Effects of climate change on daily minimum and maximum temperatures and cloudiness in the Shikoku region: a statistical downscaling model approach

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Data and study site:

研究地区：Shikoku region, Japan.

研究变量：Tmax, Tmin, DTR, CLD.

研究时间：1961-1990 (calibration), 1991 - 2000 (validation), 2071-2099 (future, A2, A1B);

数据：

·*Observed data:* surface data point (SDP) network of the Japan Meteorological Agency (JMA).

·*Models:* the Hadley Centre Coupled Model, version 3 (HadCM3), the third generation Coupled Global Climate Model (CGCM3).

·NCEP/NCAR reanalysis gridded datasets.

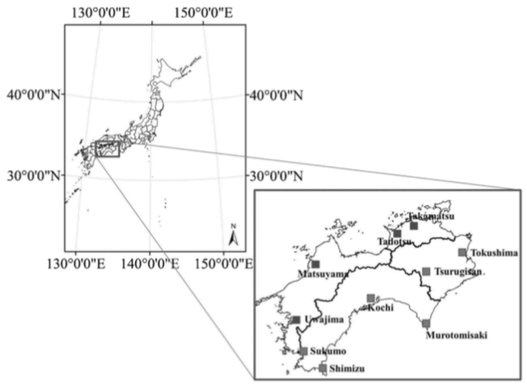


Fig. 1 Location of the study area

Methods:

SDSM (Statistical DownScaling Model): a combination of multilinear regressions and a weather generator. (Wilby et al. 2002)

Results:

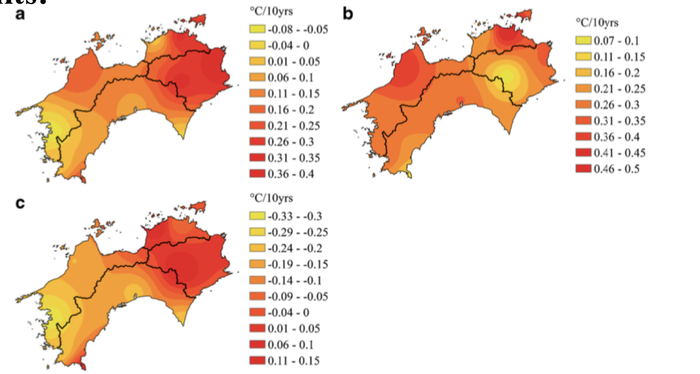


Fig. 2 Spatial patterns of the temporal change of the observed values of atmospheric variables in the Shikoku region for the period 1950–2011 **a** daily maximum temperature (TMAX), **b** daily minimum temperature (TMIN), **c** diurnal temperature range (DTR))

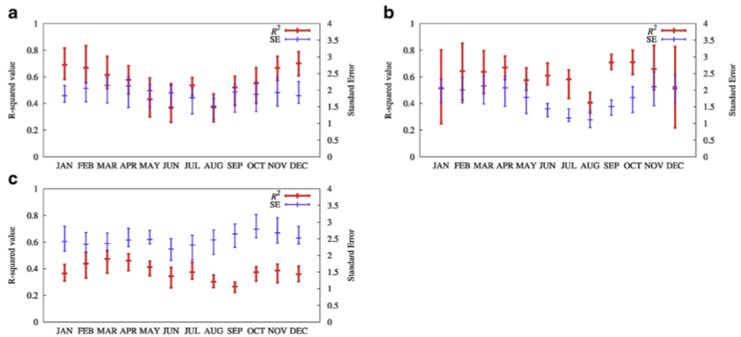


Fig. 3 R^2 and standard error (SE) between the observed and simulated values during the calibration period (1961–1990) averaged over all stations and for each month of the year **a** TMAX, **b** TMIN, and **c** CLD)

Fig. 4 Dependency of changes in the period-averaged values of the simulated TMAX and TMIN on the changes in the period-averaged values of the simulated CLD between the base period (1961–1990) and the future period (2071–2099) (**a** TMAX in winter, **b** TMAX in summer, **c** TMIN in winter, **d** TMIN in summer). Each *data point* in the figure represents data values from one of the SDP

