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Welcome, the RBR Webinar will begin shortly…

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rbr-global.com

Measuring waves and deployment tips

Candace Smith
Technical Sales Manager

Loggers

OEM

Sensors

Systems


RBRcoda³
RBRconcerto³
RBRmaestro³
RBRconcerto³
RBRbrevio³
RBRsolo³

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Deployment considerations

Ie what to consider when deploying a wave instrument

Deployment considerations

1. *What **wave period** are you trying to capture or **sampling regime** (XXHz for YYmin every ZZmins)
2. *How deep the water is
3. *How far off the bottom the instrument is
4. *How long the deployment you want/how often can you access the site
5. What accuracy/resolution is needed
6. Sampling features: process own data or use Ruskin processing?

Not sure? Ask us ! (info@rbr-global.com)

*Ruskin parameters

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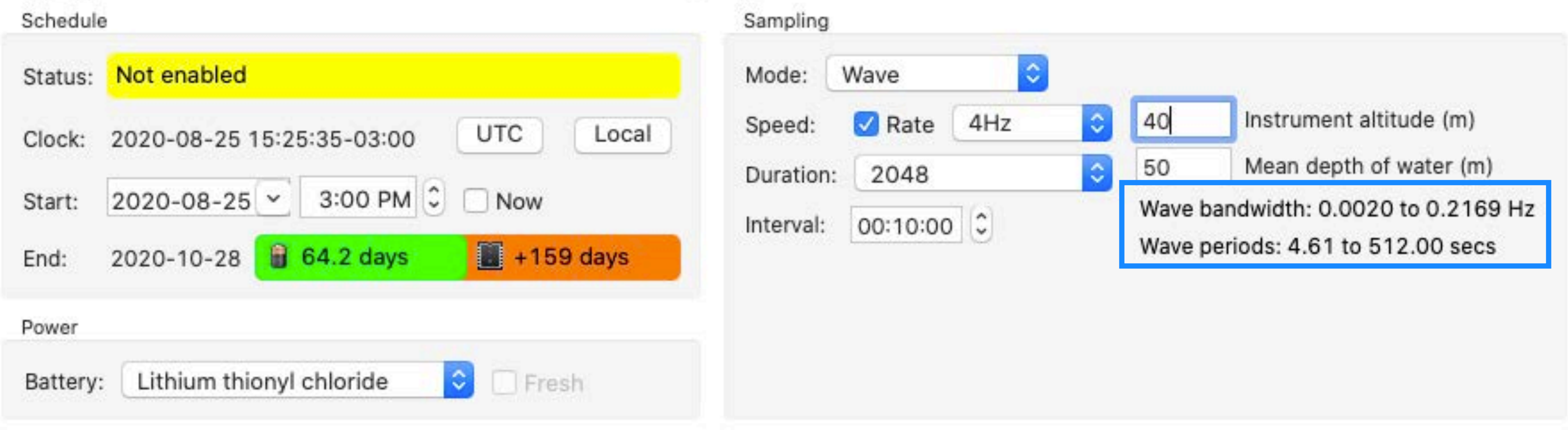
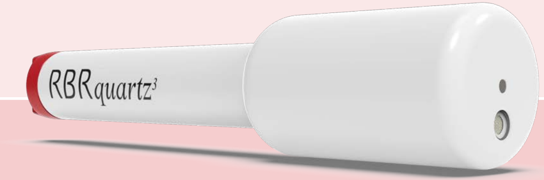
Deployment considerations: sampling regimes, wave period, depths and autonomy

RBR*solo*³ D|wave16



Deployment considerations: accuracy/resolution

<table>
<tr><th>Compact</th><th>Standard</th><th>Quartz</th></tr>
<tr><td>Ideal when instrument size is critical</td><td>Ideal for very long deployments</td><td>Ideal for deployments beyond 50m</td></tr>
<tr><td>RBRsolo^3 D|wave16 (or |tide16)
</td><td>RBRvirtuoso^3 D|wave16 (or |tide16)
</td><td rowspan="2">RBRquartz^3 Q
</td></tr>
<tr><td>RBRduet^3 T.D|wave16 (or |tide16)
</td><td>RBRduo^3 T.D|wave16 (or |tide16)
</td></tr>
</table>

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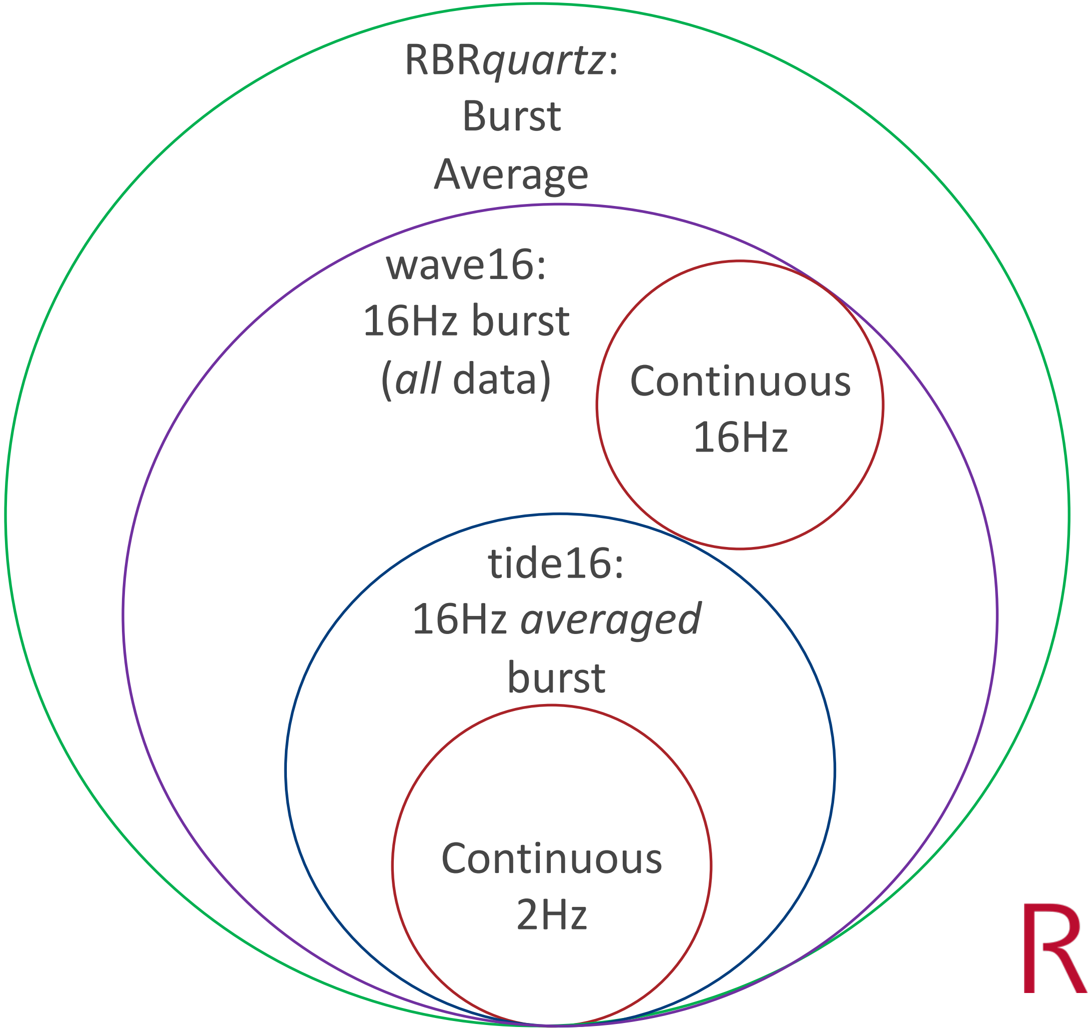
Deployment considerations: sampling features



