

Introduction:

• Global averaged temperature has risen over the past hundred years by about 0.5°C , and over half of the increase has taken place during the past three decades. The warming is not uniform. Some cooling has taken place in the North Atlantic, northeastern Canada and central North Pacific.

• We will display that there is stronger upward trend than ever estimated for the annual temperature of China over the past hundred years. Also, the stronger warming trend than global mean has occurred in most eastern Asia during the last 2 decades, and demonstrate the temperature observed in 1998 was the warmest since 1880 in China.

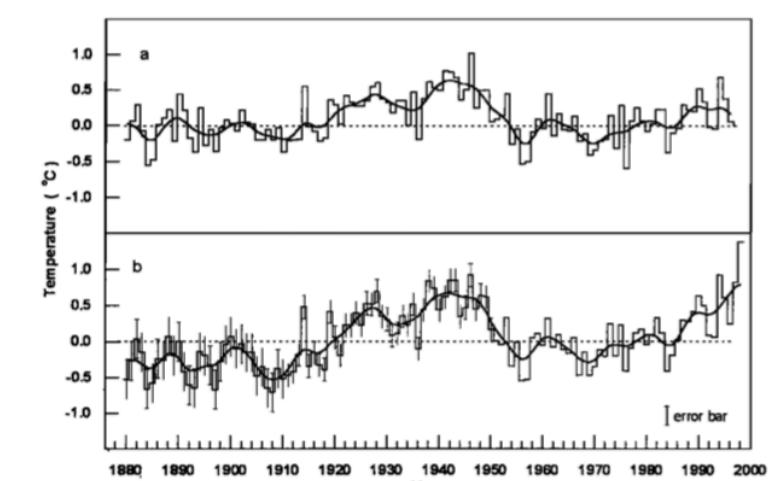


Figure 1. Annual mean temperature anomalies of China. Curve *a* is calculated using four stations located in east China for the period of 1880-1996 [Wang, 1990], *b* is the series with complete coverage of all 10 regions of China and updated to 1998. For series *a*, the linear trend is only $0.09^{\circ}\text{C}/100\text{yr}$, but for *b* the trend increases to $0.50^{\circ}\text{C}/100\text{yr}$, which is comparable to the global warming trend of $0.5\text{--}0.6^{\circ}\text{C}/100\text{yr}$. It shows the importance of data coverage when the mean temperature was calculated. Reference period is 1961-1990. Both smoothed with a 9-point Gaussian filter and shown in solid lines.

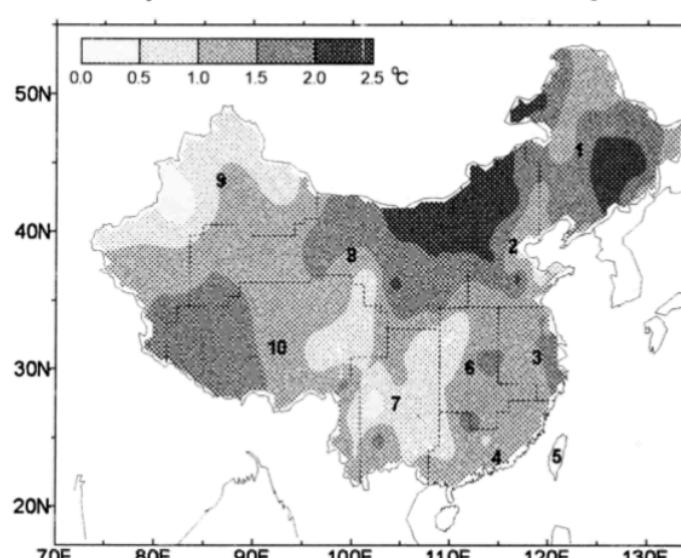


Figure 2. Anomalies of annual surface air temperature of 1998 over the mainland of China. Reference period is 1961-1990. Numbers indicate the ten regions, the names and area weights see Table 1.

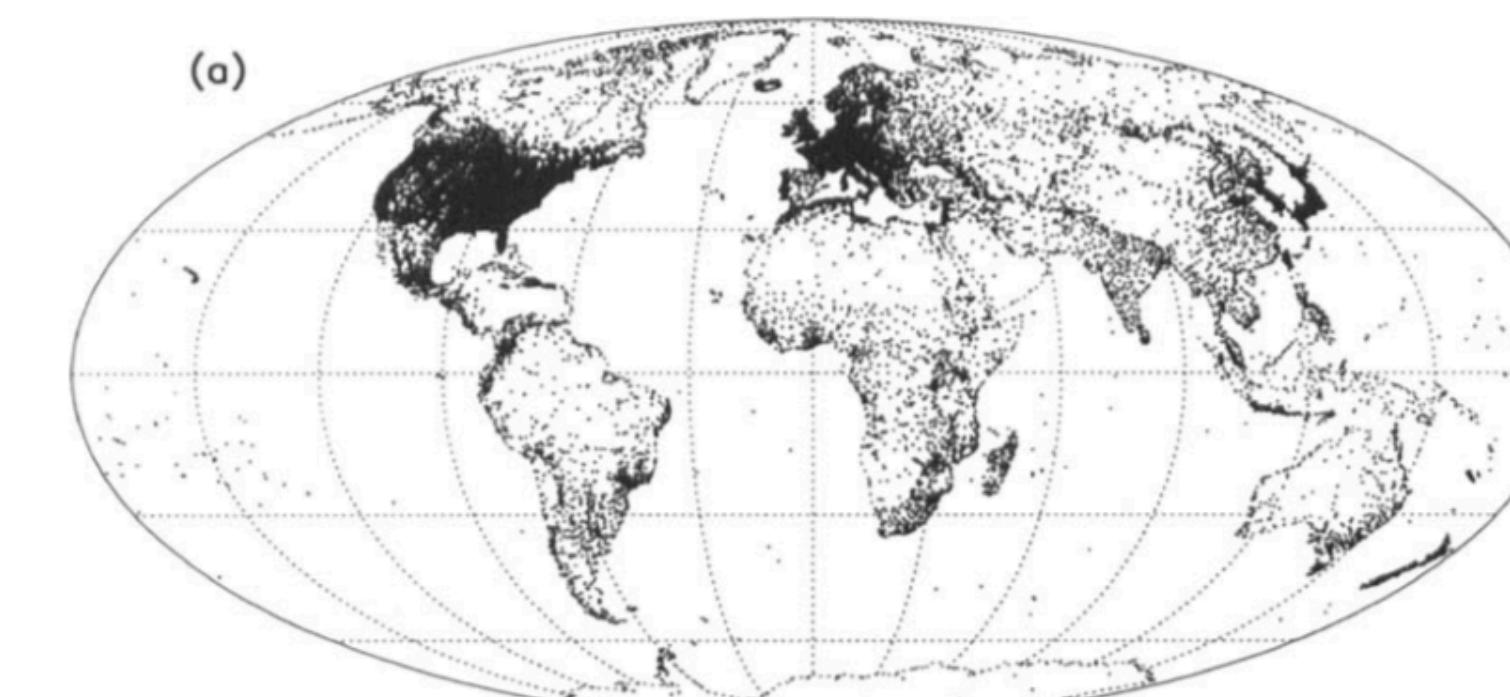
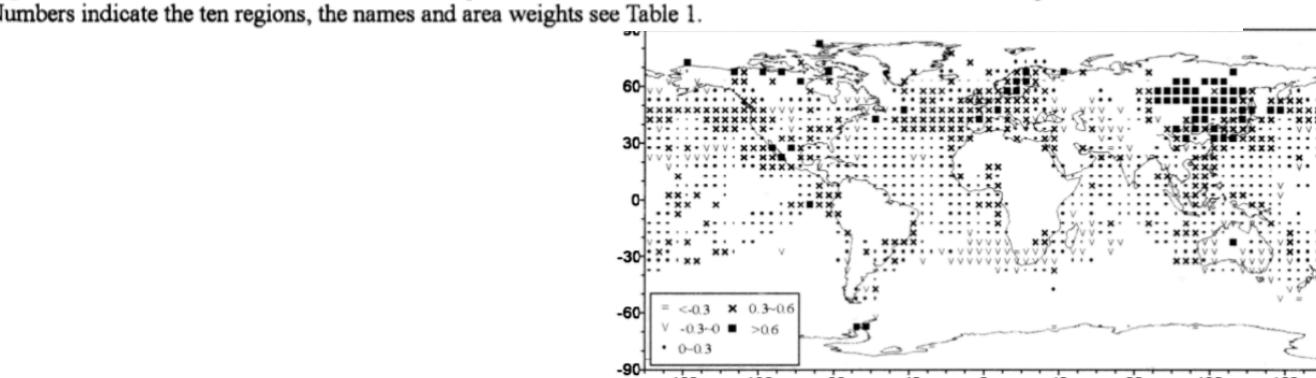


Figure 2(a). Spatial distribution of the 17986 air-temperature stations of Legates and Willmott (1990).

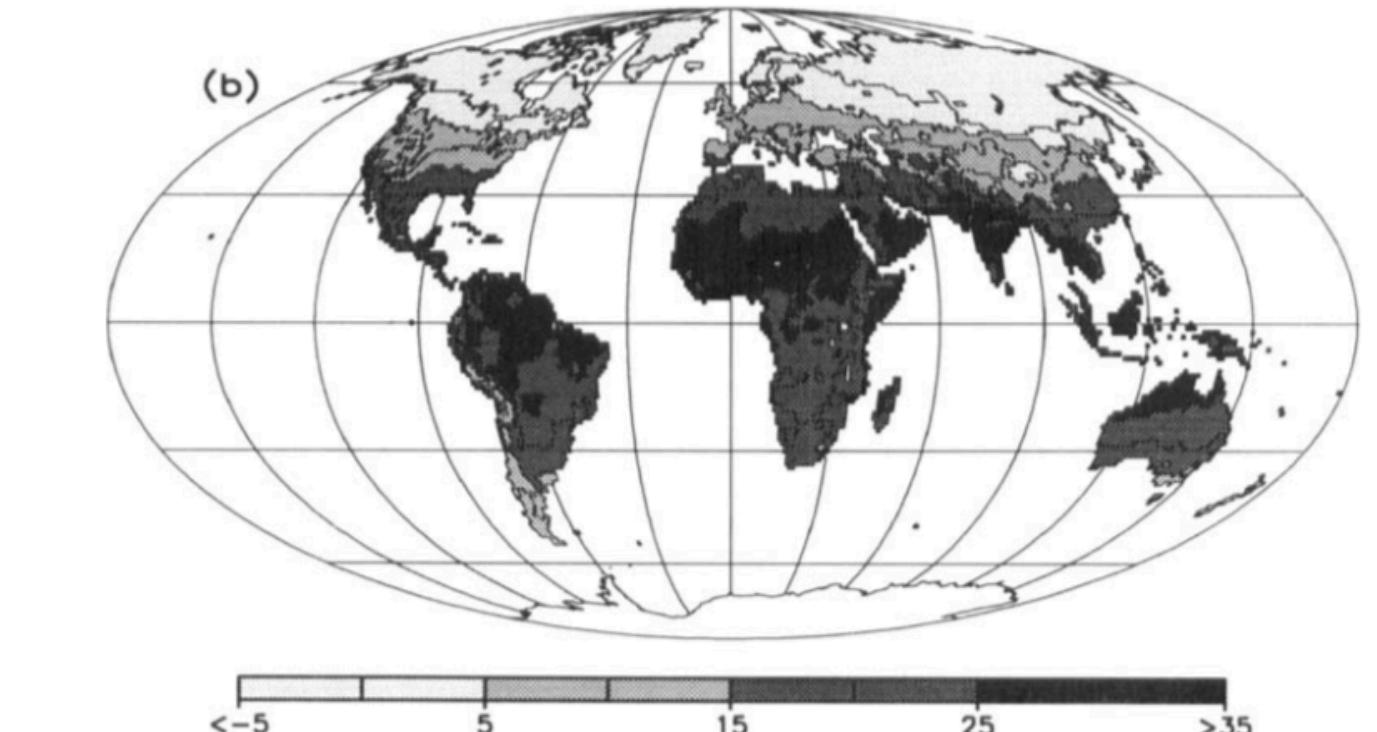


Figure 2(b). Spatial distribution of annual mean temperature ($^{\circ}\text{C}$) from the climatology of Legates and Willmott (1990).

$$w_i = \frac{h_i^{-p}}{\sum_{j=1}^{n_i} h_j^{-p}}$$

p 是一个任意正实数, 通常, $p=2$; \downarrow

h_i 是离散点到插值点的距离; \downarrow

$$h_i = \sqrt{(x - x_i)^2 + (y - y_i)^2}$$

(x, y) 为插值点坐标; \downarrow

(x_i, y_i) 为离散点坐标; \downarrow

$$\hat{T}_i = \bar{T}_i + \sum_{j=1}^{n_i} w_{ij} \delta T_j / \sum_{j=1}^{n_i} w_{ij}$$

由 inverse-distance weighting method (interpolation method) 引申而来。

Where each weight (w_{ij}) is an inverse function of the distance from a sampled location (j) to an upsampled location (i), T_j is an air temperature at nearby station j , and n_i is the number of nearby stations that influence the estimate at location i . \bar{T}_i is Willmott (1985)'s long-term average.

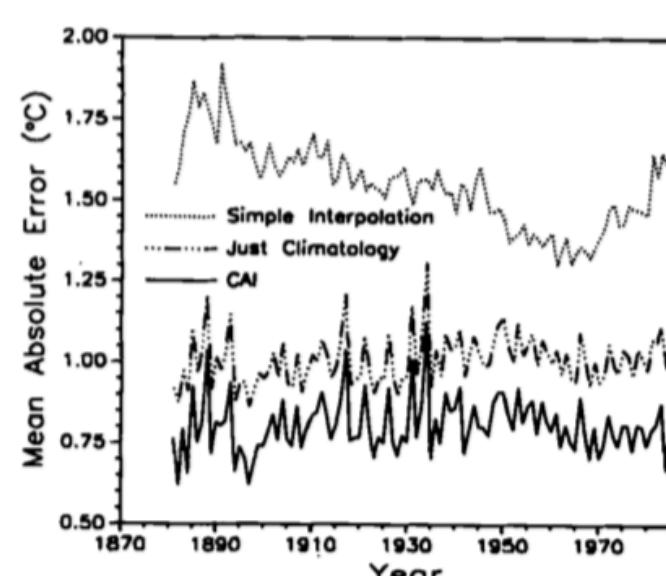


Figure 3. Time series of spatially integrated mean absolute interpolation error (MAE) from cross-validation analyses of (i) Willmott et al.'s (1985) interpolations from Jones et al.'s yearly station data (dotted line), (ii) climatologically aided interpolation (CAI) again interpolating with Willmott et al. (solid line), and (iii) climatology alone (mixed dashed and dotted line).

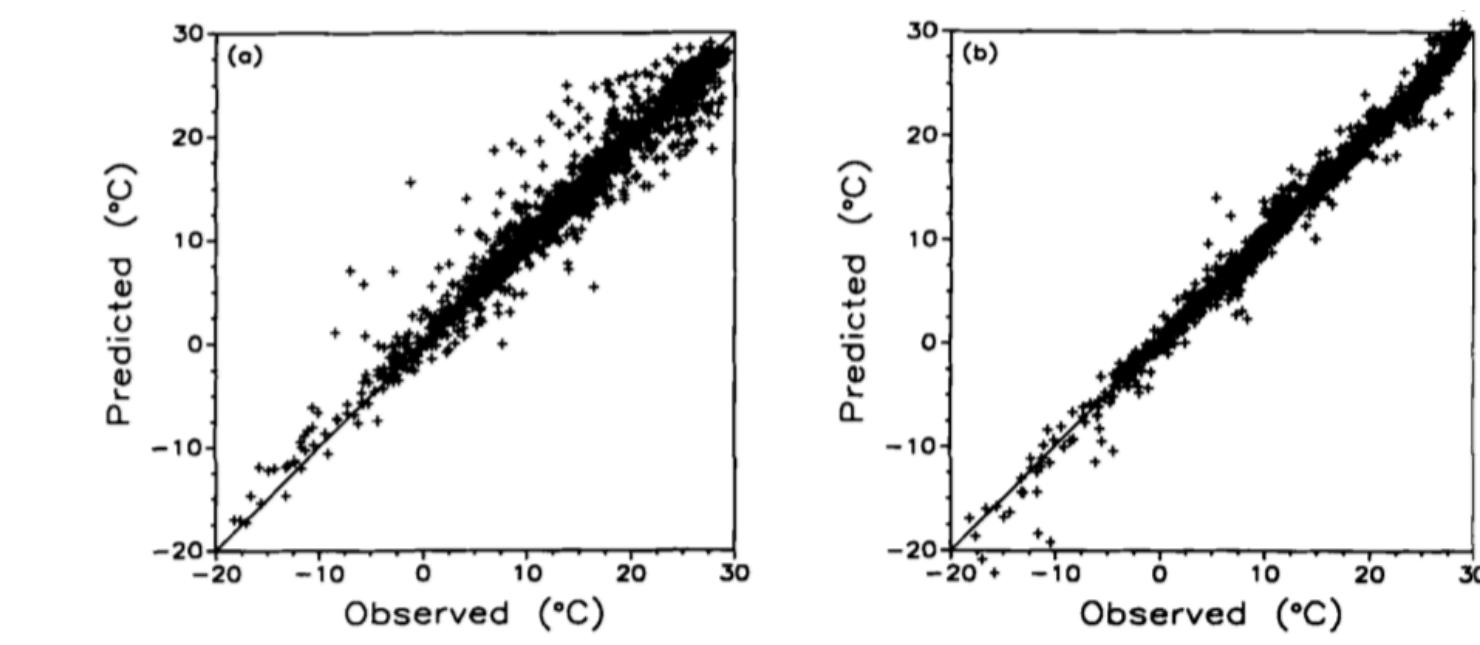


Figure 4. Scatter plots of observed air temperature versus cross-validation estimates for 1962 using (a) Willmott et al.'s algorithm with the yearly station data only and (b) climatologically aided interpolation (CAI).

