

State of the objective of the project

Wide beaches and sufficiently high dunes are natural protection of the hinterland from both erosion and marine flood. Enhanced loss of beaches and destruction of dunes, observed in recent decades, combined with increasing tourism and the number of recently built coastal structures, are the main reasons underlying the need of comprehensive research of dune and beach degradation processes in connection with the associated technical, economic, environmental and social aspects.

A **research hypothesis** was put forward in the project. It states that the wave run-up process is not an entirely random process and the run-up height depends on periodic superposition of 1st and 2nd wind waves harmonics at a depth of seabed of ca. 0.5 m.

The project goal is determination of mathematical tools describing the wave run-up on beaches, including superposition of two major constituents of wind waves at an approximate depth of seabed of 0.5 m.

Implementation of the above goal will be done through determination of:

- the range of wave action on a beach;
- qualitative and quantitative description of periodic (or random) superposition of wind waves harmonics at a depth of ca. 0.5 m.

What research tasks shall be implemented in the project?

The group of interdisciplinary basic research to be tackled in the project is encompassed by the thematic panel. They include: Coastal engineering; Geomorphology; and Physical oceanology. The project will cover: **(a)** execution of novel and technologically advanced measurements and in-situ observations in the nearshore region, **(b)** elaboration of mathematical and numerical model describing the wave run-up process.

The reasons for choosing the research topic

The current state-of-the-art regarding physical oceanology, hydraulic engineering and geomorphology is sufficient to pursue investigations aimed at the approximate assessment of the range the range of wave action on a beach. The existing models of wave run-up do not incorporate nonlinear processes taking place in shallow water part of the nearshore region. In order to improve our understanding of physical processes during the wave run-up, the proposed project plans to include quasi-random superposition of shallow water wind waves harmonics. Implementation of methods so far utilized in identification of infragravity waves on the Polish coast shall contribute to development of scientific disciplines of physical oceanology and geomorphology.

Even though the presented hypothesis and the postulated goals of the project belong to the basic research, there is a possibility of applying the project results in applied research as well. Some 75% of coastal segments in Poland are dune type beaches. Their hinterland is usually highly urbanized and densely populated. The dunes are a natural barrier against seawater intrusions. It is estimated that at the end of the 20th century and the beginning of 21st century an average rate of retreat for the entire Polish coast was equal to 8 m/year. In addition increased storminess of the Baltic Sea has been observed in recent time. All this necessitates the execution of assessment of flood and erosive threats of coastal areas. One of key pieces of information needed in such studies is the correct determination of the range of wave action on a beach.