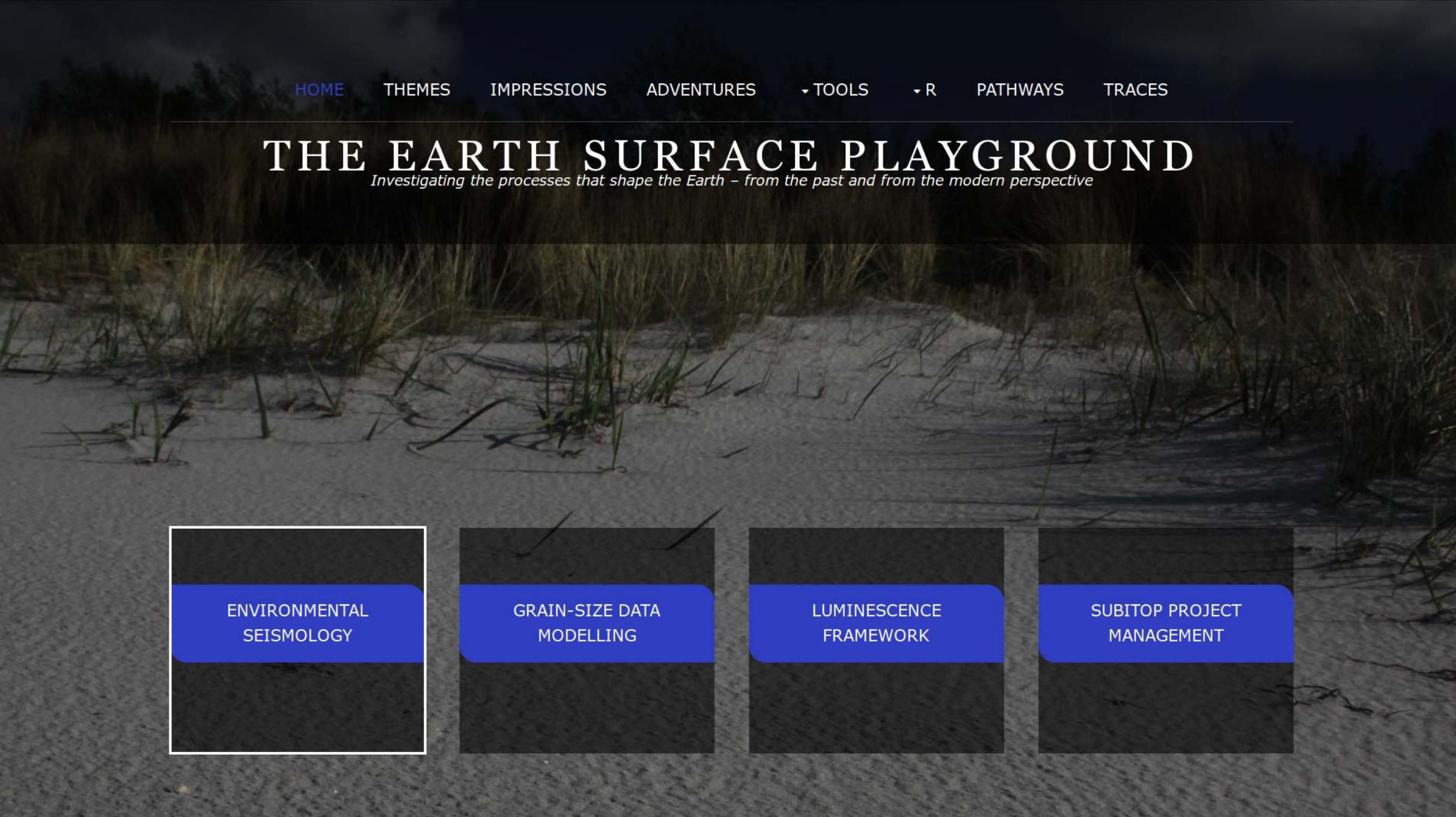


THE EARTH SURFACE PLAYGROUND

Investigating the processes that shape the Earth – from the past and from the modern perspective

A photograph of a sandy dune landscape with tall, greenish-brown grasses growing out of the sand. The sand is light-colored and appears slightly textured. The background is dark, suggesting a forest or dense vegetation.

ENVIRONMENTAL
SEISMOLOGY

GRAIN-SIZE DATA
MODELLING

LUMINESCENCE
FRAMEWORK

SUBITOP PROJECT
MANAGEMENT

The seismic "Shake Scape" of the Earth

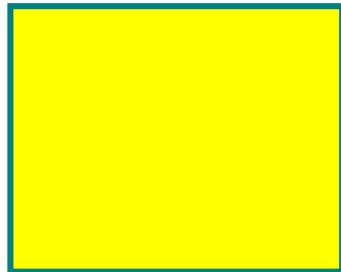
Michael Dietze, Kristen Cook, Arnaud Burtin, Anne Schöpa, Sophie Lagarde, Jens Turowski, Niels Hovius

GFZ German Research Centre for Geosciences, Section 4.6 Geomorphology (and migrated to other institutions)

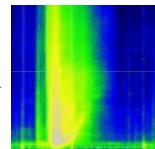
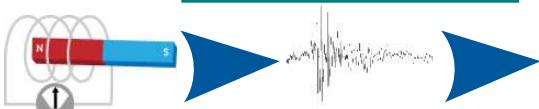
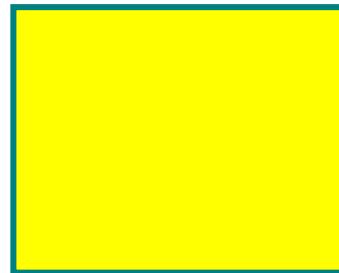


Michael Dietze @ GFZ Potsdam > Geomorphology Section > Environmental Seismology > DKG/AKG 2019

A Shake Scape?



A Shake Scape?





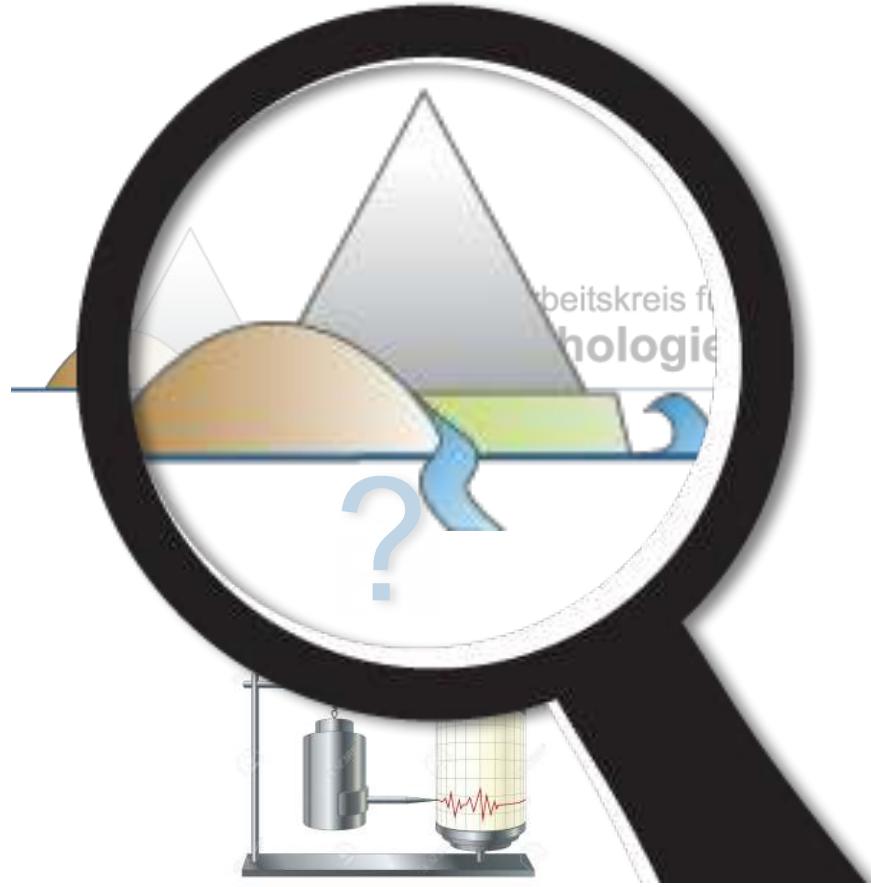
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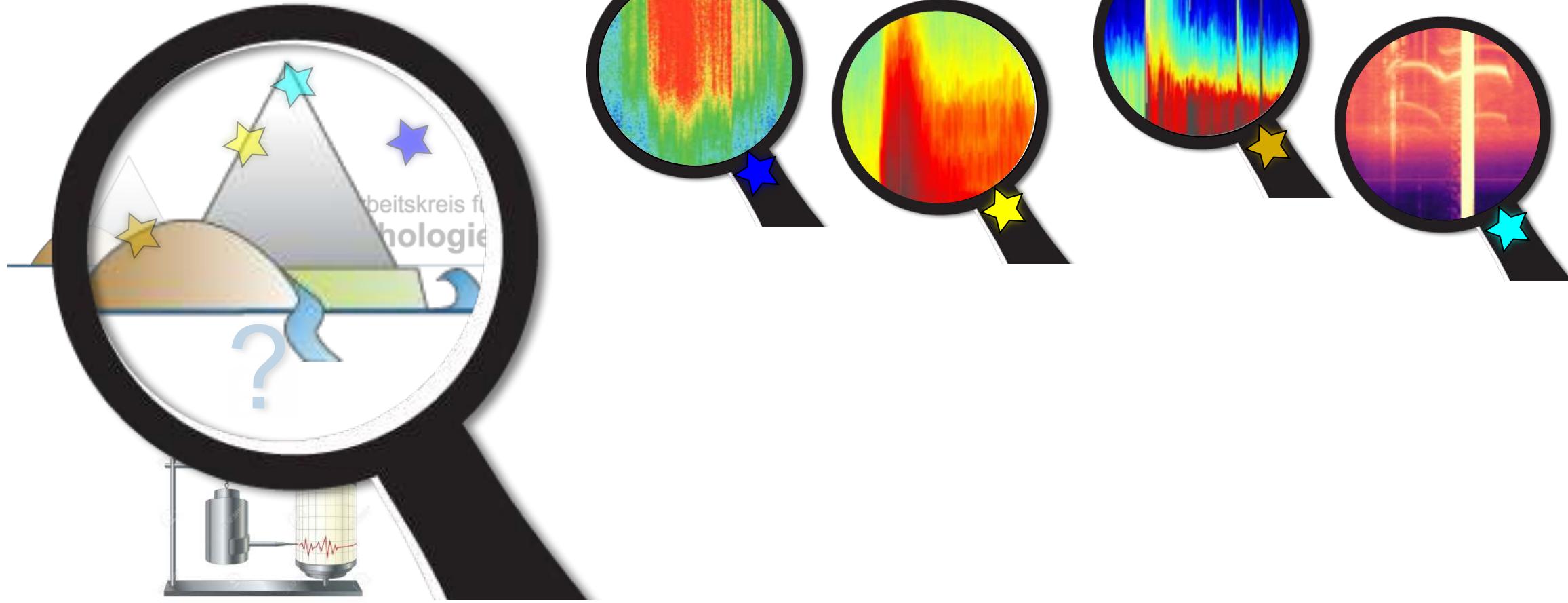
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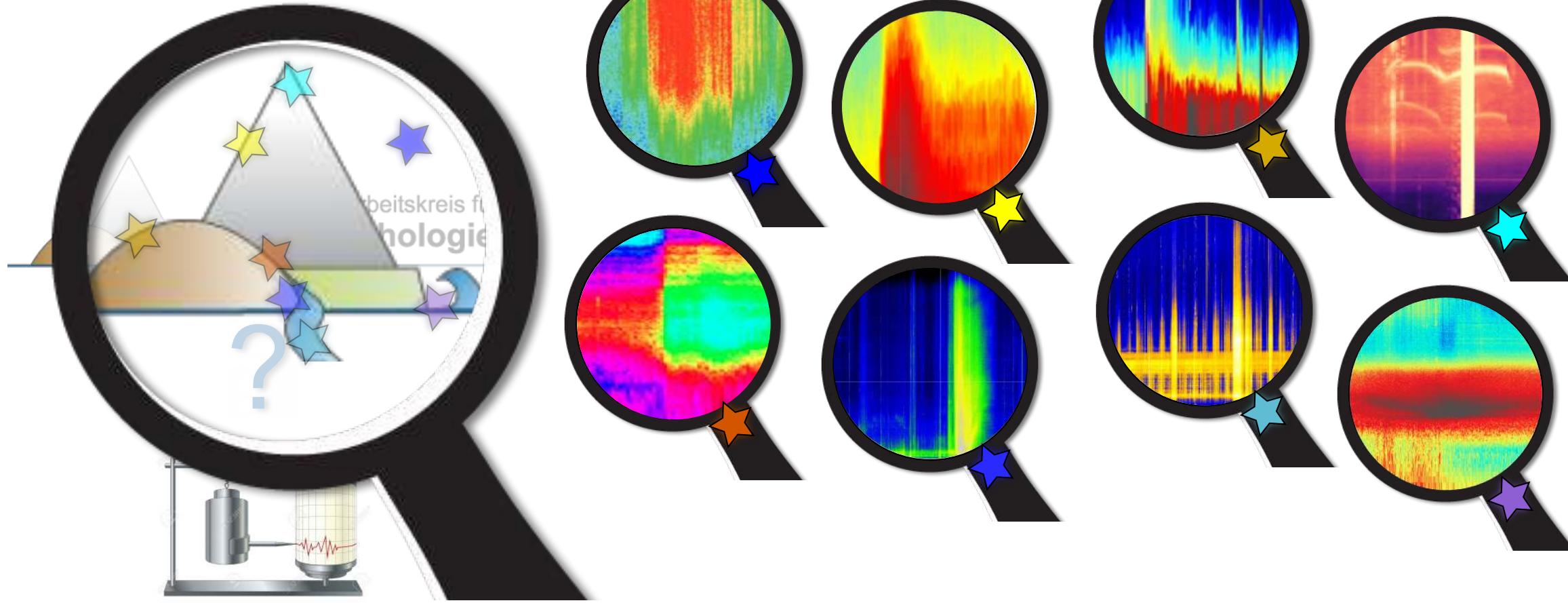
A Shake Scape?



