2020/05/14

Performance *comparison* of three *predictor selection methods* for statistical downscaling of daily precipitation

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Springer-Verlag Wien 2016 12pages

7 October 2016

Introduction:

Predictor selection is a critical factor affecting the statistical downscaling of daily precipitation.

考察变量：*mean, variance, and the distribution of monthly mean daily precipitation, wet spell length, and the number of wet days*

Data and methods:

研究地区：the upper Heihe River basin (HRB), the second largest inland river basin in China.

研究变量：Daily precipitation from Qilian (QL), Yeniugou (YNG), and Tuole (TL).

研究时间：1961-2000, 2001-2010;

wet season (April to September) and dry season (October to the following March).

数据：

·the National Climate Center of the China Meteorological Administration

·the NCEP/NCAR reanalysis gridded datasets

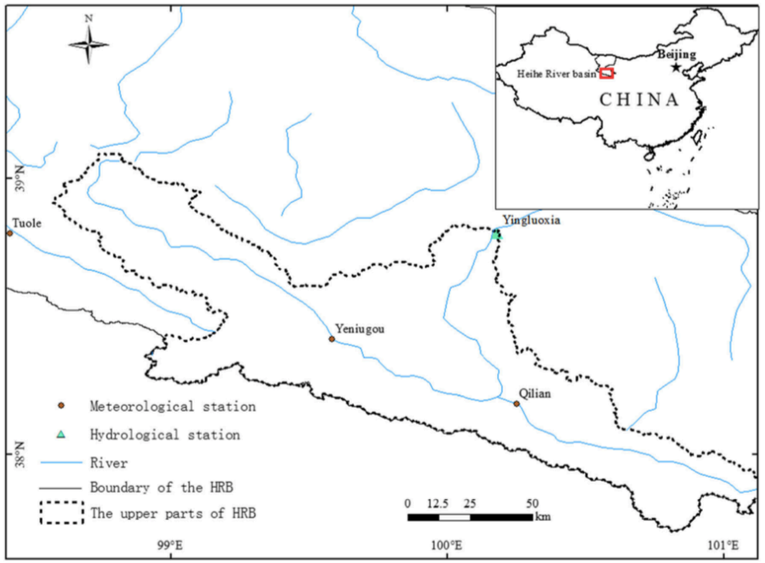


Fig. 1 Map showing the locations of meteorological stations in the upper reaches of the Heihe River basin

Predictor selection methods:

-*Correlation analysis*: calculating correlation coefficients for predictor variables and daily precipitation, if the correlation passed the significance test ($p < 0.05$), the predictor was selected

-*Partial correlation coefficients*

-*Stepwise regression analysis*

Table 2 The selected predictor variables using the correlation (CA), partial correlation (PCA), and stepwise regression (SRA) analysis

Predictor	Station QL						Station TL						Station YNG					
	Dry			Wet			Dry			Wet			Dry			Wet		
	CA	PCA	SRA	CA	PCA	SRA	CA	PCA	SRA	CA	PCA	SRA	CA	PCA	SRA	CA	PCA	SRA
temp2	√		√	√		√	√		√	√			√		√	√		√
temp5																		
temp		√						√						√				
div2	√																	
div5					√													
div			√									√			√			
vor2					√						√						√	
vor5		√									√			√				
vor						√												
hgt2				√						√	√					√		
hgt5																		
omega2				√												√		
omega5		√						√						√			√	
omega	√						√			√			√					
rhum5	√			√	√	√	√			√			√	√		√	√	
rhum		√	√			√		√			√				√			√
shum																		
shum5			√						√			√			√			√
mslp																	√	√
uwnd2																		
uwnd5					√			√	√		√	√						
uwnd							√						√					
vwnd2	√	√		√			√	√	√	√	√	√	√	√		√		
vwnd5																		
vwnd			√		√	√			√						√		√	√

Downscaling performance of a combination of predictor variables is better than that of a single variable, and the predictands at a given station are generally controlled by between four and seven predictor variables.

