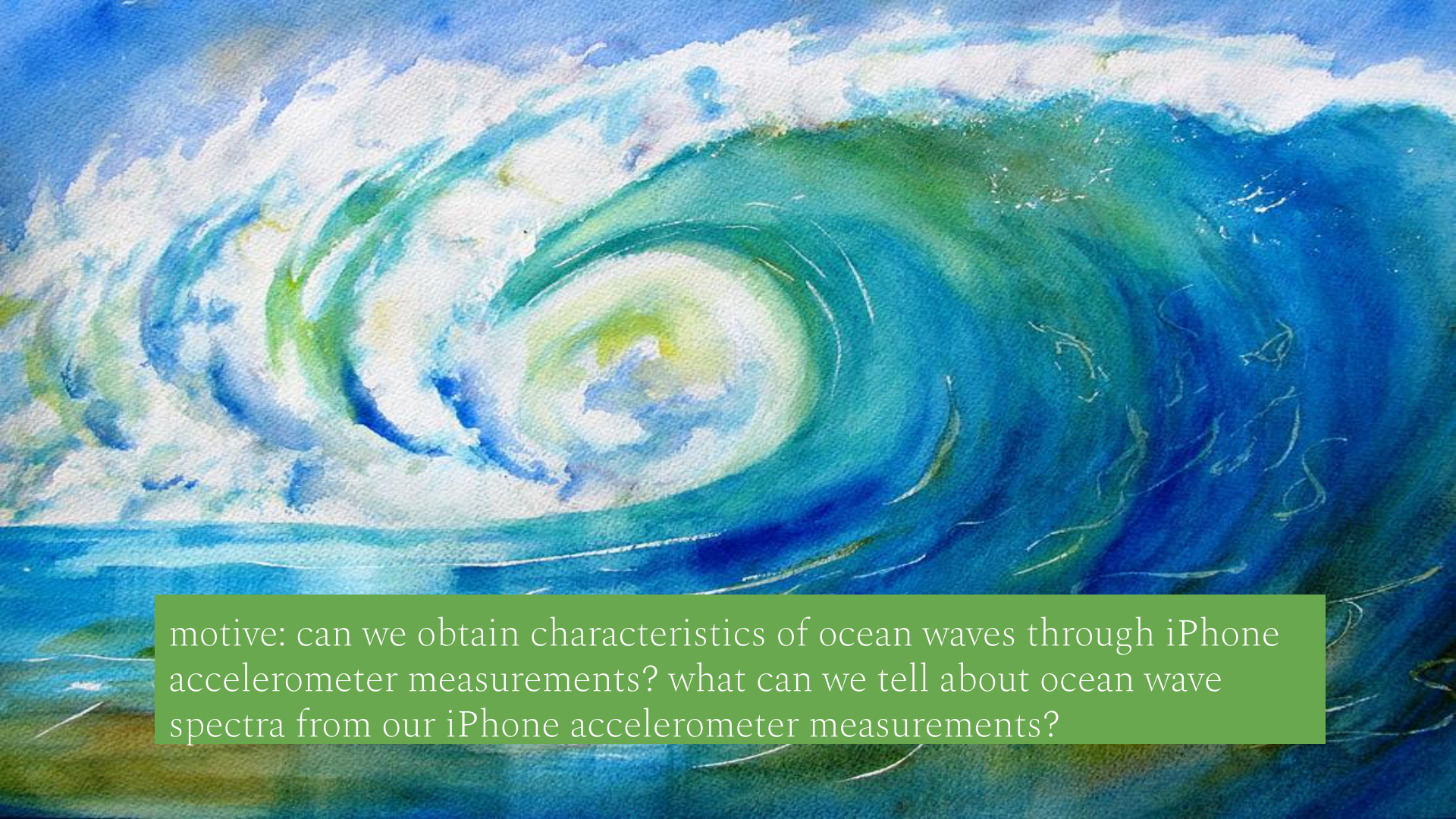


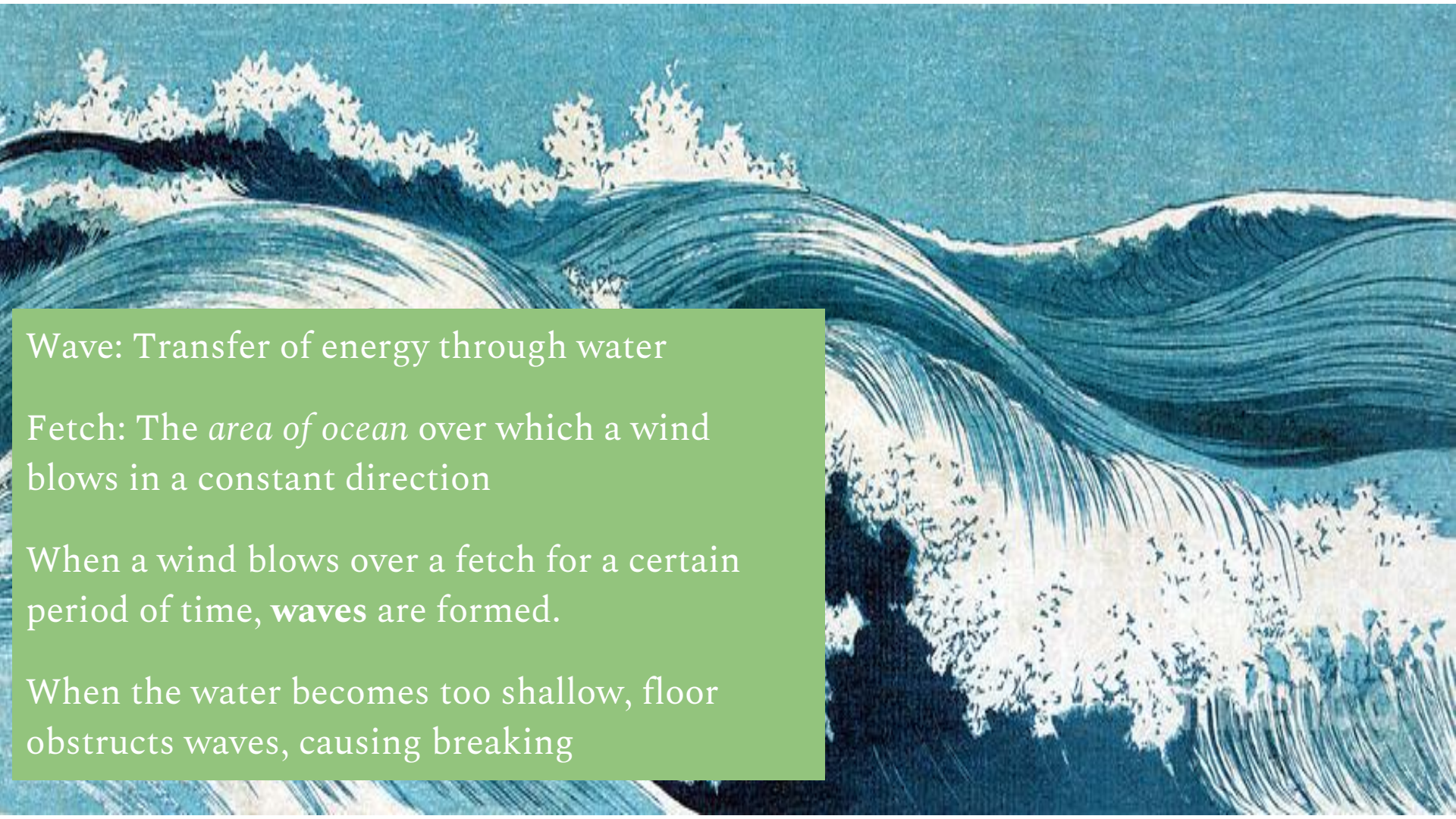
do you have a buoy in  
your pocket ?

amy amatya & kai zheng.

applying Pierson-Moskowitz  
model to iPhone-derived wave  
spectra.



motive: can we obtain characteristics of ocean waves through iPhone accelerometer measurements? what can we tell about ocean wave spectra from our iPhone accelerometer measurements?

