



# 36TH INTERNATIONAL CONFERENCE ON COASTAL ENGINEERING 2018

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*The State of the Art and Science of Coastal Engineering*

## Characterizing Three-Dimensional Wave-Driven Morphological Diffusivity In The Nearshore

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# MORphological Diffusivity EXperiment MODEX

Characterizing Three-Dimensional Wave-Driven Morphological  
Diffusivity In The Nearshore



## The MODEX Team

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# MORphological Diffusivity EXperiment MODEX

Characterizing Three-Dimensional Wave-Driven Morphological  
Diffusivity In The Nearshore



# Motivation

Diffusion of  
sediment mounds in  
shallow water



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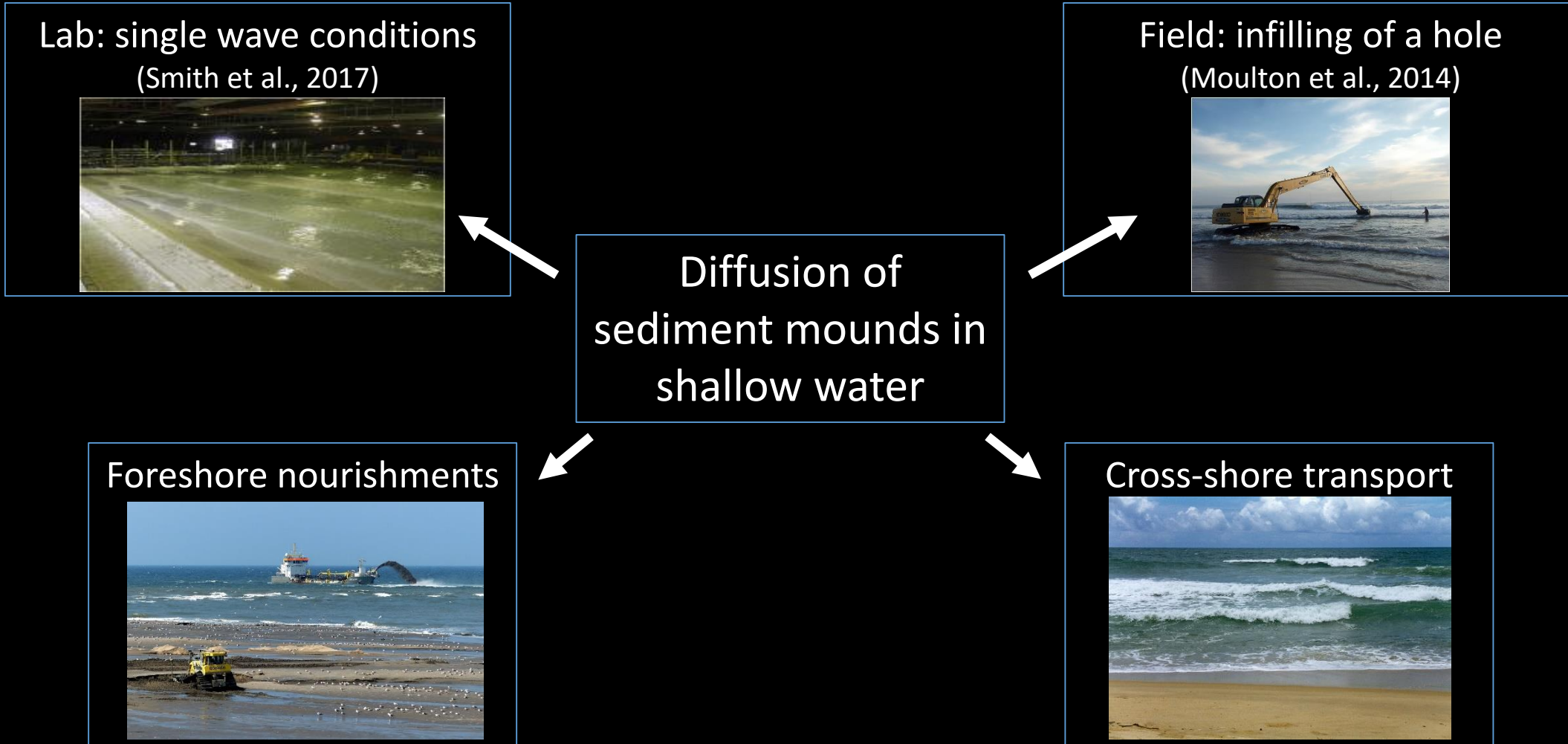
Foreshore nourishments



Cross-shore transport

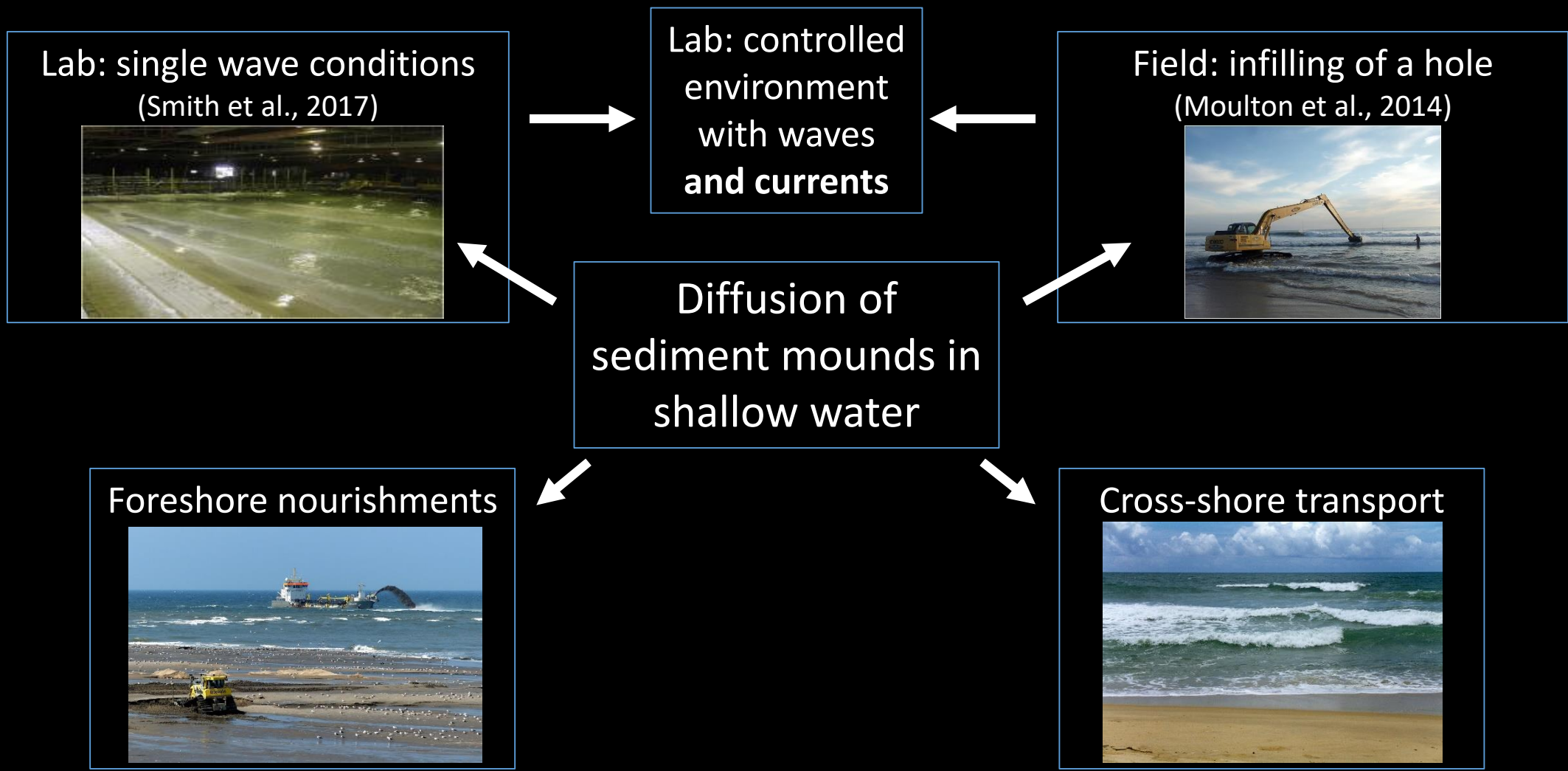


# Motivation



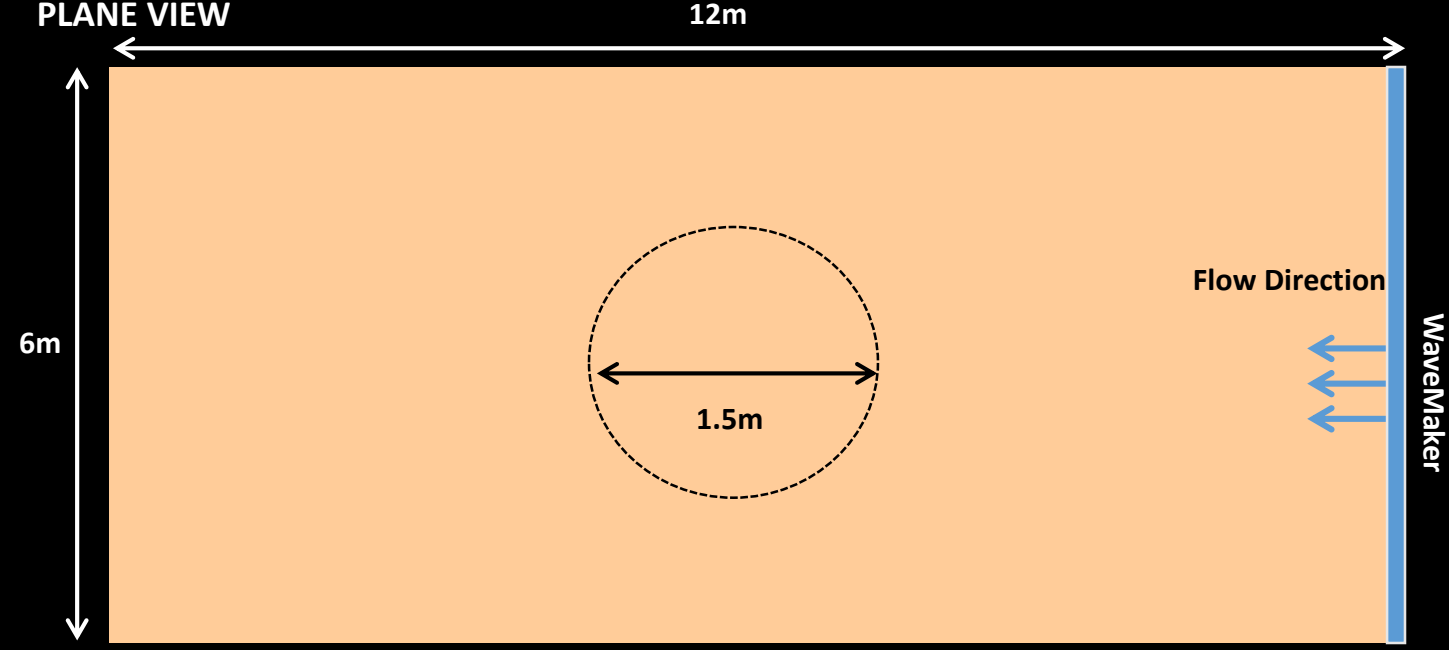
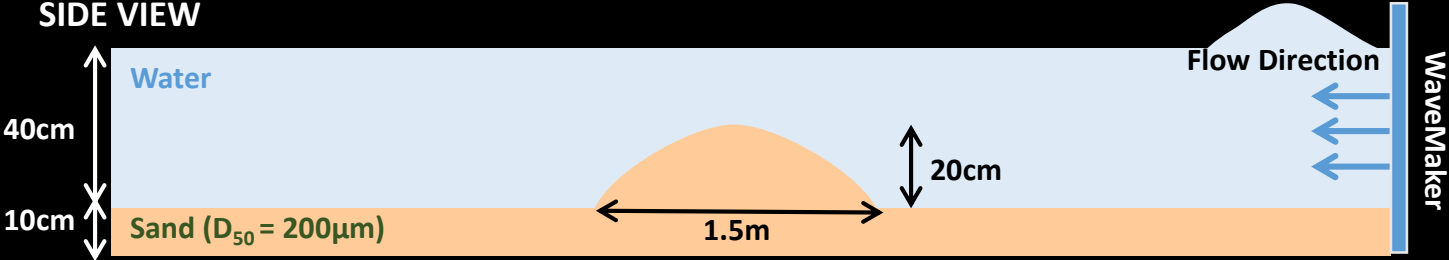