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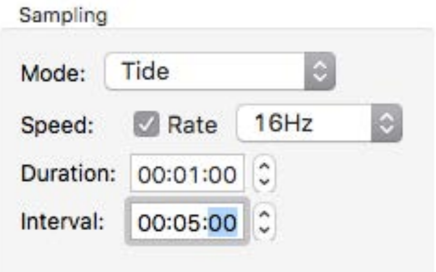
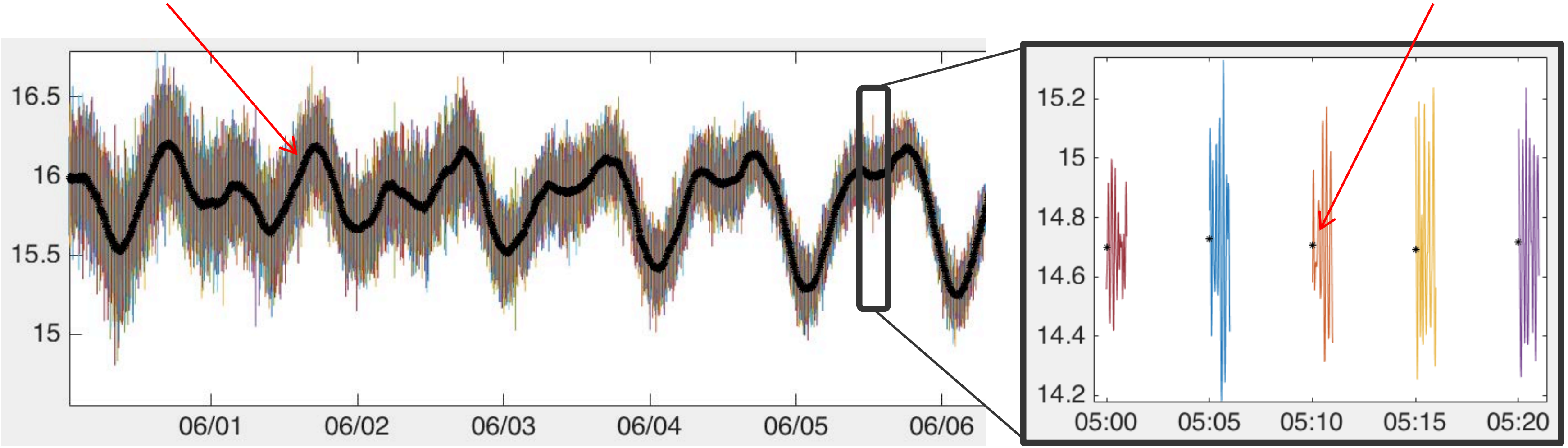
tide16 and wave16 in Ruskin

|tide16



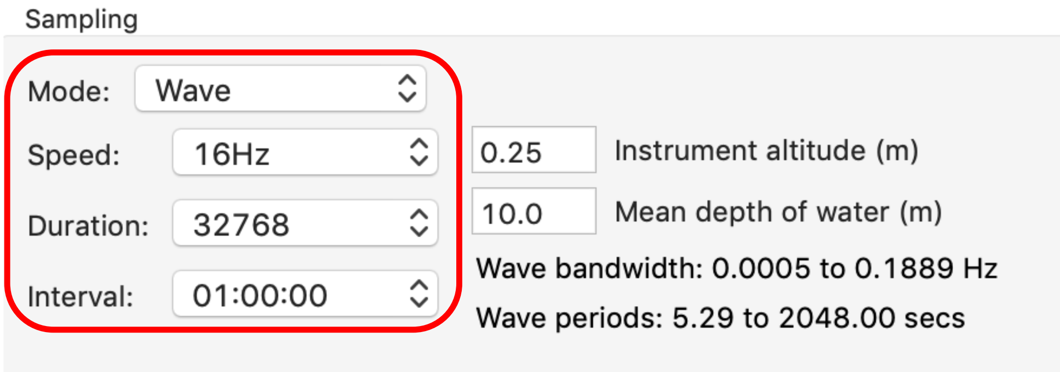
Filter out higher frequency variation

Only averaged data is saved



wave16

Wave
"Burst"
Sampling

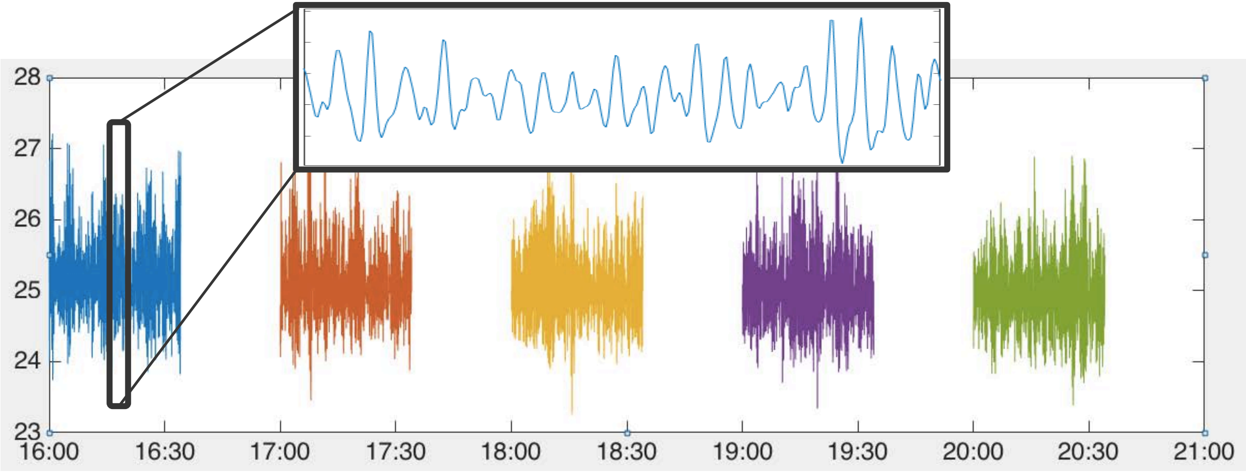


~34 min

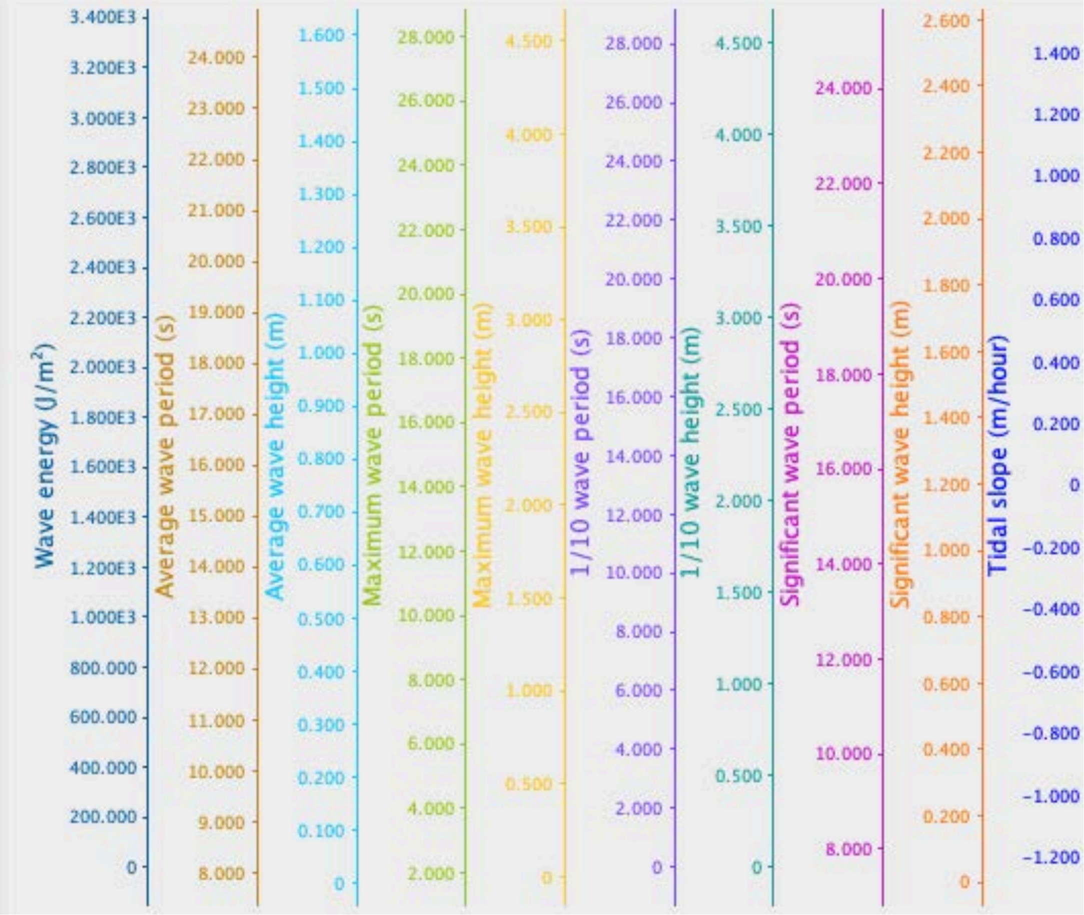
Every

1 hour

(32768 ÷ 16 ÷ 60)