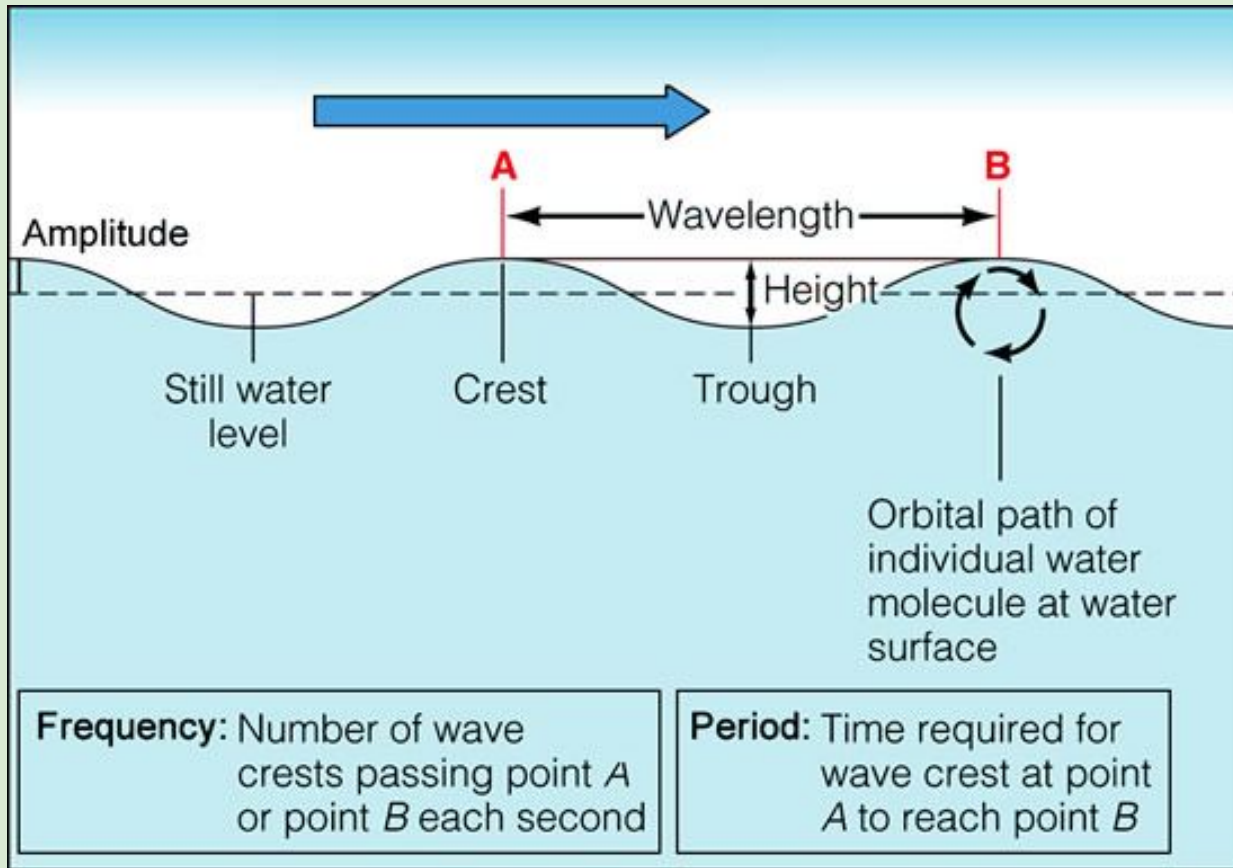


Wave: Transfer of energy through water

Fetch: The *area of ocean* over which a wind blows in a constant direction

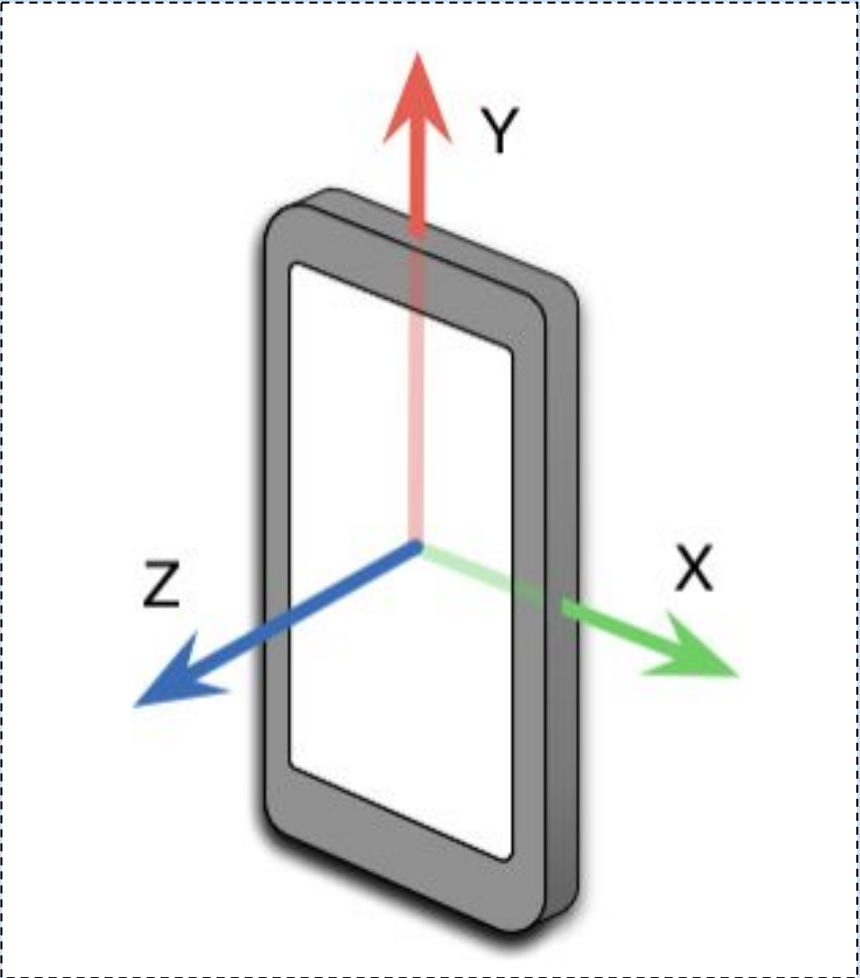
When a wind blows over a fetch for a certain period of time, **waves** are formed.