# Motivation



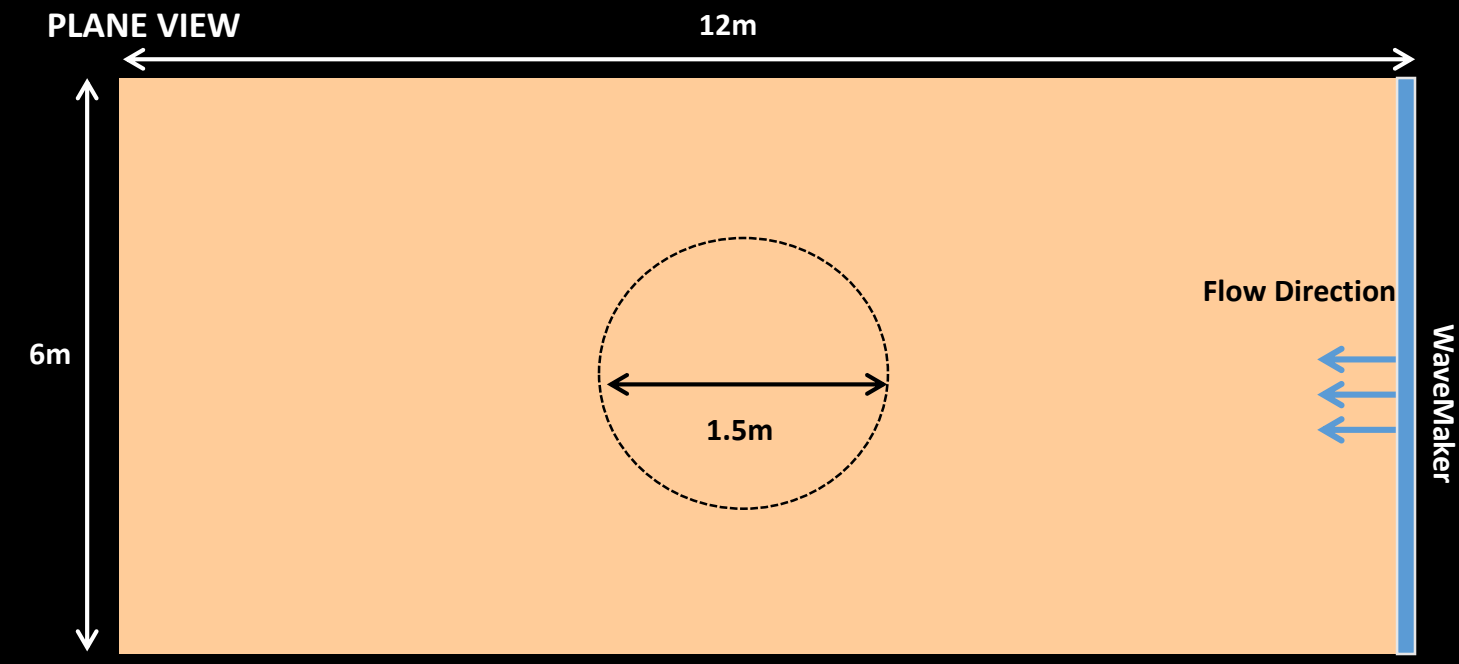
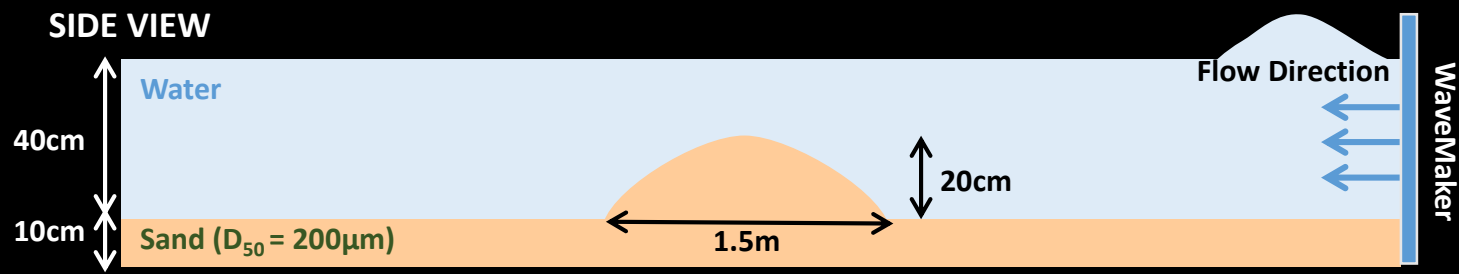
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# Experimental Set-Up



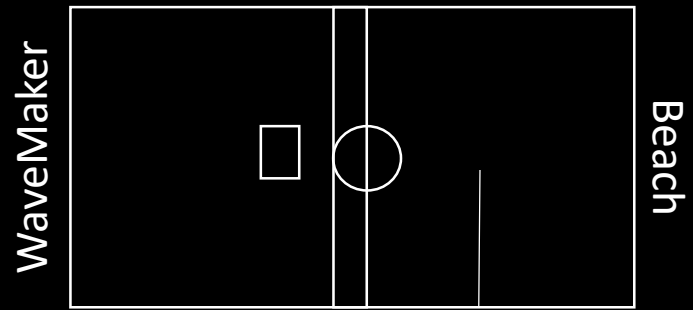


# Experimental Set-Up



Condition	Shear Stress	Hsig
Wave Alone	Low	11 cm
Wave Alone	Med	14 cm
Wave Alone	High	16 cm
Wave-Current	Wave = Current	11 cm
Wave-Current	Current > Wave	14 cm
Wave-Current	Wave > Current	16 cm

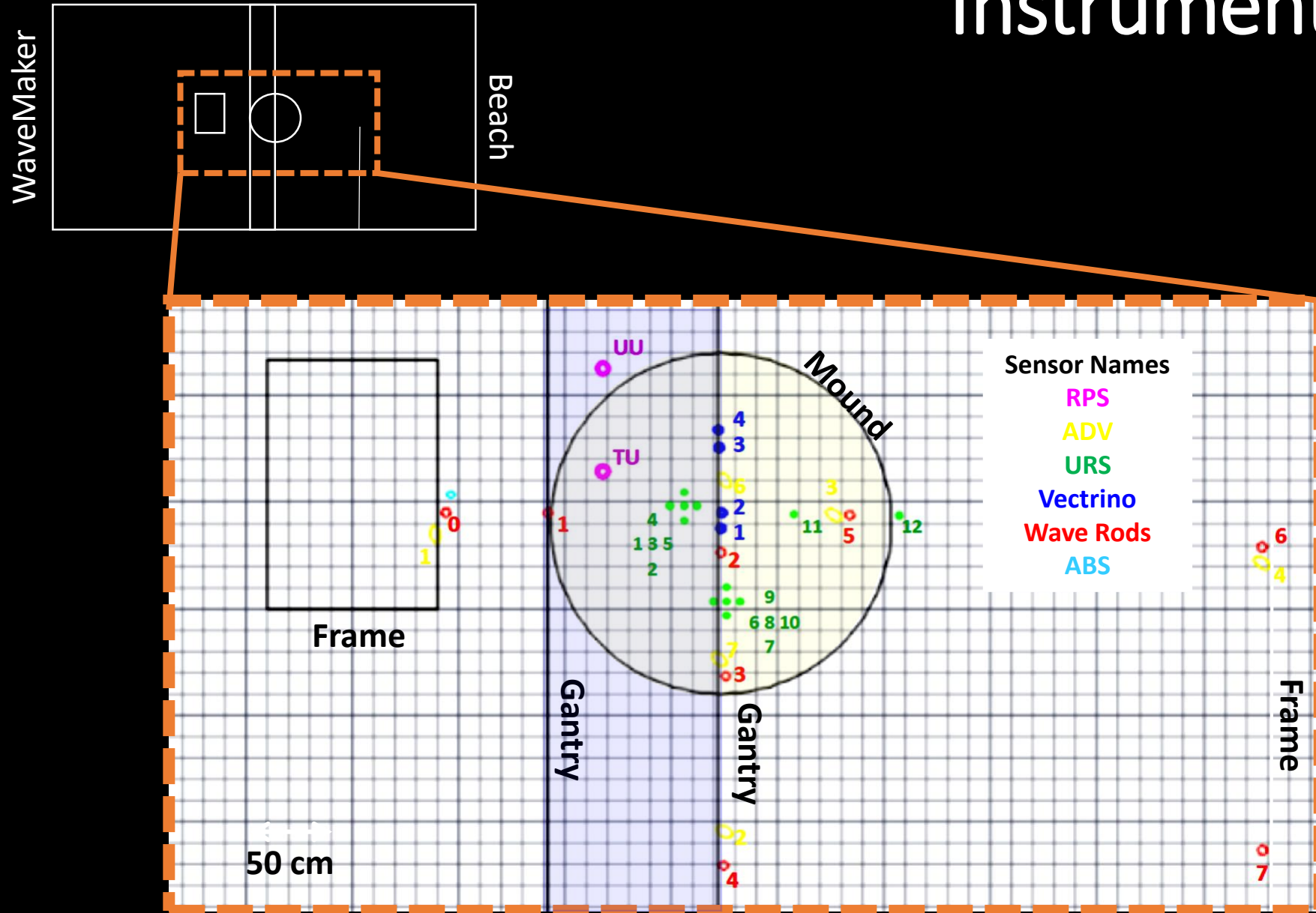




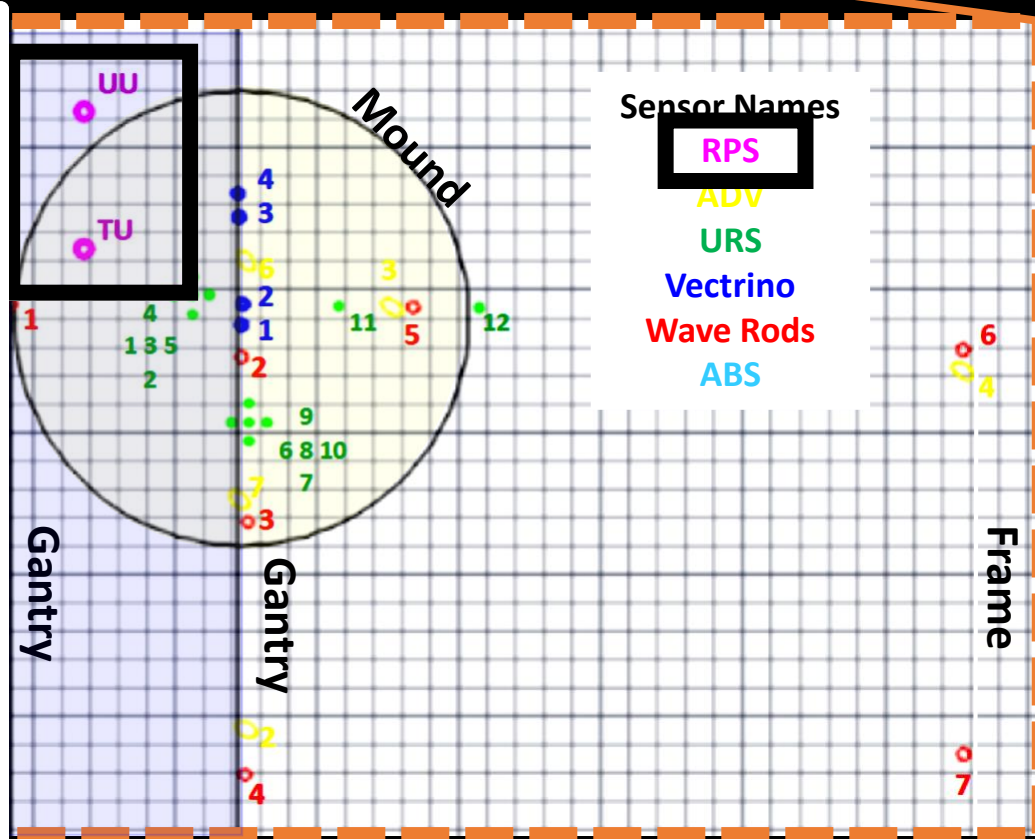
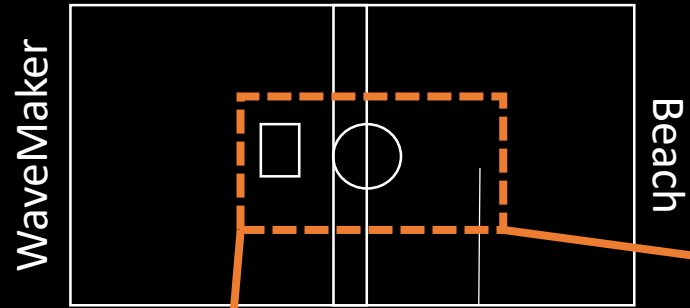
# Instrumentation



