A NEW DAILY QUALITY-CONTROLLED DATA BASE FOR THE PYRENEES (1950-2015)

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LAYOUT

1. The **CLIM'PY** project

2. Data base description

3. Methodology:
   - Quality Control
   - Gap filling

4. Approach 1: period 1959-2015 (individual series)
   - Homogeneity analysis
   - Yearly and seasonal trends

5. Approach 2: period 1981-2015 (grid 1x1 km)
   - Climate indices trends

- **CLIM'PY** (Characterization of the evolution of climate and provision of information for adaptation in the Pyrenees) is a transboundary research project including several public administrations.


- The project has a 65% funding by the European Regional Development Fund (FEDER) through the Interreg Programme V-A Spain-France-Andorra (POCTEFA 2014-2020). The project lasts 3 years (2016-2019).

- CLIM'PY is a project under the Pyrenees Climate Change Observatory (OPCC) along with CANOPEE, REPLIM, FLORAPYR and PYRAGUA projects: https://www.opcc-ctp.org.

CLIM'PY PROJECT

- **MAIN OBJECTIVES:**

  - O1: Creation of a daily database of temperature (TX/TN), precipitation and snow-cover for the Pyrenees, encompassing the period 1950-2015.

  - O2: Definition and calculation of climate indicators for monitoring climate change and variability.

  - O3: Estimation of climate change projections for the Pyrenees based on the new IPCC AR5 scenarios (XXI century).
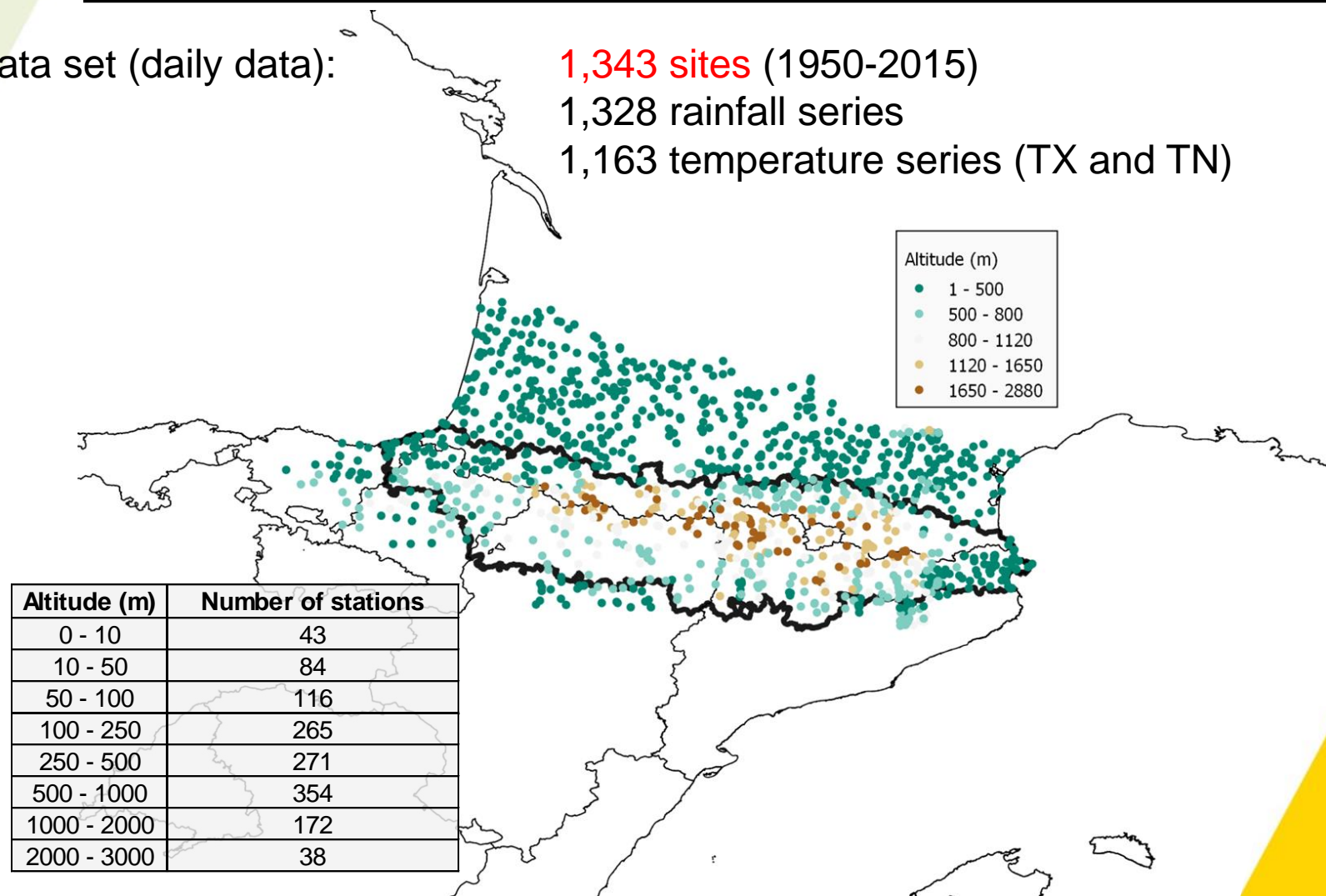
DATA BASE