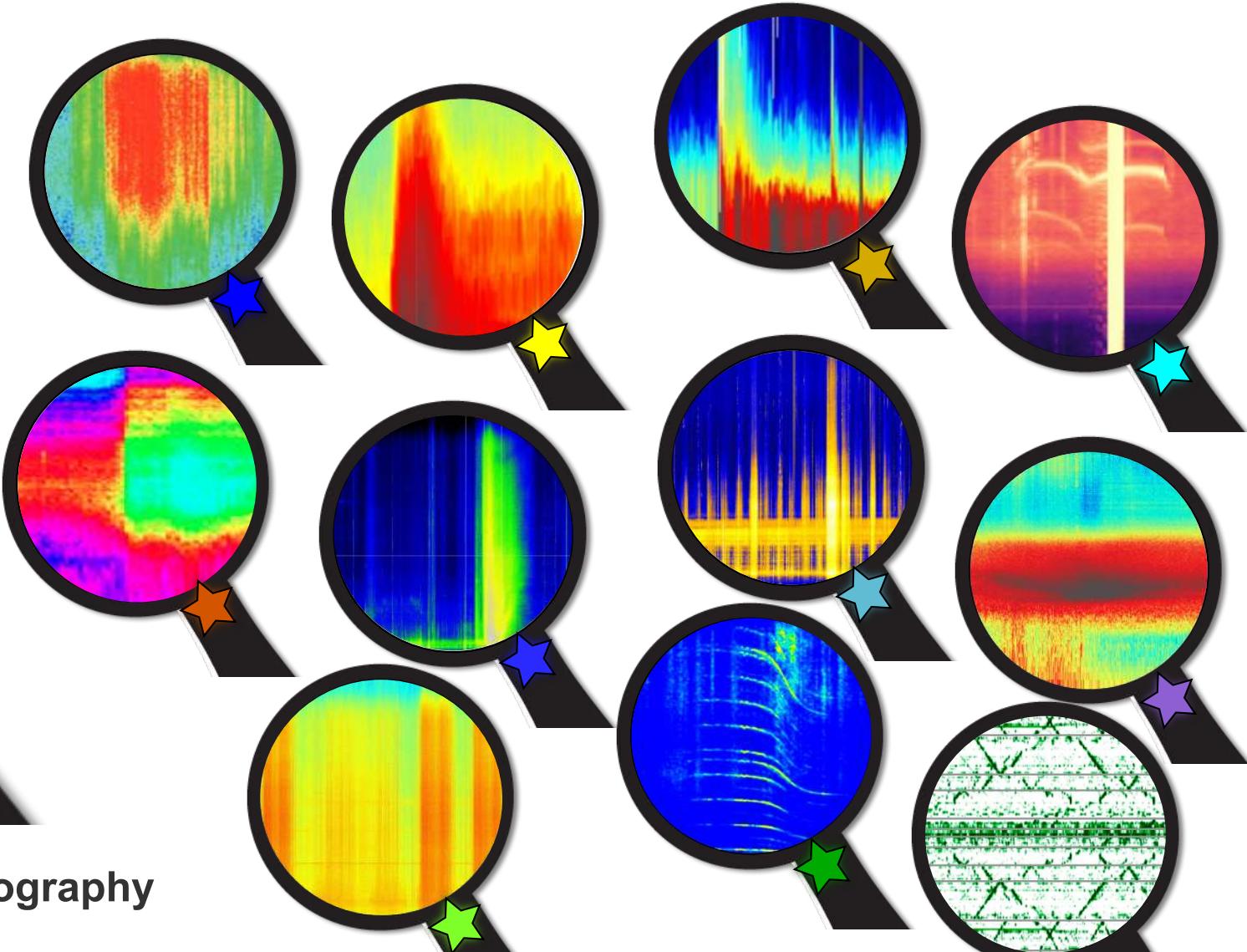
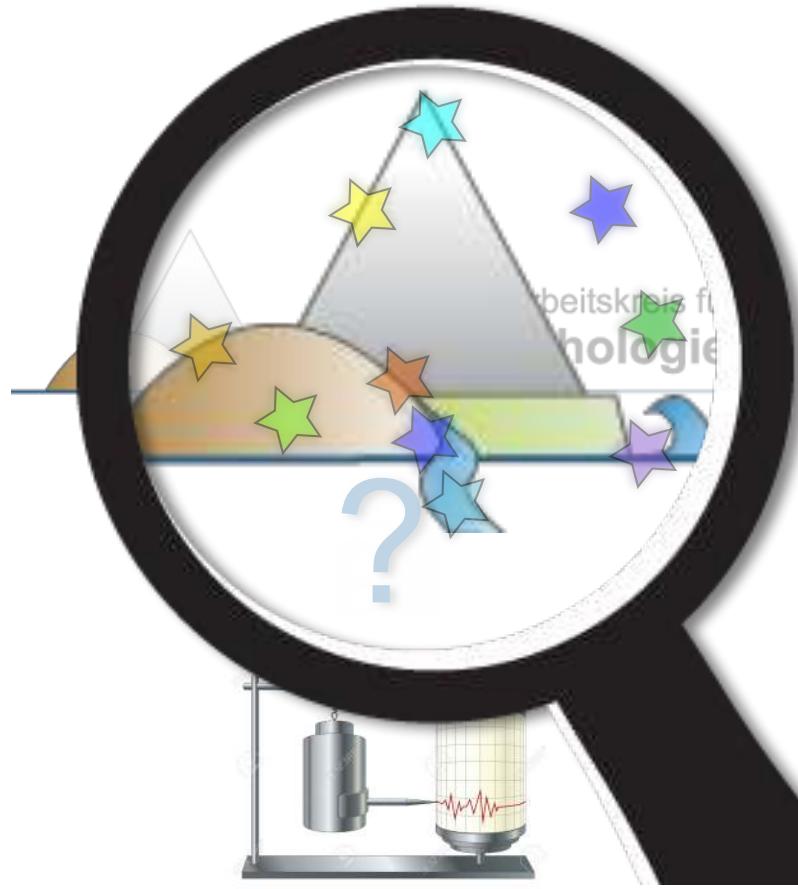
A Shake Scape?



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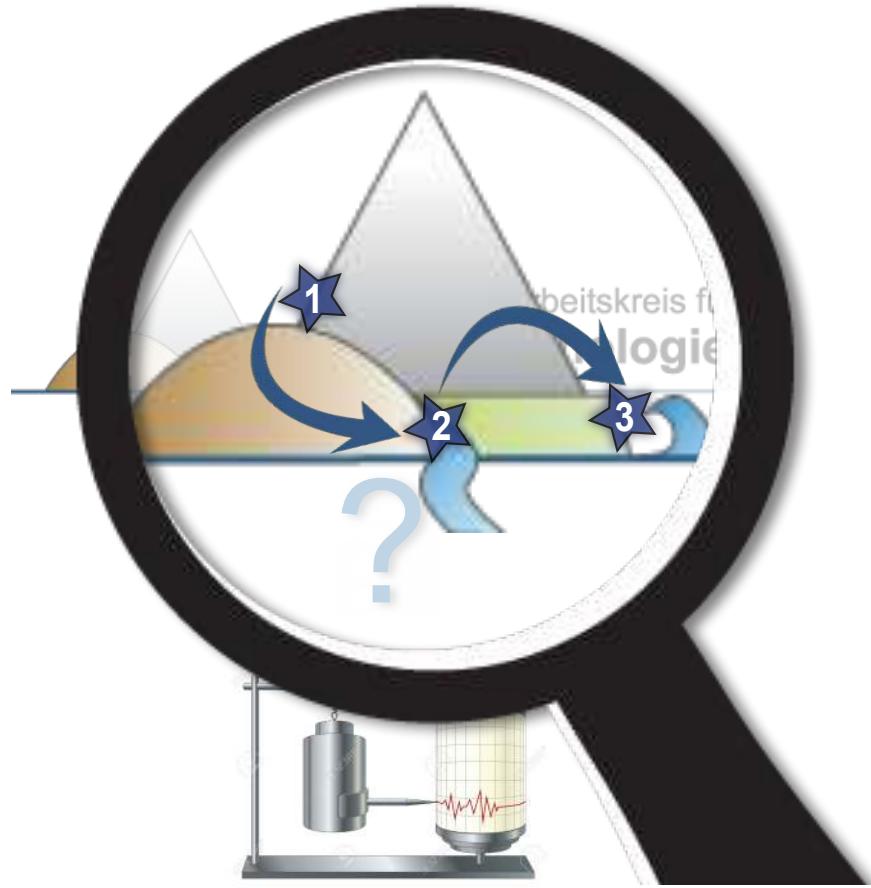


A Shake Scape?



Not to forget: "noise"-based tomography

A Shake Scape?



1) The slope

When and where do mass wasting events happen?

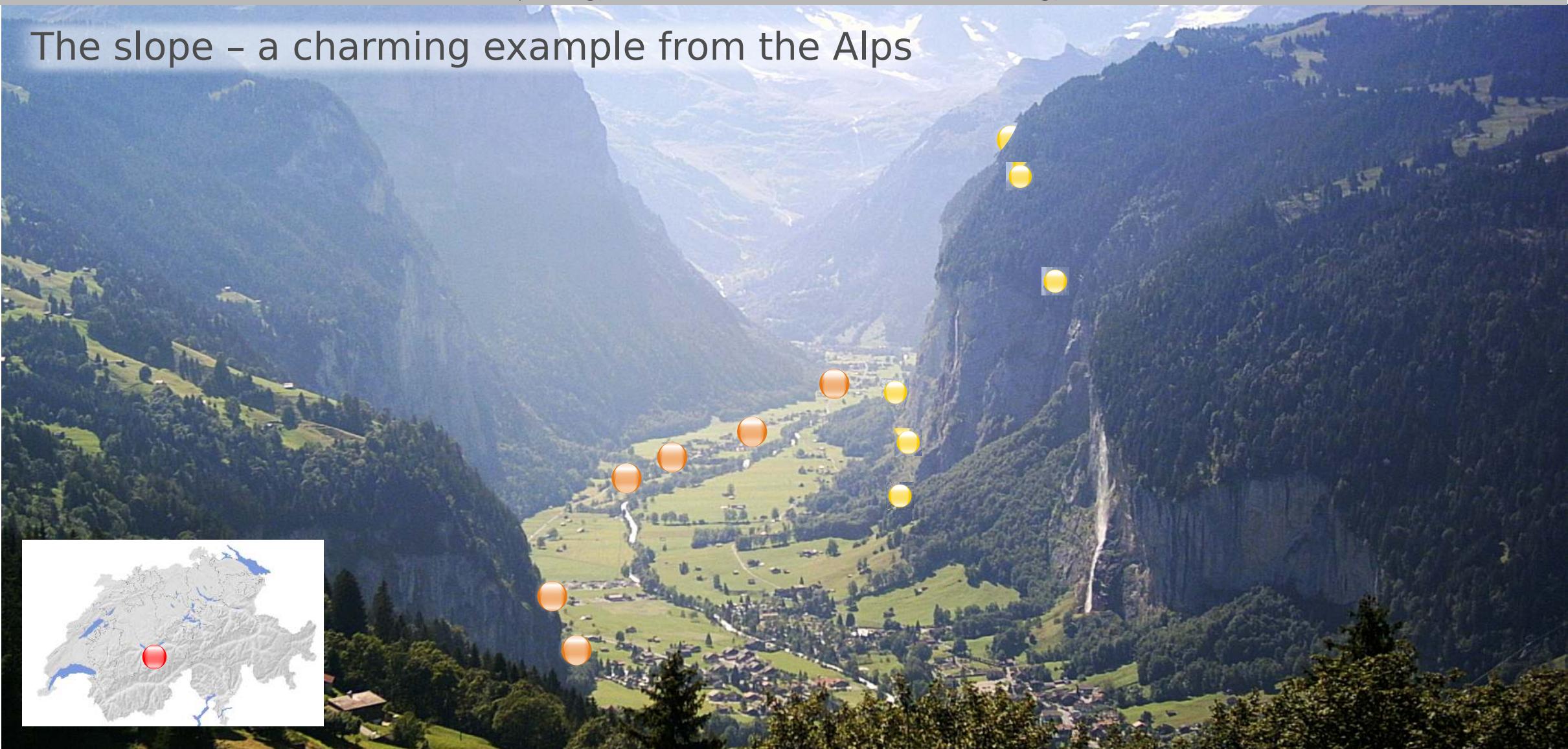
2) The channel

How much water and sediment do channels convey?

