

# Data availability in the Mediterranean: requirements for climate change detection and modelling research

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# Outline

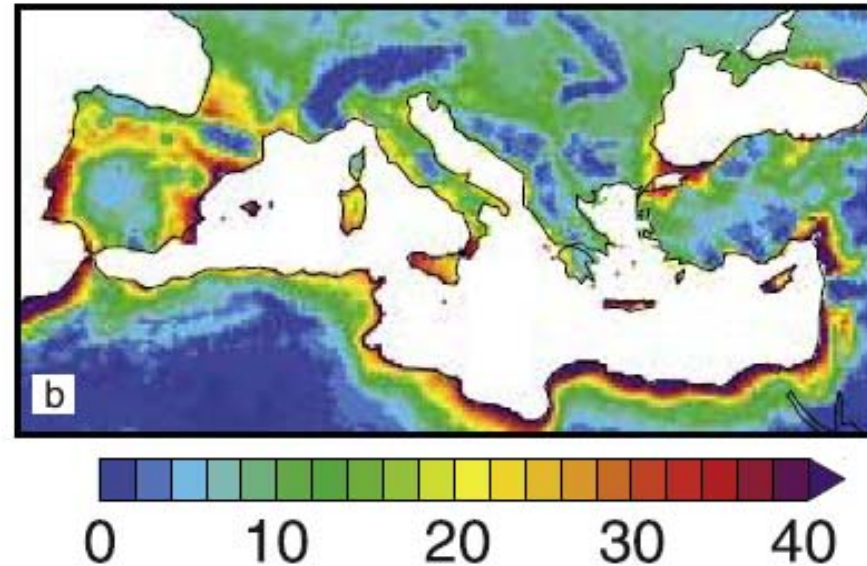
- **Why is the Mediterranean of importance?**
- **The Mediterranean climate – What data is required?**
  - Extreme events
  - Detection & Attribution
  - The future – Regional Climate Models
- **What data is available?**
- **What can we do with this data?**
- **Conclusions**
- **Outlook**

A “hotspot” whose climate is especially responsive to global change and where potential climate change impacts are particularly strong

*Giorgi 2006*

&

*Diffenbaugh et al. 2007*



Diffenbaugh et al. 2007

# Mediterranean vulnerability

- **Temperature extremes**
  - Heat waves
    - Mortality, air pollution, ...
    - Tourism
- **Hydrologic cycle**
  - Water resources & water quality
  - Agriculture & environment
  - Economics & social development & behaviour
- **Extent & severity of desertification**
- **Food security**
- **Public health**
- **National economies – Tourism**

# Data requirements

## The Mediterranean Climate

- **Temperature**
  - ↳ **monthly & daily, long, high quality temperature time series**
- **Precipitation**
  - ↳ **monthly & daily, long, high quality precipitation time series**
- **Atmospheric circulation – Sea Level Pressure**
  - ↳ **monthly & daily, long, high quality sea level pressure time series**
- **Other variables**
  - ↳ **air quality, air humidity, etc.**

# Data requirements

## The Mediterranean Climate – Extreme Events

- Temperature extremes

  - ↳ **daily, high density, long, high quality temperature time series**

- Hydrologic cycle

  - ↳ **daily, high density, long, high quality precipitation time series**

# Data requirements

## The Mediterranean Climate – Extreme Events

- Temperature extremes

- ↳ continuous, 40+ years, homogeneous temperature time series

- Hydrologic cycle

- ↳ continuous, 40+ years, quality controlled precipitation time series



# Detection & Attribution of Climate Change

- **Detection**

“detection is the process of demonstrating that an observed change is statistically significantly different than can be explained by natural internal variability” IPCC, 2001

- **Data requirements**

**Detection & Attribution at Regional Scale (Planton, 2010)**

- ⇒ **the lower the scale, the higher the internal variability**
- ⇒ **dense network of observations**
- ⇒ **at least five decades**
- ⇒ **homogeneous time series**



# Data requirements

## The Mediterranean Future Climate Change

- **Temperature**
  - ↳ **monthly & daily, long, high quality temperature time series**
- **Precipitation**
  - ↳ **monthly & daily, long, high quality precipitation time series**
- **Atmospheric circulation – Sea Level Pressure**
  - ↳ **monthly & daily, long, high quality sea level pressure time series**
- **Other variables**
  - ↳ **air quality, air humidity, etc.**

# Data available in the Mediterranean Temperature and Precipitation

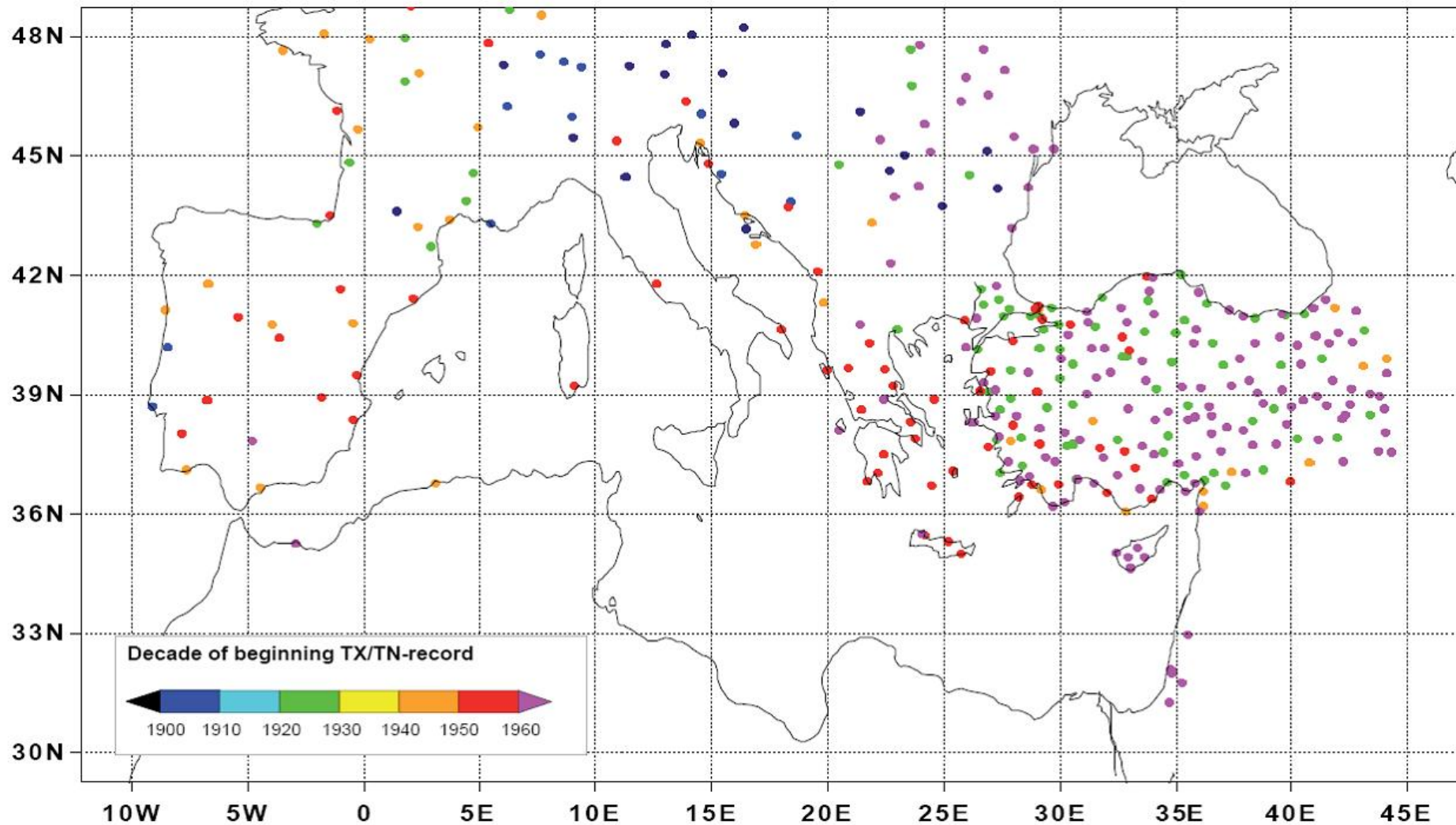
# Mediterranean climatological data – observations

## The CIRCE IP

- **Daily and monthly station time series from 22 countries across the Greater Mediterranean Region – up to 2006**
  - Global Historical Climatology Network (GHCN)
  - European Climate Assessment & Data set (ECA&D)
  - WMO–Initiative on Mediterranean Climate Data Rescue (WMO-MEDARE)
  - National Meteorological and Hydrological Services (NMHSs)
  - Algeria, Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Egypt, France, FYROM, Greece, Hungary, Israel, Italy, Jordan, Libya, Moldova, Morocco, Portugal, Romania, Serbia, Slovenia, Spain, Switzerland, Syria, Tunisia, Turkey