Ruskin |wave16



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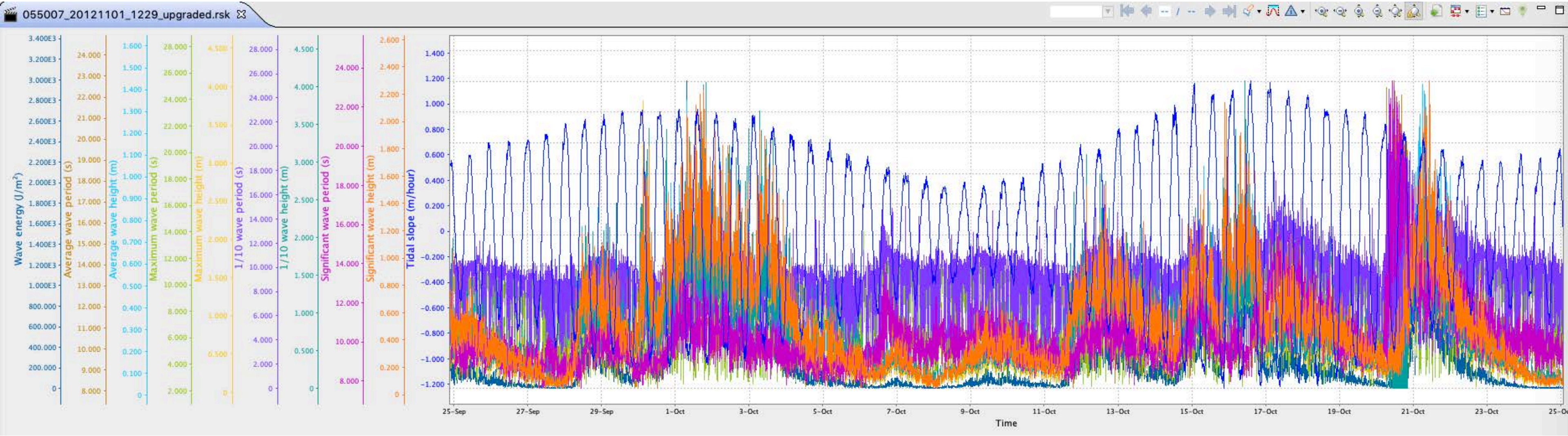
Ruskin |wave16:



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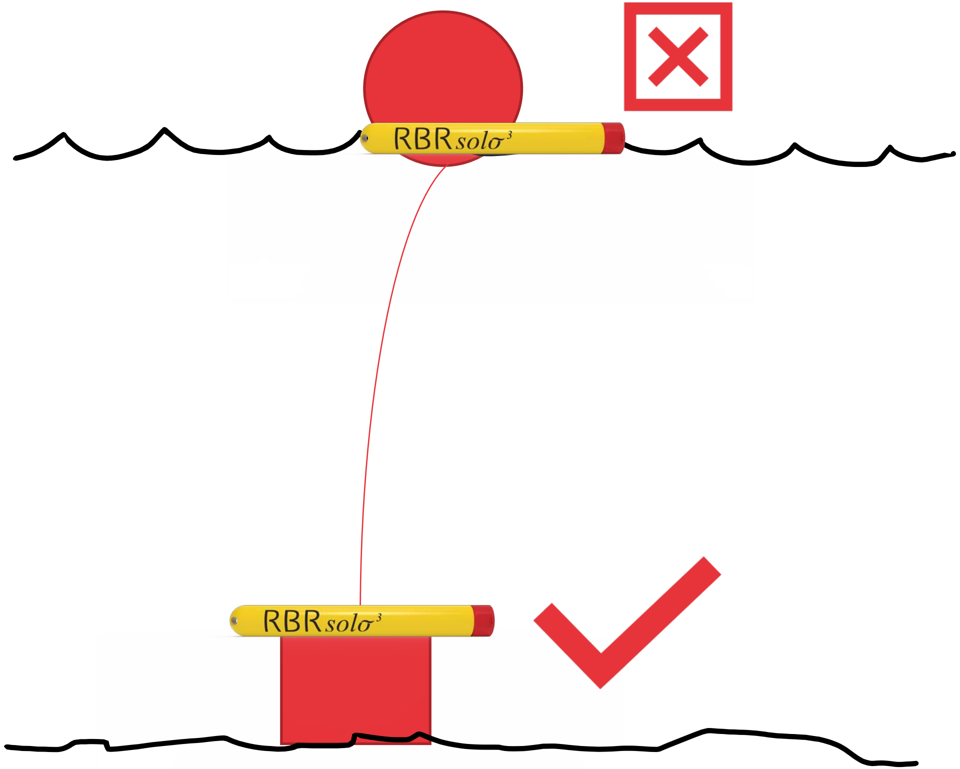
Deployment Tips

Mount from bottom



If mounted from the buoy, the logger will move up/down with the waves, the very things that you're trying to measure

If mounted on the bottom the waves can pass at the surface and will be detected at depth!

Use plenty of weight, so the anchor doesn't "hop" with large waves. Think of hurricane level waves!

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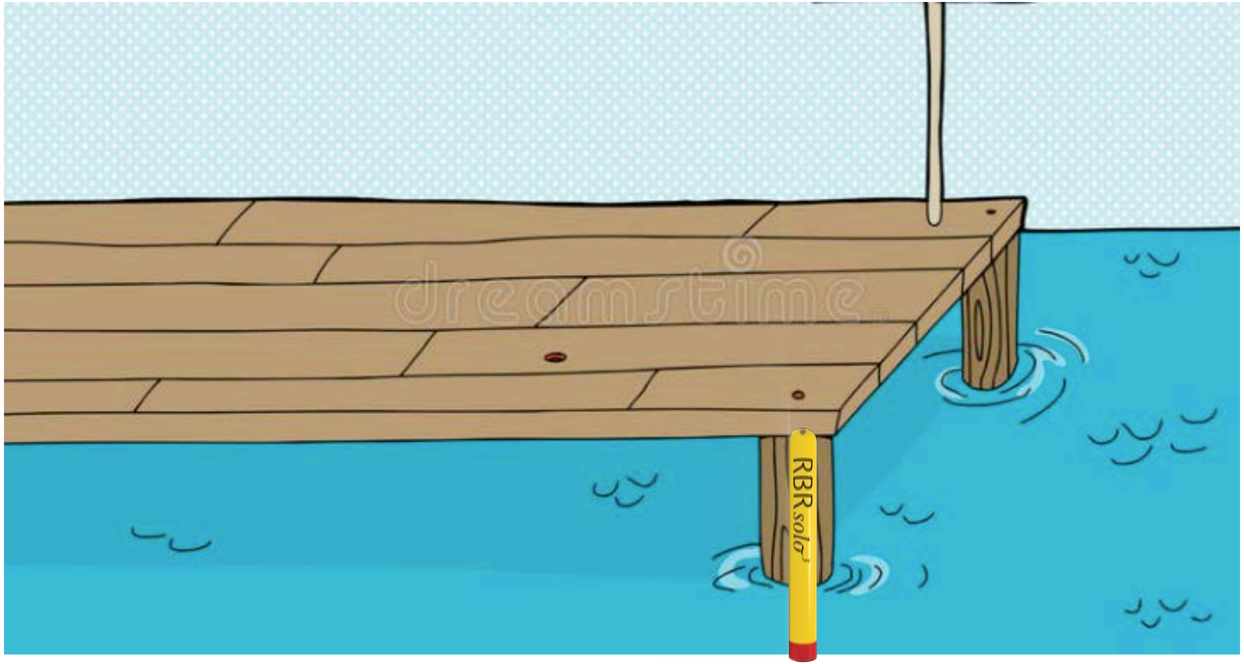
Mount from pier/dock

Can easily attach to dock/pier for easy* access



*Sometimes people are curious or nefarious and remove/steal/vandalize instruments, so try to deploy in a more private area, if possible

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How do I attach it?

