Supplement of Adv. Sci. Res., 17, 191–208, 2020
https://doi.org/10.5194/asr-17-191-2020-supplement

Advances in Science & Research
Open Access Proceedings

Supplement of

High resolution climate change projections for the Pyrenees region

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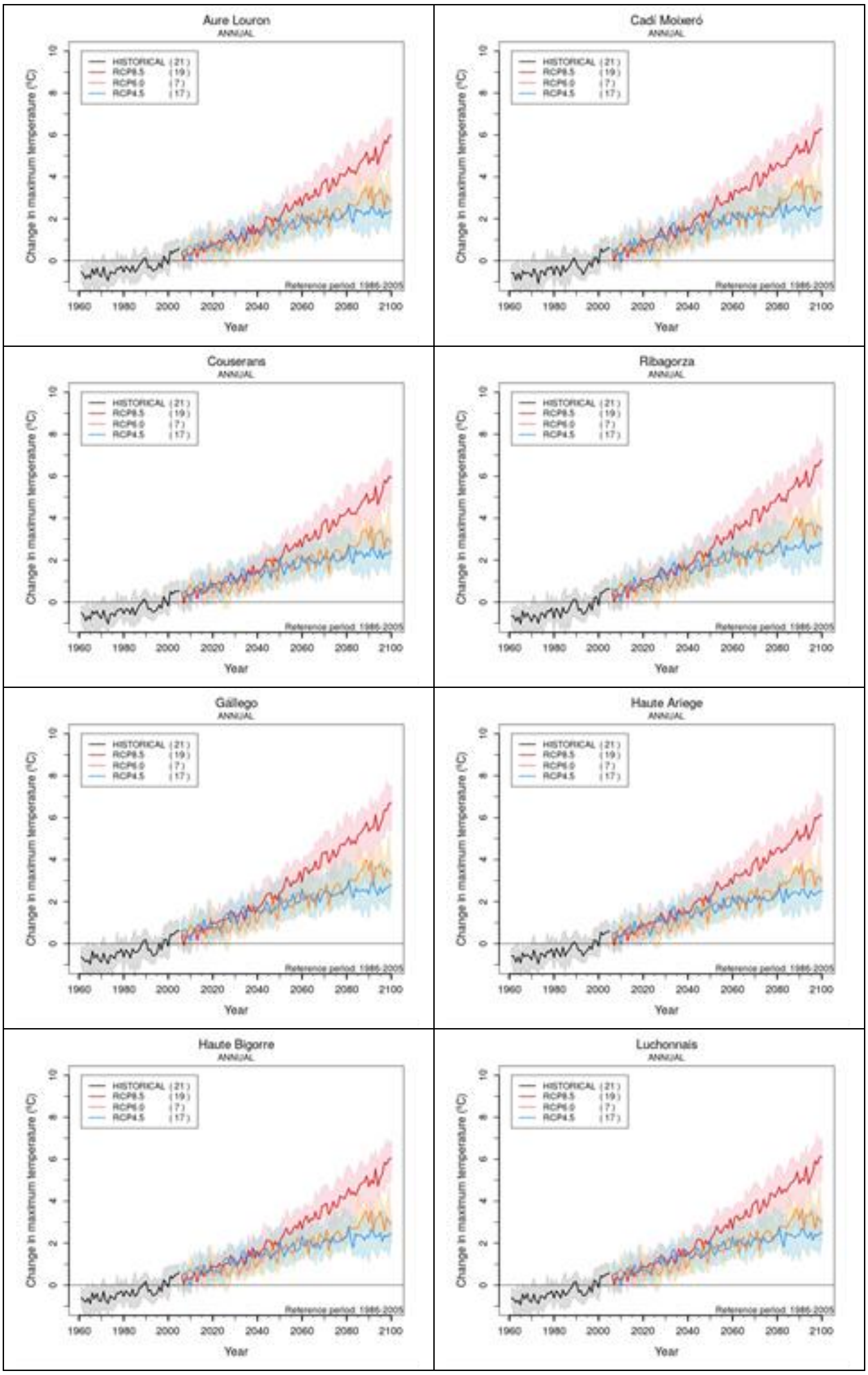
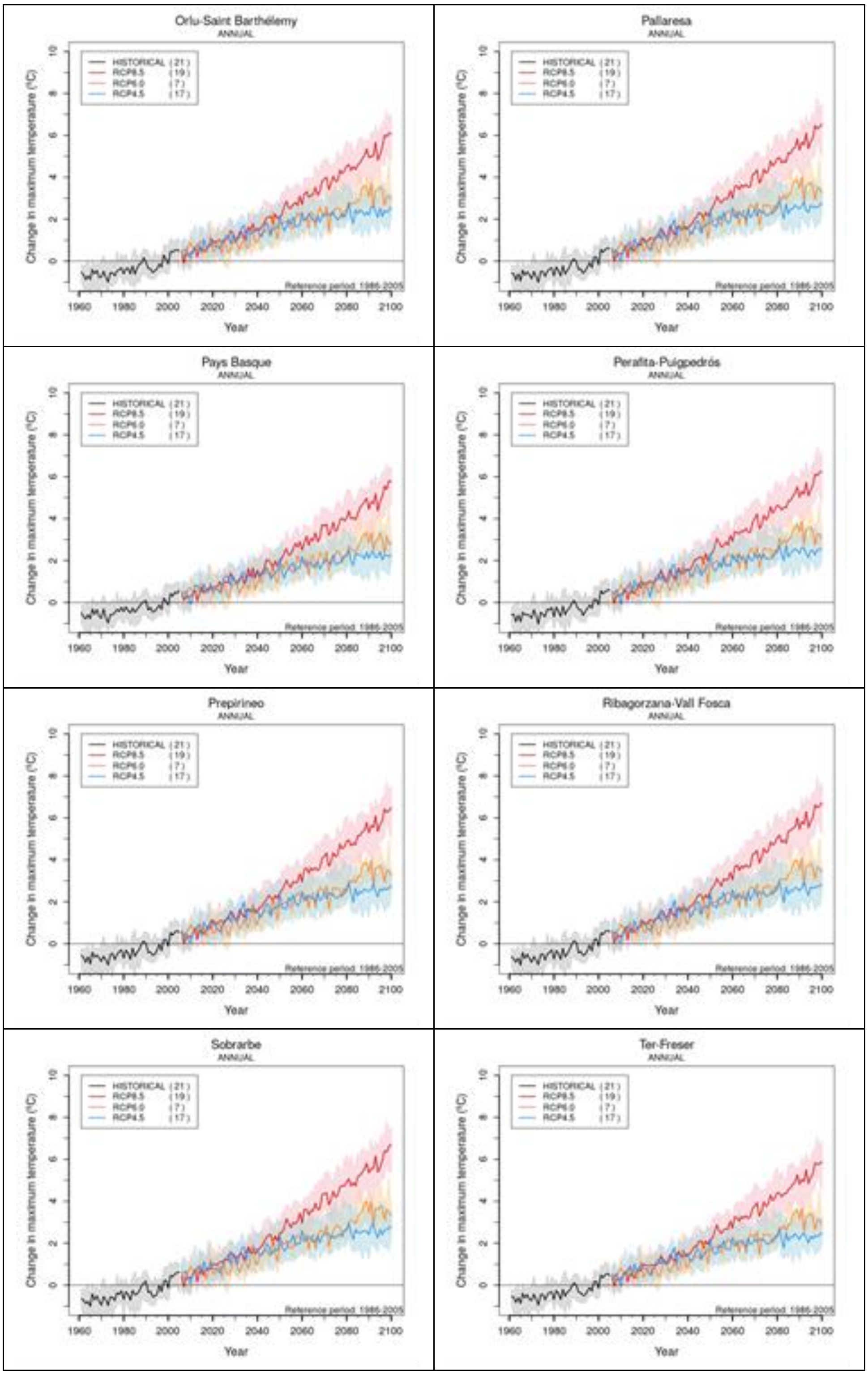
Analogues (Precipitation)	Regression (max and min temperature)
Mean sea level pressure (mslp)	Mean sea level pressure
Ug,Vg (geostrophic wind components at sea level)	T850
Q700 (specific humidity at 700 hPa)	U850,V850
U500, V500	T700
T500	U700,V700
Vertical gradient of temperature between 500 hPa and 850 hPa	T500
	U500, V500
Geostrophic vorticity at sea level	Q850,700,500
Tendency of Mean sea level pressure (variation of mslp with respect to the previous day)	U10, V10

Table S1. List of predictors used in precipitation (analogues) and temperature (regression)

Figure S1. Evolution of downscaled (regression method) maximum temperature change for massifs in the Pyrenees not included in the main text. Median is represented by thick line and shadow represents 17th percentile and 83rd percentile. Number in parentheses indicates the number of models used for the corresponding emission scenario

