Project idea form - small projects

Version 2.1

Registration no. (filled in by MA/JS only) _____

Project Idea Form

Date of submission 05/06/2025

1. Project idea identification

Project idea name	SEismic Activity in COastal environments of the southern Baltic Sea
Short name of the project	SEACOBS
Previous calls	yes ◯ no ◉
Seed money support	yes ◯ no ◉

2. Programme priority

	1. Innovative societies

3. Programme objective

	1.2. Responsive public services

4. Potential lead applicant

Name of the organisation (original)	Christian-Albrechts-Universität zu Kiel
Name of the organisation (English)	Kiel University
Website	https://www.uni-kiel.de/de/
Country	DE

Type of Partner	Higher education and research institution

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Which organisation(s) in the planned partnership take part in a project within the Interreg Baltic Sea Region Programme for the first time? Please list the respective partners.

Institute of Geophysics, Polish Academy of Sciences
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Department of Geophysics and Sedimentary Basins
Geological Survey of Denmark and Greenland (GEUS)
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5.1 Specific challenge to be adressed

Natural hazards such as storms, heavy rainfalls and earthquakes are known to affect coastal areas in the southern Baltic Sea Region (BSR). Besides the impact of such an event itself, secondary events like subrosion, rockfalls or landslides are very local threats along large portions of the southern Baltic Sea coasts in Germany, Denmark and Poland. In times of a warming climate where storm and heavy rainfall events are becoming more likely to occur, rockfalls and cliff erosion events are equally becoming more likely to increase in number and intensity. In addition, huge amounts of unexploded ordnance (UXO) are still covering large stretches of the seabed in the study area and uncontrolled detonations of UXO pose an imminent threat to local populations and fishermen alike. Beyond the coastal communities and settlements at village to city scale, large portions of the southern BSR are economically reliant on

touristic infrastructure including many national parks with spectacular coastal cliffs. To monitor potential vulnerabilities from natural hazards of these target groups, passive seismic monitoring offers a cost-effective public service to monitor any type of event that induces seismic waves. Seismic monitoring uses well established technology but particularly in the southern BSR, low station density and unfavourable data recording conditions require denser spacing in instrumentation to reliably detect and localize sources of seismic events, such as earthquakes or explosions. Using ambient seismic noise, the dynamic state of the ocean can be monitored in realtime, e.g., during storm events and provides observational data of the dynamic interaction of water and coastlines. In this project, we propose to intensify transnational cooperation between northern German, Danish and Polish seismic monitoring services to strategically increment observational density with seismic instrumentation in the southern BSR. This will go beyond well-established onshore sites and include a prototype installation of a cabled ocean-bottom seismometer (OBS) system as a test case to demonstrate the feasibility of conquering the ocean as locations for realtime seismic monitoring. New technologies including AI will be developed to improve the detection and location capabilities of small amplitude seismic events in the BSR as well as to localize sources of ocean generated microseism in coastal areas to statistically monitor the impact of surface gravity waves on sediment transport.

5.2 Focus of the call

Our proposed project will improve seismic monitoring of vulnerabilities in the entire study area. Near coastal towns and villages may be directly affected by natural hazards and the socio-economic impacts of a large event can be dramatic. Similarly, touristic infrastructure, particularly in national parks, is often remote from towns and villages but is at the same time an important economic factor in the respective region. In the proposed project, we will improve the coherent seismic monitorin capabilities of natural and induced seismic events by densifying the seismic network, elaborating on the data exchange, and by homogenization of the analysis. The monitoring of unexpected detonations of UXO will be improved in the vicinity of Lübeck, the island of Bornholm and Gdańsk. Regarding the coastal cliffs, we will focus on the Bays of Eckernförde and Kiel, the island of Rügen in Germany, the cliffs of Gdynia-Orłowo and Trzęsacz in Poland and Møns Cliff and Stevns Cliff in Denmark. These areas will be studied with respect to cliff retreat and sediment transport. A better monitoring and understanding of the impact of storm events on localized coastal stretches will provide the basis for focusing resilience building strategies in each respective community by forming innovation partnerships.

