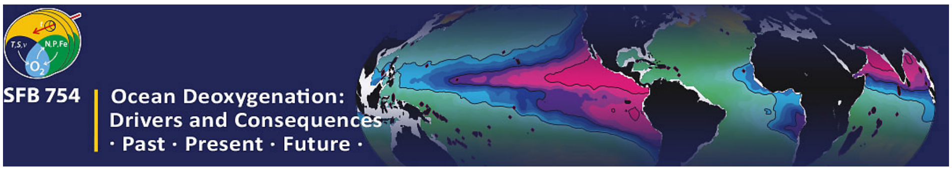

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A comparative study of coastal ocean hypoxia and acidification in two large river dominated systems (northern Gulf of Mexico and East China Sea)

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The northern Gulf of Mexico (nGOM) and the East China Sea (ECS) face similar physical drivers and anthropogenic stressors. Most importantly, both systems are strongly influenced by large rivers (the Mississippi and Changjiang) and intense eutrophication due to agriculture and population growth. Bottom water hypoxia and acidification appear to grow more severe in recent years in both systems despite the fact that riverine nutrient supply has been stabilized since the 1980's in the nGOM, however, it is increasing in the ECS.
In the surface water of the nGOM and ECS, the spatial distributions of O2and pH are associated with the trajectory of the river plumes and in situ biological activity driven by riverine nutrients. In both plume regions the highest O2 and pH values and lowest pCO2 values were observed at intermediate salinities where light and nutrient were both favorable for phytoplankton production. In the bottom layer, low O2 and pH values were observed in hypoxic waters. The subsurface pH shows correlations with DIC and apparent oxygen utilization (AOU), suggesting that decomposition of organic matter was the dominant factor regulating pH variability. In addition to the low O2and pH in the hypoxic bottom water, there was a layer of low O2 and pH at mid-water depth in the nGOM. T-S diagrams and numerical modeling suggest that this mid-water acidification and hypoxia was not caused by respiration of organic matter from local surface production, but was a result of intrusion of low O2 and pH water from a nearshore bottom layer. This extension of hypoxia and acidification from the nearshore bottom to the offshore mid-depth can form rapidly after a storm disruption and can then extend further to the bottom. This process might be a threat to marine organisms in offshore mid-water depths once thought to be unaffected by bottom hypoxia. Lateral transport also plays an important role in the formation of hypoxia and acidification in the ECS. We further reveal that the intensity and extensiveness of hypoxia and acidification events closely correlated to a climate change index in the ECS. We will discuss the common drivers and the differences between these two large-river dominated, eutrophic coastal systems with examples from recent and historical cruises.

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