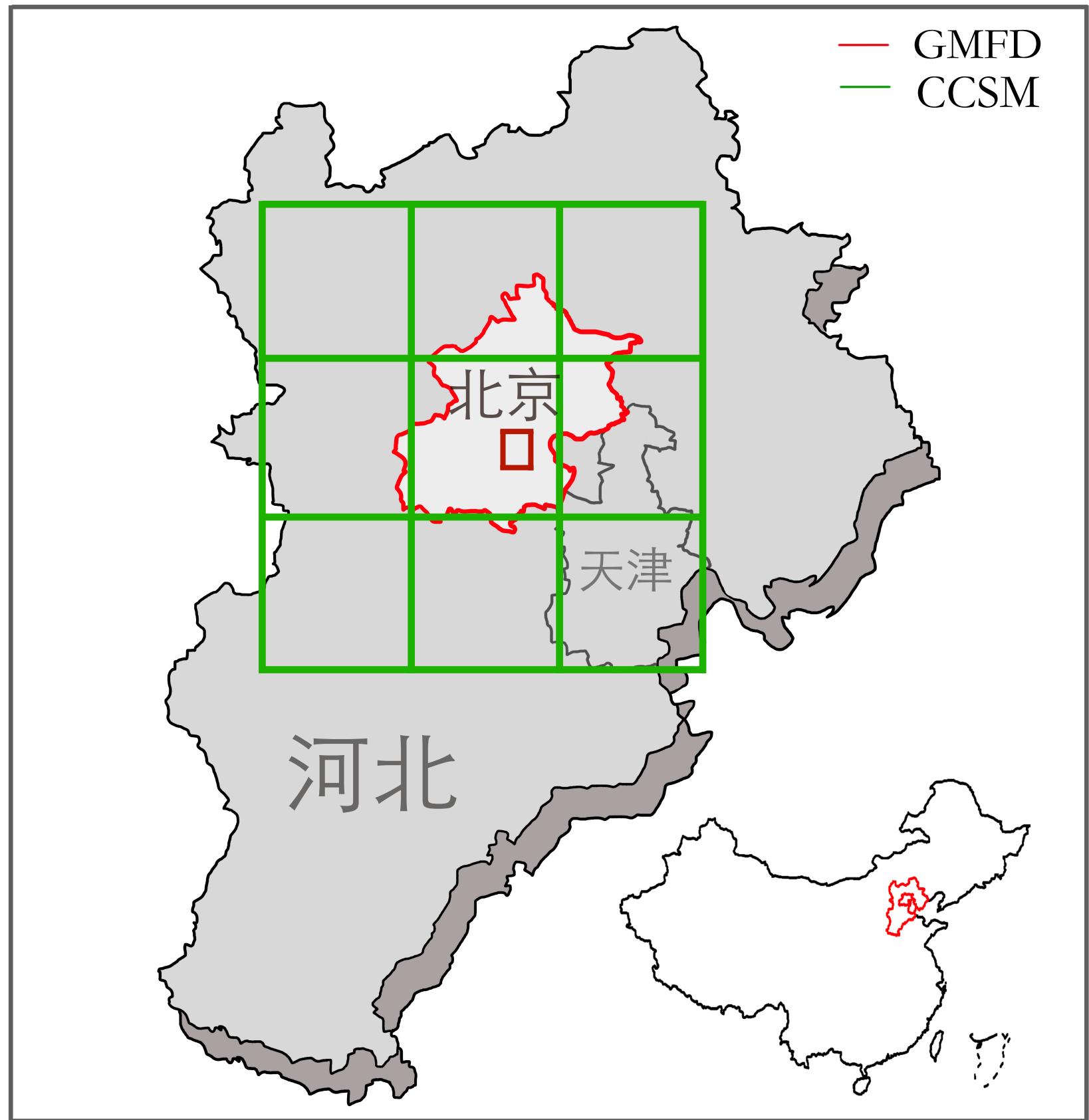


图1

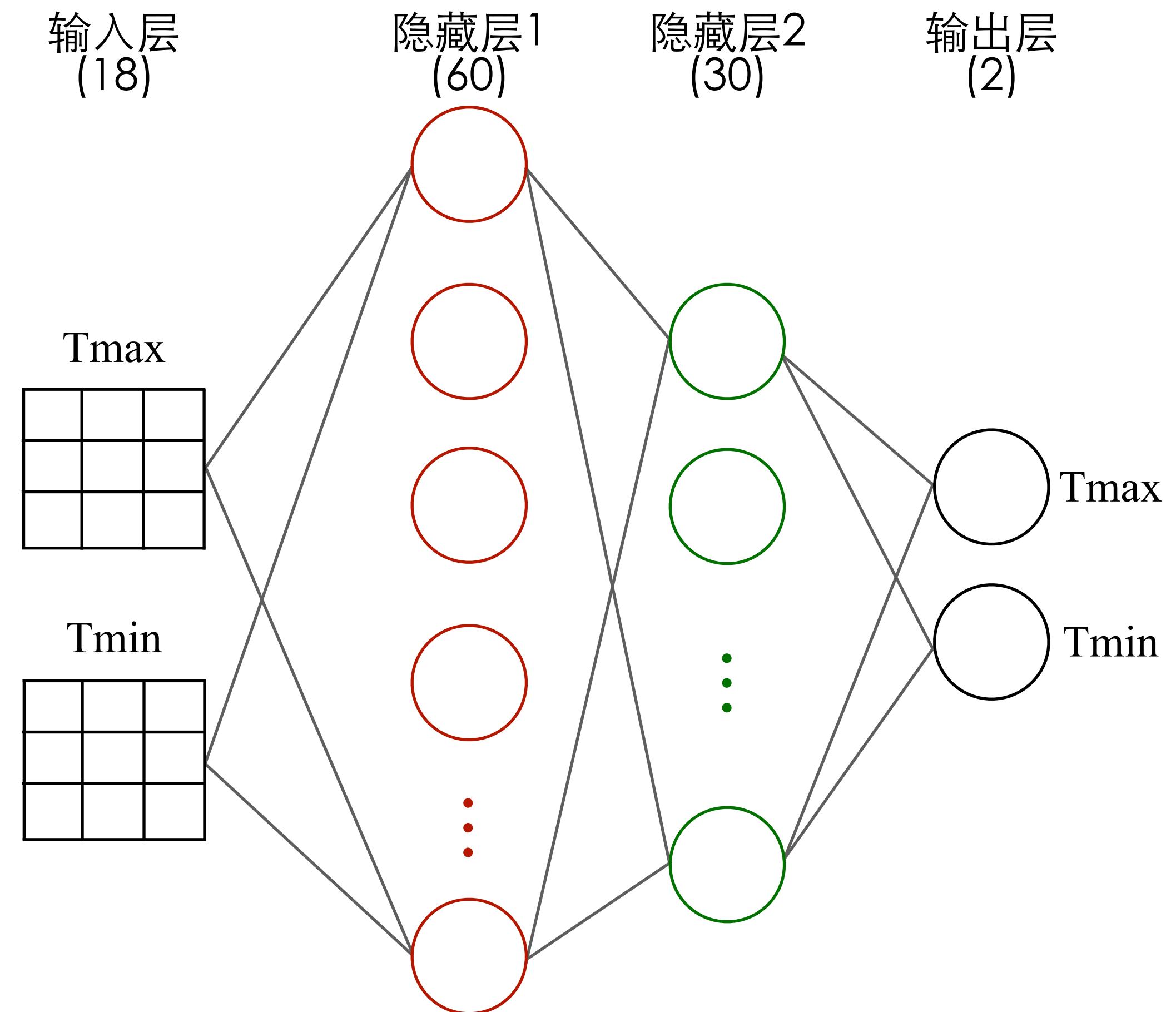


图2

讨论

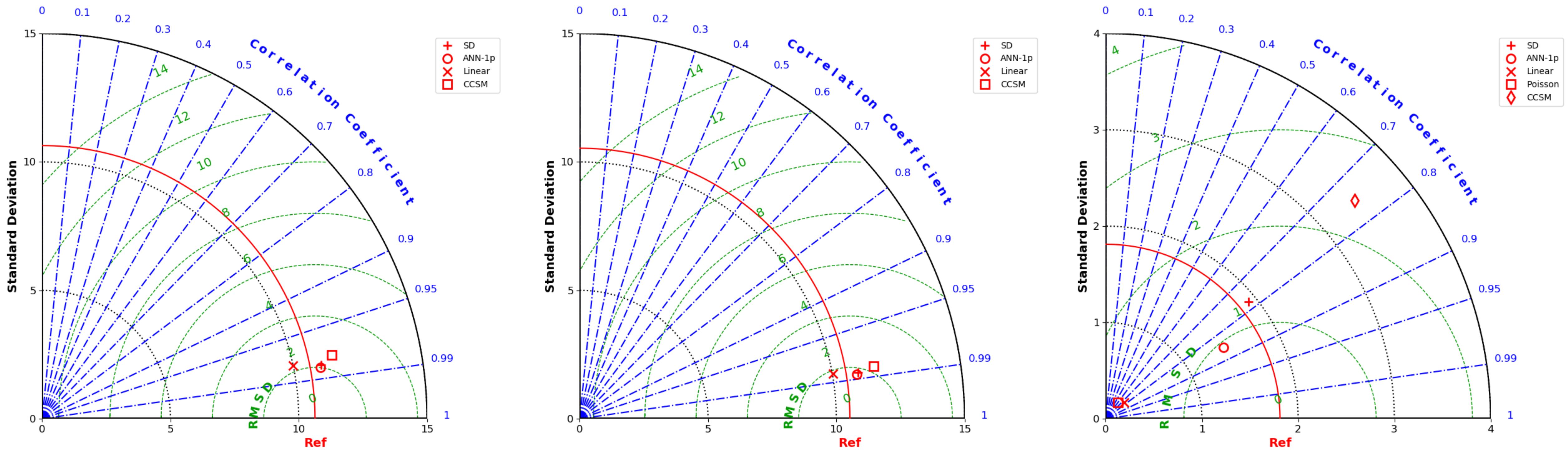


图3

表1

Train

	Tmax			Tmin			Pr		
	Obs	CCSM	SD	Obs	CCSM	SD	Obs	CCSM	SD
Mean	25.05	24.56	25.25	-13.79	-16.38	-13.62	3.66	4.64	3.67
StdDev	0.43	0.73	0.66	1.10	1.12	0.86	0.33	0.47	0.42
RMSE		0.91	0.73		2.98	1.28		1.17	0.59

表2

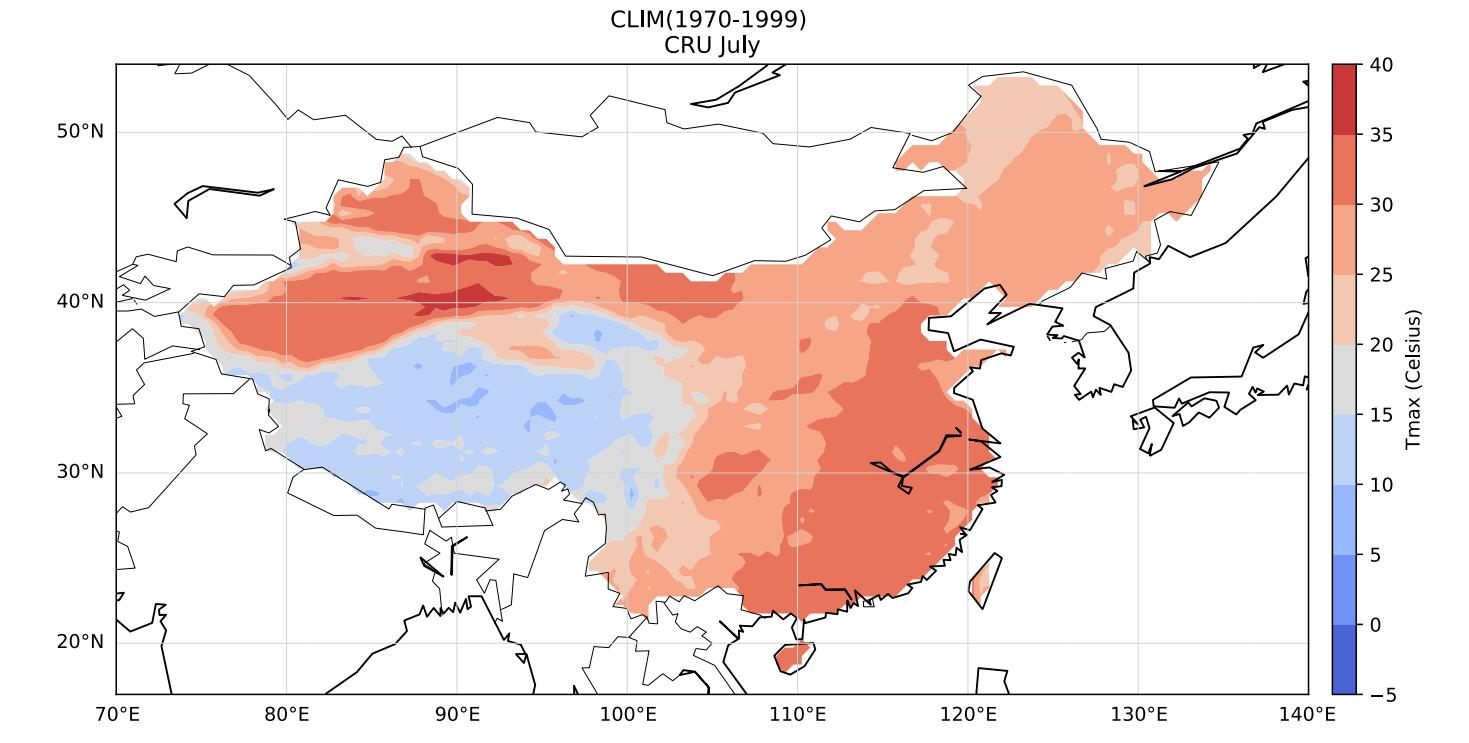
Validation

	Tmax			Tmin			Pr		
	Obs	CCSM	SD	Obs	CCSM	SD	Obs	CCSM	SD
Mean	25.17	24.52	25.21	-13.89	-16.17	-13.70	3.69	4.68	3.74
StdDev	0.56	0.69	0.59	0.85	0.88	0.71	0.22	0.40	0.34
RMSE		0.89	0.55		2.49	1.01		1.09	0.44