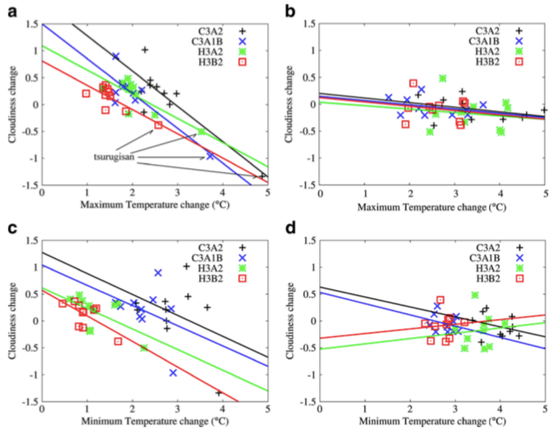
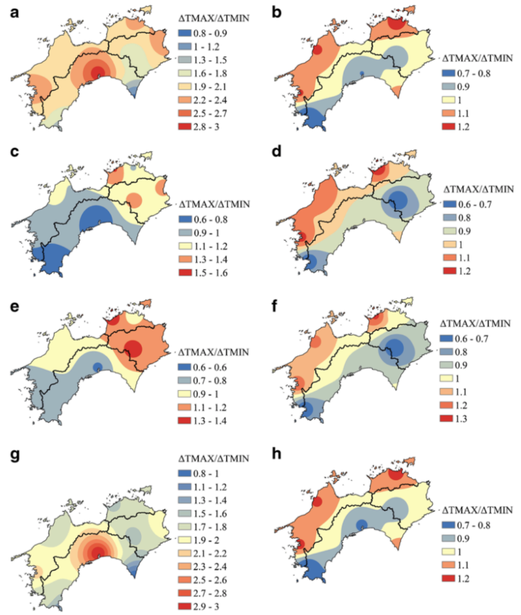


Fig. 5 Spatial distribution of the ratio of changes in TMAX to changes in TMIN. Changes in TMAX (TMIN) were calculated as the difference between TMAX (TMIN) averaged over the future period (2071–2099) and TMAX (TMIN) averaged over the base period (1961–1990) (**a** H3A2 for winter, **b** H3A2 for summer, **c** C3A2 for winter, **d** C3A2 for summer, **e** C3A1B for winter, **f** C3A1B for summer, **g** H3B2 for winter, and **h** H3B2 for summer)



Conclusions:

1. 训练阶段Tmax, Tmin和CLD的相关系数和标准误差有着明显的季节规律（冬季高夏季低）；
2. 使用SDSM降尺度方法可以成功捕捉到Tmax, Tmin和CLD的特征；
3. 验证集上，SDSM方法可以准确模拟Tmax, Tmin和CLD的值；
4. 冬季，Tmax的变化和CLD的变化有显著的负相关，而在夏季两者的相关性较弱；
5. 对于Tmin变量，在夏季的相关性情况和Tmax相似，而Tmin变量在C3A1B和C3A2两个数据集上冬季的负相关性要弱于另两个数据集；
6. DTR的变化和CLD的变化在冬夏季节之间的关系尚不明了，若想要知晓其中关联，还需在考虑未来气候变暖的前提下做进一步研究。

