Wave attenuation behind a reef

Cedric Monteiro

ISITV, France

Kim Klaka

CMST, Australia

To determine whether an anchorage is comfortable, need to predict:

- Environment - wind, waves, current
- vessel orientation to waves
- resulting vessel motions

Project aims

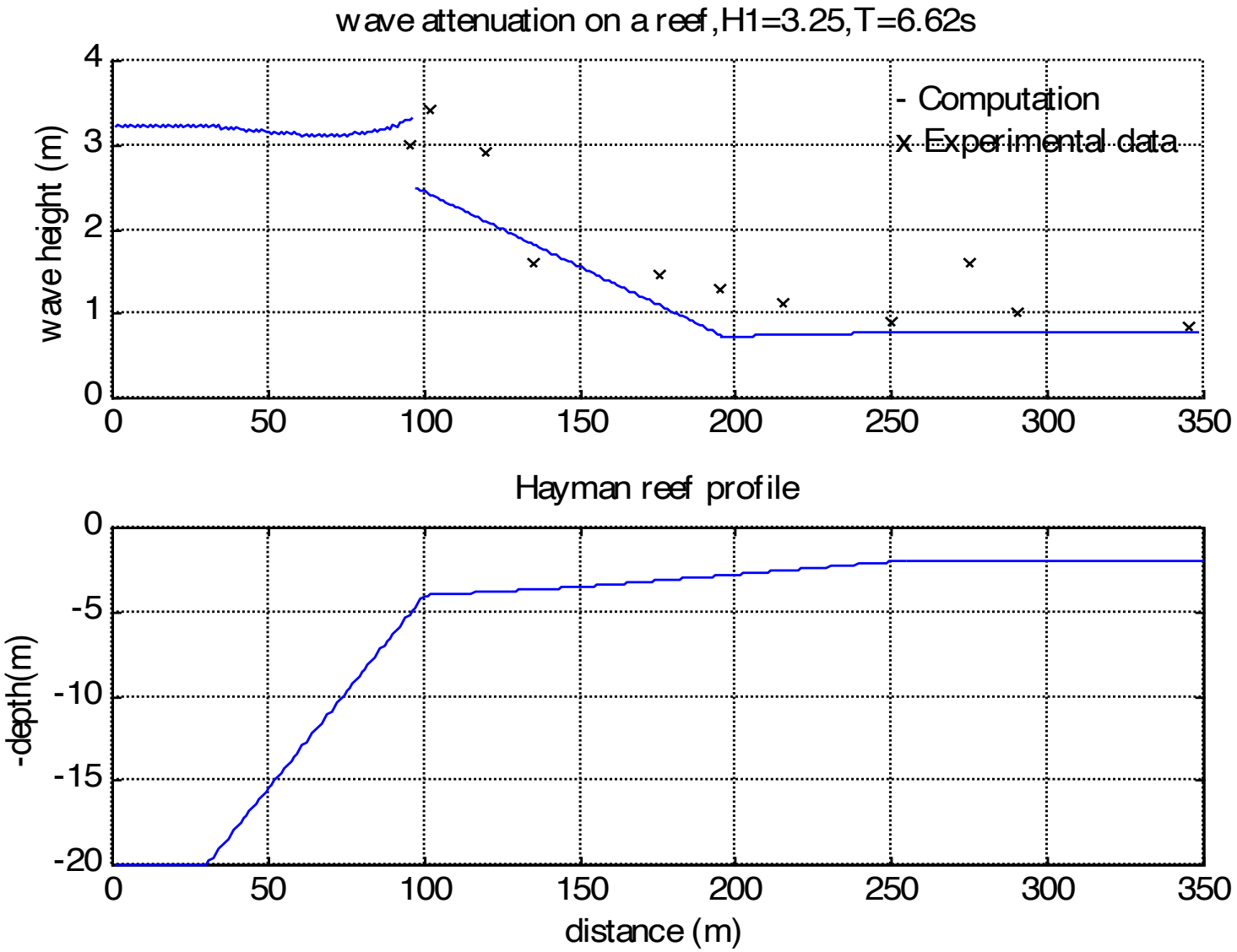
- Develop a model of wave attenuation over a reef
- validate said model by full scale experiment

