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A Time-scale Decomposed Threshold Regression Downscaling Approach to Forecasting South China Early Summer Rainfall

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A time-scale decomposed threshold regression (TSDTR) downscaling approach to forecasting South China early summer rainfall (SCESR) is described by using long-term observed station rainfall data and the National Oceanic and Atmospheric Administration Extended Reconstructed sea surface temperature (SST) data. It makes use of two distinct regression downscaling models corresponding to the interannual and interdecadal rainfall variability of SCESR. The two models were developed based on the partial least square (PLS) regression technique linking SCESR to SST modes in preceding months on both interannual and interdecadal timescales. Specially, using the datasets in the calibration period 1915-1984, the variability of SCESR and SST were decomposed into interannual and interdecadal components. On the interannual timescale, a threshold PLS regression model was fitted to interannual components of SCESR and March SST patterns by taking account of the modulation of negative and positive phases of the Pacific Decadal Oscillation (PDO). On the interdecadal timescale, a standard PLS regression model was fitted to the relationship between SCESR and preceding November SST patterns. The total rainfall prediction was obtained by the sum of the outputs from both interannual and interdecadal models. Results show that the TSDTR downscaling approach achieved a reasonable skill to predict the observed rainfall in the validation period 1985-2006, compared to other simpler approaches. This study suggests that the TSDTR approach considering different interannual SCESR-SST relationships under the modulation of PDO phases, as well as the interdecadal variability of SCESR associated with SST patterns may provide a new perspective to improve the climate predictions.