Primer Congreso de Oceanografía Física, Meteorología y Clima
Auditorio EMPREUDEC, Universidad de Concepción, Concepción, Chile
30 Septiembre – 02 de Octubre de 2009

On the influence of the Galapagos archipelago and the intraseasonal Kelvin wave on the coastal upwelling off Peru

Boucharel J. [1], Dewitte B. [1,3], Cambon G. [1], Echevin V. [2], Eldin G.[1], Du Penhoat Y. [1]
(1): Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS) (2) LOCEAN (3) IMARPE
E-mail : boucharelj@yahoo.fr

Recent studies have shown that water masses which compose the poleward Peru-Chile Undercurrent (PCUC) and the equatorward Peru Coastal Current are influenced by the mean state and variability of the Equatorial Under Current (EUC) and of the South Equatorial Current. Several modelling studies emphasized that EUC intensity is strongly affected by the topographic barrier formed by the Galapagos Islands (GI) and the spatial resolution of the model, which can reduce the eastward flow and the associated cold bias usually present in the cold tongue in the majority of CGCMs (which do not properly include this topographic feature). Consequently, the archipelago appears to be a key element connecting the Equatorial Pacific and the Humboldt Current System.

In this study, several ROMS (Regional Oceanic Model System) model experiments were designed to investigate the role of the small scale topography of the GI along with the characteristics of the equatorial forcing on the dynamics of the eastern tropical region. They consist in taking into account or removing the GI from the topography of a 1/6° resolution ROMS configuration and considering successively climatological and realistic forcings for the open boundary conditions. A first series of simulations considers only climatological forcing whereas the others simulations uses the QuickSCAT winds as surface boundary conditions and the outputs of Mercator system as oceanic boundary conditions over the period 2000-2008.

The comparison between the climatological simulations and interannual simulations indicate a significant impact of the intraseasonal Kelvin wave on the mean upwelling conditions. In particular a reduction by ~1°C on average of the coastal upwelling is induced by the presence of the intraseasonal variability. The GI also acts as a key parameter in controlling the intensity of both the equatorial and coastal upwelling through the main pathways of equatorial waters. The GI modifies the route and amplitude of the EUC in the far eastern equatorial Pacific which impact on the characteristics of the PCUC. It is suggested that the change in main circulation associated to the presence of the GI increases the stratification in the far eastern equatorial Pacific, which in turn impact the characteristics in the equatorial Kelvin impinging on the coast and the heat budget of the mixed layer at the coast. The change in propagating characteristics of both the equatorial Kelvin wave and the Rossby waves is documented based on a modal decomposition of the simulated variability of the various experiments.