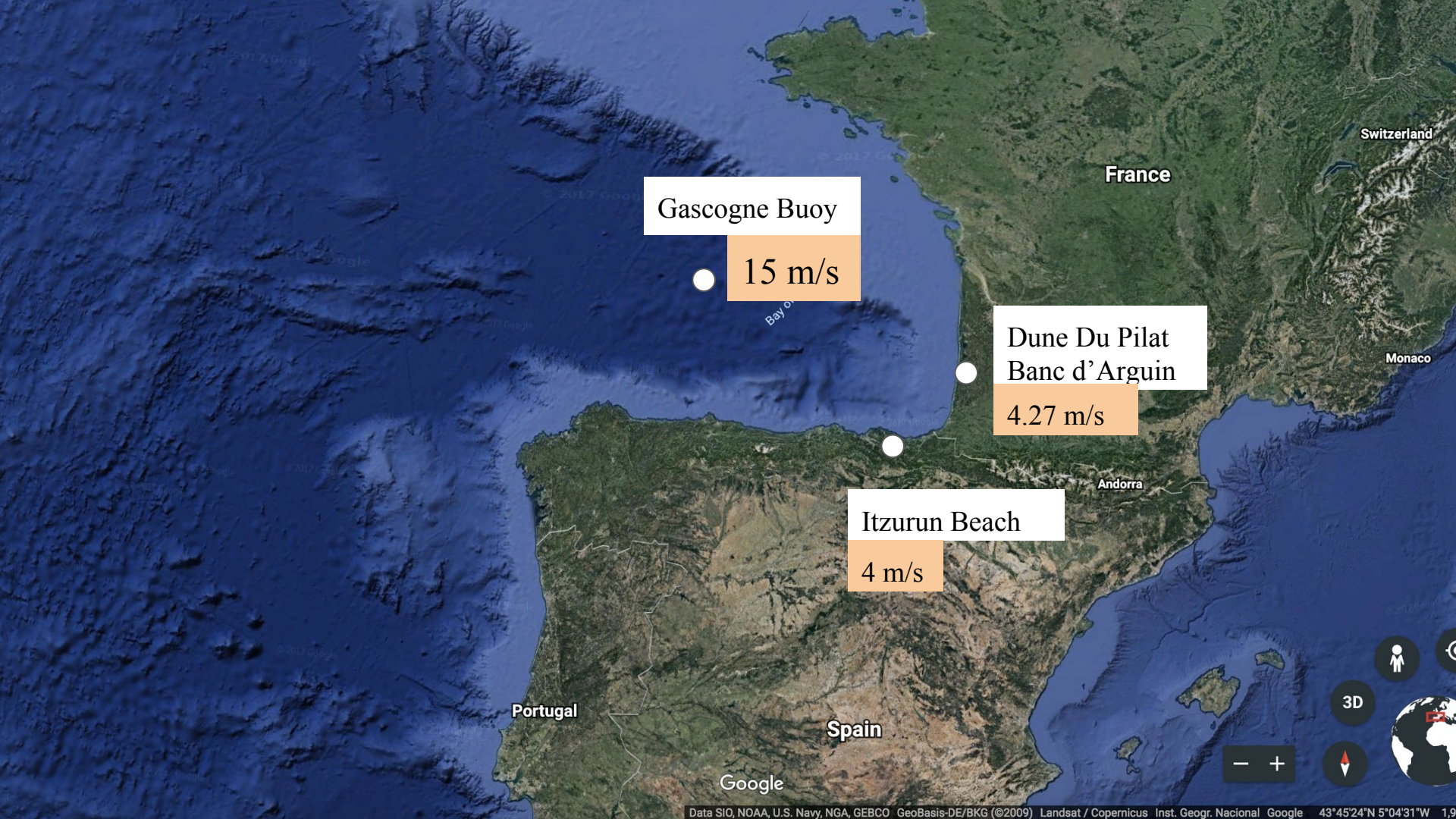
When the water becomes too shallow, floor obstructs waves, causing breaking



❖ App: \*VibSensor (Accelerometer)

❖ Measuring Frequency: 10 hz ('Low')