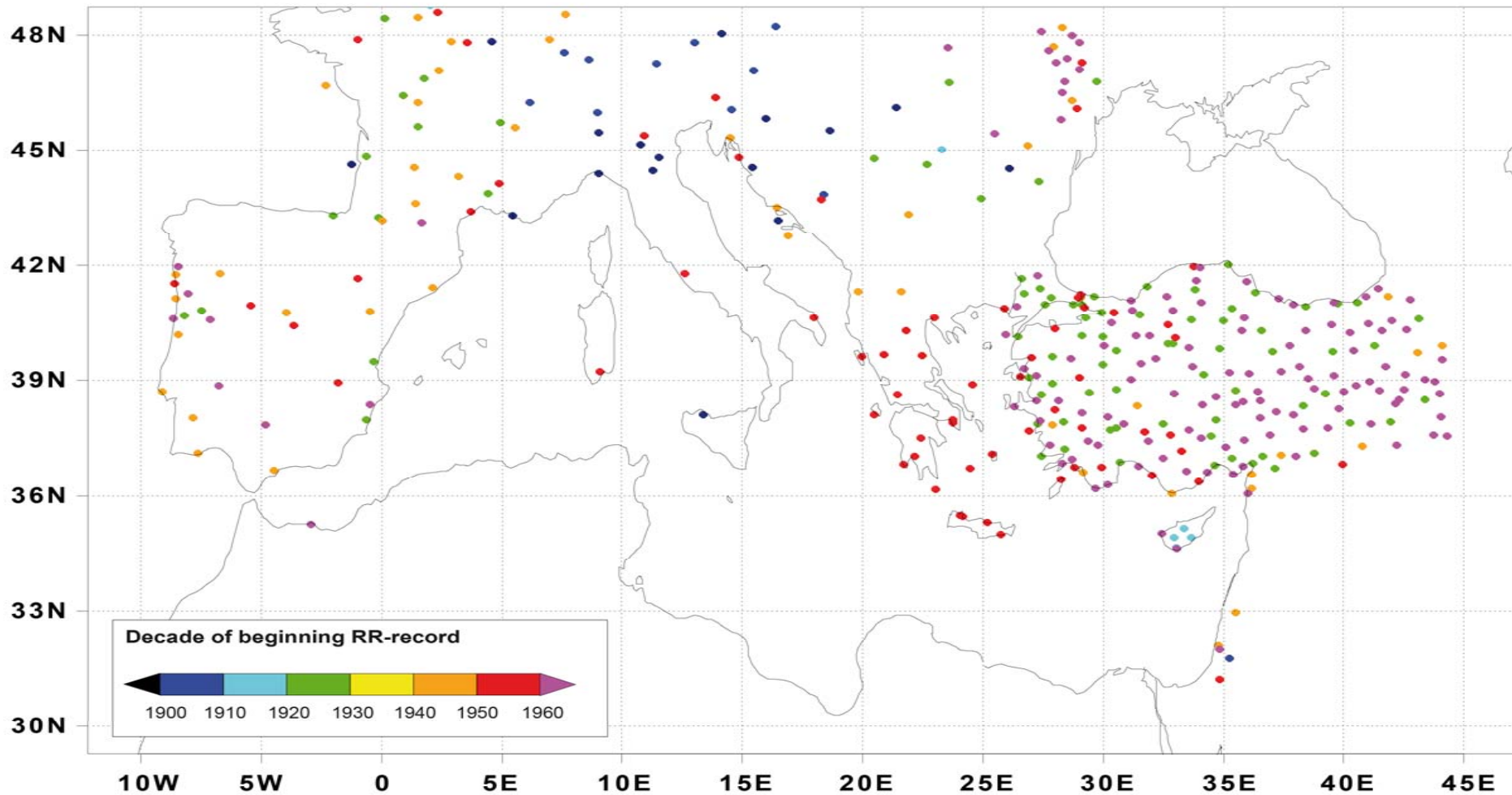
# Mediterranean climatological data

## Daily observations – Tmax & Tmin



# Mediterranean climatological data

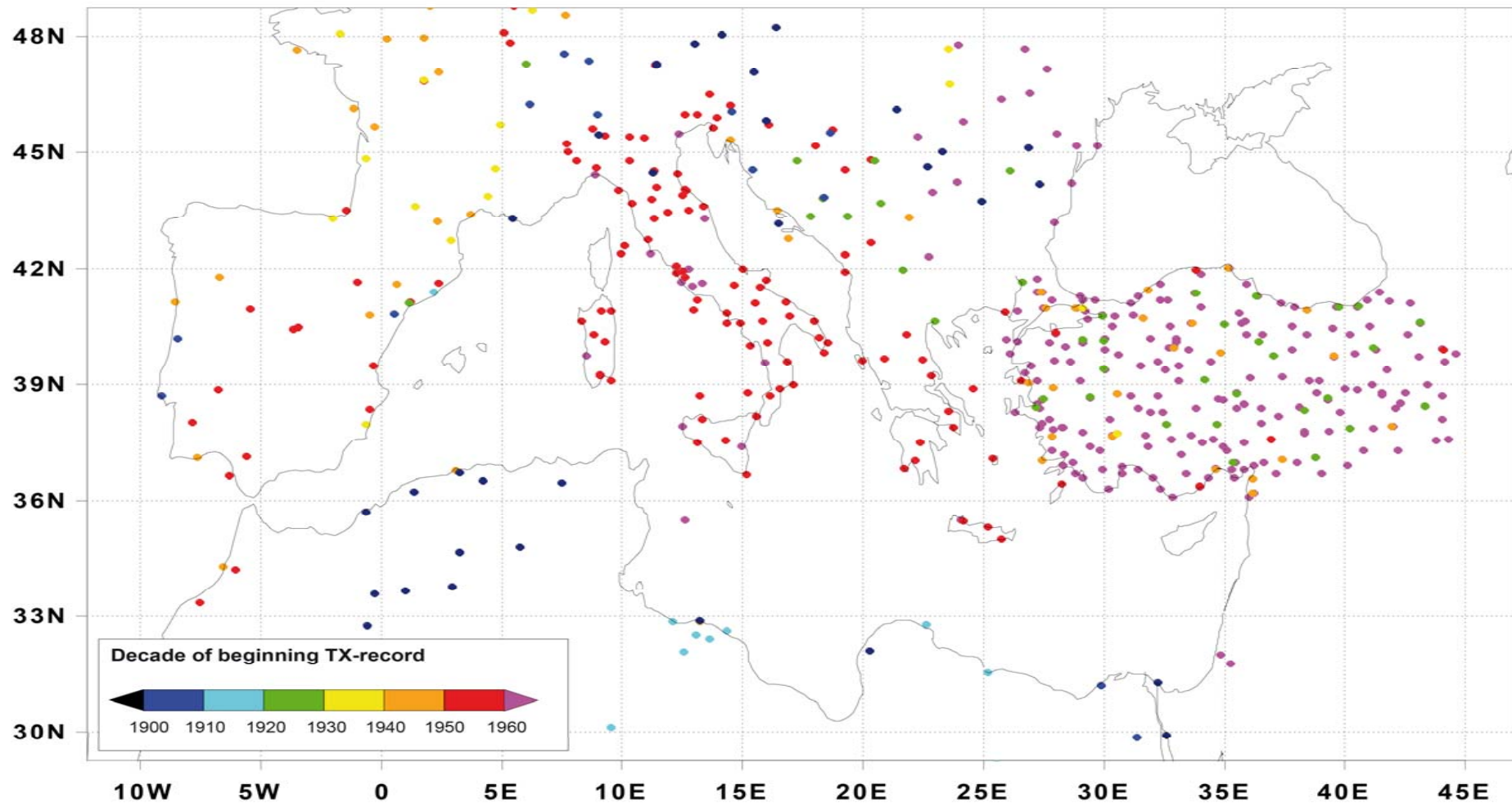
## Daily observations – Precipitation





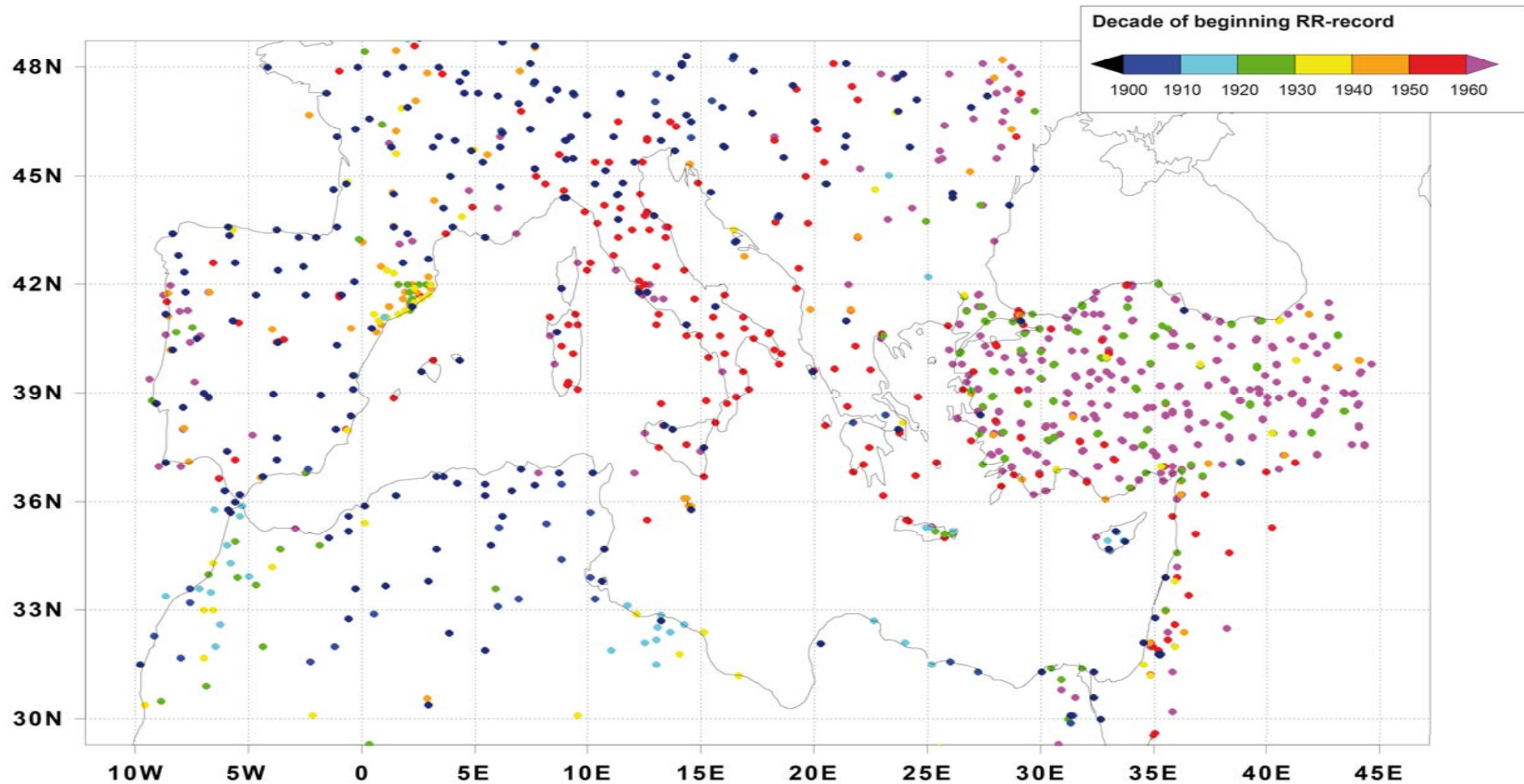
# Mediterranean climatological data

## Monthly observations – Tmax, Tmin



# Mediterranean climatological