Inner shelf circulation off Cartagena de Indias, Caribbean coast of Colombia

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ABSTRACT

This work studies temporal variability of the inner shelf circulation using experimental data collected near the city of Cartagena de Indias on the Colombian Caribbean Sea, from water depths varying from 7 to 20 m. The analysis has focused in two particular scales: subtidal and diurnal. The region is characterized by two main seasons, the “dry”. and • ”rainy” season.

During the “dry” season (December to April) the water column is well-mixed and subtidal along-shelf currents flow southwestward following the steady trade winds that are common during this period. In the “rainy”. season (May to November) the water column experiences continuous events of weak stratification and the subtidal along-shelf currents flow northeastward, in a direction opposite to the prevailing winds which are toward the southwest but relatively weak. Subtidal alongshelf circulation during the “dry” season is mainly wind driven, while during the ”rainy” season, pressure gradient appears to be the main forcing. In the cross-shelf direction upwelling conditions are observed most of the year and the flow is found to be in geostrophic balance.

In addition to the subtidal flows, a strong diurnal (24 hour) oscillatory signal is present in the alongshore current flow. The observed diurnal flows are found to be driven by the diurnal wind forcing (sea breeze) that is present in the area during the whole year. Tidal contribution is minimal and mainly due to the 1 K constituent. During the Caribbean “dry” season the sea breeze attains its maximum amplitude, and it has a relatively stable phase and sense of rotation and the diurnal currents amplitude reach their maximum values. During the “rainy” season the amplitude of the sea breeze is reduced and it is characterized by continuous variations in phase, sense of rotation and orientation of the main axis. Intensification of near surface currents and vertical differences in phase indicate stratification influence during the “rainy” season. An idealized model considering wind stress, friction and Coriolis force is able to reproduce the main features of the inner shelf and nearshore diurnal oscillations providing an insight of the forces driving inner shelf circulation in the region.