Supplement to: Uncertainty sources in a large ensemble of hydrological projections: Regional Climate Models and Internal Variability matter

Evin Guillaume[1], Hingray Benoit[1], Thirel Guillaume[2,3], Ducharne Agnès[4], Strohmenger Laurent[2], Corre Lola[5], Tramblay Yves[6], Vidal Jean-Philippe[7], Bonneau Jérémie[7,8], Colleoni François[9], Gailhard Joël[10], Habets Florence[11], Hendrickx Frédéric[12], Héraut Louis[7], Huang Peng[4], Le Lay Matthieu[10], Magand Claire[13], Marson Paola[14], Monteil Céline[12], Munier Simon[5], Reverdy Alix[1], Soubeyroux Jean-Michel[14], Robin Yoann[15], Vergnes Jean-Pierre[16], Vrac Mathieu[15], and Sauquet Eric[7]

[1]Univ. Grenoble Alpes, INRAE, CNRS, IRD, Grenoble INP, IGE, Grenoble, France
[2]Université Paris-Saclay, INRAE, UR HYCAR, Antony, France
[3]Univ Toulouse, CNES/IRD/CNRS/INRAE, CESBIO, Toulouse, France
[4]Sorbonne Université/CNRS/EPHE, METIS-IPSL, Paris, France
[5]CNRM, Météo-France, CNRS, Université de Toulouse, Toulouse, France
[6]UMR Espace Dev (Univ. Montpellier, IRD), Montpellier, France
[7]UR RiverLy, INRAE, Villeurbanne, France
[8]INSA Lyon, DEEP, UR 7429, Villeurbanne, France
[9]UMR RECOVER, INRAE, Aix-Marseille University, Le Tholonet, France
[10]Département Eau Environnement, EDF-DTG, Saint Martin le Vinoux, France
[11]Geology Laboratory of Ecole Normale Supérieure, Pierre Simon Laplace Research University, CNRS UMR 8538, Paris, France
[12]Département LNHE, EDF-R&D, 78401 Chatou, France
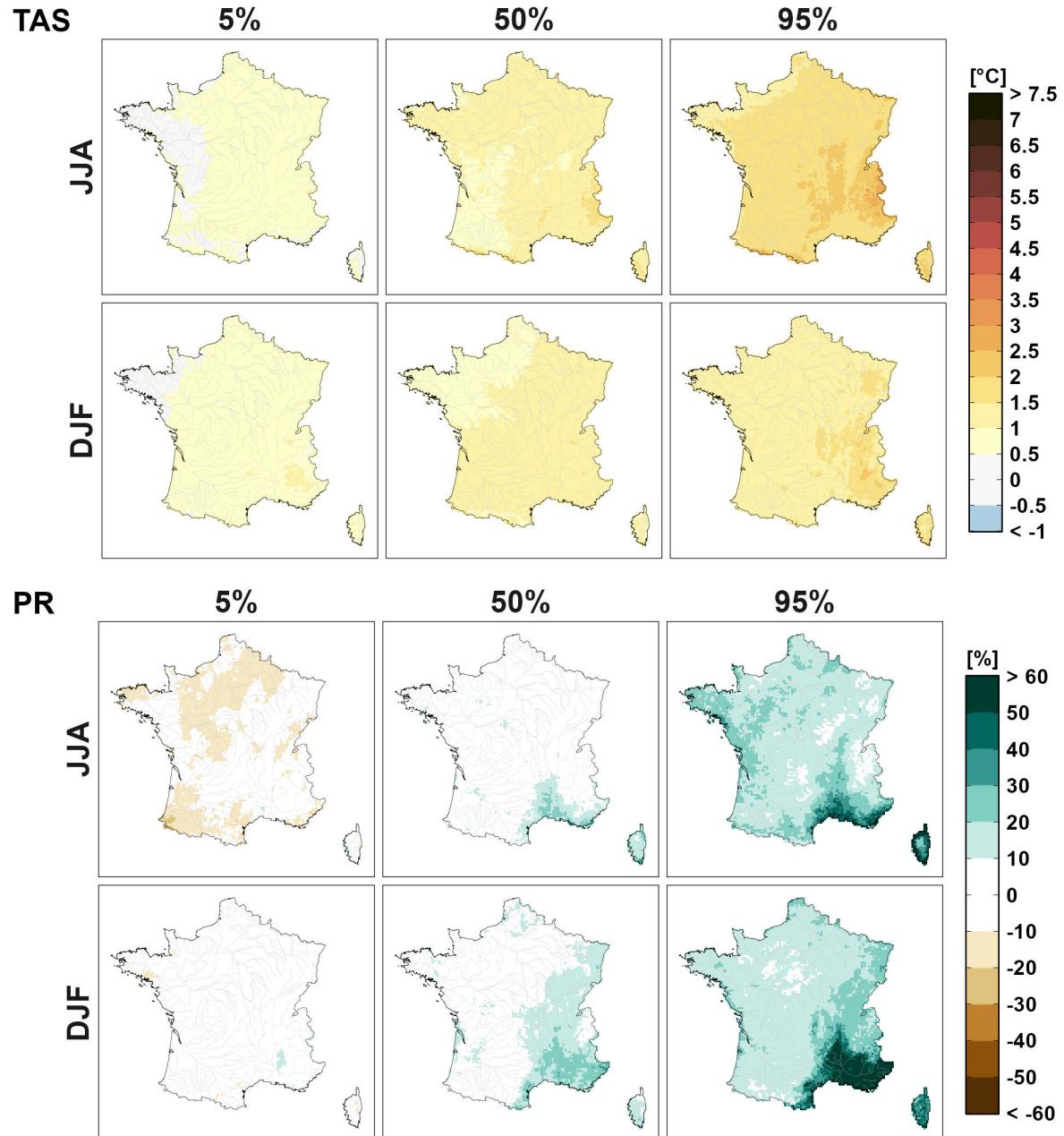[13]OFB, Direction de la recherche et de l'appui scientifique, Nantes, France
[14]Météo-France, Direction de la Climatologie et des Services Climatiques, Toulouse, France
[15]LSCE, IPSL, CEA-CNRS-UVSQ, Univ. Paris-Saclay, Gif-sur-Yvette, France
[16]BRGM – French Geological Survey, Orléans, France