Common items :

- Zip ties
- Tape
- Both

Common weights:

- Something heavy with a hole to attach to
- Cinder blocks
- Weightlifting weights

Mooring line:

- RBR clamps

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Which orientation?

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Why not facing up?

Upcoming Webinars

Future Webinars

Surf zone monitoring at the Palm Beach artificial reef using nine RBR*duet* T.Ds

Evan Watterson (Bluecoast Consulting Engineers)

August 27, 2020 at 11AM AEST (GMT+10)

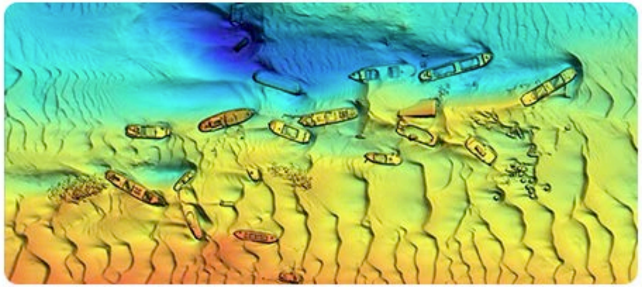
Surf zone wave monitoring to assess the performance of the Palm Beach artificial reef, using nine RBR*duet* T.Ds deployed in the lee of the artificial reef along two shore parallel lines.

Observing beach breaching in Carmel, CA

Mara Orescanin (Naval Postgraduate School)

September 2, 2020 at 12PM EDT (GMT-4)

This webinar will show observations of beach breaching at Carmel River that include seasonal migration of the beach as well as prediction of breach closure.



Tidal measurements to support hydrographic operations in Queensland

Giles Stimson (Port of Brisbane Ltd)

September 3, 2020 at 11AM AEST (GMT+10)

Learn how the Port of Brisbane is using high accuracy tidal observations to support hydrography at their port and throughout Queensland.

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Measuring the pore pressure response in sandy beaches using SoloDs

Speaker: Nina Stark

ninas@vt.edu

@NinaStark18

Motivation

Coastal Erosion

Scour

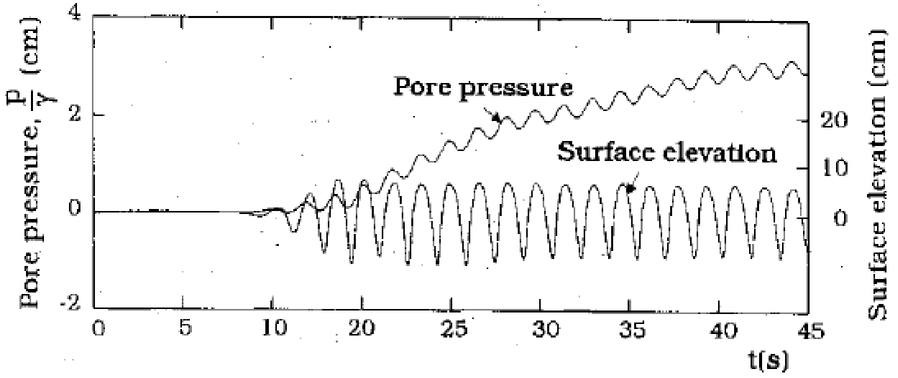
Motivation

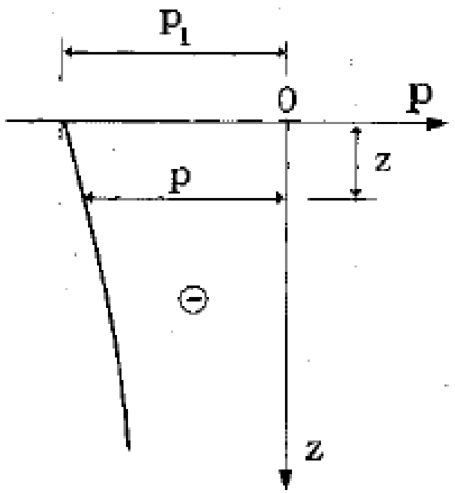
Sediment liquefaction can contribute to sediment erosion and scour in coastal environments:

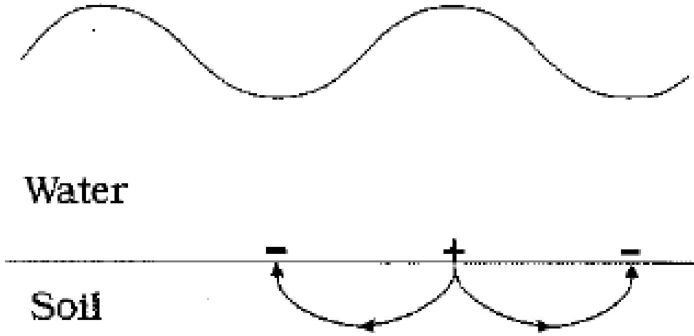
1. Residual liquefaction

2. Momentary liquefaction from vertical pressure gradients

3. Momentary liquefaction from horizontal pressure gradients







Sumer, B. Mutlu. *Liquefaction around marine structures*. 2014.

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Motivation

Pore pressure behavior

When rearranging sediment particles, loading sediment, flow of pore water, or changing hydrostatic pressure rapidly, the pressure of water in the soil pores can rise above (suprahydrostatic or positive excess pore pressures) or sink below (subhydrostatic or negative excess pore pressures) hydrostatic level.

This affects the sediment strength, can initiate pore water flow, or even destroy the soil fabric (liquefaction/ fluidization). It is affected by soil properties such as state of consolidation, porosity, and saturation.

We would like to measure the pore water response to

- Waves (rapid changes in hydrostatic pressure, shear stresses on the bed surface, particle rearrangement)
- Tides (some slower changes in hydrostatic pressure, groundwater flow, maybe particle rearrangement)
- Anthropogenic affects (vehicles moving over the beach, etc.)

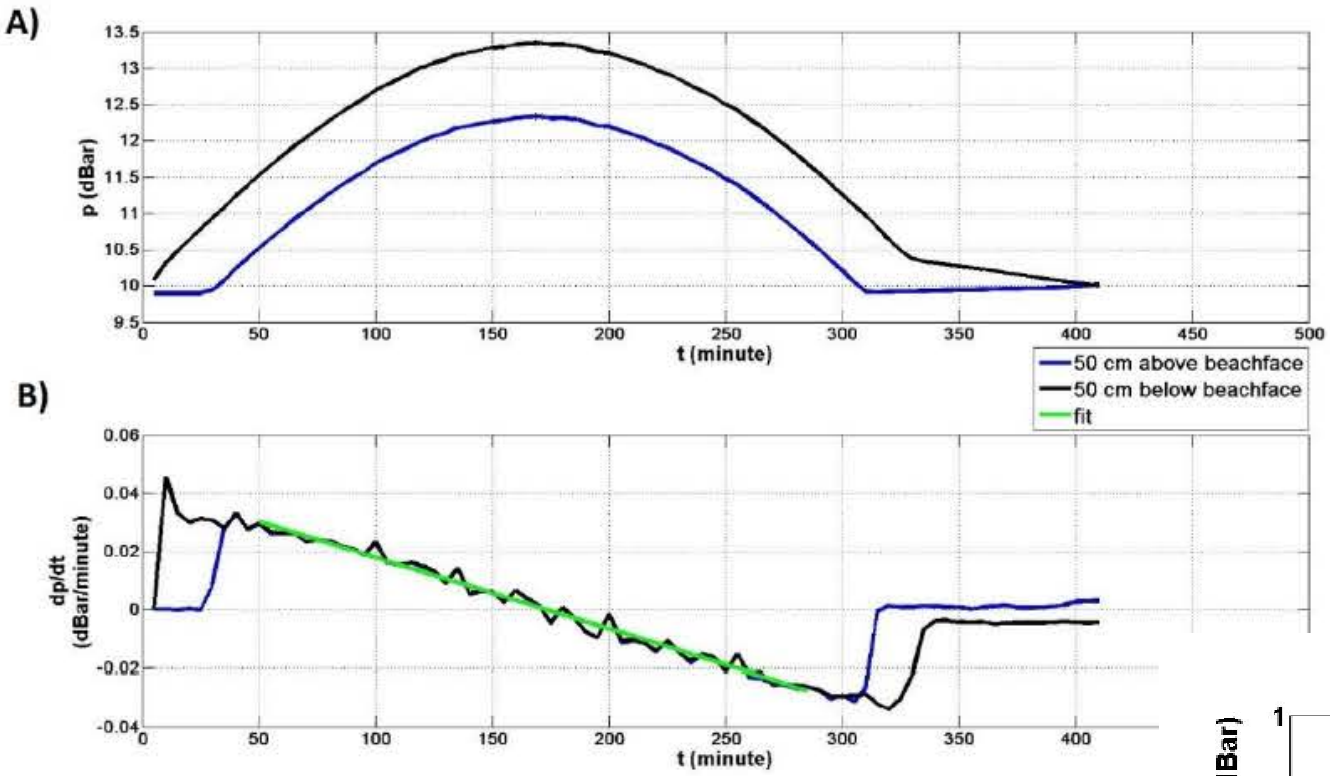
Re-purposing RBR Solos for Pore Pressure Measurements