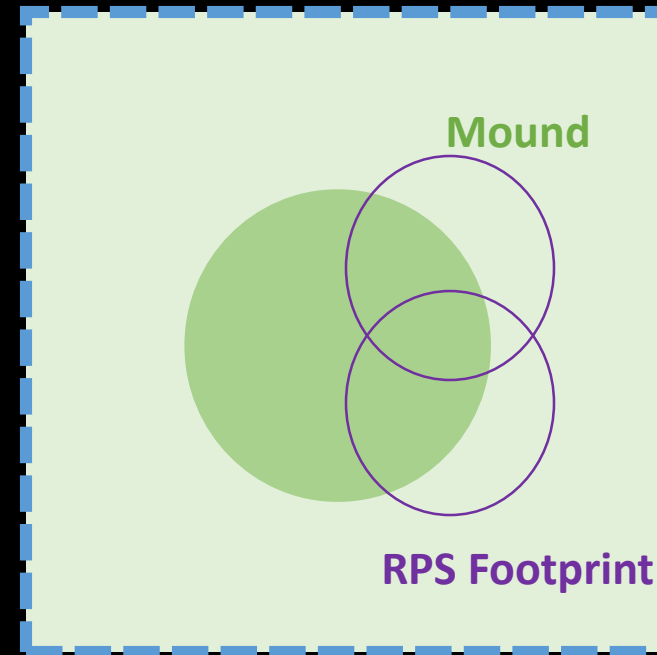
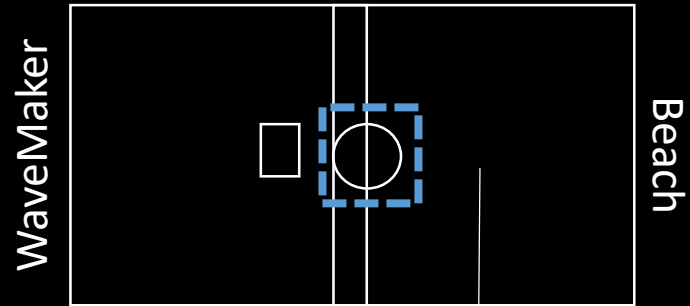
# Instrumentation



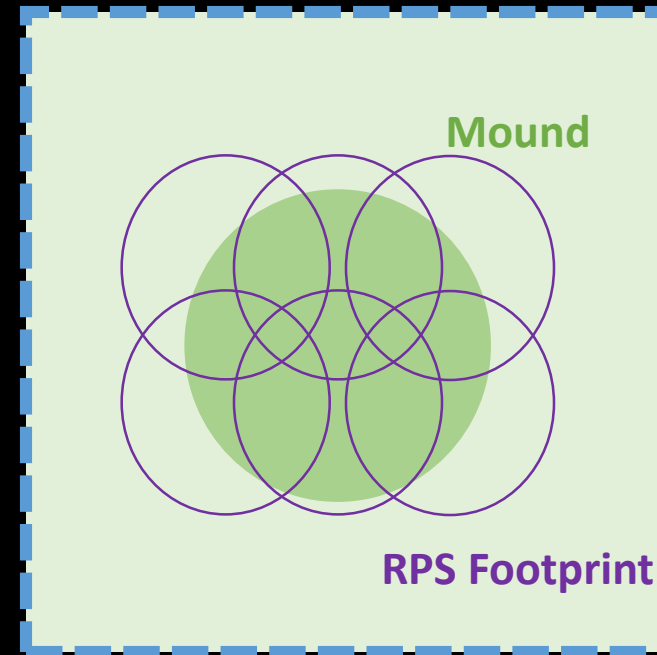
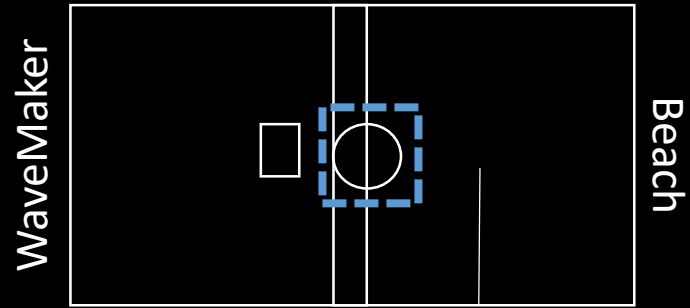
# Instrumentation



# Instrumentation



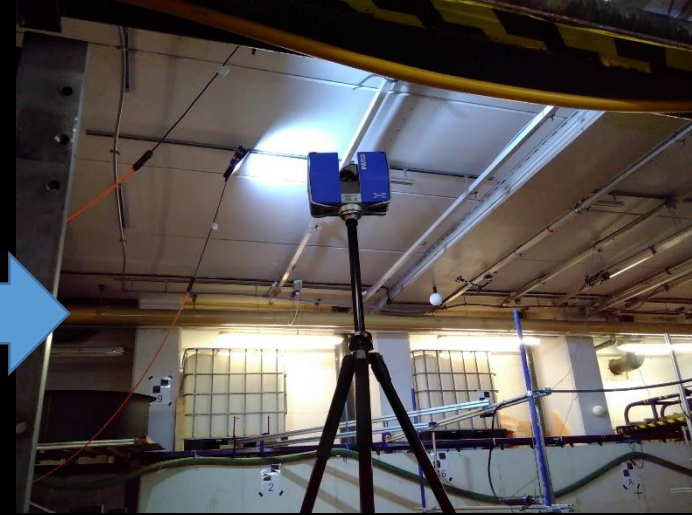
# Instrumentation



# Experiment Workflow



# Experiment Workflow

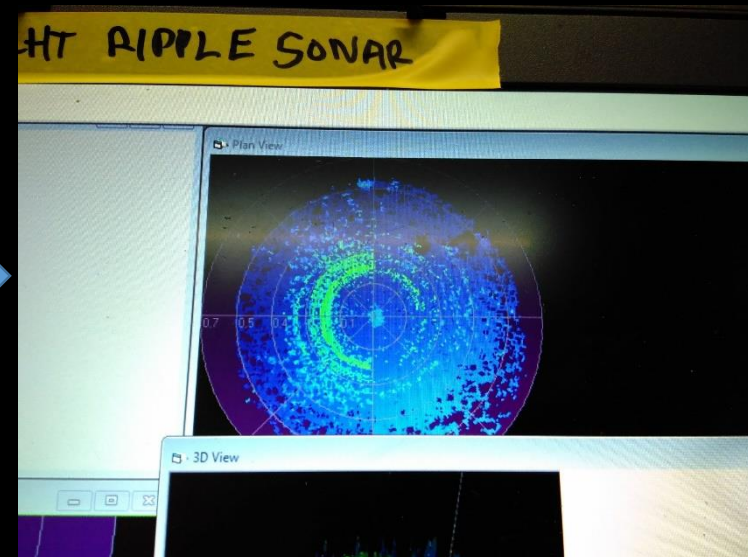
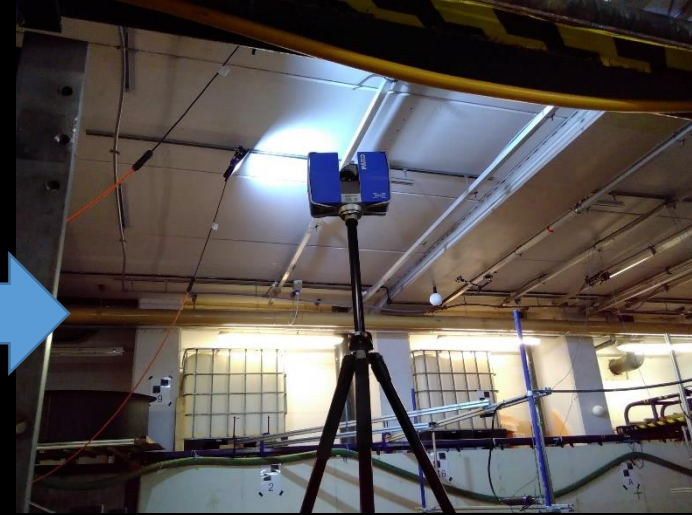