data

## Monthly observations - Precipitation





# What can we do with the data?

# Quality control & homogenization

## Daily data

- **Break Detection**

Caussinus and Mestre 2004

Wang 2008

Wang et al. 2007

**Toreti et al. 2010 - GAHMM**

- **Correction**

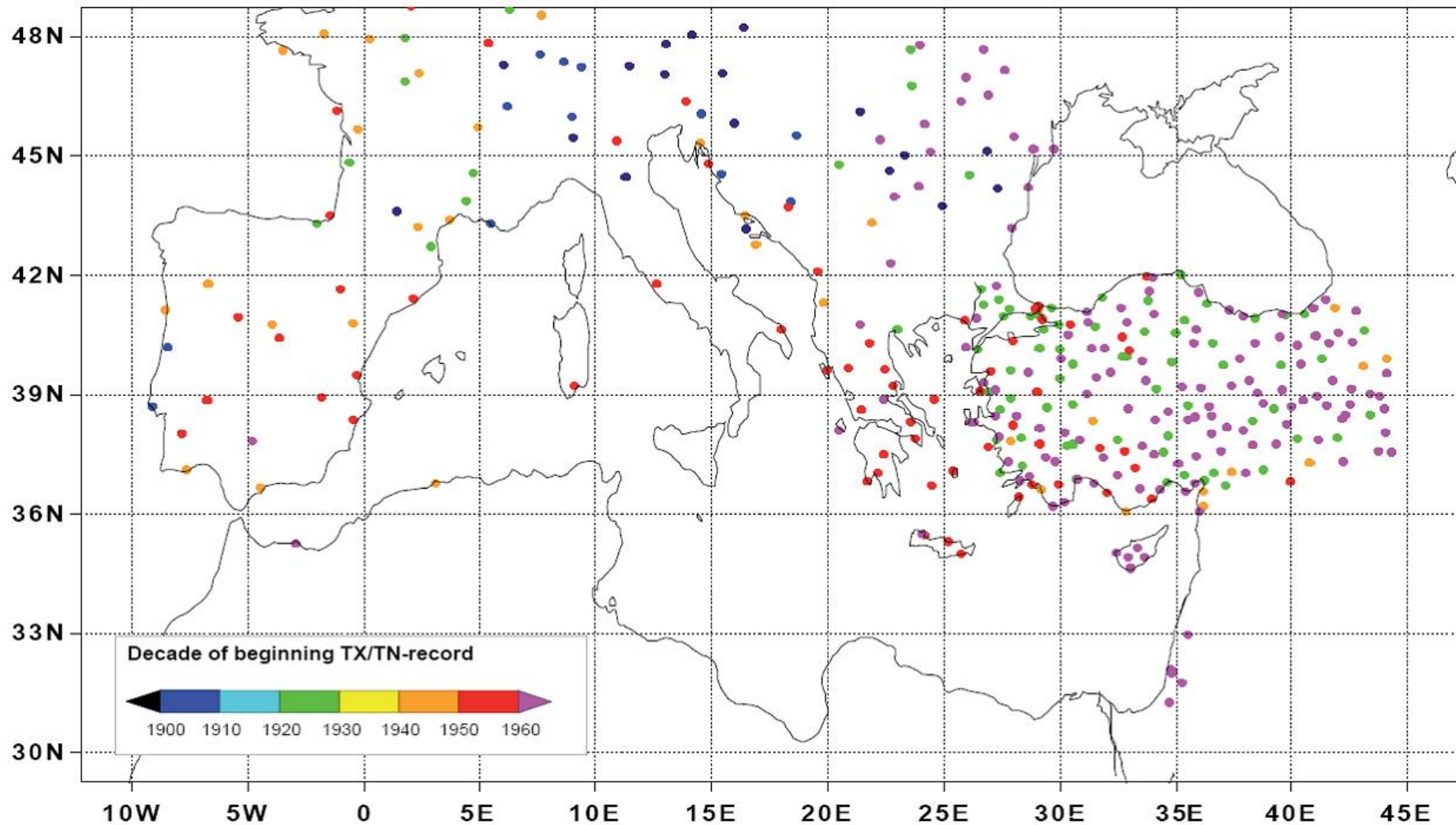
**PENHOM (Kuglitsch et al. 2009)**

**HOMAD (Toreti et al. 2010)**

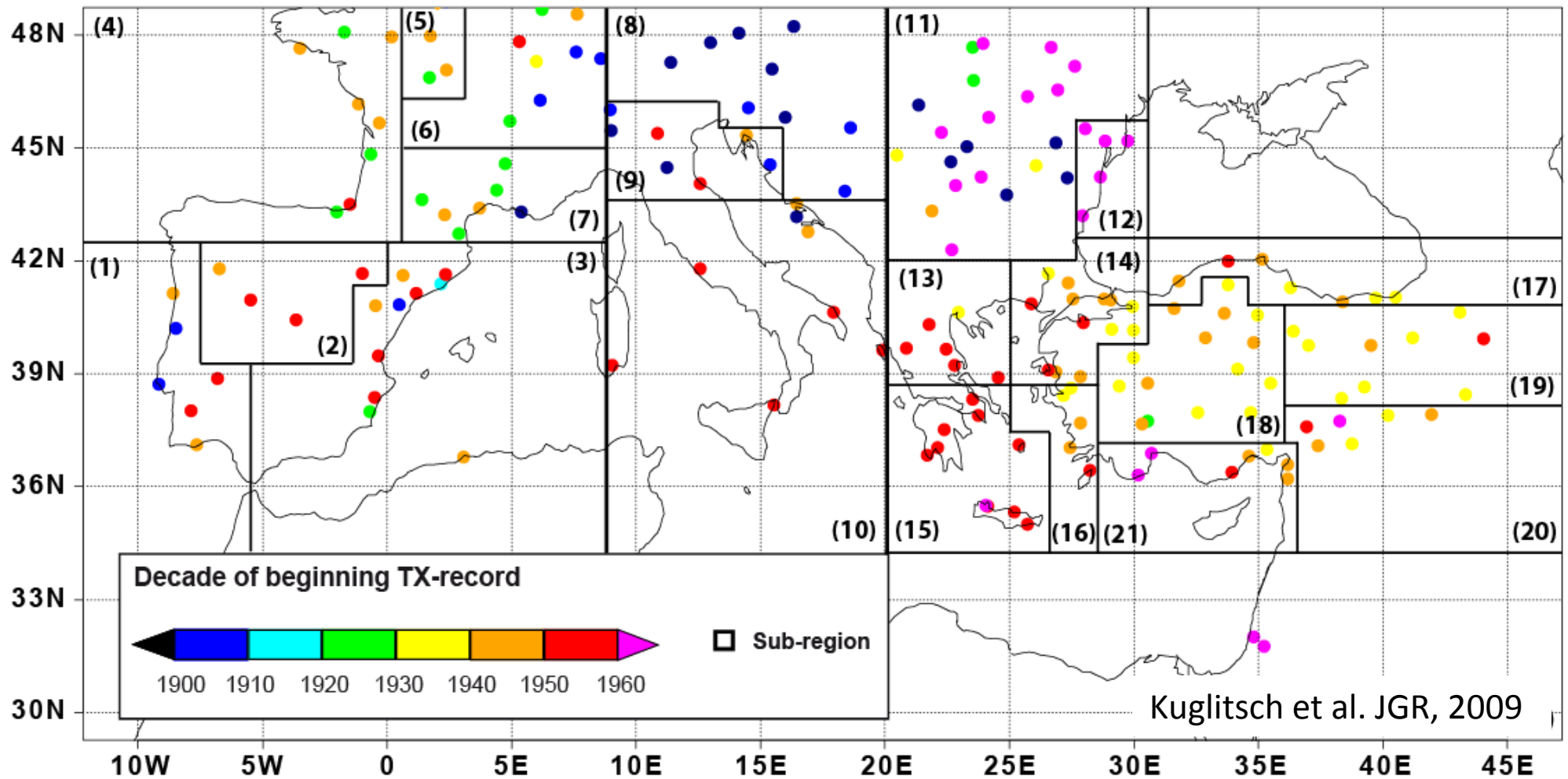
