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The effect of Upper Cold Low on convections over the Summer North Pacific

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Near the tropopause over the North Pacific in summer, an isolated low pressure system (Upper Cold Low, UCL) is often generated by the deepening and cut off of a trough in the mid-latitude westerlies. The structures of UCLs have been investigated. These cyclonic circulations are seen in upper troposphere and weak in lower troposphere. They have a warm core around 150hPa in the stratosphere and a cold core around 200～600hPa in the troposphere. The air is dry in the cyclonic circulation center from low level to high level, while it is wet and convective cloud zones are often seen around southeast of UCLs. Typhoon sometimes generates in these convective cloud zones. Because of the cold-dry air in UCLs and warm-wet air from the tropics, the gradient of equivalent potential temperature is large in the convective cloud zone. When we estimate frontogenesis defined by equivalent potential temperature gradient, the shear term is dominant in low and mid levels like the feature of subtropical frontal zone.

The abrupt northeastward shift of active convective region is occurred around 15-20^{O}N/150^{O}E in late July as the mature process of the summer monsoon. It is called “Convection jump” (Ueda and Yasunari, 1995). Ueda and Yasunari (1996) devided 15 years (1980-1994) into 8 remarkable convection jump years (typical case) and 7 other years (atypical case). They showed the features of low level circulation field and SST field for each case by composite analysis. We investigate the effect of UCLs on the convection jump in each 24 year (1980-2003). When the UCL generates and convective clouds are seen around south of it, the convection zone extends northeastward and convection jump is occurred in 1985 as shown in left panel of figure (one of the typical years). However, UCLs are not generated in 1982 as shown in right panel of figure (one of the atypical years). Estimating the frontogenesis terms, the shear term is dominant and the cyclonic circulation and the cold core of UCL may play an important role for the convection jump.

Keywords: Upper Cold Low, convection, monsoon, subtropical frontal zone

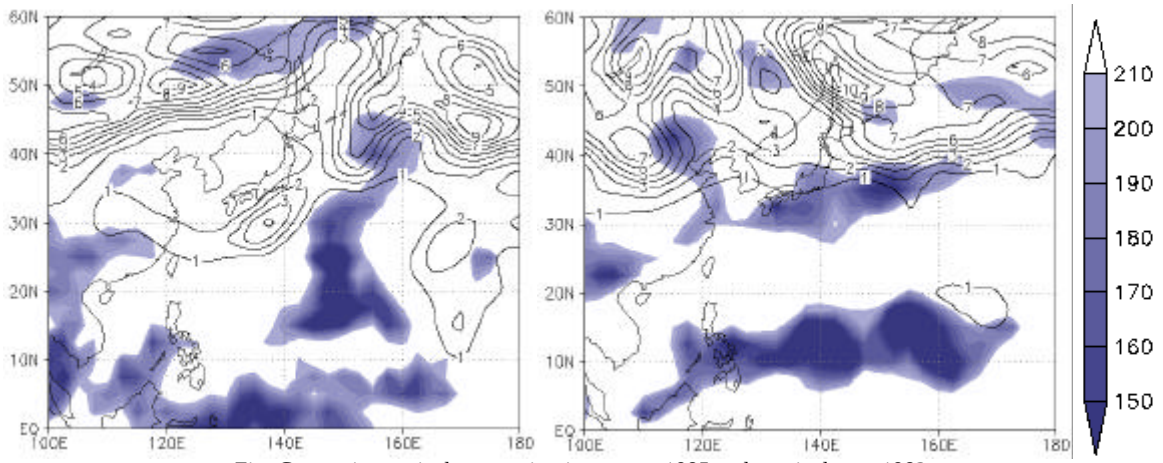

Fig. Comparing typical convection jump year 1985 and atypical year 1982.
Shadings indicate OLR and contours are PV at 200hPa[PVU]. Left panel shows an example of typical year (23rd JUL 1985) and Right panel is atypical year (24th JUL 1982).

References

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