What is the I4C indicator data and how do we access it?

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IMPETUS **4**CHANGE

Hazard Indices

- Worked with demonstrators from start of project to develop list of hazard indices

- 19 general indices and 4 demonstrator-specific indices

- All calculated indices will be available through an online toolkit

- Details of indices given in a report to the EU (delivered in June 2023)

Generl Hazard Indices		
Number of tropical nights	Cooling degree days	Consecutive wet days
Number of equatorial nights	Heating degree days	Return value of daily precipitation
Number of summer days	Standardised Precipitation Index 6 months	Maximum one day precipitation
Heat wave annual	Number of dry days	Days with precipitation above threshold
Heat event annual	Decadal drought frequency	Monthly maxima of hourly precipitation
Excess Heat Factor (EHF)	Fire weather index	Hours with precipitation above threshold
NOAA Heat index (HI)		

Calculating Indices

1. EURO-CORDEX

2. Existing convection permitting climate model (CPCM) simulations

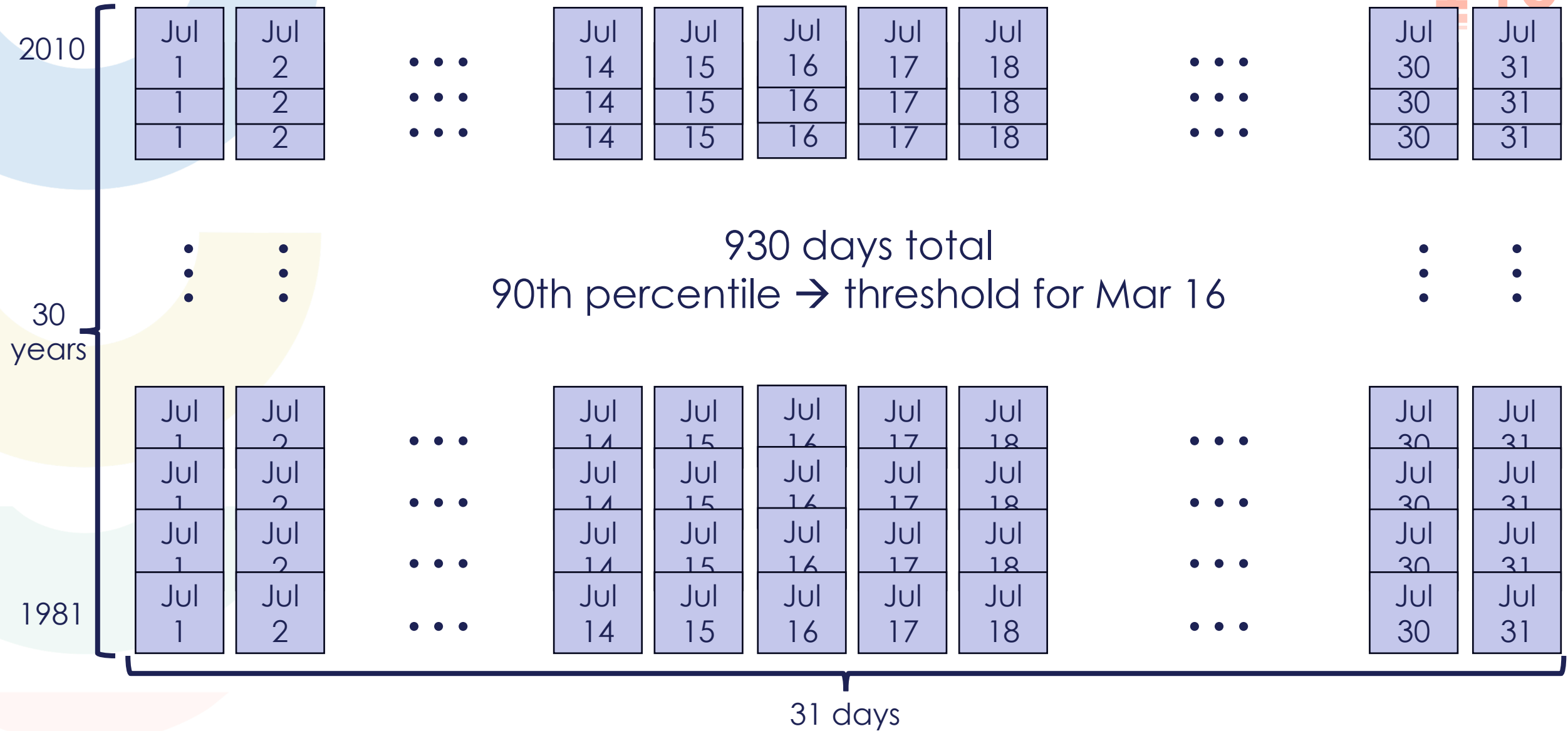3. Calculate from simulations and emulations developed and run in I4C

- 0.11° (~11 km) horizontal resolution

- 67 simulations
    8 GCMs
    15 RCMs

- 412 by 424 grid points
  (Some variation in different models)

- Indices as timeseries of 1980-2100 and for Global Warming Levels (GWLs)
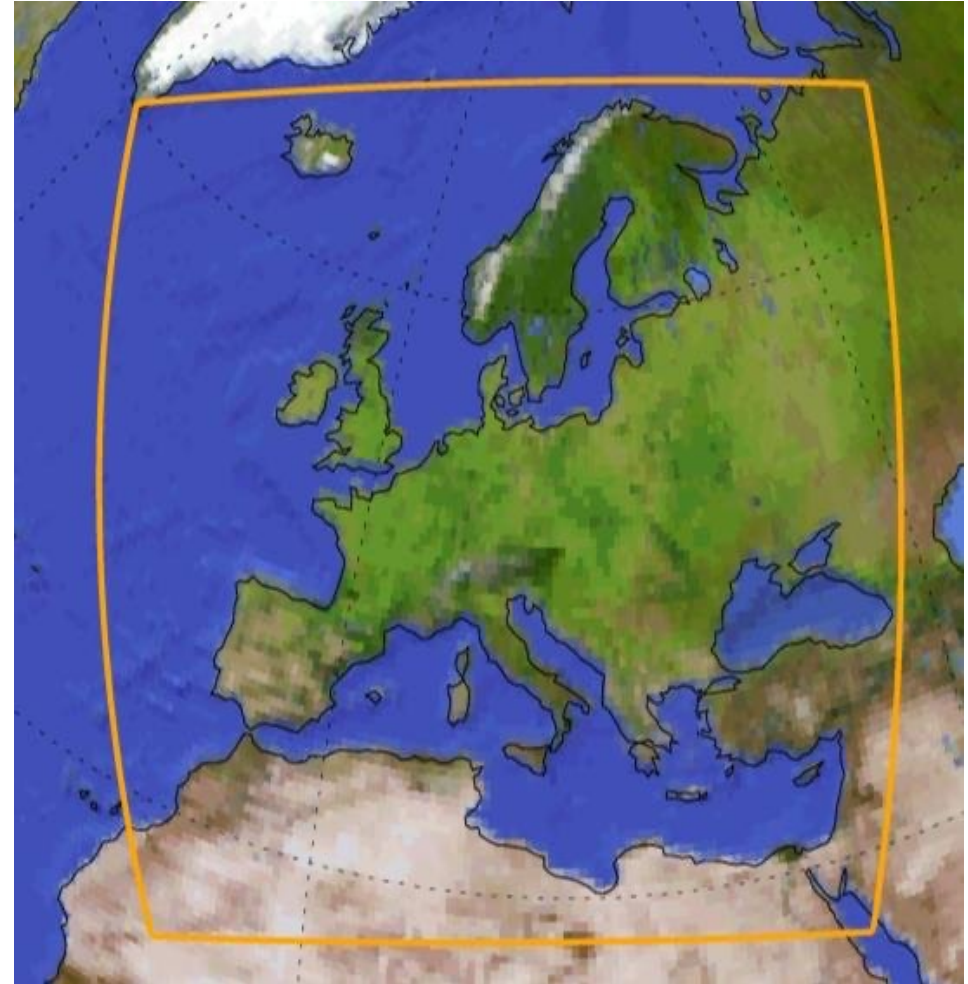
Heat Wave Annual (HW_Annual)

Definition:

Heat wave as three or more consecutive days with maximum daily temperature above the daily threshold, which is defined as the 90th percentile of maximum daily temperature over ± 15 days for the reference period 1981-2010

2010

30 years

1981

Jul 1 | Jul 2 | ... | Jul 14 | Jul 15 | Jul 16 | Jul 17 | Jul 18 | ... | Jul 30 | Jul 31