Predictor combinations have stronger correlations with downscaled results when up to four predictors are combined, but the correlations weaken if too many predictors are considered

Fig. 3 Errors (absolute values) in monthly mean daily precipitation at three stations using the CA, PCA, and SRA methods

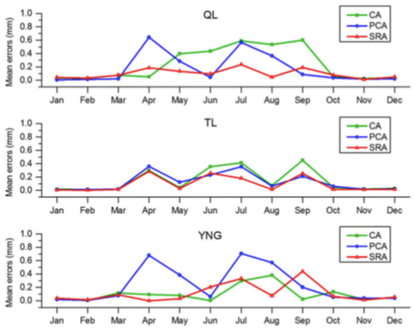


Fig. 4 Monthly variance of downscaled (CA, PCA, and SRA) and observed (OBS) daily precipitation at three stations

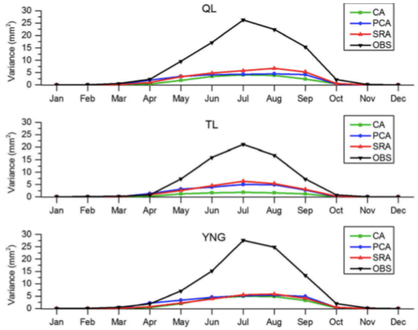


Table 5 Kolmogorov-Smirnov goodness-of-fit test results (p values) for comparing 50-year (1961–2010) distributions of observed and downscaled monthly mean daily precipitation

	Station QL			Station TL			Station YNG		
	CA	PCA	SRA	CA	PCA	SRA	CA	PCA	SRA
J	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00
M	0.00	*0.15*	0.00	0.01	0.03	0.02	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	*0.36*
M	0.00	0.02	*0.15*	0.01	*0.15*	*0.51*	*0.24*	0.00	*0.24*
J	0.01	*0.84*	*0.84*	0.00	*0.15*	*0.24*	*0.98*	*0.68*	*0.36*
J	0.00	0.00	*0.06*	0.00	0.03	*0.24*	*0.10*	0.00	*0.10*
A	0.00	*0.15*	*0.24*	*0.10*	*0.24*	*0.24*	0.01	0.00	*0.06*
S	0.00	*0.36*	*0.24*	0.00	*0.10*	*0.10*	*0.15*	*0.06*	0.00
O	*0.51*	*0.68*	*0.10*	0.00	0.00	*0.06*	0.00	*0.10*	*0.24*
N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The italicized entries show values with $p > 0.05$

Conclusions:

1. 总体上，SRA方法是三种方法中最好的；
2. ANN本身在方差等变量上有劣势，应该尝试其他方法。

Report

2020.05.19

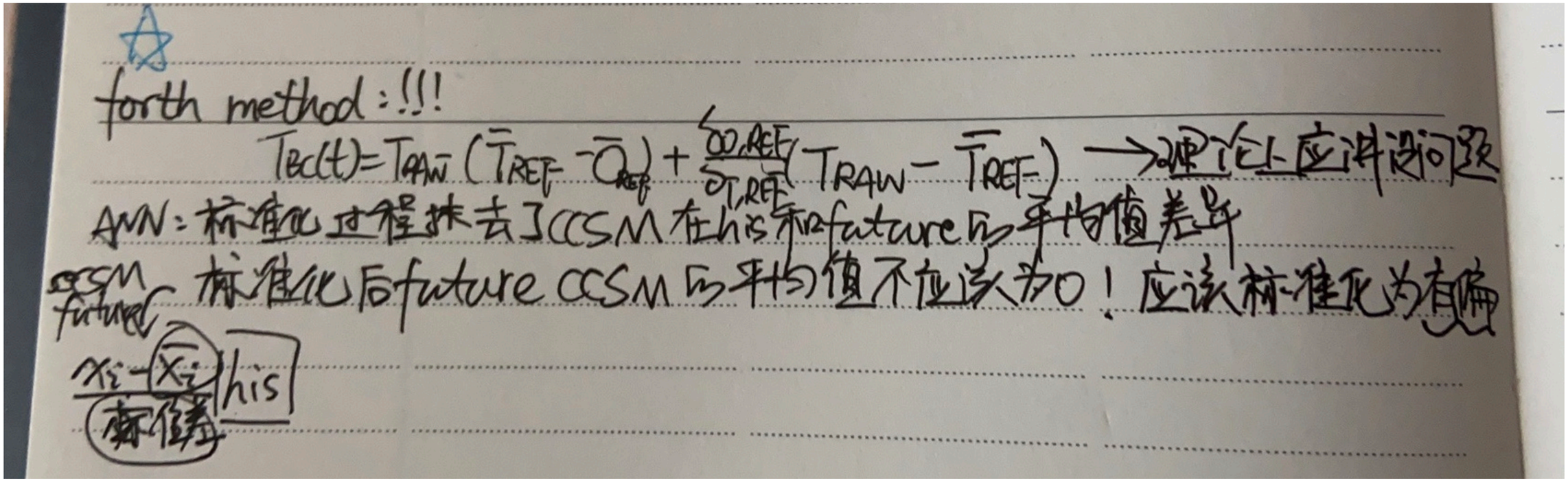
張慕琪

Methods

实验设计：

·ANN test使用新的标准化方法（有偏标准化）；

·使用新的Bias Correction公式（forth method）；



Historical的Bias Correction是否也使用第四版新方法?