Monochromatic model

$$\frac{d(EC_g \cos\theta)}{dx} = \frac{\kappa}{h}\left[EC_g - EC_{g_s}\right] + \frac{\rho C_f}{6\pi}\left(\frac{2\pi H}{T \sinh kh}\right)^3$$

- E is the wave energy per unit surface area of ocean:
- κ is an empirical decay coefficient (=0.15).
- h is the water depth.
- EC_{gs} is the energy flux associated with stable wave height $H_s=\Gamma h$, where $\Gamma=0.4$.
- H is the wave height
- T is the wave period
- θ is the incident wave direction
- ρ is the sea water density
- x is the wave direction propagation
- k is the wave number
- C_f is the bottom friction coefficient.
- C the phase velocity

Comparison with lab expt



Spectral model

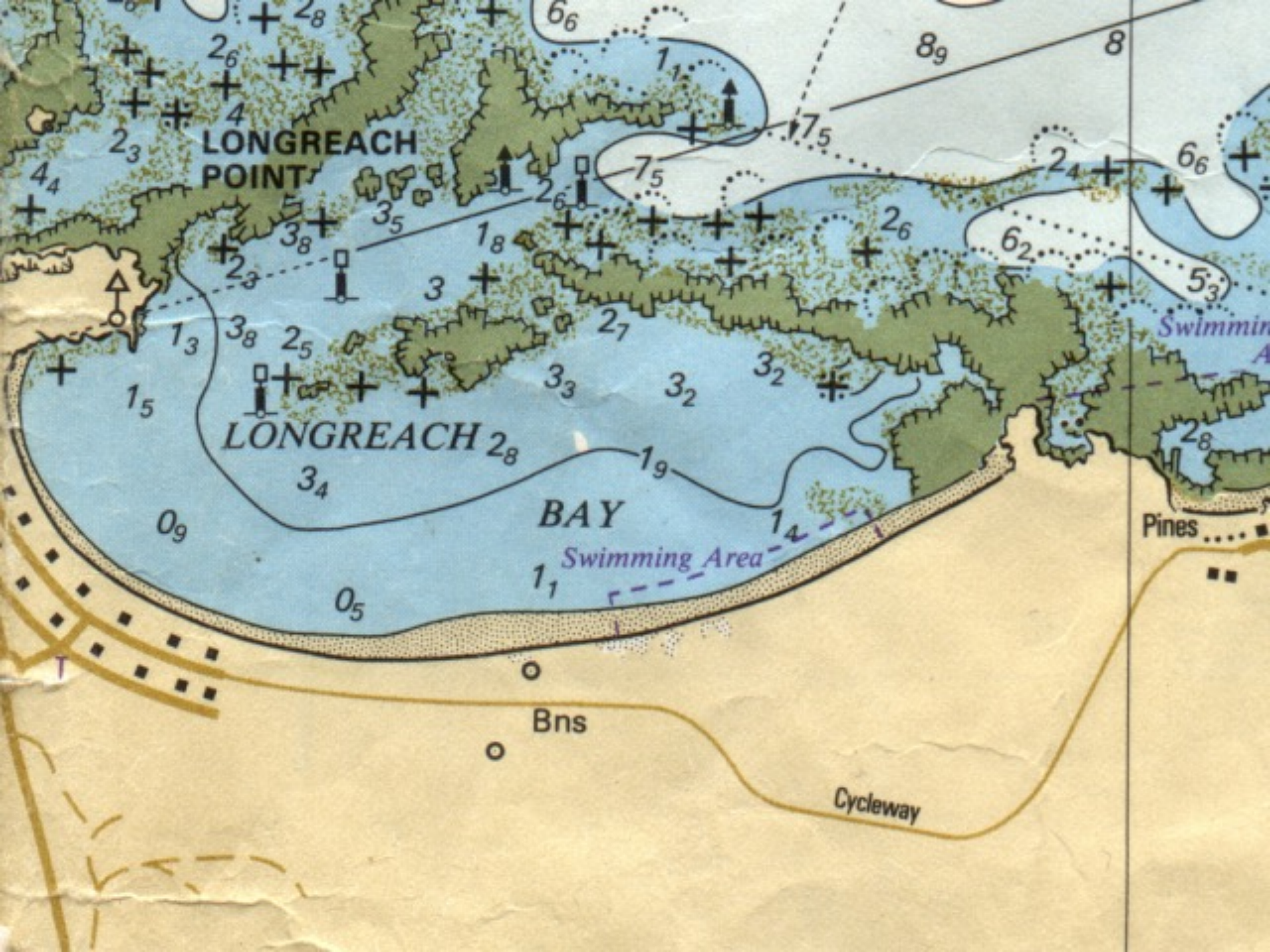
$$\frac{\partial EC_g}{\partial x} + D = 0$$

