The possible cause of the summer drought over Southwest China since 2002/2003

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1. Introduction

Severe drought has attacked Southwest China (SWC, with region22.5° -30° N,97.5° -107.5° E) over the recent 10a. The temporal and spatial distribution of the drought and flood is examined using the different observations and Interim reanalysis data during 1979-2013 . Most researches focus on the anomaly of the large-scale atmospheric circulation, MJO and precipitation construction and so on. In fact, those are only the external condition in favor of the SWC drought. But what is the internal ones?

2. Data & Methods

- **Data: A dataset including 75 stations for daily and month rain gauge, temperature, pressuer, ground temperature, wind speed and evaporation observations is provided by the National Meteorological Information Center (NMIC), China Meteorological Administration (CMA). The daily reanalysis data are provided by NCEP/NCAR with a horizontal resolution of 2.5° ×2.5° and 17 vertical levels.**
- **Method: the cross wavelet transform,the HYSPLIT_4.9 model**

3. Results

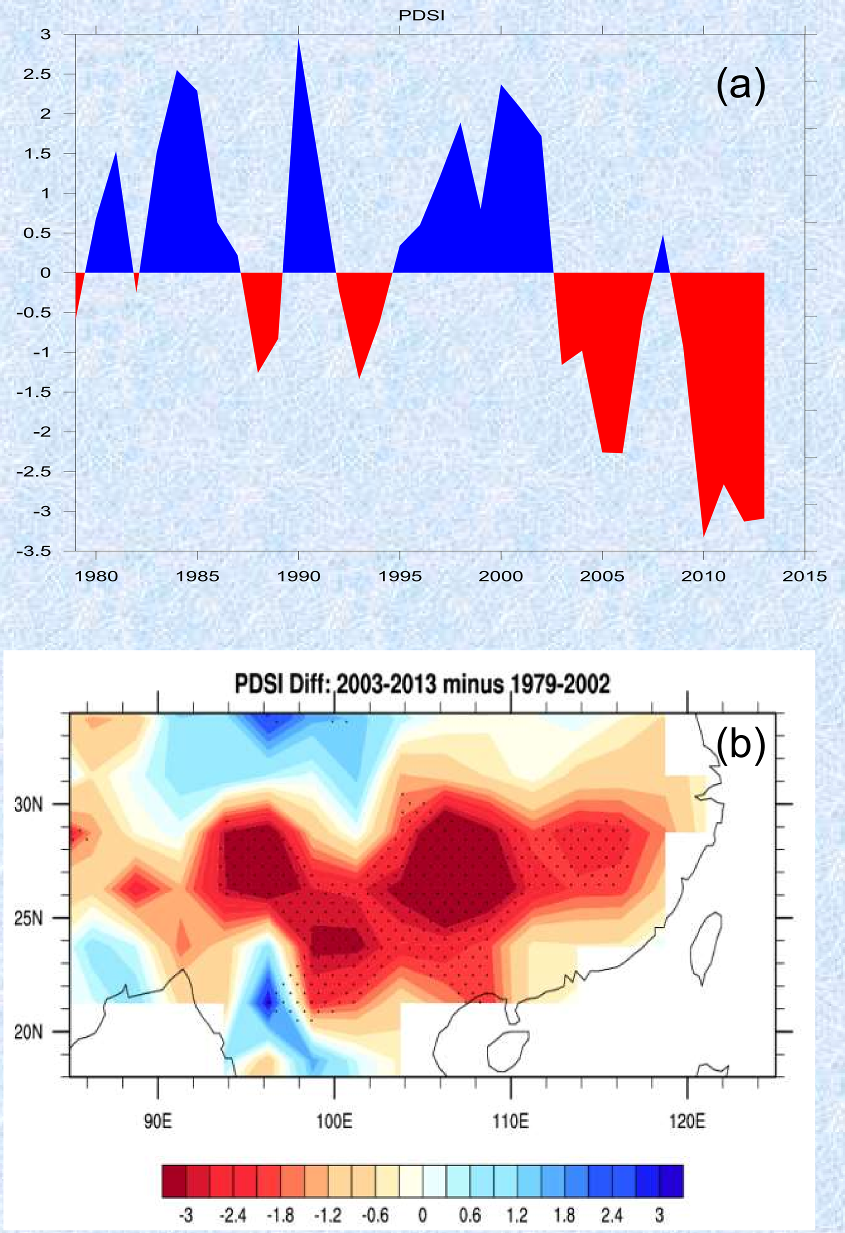

Figure 1 Summer PDSI over Southwest for 1979-2013(a) and the difference between 1979-2002 and 2003-2013(b)(the black dotted region is statistically significant at 95% confidence level)

