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3RD INTERNATIONAL CONFERENCE ON
ECOHYDROLOGY, SOIL AND CLIMATE CHANGE, ECOHCC'14

# RECENT CLIMATE CHANGE TRENDS OF EXTREME PRECIPITATION IN THE IBERIAN PENINSULA

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OVERVIEW

# I. Climate changes and extreme precipitation

1. Climate changes
2. Recent extreme indices trends
3. Extreme precipitation

# II. Data and methods

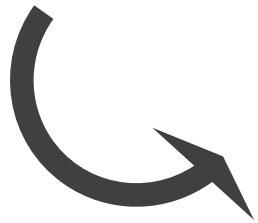
1. Data sets
2. Methods

# III. Results and Discussions

1. Precipitation Climatology
2. EObs vs WRF:
    1. Trends of Consecutive wet days (CWD),
    2. Trends of Consecutive dry days (CDD);
    3. Trends of Simple Daily Intensity Index (SDII);
    4. Trend of Prec90th (Percentile 90th)
3. WRF vs MPI

# IV. Conclusions

# Climate change



***may cause changes in the ...***

- Frequency of precipitation
- Occurrence probability of extreme weather and climate events
- Dry spells between precipitation events

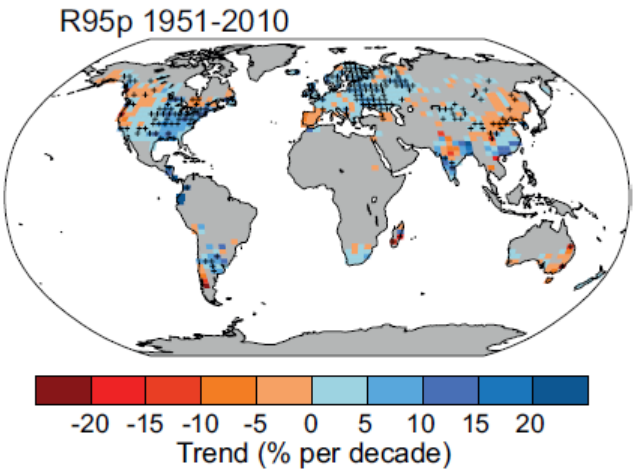
**EXTREME PRECIPITATION EVENTS**

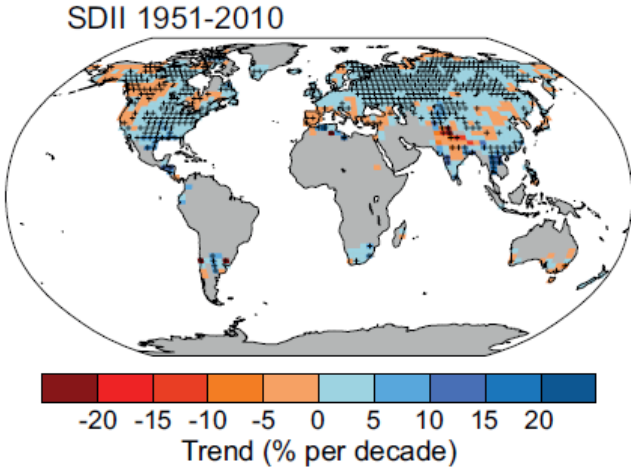
DIFFICULT TO PROVIDE A UNIVERSALLY VALID DEFINITION OF **"EXTREME PRECIPITATION"**

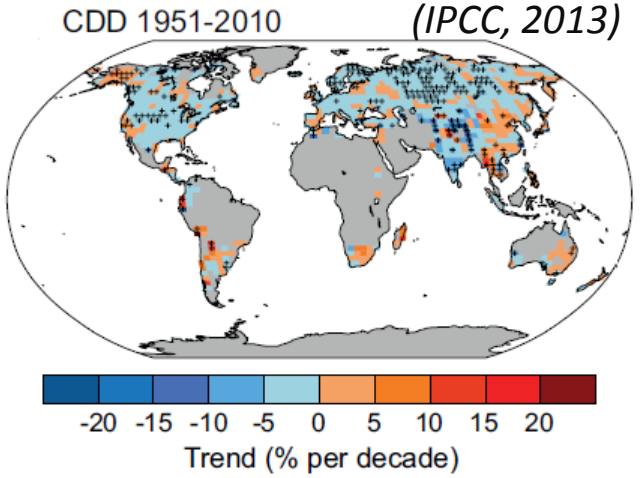
EXTREME PRECIPITATION INDICES (SDII, CWD, CDD, R95P, RX1DAY,...)

