WeeklyNote

2019.11.21

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Clim. Past, 12, 635–662, 2016
www.clim-past.net/12/635/2016/
doi:10.5194/cp-12-635-2016

Climate of the Past
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Probabilistic precipitation and temperature downscaling of the Twentieth Century Reanalysis over France

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Received: 7 August 2015 – Published in Clim. Past Discuss.: 18 September 2015
Revised: 15 February 2016 – Accepted: 29 February 2016 – Published: 16 March 2016

Introduction

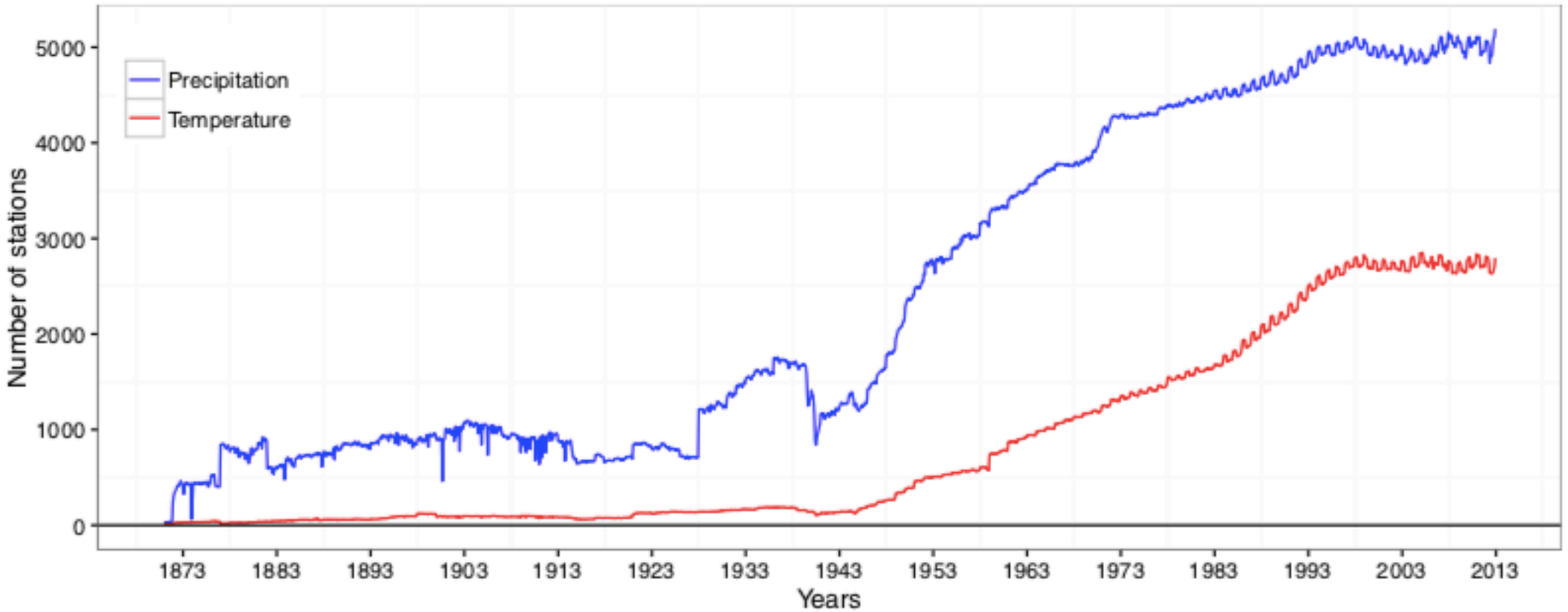
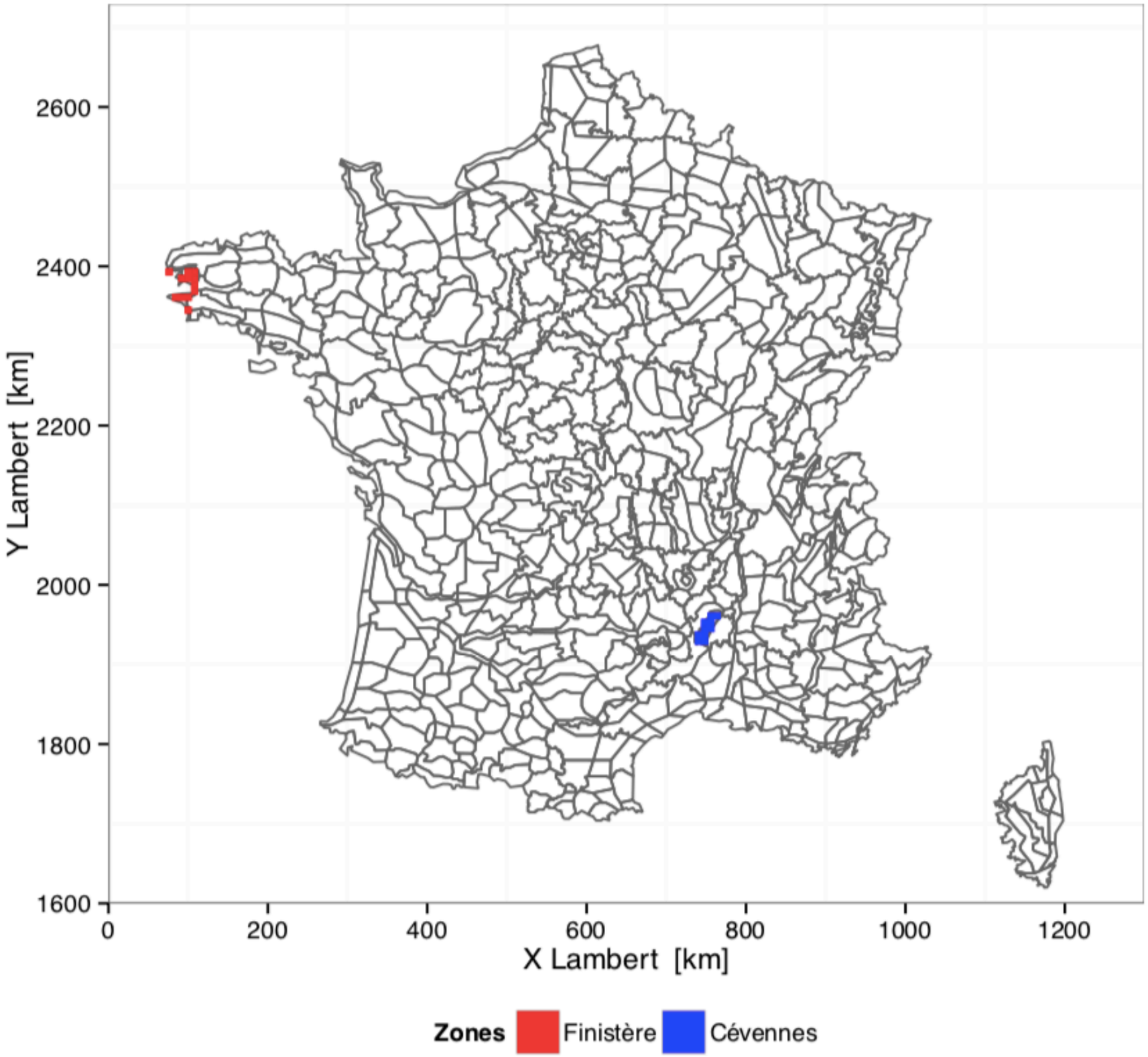


