WMO
MEDARE
initiative

Third WMO/MEDARE International Workshop

Need for integrating in a Mediterranean database long-term and high quality climate series in the context of detecting, predicting and responding to climate variability and change

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INTRODUCTION

- National Meteorological Services have systematically monitored the atmosphere since the mid-1900s.
- But, currently there is a limited availability of long and high-quality surface instrumental climate records

- This situation impedes our capacity to carry out more robust assessments of the climate as stated in the 4th IPCC assessment report.

Long-period and high-quality climatic instrumental time series are essential for the production of reliable assessments of the global climate system with a view to better understand, detect, predict and respond to global climate variability and change.

INTRODUCTION

- There are some locations, mainly in Europe and US, that have very long climate series
- For a lot of countries and regions, the availability of digital climate data is often restricted to 2nd half of the 20th century over many parts of the world,
- It is worse in the case of daily series needed for extreme data analysis.
- Another problem: some of the available data don't have the quality and the homogeneity needed for a successfully climate analysis and applications.
- Climate data suffers of errors introduced in the process of colleting, digitising, transferring, storing and transmiting the data

INTRODUCTION

- A quality control of the raw data has to be made as recommended by WMO
- The climate series have also to be subjected to homogeneity test to demonstrate that its variability is only due to weather and climate factors and it is not due to changes in instrumentation, observational methods, relocation of observatories or changes in in the surroundings
- If homogeneity problems arise in the climate time series, it is necessary to adjust them.
- Then the adjusted and error free climate series can be used in all kind of climate analyses and assessment.

INTRODUCTION

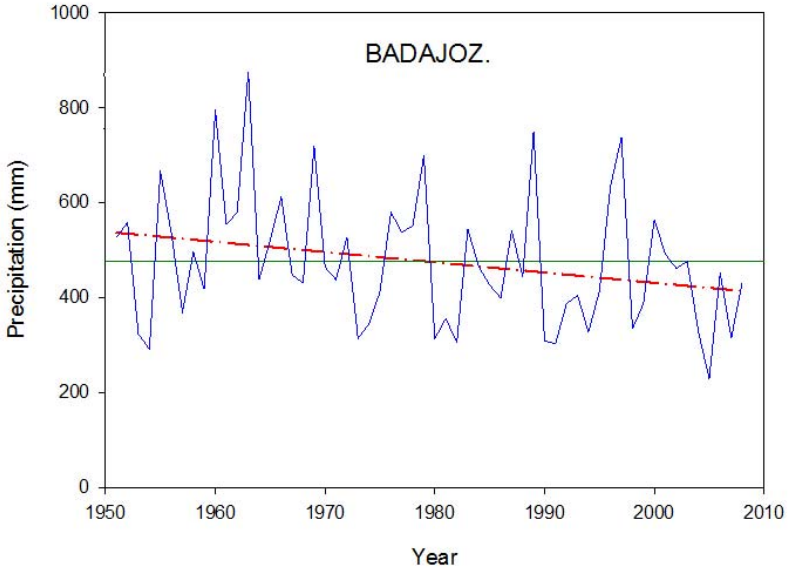
Long-period and high-quality climatic instrumental time series have not only scientific value but also political, social and economic advantages.

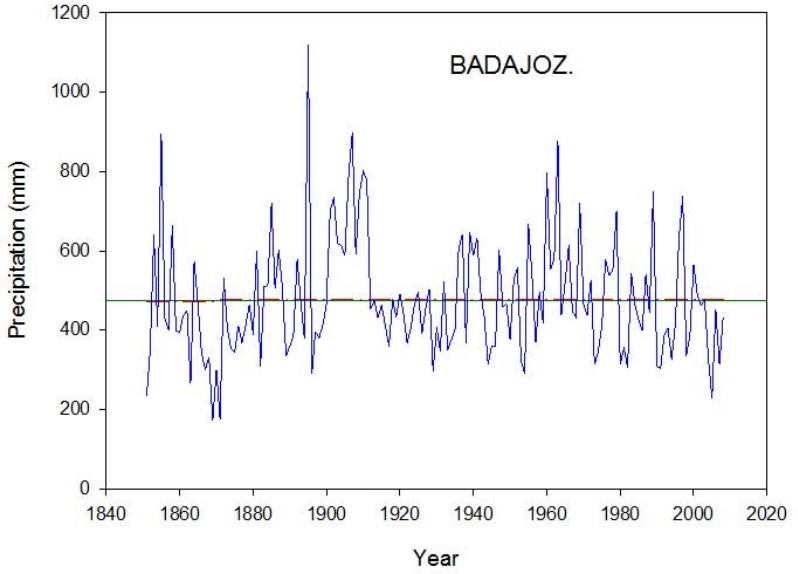
1. Enhance our knowledge about instrumentally measured climate variability and change, and the possible factors causing these changes across a region.
2. Place extreme events in a longer-term context allowing, for example, for more accurate assessments of their return periods.
3. Contribute to the advancement of climate change detection and attribution studies
4. Develop climate change scenarios by combining observational climate measurements with projections from Regional Climate Model (RCM) simulations.
5. Provide input to extended historical reanalysis prior to 1948
6. Calibrate natural/documentary proxies to extend the known climatic history of a country/region

1. Analysis of observed climate variability and change

- The instrumental climate variability (about the past 200 years) has to be understanding very well in order to assess not only the past but also the future climate
- We need to know if climatic models reproduce in a confident manner the observed climate $\Rightarrow$ it will be possible predict the future more precisely.
- Improved climate data availability will get better understanding, detection and prediction of global climate variability and change
- A more robust climate assessments can be possible

