

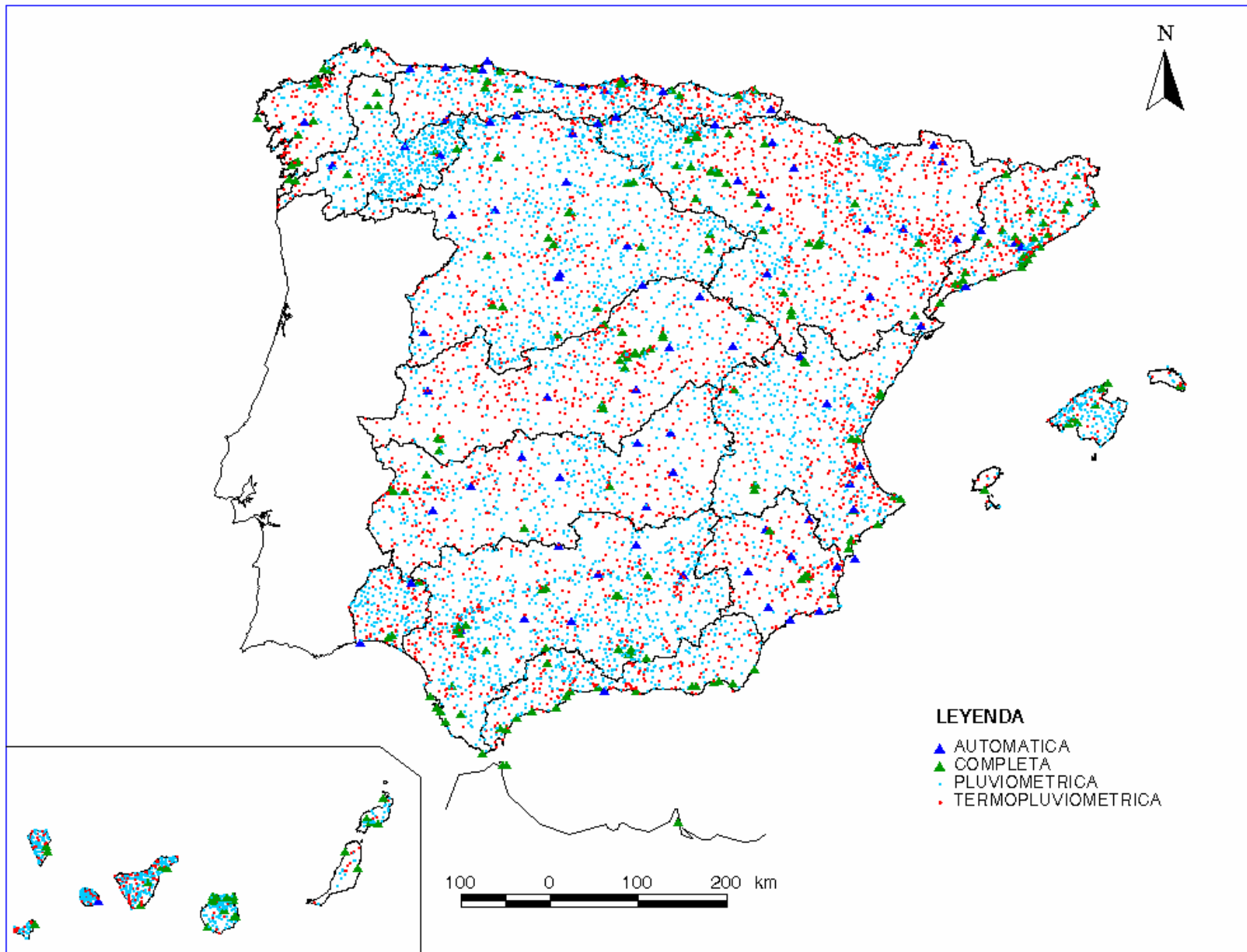
Representativeness and application of the SPAIN02 precipitation dataset in the Northeast of Spain

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University of Barcelona

MedClivar meeting, 3 September 2010, Corfú

Outline

- Rainfall networks in NE Spain
- esTcena project
- Spain02 versus Barcelona data
- Trends analysis



Red de estaciones meteorológicas con registros históricos del INM (Libro Blanco del Agua)

SPAIN02

Characteristic:

High-resolution (20km) daily gridded precipitation dataset over Spain (Herrera et al. 2010)

Period: 1-Jan-1950 31-Dec-2003

Development:

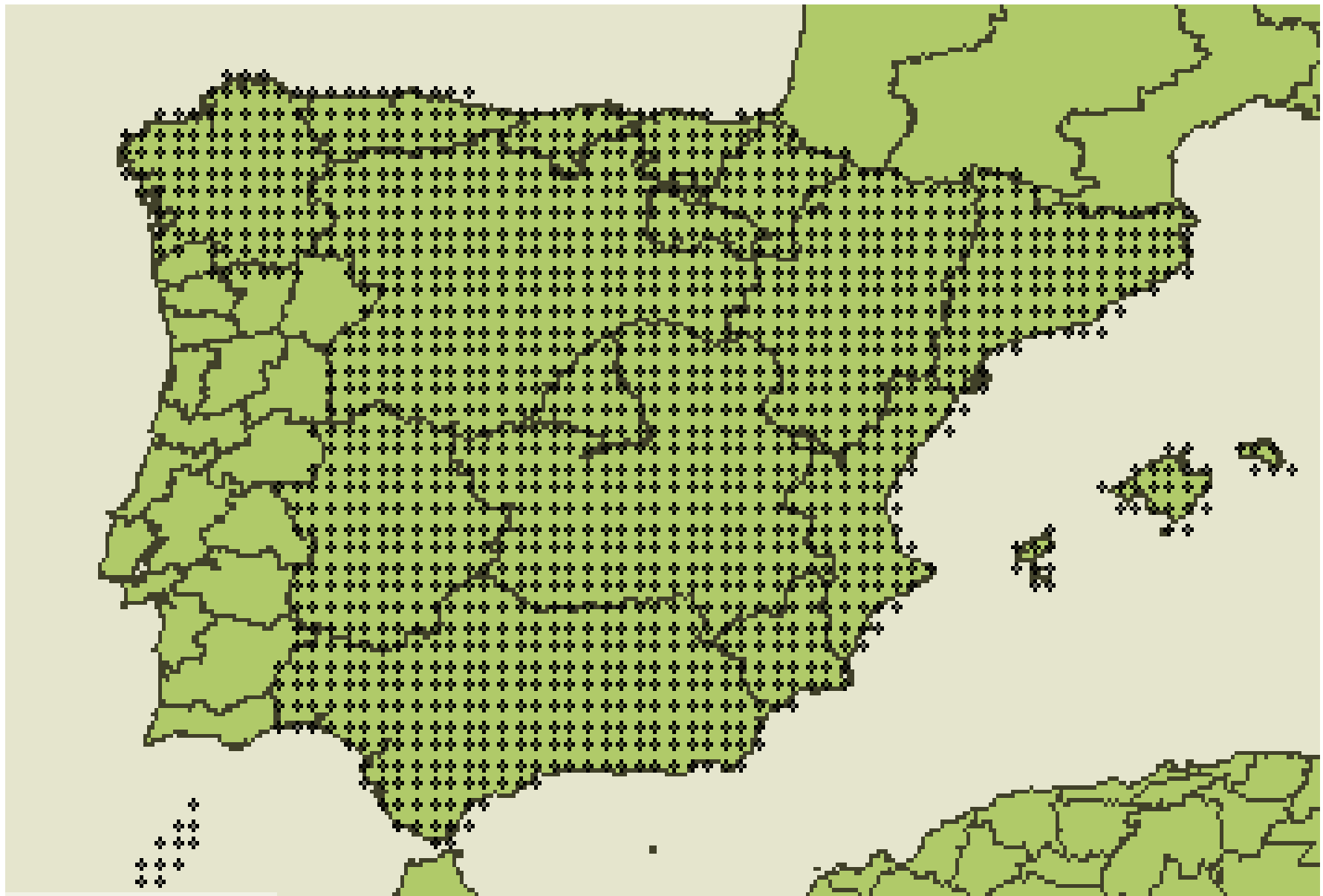
Total precipitation

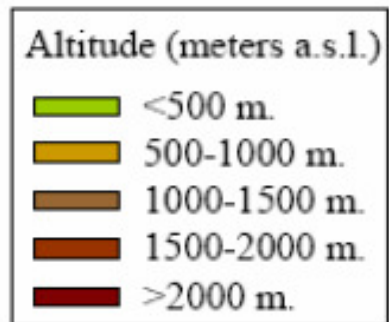
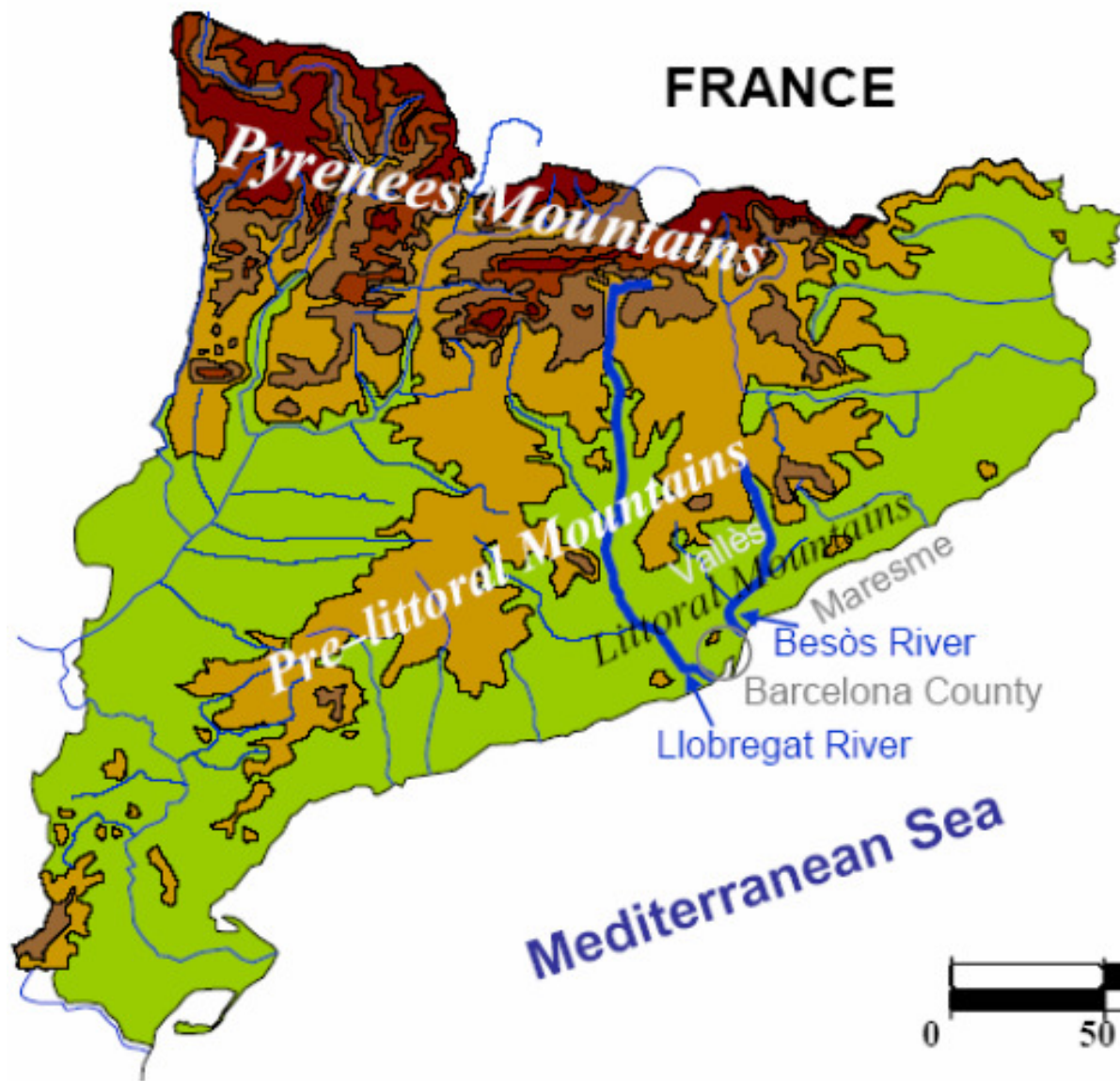
Two-step process (similar for E-OBS data, Haylock et al. 2008):