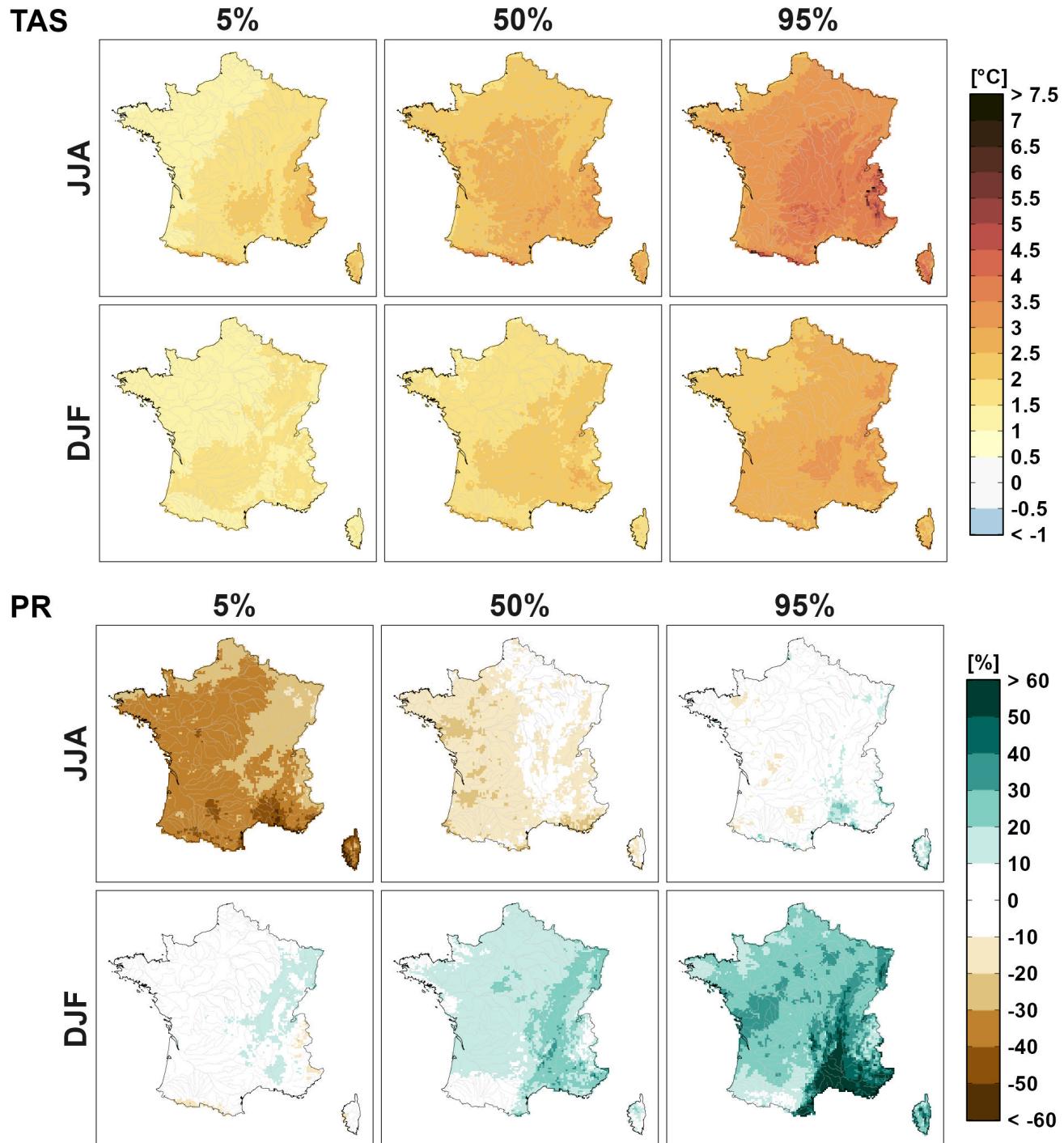**Correspondence:** Evin Guillaume (guillaume.evin@inrae.fr)

Figure S1. 5%, 50%, and 95% quantiles of the CCR for seasonal temperature (TAS), precipitation (PR), reference evapotranspiration (ET0) and annual precipitation maxima (RX1D) changes (2071-2099 relative to 1976-2005) in summer (JJA) and winter (DJF) for the RCP2.6.
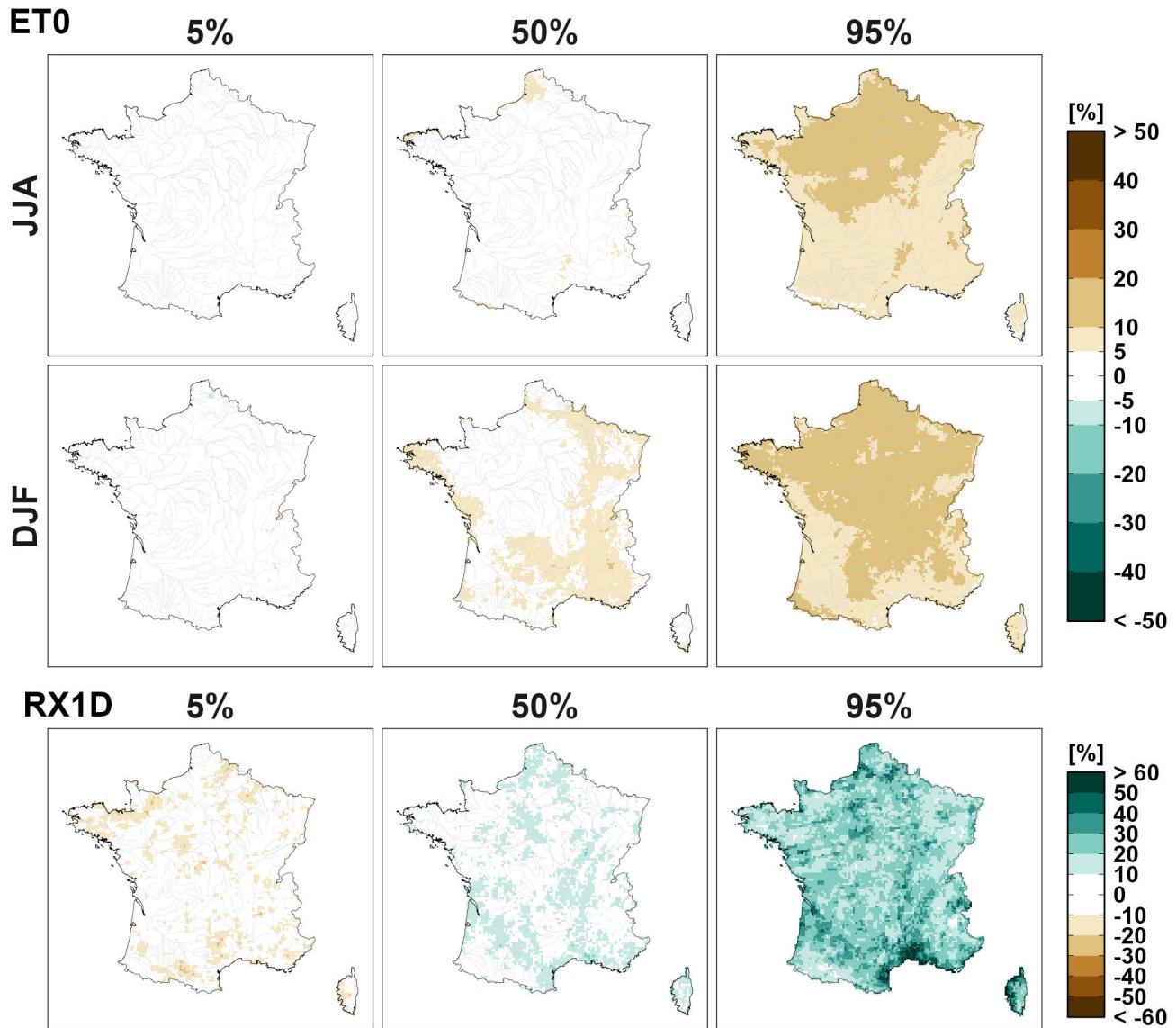
Figure S1. (continued).