Gascogne Buoy

15 m/s

Dune Du Pilat  
Banc d'Arguin

4.27 m/s

Itzurun Beach

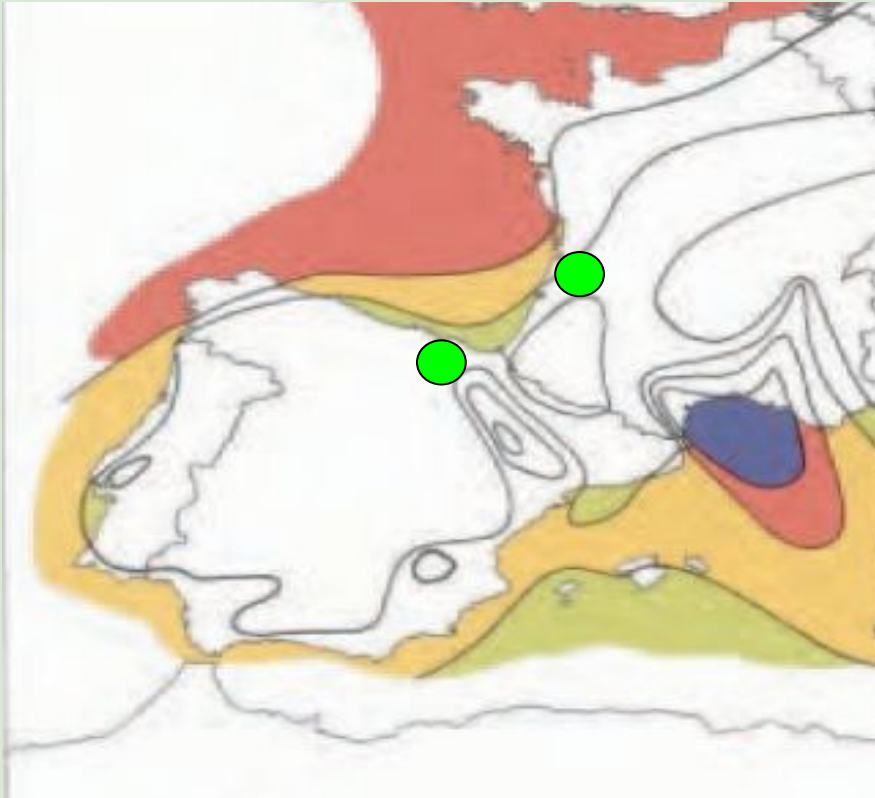
4 m/s



Late January



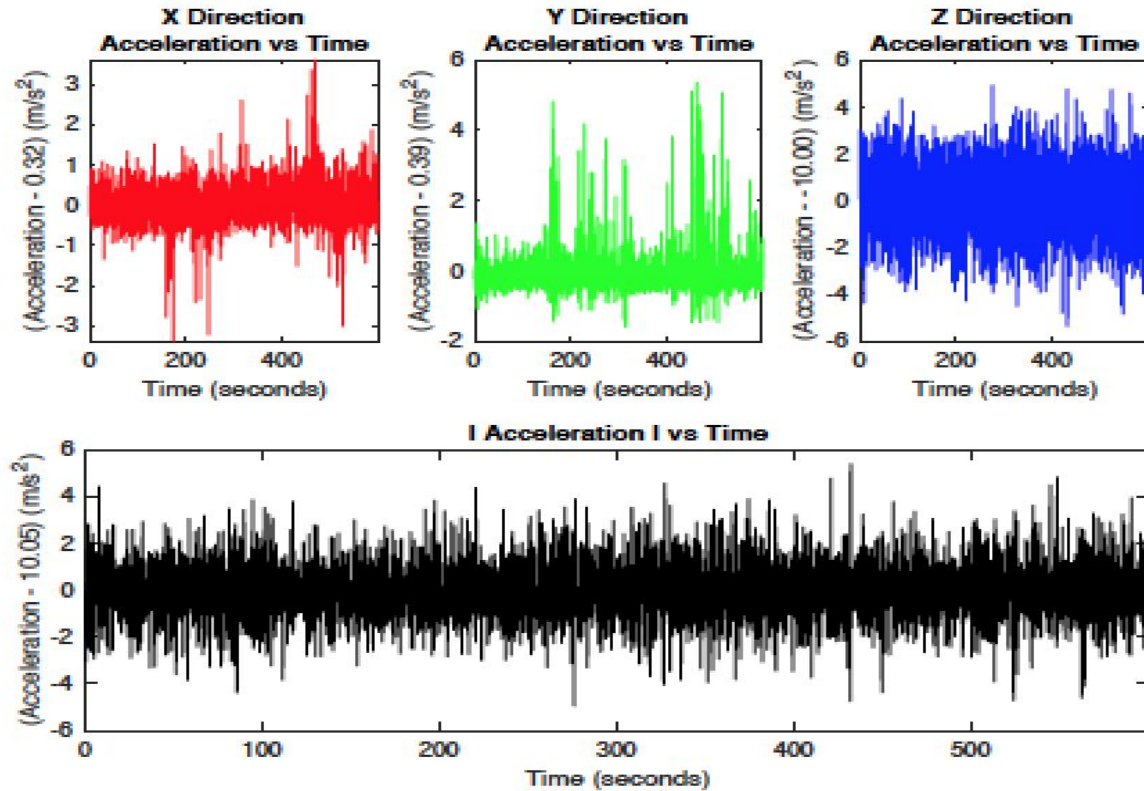
Late September

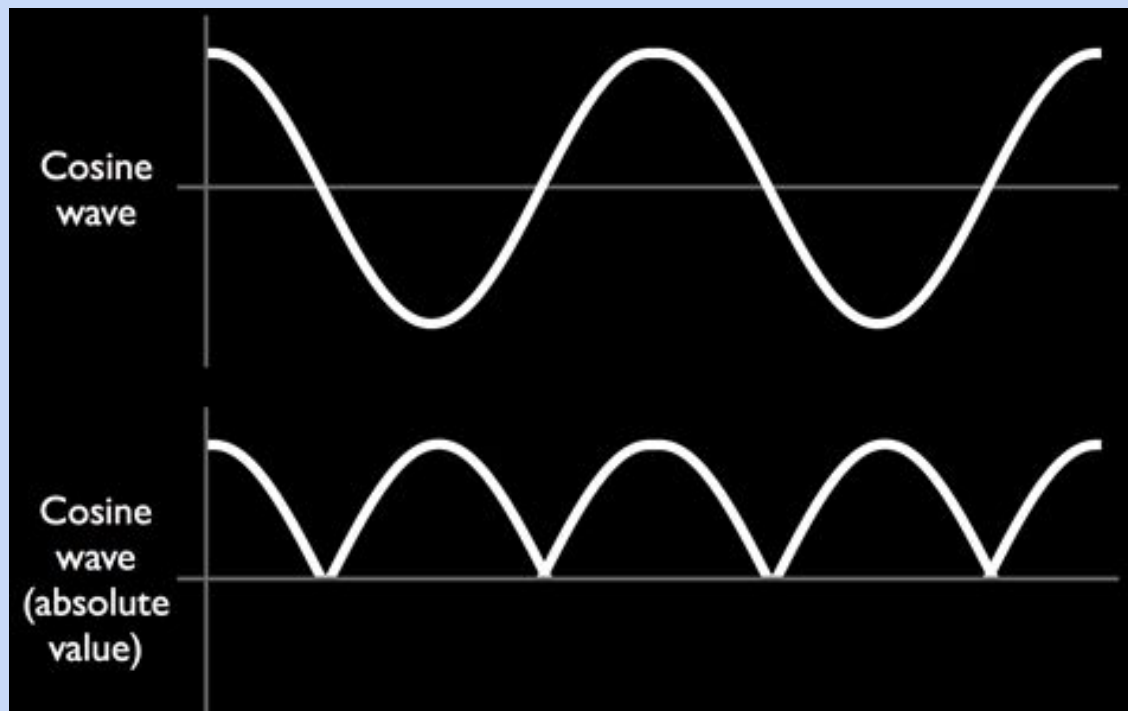


	> 9
	8.0 - 9.0
	7.0 - 8.0
	5.5 - 7.0
	< 5.5