$$D = \frac{\alpha}{4} Q_b f_p \rho g H_b^2$$

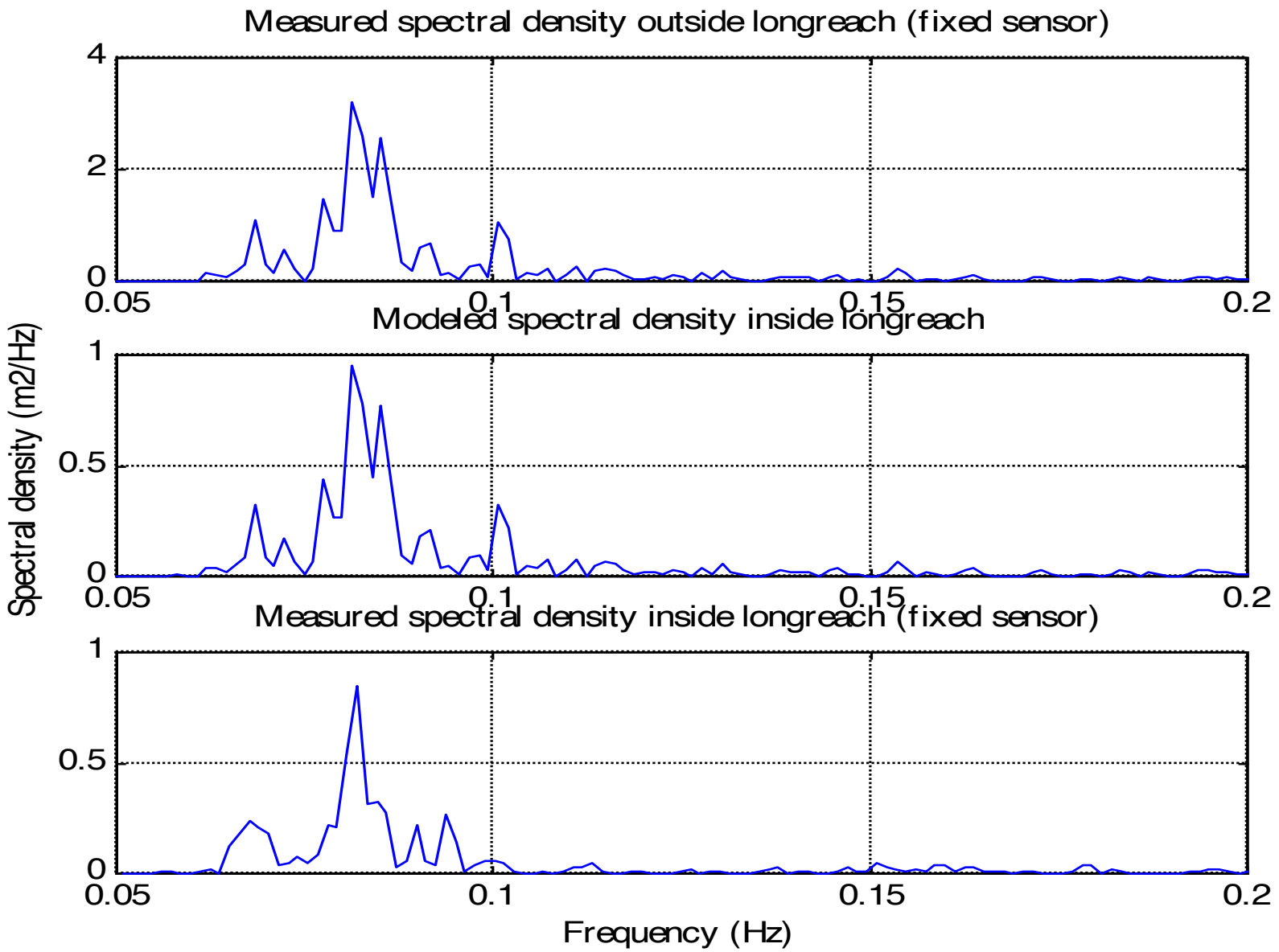
$$Q_b = P(h > H_b) = \exp(-\frac{H_b^2}{m_0})$$

