Changes of Temperature and Precipitation Extremes

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Contents

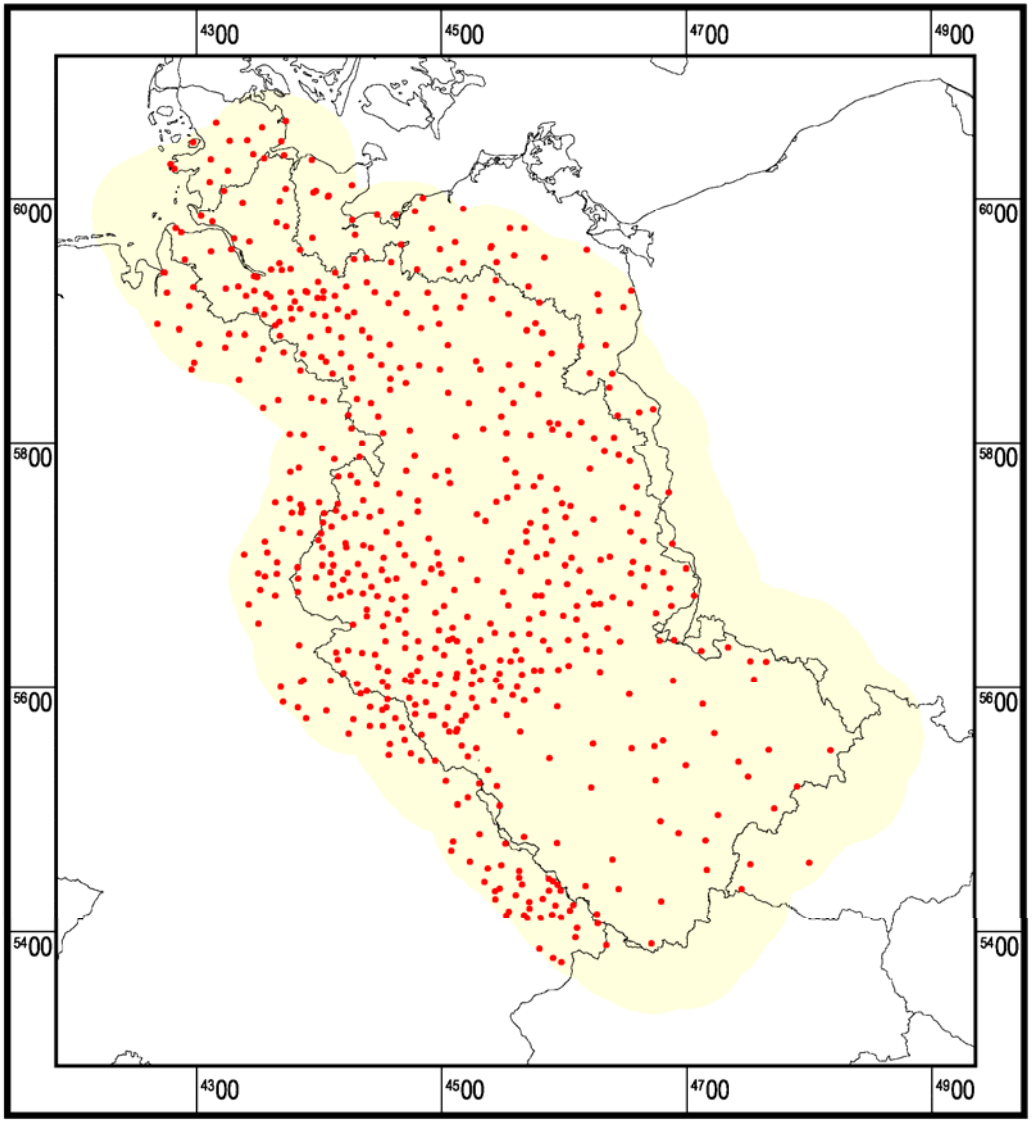
Data

- **Daily values of 11 meteorological parameters of 831 German and Czech stations,**
- **Period: 1951 – 2003**
- **Szenario ECHAM5 – A2 transient**

Meteorological parameters

Air temperature	-	Tmax, Tmean, Tmin	
Precipitation		Relative humidity	Air pressure
Vapour pressure		Cloudiness	Sunshine duration
Global radiation		Wind velocity	