- Study area
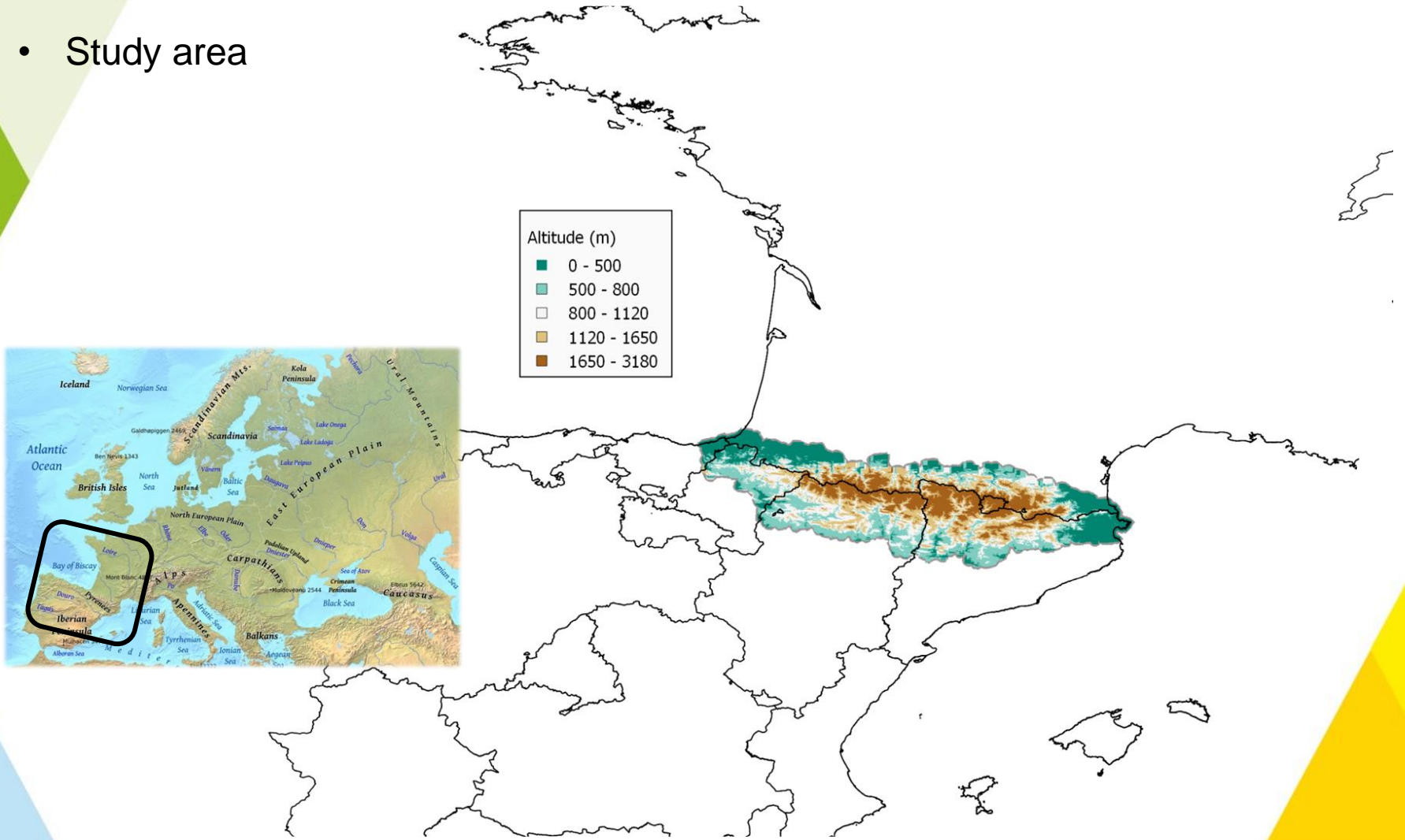
DATA BASE

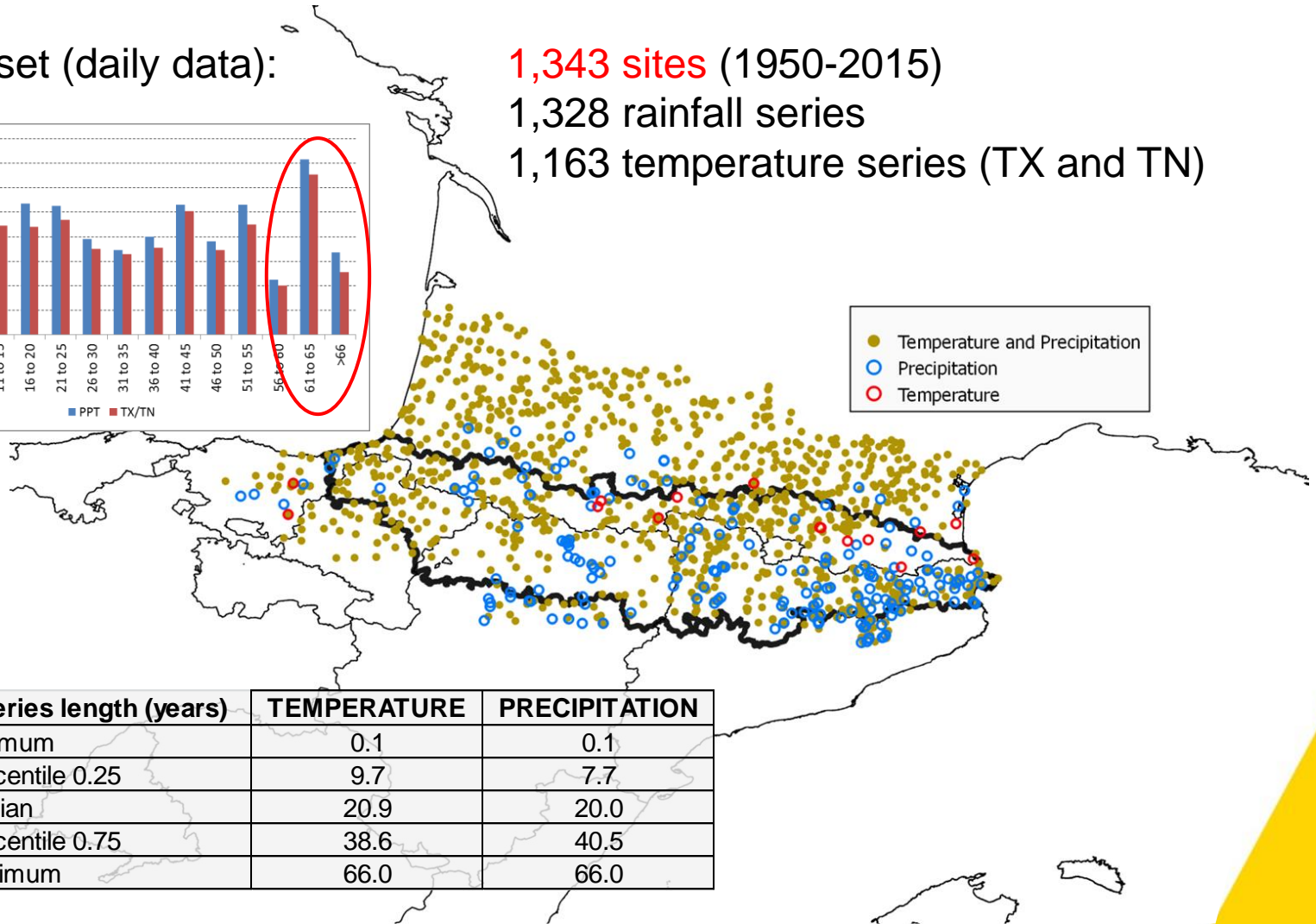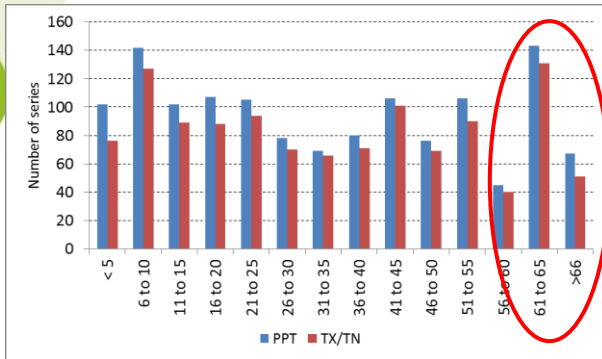- Data set (daily data):   1,343 sites (1950-2015)
  1,328 rainfall series
  1,163 temperature series (TX and TN)

