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On the influence of the Galapagos Islands on the Humboldt Current System

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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 modeling 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. Consequently, the archipelago appears to be a key element connecting the Equatorial Pacific and the Humboldt Current System.

A ROMS (Regional Oceanic Model System) model configuration was designed to address the role of the small scale topography of the GI on the dynamics of the area. The employed methodology was quite simple: 2 climatological simulations (15 years after spin ups) were run, one including the archipelago with a 1/6º resolution, the other one excluding all bathymetric features above 3000m depth in the vicinity of GI.

The main investigated questions are how the model spatial fine resolution impacts the Eastern Pacific mean state, seasonal variability, meso-scale dynamics in the region and the EUC/PCUC pathways, which are studied using Lagrangian diagnostics. The influence of these islands on the propagation of equatorial and coastally trapped Kelvin waves, and on the reflection of Rossby waves is also diagnosed. Because of the role of these waves on the surface and sub-surface water properties off South America coast, the possible rectification of Tropical eastern Pacific mean state through nonlinear processes and changes in waves propagation features, namely changes in vertical stratification, is also investigated.