Data

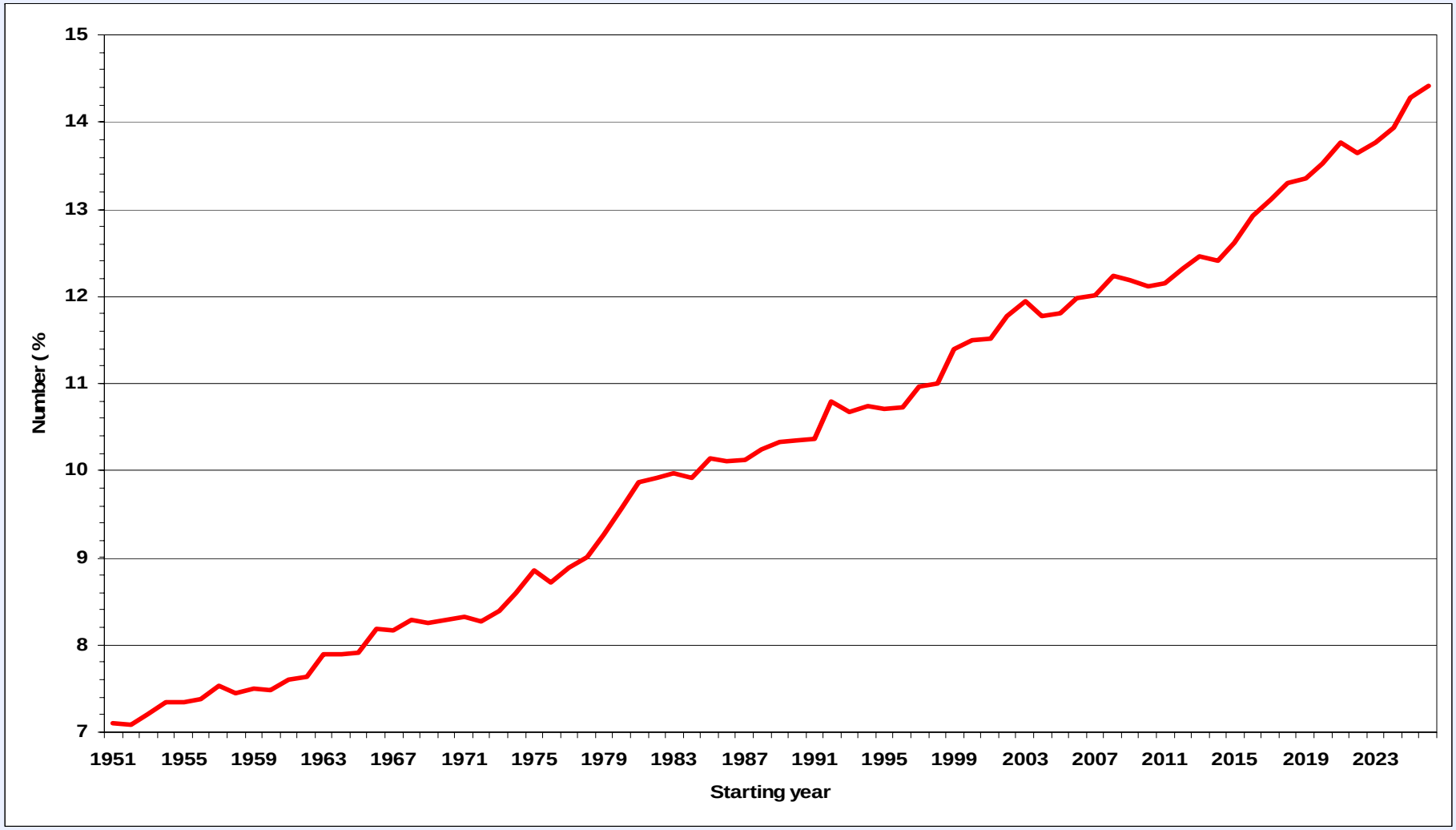


Stations of the Elbe river basin

Model verification

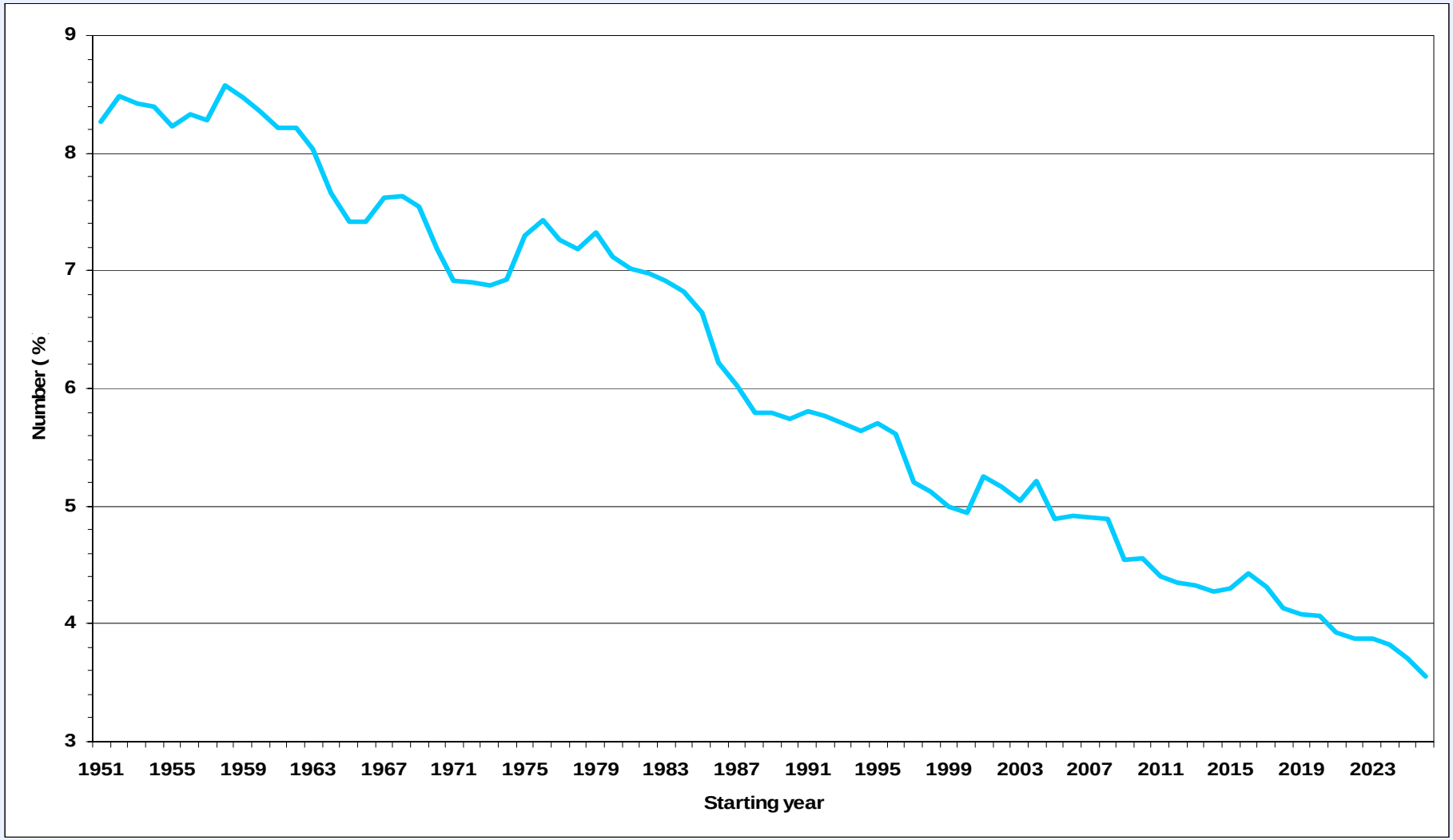
Meteo. parameter	Obs.	STAR	Difference	Signifikance	Event days	Obs..	STAR	Difference	Signifikance
Air temperatur Tmax [°C]	12.68	12.72	0.04	-	Tmax ≥ 30 °C Tmax ≥ 25 °C Tmax < 0 °C	5.55 30.58 23.98	4.79 28.93 22.95	-0.76 -1.65 -1.03	20.0 - -
Air temperatur Tmean [°C]	8.58	8.55	-0.03	-	Tmean ≥ 20 °C Tmean < 0 °C	20.31 45.00	18.15 46.03	-2.16 1.03	20.0 -
Air temperatur Tmin [°C]	4.79	4.68	-0.11	-	Tmin ≥ 15 °C Tmin < 0 °C	17.16 85.32	15.53 86.77	-1.63 1.45	20.0 -
Precipitation sum [mm]	650.21	641.17	-9.04	-	PP < 0.1 mm PP ≥ 10 mm	188.33 15.42	193.70 15.36	5.37 -0.06	20.0 -
Relative humidity [%]	78.32	78.83	0.51	10.0	Relh ≥ 90% Relh < 50%	70.14 7.06	71.69 6.60	1.55 -0.46	- -
Air pressure [hPa]	994.52	993.82	-0.70	5.0	Pres ≥ 1020 hPa Pres < 900 hPa	30.76 7.60	26.17 7.60	-4.59 0.00	5.0 -
Vapour pressure [hPa]	9.33	9.41	0.08	20.0	Vap≥ 15 hPa Vap < 5 hPa	34.15 41.94	36.83 40.29	2.68 -1.65	10.0 -
Sunshine duration [h]	4.34	4.41	0.07	-	Sund ≥ 10 h Sund ≤ 0.1 h	46.25 73.28	49.24 54.55	2.99 -18.73	20.0 1.0
Cloudiness [-/8]	5.33	5.38	0.05	-	Cloud = 8/8 Cloud < 1/8	53.01 9.29	56.53 7.75	3.52 -1.54	10.0 10.0
Global radiation [J/cm²]	982.06	983.94	1.88	-	Grad ≥ 2000 J/cm² Grad < 100 J/cm²	46.61 8.66	47.10 10.90	0.49 2.24	- 5.0
Wind velocity [m/s]	2.67	2.74	0.07	5.0	Wind ≥ 5 m/s Wind < 1 m/s	38.34 56.03	43.15 52.00	4.81 -4.03	1.0 10.0

Temperature extremes



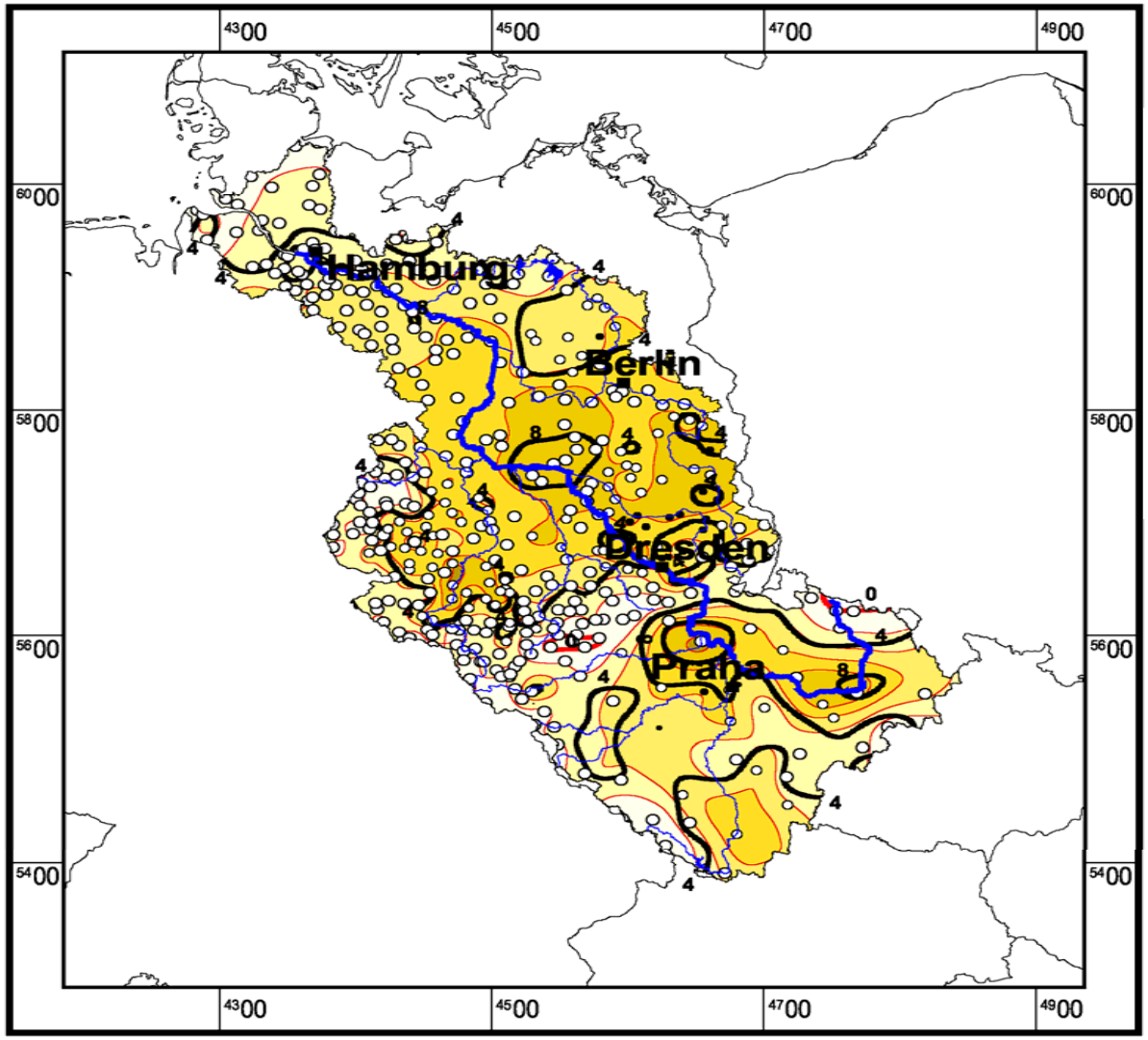
Mean number (%) of summer days, 1951 – 2055, 30year shifting intervals, averaged over the Elbe river catchment

Temperature extremes



Mean number (%) of ice cold days, 1951 – 2055, 30year shifting intervals, averaged over the Elbe river catchment

Temperature extremes



Number of hot days
basic scenario 1951/2003

Mean value (days)