Figure S2. 5%, 50%, and 95% quantiles of the CCR for seasonal temperature (TAS), precipitation (PR), reference evapotranspiration (ET0) and annual daily precipitation maxima (RX1D) changes (2071-2099 relative to 1976-2005) in summer (JJA) and winter (DJF) for the RCP4.5.
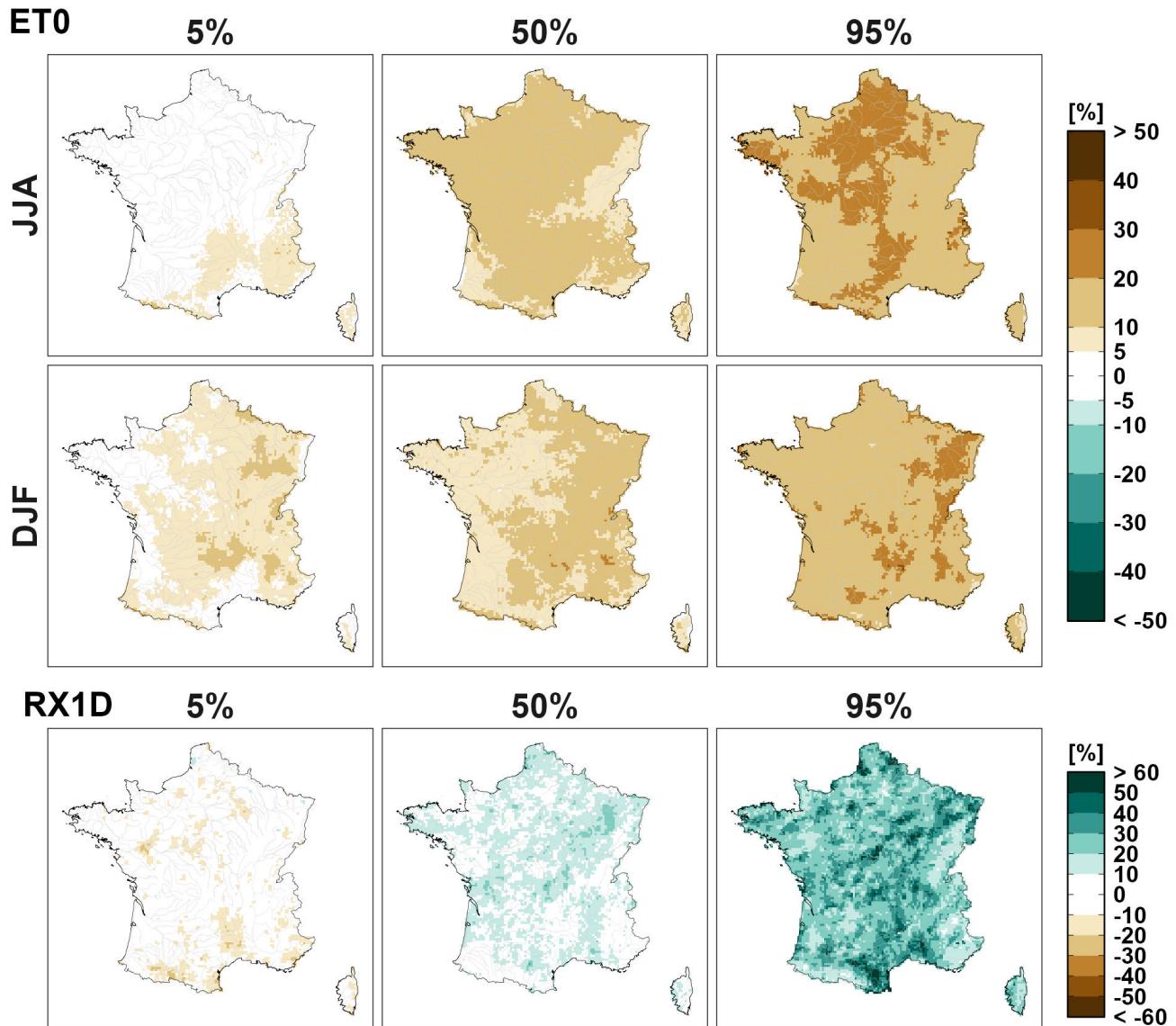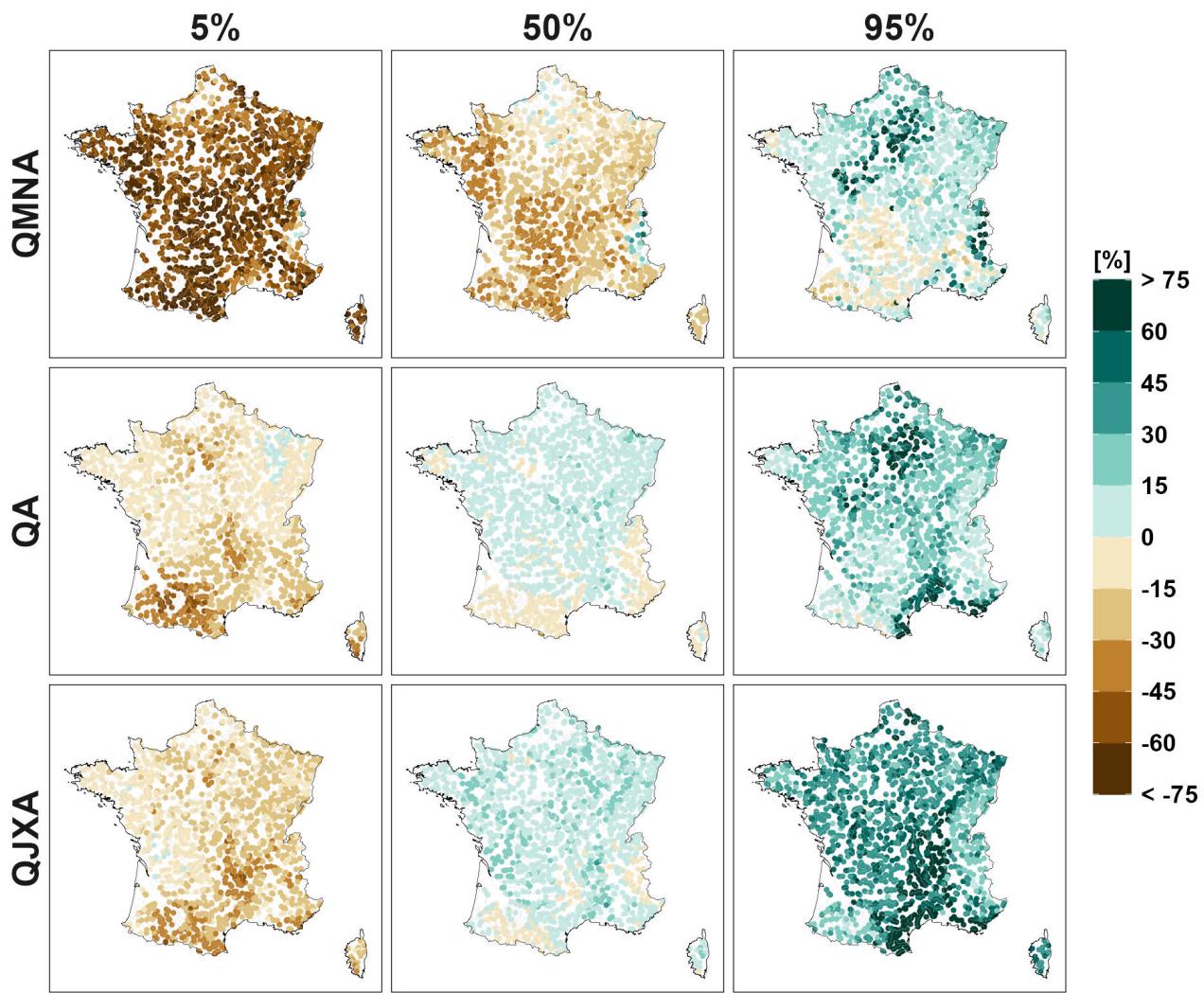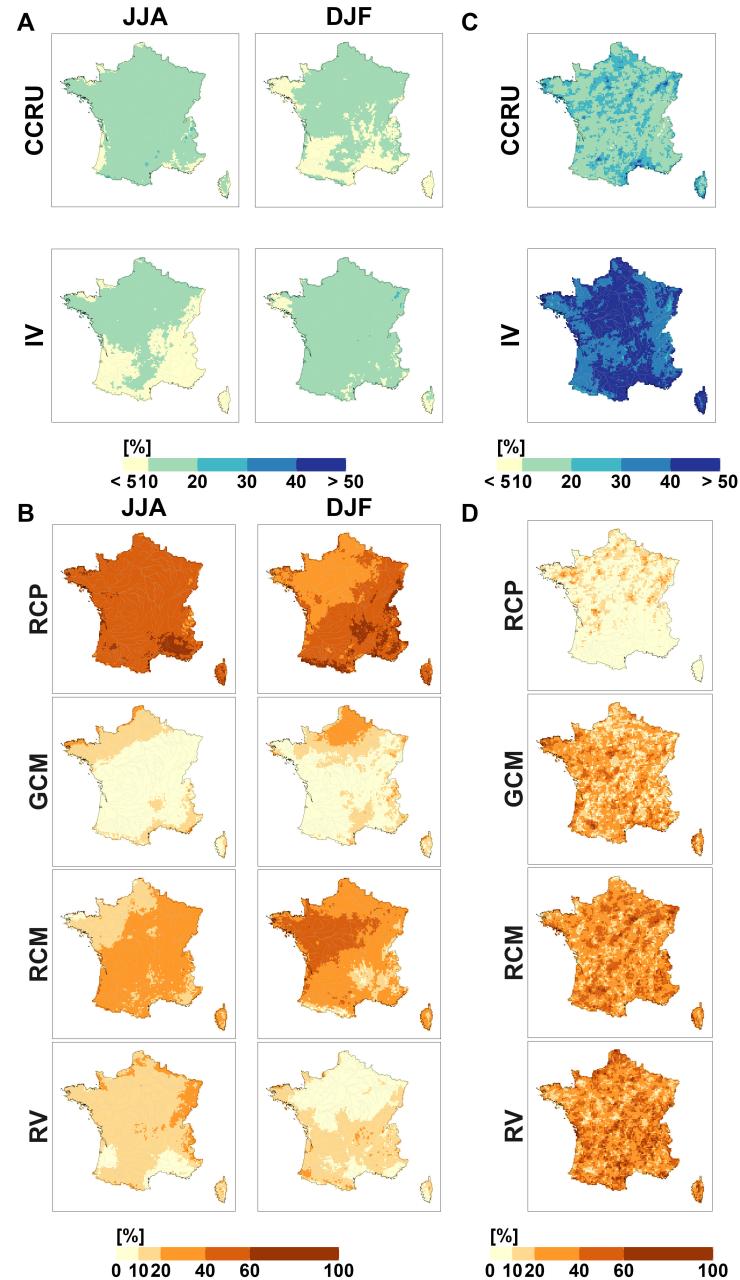
Figure S2. (continued).
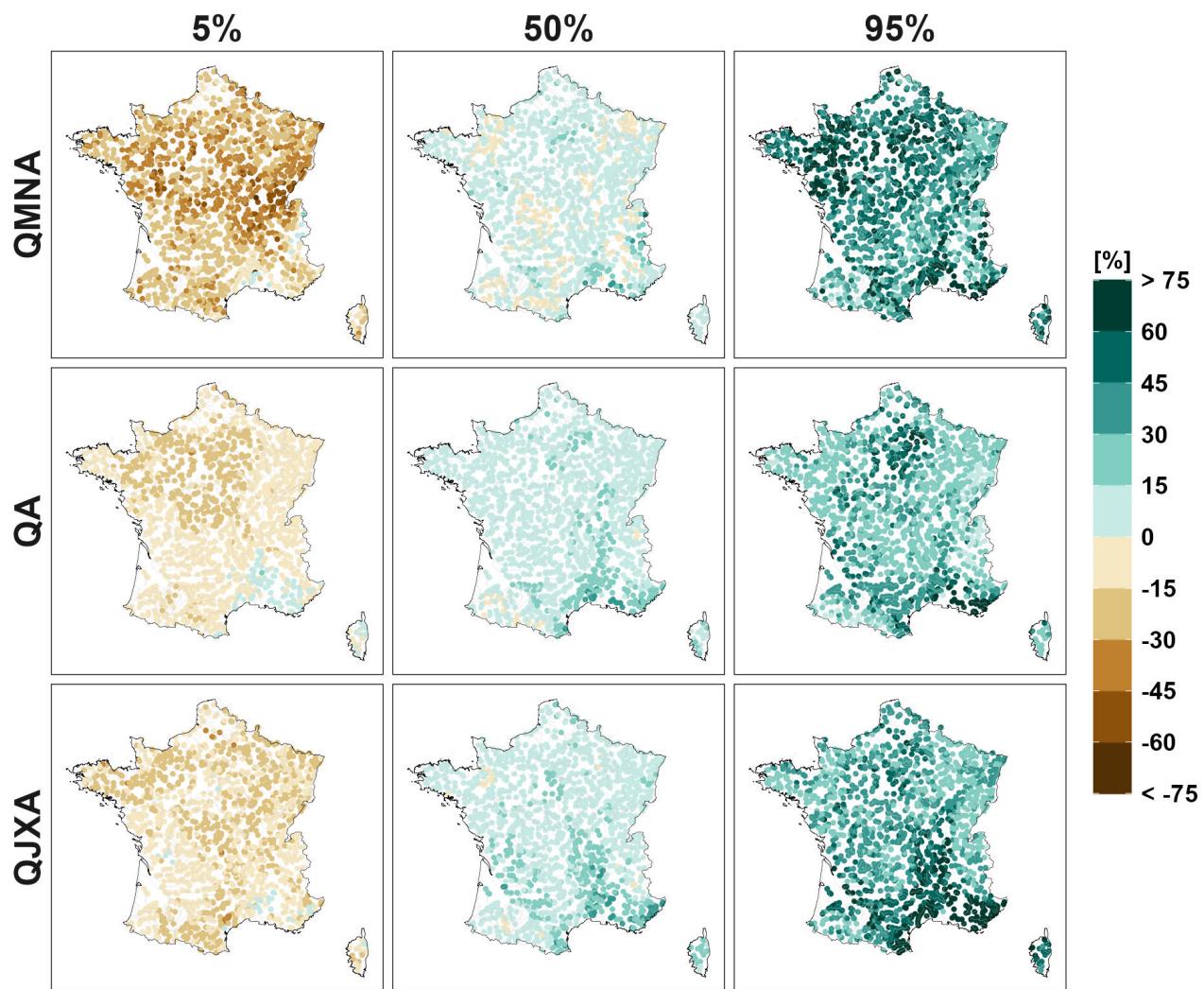
Figure S3. 5%, 50%, and 95% quantiles of the climate change responses for QMNA, QA, and QJXA changes (2071-2099 relative to 1976-2005) for the RCP2.6.