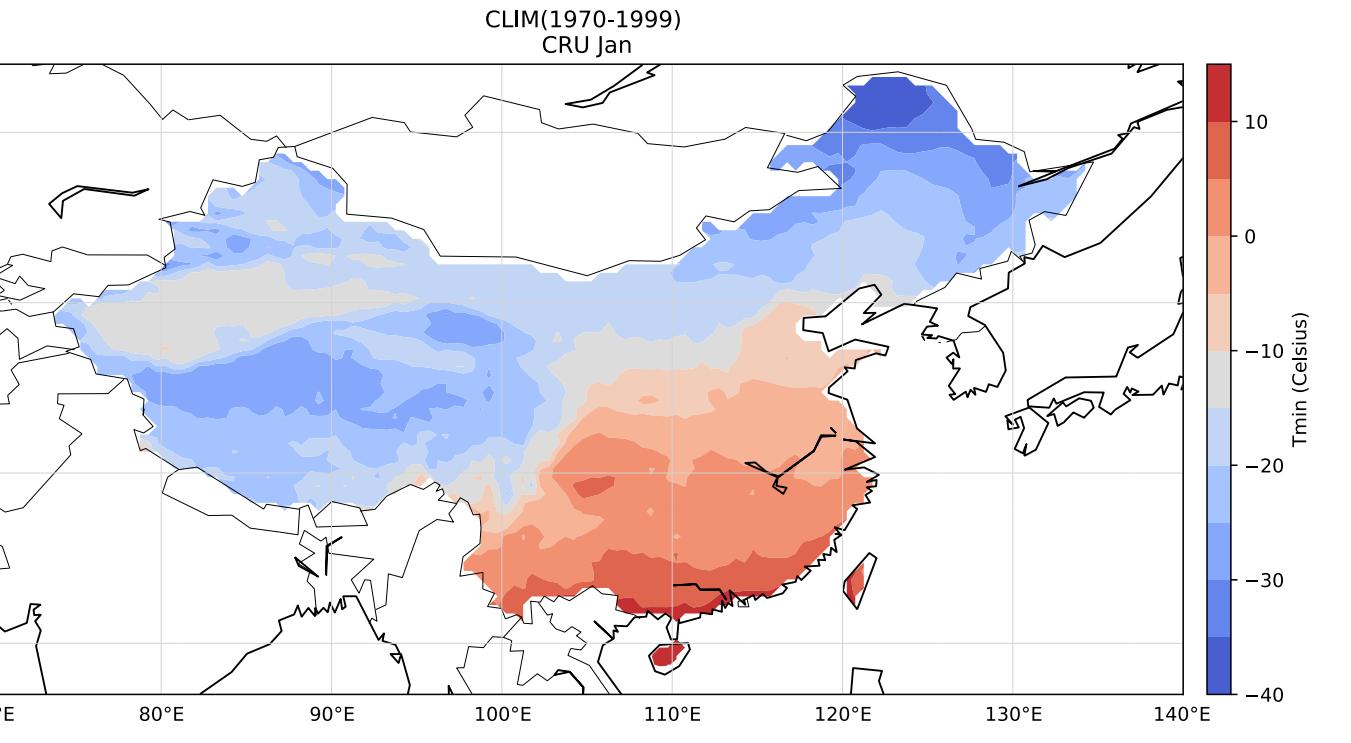
图4

Tmax

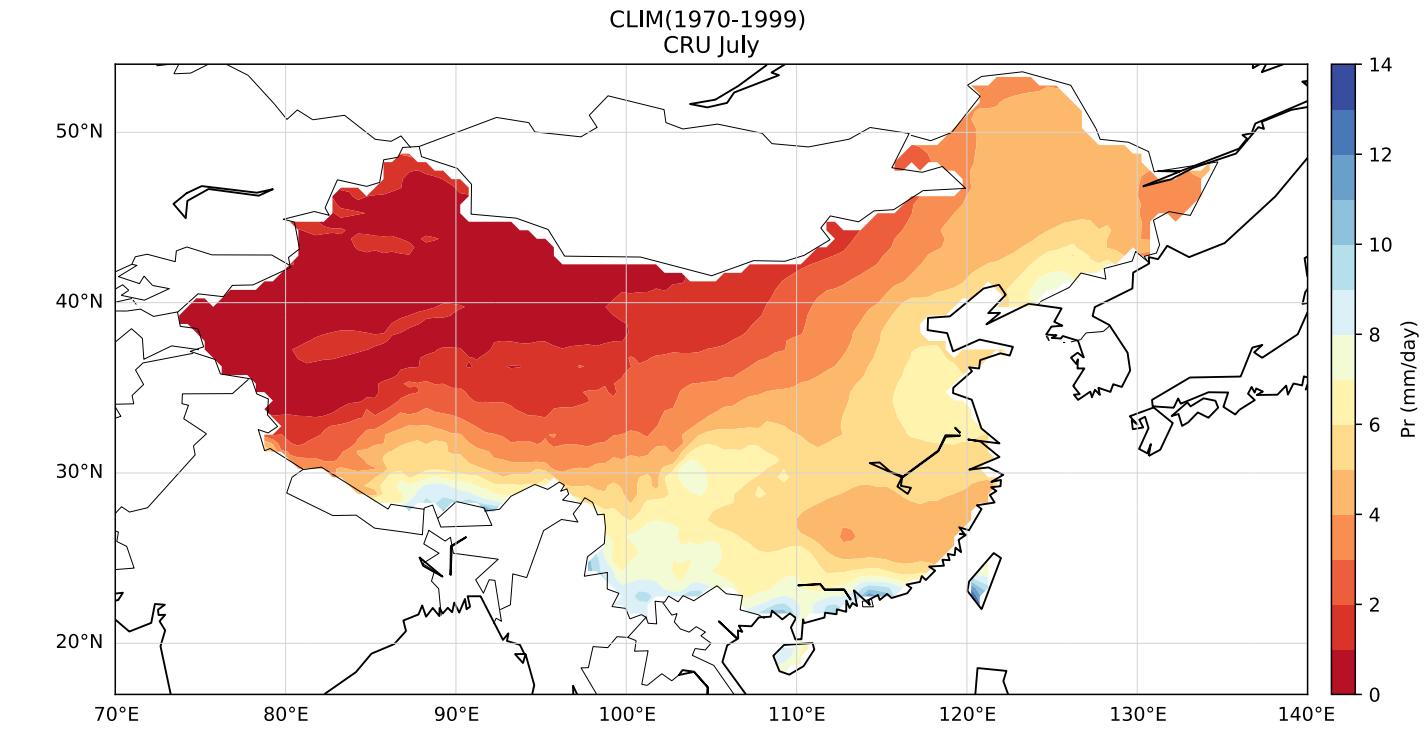
CRU



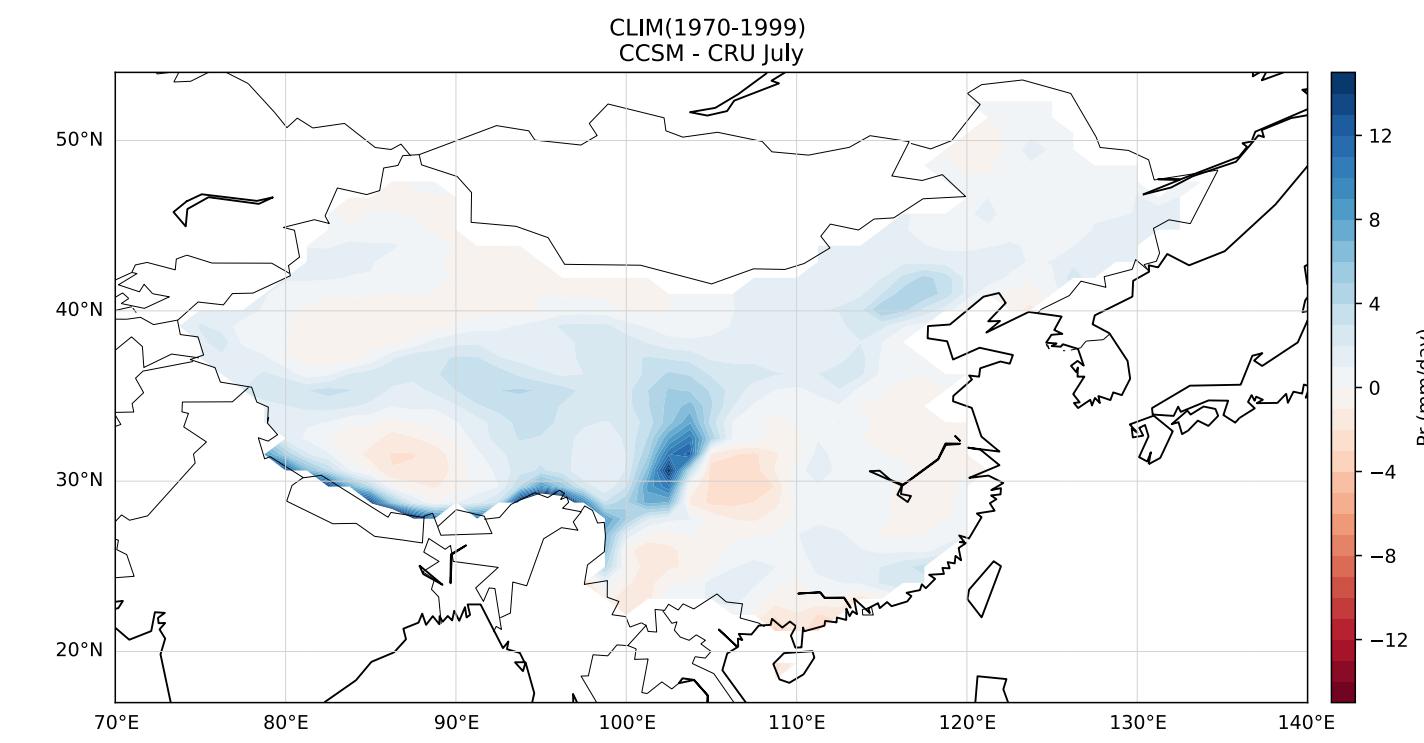
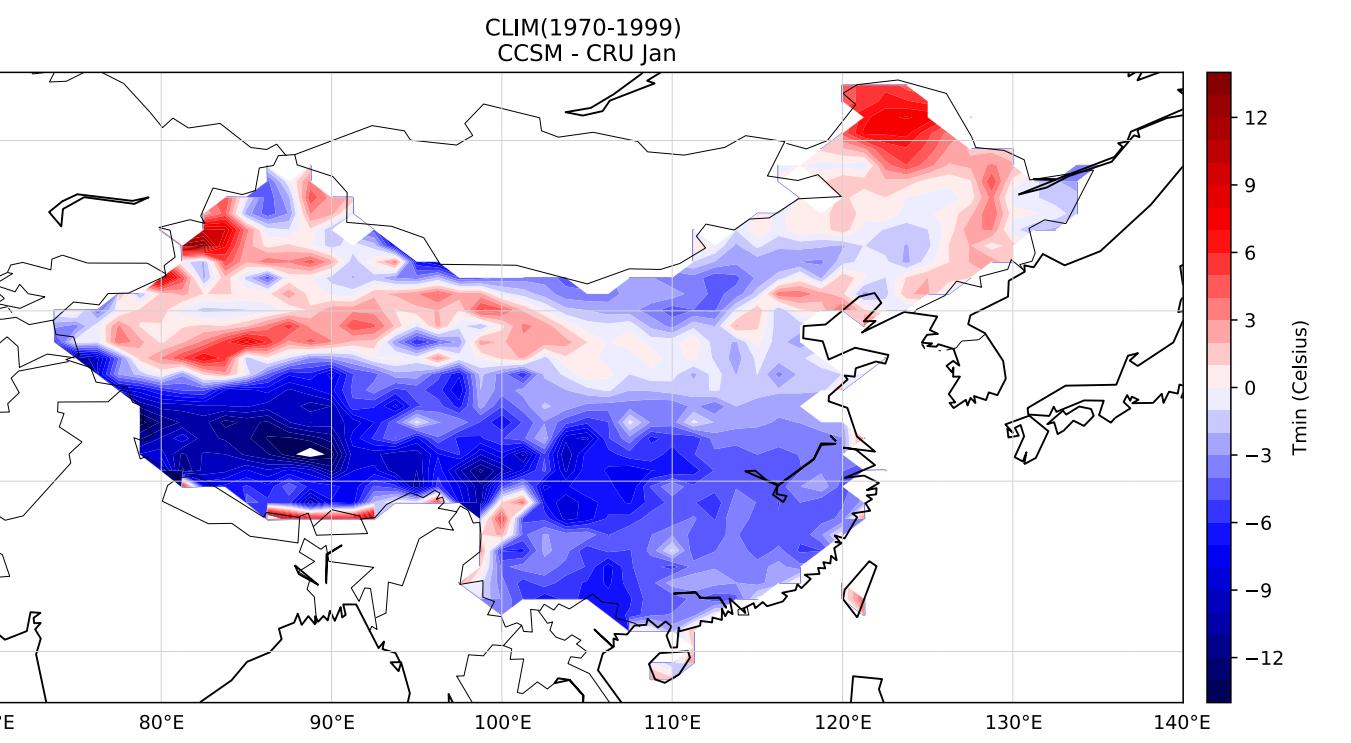
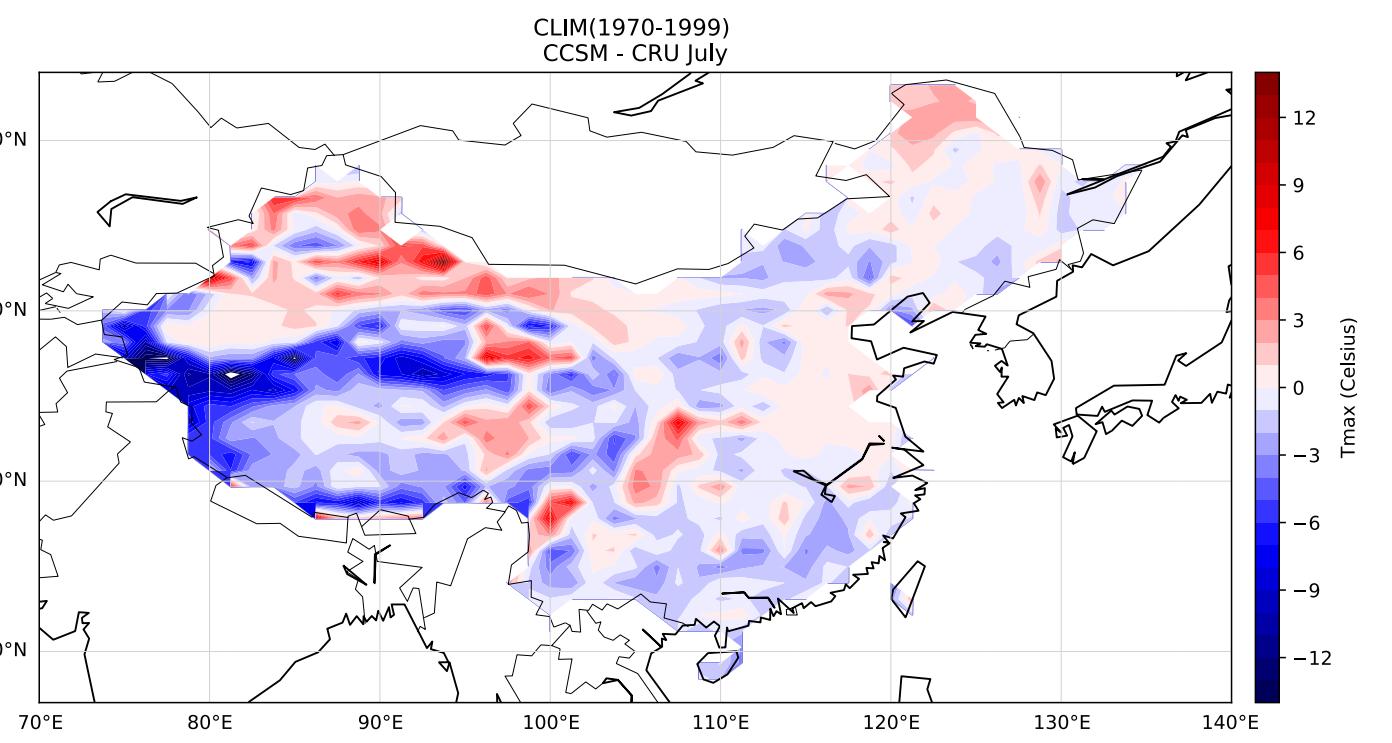
Tmin



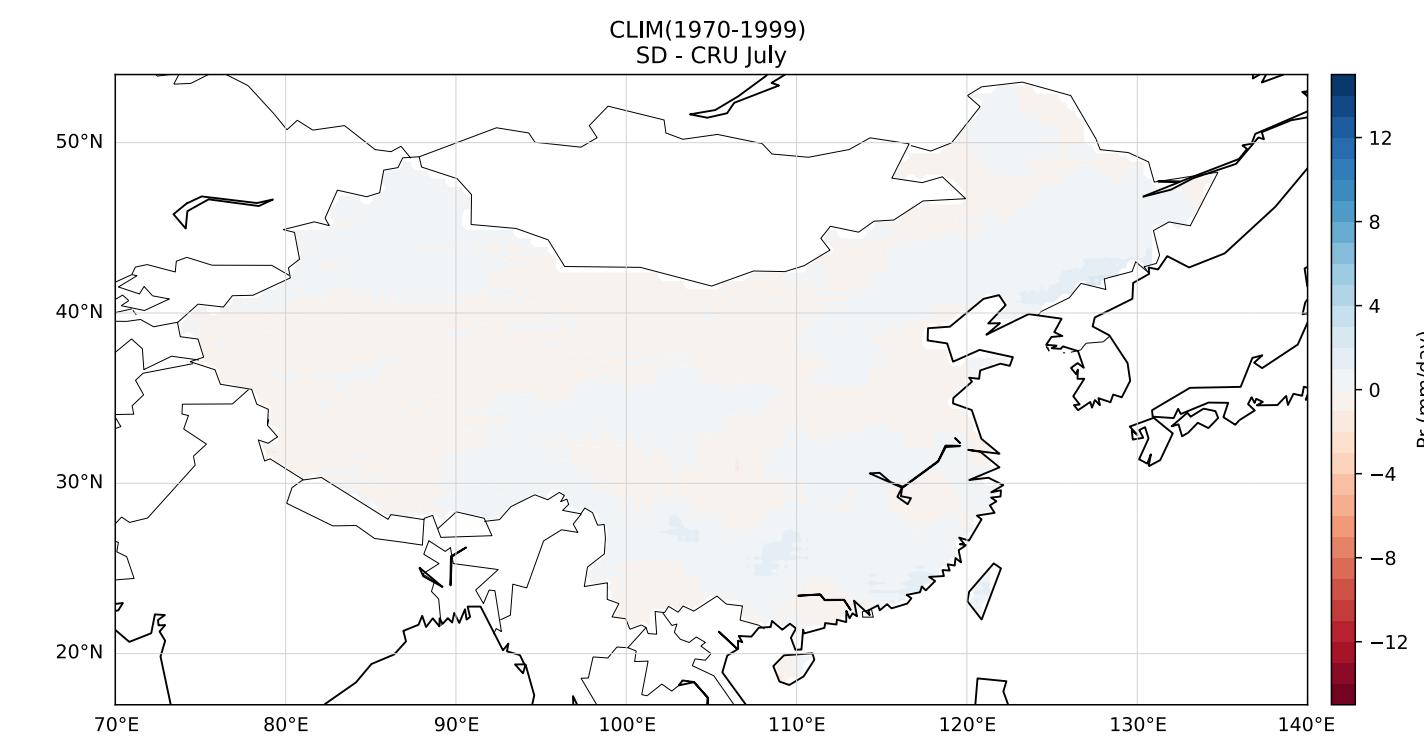
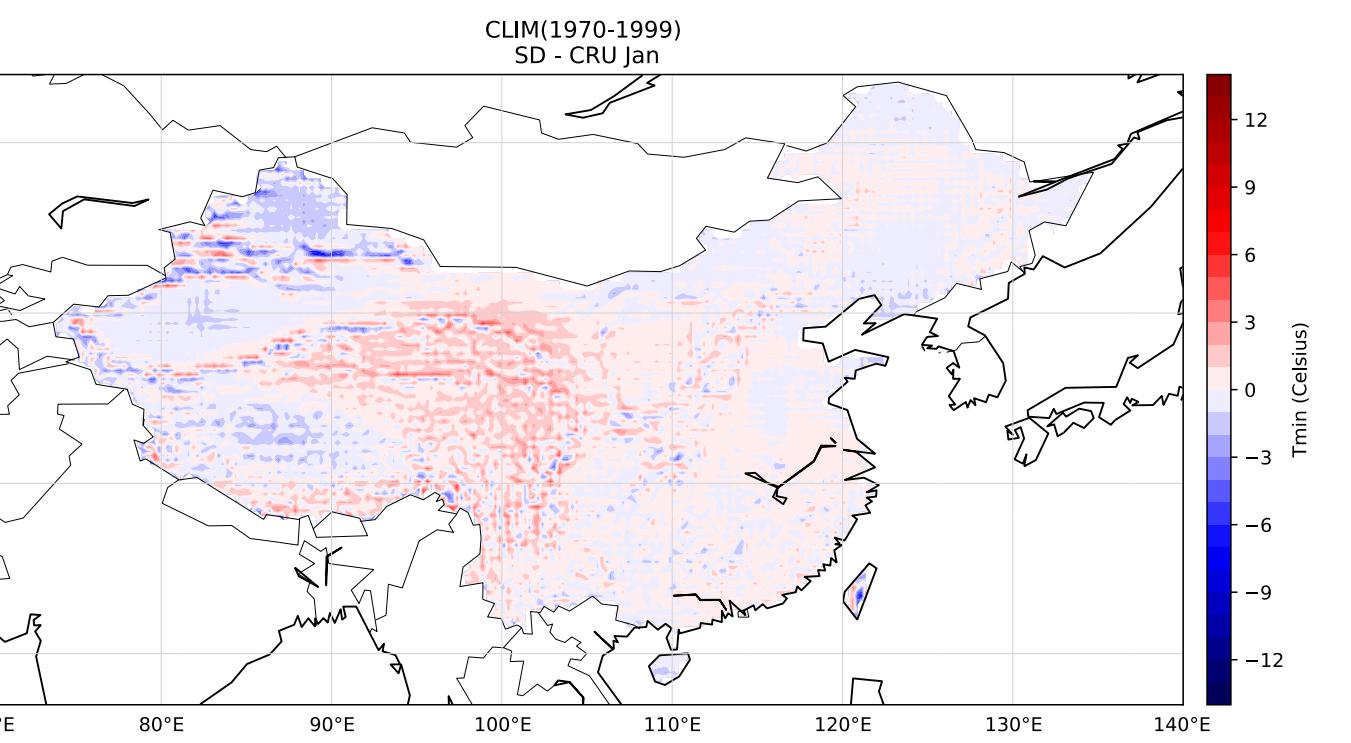
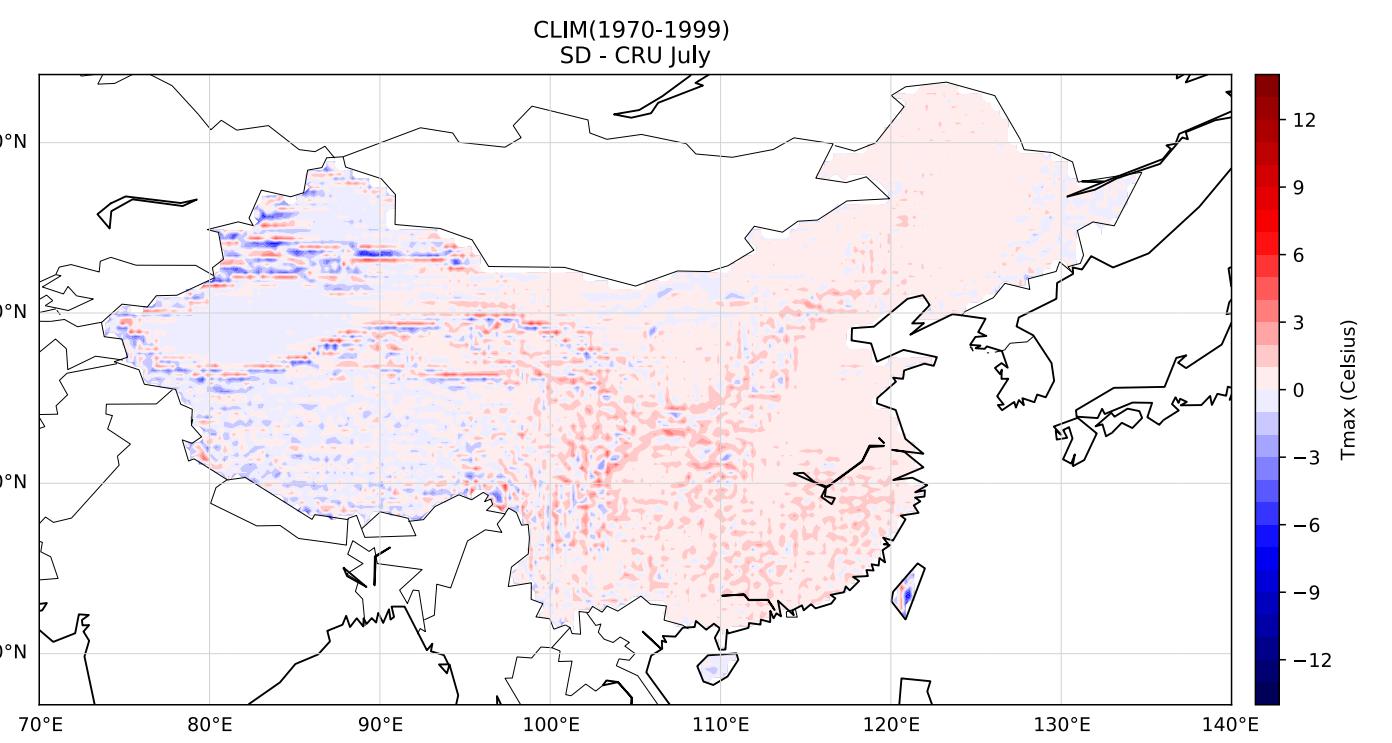
Pr