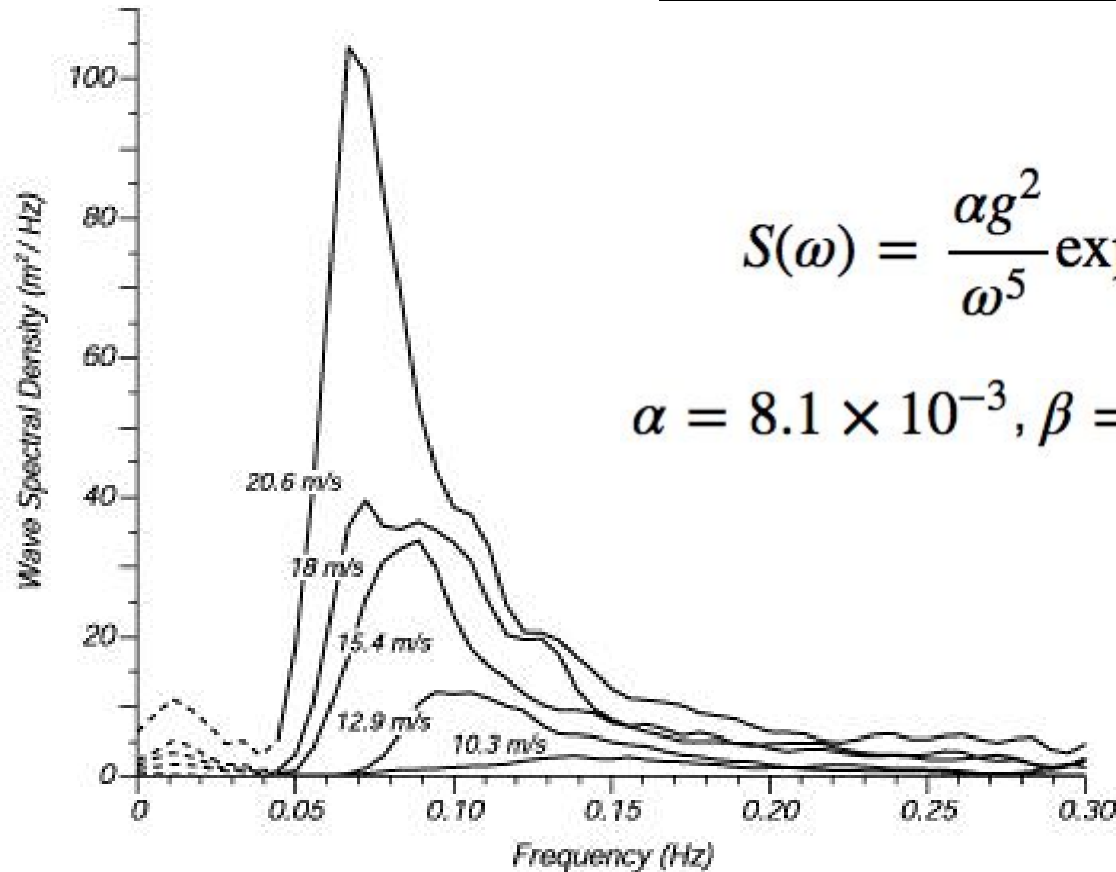


10/29/2017, 15:03:45





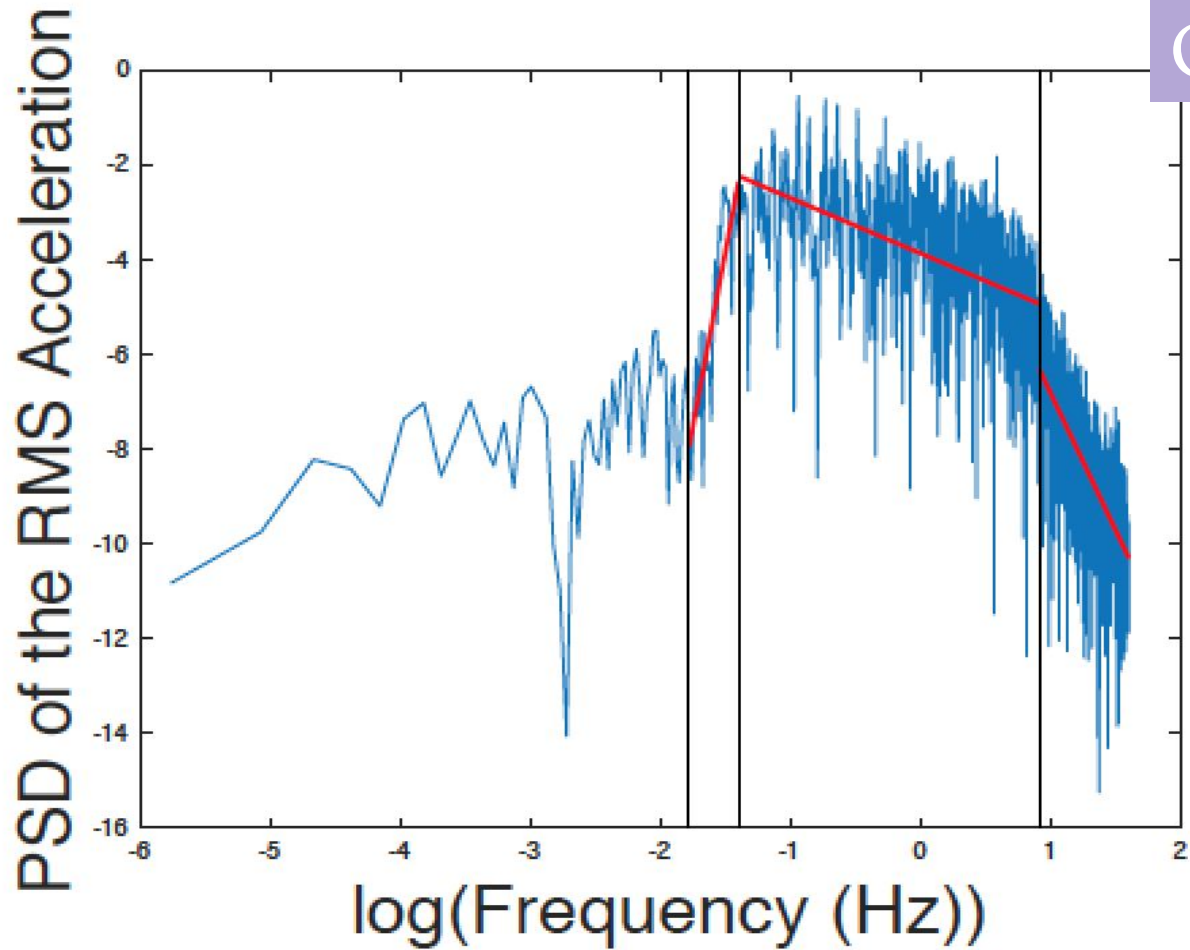
# Pierson Moskowitz Model 1964



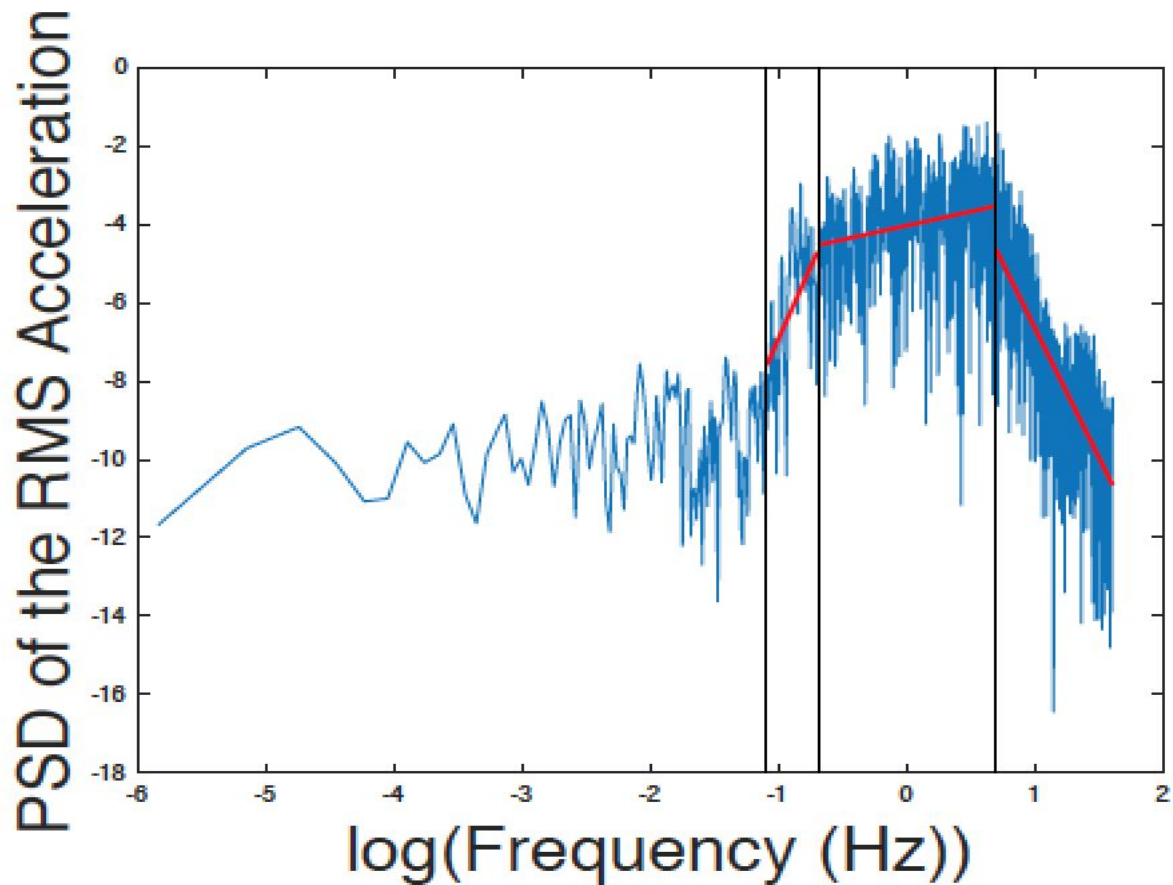
$$S(\omega) = \frac{\alpha g^2}{\omega^5} \exp\left(-\beta \left(\frac{\omega_0}{\omega}\right)^4\right)$$

