

# **The development of the Spanish Daily Adjusted Temperature series (SDATS): A case-study discussing from data rescue procedures to daily adjustments application**

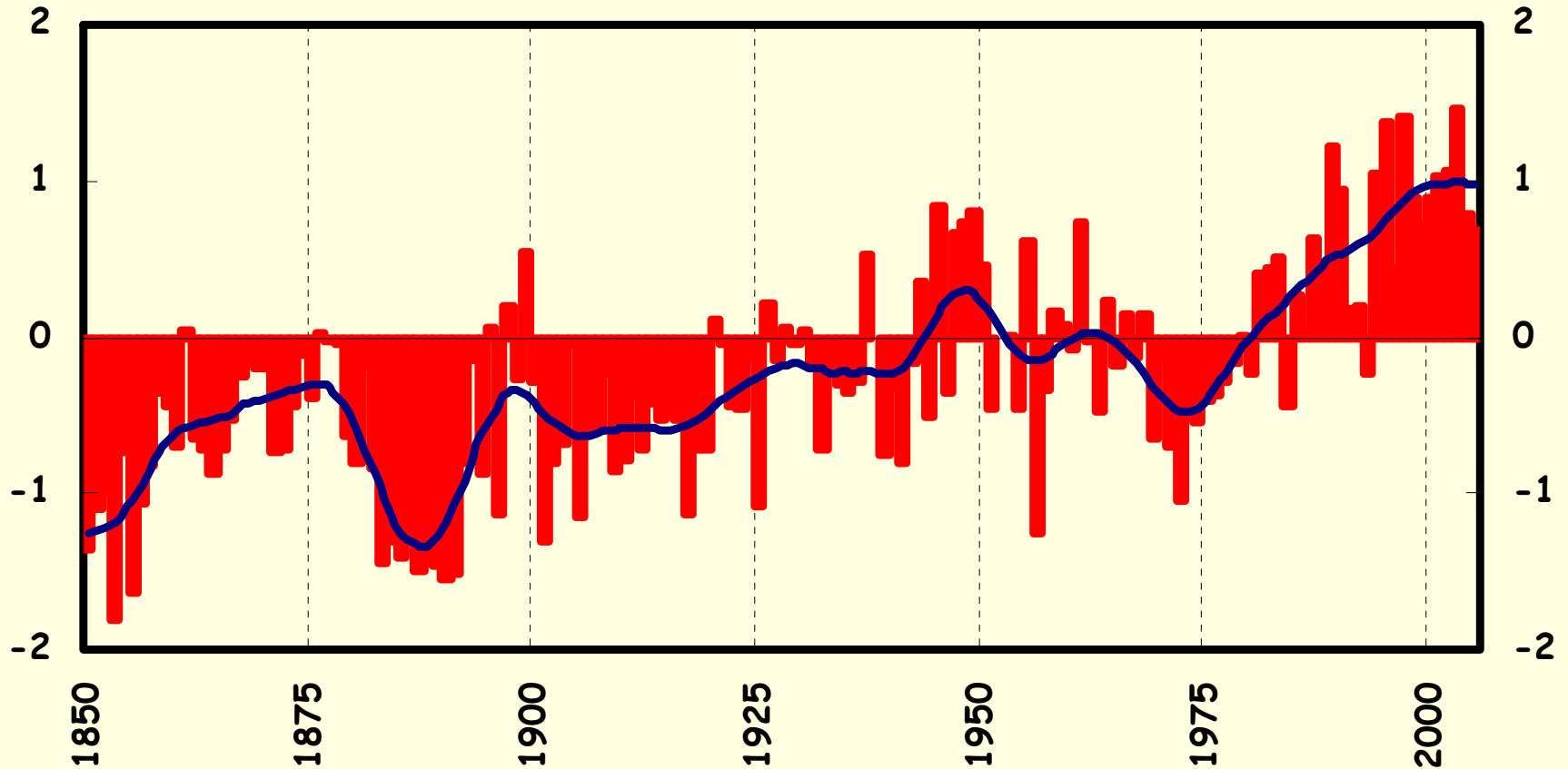
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# A simple plot showing long-term Spanish temperature change



Brunet M., et al. 2007. Temporal and spatial temperature variability and change over Spain during 1850-2005. *J Geo Res - Atmospheres*, 112, D12117, doi:10.1029/2006JD008249.

