Basin scale coupled ocean-shelf ecosystem modelling

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The biogeochemistry and ecosystems of the open-ocean and shelf seas are intimately connected. For example, continental shelves can receive a substantial fraction of their nutrients from the wider ocean, while exporting carbon at depth, sequestering it from atmospheric exchange. Similarly rivers transport substantial quantities of terrestrial nutrients and dissolved organic carbon into the coastal zone. The ultimate fate of this material is dependent on its recycling within and transport across the continental shelves. In both cases the open-ocean to shelf sea coupling is mediated by the complex dynamical processes at the shelf-break and on-shelf. Basin scale, hydrodynamic ecosystem models that merge the modelling approaches of the global scale and the coastal ocean scale, provide an important window into these processes. We draw of results from a 1/12° basin-scale NEMO-ERSEM model of the Northern North Atlantic (Holt et al 2014) with specific features relevant to shelf seas (e.g. tides and advanced vertical mixing schemes). This model is eddy resolving in the open-ocean, and well resolves barotropic scales on-shelf. We use this model to explore the ocean shelf nutrient transport and its relation to wider scale oceanic and atmospheric variability (e.g. sub-polar gyre variability and the North Atlantic Oscillation). We compare the performance of this model with its parent global ocean model and global climate models from the CMIP5 ensemble; demonstrating a marked improvement. We go beyond this North Atlantic work to introduce new basin-scale and global-scale coupled ecosystem modelling efforts focusing in the western Indian Ocean and South East Asian seas, and we explore how the capabilities developed in this context can be translated to global models (Holt et al 2017).

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