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Diagnostic case study of a cold-core cut-off low formation mechanism

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The authors utilized the European Center for Medium-Range Weather Forecasts (ECMWF) 0.5° latitude-longitude gridded data to analyze an upper-level cold-core cut-off low (CCL or COL) during 2-7 May 1998 at southeast Asia to discuss its structure, and utilized model sensitivity test to discuss its cutting-off process from a mid-latitude baroclinic trough.

The structural characteristics of this Palmen type (mainly cut-off from mid- latitude trough) CCL are generally similar to the Palmer type (mainly originate in tropics) CCL. Some differences between the Palmen and Palmer type CCL are the lifetime and mean movement.

The cutting-off process started from an amplifying north-south oriented shout-wave trough, which was embedded in anticyclonic shear environment. These patterns will result in trough line rotating clockwisely to northeast-southwest orientation and shrink in zonal scale. The trough line separation was resulted from upper-level ridge amplification at southeast side of the trough, which was mainly caused by effective heating of convection. Model sensitivity experiment also showed a different cutting-off process if the heating from convection was turned off. Without convective heating, the evolution of trough was similar to (dry) theoretical expectation. On the contrary, effective heating provided upper troposphere easterly to block south portion of the trough and caused the COL to form at a region adjacent to Taiwan.