CCSM - CRU



SD - CRU



讨论

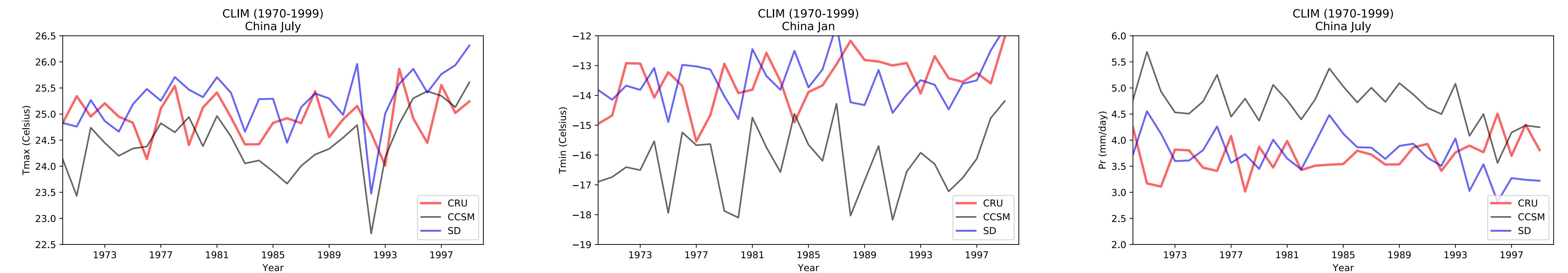


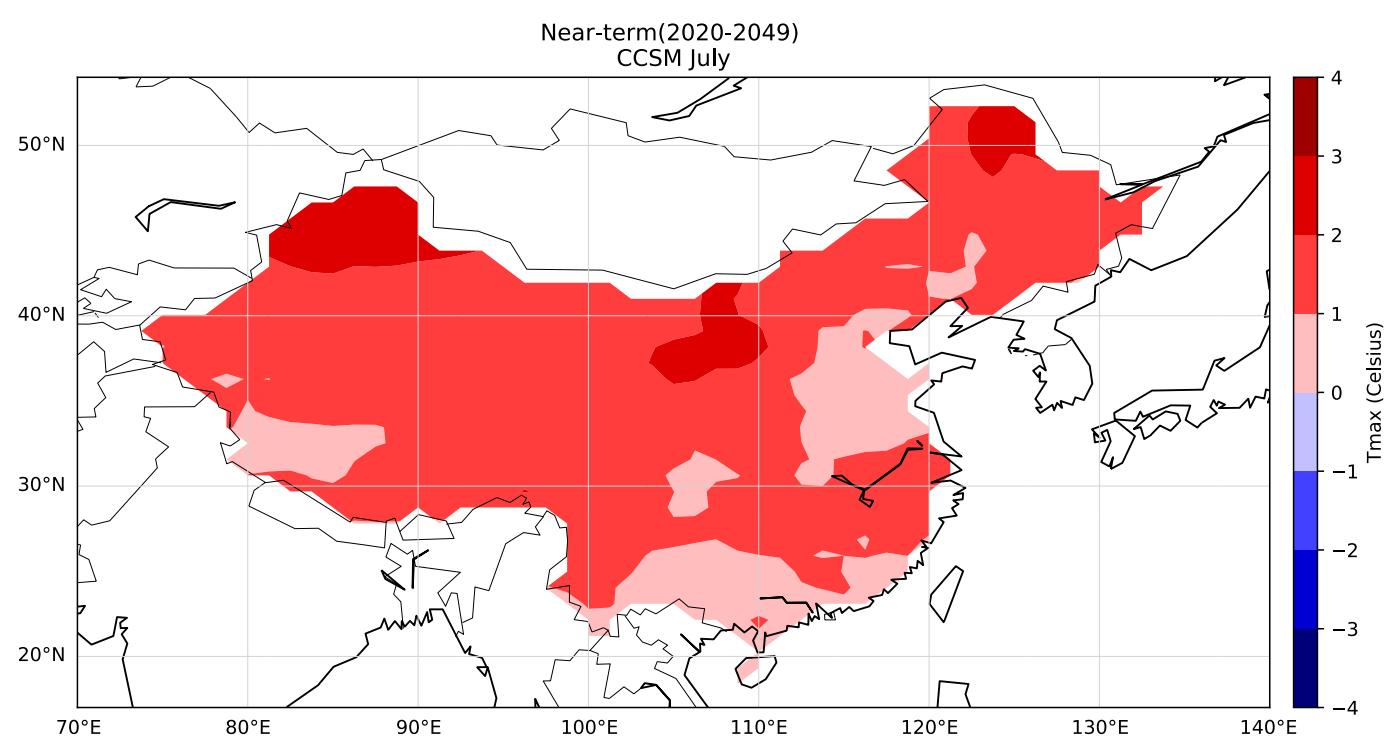
图5

图6

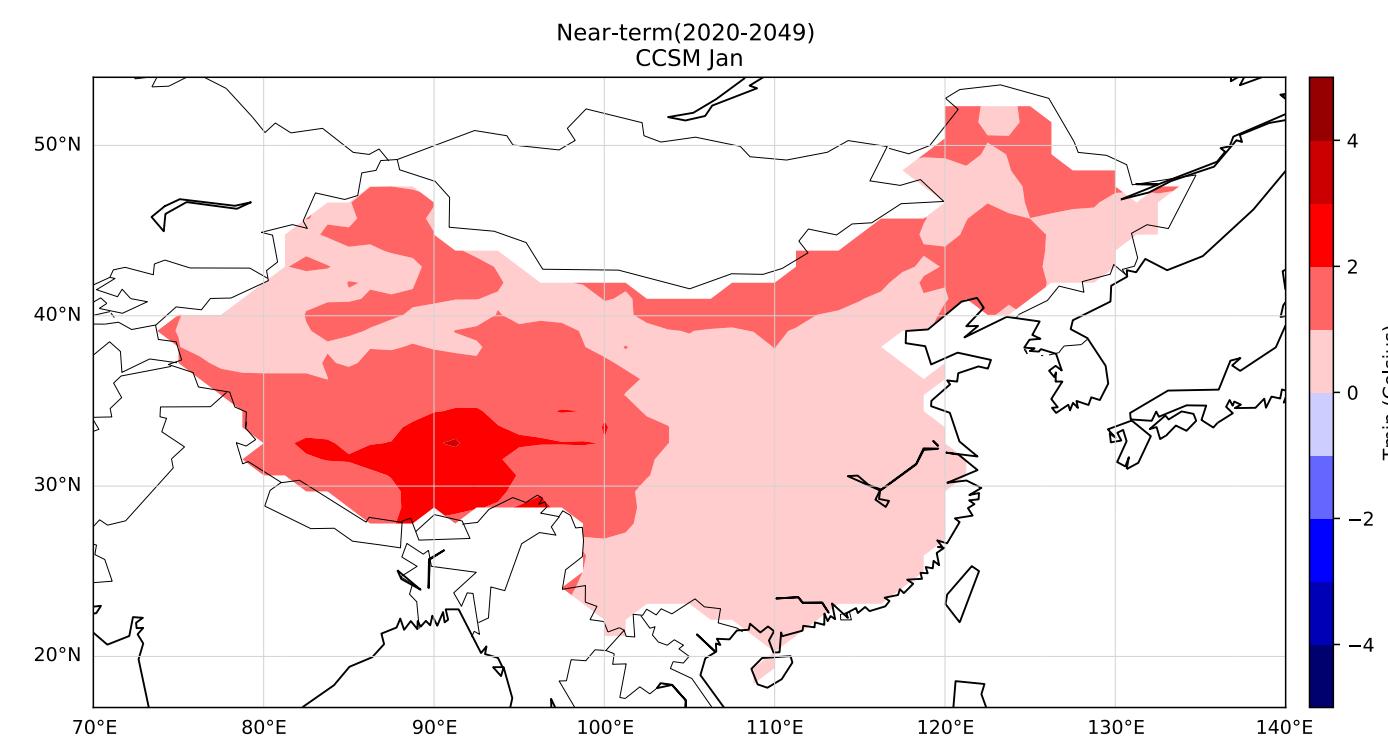
Near-term, RCP2.6

CCSM

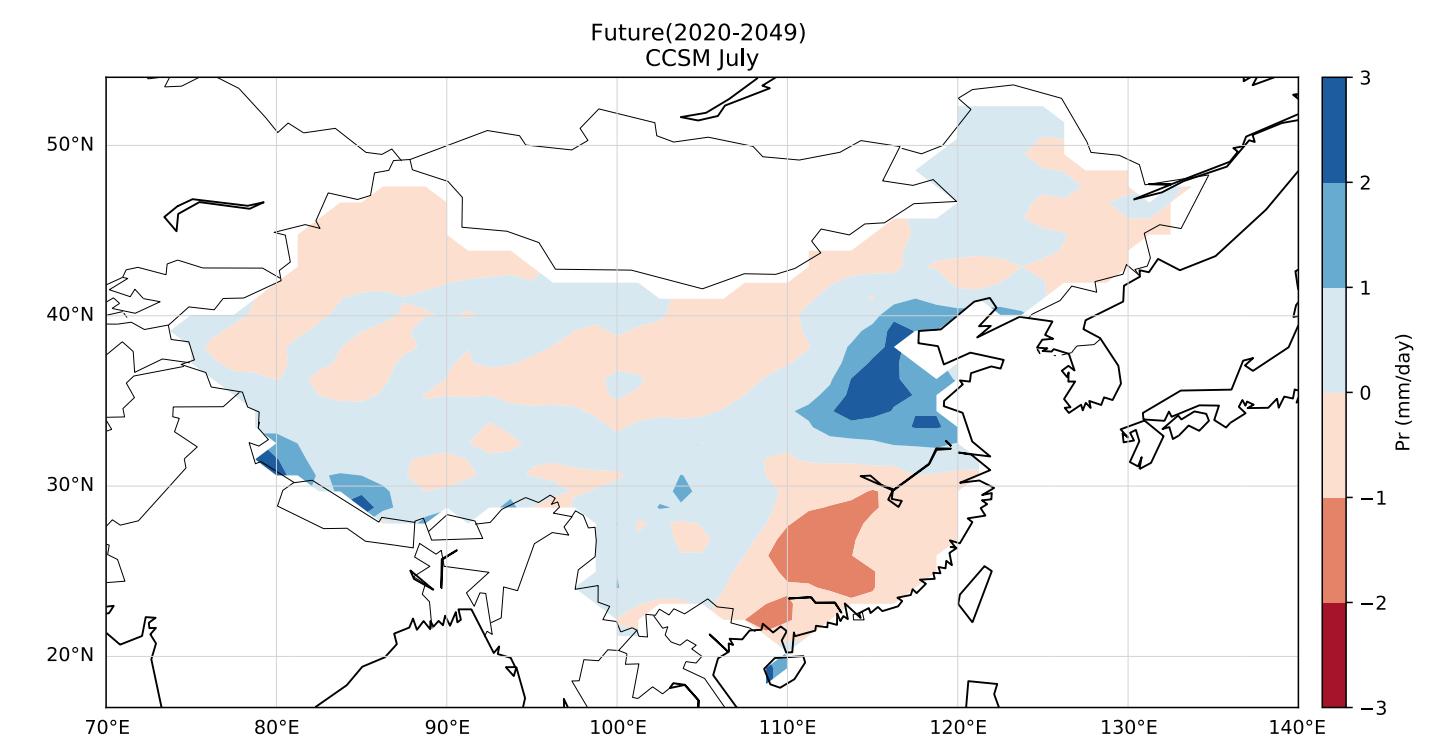
Tmax



Tmin



Pr



SD

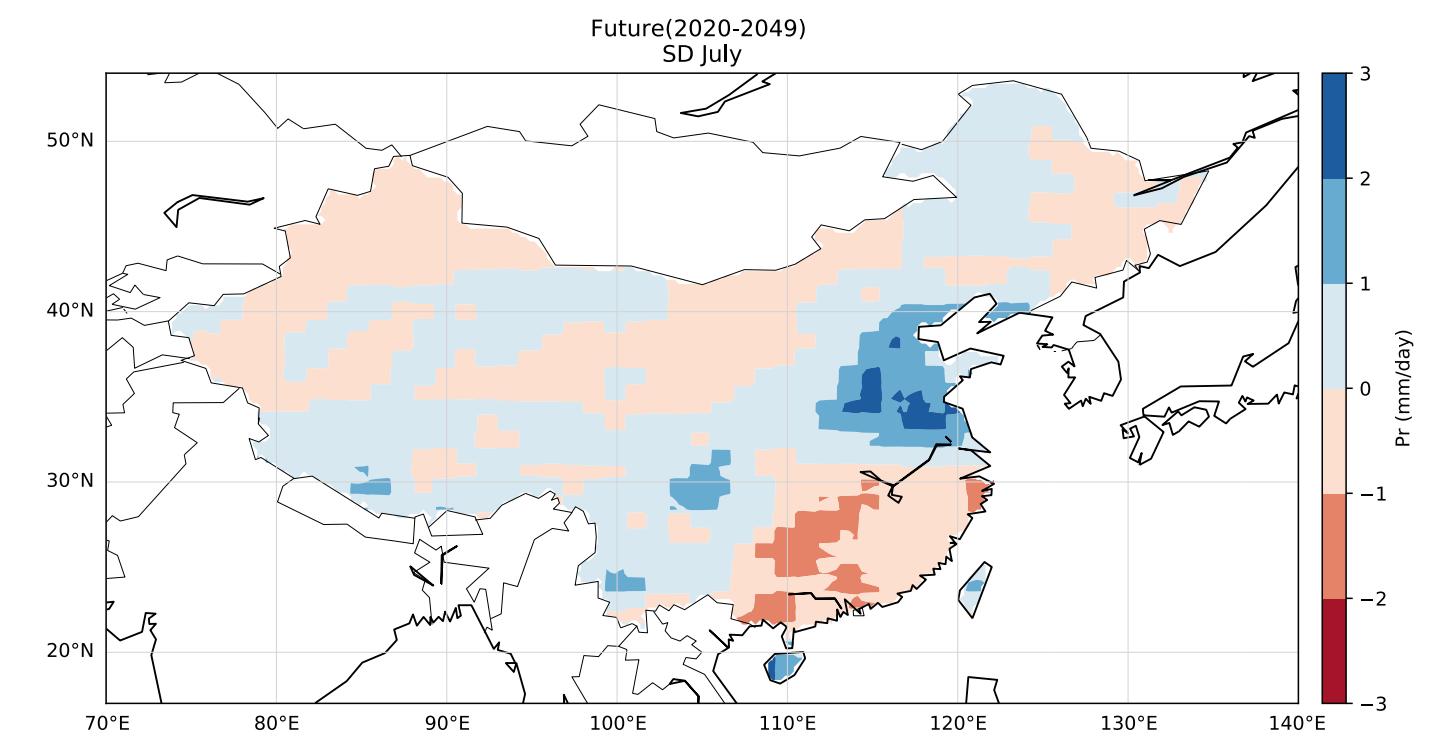
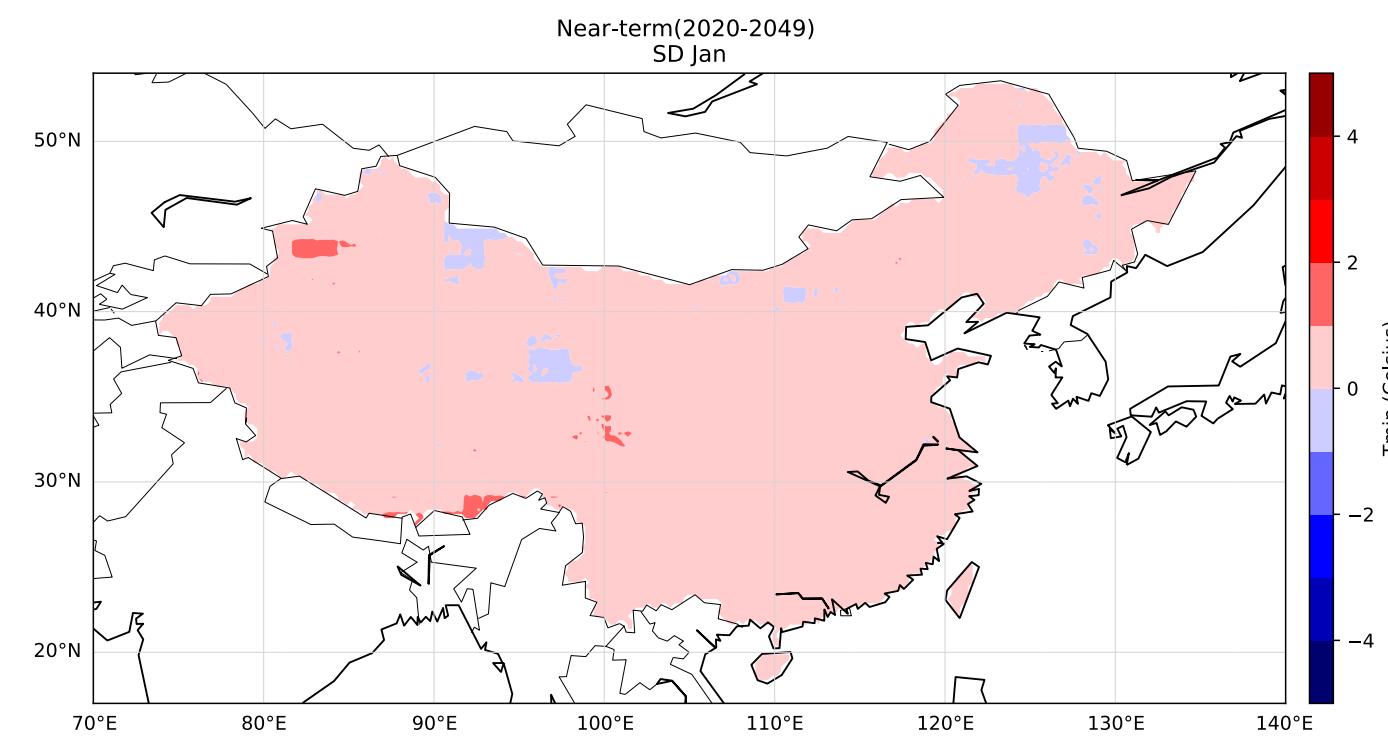
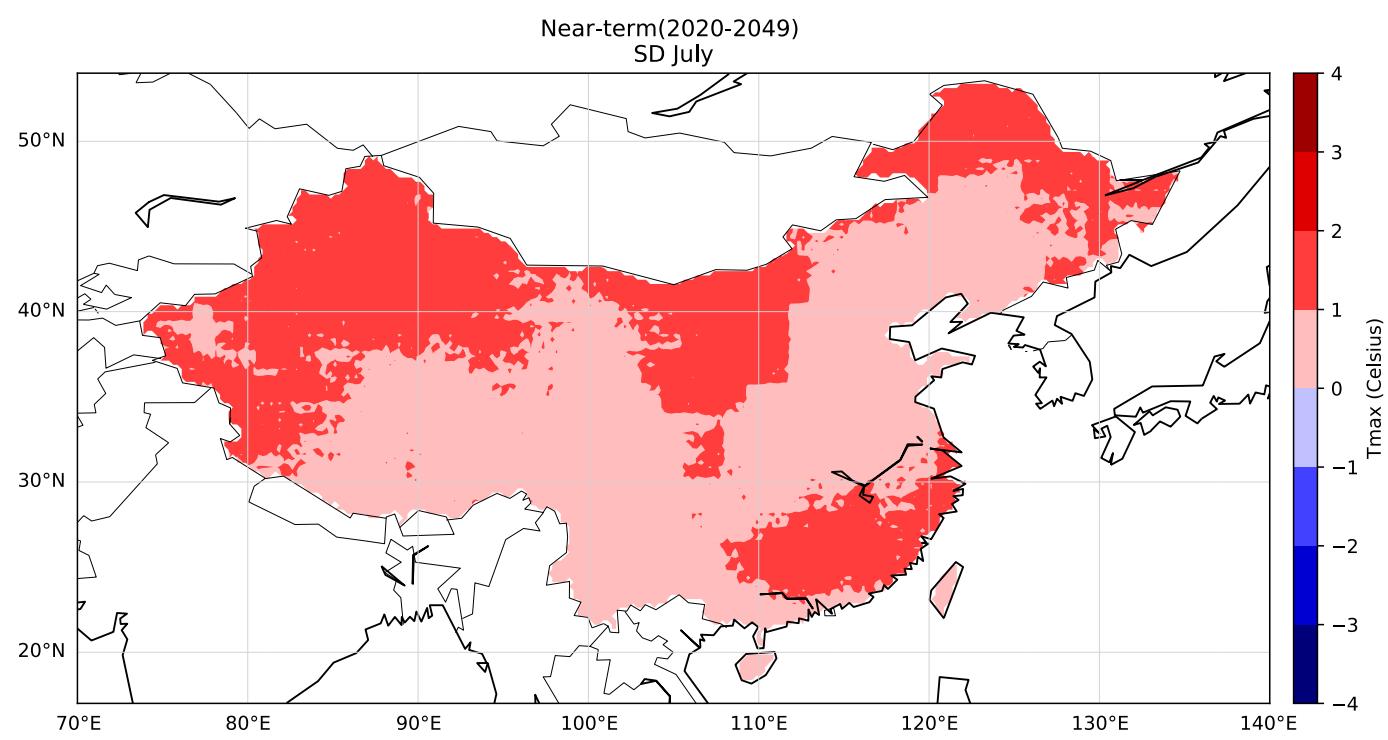
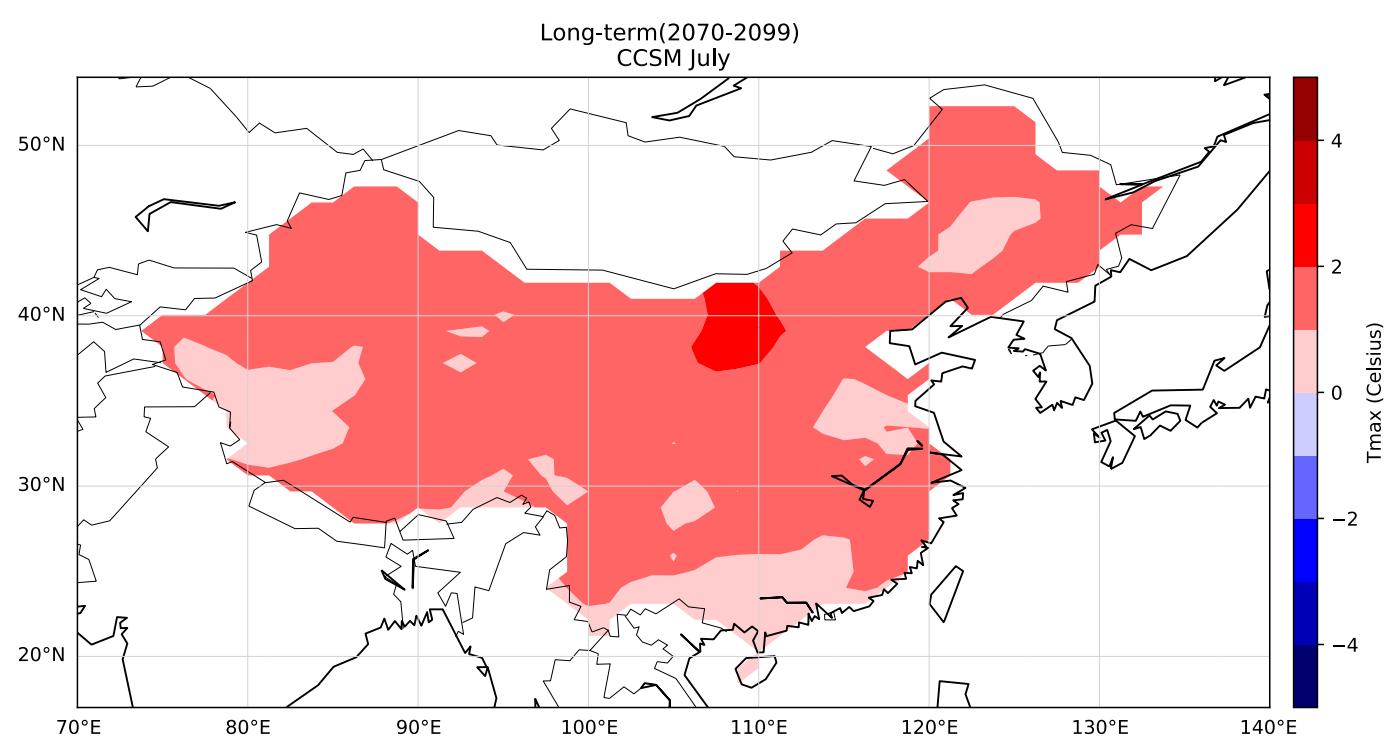