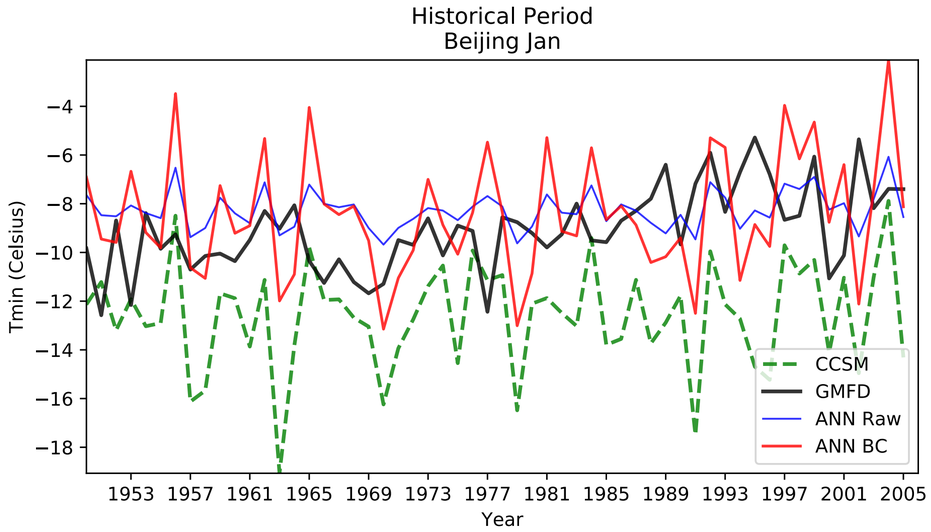
Results

Time series

Beijing

Historical (new method)

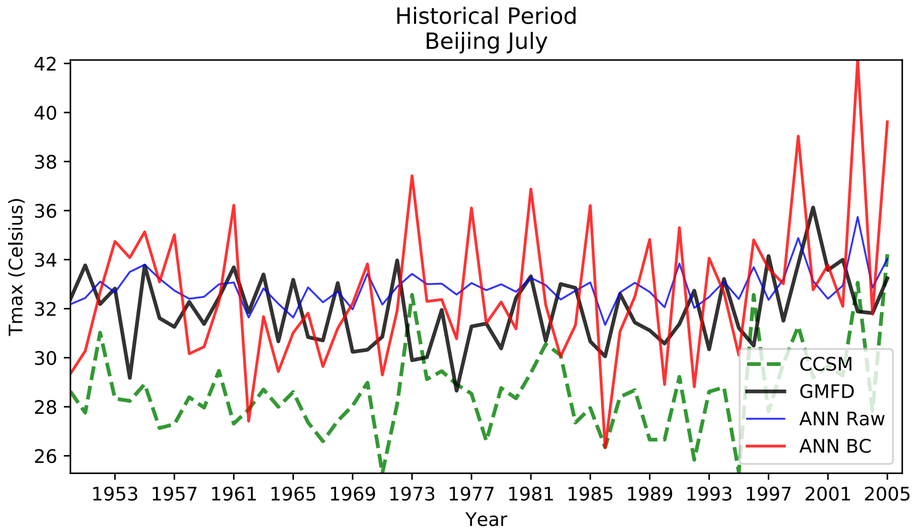
Tmin




```
mean_ccsm =  -12.599457
mean_ground =  -9.066935
mean_ann_raw =  -8.267509
mean_ann_bc =  -8.438462

std_ccsm =  2.1791046
std_ground =  1.6685536
std_ann_raw =  0.76728755
std_ann_bc =  2.458354
```

Tmax




```
mean_ccsm =  28.612423
mean_ground =  31.921953
mean_ann_raw =  32.856594
mean_ann_bc =  32.689507

std_ccsm =  1.7578304
std_ground =  1.4520789
std_ann_raw =  0.7223801
std_ann_bc =  2.945389
```