INDICATE CHANGES IN PRECIPITATION EXTREMES

## I. CLIMATE CHANGES AND EXTREME PRECIPITATION | Recent extreme indices trends




*(IPCC, 2013)*

As eg., **R95p** and **SDII** show that are more areas with significant **extreme precipitation** increases than decreases

**Droughts** had become more common, especially in the tropics and sub-tropics since about 1970

**Climate varies from region to region:**

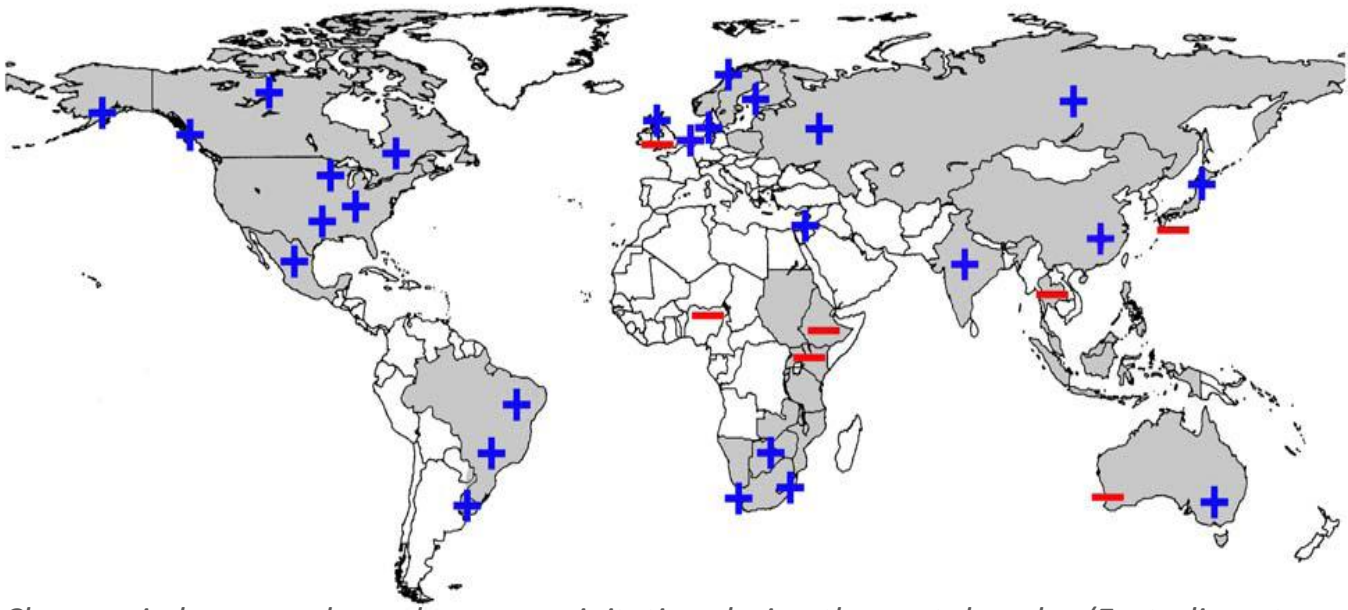
*- uneven distribution of solar heating;*

*- responses of the atmosphere;*

*- oceans and land surface and their interactions;*

*- physical regions characteristics.*





*Changes in heavy and very heavy precipitation during the past decades (Easterling et al. 2000c,updated).*

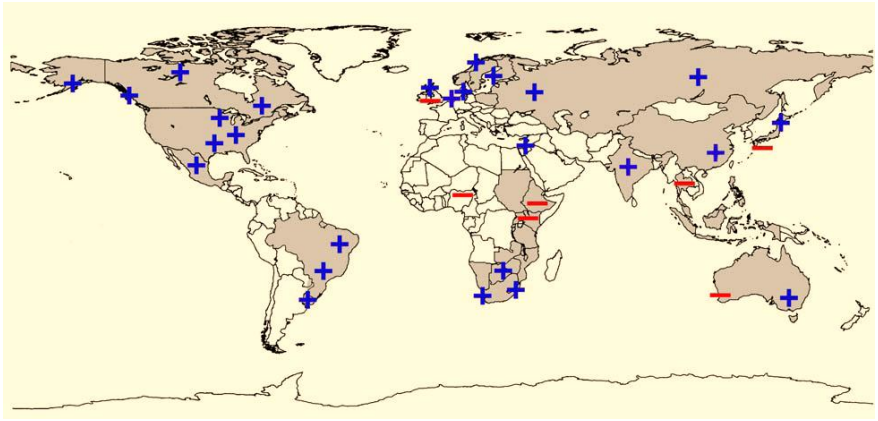
Extreme precipitation events have been the target of studies all over the world, to evaluate their eventual changes under the possible range of climate change scenarios with consequences on human society.

