TEMPERATURE AND PRECIPITATION EXTREMES OVER SPAIN FOR THE 21st CENTURY: RETURN PERIODS

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Agencia Estatal de Meteorología

Outline

- Introduction
- Data and method
- Results
- Conclusions.

INTRODUCTION

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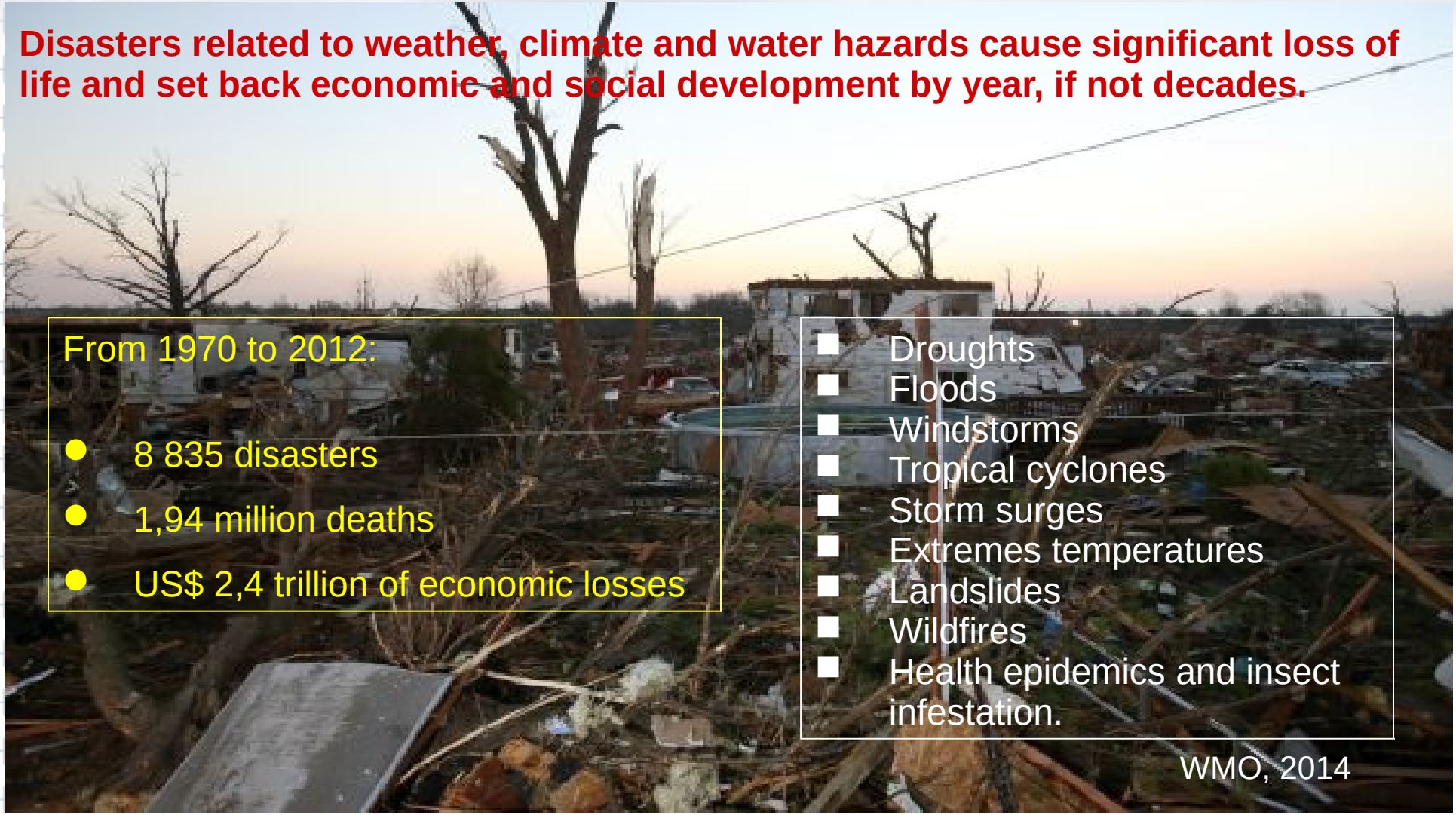
Disasters related to weather, climate and water hazards cause significant loss of life and set back economic and social development by year, if not decades.



From 1970 to 2012:

- 8 835 disasters
- 1,94 million deaths
- US$ 2,4 trillion of economic losses

- Droughts
- Floods
- Windstorms
- Tropical cyclones
- Storm surges
- Extremes temperatures
- Landslides
- Wildfires
- Health epidemics and insect infestation.

