

Diagnosing formation of the severe drought in SWC during 2009-2010

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An extraordinary severe drought hit Southwest China (SWC) from late 2009 to early 2010 and caused enormous losses. The local long-lasting rainfall deficiency which started several months before and the warmer surface air temperature during this period were considered to be the direct meteorological reasons for this disaster. Station observations covering SWC show that there was an almost unbroken rainfall shortage period from May 2009 to March 2010, including two remarkable spells in 2009, May-Jun-July (MJJ) and the boreal autumn (SON). During the first spell, local anomalous descent in the mid-to-low troposphere plays a dominate role to suppress the convection even the water vapor is enough. Diagnosing the vertical motion equation indicates that the local descent is primarily maintained by the anomalous cold temperature advection processes. Both the advection of mean temperature by anomalous wind and the advection of anomalous temperature by mean wind contribute are important. In SON 2009, a quite different situation is proposed that the less than normal northeastward low-level water vapor transport anomaly instead of the descent motions anomaly lead to the rainfall shortage in SWC. Advanced diagnoses illustrate that the low-level water vapor convergence over SWC is significantly less as the transport reduces and the mean water vapor converged by anomalous wind is mainly responsible for this anomaly. Ultimately, the regional circulation anomaly over SWC is controlled by the concurrent El Niño event, which is distinctive and generates an anomalous cyclone centered over the northwest tropical Pacific Ocean.

Keywords: Rainfall , Southwest China, The tropical Pacific