

Anne Hennke – Marine Geosystems (MG)

Baltic Sea algae habitats – mapping German EEZ Reefs and insights from AL652

The BfN-funded project “ROVKA – Reefs of the Baltic Sea: Occurrence and Climate Protection Performance of *Fucus* and *Saccharina* in the German EEZ” aims to assess the blue carbon potential of these two key macroalgal species and to determine their spatial distribution in the Baltic Sea. The project is designed for a six-year duration and includes biannual research cruises conducted in May and late October. This sampling strategy enables the analysis of seasonal dynamics as well as interannual variability in macroalgal abundance and distribution.

A combination of hydroacoustic and optical methods is employed, including ship-based and AUV-based mapping as well as ROV-supported exploration. These datasets are complemented by biological sampling, current measurements, water column properties, and sediment cores to provide an integrated understanding of algal distribution, habitat characteristics, and transport processes.

Following the completion of the second research expedition, this presentation will introduce the project framework and provide first insights into the collected data, preliminary data products, and initial observations from the field campaigns.

Svenja Frey – Biogeochemical Modelling (BM)

Opposing impact of climate perturbations on natural and anthropogenic carbon in the ocean under CO₂ emission reversibility

Ocean carbon storage responds to changes in atmospheric CO₂, reflected in particular in the uptake of anthropogenic carbon under contemporary "net-positive" CO₂ emissions. Under future net-negative emissions scenarios, however, the ocean is expected to release part of the previously absorbed anthropogenic carbon back to the atmosphere. In addition to this direct atmospheric CO₂ effect, anthropogenic climate change modulates the uptake of anthropogenic carbon as well as impacts the natural carbon cycle, for instance an increase in sea surface temperature decreases solubility of CO₂ in the ocean, and changes ocean stratification and hence ocean circulation.

Previous studies have largely focused on how climate change affects natural and anthropogenic carbon storage together, and compared this to the direct effects of the atmospheric CO₂. This approach obscures differences in the mechanisms governing natural versus anthropogenic ocean carbon response to climate change perturbations. To isolate these mechanisms, we use an Earth System Model with idealized tracers to separately track natural and anthropogenic carbon. We analyze the ocean carbon under an emissions reversibility scenario

("flat10-cdr"), characterized by symmetric CO₂ emissions: a net-positive phase followed by a net-negative phase, ultimately returning cumulative emissions to zero. Despite the reversal of cumulative emissions to zero, our results reveal persistent and irreversible changes in the total ocean carbon response to climate perturbations. Our mechanistic separation provides new insight into ocean carbon responses to climate perturbations and highlights the role of circulation-driven processes in shaping asymmetric and irreversible behavior.

Kai Schulz – Biogeochemical Oceanography (BI)

Five Years of Pelagic Ocean Alkalinity Enhancement Impact Studies: Lessons learned and Knowledge Gaps

Ocean Alkalinity Enhancement (OAE) is the marine carbon dioxide removal technology with the largest potential, which could help reaching the 1.5 degree warming target of the Paris Agreement. However, potential side effects on marine organisms/ecosystems and the services they provide need to be critically assessed. Here I will draw from five years of experimental OAE research on the effects on pelagic communities and synthesise emerging trends and thresholds for the various OAE approaches. Finally, I will highlight knowledge gaps and identify research priorities.

Niklas Helle – Chemical Oceanography (CH)

Development of an in-situ sensor for autonomous, high-resolution tracing of ammonia levels in marine waters

Ammonium is a key component of the marine nitrogen cycle and an important indicator of water quality and ecosystem dynamics. Accurate quantification in marine environments remains challenging due to rapid biological and chemical transformations influenced by temperature, pH, and microbial activity. Conventional sampling followed by laboratory analysis is prone to errors, as ammonium concentrations can change significantly during storage and handling. In addition, variations in salinity and matrix composition further compromise measurement accuracy and precision. Existing in-situ approaches only partially address these limitations. Ion-selective electrodes offer fast response times but suffer from interferences in seawater and limited long-term stability. Flow-based systems using the indophenol blue method are currently the most advanced, providing automation and sensitivity, but they rely on toxic reagents and relatively high consumption of those.

I will present a novel in-situ sensor based on the o-phthalaldehyde (OPA) fluorometric method, show how this chemistry has been optimized and demonstrate its implementation into a miniaturized, flow-based system to enable accurate, high-resolution and environmentally safer ammonium measurements directly in the marine environment.