

EnvSeis Doctoral Network: Environmental Seismology



Landslides, debris flows, rivers, ocean & glaciers

Field- & lab-scale measurements, modelling & simulation

10 Universities and 11 stakeholders

12 ESR coupling seismology and geomorphology

PI GFZ (Jens Turowski)

<https://www.envseis.eu/>



Need to co-ordinate and transfer knowledge
seismology \Leftrightarrow geomorphology

Sediment mobilization and transport

ESR 1: Channel-hillslope coupling

Signature of different hillslope processes (landslide, debris flows, sediment storage & transport, water flux, etc.) on the generated seismic signal – **field work** in Taiwan and **physics-informed empirical analysis**

ESR 2: Seasonality in erosional landscape dynamics

Characterization of seasonal patterns in sediment production, mobilisation and transport from the generated **seismic signal** and distributed **field observations** of short-term and seasonal variations of weather in Alps, Nepal Himalayas and Taiwan



Sediment mobilization and transport

ESR 3: Seismic sensing of bedload in variable roughness rivers across 3 continents

Bedload **seismic monitoring** systems in 5 different areas (USA, Israel, Austria, Japan, Taiwan) and 7 different rivers to determine the seismic response of bedload and turbulence in a wide spectrum of sediment sizes and bed roughness

ESR 12: Debris Flow Monitoring with Distributed Acoustic Sensing

Monitoring torrential and debris flows processes at high spatial resolution using pre-installed **fibreoptic infrastructure**. Detection algorithm development based on 10-20 debris flows at Illgraben and Val Greva, Switzerland

