An Analysis of an extreme Rainstorm Caused by the Interaction of the Tibetan Plateau vortex and the Southwest China vortex during the Intensive Observation Period

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Abstract

A rainstorm caused by the coupling of the Tibetan Plateau Vortex (TPV) and the Southwest China Vortex (SWCV) in eastern Sichuan during 29 June－2 July 2013, is analyzed by using conventional weather station data, plus the in-situ intensive observation data for SWCV during flood season. The results show that: under the control of a large transverse trough in Eurasia region at mid-high latitude, the westerly flow in northern China leads TPV eastward movement. And SWCV moves northward and merges with TPV, finally form a major synoptic system resulting in heavy rainfall. In addition, the water vapor from both the Bay of Bengal and the South China Sea provides the sufficient condition for heavy rainfall. The intensive observation clearly reflects the nascent state of TPV and SWCV, the effect of cold advection, the evolution of two vortices, as well as the two vortices merging process that induces rainstorm. But, it's hard to identify the vortices activities and the precipitation variations only by using conventional station data. When the two vortices merge and strengthen, there exists a phenomenon that cold tongue and warm flow meet together. The structure is similar to front: rainfall regions are mainly distributed in the high gradient areas of average temperature deviation. Only relying on conventional observation data, it cannot effectively exhibit the abnormal structure and different characteristics. So, improving intensive observations, augmenting scientific experiment and focusing on meticulous study are conducive to reveal the evolution of SWCV and TPV, as well as their precipitation.

Key words: Intensive observation, Tibetan Plateau Vortex, Southwest China Vortex, Coupling effect, Rainstorm

