Development of a Downscaling Method in China Regional Summer Precipitation Prediction

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Introduction

Monthly to seasonal climate prediction has been a focus in climate research and is also important for flood and drought prevention. For decades, scientists at home and abroad have done much work to improve the accuracy of monthly to seasonal climate prediction. The downscaling method based on optimized information extracted from climate models has proved to be very effective. In this paper we will establish a downscaling method to do the regional summer precipitation prediction (RSPP) in China and analyze the causes of high skill predictions of RSPP.

Scheme of Downscaling Method

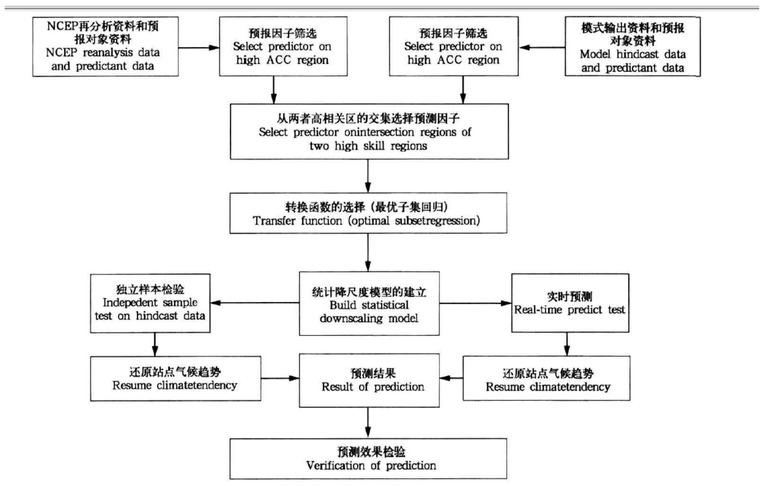

Fig.1 Following Chart of the Downscaling Model

(1)Use a simple linear regression to eliminate long-term trends in the precipitation data, the dynamic model outputs, and the reanalysis data.
(2)Calculate the anomaly correlation coefficients (ACCs) of the detrended precipitation and the dynamic model outputs, the reanalysis data each other.
(3)Decide the prediction area where the model successfully predicts the large-scale
atmospheric circulation elements that are closely related to the regional precipitation.
(4)Take the representative model data at the grids within the high-skill area as predictors.
(5) Establish the downscaling prediction models through the OSR.
(6) Test prediction results.

Results and Discussion

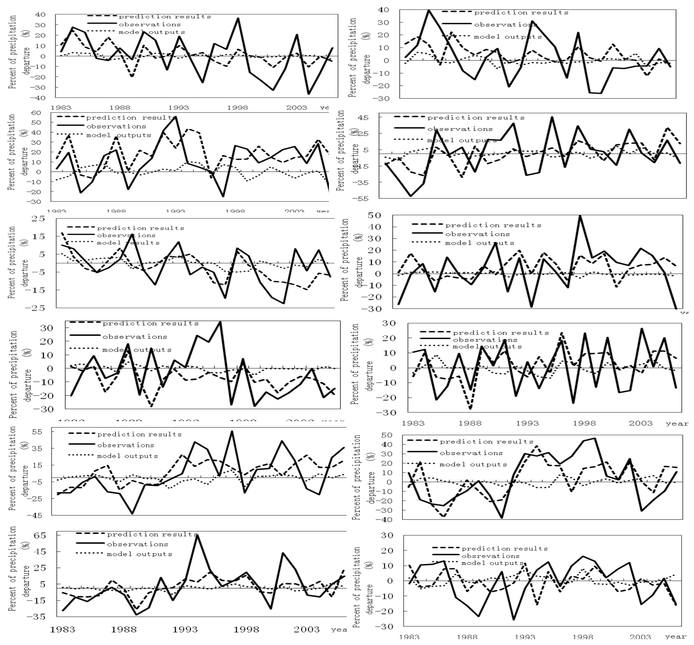

Fig.3 Comparison of downscaled RSPPs (dashed line), model outputs (dotted line), and observations

Table 2. The correlation coefficient of summer precipitation anomalies between RSPPs and observations in each region based on 24-yr sample data

Region	Northern Northeast China	Southern Northeast China	Northern Xinjiang area	Southern Xinjiang area	Qinghai area	Tibetan area	Hetao and North China	Huang-huai region	South-eastern coastal areas	Jiangnan region	Yunnan area	Guangxi area
ACC	0.49	0.34	0.45	0.45	0.54	0.36	0.29	0.43	0.45	0.64	0.13	0.60

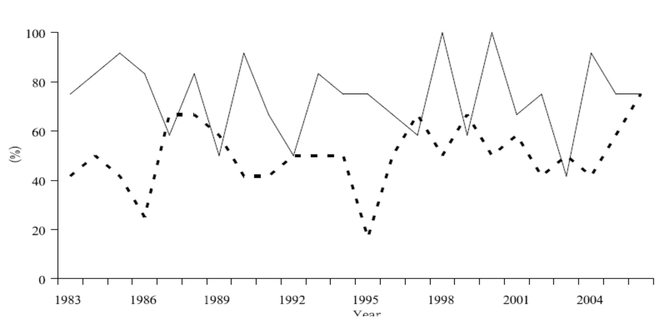

Fig.4 The skills of downscaled RSPPs (real line) and model outputs (dotted line) of precipitation anomalies

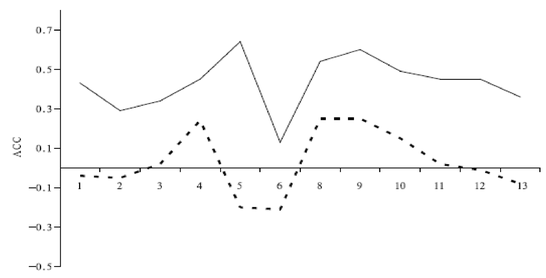

Fig.5 ACCs of the observation with downscaled RSPPs (real line), and with CGCM/NCC outputs (dotted line)

Conclusion

(1) The long-term tendency in the model data, reanalysis data, and observation data is removed before calculating the ACC so as to avoid the influence of the long-term trend of the data and to improve the accuracy of the interannual rainfall prediction.
(2) The optimal predictors are selected through calculation of anomaly correlation coefficients (ACCs) twice to ensure that the high-skill areas of the CGCM/NCC are also those of observations, with the ACC value reaching the 0.05 significant level.
(3) The downscaling method based on the high skill outputs of the CGCM/NCC can greatly improve the accuracy of the RSPP, and the performance of the RSPP depends signi¯cantly on the skill of the model used.