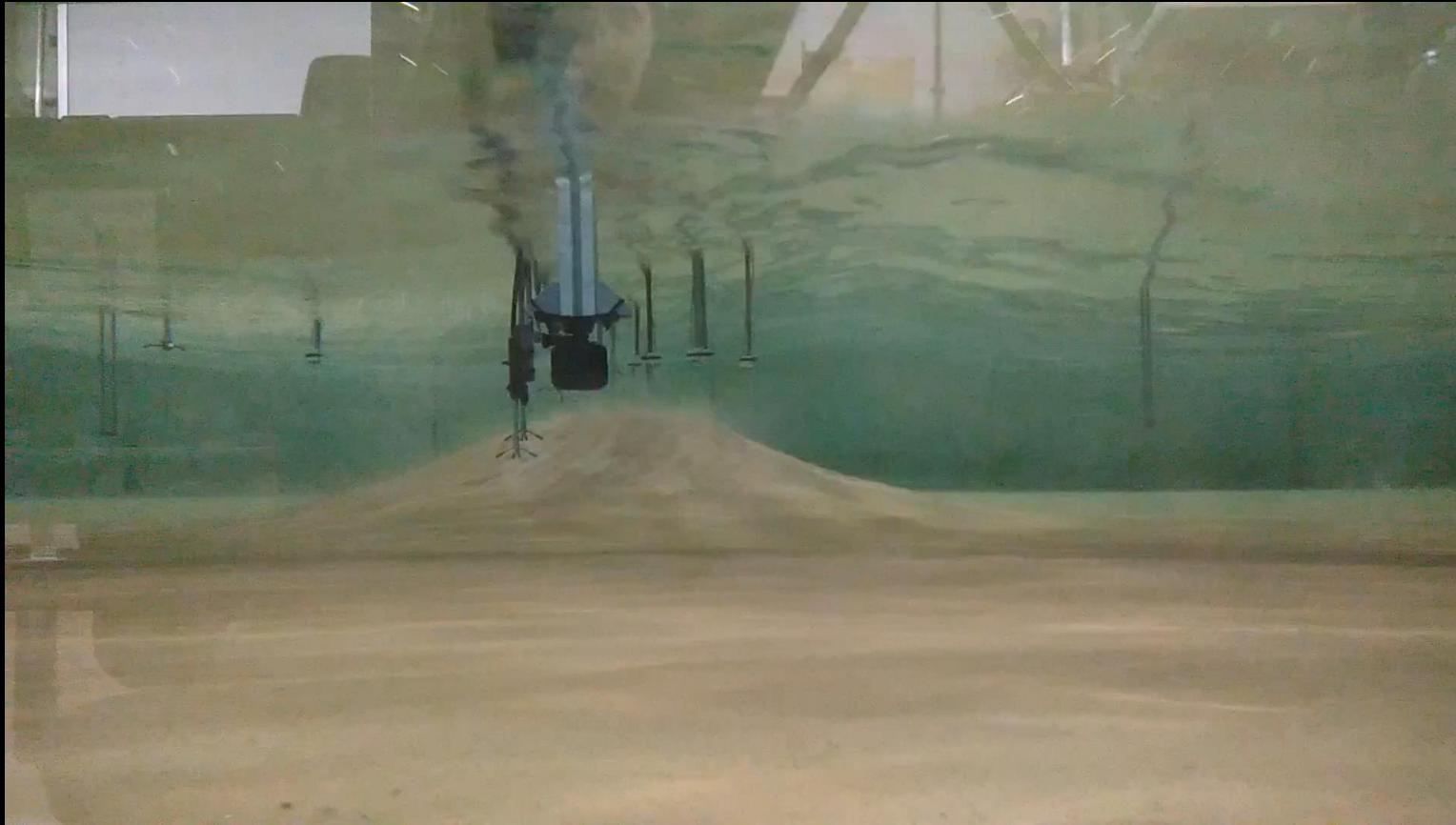
# Experiment Workflow



# Experiment Workflow



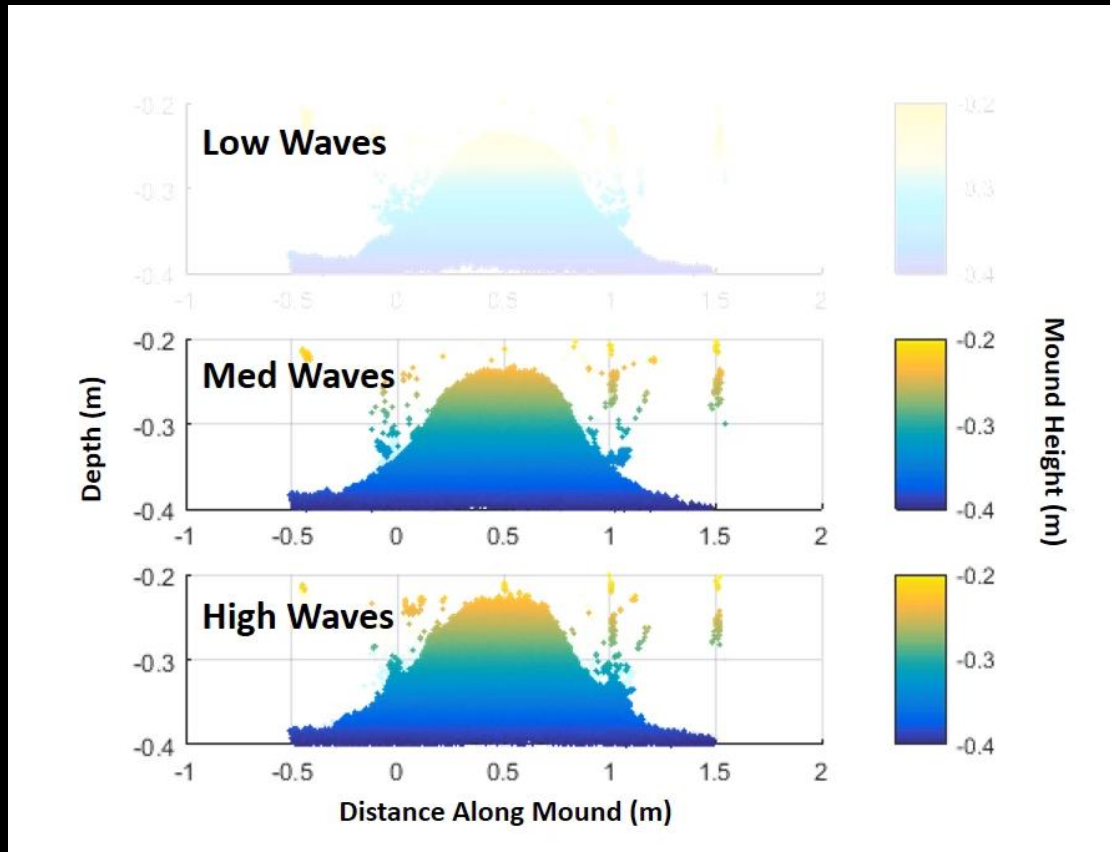
# Initial Observations: Flow



# RPS Results: Waves Alone

## Along Flume View

## Across Flume View



← WaveMaker

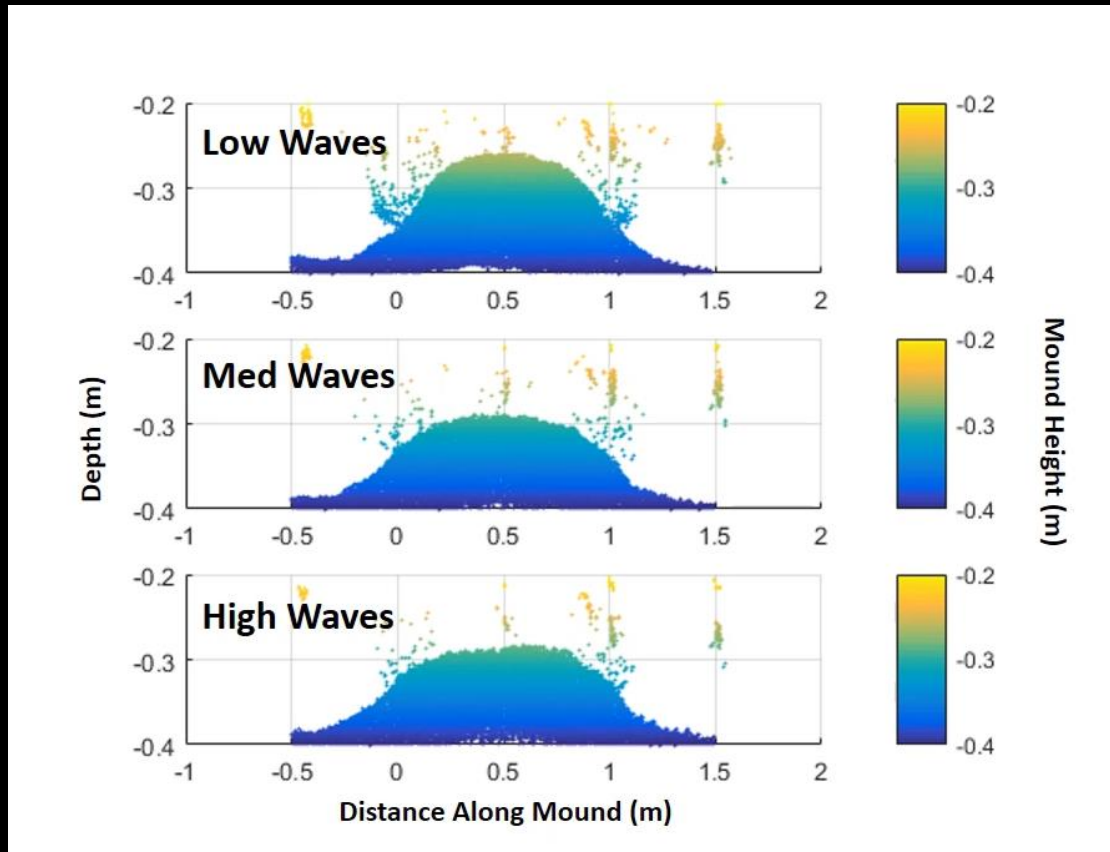
Beach →



# RPS Results: Waves Alone

## Along Flume View

## Across Flume View



← WaveMaker

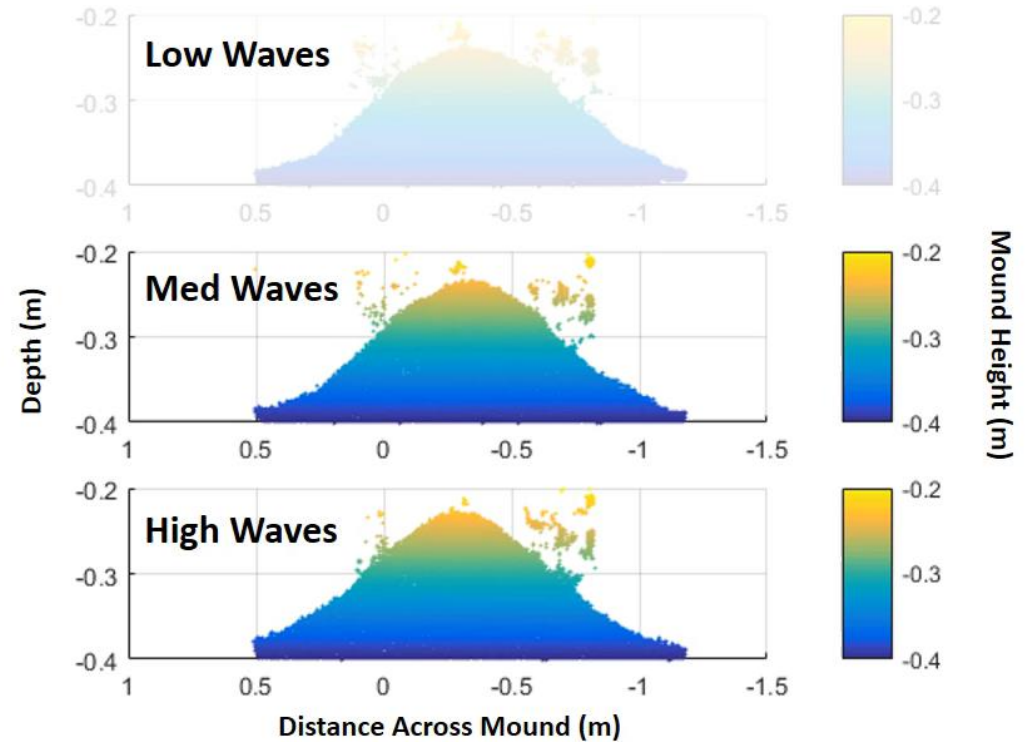
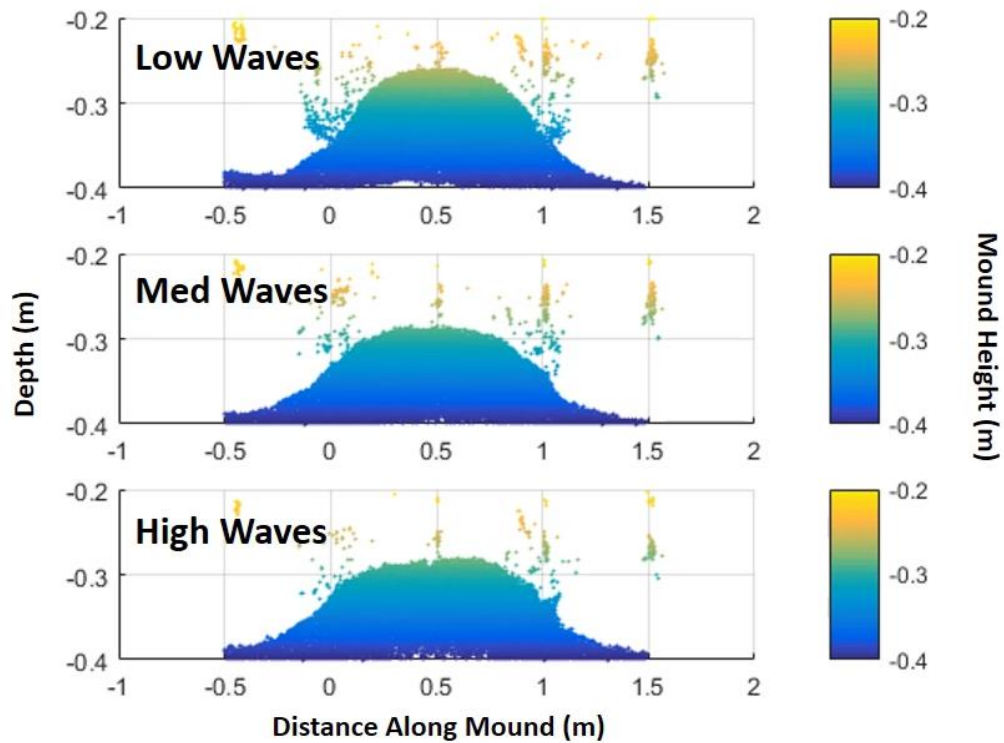
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# RPS Results: Waves Alone

