Improving coastal hazard assessment by the linkage between storm-induced landforms, sedimentary record and instrumental measurements – STORMLINK

Instrumental measurements and historical data are too limited in timespan to be the only source of information used in risk estimation related to natural hazards in coastal areas. Thus, geomorphological and sedimentological evidence of past events increase usage and can be used in coastal flood risk estimation in the future. Unfortunately, due to the complexity and high dynamic of the coastal environment (different geological, atmospheric, and oceanographic conditions), there is no universal model dedicated to coastal flooding risk estimation and explaining results of storm surge events in a geological context.

The STORMLINK project aims to develop a methodology of storm hazard research based on integrating geological, meteorological, and oceanographic data on specific types of the coast – sandy barriers and coastal wetlands of semi-enclosed, nearly tideless basin in mid-latitudes zone – of Baltic Sea. The project aims to answer for below research questions:

- Which environmental components (geomorphological, atmospheric, oceanographic) of sandy barriers and coastal wetlands environment play a key role in forming storm surge sedimentary record?
- Is it possible to use semi-automated objective classifications of washover features within the sandy barriers and coastal wetlands?
- Is it possible to combine geomorphological characteristics of washover landforms or sedimentary record preserved at wetlands to actual storm surge characteristics and develop a predictive model?

Research methods in 3 years of the project include seafloor scanning of nearshore using multibeam echosounder (MBES), imaging and altitude measurements with unmanned aerial vehicle (UAV), and monitoring of sediment flux to coastal wetlands. Digital data will be processed using dedicated software, e.g. Qimera, ArcGIS, Matlab, R or eCognition. Geological samples will be analysed in the laboratory with a petrographic microscope and particle and shape analyser Morphologi G3. Answer to research questions requires the application of advanced statistical analyses, including but not limited to machine learning algorithms or multiple regression.

Conducting research planned in the project will be one of the first approaches to quantitative analyses of the geological impact of storm surges on the coastal area. It will expand the knowledge on the influence of different environmental factors and coastal features on the formation of storm deposits and build the bridge to the reconstruction of palaeostorms based on sedimentary record covering a period of hundreds to thousands of years of coastal history. In a future perspective, such reconstructions will help better estimate extreme natural hazards based on reconstructed specific storm surge parameters from the pasts in a similar way, like palaeoclimate reconstructions – using appropriate proxies and relating them to calibrating the time window of instrumental datasets.