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Using annually-resolved bivalve records and biogeochemical models to understand and predict climate impacts in coastal oceans

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It is more important than ever to study the oceans and especially the shelf seas, which are disproportionately productive, sustaining over 90% of global fisheries . The economic and societal significance of these shallow oceans, as the interface through which society interacts with the marine environment, makes them highly relevant to the decisions of policy-makers and stakeholders. These decision-makers rely upon empirical data informed by consistent and extensive monitoring and assessment from experts in the field, yet long-term, spatially-extensive datasets of the marine environment do not exist or are of poor quality. Modelling the shelf seas with biogeochemical models can provide valuable data, allowing scientists to look at both past and future scenarios to estimate ecosystem response to change. In particular, the European Regional Sea Ecosystem Model or ERSEM combines not only the complex hydrographical aspects of the North West European shelf, but also vast numbers of biological and chemical parameters. Though huge efforts across the modelling community are invested into developing and ultimately increasing the reliability of models such as the ERSEM, this is typically achieved by looking at relationships with aforementioned observed datasets, restricting model accuracy and our understanding of ecosystem processes. It is for this reason that proxy data of the marine environment is so valuable. Of all marine proxies available, sclerochronology, the study of the growth bands on long-lived marine molluscs, is the only proven to provide novel, high resolution, multi-centennial, annually-resolved, absolutely-dated archives of past ocean environment, analogous to dendrochronology. For the first time, this PhD project will combine the proxy data of sclerochronology with model hindcast data from the ERSEM with the aim to better understand the North West European shelf sea environment and potentially improve predictions of future climate change in this region and beyond.