1. Analysis of observed climate variability and change

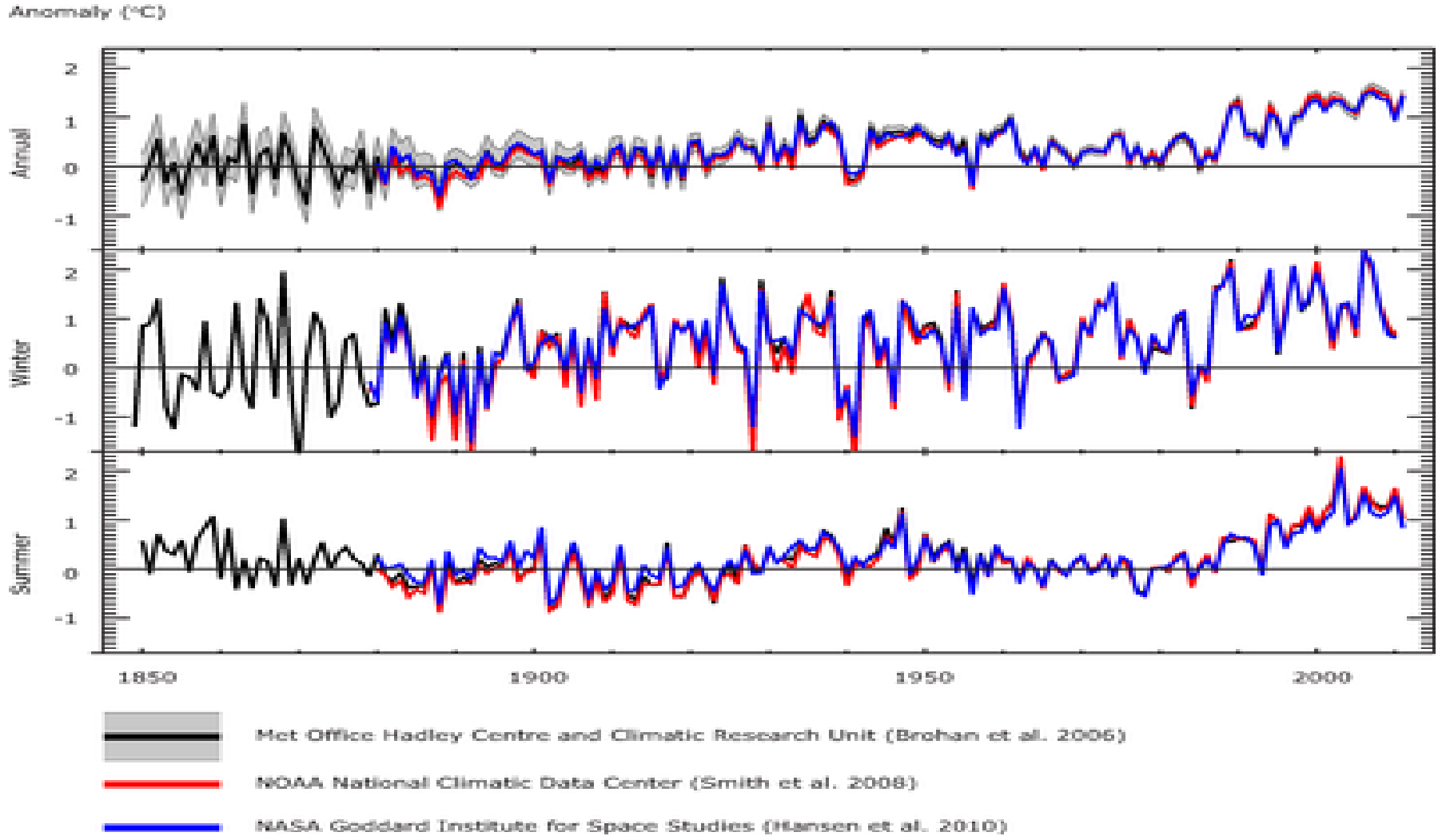




Longer climate records make possible more extensive trend assessment

Example: Badajoz observatory in SW Spain shows a clear negative trend in precipitation for 1950-2010 record but there is not significant trend when 1850-2010 period is considered.