3) The coast

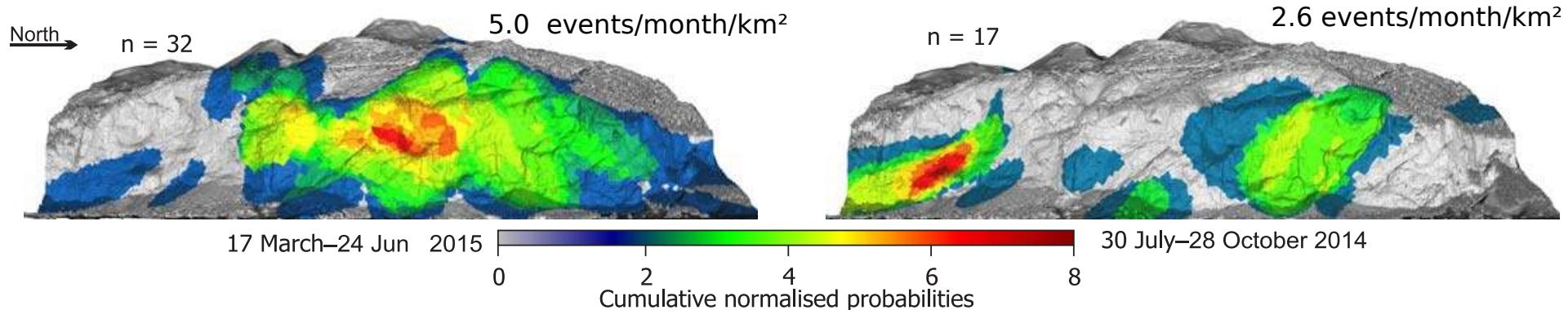
What drives the activity of cliff coasts?