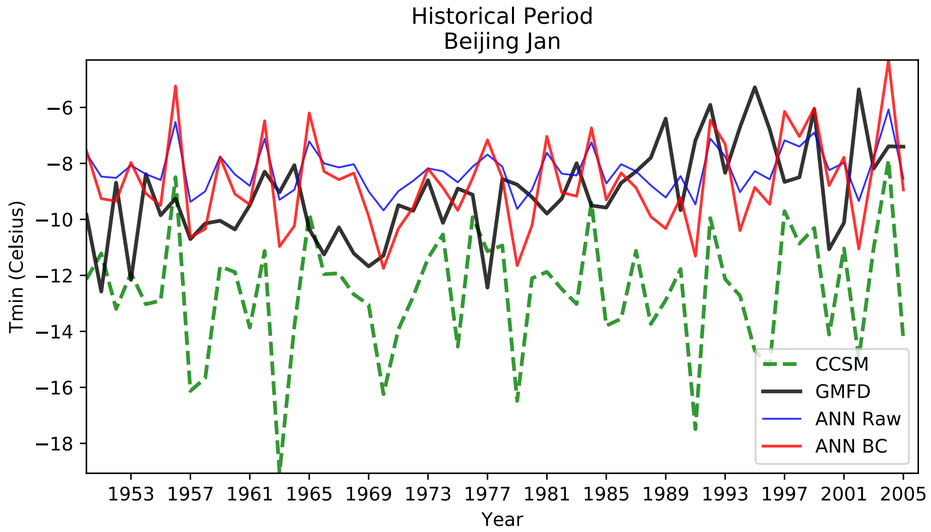
Results

Time series

Beijing

Historical (old method)

Tmin

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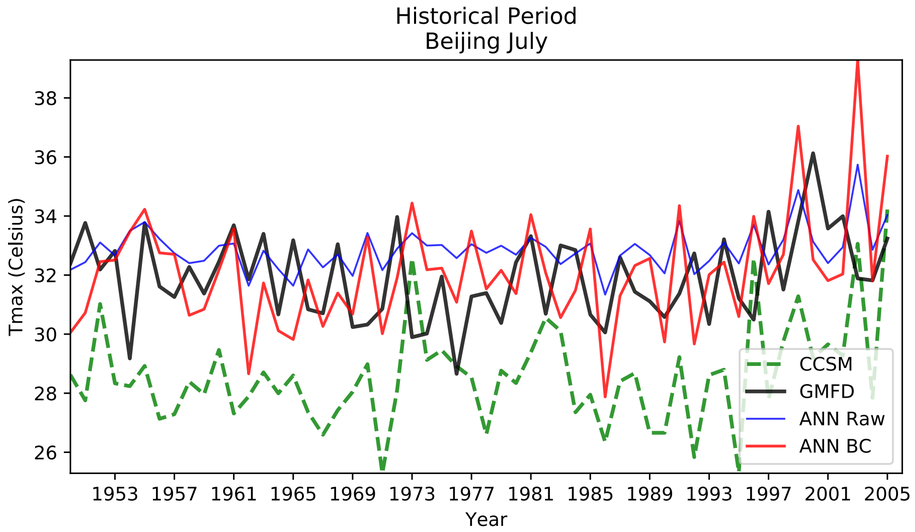
mean_ccsm =  -12.599457
mean_ground =  -9.066935
mean_ann_raw =  -8.267509
mean_ann_bc =  -8.720985

std_ccsm =  2.1791046
std_ground =  1.6685536
std_ann_raw =  0.76728755
std_ann_bc =  1.5988857
```

Tmax



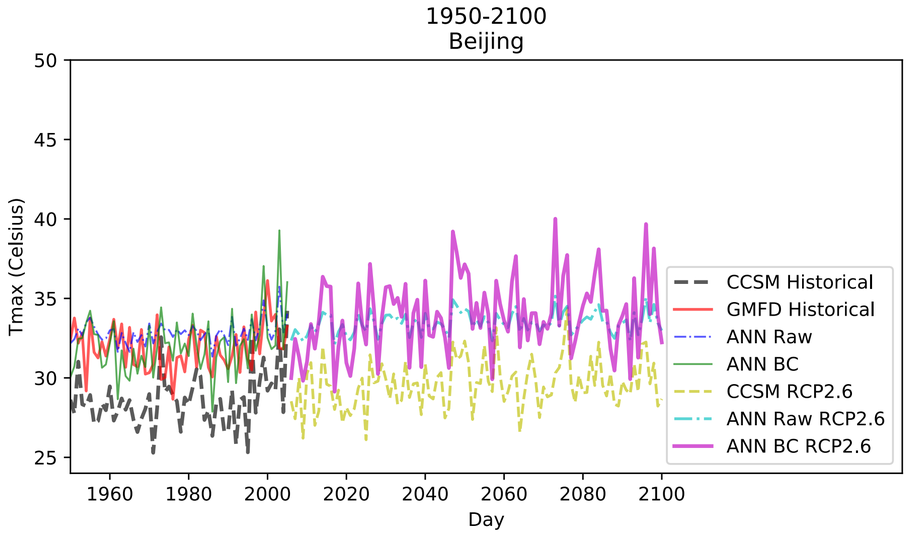