Advisors: Jonathan Laronne
Fabian Walter



Joganzi River,
Japan

Collaboration:
GFZ, NMT, USA,
Kyoto U, Japan, Boku
Austria



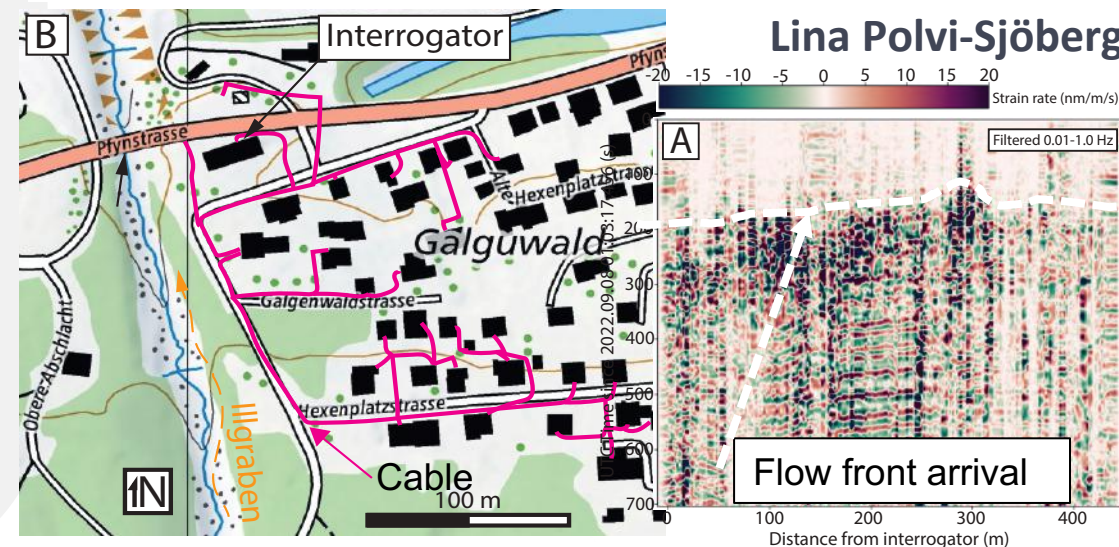
Arroyo de los Pinos, USA - sandy gravel



Unil
UNIL | Université de Lausanne

Advisors: Fabian Walter
Stuart Lane

Lina Polvi-Sjöberg

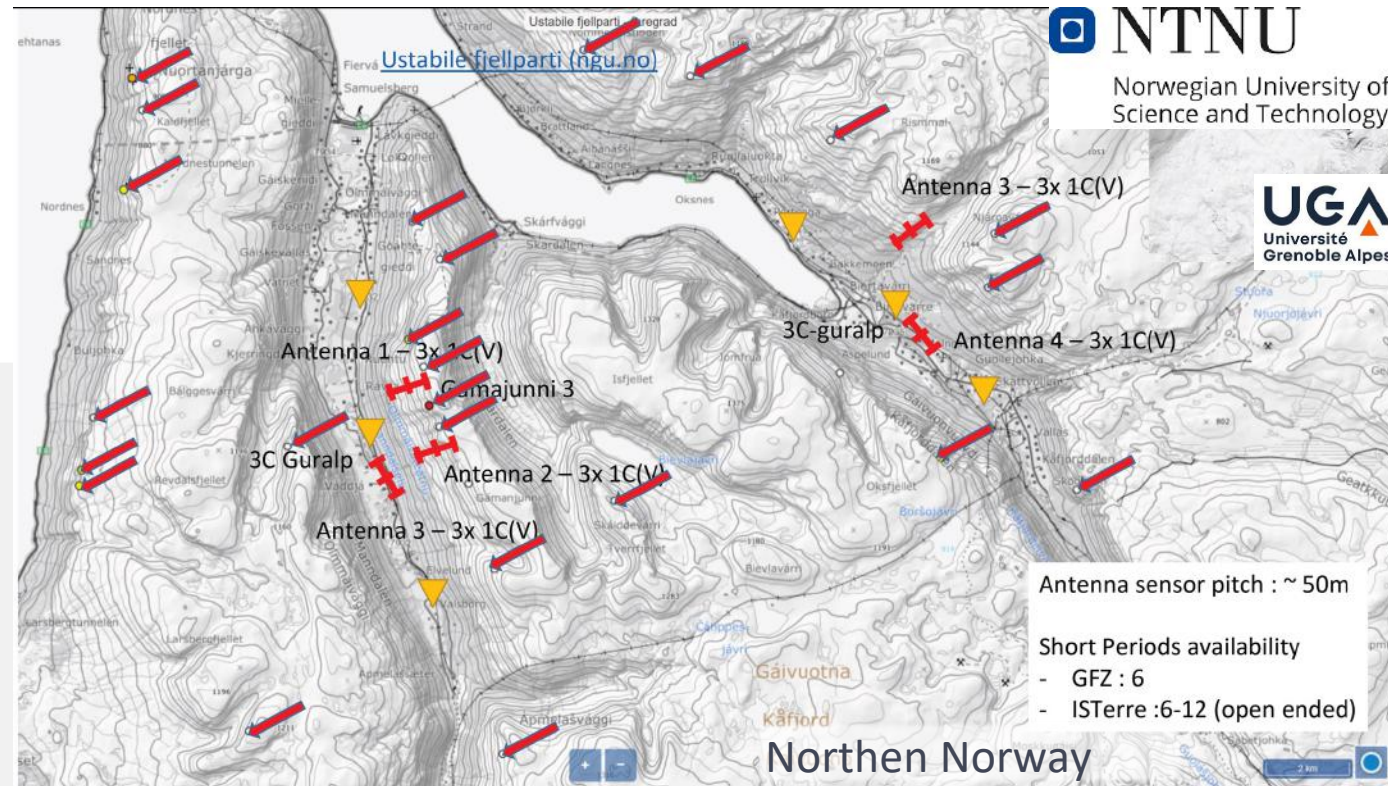


Illgraben, Switzerland

Sediment mobilization and transport

ESR 9: Seismic detection of rockslide activity in Norway

Quantification of seismic noise from rockslides, snow avalanches, rock falls, and rock glaciers to distinguish rockslide seismicity from other signals in northern Norway using **field measurements**