The slope - a charming example from the Alps

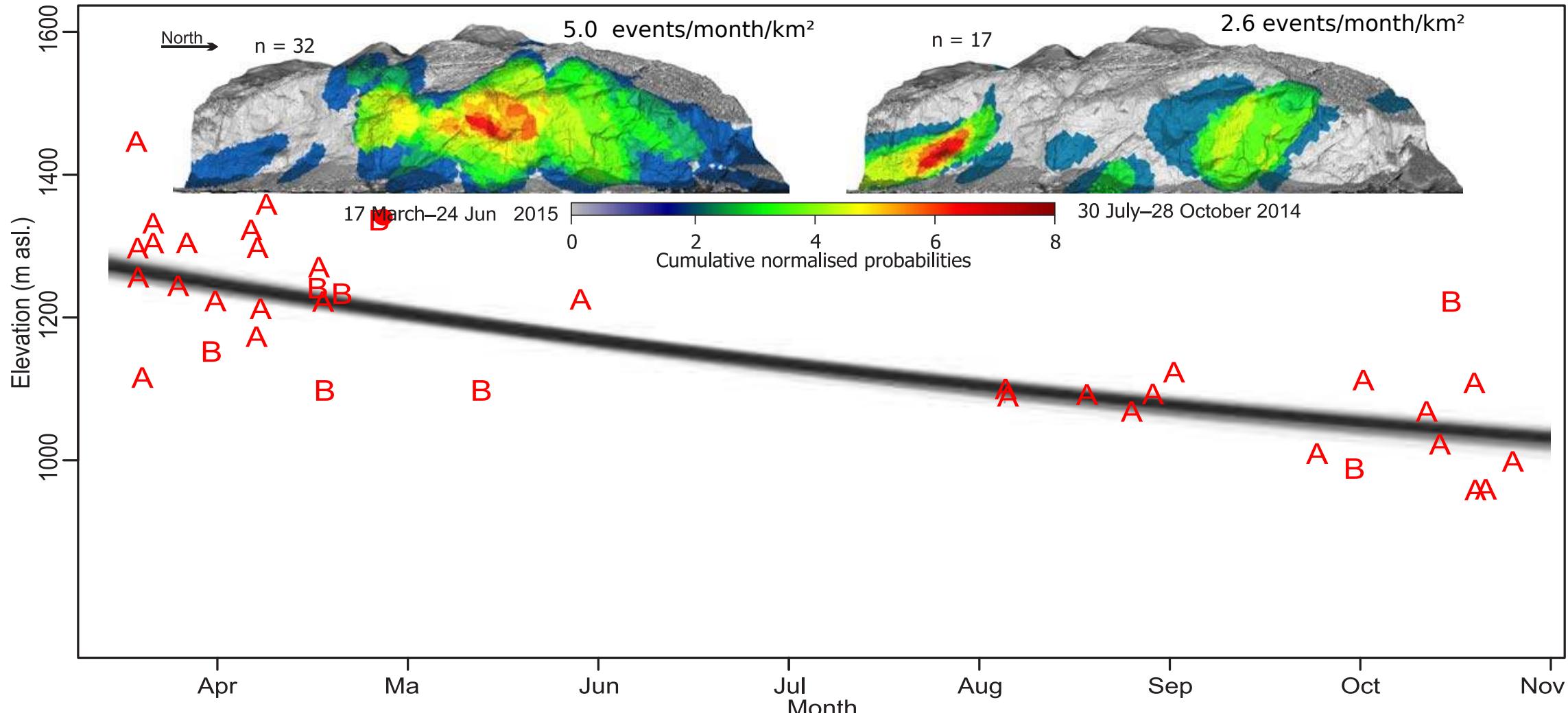




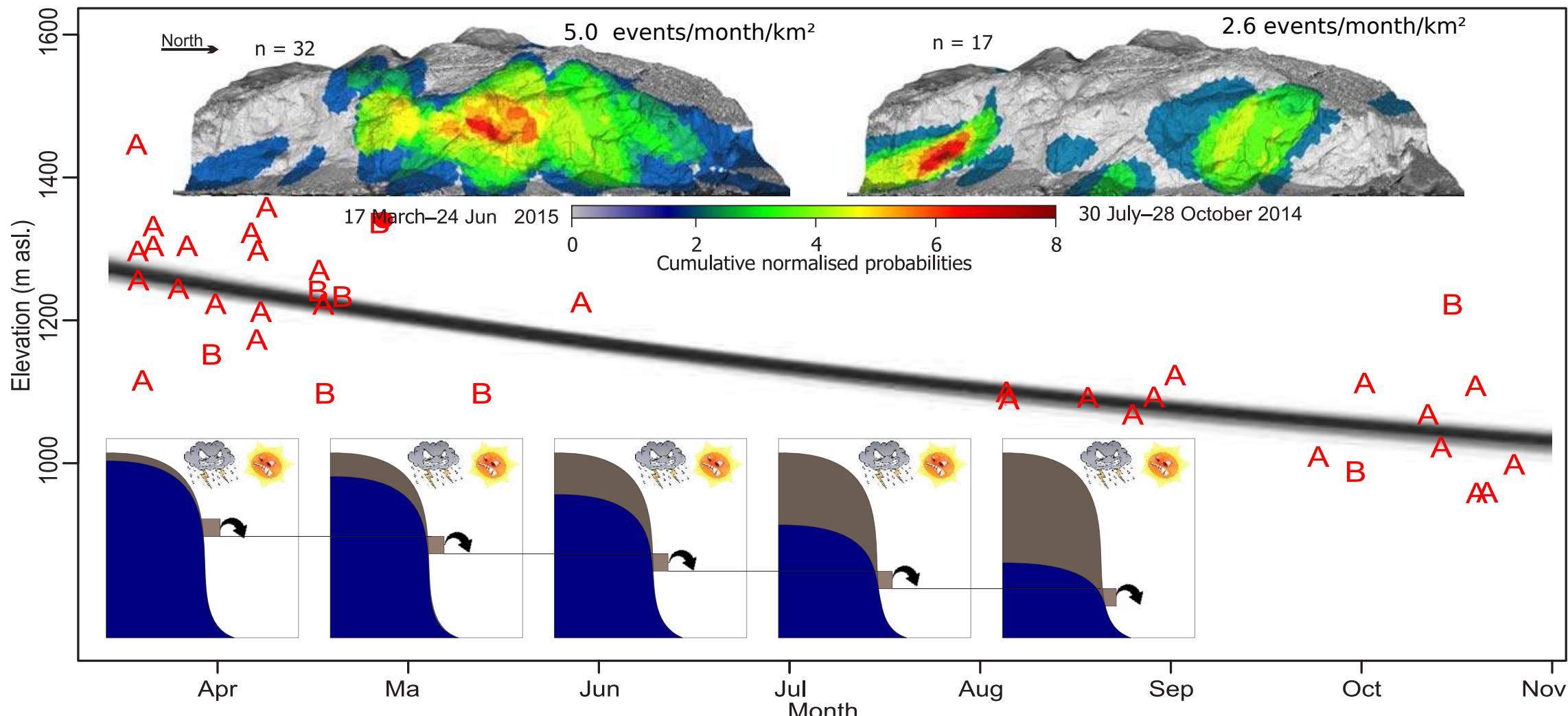
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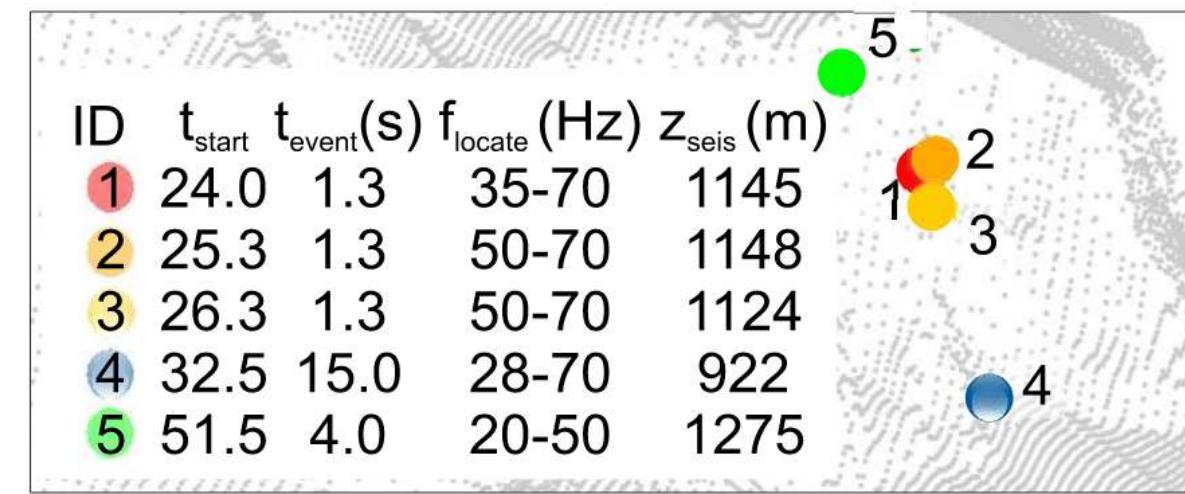
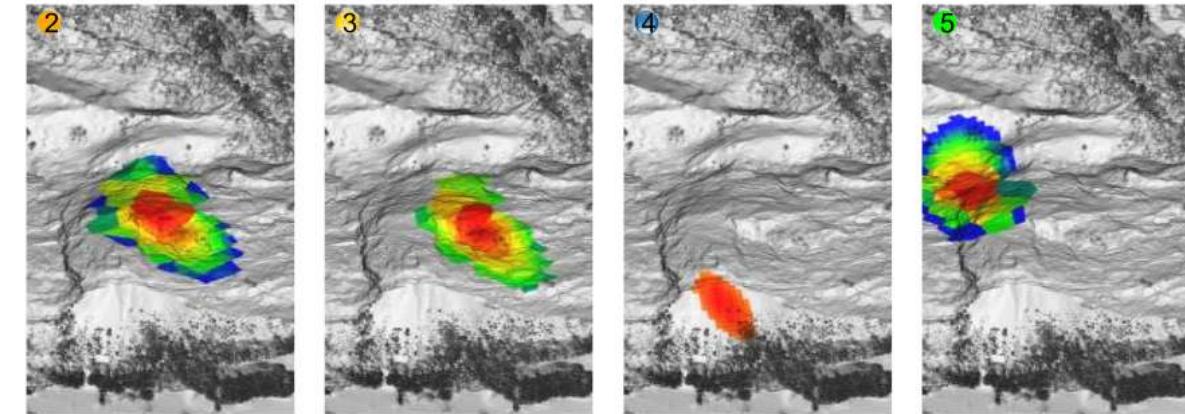
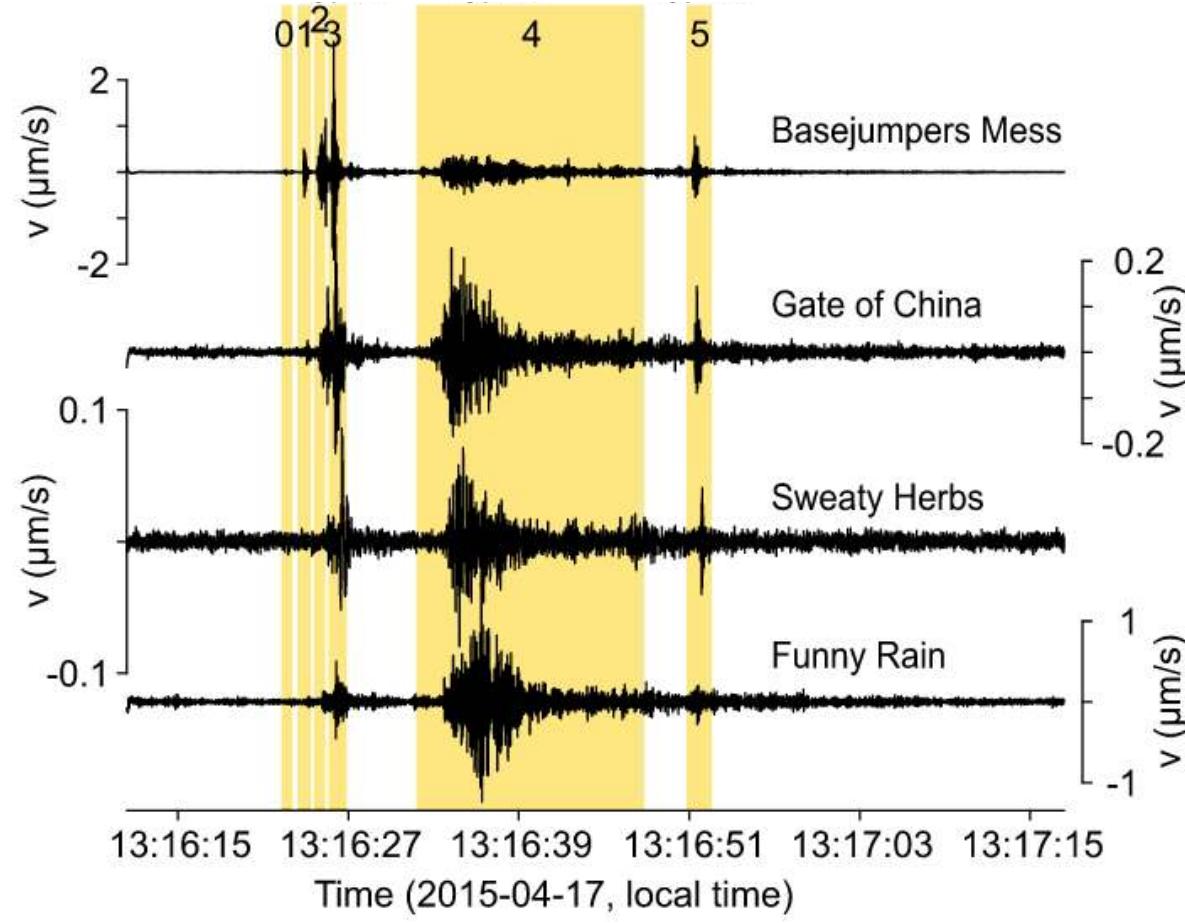
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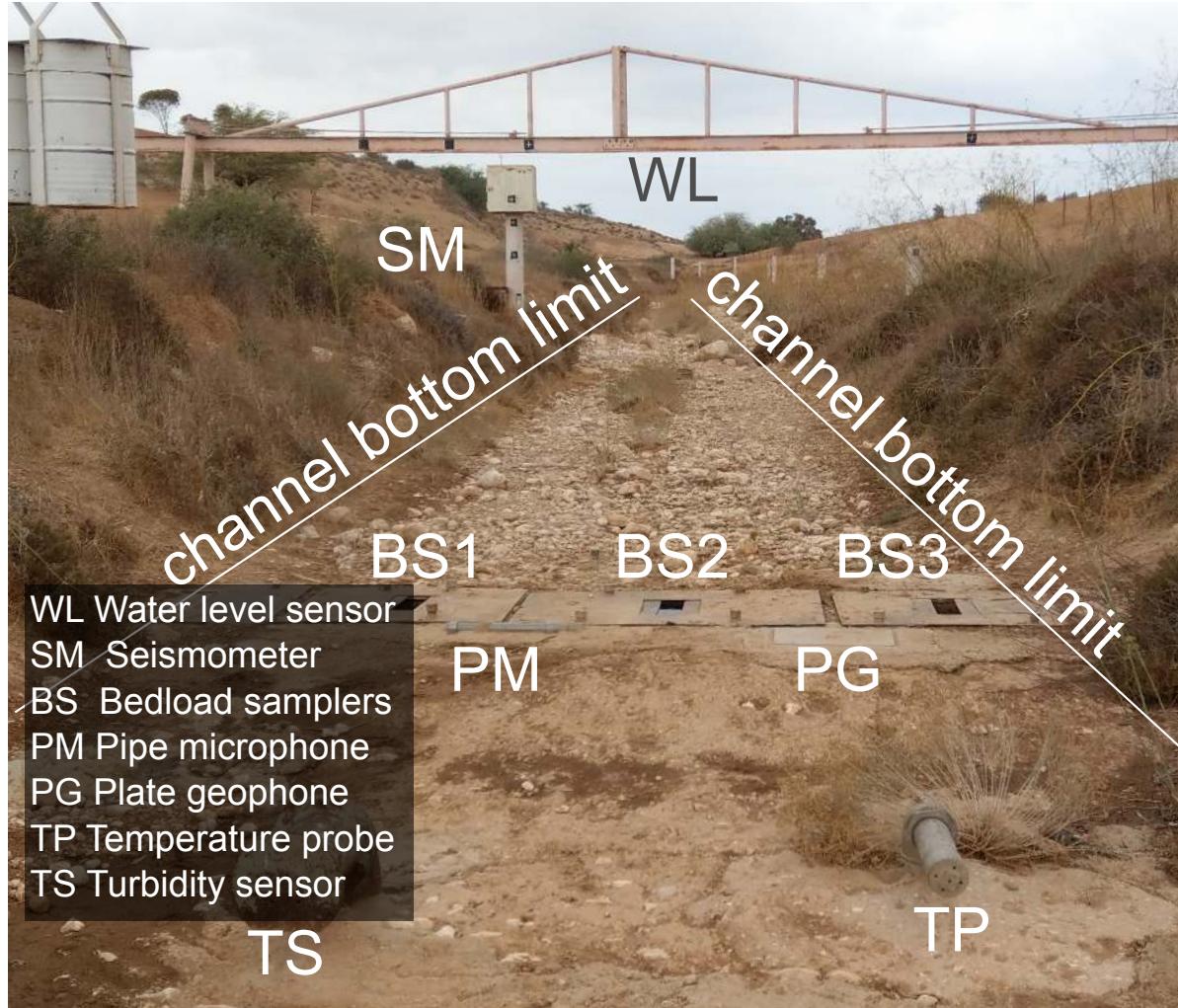
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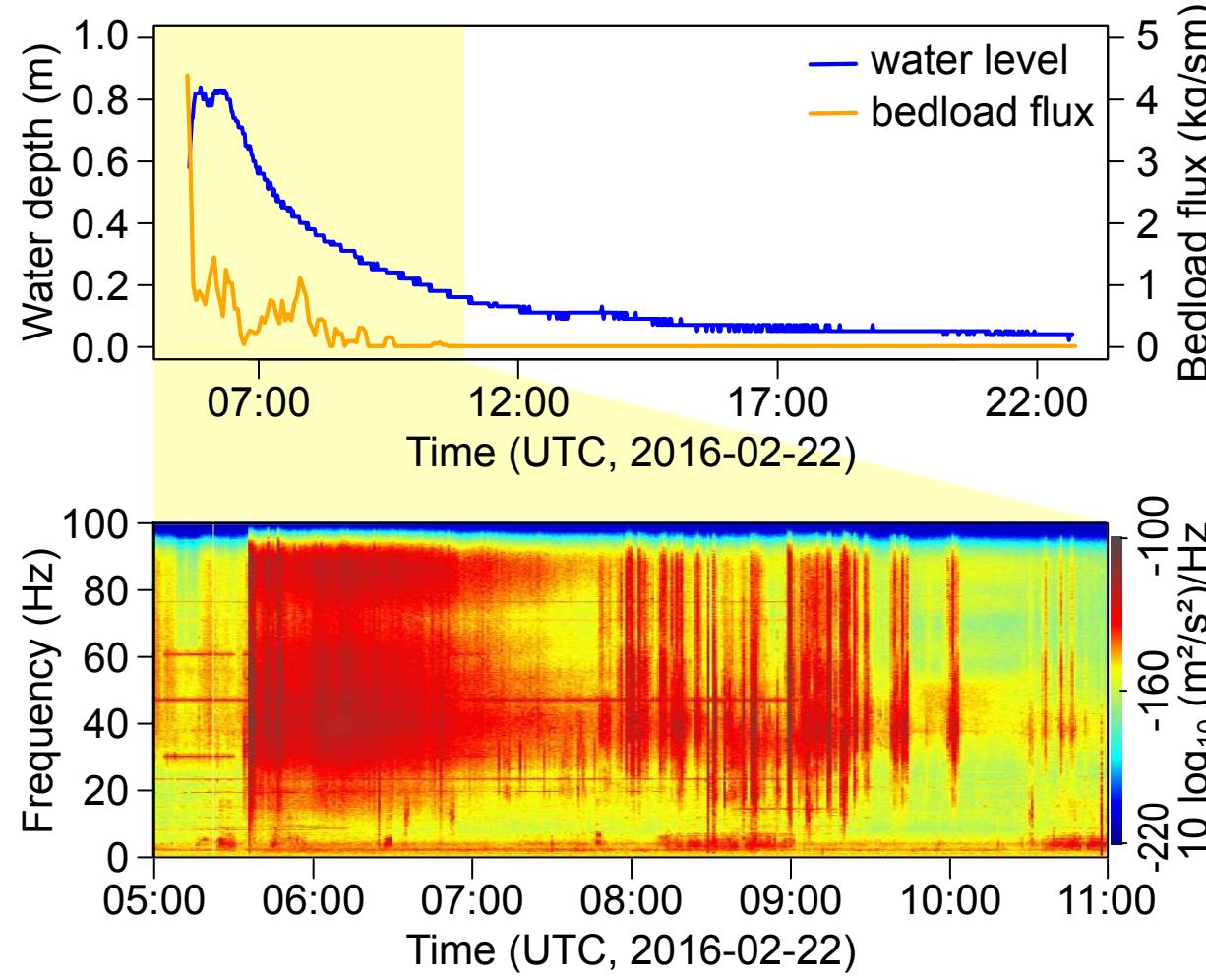
The channel - an extreme desert example



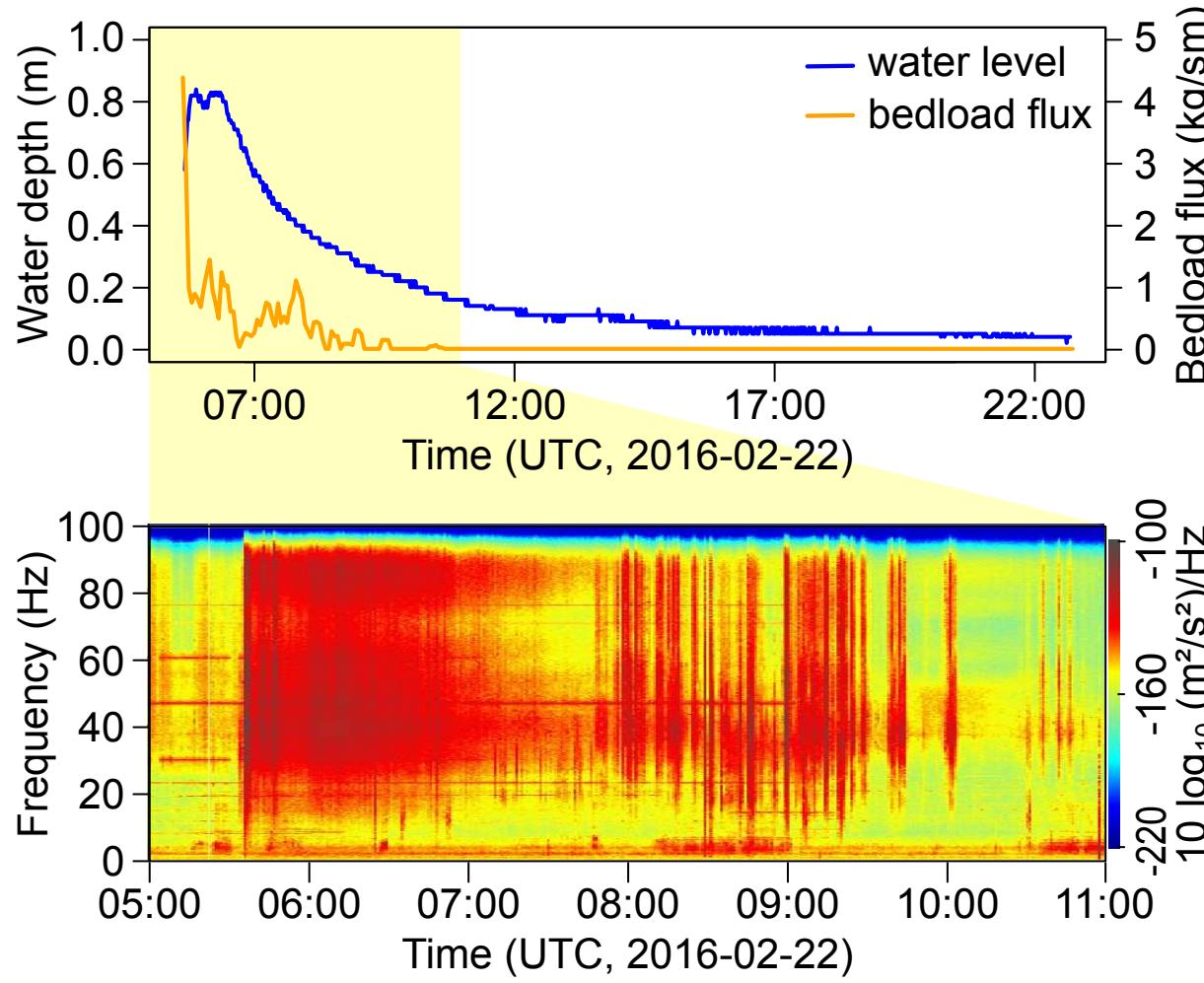
The channel – an extreme desert example



The channel - an extreme desert example



The channel - an extreme desert example



Fluid flow turbulence

$$P_{w_1}^T(f) \approx \frac{KW}{3k_s^{2/3}} \left(\frac{\rho_w}{\rho_s(0)} \right)^2 \frac{(1+\xi)^2}{f_0^{5\xi} v_{c0}^5} \cdot \zeta(H/k_s)$$

$$\psi_\beta(f) \cdot \phi_D(f) \cdot f^{4/3+5\xi} \cdot g^{7/3} \sin(\theta)^{7/3} \cdot C^2 H^{7/3}$$