0 4 8 12

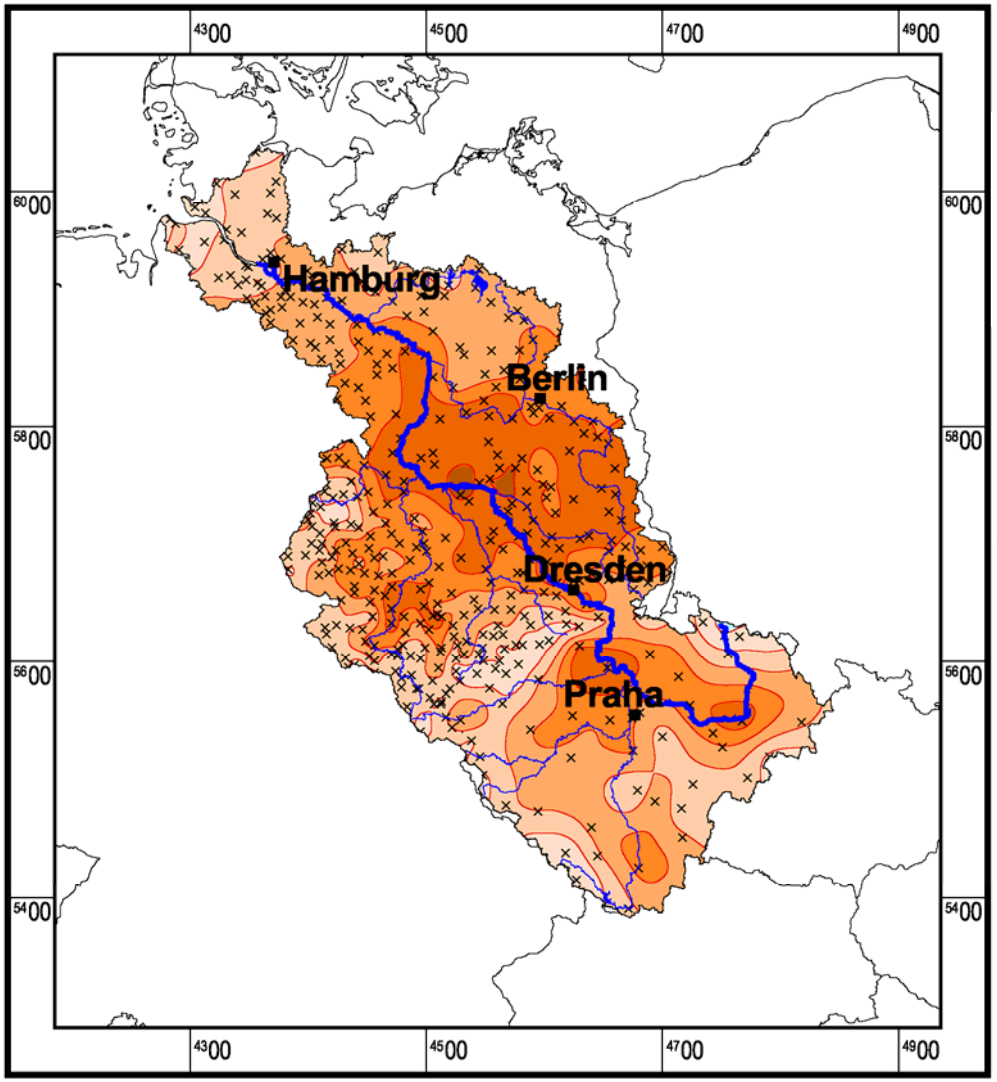
Trend (days)

Equidistance 4
Values = 0
Values > 0

P [%]

0 80 90 95 99

Temperature extremes



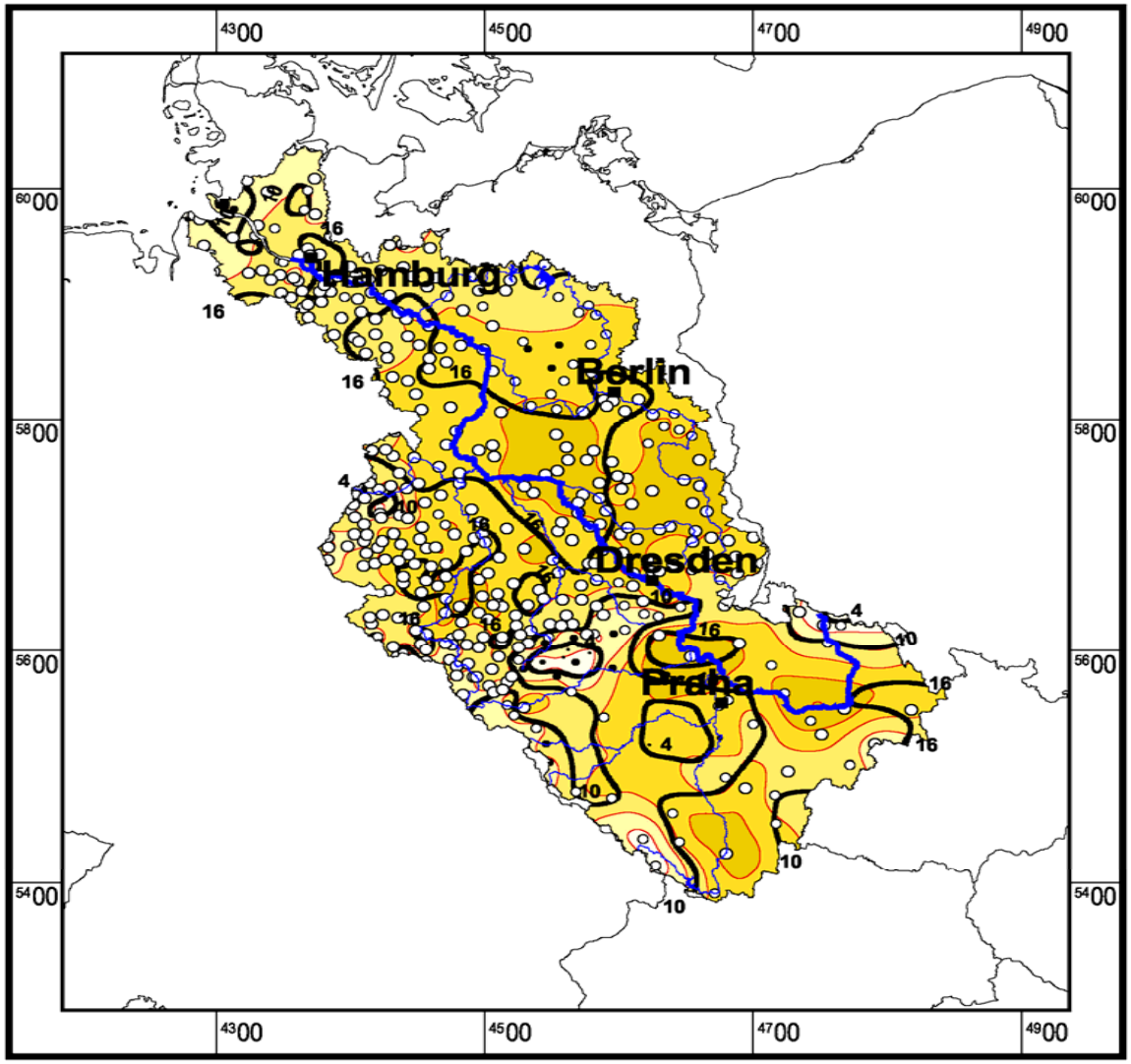
Change in number of hot days
2046/2055 - 1951/2003

Mean value (days)

-3 0 3 9 15 21

× *Meteorological station*

Temperature extremes



Number of summer days
basic scenario 1951/2003

Mean value (days)

0 20 40 60

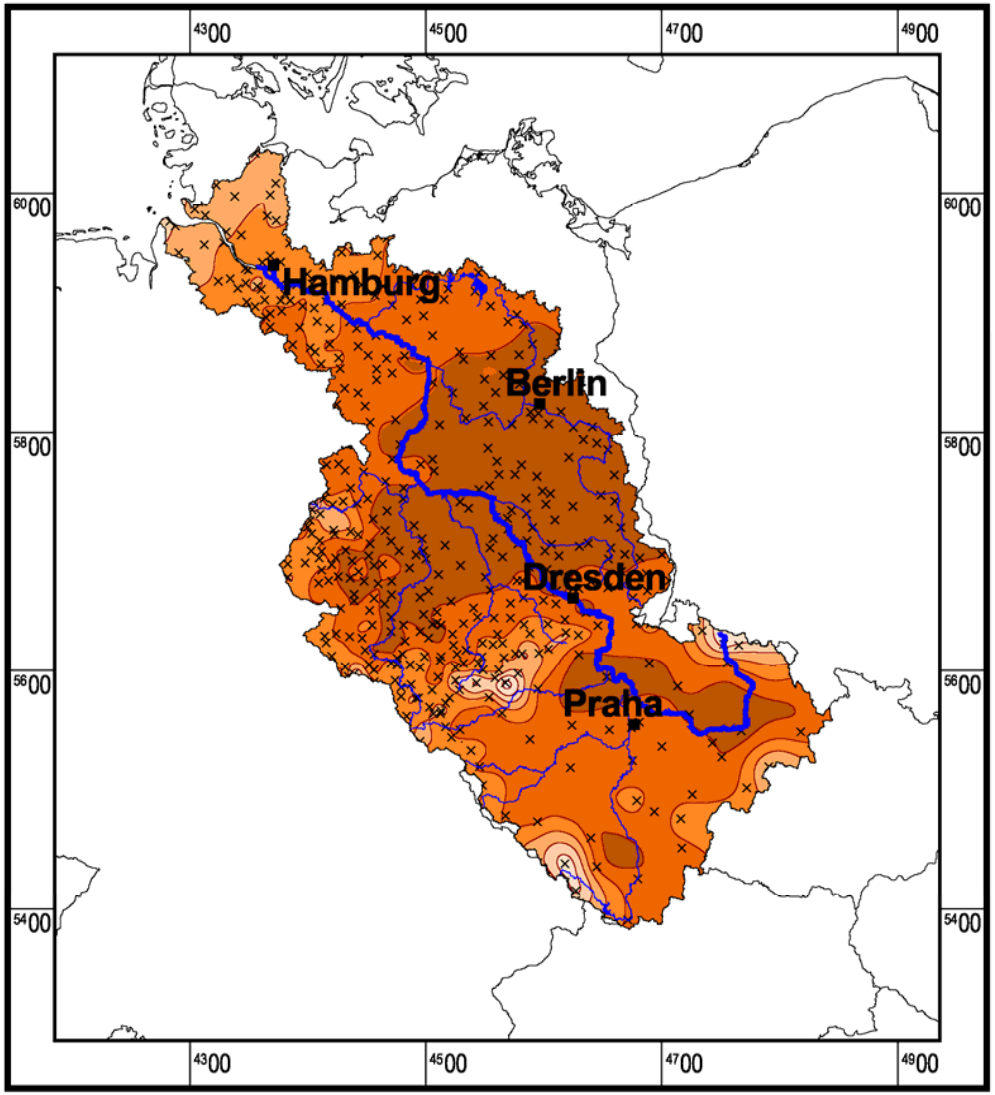
Trend (days)

Equidistance 6
Values ≥ 4

P [%]