Figure S4. 5%, 50%, and 95% quantiles of the climate change responses for QMNA, QA, and QJXA changes (2071-2099 relative to 1976-2005) for the RCP4.5.

## S3   Main uncertainty sources for ETO and RX1D

Figure S5. Uncertainty components for seasonal ET0 (A-B) and RX1D (C-D) changes (2071-2099 relative to 1976-2005). (A and C) CCR uncertainty and internal variability (standard deviations expressed in % for relative changes). (B and D) Percentage contribution of uncertainty sources to the CCR variance.
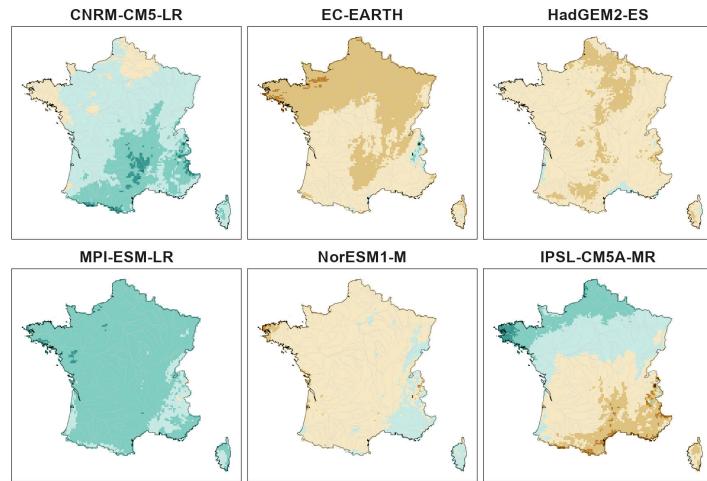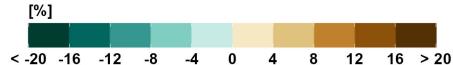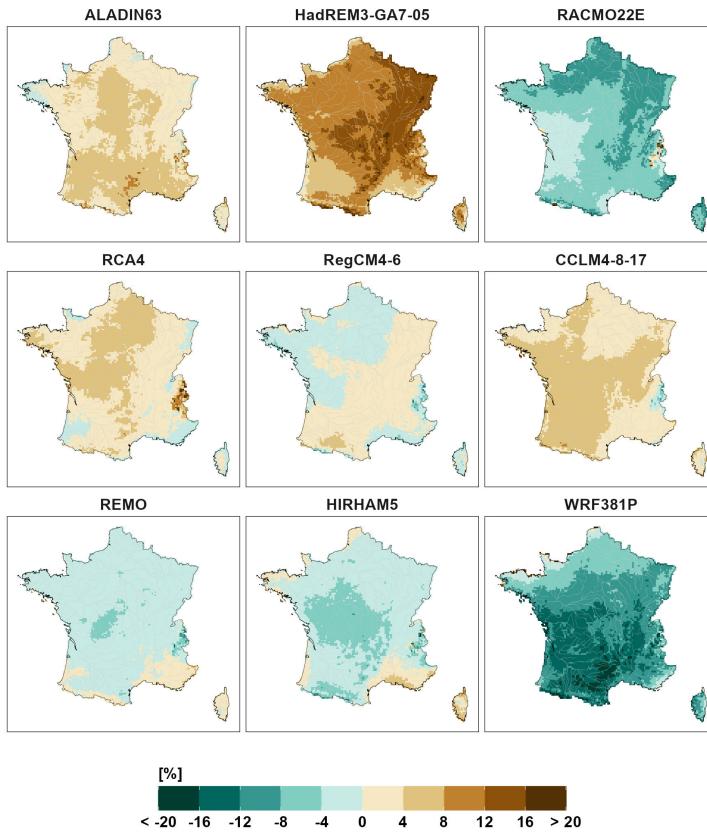