Report

2020.05.25

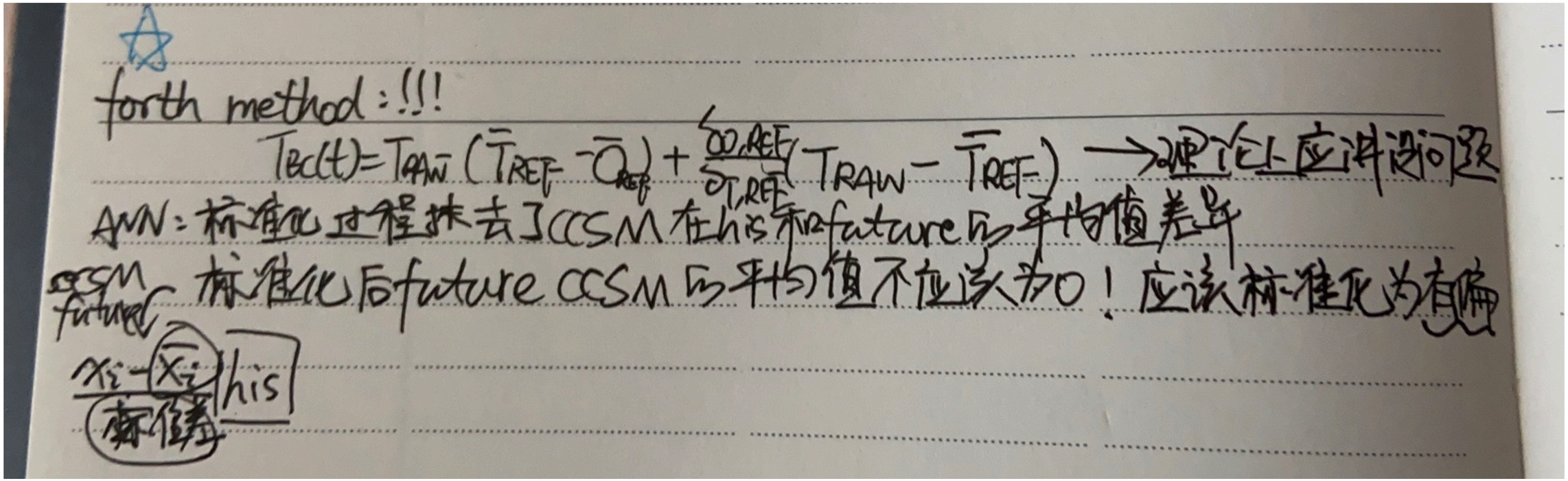
張慕琪

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）；

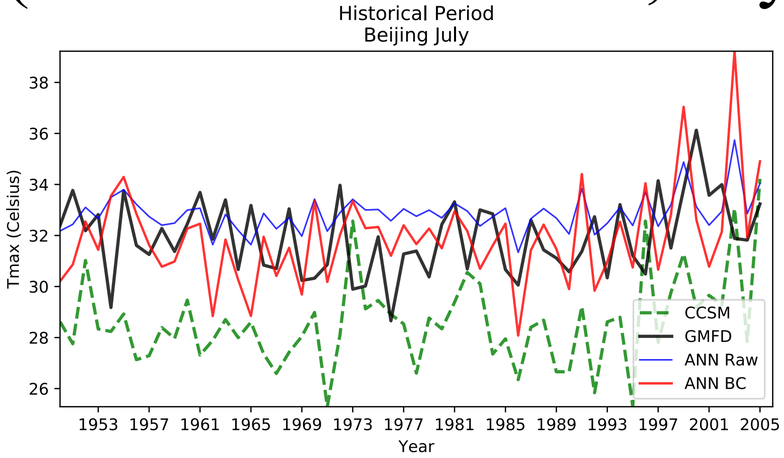


~~Historical的Bias Correction是否也使用第四版新方法？~~

Results

Time series Beijing Historical Tmax

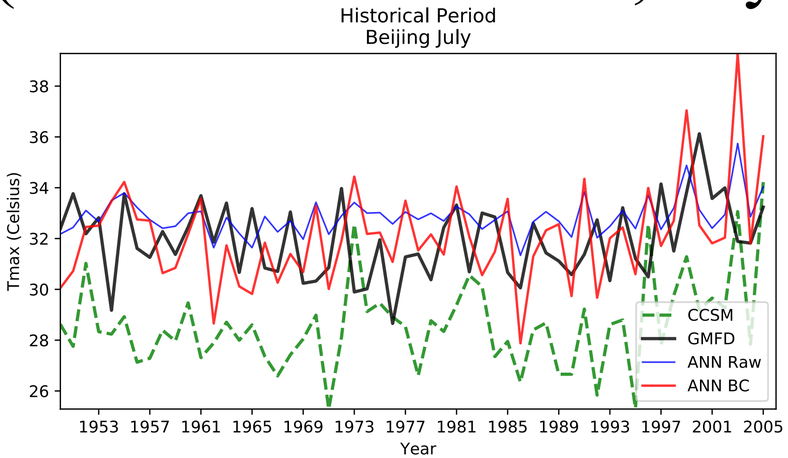
(second/third method, 56yr)




```
mean_ccsm =  28.61
mean_ground =  31.92
mean_ann_raw =  32.86
mean_ann_bc =  31.92

std_ccsm =  1.76
std_ground =  1.45
std_ann_raw =  0.72
std_ann_bc =  1.83
```