```
mean_ccsm =  28.612423
mean_ground =  31.921953
mean_ann_raw =  32.856594
mean_ann_bc =  32.103893

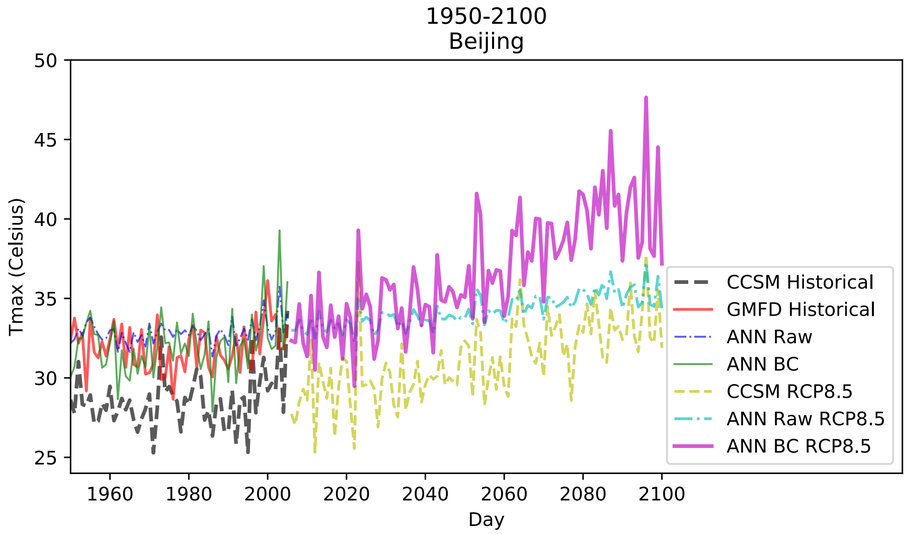
std_ccsm =  1.7578304
std_ground =  1.4520789
std_ann_raw =  0.7223801
std_ann_bc =  1.9083097
```

Results

Time series Beijing Future

