Regional Climate Simulation of Seasonal Surface Temperature and Precipitation by Downscaling Approach over the Southeast United States

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The large-scale surface climate simulation for spring and summer has been downscaled to local spatial scale of 0.2°×0.2° (~20 km) over the southeast US region, covering Florida, Georgia, and Alabama. The regionalization from the global model simulation is conducted by both dynamical and statistical methods. Daily surface temperature (T_{max} and T_{mean}) and precipitation data obtained from FSU/COAPS GSM (Florida State University / Center for Ocean Atmospheric Prediction Studies Global Spectral Model, ~1.8° lon.-lat. (T63)) seasonal integrations are employed for this downscaling. In this study, 7 month GSM seasonal integrations for each year with the atmospheric initial condition on 1 March are conducted for the period of 1987 to 2004.

Dynamically downscaled variables are constructed using the FSU/COAPS NRSM (Nested Regional Spectral Model), which has been nested into the southeast US region of the FSU/COAPS GSM domain. The statistical downscaling is conducted based on the clearer separation of prominent local climate signals (e.g., seasonal cycle, dominant intraseasonal or interannual oscillations) over the training period. The statistical information identified from training leads to better prediction of local climate scenario from the large-scale simulations. CSEOF (Cyclostationary EOF) analysis and the multiple regression methods are primarily used for the statistical downscaling.

Downscaled temperature and precipitation are compared with the FSU/COAPS GSM fields and observations. Downscaled seasonal anomalies exhibit good agreement with observations and a reduction in bias relative to the direct GSM simulations. Interannual variation is also reasonably simulated at local grid points. A series of evaluations including mean absolute errors, anomaly correlations, frequency of extreme events, and categorical predictability reveal that both downscaled simulations can be reliably used for numerous seasonal climate applications.

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