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# Inorganic carbon fluxes on the Mackenzie Shelf of the Beaufort Sea

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The Mackenzie Shelf in the southeastern Beaufort Sea is a region that has experienced large changes in the past several decades as warming, sea-ice loss, and increased river discharge have altered carbon cycling. Upwelling and downwelling events are common on the shelf, caused by strong, fluctuating along-shore winds, resulting in cross-shelf Ekman transport, and an alternating estuarine and anti-estuarine circulation. Downwelling carries dissolved inorganic carbon (DIC) and other remineralization products off the shelf and into the deep basin for possible long-term storage in the world oceans. Upwelling carries dissolved inorganic carbon and nutrient-rich waters from the Pacific-origin upper halocline layer (UHL) onto the shelf. Profiles of DIC and total alkalinity (TA) taken in August and September of 2014 are used to investigate the cycling of dissolved inorganic carbon on the Mackenzie Shelf. The along-shore transport of water and the cross-shelf transport of DIC are quantified using velocity field output from a simulation of the Arctic and Northern Hemisphere Atlantic (ANHA4) configuration of the Nucleus of European Modelling of the Ocean (NEMO) framework. A strong upwelling event prior to sampling on the Mackenzie Shelf took place, bringing $CO_2$-rich (elevated $pCO_2$) water from the upper halocline layer (UHL) onto the shelf bottom. The maximum on-shelf DIC flux was estimated at 16.9 x 10+3 mol C d-1 m-2 during the event. The maximum on-shelf transport of dissolved inorganic carbon through the upwelling event was found to be 65 $\pm$ 15 x 10-3 Tg C d-1. TA and the oxygen isotope ratio of water ($\delta$ 18 O) are used to examine water-mass distributions in the study area and to investigate the influence of Pacific Water, Mackenzie River freshwater, and sea-ice melt on carbon dynamics and air-sea fluxes of carbon dioxide ($CO_2$) in the surface mixed layer. Understanding carbon transfer in this seasonally dynamic environment is key to quantify the importance of Arctic shelf regions to the global carbon cycle and provide a basis for understanding how it will respond to the aforementioned climate-induced changes.