

Exploring the interplay of wave climate, vertical land motion, and rocky coast evolution

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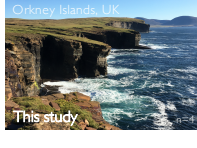
* note: all cited references are [active links](#) – click away! *

We aim to better understand the links between wave climate and rocky coast evolution

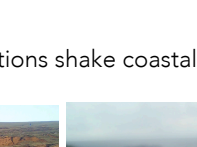
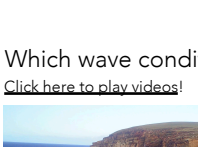
This display:

How sensitive are rocky coasts to variability in wave climate?

Approach: environmental seismology across 4 sites



Seismic monitoring to measure intensity of cliff shaking in response to variable wave conditions



n = # of seismometers

Which wave conditions shake coastal cliffs more?

[Click here to play videos!](#)



Bigger waves = more displacement = more erosion?

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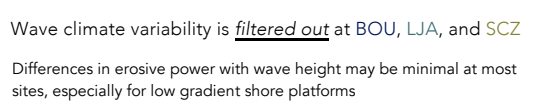
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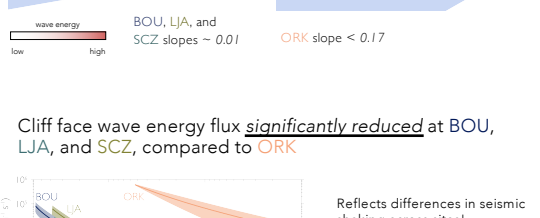
Reality: One site (of four) is sensitive to changes in wave height

ORK is significantly more sensitive to variations in wave height than **BOU**, **LJA**, and **SCZ**

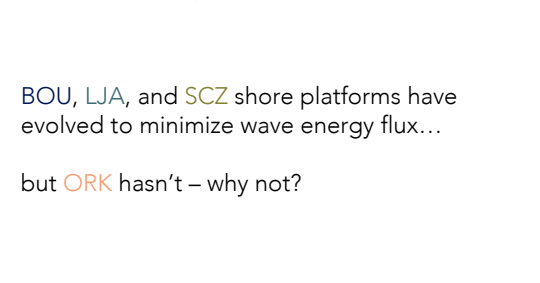


Wave climate variability is filtered out at **BOU**, **LJA**, and **SCZ**

Differences in erosive power with wave height may be minimal at most sites, especially for low gradient shore platforms



Cliff face wave energy flux significantly reduced at **BOU**, **LJA**, and **SCZ**, compared to **ORK**



BOU, **LJA**, and **SCZ** shore platforms have evolved to minimize wave energy flux...

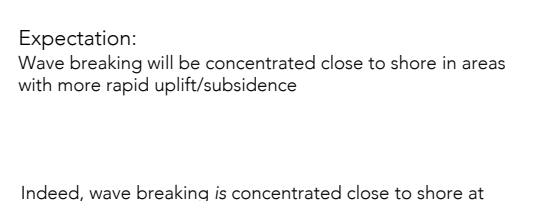
but **ORK** hasn't – why not?

Working Hypothesis:

Rapid uplift or subsidence *outpaces* shore platform adjustment

Prevents near-shore filtering and retains variable wave energy flux at the cliff face

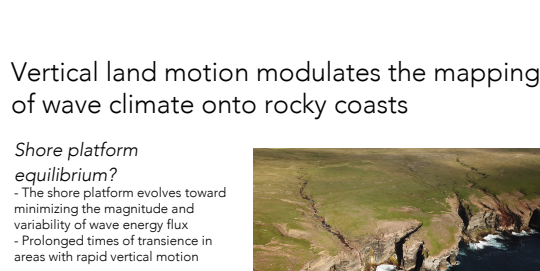
Under more moderate vertical motion, the shore platform evolves to *minimize variability* in delivered wave energy.



Expectation:

Wave breaking will be concentrated close to shore in areas with more rapid uplift/subsidence

Indeed, wave breaking is concentrated close to shore at sites with more rapid vertical motion



Shore platform equilibrium?

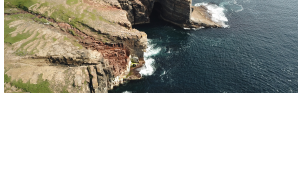
- The shore platform evolves toward minimizing the magnitude and variability of wave energy flux
- Prolonged times of transience in areas with rapid vertical motion

Vertical motion and cliff erosion + retreat

- Rapid vertical motion maintains higher energy flux, may result in more rapid cliff erosion (see [Huppert et al., 2020](#))
- Potential for larger influence of extreme conditions in unadjusted settings

Sensitivity to future climate change

- Highlights areas that will "feel the force" of increased winter storms and sea level rise most significantly
- Environmental seismology provides key insight into sensitivity if rocky coasts to imposed wave climate



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