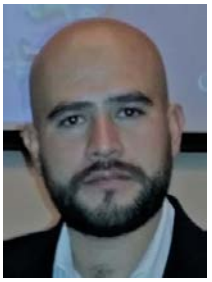
SEMINARIO

CICESE - UNIDAD LA PAZ

Jueves 7 de diciembre de 2017

10:00 a.m. – Sala de Juntas



Subtidal hydrodynamics in a tropical lagoon: a dimensionless numbers approach

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Abstract

Observations in a tropical lagoon of the Yucatan peninsula motivated a non-dimensional number analysis to examine the relative influence of tidal stress, density gradients and wind stress on subtidal hydrodynamics. A two-month observation period in Chelem Lagoon covered the transition from the dry to the wet season. Chelem Lagoon is influenced by groundwater inputs and exhibits a main sub-basin (central sub-basin), a west sub-basin and an east sub-basin. Subtidal hydrodynamics were associated with horizontal density gradients that were modified seasonally by evaporation, precipitation, and groundwater discharge. A tidal Froude number (Fr_0), a Wedderburn number (W), and a Stress ratio (S_0) were used to diagnose the relative importance of dominant subtidal driving forces. The Froude number (Fr_0) compares tidal forcing and baroclinic forcing through the ratio of tidal stress to longitudinal baroclinic pressure gradient. The Wedderburn number (W) relates wind stress to baroclinicity. The stress ratio (S_0) sizes tidal stress and wind stress. S_0 is a new diagnostic tool for systems influenced by tides and winds, and represents the main contribution of this research. Results show that spring-tide subtidal flows in the tropical lagoon had $\log(\mathrm{Fr}_0) \gg 0$ and $\log(S_0) > 0$, i.e., driven mainly by tidal stresses (advective accelerations). Neap tides showed $\log(\mathrm{Fr}_0) \ll 0$ and $\log(\mathrm{S}_0) < 0)$, i.e., flows driven by baroclinicity, especially at the lagoon heads of the east and west sub-basins. However, when the wind stress intensified over the lagoon, the relative importance of baroclinicity decreased and the wind stress controlled the dynamics ($\log(\mathrm{W}) \gg 0$). Each sub-basin exhibited a different subtidal response, according to the dimensionless numbers. The response depended on the fortnightly tidal cycle, the location and magnitude of groundwater input, and the direction and magnitude of the wind stress.