Figure 1. Evolution of the monthly averaged number of available precipitation and temperature stations in the Météo-France database (as of March 2015) since 1871.

Method


2600
2400
2200
2000
1800
1600
Y Lambert [km]
0
200
400
600
800
1000
1200
X Lambert [km]
Zones
Finistère
Cévennes

Method

Data:

1. NOAA Twentieth Century Reanalysis: Version 2 of 20CR(Compo et al., 2011), 2.0° spatial resolution and 6 hourly tem- poral resolution from the 1 January 1871 to present.

(temperature at 925 and 600 hPa, geopotential height at 1000 and 500 hPa, vertical velocity at 850 hPa, precipitable water content and relative humidity at 850 hPa)

2. NOAA Extended Reanalysis sea surface temperature version 3b(ERSST, Smith and Reynolds, 2003; Smith et al., 2008), 2.0° spatial resolution since the 1 January 1854.

(SST)

3. Safran: a meteorological reanalysis available at an 8 km spatial resolution and at the hourly temporal resolution from the 1 August 1958 to present.

(daily precipitation and temperature)

Method

SANDHY method:

1. First Predictor domain selection
2. Calendar selection
3. Stepwise selection

Results

1. 所有方法的偏差在年尺度上表现都很小；
2. First domain selection方法在冬季（夏季）存在较大的正偏差（负偏差）；
3. 后两种方法在季节上的偏差都得到了改进，冬季法国北部地区的偏差在0.5°C以下。