WMO, 2014

INTRODUCTION

- Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. (IPCC, 2014)
- There is evidence from observations gathered since 1950 of change in some extremes. (IPCC 2012)
- Observed changes in climate extremes reflect the influence of anthropogen change in addition to natural climate variability. (IPCC 2012)
- An changing climate leads to changes in the frequency, intensity, spatial extent, duration and timing of extreme weather and climate events. (IPCC 2012)
- Changes in extremes can be linked to changes in the mean, variance or shape of probability of distributions, or all of these. (IPCC 2012)

Climate Extremes

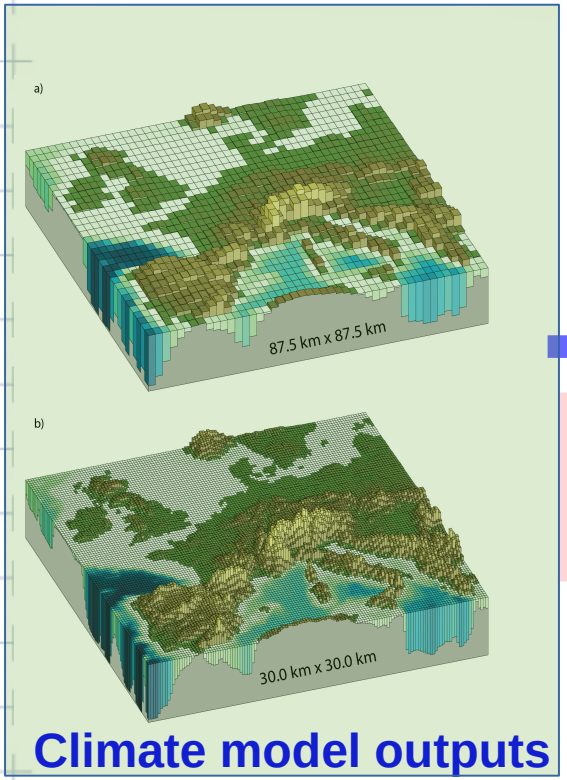
Climate indices:

- Number of warm days
- Warm spell duration
- Maximum length of dry spell
- ...

Frequency analysis

- **Return period** : number of time units necessary to obtain a value equal to or greater than an certain value one time.
- **Return value** associated with a given time scale.

