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Coupled Physical-Biogeochemical Study of Eutrophication/Hypoxia in the Pearl River Estuary off Hong Kong

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The coastal waters around Hong Kong are affected by persistent and increasing eutrophication. This deteriorating situation may increase the frequency of HABs, expand the area of hypoxic zones and lead to other ecosystem disruptions and worse of all, offset the environmental improvements achieved through the costly Harbour Area Treatment Scheme over the last decade. Eutrophication/hypoxia in Hong Kong waters is primarily caused by the ecosystem's responses to the increasing nutrient discharge from the Pearl River and local sewage effluent. Highly variable oceanic currents transport the nutrients in the interactive river-estuary-shelf (RES) waters around Hong Kong, which undergo complex coupled physical-biogeochemical processes and modulate eutrophication/hypoxia. To date, these key processes have not been investigated in a comprehensive manner in the RES waters, and they remain largely unresolved in similar ecosystems elsewhere in the world. Understanding the full spectrum of intrinsic coupled physical and biogeochemical processes in eutrophication is crucial to predicting and mitigating the impacts of eutrophication, and it remains a huge scientific challenge regionally and globally. By conducting an interdisciplinary study, we investigate the coupled physical-biological-chemical processes in this interactive RES system, and diagnose the eutrophication/hypoxia in the study region. We conducted interdisciplinary mapping and time-series measurements, and based on them, developed a novel coupled physical-biogeochemical modelling system under a grand OCEAN_HK project to determine: sources and sinks of nutrients, their biogeochemical controls, ecosystem dynamics, and physical controls on the eutrophication/hypoxia in the RES waters.

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