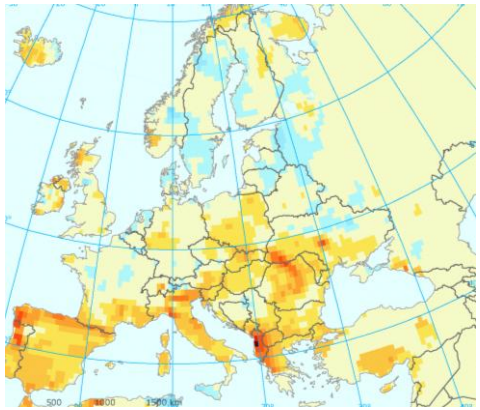
There is a growing need for a **more detailed knowledge of precipitation climate change**

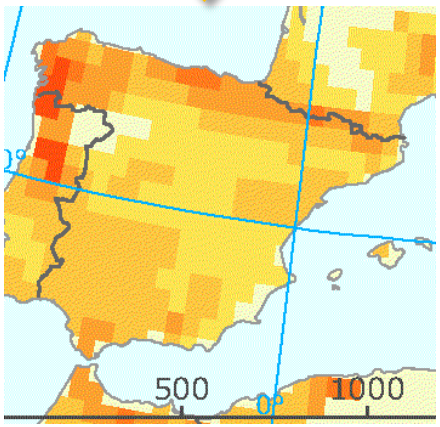
➡ OBJECTIVE



STUDY AREA



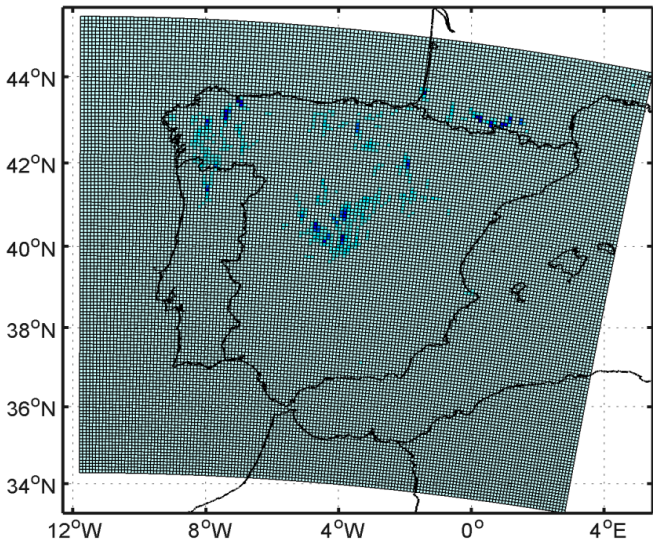





Global changes > Europe > Iberian Peninsula

Daily Precipitation
**1986 to 2005**



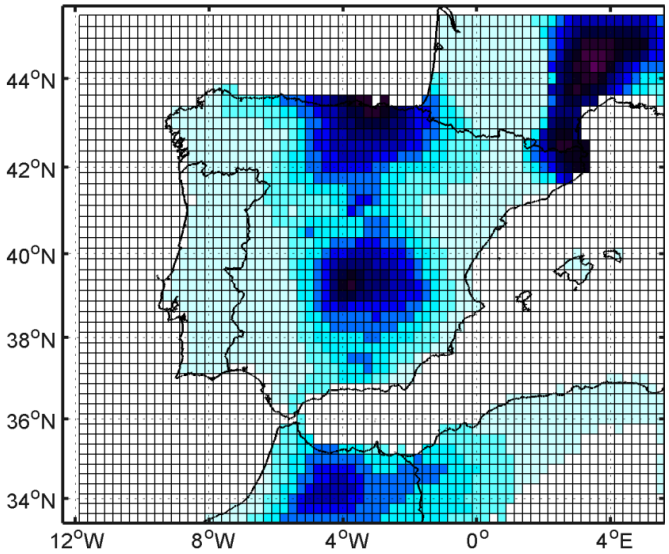



## MODEL WRF

Forced MPI-ESM-LR, (one of the best overall models in simulating the European climate);

## HORIZONTAL RESOLUTION

9 km (Rotated grid)




## OBSERVED DATA (EObs)

European Climate Assessment & Dataset;

## HORIZONTAL RESOLUTION

0.25° or 28 km (Regular grid)

## II. DATA AND METHODS | Methods

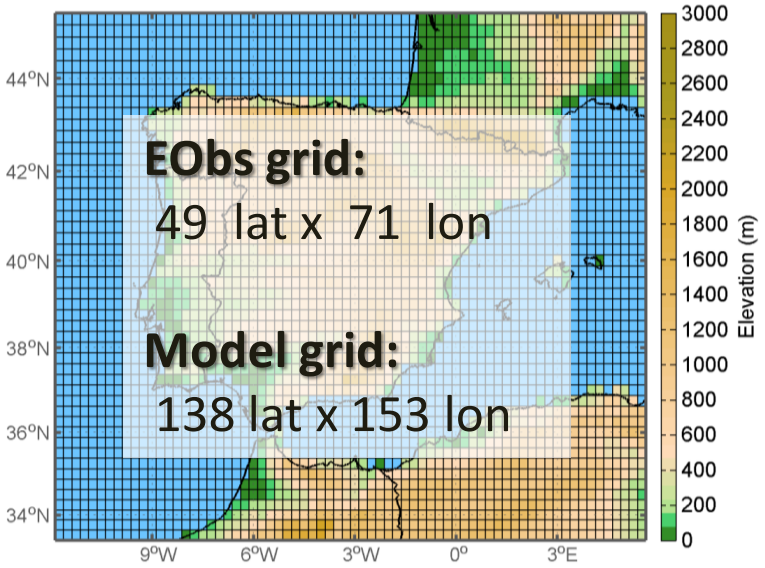
**1.** Annual and seasonal extreme precipitation indices recommended by the *Expert Team for Climate Change Detection Monitoring and Indices* (ETCCDMI);

| | |
|---|---|
| ***CDD*** | Consecutive dry days |
| ***CWD*** | Consecutive wet days |
| ***SDII*** | Simple daily intensity index |
| ***Prec90p*** | 90th percentile at wet days |