0 80 90 95 99

Temperature extremes



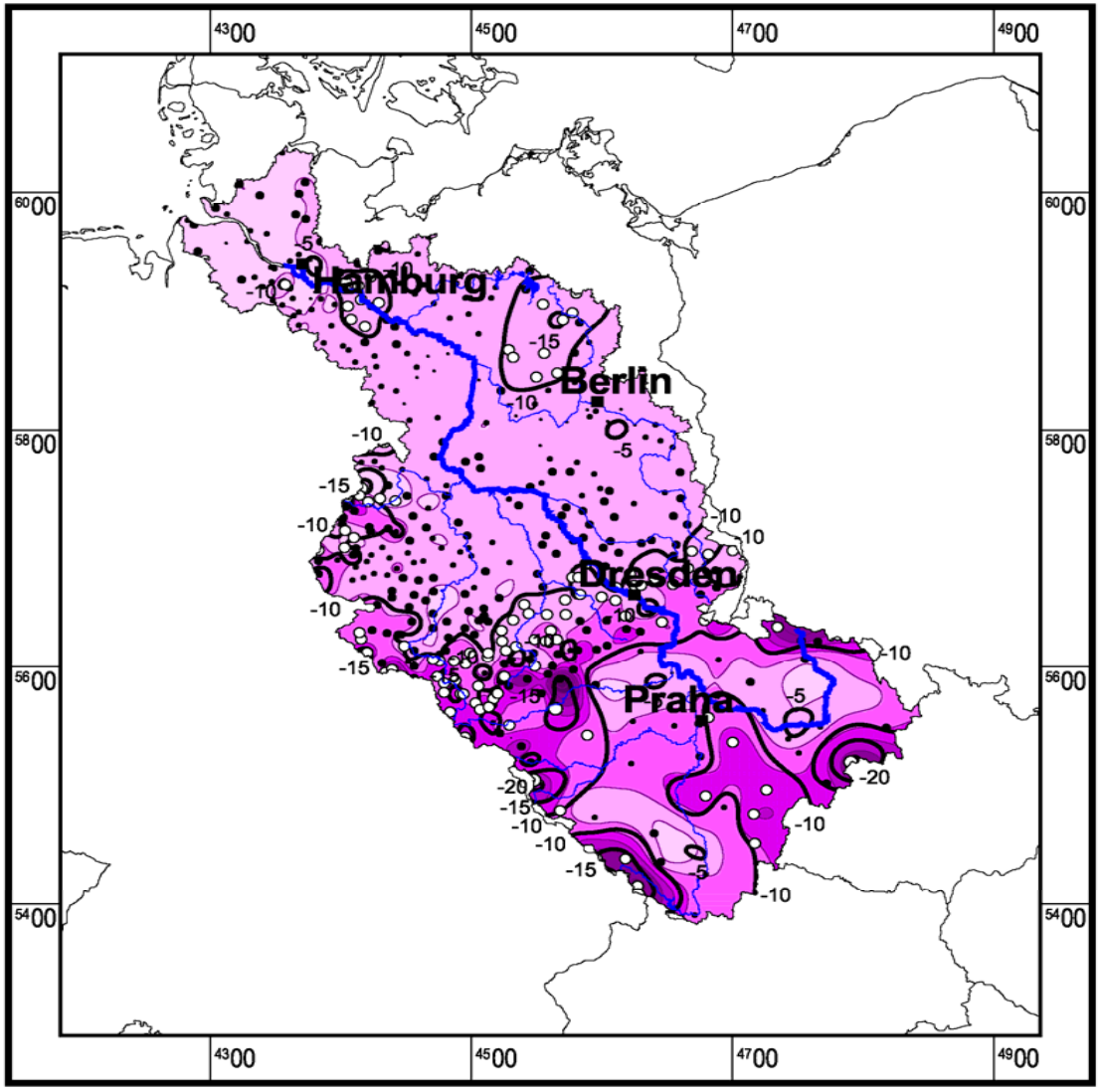
Change in number of summer days
2046/2055 - 1951/2003

Mean value (days)

0 10 20 30 40

× *Meteorological station*

Temperature extremes



Number of ice days
basic scenario 1951/2003

Mean value (days)

0 20 40 60 100

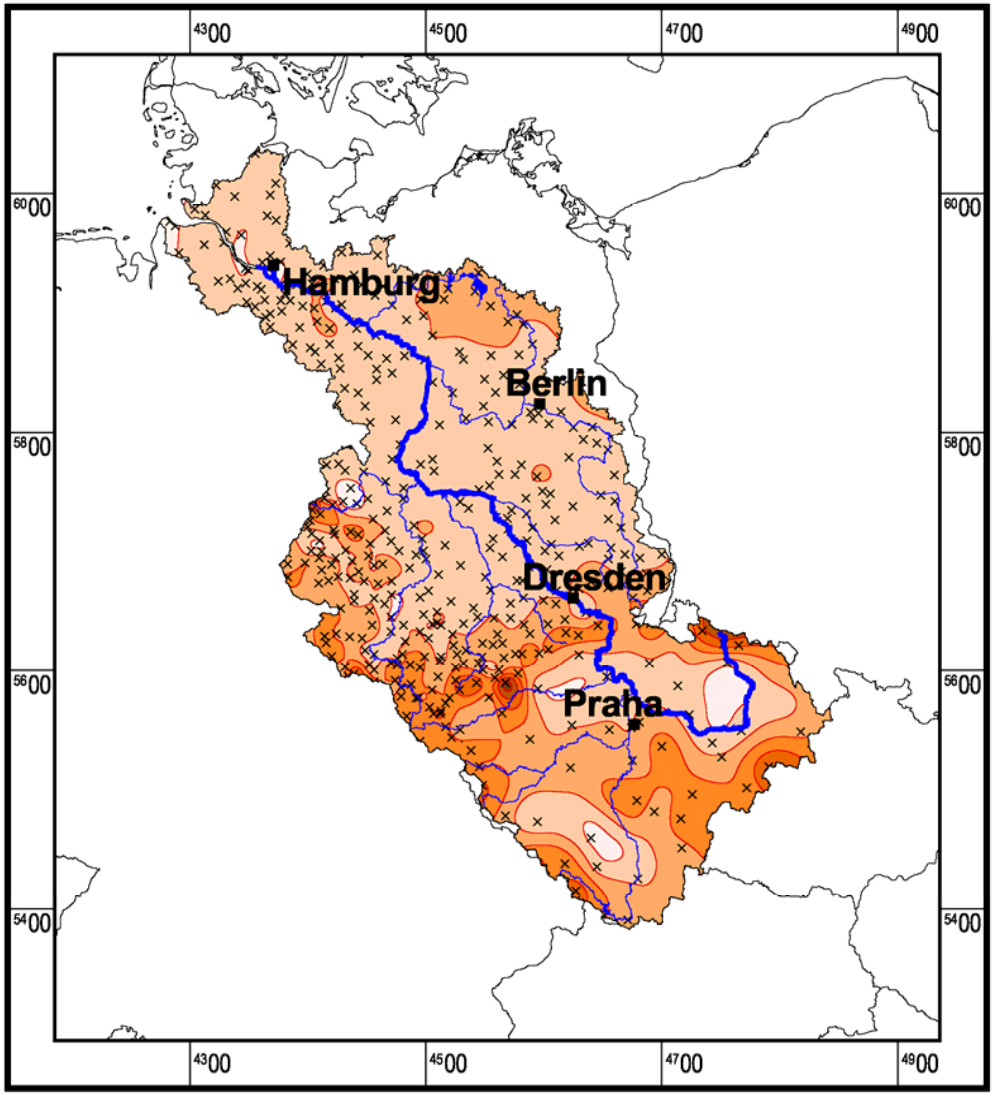
Trend (days)

Equidistance 5
Values < 0

P [%]

0 80 90 95 99

Temperature extremes



Change in number of ice days
2046/2055 - 1951/2003

Mean value (days)