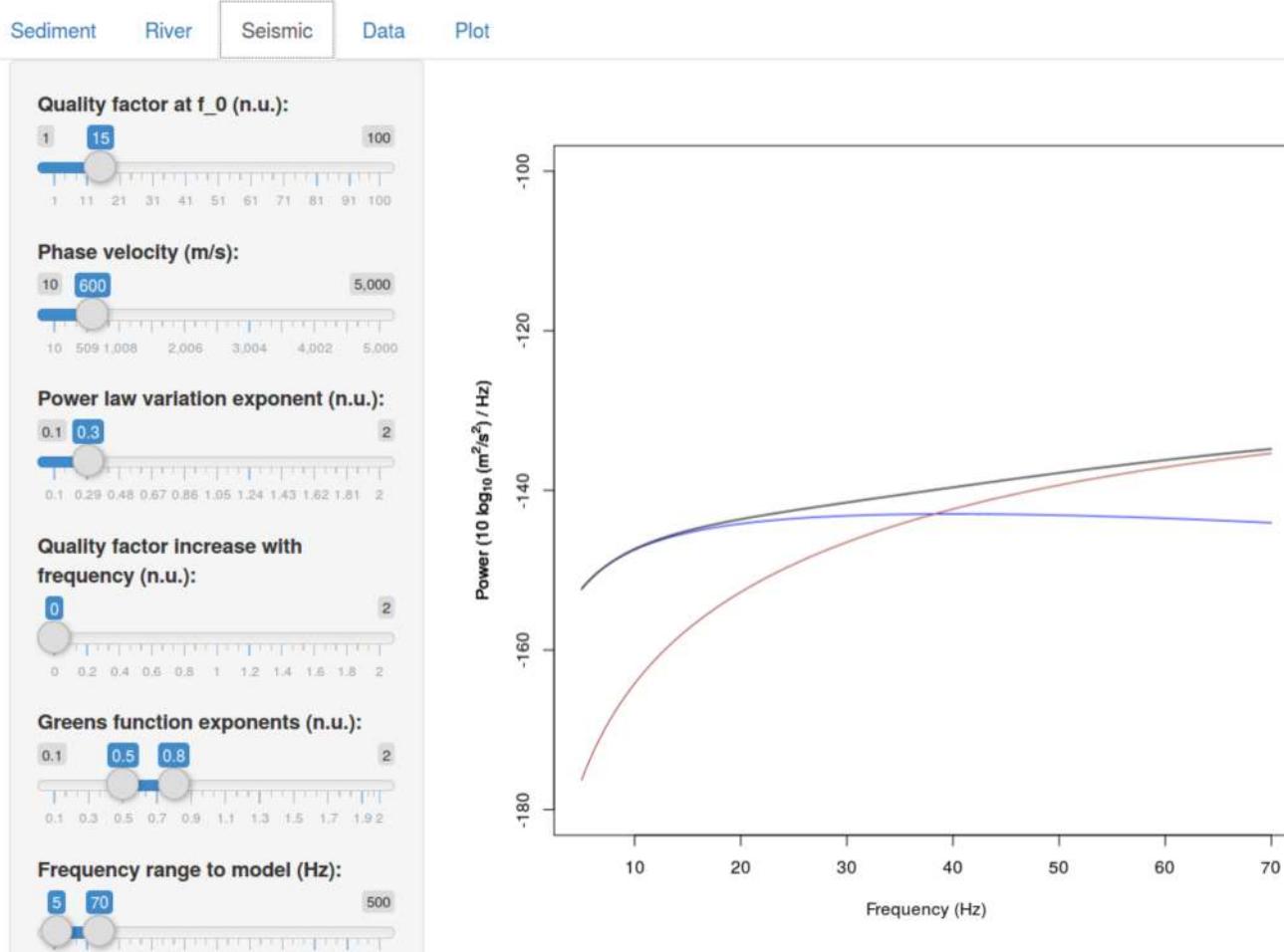
Bedload particle impacts

$$P_v(f; D) \approx \frac{n}{t_i} \frac{\pi^2 f^3 m^2 w_i^2}{\rho_s^2 v_c^3 v_u^2} \chi(\beta)$$

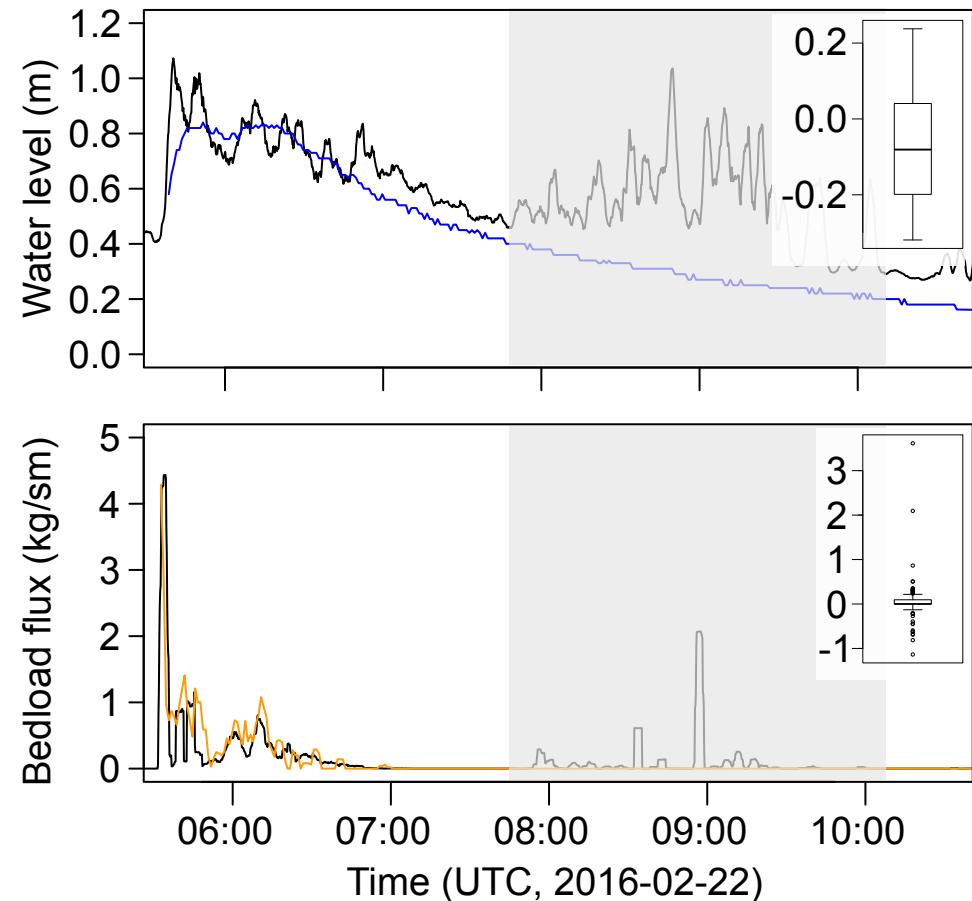
$$\dot{u}(f, x) = 2\pi i f F(f, x_0) G(f, x; x_0)$$