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Sobrarbe
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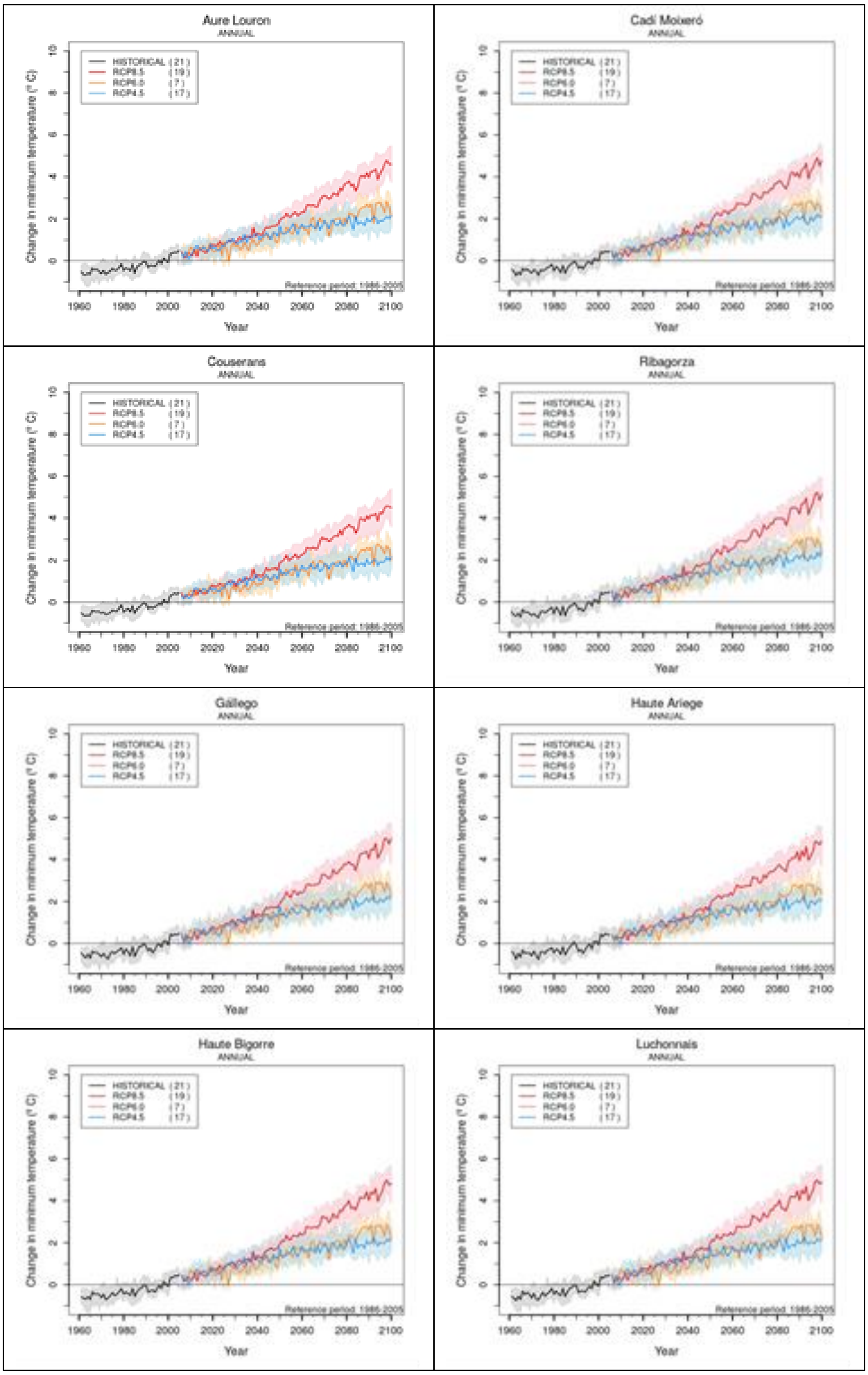
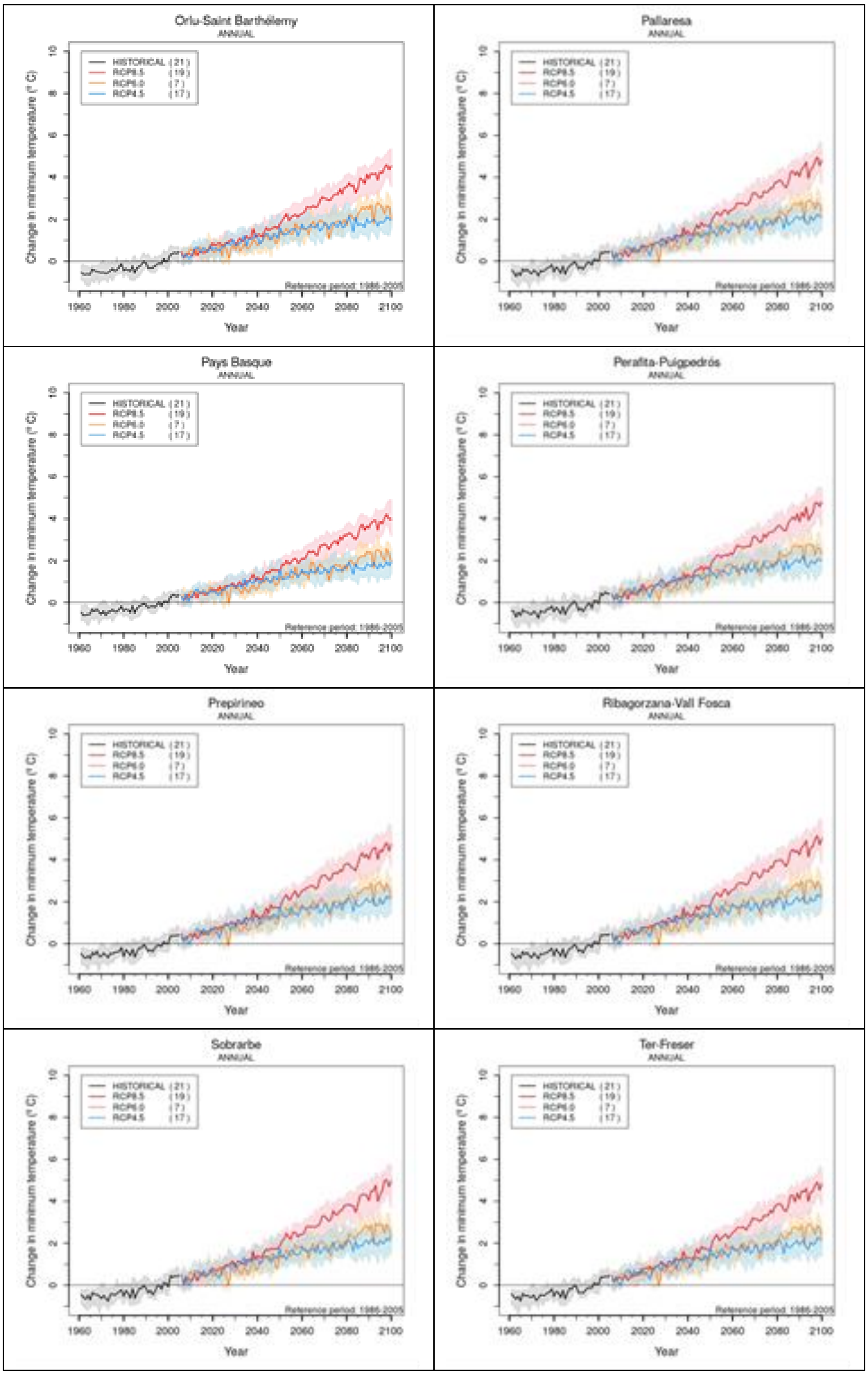
Ter-Freser
ANNUAL
HISTORICAL (21)
RCP8.5 (19)
RCP6.0 (7)
RCP4.5 (17)
Change in maximum temperature (°C)
Year
Reference period: 1986-2005

Figure S2. Same as Figure S1 but for minimum temperature.

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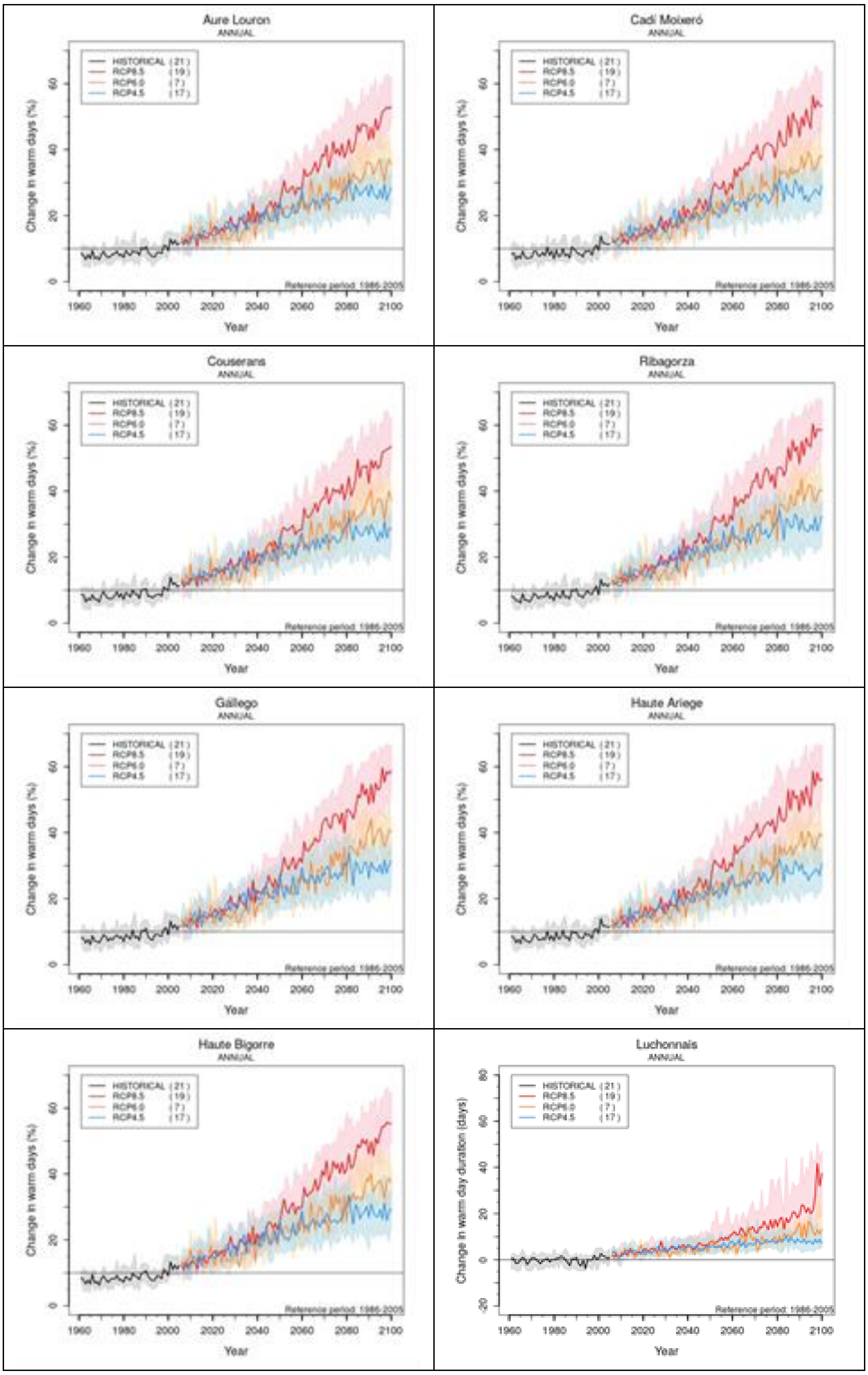
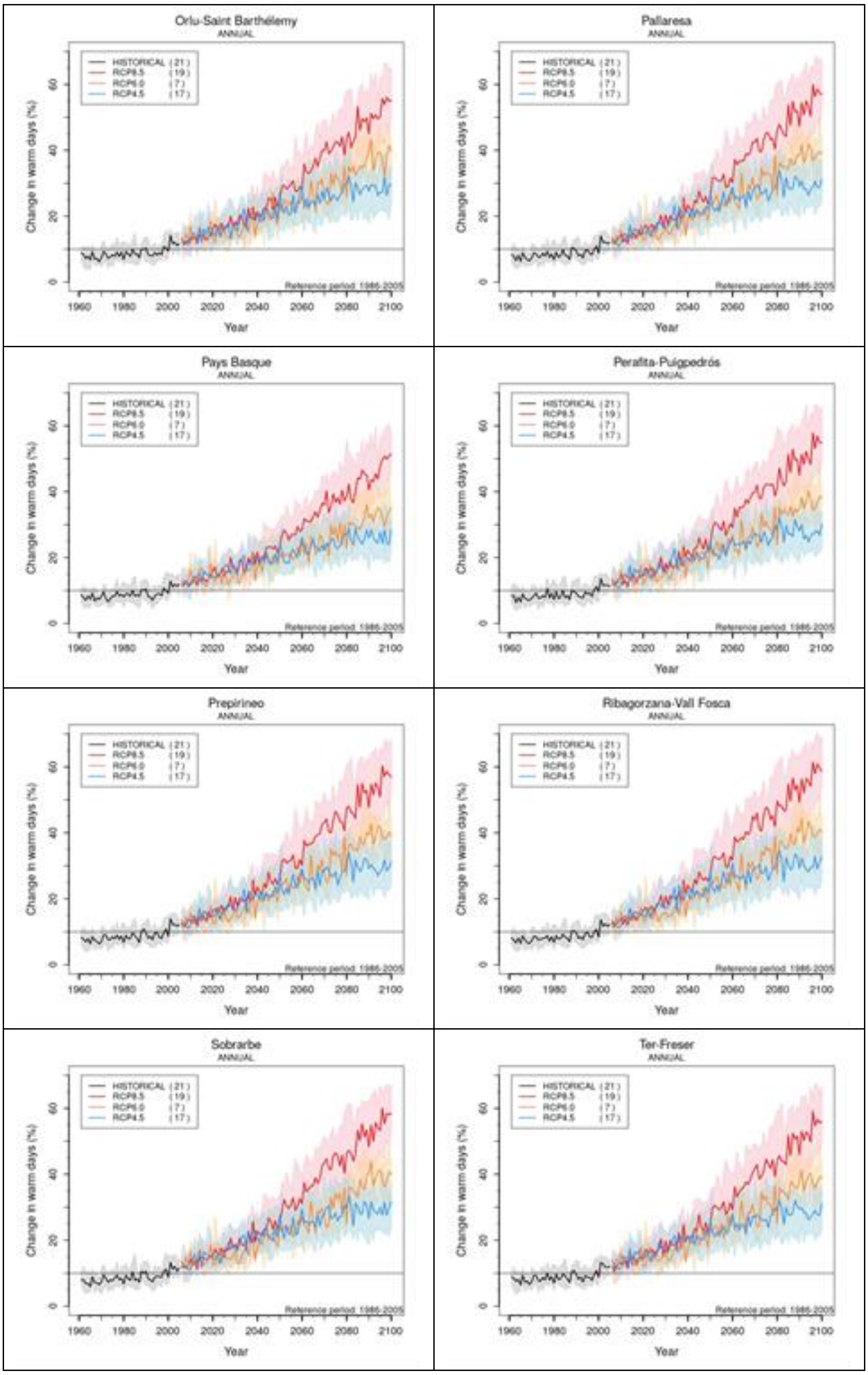
HISTORICAL (21)
RCP8.5 (19)
RCP6.0 (7)
RCP4.5 (17)
Change in minimum temperature (° C)
Year
Reference period: 1986-2005

