HYPOXIA IN ESTUARINE & COASTAL WATERS

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As the result of increased nutrient loading into riverine, estuarine, and coastal waters, Hypoxia and dead zones exist in US, South America, China, Japan, Australia, New Zealand, and Baltic Sea, etc. A dead zone ~22,000 km^2 exists off the mouth of Mississippi River as a result of nutrient loading from the entire Mississippi River Basin. Dead zone of thousands square kilometers exists in Chesapeake Bay. Hypoxia and dead zone can be found in Florida estuarine and coastal waters as well. This paper presents a comprehensive illustration on the development of hypoxia due to nutrient loading and stratification in estuarine and coastal waters, using the results of a case study on Charlotte Harbor, Florida. An integrated approach to determine nutrient load reduction limit is also presented.

Hypoxia has occurred in Charlotte Harbor during the past decades due to nutrient loading and during spring when high freshwater flows enter from the Peace and Myakka Rivers and causing significant vertical stratification. Hypoxia in 2000 was simulated using an integrated modeling system which includes coupled models of circulation, wave, sediment transport, and water quality, and a model domain which extends from the upper reaches of the rivers to 60km offshore. Model simulation showed that hypoxic conditions are strongly related to high freshwater inflows and sediment oxygen demand (SOD) which is related to nutrient loading. Higher-than-average river discharge resulted in strong vertical salinity stratification, reducing vertical mixing and preventing surface water from supplying dissolved oxygen (DO) to bottom water where, SOD continuously consumed DO. The integrated modeling system can be used to develop nutrient load reduction limit in even large water body such as the Mississippi River Basin and its coastal waters, with the assistance of a cyberinfrastructure technology.