Seasonally Averaged Circulation and Baroclinic Structure in the Northern Gulf of Mexico

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Acoustic measurements from moored and shipboard acoustic Doppler current profilers (ADCPs) are used to estimate the seasonal circulation and vertical structure of the northern Gulf of Mexico. In addition to the ADCP data, Eulerian velocities, computed from historical drifter data, and sea surface height (SSH) information from satellite altimetry are included in the seasonal flow field estimations. A weighted least squares technique is used to combine these data sets with a system of dynamics governed by the linear, time-independent, multi-layered, baroclinic, shallow water equations. The solution weights are based on the expected errors to the dynamical equations and measurements.

The forcing for the dynamics are wind stress and density gradients, which are provided by the Navy Global Ocean and Atmospheric Prediction System (NOGAPS) and computed from the Modular Ocean Data Assimilation System (MODAS) respectively. A conjugate gradient inverse method determines the flow field that best satisfies the weighted data and dynamics for each season. These best fit solutions include both the Northeast Gulf of Mexico Shelf and the Texas-Louisiana Shelf regions. By including the area just south of Louisiana in the solutions, the seasonal flow, along with its vertical structure, can be estimated between these two regions.