

ABSTRACT

Modeling the hydrometeorology and circulation in the Gulf of Honduras and the

MesoAmerican Lagoon, Western Caribbean

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Physical (hydrometeorological and oceanographic) processes in the Gulf of Honduras (GoH) and the MesoAmerican Barrier Lagoon (MABL) in the western Caribbean are assessed by applying empirical and numerical models. The GoH and the MABL border the MesoAmerican Barrier Reef System (MBRS) which is the world's second largest coral reef complex. The watersheds of the GoH span across four countries (Mexico, Belize, Guatemala, and Honduras). The inner GoH receives $1232 \text{ m}^3 \text{ s}^{-1}$ of runoff from twelve rivers whose drainage basins are characterized by runoff ratios of 0.30-0.55 and simulated sediment yields as high as $869 \text{ t km}^{-2} \text{ yr}^{-1}$. The Southern Oscillation Index explains on average 7-15% of the precipitation and temperature variability for the inner GoH. The MABL is connected to the Caribbean Sea by numerous channels across the reef. The circulation in the MABL and the water exchange with the Caribbean Sea are analyzed using a 2D finite element hydrodynamic model. Five simulation cases are executed to analyze the circulation. The circulation is primarily forced by the trade winds, especially in the northern half of the lagoon. Tides also play an important role even though they are small in magnitude. The West Caribbean Sea (WCS) is modeled using the 3D Princeton Ocean Model. Eight simulations are executed including combinations of 25 Sv flow-through from the Caribbean, climatological winds, tidal forcing, and initialization with satellite altimetry data. The base flow in the WCS is

in itself highly variable, and its interaction with the bathymetry gives rise to cyclonic eddies in the GoH. The velocity field along the MBRS is influenced by the propagation of mesoscale eddies. The area-averaged mean surface kinetic energies are influenced by the 25 Sv flow-through and climatological winds, and the eddy surface kinetic energies are influenced by the action of the eddies.

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