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Reconstructing Tropical Pacific Variability During the Last Glacial Maximum Using Individual Foraminifera: An Investigation of ENSO Flavors

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The El Niño Southern Oscillation (ENSO) dominates tropical climate variability. While it is defined by alterations in sea surface temperatures in the eastern and central tropical Pacific, ENSO influences temperature and precipitation patterns across the globe through a network of atmospheric and oceanic teleconnections. Whether ENSO is controlled or responds to external climate factors has long remained elusive, in large part due to the lack of paleoclimate evidence of tropical variability during different climate states. Here we utilize the geochemical signatures of planktic foraminifera to reconstruct eastern and central tropical variability during the last glacial maximum (LGM), some 20-25,000 years ago. Climate conditions during the LGM were very different, featuring atmospheric CO_2 concentrations, global temperatures, and sea level all substantially lower than today. However, precessional forcing, thought to be a potential control on ENSO expression, was similar to modern orbital configuration. Our reconstruction spans the central and eastern tropical Pacific during this key time frame and assesses how the patterns of variability - or ENSO 'flavors' - may have changed. We compare our spatial reconstructions of variability to changes in the equatorial Pacific thermocline and test hypotheses of thermocline control of ENSO. We explore the evolution of the eastern and central Pacific thermocline, and how their relationship may be an additional factor in influencing ENSO expression. Our results provide key insights into the evolution and history of tropical variability under differing background climate states, providing context for modern ENSO behavior and prediction.