**2.** Trends of these indices by Theil-Sen Method (Theil, 1950 & Sen, 1968);

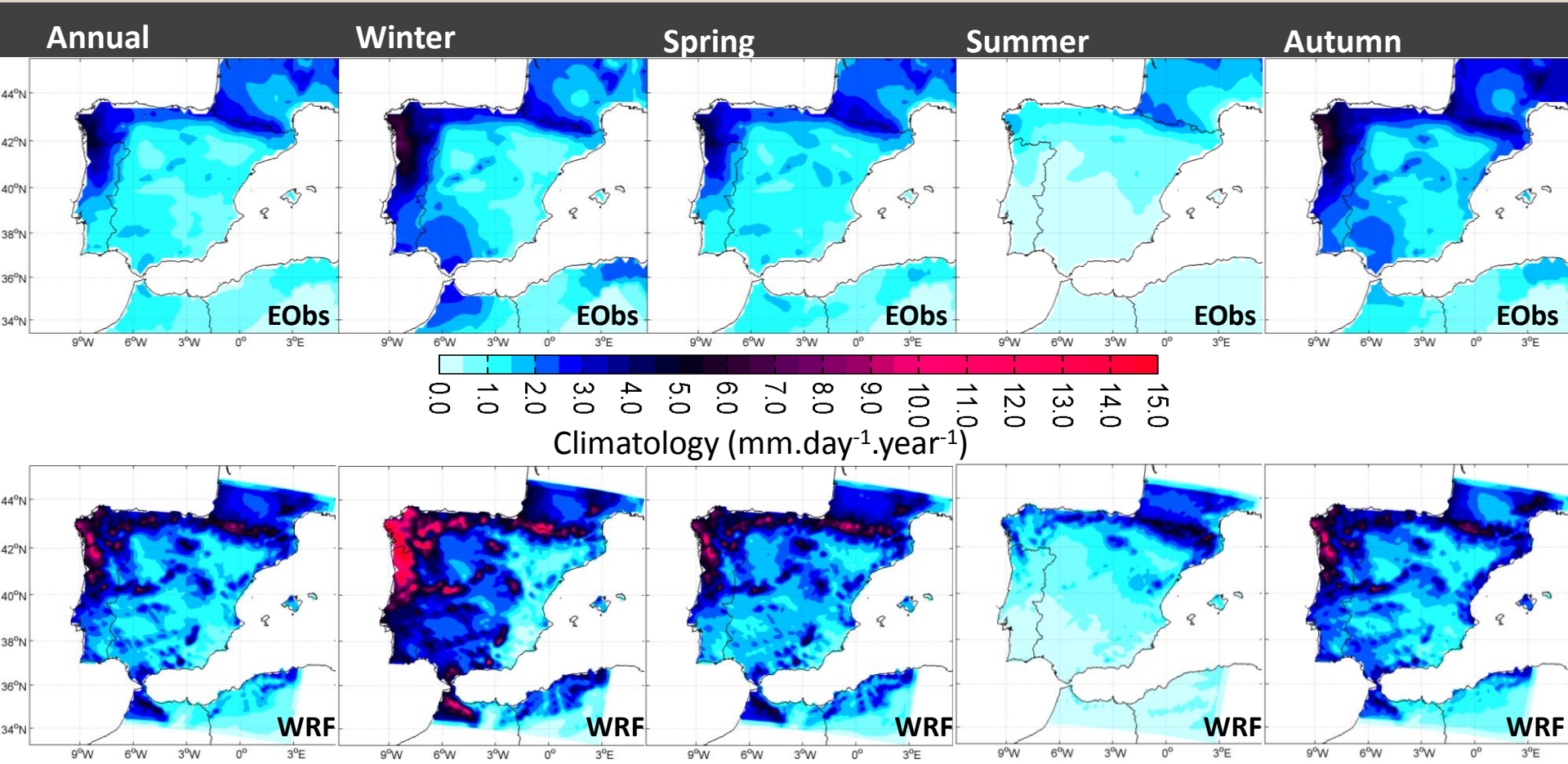
**3.** Mann-Kendall test (evaluates the statistical significance - Mann, 1945 & Kendall);

**4.** Trend and Mann-Kendall test applied to the extreme precipitation indices extracted from MPI



Precipitation Climatology
(1986-2005)