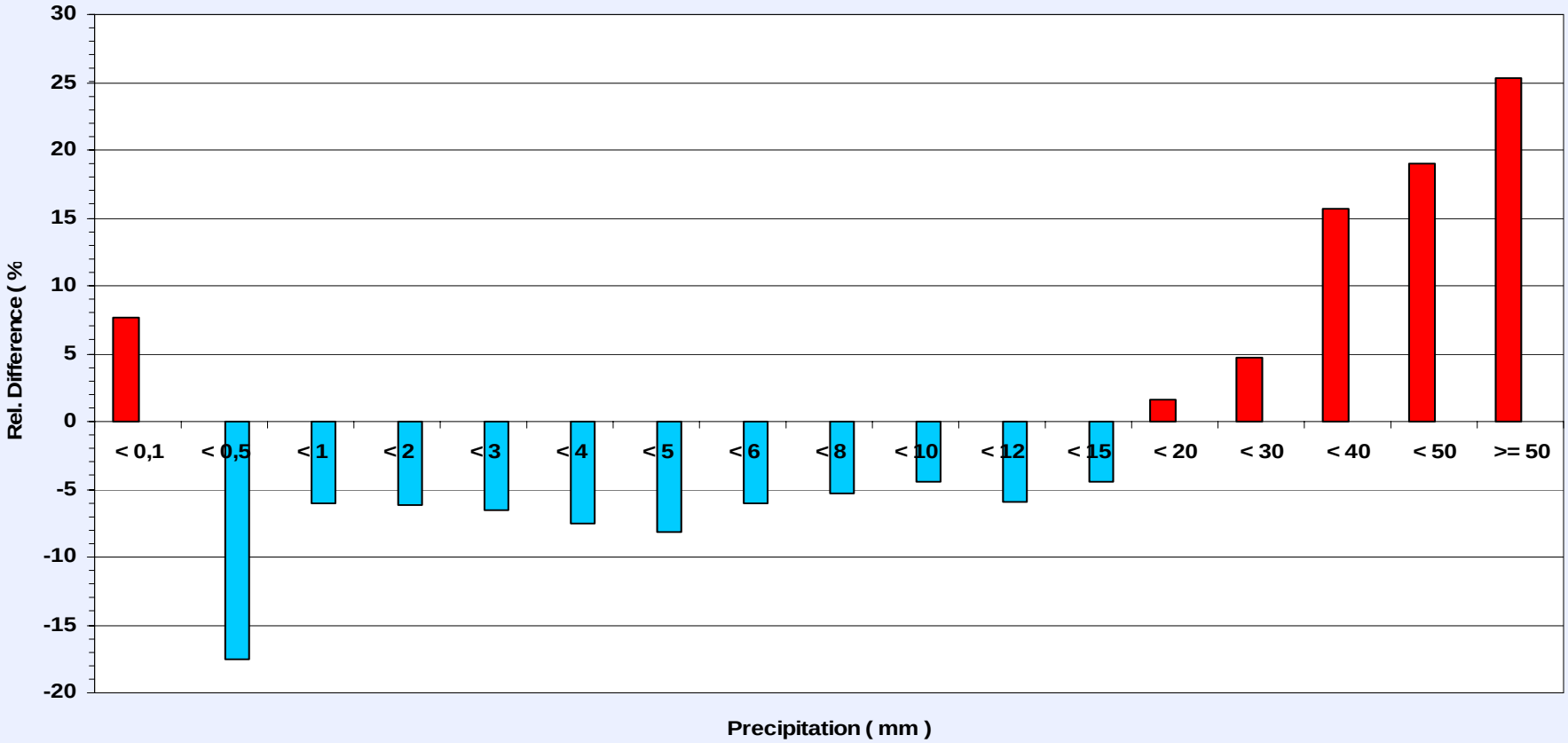
-10 -20 -30 -40

× *Meteorological station*

Summary temperature

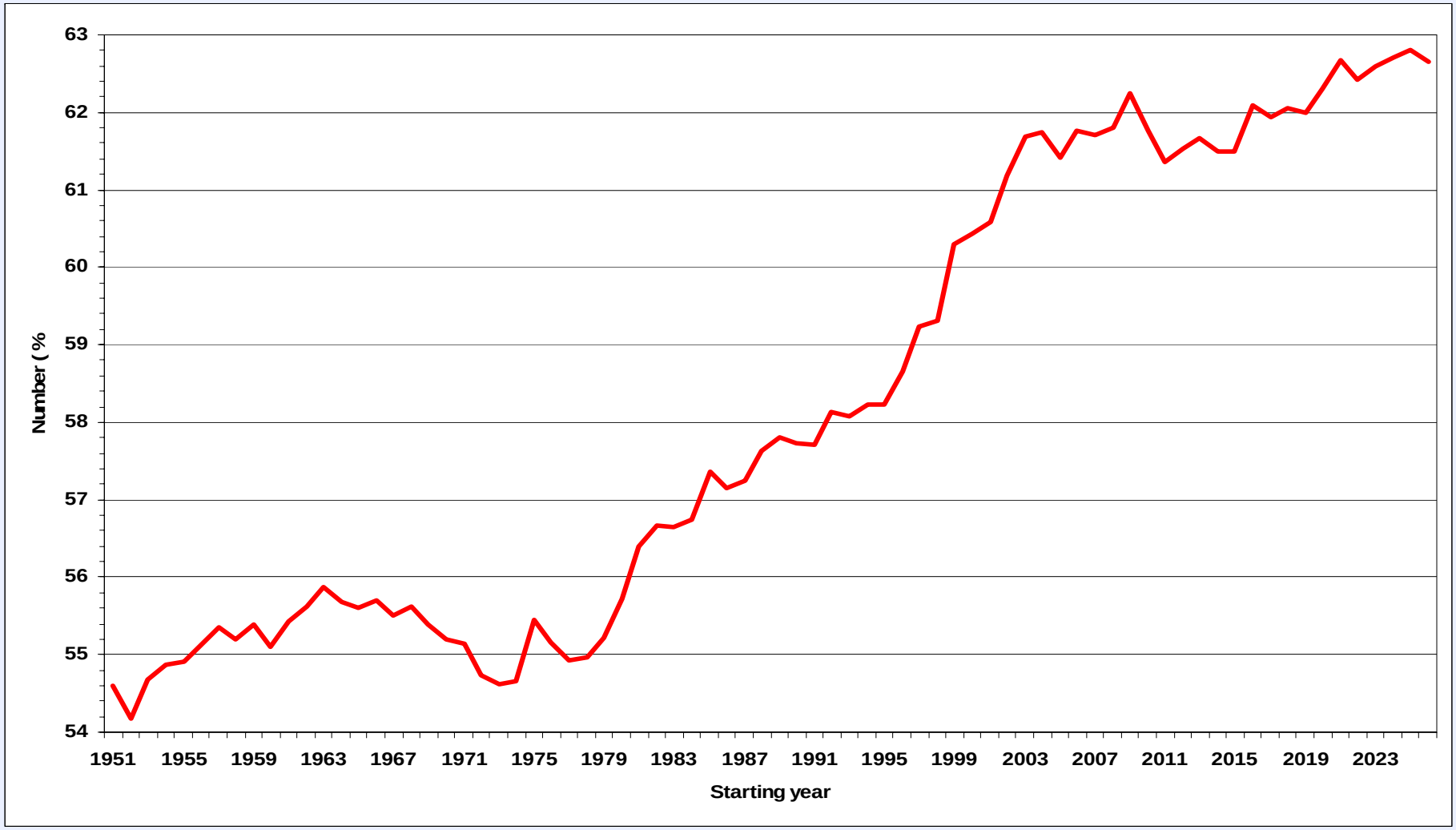
- Doubling of summer days
- Reducing of ice cold days up to 50%
- Important increase of hot and summer days in the central Elbe River basin
- Significant decrease of ice cold days in the upper course of the Elbe River

Precipitation extremes



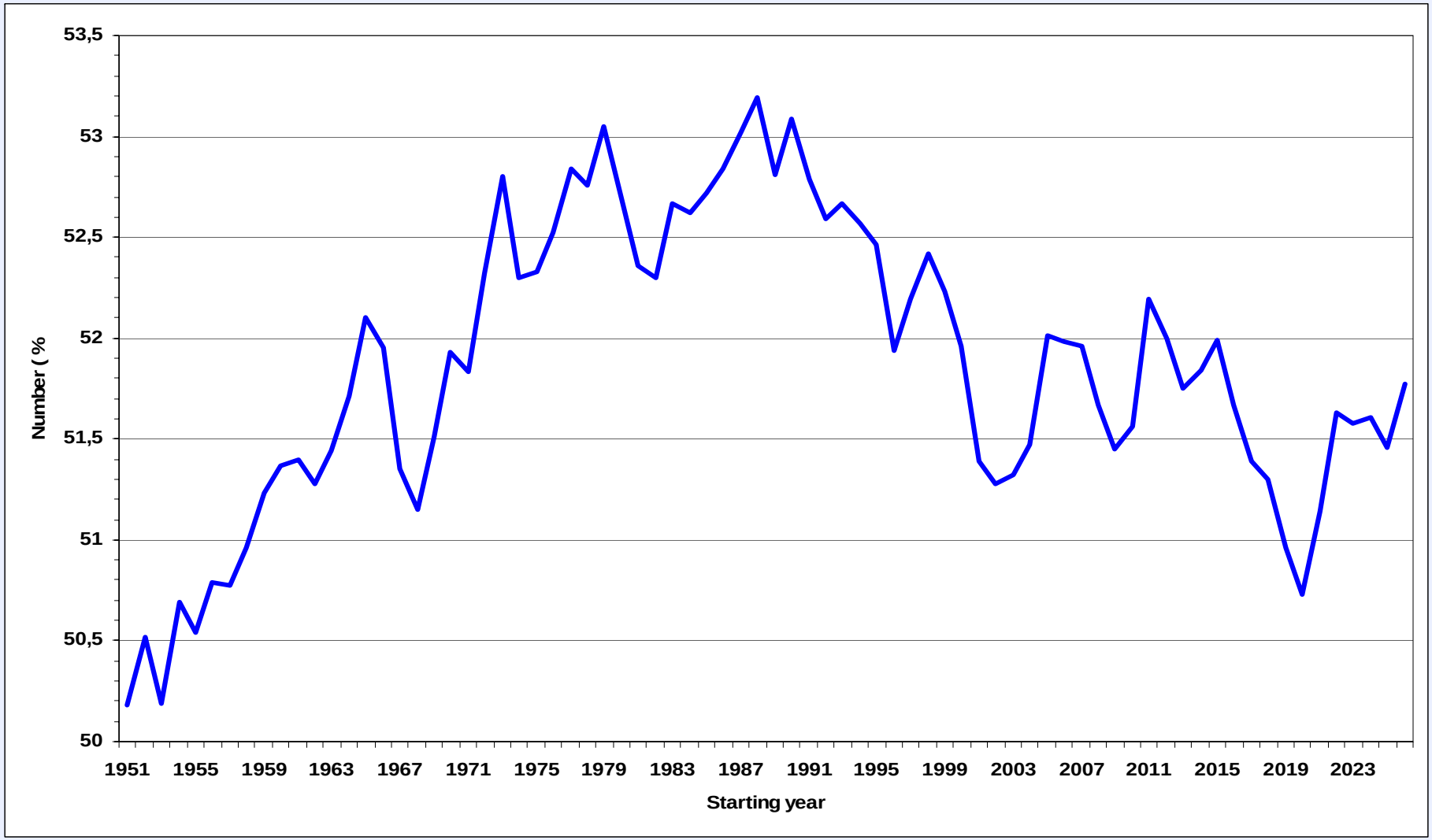
Differences (%) of the frequency of daily sums of precipitation, 2046/2055 – 1951/2003