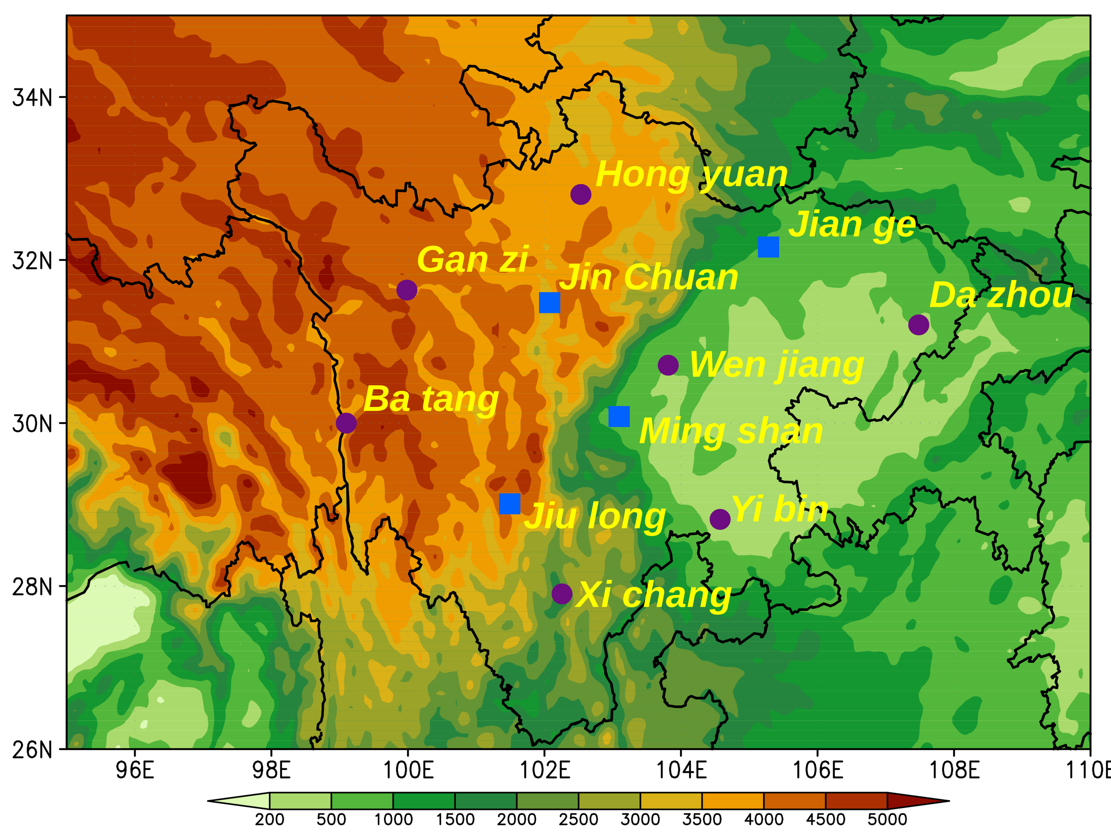

Figure 1 The distribution of terrain and sounding sites of intensive observation period of SWCV (Blue rectangle represent the stations intensified in spatial, purple solid round represent the stations intensified in temporal and shaded areas represent altitude, unit: m.)

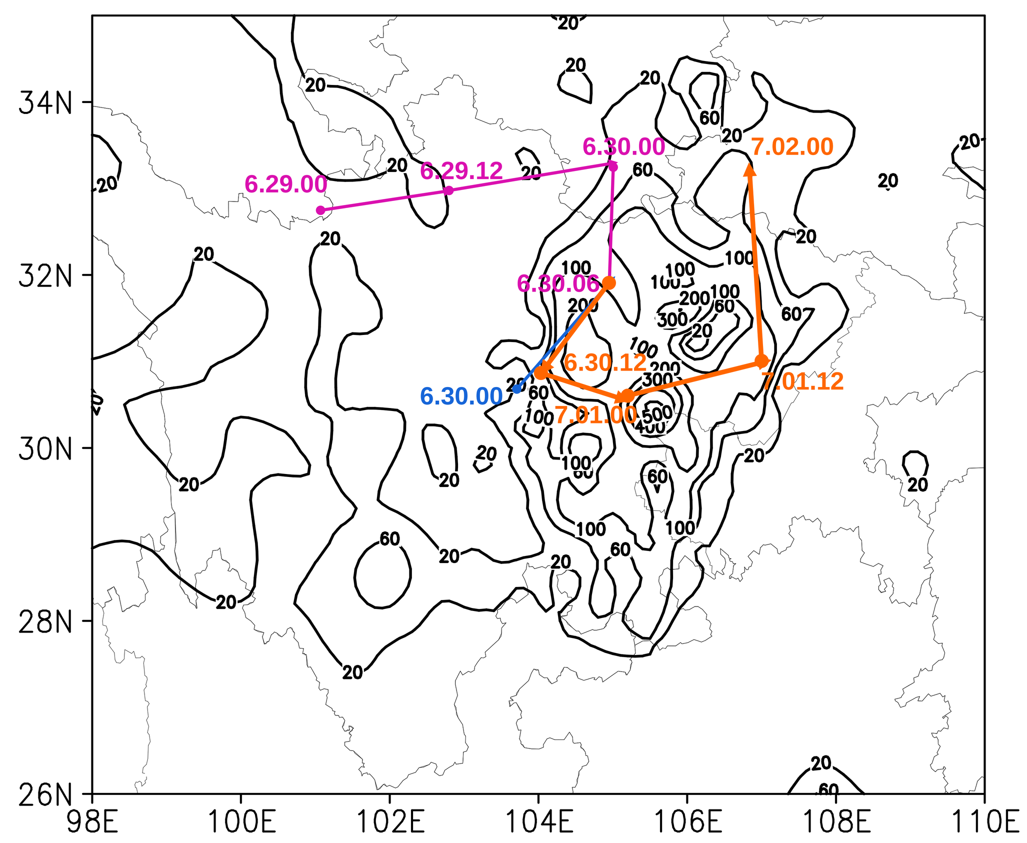

Figure 2 The precipitation (contour, unit: mm) and motion path of vortices (Pink arrows represent the TPV motion path, blue arrows represent the SWCV motion path and orange arrows represent the combined vortex motion path) 0000 UTC 29 June to 0000 UTC 2 July 2013