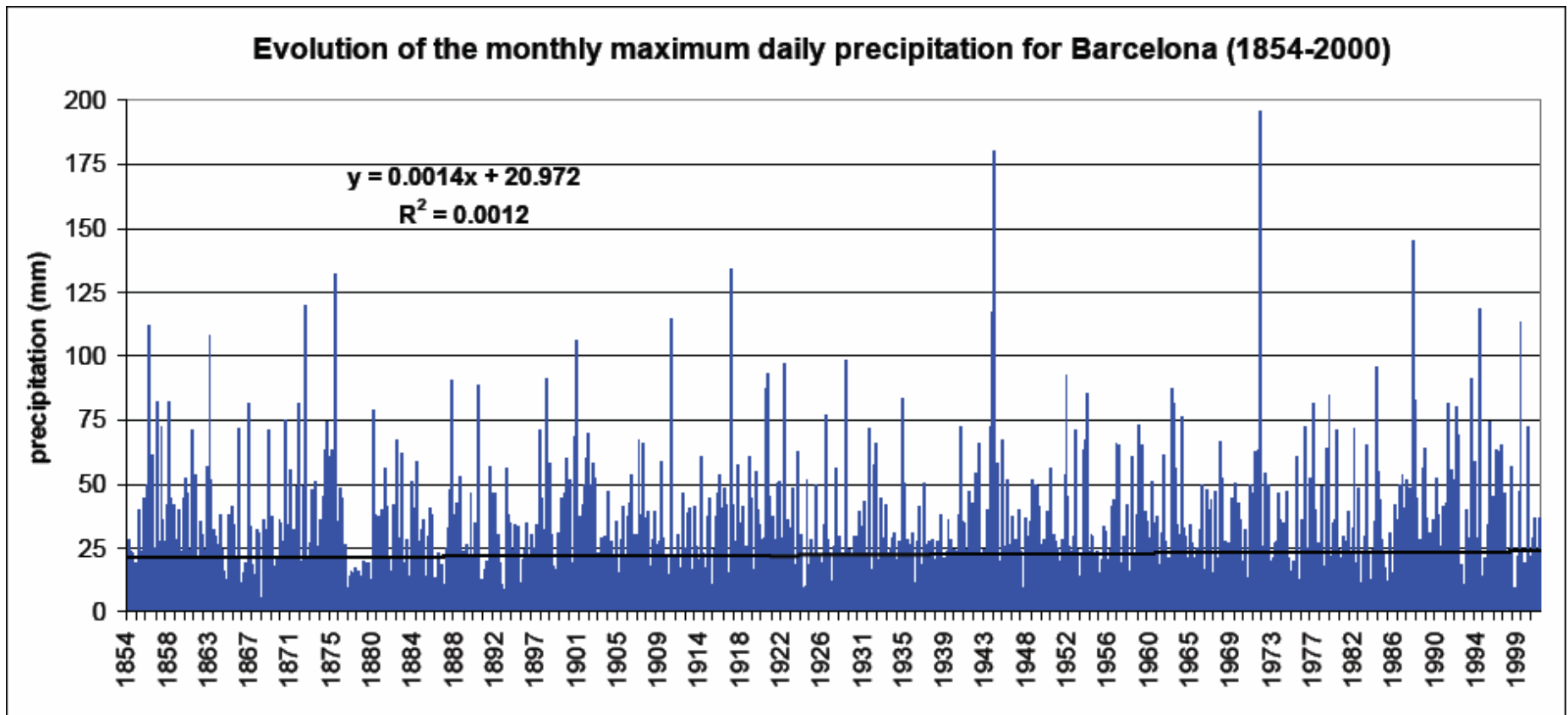
From 2756 quality-controlled stations

→ occurrence is interpolated using a binary kriging

→ the amounts are interpolated by applying ordinary kriging to the occurrence outcomes