图7

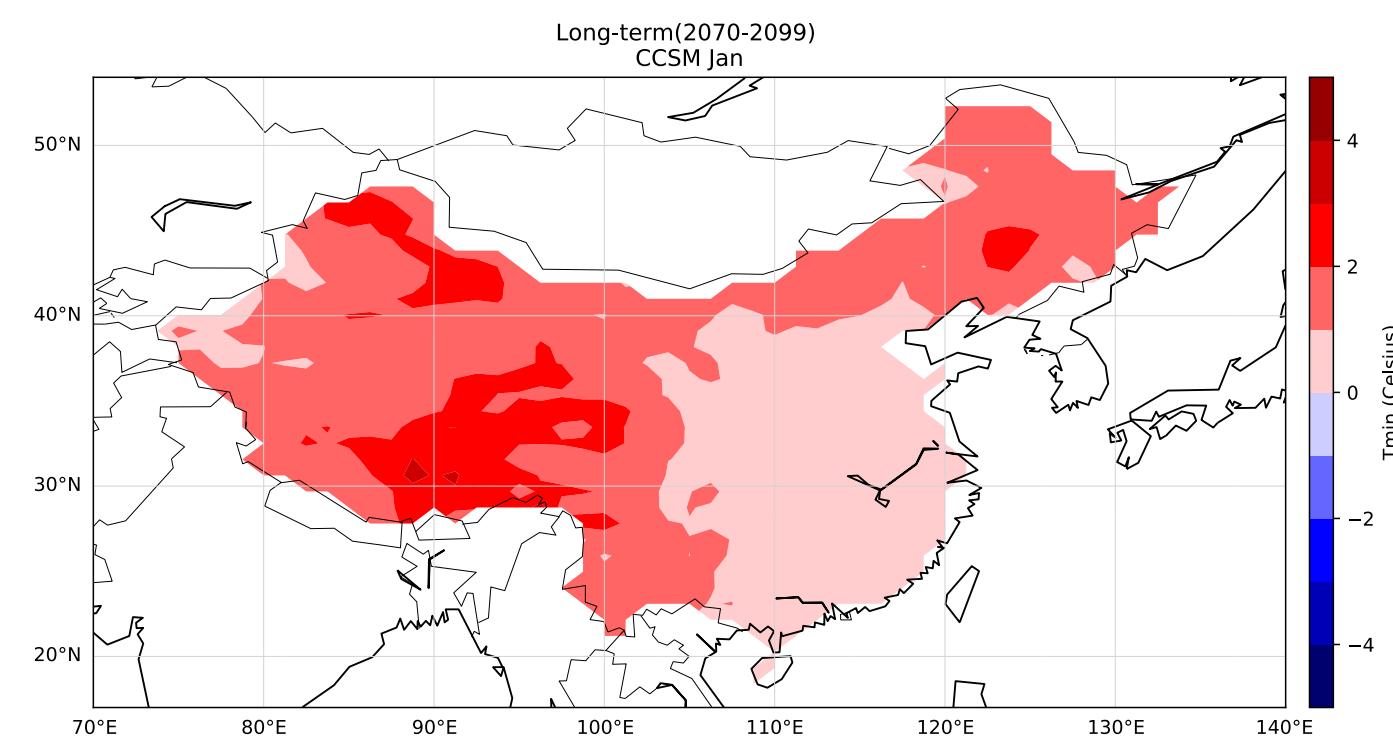
Long-term, RCP2.6

CCSM

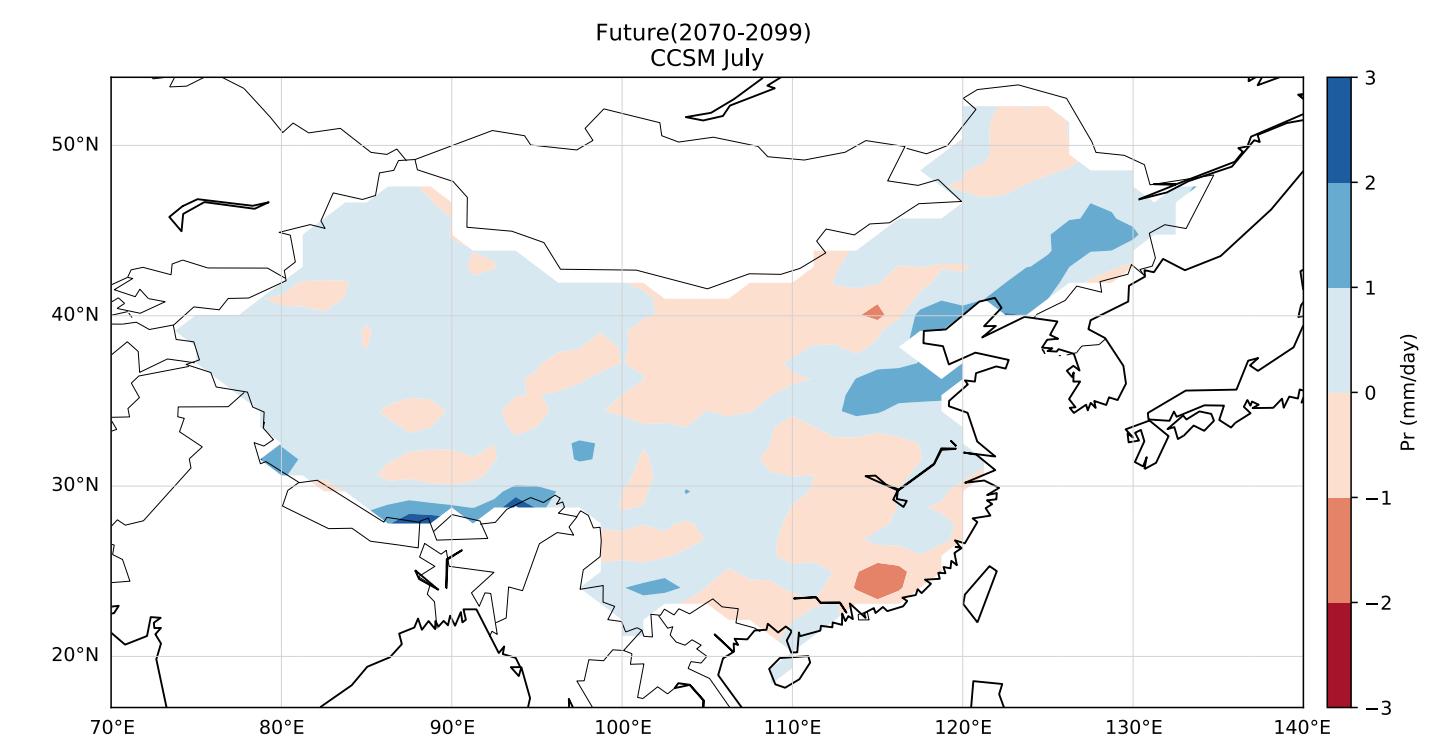
Tmax



Tmin



Pr



SD

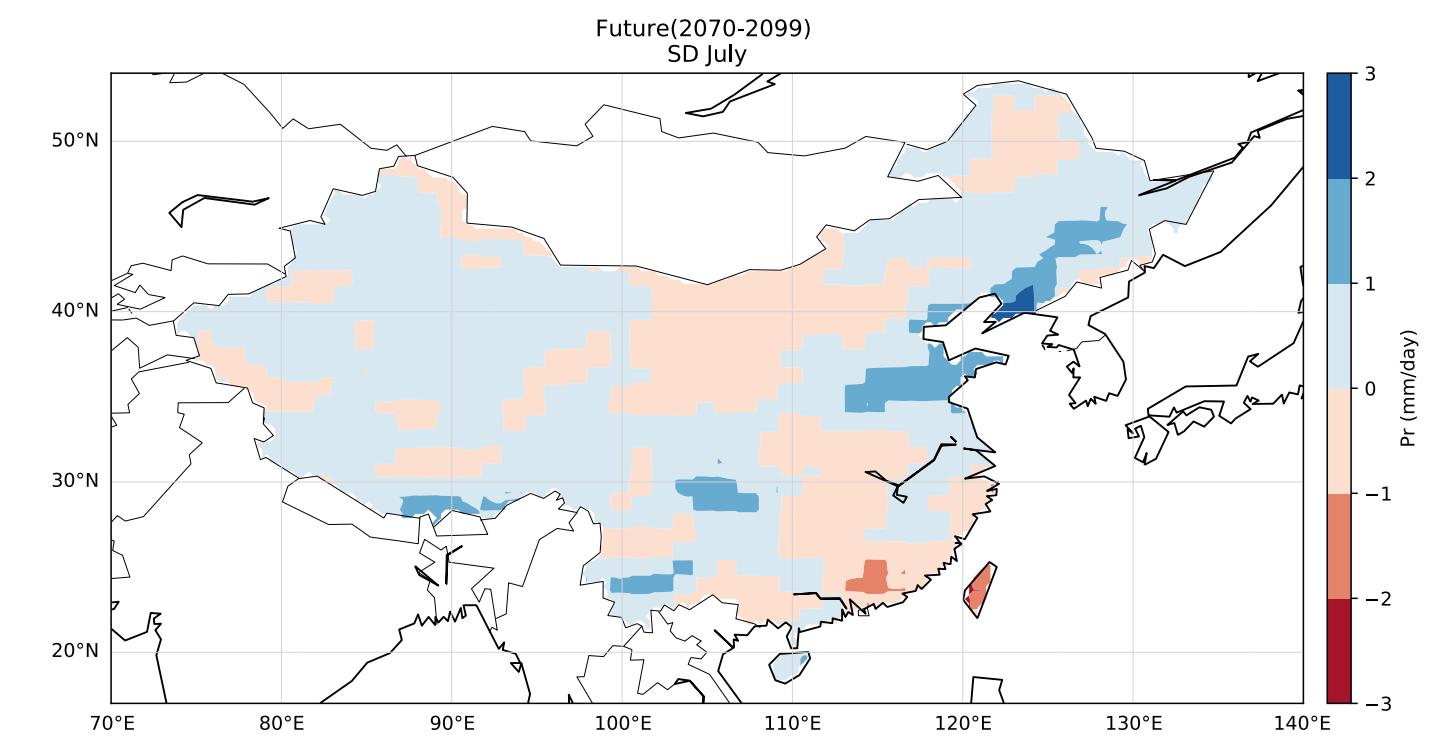
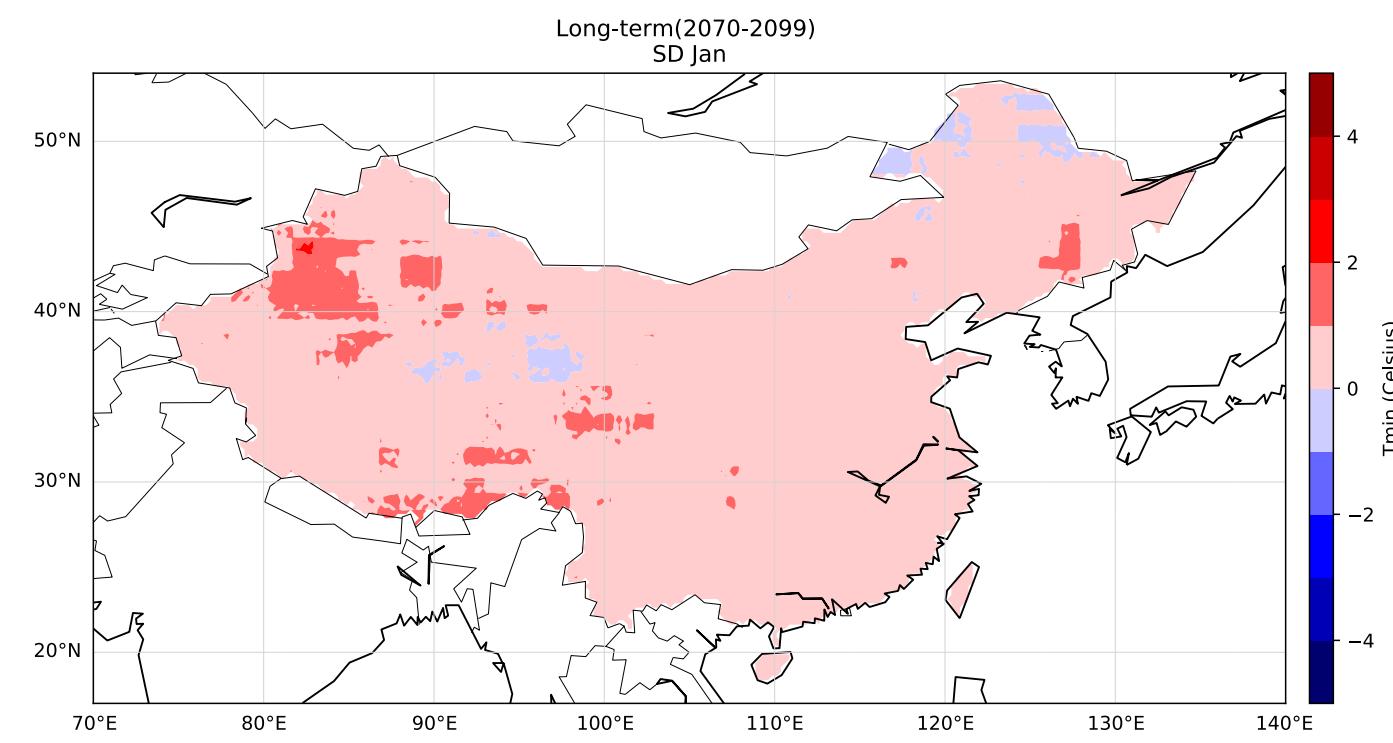
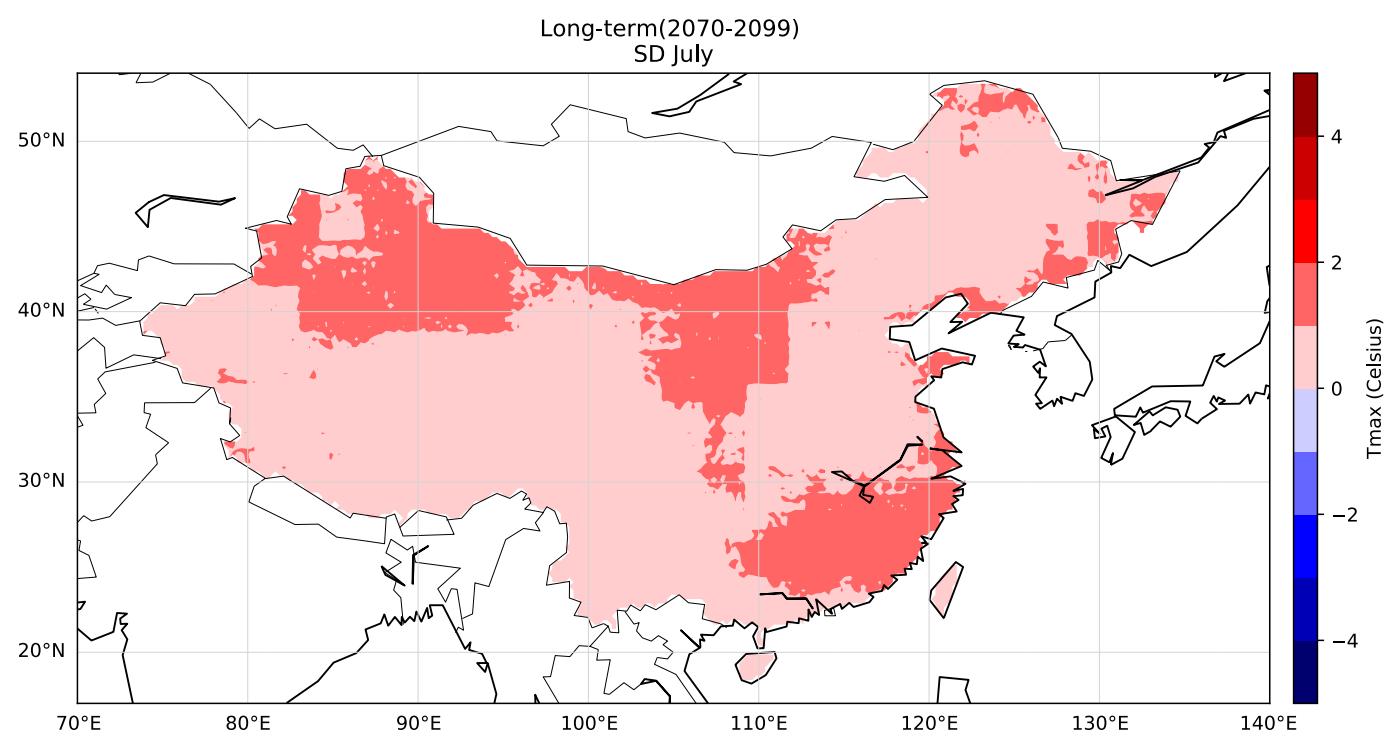
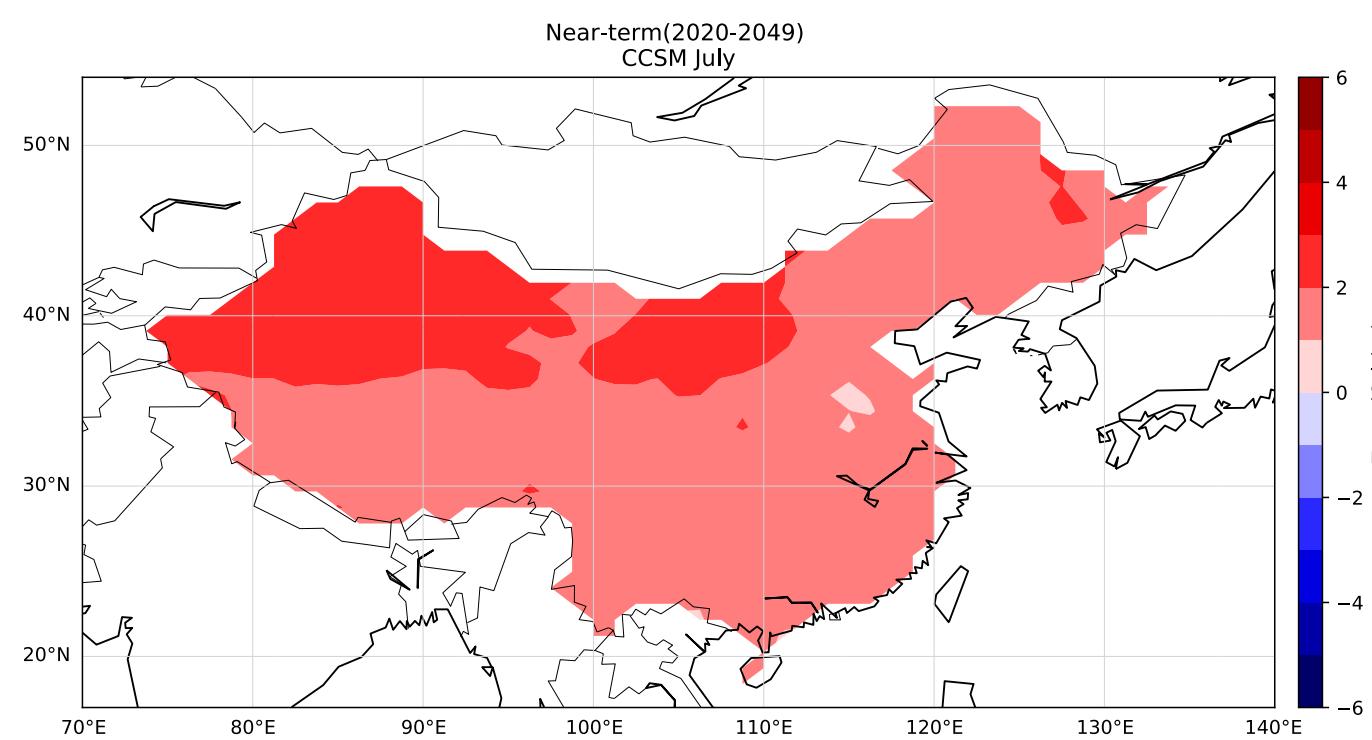