$$\alpha = 8.1 \times 10^{-3}, \beta = 0.74, \omega_0 = g/U_{19.5}$$

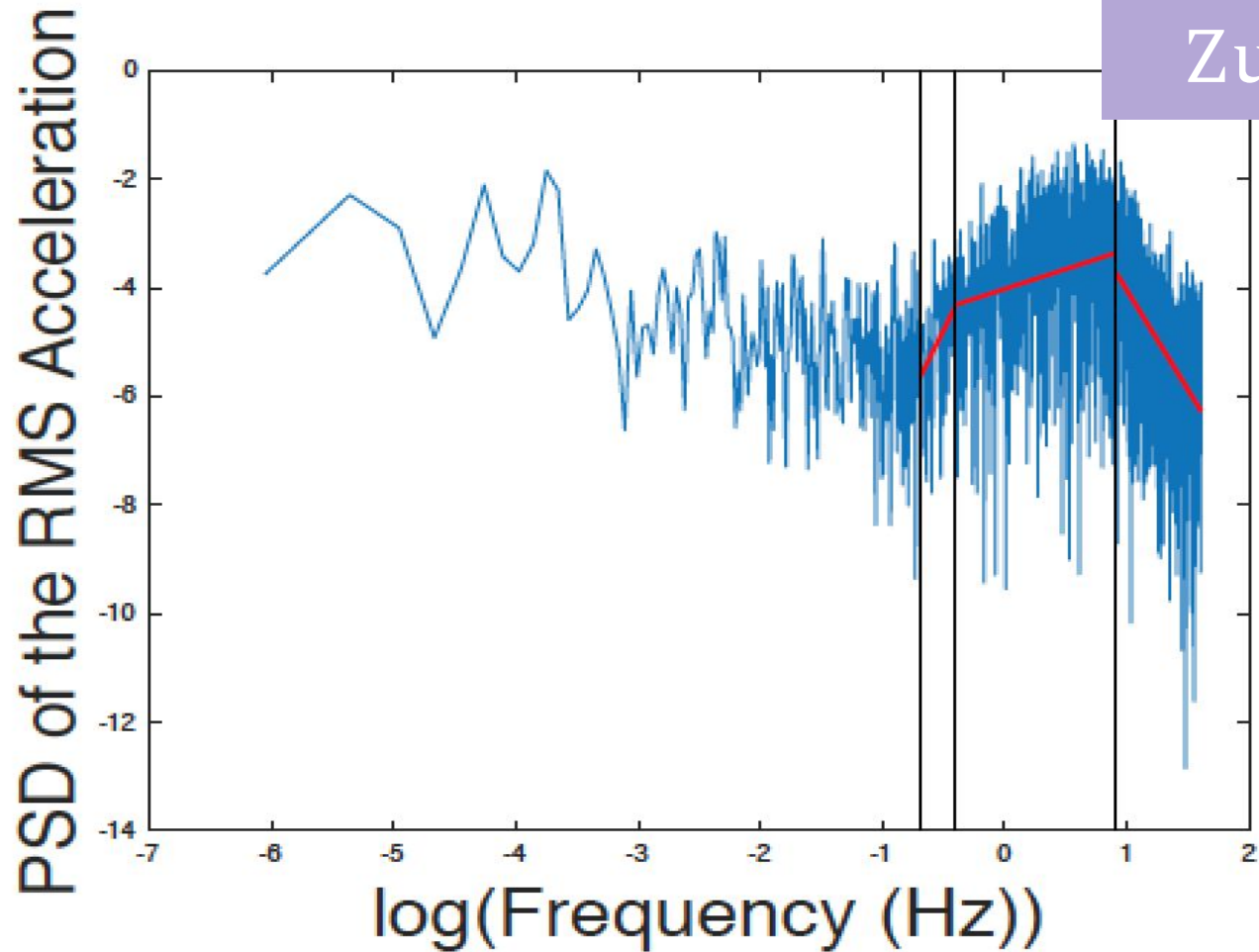
Open Ocean, 12s



# Dune Du Pilat Beach, 2s



# Zumaia Beach, 1s



Average Region 1 Slope

Average Region 2 Slope

Average Region 3 Slope

10/29/2017 Open Ocean  
(Near DDP)