930 days total
90th percentile → threshold for Mar 16

31 days

JANUARY

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

FEBRUARY

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

MARCH

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

APRIL

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

MAY

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

JUNE

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

JULY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

AUGUST

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

SEPTEMBER

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

OCTOBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

NOVEMBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

DECEMBER

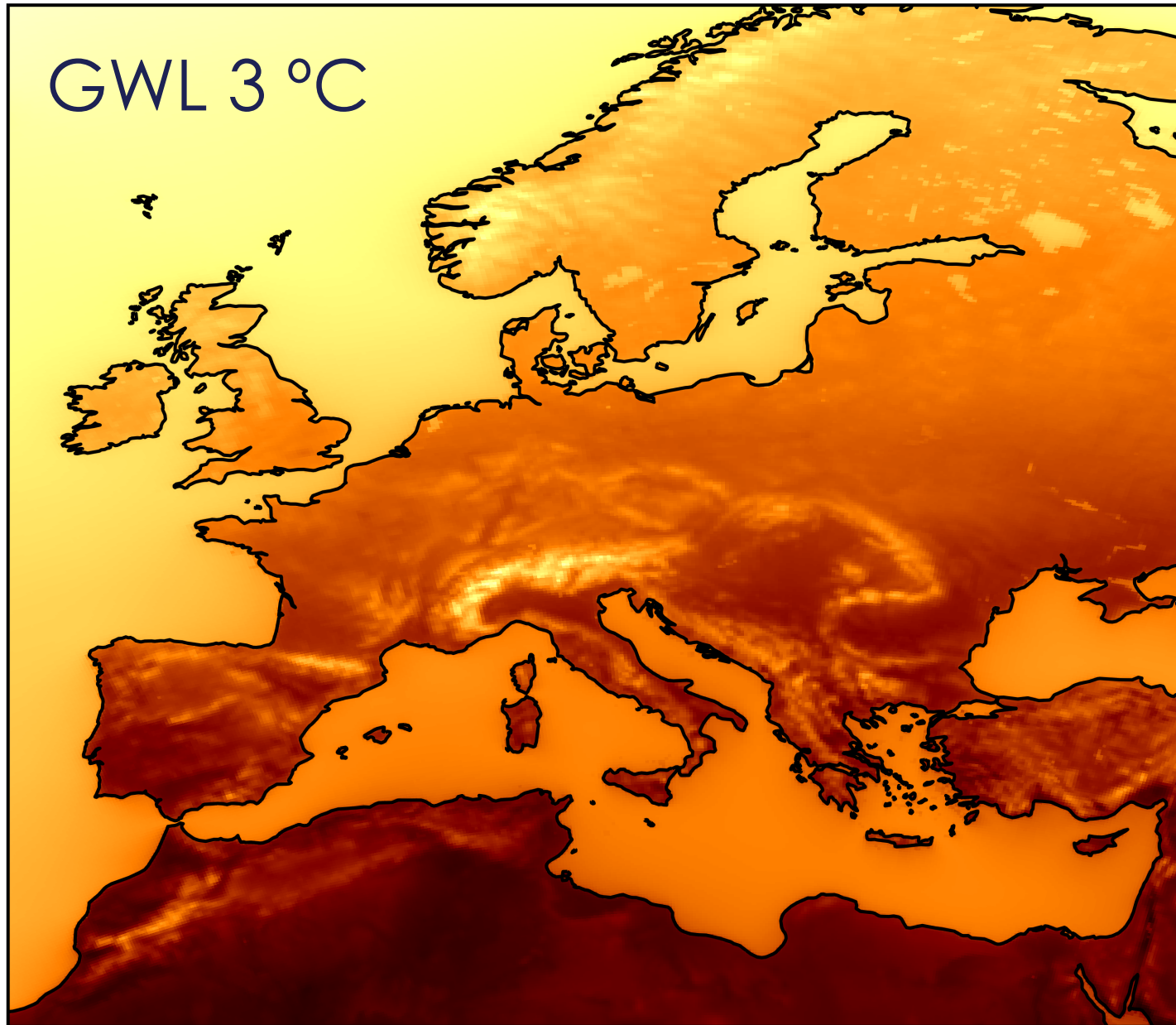| S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

I4C

Barcelona

Global Warming Levels - GWLs

Barcelona
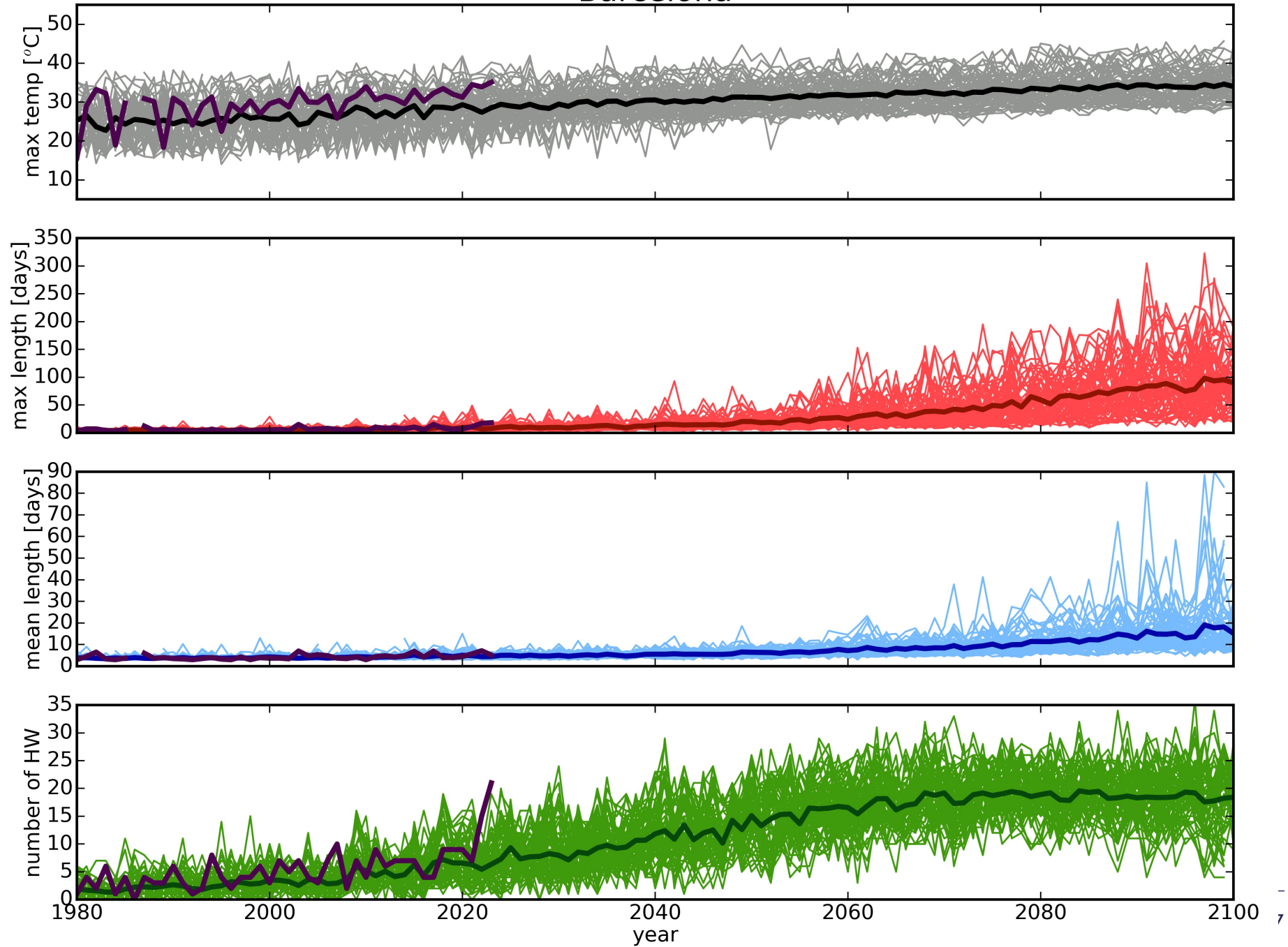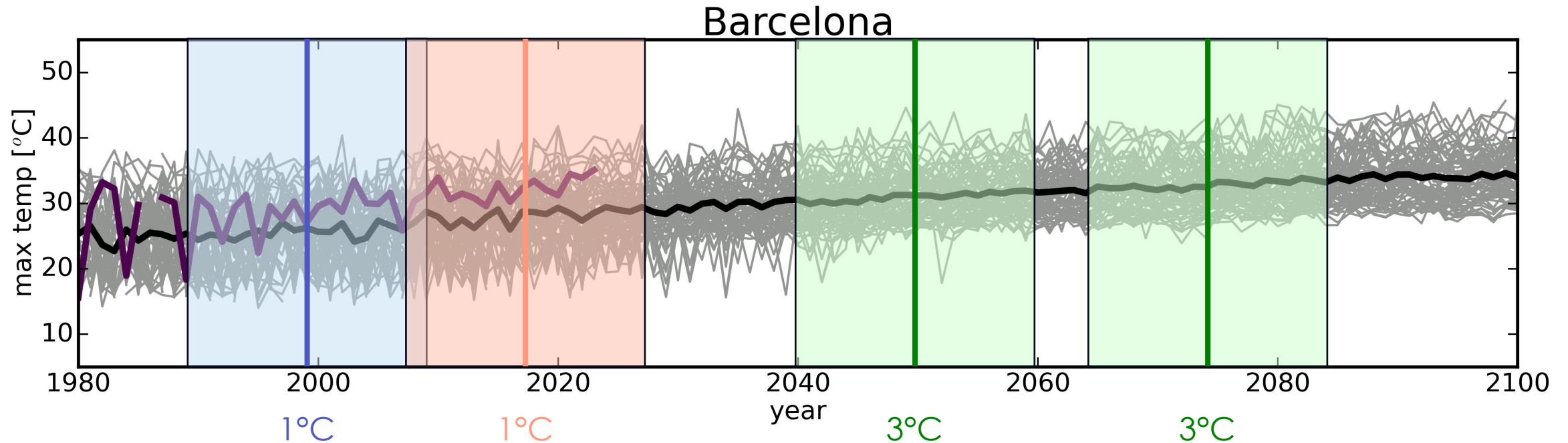
GWL is when mean global near-surface temperature reaches specified level above pre-industrial temperature, e.g. 2°C