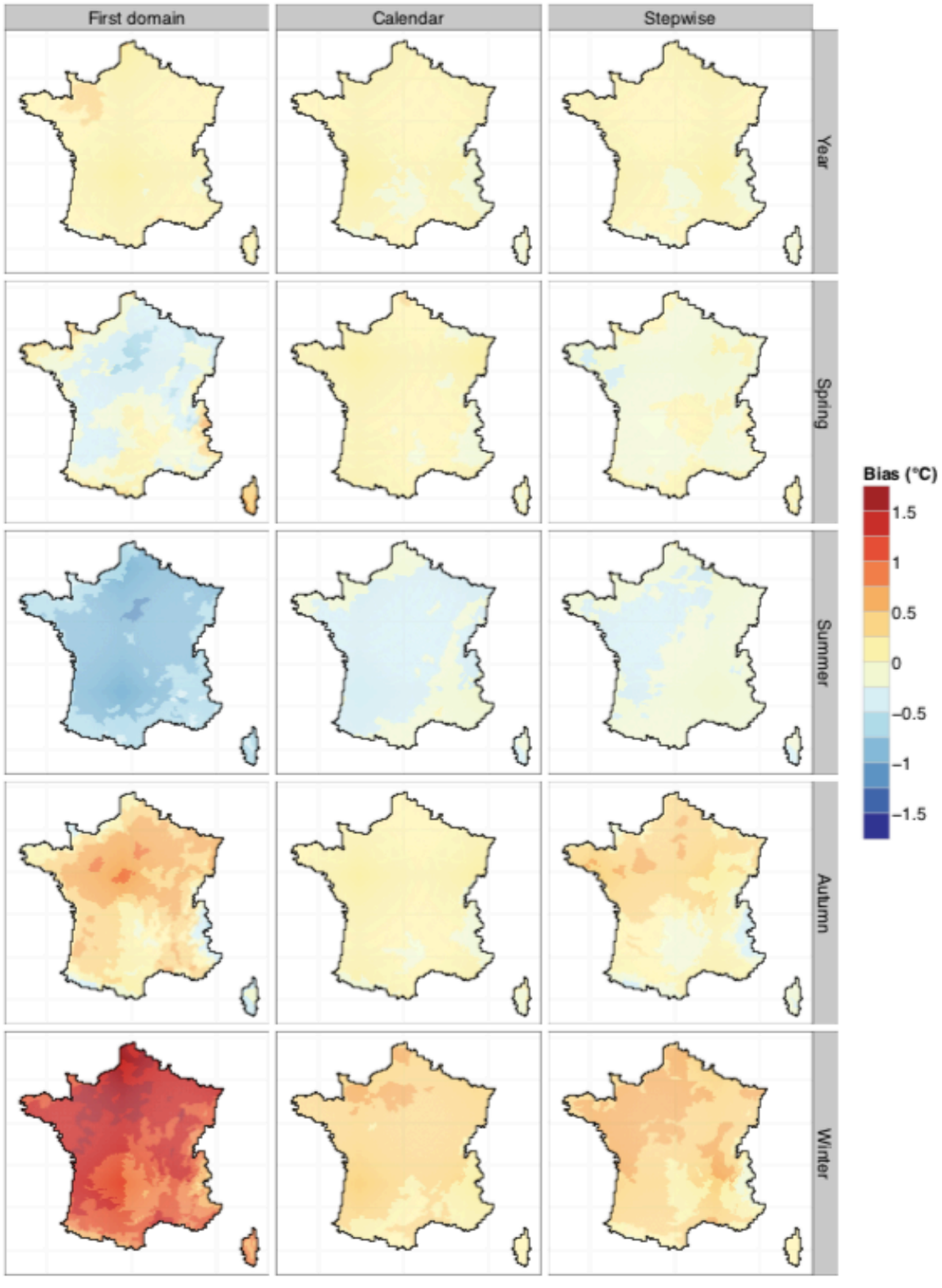


Figure 6. Median of annual and seasonal temperature bias between Safran and the three subselection methods for the 1959–2007 period. Red corresponds to an overestimation of the reconstructed temperature. Minimum bias of −1.0 °C for the first domain selection in summer and maximum bias of 1.7 °C for the first domain selection in winter.

Results

1. 在年尺度上，降水的偏差大概在-10%（-20%～+5%）；
2. First domain selection方法在四季均存在较大的正偏差（负偏差）；
3. 后两种方法在季节上的偏差并未得到显著改进。

