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Variations of the Summer Somali and Australia Cross-Equatorial Flows and the Implications for the Asian Summer Monsoon

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The temporal variations during 1948–2010 and vertical structures of the summer Somali and Australia cross-equatorial flows (CEFs) and the implications for the Asian summer monsoon were explored in this study. The strongest southerly and northerly CEFs exist at 925 hPa and 150 hPa level, respectively. The low-level Somali (LLS) CEFs were significantly connected with the rainfall in most regions of India (especially the monsoon regions), except in a small area in southwest India. In comparison to the climatology, the low-level Australia (LLA) CEFs exhibited stronger variations at interannual time scale and are more closely connected to the East Asian summer monsoon circulation than to the LLS CEFs.
The East Asian summer monsoon circulation anomalies related to stronger LLA CEFs were associated with less water vapor content and less rainfall in the region between the middle Yellow River and Yangtze River and with more water vapor and more rainfall in southern China. The sea-surface temperature anomalies east of Australia related to summer LLA CEFs emerge in spring and persist into summer, with implications for the seasonal prediction of summer rainfall in East Asia. The connection between the LLA CEFs and East Asian summer monsoon rainfall may be partly due to its linkage with El Nino-Southern Oscillation. In addition, both the LLA and LLS CEFs exhibited interdecadal shifts in the late 1970s and the late 1990s, consistent with the phase shifts of Pacific Decadal Oscillation (PDO).