Precipitation extremes



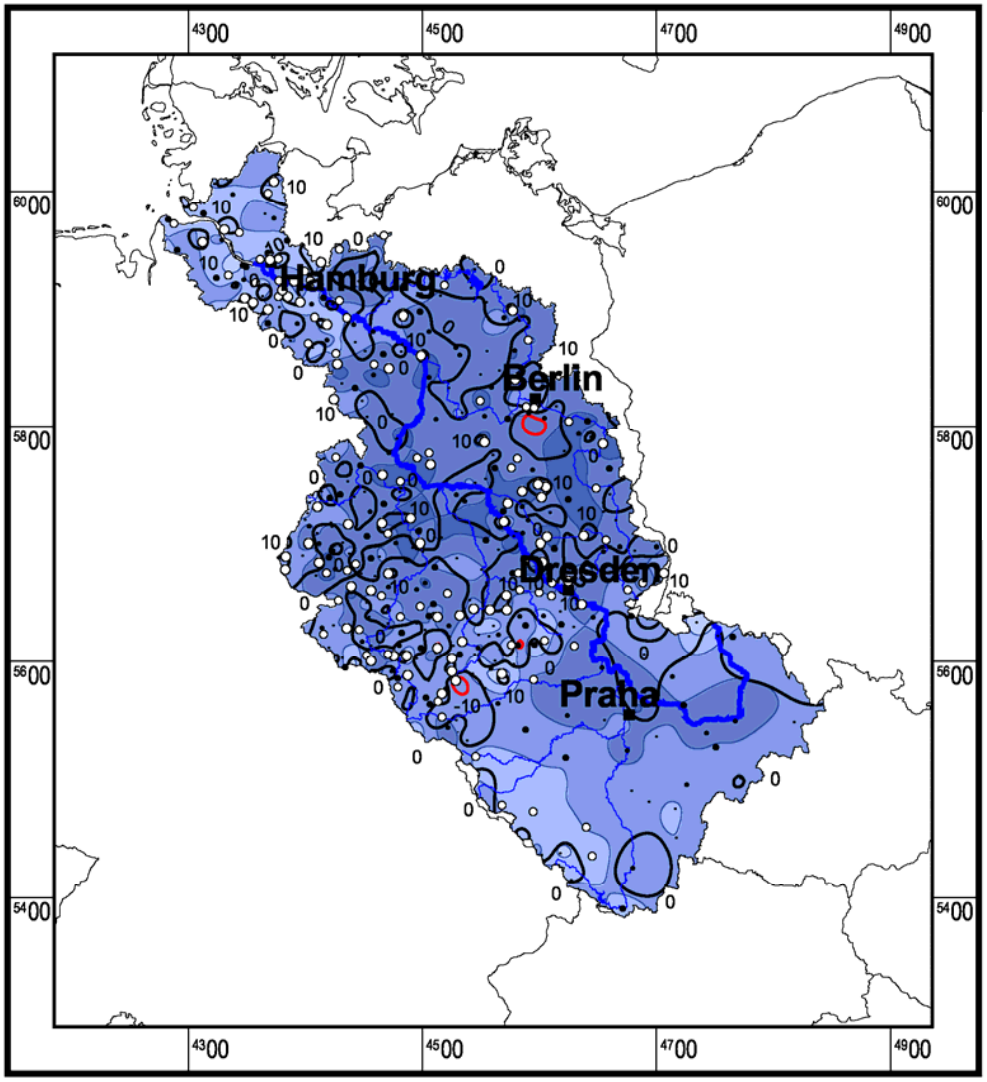
Mean number (%) of days without precipitation, 1951 – 2055, May – October, 30year shifting intervals, averaged over the Elbe river catchment

Precipitation extremes



Mean number (%) of days with precipitation, 1951 – 2055, November - April, 30year shifting intervals, averaged over the Elbe river catchment

Precipitation extremes



Days with precipitation ≤ 0.1 mm
basic scenario 1951/2003, summer

Mean value (days)

35 45 55

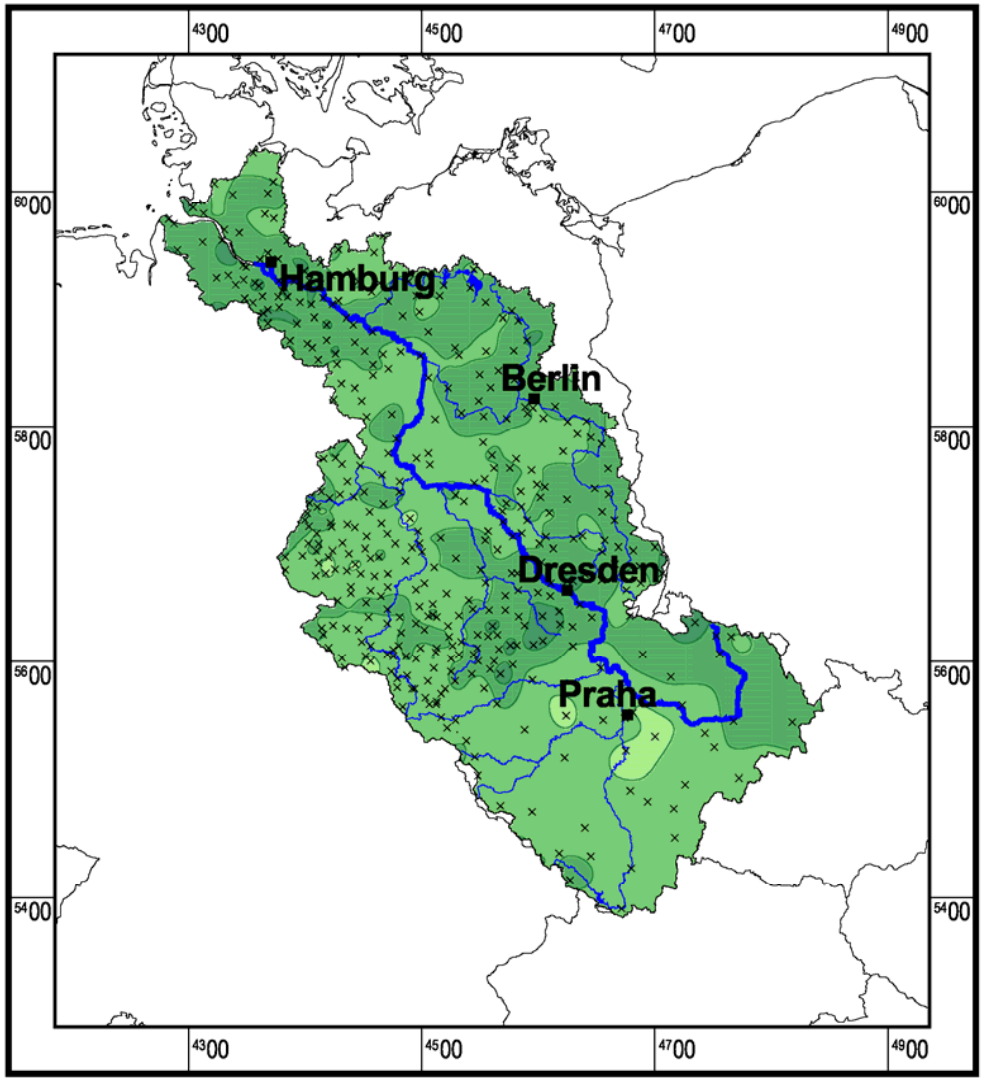
Trend (days)

Equidistance 10
Values ≥ 0
Values = -10

P [%]

0 80 90 95 99

Precipitation extremes



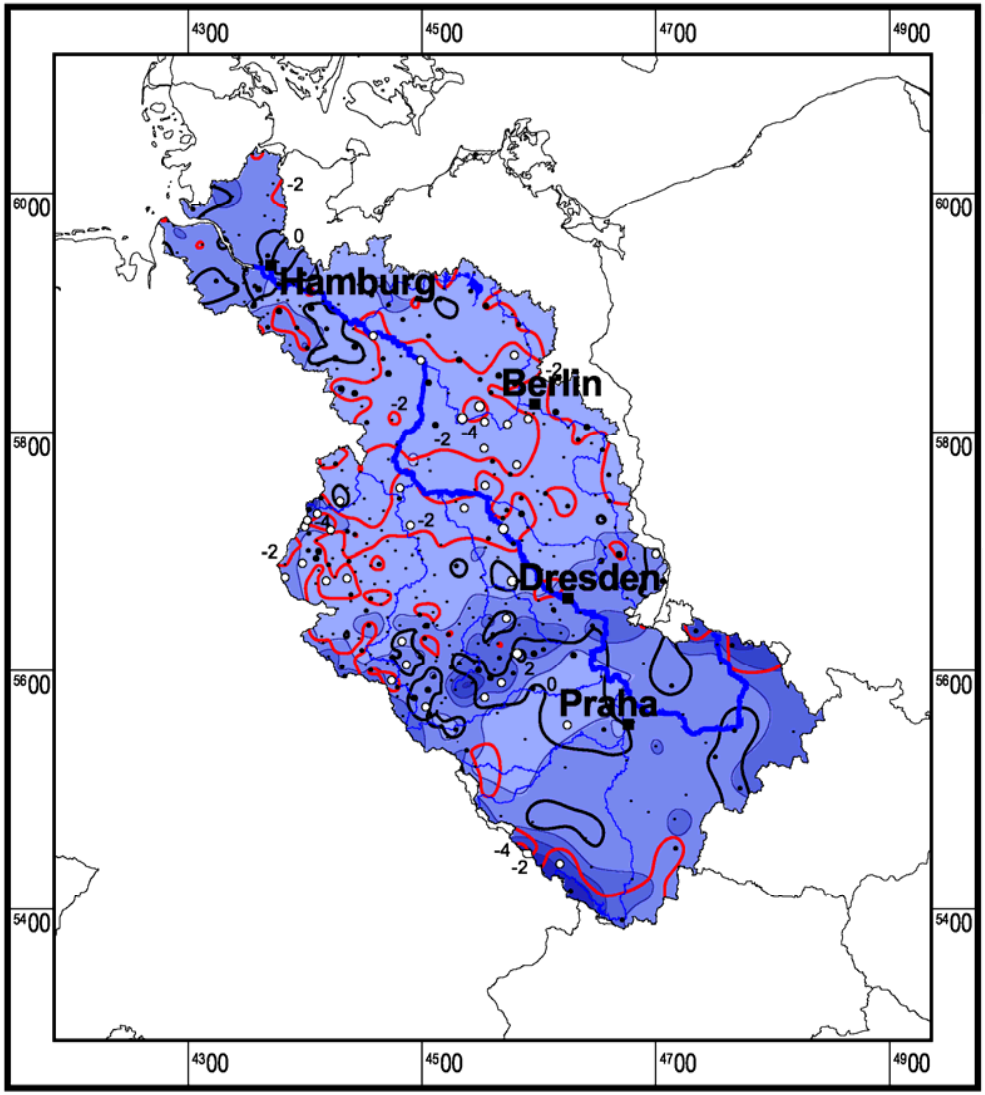
Änderung der Tage mit Niederschlag ≤ 0.1 mm
2046/2055 - 1951/2003, Sommer