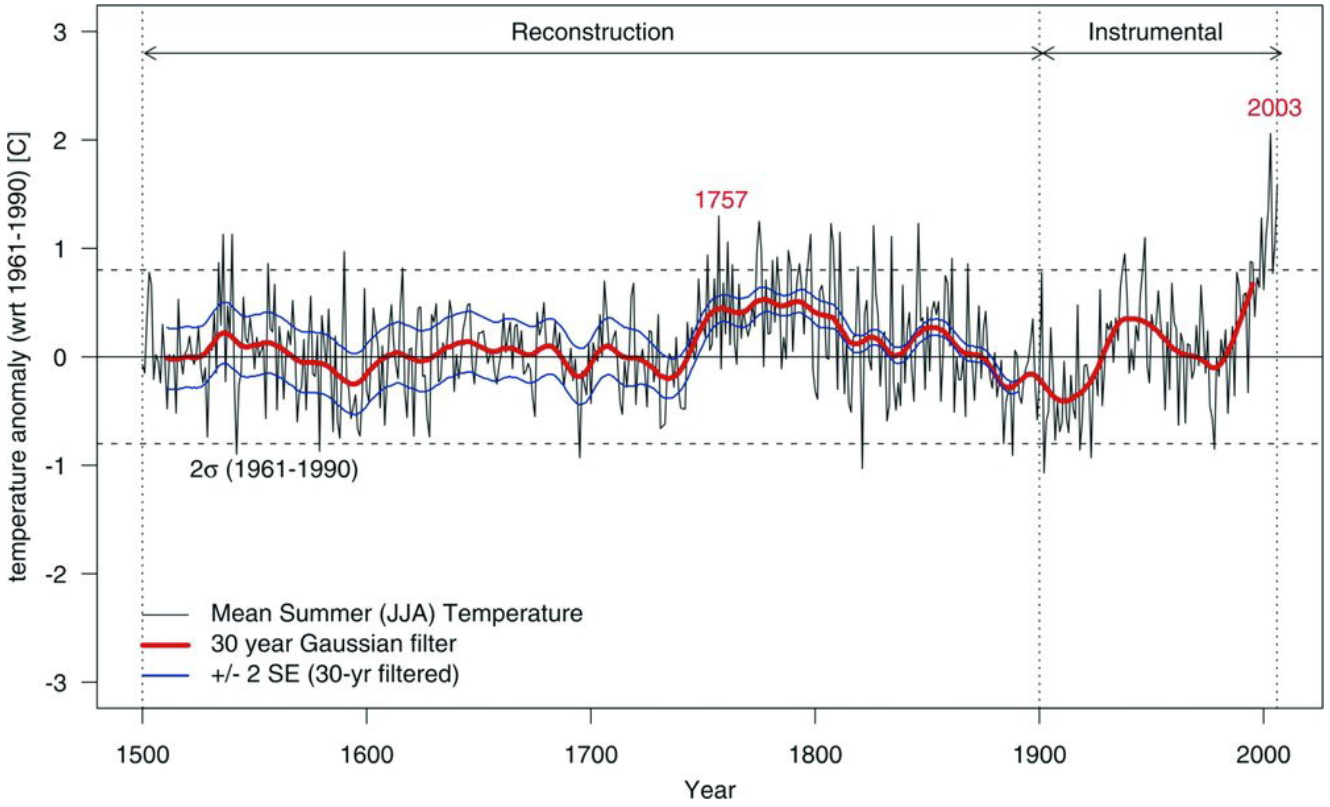
1. Analysis of observed climate variability and change



Mean global temperature anomalies 1850-2012 (reference 1961-1990) from WMO

2. Assessment of the extreme event return periods

Exceptional heat wave of summer 2003 in Europe can be put in the context of the longest climatic records, instrumental and proxy

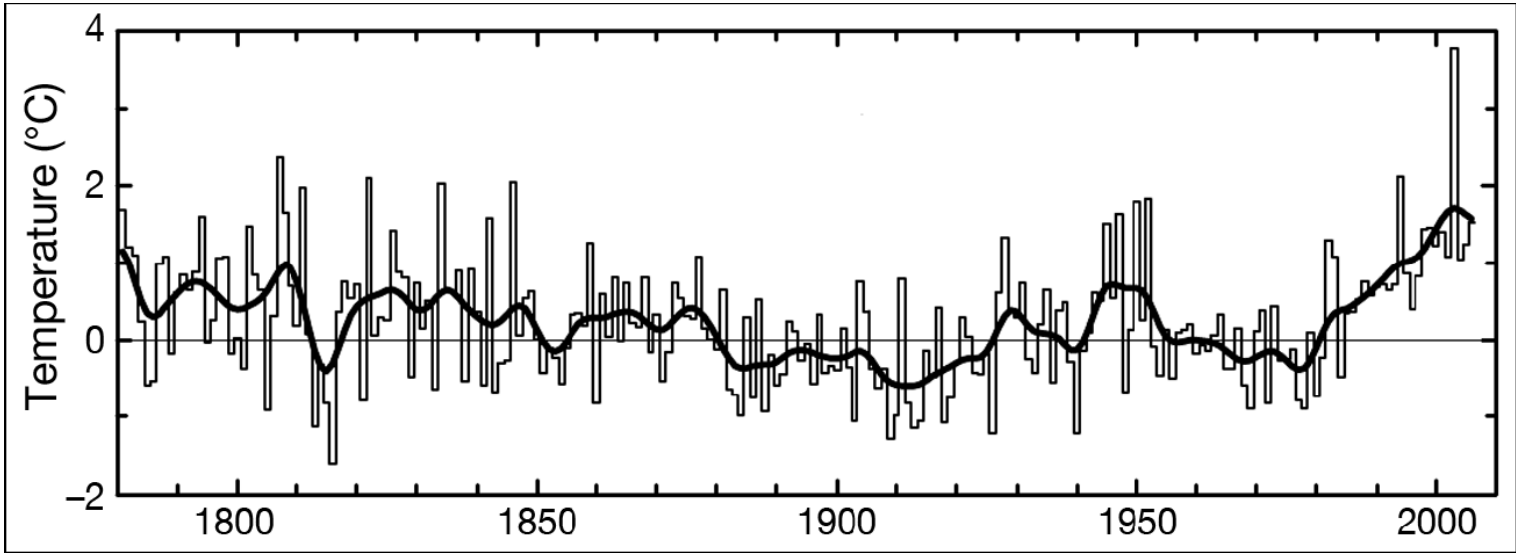


Summer (JJA) average mean European temperature anomaly (relative to the 1961 to 1990 reference period) time series from 1500 to 2006 from Garcia-Herrera et al (2010) Critical Reviews in Environmental Science and Technology, Vol 40.