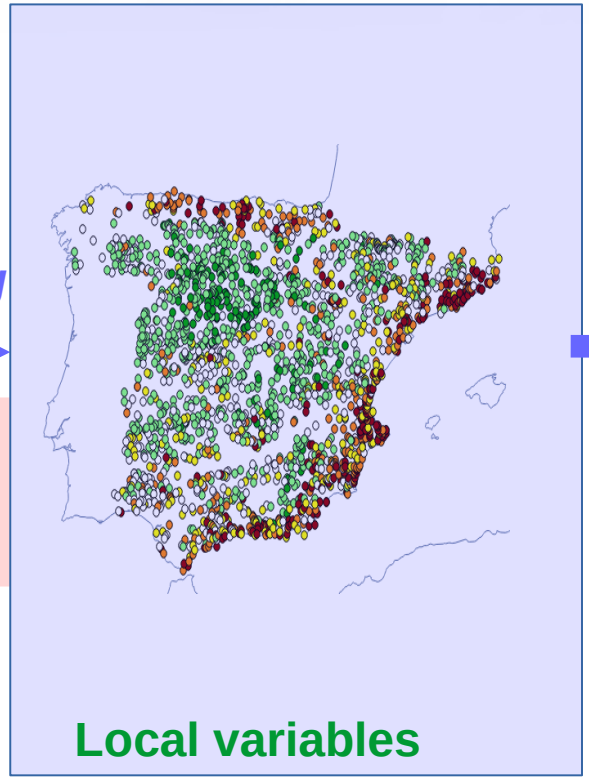
DATA



Climate model outputs

Statistical downscaling

- Analogue
- Regression

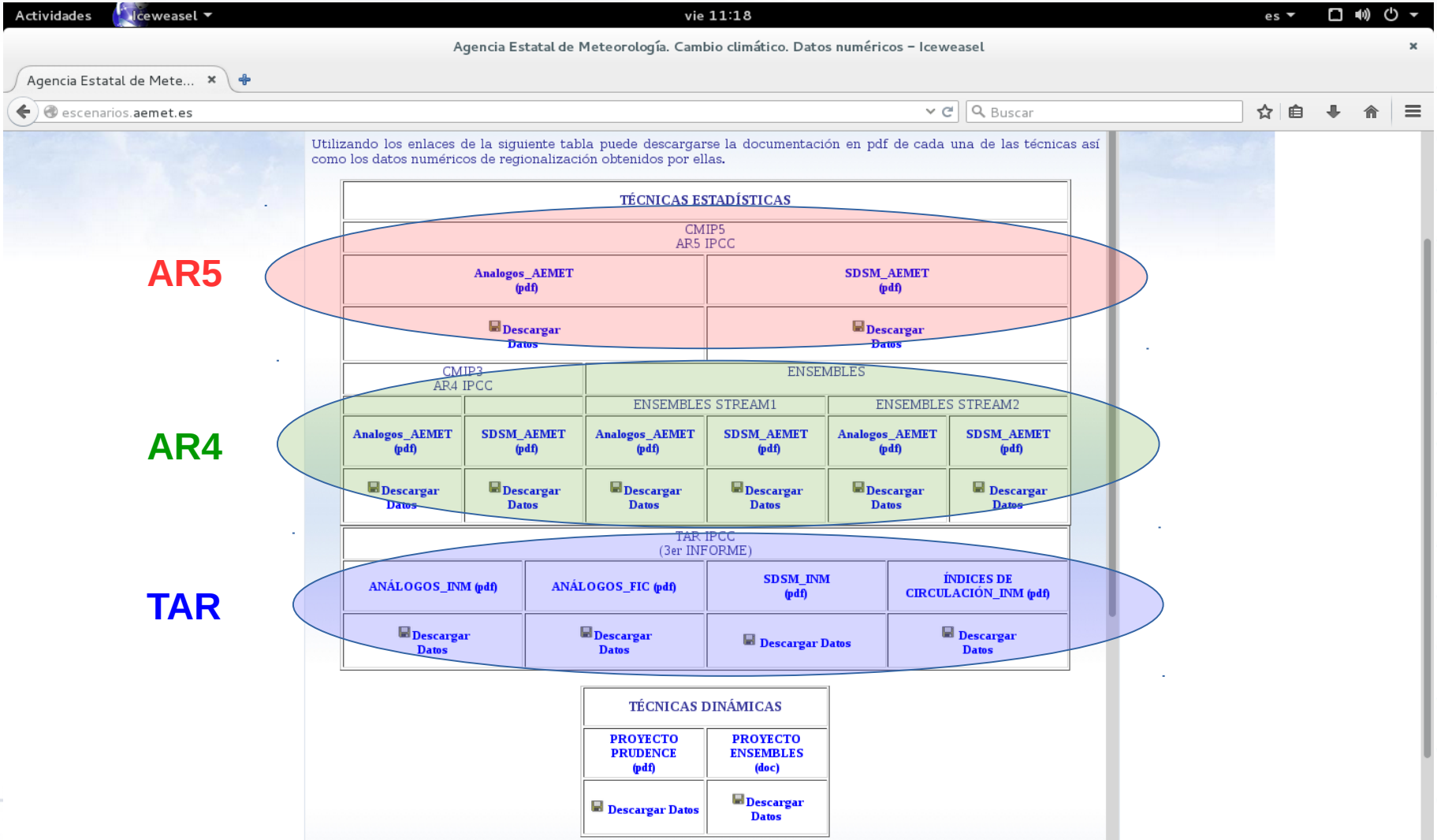


Local variables

EXTREMES

Source: Cap. 1. IPCC 2014

DATA


Actividades
Iceweasel
vie 11:18
es
Agencia Estatal de Meteorología. Cambio climático. Datos numéricos – Iceweasel
Agencia Estatal de Mete...
escenarios.aemet.es
Buscar
Utilizando los enlaces de la siguiente tabla puede descargarse la documentación en pdf de cada una de las técnicas así como los datos numéricos de regionalización obtenidos por ellas.
TÉCNICAS ESTADÍSTICAS
CMIP5
AR5 IPCC
Analogos_AEMET (pdf)
SDSM_AEMET (pdf)
Descargar Datos
Descargar Datos
AR5
CMIP3
AR4 IPCC
ENSEMBLES
ENSEMBLES STREAM1
ENSEMBLES STREAM2
Analogos_AEMET (pdf)
SDSM_AEMET (pdf)
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TAR IPCC
(3er INFORME)
ANÁLOGOS_INM (pdf)
ANÁLOGOS_FIC (pdf)
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PROYECTO ENSEMBLES (doc)
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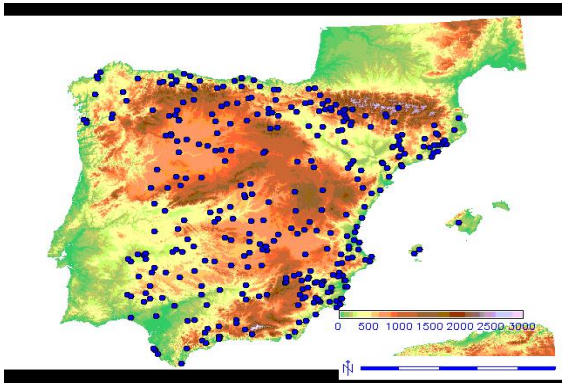
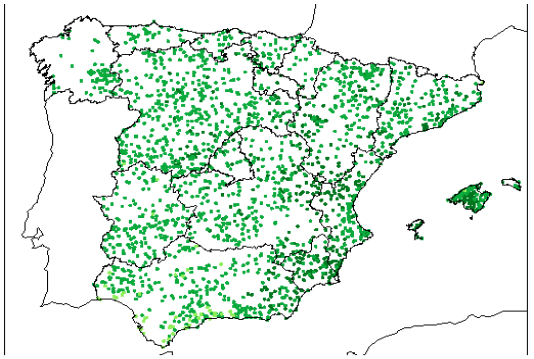
DATA

- Temperature and precipitation projected over the 21st century from climate models (24) under 3 RCP plus the historical.
- Number of projections: 78
- Number of data by station and variable: 365 * 95 * 78 + 365 * 40 =2 690 780.

