

# THE ROLE OF ATMOSPHERE-OCEAN INTERACTIONS IN GOVERNING PALEOCLIMATES

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The tropical Pacific Ocean is crucial to climate given its enormous surface area. Its impact on modern climate is best exemplified by the El Niño Southern Oscillation. The state of the tropical oceans in Earth's past remains uncertain. I will discuss two examples from the late Quaternary. First, tropical sea surface temperatures (SSTs) during the Last Glacial Maximum have been debated in the data and modelling communities for nearly two decades. Proxy data analysed by the CLIMAP project suggested only a modest cooling of 1-2 degrees C. More recent proxy data, however, suggest that the tropics cooled to a much greater extent (up to 5-6 degrees C). This relatively large cooling has only been reproduced in coupled atmosphere-ocean general circulation models and is a result of atmosphere-ocean coupling. These colder SSTs have a pronounced effect on the South Asian monsoon direction, strength, and precipitation. Second, the state of the equatorial Pacific Ocean during the early-mid Holocene is under debate. Proxy data suggest a lack of interannual variability between El Niño and La Niña states in the early Holocene. Other proxy data indicate a very strong south Asian monsoon. Since strong monsoons are well correlated with La Niña states, these data suggest that La Niña conditions prevailed. Numerical simulations with a coupled GCM demonstrate that a cold equatorial Pacific is indeed the preferred state.