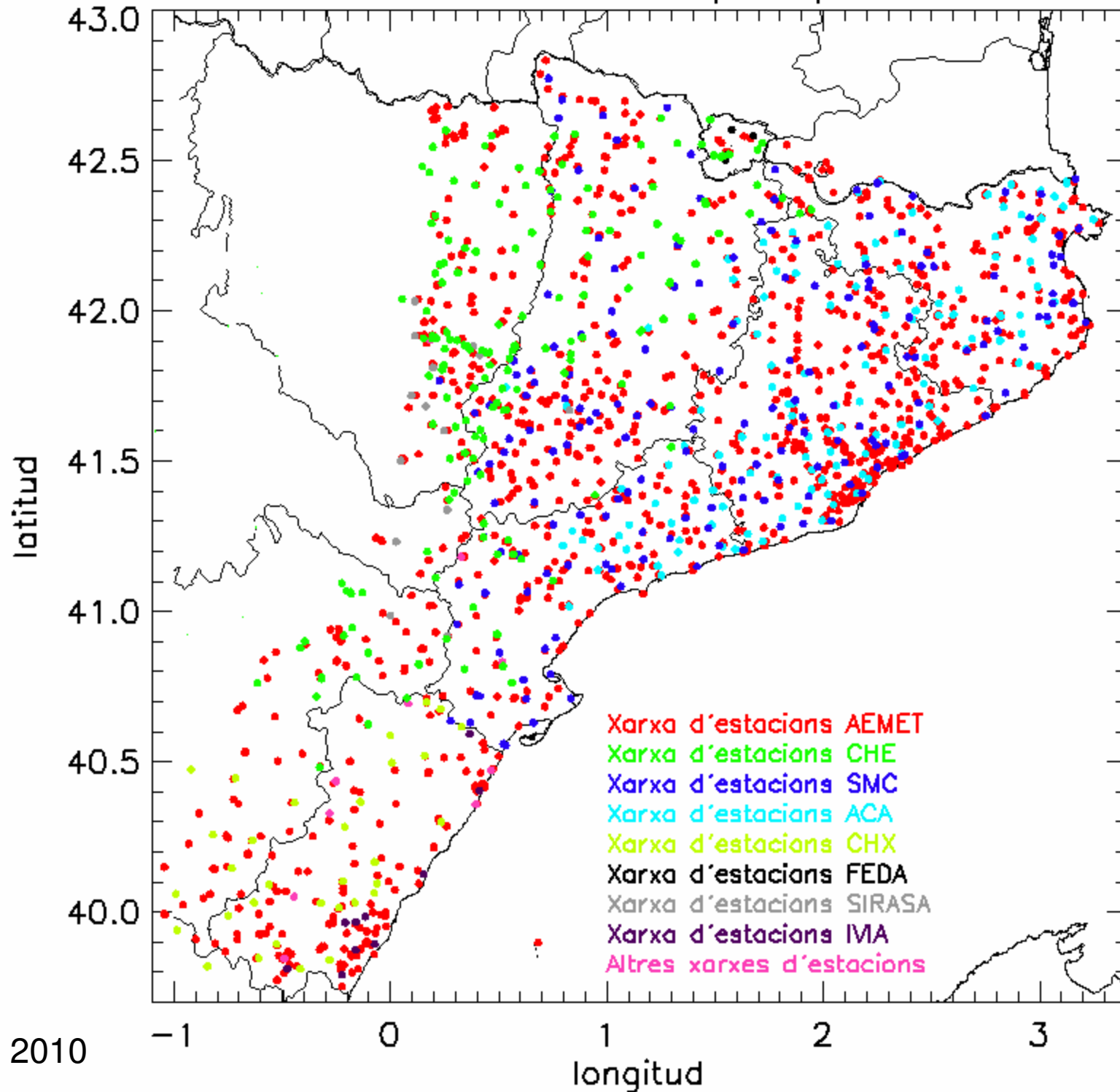






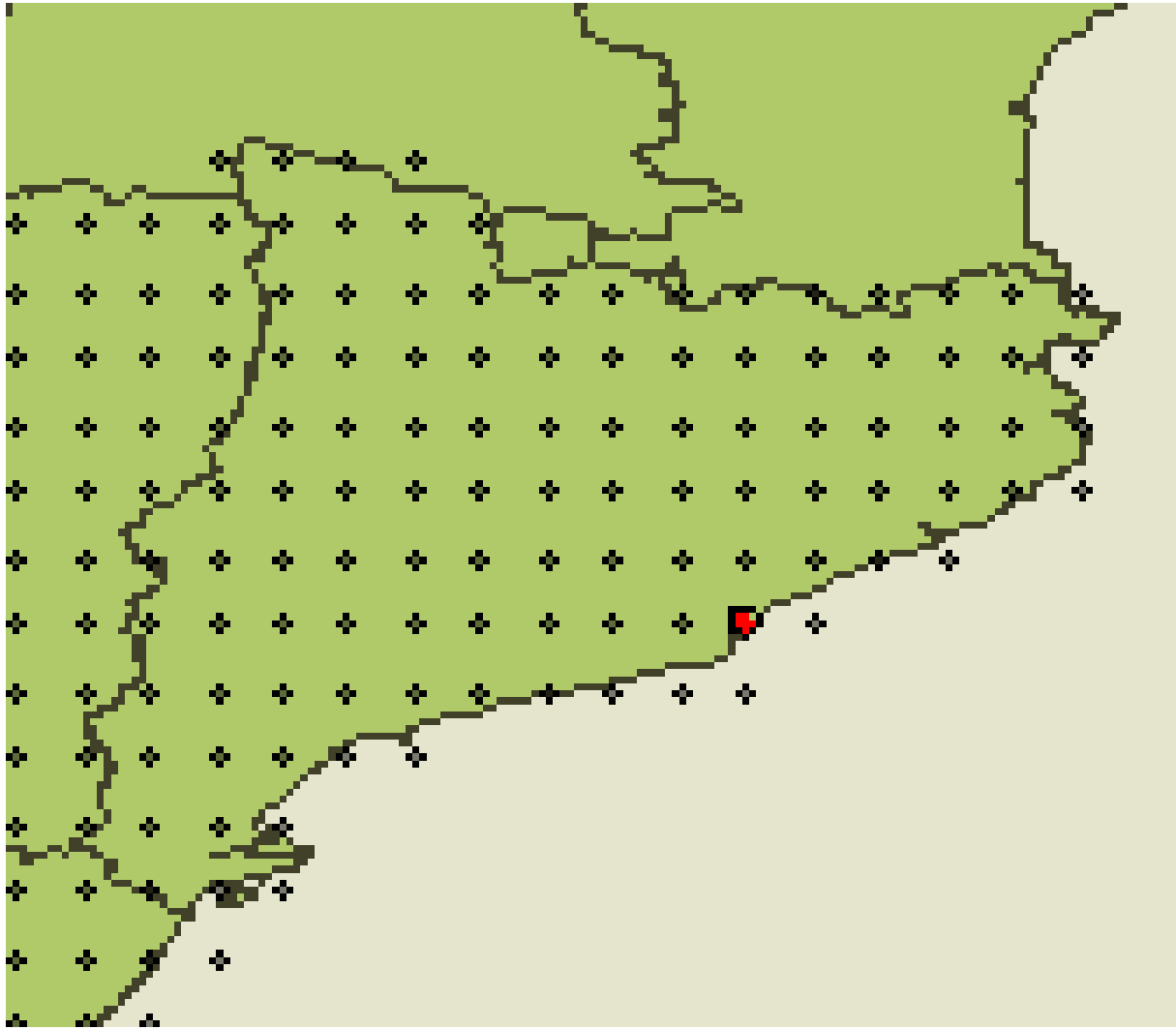
Barrera et al, 2006

Punts de mesura precipitació



- A great number of stations but...
- Heterogeneity
- Doubts about their quality

- A deep control quality process would be need



Project type: National project

Funding institution: Ministerio de Medio Ambiente y Medio Rural y Marino, Oficina Española del Cambio Climático

Program: Spanish R+D Program 2008-2011

Objective: regional (20 km) and local (stations) scenarios for temperature (maximum and minimum) and precipitation for the XXI century, at a daily scale in Spain. Statistical downscaling

Start data: September 2009

Objectives of this work:

- **Representativeness:**

to analyze the quality of this dataset in two ways:

- by comparison with a reference series
- by estimating the sampling error by means of a Monte-Carlo method

- **Application:**

to better understand the past extreme precipitation variability in the NE of Spain → preliminary step to set up a base to develop climate regional scenarios (**esTcena**)

- Validation and calibration of downscaling methods interpolated dataset produce averages of station data, that are more comparable to the grid-point average of the model than individual station. **The SPAIN02 is the reference dataset for the projects ESCENA and esTcena from the Spanish strategic action on Energy and Climate Change, funded by the Ministerio de Medio Ambiente, Rural y Marino.**

EXTREME INDEX (<http://cccma.seos.uvic.ca/ETCCDI>)

Name	Definition	User-freindly name
PRCPTOT	total precipitation in wet days (> 1mm)	Precipitation
SDII	mean precipitation amount on a wet day	Precipitation intensity
R95p /PRCPTOT	percentage of precipitation due to very wet days (>95th percentile on wet days in the base period 1961-1990).	Heavy rainfall proportion
RX5DAY	highest precipitation amount in five-day period	Greatest 5-day rainfall
CDD	maximum length of dry spell	Longest dry period

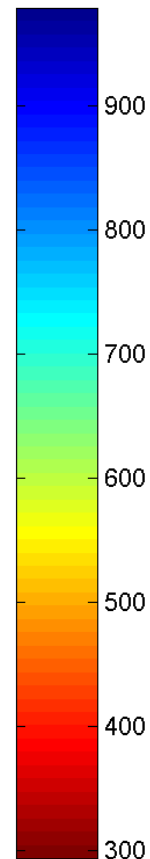
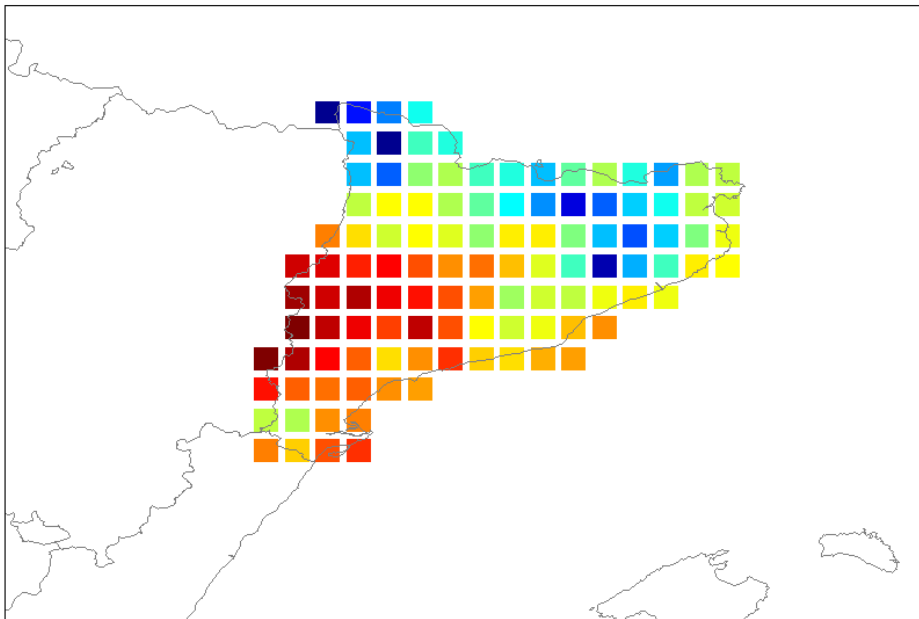
ETCCDI: Expert Team on Climate Change Detection and Indices