Figure S3. The same as Figure S1 but for Warm Days (WD). A warm day is defined as a day with Tmax> calendar day 90th percentile centred on a 5-day window for the base period.

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Ribagorzana-Vall Fosca
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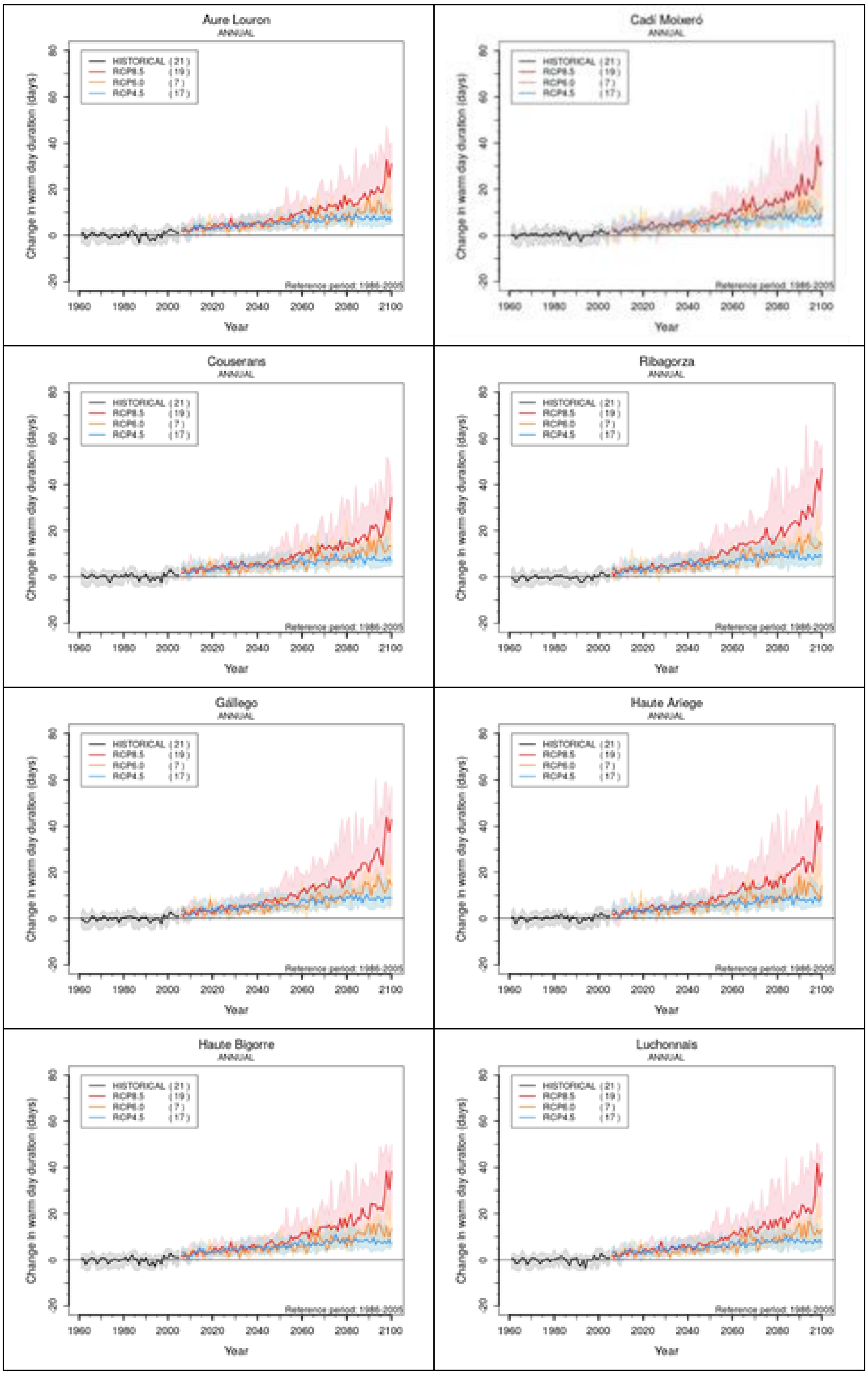
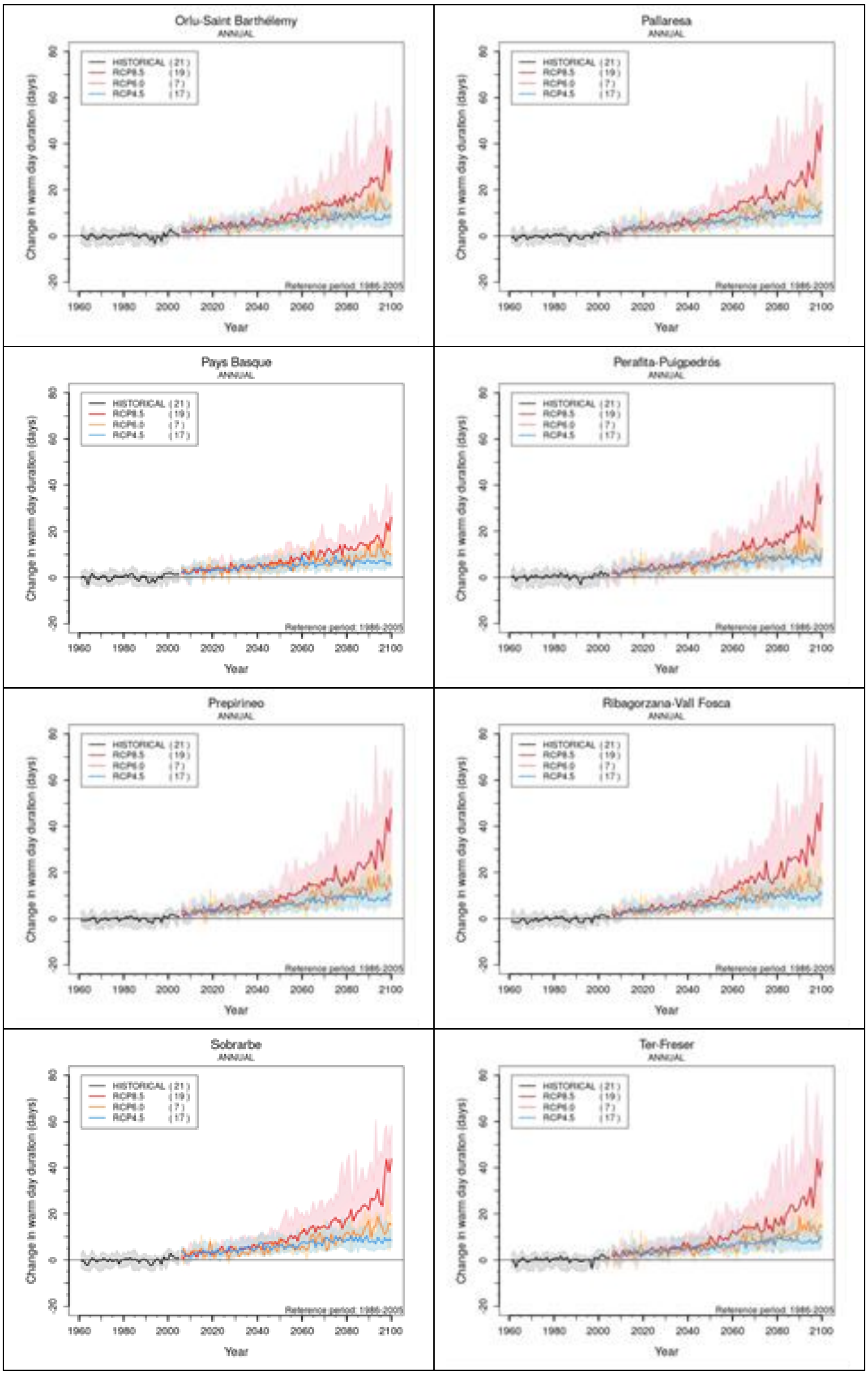
Sobrarbe
ANNUAL
Ter-Freser
ANNUAL
HISTORICAL (21)
RCP8.5 (19)
RCP6.0 (7)
RCP4.5 (17)
Change in warm days (%)
Reference period: 1986-2005
Year
1960
1980
2000
2020
2040
2060
2080
2100
0
20
40
60

Figure S4. The same as Figure S1 but for Warm Spell Duration Index (WSDI). Annual count of days with at least 6 consecutive warm days.