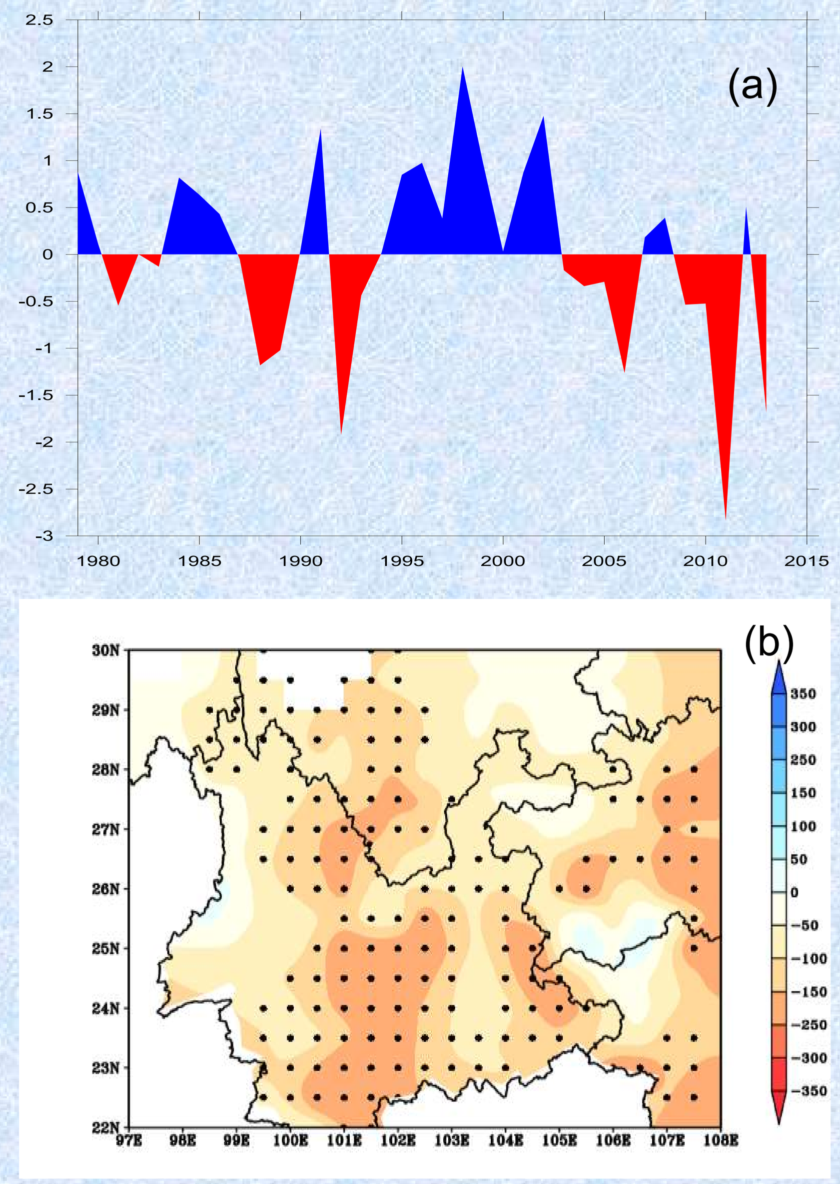

Figure 2 Standardized summer rainfall over Southwest for 1979-2013(a) and the difference between 1994-2002 and 2003-2013(b)(unit:mm)(the black dotted region is the same as that in figure 1

