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A 14 ka record of lithogenic grain size, upwelling and biological production in the NE tropical Pacific, terrestrial and oceanic processes linked to teleconnections at millennial-scale

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We study the marine sediment core MV99-GC41/ PC14 collected from Soledad Basin at 540 m water depth, 85 km off the western coast of southern Baja California, Mexico, spanning the end of deglaciation and the Holocene. We used biogenic opal (% opal), organic carbon (% Co) and inorganic carbon (% Ci), as proxies of biological production; whereas the Si/Co and Ci/Co ratios as indicators of C-export by siliceous and carbonaceous producers. We used grain size analyses as proxies of terrestrial inputs and wind intensity. Based on the Si/Co and Ci/Co ratios, we found a change in the biological communities that export C to the sediments. An increase in carbonate organisms occurs during deglaciation and early-Holocene (14-6 ka). An increase in siliceous organisms during the mid-Holocene (6-3 ka) to then reduce gradually over the last 2 ka. Overall, the highest biological production occurred during the early- to mid-Holocene, corresponding to reconstructed La Niña-like conditions, which corresponds to a northward displacement of the Intertropical Convergence Zone (ITCZ) and an overall positive phase related to the Pacific Decadal Oscillation (PDO). The opposite occurred during the late-Holocene, which coincides with El Niño-like conditions, the southern migration of the ITCZ and a less intense PDO-related hydrological variability. The grain size analysis shows that a higher proportion of the coarse fraction was found during the middle Holocene, which seems to be associated with upwelling intensification and humidity on land. A more significant amount of fine fraction was present during the late-Holocene, suggesting higher wind intensity and dryness on land. Comparison with lake records, as well as paleoceanographic reconstructions from neighboring sites provides insight into the source of land moisture and biological productivity forcing. We suggest that in the NE tropical Pacific, ENSO-like variations had an influence on biological export producers on a scale of 2-4 ka periods, but the PDO-related variability acts drives changes at scales of 1-2 ka periods.