Number of climate stations:

- **Temperature: 360**
- **Precipitation: 2092**





	Regression	Analogues	Total
RCP4.5	18	13	31
RCP6.0	7	7	14
RCP8.5	20	13	33
Total	**78**		

METHOD

- Extract the annual extremes from daily data (maximum and minimum temperature and 24 h accumulated precipitation)

- GEV (Generalized Extreme Value) distribution is fitted to a sample of annual extremes by the method of L-moments (Historical and RCP)

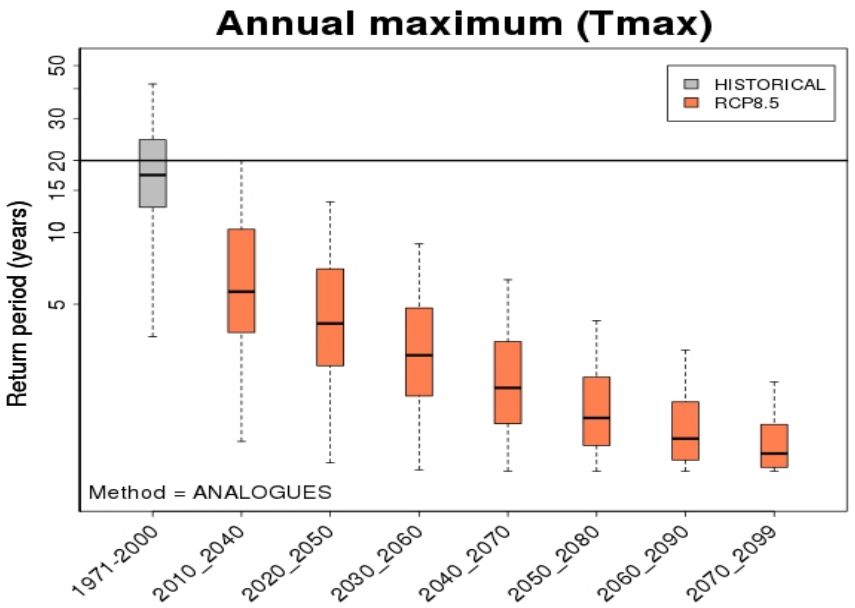
  - The 20-yr return value is obtained using quantiles method (Historical and RCP)

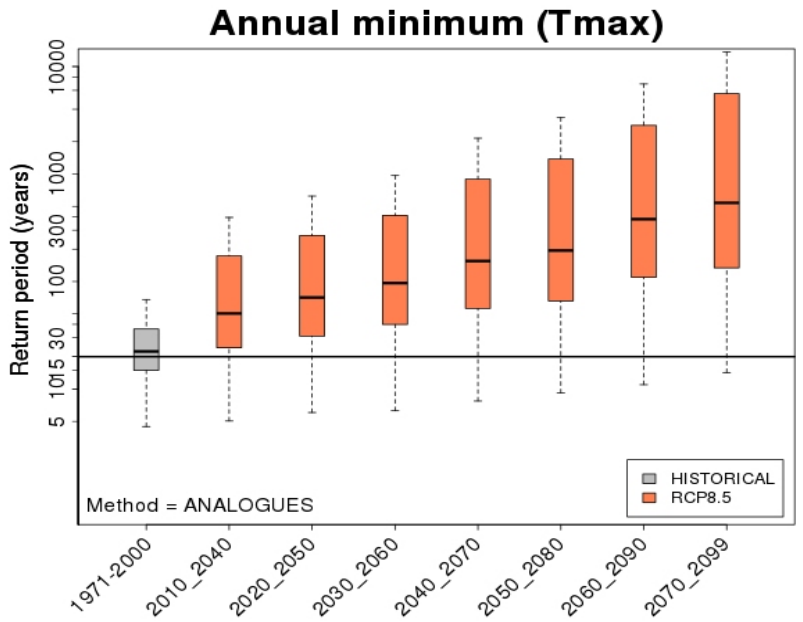
    → The return period for the 20-yr return value in the current climate is obtained from the fitted GEV distribution (RCP).

Tools:lmom library of R project code

RESULTS: MAXIMUM TEMPERATURE

Change in return periods





- Higher maximum temperatures will be more frequent in the future climate, decreasing its return period over the century in all climatological stations.
- Lower maximum temperatures will be less frequent.
- These is a consequence of a change of the probability distribution of the maximum daily temperatures toward higher values.