SPAIN02

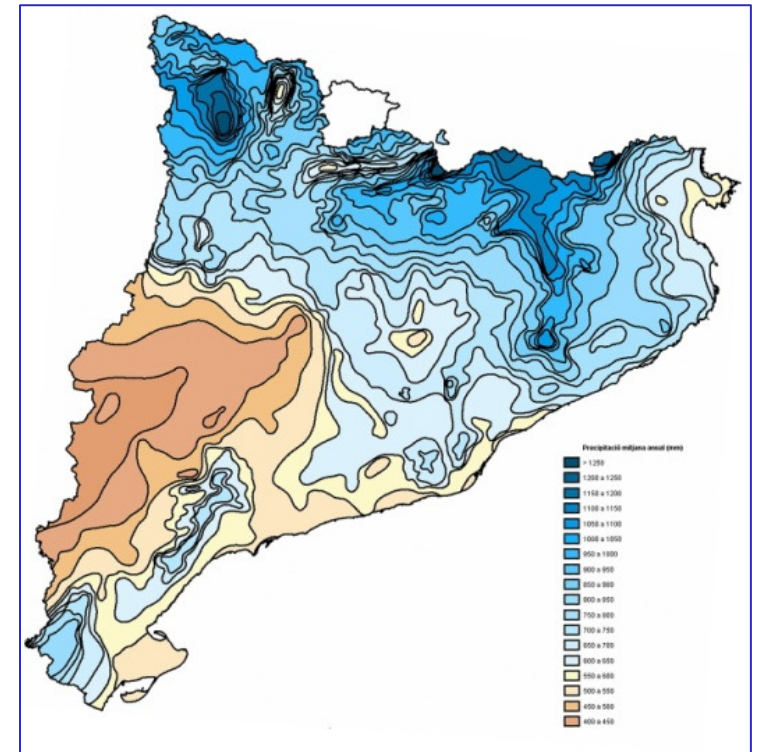
High-resolution daily gridded precipitation dataset over Spain (Herrera et al. 2010)

Annual precipitation

SPAIN02



www.meteo.cat



Period: 1/Dic/1950 – 30/Dec/2003

Representativeness: SPAIN02 vs BARCELONA series

- BARCELONA series

S1 = 1) FABRA (8% NaN)

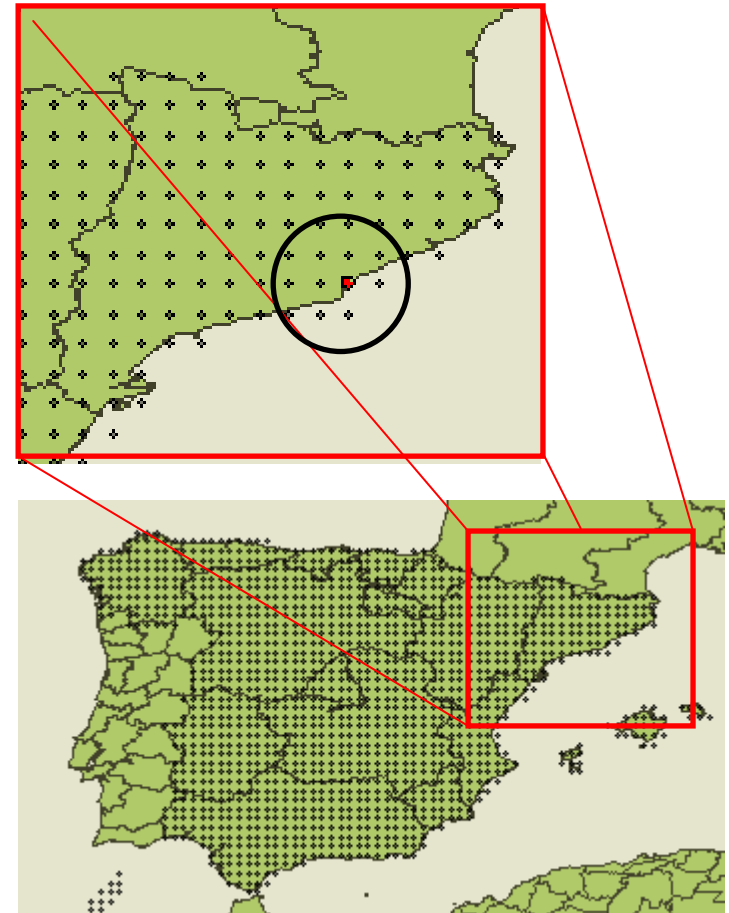
2) “FINAL” (0% NaN)

Barrera (2008)