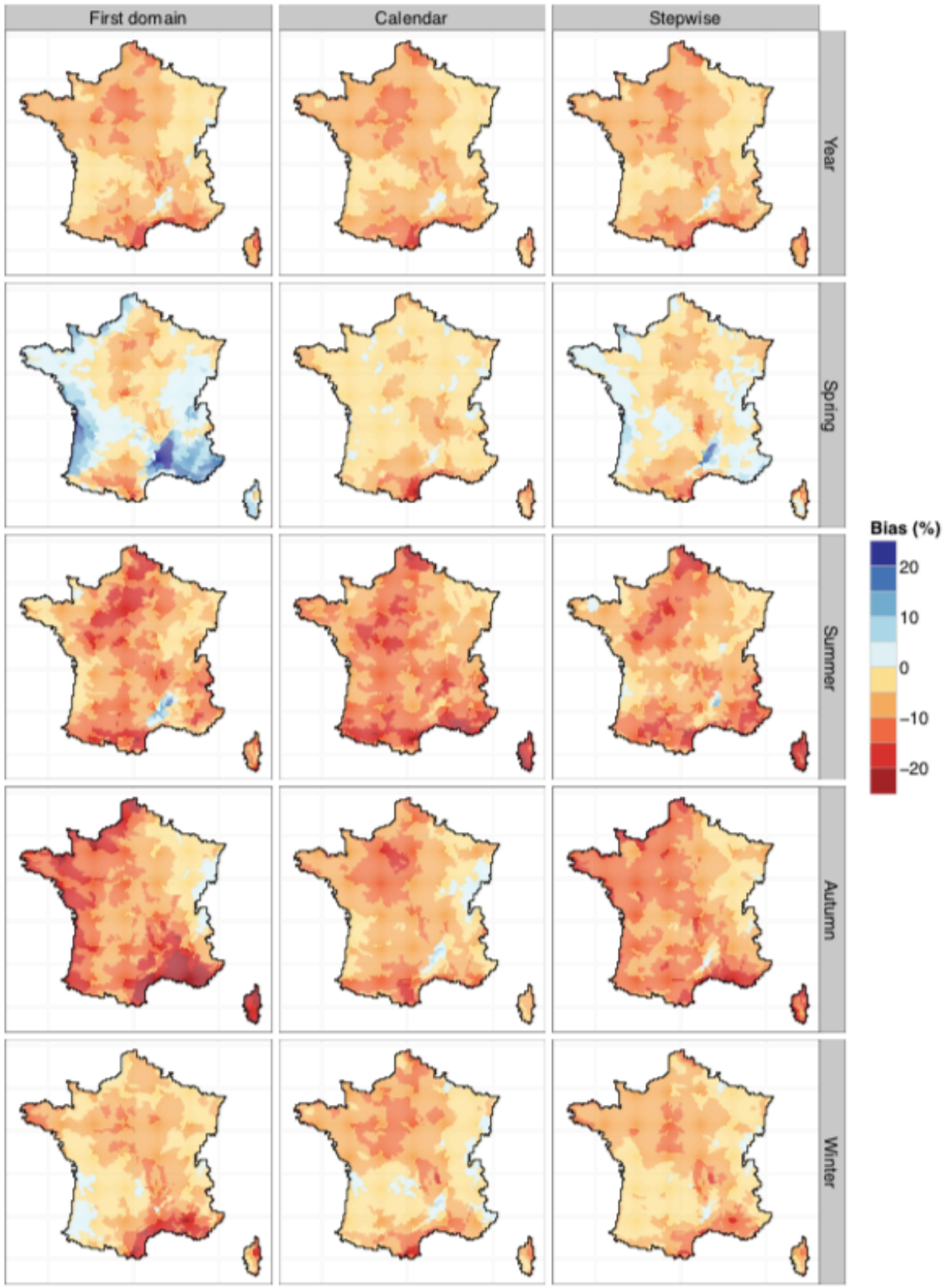


Figure 7. As for Fig. 6, but for precipitation. Red corresponds to an underestimation for precipitation. Minimum bias of −34 % for the first domain selection in autumn and maximum bias of 41 % for the first domain selection in spring.

Results

1. 相关系数最低发生在夏季（特别是东部地区）；
2. 使用Calendar selection方法并没有使相关系数有所提升；
3. 同时，stepwise selection却能得到相当高的相关系数（几乎大于0.9）。

