NGOMEX 2015 Mechanisms Controlling Hypoxia - Glider Application to Gulf of Mexico Hypoxic Zone Monitoring: Pilot Study and Transition to Operations

Dr. Steven F. DiMarco (Lead-PI)
Department of Oceanography
Geochemical and Environmental Research Group
3146 TAMU
College Station, Texas 77843-3146

Project Period of Performance: 1 September 2015 – 31 August 2017

Abstract/Project Summary

The physical and biogeochemical processes that control and maintain the hypoxic zone in the northern Gulf of Mexico are complex and their relative strengths are known to vary temporally and spatially at many scales. Although close to the Mississippi River Delta, the mechanisms that maintain and sustain the hypoxia are mostly driven by biological processes, further downstream the dominant controlling processes are mostly physical as currents and winds combine to break down the vertical stratification necessary to sustain the low dissolved oxygen. National and global ocean observing trends increasingly has included the use of ocean buoyancy gliders and hybrid (buoyancy plus power assisted) gliders for routine monitoring of the coastal and open ocean zones. Recently, observing strategies in the northern Gulf of Mexico have placed increasing emphasis on the use of gliders to monitor key metrics of the coastal hypoxic area. These metrics include spatial extent, severity, seasonal timing of shelfwide onset, duration, and the associated variability of each of these parameters. However, many challenges exist which question the utility of gliders in the northern Gulf of Mexico to provide quantitatively reliable estimates for these metrics. These include near-bottom proximity for oxygen depletion, strong (> 1 m/s) coastal currents, large vertical and horizontal stratification, large numbers of surface piercing and subsurface offshore industry platforms, heavy commercial and recreation fishing activity, active and heavily used shipping lanes, and frequent tropical weather.

The proposed research has the following scientific objectives: 1) to conduct two targeted field campaigns in the summers of 2016 and 2017 using ocean gliders within the Gulf of Mexico hypoxic zone to demonstrate their capability and operational robustness to obtain dissolved oxygen data as part of a comprehensive approach to hypoxic zone monitoring; 2) to use past research and testing to evaluate the effectiveness of gliders for routine hypoxic zone characterization in terms of efficiency (time, cost), accuracy, resolution, breadth (e.g. closeness to bottom, areal and volumetric expanse), telemetric capabilities (e.g. near real-time), and sensor response time; and 3) to develop a scalable glider monitoring implementation plan for the hypoxic zone that can be used for transitioning glider applications to operations by 2017.

The principal activities of this study build upon previously funded (2003-2014) research of 33 major oceanographic cruises, which included the use of advanced technologies such as gliders and undulating towed vehicles, and the development of a near-operational coupled physical-biogeochemical numerical model. Observational activities will be coordinated with relevant and existing federal and state funded operational and regional efforts and other regional investigators through active data exchange and participation on appropriate and available cruises of opportunity.