A diagnostic study of water vapor during an extreme precipitation event in Yili river valleyA diagnostic study of water vapor during an extreme precipitation event in Yili river valley

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An extreme precipitation events was happened during 31 July to 1 August, 2016 at Yili river valley which multi-stations breakthrough extreme precipitation’ s value. Based on calculation of water vapor transport stream function and the non-divergent (rotational) components, potential function and divergent (irrotational) components, the water vapor transport budget and water vapor transport trajectories for the Yili river valley using the conventional detection,1° x 1° NCEP/NCAR reanalysis, HYSPLIT model based on Lagrangian method, Ground-based GPS observation precipitable water vapor data(GPS-PWV) , the large-scale water vapor transport and convergence characteristics were analyzed during the heavy rainfall period. The results showed that: (1) The Indian, the Pacific and the Atlantic ocean all contributed to the water supply during the heavy rain period, and Indian summer monsoon circulation, the south China sea summer monsoon circulation at low latitudes and Atlantic ocean’ s east airflow at mid-latitude were constituted the water vapor transmission channel, which the Indian Ocean southwest water vapor transport mainly concentrated in the lower troposphere, and middle troposphere water vapor transport was given priority to the west flow of the Atlantic ocean and low trough itself; the valley was in the convergence area of water vapor flux during the heavy rain, and the convergence and uplift of the terrain to the West opening caused vertical motion development provided a favorable dynamic convergence mechanism for the occurrence of local heavy rain.(2) The 3000 m water vapor transmission trajectory included the westward and eastward path at bottom layer and the northward path at middle troposphere as complement of water vapor for the lower troposphere through the vertical motion, the southward path at lower troposphere which water vapor come from the Arabian sea,and the mid-latitude water vapor transport of the westward path was the most powerful ; The 5000 m water vapor transmission trajectory was dominated by the westward path and the low trough itself;(3) During the precipitation period, the water vapor was concentrated in the lower troposphere which transported to the upper level through vertical movement, and the water vapor was positive at the middle and upper layers contrasted with negative at the lower layer. south boundary of water vapor inflow was rapidly increasing at the lower layer while the middle and higher layer water vapor inflow derived from the western boundary during the heavy rainfall period;(4)Yili river valley GPS-PWV jumped caused by the southwest airflow front of low trough before the rainfall happened and steadily maintain the high value influenced by India southwest monsoon during the heavy rainfall period. The large-scale water vapor transport convergence enhancement corresponding local GPS-PWV increased, suggested that the water vapor supply in local heavy rain event was at least associated with the water vapor transport and convergence of hemisphere scale.

Keywords: torrential rain, transfer of water vapor, lagrange trajectory, ground-based GPS

