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Westerly wind bursts and the dynamical response of the western Pacific warm pool

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Strong intraseasonal westerly wind bursts (WWBs) in the tropical Pacific Ocean generate zonal surface current anomalies that can advect the pool of warm water that is normally confined to the western Pacific Ocean (the "western Pacific warm pool") eastward, a process that has been implicated in the development of El Niño events. However, the relationship between WWBs and El Niño is complicated: not all WWBs force strong currents, and not all currents result in an eastward displacement of the warm pool. Moreover, WWBs appear to be partially controlled by large-scale atmospheric and oceanic variability, suggesting that El Niño itself could modulate WWB activity. Although our ability to predict high-frequency wind variability remains poor, by developing a better picture of how the upper ocean responds to WWBs we can improve our understanding of how El Niño events may develop.

In the present study, we use output from a coupled general circulation model (ORCA05) to examine $\sim$150 individual WWBs from 1980 to 2007. We use an upper-ocean momentum balance to quantify the relative importance of winds, zonal pressure gradients, and horizontal advection in driving surface currents. We characterize the relationship between wind properties, background ocean conditions, and local ocean response to the WWBs, including the eastward migration of the warm pool. In situ and satellite observations confirm the findings obtained using the model.