2. Assessment of the extreme event return periods

Having a Long-period and high-quality climatic instrumental time series make possible the study of extremes.

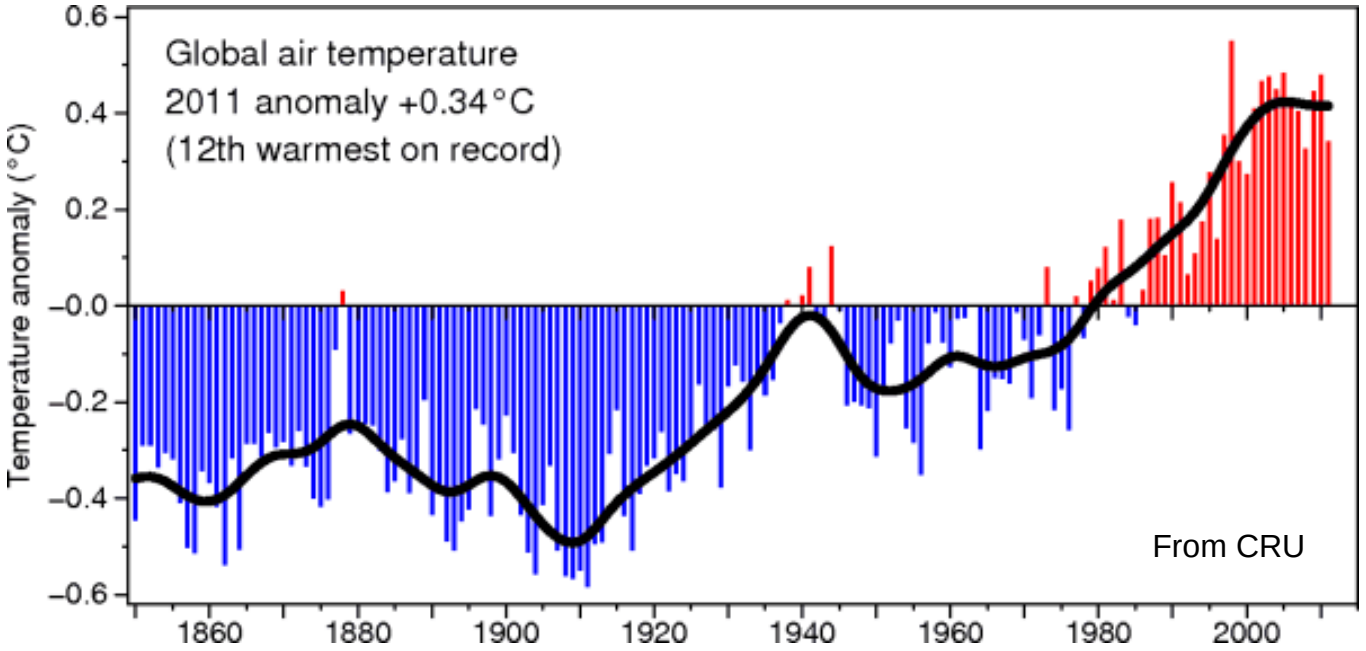
It is possible to explore whether the recent anomalous values are or not exceptional



Summer (JJA) average temperature anomaly for Central Europe (relative to the 1961 to 1990 reference period) from Brunet and Jones (2011) Climate Research.

