Diagnosis of CO_2 Fluxes and pH in a River-dominated Ocean Margin: The Northern South China Sea Shelf Affected by the Pearl River Plume

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Ocean margins adjacent to large rivers, often termed as River-Dominated Ocean Margins (RiOMar), are subject to significant impacts from riverine inputs, resulting frequently in enhanced surface eutrophication and bottom hypoxia thereby altering drastically the dynamics of CO_2 and pH on the shelf. However, mechanistic understanding towards quantitative diagnosis of these processes remains challenging. Here, we examine a RiOMar case based on a process study cruise in July 2016 to the northern South China Sea (NSCS) shelf featured by strong river plumes originating from the Pearl River. A semi-analytical diagnostic approach was applied to resolve CO_2 fluxes and pH dynamics based on a validated multiple-endmember mixing model. We show that dissolved inorganic carbon (DIC) was significantly drawdown by primary productivity, amounting to -64±19 μmol kg^{-1}, which was compensated by the sea-air CO_2 exchange which added in on average 40±18 μmol kg^{-1} of DIC. Similarly, pH was augmented by 0.10±0.04 units by biological productivity which was however offset partly by the sea-air CO_2 exchange as -0.07±0.04 units. The additional pH variation of 0.06±0.04 units was attributed to the enhanced buffering capacity of the carbonate system in plume waters. Using a similar approach, we will also present our diagnosis to a hypoxia case based on a field campaign conducted in July 2017, showing significant enhanced acidification in the hypoxic waters.