

# OBSERVED CLIMATIC TRENDS IN THE PYRENEES (1950-2015)

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de Catalunya



- **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.



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de Catalunya



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

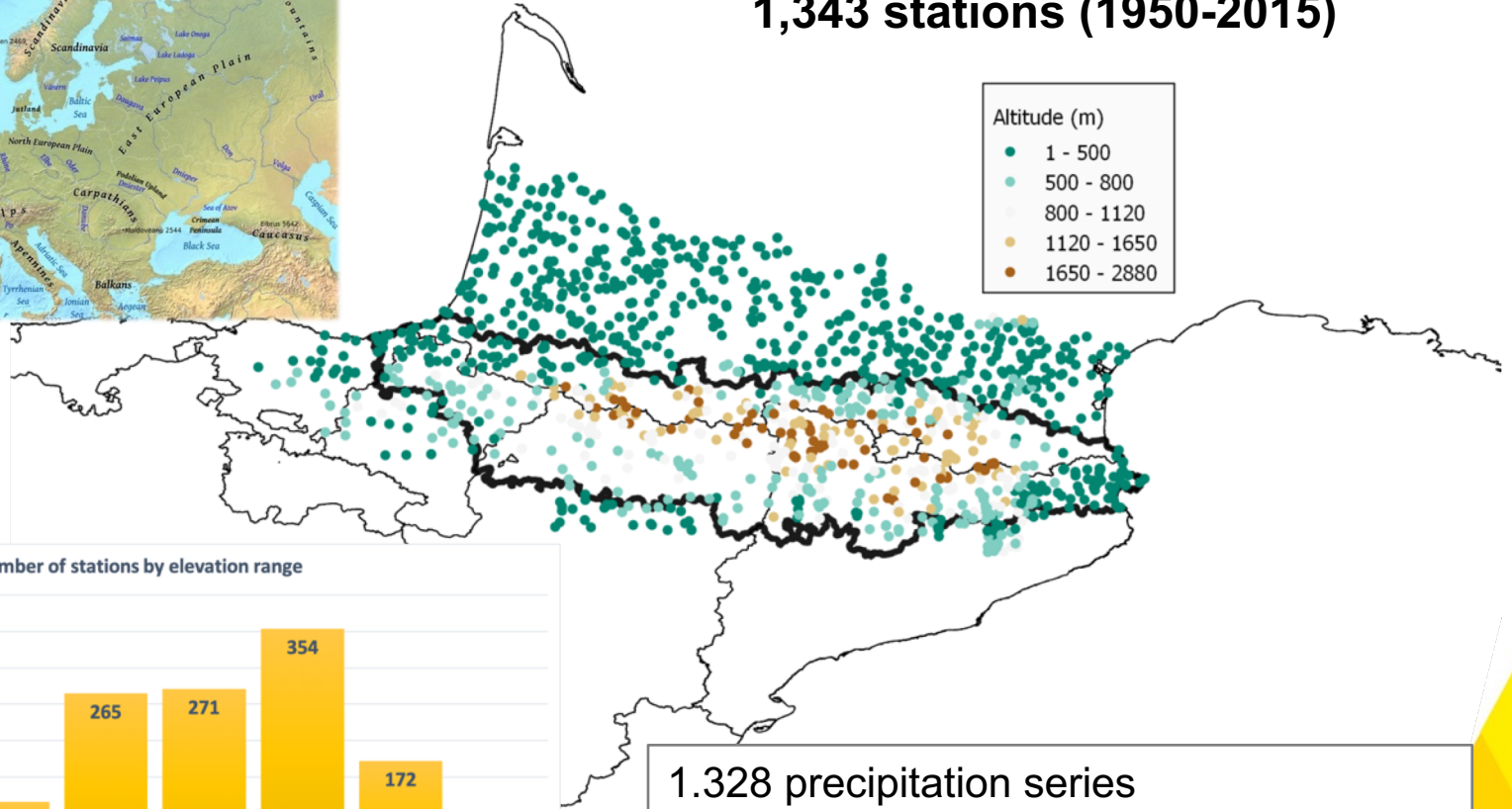
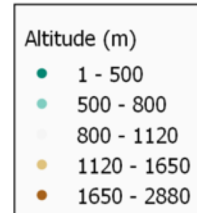
## Objectives:

1. Creation of a **daily database** of temperature (TX/TN), precipitation and snow-cover for the Pyrenees, encompassing the period **1950-2015**.
2. Definition and calculation of **climate indices** for monitoring climate change and variability.
3. Estimation of **climate change projections** for the Pyrenees based on the new IPCC AR5 scenarios (XXI century).

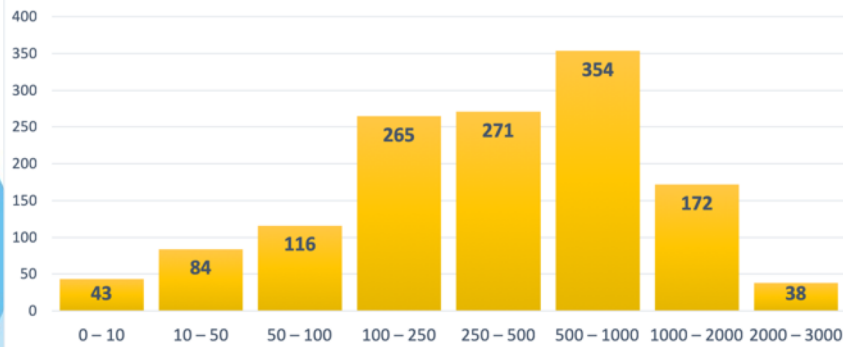
# Study area



1,343 stations (1950-2015)