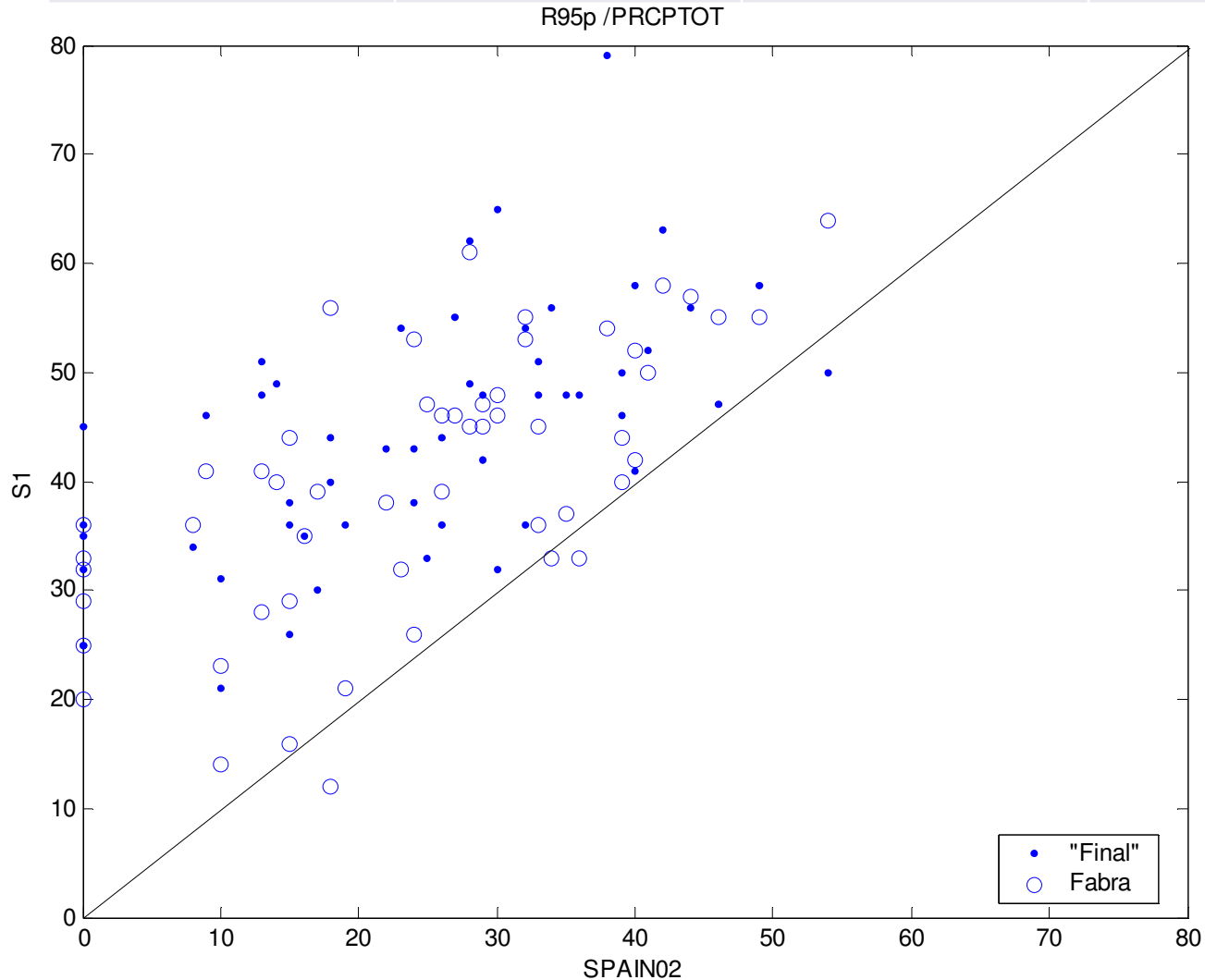
Pearson correlation

& Mean Error:

$$ME = 100 * \frac{1}{N * \text{mean}(SPAIN02)} \sum_{i=1}^N (S1(i) - SPAIN02(i))$$

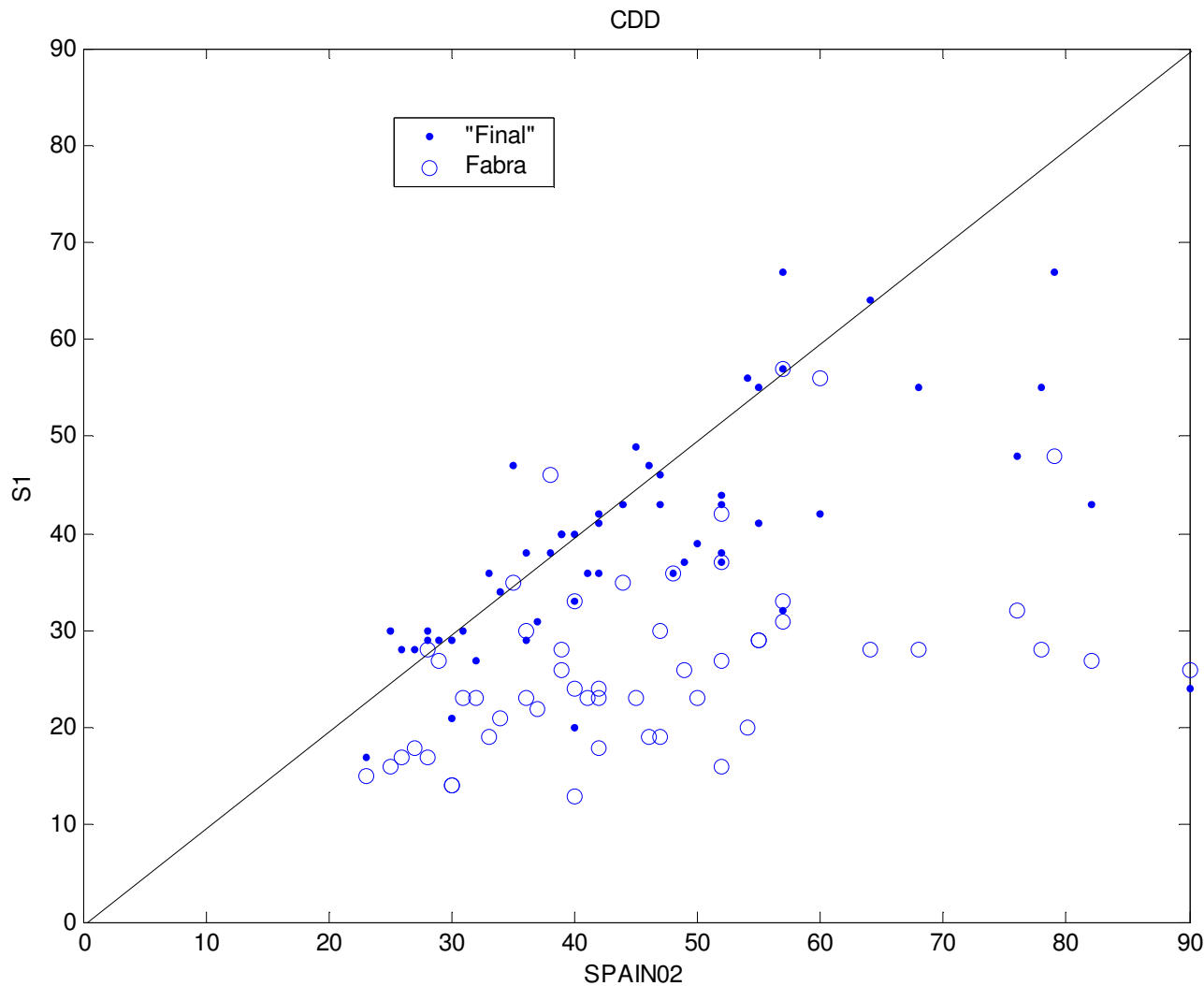


INDEX	FABRA-SPAIN02		FINAL-SPAIN02	
	CORRELATION	MEAN ERROR	CORRELATION	MEAN ERROR
R95p /PRCPTOT	0.66	65	0.62	82



- Quite good correlation
- Not surprising SPAIN02 underestimated → SPAIN02 point is an areal average and not a point value and heavy rainfall is usually convective