Field experiment 16/6/00

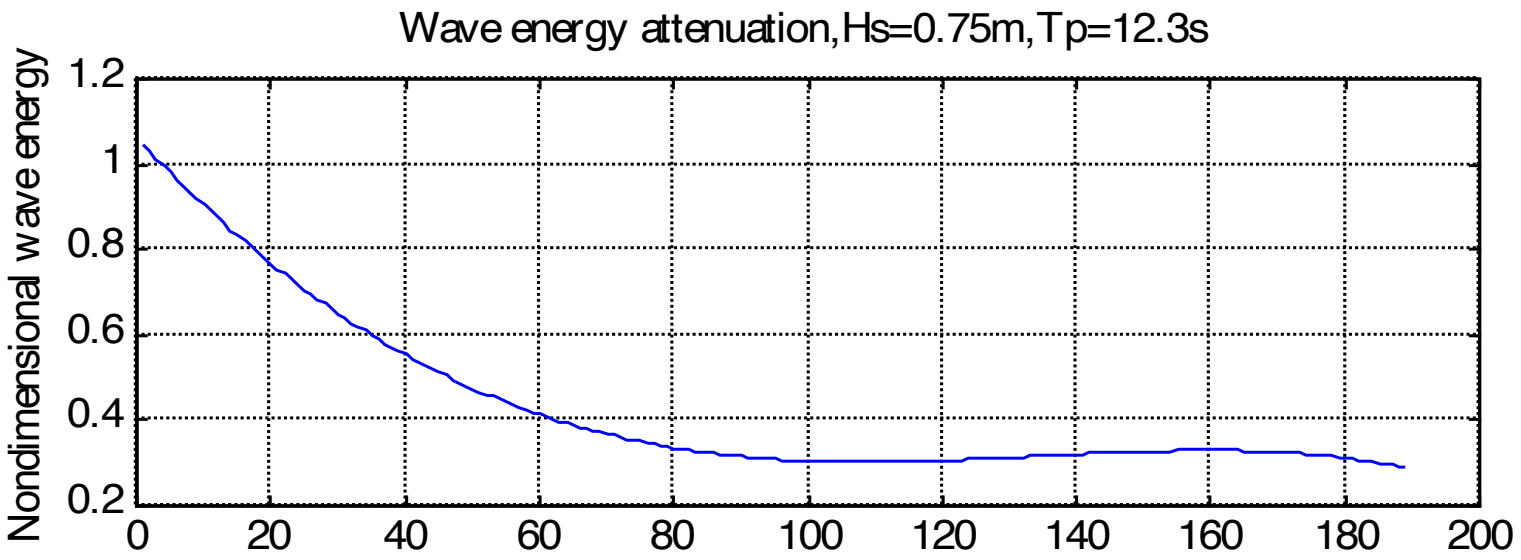
- Longreach Bay, Rottnest
- CMST seabed and floating sensors
- deploy inside and outside reef
- measure water depth over reef