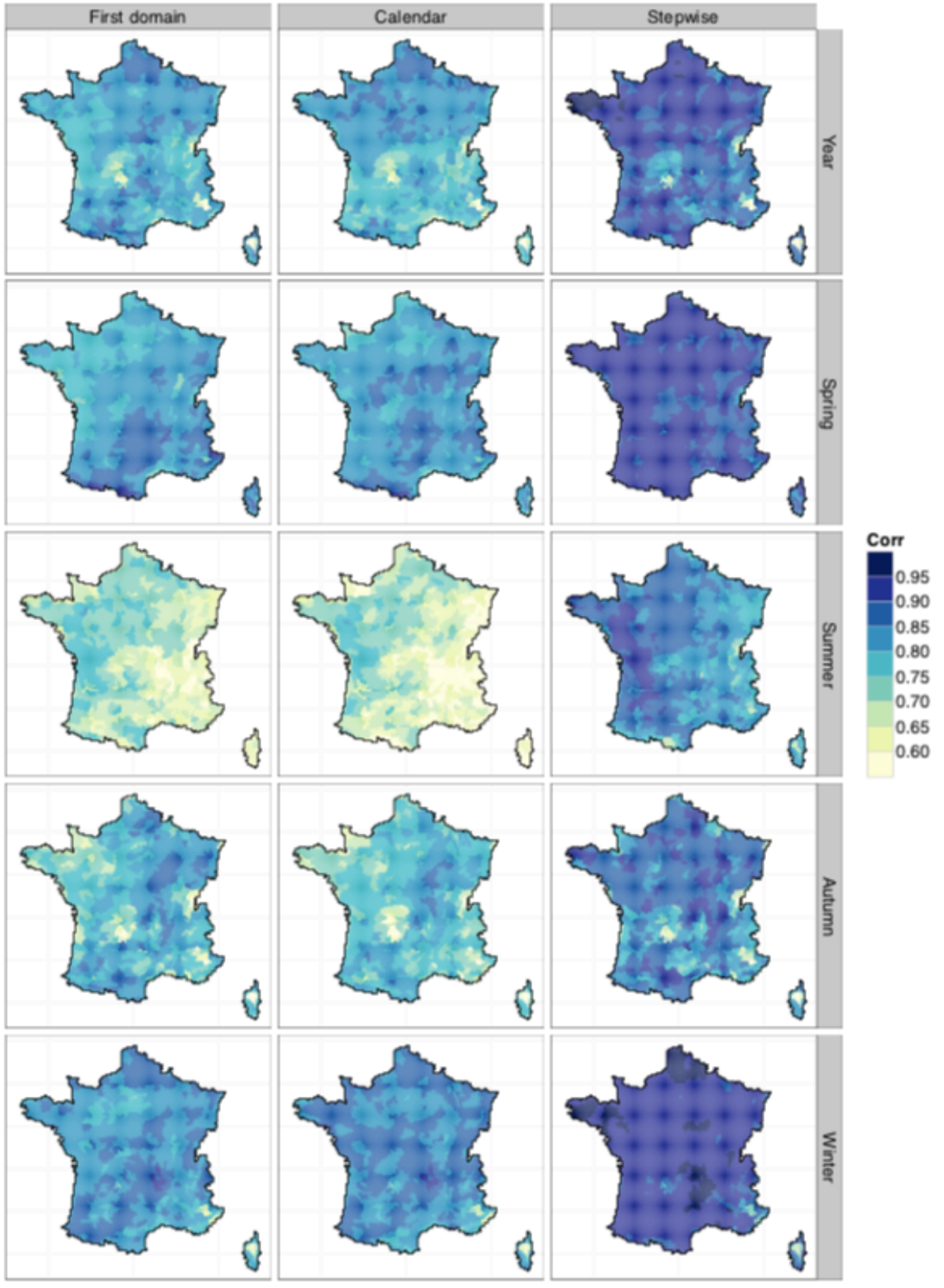


Figure 8. Median of the annual and seasonal temperature rank correlation between Safran all subselection methods for the 1959–2007 period. Minimum value of 0.35 for the first domain selection (year) and maximum value of 0.97 for the stepwise selection (year).

