Applications of Buoyancy Gliders in the Western Gulf of Mexico: Loop Current Dynamics, Coastal Hypoxia, Ocean Noise, Acidification, and Hurricane Intensification

Steven DiMarco | Texas A&M University

Co-Authors

Kerri Whilden | Texas A&M University and Anthony H. Knap | Texas A&M University

Abstract (Oral Presentation)

The western Gulf of Mexico is home to a myriad of physical processes that control the circulation dynamics and the transport and transformation of biogeochemically relevant parameters and constituents. The Gulf of Mexico is also home to unique ecosystems and biological environments that are at risk from a multitude of environmental and anthropogenic threats. The circulation is strongly influenced by seasonal and strong coastal currents, diurnal winds and sea breeze, multiple freshwater sources, and the penetration of offshore mesoscale circulation features. The strong vertical gradients of stratification, current shear, rapidly changing meteorological conditions, and complicated by the presence of heavy offshore vessel traffic and the presence of thousands of surface piercing offshore structures and thousands of kilometers of subsurface pipelines and infrastructure related to offshore oil and gas exploration and production make piloting and navigation of buoyancy ocean gliders extremely challenging. The deepwater circulation of the region is strongly influenced by the presence and migration of mesoscale eddies associated with the Loop Current System in the eastern Gulf of Mexico. Interactions of these features with bathymetry, the continental shelf, and each other can lead to energetic and unpredictable currents. However, the use of gliders for scientific inquiry can be of great use to further the understanding of many environmental issues that are present on the shelf. These include harmful algal blooms, coastal hypoxia, ocean acidification, species recruitment and spawning patterns, hurricane intensification and anthropogenic coastal hazard such as oil spill. Recent events such as Hurricane Harvey (2017) have revealed new threats to coastal communities and ecosystems through previously unknown mechanisms for rapid intensification over super-heated continental shelves and for the injection of massive volumes of freshwater into the coastal ocean from terrestrial rainfall. The aftermath of Harvey posed a significant threat to the coral reefs of the Flower Garden Banks National Marine Sanctuary. The Texas-Louisiana Shelf is home to the largest seasonal hypoxic area in the western hemisphere. Strong stratification, horizontal density gradients, and highly baroclinic current structure contribute to difficulties in glider performance to reach subpynocline depths necessary to monitor oxygen dynamics.