RESULTS: MAXIMUM TEMPERATURE

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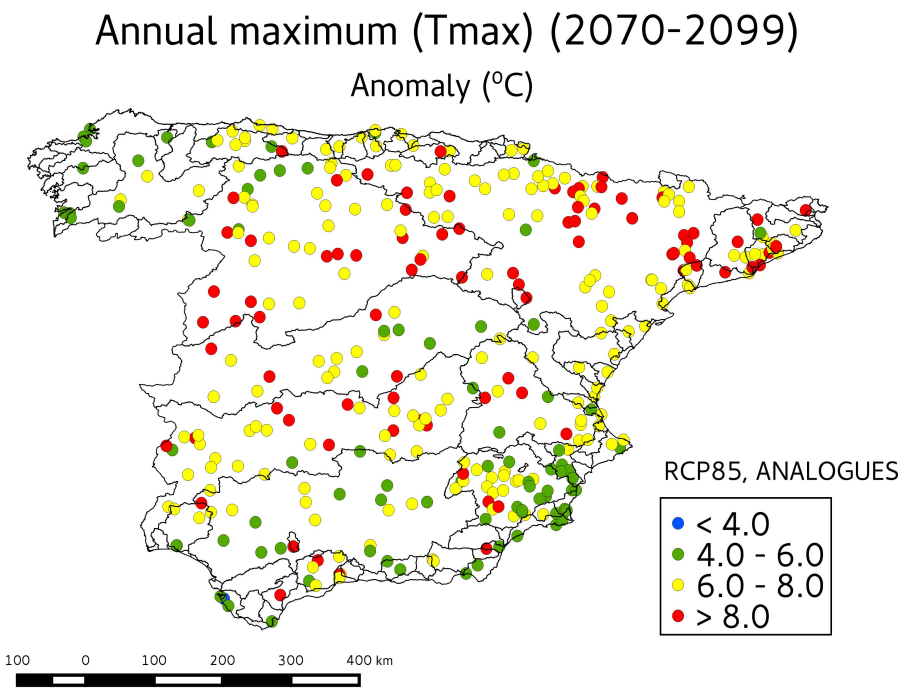
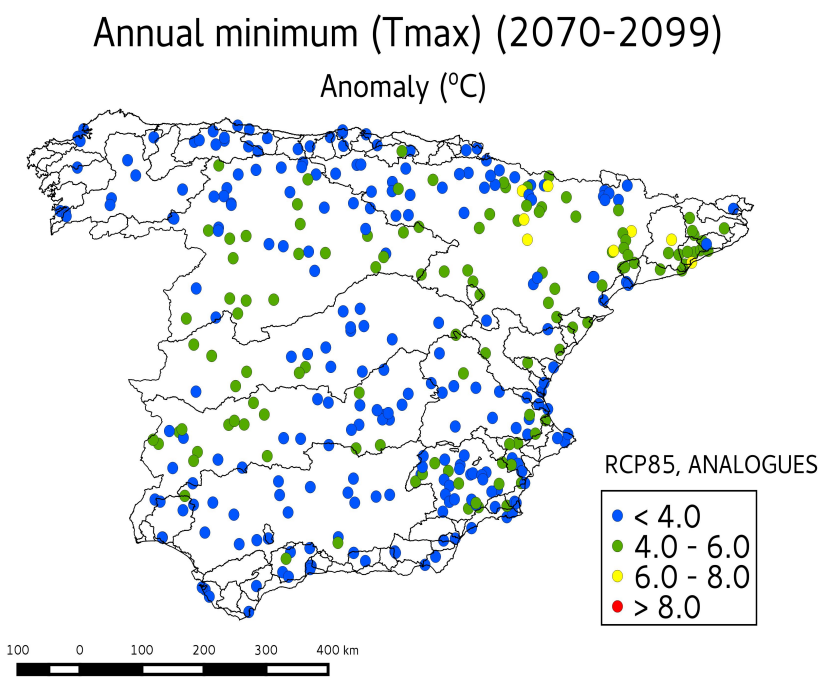
Change in 20-yr return values





The extreme values increase, specially higher values (6ºC - 8ºC), and also lower values (< 4ºC).

