Erasmus+ lecture at the Department of Geography,
Masaryk University (Brno, Czech Republic)
March, 27-31, 2017

URBAN CLIMATE RESEARCH GROUP FROM NOVI SAD (SERBIA) AND URBAN HEAT ISLAND ISSUES

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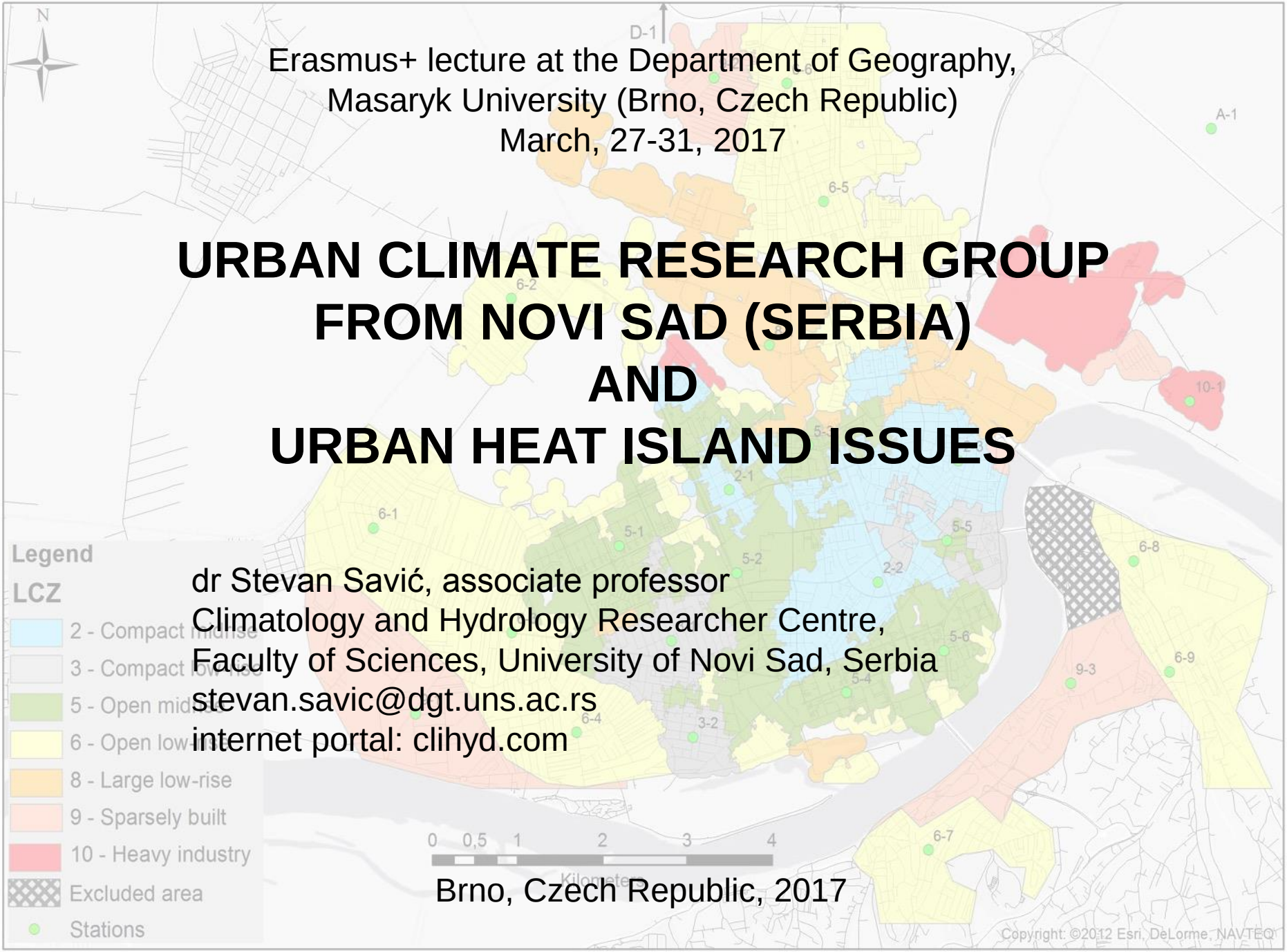
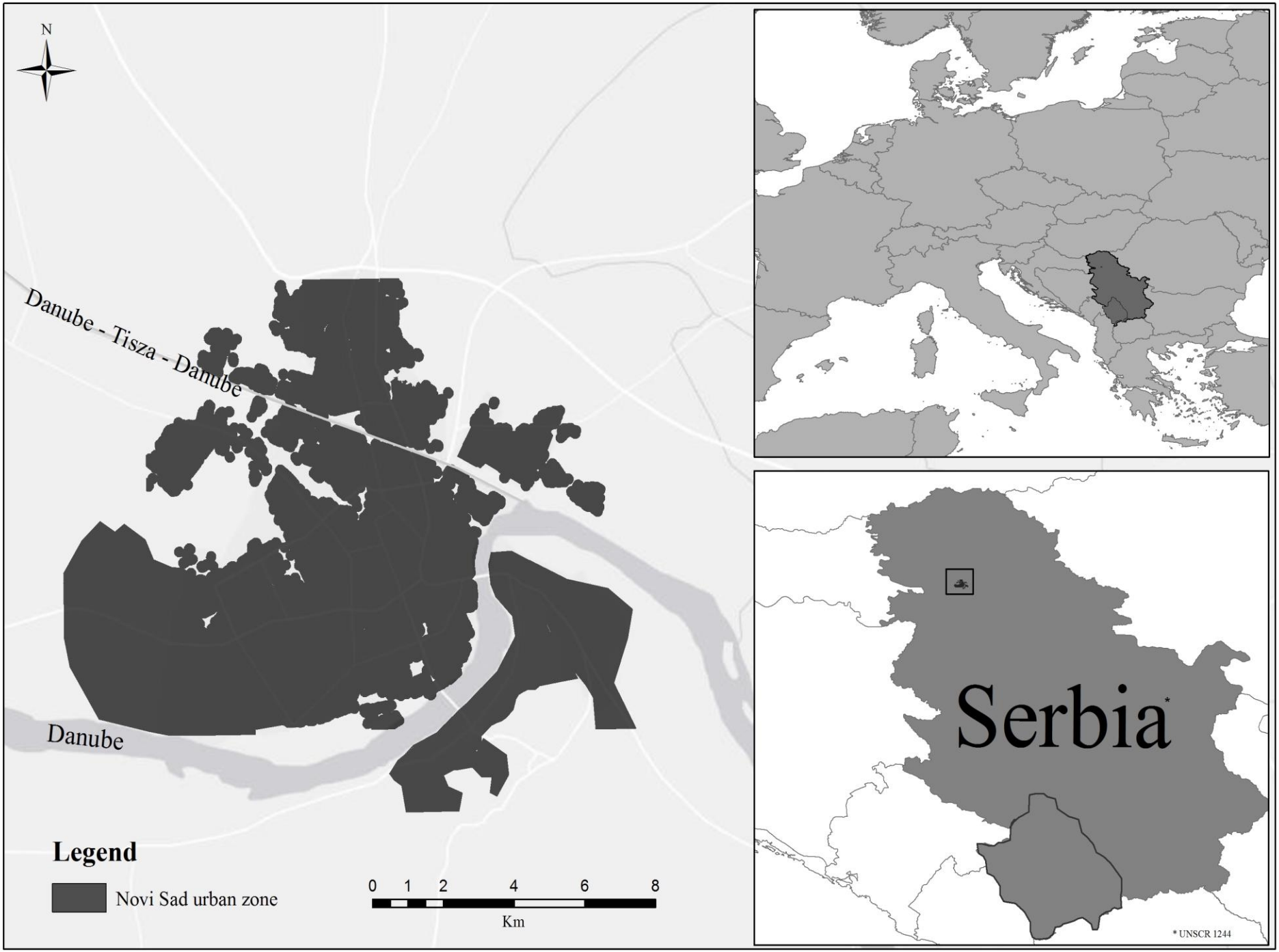
internet portal: clihyd.com