图8

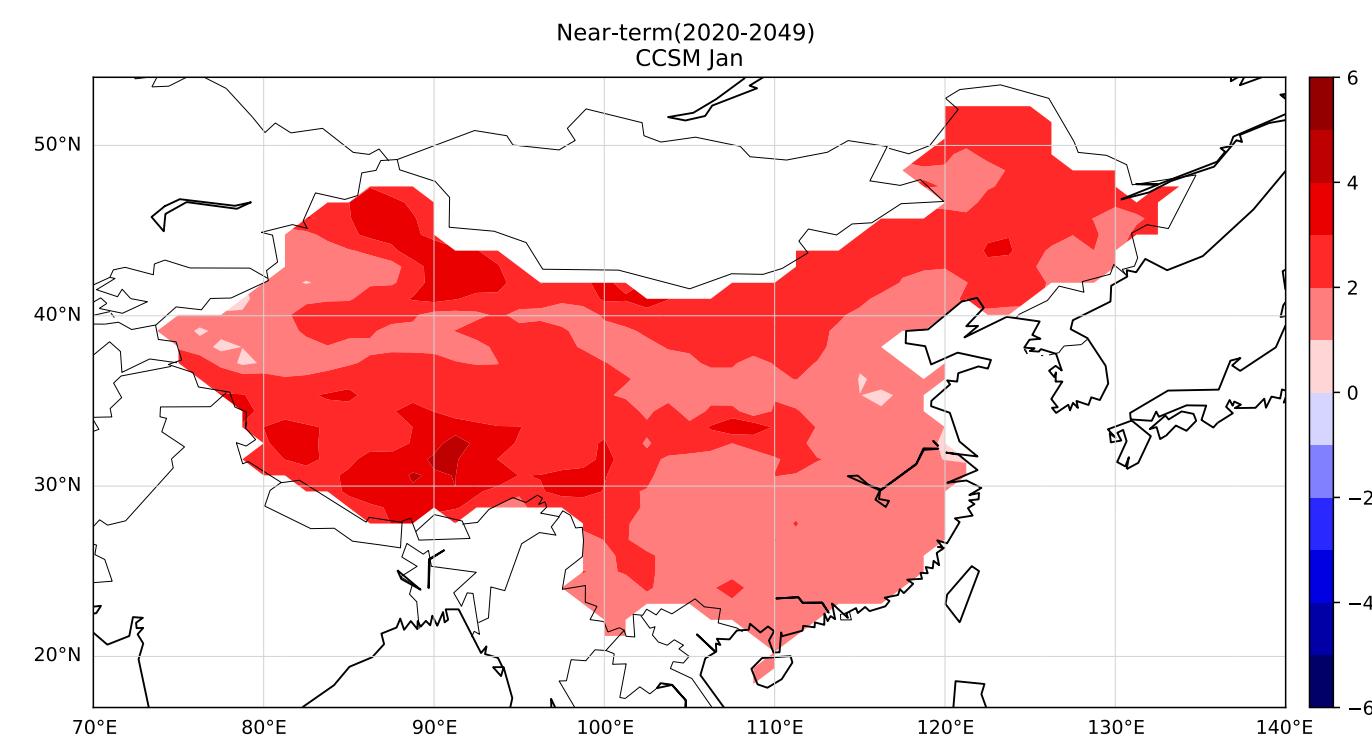
Near-term, RCP8.5

CCSM

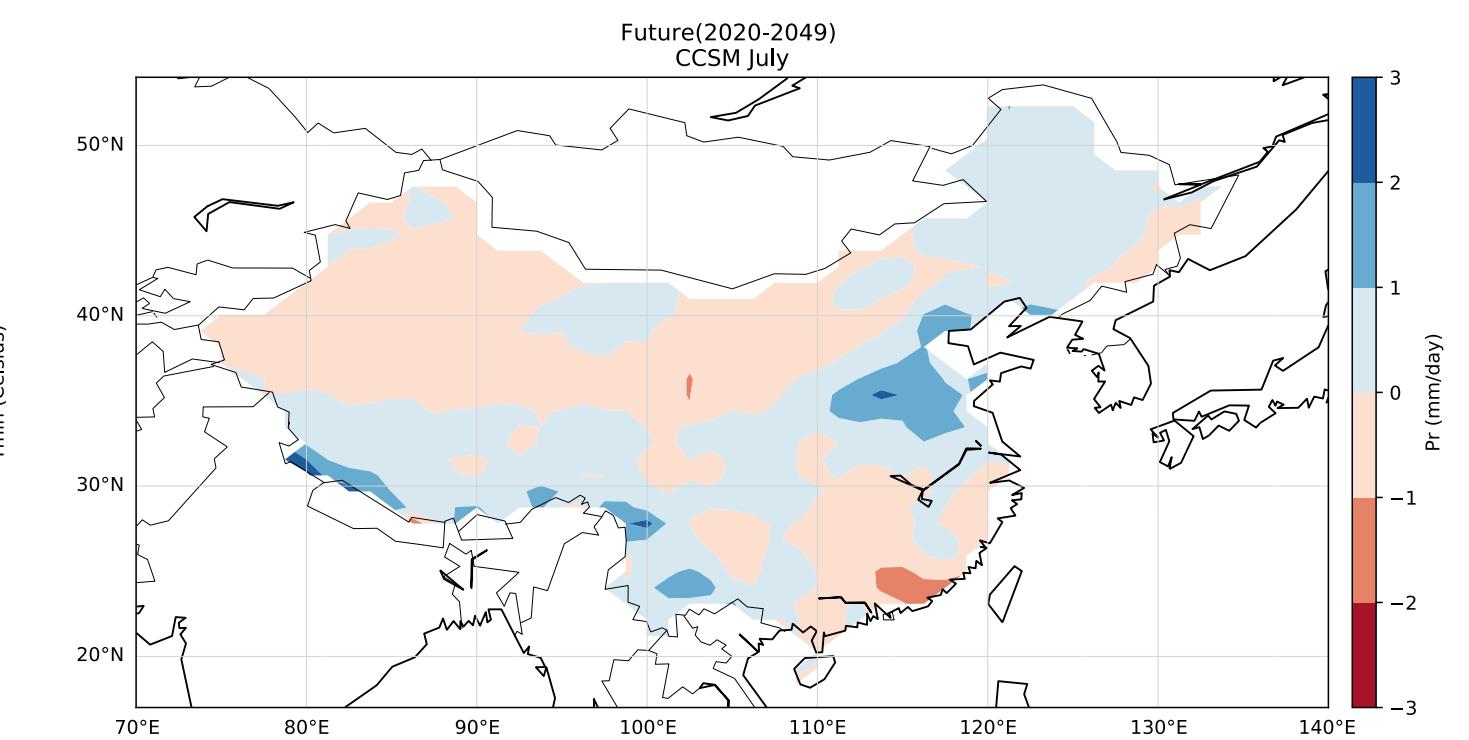
Tmax



Tmin



Pr



SD

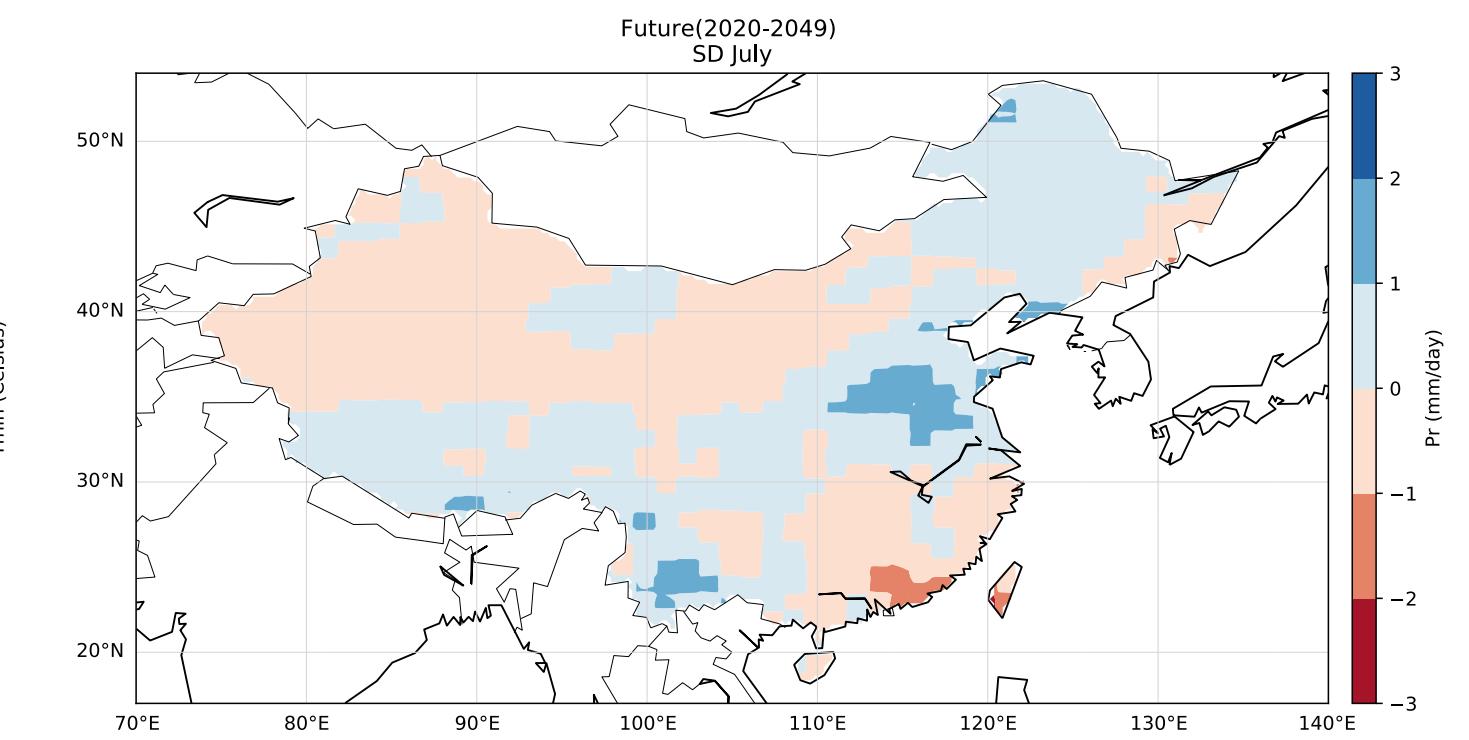
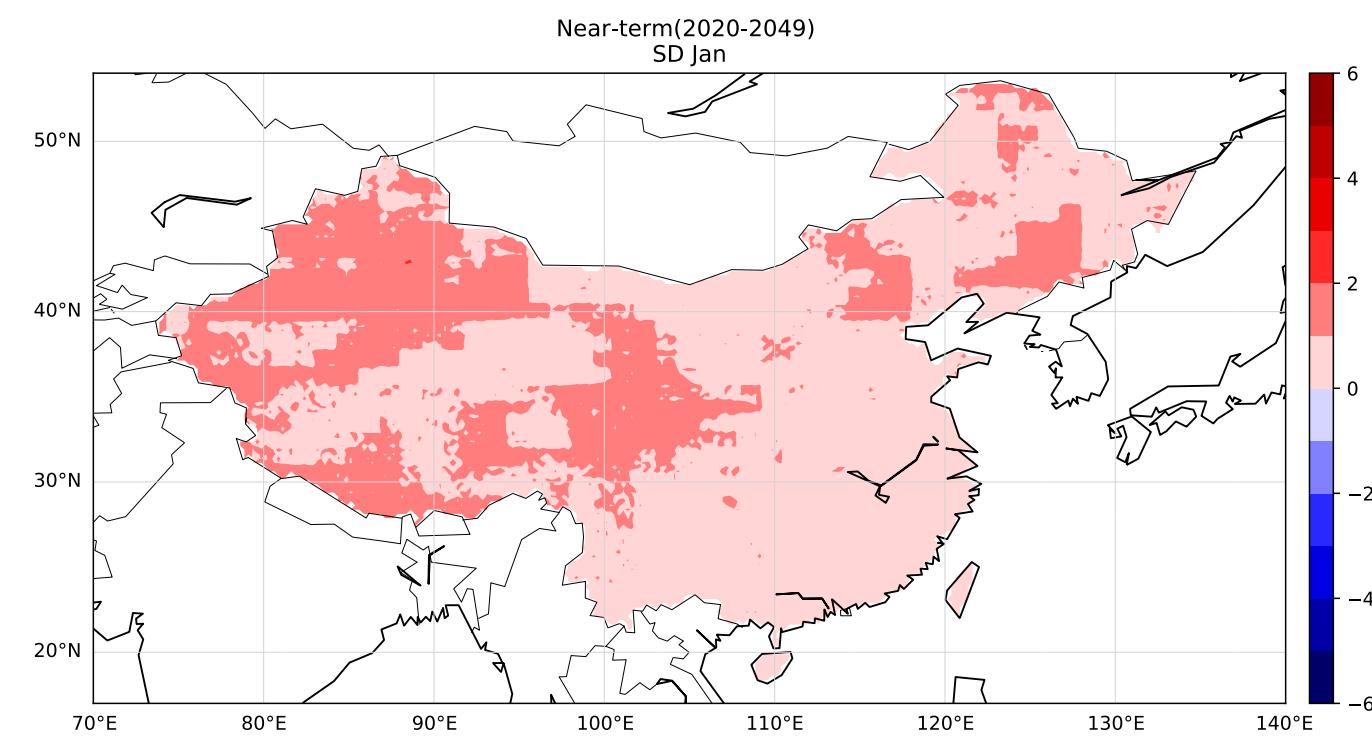
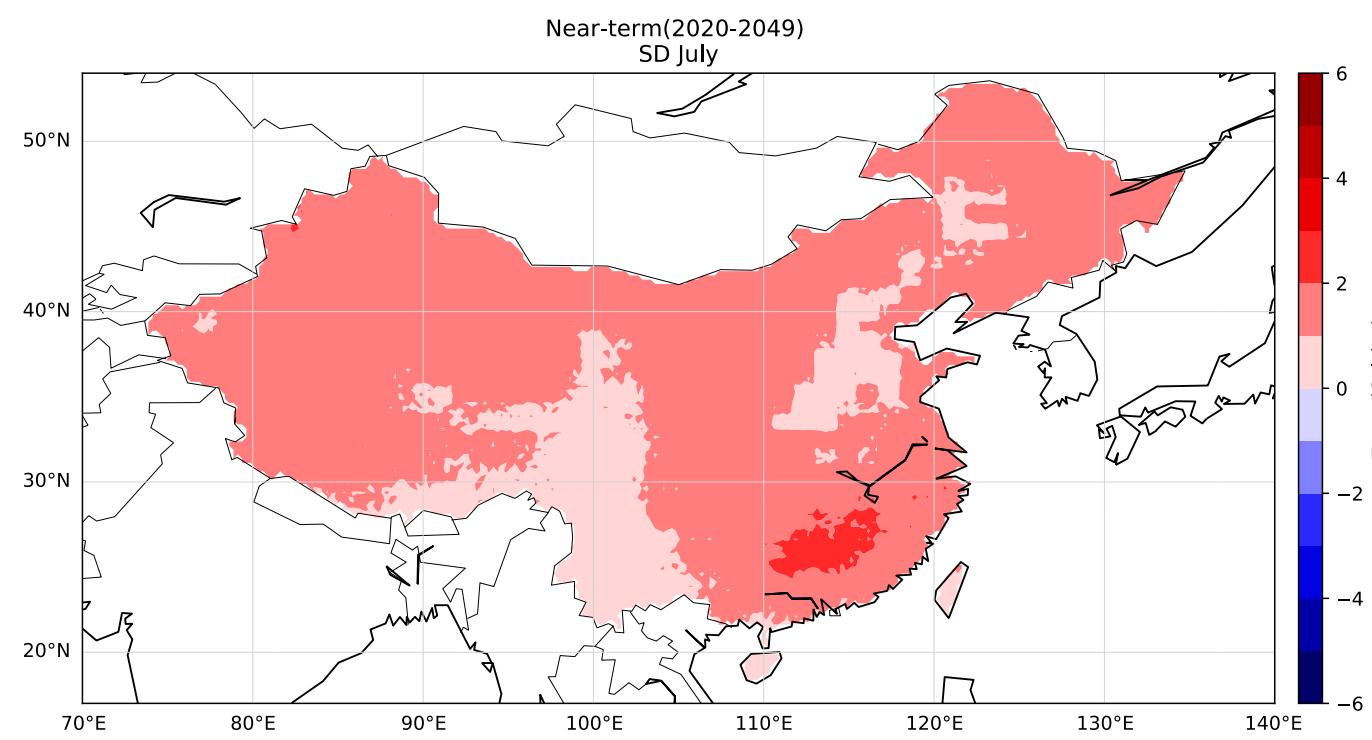
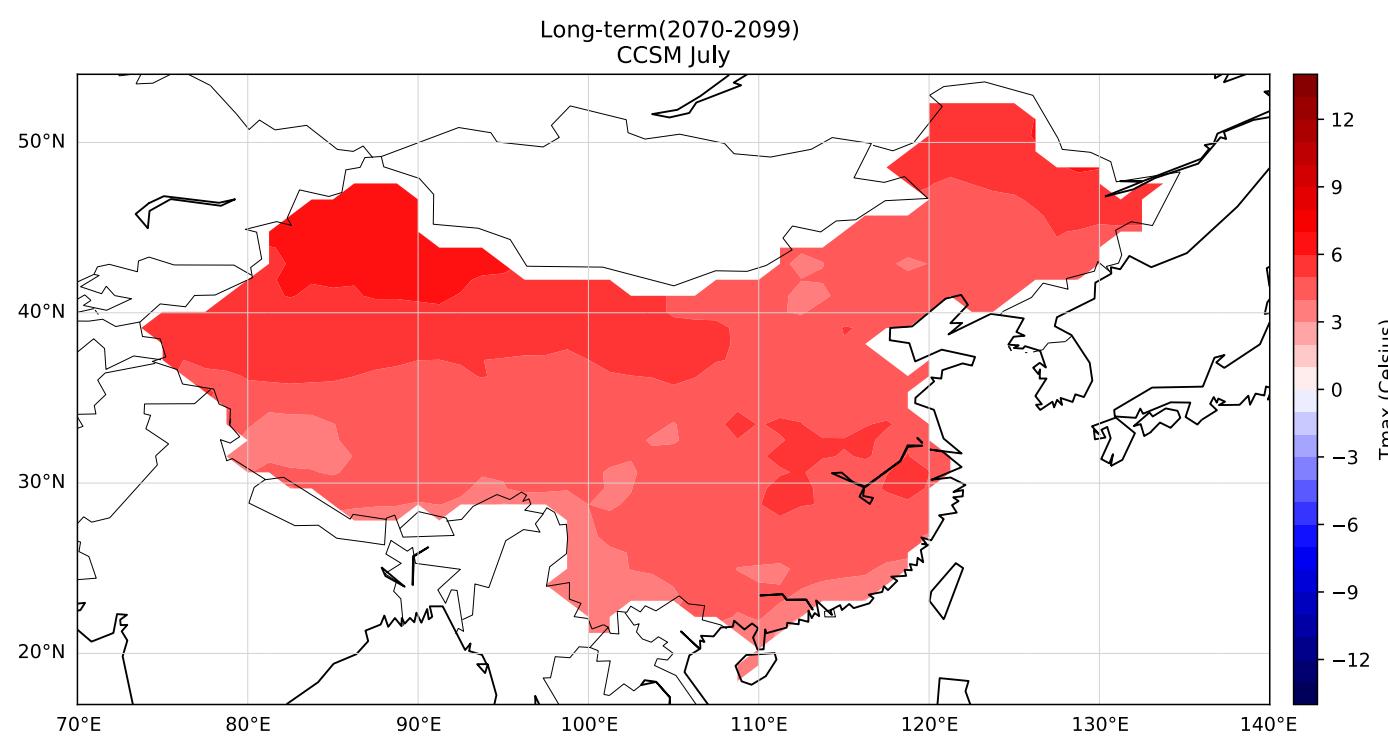


