

Decadal shifts of summer heavy rainfall in southern China

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The present study documents two reverse shifts of summer heavy rainfall in southern China under global warming, and explores the plausible reasons for these two shifts. Southern China summer heavy rainfall had a sudden increase around early-1990s but experienced an abrupt decrease around early-2000s. Coherent changes in atmospheric circulation are investigated. The changes in lower-level wind around early-1990s feature two anomalous anticyclones: one over the SCS– subtropical WNP, and the other over north China–Mongolia. The outflows from the two anomalous anticyclones converge over southern China, leading to anomalous moisture convergence, enhanced ascent, and increased heavy rainfall. The development of the northern anticyclone is related to an increase in the preliminary Tibetan Plateau snow cover while the southern anticyclone is related to an increase in sea surface temperature (SST) in the equatorial Indian Ocean. The changes in lower-level wind around early-2000s exhibit a southeast-northwest oriented dipole pattern: an anomalous cyclone over northern China–Mongolia, and an anomalous anticyclone over southeastern China–subtropical WNP. Simultaneously, an anomalous anticyclone dominates the upper troposphere over southern China. Other than the climatic effect of Tibetan Plateau, SST warming over tropical Indian and central Pacific oceans plays an important role in the development of the lower-level anticyclone leading to anomalous moisture divergence and decreased heavy rainfall in southern China around early-2000s.