RESULTS: MINIMUM TEMPERATURE

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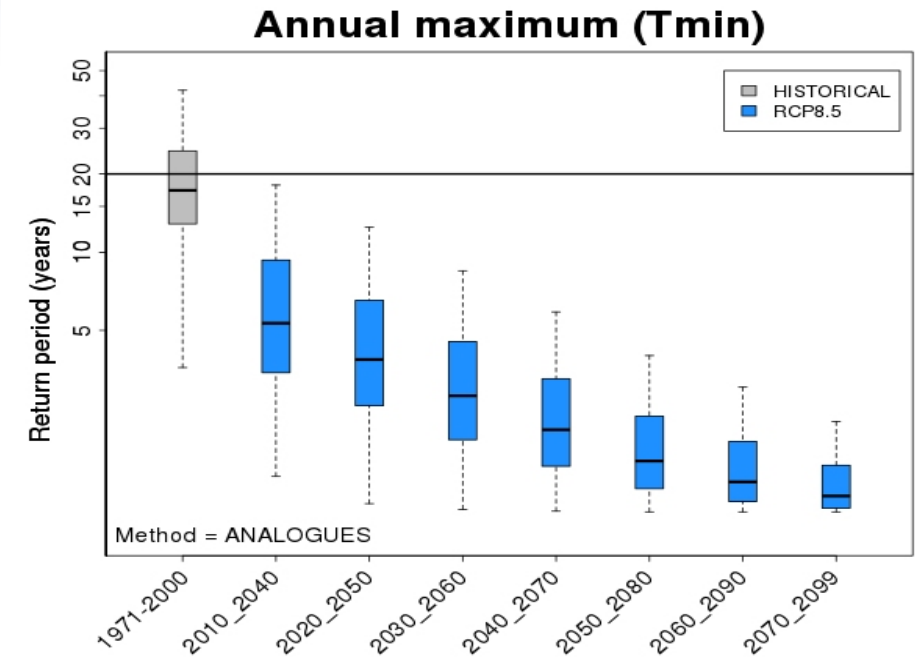
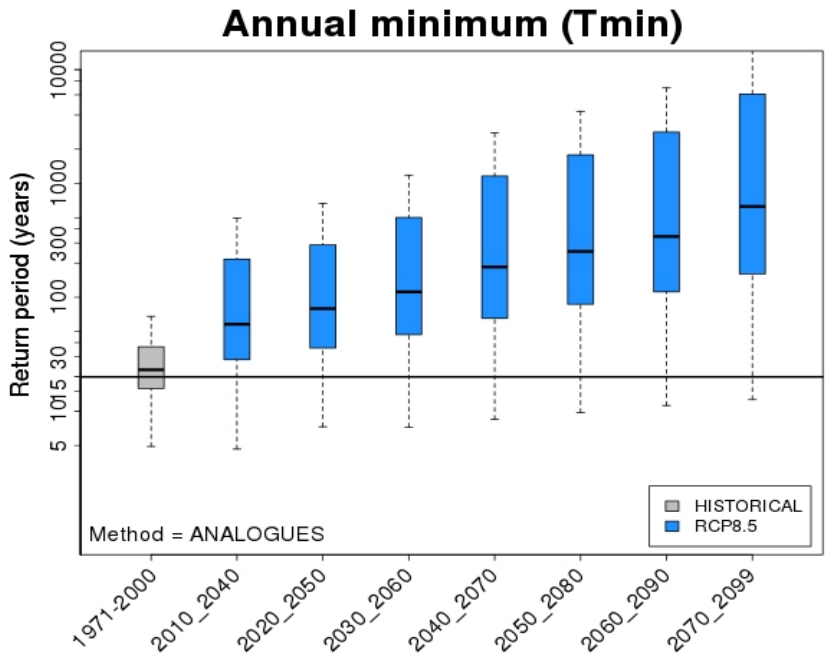
Change in return periods





- Higher minimum temperatures will be more frequent in the future climate, decreasing its return period over the century in all climatological stations.
- Lower minimum temperatures will be less frequent.
- These is a consequence of a change of the probability distribution of the minimum daily temperatures toward higher values.

RESULTS: MINIMUM TEMPERATURE

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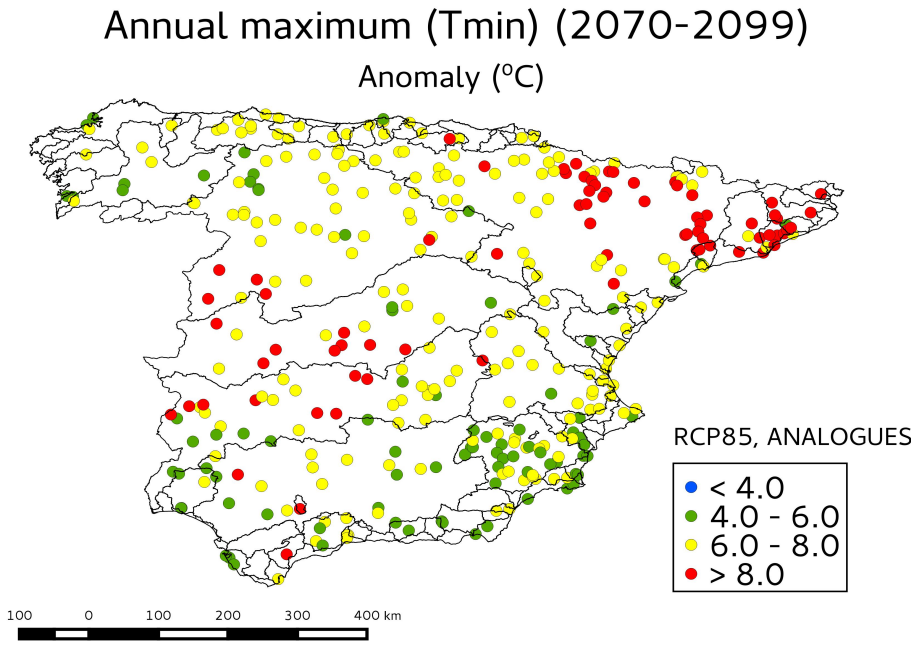
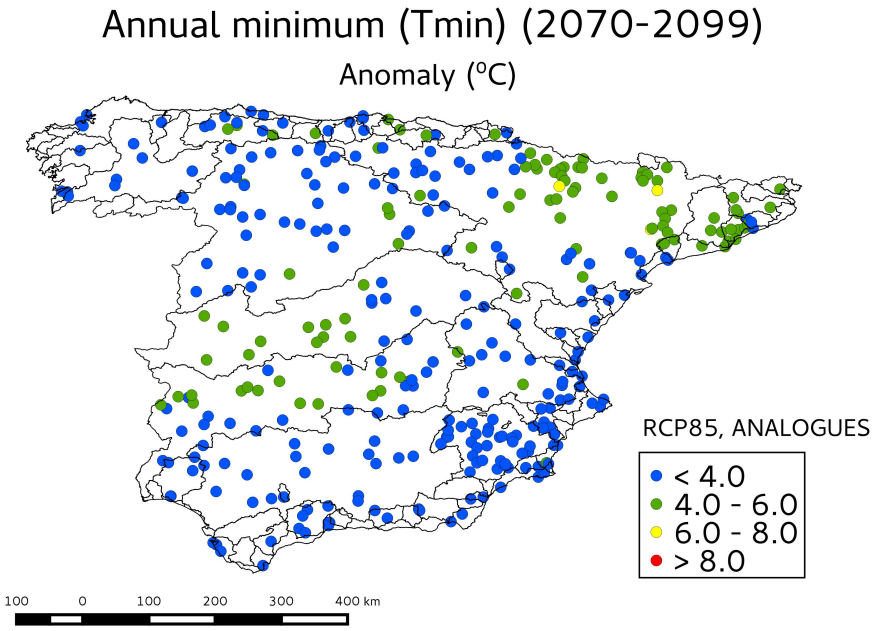
Change in 20-yr return values