Recommended Assessment – Average of ±10 years around the year where the global temperature the specified GWL
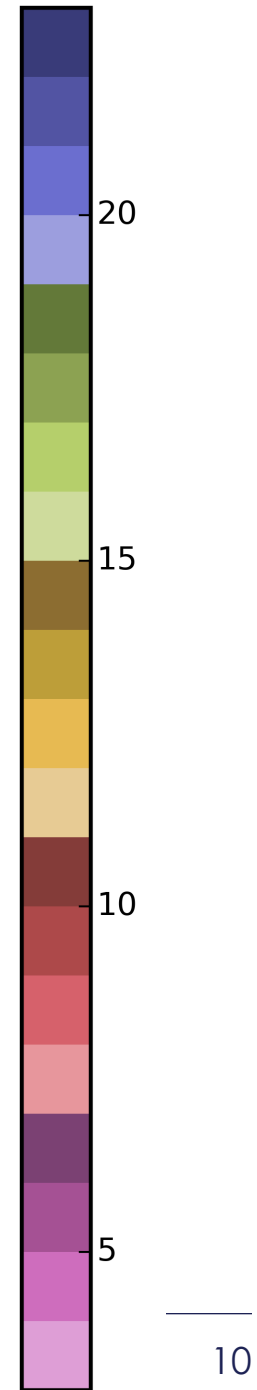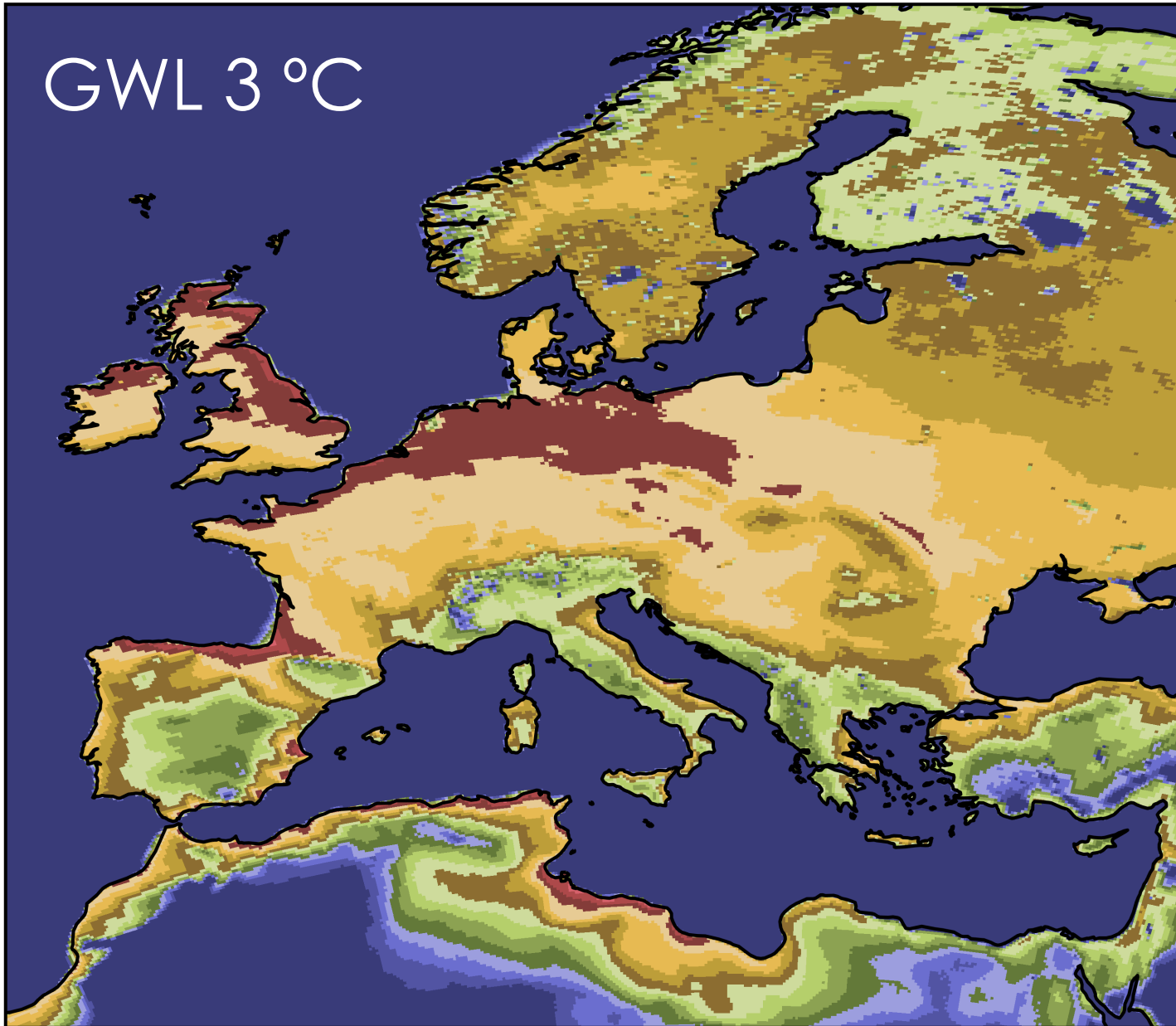
GWL 3 °C

HW Annual

Maximum
temperature
in heat wave
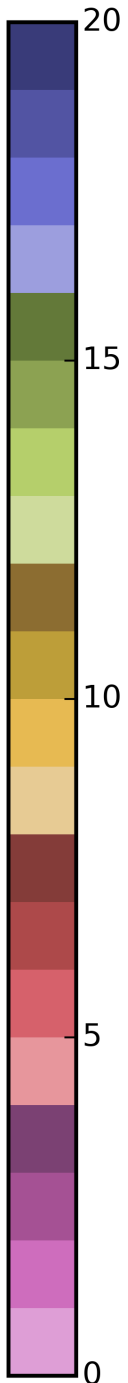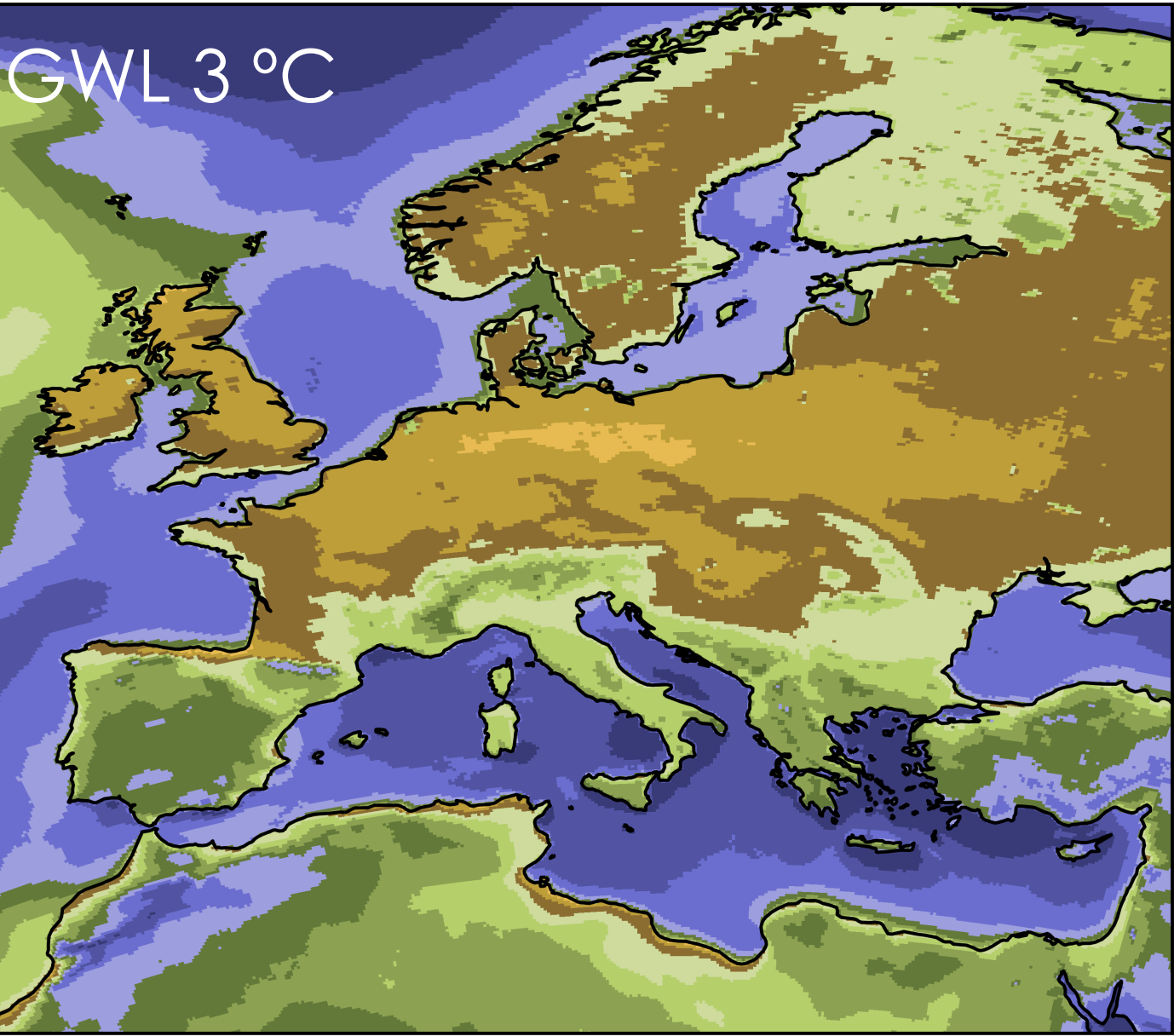(°C)