# Used to document Spanish temperature change by :



Informe para el Presidente del Go




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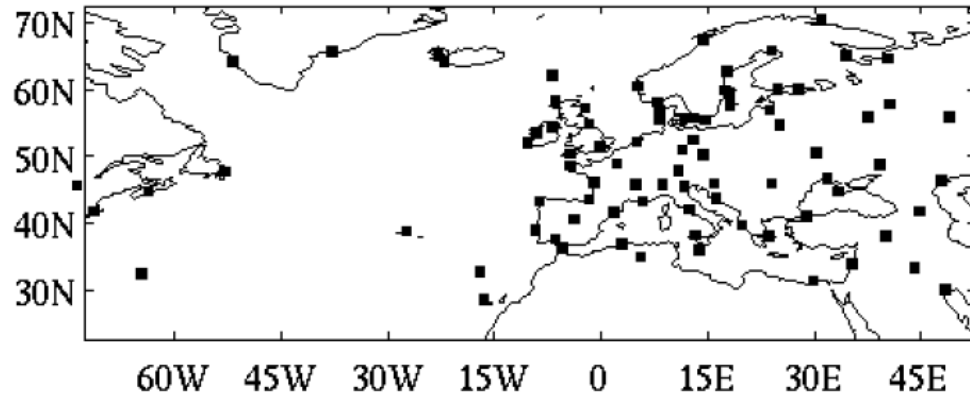
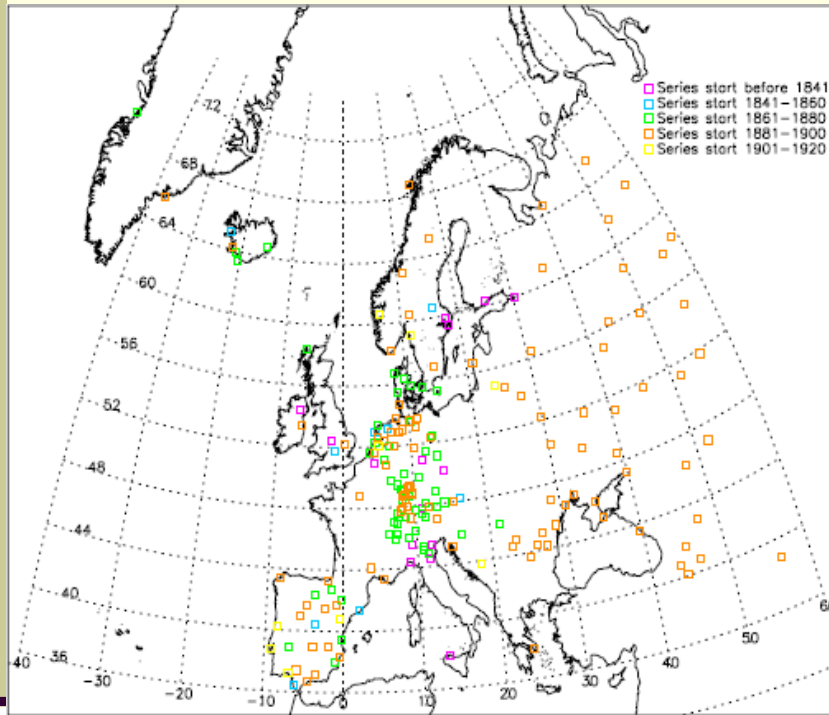
A Case-Study/Guidance on the  
Development of Long-term Daily Adjusted  
Temperature Datasets

y futuro  
mático Regional

IVAR  
PAÑA



# And developed under EU-funded project: EMULATE



- Carried out under the EU-funded project European and North Atlantic daily to MULTidecadal climATE variability (EMULATE), which enabled to develop the EMULATE pressure, temp & prec datasets over 1850-2003, highly contributing to enhance atmospheric influences on climate variability
- Could the recently EU-funded EURO4M: European Reanalysis and Observations for Monitoring an opportunity for MEDARE?