3. Climate change detection and attribution studies

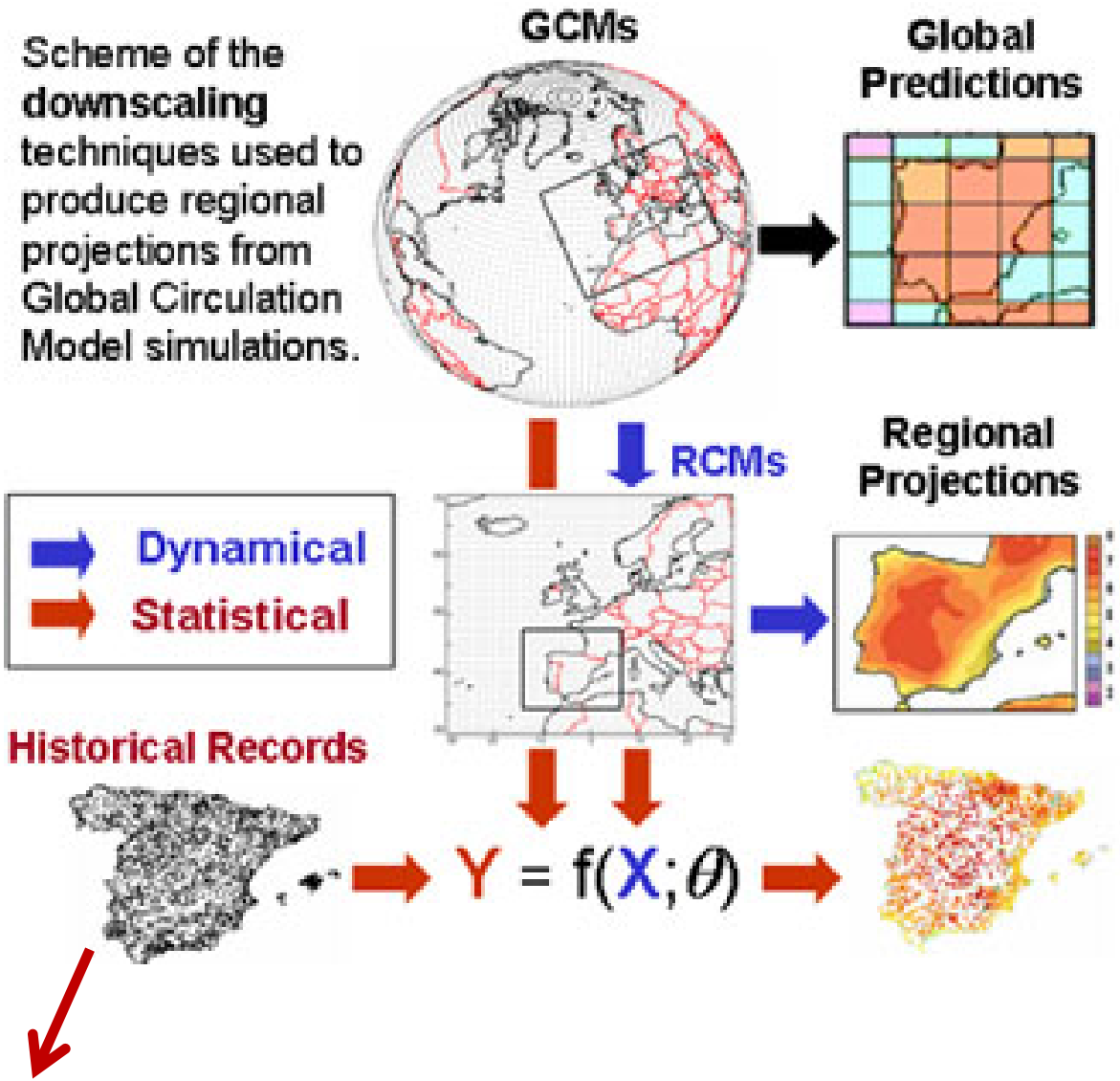
- In the IPCC Fourth Assessment Report makes use of observational datasets in detect climate change
- For climate change detection, anomaly time series were constructed using historic anomalies, derived from the monthly data holdings of the Climatic Research Unit (CRU) and the Global Historic Climatology Network (GHCN)



4. Climate change scenarios

- Climate change scenarios provide the best-available means of exploring how human activities may change the composition of the atmosphere, how this may affect global climate, and how the resulting climate changes may impact upon the environment and human activities.
- They should not be viewed as predictions or forecasts of future climate, but as internally-consistent pictures of possible future climates, each dependent on a set of prior assumptions.
- The principal source of information for climate change impacts analyses is the GCM models **BUT** the models may only be able to satisfactorily reproduce the characteristics of surface meteorological variables such as temperature or rainfall at the hemispheric or global scale rather than the required regional or local scale
- There is therefore a scale mismatch between the requirements of the impacts analyst and the availability of useful information from GCMs
- This may be overcome by downscaling: statistical or dynamical
- In both cases, a set a long-period and high-quality climatic instrumental time series are required.