Ensemble
mean over
67 simulations

GWL 3 °C

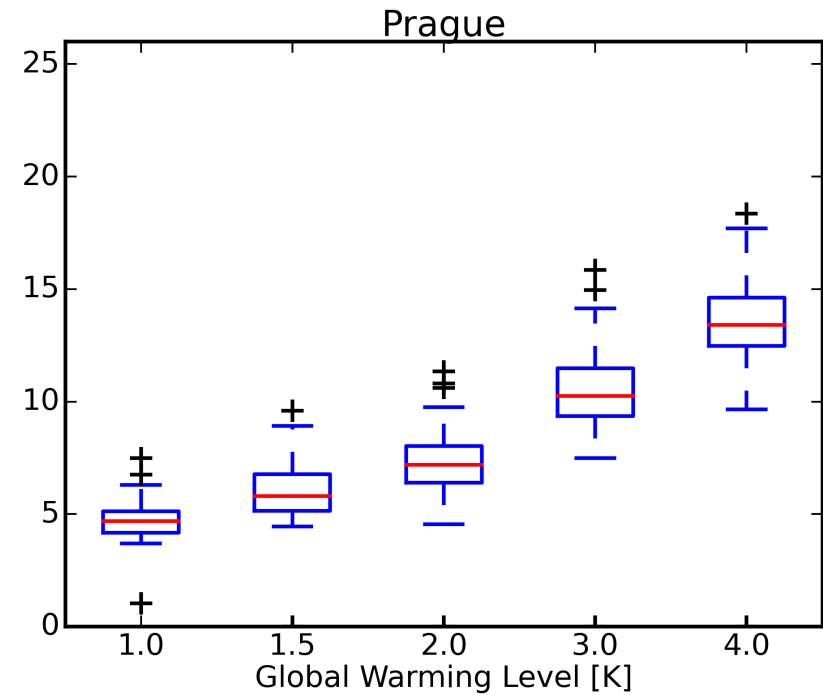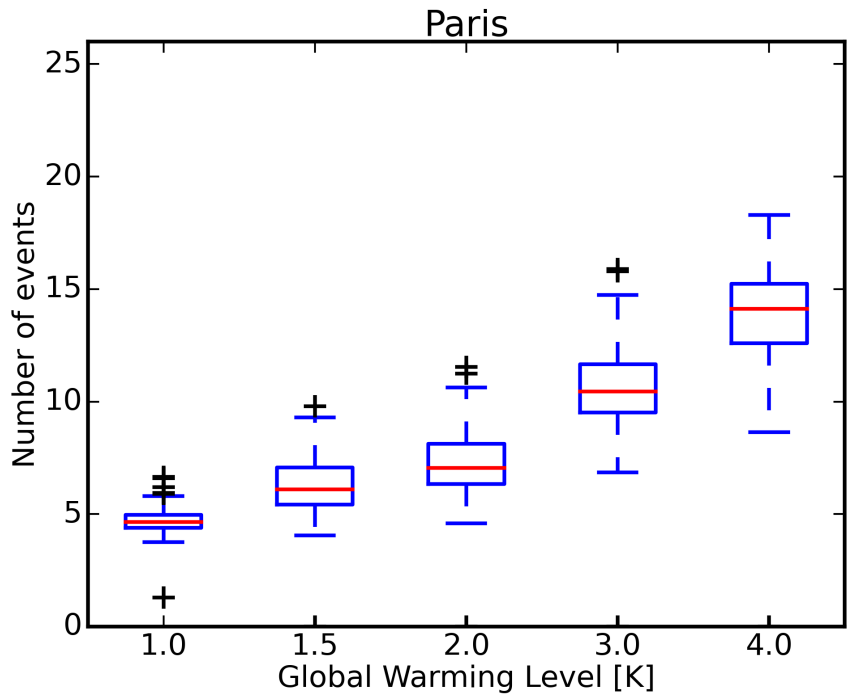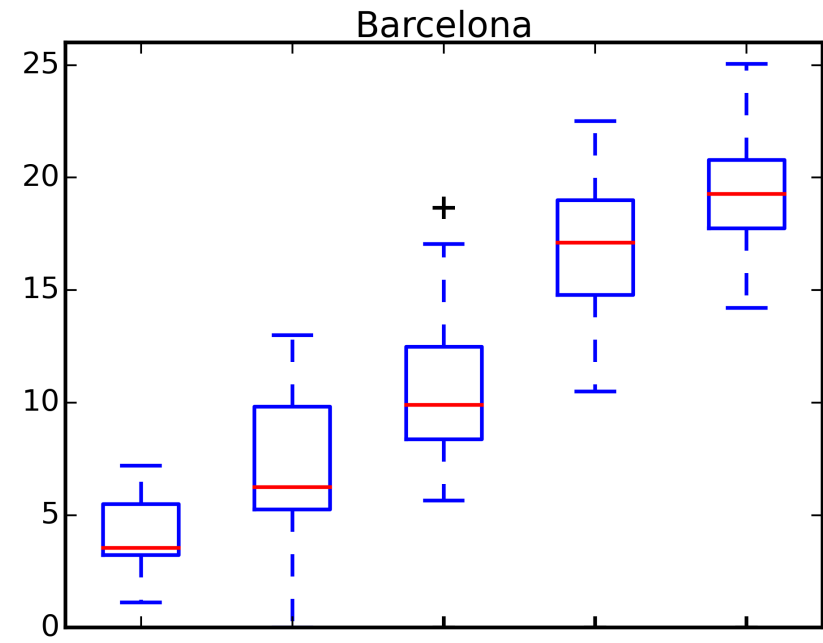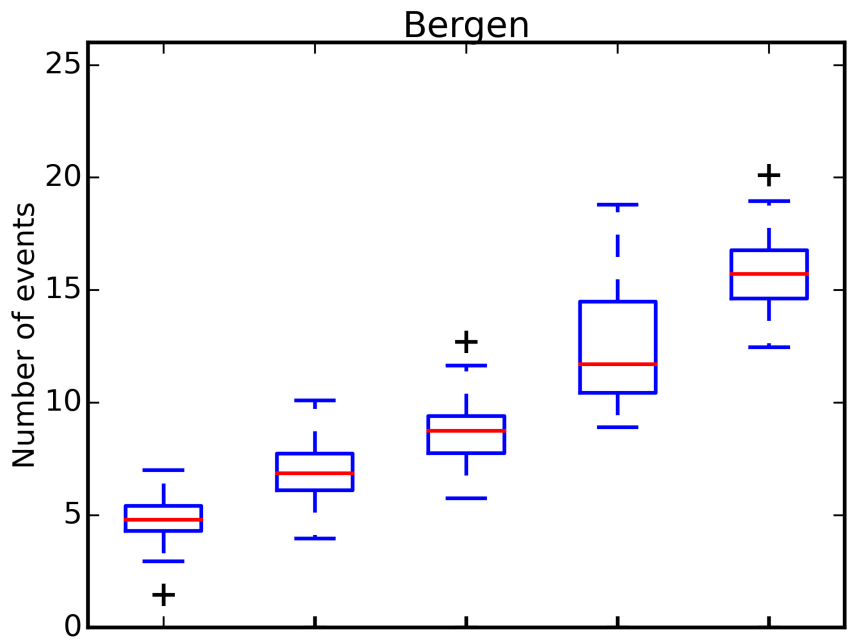Max Length of heat wave (days)

Ensemble mean over 67 simulations

GWL 3 °C

Number of
heat waves

Ensemble
mean over
67 simulations

Number of heat waves

Spread across 67 simulations
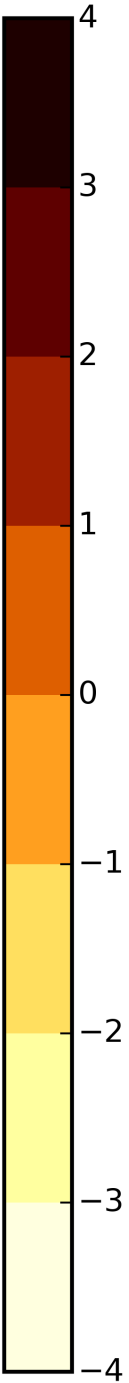
Number of tropical nights ($T_{min} > 20°C$)