图9

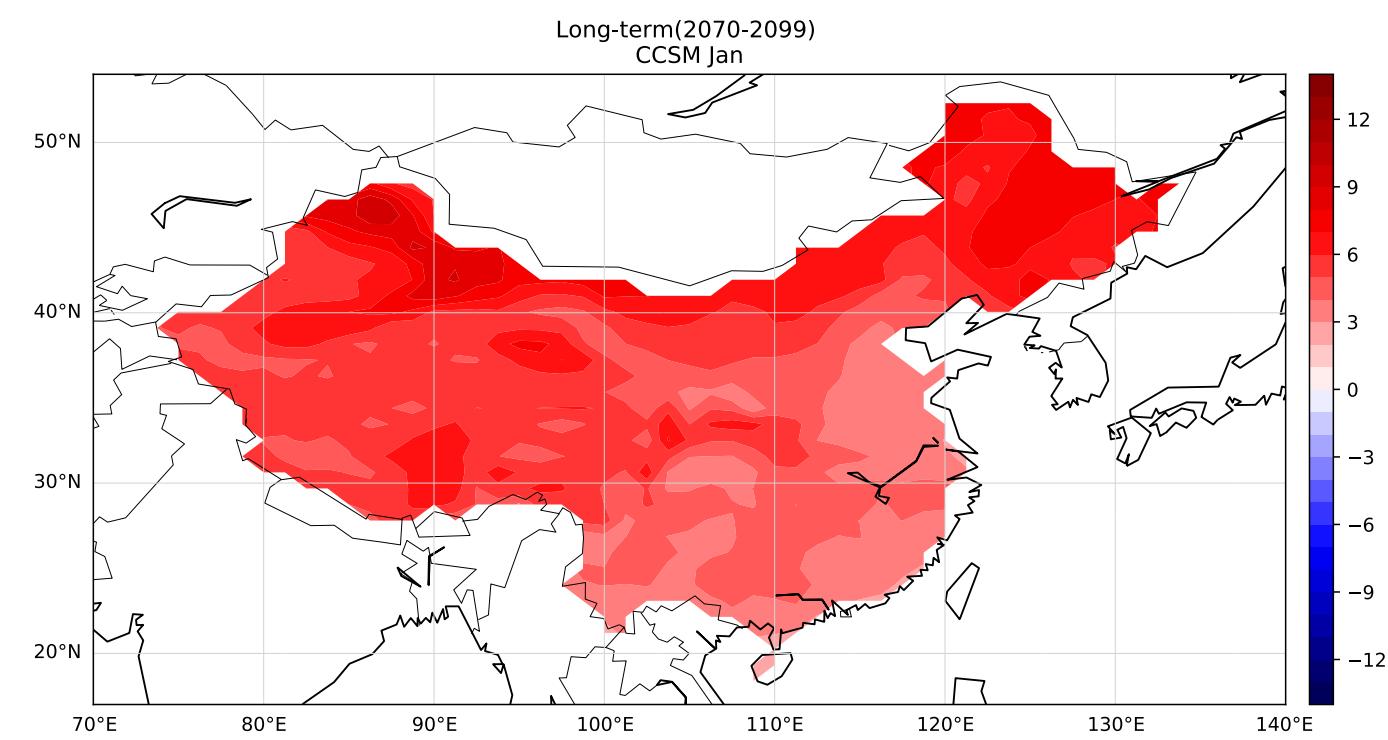
Long-term, RCP8.5

CCSM

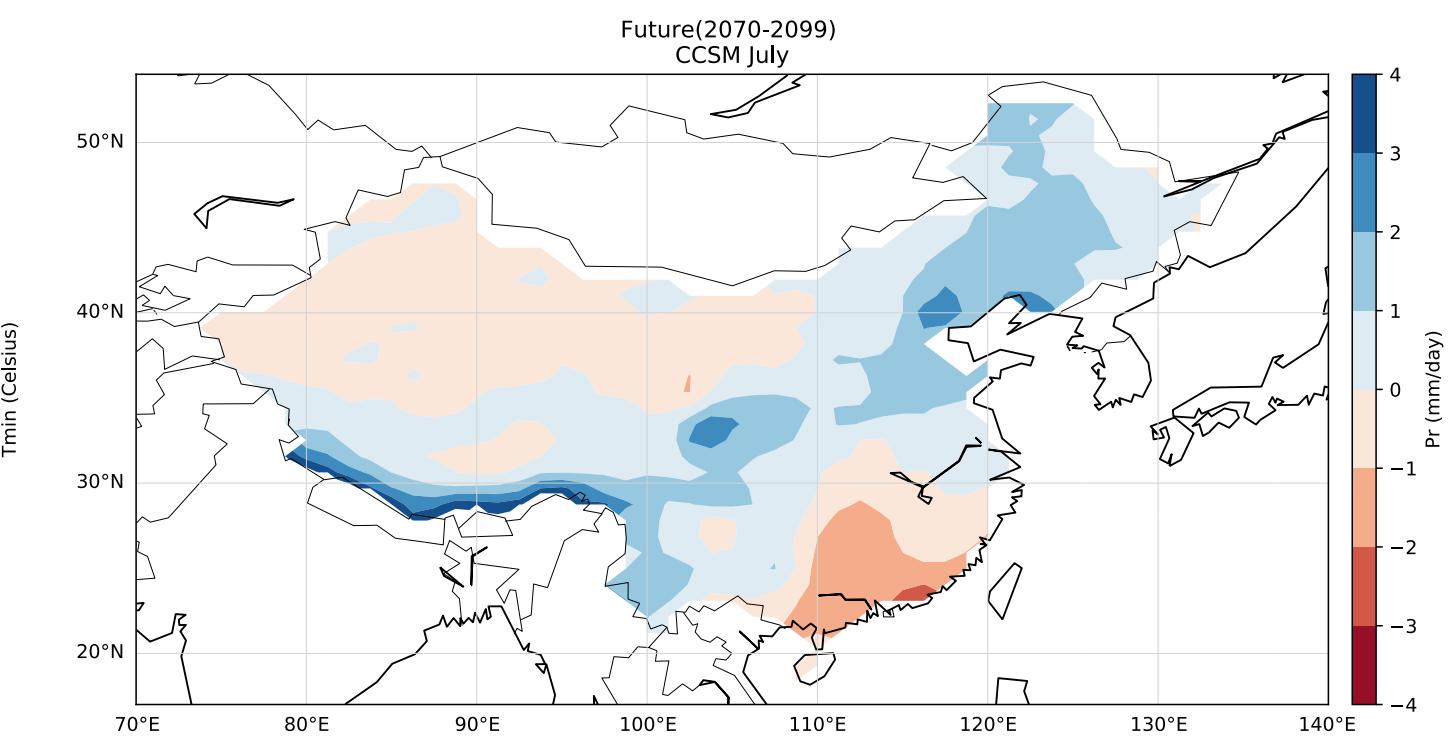
Tmax



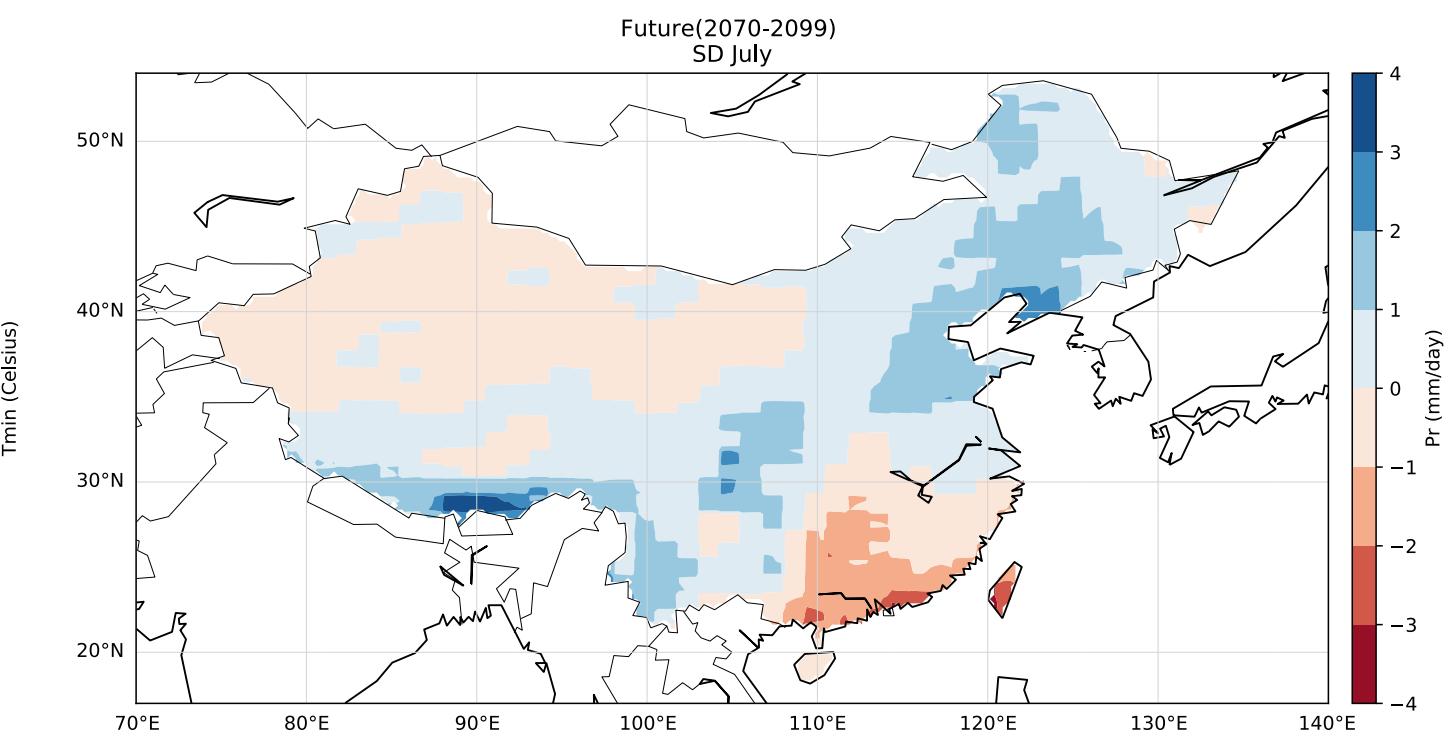
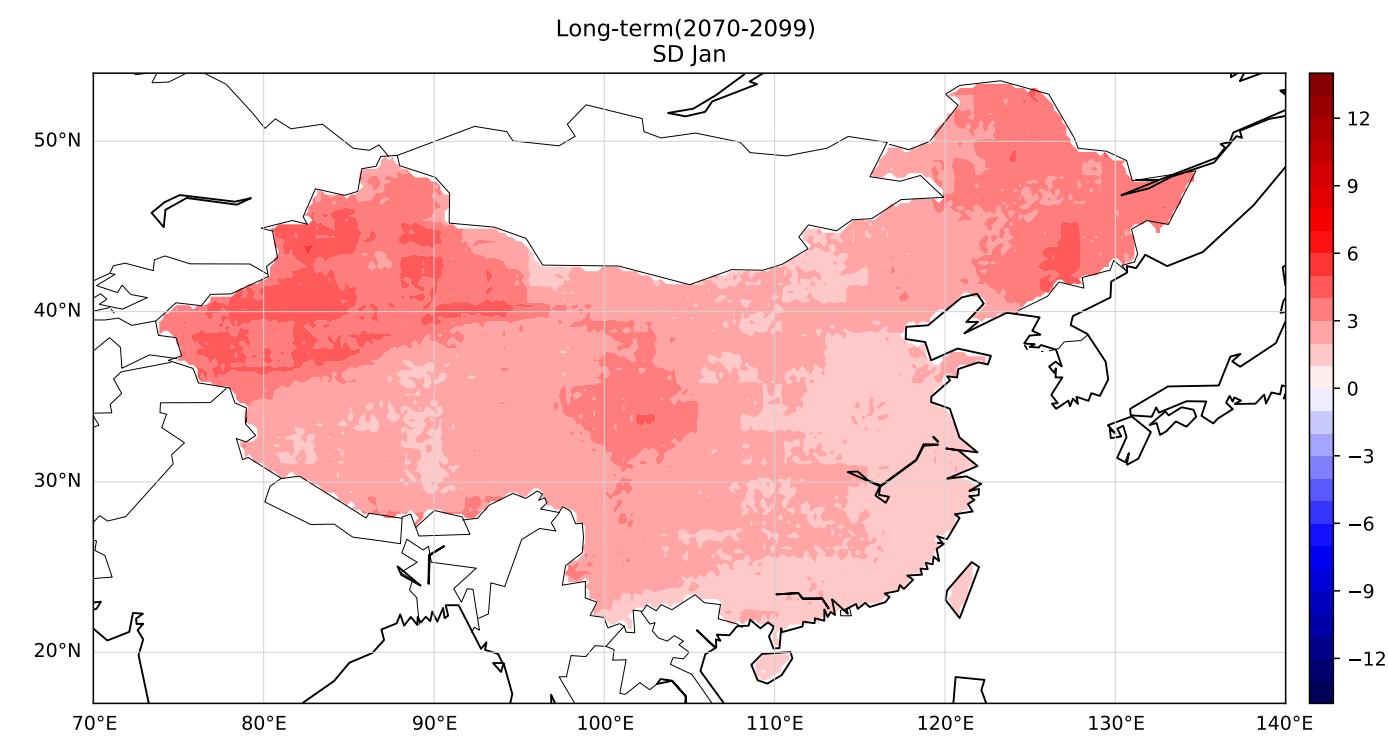
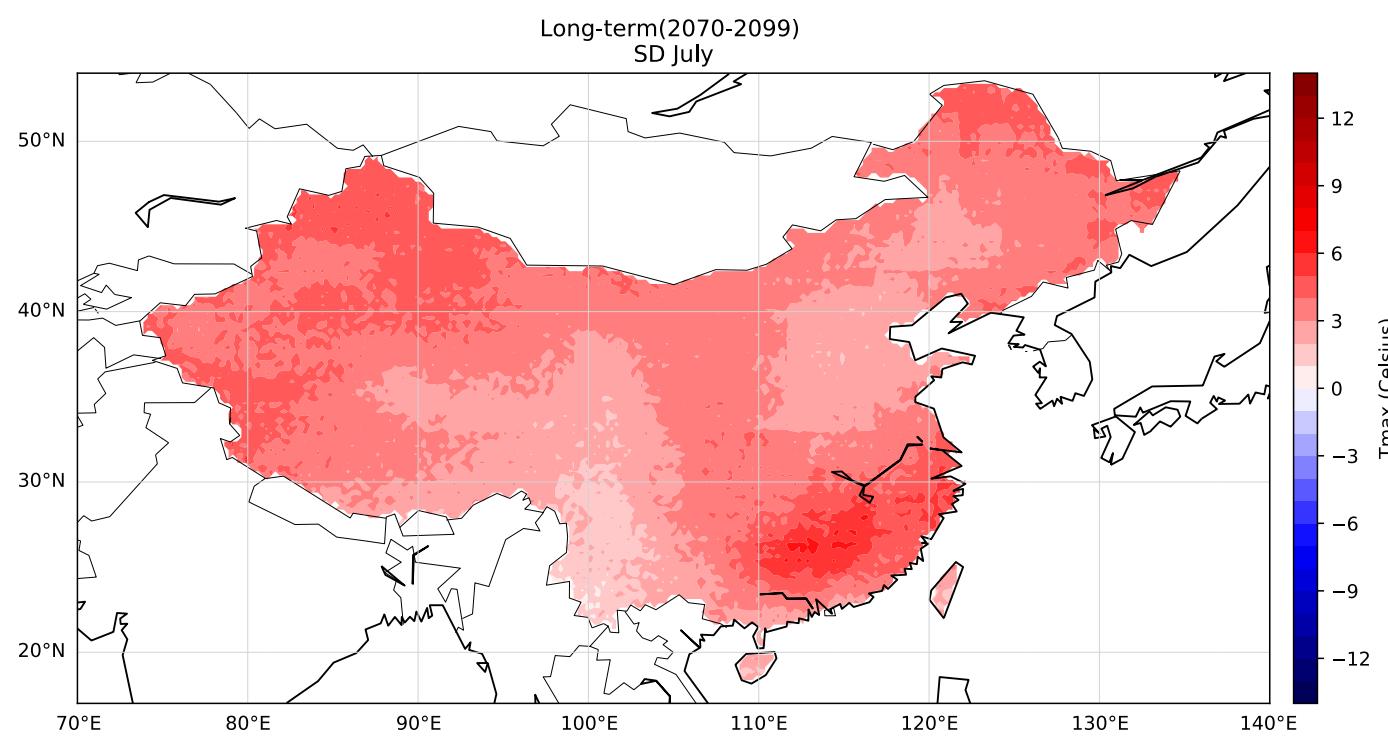
Tmin