# **But lots of activities involved before arriving to produce that plot**

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- **From climate data location & recovery & digitisation & quality control to data homogenisation**
- **A set of integrated DATA RESCUE & DEVELOPMENT (DARE & D) procedures and methodologies have been followed and applied to develop long and high-quality climate datasets**



# Data archaeology, records' composition & QC

- Identifying/converting ancient units to SI units

- Composing records: stations' relocations within same location, nearby & highly related stations...

- Passing QCs (gross error checks, tolerance tests, internal consistency, temporal & spatial coherency) separately to data from each composition/source

NAME	INM CODE	PERIOD	NAME	INM CODE	PERIOD
ALBACETE	8178	1893-1936	MURCIA	7182C	1863-1950
AL/LOS LLANOS	8175	1939-2005	MURCIA	7182A	1951-1967
ALICANTE	8025E	1894-1920	MURCIA	7182	1968-1984
ALICANTE	8025G	1921-1938	MU/GUADALUPE	7181I	1985-2005
ALICANTE	8025	1939-2005	PAMPLONA	9262	1880-1974
BADAJOS	4478	1864-1954	PA/NOAIN	9263D	1975-2005
BATALAVERA	4452	1955-2005	SALAMANCA	2870D	1893-1944
BARCELONA	0201E	1885-1925	SA/MATACAN	2867	1945-2005
BAR/FABRA OB.	0200E	1923-2005	SAN SEBASTIAN	1024D	1893-1900
BURGOS	2327	1870-1943	SS/IGUELDO	1024E	1916-2005
BU/VILLAFRIA	2331	1944-2005	SEVILLA	5787D	1893-1932
CADIZ	5972	1850-2005	SEVILLA	5790	1933-1950
CIUDAD REAL	4121C	1893-1970	SE/SAN PABLO	5783	1951-2005
CIUDAD REAL	4121	1971-2005	SORIA	2030	1893-2005
GRANADA	5515A	1893-1937	VALENCIA	8416A	1863-1932
GR/ARMILLA	5514	1938-2005	VALENCIA	8416	1935-2005
HUELVA	4605	1903-1984	VALLADOLID	2422C	1893-1923
HUELVA	4642E	1984-2005	VALLADOLID	2422F	1924-1940
HUESCA	9901F	1861-1943	VALLADOLID	2422C	1942-1969
HU/MONFLORITE	9898	1944-2005	VALLADOLID	2422G	1970-1973
LA CORUÑA	1387	1882-2005	VALLADOLID AIR	2422	1974-2005
MADRID	3195	1853-2005	ZARAGOZA	9443D	1887-1950
MALAGA	6171	1893-1942	ZARAGOZA AIR	9434	1951-2005
MA/ROMPEDIZO	6155A	1943-2005			

Total amount of tested values	1981192	
Flagged values	11505	0.58%
Recovered values	8090	0.41%
Not recoverable values	3415	0.17%

	Gross error checks	Tolerance tests	Internal consistency test	Temporal coherency test	Spatial coherency tests
Total of flagged values	4941 (0.25)	5995 (0.3)	161 (0.008)	192 (0.01)	216 (0.01)