Altitude (m)
- 1 - 500
- 500 - 800
- 800 - 1120
- 1120 - 1650
- 1650 - 2880

Altitude (m)	Number of stations
0 - 10	43
10 - 50	84
50 - 100	116
100 - 250	265
250 - 500	271
500 - 1000	354
1000 - 2000	172
2000 - 3000	38

OPCC

CTP
Communauté de Travail des Pyrénées
Comunidad de Trabajo de los Pirineos
Comunitat de Treball dels Pirineus
Pirinioetako Lan Elkartea

Interreg
POCTEFA

Fondo Europeo
de Desarrollo
Regional (FEDER)

UNIÓN EUROPEA
UNION EUROPÉENNE

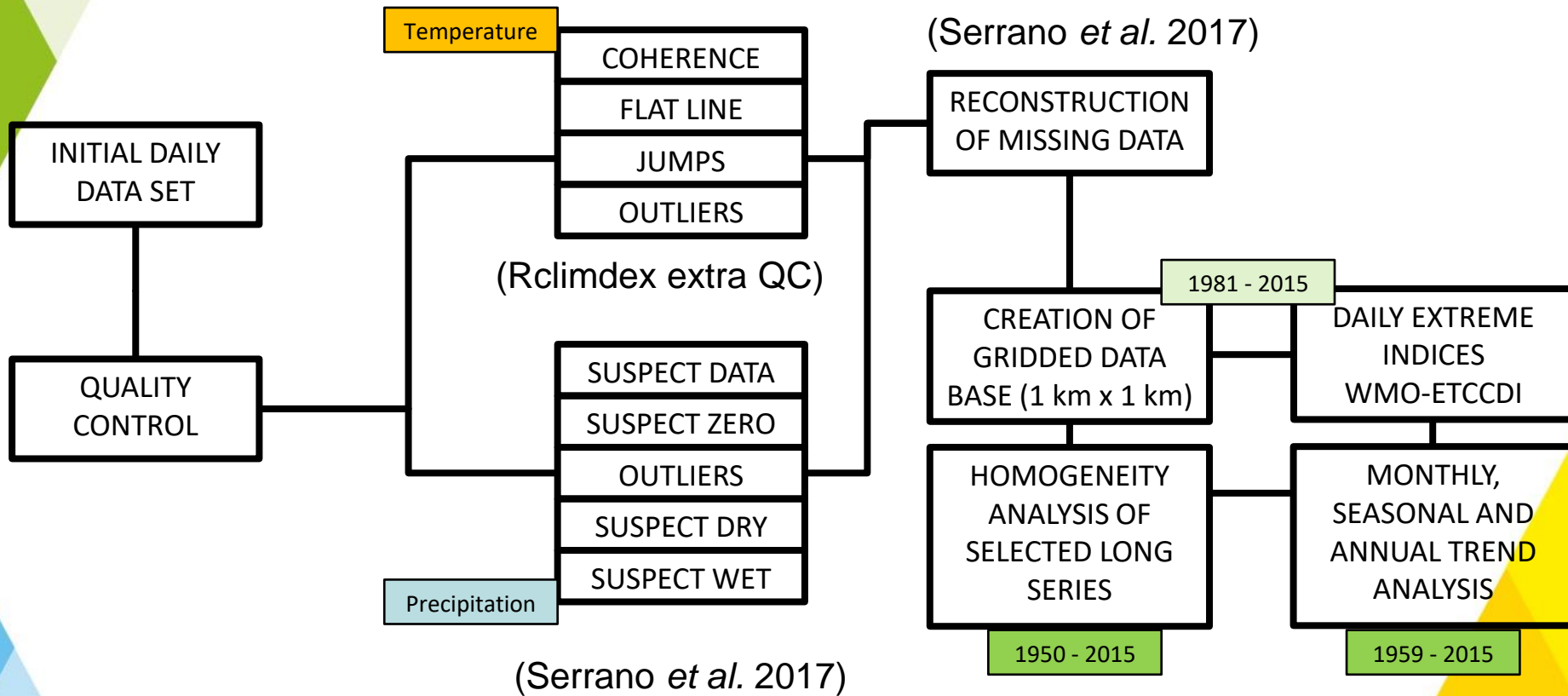- Data set (daily data): 1,343 sites (1950-2015)
1,328 rainfall series
1,163 temperature series (TX and TN)

Series length (years)	TEMPERATURE	PRECIPITATION
Minimum	0.1	0.1
Percentile 0.25	9.7	7.7
Median	20.9	20.0
Percentile 0.75	38.6	40.5
Maximum	66.0	66.0

- **Outline**

- Results of the CQ

		Initial data	Detected doutful daily data	COHERENCE	FLATLINE	JUMPS	OUTLIERS
Maximum daily Temperature	Nº of days	6739767	14720	6293	8299	128	0
	Percentage		0.22%	0.09%	0.12%	0%	0%
Minimum daily Temperature	Nº of days	6694142	24466	6293	18151	22	0
	Percentage		0.37%	0.09%	0.27%	0%	0%

Precipitation	Initial data	Detected doutful daily data	SUSPECT DATA	SUSPECT ZERO	OUTLIERS	SUSPECT DRY	SUSPECT WET
Nº of days	2184325	137230	91592	44590	134	660	254
Percentage		6.28%	4.19%	2.04%	0.01%	0.03%	0.01%

