

The widespread use of plastic materials worldwide, driven by their low cost of production and versatility, has led to severe environmental consequences. Plastic pollution is one of the most challenging problems facing our planet, affecting the oceans, land, atmosphere, and all forms of life. Plastics can degrade into tiny particles called microplastics (MPs) or even smaller nanoplastics. These particles can be transported across the globe and have even been found in remote areas like the Arctic and deep ocean regions. MPs can carry harmful chemicals that pose risks to humans, animals, and ecosystems. They can enter the food chain through various pathways, ultimately reaching humans. However, the exact routes through which plastic and microplastic particles are transported in the environment are still poorly understood.

To address these challenges, our research project has set out the following **main objectives**:

- (1) Implementing a novel method called Relaxed Eddy Accumulation to measure airborne microplastic particles emissions and depositions (AMPs).
- (2) Investigating the role of air-sea-land exchange in the transport of microplastic particles (see fig. 1).
- (3) Conducting long-term observations to understand the variability of AMPs in the Baltic Sea area and during three cruises to the North Atlantic Ocean.
- (4) to develop an AMP transport statistical model based on field data using the Monte Carlo method.

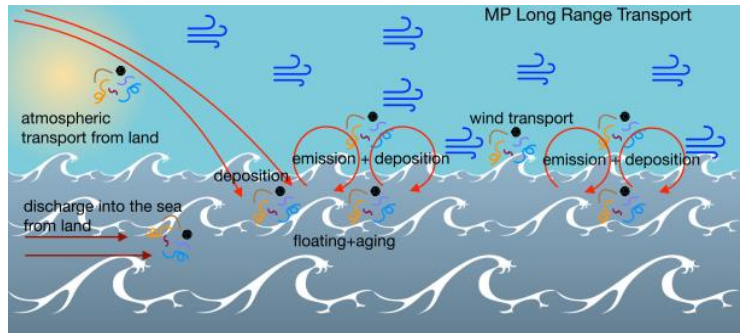


Figure 1 The complex system of microplastic particles transport in marine environments.

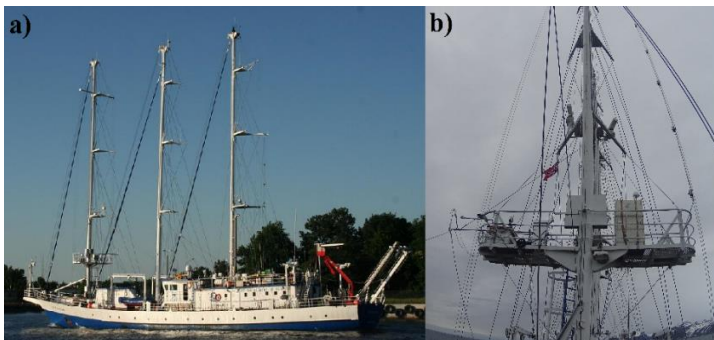


Figure 2. The research vessel Oceania (a) and aerosol and meteorological measurement platform in the foremast of the ship.

Our project is interdisciplinary in nature, and our team consists of experts in marine science, atmospheric physics, and aerosol measurements. We are collaborating with specialized institutions, such as Stockholm University (SU) and Milan University Bicocca (UniMiB), to support our research. Scientists from UniMiB are experts in aerosol chemistry and physics, while SU brings deep expertise in atmospheric measurements. Together with SU, we are developing the first Relaxed Eddy Accumulation system dedicated to measuring MPs. We plan to collect samples from the air

and sea at various measurement sites in the open sea and shoreline areas. Our primary platform for field measurements will be the research vessel rv Oceania, owned by the Institute of Oceanology Polish Academy of Sciences (fig 2).

Through extensive interdisciplinary measurements (see Fig. 3) conducted as part of this project, we aim to unravel the mechanisms of MP transport across different environmental compartments, including the air, sea, and land.

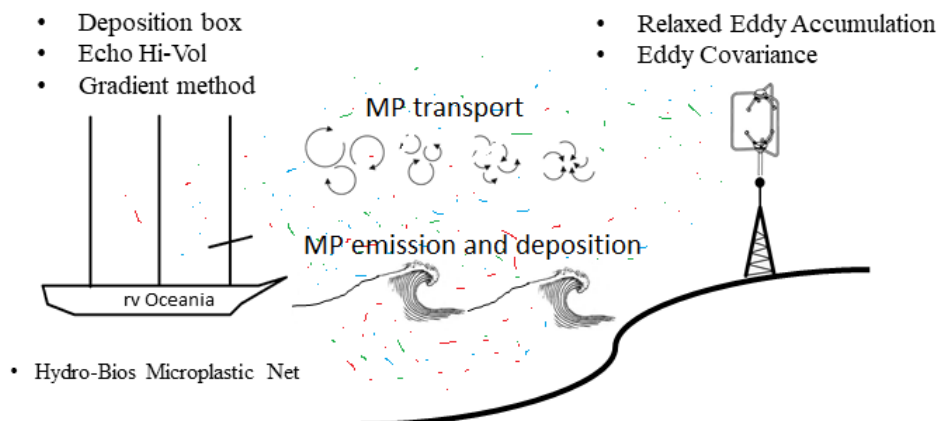


Figure 3. Illustrative picture of the planned research.