Differenz [Tage]

3 9 15

× *Meteorologische Stationen*

Precipitation extremes



Days with precipitation > 10 mm
basic scenario 1951/2003, summer

Mean value (days)

4 8 12

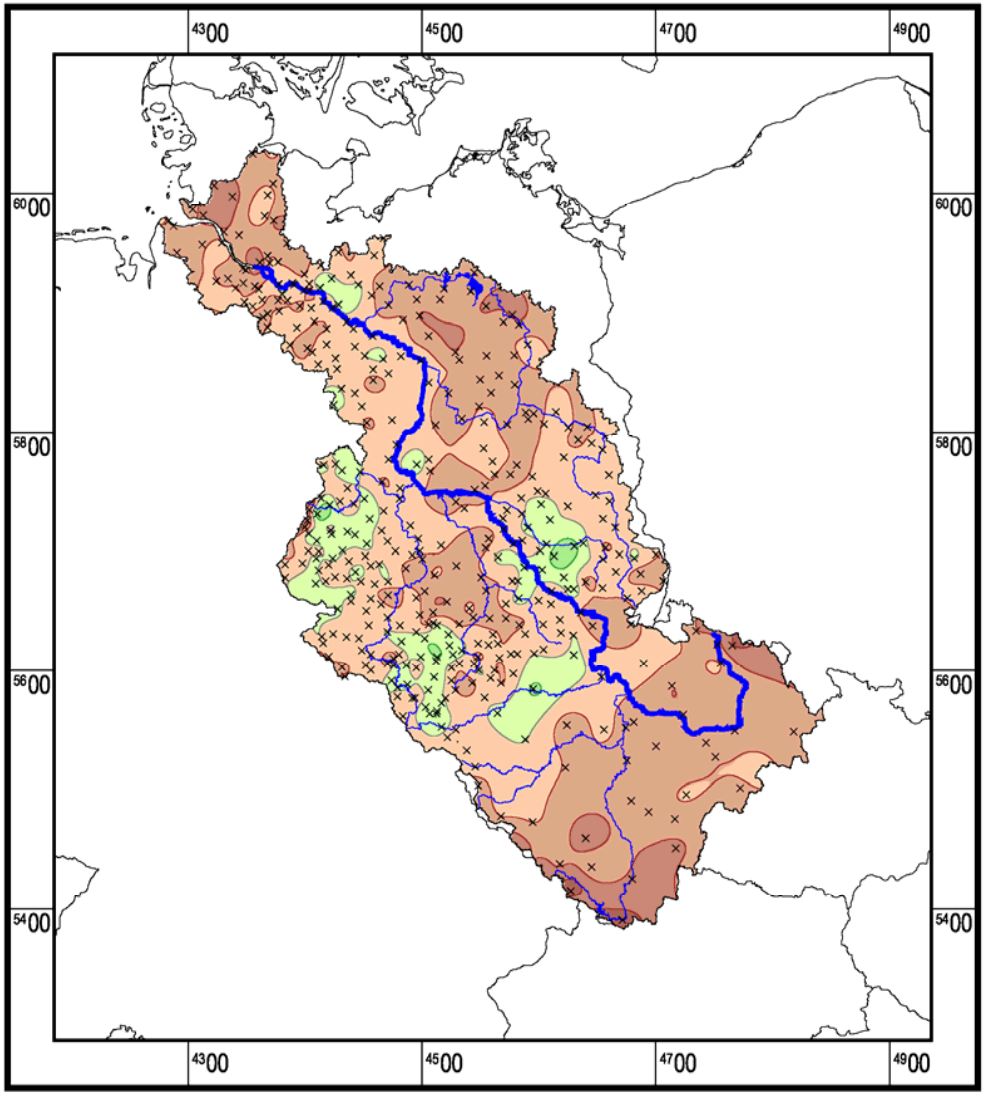
Trend (days)

Equidistance 2
Values ≥ 0
Values < 0

P [%]

0 80 90 95 99

Precipitation extremes



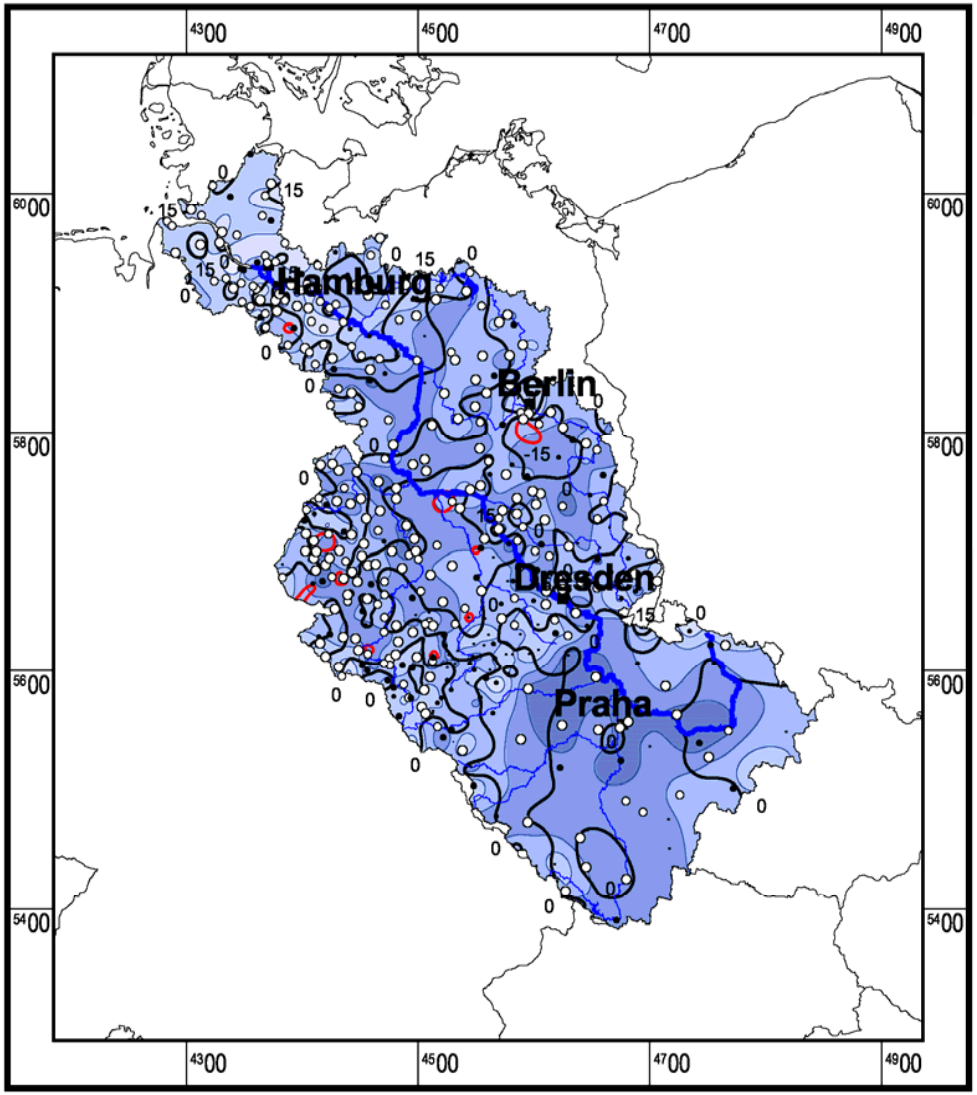
Change in days with precipitation > 10 mm
2046/2055 - 1951/2003, summer

Difference (days)

-4 -2 0 2

× *Meteorological station*

Precipitation extremes



Days with precipitation ≤ 0.1 mm
basic scenario 1951/2003, winter

Mean value (days)

25 35 45 55

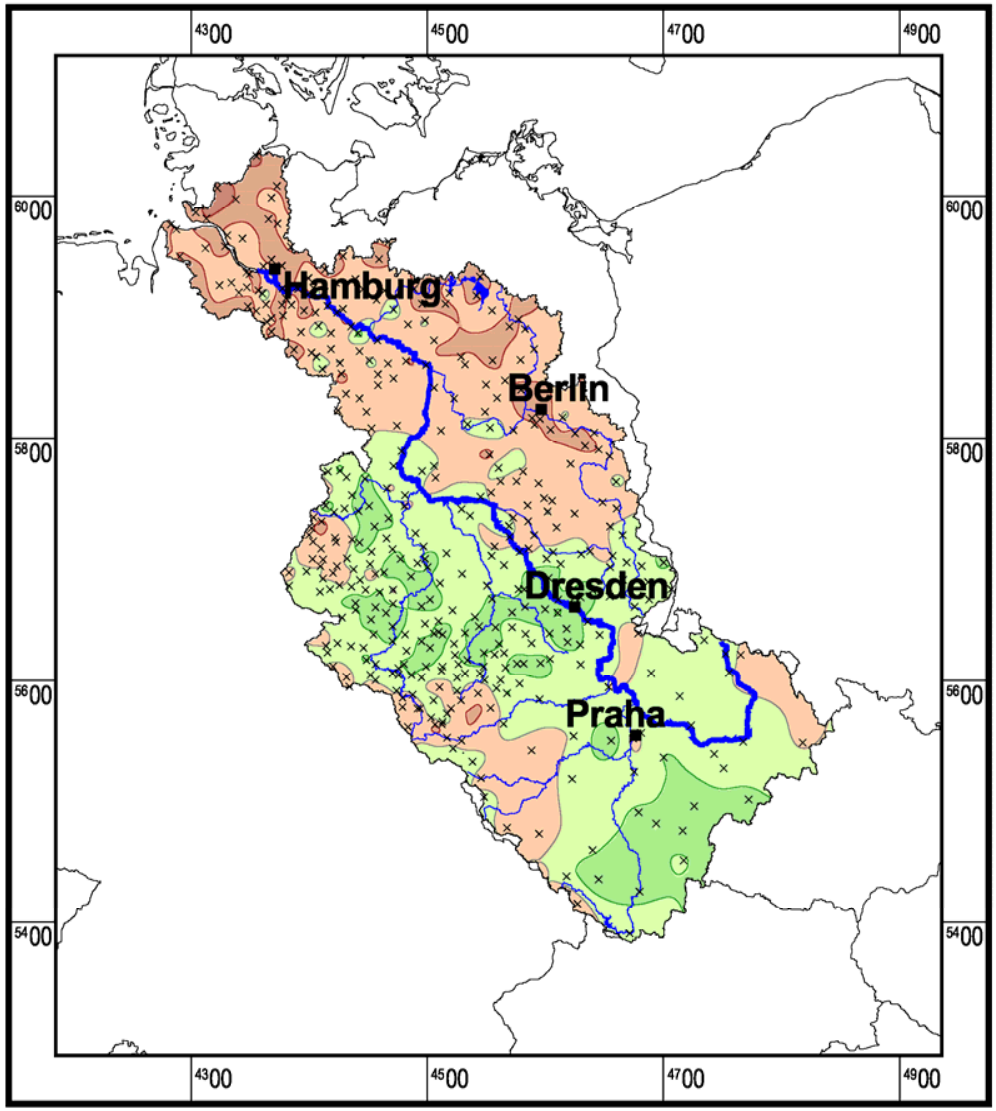
Trend (days)