# Addressing data homogenisation

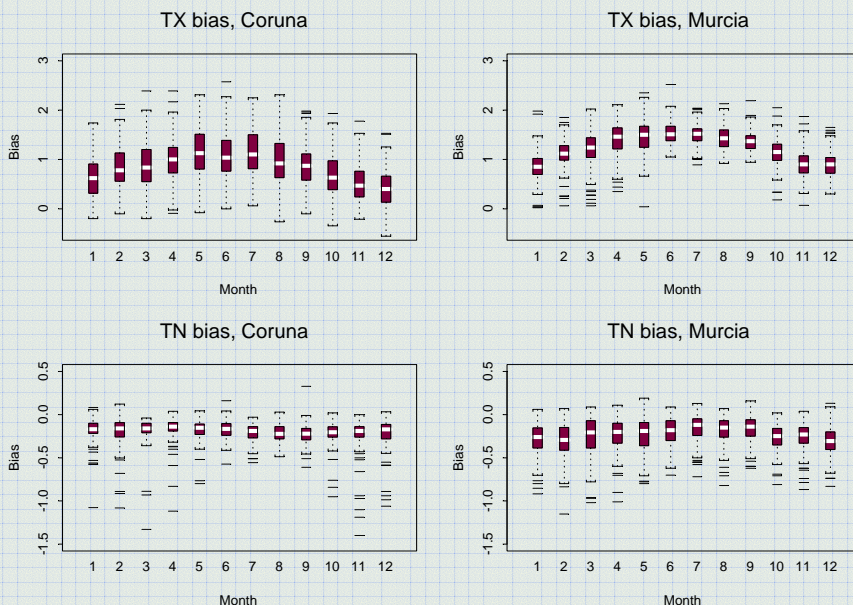
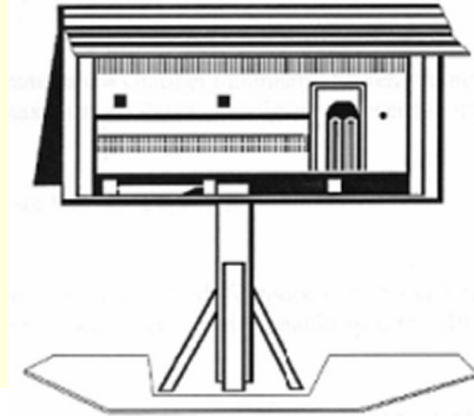
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- Long, but also short, climate timeseries affected by non-climatic factors, such as: changes in station locations, local environments, instrumental exposures & instrumentation, observing practices or data processing and inducing gradual or abrupt breaks in homogeneity that have to be adjusted
- So, need to homogenise records before using them. Better counting with good metadata to guide the Ihs detection, but also possible without
- Both gradual or abrupt changes can be adjusted by relative homogenisation methods easily if they happened at different times at each station of a network, but difficult if occurring at the same time for the entire network, such as changes in the screen to protect thermometers or the “screen bias”
- First homogenisation stage for developing the SDATS: to minimise “screen bias”