**S4   Main effects of the GCM and RCM models for the climate indicators**
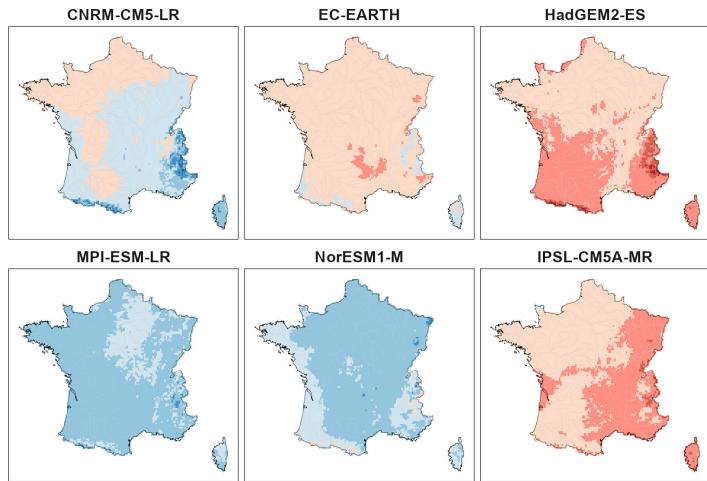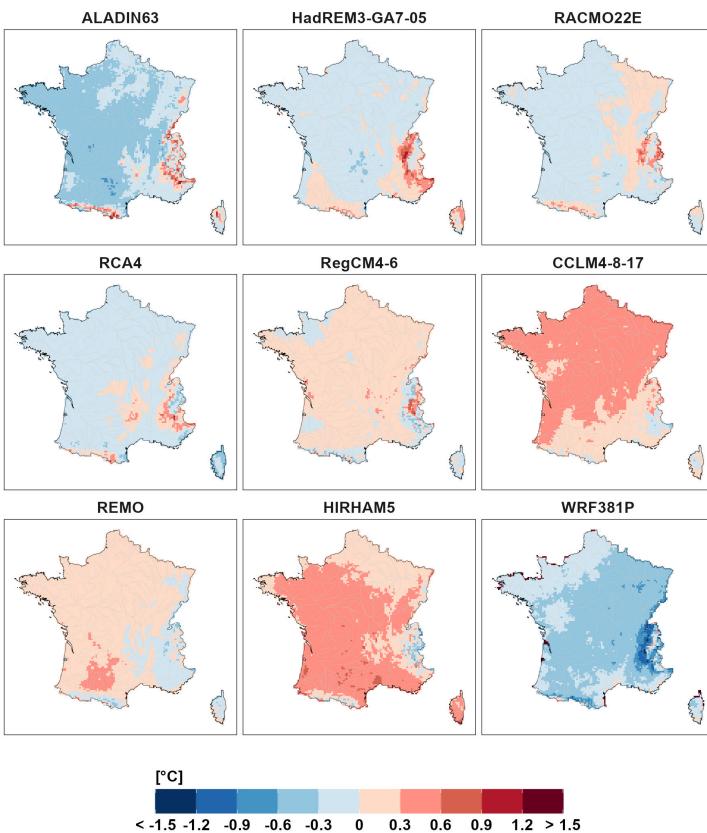
Figure S6. Main effects (i.e. deviations from the grand ensemble mean) of individual GCMs and RCMs for winter temperature changes (2071-2099 relative to 1976-2005).
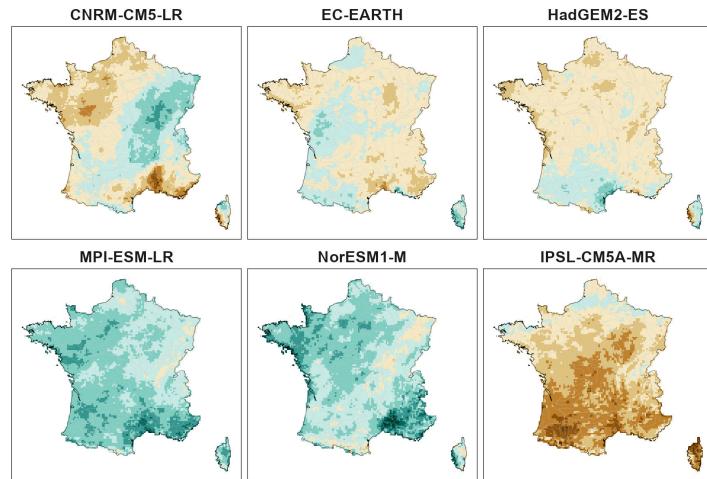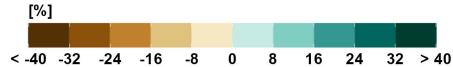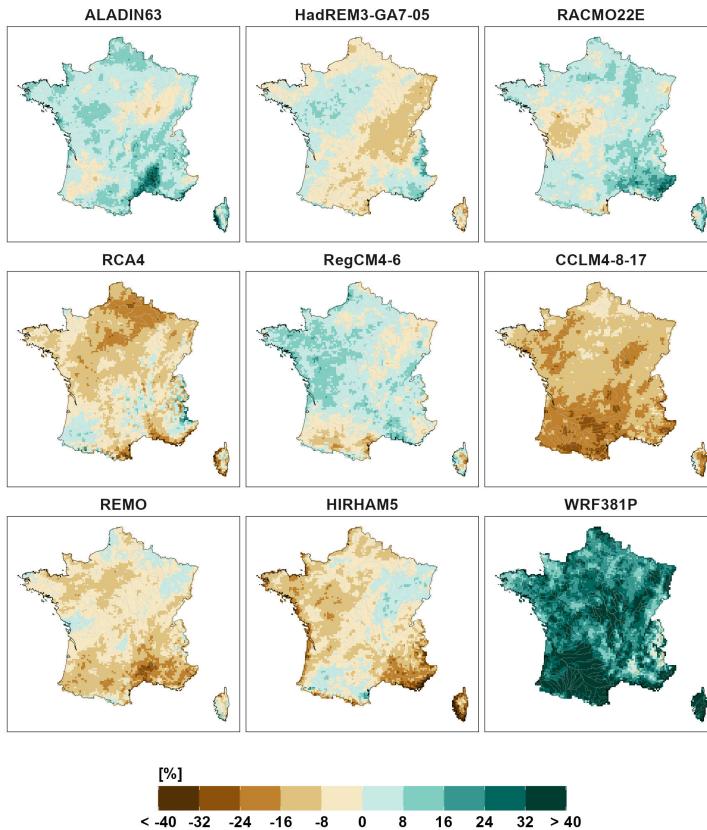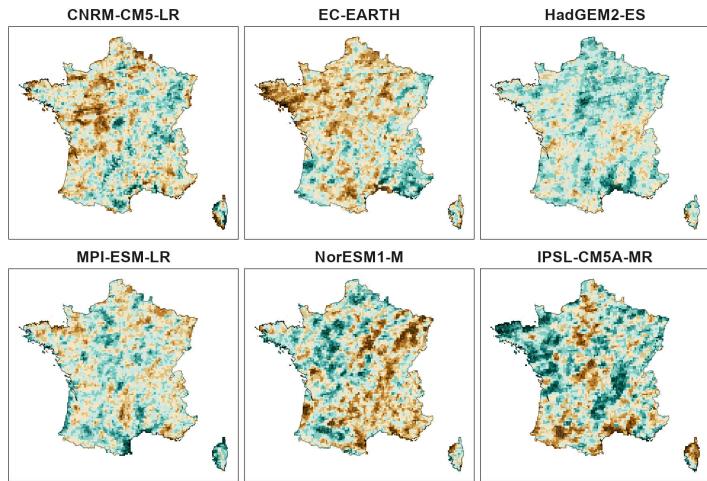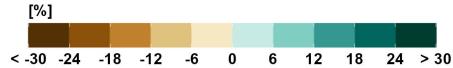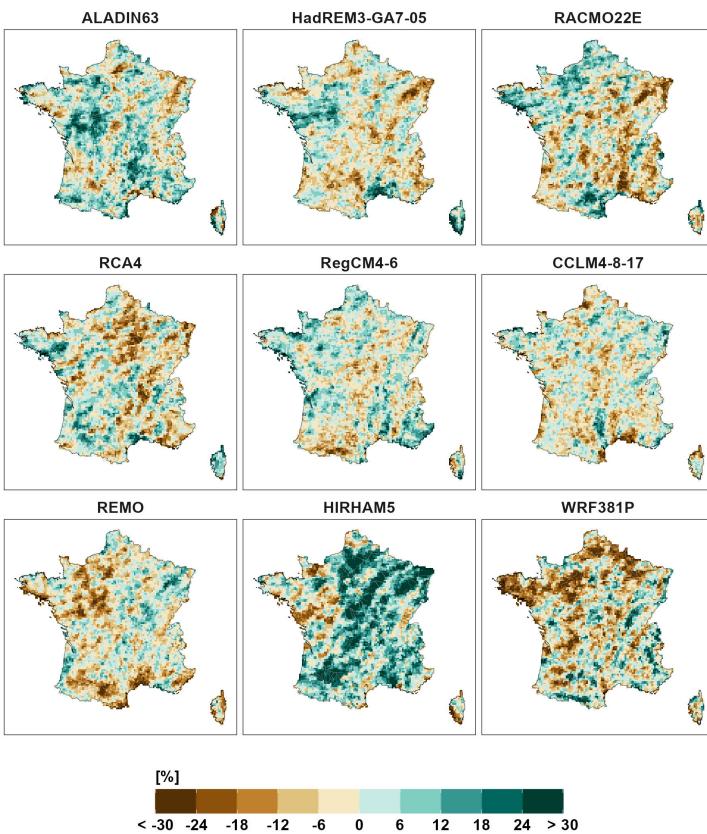
Figure S7. Main effects of individual GCMs and RCMs for summer precipitation changes (2071-2099 relative to 1976-2005).