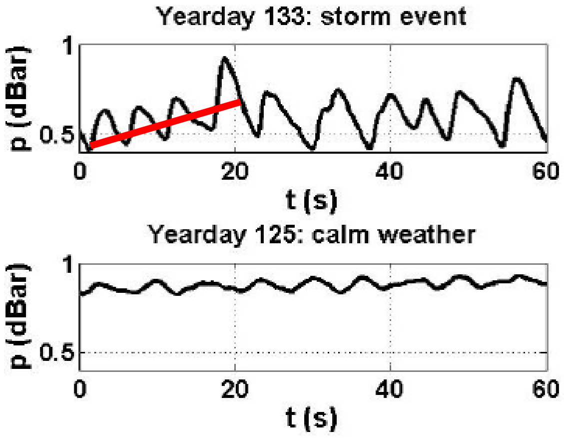
- **There are no off-the-shelf sensors designed for measuring pore pressures in coastal environments.**

- **Challenges:**
  - Sand should not press on the sensor.
  - Timing as correlation of sensors is crucial for data analysis.
  - Deployment
    - Safety of personnel
    - Loss/damage of sensors
    - Disturbance of sand
  - Each of the above mentioned challenges affects data quality and data analysis
  - There are no established methods for deployment or data processing available, yet.

- **Our general approach:**
  - Use a shield to keep sand away from sensor (first attempt: a perforated can; now: non-woven geotextiles)
  - Anchor sensor(s); usually at least 2 in a vertical arrangement (pipes, shelf-materials, etc.)
  - Synchronize sensors to same start time (usually at least 24 hours after deployment to allow for sand settlement)
  - Deploy them (so far: mostly in the intertidal zone, some in the upper subtidal zone; future: in any water depth?)
  - Leave them in place for > 2 days
  - Recover and analyze data