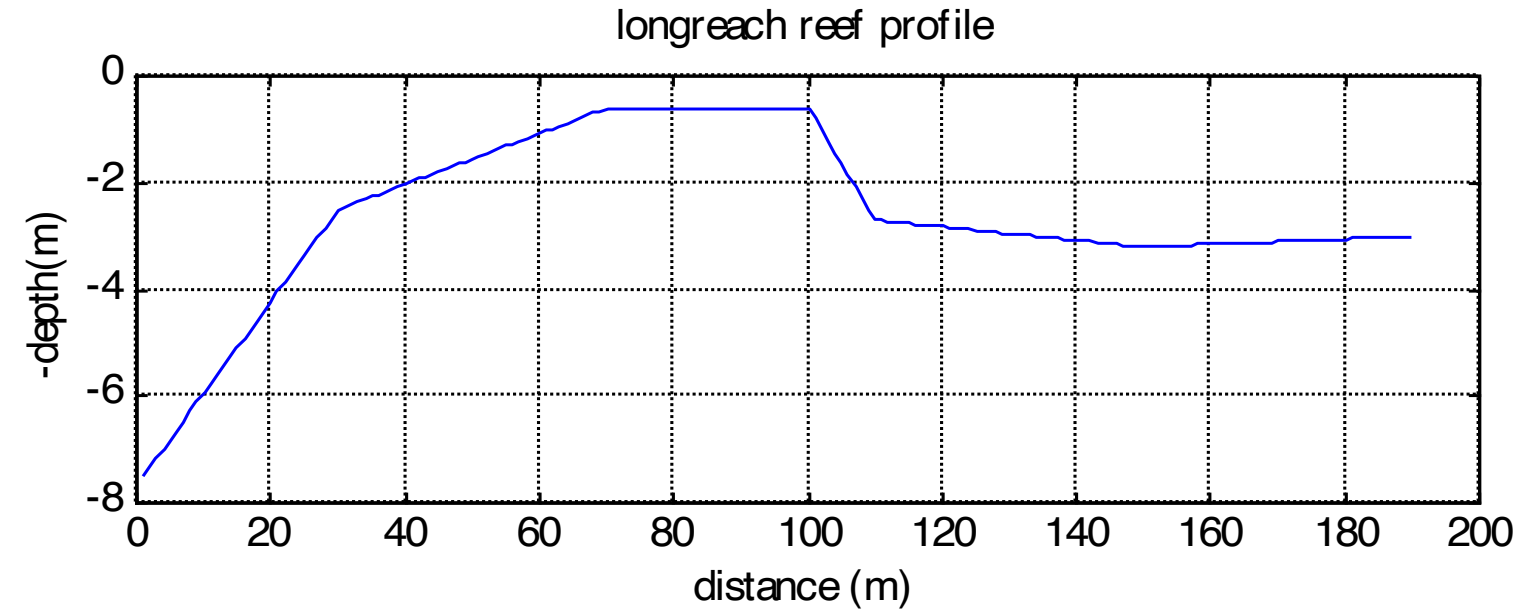

LONGREACH POINT
LONGREACH BAY
Swimming Area
Swimming Area
Pines
Bns
Cycleway

results


Measured spectral density outside longreach (fixed sensor)
Modeled spectral density inside longreach
Measured spectral density inside longreach (fixed sensor)
Spectral density (m2/Hz)
Frequency (Hz)
0.05
0.1
0.15
0.2
0
2
4
0.5
1

More results





Conclusions

- Model works well
- water depth over reef is critical
- research in waves can be wet!