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Sobrarbe
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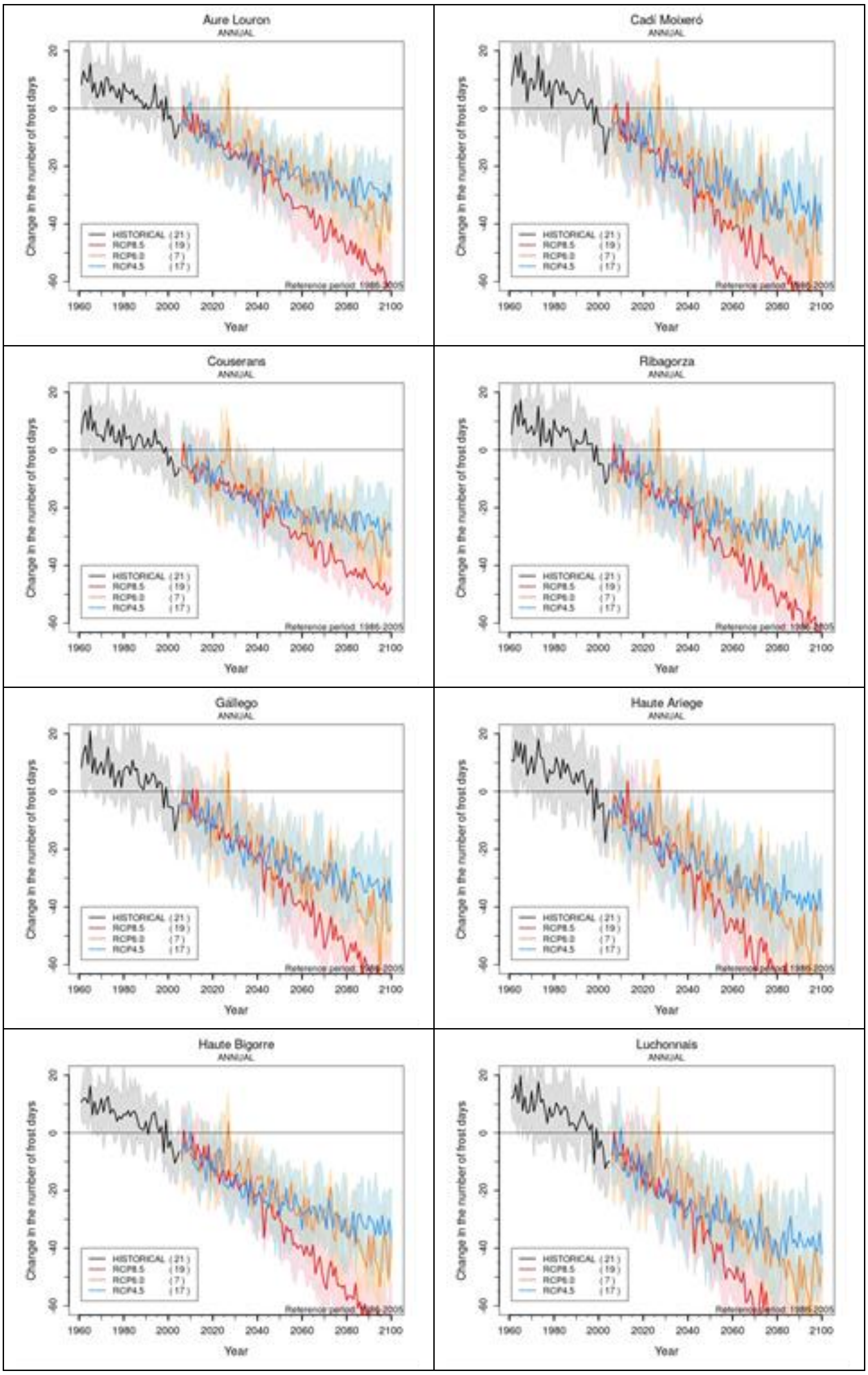
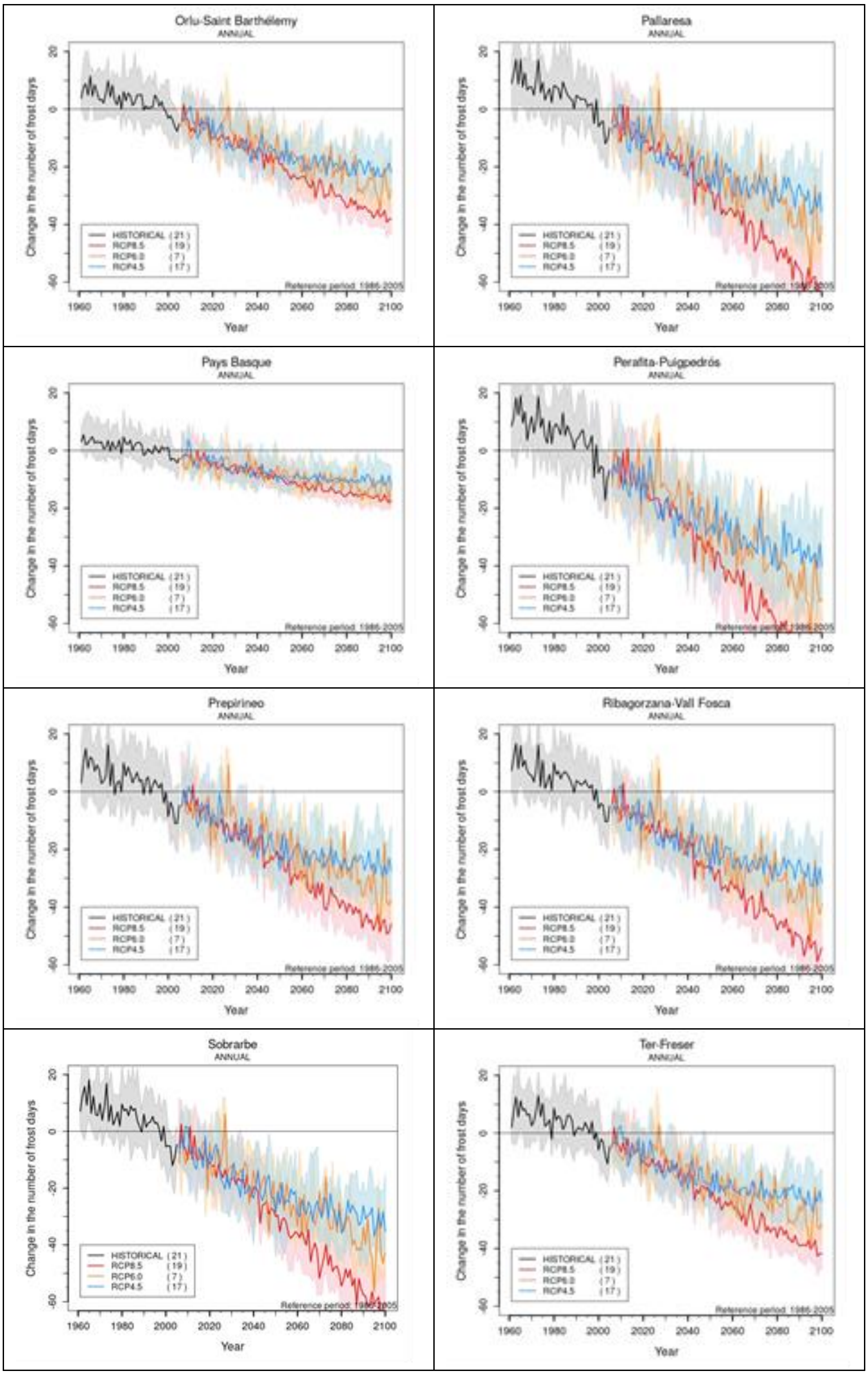
Ter-Freser
ANNUAL
HISTORICAL (21)
RCP8.5 (19)
RCP6.0 (7)
RCP4.5 (17)
Change in warm day duration (days)
Year
Reference period: 1986-2005

Figure S5. The same as Figure S1 but for Frost Days (FD). Annual count of days when daily minimum temperature Tmin < 0°C.

