



CL3.07/AS4.27

COLD AND HEAT WAVES IN THE NEAR FUTURE IN RELATION WITH ELECTRICITY DEMAND

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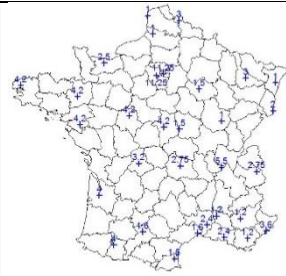
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Introduction

Because of a large share of electrical heating, electricity demand in France is highly dependent on temperature in winter. Such a dependency emerges now in summer too along with a growing cooling demand. Therefore, some insight about the possible evolution in the frequency, duration and intensity of cold and heat waves in the near future is of some interest for long term planning.

Thermal indicator and cold / heat waves



T_{32} = weighted average of the temperature observed in 32 locations

In this study:

- Daily mean temperature
- Cold wave: $T_{32} \leq 0^\circ\text{C}$
- Heat wave: $T_{32} \geq 23^\circ\text{C}$

Heat and cold waves:

Frequency: number of events

Duration: number of days

Intensity: summation over wave length of the differences to the threshold

Datasets

Observations: Météo-France stations, 1980-2009

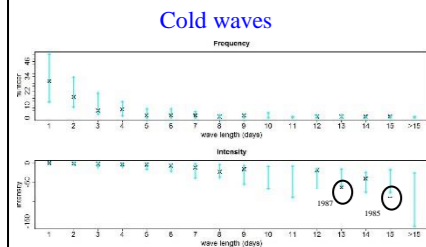
Climate models: 23 CMIP5 models, 1 simulation, RCP8.5 + 1 model, 10 simulations, RCP8.5

Validation

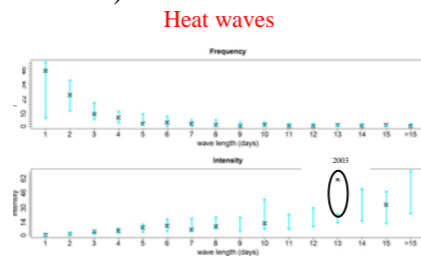
Climate models: no bias adjustment

threshold adapted to tackle model biases: similar percentile of the temperature distribution as 0°C or 23°C for the observations (respectively 2.1% and 97.8%)

good reproduction of observed events, except for the most intense ones (2003 heat wave or 1985 and 1987 cold waves)

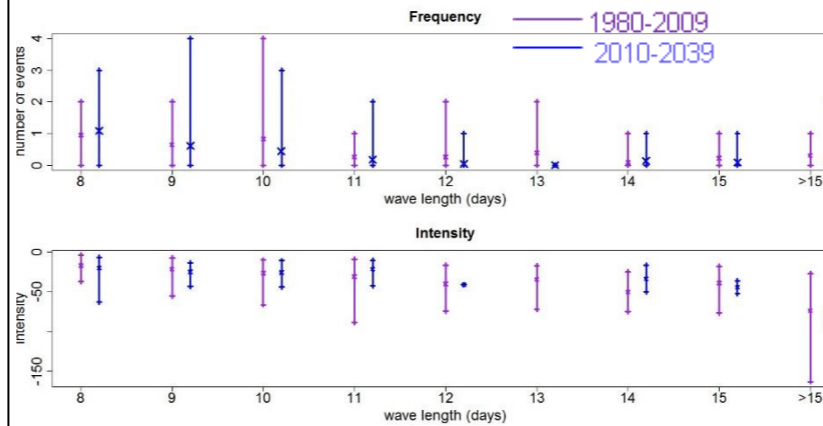


x observation
— GCMs



Future period 2010-2039

Cold waves: zoom on the longest events

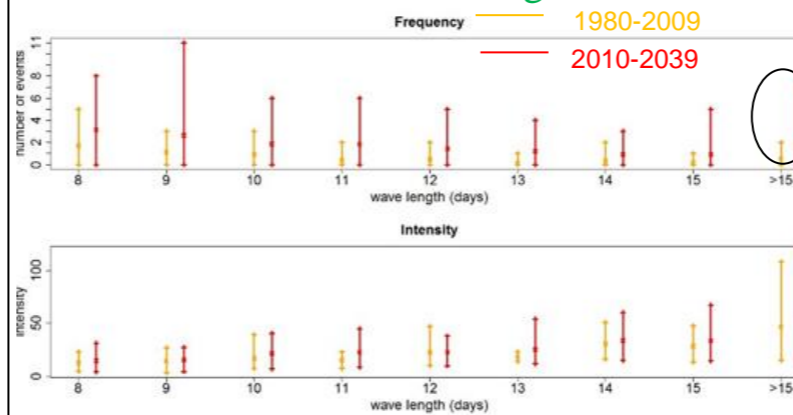


⇒ Less frequent but as severe events still possible

Examples of GCM results

GCM	1980-2009			2010-2039		
	Number	Mean duration (days)	Maximum duration (days)	Number	Mean duration (days)	Maximum duration (days)
CSIRO-BOM/ACC ESS1-0	74	3.1	10	61	3.9	30
MRI/MRI-CGCM3	103	2.2	30	79	2.5	10
Ensemble mean	78.2	2.9	14.4	47.4	2.8	10.7

Heat waves: zoom on the longest events



⇒ Significantly more frequent but similar intensity

Examples of GCM results

GCM	1980-2009			2010-2039		
	Number	Mean duration (days)	Maximum duration (days)	Number	Mean duration (days)	Maximum duration (days)
CSIRO-BOM/ACC ESS1-0	78	3.8	30	145	4.6	33
ICHEC/EC-EARTH	84	2.3	11	104	2.8	18
Ensemble mean	82.6	3.1	16	144.3	3.8	23.1