The channel – an extreme desert example

Seismic spectra model visualisation



Monte-Carlo-based inversion of empirical data



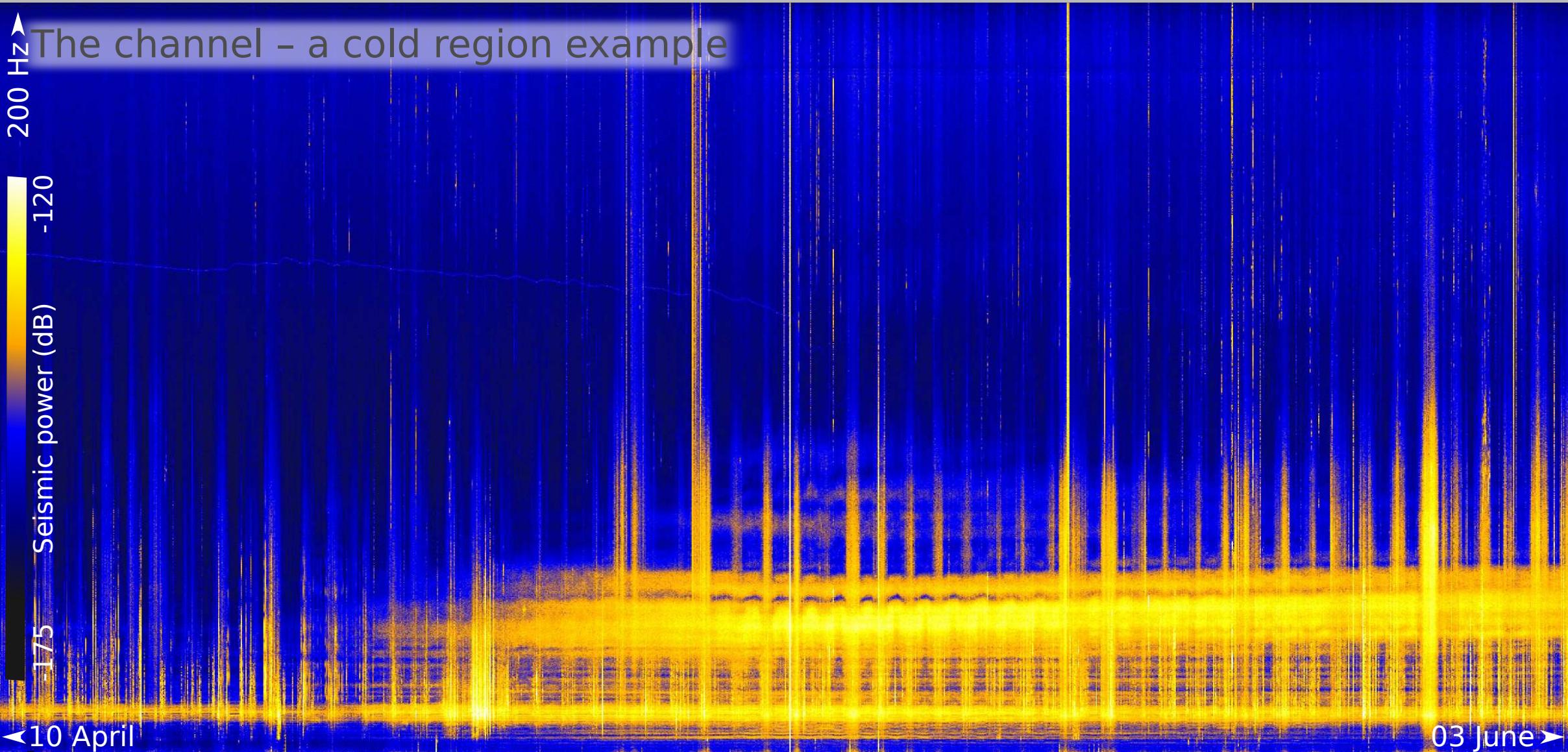


The channel – a cold region example

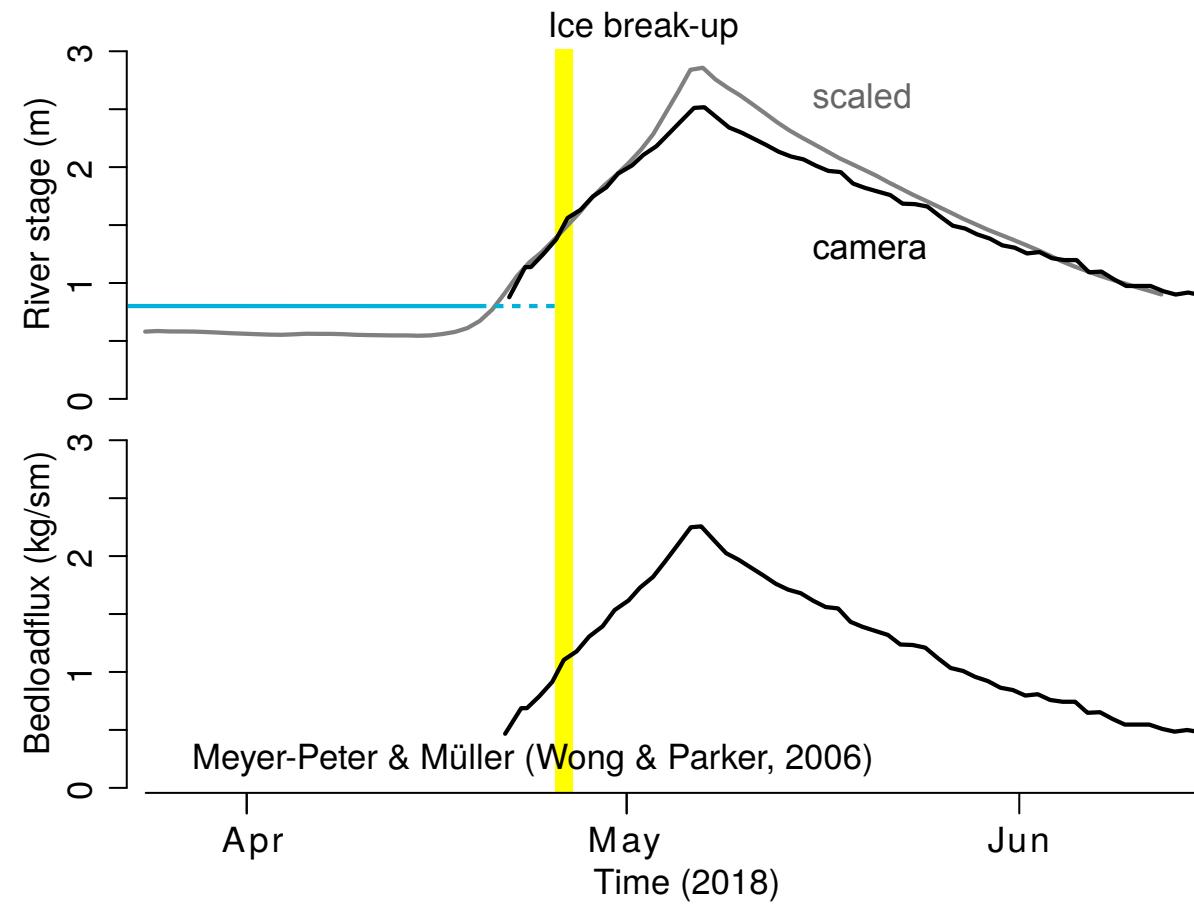


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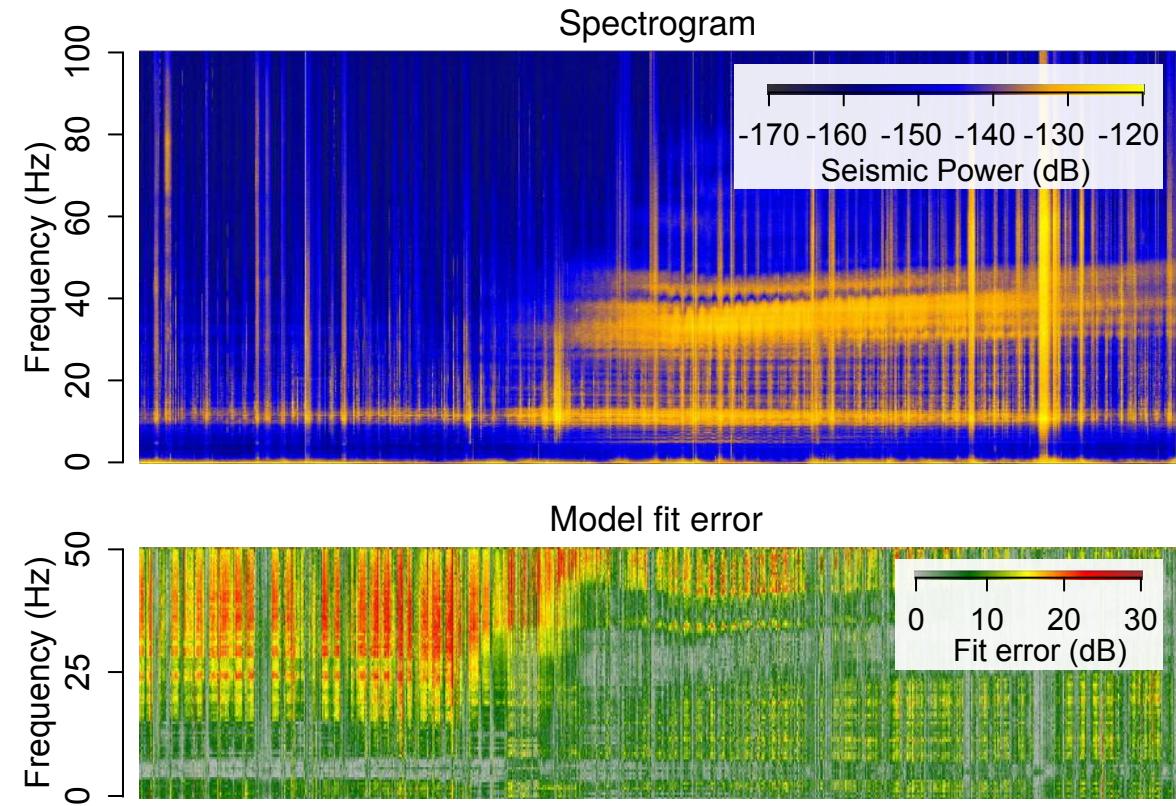
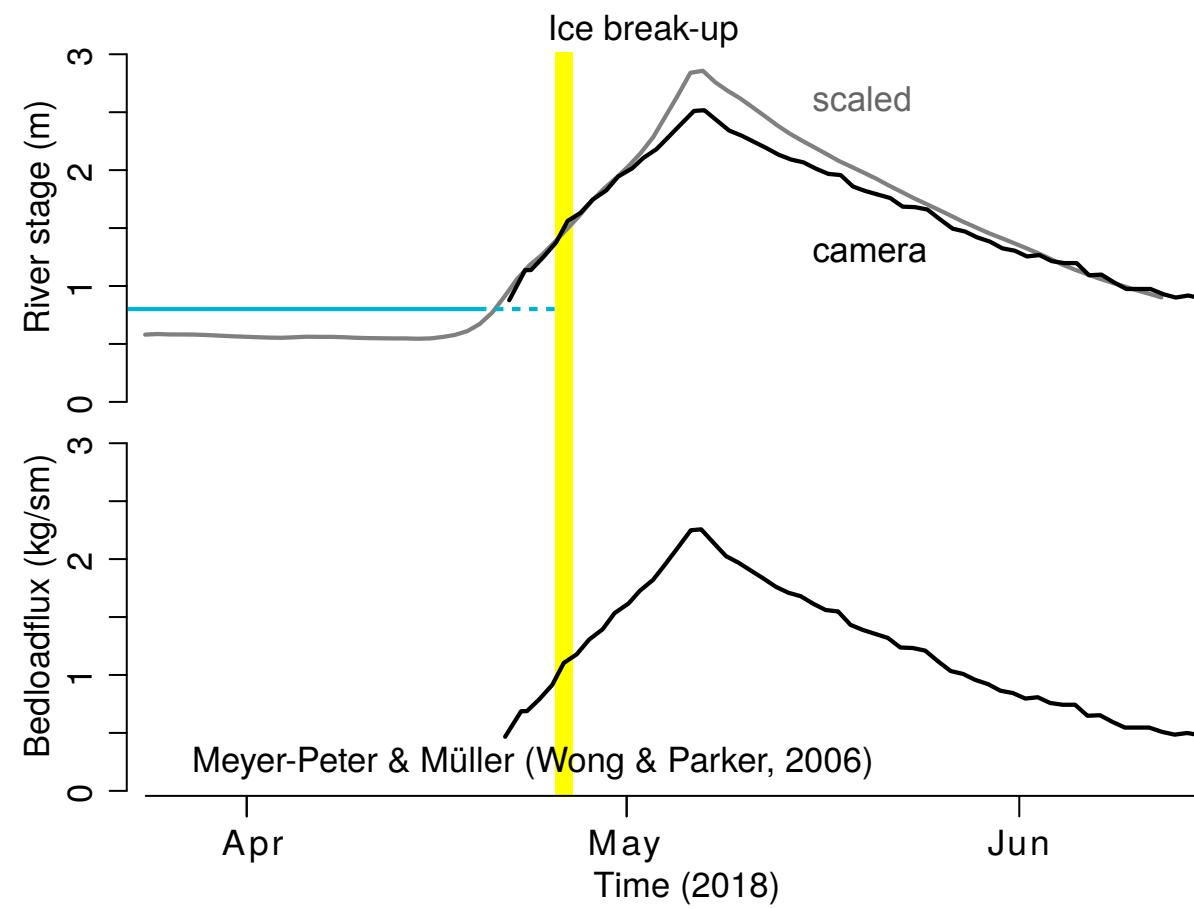