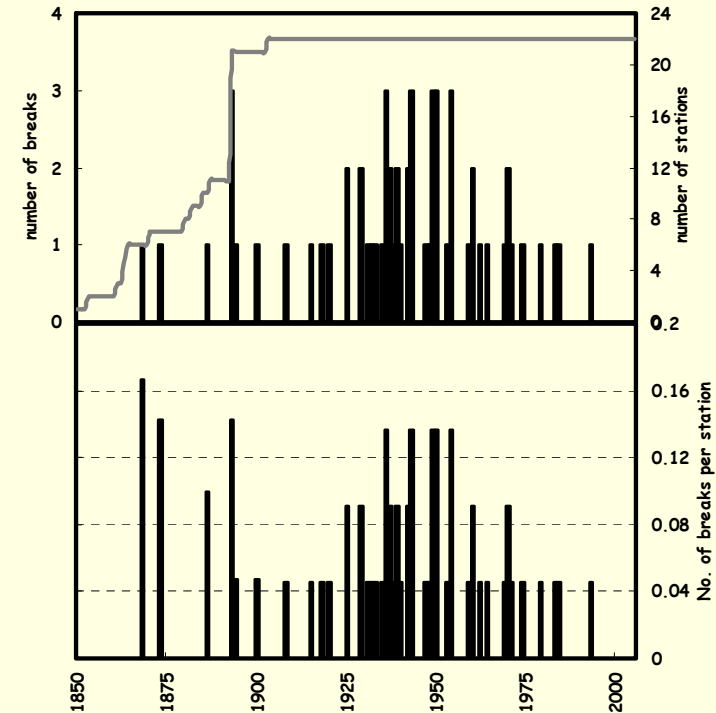
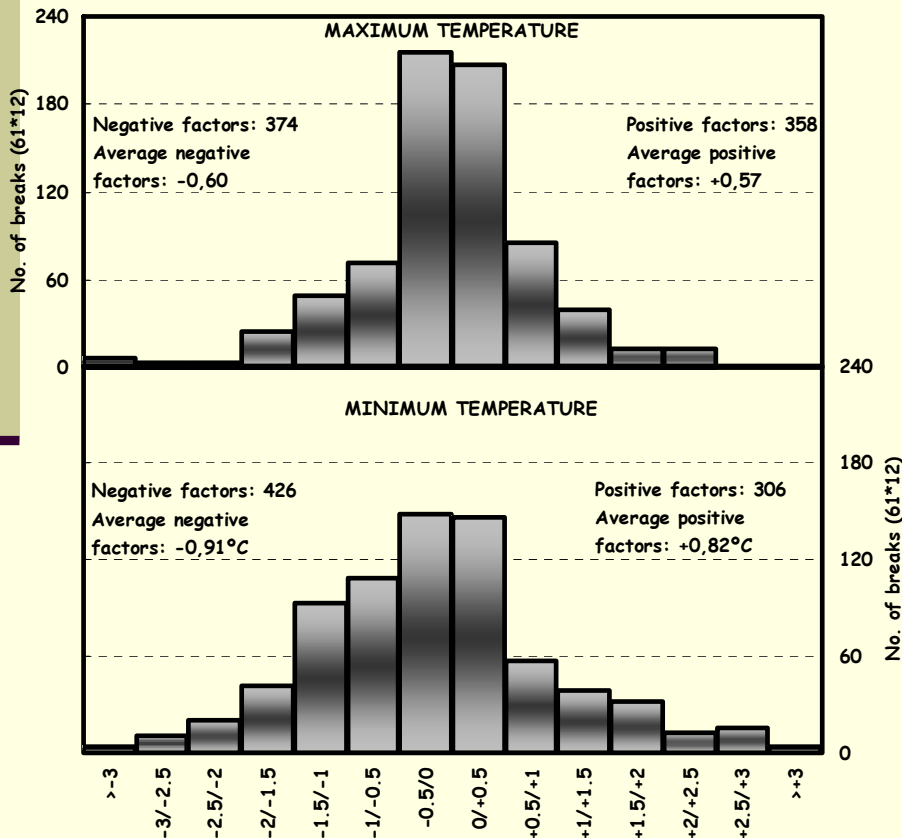
# The *screen bias*: an untreatable common inhomogeneity in long temp series

- Open stands overestimate Tx, slightly underestimate Tn readings wrt Stevenson screens
- Dual temp observation at Murcia & La Coruña met gardens
- Estimating factors for adjusting affected raw data