- **Selected series**

- Good temporal coverage

- <10% missing values
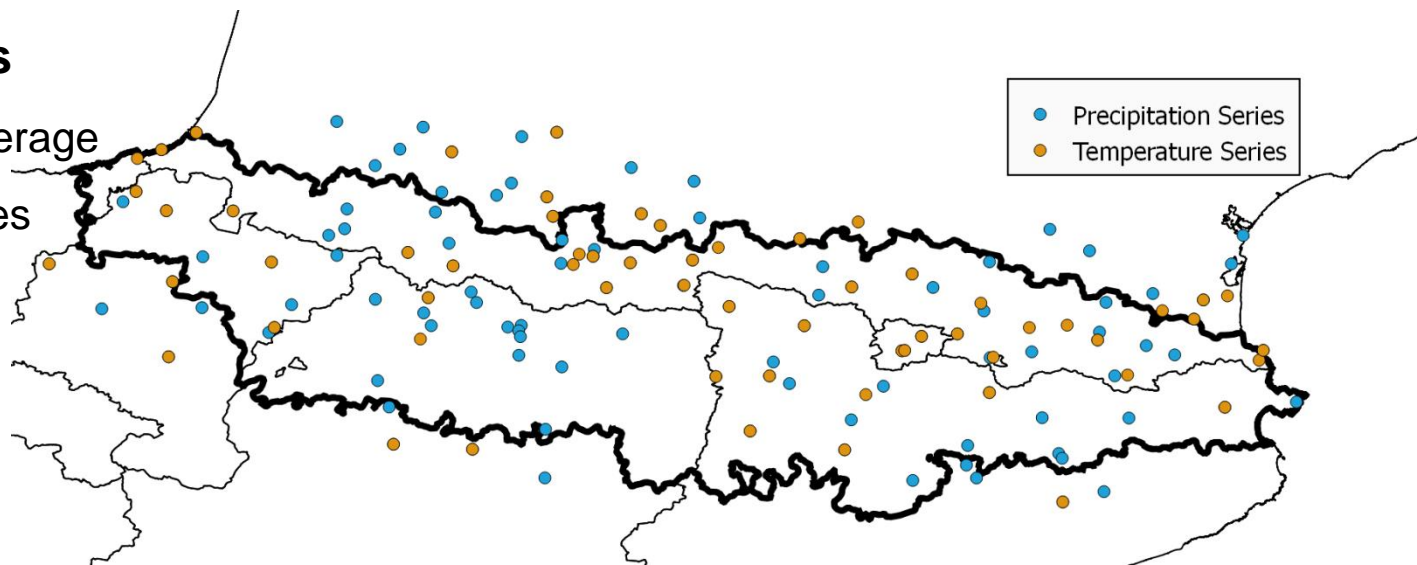
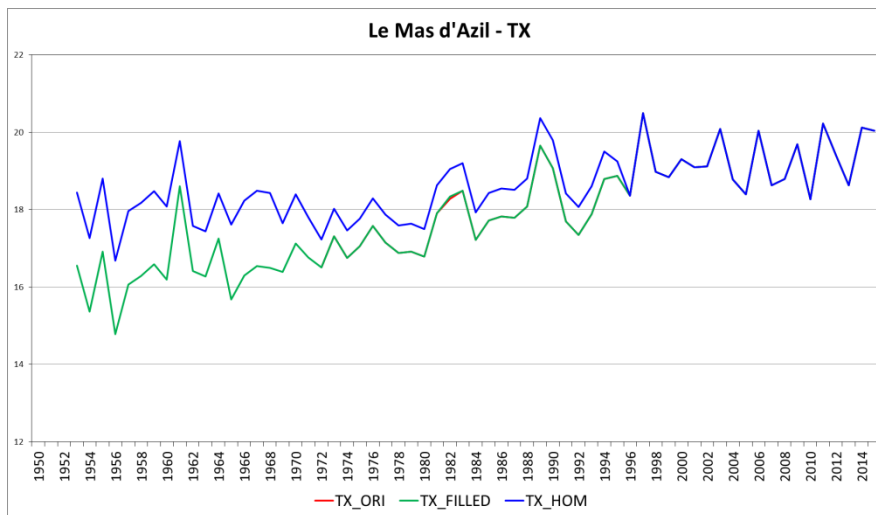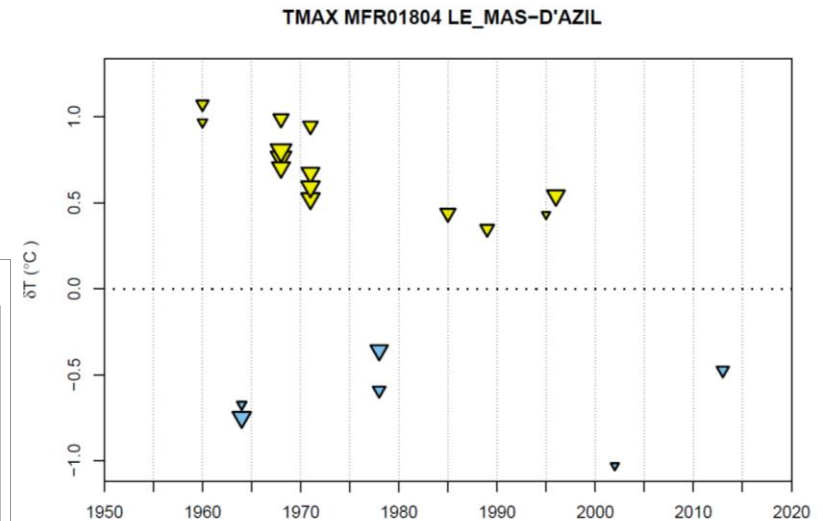| Nº of series	Tx	Tn	PPT
Altitude < 500 m	27	27	53
Altitude 500-1500 m	30	30	62
Altitude > 1500 m	4	4	4
Total	61	61	119

HOMOGENIZATION, 1950-2015

- **Methodology**: HOMER procedure for detection and correction of inhomogeneities (IH) in monthly and yearly climate series (Mestre *et al.* 2013). Is an interactive semi-automatic method based on pairwise comparison technique.