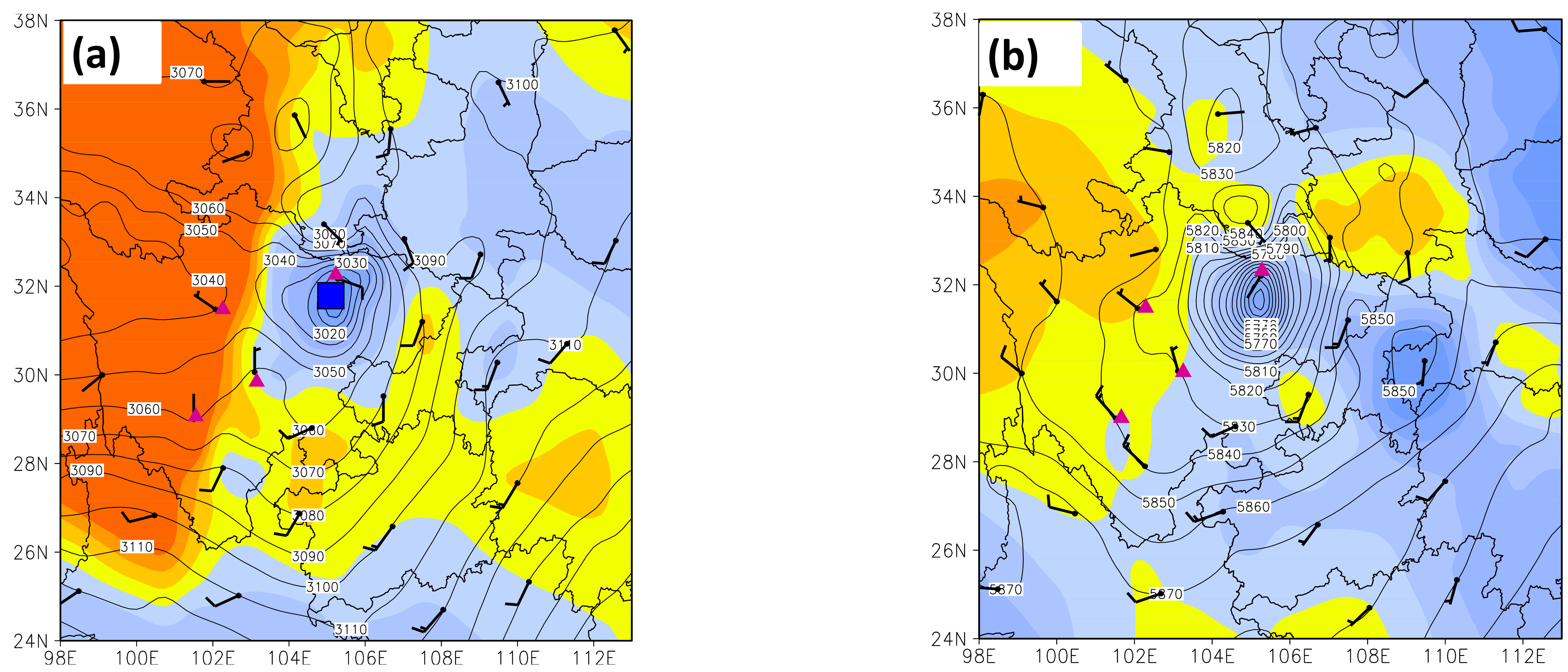

Figure 3 The geopotential heights (contour, unit: gpm), temperature (shaded, unit: ℃) and wind vector, unit: m/s) at 700hPa (a) and 500hPa (b) at 0600 UTC 30 June; (Purple triangle represent the stations intensified in temporal, blue rectangle represent the combined vortice center.

