ABSTRACT

Wind-driven Hydrodynamics, with variable horizontal eddy viscosity coefficients, of the Gulf of Paria.

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The Gulf of Paria is very important to the development of Trinidad for a number of reasons. Therefore, the proper use of the Gulf of Paria and its resources is necessary. One way of ensuring the proper utilization of the Gulf's resources is to predict how the Gulf will react to various inputs (biological, chemical and physical). A two-dimensional, vertically integrated, barotropic[1] circulation model[2] is developed for the Gulf of Paria. A new approach was used in the development of the shallow-water hydrodynamic equations. The constant horizontal eddy viscosity coefficients were replaced with variable eddy viscosity coefficients, which were defined as functions of the Gulf's dimensions and the velocity (current) fields.

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[1] The state of a fluid in which surfaces of constant density (or temperature) are coincident with surfaces of constant pressure. It is the state of zero baroclinity.

[2] For a barotropic model, some of the following conditions exist throughout the motion.

- Coincidence of pressure and temperature surface.
- Absence of vertical wind shear.
- Absence of vertical motions.
- Absence of horizontal velocity divergence.

The use of the variable horizontal eddy viscosities predicted the formation of unstable gyres (eddies) in the Gulf of Paria. The developing current field is a function of the water depth, water density, vertical curl of the wind-stress and the Reynolds Number of the flow.

The horizontal eddy viscosity coefficients estimated with the thesis's mathematical model were compared to Munk (1948) estimates and there was a strong correlation between both estimates at very high wind speeds.

Keywords: Larry Richards; circulation model; hydrodynamics; finite difference method; horizontal eddy viscosity coefficient; Gulf of Paria.

- Conservation of the vertical component of absolute vorticity.