Interannual variations of Tropical Divergent Motions and Teleconnections over the Pacific.

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Abstract

A 15-year (1974-1988) data set based on the US Navy's tropical global band analysis is used to study the interannual variations of 200 mb winter flow over the Pacific. Unlike typical operational global data sets, the analysis uses persistence as first guess and is not part of a numerical weather prediction assimilation system. The tropical divergence field in this analysis is therfore free from numerical model prediction influences that typically exist in other operational data sets. The monthly-mean divergence in the 'ropics agrees well with the mean outgoing longwave radiation data.

An out-of-phase interannual variation between two major equatorial centers of large-scale divergence anomalies, one over the central Pacific and the other over the western extreme of the western Pacific (maritime continent), is most noticeable. A third majorcenter of divergence anomalies is located southwest of the Mexican coast. This center also shows an out-of-phase variation with that in the equatiorial central pacific. Composite and single-point correlation studies are used to reveal the possible vorticity responses to tropical divergence forcing. In general, the symmetric equatorial responses are consistent with the structure predicted by equatorial wave theory. Away from the equator the results support the notion that the teleconnection patterns are related to equatorial divergence anomalies. In particular, divergence forcing from the central Pacific appears important for the PNA pattern, and forcing from the maritime continent area appears important for a northeastward wave train pattern in the North Pacific. These two teleconnection patterns have streamfunction anomalies of the opposite sign over the northeastern Pacific.

Previous general circulation model simulations have reported that the teleconnection pattern in the middle and high latitudes are insensitive to the longitudinal location of tropical forcing. By examining the change of the single-point correlation patterns as the divergence base point is moved around the equatorial belt, we found that the insensitivity exists only within limited regions. In the equatorial Pacific, the PNA correlation pattern changes slowly when the equatorial divergence base point is within 150°E-120°W. The pattern changes rapidly when the base point is moved outside of this region.