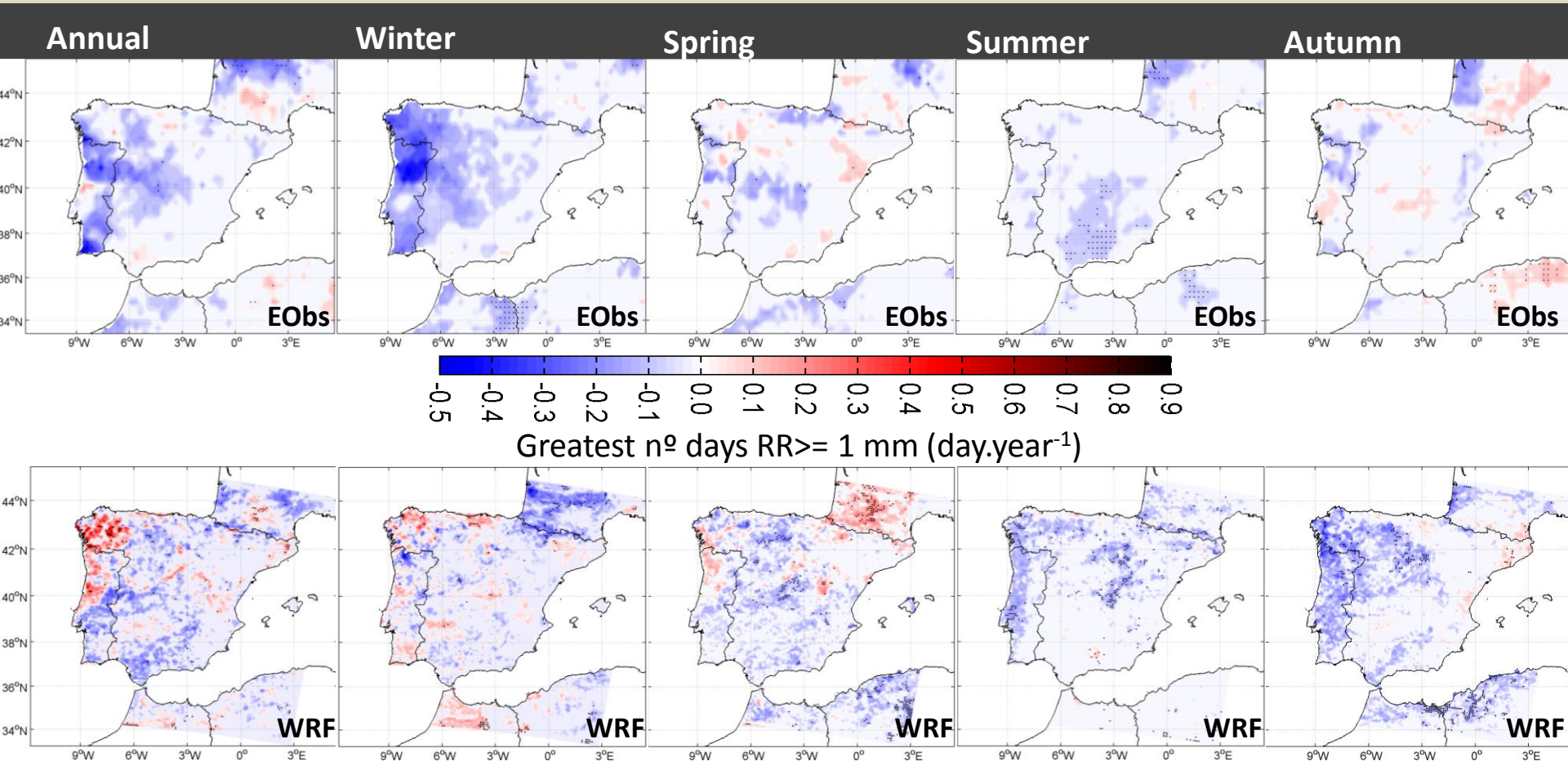
## III. RESULTS AND DISCUSSION | EObs vs WRF




Highest values: in the **winter** (WRF and observations) and over the **Northwest of Portugal**

Trend of:
Consecutive wet days (CWD)

