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# Effects of ENSO on the Cold Tongue and the Warm Pool ecosystems in the equatorial Pacific Ocean: a modeling study.

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Effects of the El Niño Southern Oscillation (ENSO) on the lower trophic levels of the Cold Tongue (0°N, 140°W) and the Warm Pool (0°N, 165°E) regions in the equatorial Pacific Ocean are investigated. This research objective is addressed using a one-dimensional multi-component lower trophic level ecosystem model (Salihoglu, 2005) that includes detailed algal physiology, such as spectrally-dependent photosynthetic processes and iron limitation on algal growth. The ecosystem model is forced by eight-year (1991-1999) time series of spectrally-dependent light, temperature, and water column mixing obtained from the TAO Array moorings. The simulations for the time 1991-1999 period included three ENSO cycles.
The simulated response of the lower trophic levels in the Cold Tongue and the Warm Pool regions of the equatorial Pacific to ENSO cycles differ in community structure and level of production. For the Cold Tongue region, the ENSO warm phase results in a shift to small algal forms (e.g., $Prochlorococcus$ spp. and $Synechecoccus$) and low primary productivity (25 mmol C $m^{-2}$ $d^{-1}$ versus an annual average of 75 mmol C $m^{-2}$ $d^{-1}$). For the Warm Pool region, the phytoplankton community is dominated by larger algal forms (e.g., autotrophic eukaryotes) and primary production increases (150 mmol C $m^{-2}$ $d^{-1}$ versus an annual average of 59 mmol C $m^{-2}$ $d^{-1}$).
Simulations indicate that during ENSO events carbon production and export in the Cold Tongue are limited by iron, whereas the relative abundance of iron and macronutrients (i.e. nitrate, silicate) limits production and export in the Warm Pool. The simulations show that the primary production and carbon export flux in the Cold Tongue are higher than those for the Warm Pool, although the iron levels are much higher in the Warm Pool. This suggests that the relatively higher primary production levels in the Cold Tongue are not due to iron but a result of high macronutrient concentrations

in the region.