*Della-Marta and Wanner, 2006*

# Mediterranean climatological data

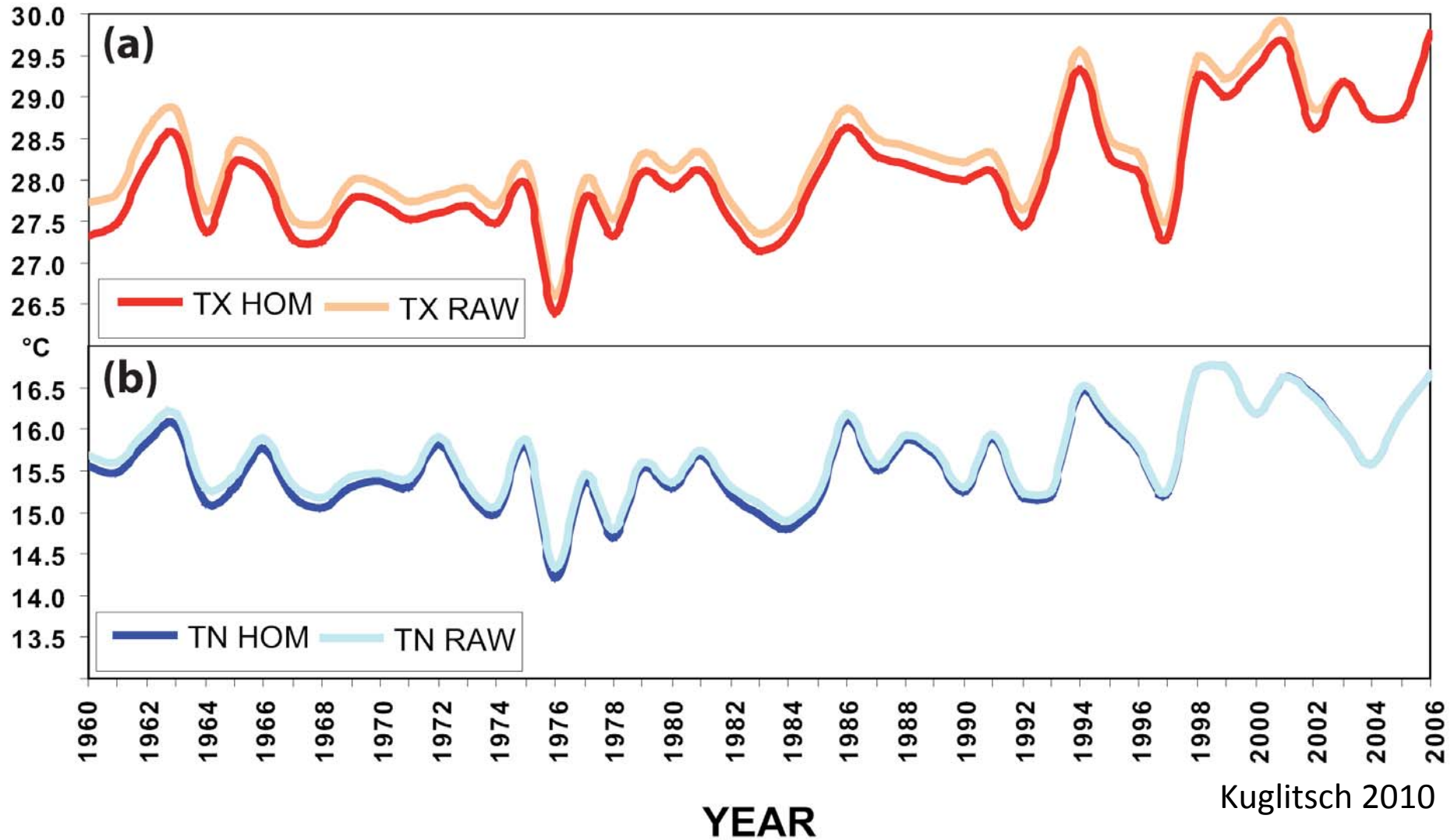
## Daily observations – Tmax & Tmin



# Homogenised Tmax

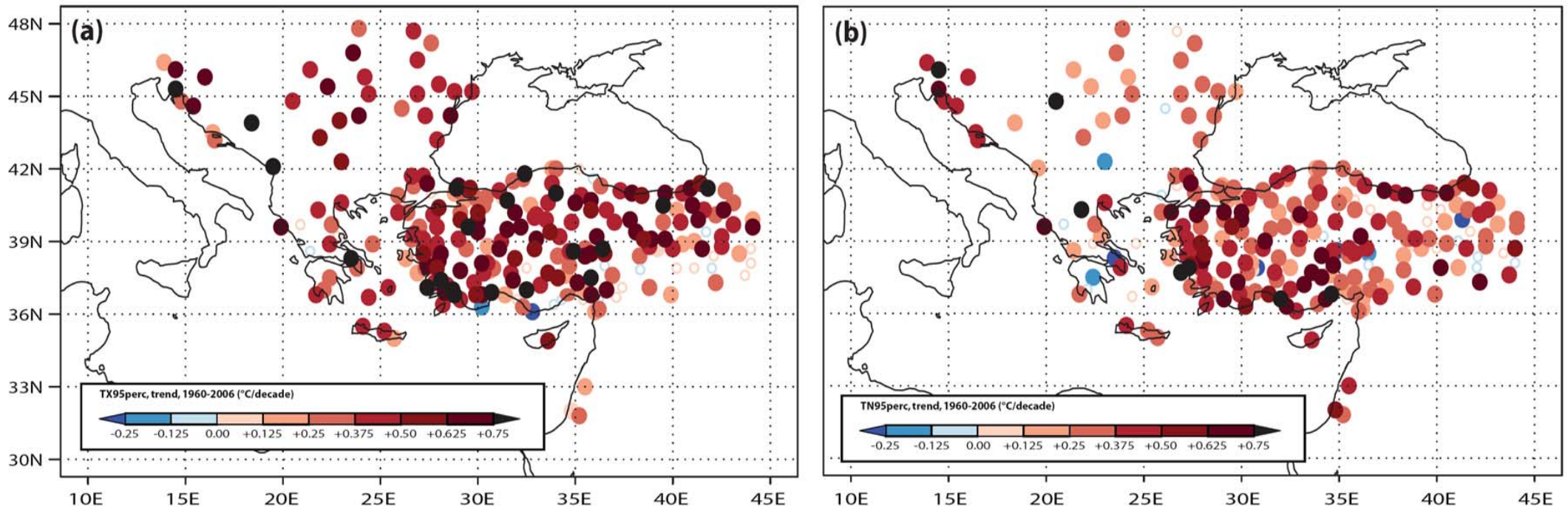


# Mean Mediterranean Tmax, Tmin





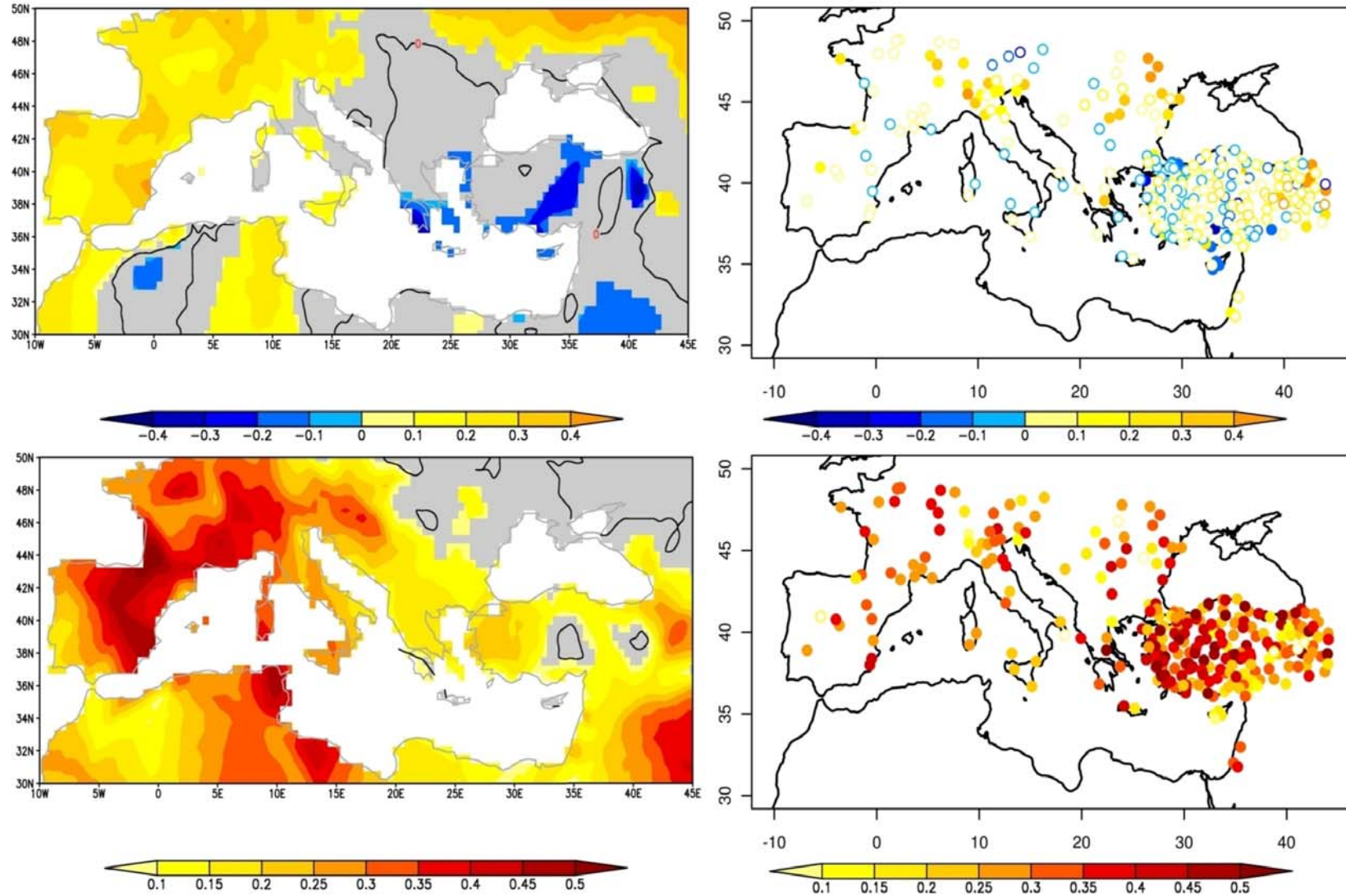
# Trends estimation – Tmax, Tmin 95th percentile