Advisors:
Reginald Hermanns
Eric Larose



Sediment mobilization and transport

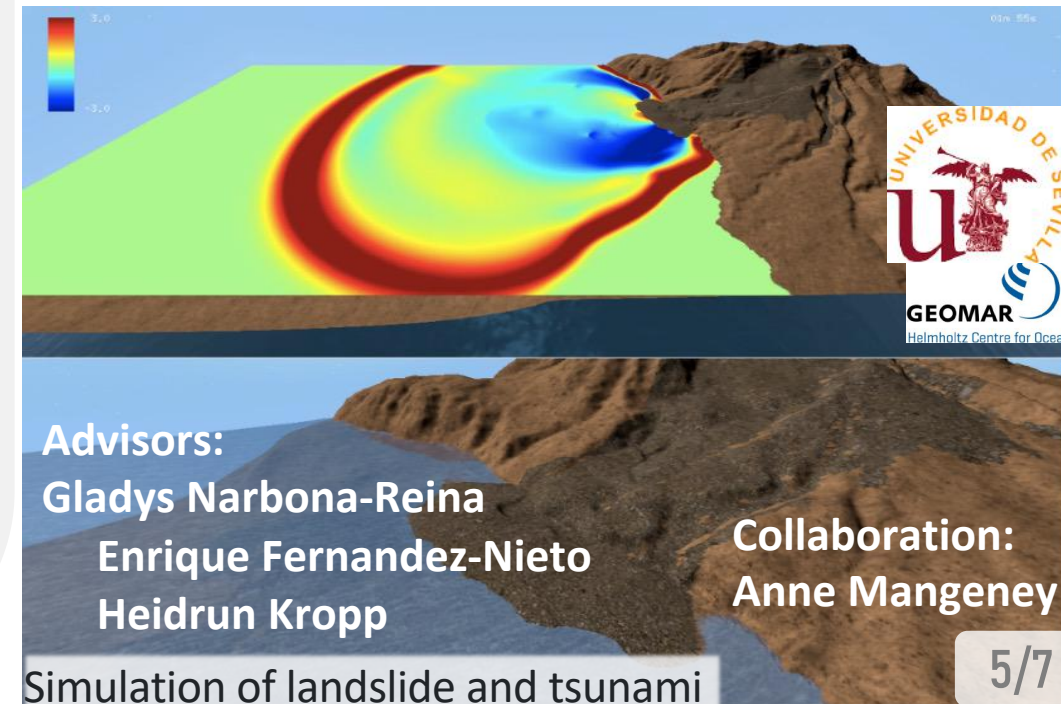
Advisors: Florent Gimbert
Jens Turowski

ESR 8: The seismic signature of extreme floods with highly concentrated sediment transport

Experiment, observe and describe how granular mechanics and river morphology sets seismic noise properties under extreme floods using **laboratory experiments** and **field seismic array** observations in the Alps

ESR 10: Modelling of seismic waves generated by submarine landslides & tsunamis

Develop **mathematical model** and **numerical methods** for submarine landslides and generated tsunami & seismic waves. Comparison with low frequency recorded **seismic data** of submarine landslides



Sediment transport beneath ice

ESR 5: Climate change impacts on river ice-related sediment transport & erosion

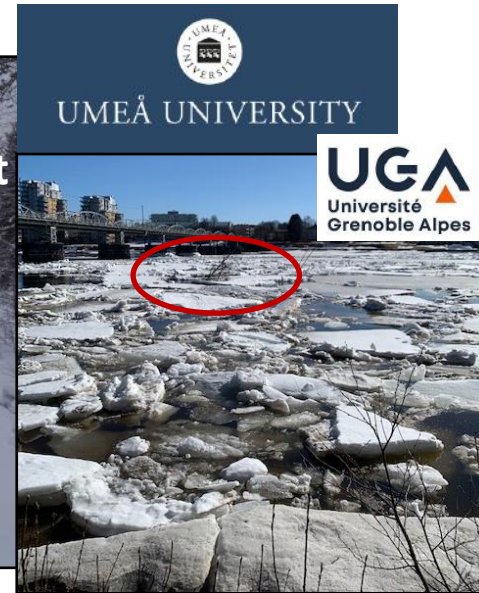
2-year **seismic monitoring** of sub-ice sediment transport during ice break-up to compare with erosion and sediment transport processes: determine the role of different river ice regimes on shaping channels

ESR 11: Seismic sensing of subglacial to proglacial marginal sediment flux

Understanding the role of sediment flux underneath glaciers in the evolution and timescales of subglacial hydrology using **borehole seismology & particle and morphology measurements** compared to conceptual **models** for subglacial sediment transport

