Project Report

Project: 1315
Project title: CoastalFutures
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Project duration: Second Phase: 01.12.2024 to 30.11.2027
Report period: 01.06.2025—30.04.2026

The following is the report for 2025/2026, organized according to the work packages (WPs) of cF-II. In sections for each cF-II WP, the report is on experiments which were described in the proposal of the previous period 2024/2025.

In cF-II, the resource of bg1315 has been used to contribute to works in four WPs (WP2, WP3, WP4, and WP5).

- **cF-II-WP2**: Cumulative effect of offshore wind energy expansion
- **cF-II WP3:** Impacts of climate change and adaptation strategies
- **cf-II WP4:** Future of Fisheries
- **cf-II WP5:** Marine Conservation and MPAs (Marine Protected Areas)

Most of the works will contribute to cF-II WP5, therefore, we report works for cF-I WP2, 3 and 4 in detail as following.

cF-II WP2: Cumulative effect of offshore wind energy expansion (Ute Daewel, Hoa Nguyen, and Naveed Akhtar)

Report on experiments 1.1

Ute Daewel has planned to run some experiments of the model SCHISM and the coupled model SCHISM-ECOSMO for several areas such as the Northwest European Shelf and Wadden Sea. However, the planned simulations have not yet started due to unresolved bugs and tuning issues. There is no further plan for this task in the next period.

Report on experiments 1.2

Hoa Nguyen has integrated the coupled model NEMO-ECOSMO E2E – OSMOSE into the GCOAST framework in cF-II and conducted simulations to reproduce observation that is required for assess impacts of human activities and climate change to marine ecosystem of North and Baltic Seas. She has run numerous NEMO-ECOSMO E2E – OSMOSE simulation to setup, calibrate the model in the period 2025/2026. Reference simulations (without offshore wind) for the North Sea were conducted using the two-dimensional multi-species OSMOSE model. Based on this, key ecosystem indicators were calculated, including the Large Fish Indicator size-spectrum slope mean trophic level, typical length, and proportion of mature biomass.

Report on experiments 2

The wind farm parameterization was upgraded from COSMO5 to COSMO6, allowing for the implementation of different turbine types as well as the chronological evolution of wind farm development in the North Sea (Elizalde et al., 2026). Naveed Akthar has conducted several COSMO-CLM atmospheric simulations of wind farms and COSMO-CLM atmospheric simulations without wind farms during cF-I WP3 and in cF-II WP2 up to now. The data from the five technical scenarios simulated with COSMO-CLM have been fully analysed, and a scientific publication has been submitted (Akhtar et el., 2026). This dataset is also being used by several groups as forcing for ocean, wave, and ecosystem models.

cF-II WP3: Impacts of climate change and adaptation strategies (Bo Miao, Ha Hagemann, and Marcel Ricker)

Report on experiments 3.1

Ha Hagemann has developed the regional Earth system model GCOAST-AHOI which includes the atmospheric models COSMO-CLM and ICON-CLM, the ocean model NEMO and the hydrological discharge model HD. GCOAST-AHOI1-1 and GCOAST-AHOI2-1 were applied to conduct climate simulations over Europe to contribute to the cF-I WP6 and continue in cF-II WP3. Simulations of GCOAST-AHOI are stored at /work/bg1315 for on-going evaluation and publication. Publications on the coupled system of ICON-CLM, NEMO and HD models were published to contribute to CoastalFutures (Ho-Hagemann et al., 2024; Maurer et al., 2026).

In cF-II, the biogeochemical model ECOSMO has been coupled to the system GCOAST-AHOIB1-1. We have conducted several sensitivity tests of GCOAST-AHOIB1-1 to investigate and reduce sea surface temperature (SST) and salinity biases as well as to analyze effects of different air-sea coupling methods. We ran a hindcast simulation of GCOAST-AHOIB1-1 for 63 years (1959-2021) as a production simulation for CoastalFutures. Data are also used for joint publications within the EURO-CORDEX initiative. In addition, one simulation of GCOAST-AHOIB1-1 downscaled the CMIP6 MPI-ESM1-2-HR was conducted starting from 1950 and reaches the simulation year 1970 currently. Simulations with the fully coupled model GCOAST-AHOIB in 2026/2027 are provided in the proposal.

Report on experiments 3.2

Marcel Ricker has conducted several stand-alone simulations of the ocean model NEMO (v3.6 and v4.2) and the wave model WAM, did some bug fixes and extensive validations and calibrations for the models over the North Sea and North Sea-Baltic Sea areas on the grid of about 1.8 km and 3.6 km. Simulations have been initiated with a focus on hindcasts covering the last 15 years. A suite of reference configurations was compiled to be used for future simulations. In parallel, he also has set up the coupled model NEMO+WAM for the North Sea (1.8 km).

cf-II WP4: Future of Fisheries (David Drewes)

Report on experiments 1.3

David Drewes has worked on the SCHISM-Tracking Experiment combined with an individual-based model (IBM) describing the stage specific development of early life stages of the European Smelt. In 2025, most of the simulations were finished, just minor adjustments and potential new runs need to be done for final publication. The runs included 5 scenarios for the setup with small amounts of particles that were released. Data analysis and potential runs conducted based on reviewer's feedback might be needed in 2026. Data from cF-II WP2 and WP3 works will contribute to the study of North Sea fisheries in WP4.

Levante Storage

The total allocated storage at /work/bg1315 is **906 TiB**, of which **847 TiB** is currently in use. Last year, in collaboration with the **DKRZ support team**, an effort was made to archive a significant portion of the data. As a result, approximately **252 TiB** of data was deleted after successful archiving. Although most of the data has now been archived, a substantial part still needs to be retained on the work storage due to its extensive use by multiple research groups for model forcing and for analysis related to ongoing and future publications.