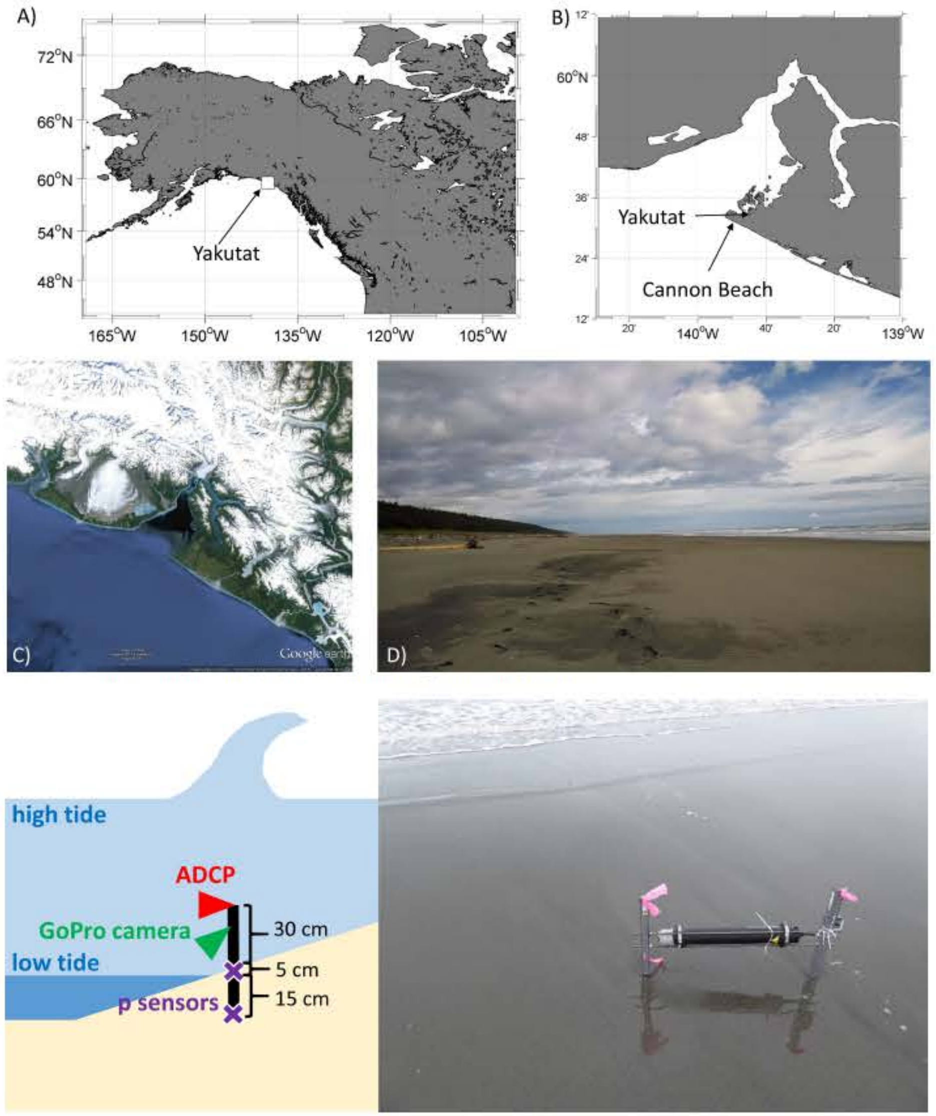
Advocate Beach, Nova Scotia, 2013

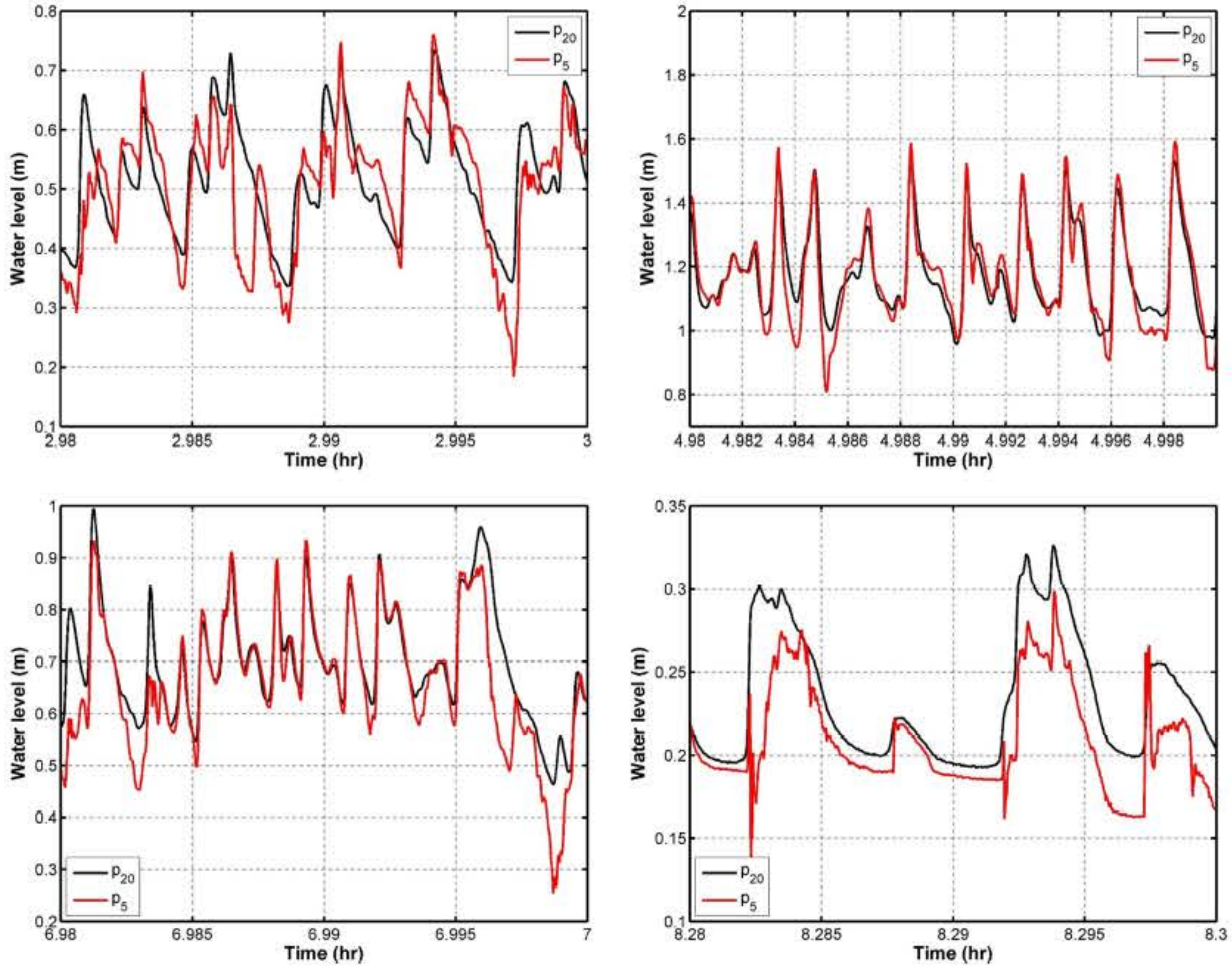




Stark & Hay (2014)

Cannon Beach, Yakutat, Alaska, 2014



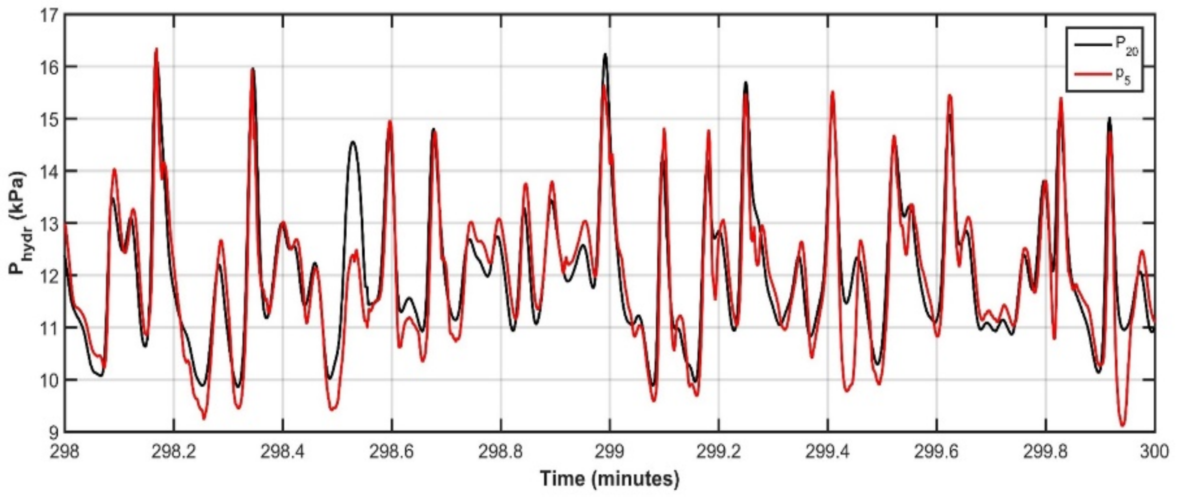


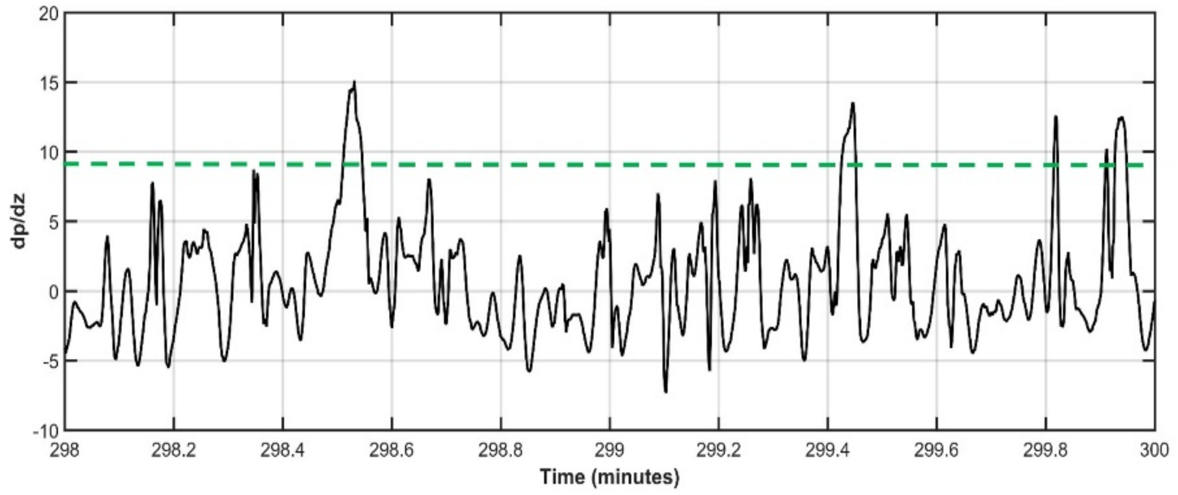
Stark & Quinn (2015)

Cannon Beach, Yakutat, Alaska, 2014 & 2015

Momentary liquefaction after Yeh and Mason (2014)

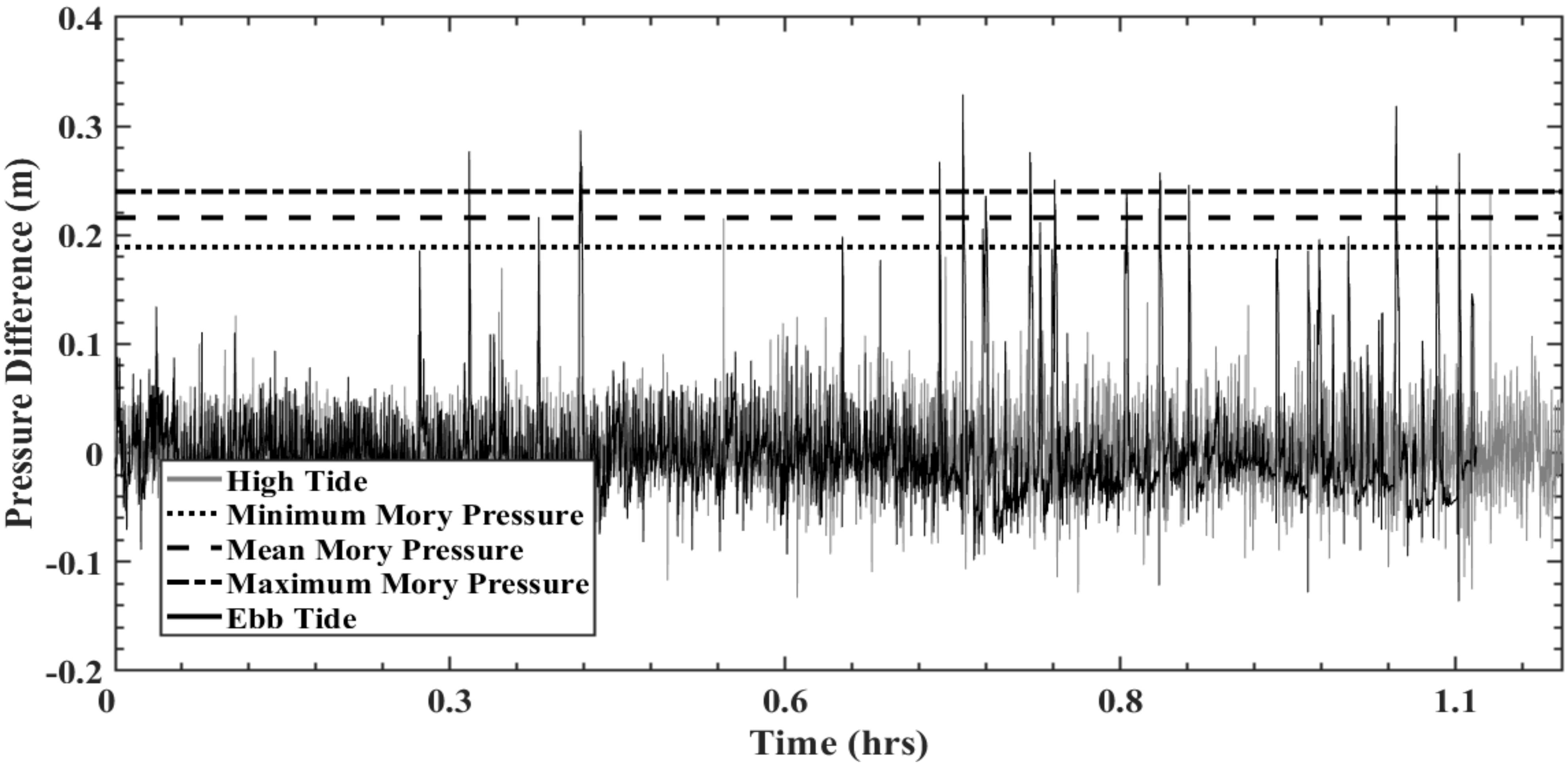
$$-\frac{\partial p}{\partial z} > \gamma'$$