- The extreme values increase, specially higher values (6ºC - 8ºC), and also lower values (< 4ºC).
- The maximum changes occur northeast area.

RESULTS: MAXIMUM PRECIPITATION

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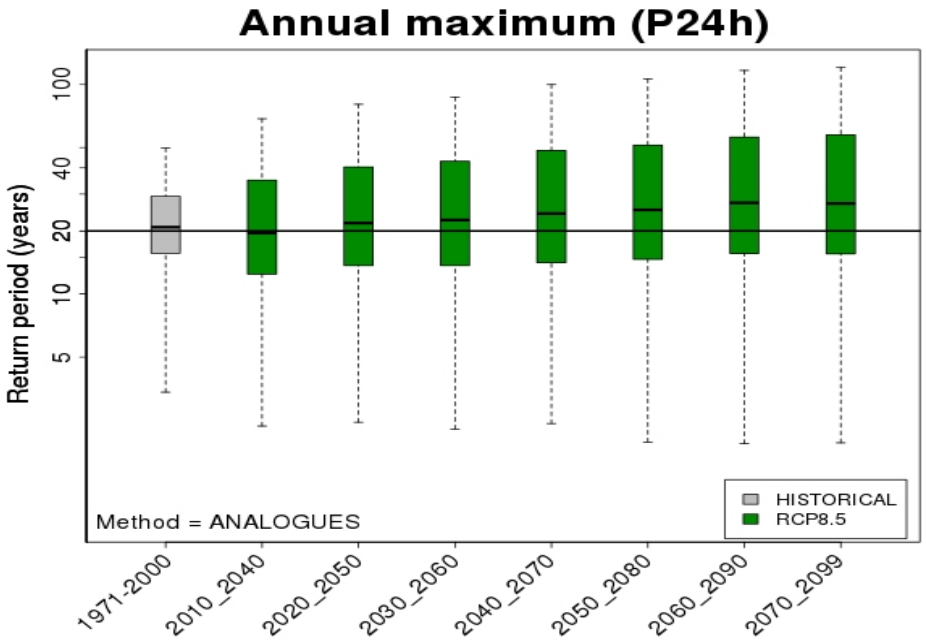
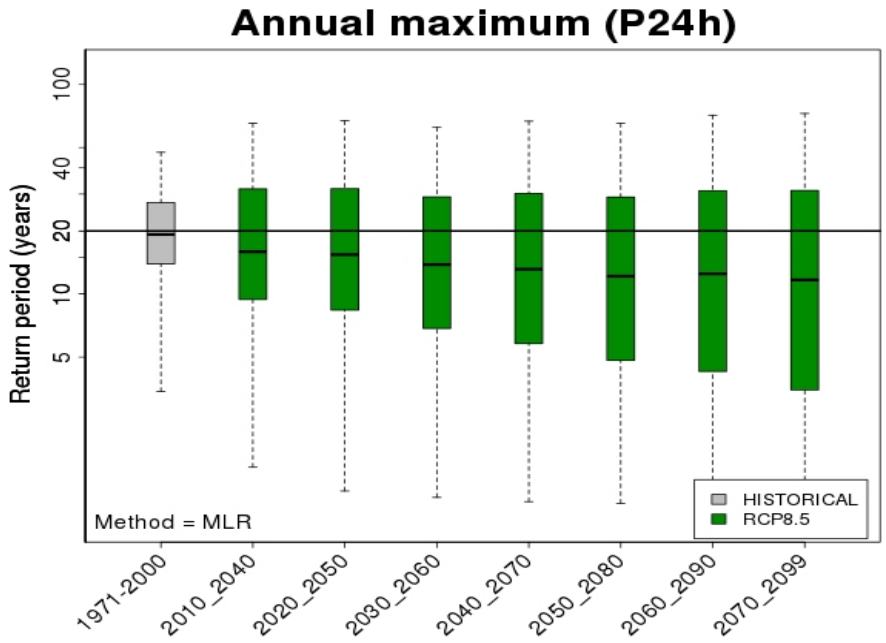
Change in return periods





- The behaviour of extreme precipitations depends on the downscaling method.
- There are not a clear tendency.

