The aim of planned research is to describe the mechanism and patterns of the coastal soft cliff environment behaviour under storm conditions.

The number of extreme storm surges in the Baltic Sea is increasing steadily, which in turn - together with milder winters and limited ice cover - exacerbate coastal erosion. We believe that understanding dynamics of nearshore bathymetry, which naturally respond to storm conditions, is crucial in order to determine coastal cliffs sensitivity to disturbance by erosion and find its relevant measures directly on the beach-cliff system.

Therefore, the primary scientific objective of the proposed INSUMOR project (*INfluence of SUrfzone and beach MORphology on coastal cliff retreat*) is to **study material balance influence on erosion processes** and to **develop low-cost, image-based nearshore bathymetry mapping technique for Baltic sea.**

The problem of material balance has not yet been investigated in the short-term soft-cliff analysis. To investigate all possible relationship several modern, up to date statistical methodologies like graphical, probabilistic Bayesian Network model, also known as Bayesian belief nets and machine learning techniques like Random Forest will be used.

The second scientific activity focuses on the changes in nearshore bathymetry of Baltic sea coastal zone. Identifying short term morphology variations in the coastal zone is crucial for the analytical processes. In recent times, bathymetry estimation from coastal video imagery has been considered to be a promising method. Here we will test a new approach based on dependence between water depth and image brightness including the effect of sediment type changes. Since mapping underwater depth in general is expensive there is a high demand for such low-cost method of coastal bathymetry mapping that can be implemented more frequently and flexibly.

The research proposed in this project is important also in terms of empirical data as it assumes repeatedly realized campaigns of simultaneous acquiring of bathymetry (surf zone) and topography (beach-cliff system) in order to estimate precise values of erosion and deposition processes. The specific research goal of the monitoring part is to provide combined datasets using newest technology advances. Those are: hydroacoustic realized with a surf drone (USV) and unmanned aerial vehicle (UAV) integrated with light detection and ranging (LiDAR) system called LasUAV. Supported with underwater video and satellite images it will be used to develop accurate morphology and bathymetry mapping based on reliable data. All proposed monitoring techniques represent high quality, state-of-the-art methodologies used in recording natural environments. Moreover, the interest of scientists in using both USVs and UAVs to monitor processes and phenomena developing both on the surface of the Earth and underwater has clearly increased in recent years. Notwithstanding, proposed methodologies has not been used yet for combined monitoring of morphology and bathymetry of coastal environment.

The approach applied herein is important for gaining both theoretical and practical knowledge. It enables us to provide a new overview of the analysed topic and at the same time conduct tasks related to safety in the coastal zone. The most tangible outcome of the proposed project will be reproducible algorithm for determining nearshore bathymetry form UAV images.