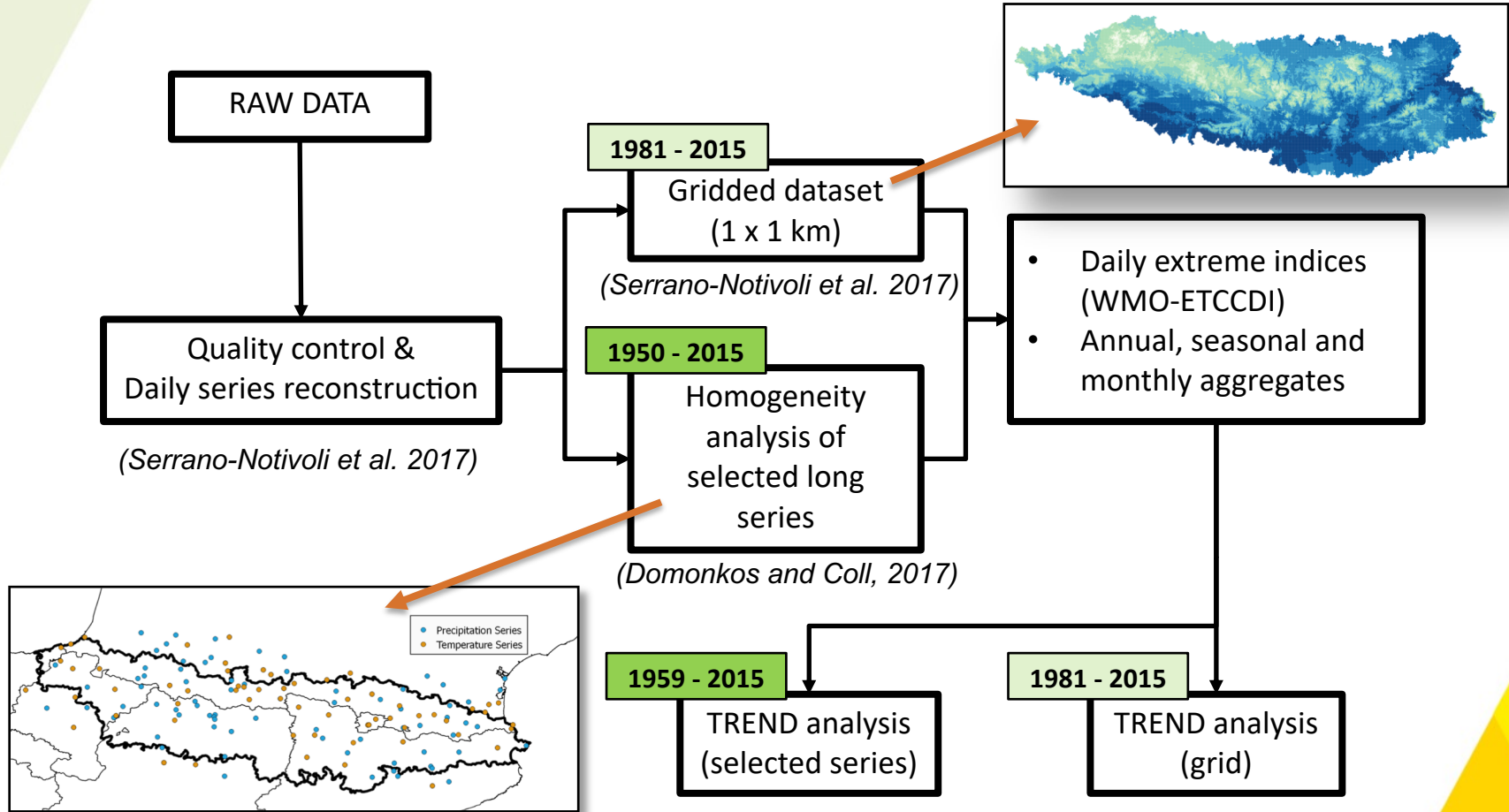
Number of stations by elevation range



1.328 precipitation series  
1.163 temperature series (TMAX & TMIN)