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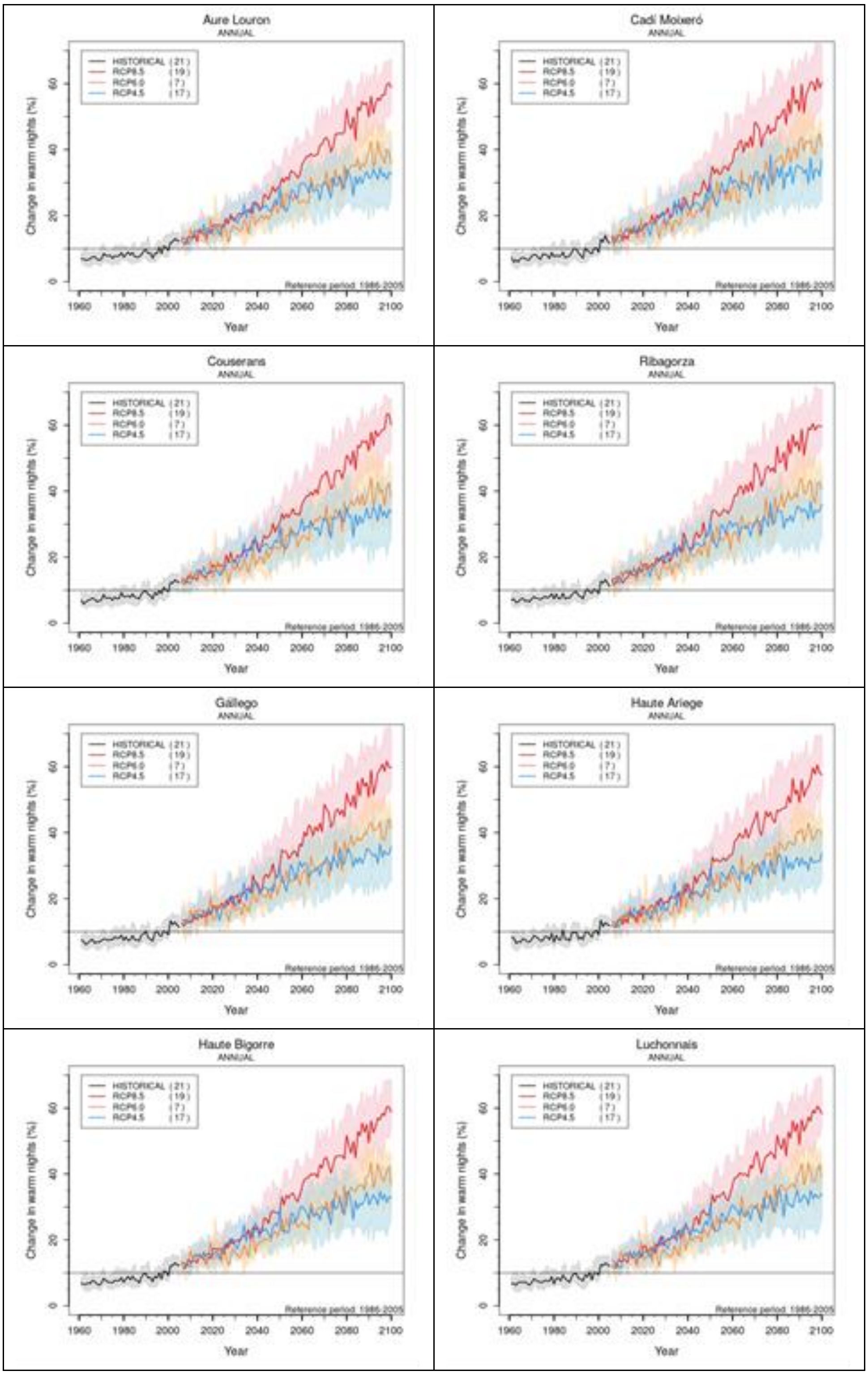
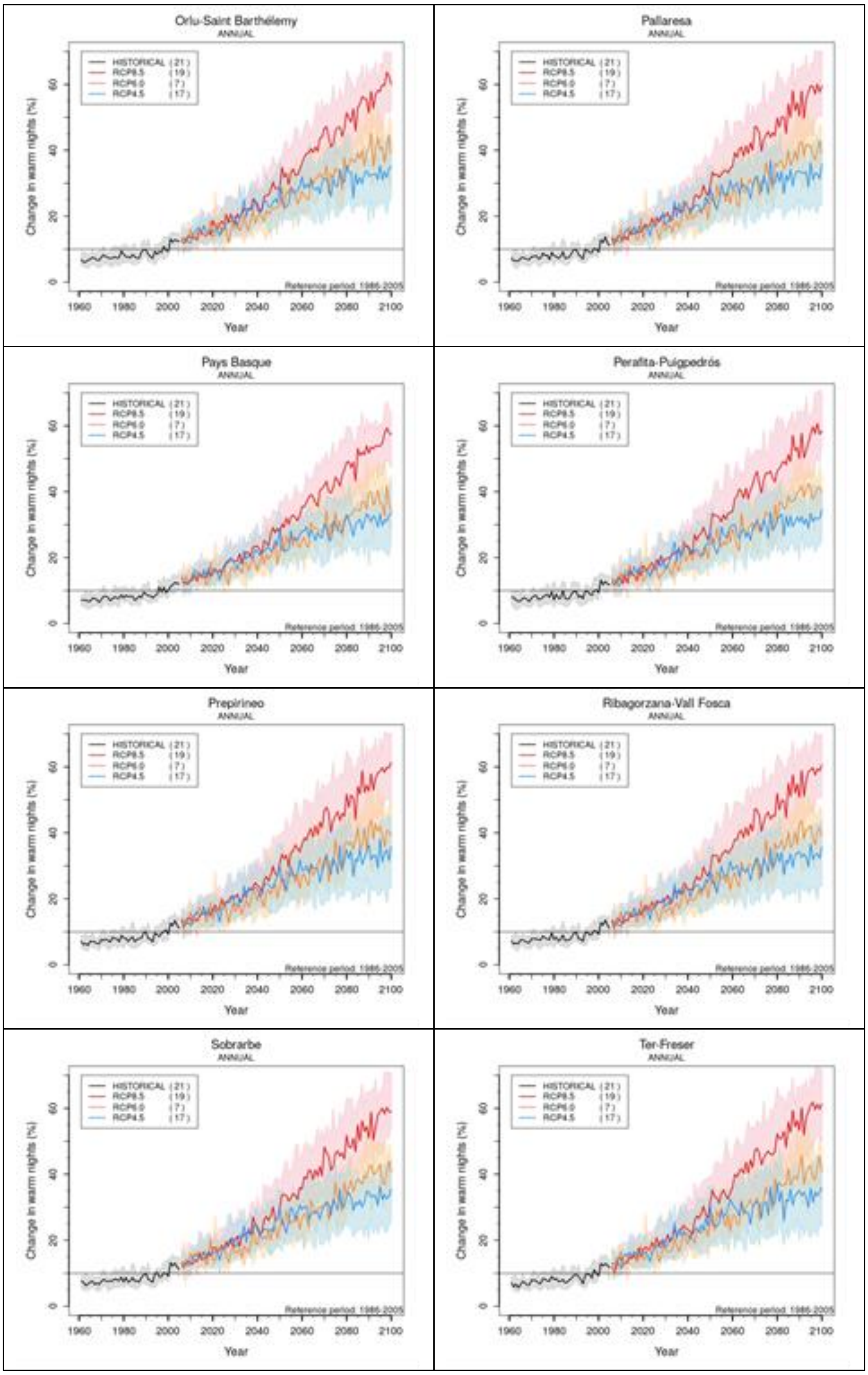
Pays Basque
Perafita-Puigpedrós
Prepirineo
Ribagorzana-Vall Fosca
Sobrarbe
Ter-Freser
ANNUAL
Change in the number of frost days
Year
HISTORICAL (21)
RCP8.5 (19)
RCP6.0 (7)
RCP4.5 (17)
Reference period: 1986-2005

Figure S6. The same as Figure S1 but for Warm Nights (WN). A warm night day is defined as a day with Tmin > calendar day 90th percentile centred on a 5-day window for the base period.