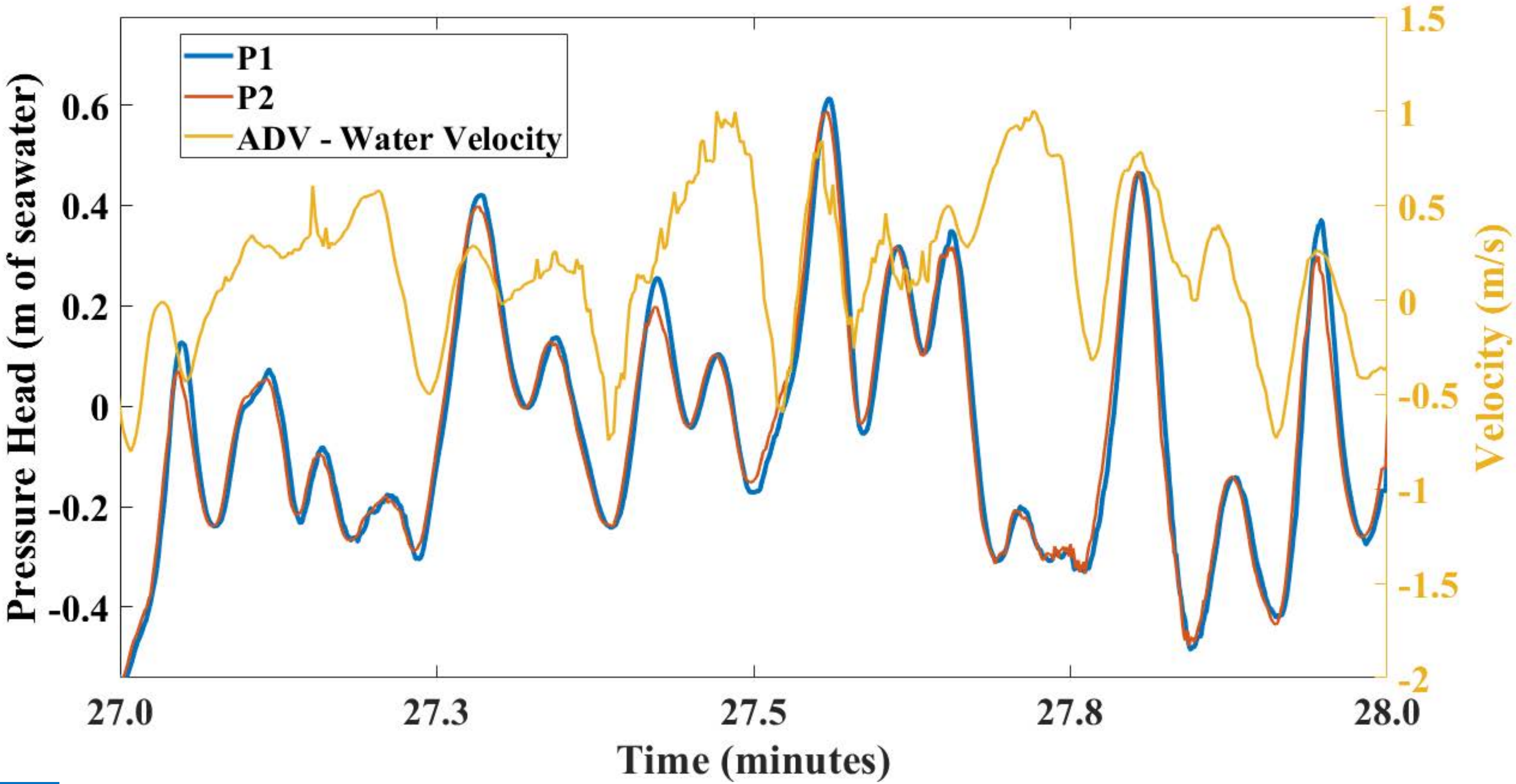
Stark (2017)