6. Transnational relevance

Neither earthquakes nor storm or heavy rainfall events care about national borders. Therefore, seismic monitoring requires transnational cooperation particular in areas where national coasts are located in close spatial proximity. A strategic densification of the existing seismic network in the southern BSR is necessary to increase the seismic monitoring capabilities of coastal areas. This will provide the basis for reducing location uncertainties and detection thresholds of local seismic events, either of natural or anthropogenic origin. Moreover, transnational seismic network densification increases imaging resolution of source areas of ocean generated microseism in the BSR and beyond and consequently improves our understanding of temporal and spatial variations in impact of coastal dynamics on coastal areas. In the past, the Pomeranian Bay was regularly point of contact with local storms and seemed to be a source area of large amplitude ocean generated microseism which affects the coastal

environment. As another example there are today no publicly accessible seismic stations along the Polish Baltic Sea coast. A collaborative network extension will hence not only improve monitoring in the Pomeranian Bay but also include monitoring of e.g., the hazardous cliff in Trzęsacz. The Baltic facing limestone and chalk cliffs in Denmark, similar in geology to the ones on Rügen, such as Møns Cliff and Stevns Cliff are also known to produce hazardous landslides. They are the subject of an ongoing Danish research project on landslides that includes a temporary local seismic network for monitoring. Knowledge exchange between projects will take place to ensure synergy and efficient use of resources.

7. Specific aims to be adressed

Building trust that could lead to further cooperation initiatives

The seismological services in the Nordic countries have a long history of close corporation. This project will help build a stronger bridge between the southern Baltic countries and Germany and Poland. This is an important step towards closer integration and better detection capabilities in the Baltic Sea in the future.

Initiating and keeping networks that are important for the BSR

This project provides the unique opportunity to initiate a transnational cooperation and install a dense and comprehensive seismic array along the Baltic Sea coast line and provide continuous and real-time seismic measurements. The partners will be implemented in the existing network community in Northern Germany. By increasing the seismic network to neighbouring countries, the monitoring capabilities increase considerably. The focus may not end in the southern Baltic Sea but may lead to the possibility for further extension of the seismic network and more partners in the future.

Bringing the Programme closer to the citizens

One major project aim is to raise awareness of the potential of passive seismic monitoring in local, coastal communities in the southern BSR that are particularly exposed to the mentioned threats. With increasing numbers of storm and heavy rainfall events in a warming climate, rockfalls and cliff retreat are becoming more likely and intense. By increasing the detection capabilities of uncontrolled detonations of UXO and smaller scale rockfalls, that typically remain unnoticed by the public and authorities, we aim to transfer the potential of seismic observation as a monitoring tool for these types of events closer to local communities by establishing innovation partnerships. We envisage in perspective that near-realtime information about detected events can be disseminated publicly via e. g., public digital information platforms integrated with a feedback routine that receives public responses of locally observed phenomena.

Allowing a swift response to unpredictable and urgent challenges

A swift response to urgent challenges is possible to execute, despite of local natural or anthropogenic seismic events, local weather phenomena or technical issues. The seismic network operates in real-time. Therefore, reacting to seismic events, either natural or anthropogenic are immediately executed. Uncontrolled explosions of UXO requires a swift response and report to local authorities and explosive ordnance disposal services. Local weather phenomena, which may affect coastal areas require additional, temporary and local seismic monitoring. Additional deployments of single temporary seismometers are able to schedule and conduct within days. Station maintenance is regularly (at least twice per year) conducted and even urgent technical issues of seismometers are immediately solvable.

8. Target groups

In the course of this project, we are aiming to involve local coastal communities in the areas located near the cliffs of Schwedeneck and Stohl near Eckernförde and Kiel, Sassnitz and Göhlen on the island of Rügen, Trzęsacz, Gdynia-Orłowo and Gdańsk in Poland and Møns Cliff and Stevns Cliff in Denmark which are facing the challenge of being particular exposed to cliff retreat, triggered by storm events or in the proximity of UXO. Seismic monitoring of these areas allows for a more comprehensive observation and understanding of cliff retreat due to rockfalls and landslides, estimations on sediment transport in coastal areas based on the seismic impact as well as monitoring of UXO in close connection to the respective local communities.
At a certain point of time, seismic measurements will be open source and publicly available. Therefore, higher education and research institutes, e.g., seismology groups, will be interested in using the data and possibly our technical development for their own purposes.

	Please use the drop-down list to define up to five target groups that you will involve through your project's activities.	Please define a field of responsibility or an economic sector of the selected target group	Specify the countries and regions that the representatives of this target group come from.
1.	Local public authority	Local public authorities responsible for local costal communities located in the areas exposed to cliff retreat, storm events or in the proximity of UXO	Denmark (vicinity of the Møns and Stevns Cliffs), Germany (coastal cliffs along the Bays of Eckernförde and Kiel and Rügen Island), Poland (vicinity of the Gdynia-Orłowo and Trzęsacz Cliffs, Gdańsk)
2.	Interest group	Local communities affected by the cliff retreat, storm events or UXO	Denmark (vicinity of the Møns and Stevns Cliffs), Germany (coastal cliffs along the Bays of Eckernförde and Kiel and Rügen Island), Poland (vicinity of the Gdynia-Orłowo and Trzęsacz Cliffs, Gdańsk)

3. Higher education and research institution	Universities and research institutions which carry out research and operate programmes related to seismic monitoring, landslides hazard and coastline protection	Denmark, Germany, Poland and other countries for which coastal protection is an important and urgent issue

9. Contribution to the EU Strategy for the Baltic Sea Region

Please indicate if your project idea has the potential to contribute to the implementation of the Action Plan of the EU Strategy for the Baltic Sea Region (https://eusbsr.eu/implementation/).

yes ◉ no ◯

Please select which policy area(s) of the EUSBSR your project idea contributes to most.