Kuglitsch et al. GRL 2010

# Comparison with gridded datasets

## TEMPERATURE

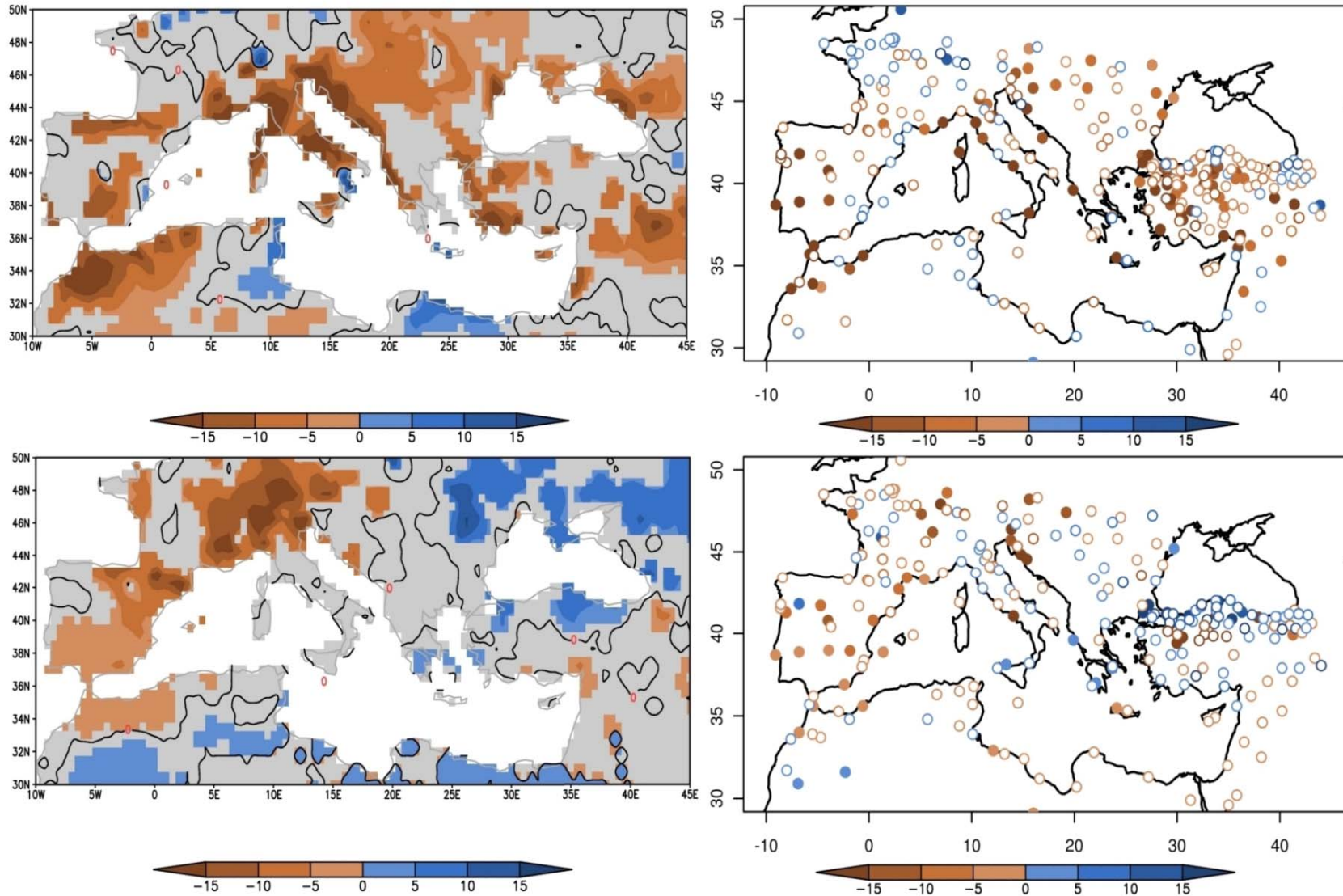


Toreti 2010



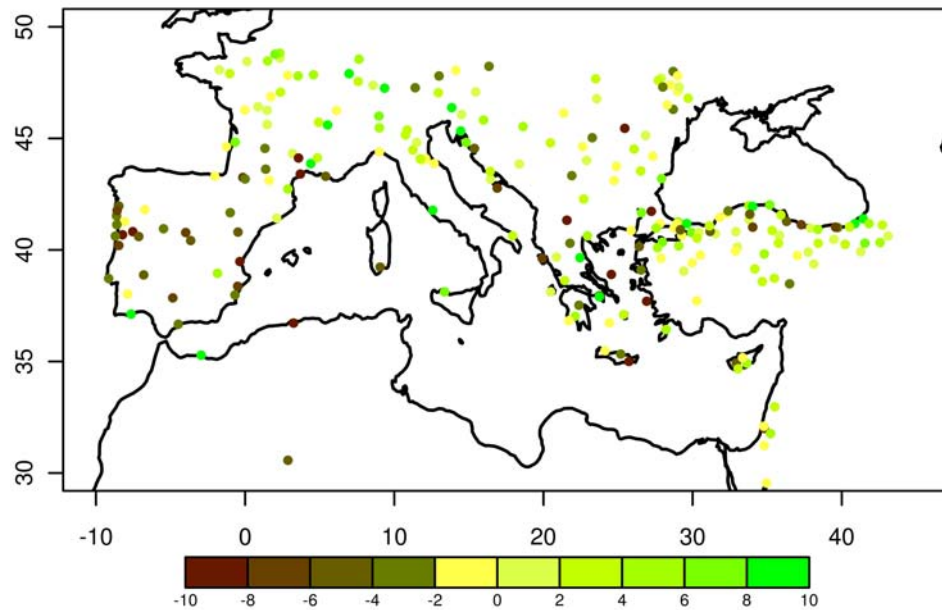
# Comparison with gridded datasets

## PRECIPITATION



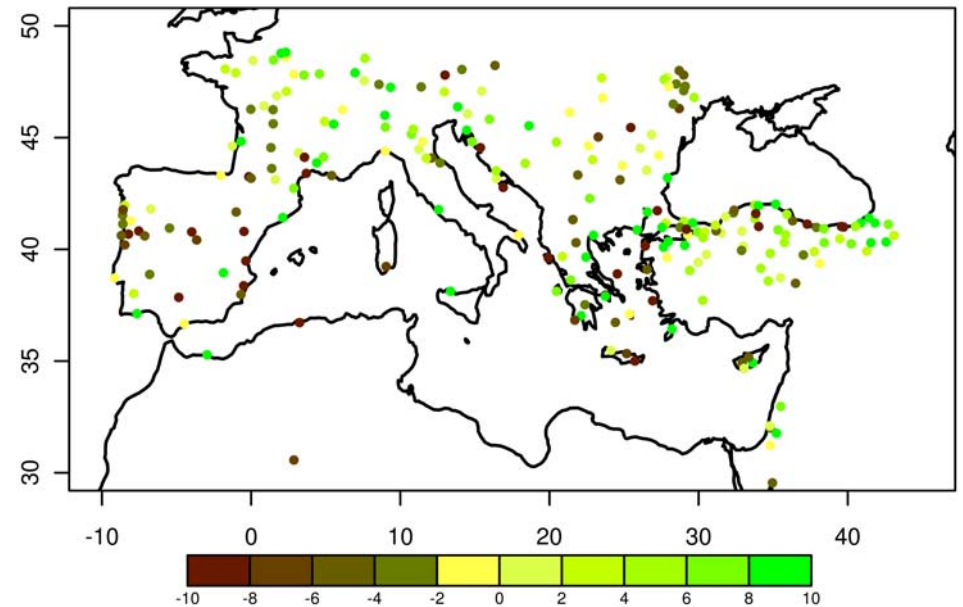
