

## **Southern Ocean upper-ocean spatial scales and the NEMO modelling platform**

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Carbon exchange between the air-sea interface as well as between the surface-deep ocean is driven by biological and physical processes of the upper ocean (the biological and solubility pumps, respectively). The Southern Ocean Carbon and Climate Observatory group uses the coupled ocean-ice-biogeochemical model, NEMO, as an experimental platform to understand these underlying processes. NEMO is a flexible tool which allows us to examine forcing and parameter sensitivities in computational experiments. To complement Southern Ocean ship and autonomous vehicles observations of biogeochemistry, a hierarchy of regional configurations focusing on the South Atlantic sector of the Southern Ocean and South Antarctic Zone (SAZ) were implemented and run. In addition to better representation of horizontal motion, such as stirring, increasing model resolution improves the vertical fluxes in the model which has particularly important implications to the biogeochemistry. We present the models as well as an evaluation of the upper ocean vertical fluxes with respect to model resolution. From coarse to fine spatial scales, the models are: global coarse (200km), Southern Ocean eddy-permitting (50km), South Atlantic mesoscale-resolving (10km) and localised submesoscale-permitting ultra-high resolution (3km).