

TEMPERATURE AND PRECIPITATION EXTREMES OVER SPAIN FOR THE 21st CENTURY

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1.- INTRODUCTION

Extreme events are responsible for a large part of climate related damage and of great concern to the impact community and stakeholders. Therefore, the knowledge about frequency and severity of climate extreme events are essential for the adaptation to climate variability and change in many sectors sensitive to climate conditions.

We have explored some precipitation and temperature relative extreme indices for 21st century over Spain, a country already vulnerable to climate variability, and its uncertainties.

2.- DATA AND METHOD

We have used a dataset of downscaled climate projection from the ENSEMBLE project to explore trends of temperature and precipitation extremes over Spain for 21st century. These projections with 25 km resolution have been generated for the A1B scenario by different climate regional models using several global models (van der Linden and J.F.B., 2009).

The original data have been interpolated to a common grid using a modified nearest neighbours method (Brunet *et al.* 2008) before calculate extreme indices.

3.- RESULTS

TEMPERATURE

Index definitions:

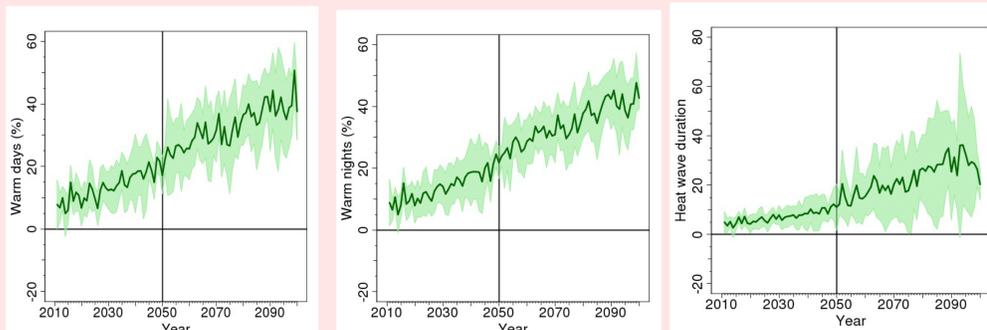
- **Warm days (TX90):** Percent of time $T_{max} > 1961/90$ 90 th percentile of daily maximum temperature.
- **Warm nights (TN90):** Percent of time $T_{min} > 1961/90$ 90 th percentile of daily minimum temperature.
- **Heat wave duration (HWF):** Maximum period > 5 day consecutive days with $T_{max} > 1961/90$ 90 th percentile of daily maximum temperature.

TX90

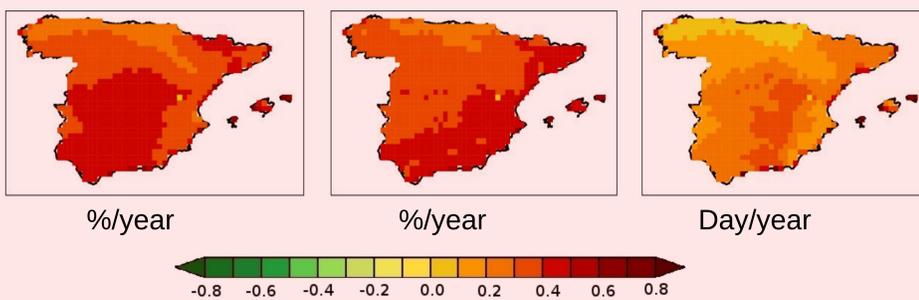
TN90

HWF

Annual time series anomalies relative to 1961-1990 mean values



Ensemble trends for 2011-2098 period



PRECIPITATION

Index definitions:

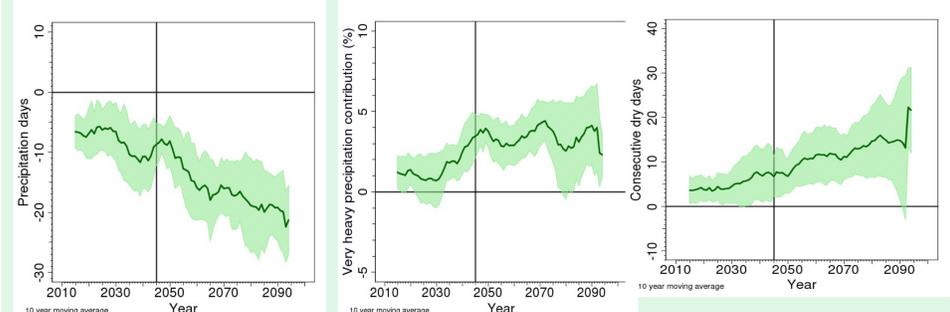
- **Precipitation days (R1):** Number of day with precipitation > 1 mm.
- **Consecutive dry days (CDD):** Maximum number of consecutive days with precipitation < 1 mm.
- **Very heavy precipitation contribution (R95T):** Fraction of annual precipitation due to events exceeding the 1961/1990 95th percentile.

R1

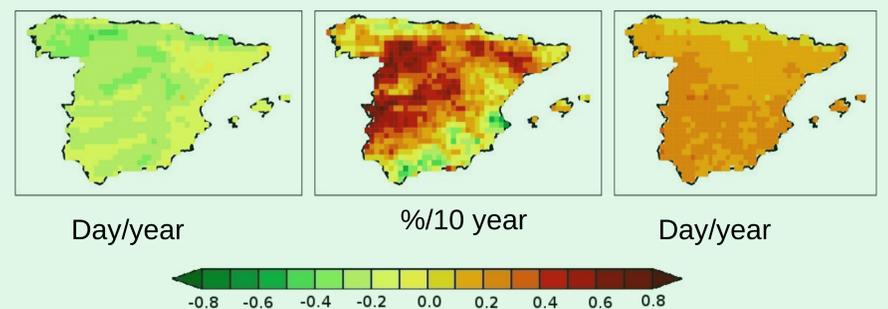
R95T

CDD

Annual time series anomalies relative to 1961-1990 mean values



Ensemble trends for 2011-2098 period



5. RESUMEN Y CONCLUSIONES

- We have used dataset from ENSEMBLE project to explore trends in six standard extreme index, three related to temperature and three related to precipitation, over Spain for the 21st century.
- Over the 21st century, all analyzed models show a positive trend in the three temperature-related extreme indices over Spain. However, the trend magnitude differs between models and geographically. The difference between models is bigger in heat wave duration than in other two index. Therefore, the uncertainty about the increase of the annual maximum length is great.
- In general, the rise in the number of warm days and the maximum length of warm spell is bigger in the central and southern Spain and smaller along the Cantabrian coast. The maximum trend in the warm nights is located along the mediterranean area.
- With respect to precipitation, we can detect a trend to decrease the number of precipitation days, specially in largely western Spain.
- For the change of consecutive dry days and very heavy precipitation contribution, the consistency between models is smaller. It's likely that dry spells will be slightly longer in the south half of Spain but an increase of the very heavy precipitation contribution is not significative.

6. REFERENCIAS

- van der Linden P. and J. F.B. Mitchell (eds) (2009). ENSEMBLE: Climate Change and its Impacts: Summary of research and results from ENSEMBLE project. Met Office Hadley Centre, FitzRoy Road, Exeter EX1 3PB, UK. 160 pp.
- Brunet, M. et al. (2008). Generación de escenarios regionalizados de cambio climático para España. Ministerio de Medio Ambiente Medio Rural y Marino. ISBN: 978-84-8320-470-2.