TMAX MFR01804 LE_MAS-D'AZIL

Example of HOMER output for detection of IH

Le Mas d'Azil - TX

Original vs homogenized TX series in Le Mas d'Azil

Mean annual temperature (1959-2015) - Pyrenees

+0.24 ºC/dec.
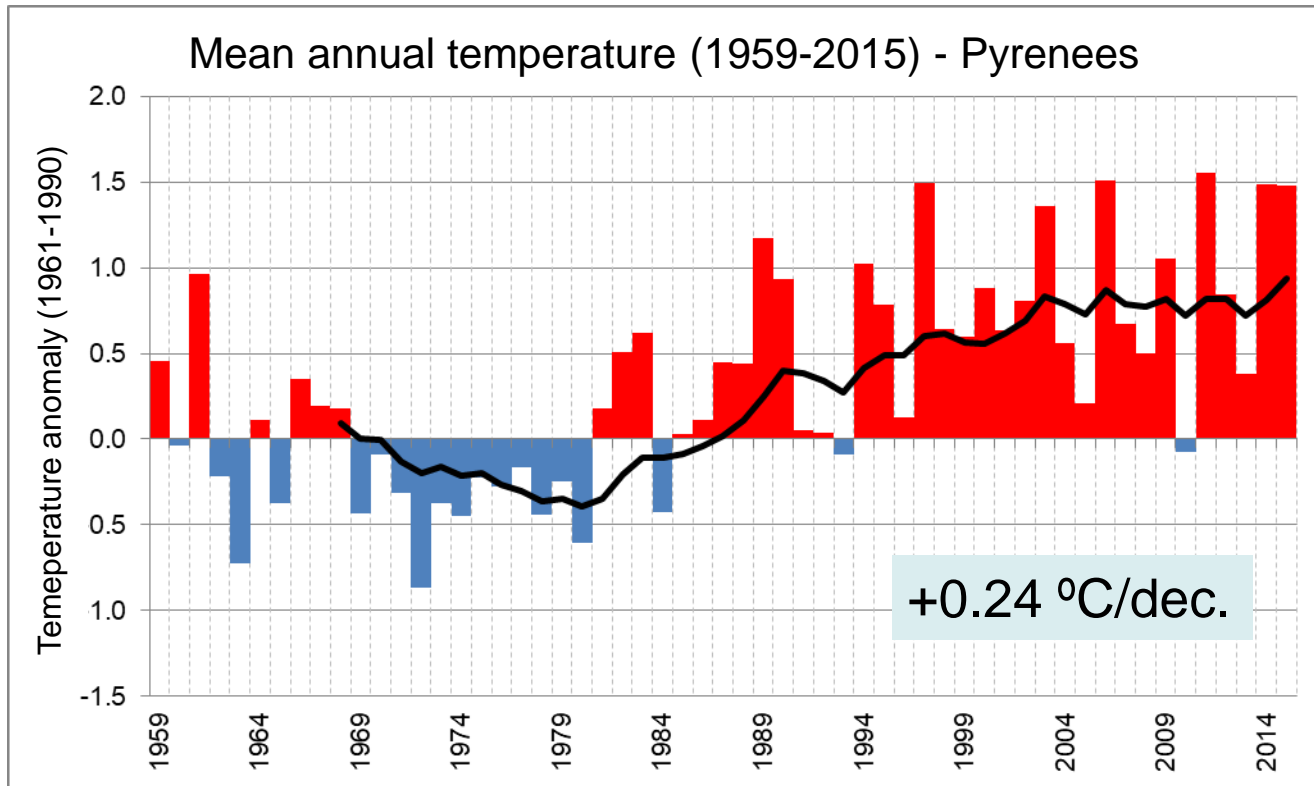
TRENDS 1959-2015

- Temperature Trends: summary

Period 1959-2015	Annual		
	(a) Mean value (°C/decade)	(b) Extreme values (°C/decade)	(c) Nº of series with p-value < 0.05
TX	+0.30	+0.26 , +0.37	49 (100%)
TN	+0.18	+0.11 , +0.23	49 (100%)
TM	+0.24	+0.21 , +0.28	49 (100%)

	Winter (DJF)			Spring (MAM)			Summer (JJA)			Autumn (SON)		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
TX	+0.17	+0.03, +0.27	14 (29%)	+0.39	+0.30, +0.46	49 (100%)	+0.40	+0.30, +0.56	49 (100%)	+0.23	+0.13, +0.33	35 (71%)
TN	+0.02	-0.06, +0.12	0 (0%)	+0.21	+0.06, +0.28	48 (98%)	+0.31	+0.22, +0.38	49 (100%)	+0.15	+0.02, +0.23	29 (59%)
TM	+0.10	+0.02, +0.18	1 (2%)	+0.30	+0.20, +0.37	49 (100%)	+0.36	+0.27, +0.41	49 (100%)	+0.19	+0.12, +0.27	39 (80%)

- Mean Temperature: annual (ºC/decade)

