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Thermal contrast between middleLatitude Asian continent and adjacent ocean and its connection to the East Asian summer monsoon precipitation

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To analyze the middle-to-lower troposphere atmospheric thermal contrast between over the middle latitude Asian continent and over its eastern adjacent ocean near Japan, an empirical orthogonal function (EOF) analysis to the ERA-40 reanalysis data of June-July-August (JJA) 500-hPa geopotential height over Asia to Pacific area (60^{o}-180^{o}E-10^{o}-80^{o}N) during 1958-2000 was done. It shows that the dominating pattern of the thermal contrast may well be represented by the opposite change at a land area (75^{o}-90^{o} E, 40^{o} -55^{o}N) and an oceanic area (140^{o} -150^{o}E, 35^{o} -42.5^{o}N). An index showing the difference between the two areas is defined as the middle-latitude Land-Sea thermal contrast Index (LSI). The LSI has significant interannual and interdecadal variability. Its interannual variation is mainly attributed to the atmospheric thermal condition over the ocean which has remarkably regional unique feature, while the interdecadal variability is greatly attributed to that over the land. The LSI has close connection to the East Asian summer monsoon precipitation. The results show that large/small LSI is related to rich/poor summer precipitation in the middle-to-lower reaches of the Yangtze River, Korea, Japan and its eastern adjacent ocean at the same latitude and poor/rich precipitation in the South China Sea and tropical western Pacific, as well as poor/rich precipitation in North China and high-latitude northeast Asia, respectively. The pattern of correlation between LSI and precipitation resembles to the spatial distribution of the principle EOF mode of year-to-year precipitation variations. Furthermore, the variation of LSI is highly correlated to the time series of the first EOF mode of summer precipitation anomalies. This suggests that the middle-latitude land-sea thermal contrast is one of important factors to influence on the summer precipitation variations over the area from the whole East Asia to the western Pacific. The possible physical mechanisms of the land-sea thermal contrast impacting on the East Asian summer monsoon precipitation are also investigated.