Change in ensemble mean

GWL 3 – GWL 1

13
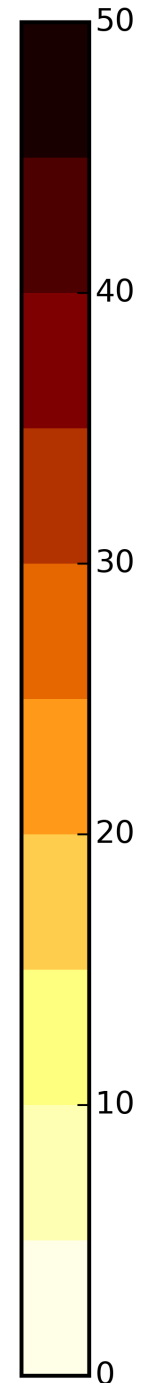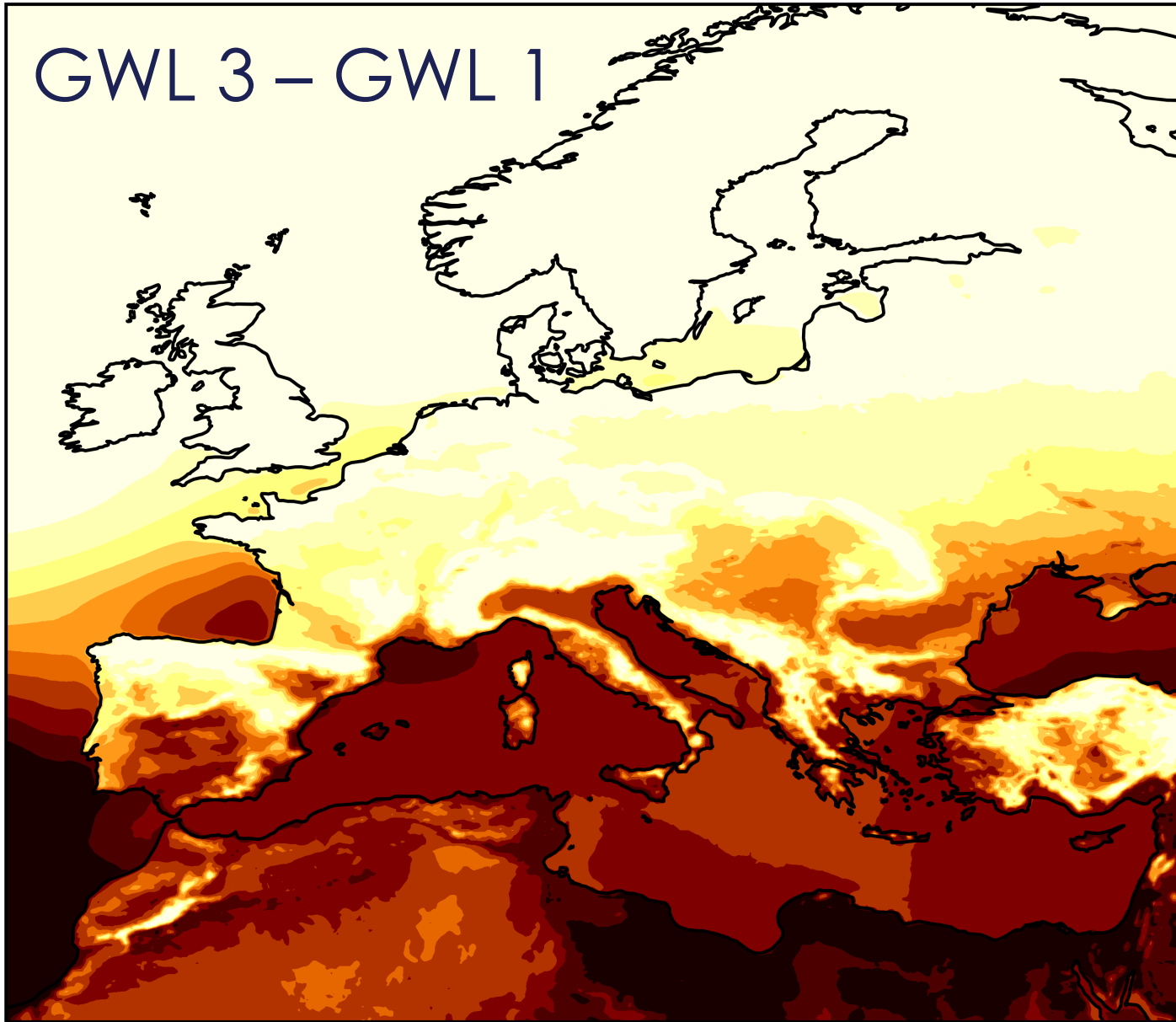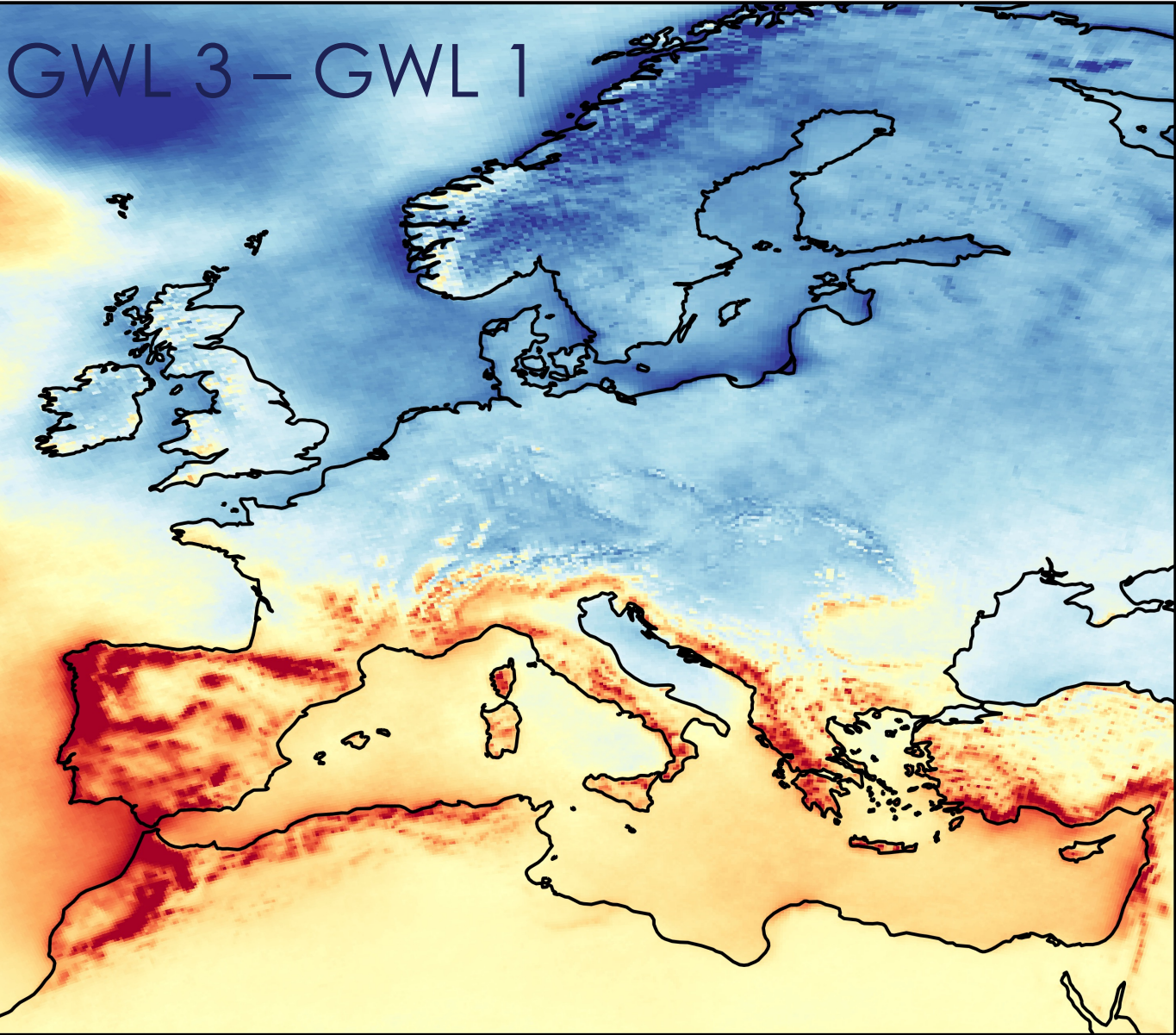
Number of days with rain over 10 mm

