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Interannual Variations of Early Summer Monsoon Rainfall over South China under Different PDO Phases

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The interannual variations of the early summer monsoon rainfall over South China (SCMR) relative to different Pacific Decadal Oscillation (PDO) backgrounds are examined based on station rainfall data, and the European Centre for Medium-Range Weather Forecasts (ECMWF) 40-Year Reanalysis (ERA-40) data. The objective of this study is to investigate the atmospheric circulation patterns responsible for interannual SCMR variations, thereby understanding the interdecadal modulation and the cause for the extreme wet and dry SCMR.
The interdecadal change in interannual SCMR variance around the late 1970s is found to coincide with the transition from the recent negative to positive phases of the PDO index, with the signatures of interannual variations of SCMR identified for the dominantly negative PDO epoch 1958-1976 and positive PDO epoch 1980-1998. Significant interdecadal differences are found to exist between these two epochs in terms of anomalous sea surface temperature (SST) pattern, and anomalous atmospheric circulation structures at different levels. The dominant atmospheric teleconnection patterns associated with extreme interannual variations of SCMR are remarkably different between the two epochs. During 1958-1976, anomalous SCMR is preceded by a monopole circulation anomaly over Ural Mountains in the preceding winter, with a significantly anomalous anticyclone over the SCS and western Pacific in the lower troposphere and a meridional wave-like coupling from tropics to middle-high latitudes along the coast of western North Pacific in the early summer. But during 1980-1998, anomalous SCMR follows a remarkable coherent long wave train teleconnection pattern in middle and high latitudes in the preceding winter, with a relatively weaker anomalous anticyclone over the SCS and without a significantly meridional juxtaposition of anomalous circulations in the early summer. Such interdecadal differences in dominant anomalous circulation structures suggest that the relative roles of internal atmospheric variability and external forcing may be different from different epochs. But for both epochs the circulation anomalies over the Ural Mountains may be important precursory signals for improving seasonal forecasting of SCMR.