Abstract View

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The Response of Equatorial Oceans to a Relaxation of the Trade Winds

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ABSTRACT

The trade winds over the central Pacific are observed to weaken several months after the appearance of anomalously warm surface waters in the eastern equatorial Pacific Ocean. The following results obtained with a numerical model indicate how this relaxation of the winds affect the later stages of El Niño. A weakening of the westward trade winds causes a zonal redistribution of heat in the equatorial oceans and a warming of the eastern part of the basin. The warming depends on the zonal extent of the region over which the winds relax, and on the length of time *T* for. which the winds relax. As *T* increases the warming in the east increases until it asymtotes to a maximum value when *T* exceeds the adjustment time of the basin (which is ~ 400 days in the case of the Pacific Ocean). Maximum heating is associated with a permanent weakening of the winds, unless the winds reverse direction and become eastward. Even weak eastward winds for a short period can cause disproportionately large temperature increases (because of nonlinear mechanisms).

In the region where the winds relax, the heating is due to convergence of surface waters on the equator, and advection by accelerating eastward surface currents. As the time scale *T* increases, the acceleration becomes less pronounced. East of the region where the winds relax, Kelvin waves suppress the thermocline but leave the sea surface temperature unchanged in linear models. In nonlinear models advection by eastward currents in the wake of Kelvin waves can cause a warming, even at the surface. For winds with a realistic spatial and temporal structure the identification of these waves is difficult.