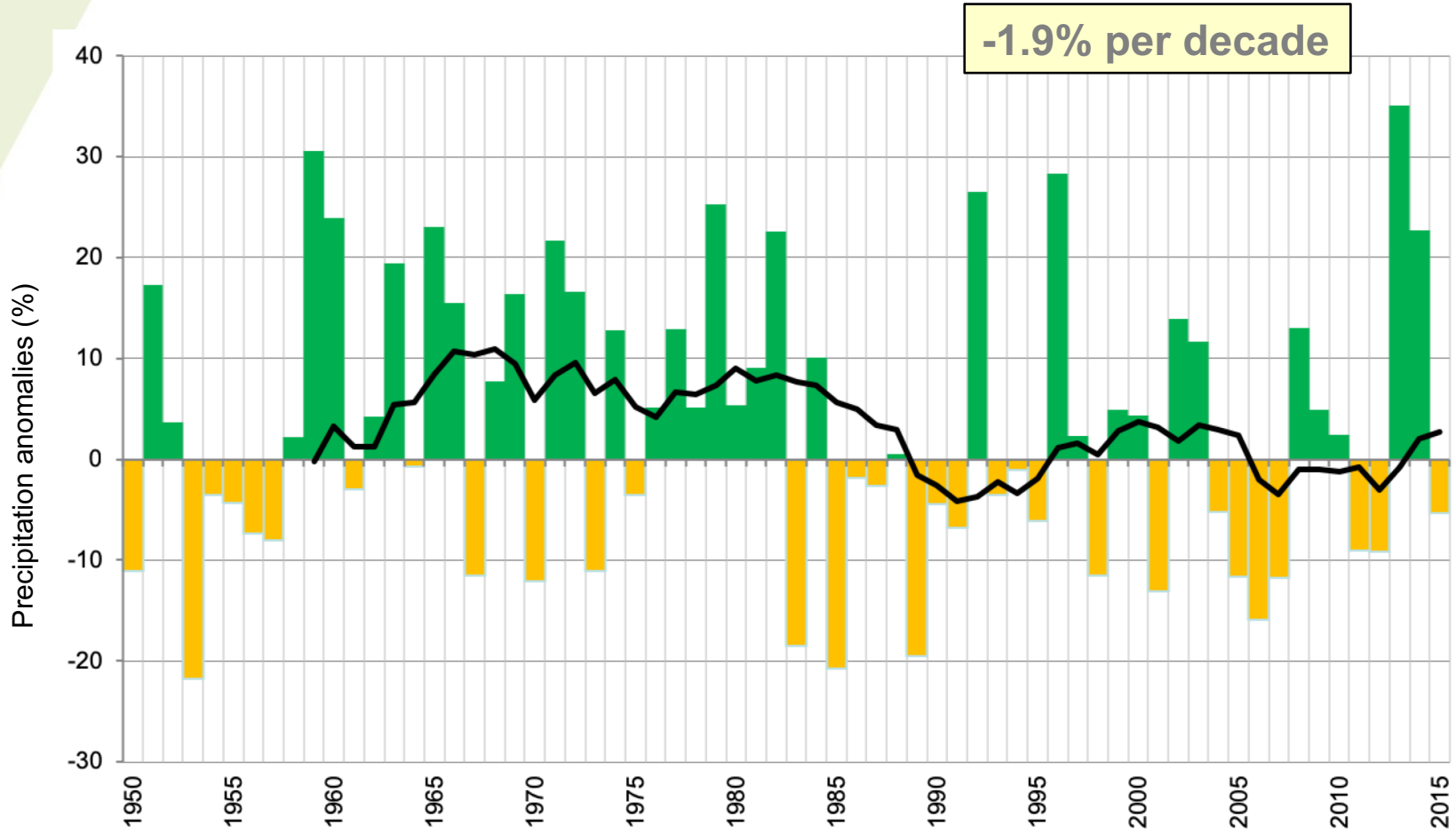
# Workflow



Serrano-Notivoli et al. (2017), *Climate Research*, 73, 167-186

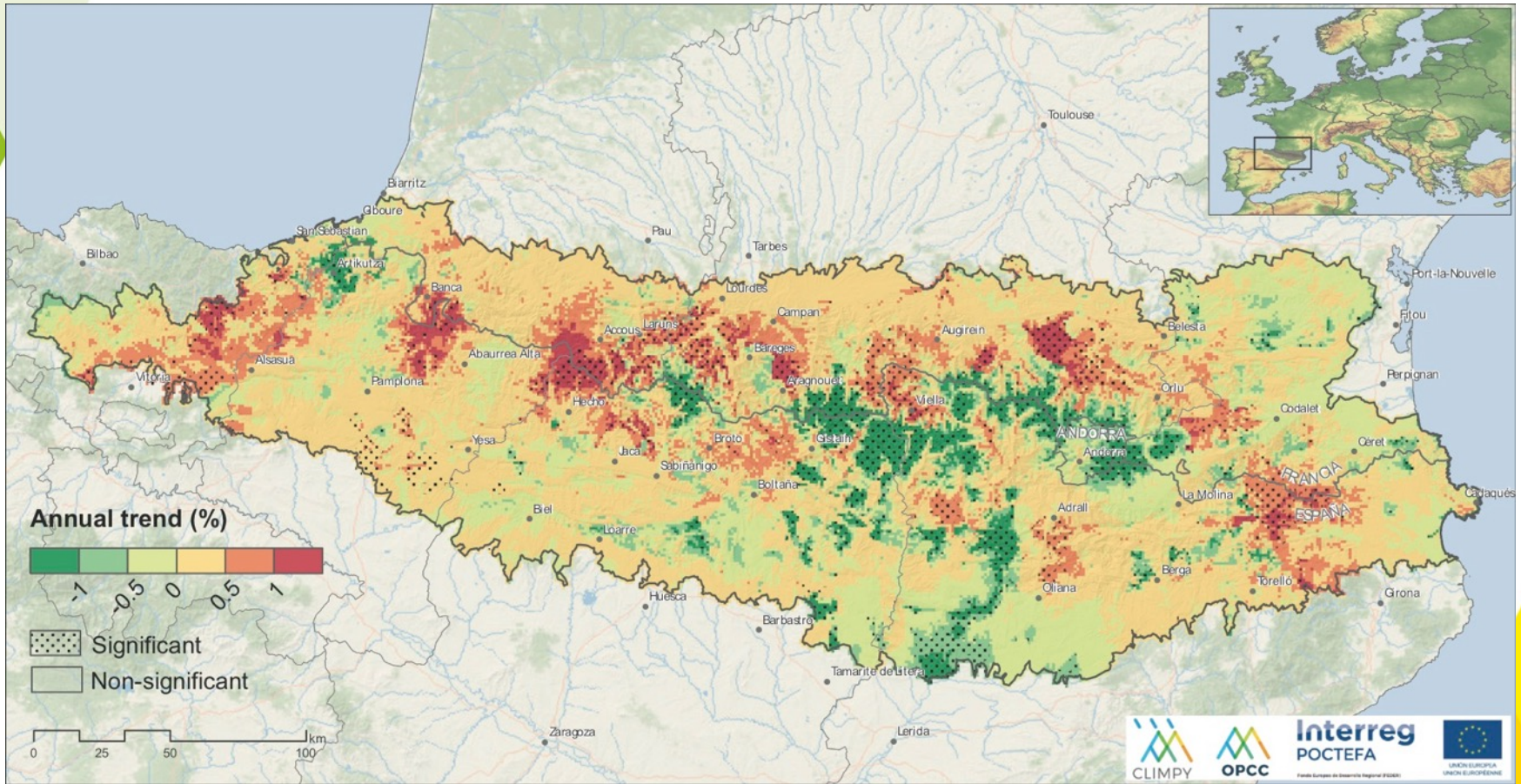
Domonkos and Coll (2017), *International Journal of Climatology*, 37(4), 1910-1921