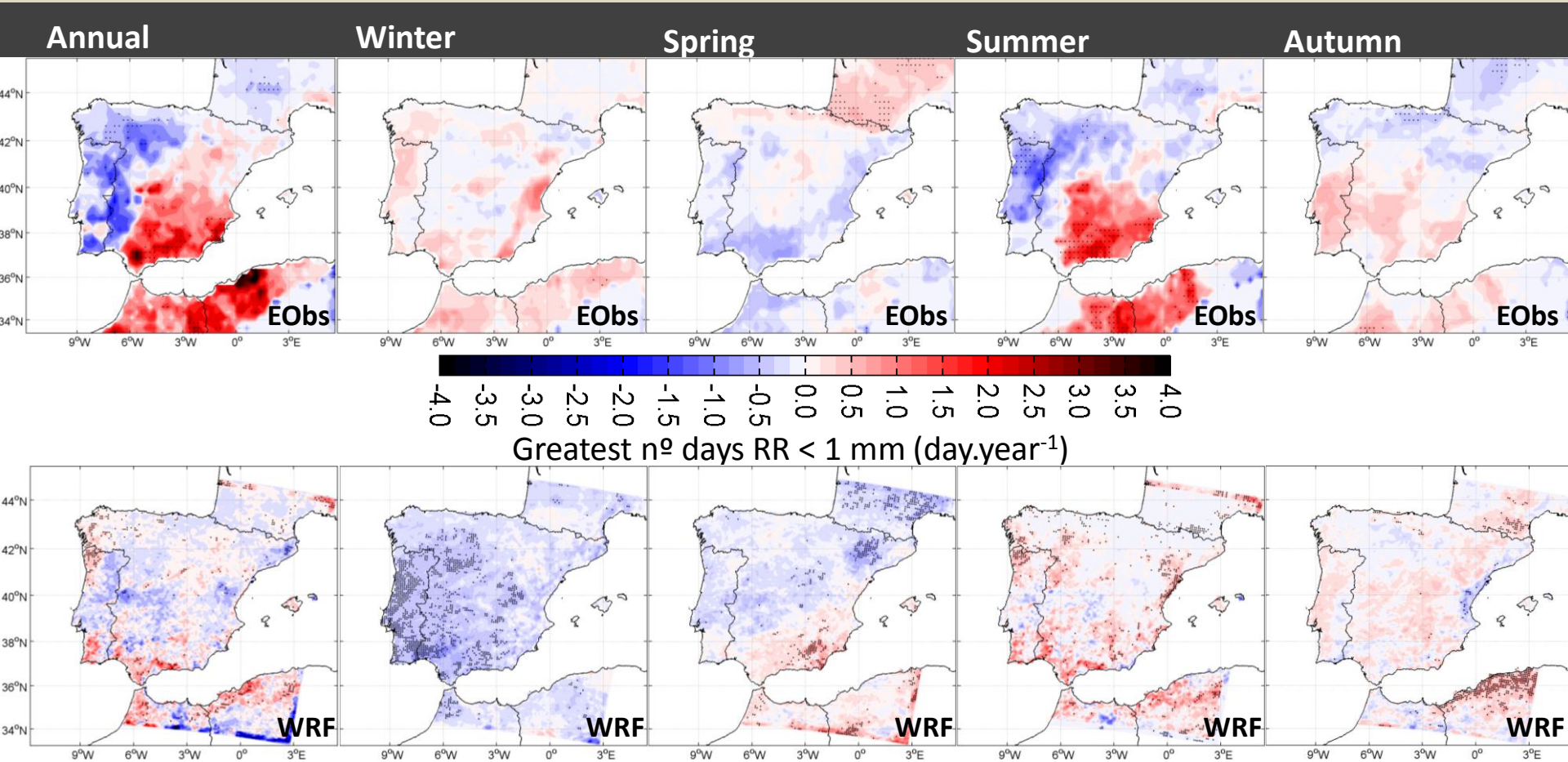
## III. RESULTS AND DISCUSSION | EObs vs WRF




In general, greatest consecutive wet days **decrease** during the analysed period.

Trend of:
Consecutive dry days (CDD)

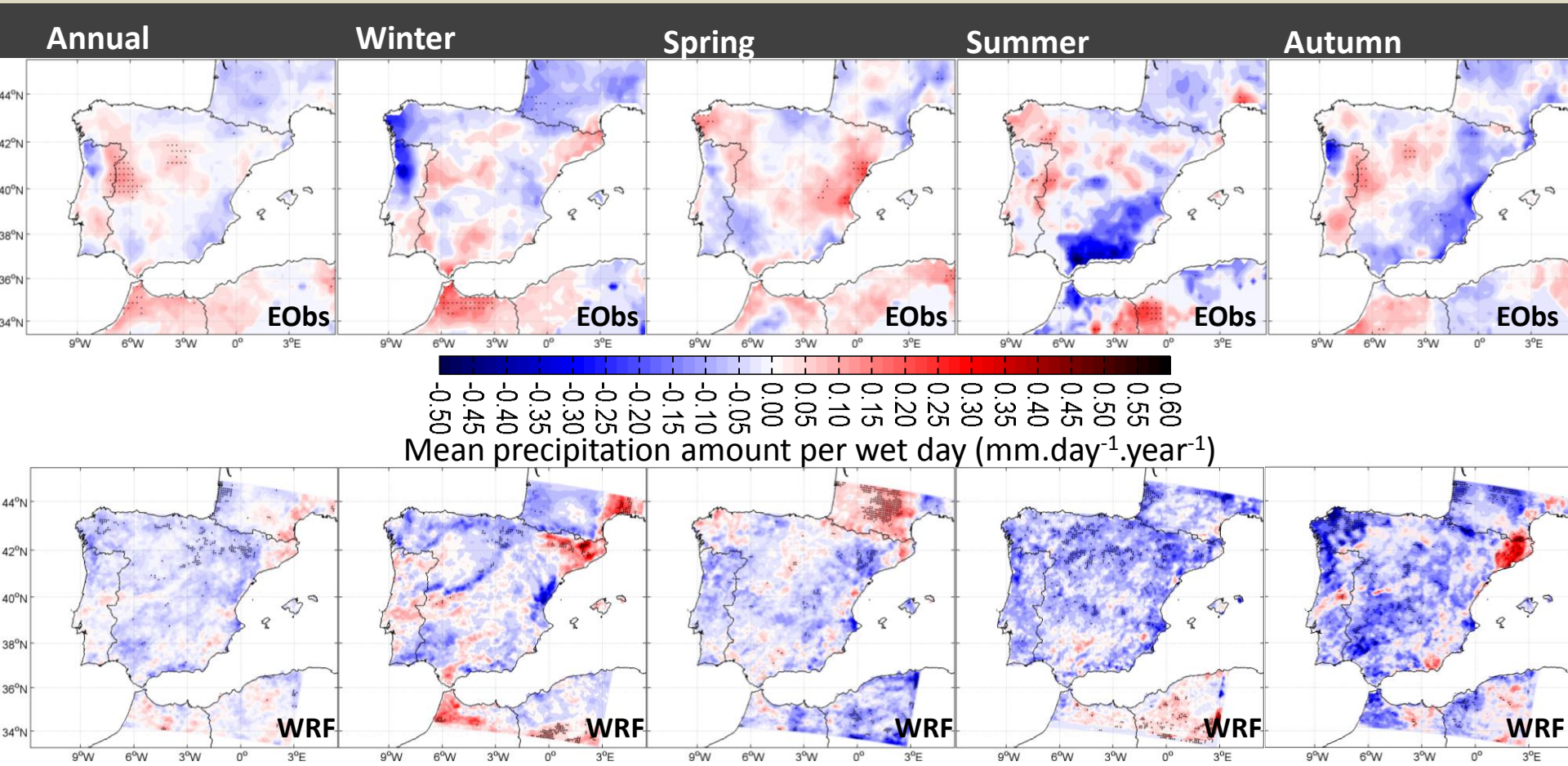
## III. RESULTS AND DISCUSSION | EObs vs WRF