INDEX	FABRA-SPAIN02		FINAL-SPAIN02	
	CORRELATION	MEAN ERROR	CORRELATION	MEAN ERROR
CDD	0.44	-42	0.60	-14



This index could be the very sensible to invalid data since a missing data in the middle of a longest dry spell trims the counting of the length of the spell

→ The FABRA temporal gaps affect this comparison

Comparison between Fabra series and “Final”

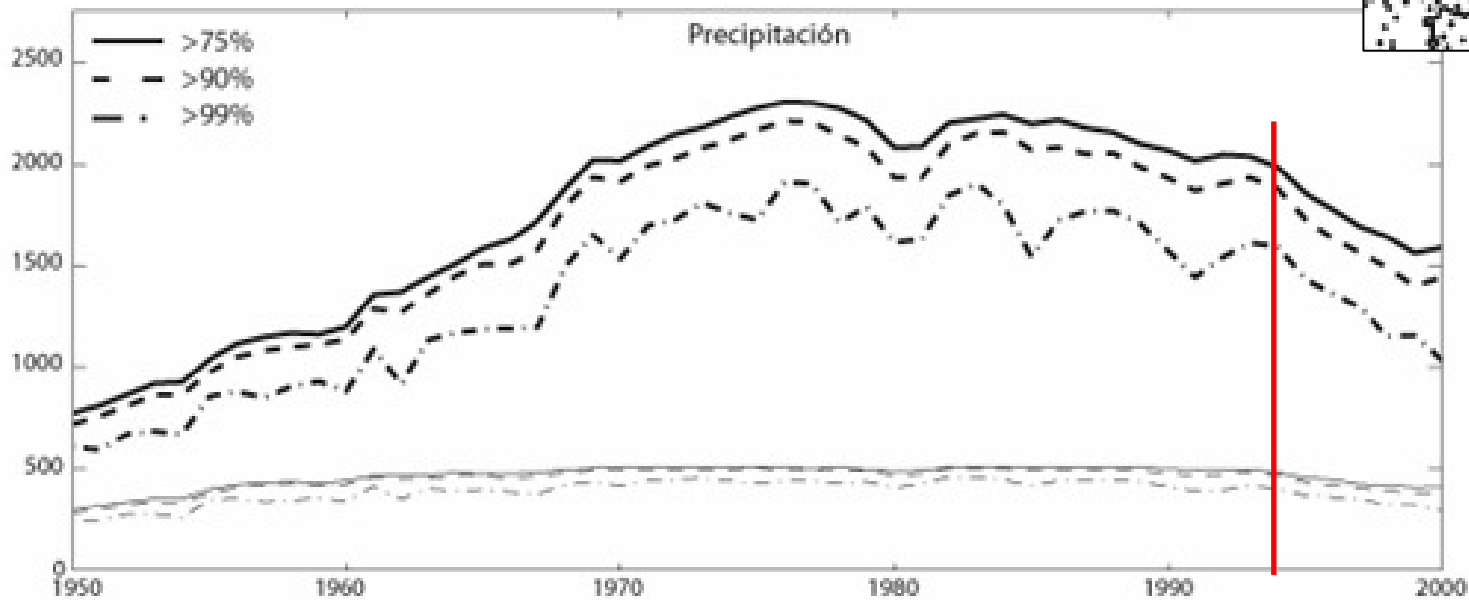
INDEX	FABRA-SPAIN02		FINAL-SPAIN02	
	CORRELATION	MEAN ERROR	CORRELATION	MEAN ERROR
PRCPTOT	0.81	25	0.78	17
R95p /PRCPTOT	0.66	65	0.62	82
RX5DAY	0.78	14	0.71	14
SDII	0.71	6	0.48	11
CDD	0.44	-42	0.60	-14

In general there is **good correspondence** with the series and, not surprising, the SPAIN02 point for Barcelona present an underestimation (i.e. Mean Error greater than 0) for almost all the indexes.

Two of them present larger error →

SIGNIFICANCE LEVEL: 99%

Sampling error



❖ **Problem:** Hofstra et al. (2009), analyzed the **over-smoothing** effect due to variability of the density of the station network and sparseness of the network.

The gridded datasets have biases that need to be considered in all the different studies for which interpolated data is important

Method of analysis: 5 steps

1/5. TREND SIGNIFICANCE (significance and field significance)

The extreme precipitation indices generally have **non-Gaussian distributions** and could be **not independent** (WMO, 2009)

→ the standard methods to estimate the significance of the trends could be unreliable (Alexander et al., 2006)

How do we take into account these problems?

(Circular) Block Bootstrap (Kiktev et al. 2003)

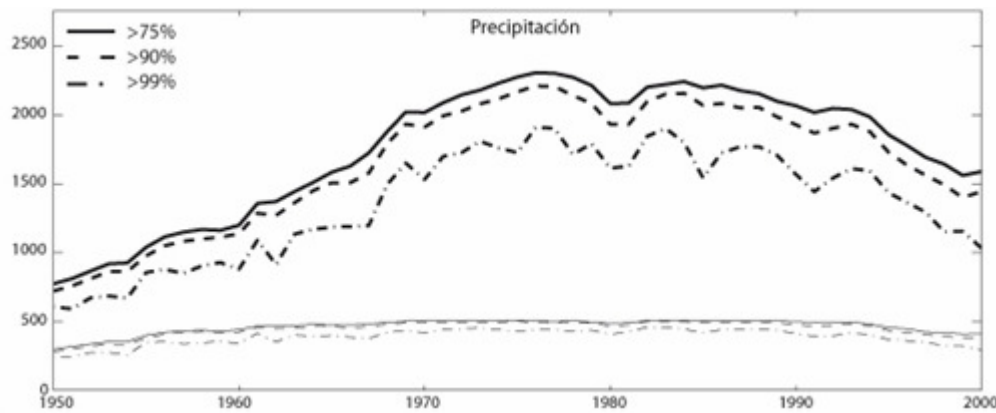
No hypothesis of Gaussian distribution

To deal with temporal correlation → circular block bootstrap of residual patterns in blocks of several consecutive years

To preserve spatial coherence of trends → resampled patterns of station trend residuals rather than individual station series