RESULTS: MAXIMUM PRECIPITATION

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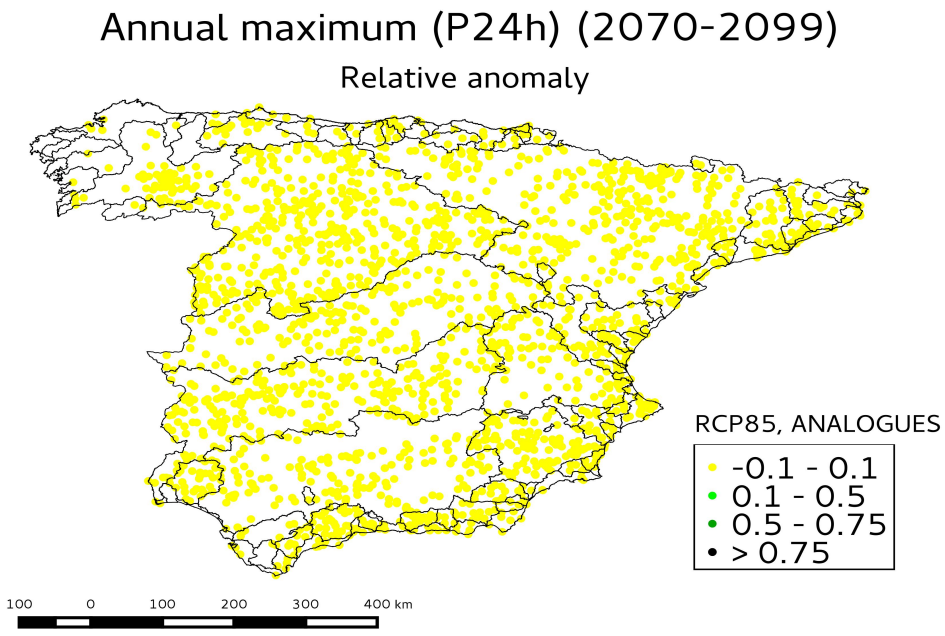
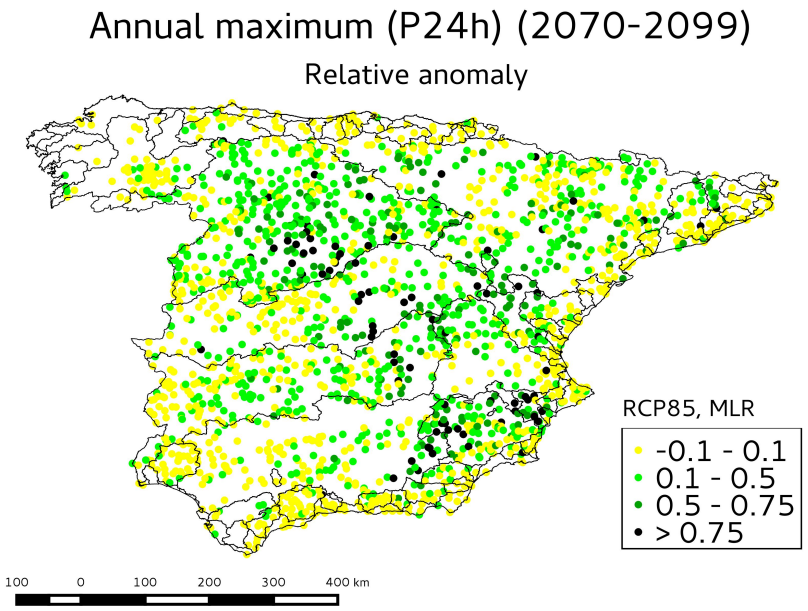
Change in 20-yr return values





- The change in extreme precipitation depends on the downscaling method.
- The analogues method doesn't predict changes.
- The MLR method displays a significant dispersion with higher values in the castilian plateau and the Segura basin.

CONCLUSIONS

- We have analyzed projected temperatures and precipitation for the 21st century.
- The frequency of highest values of maximum and minimum temperatures will increase over 21st century.
- On the contrary, the lowest values of maximum and minimum temperatures will be less frequent.
- Changes in the return values of maximum and minimum temperature are in agreement with the idea of a global warming, with a desplacement of the probability distributions toward higher values.
- For the precipitation, the dispersion in the projection is higher. The trend depends of the downscaling method.

THANK YOU FOR YOUR ATTENTION