4. Climate change scenarios

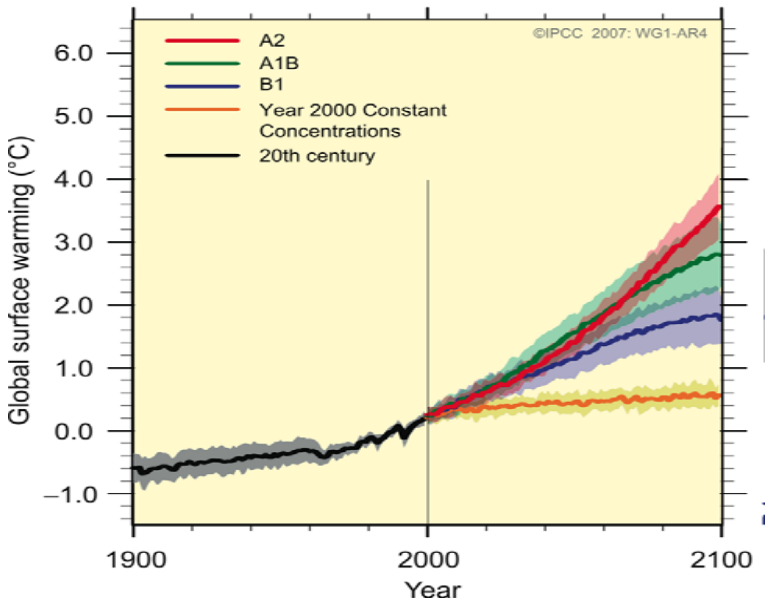


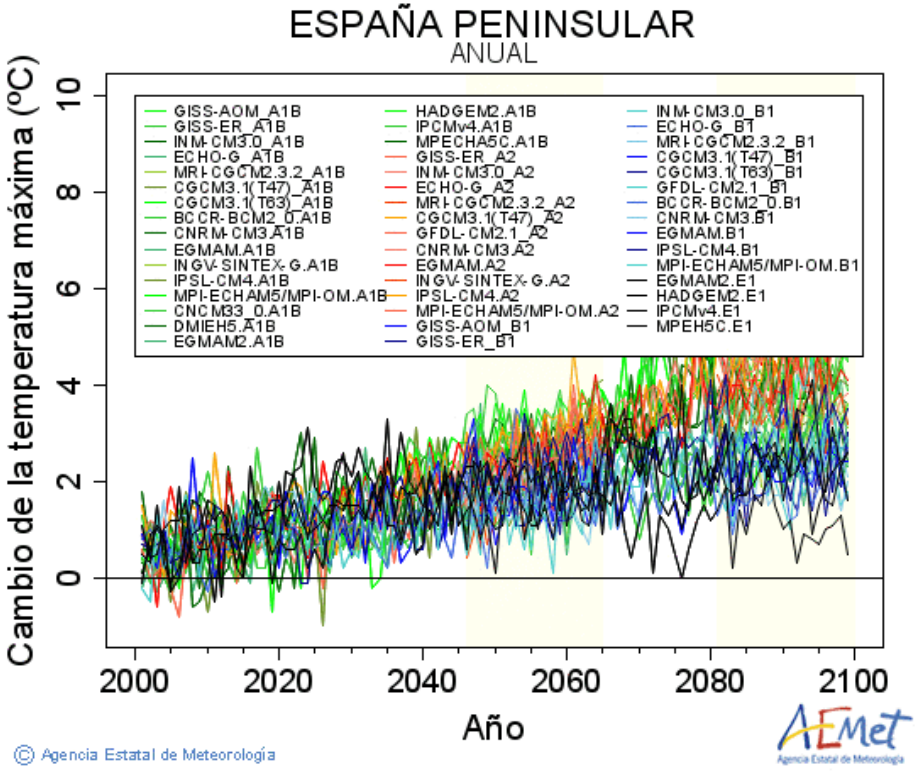
For obtaining the climate change scenarios, long-period and high-quality climatic instrumental time series are needed (figure from UNICAN, Spain)

4. Climate change scenarios

Results for the change in maximum temperature in Spain obtained from statistical downscaling of GCMs

www.aemet.es/es/web/serviciosclimaticos/cambio_climat/result_graficos

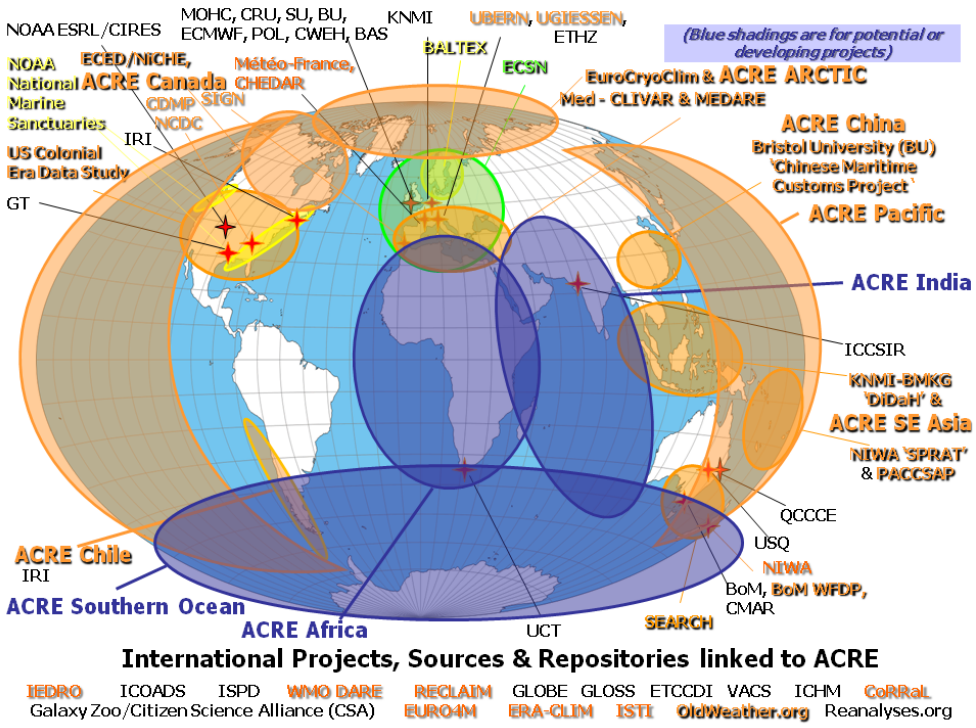




5. Extended historical reanalysis prior 1948

ACRE is the international Atmospheric Circulation Reconstructions over the Earth initiative