Consecutive dry days **increase** especially in summer, in the Southeast of the IP, which is the season that contributes the most to the **positive** annual trend.

Trend of:
Simple daily intensity index (SDII)

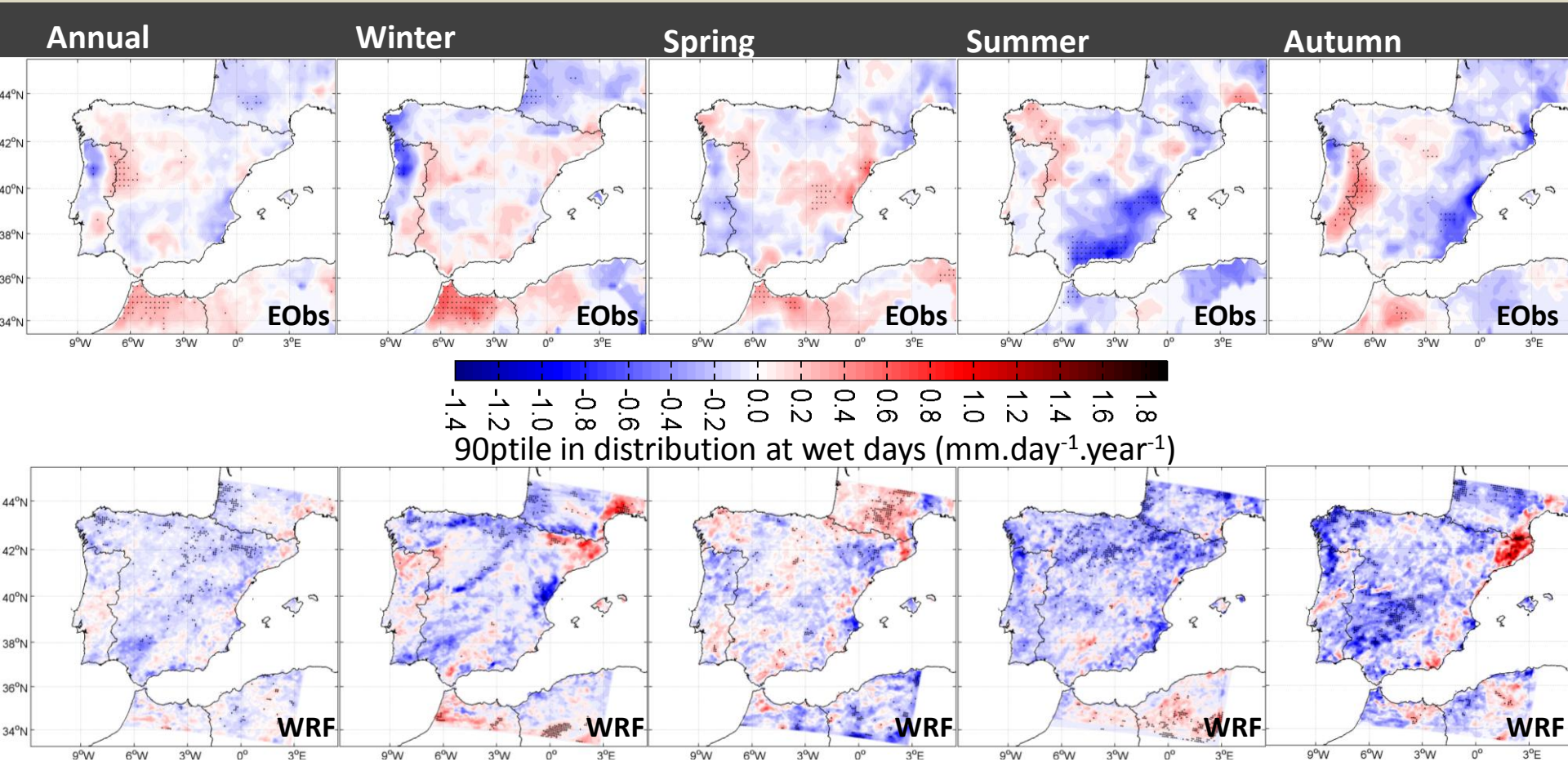
## III. RESULTS AND DISCUSSION | EObs vs WRF