# Precipitation trends (annual)



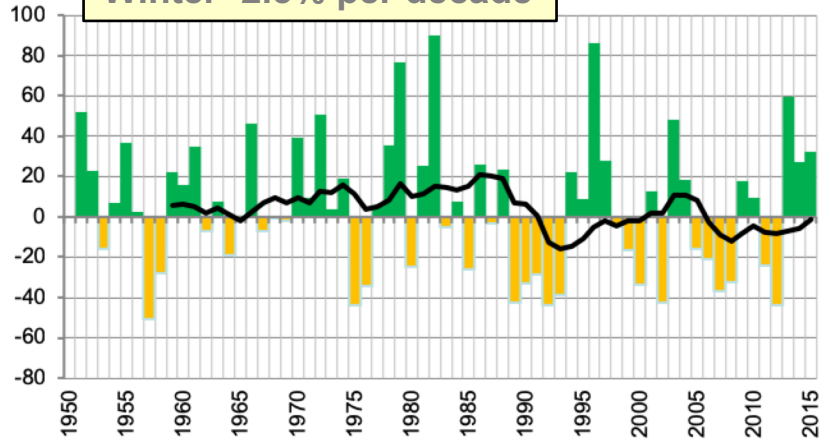
**Non-significant trend**

# Precipitation trends (annual)

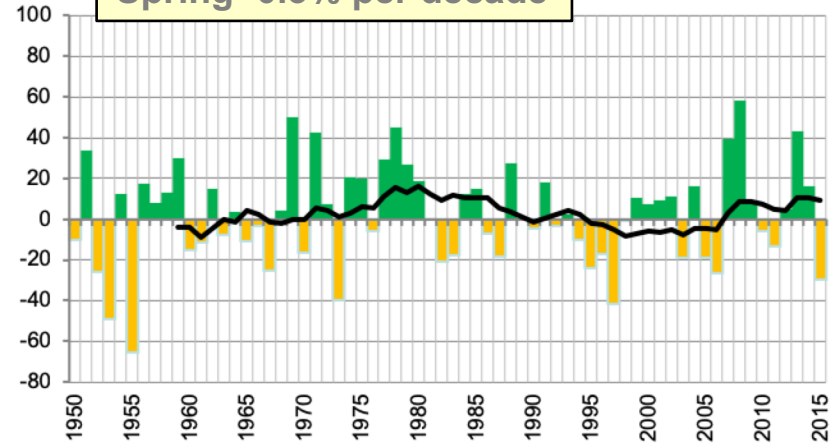


# Precipitation trends (seasonal)

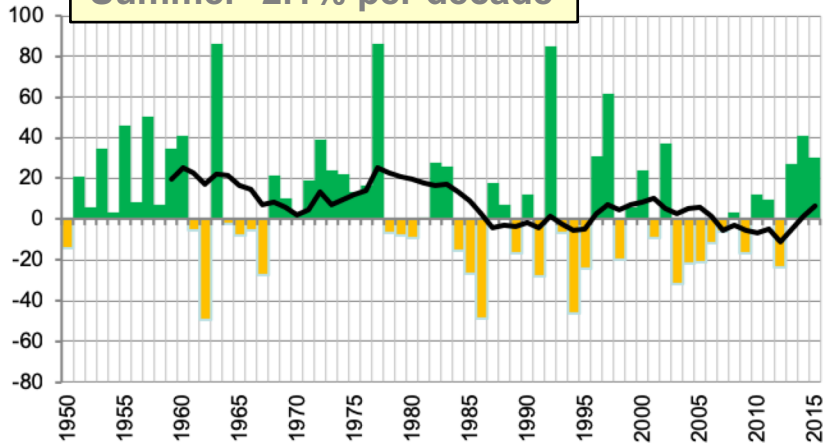
Winter -2.5% per decade



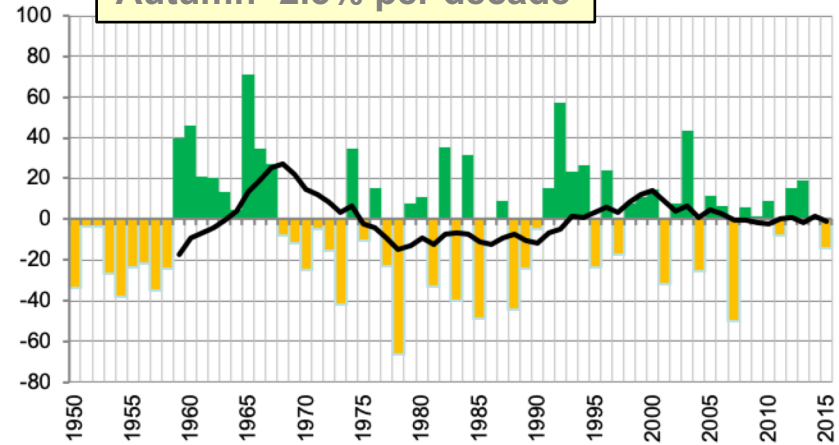
Spring -0.3% per decade



Summer -2.1% per decade



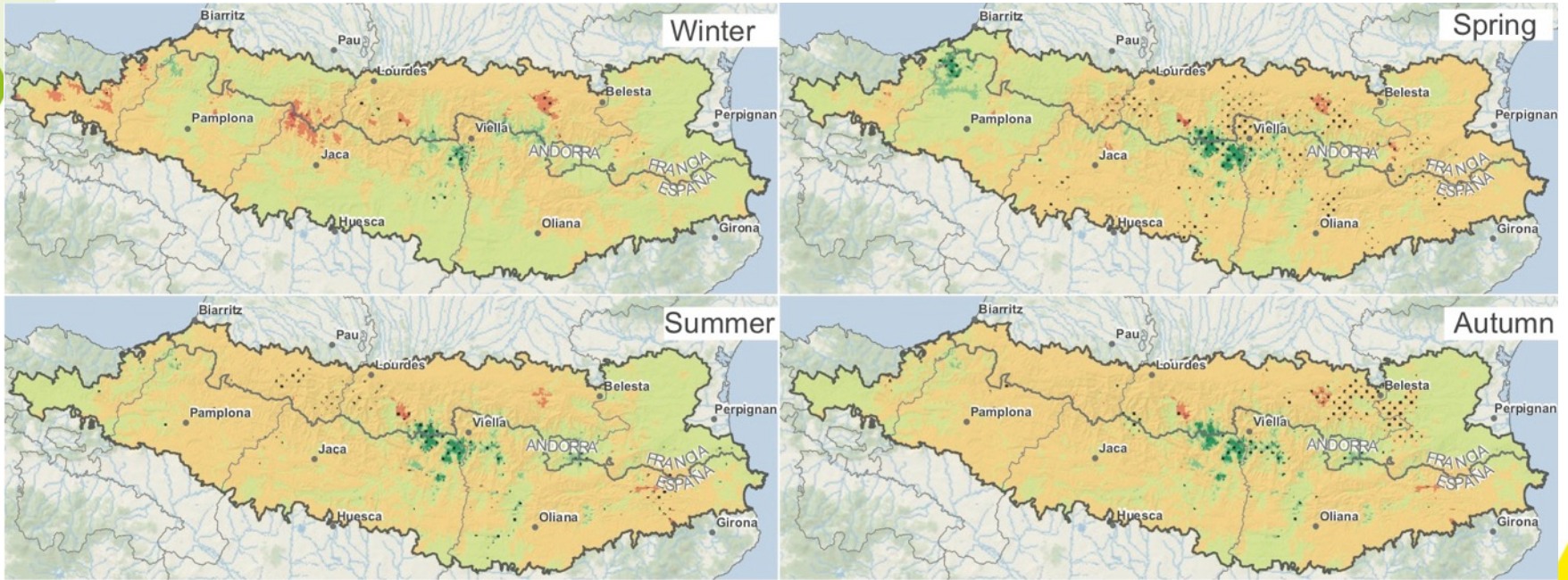
Autumn -2.5% per decade



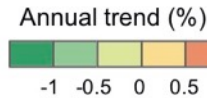
