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Compositional impact of acidification and warming on Fucus vesiculosus: First biogeochemical and stable isotope results from coastal benthocosm experiments

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In the frame of the German BIOACID II project, the separate and combined effects of warming and acidification on the elemental and stable isotope composition of Fucus vesiculosus are investigated by means of benthic mesocosm experiments in brackish waters of the Baltic Sea. We aim for a calibration of the composition of Fucus in response to single and combined temperature and pCO_2 elevation.

Benthocosm experiments are carried out in the Kiel Fjord with a fully crossed array of 2 globally important stressors: an increase in temperature and an increase in atmospheric CO_2 partial pressure. The experiments run for almost 3 months per season (winter, spring, summer, autumn). There are analyses from the experiments of the aquatic chemistry (TA, pH, salinity, carbon isotope composition of DIC, main and trace elements and nutrients) as well as the composition of the Fucus vesiculosus organic tissues (C-N-S-P contents, and C and N stable isotope composition, as well as major and trace elements). The composition of the aqueous solution in the mesocosms was recovered two times a week and for the Fucus tissue at the start and the end of the experiments. In addition several 24h cycles were followed in high temporal resolution to characterize the community response to diurnal light cycles.

It was found, that seasonal variations in the composition of the input solutions (brackish water from the Kiel Fjord) were reflected by changes in the experiments with short time delay. The changes in the aquatic chemistry of the mesocosms, however, were strongly superimposed for most parameters during daytime by biological activity. The response of the communities to light conditions was clearly observed during the 24h-campaigns, when alternating phases of net respiration and photosynthesis were creating strong variations in the dissolved carbonate system. These variations were accompanied by significant changes in the carbon isotope composition of DIC. The atmosphere of some experimental set-ups was enriched with isotopically light gaseous carbon dioxide. This caused fast corresponding changes in the isotopic composition of DIC, thereby acting as a tracer for newly formed organic tissue and carbonates. The chemical and isotopic parameters of the dissolved carbonate system showed differences between the set ups. Fucus vesiculosus shows seasonal variability in the C, N, S contents and the isotopic composition.