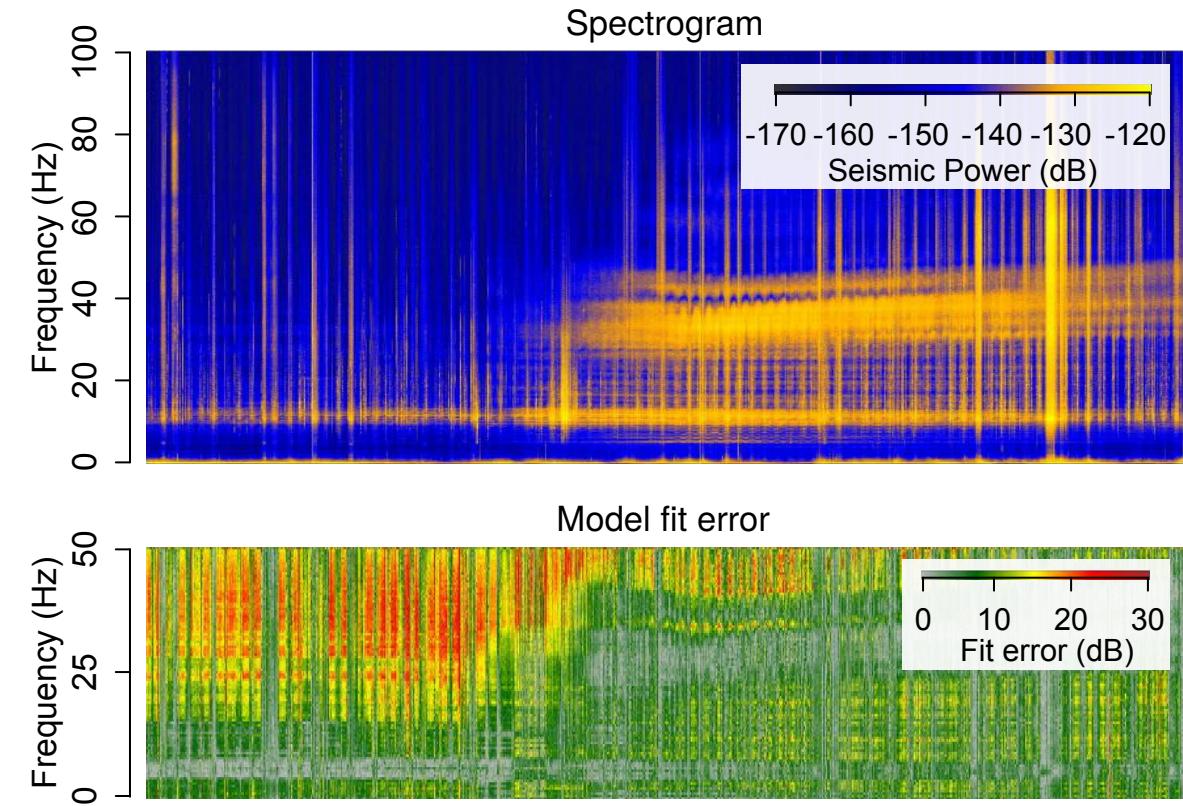
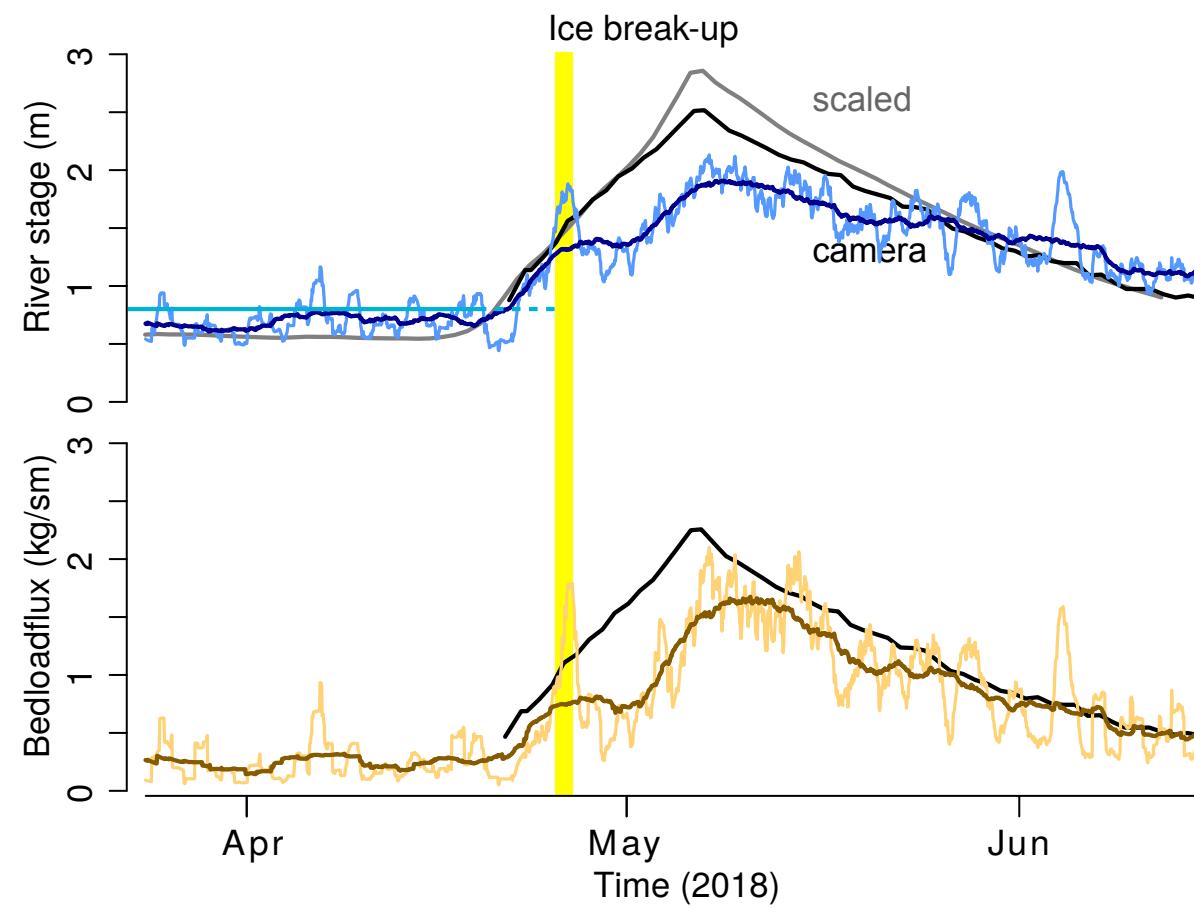
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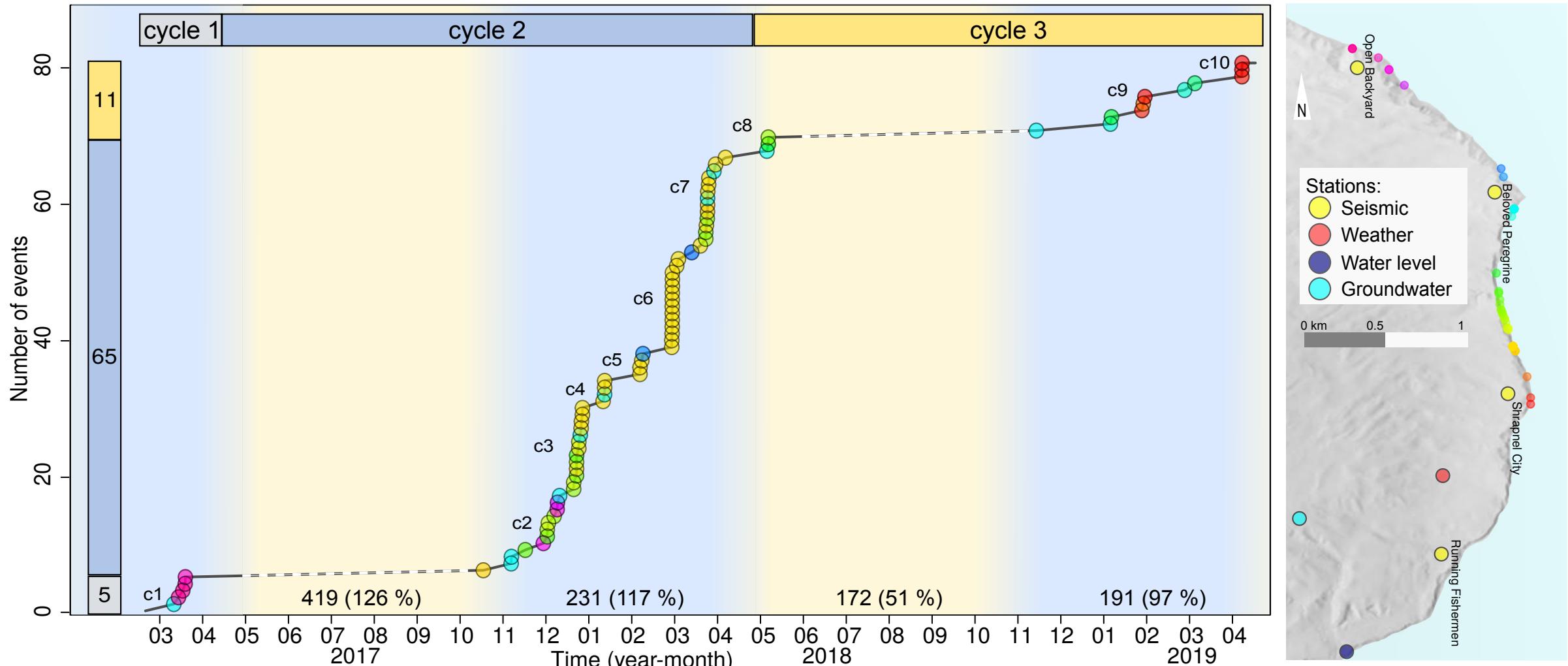
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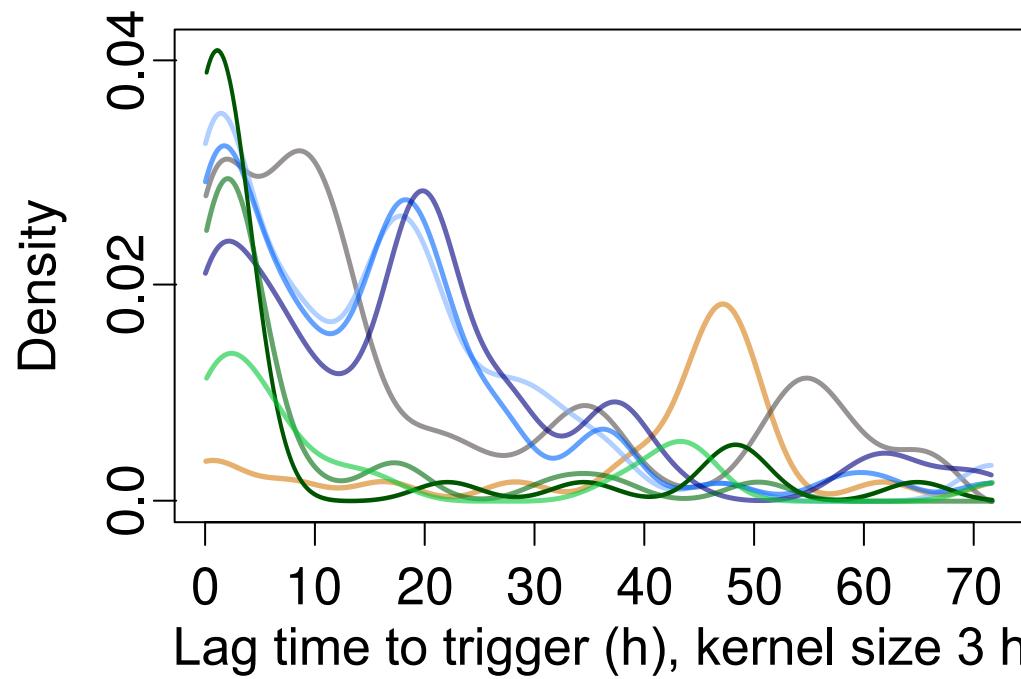
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The coast - access to game changing data?

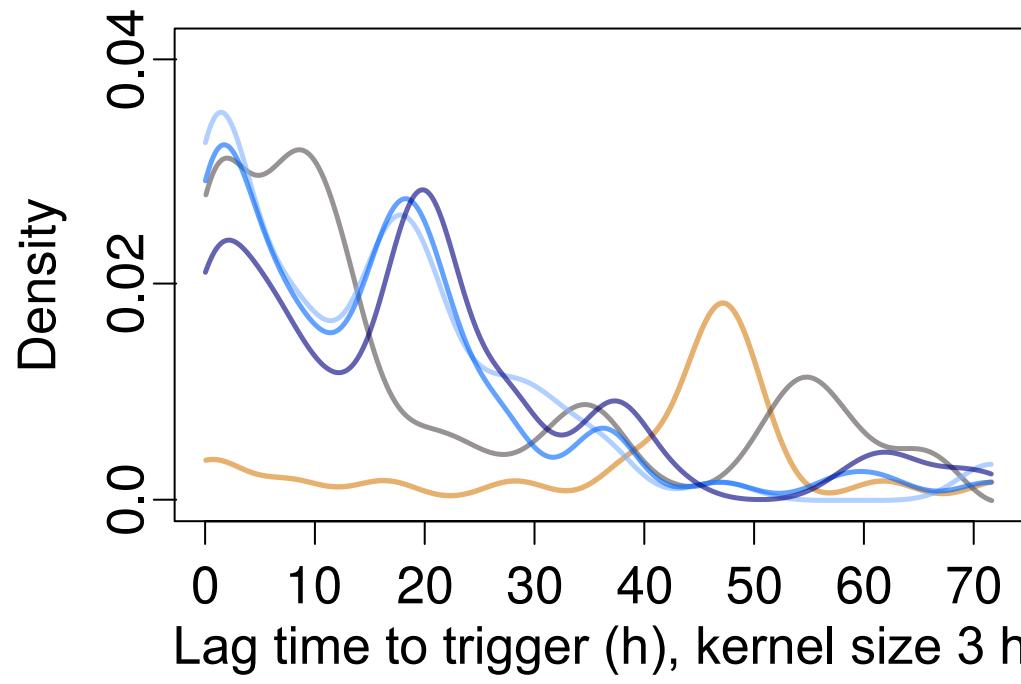


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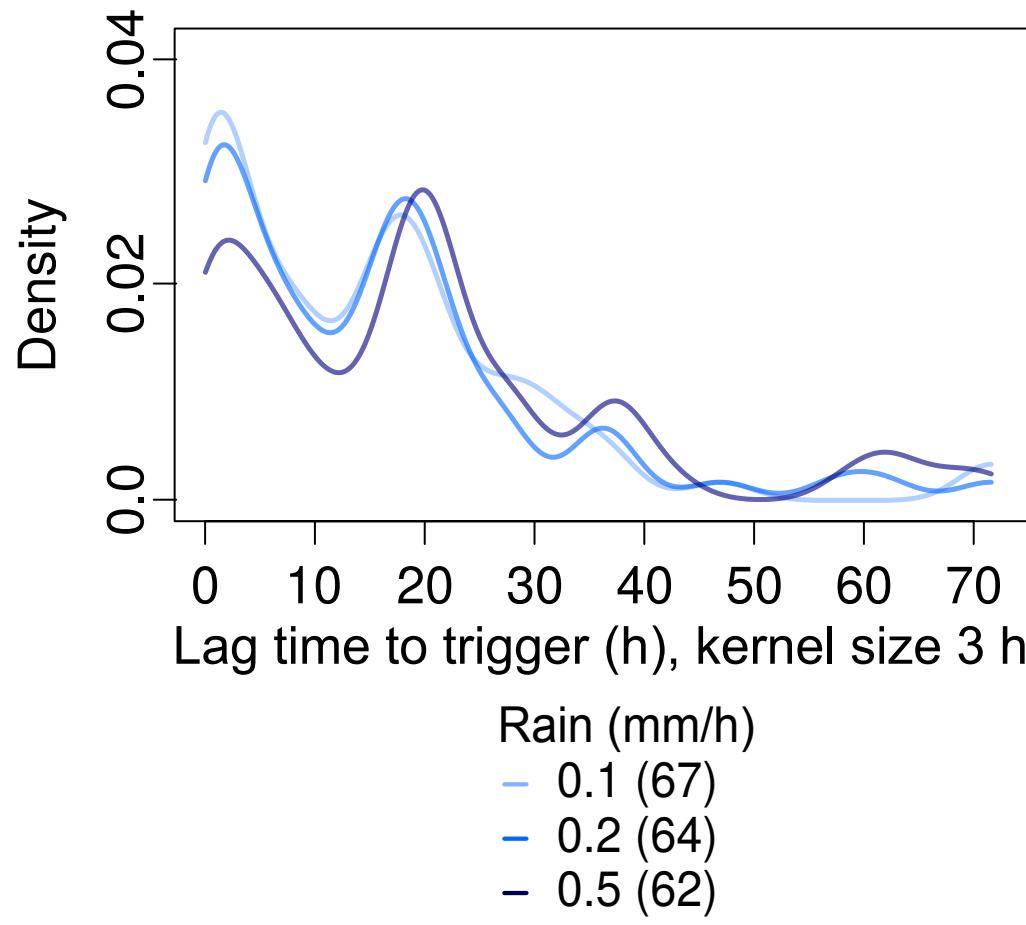
Freeze-Thaw	Rain (mm/h)	Water (cm)
- 524 (20)	- 0.1 (67)	- 524 (30)
Wind (Bf 6)	- 0.2 (64)	- 535 (24)
- 524 (71)	- 0.5 (62)	- 543 (17)

The coast - access to game changing data?

