

Interannual Modulation of the Local Hadley Circulation on Clouds, Radiation and Diagnostic Fields over the Western North Pacific

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Variation of the local Hadley cell (HC) northern boundary over the western North Pacific, and its interannual imprints on the tropospheric clouds and atmospheric fields are examined with observation and reanalysis data for the winter season from December 1982 to February 2016. The poleward shift of the local HC subsiding edge is marked by anomalous rising motion, large-scale decreased static stability, and corresponding increases of the midlevel cloud amount over the climatological sinking zone around 30N. These responses primarily locate over the continental and coastal areas instead of the open oceans. Concomitant with the increasing cloud fraction, a net negative top-of-atmosphere radiation anomaly is identified, and the main contributor is suggested to be the cumulus congestus, whose top pressures are in a range of 440–680 hPa, and optical thicknesses in a range of 23–60. Interactions between this specific cloud type and the vertical moist instability, and their constrains on the precipitation field is further discussed.

Keywords: Regional Hadley cell, Cloud and radiation, Precipitation pattern