SCALE INTERACTION IN THE WESTERN PACIFIC MONSOON

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ABSTRACT

The lower-tropospheric scale interactions occurring in the summer monsoon of the western North Pacific are reviewed and summarized in a conceptual model. Diabatic heating produces a circulation with similar characteristics to those that are observed. In the lower troposphere the advection of vorticity by the divergent wind produces a compact, and more intense response than in the upper levels. Subsequent phase dispersion westward, and group propagation eastwards, lead to a monsoon depression in convectively suppressed conditions, a westerly jet with cross-equatorial flow, and a strong confluence region to the east of the monsoon depression.

We suggest that this confluence zone traps tropical waves in the mid-lower troposphere in a similar manner to the accumulation and emanation mechanisms described by Chang and Webster. The details of the convection in the confluence zone are of little direct consequence to the monsoon circulation, which is similar in scale to the deformation radius for the undisturbed tropics. However, mesoscale convective systems can both self organise into larger coherent structures and produce vortices of horizontal scale 100-200 km, which are long-lived and potentially have considerable indirect influence on both the monsoon and embedded systems, such as tropical cyclones. The confluence zone provides an excellent environment for tropical cyclone formation, which is enhanced by the presence of a previously developed tropical cyclone. Scale-interaction arising from the merger of developing vortices and the large monsoon depression can lead to development of a very large typhoon and rapid breakdown of the total monsoon circulation. the interaction of tropical cyclones with the mid-latitude systems is complex and not well understood, but recurving tropical cyclones may provide a major component of the emanation of energy to higher latitudes.