Tmax

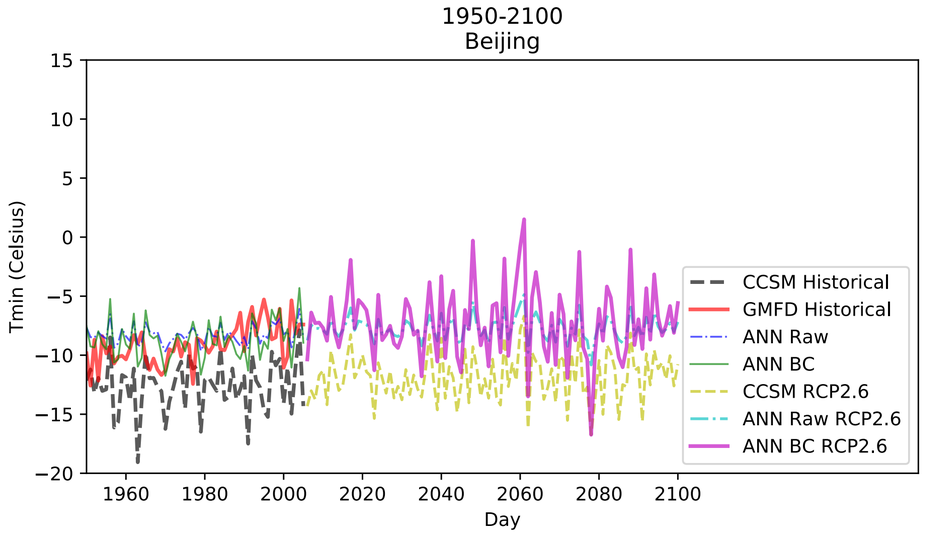


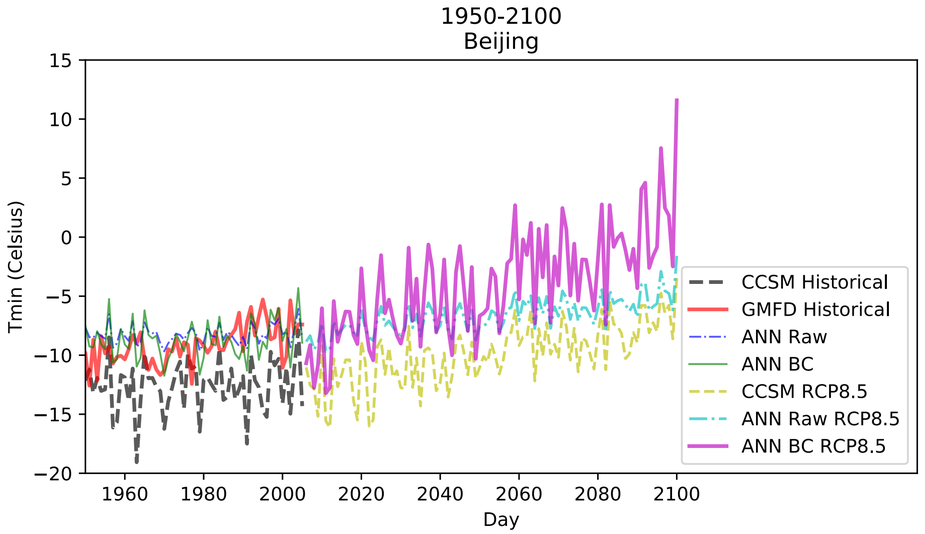


Results

Time series Beijing Future

Tmin



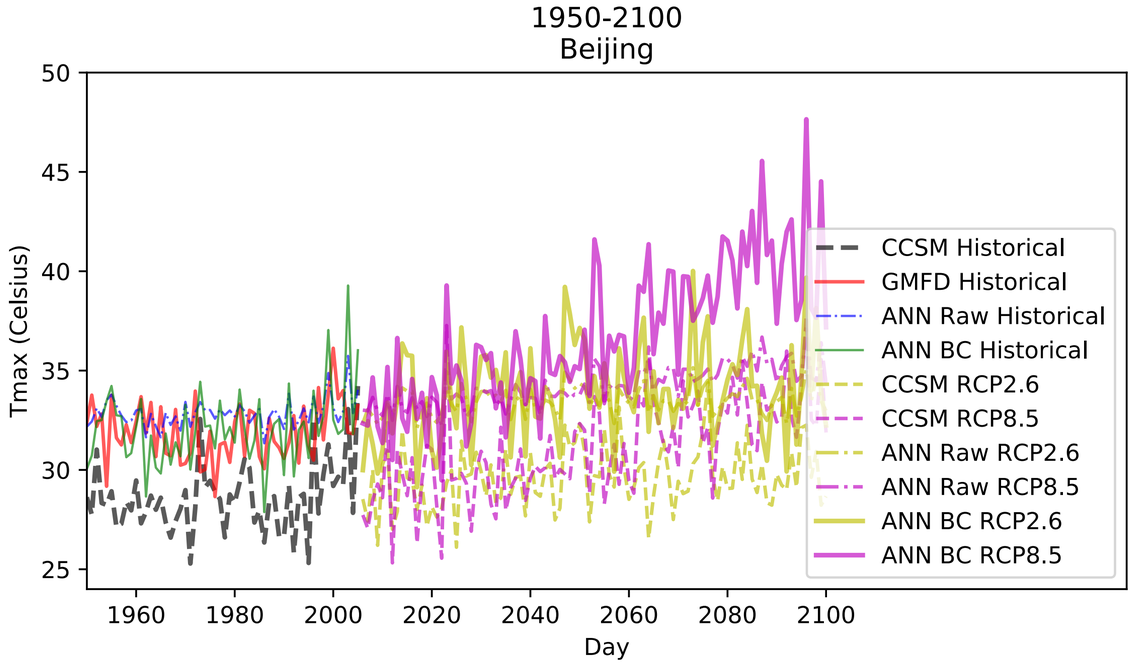


谢谢

附录

Time series Beijing Future

Tmax



附录

Time series Beijing Future

Tmin