

Turbulent mixing processes in the ocean are essential for the transport of heat, fresh water and nutrients, and therefore has serious implications for the Earth's climate.

The aim of the project is to identify, describe and analyze the main mechanisms responsible for vertical transport and mixing of water in Słupsk Furrow, in the area located on the southern Baltic in the Polish Economic Zone. This region, connecting the western and eastern part of the Baltic Sea, is located on the main route of dense, oxygen-rich waters flowing from the North Sea, making the Słupsk Furrow key importance region for the circulation of the Baltic Sea and its ecosystem. The main goal of the project is to determine the importance of dynamic factors, such as: internal waves, mesoscale eddies and surface waves, in vertical mixing processes in the Słupsk Furrow.

According to the research hypothesis, internal waves and mesoscale eddies are important driving mechanisms responsible for salt exchange in the Baltic Sea. Internal waves force vertical mixing of salt and heat at the scale of the entire Baltic Sea. Mesoscale eddies are responsible for the transfer of energy and momentum through horizontal and vertical water movement and mixing. We claim that these phenomena are of great importance in the Słupsk Furrow. These phenomena were often observed in the Baltic Sea, but their participation in mixing is not known. So far, no mixing measurements have been made in the Polish Economic Zone in the Baltic Sea. The numerical models of the Baltic Sea provided guidance on the origin of vertical mixing, indicating that about 30% of energy in deep Baltic waters is generated by the collapse of internal waves (Meier et al., 2006). However, the share of processes causing mixing and their temporal and spatial changes are still unknown. Therefore, further research is needed on these mixing processes to fully understand the role and type of mixing and its effects.

During the project an innovative approach to the problem and new technologies will be applied. The project will consist of a combination of various components and methods: measurement campaign in Słupsk Furrow (WP2), research on dynamic processes that cause mixing, such as: internal waves, mesoscale eddies and surface waves (WP3) and numerical modeling (WP4). The basis of the program are measurements performed in natural conditions, focused on gathering the maximum amount of synoptic data (observations from the ship, autonomous floats) and time sequences (anchored measuring stations). The data collected during the project will be used to improve the accuracy of the Baltic numerical model. On the other hand, process studies and the improved numerical model of the Baltic Sea will provide better prediction of physical conditions in the Baltic Sea, allowing for new applications. The implementation of the program will allow to obtain new measurement data relevant for the development of oceanography and improving the understanding of ocean dynamic processes, significantly going beyond the current state of knowledge.