Mean annual precipitation (1959-2015) - Pyrenees

-2.0 %/dec.
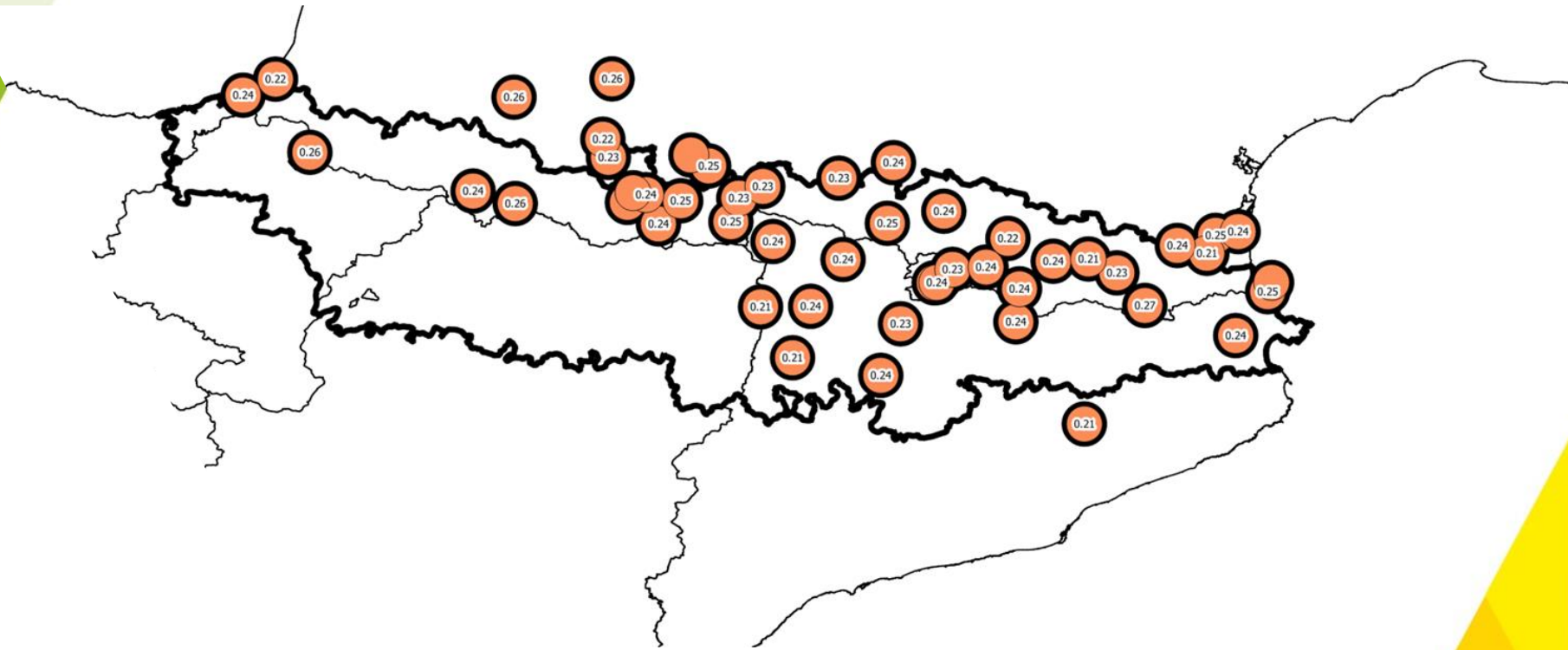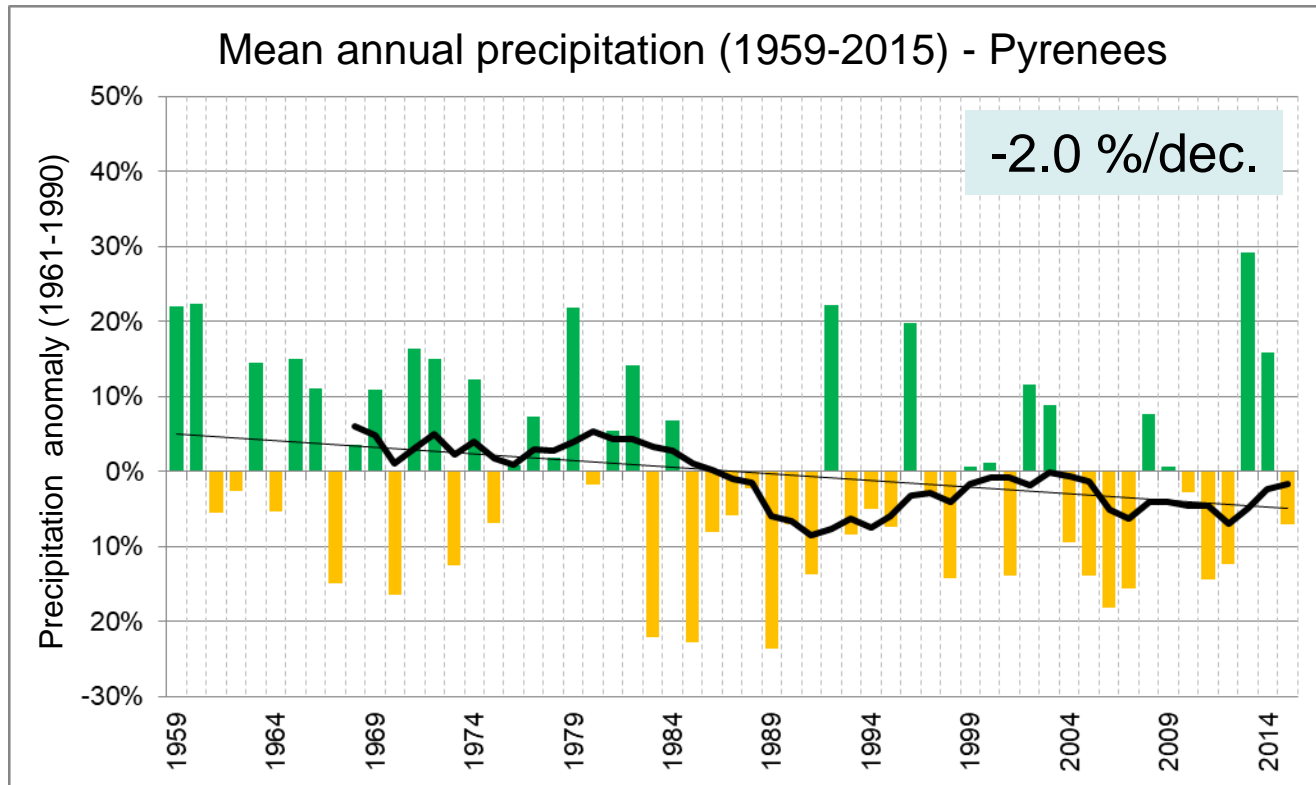
- Precipitation Trends: summary
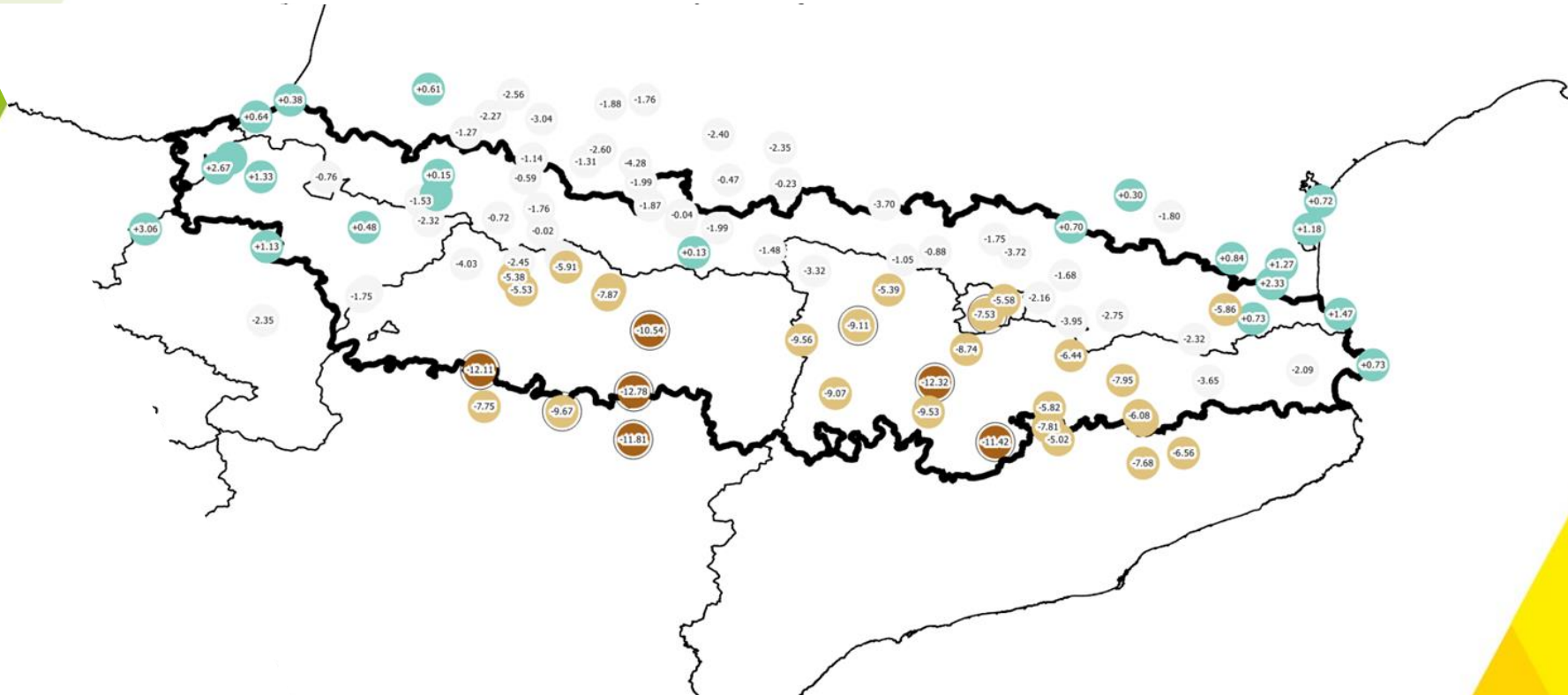
Period 1959-2015	Annual		
	(a) Mean value (%/decade)	(b) Extreme values (%/decade)	(c) Nº of series with p-value < 0.05
Precipitation	-2.0	-7.1 , +1.2	24 (24%)

Winter (DJF)			Spring (MAM)			Summer (JJA)			Autumn (SON)		
(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
-3.2	-12.8, +3.1	9 (9%)	-0.1	-4.9, +6.6	0 (0%)	-1.8	-9.0, +2.9	4 (4%)	-2.5	-8.5, +4.0	0 (0%)