Pr



SD



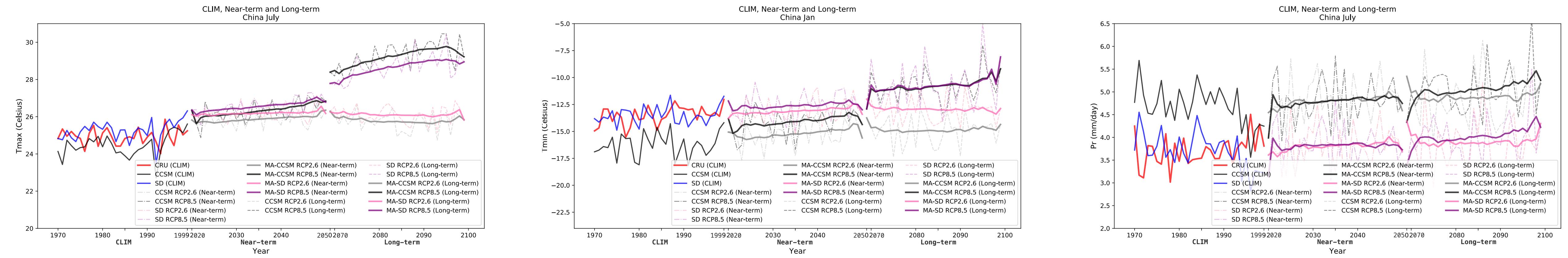
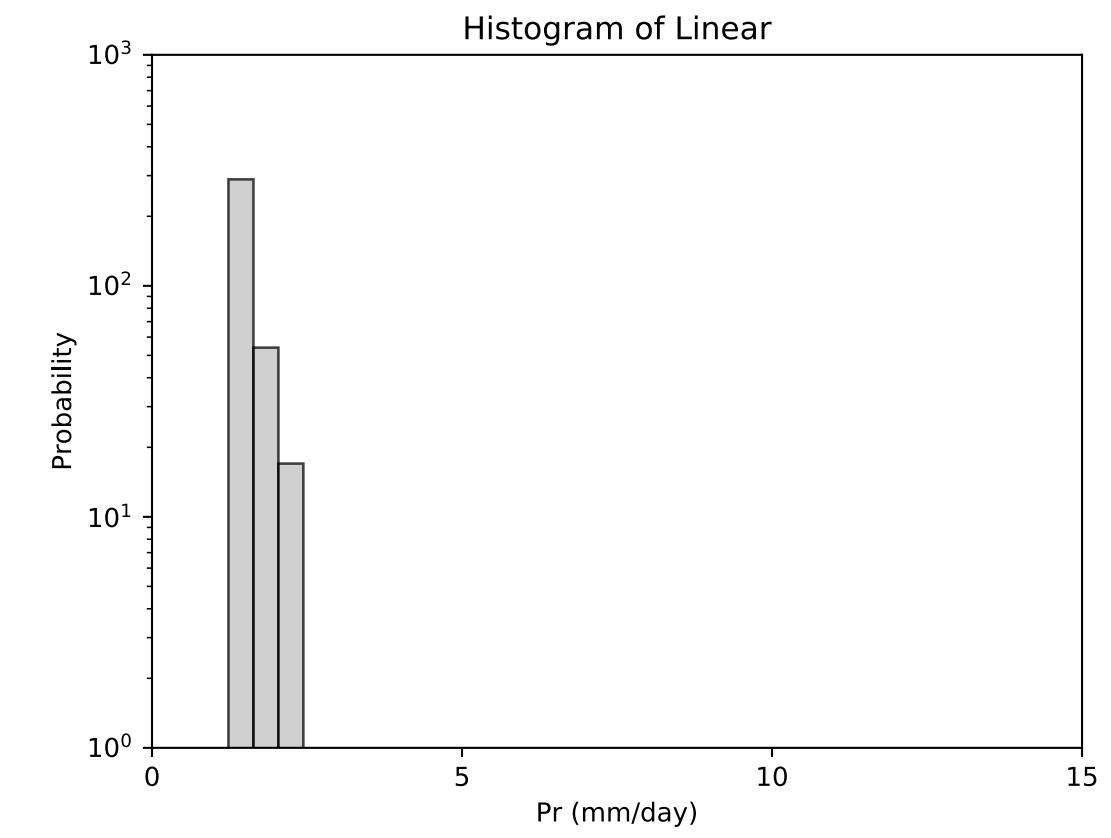
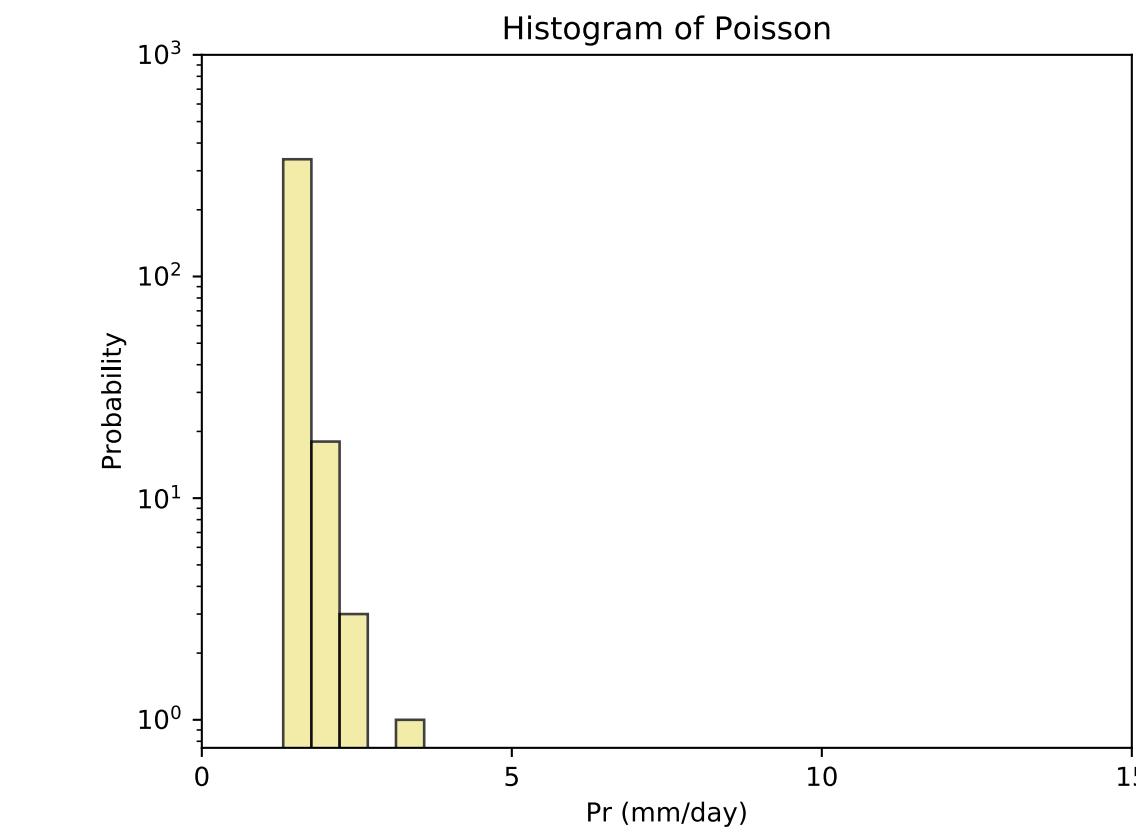
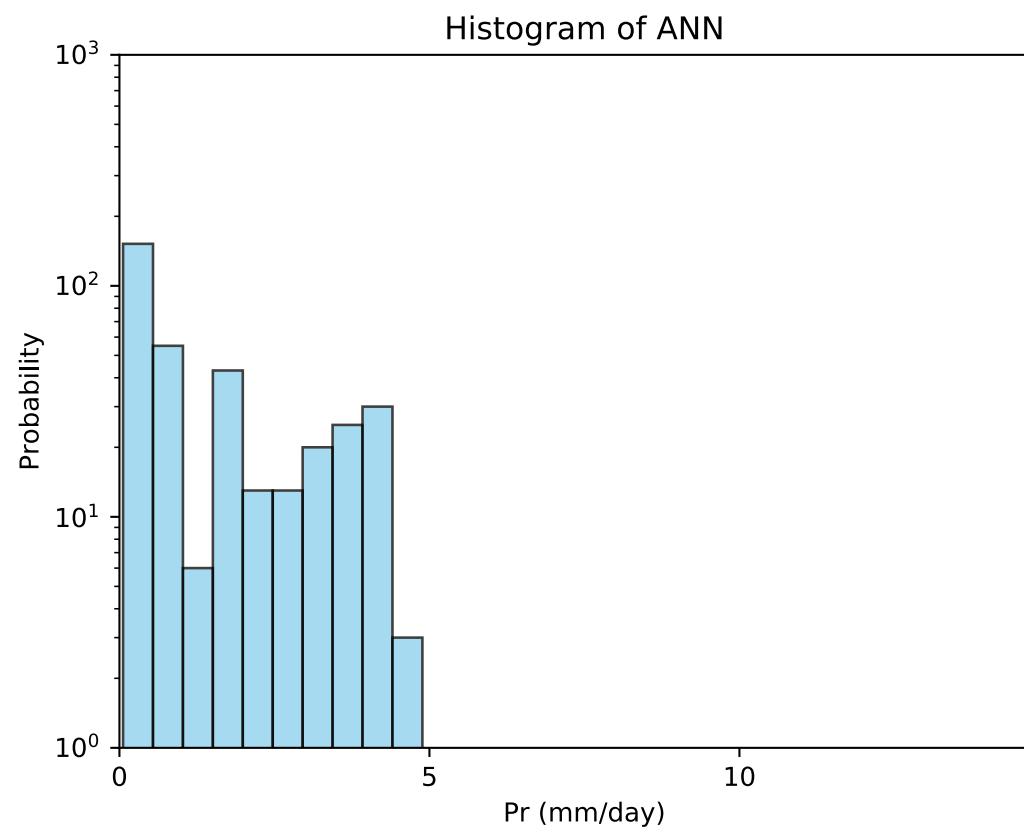
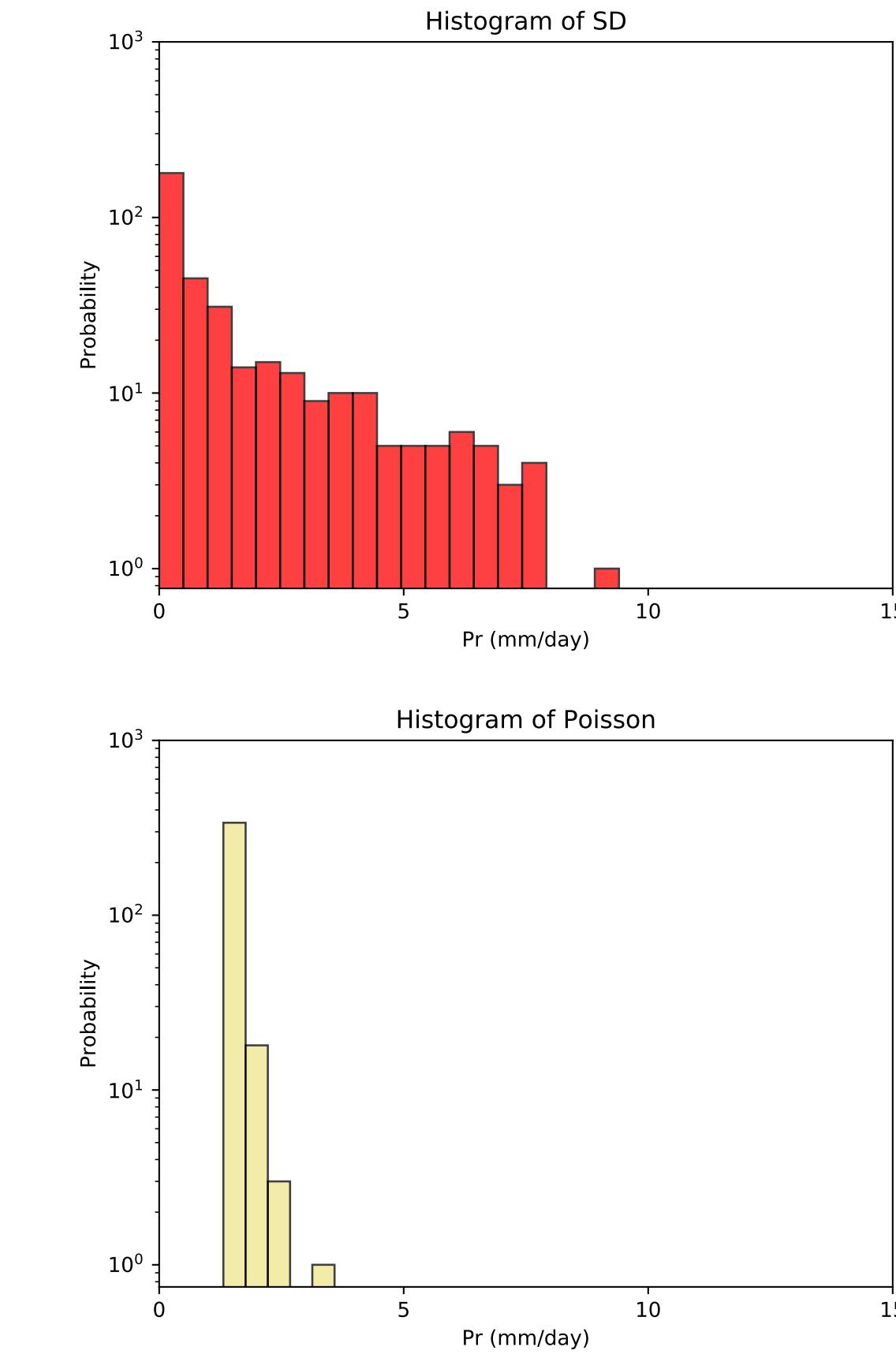
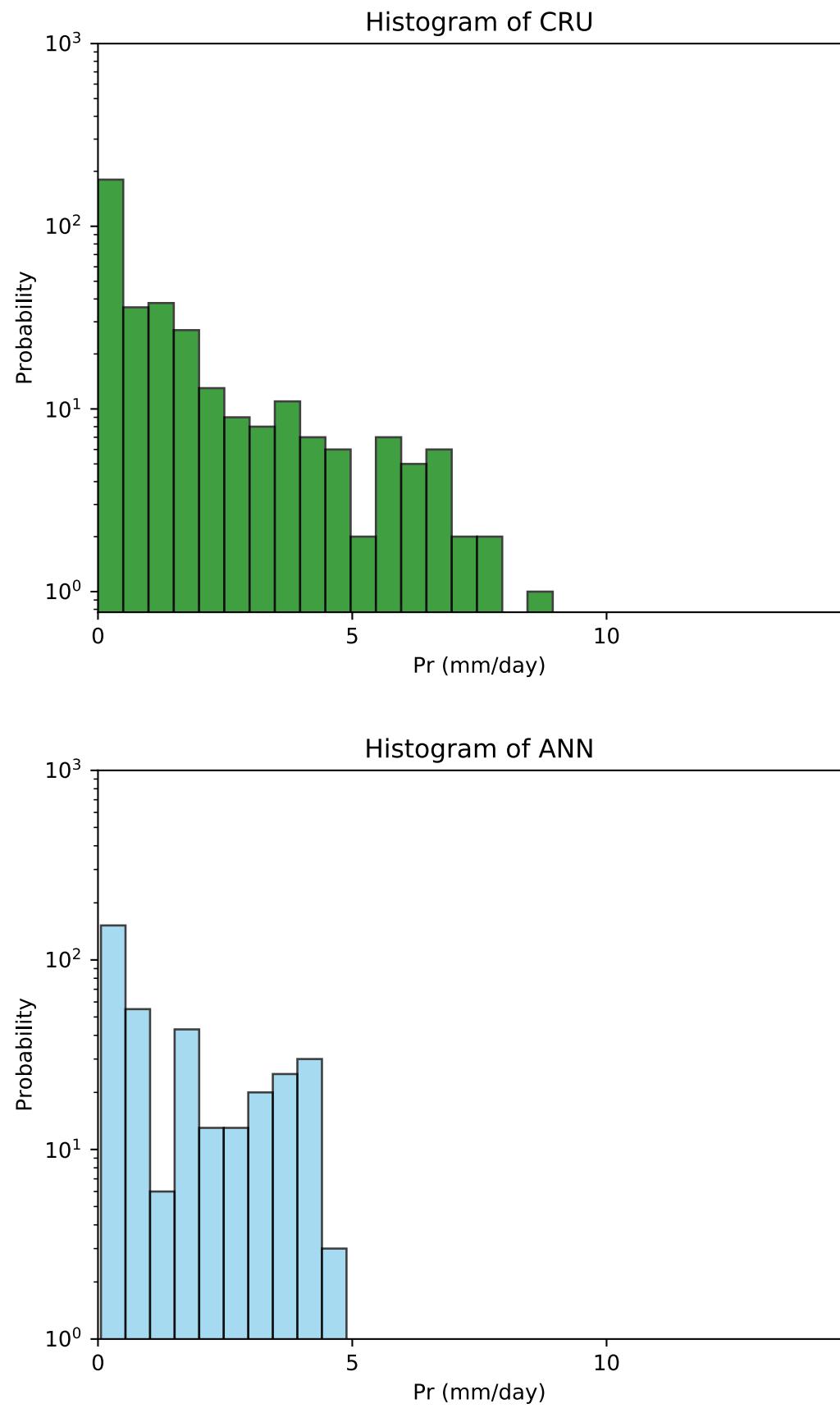
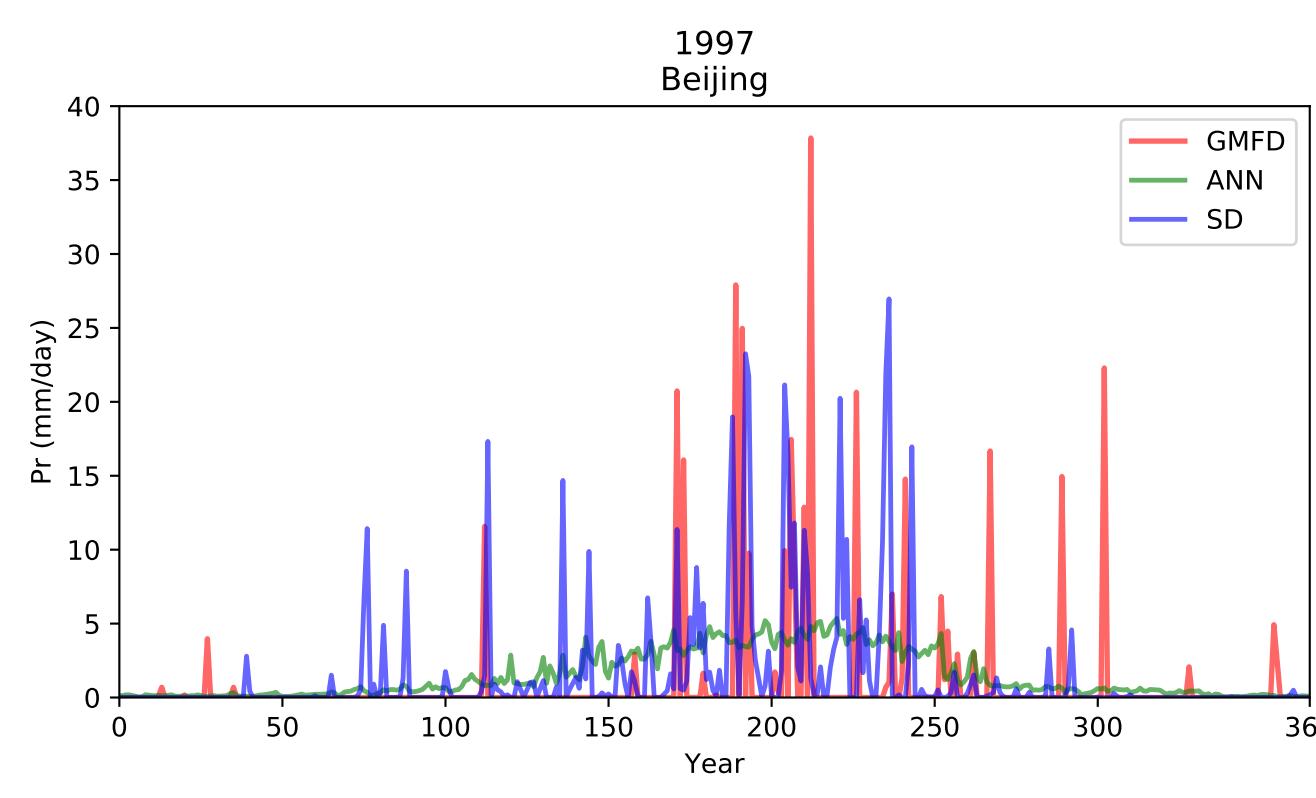


图10

讨论



附录

讨论

附录

CRU

CCSM

SD

Tmax

Tmin

Pr