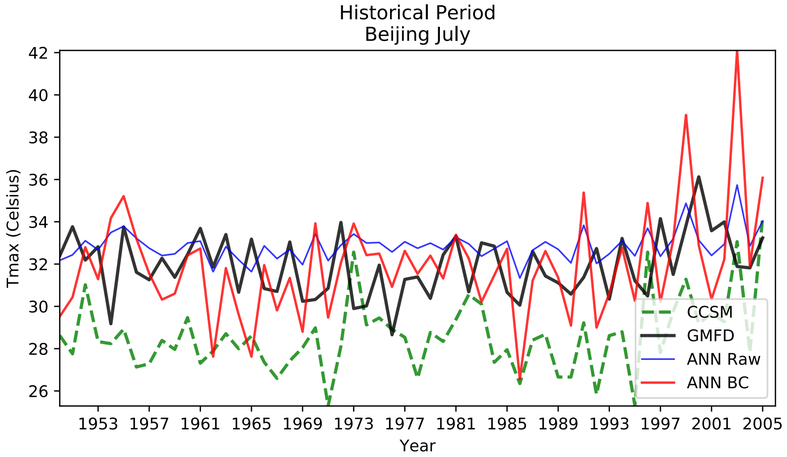
(second/third method, 42yr)




```
mean_ccsm =  28.61
mean_ground =  31.92
mean_ann_raw =  32.86
mean_ann_bc =  32.10

std_ccsm =  1.76
std_ground =  1.45
std_ann_raw =  0.72
std_ann_bc =  1.91
```

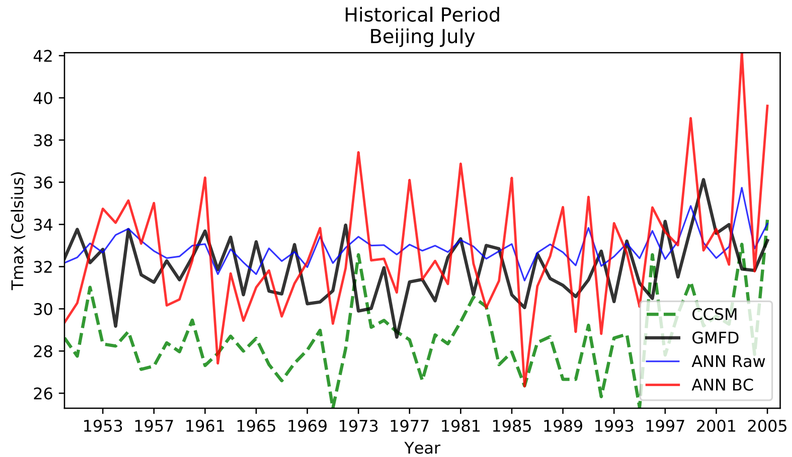
(forth method, 56yr)




```
mean_ccsm =  28.61
mean_ground =  31.92
mean_ann_raw =  32.86
mean_ann_bc =  31.92

std_ccsm =  1.76
std_ground =  1.45
std_ann_raw =  0.72
std_ann_bc =  2.55
```

(forth method, 42yr)

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mean_ccsm =  28.61
mean_ground =  31.92
mean_ann_raw =  32.86
mean_ann_bc =  32.69

std_ccsm =  1.76
std_ground =  1.45
std_ann_raw =  0.72
std_ann_bc =  2.95
```

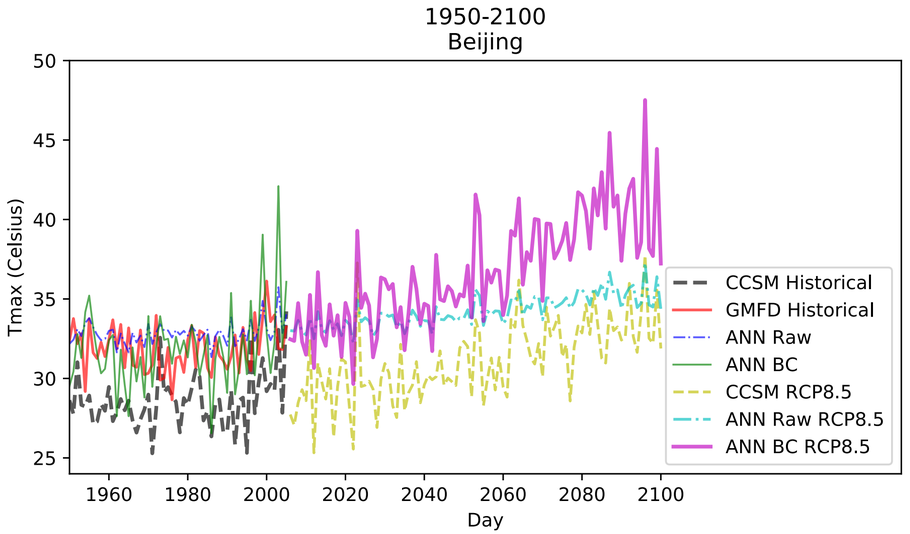
Results

Time series

Beijing

Future Tmax

(forth method, 56yr)



谢谢