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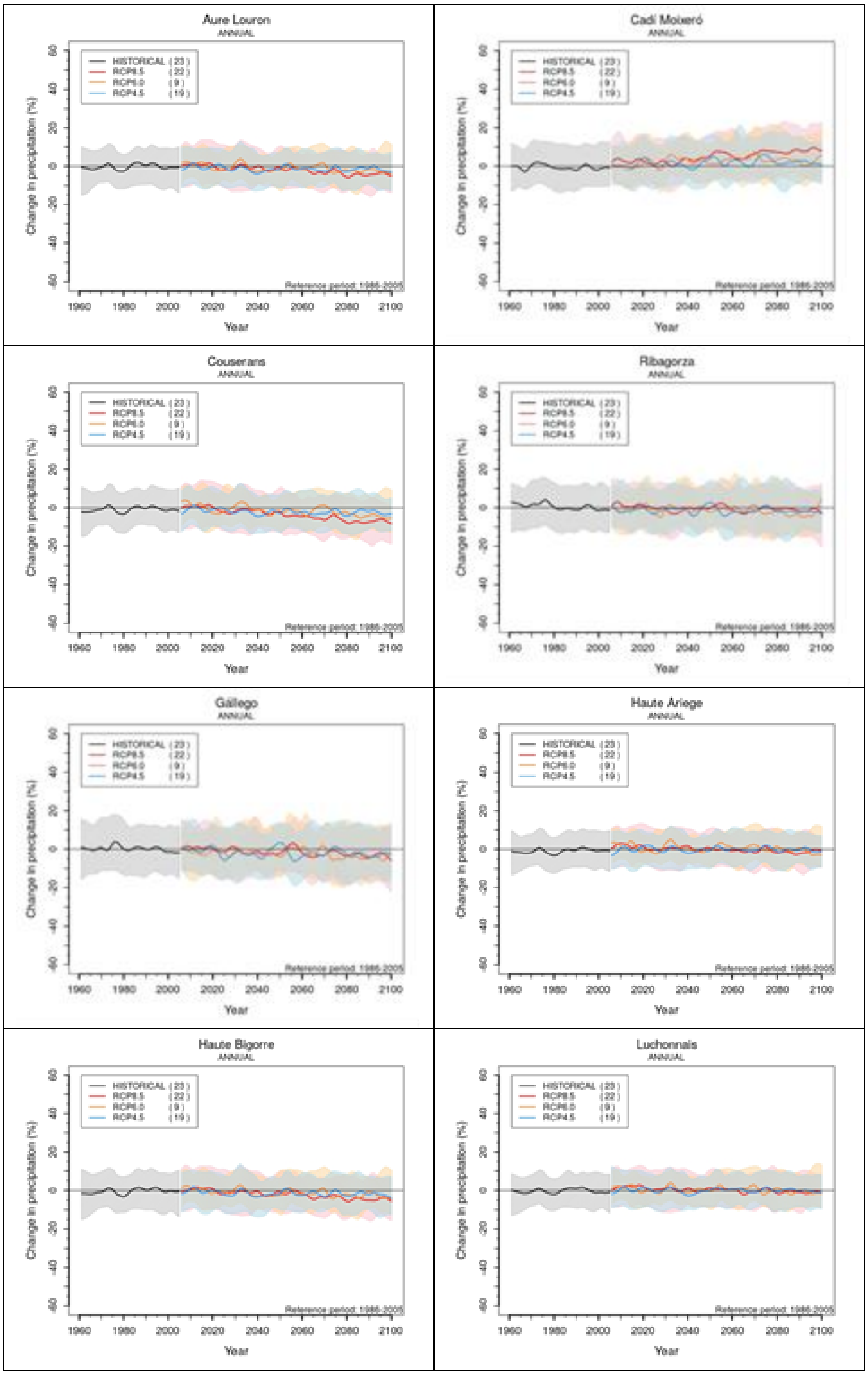
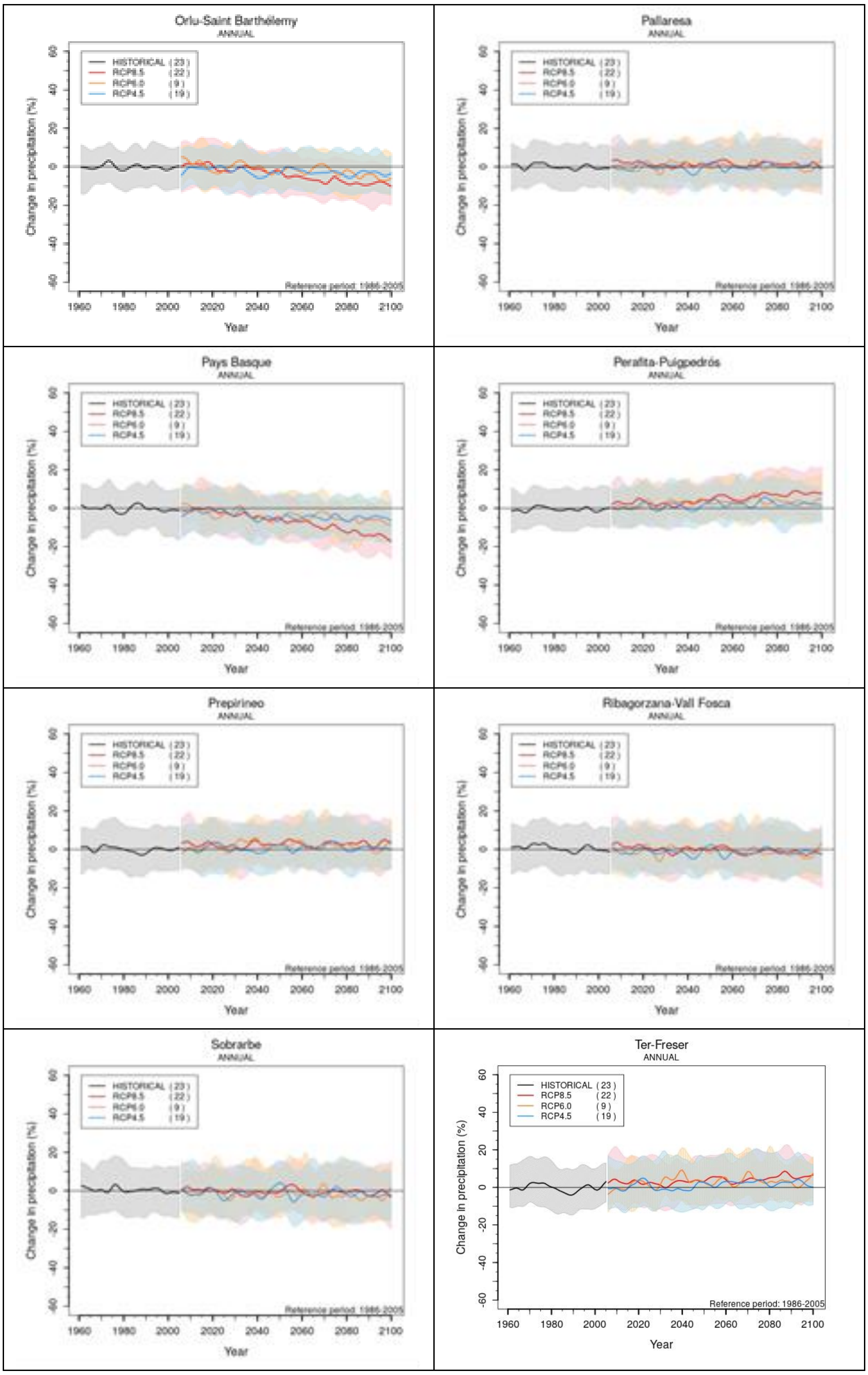
Perafita-Puigpedrós
Prepirineo
Ribagorzana-Vall Fosca
Sobrarbe
Ter-Freser
ANNUAL
HISTORICAL (21)
RCP8.5 (19)
RCP6.0 (7)
RCP4.5 (17)
Change in warm nights (%)
Year
Reference period: 1986-2005

Figure S7. The same as Figure S1 but for downscaled (analogue method) accumulated precipitation (%). A 10-point Gaussian filter has been applied.

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Ribagorzana-Vall Fosca
Sobrarbe
Ter-Freser
ANNUAL
HISTORICAL (23)
RCP8.5 (22)
RCP6.0 (9)
RCP4.5 (19)
Change in precipitation (%)
Year
Reference period: 1986-2005

I

Brief evaluation of the applied downscaling methods over the Pyrenees region

Although the here applied downscaling methods have been extensively evaluated and used in other projects, for the sake of completeness we summarised below a selection of maps showing some results of both downscaling methods (regression for temperatures and analogues for precipitation) specifically for the Pyrenees region. The calibration period was 1981-1995 whereas the evaluation covers the period 1996-2017. The calibration is based on a low resolution reanalysis (ERA Interim reanalysis at 1.5º resolution) and the new AEMET high-resolution (5 km x 5km) observational grid of surface meteorological variables. For the evaluation we compared the downscaled precipitation and temperature fields against the corresponding fields from the AEMET high resolution observational grid. Both mean (accumulated/mean over season periods) and extreme values (95th percentile) are shown.

Figure S8. Mean winter (DJF) maximum temperature (ºC) averaged over the period 1997-2016 of: a) ERA Interim (ERAI), b) AEMET observational high-resolution grid (OBS), c) downscaled ERA-Interim (DOWN), and d) bias (DOWN-OBS= BIAS).

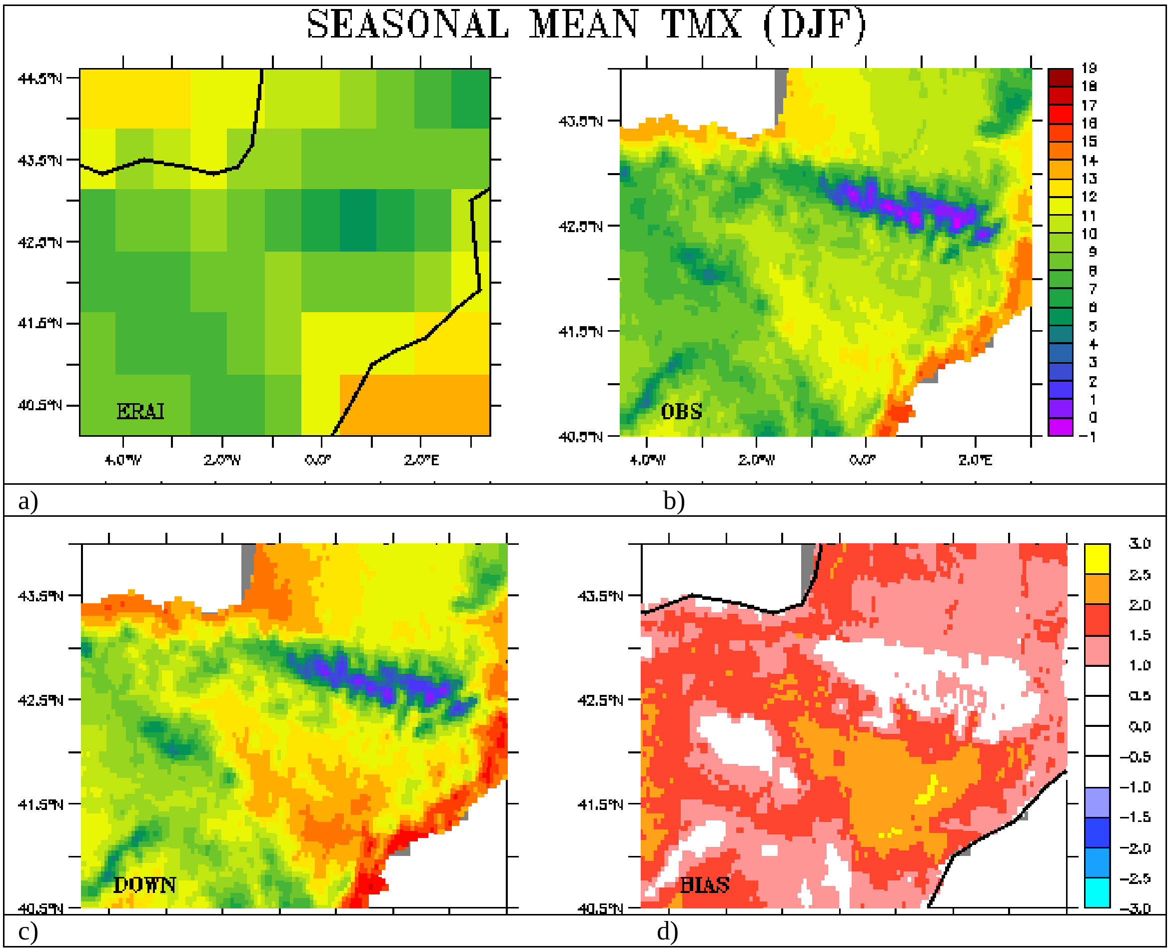

Figure S9. The same as Figure S8 but for summer (JJA) maximum temperature (ºC).