12.27

-0.69

-6.62

10/30/2017 DDP Beach

11.05

1.41

-7.84

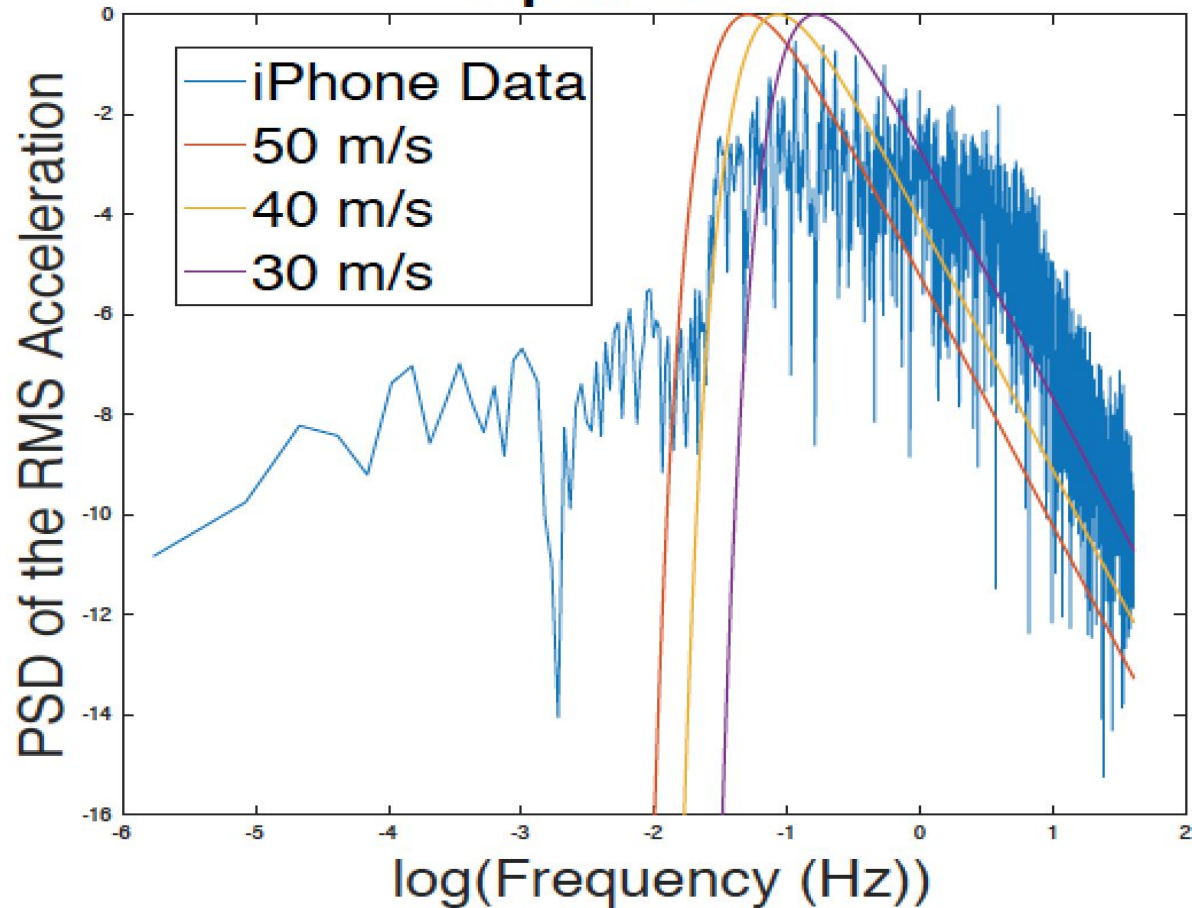
10/31/2017 Zumaia

4.44

0.94

-3.44

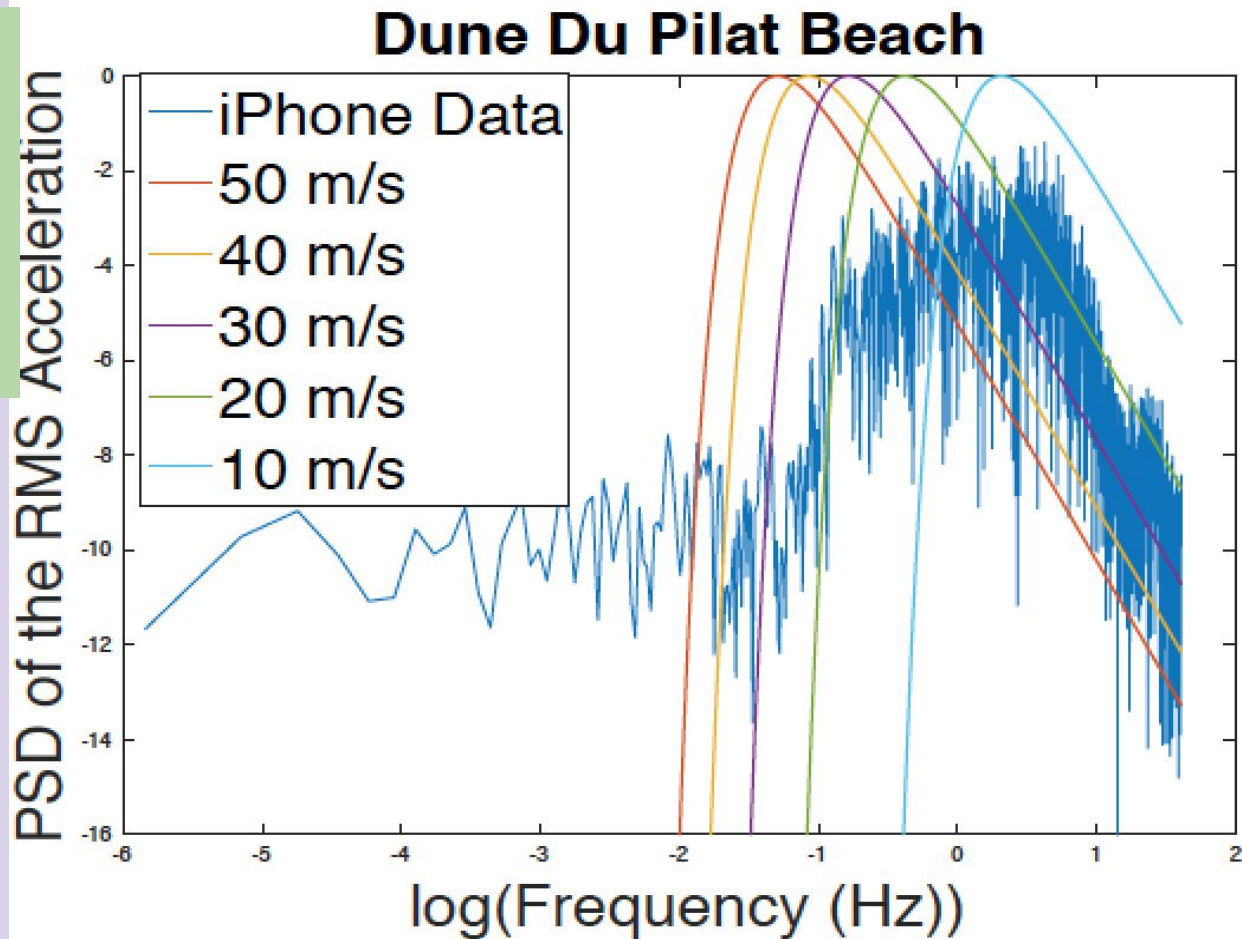
## Open Ocean



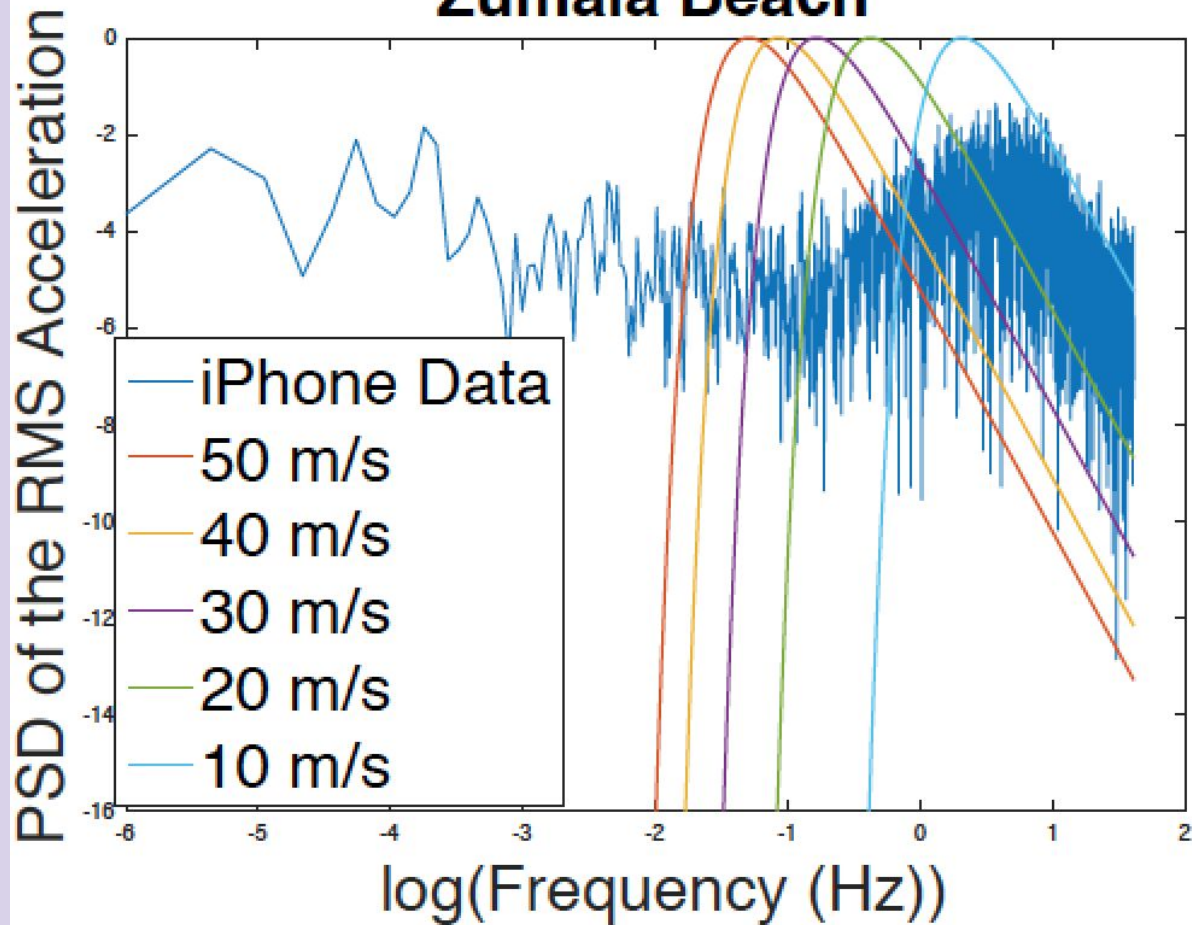
**Adjusted  $U_{19.5} \sim$   
17.5 m/s  
Dominant Period  
 $\sim 12$  s**