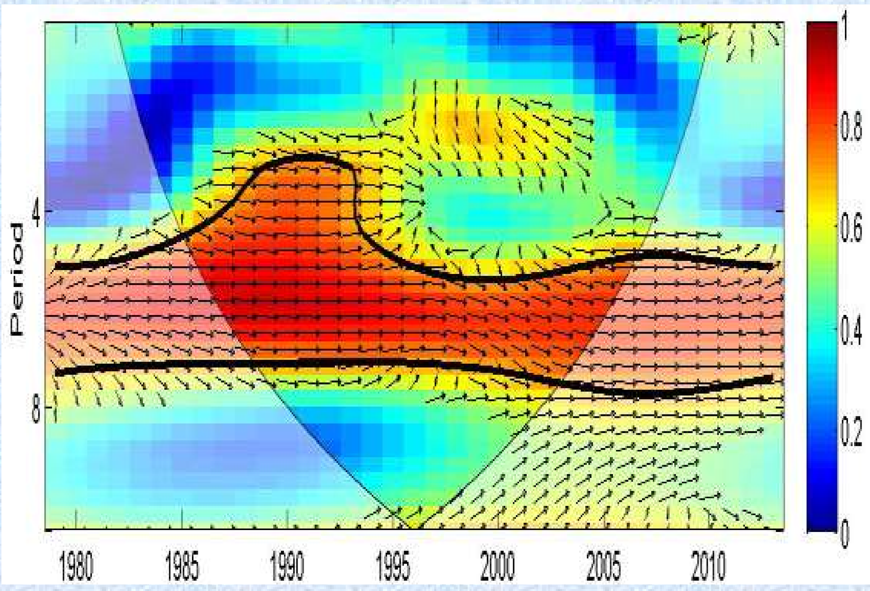

Figure 3 the cross wavelet transform between the standardized precipitation and PDSI time series.(The 5% significant level against red noise is shown as a thick contour. The relative phase relationship is shown as arrows. The outer zone of influence cone line where edge effects might distort the picture is not considered)

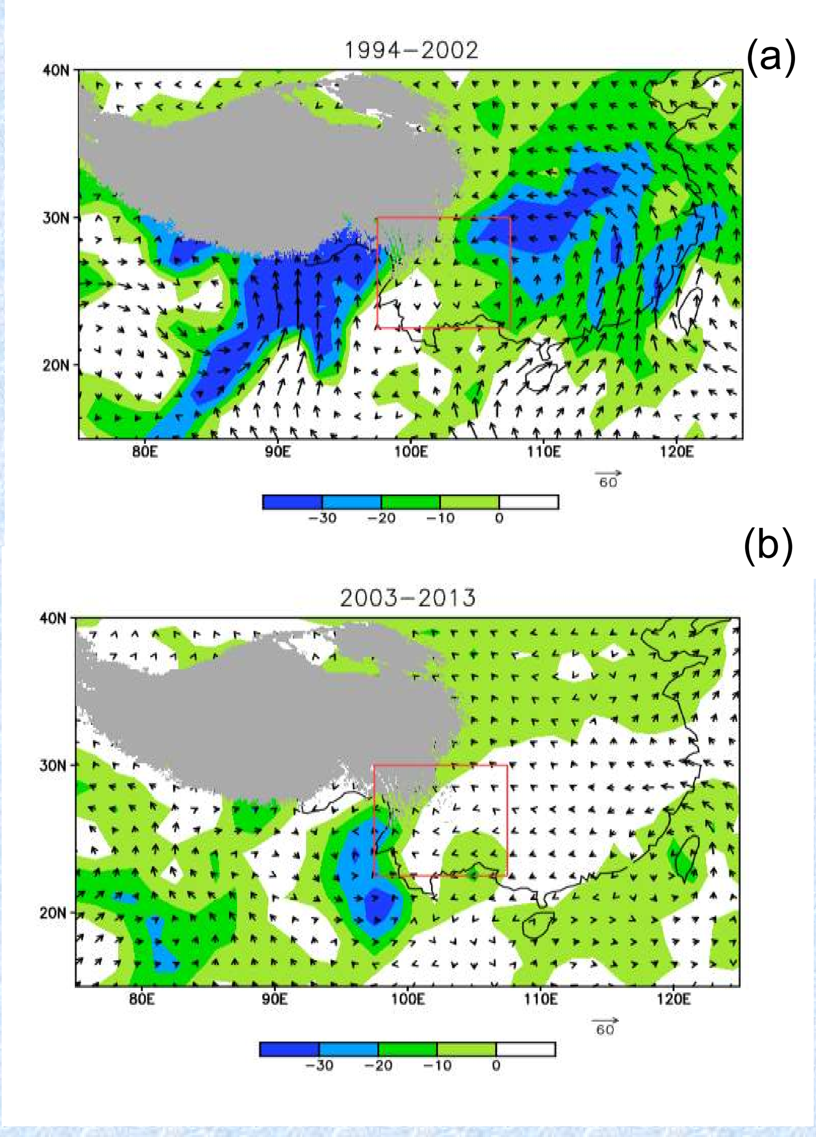

Figure 4 Vertical integrated moisture flux anomalies(vectors, kgm-2s-1) and their divergences(shadings, kgm-2s-1)in the summer between 1994-2002(a) and 2003-2013(b)(the grey is the Tibet terrain on 700hPa)