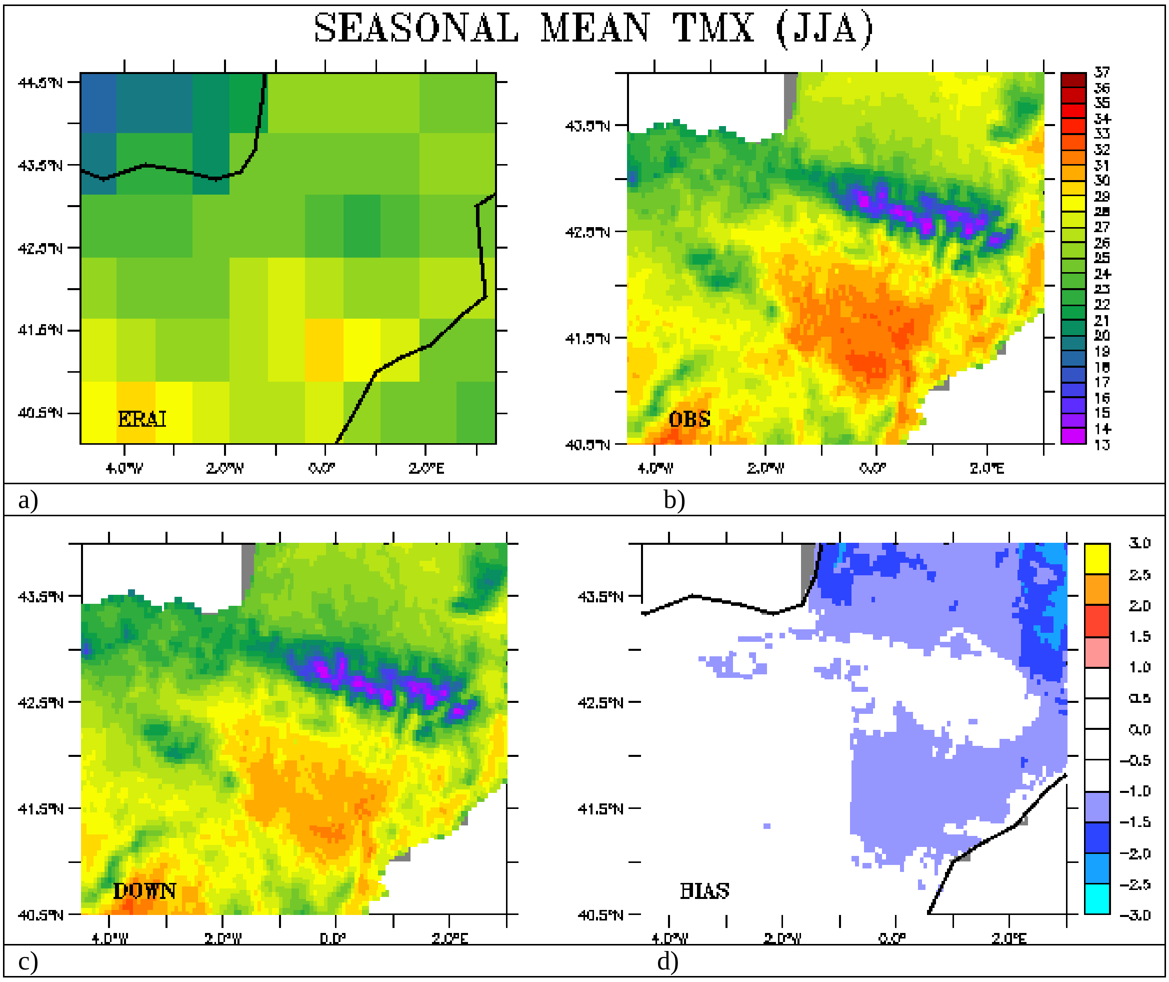

Figure S10. The same as Figure S8 but for winter (DJF) minimum temperature (ºC).

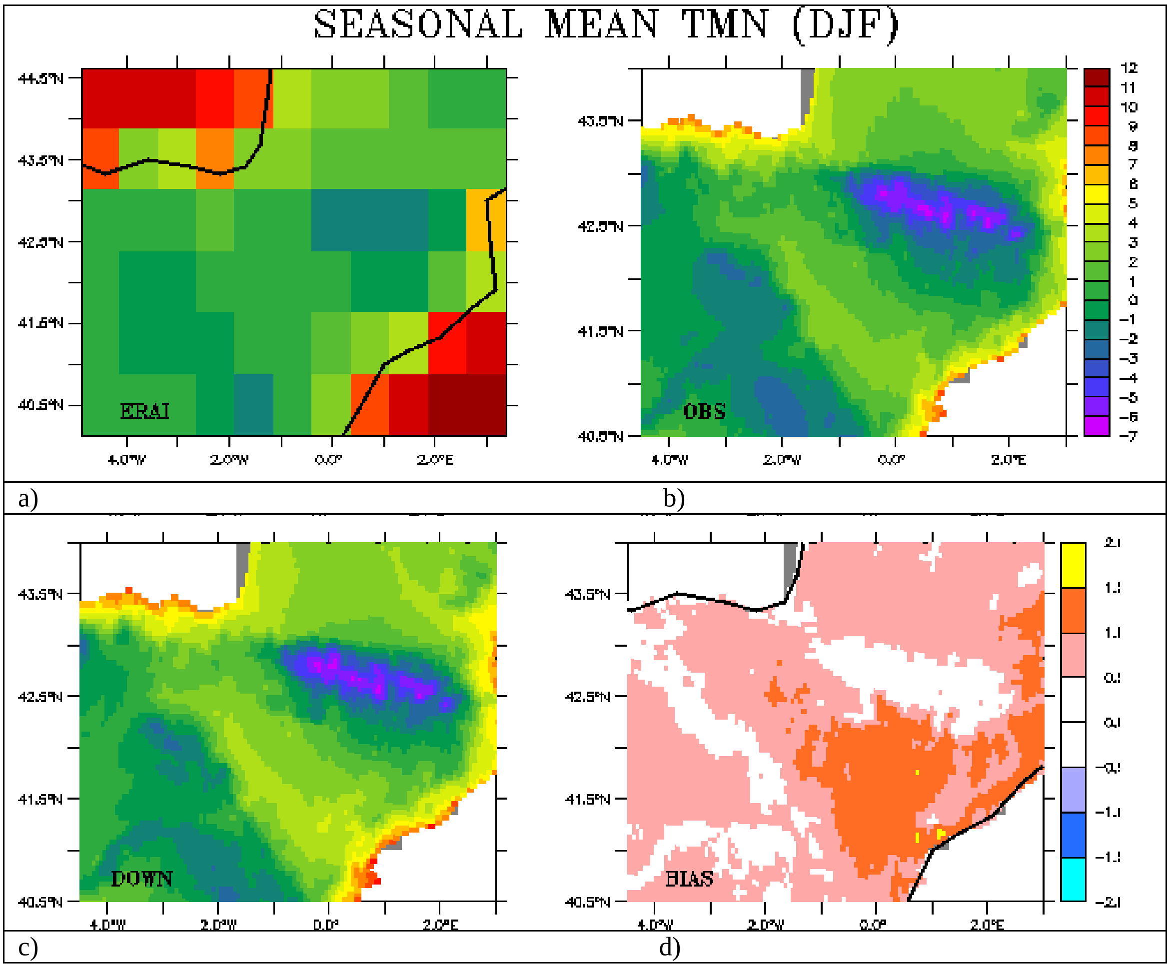

Figure S11. The same as Figure S10 but for summer (JJA) minimum temperature (ºC).

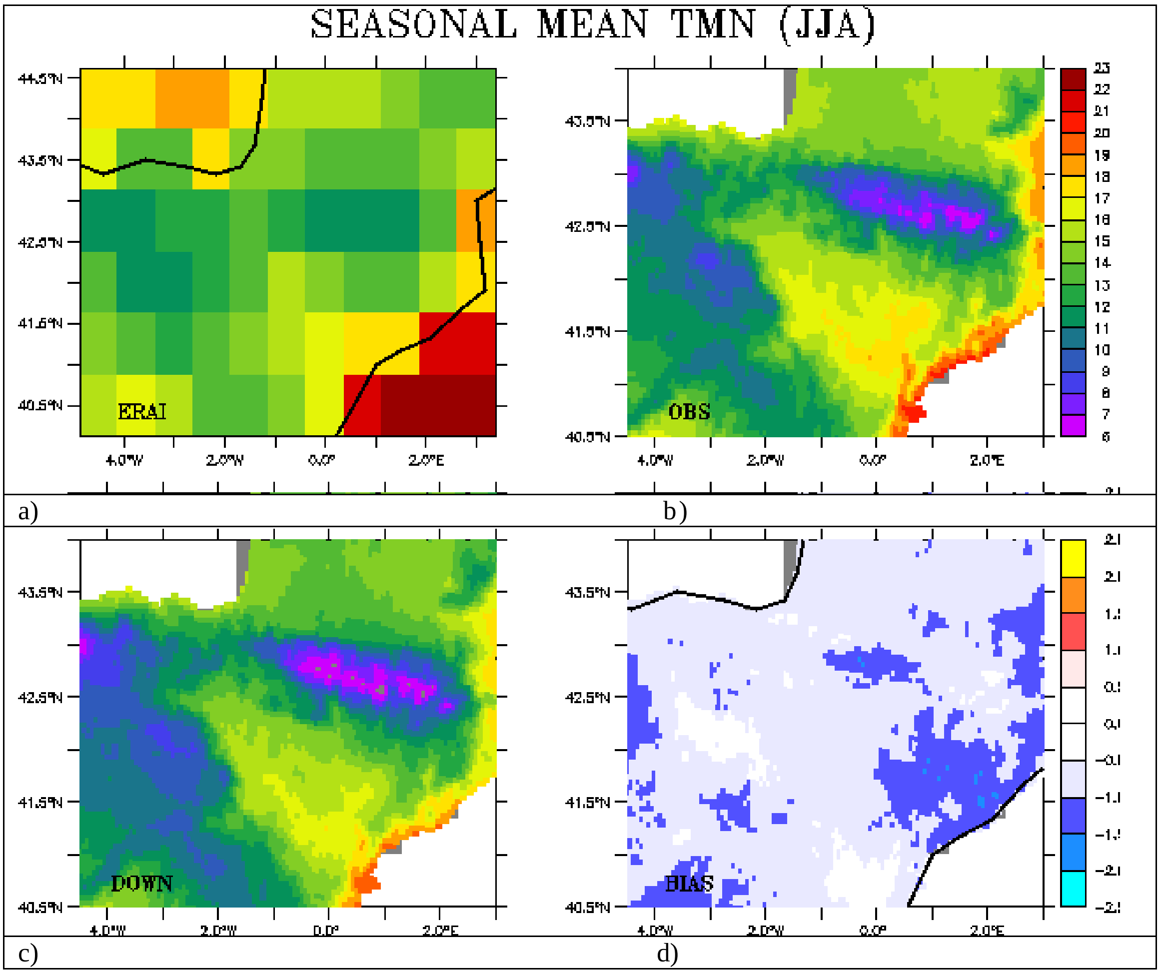

Figure S12. The same as Figure S8 but for winter (DJF) accumulated precipitation (mm).