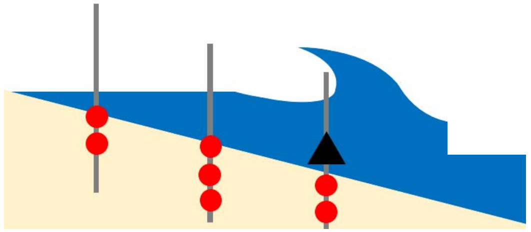
Point Carrew, Yakutat, Alaska, 2017



Florence et al. *(in prep.)*

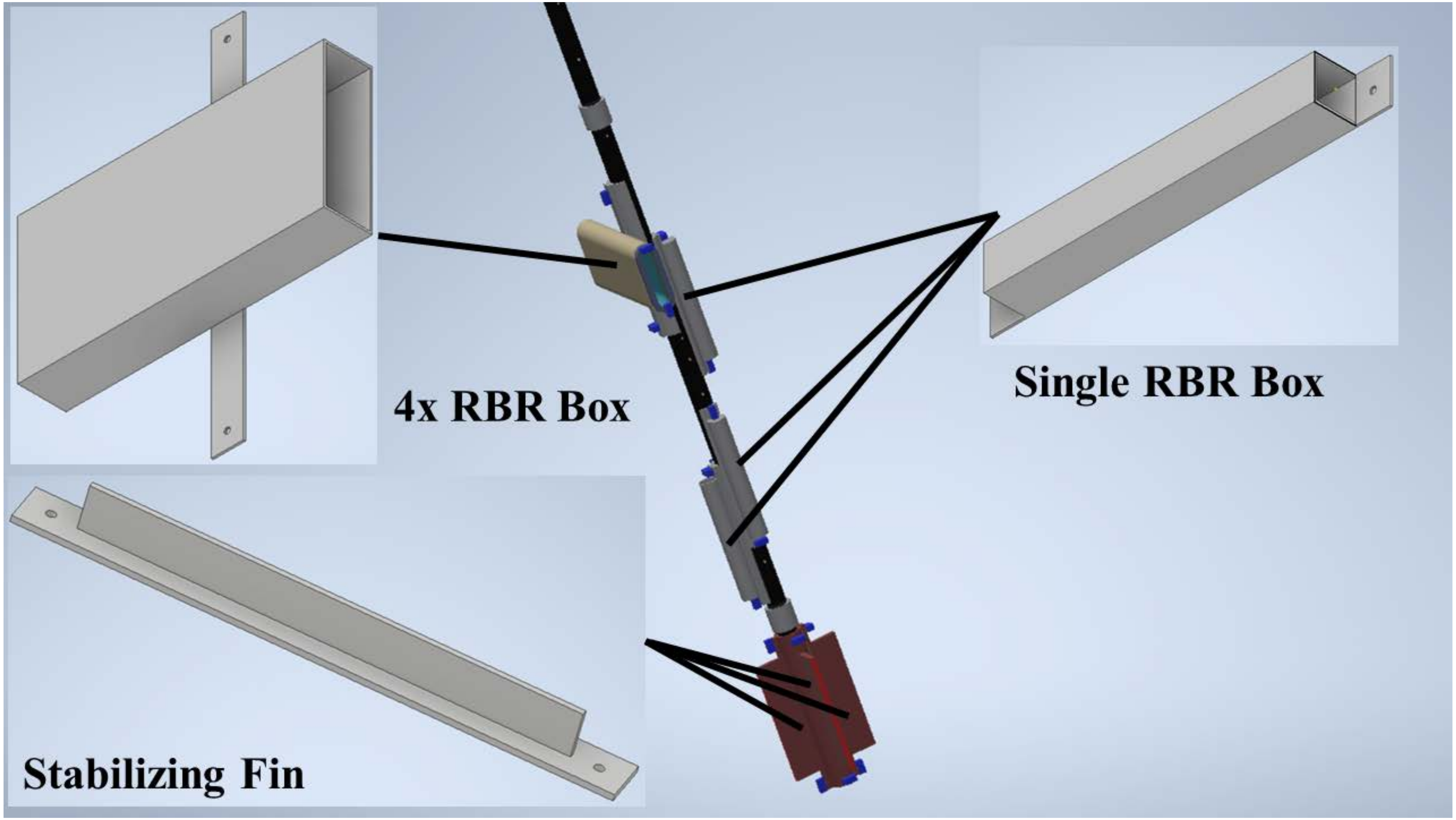
FRF, Duck, North Carolina, 2019



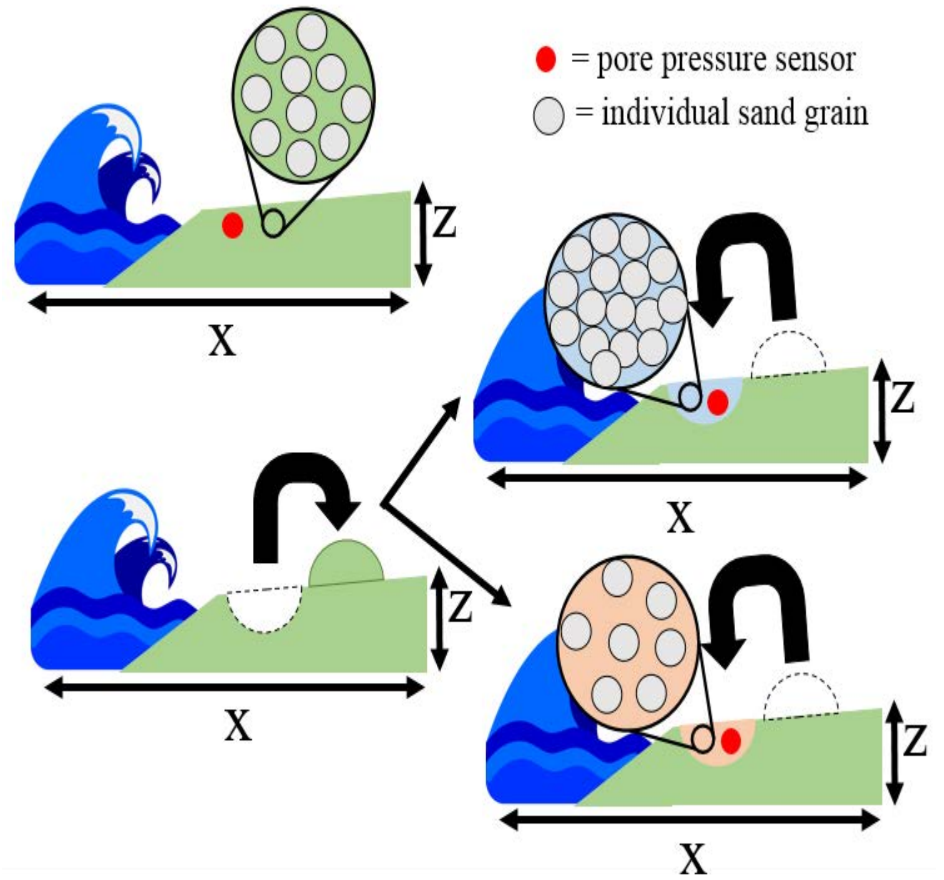


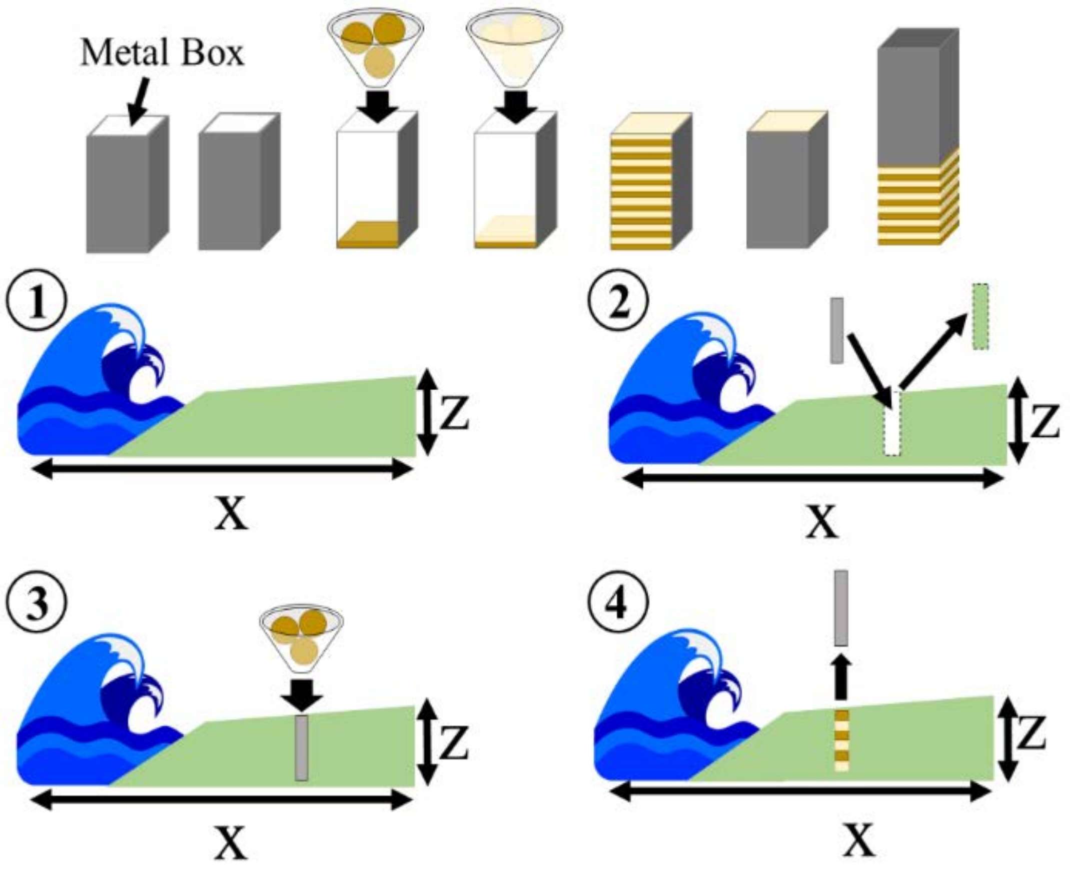
Florence et al. *(in prep.)*

Next steps: pressure lance system



Next steps: controlled large scale lab tests





Proposal in preparation with M. Florence (VT), Ryan Mulligan (UQ), and Greg Siemens (RMC)

Concluding Remarks

- The process of sediment liquefaction under ocean wave action is not fully understood, yet. Studying pore pressures under different wave conditions will assist with gaining new fundamental knowledge on this issue.
- Understanding pore pressure behavior and the effects on coastal erosion can make an important contribution to improving the prediction and mitigation of coastal hazards.
- The RBR SoloDs performed very well in this new task with only small operational modifications (addition of geotextiles).
- The data has contributed to new insights on pore pressure behavior in coastal environments and associated coastal erosion.
- Additional modifications in the operational procedures are needed to streamline the deployment, measurement, and data analysis process.
- The measurements have the potential to assist with local coastal erosion mitigation strategies.

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Special thanks goes particularly to PhD student Matthew Florence (matthf6@vt.edu) whose research has been guiding this study.

Thank you for your attention!

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