Results

1. 相关系数最高的时节是在冬（大部分地区均大于0.9）；
2. 三种方法的相关系数十分接近。

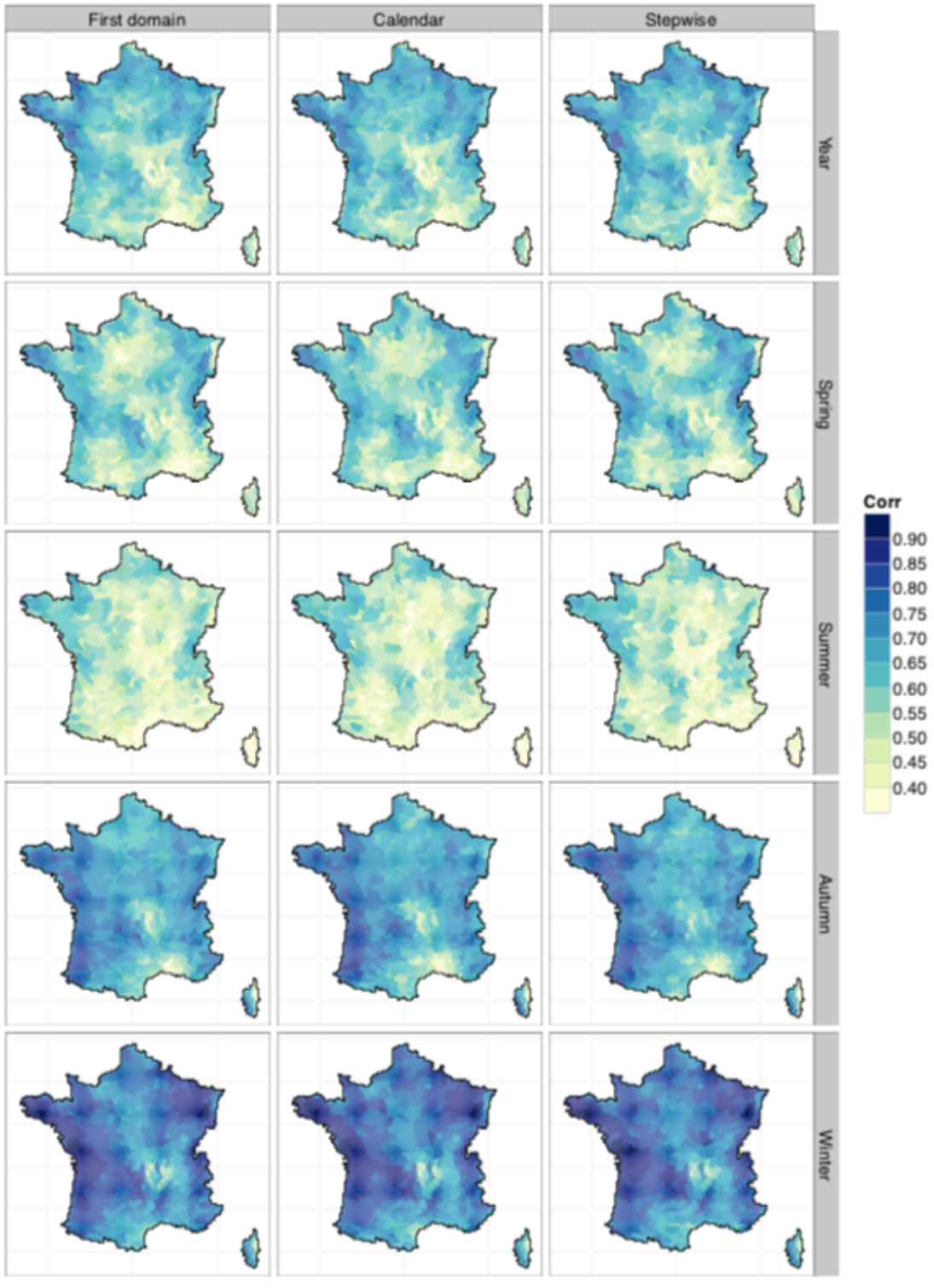


Figure 9. As for Fig. 8, but for precipitation. Minimum value of 0.19 for the first domain selection in summer and maximum value of 0.92 for the first domain selection in winter.