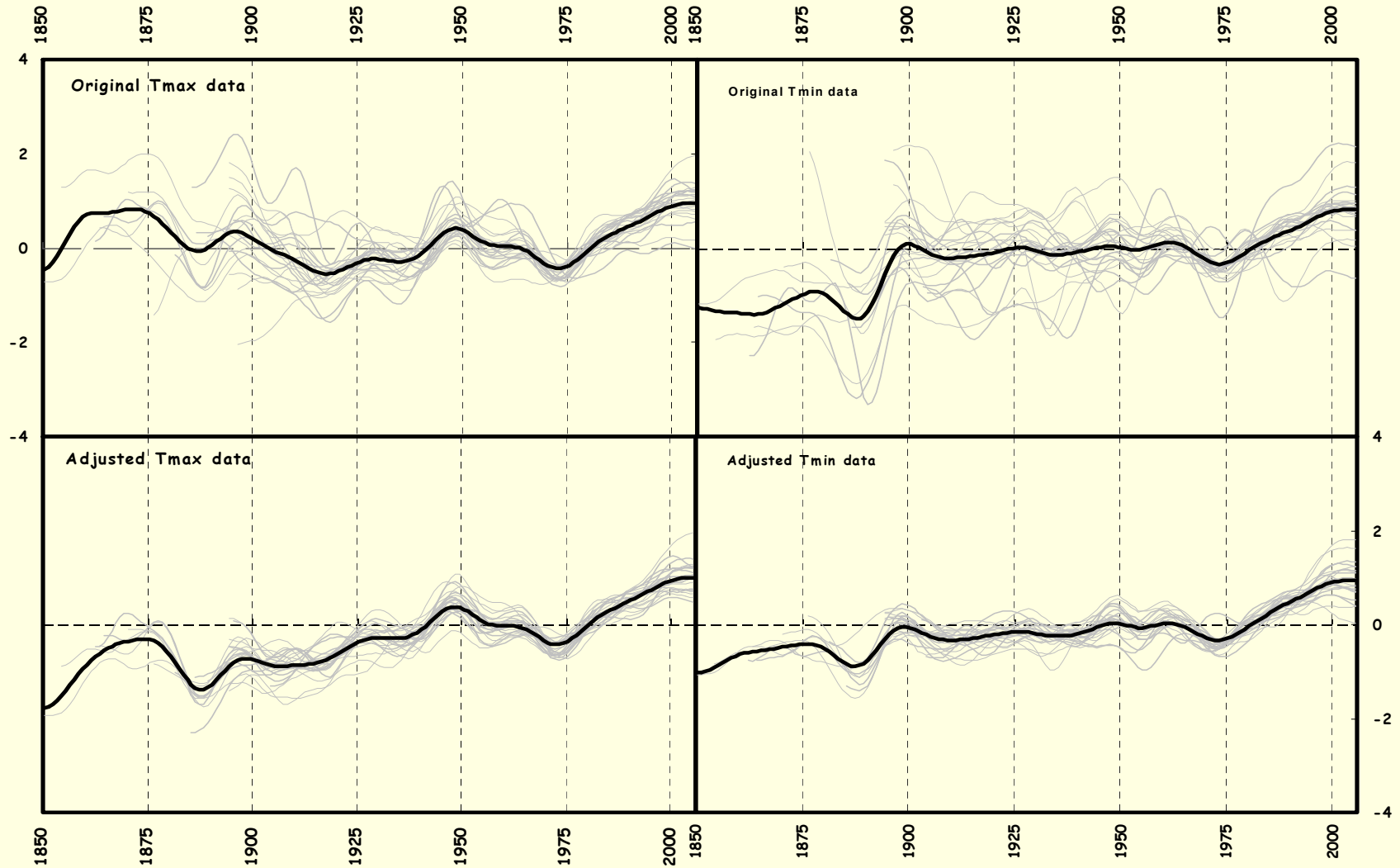
# A relative approach to detect/correct inhomogeneities

- Selecting candidate & reference sets of records ( $r \sim 0.8$ )
- Detecting breakpoints applying SNHT on annual/seasonal basis

