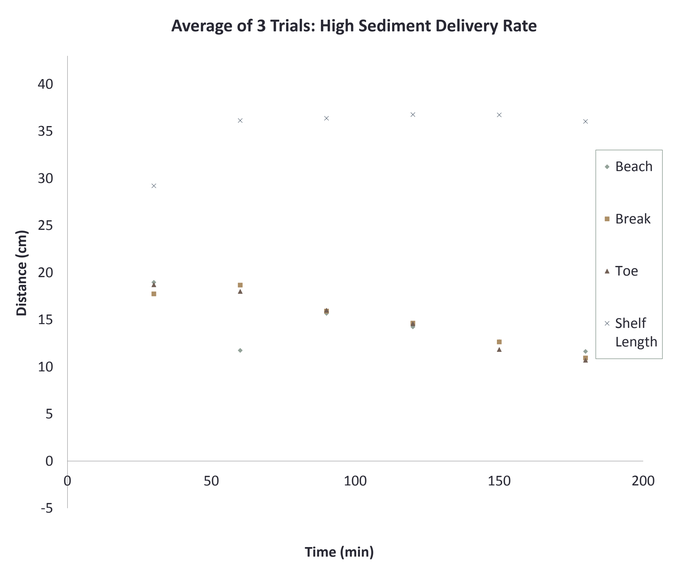
- Water in/out: 0.03 L/sec
- Sediment Feed Rate: 0.22 mL/sec
- Wind min/max: 12.8/60 mps
- Avg Shelf Length: 89.4 cm



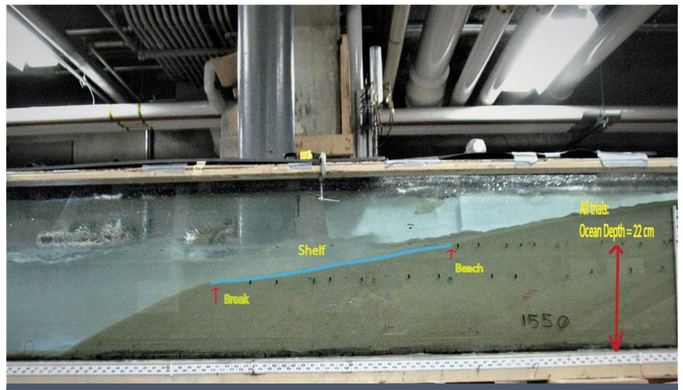
High Sediment Delivery Rate



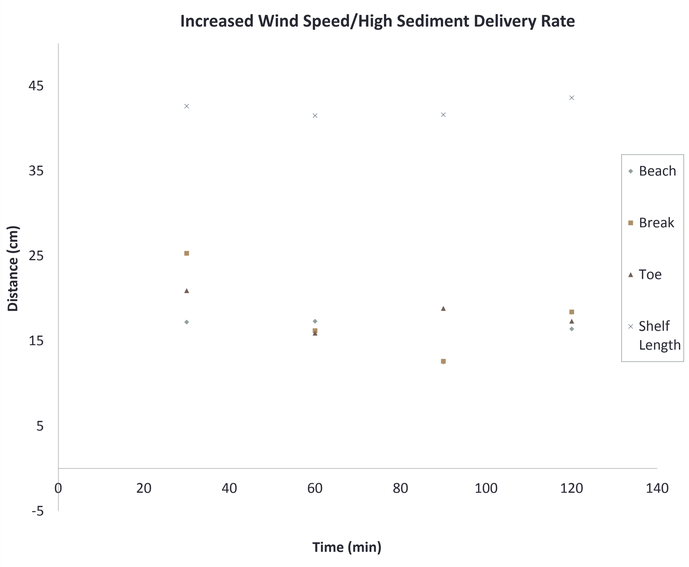
- Water in/out: 0.035 L/sec
- Sediment Feed Rate: 4.69 mL/sec
- Wind min/max: 10.4/60.6 mps
- Avg Shelf Length: 35.2 cm



Increased Wind Speed/ High Sediment Rate



- Water in/out: 0.035 L/sec
- Sediment Feed Rate: 4.69 mL/sec
- Wind min/max: 13.2/64.3 mps
- Avg Shelf Length: 42.3 cm



METHODS

- Kestrel 2000 Pocket Digital Anemometer
- Silica sand (d50 = 130 micron)
- 6” wide flume with constant head tank for the ocean

Black and Decker 12 Amp Leaf Blower as the wind source

CONCLUSIONS

- It is possible to create a steady-state subaqueous sediment transport system using waves and wind to create a downwelling current
- Steeper profile observed for higher sediment delivery rate
- More gradual profile observed for lower sediment delivery rate
- More gradual profile with increasing wind speed

REFERENCES

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