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A reconstruction of the East Asian summer monsoon index over the half past millennium

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The EASM largely determines variations in summer precipitation in the East Asian monsoon region where approximately one-quarter of the world's population live. A reliable East Asian summer monsoon (EASM) index covering several centuries is important in order to understand EASM dynamics. The wind-field is frequently used to calculate the EASM index during the instrumental period. However, available climate proxy data rather respond to direct precipitation changes. A gridded extended summer (May–September, MJJAS) precipitation reconstruction for China covering AD 1470–2000 is used to indirectly reconstruct two types of EASM indices (defined by the strength of the 850hPa southwesterly winds and a north-south gradient of the zonal winds), using the negative correlation between the EASM index and summer (June–August, JJA) rainfall in the middle and lower reaches of the Yangtze River of China. The two EASM indices are validated by independent historical documentary data for eastern China. The physical processes ruling the EASM variability are explored, highlighting a baroclinic structure over the middle and lower reaches of the Yangtze River. It includes an anticyclonic circulation accompanied by high pressure anomalies in the lower troposphere and a cyclonic circulation with low pressure anomaly in the upper troposphere. This is associated with a decrease in atmospheric water vapor content (due to divergence), which will decrease summer rainfall in the region, and contribute to the strengthen of the EASM variability. The dominated and inter-annual component of the EASM variation is possibly linked to the 'ENSO-like' sea surface temperature according to a data assimilation experiment performed with the Community Earth System Model-Last Millennium Ensemble (CESM-LME)

simulation.