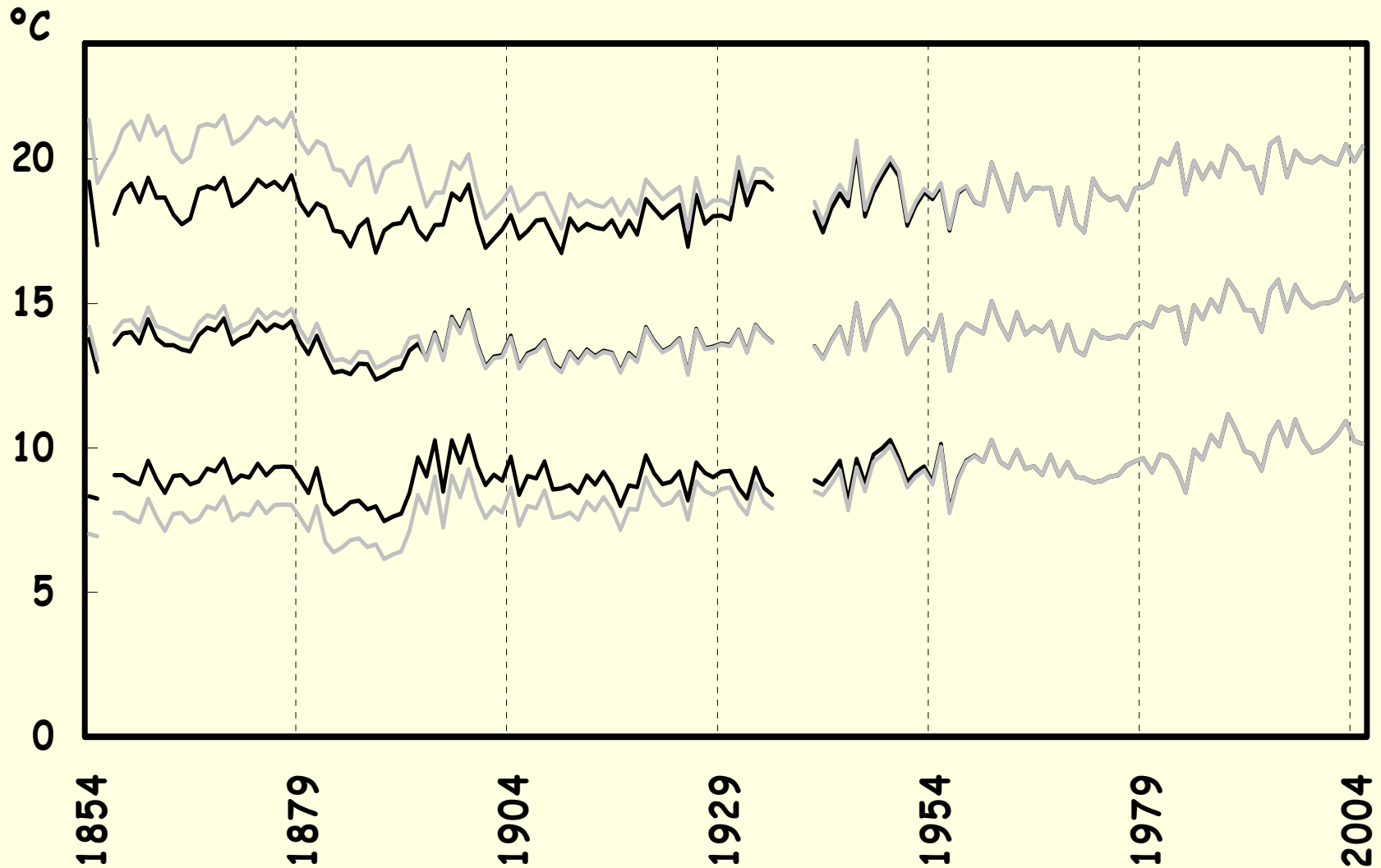


Applying correction pattern to monthly data & interpolating monthly factors into the daily scale

# Getting adjusted daily temperature data: the SDATS



# Assessing impact of adjustments in Madrid series



# Summing up

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- **The development of high-quality climate data requires undertaking integrated activities involving:**
- **Locating and rescuing/preserving data**
- **Transference into digital format**
- **Applying quality controls**
- **And testing homogeneity and homogenising records**
- **Dataset ready to be confidently used in any climate application, service or study, and of paramount importance when detecting, predicting and responding to climate change**

Comments & questions?

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