**Non-significant trends**





# Precipitation trends (seasonal)



Pyrenees. Seasonal precipitation trends 1981-2015

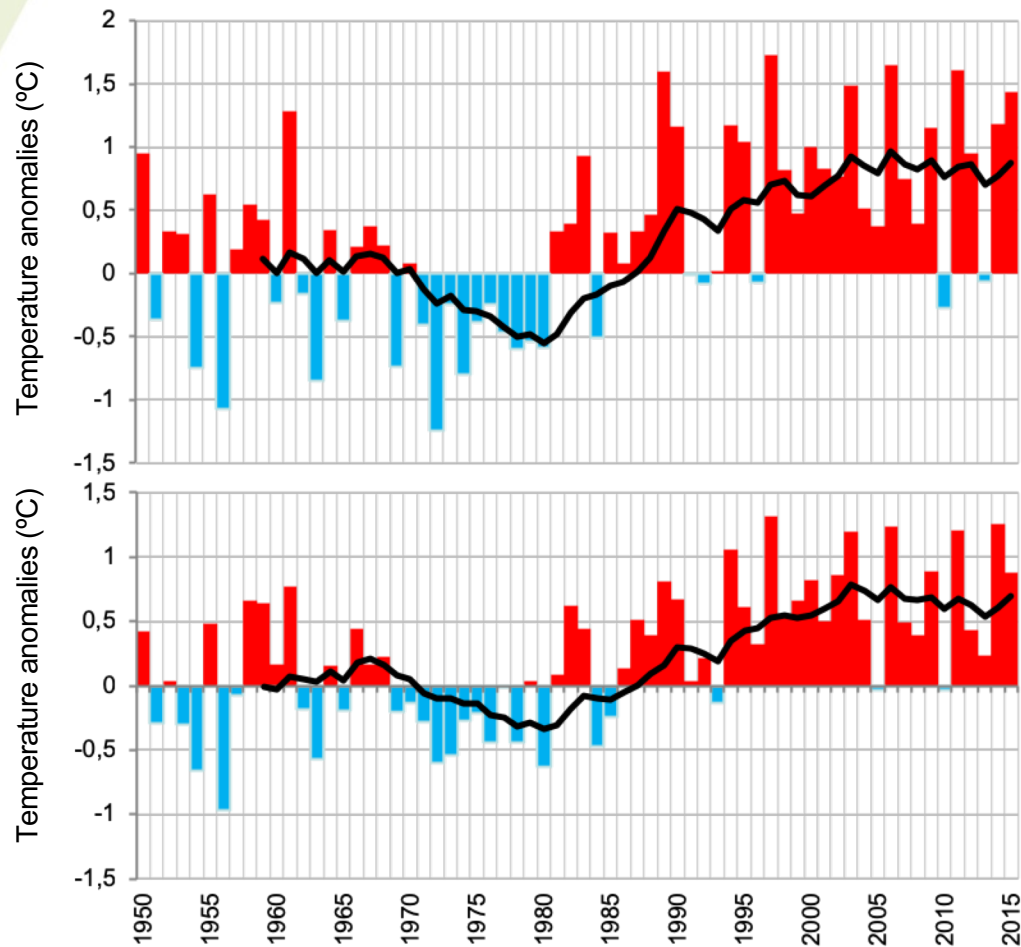


 Significant  
 Non-significant

 **Interreg**  
**POCTEFA**  
Programa Operativo de Desarrollo Regional FEDER  




# Temperature trends (annual) **PROVISIONAL**



**TMAX +0.2 °C per decade\***

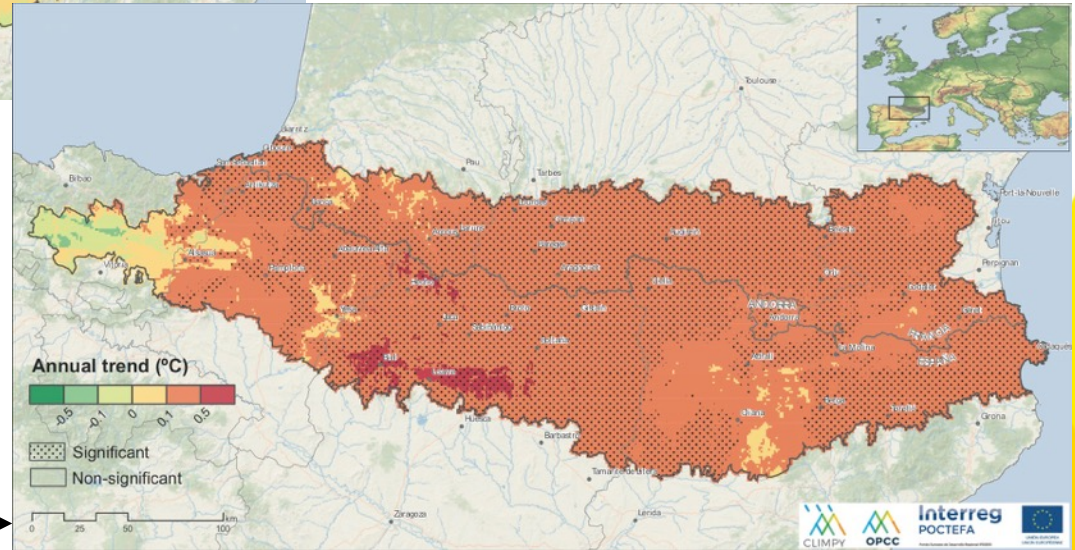
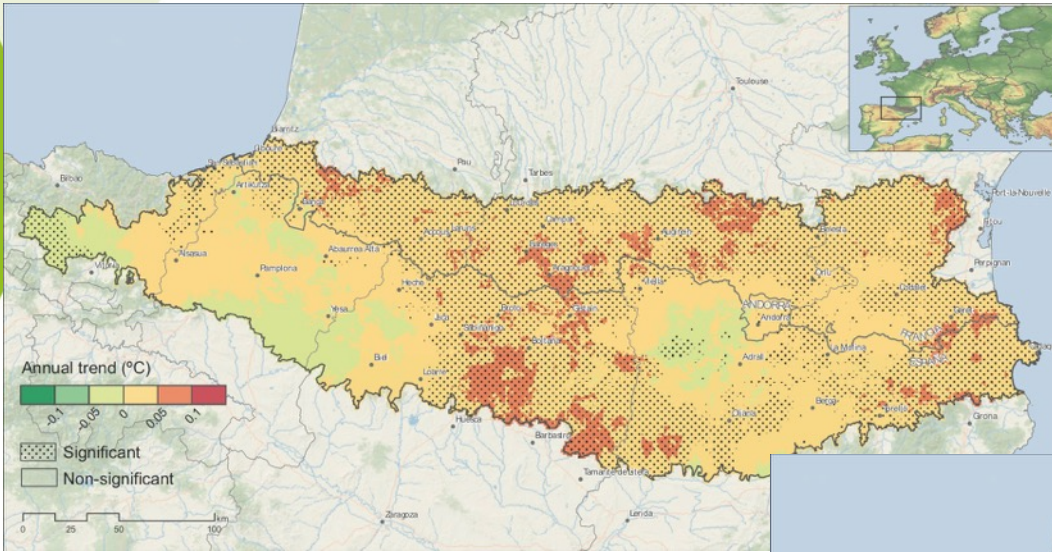
**TMIN +0.2 °C per decade\***