Toreti 2010

# Precipitation extreme events – observations

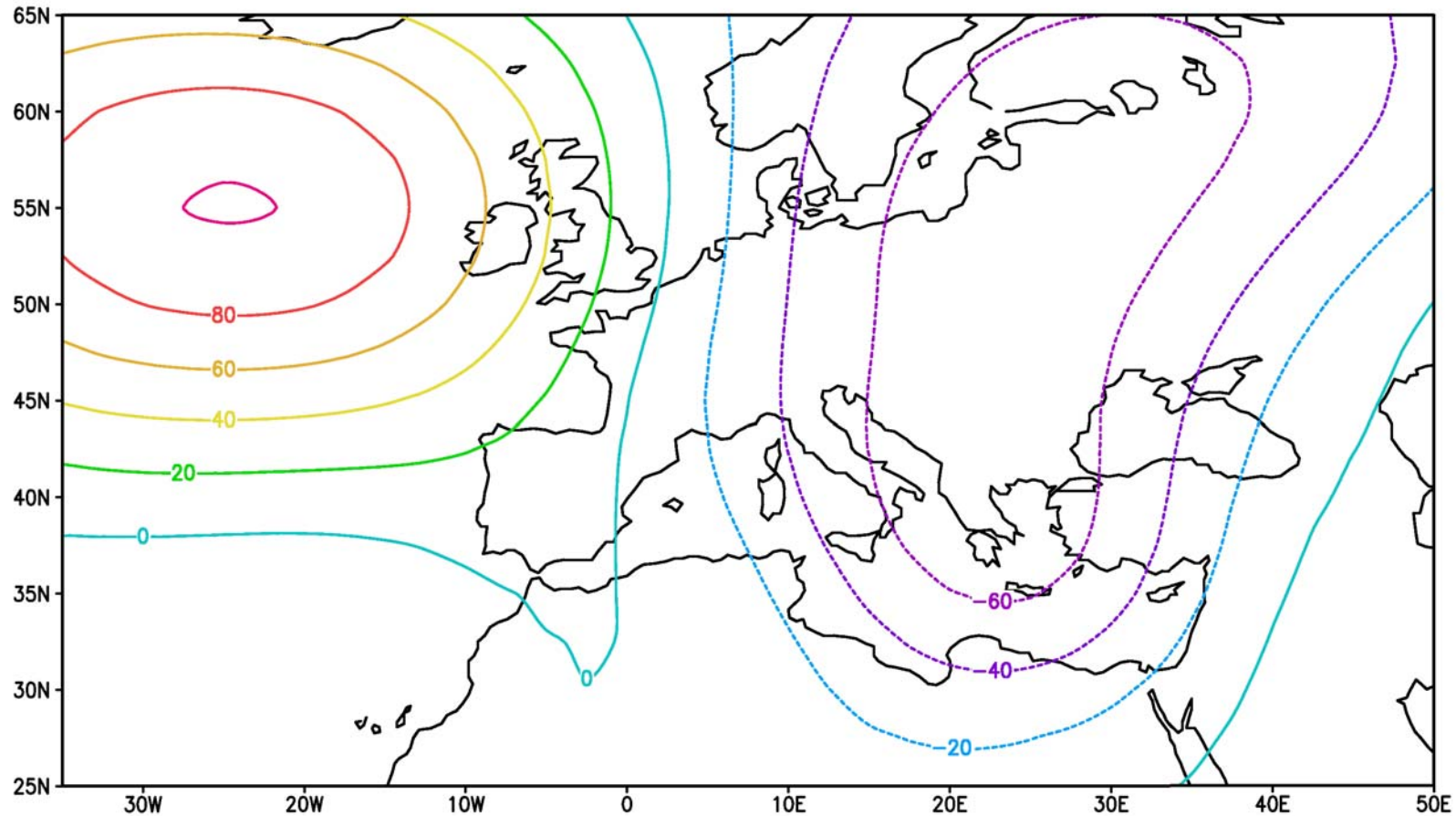


**Differences 5-yr return levels  
1981-2006 – 1955-1980**

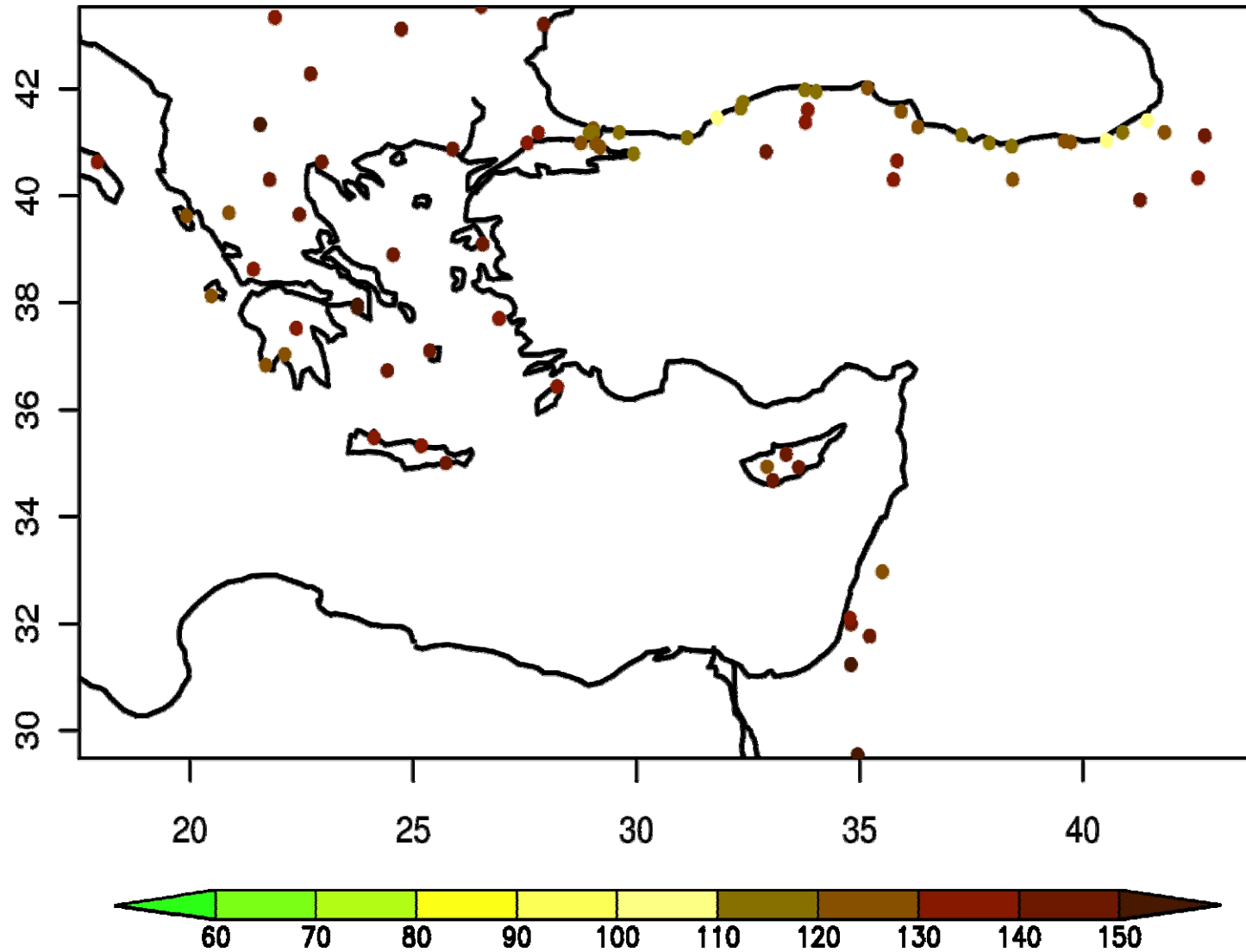
**Differences 2-yr return levels  
1981-2006 – 1955-1980**