Results

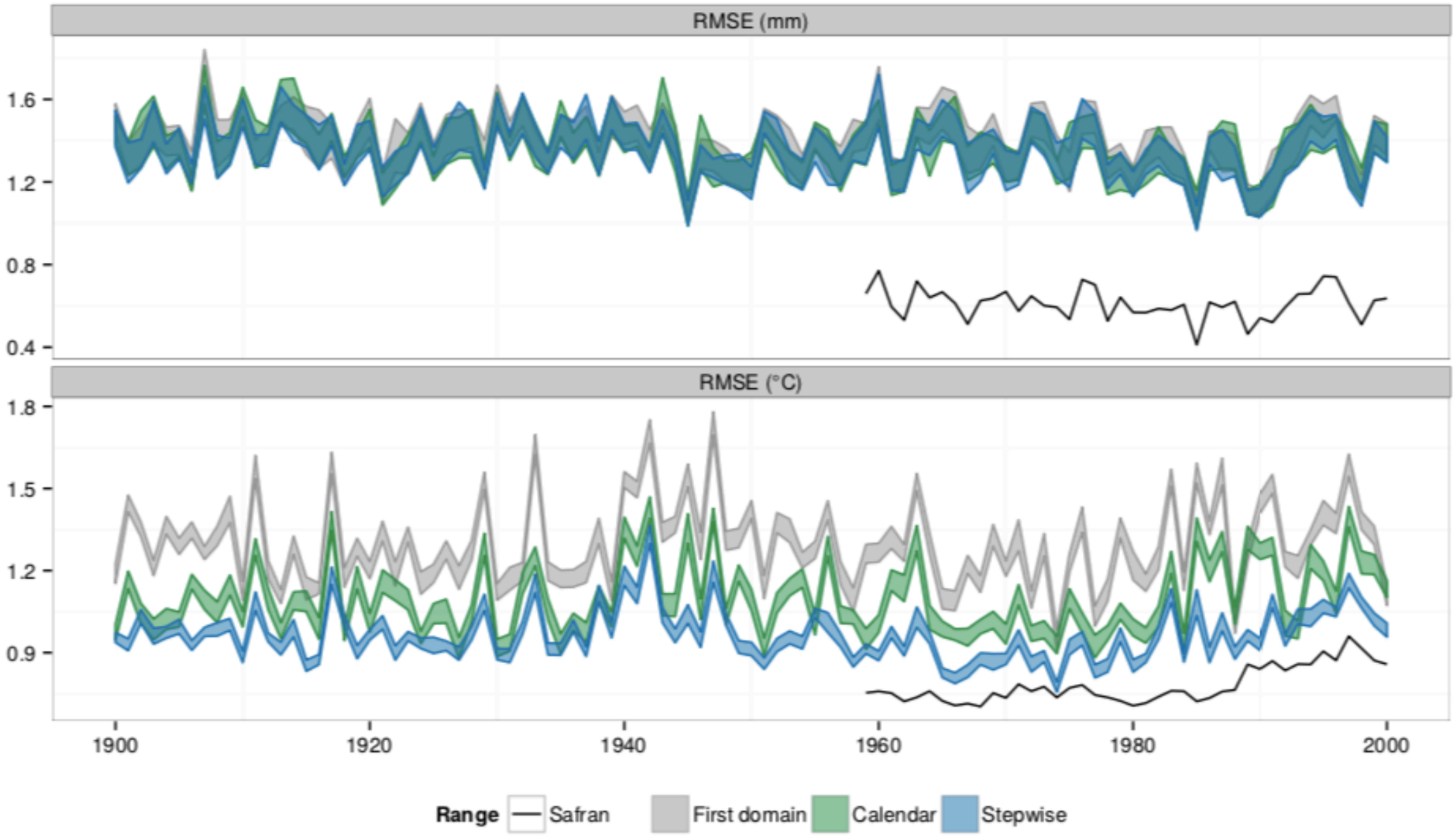


Figure 13. Temporal evolution of the precipitation and temperature RMSE for both Safran and the reconstructions with all three subselection methods, with the homogenized series as a reference. Values are initially computed at the monthly timescale. See text for details.