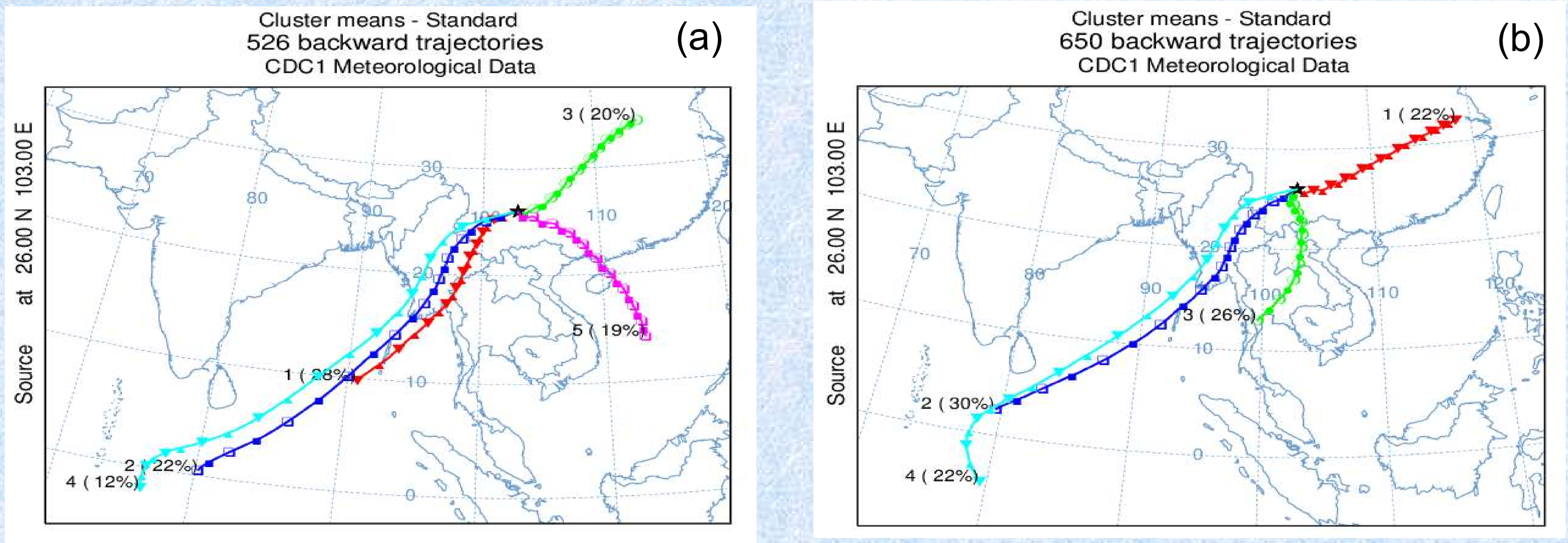

Figure 5 Moisture transport paths during abundance regime (a,1994-2002) and deficiency regime (b, 2003-2013) in Southwest China and their contributions labeled on them