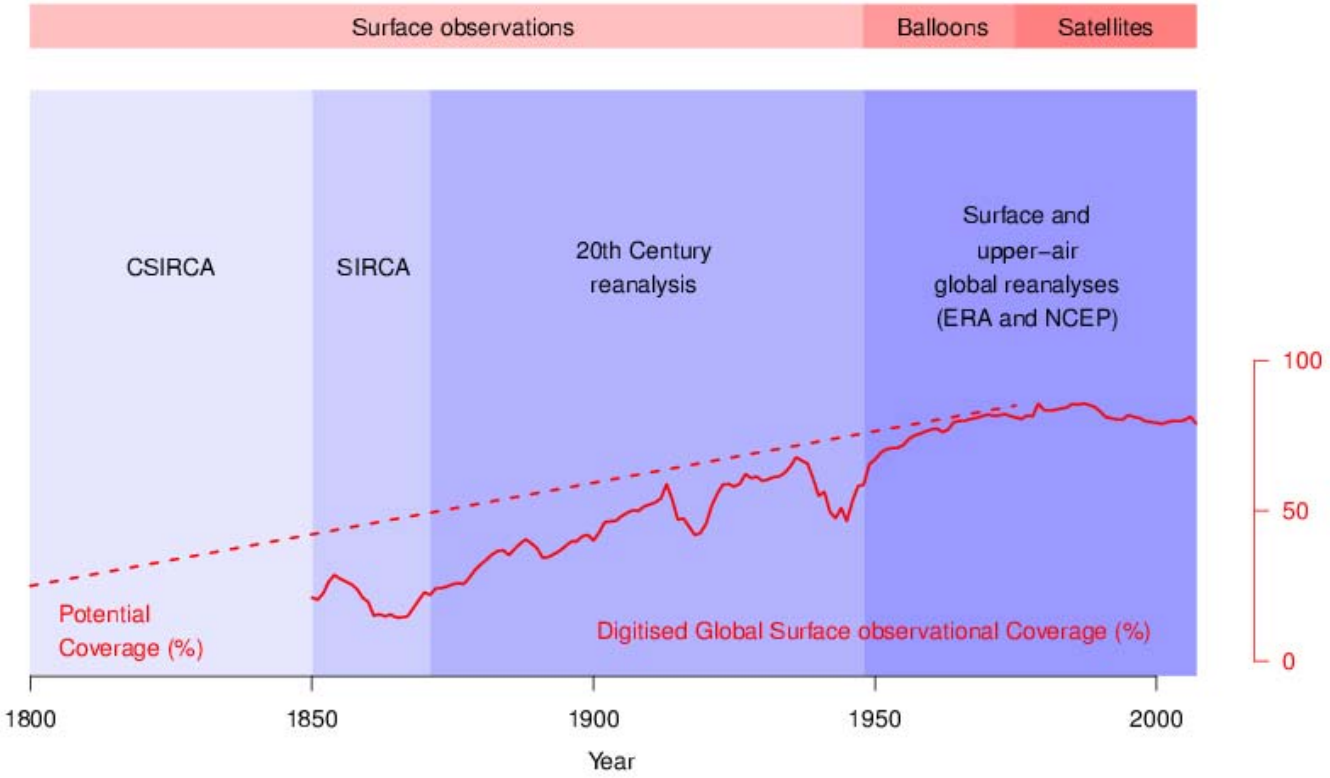
ACRE is led by a consortium of 7 partners - the Queensland State Government and the University of Southern Queensland in Australia; the Met Office Hadley Centre (MOHC) in the UK; the US National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL) and Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado; The National Climatic Data Center (NCDC) of NOAA and the University of Giessen in Germany plus the University of Bern in Switzerland.



5. Extended historical reanalysis prior 1948

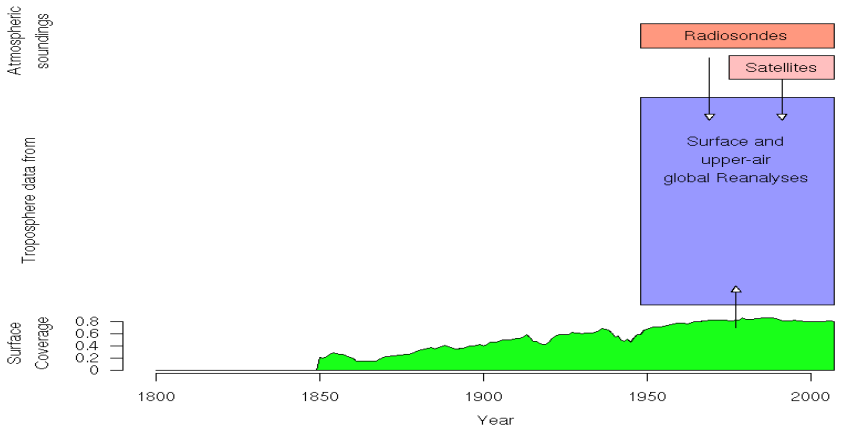
Recover historic instrumental surface terrestrial and marine observations worldwide to 4D weather reconstructions over the past 200-250 years at high resolution (2º lat x lon every 6 hours)

WG1 Data rescue: Facilitating work to make more historical observations available for climate research and reanalyses and collaborating with a number of international data rescue projects and activities