## Along Flume View

## Across Flume View



← WaveMaker

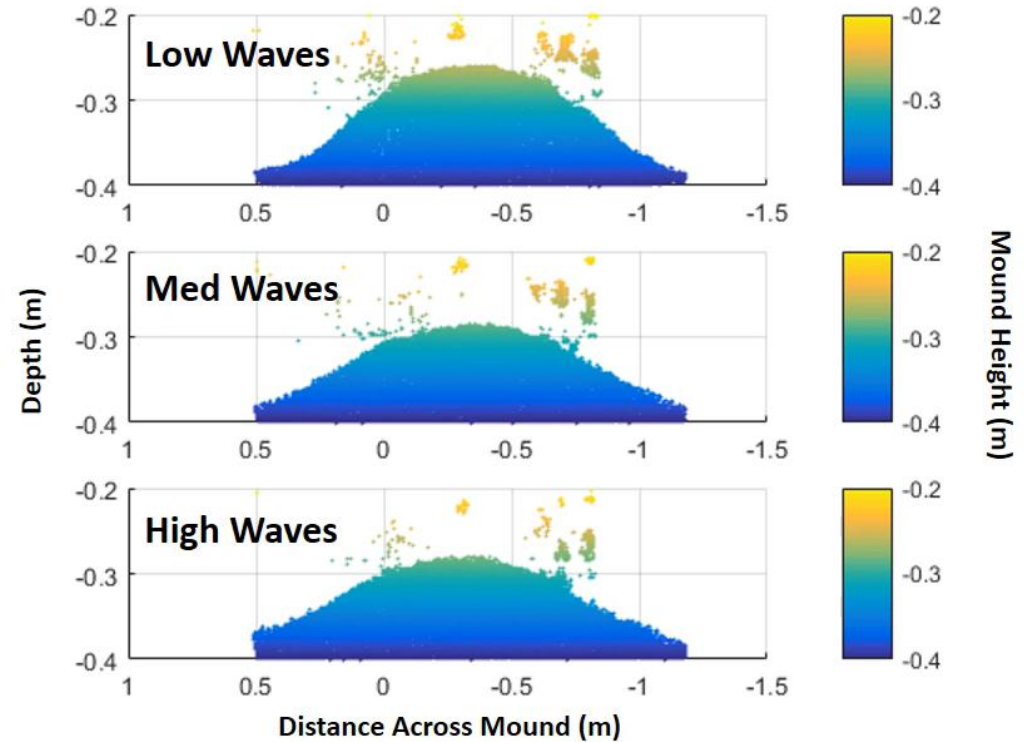
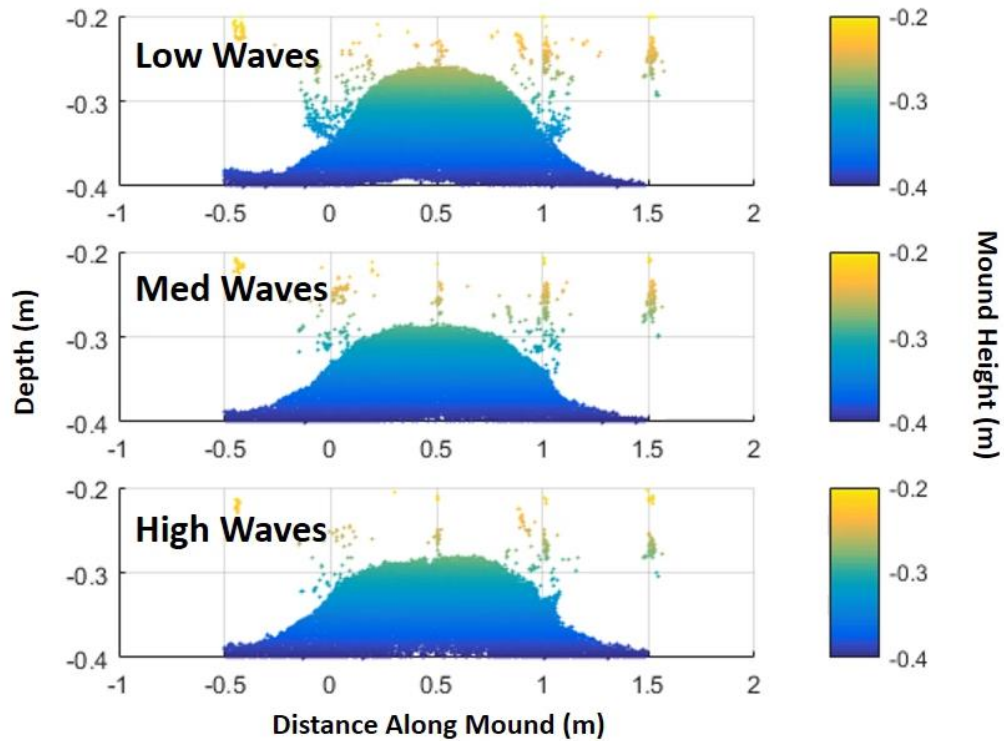
Beach →



# RPS Results: Waves Alone

## Along Flume View

## Across Flume View



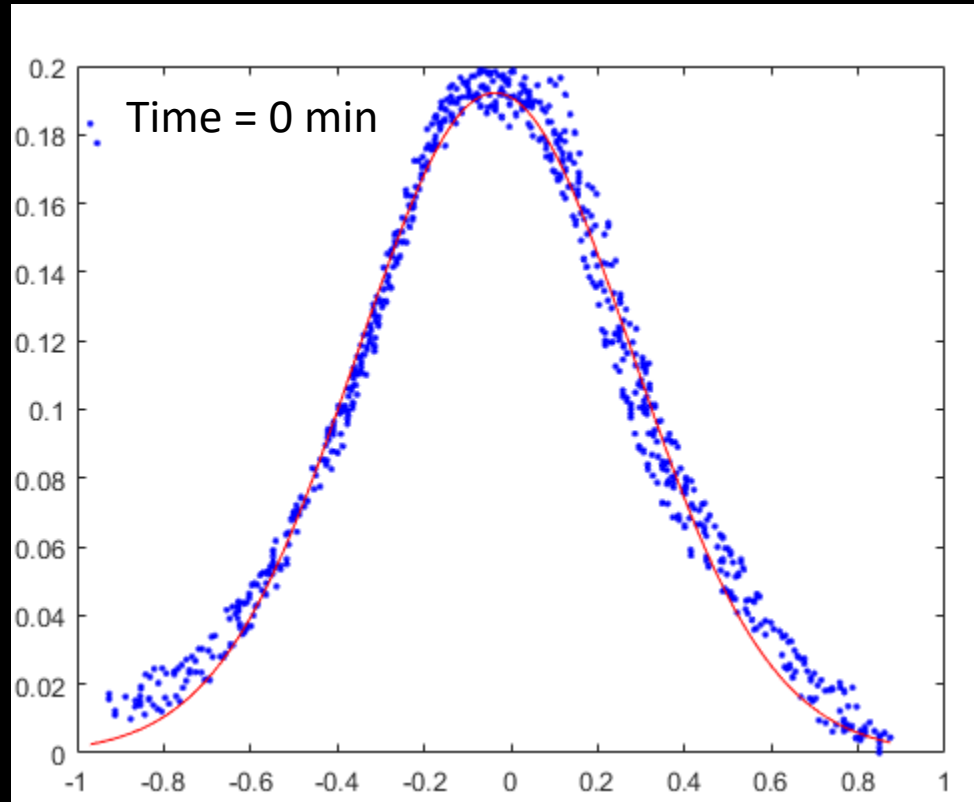
← WaveMaker

Beach →

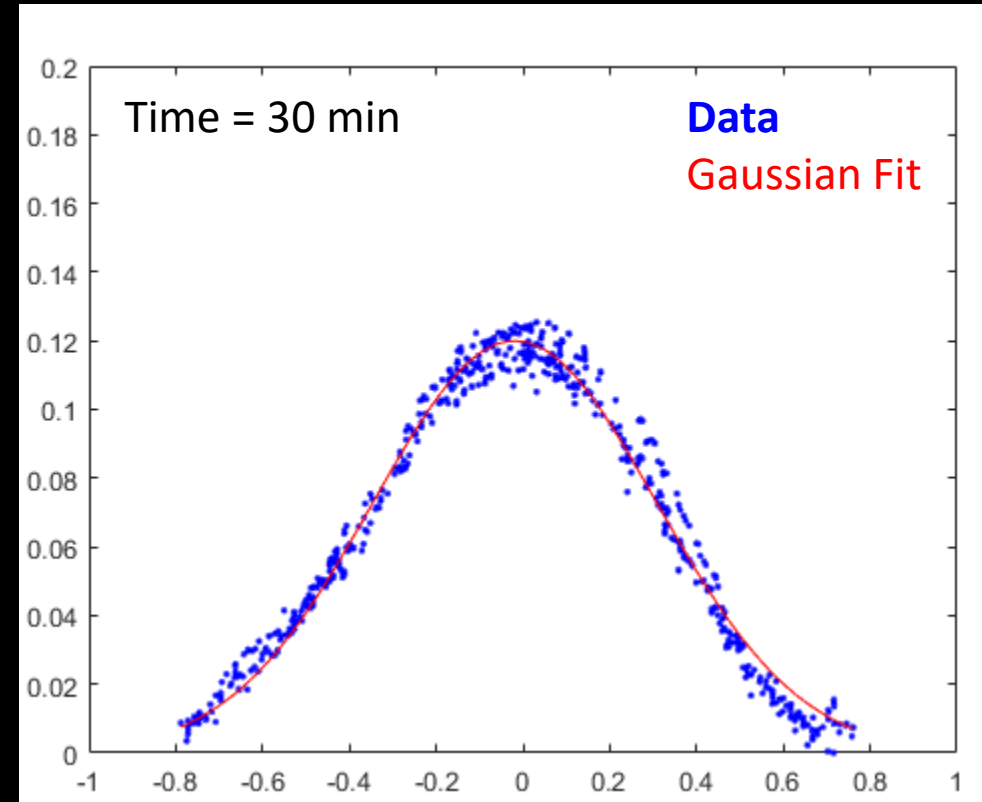


# Mound Evolution Metrics

Mound Height (m)



Across Flume Distance (m)



Across Flume Distance (m)