Change in ensemble mean

GWL 3 – GWL 1
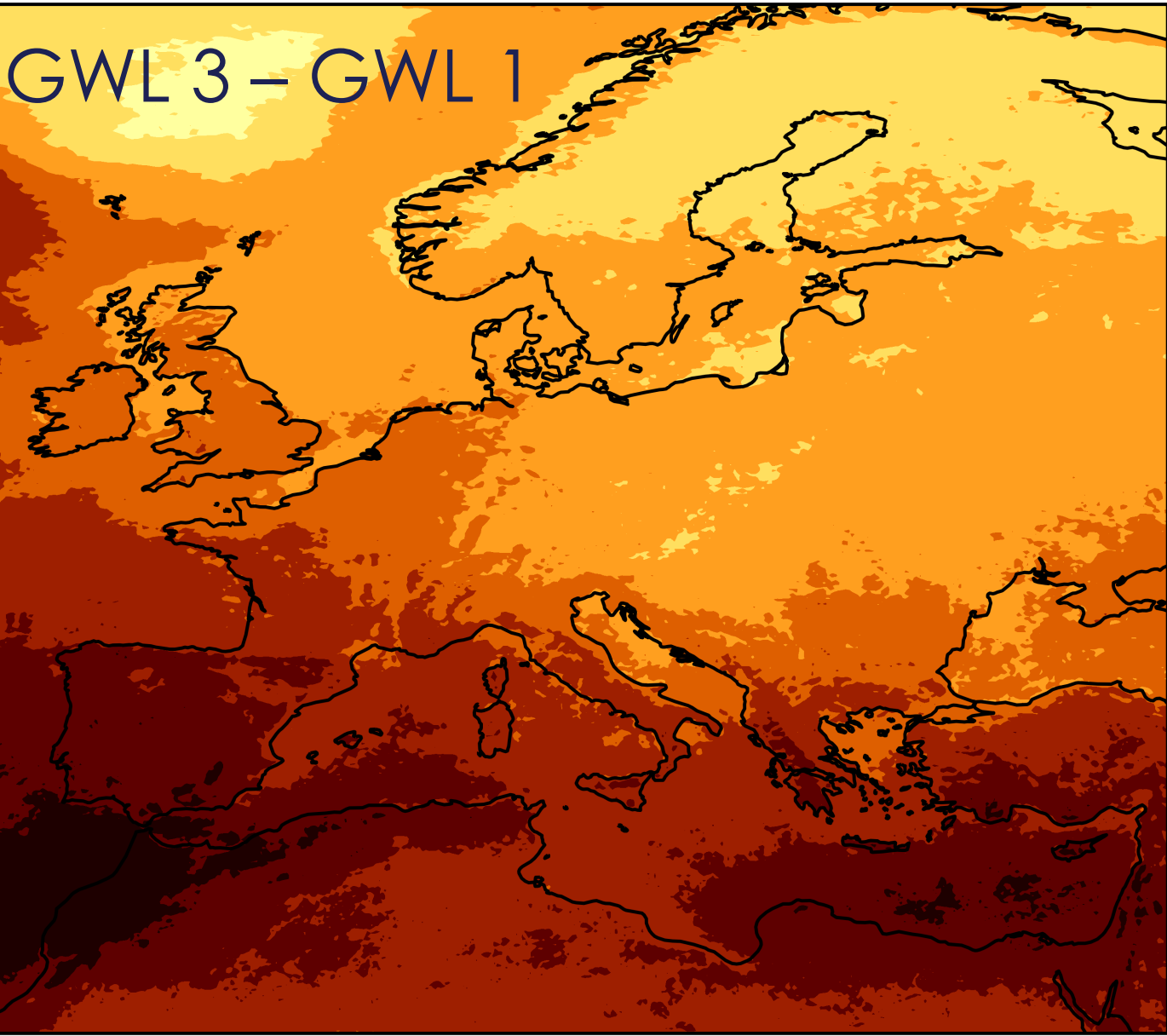
Decadal drought frequency

Change in ensemble mean

GWL 3 – GWL 1

Bergen

Barcelona

Paris

Prague

NDD [days/year]

year

Hazard Indices

| Generl Hazard Indices		
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NOAA Heat index (HI)		

Future Plans

Convection Permitting Climate Models

Advantages
- Higher resolution 3km
- Better representation of local-scale processes

Disadvantages
- Smaller domains
- 1-2 models only in most domains
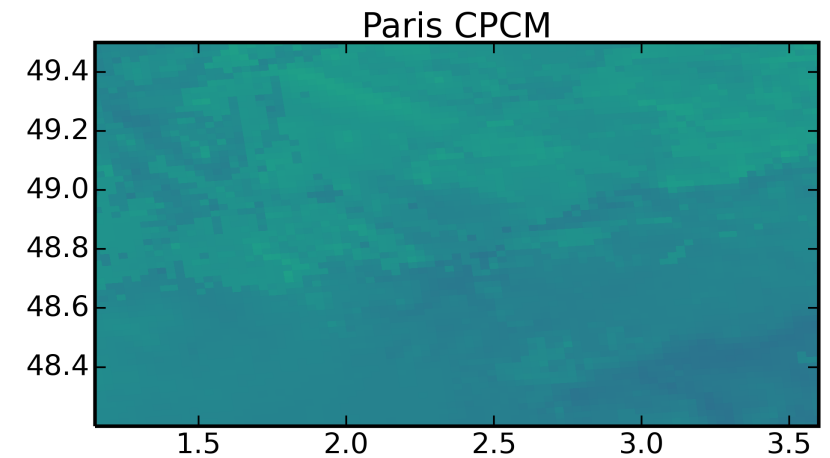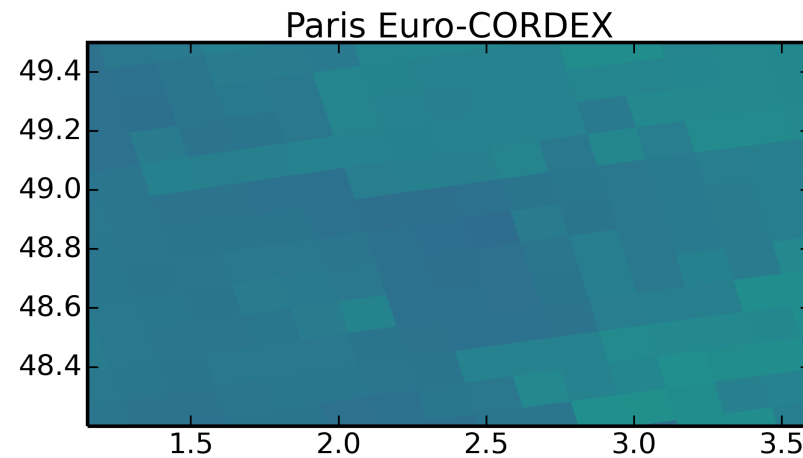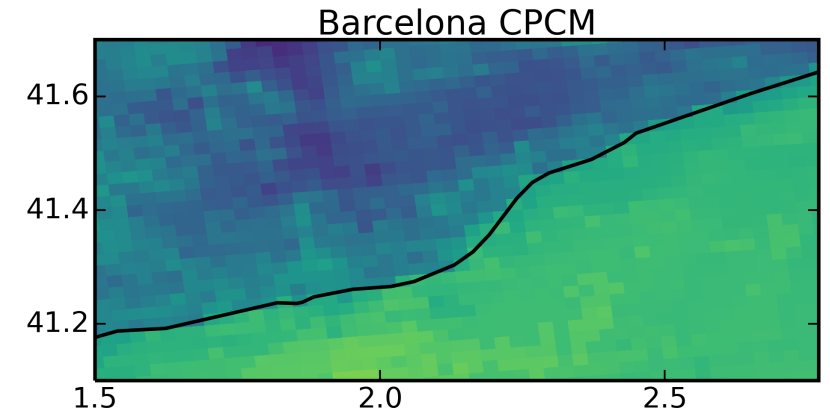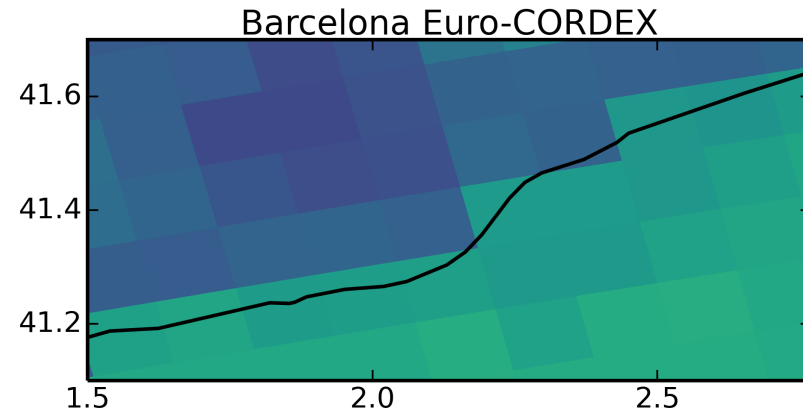- Three 10-year slices (2000, 2040s, 2090s)
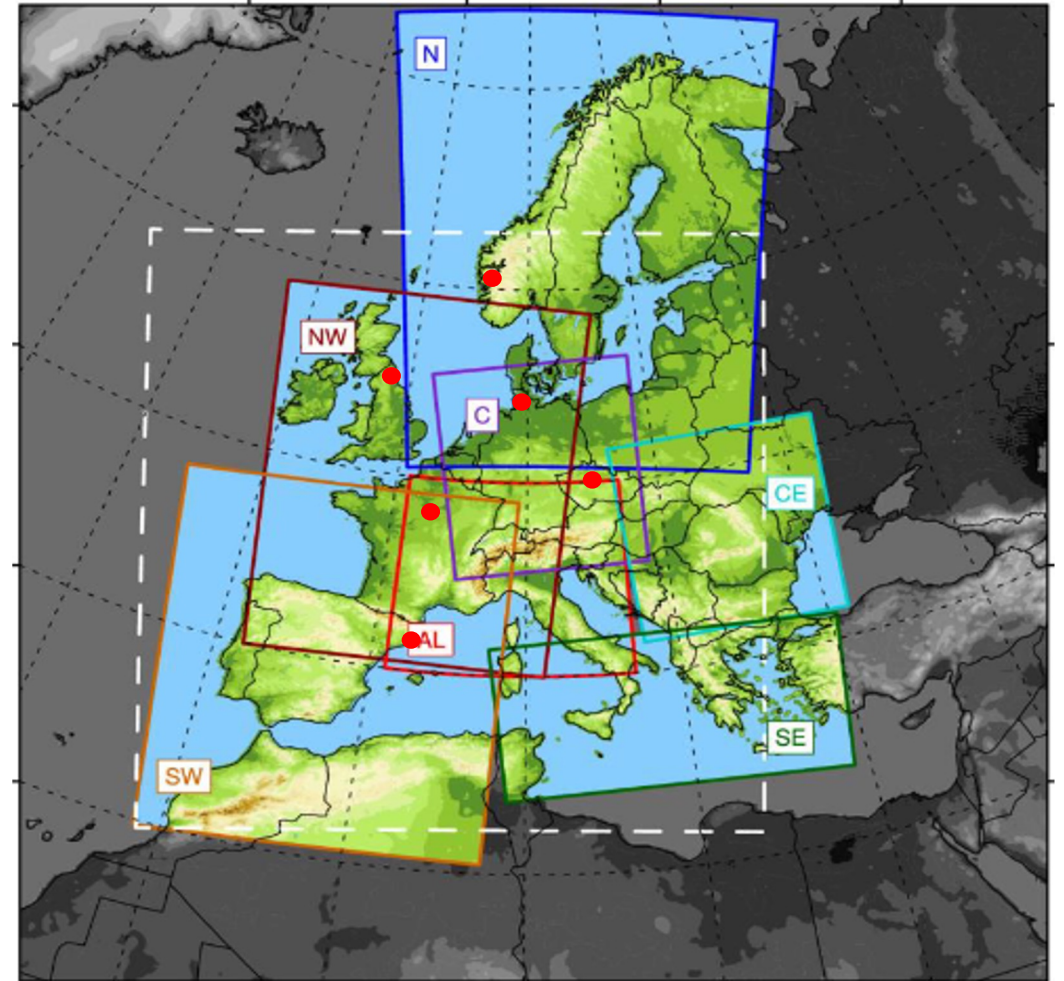
Future Plans