# 500 hPa extreme precipitation cluster 1



# Dry days, 1981-2000 - Observations

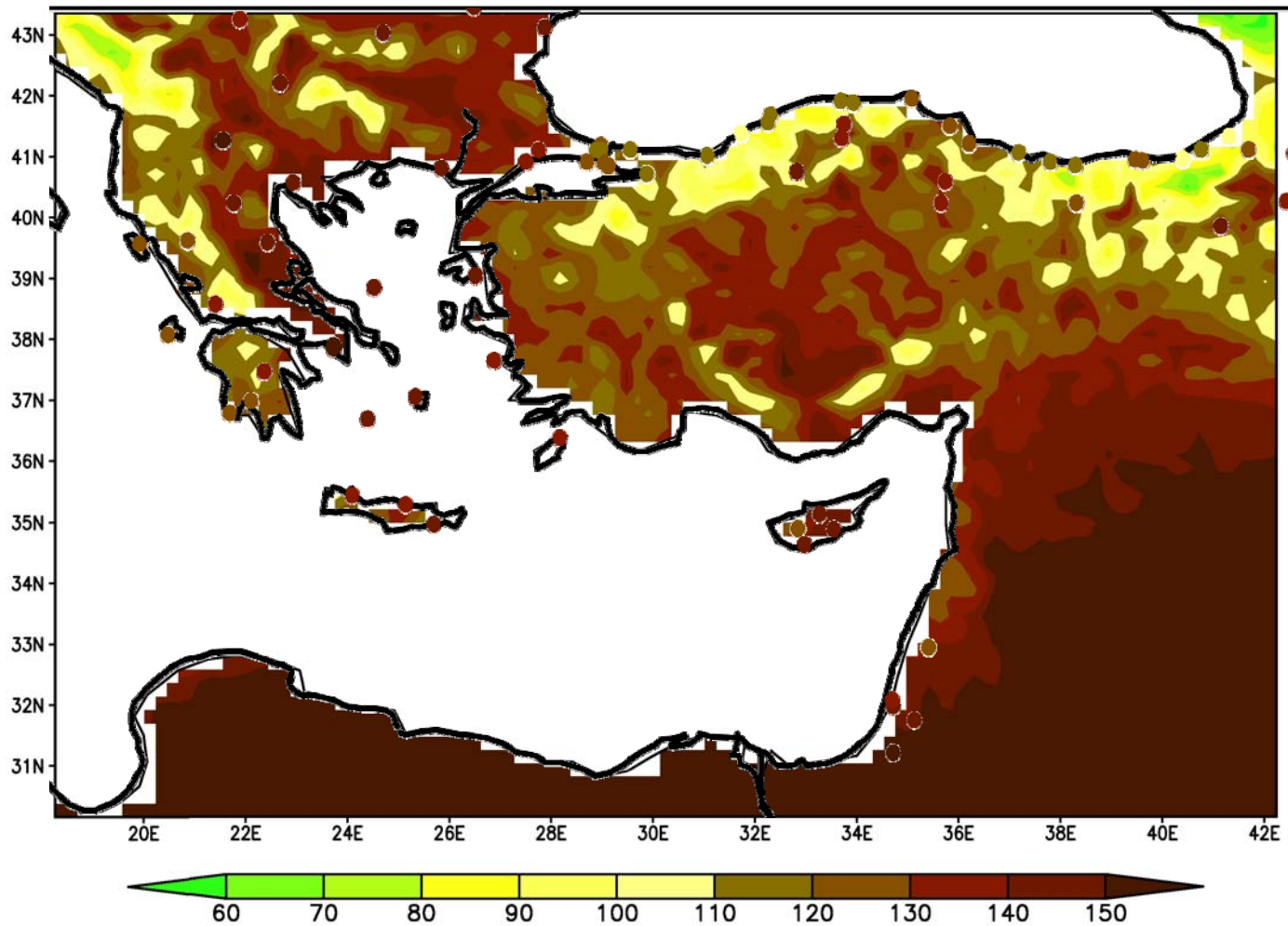


Toreti 2010



# Model valuation

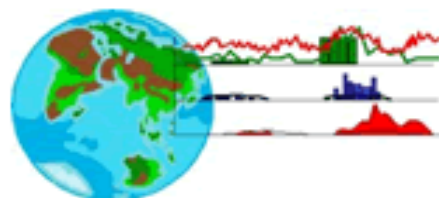
## Dry days, 1981-2000 – Observations vs. Models



# Initiatives, Projects



**WMO**  
World  
Meteorological  
Organization  
Οργανισμός  
Μετεωρολογίας  
και Κλιματικής



**WCDMP**  
World Climate Data  
and Monitoring  
Programme  
Πρόγραμμα  
Παρακολούθησης  
και Παρακολούθησης



**WCP**  
World  
Climate  
Programme  
Πρόγραμμα  
Κλιματικής

# WMO MEDARE initiative



The **MEDiterranean climate Data REScue** (MEDARE) is an initiative, born under the auspice of the World Meteorological Organization, with the main objective is being to develop, consolidate and progress climate data and metadata rescue activities across the Greater Mediterranean Region (GMR)

 **MEDARE**  
**Workshop Proceedings** [Download PDF \(5 MB\)](#)

- ▶ [The MEDARE Initiative](#)
- ▶ [MEDARE Workshop outcomes](#)
- ▶ [Workshop MEDARE](#)



**MEDARE poster**  
(PDF version)

[Download](#)



# Long Historical Weather Observations Series from the Mediterranean-Middle East

**Funder: Juerg Luterbacher, University of Giessen, Germany**

**Digitiser: Gail Willetts, ACRE, Met Office Hadley Centre, UK**

**4 series of pressure, temperature and rainfall data are being recovered, imaged, digitised and quality controlled:**

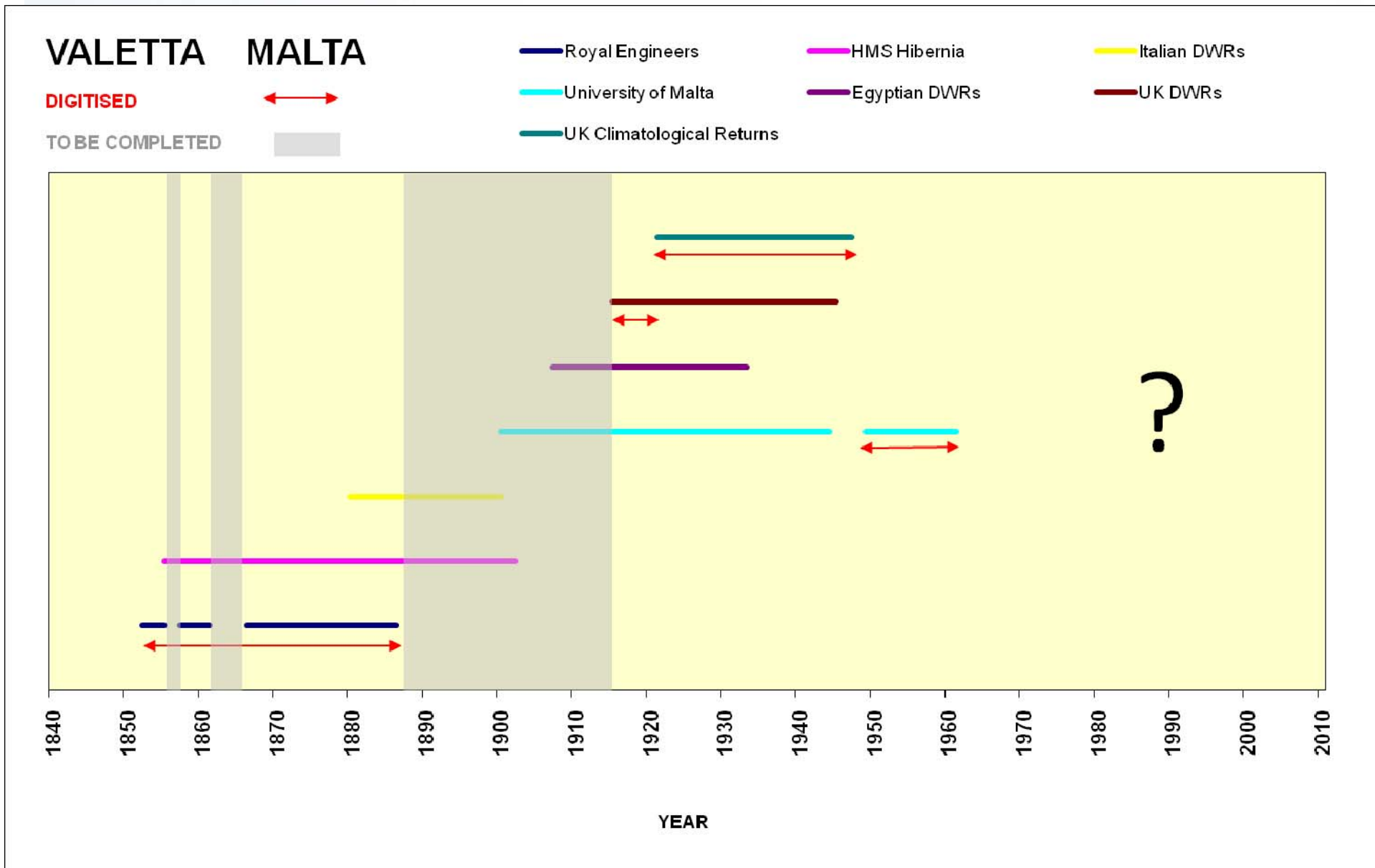
**Valetta, Malta: 1852->** (link with University of Malta Library)