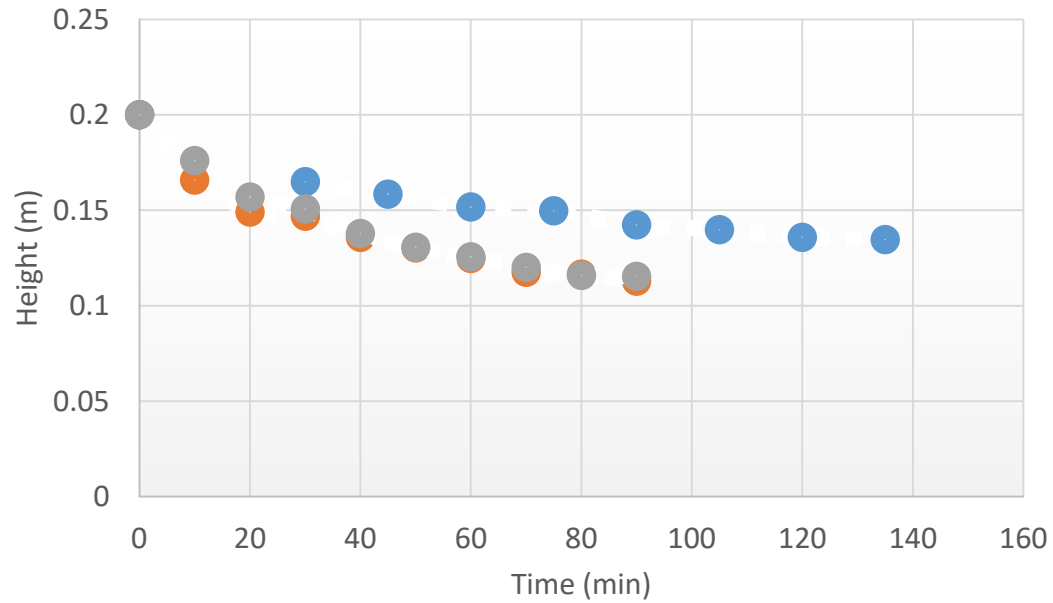




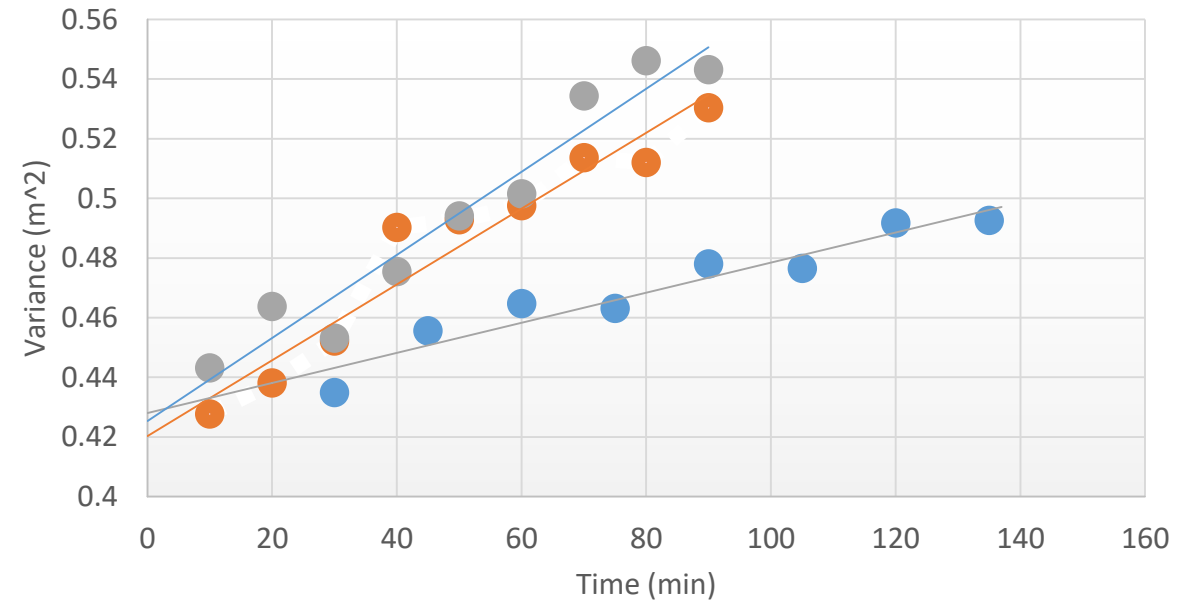
# Mound Dimensions: Waves Alone

Waves Low  
Waves Med  
Waves High

### Mound Height Reduction



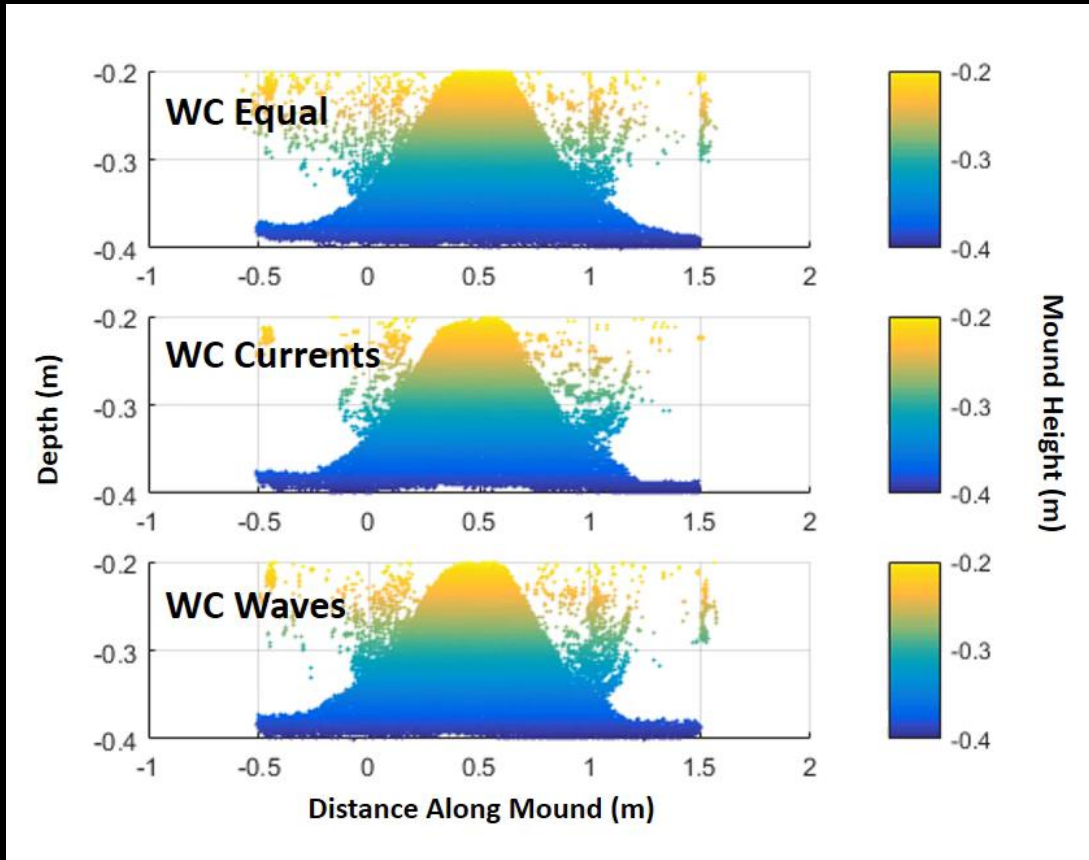
### Lateral Spreading



# RPS Results: Waves + Currents

Along Flume View

Across Flume View



← WaveMaker

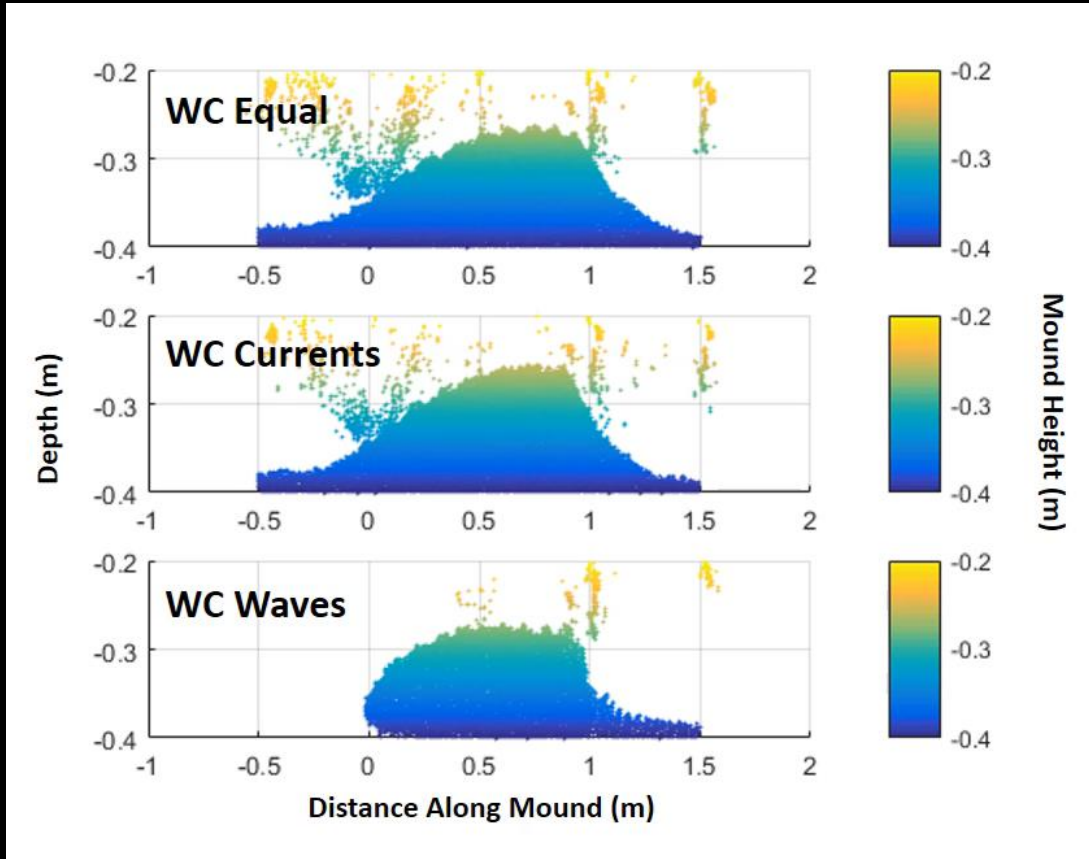