\* statistical significance at 95% confidence



# Temperature trends (annual) **PROVISIONAL**

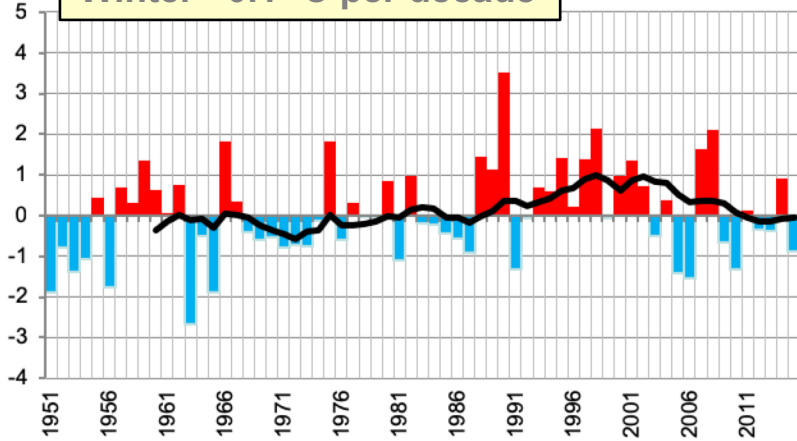
Maximum temperature



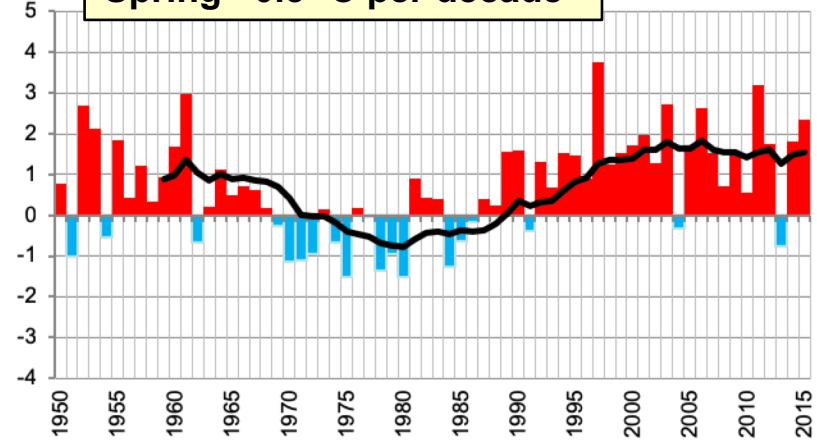
Minimum temperature

# TMAX trends (seasonal) PROVISIONAL

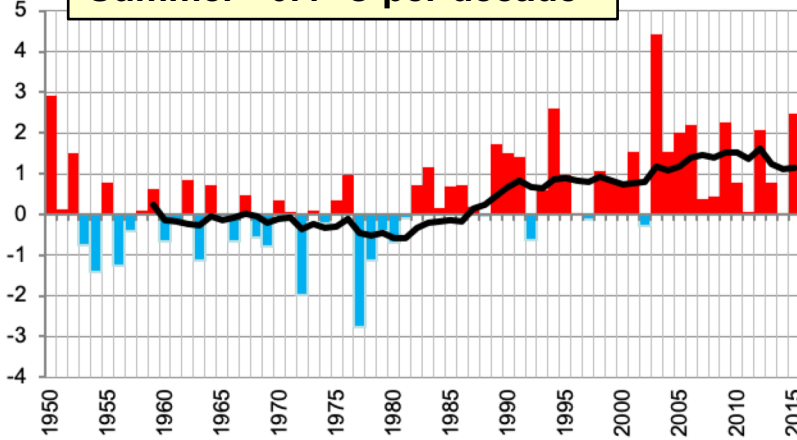
Winter +0.1 °C per decade



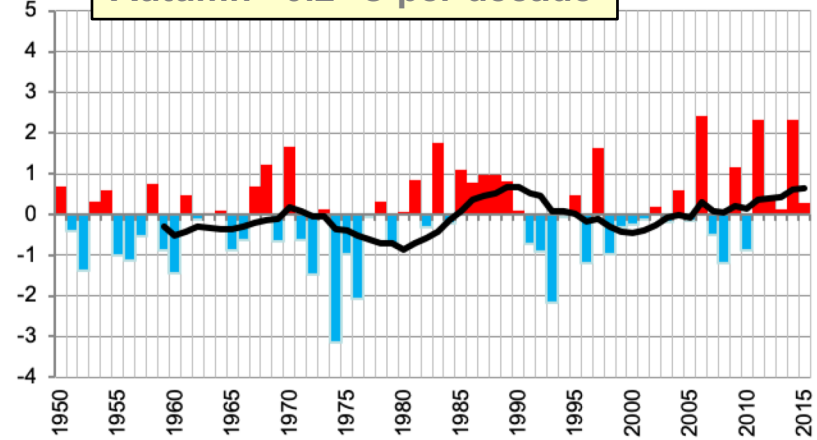
Spring +0.3 °C per decade\*



Summer +0.4 °C per decade\*



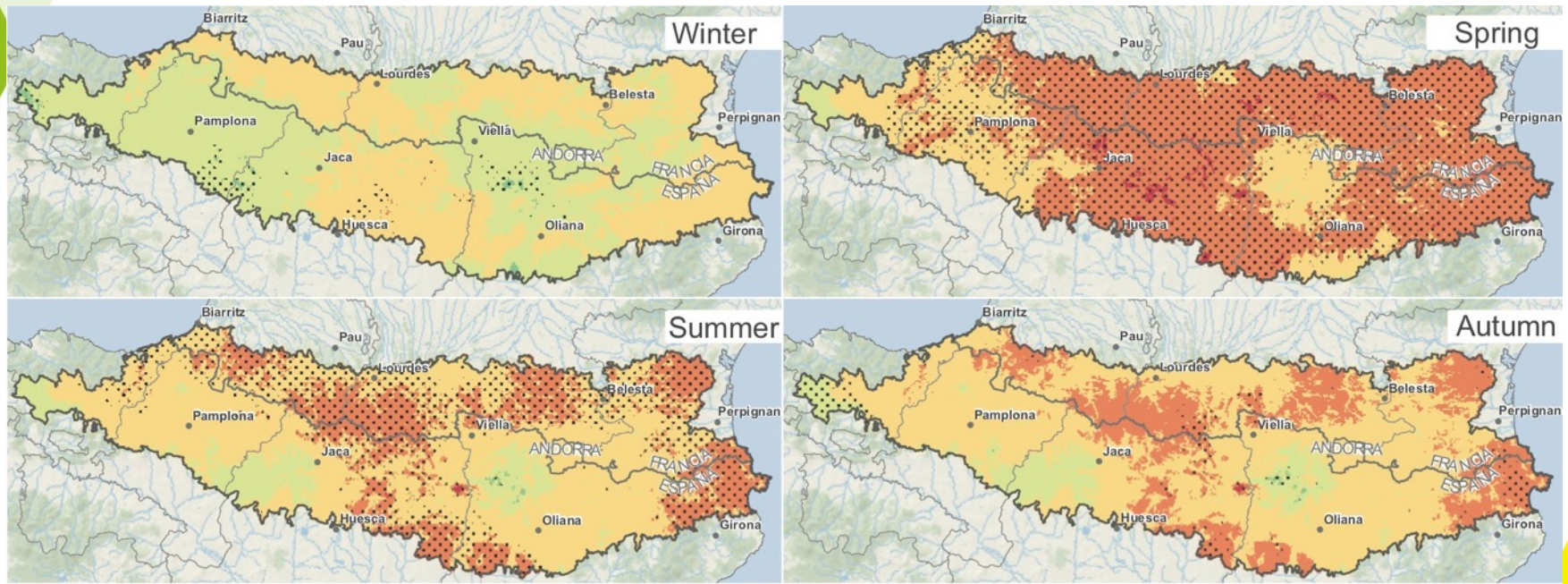
Autumn +0.2 °C per decade



\* statistical significance at 95% confidence

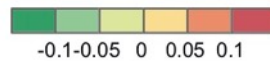


## Maximum temperature



Pyrenees. Seasonal TMAX trends  
1981-2015

Annual trend (%)