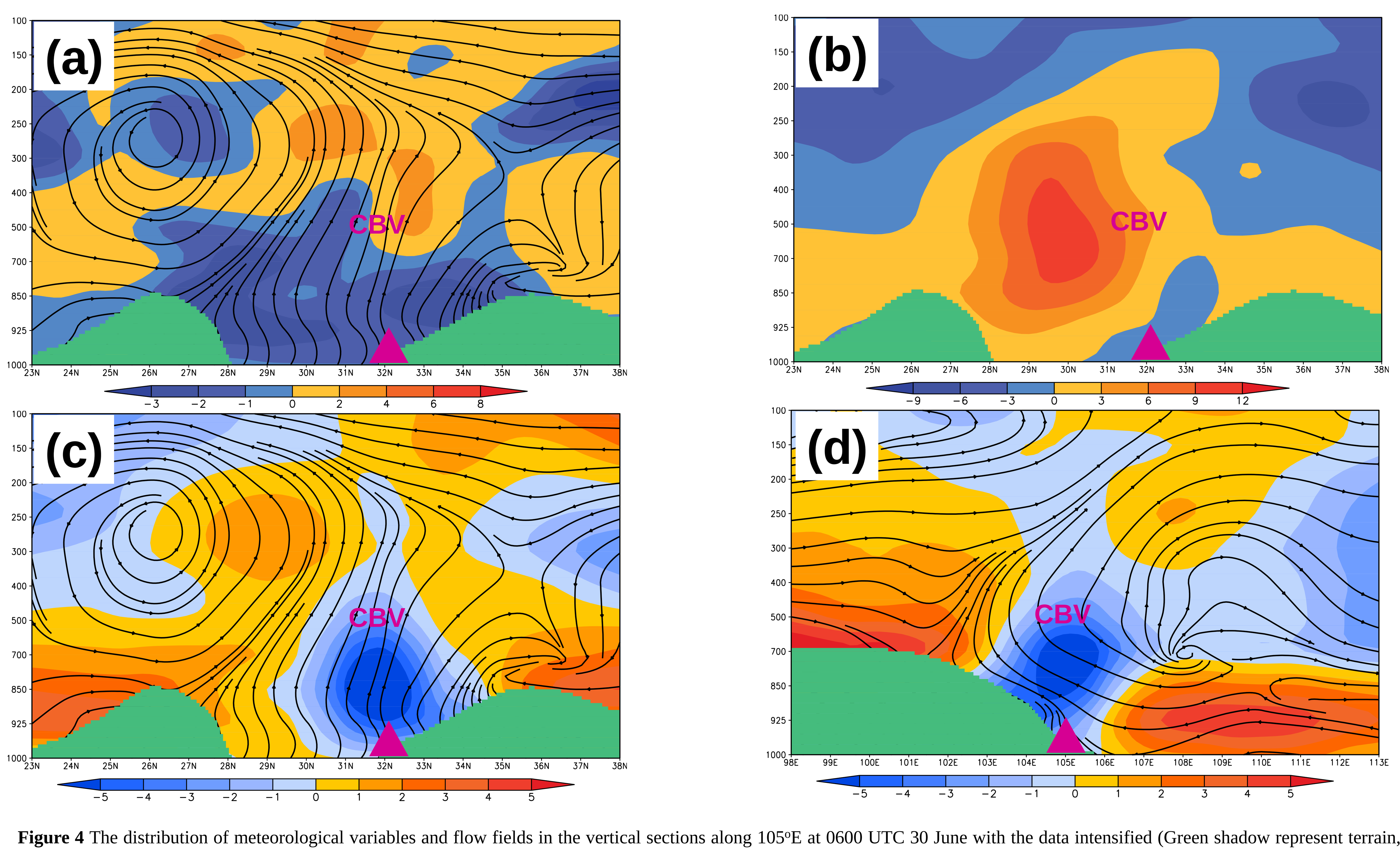

Figure 4 The distribution of meteorological variables and flow fields in the vertical sections along 105°E at 0600 UTC 30 June with the data intensified (Green shadow represent terrain, CBV present the position of the combined vortice, triangle represent the location of Jiange County): (a) divergence (unit: $10^{-5}s^{-1}$) and flow fields; (b) vorticity (unit: $10^{-5}s^{-1}$); (c) average temperature deviation (unit:℃) from 23°N to 38°N and flow fields; (d) average temperature deviation (unit:℃) in the vertical sections along 32°N from 98°E to 113°E and flow fields.