Results

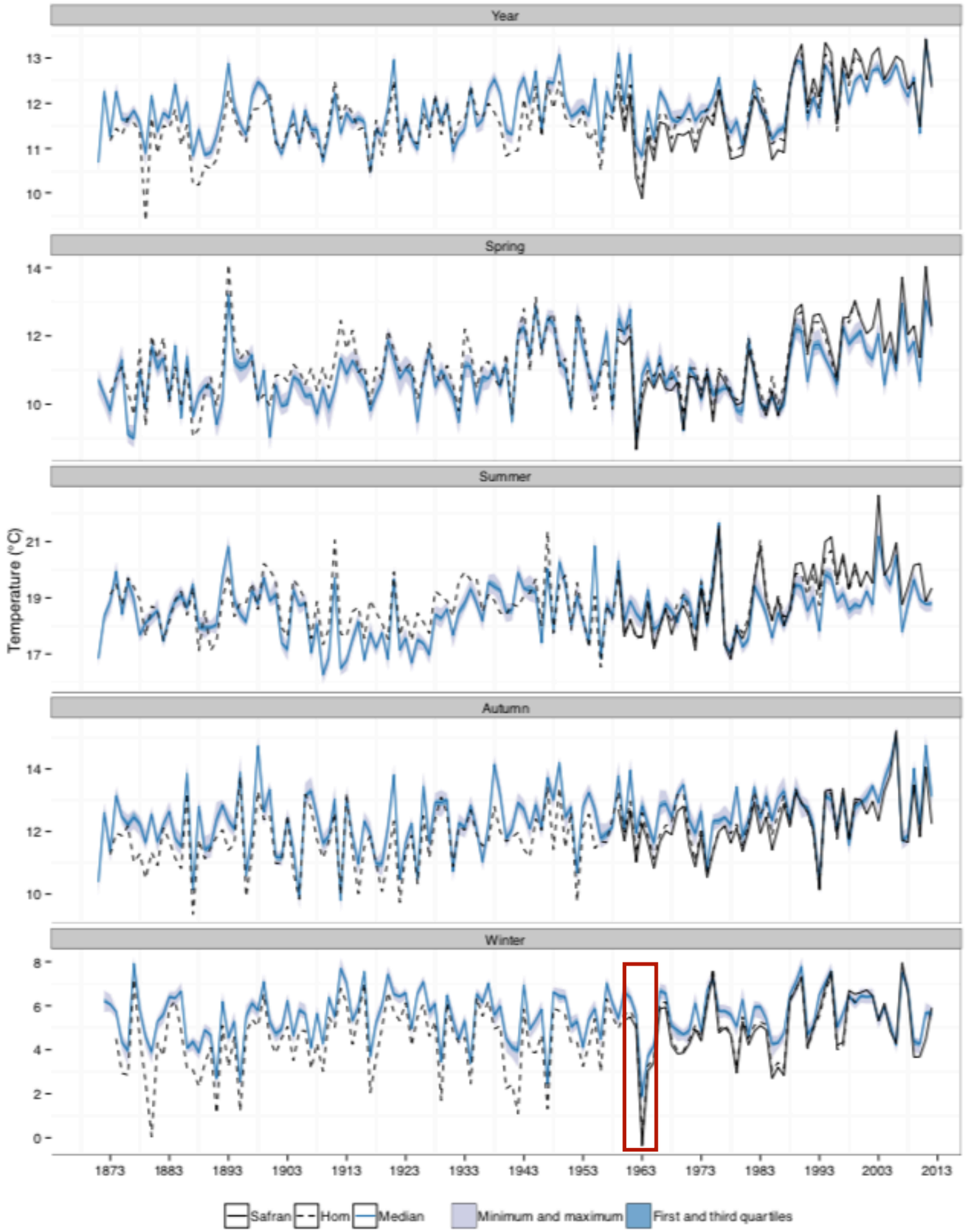
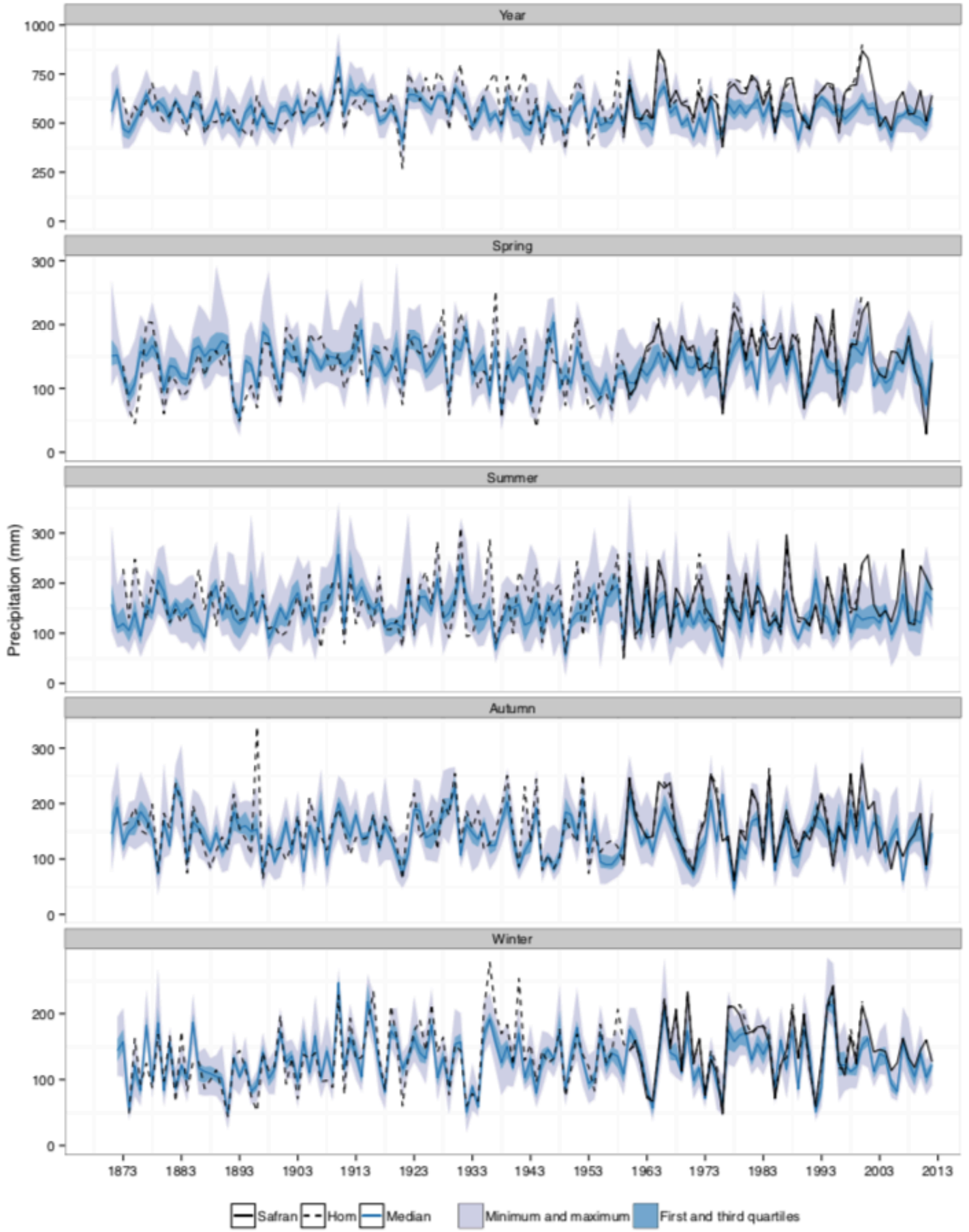


Figure 14. Paris Montsouris temperature homogenized time series, corresponding Safran data and reconstructed series from the stepwise selection at the annual and seasonal timescales over the 1871–2012 time period. Grey and blue ribbons define the range and the interquartile range, respectively, of values from all 25 realizations from the stepwise selection. Note the different scales for the *y* axes.

Results


Year
Spring
Summer
Autumn
Winter
Precipitation (mm)
1000
750
500
250
0
300
200
100
0
1873
1883
1893
1903
1913
1923
1933
1943
1953
1963
1973
1983
1993
2003
2013
Safran
Hom
Median
Minimum and maximum
First and third quartiles

谢谢