TRENDS 1959-2015

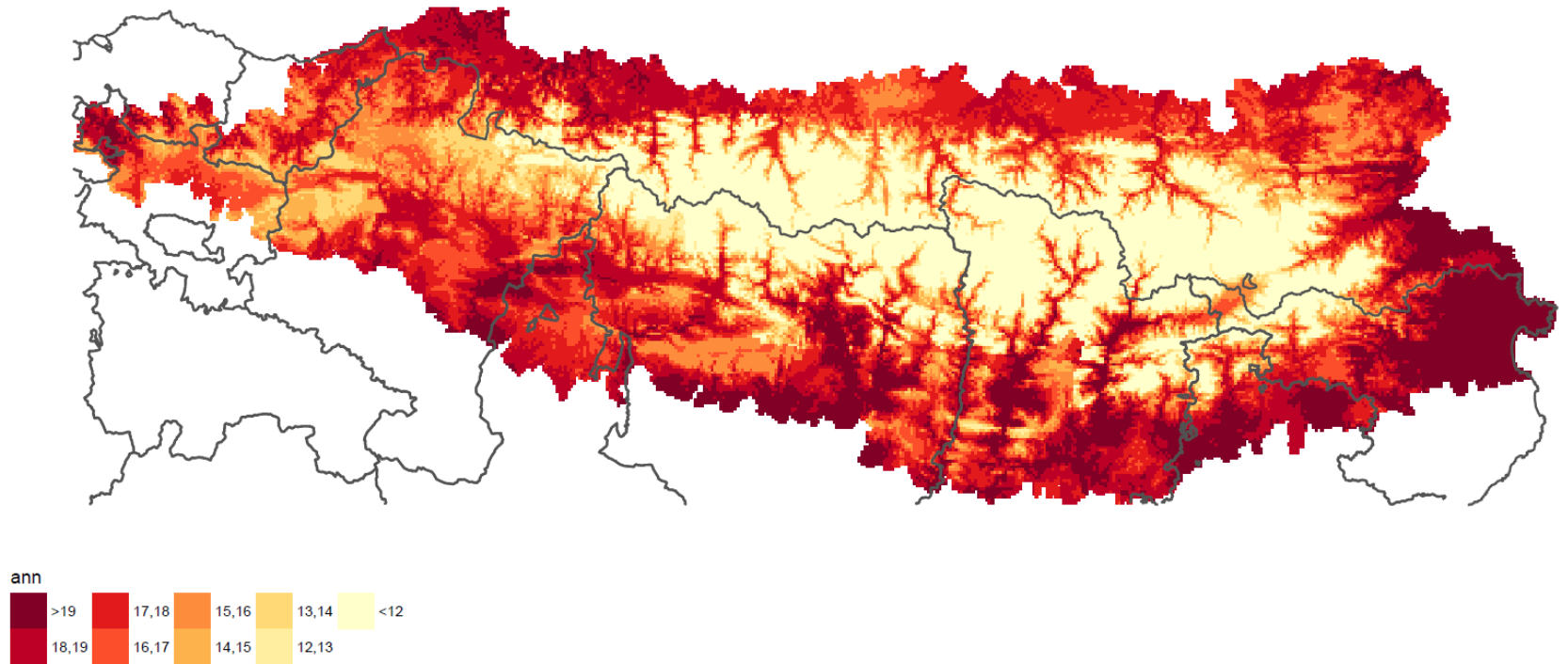- Precipitation: annual (%/decade)

TRENDS 1959-2015
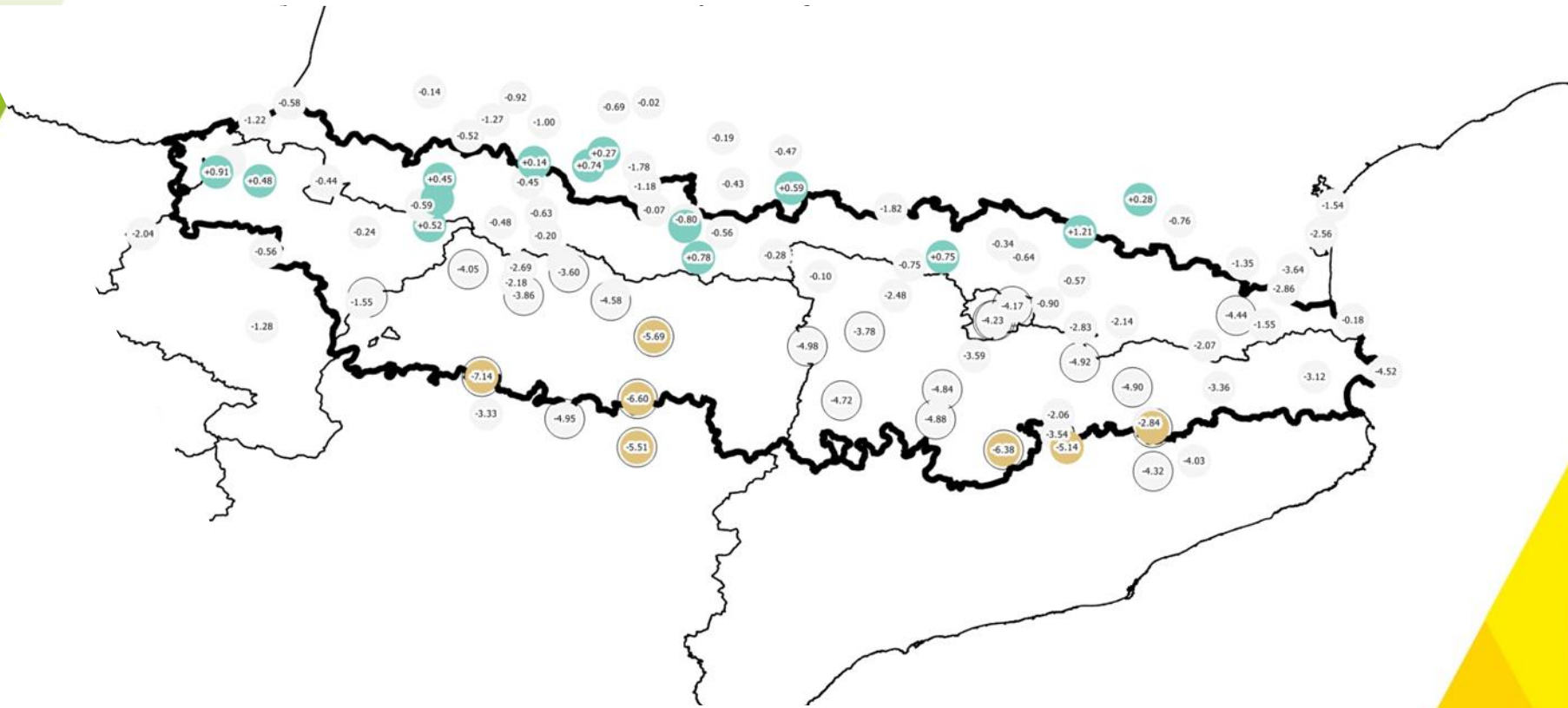
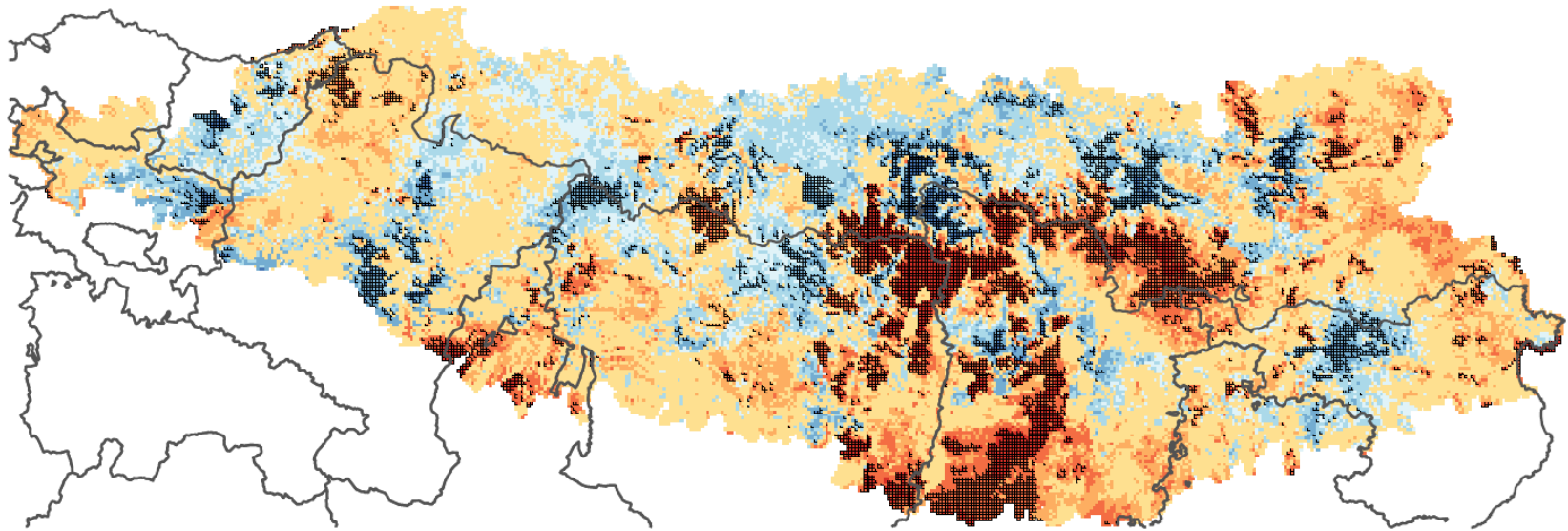- Precipitation: winter (%/decade)