2/5. Different trend periods

To analyze the influence of the length series as well as the departure point



TREND PERIOD = 53 YEARS

TREND PERIOD = 52 YEARS

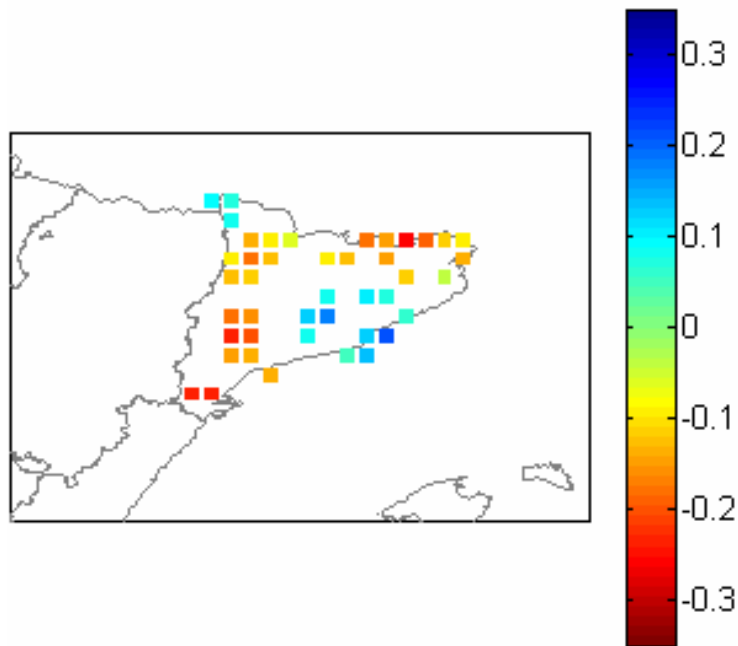
TREND PERIOD =YEARS

TREND PERIOD = 30 YEARS

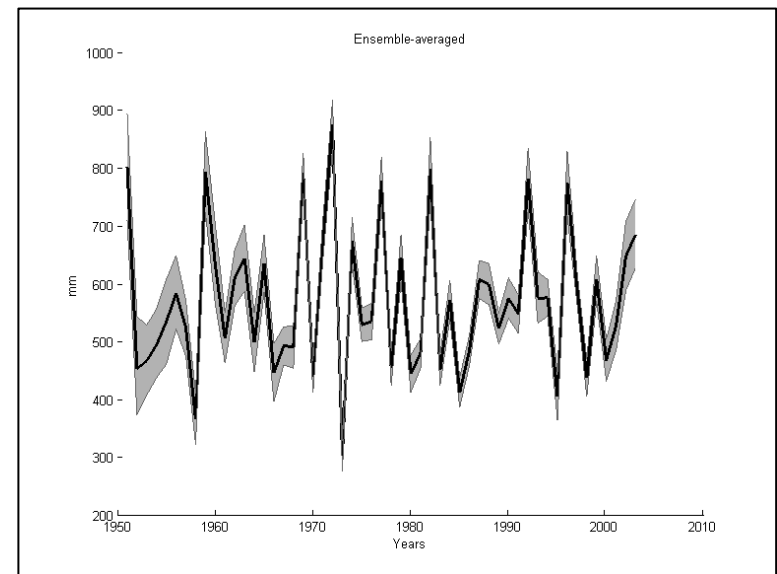
3/5. Annual and seasonal values of the indices

4/5. Application to 5 extremes indices

5/5.

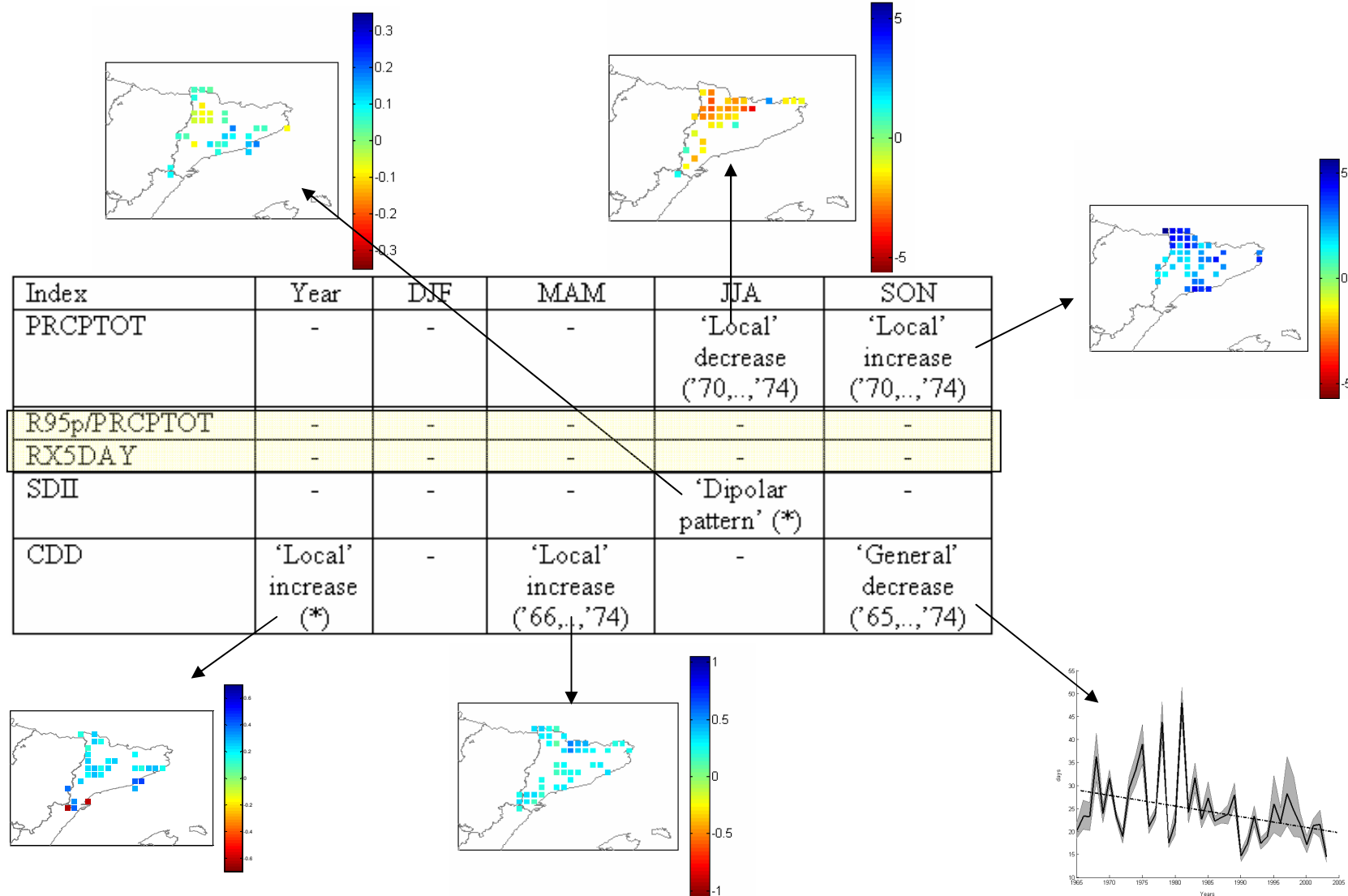


All the individual points in Catalonia



spatial average of the points in Catalonia

RESULTS



- 'General': significant trend of the regional averaged series
- 'Local': local trend pattern of significant points
- 'Dipolar pattern': 'Local' increase together with a 'Local' decrease
- (*): all the time windows
- e.g. ('70,...,'74): the series that start in the years 1971, '72, '73, '74 and end at 2003



Thank you for your attention

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