Advisors: Lina Polvi Sjöberg
Florent Gimbert

'Sävar River, Sweden



Advisors: Stuart Lane
Micha Dietze



Glacier d'Otemma, VS,
Switzerland

Ocean noise and glaciers

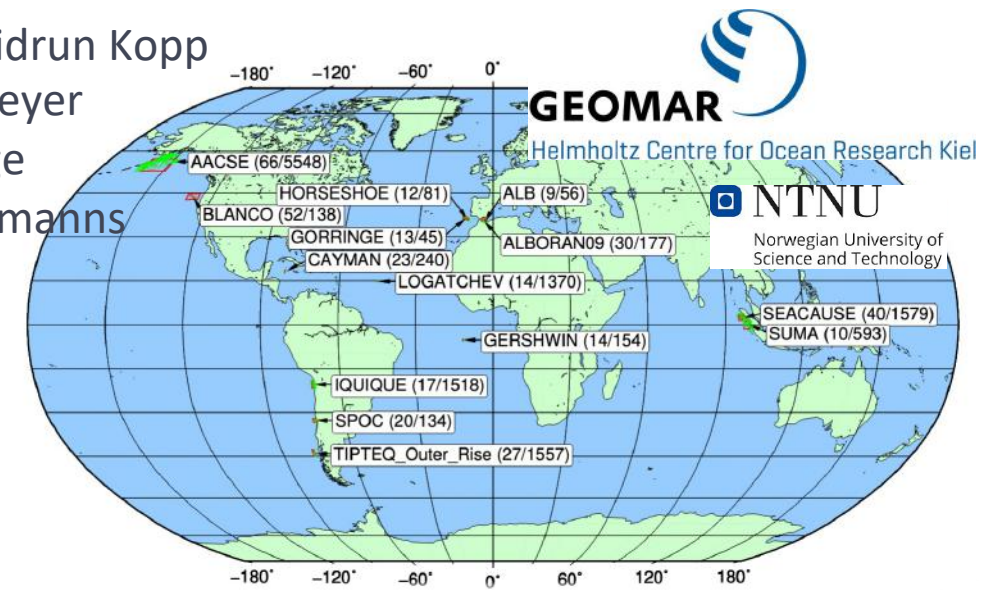
ESR 4: Noise in the ocean: Monitoring anthropogenic pollution and natural noise in the sea

Using available **ocean bottom seismometer** data from all oceans, we will investigate records covering the frequency range ~ 0.01 Hz – 100 Hz where anthropogenic changes are most prominent

ESR 6: Quantification of ice mass loss due to iceberg calving in Greenland by coupling seismology and mechanical modelling

Spatio-temporal change of iceberg volumes based on **inversion of seismic waves** and on a catalogue of **simulations** from glacier and calving models, to include in Global Climate Models.

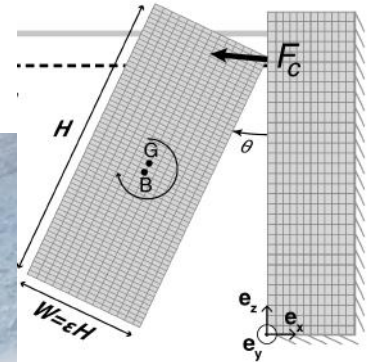
Advisors: Heidrun Kopp
Ingo Grevemeyer
Dietrich Lange
Reginald Hermanns



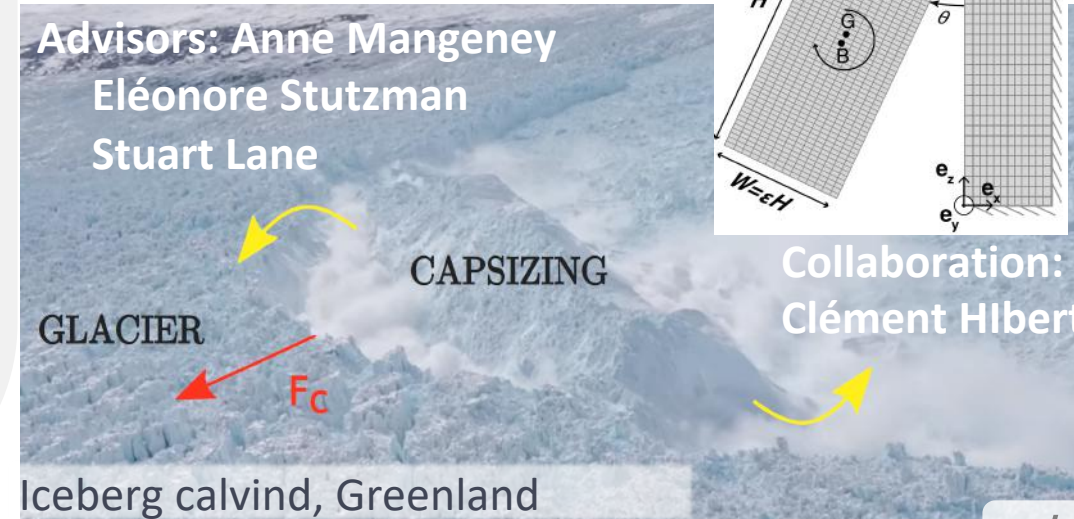
Global distribution of seafloor stations available to detect noise in the ocean



Advisors: Anne Mangeney
Eléonore Stutzman
Stuart Lane



Collaboration:
Clément Hilbert



Iceberg calvind, Greenland