

The role of the western Pacific SSH and associated changes in horizontal gyre circulation for the decadal phase shift

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Decadal variability of the Pacific Subtropical Cells (STCs) and associated sea surface height (SSH) in the western tropical Pacific during recent decades are examined by using a CMIP-class OGCM simulation (1965-2006). Since the long-term STC variations include not only decadal variations but also the long-term weakening trends, we deal with the former separately from the latter in order to focus on the decadal variability. The model exhibits decadal variations of the STCs concurrent with tropical Pacific thermal anomalies, which is similar to observations. The eastern tropical Pacific is warmer when the STCs are weaker and cooler when they are stronger. The spatial patterns of the SSH in the western tropical Pacific show different features, depending on events associated with decadal variability. During the warm phase (1977-1987), the SSH anomalies exhibit deviations from a meridionally symmetric distribution, with weakly positive (strongly negative) anomalies in the western tropical North (South) Pacific. Analysis of the heat budget in the upper 500 m of the tropical Pacific indicates that the termination of the warm phase around 1985 results from a poleward heat transport anomaly that is induced by a horizontal gyre associated with the SSH anomalies. During the cold phase (1996-2006), in contrast, the SSH anomalies are nearly meridionally symmetric, with positive anomalies in both hemispheres. Enhanced easterly wind anomalies contribute to the development of the cold phase after the late 1990s. A sensitivity of the results to OGCMs of different horizontal resolutions is also discussed.

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