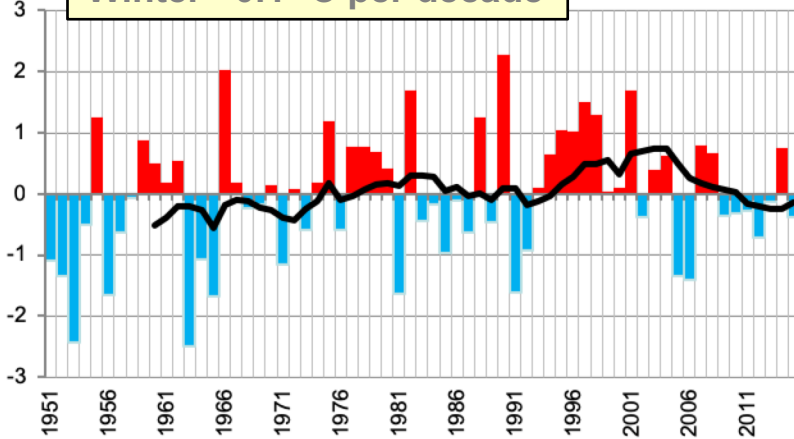


- Significant
- Non-significant

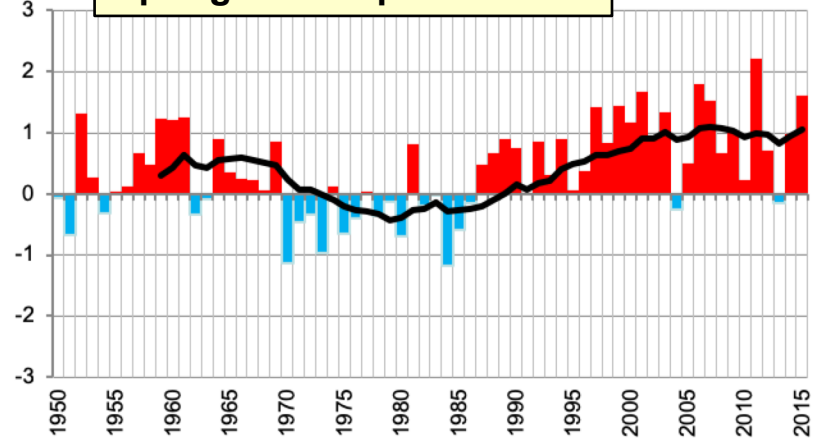


# TMIN trends (seasonal) PROVISIONAL

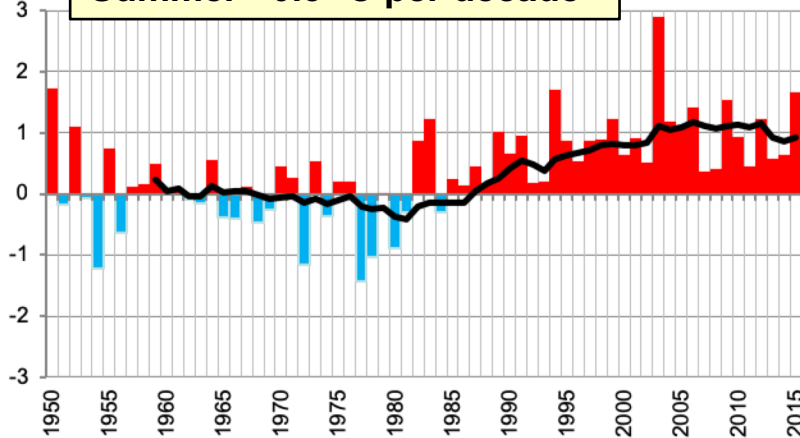
Winter +0.1 °C per decade



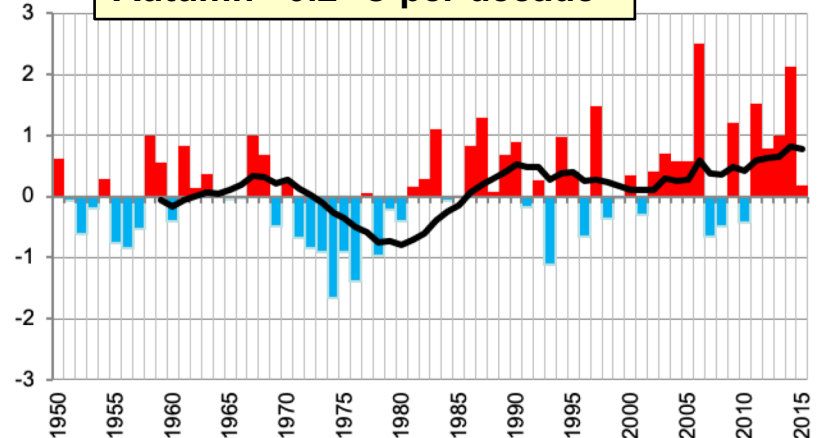
Spring +0.2 °C per decade\*



Summer +0.3 °C per decade\*



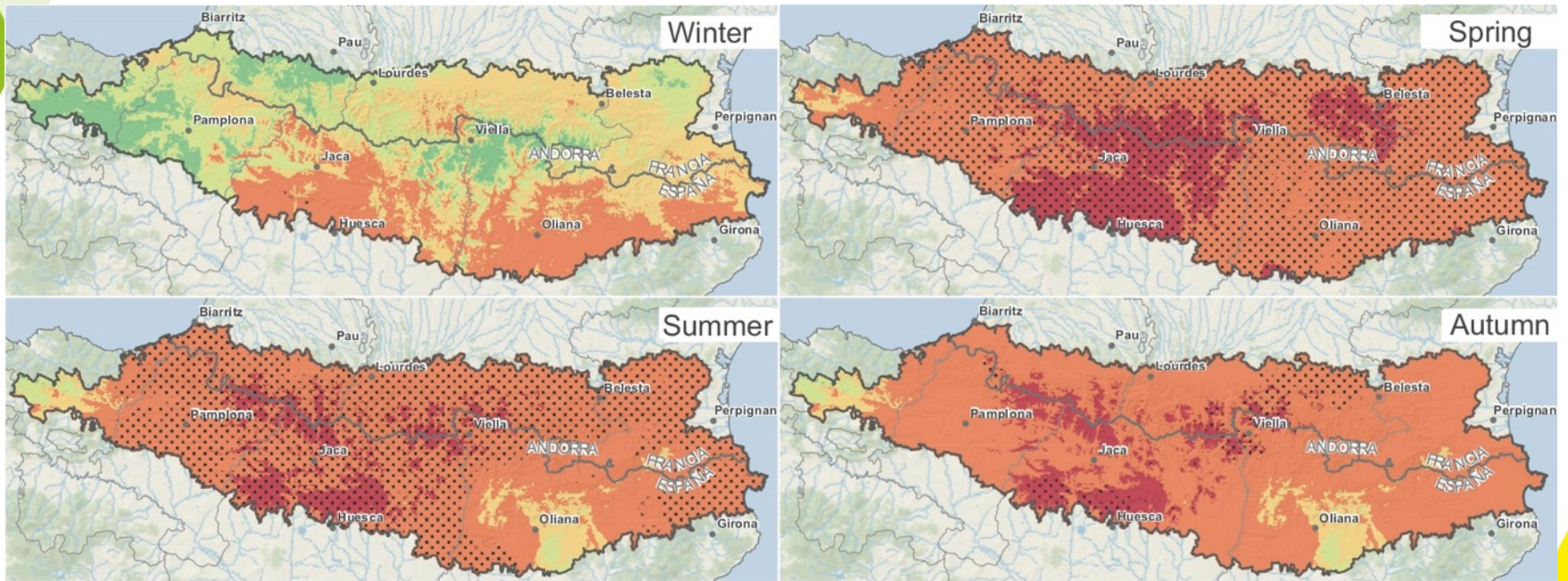
Autumn +0.2 °C per decade\*



\* statistical significance at 95% confidence

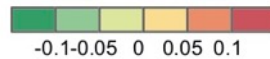


## Minimum temperature



Pyrenees. Seasonal TMIN trends  
1981-2015

Annual trend (%)



Significant  
 Non-significant



## Decadal trend 1959-2015

reference period: 1981-2010

### Whole Pyrenees

	ANNUAL	WINTER	SPRING	SUMMER	AUTUMN	
PCP	-1.9	-2.5	-0.3	-2.1	-2.5	↓
TMAX	<b>+0.2</b>	+0.1	<b>+0.3</b>	<b>+0.4</b>	+0.2	↑
TMIN	<b>+0.2</b>	+0.1	<b>+0.2</b>	<b>+0.3</b>	<b>+0.2</b>	↑