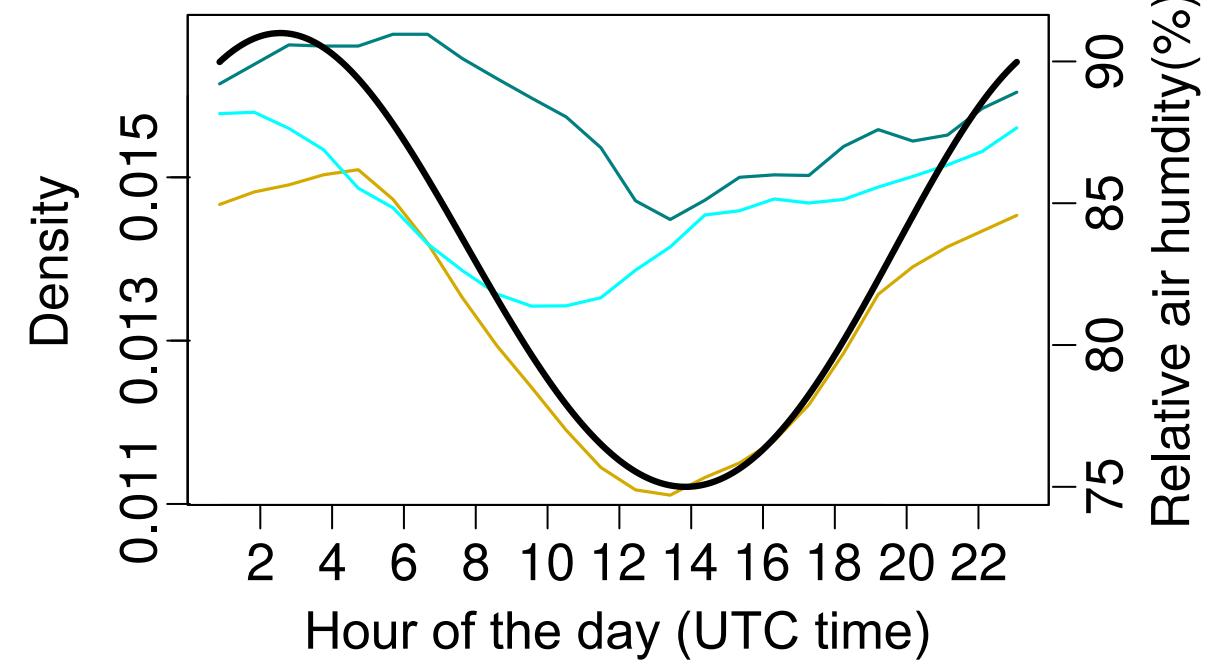
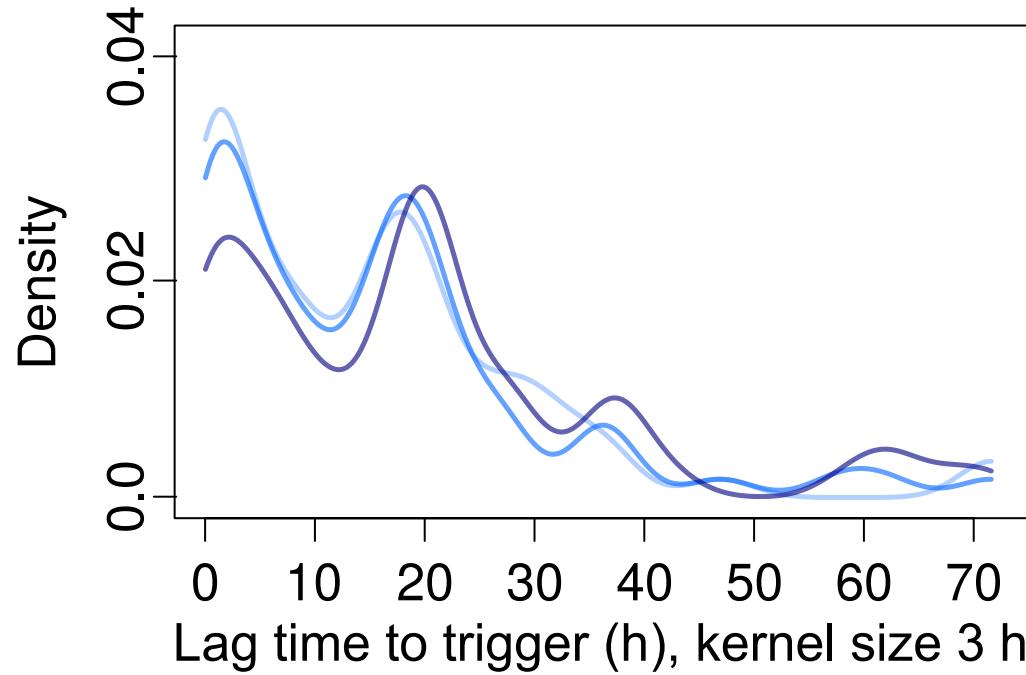


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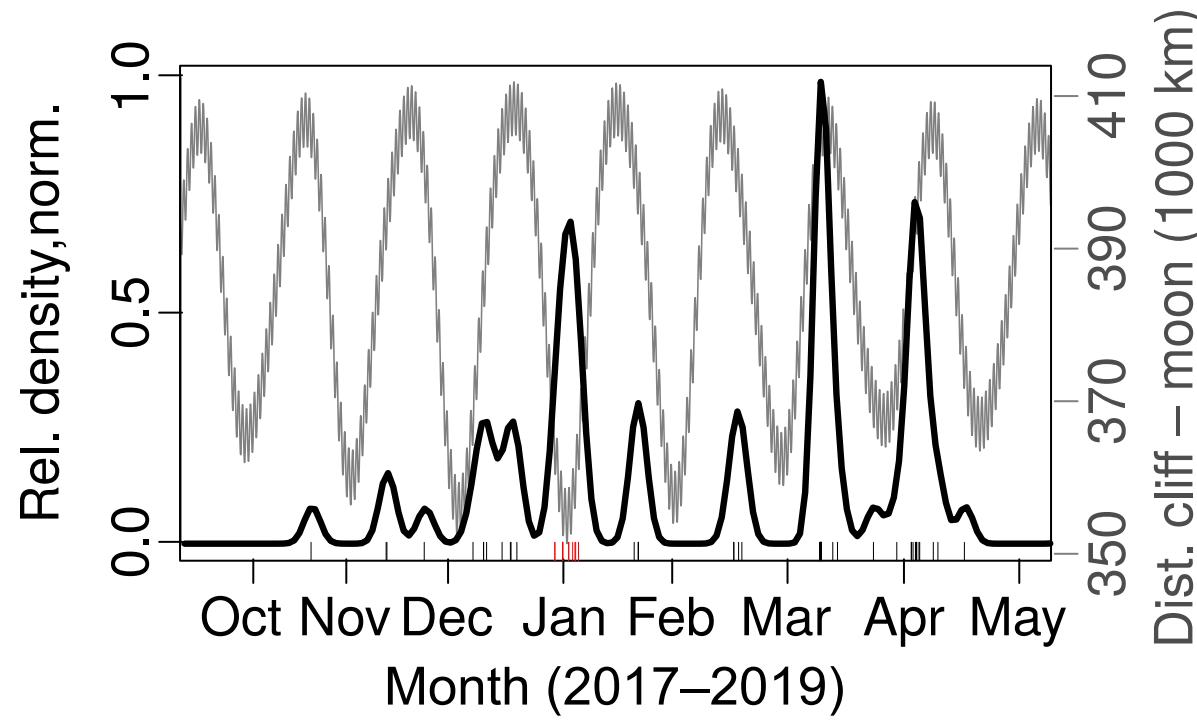
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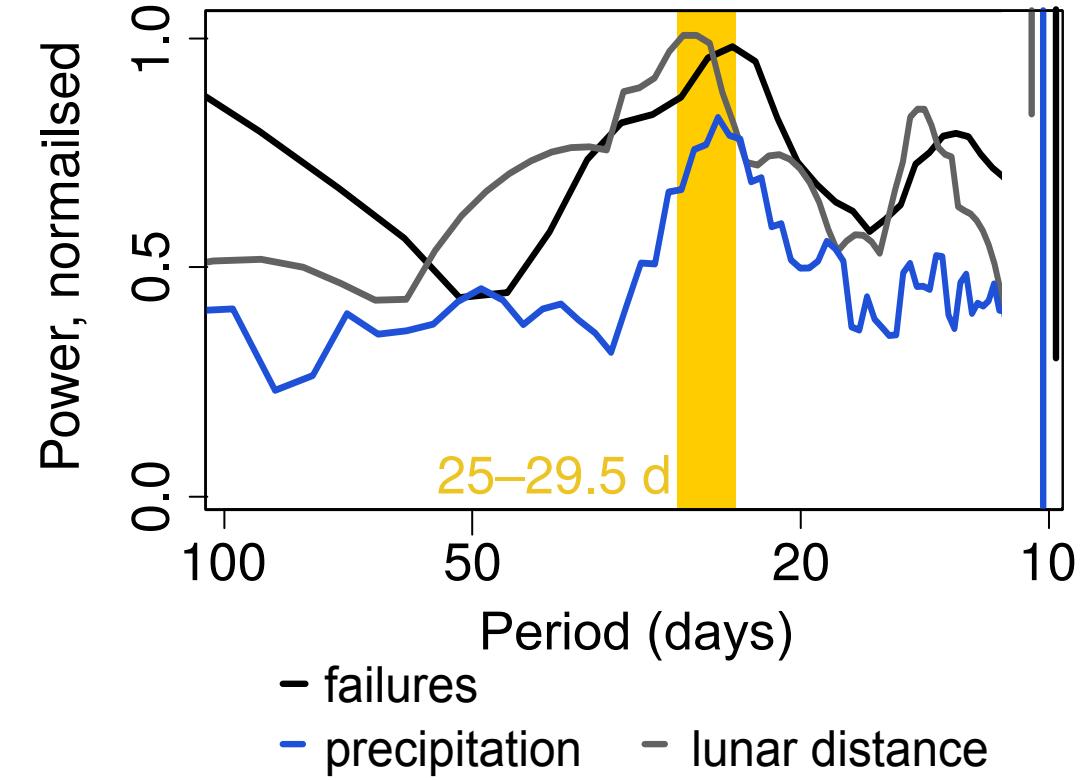
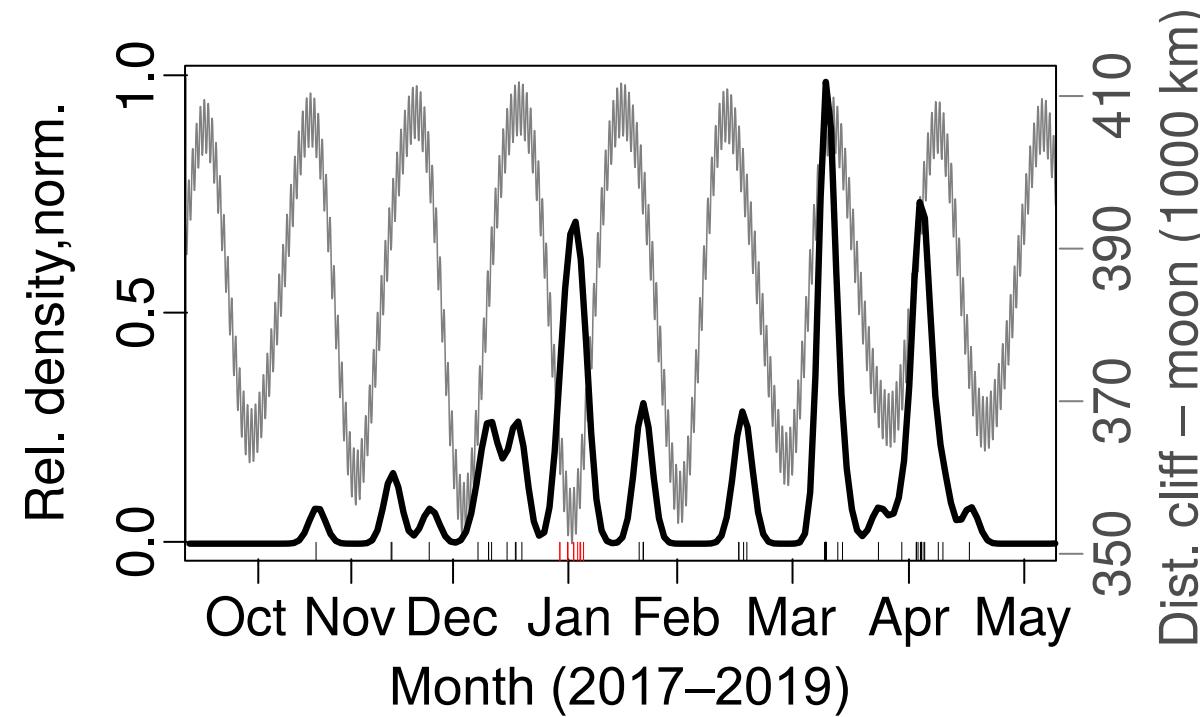
The coast - access to game changing data?



The coast - access to game changing data?



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To conclude – the possibilities

The possibilities

Environmental seismology is a rapidly evolving field (noise tomography, cryo-seismology, atmospheric seismology). Do we want to be a part of it?

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Station construction: off-the-shelf solutions, scalable, flexible, rugged

Data analysis workflow: we do our best to simplify things, be transparent and reproducible. But we need more players in that field.

To conclude – the possibilities

The challenges

Building a community, driven by research interest, not methodology

Convert "proof-of-concept" into "standard approach"

Extend/explore fields of application from a geomorphic perspective