PA Innovation

The MA/JS may share your project idea form with the respective policy area coordinator(s) of the EUSBSR. You can find contacts of PACs at the EUSBSR website (https://eusbsr.eu/contact-us/).

☐ If you disagree, please tick here.

10. Partnership

Our consortium consists of renowned scientists from academic and research institutions in northern Germany, Denmark and Poland. This includes Thomas Meier, Lars Wiesenberg and Christian Weidle from the Institute of Geosciences of Kiel University, scientists from the Institute of Geophysics of the Polish Academy of Sciences in Warszawa, the Polish Geological Institute - National Research Institute in Warszawa, which, in accordance with the Geological and Mining Law, fulfils the tasks of the State Geological Survey and is supervised by the Polish Minister of Climate and Environment. The Geological Survey of Denmark and Greenland (GEUS) in Copenhagen is an international research and advisory institution within the Danish Ministry of Climate, Energy and Utilities. Our project will proactively reach out to local public authorities, such as the ones directly affected by cliff retreat (Schwedeneck, Stohl, Rügen, Trzęsacz, Møns Cliff and Stevns Cliff) or threats from UXO (Lübeck, Bornholm and Gdańsk). Partners from all four institutes have a long record of deploying and operating seismic stations, and local knowledge to define suitable deployment sites to address the mentioned challenges of seismic monitoring. Each partner will be preferably in charge of the deployment and maintenance of seismic stations in their respective countries with logistical support from the other partners wherever needed.

11. Workplan

We aim to increase the existing seismic network on a transnational scale. For that reason, further discussions are required on network geometry and suitable stations sites, either in Denmark, Poland or northern Germany. Local coastal communities will be contacted at the start of a site selection process which will also raise their awareness of the project early-on. Data assembly, quality assessment, data handling and station maintenance are planned to be executed by the respective partner. Realtime seismic data exchange and processing will follow well-established seismological routines with the existing algorithms for event detection across the entire southern Baltic Sea region. During the project, we are aiming to report on relevant events, despite of natural or human origin. These events might lead to the deployment of additional, possibly local seismic stations in the Baltic Sea region which will enhance the detection capabilities of seismic events (earthquakes, explosions) even further. In a pilot study, a permanent cabled OBS systems will be deployed to test the feasibility of marine installations with realtime data transmission away from the coasts. Target areas are north of Darss and in the vicinity of the Eckernförde or Kiel Bay.
During the project, we will be ready to react to incurring event, e.g., a local storm where we will facilitate the installation of additional, temporary seismometers in a selected target region to temporarily increase the local monitoring capabilities. This will help to bridge the gap from local to regional scales in interpretation of seismic data.
Continuously recorded seismic data along the southern Baltic Sea coastal areas will be used to improve existing algorithms and develop new technologies (partly AI supported) to lower the detection thresholds as well as the location uncertainties of seismic events. Moreover, source areas of microseism in coastal areas will identified to understand and monitor statistically the impact of surface gravity waves on sediment transport. This essentially requires the involvement of local municipalities to discuss with stakeholder's their local observations of sediment transport and cliff retreat.
Finally, our efforts may result in a publicly available digital information platform, developed in close cooperation with geological services, to provide near-realtime information on detections to the public and, conversely, offer the public the opportunity to report back on observed phenomena.

12. Planned budget

ERDF budget (planned expenditure of partners from the EU)	EUR 500,000.00
Norwegian budget (planned expenditure of partners from Norway)	*EUR XXX*
Total budget (including preparatory costs)	**EUR 500,000.00**

13. Project consultation

Please indicate if you wish to have a consultation (online meeting) with the MA/JS to discuss your project idea

yes ◉ no ◯

14. Questions to the MA/JS

Questions related to the content of the planned project	*(max.1.000 characters incl. spaces)*
Questions related to budgeting and expenditure	*(max.1.000 characters incl. spaces)*
Any other questions	*(max. 1.000 characters incl. spaces)*

15. Additional information

(max. 1.000 characters incl. spaces)

Your account in BAMOS+

Please remember that to officially submit your application you need to access our electronic data exchange system BAMOS+. More information about the process of applying for your account in BAMOS+ you will find here:
https://interreg-baltic.eu/gateway/bamos-account