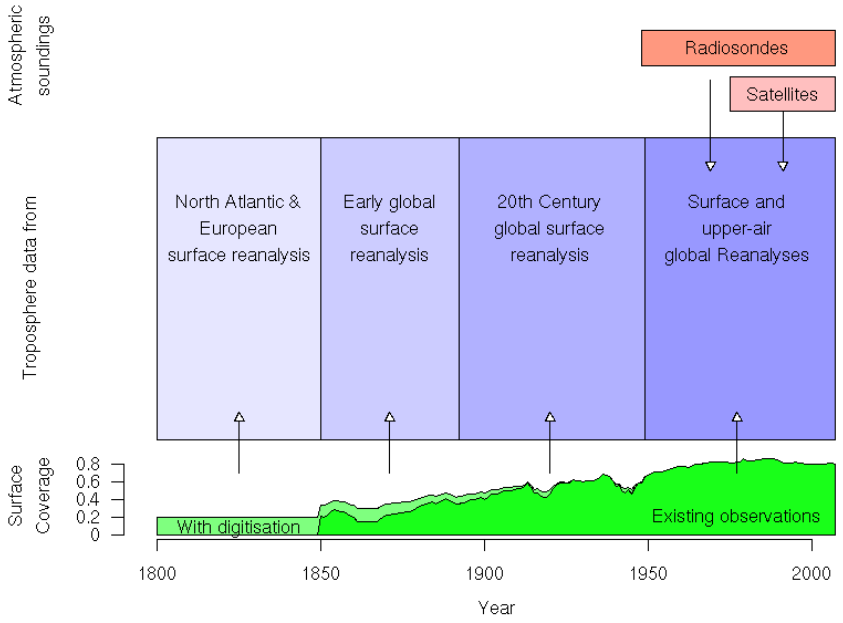


5. Extended historical reanalysis prior 1948

Global observed climate data currently accessible before ACRE



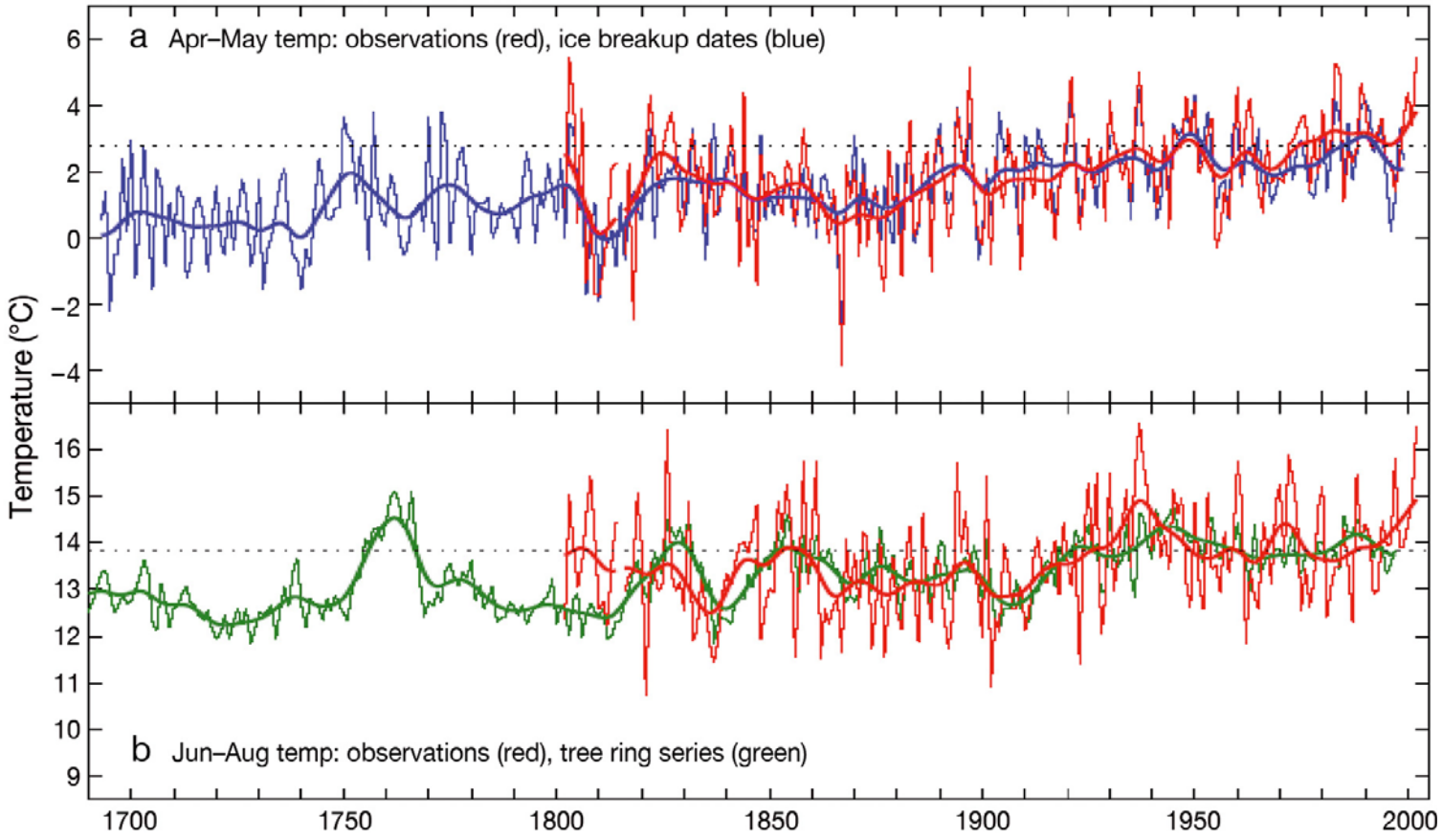
Global climate data expected after ACRE



6. Calibrate natural/documentary proxies

- Long-term and high quality climate records are also indispensable for developing climate series longer than instrumental records.
- Climate proxies such as ice cores, tree rings, corals or historical documentation (e.g. number of rogation ceremonies) can be combained with long instrumental records to calibrate the proxy evidence and then extend our knowledge about climate variability over longer than decadal time scales.
- If there a good agreement between instrumental observations and proxies, it is possible to extend back the climate records

6. Calibrate natural/documentary proxies



From Brunet & Jones (2011): April–May averaged instrumental temperature (red) and calibrated temperatures based on ice break-up dates (blue) for the Tornio River (Fennoscandia) and Summer averaged (June–August) instrumental temperatures (red) and calibrated temperatures based on tree-ring width and density records (green) near Lake Torneträsk (northern Sweden). Dashed lines: 1961–1990 means.

CONCLUSIONS

- It is clear the scientific importance of recuing and developing long and high quality climate records.
- Improving climate data availability is extremely important in order to better understand multidecadal variability
- These data will facilitate climate change detection and attribution analysis and help to validate climate models (both general climate models and regional ones)

Then, it is very important to carry out DARE activities such as MEDARE in order to develop long term and high quality climate data series