A

CNRM-CM5-LR EC-EARTH HadGEM2-ES

MPI-ESM-LR NorESM1-M IPSL-CM5A-MR

B

ALADIN63 HadREM3-GA7-05 RACMO22E

RCA4 RegCM4-6 CCLM4-8-17

REMO HIRHAM5 WRF381P

[%]

< -20 -16 -12 -8 -4 0 4 8 12 16 > 20

Figure S8. Main effects of individual GCMs and RCMs for summer reference evapotranspiration changes (2071-2099 relative to 1976-2005).
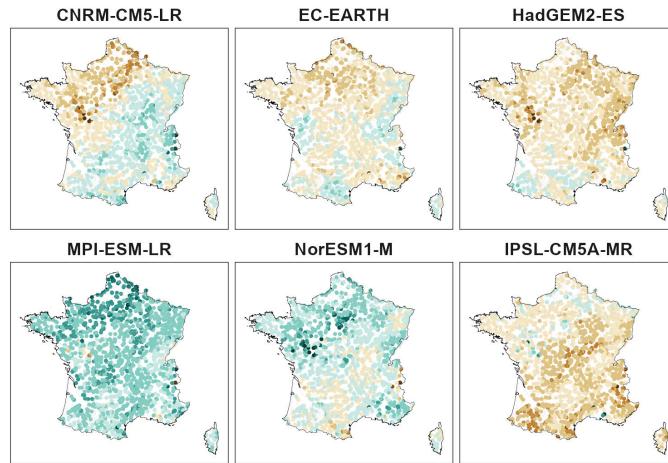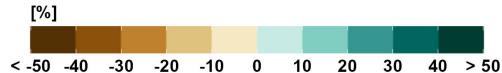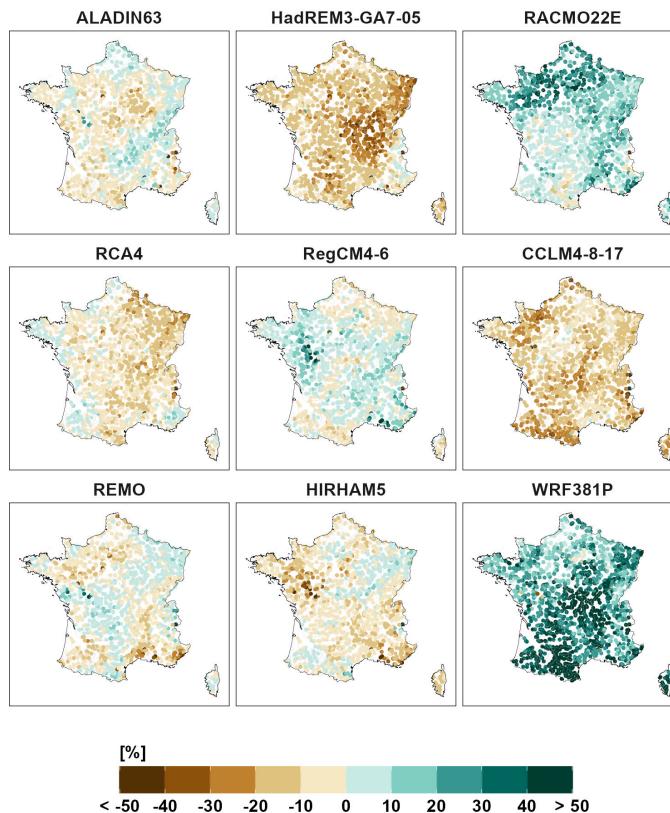
12
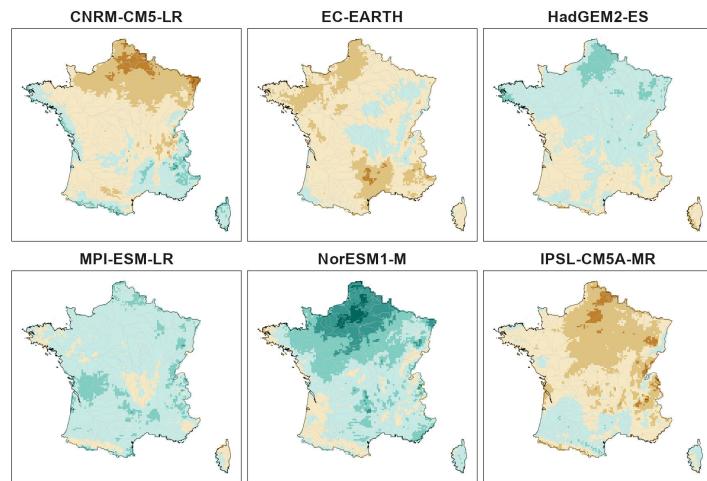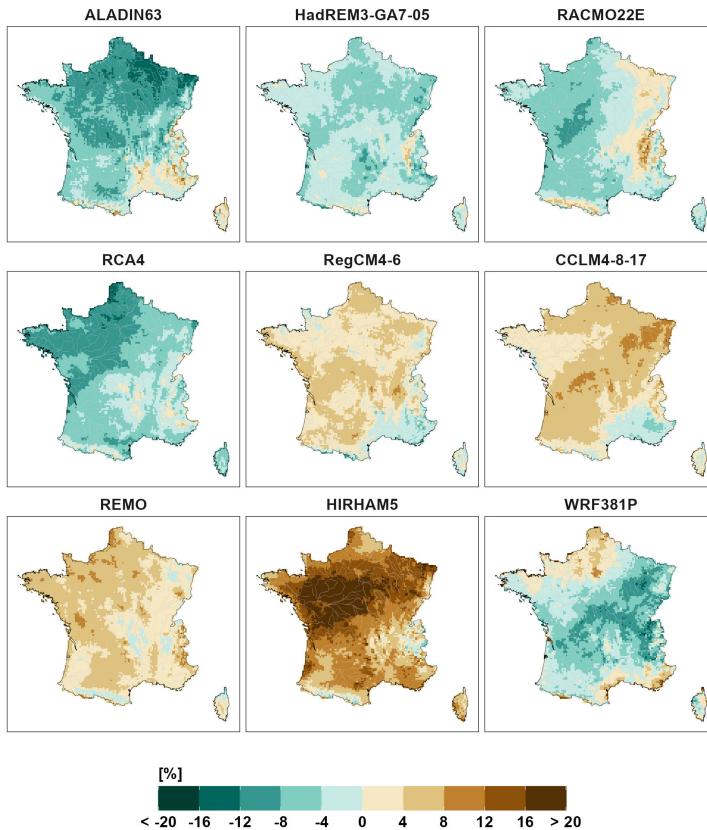
Figure S9. Main effects of individual GCMs and RCMs for winter reference evapotranspiration changes (2071-2099 relative to 1976-2005).

