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Oceanic and Atmospheric Drivers of Post-El-Niño Chlorophyll Rebound in the Equatorial Pacific

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The El Niño-Southern Oscillation (ENSO) strongly influences phytoplankton in the tropical Pacific, with El Niño conditions suppressing productivity in the equatorial Pacific (EP) and placing nutritional stresses on marine ecosystems. The Geophysical Fluid Dynamics Laboratory's (GFDL) Earth System Model version 4.1 (ESM4.1) captures observed ENSO-chlorophyll patterns (r = 0.57) much better than GFDL's previous ESM2M (r = 0.23). Most notably, the observed post-El Niño “chlorophyll rebound” is substantially improved in ESM4.1 (r = 0.52). We find that an anomalous increase in iron propagation from western Pacific (WP) subsurface to the cold tongue via the equatorial undercurrent (EUC) and subsequent post-El Niño surfacing, unresolved in ESM2M, is the primary driver of chlorophyll rebound. We also find that this chlorophyll rebound is augmented by high post-El Niño dust-iron deposition anomalies in the eastern EP. This post-El Niño chlorophyll rebound provides a previously unrecognized source of marine ecosystem resilience independent from the La Niña that sometimes follows.