Project title: IOW-ESM — A regional earth system model for the Baltic Sea region Principal investigator: Prof. Markus Meier<sup>1</sup> Allocation period: 2025-01-01 –





## Abstract

This project is concerned with the development of the IOW high-resolution regional Earth System Model (IOW-ESM), to downscale global climate simulations from the Coupled Model Intercomparison Project 6 (CMIP6) for the Baltic Sea region. The model is set up in a modular structure with interchangeable components for the atmosphere, the ocean, and the land models. In its first iteration, it utilizes the Modular Ocean Model 6 (MOM6) for the ocean and the COSMO model in Climate Mode (CCLM) for the atmosphere. The IOW-ESM allows studying regional climate phenomena and to produce climate data appropriate for end users and policymakers. Technically, the model is driven by the atmospheric boundary conditions that are a priory generated from a Global Climate Model (GCM) simulation. The bidirectional ocean-atmosphere coupling allows for a realistic air-sea feedback, which outperforms the traditional approach of using uncoupled standalone models as typically pursued with the EURO-Cordex protocol. To address marine environmental problems (e.g. eutrophication and oxygen depletion), the ocean model encompasses a marine biogeochemistry model setup for the Baltic Sea. Model forecasts are driven by reasonable Shared Socioeconomic Pathways (SSPs) including different assumptions for nutrient load scenarios for the biogeochemistry model. Besides these applications of high societal relevance, the IOW-ESM can be used for various scientific questions such as climate sensitivity experiments, reconstruction of ocean dynamics, study of past climates and natural variability as well as investigation of ocean-atmosphere interactions. Hence, it can serve for better understanding of natural processes via attribution experiments that relate observed changes to mechanistic causes.

<sup>&</sup>lt;sup>1</sup>Leibniz Institute for Baltic Sea Research, IOW