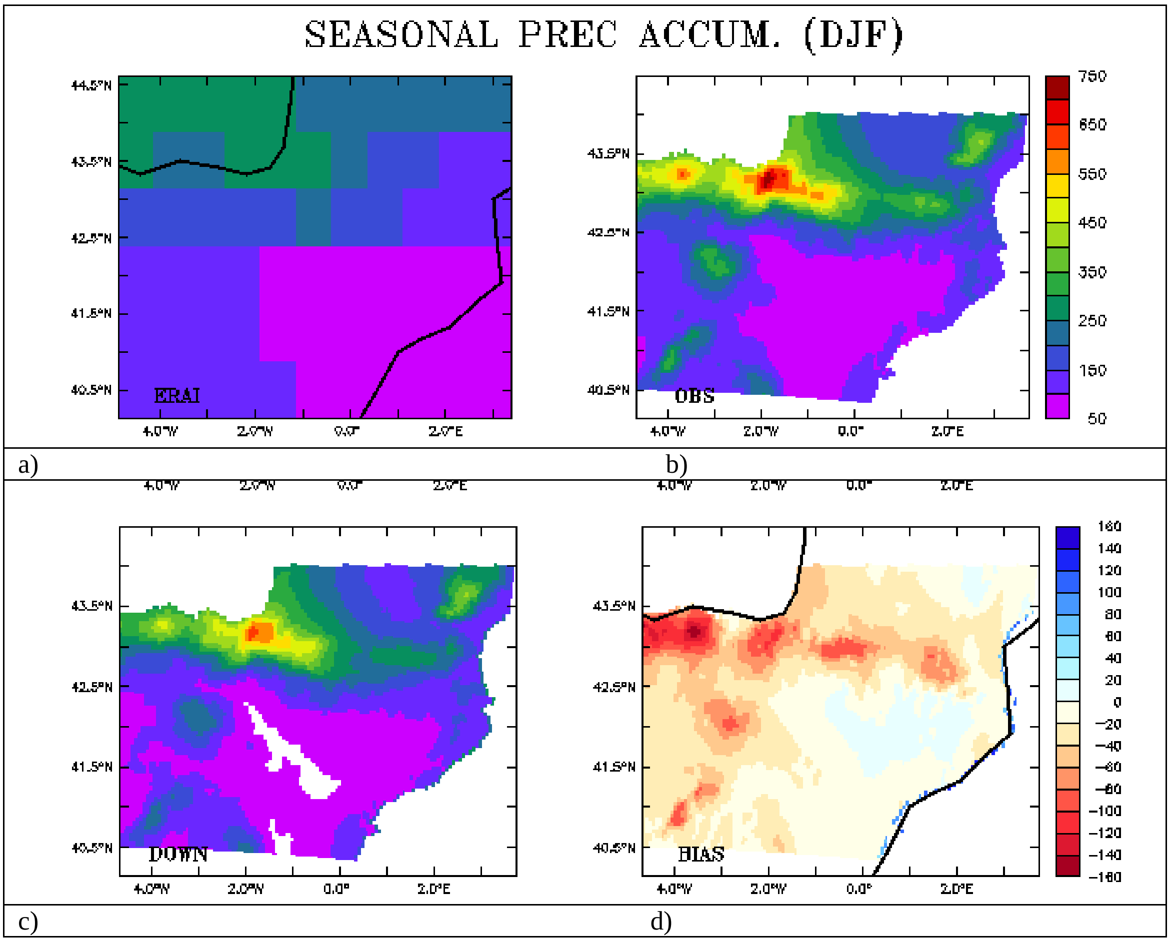

Figure S13. The same as Figure S12 but for summer (JJA) accumulated precipitation (mm).

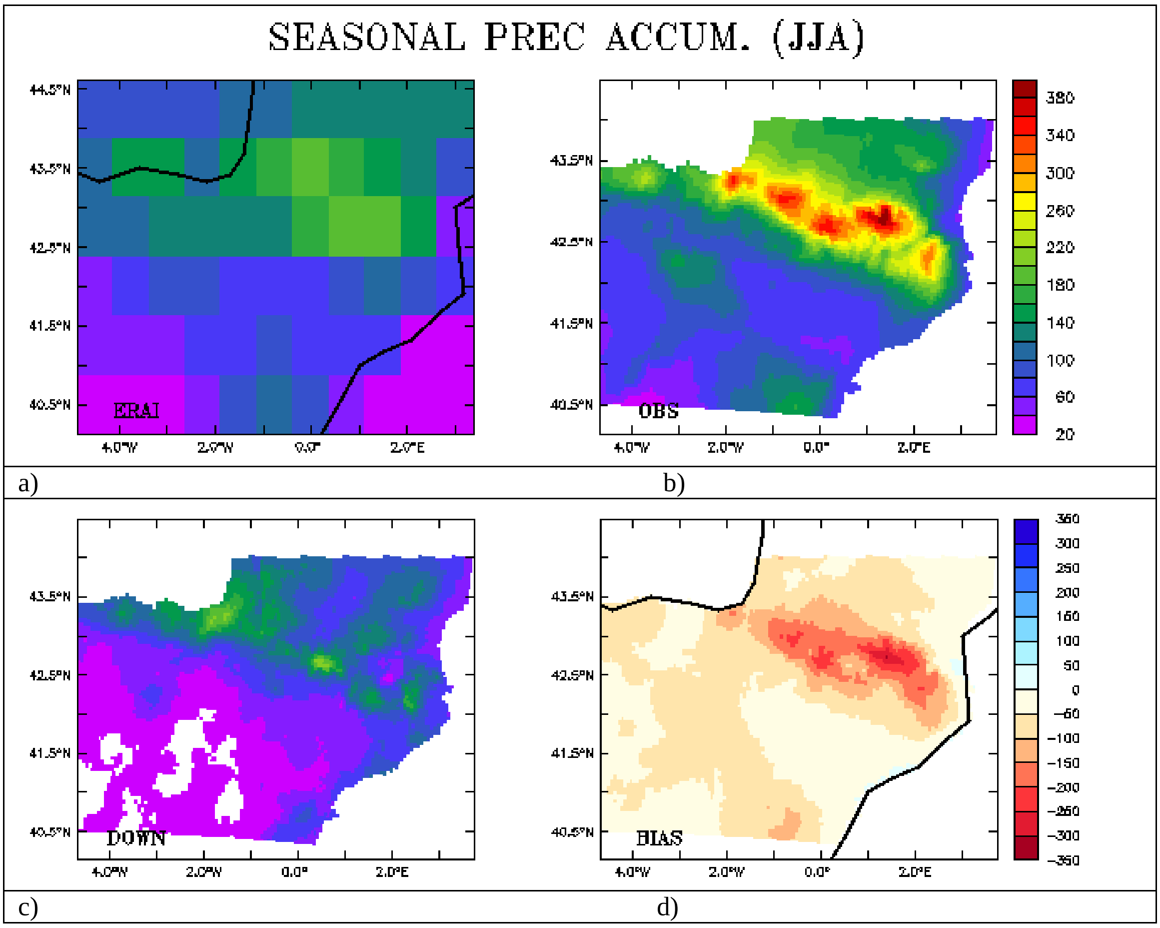

Figure S14. Bias of 95th percentile (p95) for: a) winter (DJF) maximum temperature (ºC); b) summer (JJA) maximum temperature (ºC); c) winter (DJF) minimum temperature (ºC) and d) summer (JJA) minimum temperature (ºC). Bias is calculated as downscaled ERA-Interim minus observational high-resolution grid averaged over the 1997-2016 period.

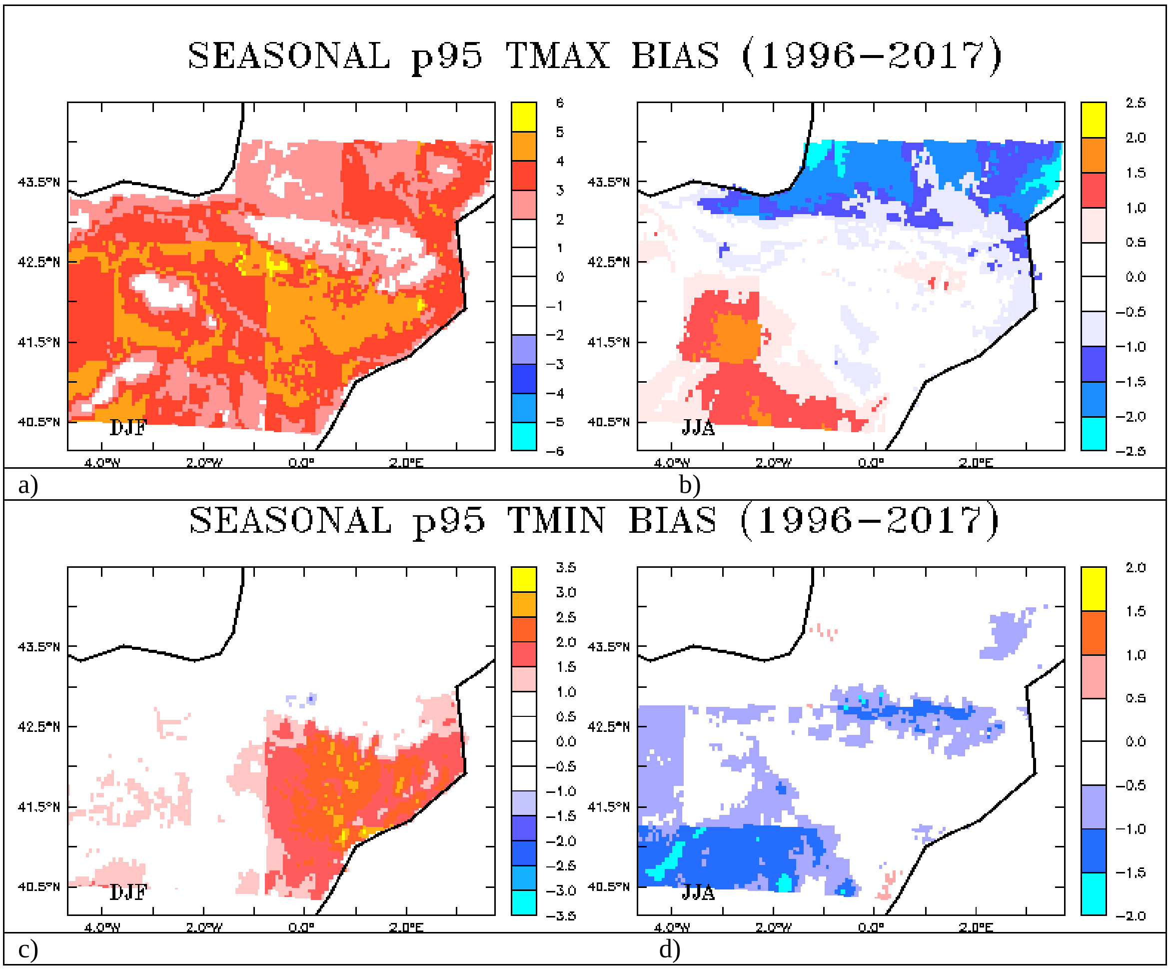

Figure S15. The same as Figure S14 but for precipitation (mm).