In general, mean precipitation per wet days **decrease** in the northwest of the IP, in winter; and **increase** in the north of Africa and in the South of Pyrenees area.

Trend of:
Percentile 90th

## III. RESULTS AND DISCUSSION | EObs vs WRF



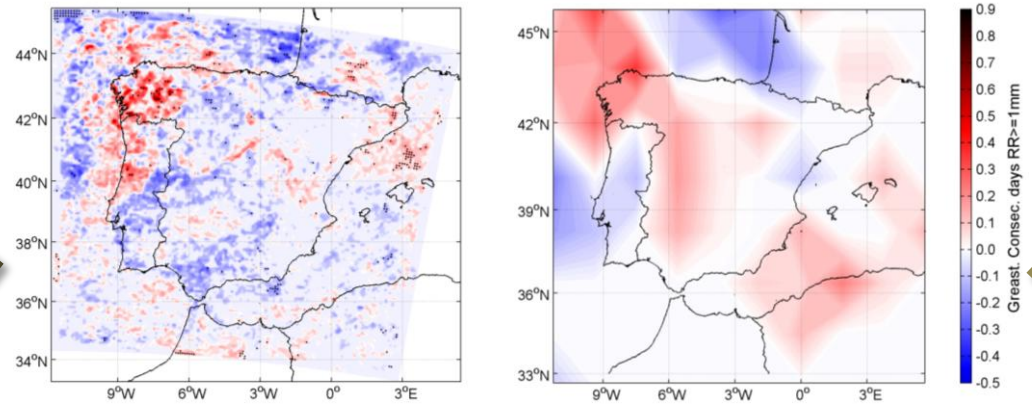

The **90th percentile** (includes the extreme events) are very **similar** with **SDII**: the intensity of precipitation has the same pattern of the extreme events.

There is a growing need for a **more detailed knowledge of precipitation climate change**

➡ OBJECTIVE



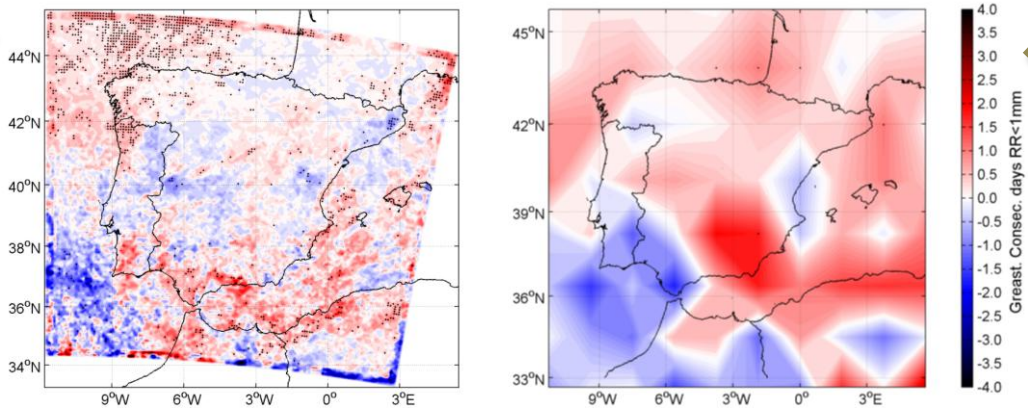
**Annual Trend of Consecutive dry days (CDD)**




**Model WRF**

**Forced Model MPI**
(horizontal resolution 1.9º)

**Annual Trend of Consecutive wet days (CWD)**



## IV. CONCLUSION

There is more precipitation in the north and west of the IP in annual and seasonal **climatologies**.

Throughout the years under analysis, there is a negative trend of **number of wet days (CWD)** during the winter.

There is an increase of **consecutive dry days (CDD)** especially in summer, in the South and Southeast of the IP.

The intensity of the wet days (SDII) and extreme wet days (90th percentile) **decrease** in the northwest of the IP;

The precipitation shows a high variability over time and space. The best resolution of the model, when compared with the resolution of the EObs, can detail some regions that isn't possible to show in the EObs. In the winter we have a larger number of samples.

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