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Relationships between the tropical SST and summertime subtropical high over the western North Pacific

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The interannual variability of the western North Pacific Subtropical High (WNPSH) in summer is investigated with the use of the NCEP/NCAR reanalysis data for the period of 1958-2005. The most significant change appears at the western edge of WNPSH, with dominant 2-3-yr and 3-5-yr power spectrum peaks.

The 2-3-yr oscillation of WNPSH and associated circulation and sea surface temperature (SST) patterns possess a coherent eastward-propagating feature, with a warm SST anomaly (SSTA) and anomalous ascending motion migrating from the tropical Indian Ocean in the preceding winter to the maritime continent in the concurrent summer of a strong WNPSH. A strong WNPSH is characterized by anomalous anticyclonic circulation and maximum subsidence in the western North Pacific (WNP). The anomalous WNPSH circulation has an equivalent barotropic vertical structure and resides in the sinking branch of local Hadley circulation, triggered by enhanced convection over the maritime continent in the summer. A heat budget analysis reveals that WNPSH is maintained by radiative cooling, which overcomes the decent induced adiabatic warming.

The 3-5-yr oscillation of WNPSH exhibits a quasi stationary feature, with a warm SSTA (anomalous ascending motion) located in the equatorial central-eastern Pacific and Indian Ocean and a cold SSTA (anomalous descending motion) located in the western Pacific. The anomaly pattern persists from the preceding winter to the concurrent summer of a high WNPSH. The maximum descent is located to the east of the anomalous anticyclone center, where a baroclinic vertical structure is identified. The anomalous anticyclone on this timescale is a Rossby wave response to a negative convective heating associated with the local cold SSTA.