**Adjusted  $U_{19.5} \sim$   
**12.5 m/s**  
**Dominant Period**  
 **$\sim 2$  s****



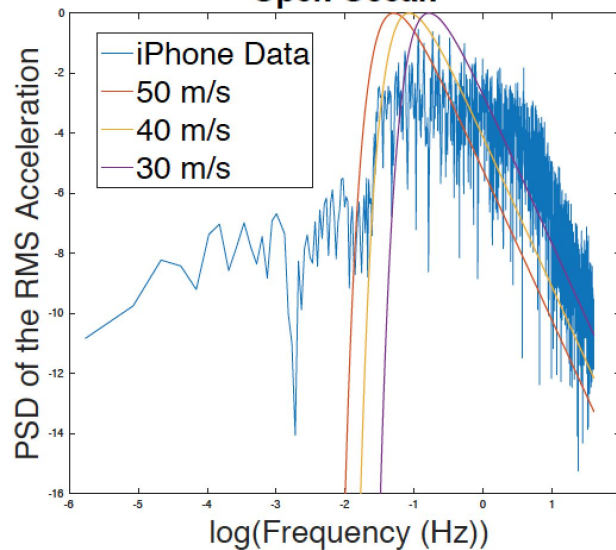
## Zumaia Beach



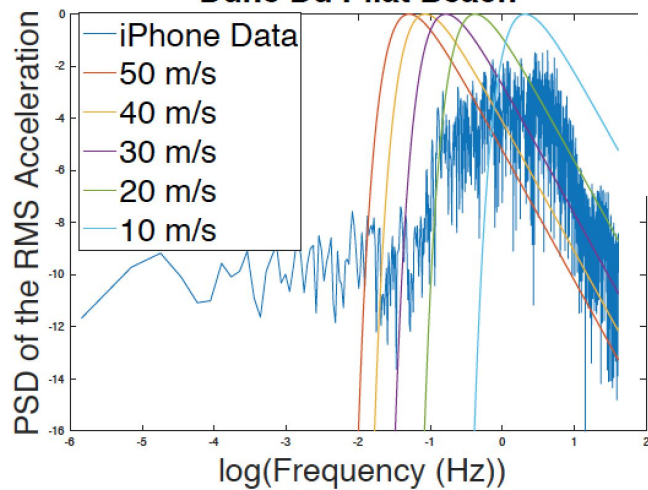
$$U_{19.5} \sim 7.5 \text{ m/s}$$

**Dominant Period**  
 **$\sim 1 \text{ s}$**

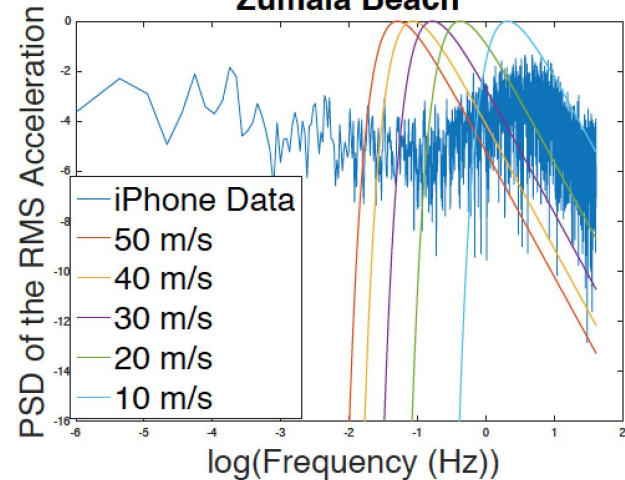
### Open Ocean



### Dune Du Pilat Beach

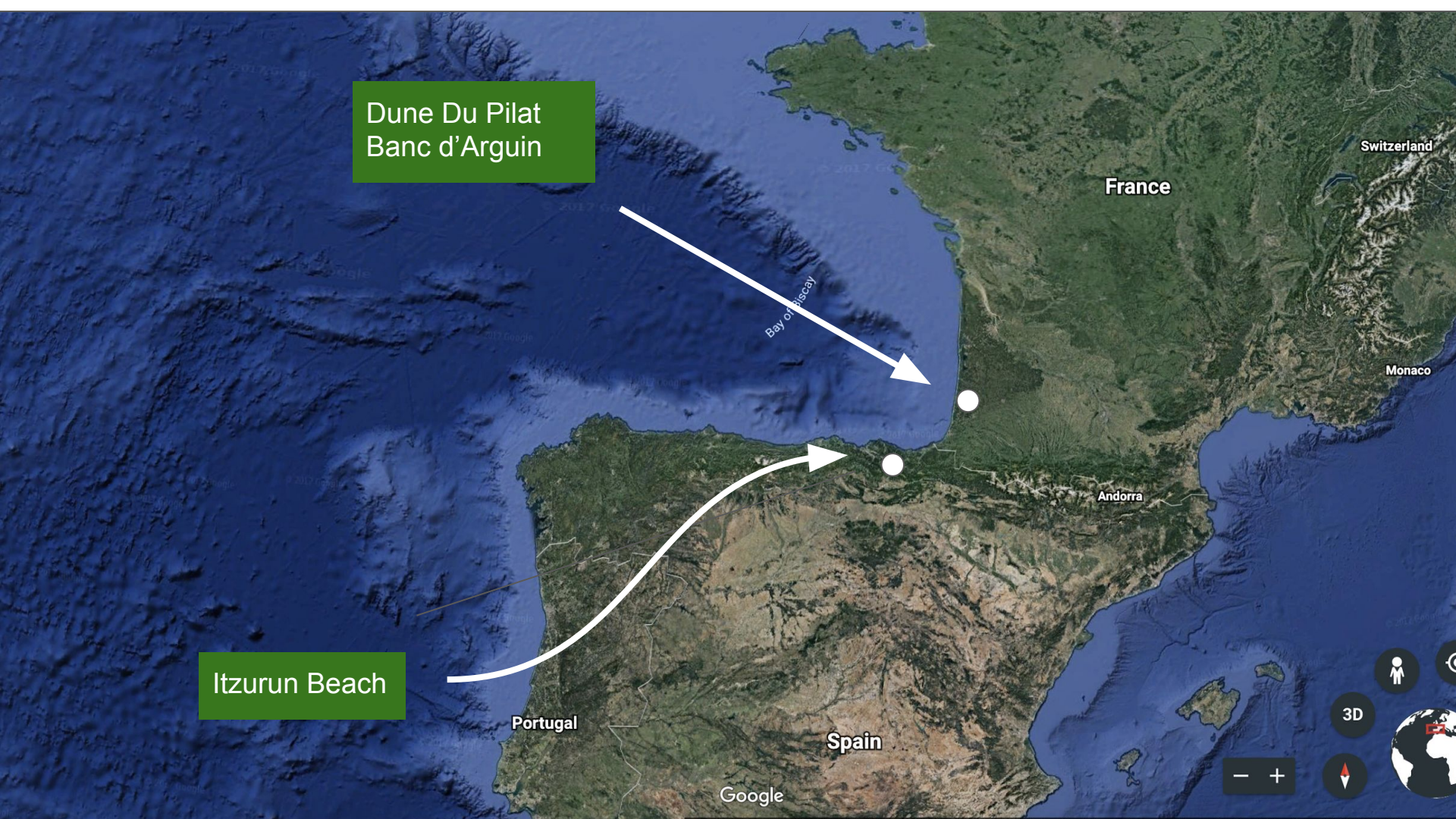


### Zumaia Beach



Dune Du Pilat  
Banc d'Arguin

Itzurun Beach





Prevailing Westerlies

Banc d'Arguin

Passe Sud

Dune du Pilat

Google



Prevailing westerlies

San Telmo ermita

2D



Region 1 slope is on average more than double in the open ocean and dune du pilat.

Breaking waves have less developed spectrums. Breaking filters out the larger period waves

Seems like weaker winds formed zumaia waves but actually multi directional waves converging

Bernabeu, A., Medina, R. & Vidal, C., 2003. Wave Reflection on Natural Beaches: An Equilibrium Beach Profile Model, *Estuarine, Coastal and Shelf Science*, 57(4), 577–585.

Dumas, F., Stanisière, J.-Y. & Maurer, D., 2009. Hydrodynamic Characterization of the Arcachon Bay, Using Model-Derived Descriptors, *Continental Shelf Research*, 29(8), 1008–1013.

Pierson, W. J. & Moskowitz, L., 1964. A Proposed Spectral Form for Fully Developed Wind Seas Based on the Similarity Theory of S.A. Kitaigorodskii, *Journal of Geophysical Research*, 69(24), 5181–5190. doi: 10.1029/JZ069i024p05181.

Putnam, J. & Johson, J., 1949. The Dissipation of Wave Energy by Bottom Friction, *EOS, Transactions American Geophysical Union*, 30(1), 67–74.





Thank you to Adam,  
Frederik, Alex, Emily,  
and all of our  
classmates!