Beach →



# RPS Results: Waves + Currents

Along Flume View

Across Flume View



← WaveMaker

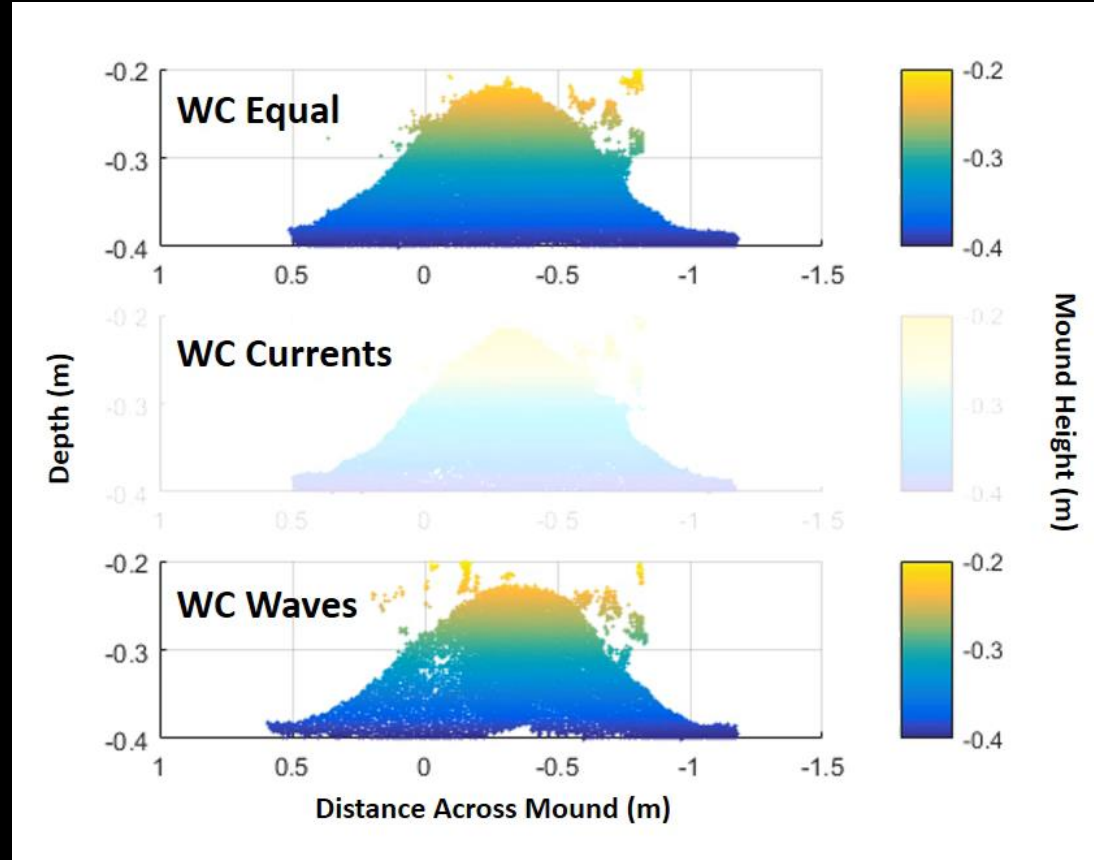
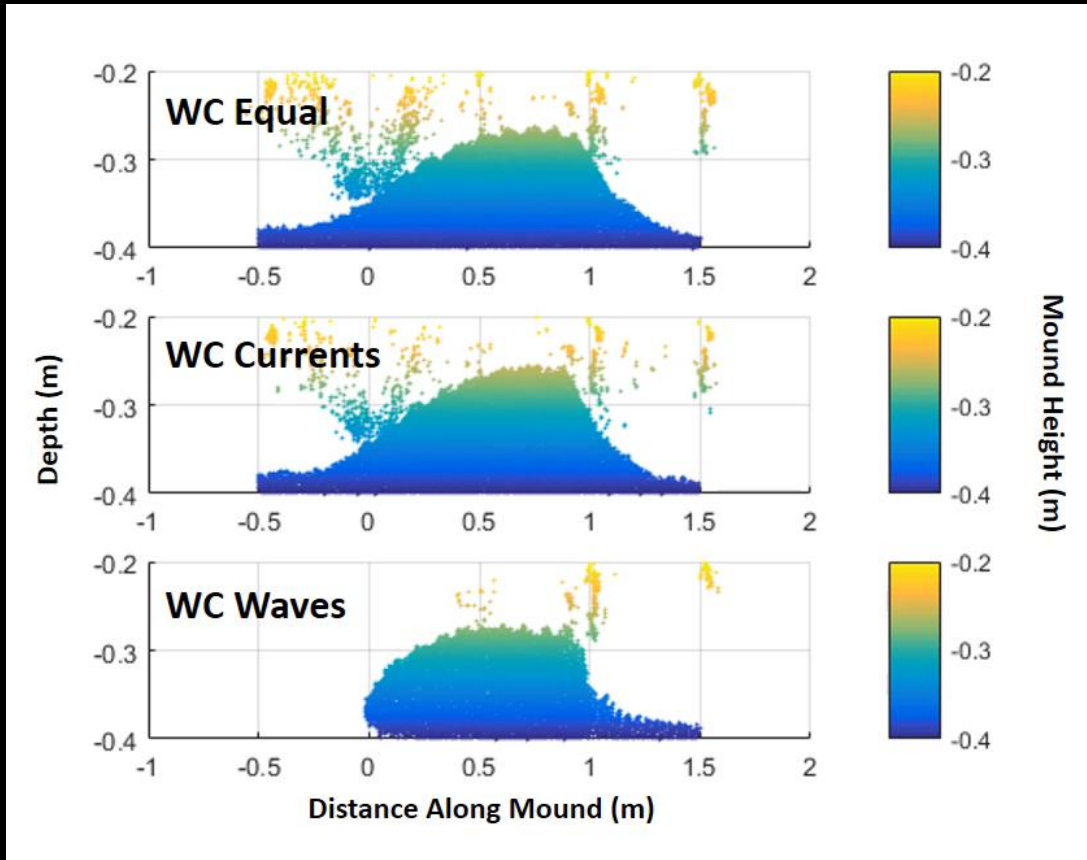
Beach →



# RPS Results: Waves + Currents

## Along Flume View

## Across Flume View



← WaveMaker

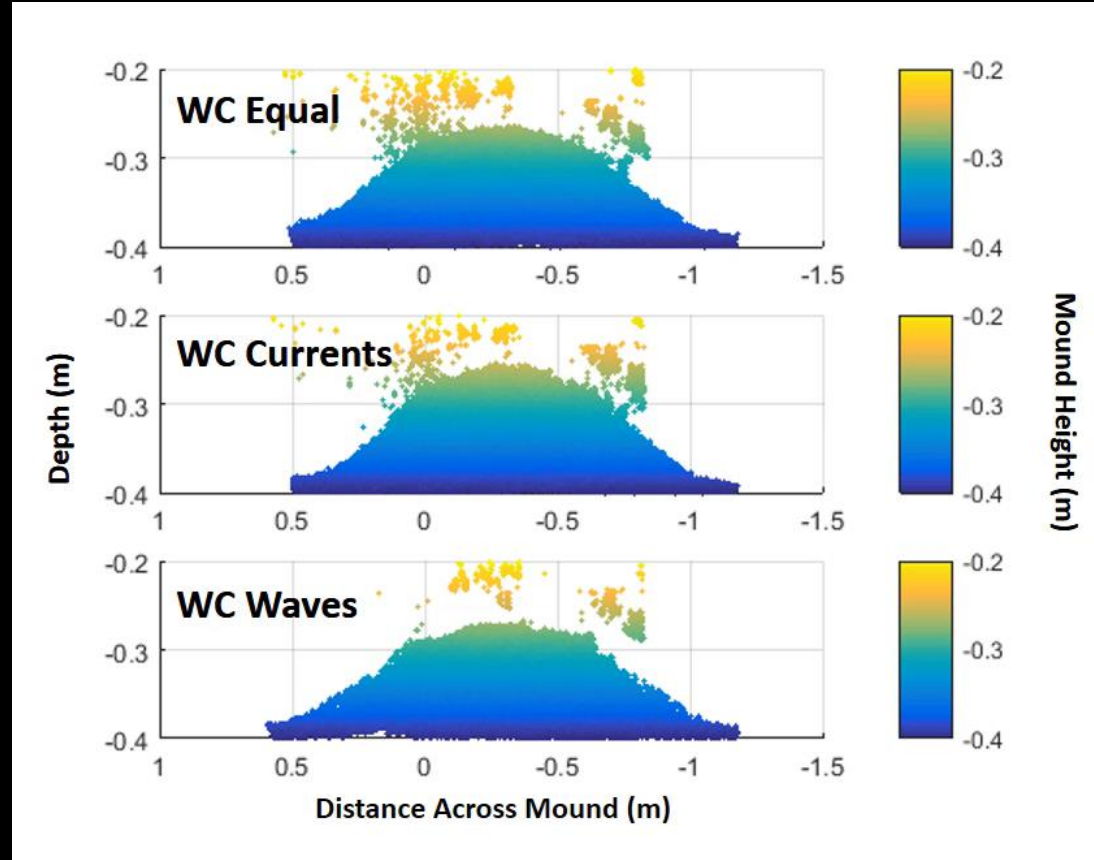
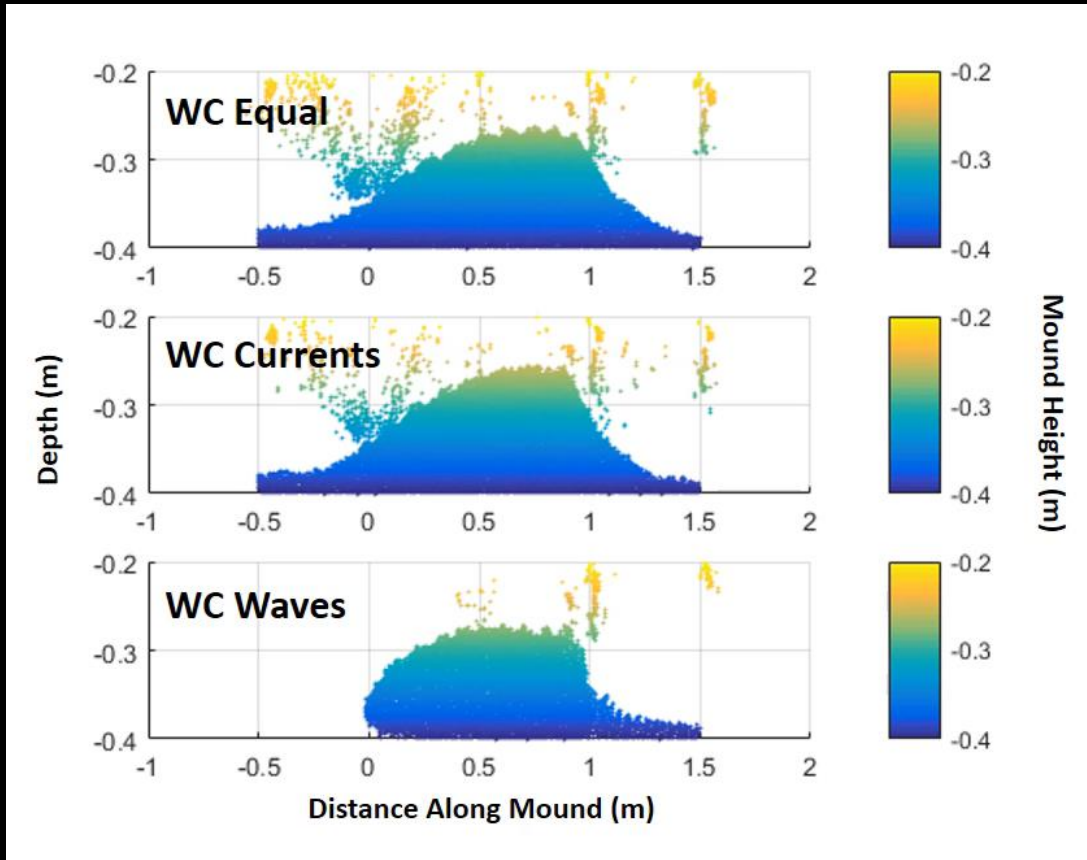
Beach →