1 x 1 km GRID. 1981-2015

- Main objective: analyse spatial and temporal patterns of extreme precipitation and temperature indices (ETCCDI/CRD), regional differences, trends in water availability...
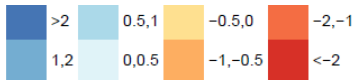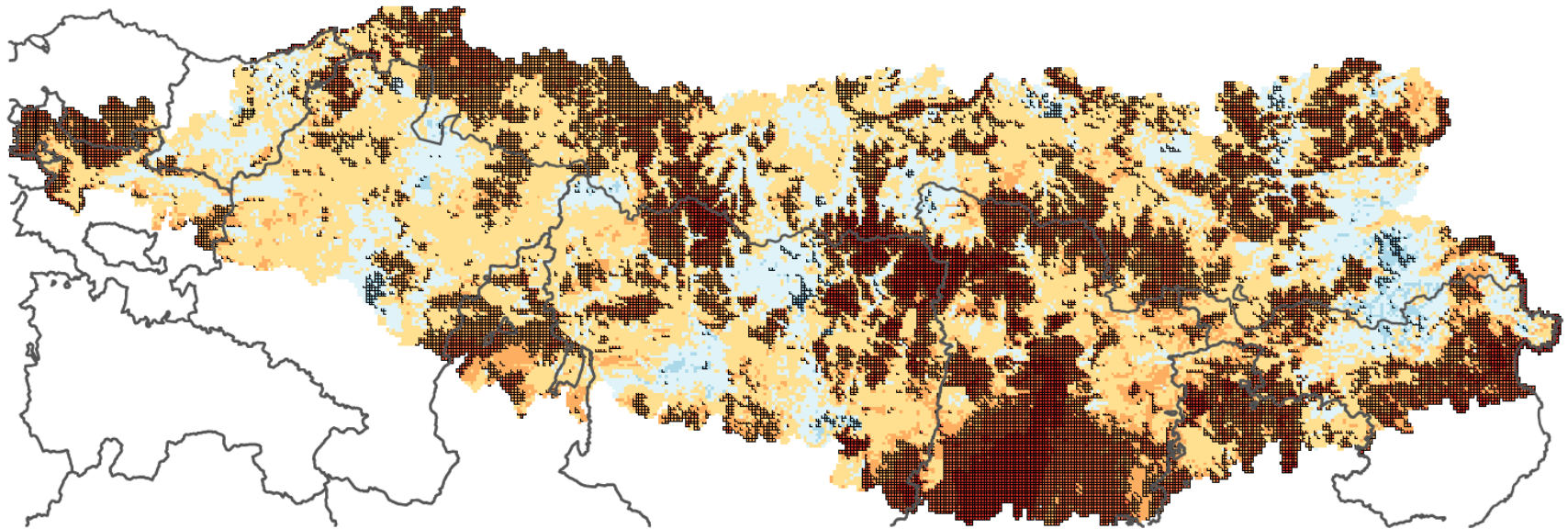
Mean annual TX (1981-2015)

ann

>19	17,18	15,16	13,14	<12
18,19	16,17	14,15	12,13	

1 x 1 km GRID. 1981-2015

- R20mm trend: *Annual count of days when PPT≥ 20mm*

Trend (change/decade)

>2	−0.5,0	
0.5,1	−2,−1	
1,2	−1,−0.5	
0,0.5	<−2	

1 x 1 km GRID. 1981-2015

- SDII: *Simple precipitation intensity index (yearly PPT amount / n. rainfall days)*

Trend (change/decade)

1,2	0,0.5	−1,−0.5	<−2
0.5,1	−0.5,0	−2,−1	
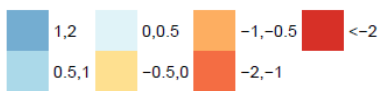
- **CLIM'PY** provides the first daily, quality controlled and homogeneous climate database for the whole Pyrenees, encompassing a period of more than 60 years.

- Monthly, seasonal and yearly aggregates of the daily data is provided for a long-term climate change monitoring (1959-2015). The Pyrenees shows a **unequivocal warming trend**: +0.24ºC/decade for mean temperature, more effective on TX and in summer.
- Precipitation trends show a clear dipole reporting drier conditions over the southernmost slope.

- A new 1x1 km grid (1981-2015) provides useful information on **extreme climate indices** behaviour, detecting a great variability within the mountainous chain.

- Follow as at researchgate or OPCC (https://www.opcc-ctp.org)