### North

	ANNUAL	WINTER	SPRING	SUMMER	AUTUMN	
PCP	-0.5	-0.9	+1.1	-0.5	-1.2	↓
TMAX	<b>+0.2</b>	-0.1	<b>+0.5</b>	+0.3	+0.1	↑
TMIN	<b>+0.2</b>	0.0	<b>+0.2</b>	<b>+0.3</b>	<b>+0.2</b>	↑

### South

	ANNUAL	WINTER	SPRING	SUMMER	AUTUMN	
PCP	<b>-3.5</b>	-4.4	-1.9	-3.8	-3.9	↓
TMAX	<b>+0.2</b>	+0.1	<b>+0.3</b>	<b>+0.4</b>	+0.1	↑
TMIN	<b>+0.2</b>	+0.1	<b>+0.2</b>	<b>+0.3</b>	+0.2	↑

Bold figures are significant at 95% confidence



# Summary

Decadal trend based on grid elevations  
(1981-2015) (not computed yet for 1959-2015)

## TMAX

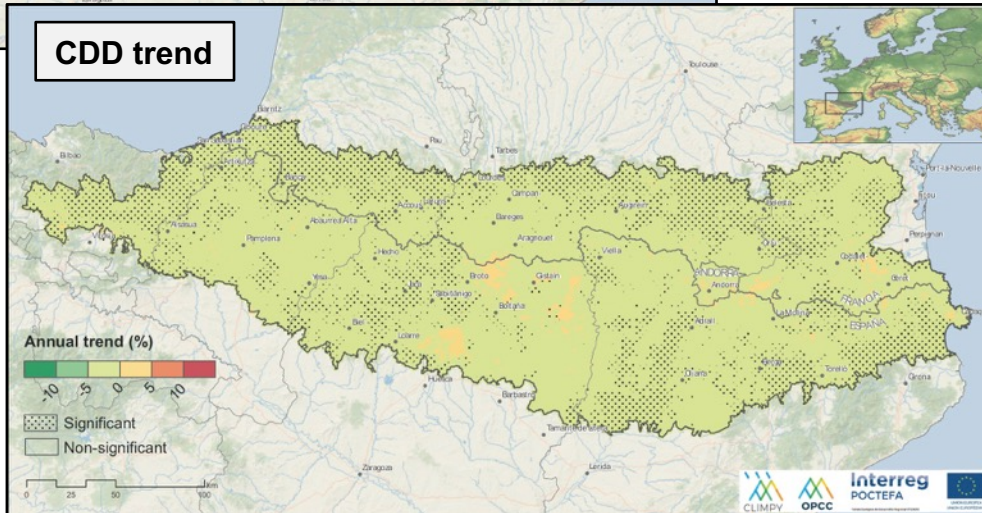
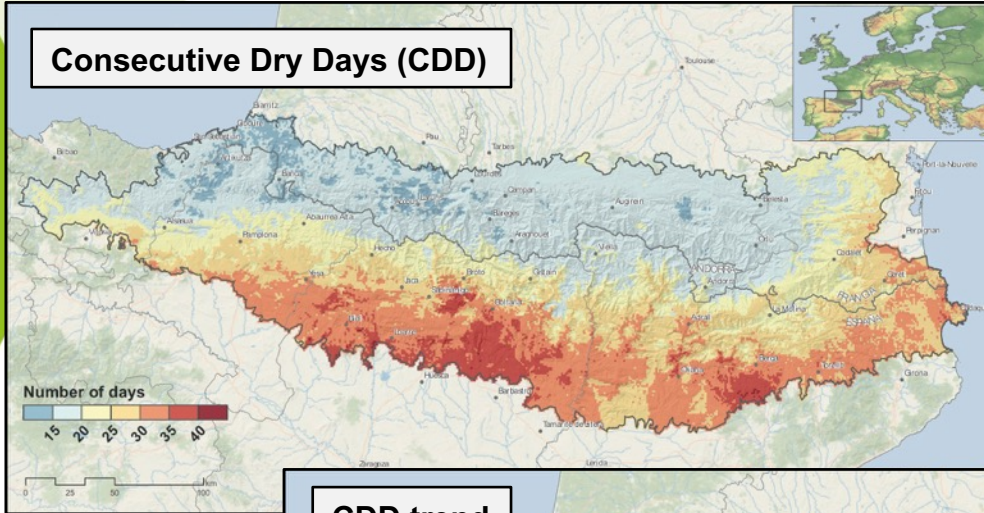
	ANNUAL	WINTER	SPRING	SUMMER	AUTUMN
500 - 1000	+0.2	0.0	+0.6	+0.3	0.0
1000 - 1500	+0.3	0.0	<b>+0.7</b>	+0.3	+0.1
1500 - 2000	+0.3	-0.1	<b>+0.7</b>	+0.3	+0.1
> 2000	+0.3	-0.1	<b>+0.6</b>	+0.4	+0.1

## TMIN

	ANNUAL	WINTER	SPRING	SUMMER	AUTUMN
500 - 1000	+0.2	0.0	<b>+0.4</b>	+0.5	+0.2
1000 - 1500	<b>+0.3</b>	+0.1	<b>+0.5</b>	+0.4	+0.2
1500 - 2000	<b>+0.3</b>	0.0	<b>+0.5</b>	+0.4	+0.2
> 2000	<b>+0.3</b>	-0.1	<b>+0.5</b>	+0.4	+0.2

Bold figures are significant at 95% confidence

# Extreme indices **PROVISIONAL**



Variable	Index	Decadal trend (1981-2015)
PCP	CDD	- 6.12%
PCP	CWD	3.45%
PCP	PRCPTOT	1.31%
PCP	R10mm	1.33%
PCP	R20mm	2.07%
PCP	R25mm	4.22%
PCP	R50mm	2.69%
PCP	R95p	2.46%
PCP	R99p	6.21%
PCP	RX1day	0.81%
PCP	RX5day	- 0.05%
PCP	SDII	- 1.17%
TEMP	CSDI	- 0.19%
TEMP	DTR	0.00°C
TEMP	FDO	- 2.24°C
TEMP	GSL	0.64°C
TEMP	ID0	- 0.01°C
TEMP	ID5	- 0.07°C
TEMP	SU25	2.06°C
TEMP	SU30	1.15°C
TEMP	TN10P	- 0.80%
TEMP	<b>TN90P</b>	<b>+1.79%</b>
TEMP	TNn	0.18°C
TEMP	TNx	0.10°C
TEMP	TR20	0.44°C
TEMP	TX10P	- 0.68%
TEMP	<b>TX90P</b>	<b>+1.43%</b>
TEMP	TXn	0.01°C
TEMP	TXx	- 0.11°C
TEMP	<b>WSDI</b>	<b>+2.35%</b>

## Conclusions

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- **CLIM'PY** provides the first monthly and daily temperature and precipitation dataset for the whole Pyrenees. Data were quality controlled and homogeneized.
- A selection of longest series showed a **decrease** in precipitation (non-significant, except in southern part) and an **increase** of temperature, significant both in TMAX and TMIN at annual scale and in spring, summer and autumn (only in TMIN).
- The higher density of stations in 1981-2015 allowed the creation of a 1x1 gridded dataset, showing the spatial differences of trends
- Follow the Project in the OPCC website (<https://www.opcc-ctp.org>) or in ResearchGate (<https://www.researchgate.net>).