HW Annual

Maximum
temperature
in heat wave
(°C)

Historical 10-years

Single model

Future Plans

HW Annual

Change in
maximum
temperature
in heat wave
(°C)

Historical to Mid-
Centruy

Single model
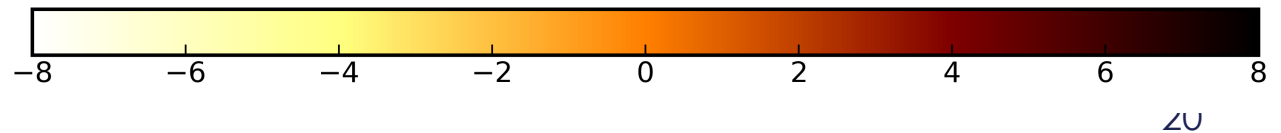
Future Plans

I4C Simulations and Emulations

- Higher resolution 3km

- Three 10-year slices (2000, 2040s, 2090s)

- Three domains – Northern, Southern, and one models running partial-European

Accessing the data

1. Currently accessible to all members of I4C
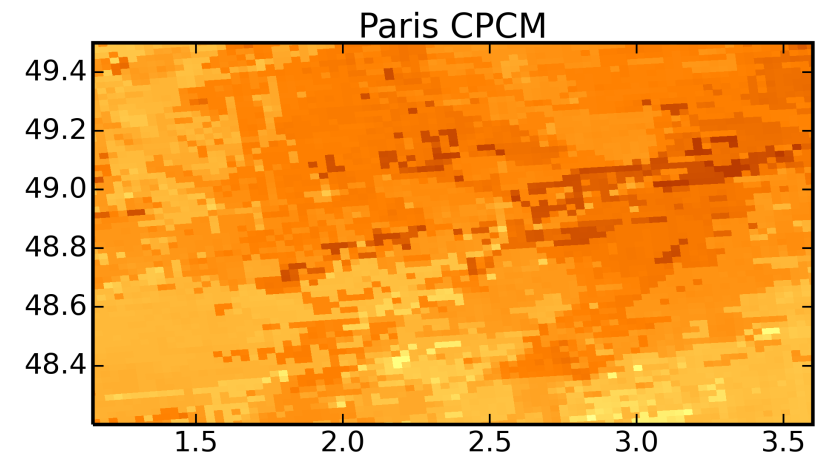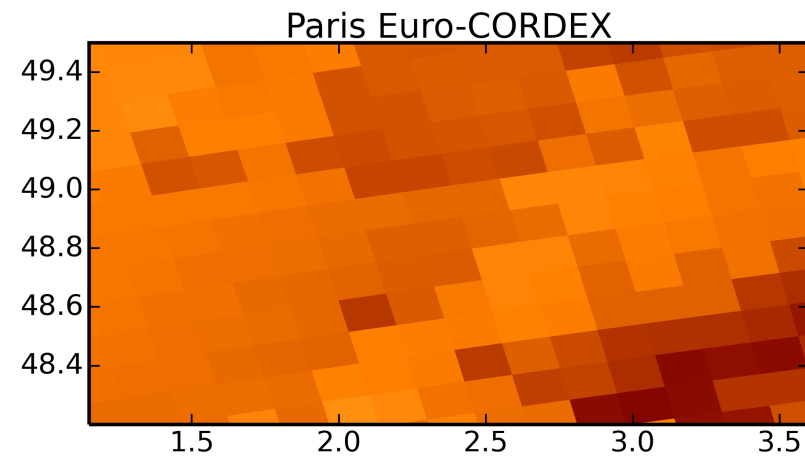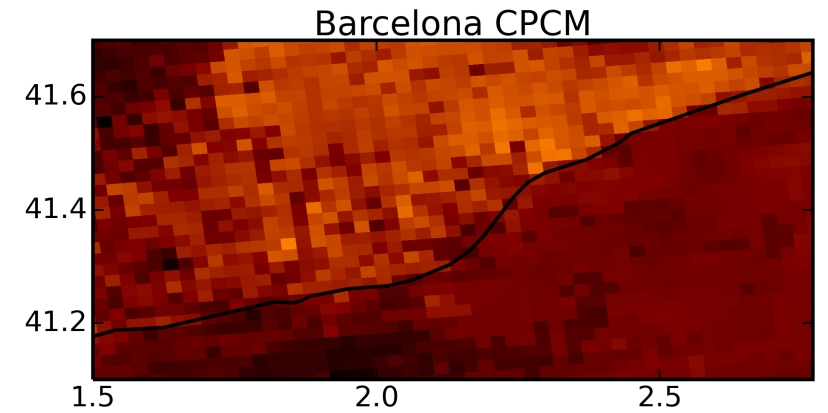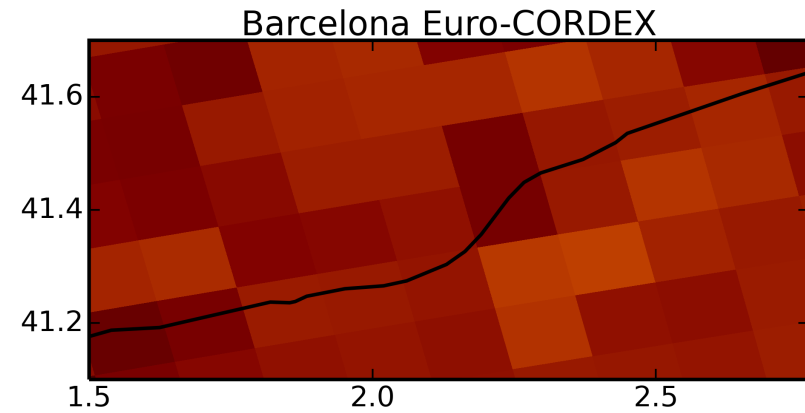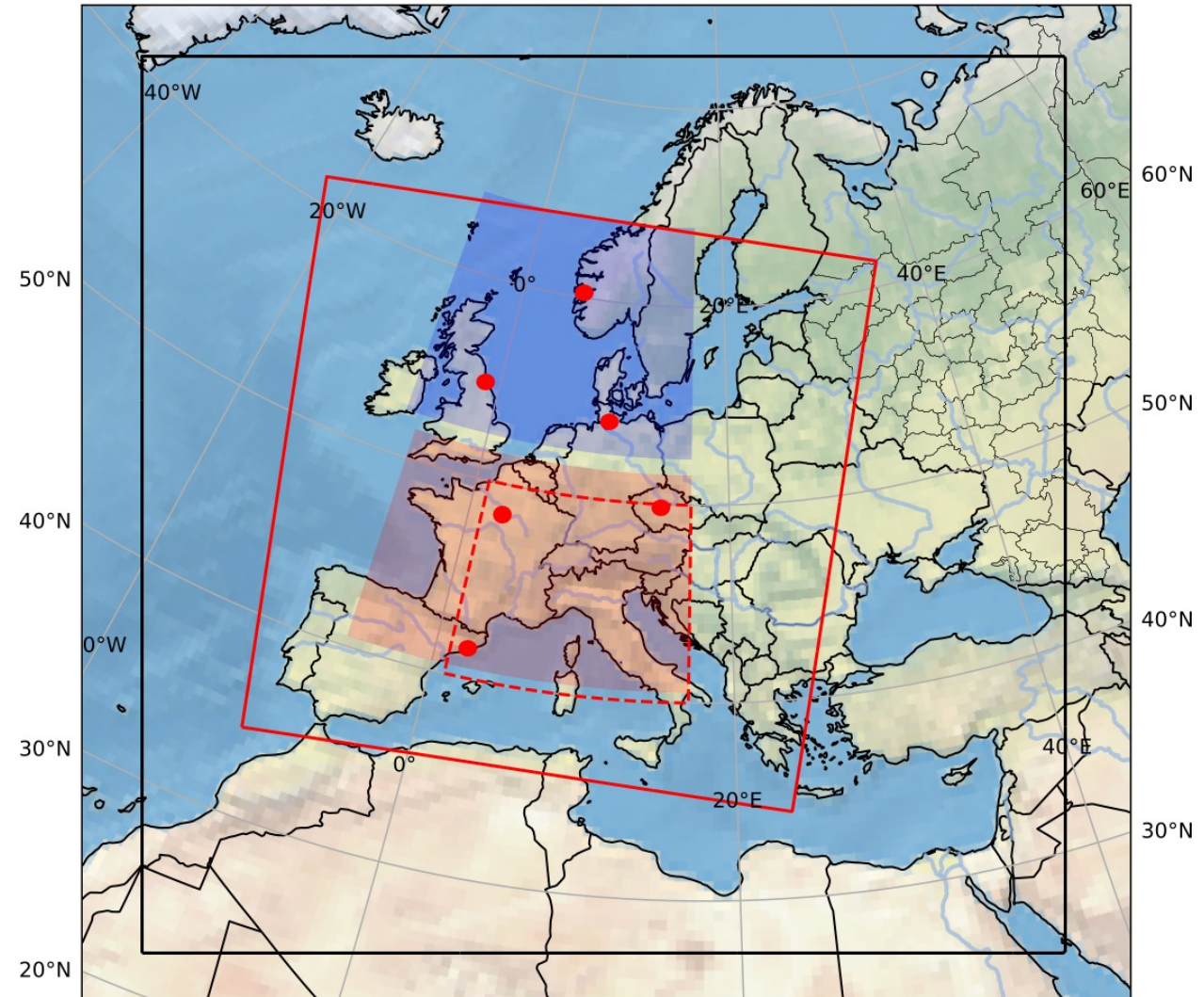
2. Stored on project server in NetCDF format

