



A Time-Scale Decomposition Statistical Downscaling Model for Seasonal Prediction of East Asian Summer Monsoon

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A new statistical downscaling model based on the time-scale decomposition (TSD) approach is proposed. It makes use of distinct downscaling models respectively corresponding to different time-scale variability with distinct different mechanisms. We employ this model to statistically downscale East Asian summer monsoon (EASM), especially, summer (July-August) rainfall over North China as example.

Summer rainfall over North China which is an important component of EASM possesses both strong interannual and interdecadal variabilities that are linked to different forcings. The TSD downscaling model makes use of two distinct downscaling models respectively corresponding to the interannual and interdecadal variabilities of summer rainfall over North China. The two models are developed based on objective downscaling scheme that 1) identifies potential predictors which are possible responsible for the interannual and interdecadal variabilities of summer rainfall over North China; 2) selects the "optimal" predictors from the identified potential predictors via cross-validation-based stepwise regression; 3) identifies the final predictors based on physical analysis for the interannual and interdecadal variabilities of summer rainfall over North China respectively. The downscaling model for the interannual summer rainfall variability over North China is linked to June El Niño–Southern Oscillation (ENSO) and June Eurasian teleconnection, while the one for the interdecadal summer rainfall variability over North China is related to the decadal variability of sea level pressure over the southwest Indian Ocean. Taking the downscaled interannual and interdecadal components together the downscaled total rainfall was obtained. The results show that the TSD approach achieved a good skill to predict the observed rainfall with the correlation coefficient of 0.82 in the independent validation period. The authors further apply the model to obtain downscaled rainfall projections from three climate models under present climate and the A1B emission scenario in future. The resulting downscaled values provide a closer representation of the observation than the raw climate model simulations in the present climate; for the near future, climate models simulated a slight decrease in rainfall, while the downscaled values tend to be slightly higher than the present state. Besides, the TSD model is employed to make seasonal prediction for summer rainfall over North China in 2011, 2012, and 2012, and the results show the good performance of the approach, implying the new TSD model could be a useful tool for seasonal prediction of EASM.