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The potential role of hydrodynamics in modulating pH buffering and CO_2 uptaking capacities of seagrass meadows

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The diurnal cycles of carbon chemistry parameters, i.e. dissolved inorganic carbon (DIC), total alkalinity (TA), partial pressure of CO_2 (pCO_2), and pH, were investigated in two hydrodynamically contrasting seagrass meadows at Dongsha Island in the northern South China Sea in August 2015. The results show that the pH and TA were higher and that the pCO_2 was lower in the semi-enclosed inner lagoon (IL) than on the open north shore (NS). The analyses of carbon chemistry parameters vs. dissolved oxygen and TA vs. DIC relationships reveal that the CO_2 dynamics were dominated by photosynthesis/respiration (P/R) alone on the NS but by the combined effect of P/R and sedimentary anaerobic pathways in the IL. We suggest that the observed divergent behaviors in carbon chemistry between the two sites could be attributed to differences in hydrodynamic regimes. The less energetic hydrodynamics and longer residence time in the IL would be favorable for the occurrence of sedimentary anaerobic TA generation and the subsequent TA accumulation in the overlying waters. The elevated TA may lead to a pH increase and a pCO_2 decrease, thus providing a buffering effect against ocean acidification (OA) and enhancing atmospheric CO_2 sequestration at local scales. The present results demonstrate that hydrodynamic regime may play an important role in regulating biogeochemical processes in seagrass meadows, and thereby modulating their capacities in OA buffering and CO_2 uptaking.