Equidistance 15
Values ≥ 0
Values = -15

P [%]

0 80 90 95 99

Precipitation extremes



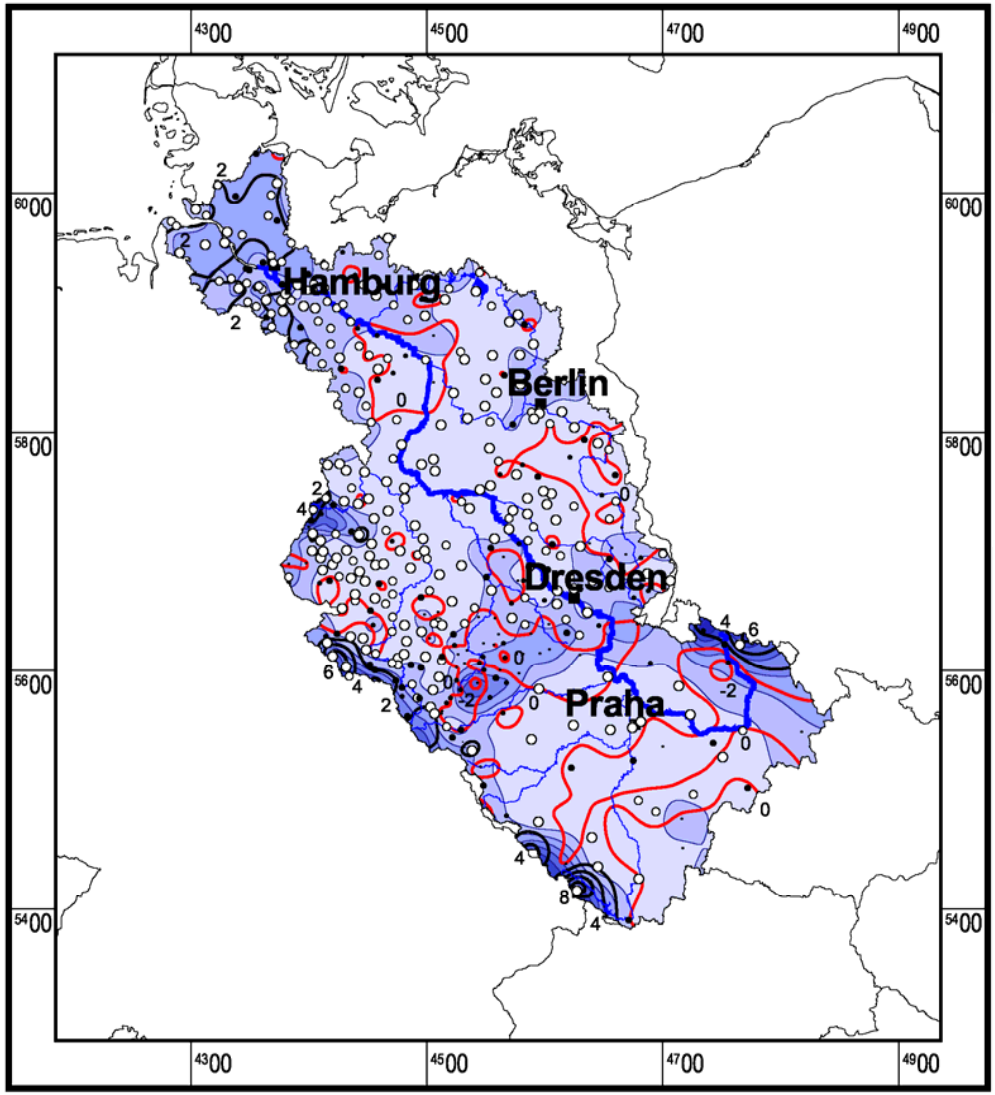
Change in days with precipitation ≤ 0.1 mm
2046/2055 - 1951/2003, winter

Difference (days)

-6 0 6

× *Meteorological station*

Precipitation extremes



Days with precipitation > 10 mm
basic scenario 1951/2003, winter

Mean value (days)

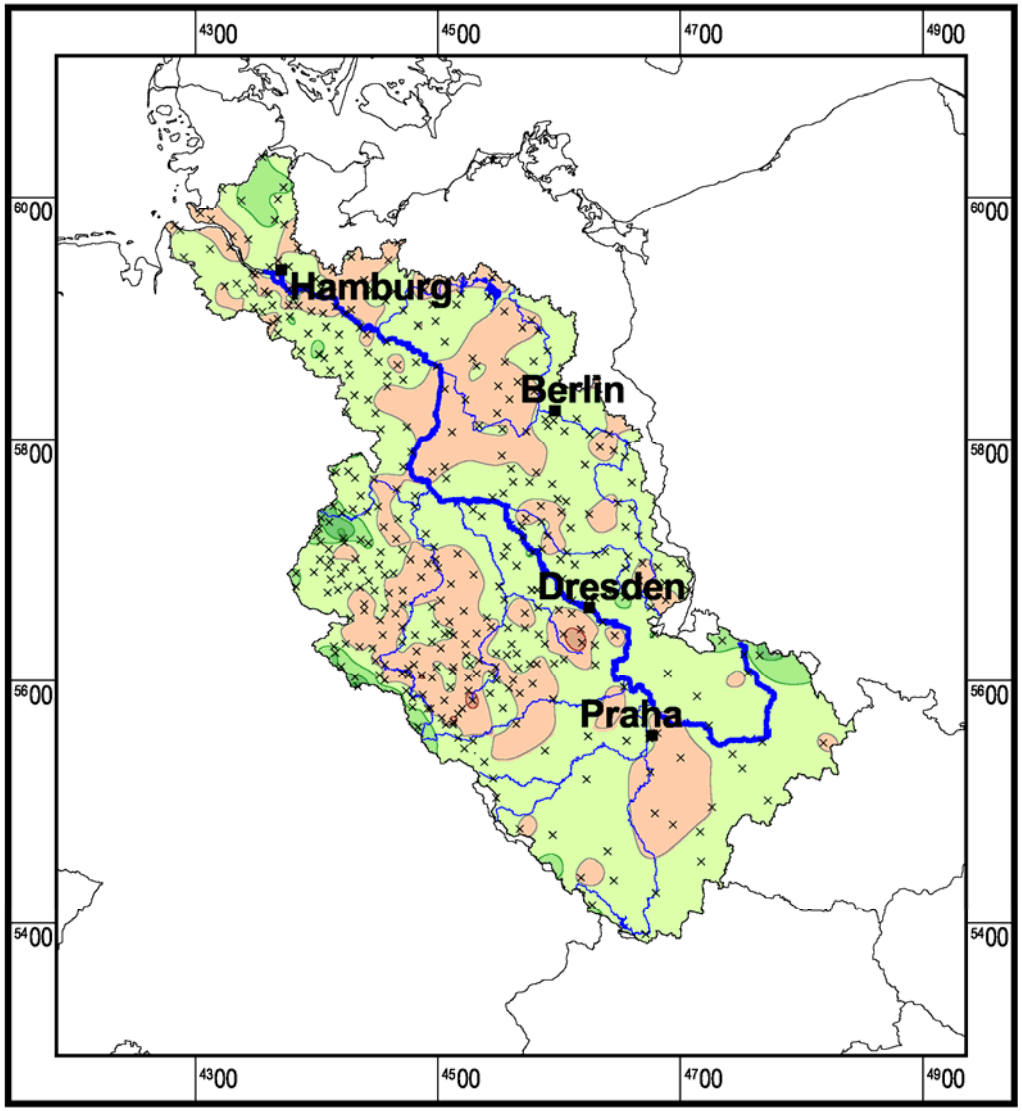
0 4 8 12

Trend (days)

Equidistance 2
Values > 0
Values ≤ 0

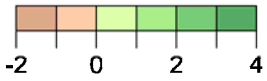
P [%]

0 80 90 95 99



Change in days with precipitation > 10 mm
2046/2055 - 1951/2003, winter

Difference (days)



× *Meteorological station*

Summary Precipitation

- Increase of days without and heavy precipitation
- Inrease of dry days in summer
- Non-significant trends of heavy precipitation events in summer
- Northern parts – reduction, southern parts - growth of dry days in winter
- In winter an increase of days with heavy precipitation dominates

Outlook

- **Further development of the STAR model**
  - **Installation of variable block sizes**
  - **Application of dynamical parameters**
  - **Improvement of the adaptation to non-stationary processes**

Thank You

for your attention!