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Study of Climate Change and its Impact on WaterCycle in Yangtze River Basin

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Under the condition of global warming, the principals of water movements and the prediction of water resources dynamic trends are recently the most popular issue in water science research.Based on the existing distributed hydrologic model system and synthesizing multiple-source data information, applying the “3S” technology and supercomputers, coupling the new generation coarse-gridded land surface model, large scale LSX-HMS is established on YRB at 20-km grids. This model accurately simulates monthly discharge at Cuntan, Hankou and Datong. The spatial variations of precipitation, evaporation, runoff depth, soil water content and other hydrologic features are also simulated with the model.

Using multiple methods for dissembling, this study also analyzes the monthly precipitation and temperature simulated under the A2, A1B and B1 scenarios of HADCM3. An artificial neural network method and Delta-DCSI method was proposed and compared with bilinear interpolation method, inverse-distance squared method and Kriging interpolation method in the application of spatial downscaling. The Delta-DCSI method is more suitable for the spatial downscale of meteorological elements and provide a new way to downscale the results of GCMs to station scale. For the temporal downscale of temperature (monthly to daily), the parabolic interpolation, spline function, sine function method which consider the distribution of residual error was proposed and could reflect the stochastic volatility of daily temperature quite well.

The dissembled results of precipitation and temperature are used to drive the coupled model LSX-HMS, in order to assess the trend of water dynamics in YRD for the period of 2010 to 2099. It indicated the increasing trend of the water resources during all the future scenarios, in accordance with the increasing trend of the precipitation. Under the conditions of Special Report on Emissions Scenarios A2, it will produce the highest possibility of the occurrence of extreme floods. Meanwhile, under the conditions of Special Report on Emissions Scenarios B1, it will produce the lowest possibility of the occurrence of extreme floods. An approach for analyzing extreme floods by using wavelet-based multi-resolution analysis shows that the change regularity is similar between the return period of daily and monthly peak flow, but the return period of yearly peak flow will becomes shorten during 2010 to 2099.