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Anticyclonic and Cyclonic Circulations of Wave Energy in the Western and Eastern Tropical-Subtropical Pacific Ocean: a Reevaluation of the Zonal Interactions

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The present study has determined the anticyclonic and cyclonic circulations of wave energy in the western and eastern parts, respectively, of the tropical-subtropical Pacific Ocean in each hemisphere. In terms of directionality, these wave energy circulation patterns contrast sharply with those in the Indian and Atlantic Oceans where wave energy circulation is cyclonic in the western part of each basin. A key feature of the present study lies in our quantification of the wave energy circulation in the absence of a smooth transition between the equatorial and off-equatorial regions. This may provide a new perspective for understanding the development and demise of the El Niño–Southern Oscillation. The study highlights an important application of the time series of the regional extrema of the energy-flux streamfunction and the energy-flux potential to investigate the zonal interaction between the western, central, and eastern parts of the basin. It is shown that the time series of these wave energy quantities should be compared with the absolute value of the Niño-3 index owing to the fact that the wave energy quantities do not differentiate between upwelling and downwelling waves. For example, the peak value of the energy-flux potential associated with the wind input in the central Pacific Ocean may be regressed as $1.13 \Delta T^2 + 0.80$ (in gigawatts), where ΔT is the sea surface temperature anomaly (in degrees Celsius) associated with the Niño-3 index.

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