**Limassol, Cyprus: 1882->** (link with Stelios Pashiardis)

**Constantinople/Istanbul, Turkey: 1840s->** (link with Serhat Sensoy)

**Baghdad, Iraq: 1782-1784, 1866-1876, 1893-1920**

# Valetta Harbour, Malta



# Limassol, Cyprus

## LIMASSOL CYPRUS

DIGITISED



TO BE COMPLETED

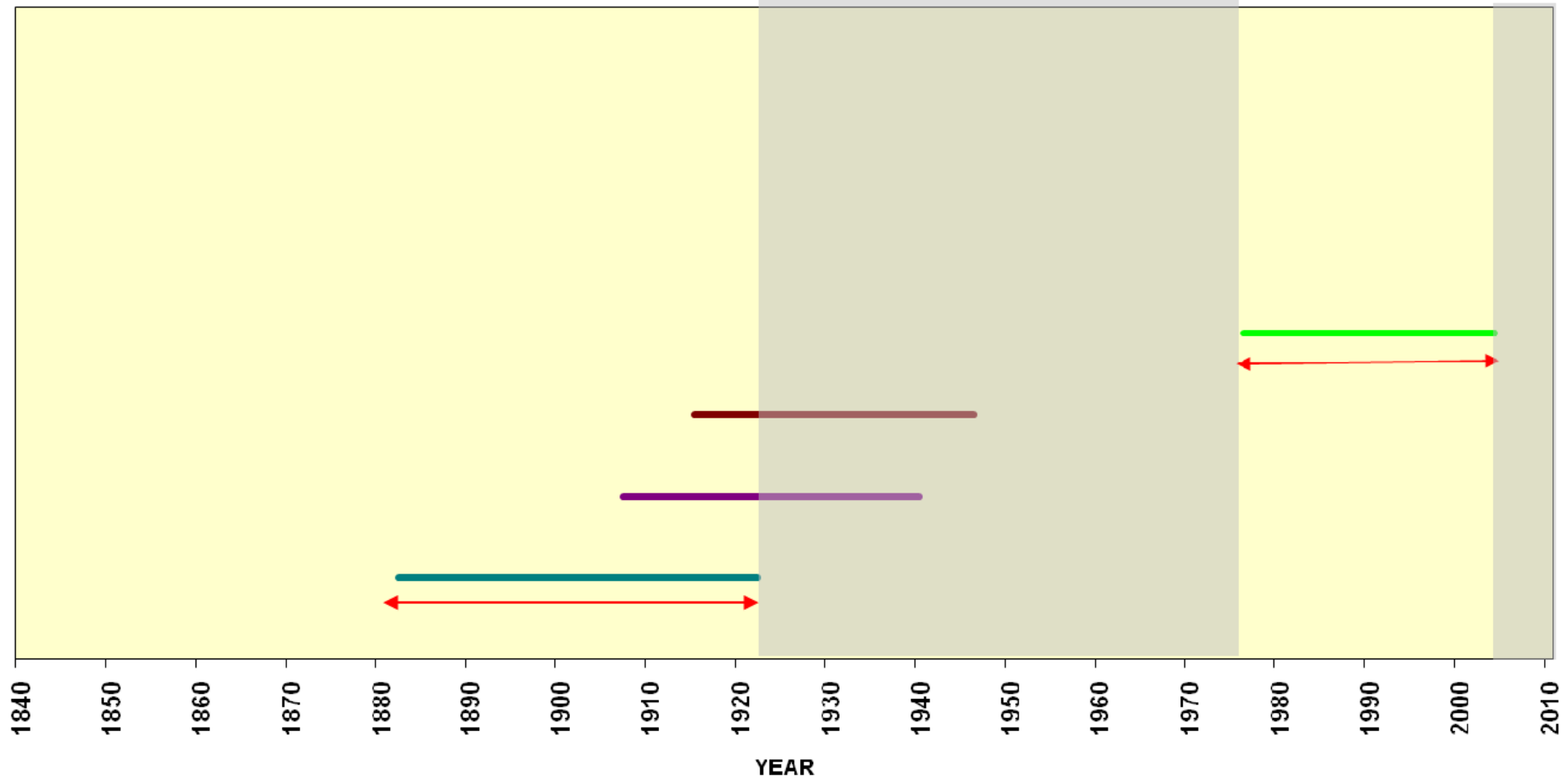


UK Climatological Returns

Egyptian DWRs

UK DWRs

ECA&D

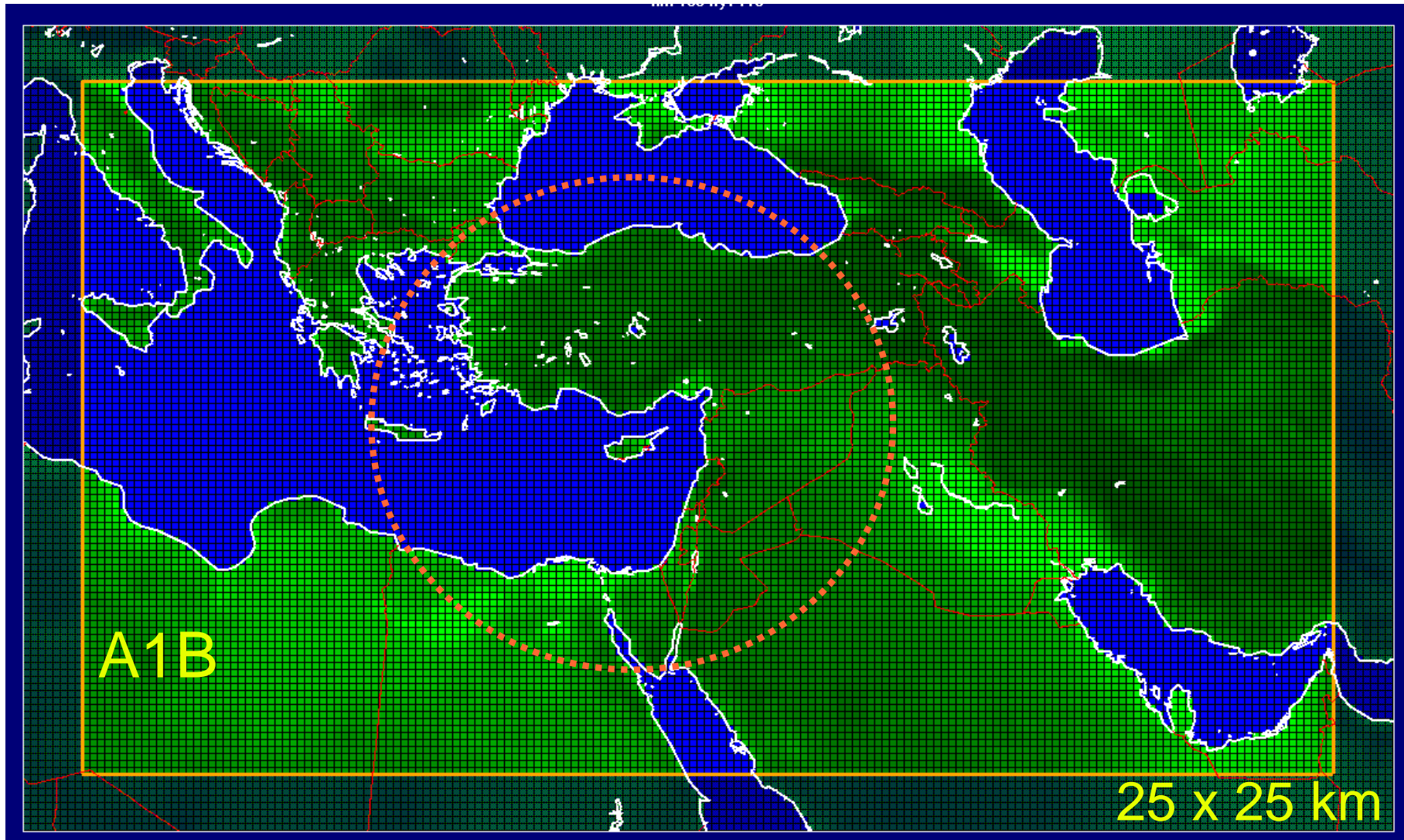


# Climate Change in the Mediterranean and the Middle East - CIMME

- **Cyl funded**
- **International collaboration**
- **Cyprus, neighbouring countries and beyond**
- **Topical reports**
- **Climate assessment**
  - Historical climatology, Climate projections-  
dynamical/statistical downscaling, Energy, Water, Air  
quality, Health, ...
- **Data repository – Meryem Tanahrte**

# PRECIS – CIMME

## Eastern Mediterranean Middle Eastern domain



# WMO's Res40Cg-XII

*“As a fundamental principle of the World Meteorological Organization (WMO), and in consonance with the expanding requirements for its scientific and technical expertise, WMO commits itself to broadening and enhancing the free and unrestricted<sup>1</sup> exchange of meteorological and related data and products”*

<sup>1</sup>**“Free and unrestricted”** means non-discriminatory and without charge.

**“Without charge”**, in the context of this resolution means at no more than the cost of reproduction and delivery without charge for the data and products themselves.

# Conclusions

- **Data availability is crucial for accurate Mediterranean climate studies**
- **Data availability allows the validation of scientific results on climate change detection and attribution**
- **Data availability allows the climate models' valuation & the accurate assessment of future climate change**
- **Data availability allows the preparation and validation climate change impacts assessment reports**
- **Data availability allows the correct consultation of policy and decision makers**



# Outlook

- Exchange knowledge, experience, data, results between researchers and NMHSs
- Establishment of data repositories to accommodate data and their products with the aim to provide accurate information to policy makers, politicians, researchers, schools, interested populations and more
- Continuous digitisation of Mediterranean time series
- Concerted effort to assess Mediterranean climate change and climate change impacts
- ...

# Thank you

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