# RPS Results: Waves + Currents

## Along Flume View

## Across Flume View



← WaveMaker

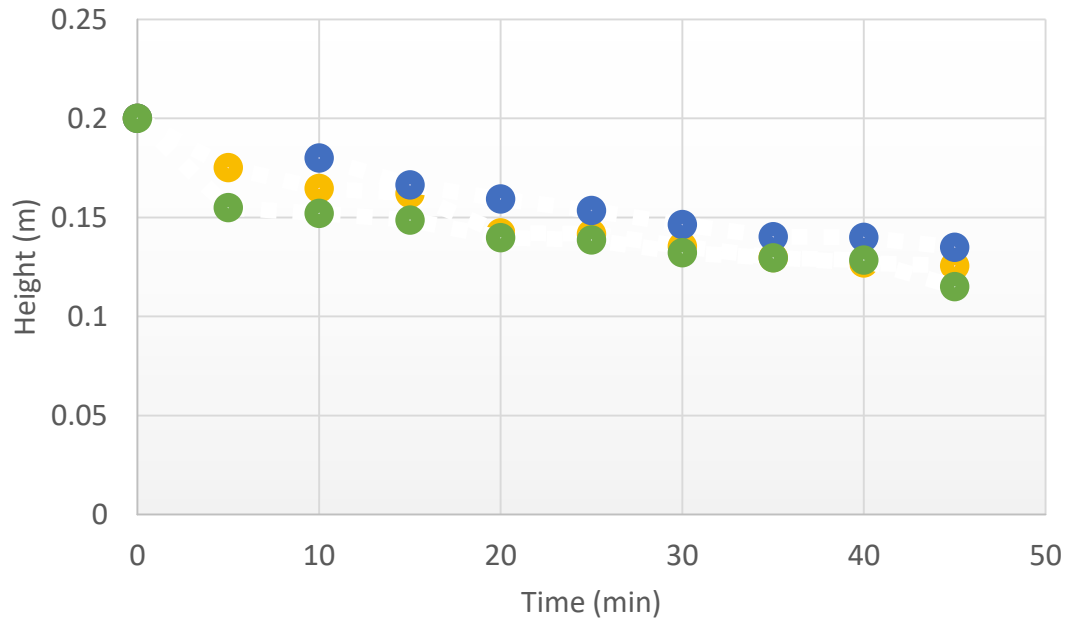
Beach →



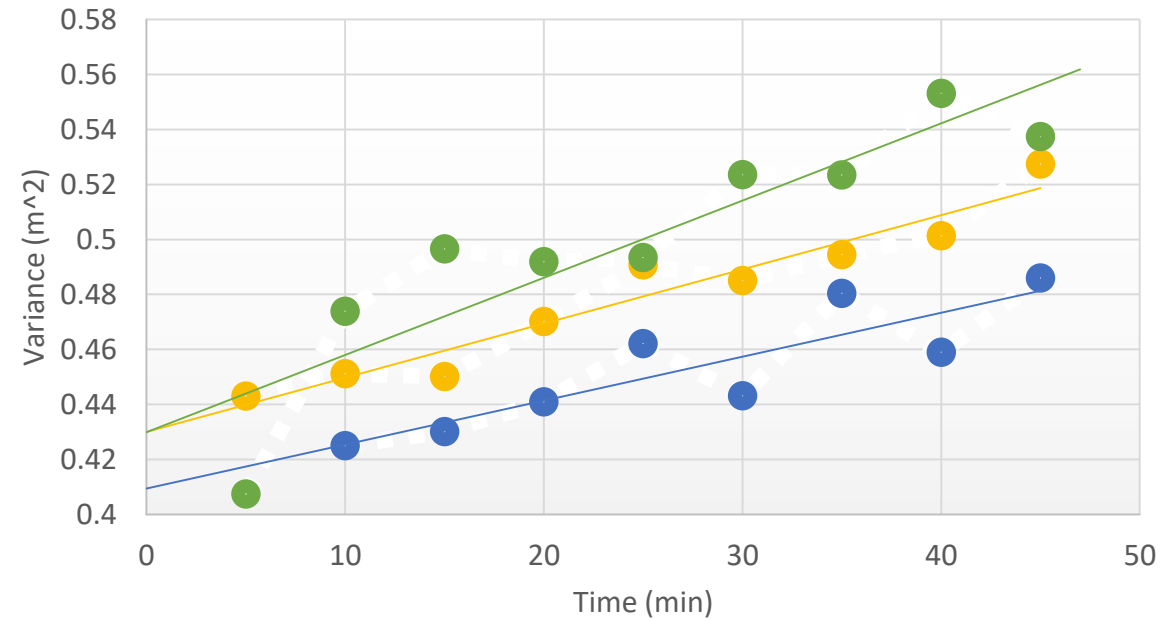
# Mound Dimensions: Waves + Currents

WC Equal  
WC Currents  
WC Waves

### Mound Height Reduction

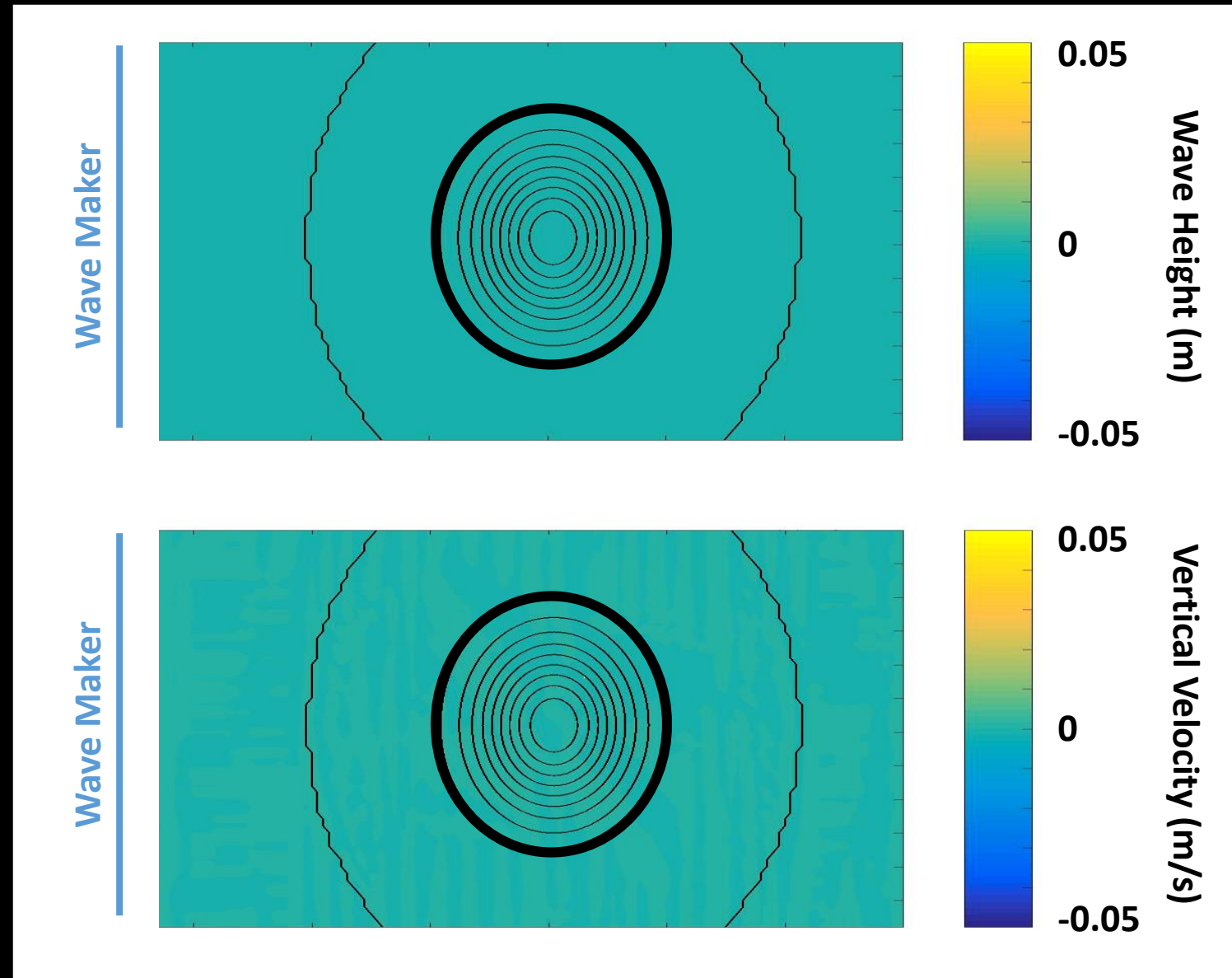


### Lateral Spreading



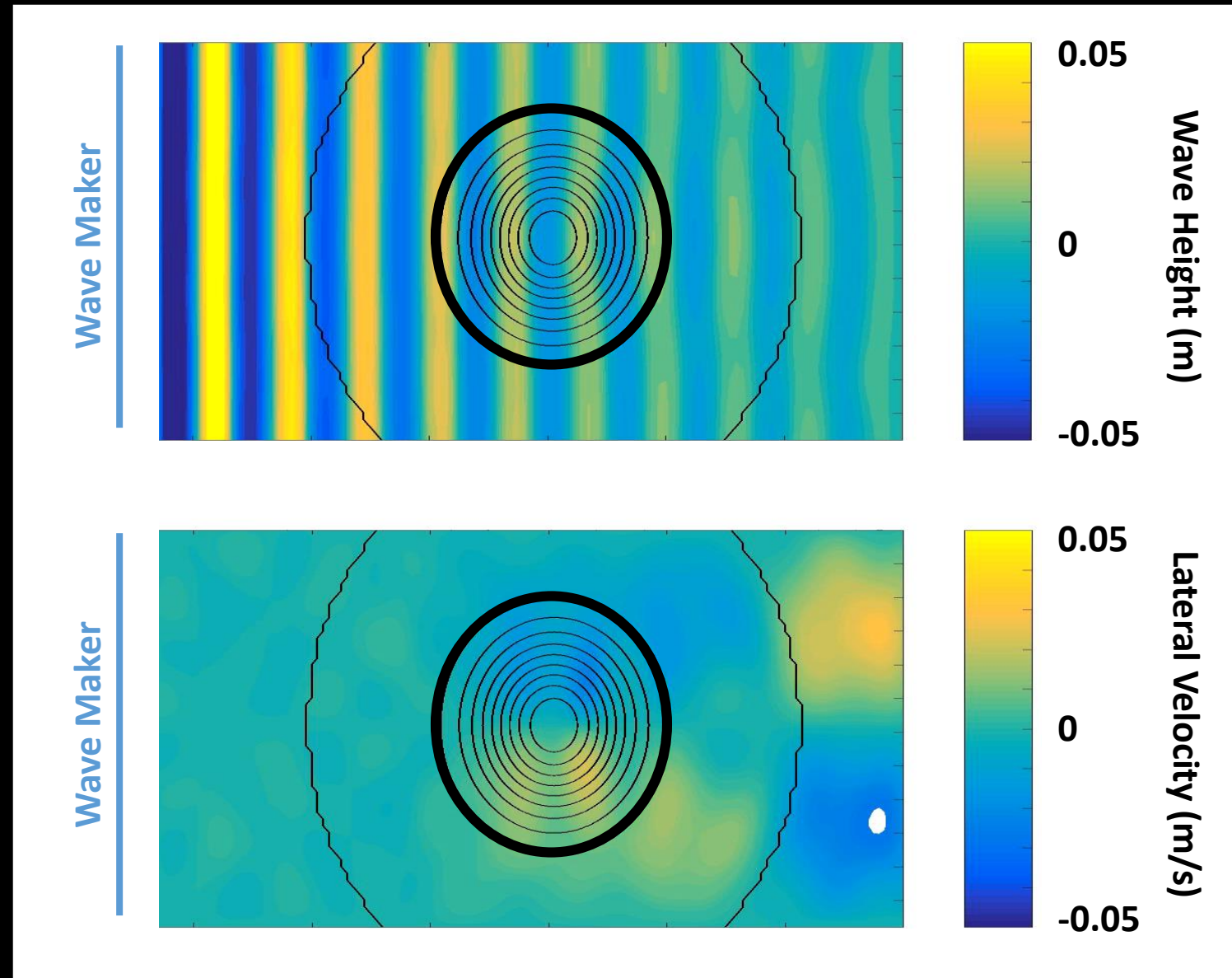
# Wave Deformation Around Mound

Simulations using  
FUNWAVE-TVD  
(Shi et al., 2012)



# Wave Deformation Around Mound

Simulations using  
FUNWAVE-TVD  
(Shi et al., 2012)





# Preliminary Conclusions

## Waves

- Enhance lateral spreading of mound
- Higher wave energy correlates to higher mound diffusion

## Currents

- Enhances skewness in along-flow direction
- Reduced impact on lateral spreading



# Next Steps

## **Sediment Transport**

- Diffusion rate owing to waves and currents
- Up-scaling to field conditions

## **Waves + Currents**

- Irregular wave conditions owing to wave/current interaction

## **FUNWAVE-TVD (Shi et al., 2012)**

- Breaking waves
- Sediment transport





## MODEX Team

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Francesca Ribas  
Bruno Castelle  
Anne Baar  
Seok Bong Lee

## University of Hull Team

Stuart McLelland  
Brendan Murphy  
Hannah Williams  
Laura Jordan

Questions?



# Mound Making Procedure



# Initial Observations: Morphology