A

CNRM-CM5-LR   EC-EARTH   HadGEM2-ES

MPI-ESM-LR   NorESM1-M   IPSL-CM5A-MR

B

ALADIN63   HadREM3-GA7-05   RACMO22E

RCA4   RegCM4-6   CCLM4-8-17

REMO   HIRHAM5   WRF381P

[%]

< -30 -24 -18 -12 -6 0 6 12 18 24 > 30
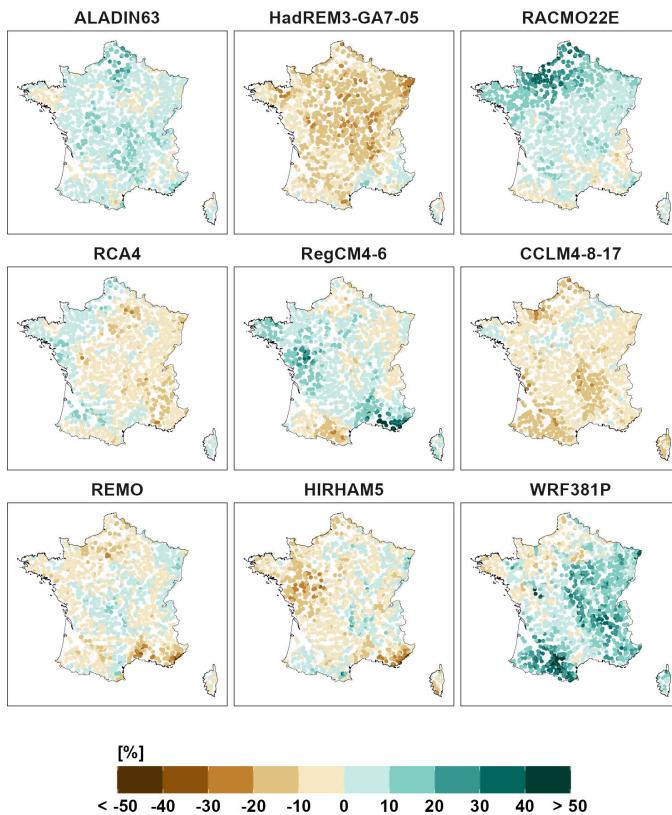
Figure S10. Main effects of individual GCMs and RCMs for annual daily maximum precipitation changes (2071-2099 relative to 1976-2005).

14

5 **S5   Main effects of the GCMs / RCMs for the hydrological indicators**

A

CNRM-CM5-LR   EC-EARTH   HadGEM2-ES

MPI-ESM-LR   NorESM1-M   IPSL-CM5A-MR

B

ALADIN63   HadREM3-GA7-05   RACMO22E

RCA4   RegCM4-6   CCLM4-8-17

REMO   HIRHAM5   WRF381P

[%]

< -50 -40 -30 -20 -10 0 10 20 30 40 > 50

Figure S11. Main effects of individual GCMs and RCMs for QMNA changes (2071-2099 relative to 1976-2005).

A
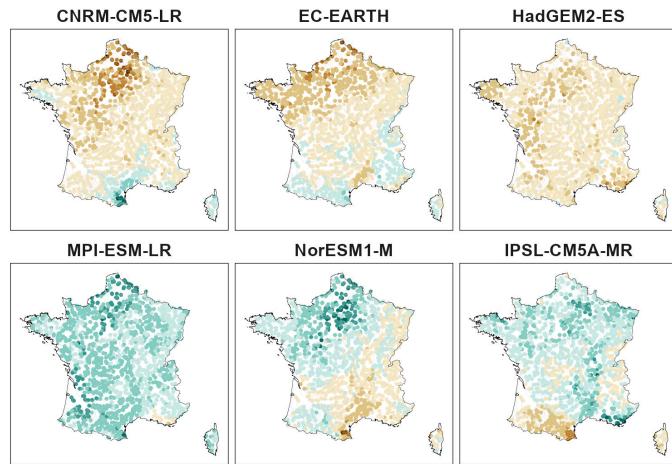
B

Figure S12. Main effects of individual GCMs and RCMs for QA changes (2071-2099 relative to 1976-2005).
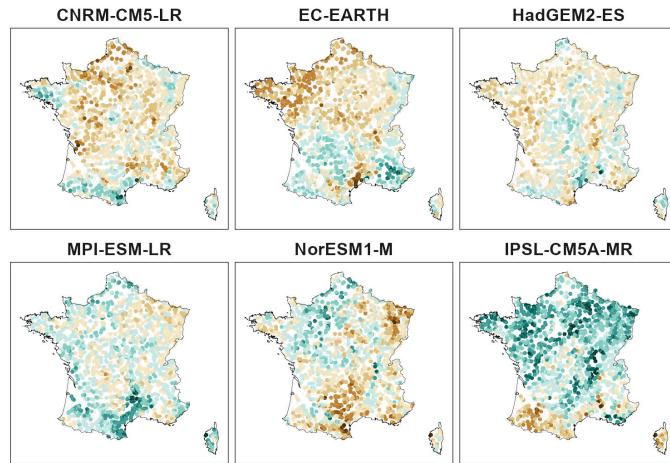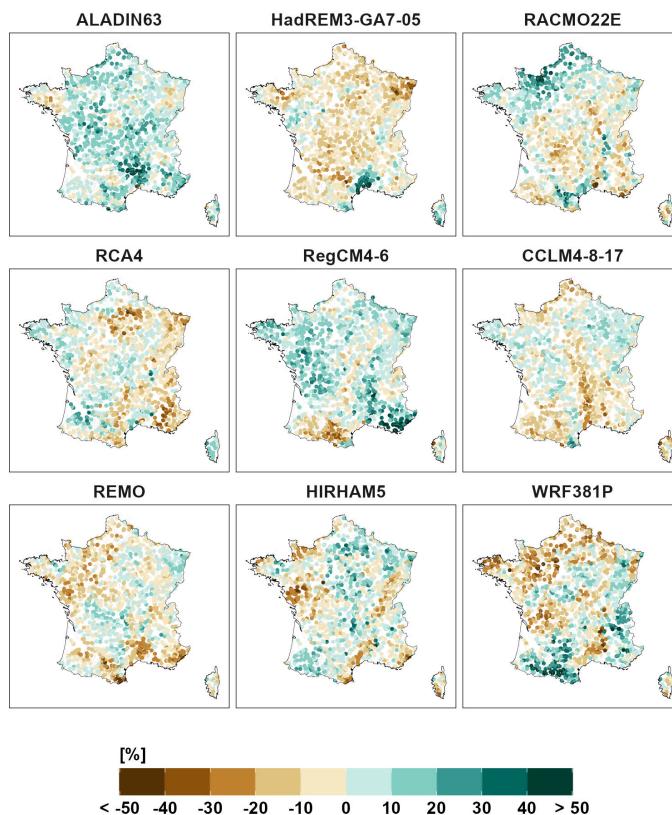
Figure S13. Main effects of individual GCMs and RCMs for QJXA changes (2071-2099 relative to 1976-2005).