



Biological Controls of the CO₂ Air-Sea Flux in the North Sea

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The carbon cycle of the North Sea has been investigated using a three-dimensional coupled ecosystem model. Simulations for the years 2001/2002 are thoroughly validated against high resolution field data sets from the same period. The results indicate that the North Sea acts as a significant sink for atmospheric CO₂. The uptake of CO₂ is balanced by an export of carbon into the deep waters of the North Atlantic, confirming observations suggesting the efficient removal of CO₂ from the atmosphere via the continental shelf pump mechanism. The simulated net community production (NCP) and net primary production (NPP) reveal the biological controls of this transport: despite the higher NPP in the southern North Sea, NCP, i.e. net carbon fixation, and the NCP/NPP ratio are small because of high remineralization of organic matter in the continuously mixed water column. In contrast, in the surface layers of the northern North Sea, NCP, net carbon fixation and the NCP/NPP ratio are high because of the high export of organic matter into the deeper layer of the seasonally stratified system, preventing organic matter remineralization in the surface layer.