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Intercomparison of Hypoxia Models for the Northern Gulf of Mexico

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Observations of coastal hypoxia have increased dramatically over the past 50 years likely due to increased anthropogenic nutrient loading. The largest of these hypoxic zones in U.S. coastal waters (15,000 $\pm$ 5,000 km2) forms every summer over the continental shelf in the northern Gulf of Mexico due to nutrient and freshwater input from the Mississippi/Atchafalaya River System. The hypoxic zone varies interannually in terms of both, extent and location due to variations in spring nutrient load, freshwater discharge, atmospheric forcing and circulation patterns. Several coupled circulation-hypoxia models are under development for this region in order to improve mechanistic understanding of the primary factors controlling hypoxia formation and to inform nutrient management decisions in the watershed. Here we report on an intercomparsion of hypoxia models for the northern Gulf of Mexico that is being undertaken within the NOAA-funded Coastal & Ocean Modeling Testbed project. The following four models are included: 1) an implementation of the Regional Ocean Modeling System (ROMS) coupled with its native hypoxia module, 2) an implementation of the Finite Volume Coastal Ocean model (FVCOM) coupled with the ROMS hypoxia module, 3) an implementation of FVCOM coupled to a modified version of the Water Analysis Simulation Program model, and 4) an implementation of the U.S. Navy's coastal ocean model coupled with the Gulf Ecosystem Model. The comparison will focus specifically on oxygen sources (determined by primary production, air-sea gas exchange and vertical stratification) and sinks (due to respiration in the water column and sediments) with the ultimate goal of improving model formulations, hindcasts, forecasts and mechanistic understanding.