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Long-term coupled variability of temperature and precipitationin eastern China and the underlying mechanisms

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This study investigates the coupled variability of temperature and precipitation in eastern China during summer using empirical orthogonal function (EOF) analysis to better understand and mitigate simultaneous occurrences of extreme events,such as compound droughts and heat waves. Two dominant modes are identified: the first exhibits a strong warming and drying trend in the region north of the Yangtze River, with the opposite occurring in the south; the second illustrates decadal oscillations in temperature and precipitation, alternating between cool-wet conditions and warm-dry conditions in southern China. The underlying mechanisms for these leading modes are revealed through correlation, composite analysis,and model simulations. The first mode is associated with a negative Pacific-Japan teleconnection in the lower atmosphere and a stationary Rossby wave train across Eurasia in the upper troposphere, which are influenced by global warming and sea surface temperature anomalies in the western North Atlantic. The second mode is linked to alternating active periods of the North Atlantic Oscillation (NAO) and Pacific Decadal Oscillation (PDO). The NAO exerts a significant influence on the summer climate in eastern China during its active phases, while the PDO shows an opposite effect when the NAO is less active. These findings provide valuable implications for long-term planning and adaptation strategies to better cope with compound extreme events in eastern China.