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Carbon dynamics in the North Sea: Insights from FerryBox measurements

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The atmosphere and the ocean absorb large amounts of the anthropogenic carbon dioxide. However, estimates of the oceanic uptake of anthropogenic CO_2 are uncertain. Specifically, the role of shelf seas and coastal areas as a source or sink of CO_2 is still not well characterized. The North Sea is a site of efficient transfer of carbon dioxide from the atmosphere to the North Atlantic Ocean via the carbon shelf pump. The variability in the carbonate system in this region necessitates high-frequency measurements of biogeochemical parameters. The use of automated FerryBox-systems on ships-of-opportunity (e.g. ferries or cargo ships) is a cost-effective way to obtain such data on a routinely basis.
FerryBox systems, installed on vessels operating along fixed routes, have been successfully used over the past six years to continuously measure carbon related parameters like pH and pCO_2 along large sections of the southern and central North Sea. Weekly surface water measurements between England, Norway and Belgium are providing a detailed picture of the carbon dynamics in surface waters in the central and south regions of the North Sea. The partial pressure difference of carbon dioxide between the atmosphere and the sea surface (ΔpCO_2) reveals distinct differences between shallow well-mixed regions and deeper, stratified areas in the summer. The measurement of pCO_2 can be combined with dissolved oxygen measurements to quantify the carbon fluxes in the surface waters, but also to potentially derive a time series of productivity estimates.