

## **FESOM-FUTURO: Development and application of a high-resolution configuration for the upwelling systems off West Africa**

Upwelling systems off West Africa sustain some of the most productive marine ecosystems worldwide. Yet, their fine-scale physical processes, such as upwelling filaments, mesoscale eddies, and cross-shelf exchange, remain poorly represented in current climate models, limiting our ability to predict regional responses to climate variability and change.

The project FESOM-FUTURO aims to develop and apply a high-resolution configuration of the Finite-Element Sea-ice Ocean Model (FESOM) to investigate fine-scale ocean dynamics in the West African upwelling systems. In the first phase, we will design the model configuration, including unstructured mesh generation with coastal refinement, realistic bathymetry, and optimized subgrid parameterizations. The setup will be validated and tuned using GEOMAR's long-term in-situ observations and satellite datasets. In the second phase, the model will be used for ocean-only and coupled simulations to resolve and quantify fine-scale dynamics controlling upwelling intensity, frontal variability, and shelf–open ocean exchanges. These simulations will establish a physically consistent framework for linking observed variability to large-scale forcing and for future coupling with biogeochemical and ecosystem models.

The requested DKRZ resources will support configuration development, testing, and production runs, providing a cornerstone modeling component for FUTURO campaign and advancing high-resolution ocean prediction in African upwelling regions.