Current Access:

Contact your I4C demonstrator partners

Future Access:

Web-based toolkit will be available for accessing the data, open to everyone

```
[stepoutt@fram EHF]$ ncdump -h EHF_NCC-NorESM1-M_r1_SMHI-RCA4_1980-2100.nc
netcdf EHF_NCC-NorESM1-M_r1_SMHI-RCA4_1980-2100 {
dimensions:
        x = 412 ;
        y = 424 ;
        years = 121 ;
variables:
        float x(x) ;
                x:units = "" ;
                x:long_name = "Number of grid points in x direciton" ;
        float y(y) ;
                y:units = "" ;
                y:long_name = "Number of grid points in y direction" ;
        float years(years) ;
                years:units = "years" ;
                years:long_name = "Years" ;
        float lat(x, y) ;
                lat:units = "degrees_north" ;
                lat:standard_name = "latitude" ;
                lat:long_name = "latitude coordinate" ;
        float lon(x, y) ;
                lon:units = "degrees_east" ;
                lon:standard_name = "longitude" ;
                lon:long_name = "longitude coordinate" ;
        float EHF_max(years, x, y) ;
                EHF_max:long_name = "Annual maximum of positive EHF" ;
                EHF_max:units = "K^2" ;
                EHF_max:missing_value = 1.e+20f ;
                EHF_max:_FillValue = 1.e+20f ;
        float EHF_mean(years, x, y) ;
                EHF_mean:long_name = "Annual mean of positive EHF" ;
                EHF_mean:units = "K^2" ;
                EHF_mean:missing_value = 1.e+20f ;
                EHF_mean:_FillValue = 1.e+20f ;
        float EHF_count(years, x, y) ;
                EHF_count:long_name = "Annual count of positive EHF days" ;
                EHF_count:units = "days" ;
                EHF_count:missing_value = 1.e+20f ;
                EHF_count:_FillValue = 1.e+20f ;

// global attributes:
                :comment = "Excess Heat Factor (EHF) derived from maximum daily te
 95th percentile of daily maximum temperature for the reference period of 1971-200
EHF days for each year." ;
                :driving_model_id = "NCC-NorESM1-M" ;
                :model_id = "SMHI-RCA4" ;
                :driving_model_ensemble_member = "r1i1p1" ;
                :driving_experiment = "NCC-NorESM1-M, historical, r1i1p1" ;
                :history = "Thu Feb 20 10:29:15 2025: ncatted -O -a _FillValue,EH
eb 20 10:29:15 2025: ncatted -O -a missing_value,EHF_count,o,f,1.0e20 NCC-NorESM1-
O -a _FillValue,EHF_max,o,f,1.0e20 NCC-NorESM1-M_r1_SMHI-RCA4/EHF/EHF_NCC-NorESM1-
20 NCC-NorESM1-M_r1_SMHI-RCA4/EHF/EHF_NCC-NorESM1-M_r1_SMHI-RCA4_1980-2100.nc\nThu
EHF_NCC-NorESM1-M_r1_SMHI-RCA4_1980-2100.nc\nThu Feb 20 10:29:15 2025: ncatted -O -
1980-2100.nc" ;
                :NCO = "netCDF Operators version 4.8.1 (Homepage = http://nco.sf.n
}
```

Data Atlas

https://www.dropbox.com/scl/fi/h5q6tpl wy6fube6j4dhic/Hazard_Indices_Atlas.p df?rlkey=7oxxoyowgdjznzx2xzvpt9tdg&st =xo1esi8r&dl=0
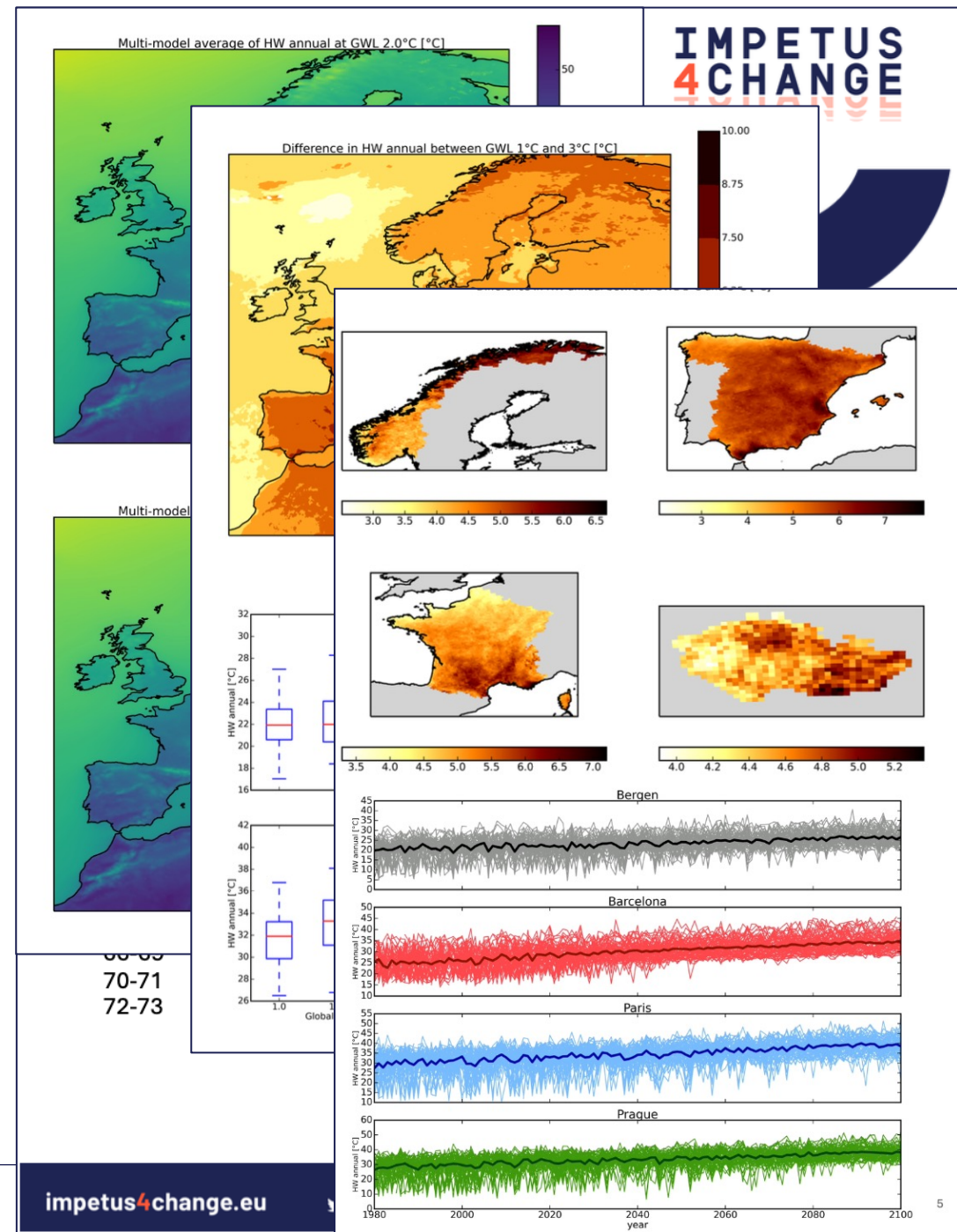
Thank you for your attention

Contact

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