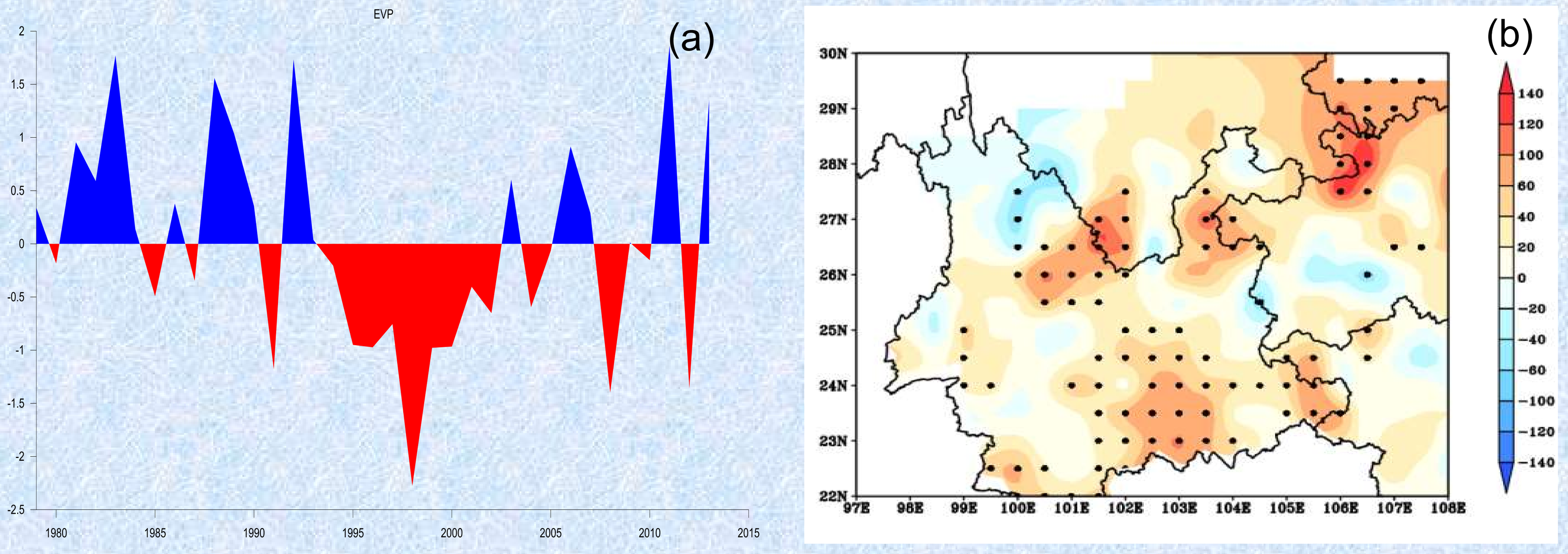

Figure 6 Same as Figure 1, but for evaporation

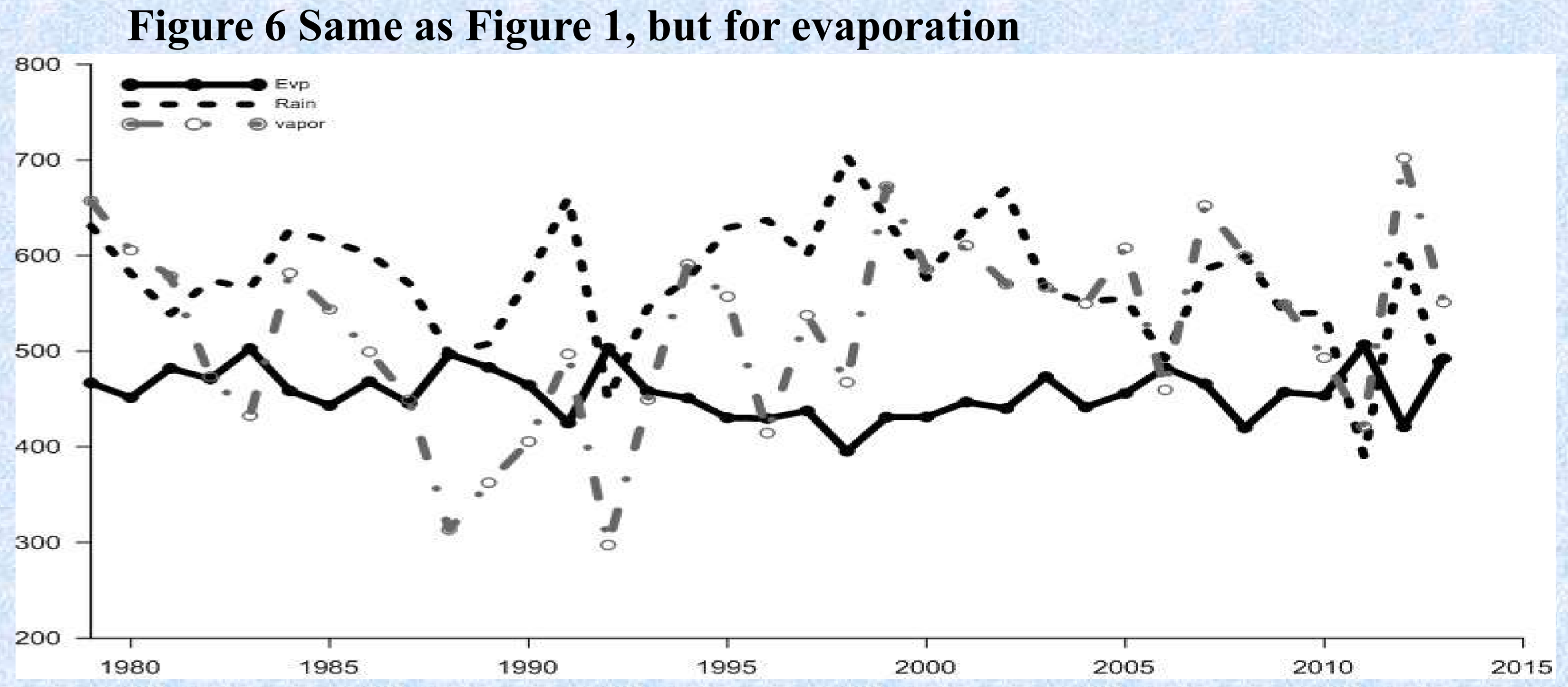

Figure 7 Summer average evaporation (black solid line), precipitation (dotted line) and vertically integrated water vapor transport (dot dash line) for 1979-2013a (unit: mm)

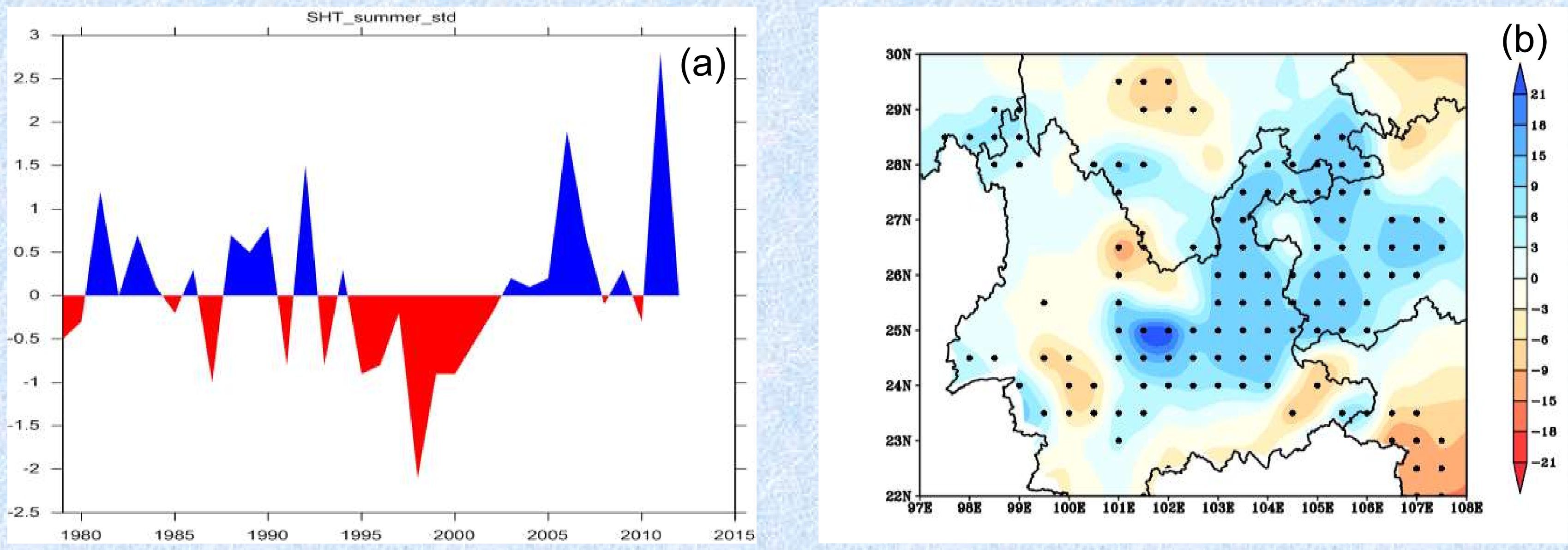

Figure 8 Same as Figure 1, but for sensible heat

4. Conclusions

Since 2002/2003a, an abrupt change of the summer Palmer Drought Severity Index(PDSI), precipitation, temperature, evaporation and sensible heat has happened. In a considerable degree, the precipitation deficiency has originated from the moisture transfer decrease from the Indian Ocean, which is the external reason for the drought over SWC. On the other hand, both the temperature and the sensible heat have played an important role in the evaporation. So the surface sensible heat and evaporation are the regional or local condition, which benefit for the drought. Consequently, conclusions as a result, the common function in above both side would cause the drought over the SWC for the recent 10a.

References:

[1] Hu Yamin, Ding Yihui, et al. The possible cause of the summer drought over Southwest China since 2002/2003. Acta Meteorologica Sinica, 2018 (submit)