Abstract View

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Statistical Relations between Ocean/Atmosphere Fluctuations in the Tropical Pacific

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ABSTRACT

Advanced statistical techniques have been used to conduct a study of the relationships between ocean and atmosphere variables in the tropical Pacific Ocean. The results of the study show that the ocean variables can hindcast features of the trade wind field (TWF) variability several months into the future. The results are compatible with the notion that the Hadley and Walker cells are associated with east-west and north-south sea surface temperature (SST) gradients as suggested by Bjerknes. However, the level of skill in even specifying the strength of these cells is small, suggesting mechanisms other than those associated with SST are responsible for much of the observed variability in those systems.

TWF predictors can hindcast themselves and ocean variables at both short lead times and lead times near one year. The main components of the wind field responsible for this long-lead-time skill are associated with the southeast trades and a near-equatorial band in the western Pacific. The results also suggest that large El Niño events are predictable a year in advance. This conclusion was supported by an independent test which successfully forecast SST anomalies off Peru one year in advance for the period 1976–79.

The results of the study have been used to test specific ideas and scenarios regarding the physical mechanisms responsible for large-scale air-sea interactions in the tropical Pacific. The results add new ideas and' additional depth to previous work plus help formulate a more cohesive description of large-scale events. During regimes of cold equator SST the northeast and southeast trade wind field merge and extend into the western Pacific. At these times there is no clear minimum in zonal component of the wind system over the western and central ocean between 15°N and 15°S. During warm equatorial SST situations the two TWF's are separated as evidenced by a strong minimum or even reversal of the zonal component in the region noted above. The associated changes in zonal stress and wind stress curl between warm and cold events is very large. During the transition from cold to warm equator the equatorial SST anomalies move westward from South America to near the dateline. The wind anomalies in the equatorial region move simultaneously from the western Pacific to the central ocean. Both types of anomaly meet in the central ocean during the summer/fall season.

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