Brno, Czech Republic, 2017




N
Danube - Tisza - Danube
Danube
Legend
Novi Sad urban zone
0 1 2 4 6 8
Km
Serbia*
* UNSCR 1244

UNIVERSITY OF NOVI SAD (VOJVODINA, SERBIA)

Internet portal: http://www.uns.ac.rs/sr/

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Faculty of Sciences is an educational and scientific institution providing teaching and scientific research within the fields of biology, chemistry, physics, mathematics, informatics, geography, tourism and environmental protection at five departments.
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Department of Physics
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CLIMATOLOGY AND HYDROLOGY RESEARCH CENTRE

NEWS & EVENTS

NOVEMBER 12 2016

CLIMATE RESEARCH

TO DISCOVER AND EXPLAIN THE IMPACTS OF CLIMATE ON SOCIETY

RESEARCH TOPICS

– The climatology and meteorology of urban areas –

– Outdoor human comfort –

– Climate and urban planning –

– Climatic changes in Europe –

– Climate impacts on agriculture –

– etc. –

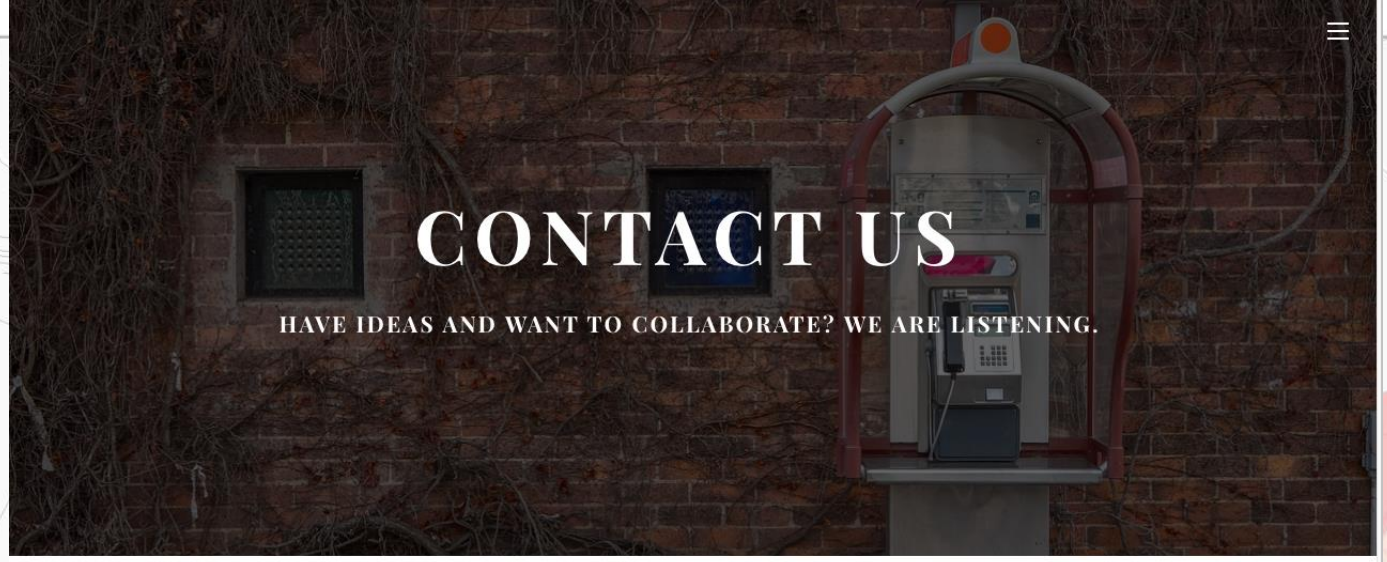
PROJECTS

– Evaluations and public display of urban patterns of human thermal conditions (URBAN-PATH Project) –

PUBLICATIONS

A list of relevant scientific papers can be downloaded:

Download



CONTACT US

HAVE IDEAS AND WANT TO COLLABORATE? WE ARE LISTENING.

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E-mail:
stevan.savic@dgt.uns.ac.rs
dragan.milosevic@dgt.uns.ac.rs

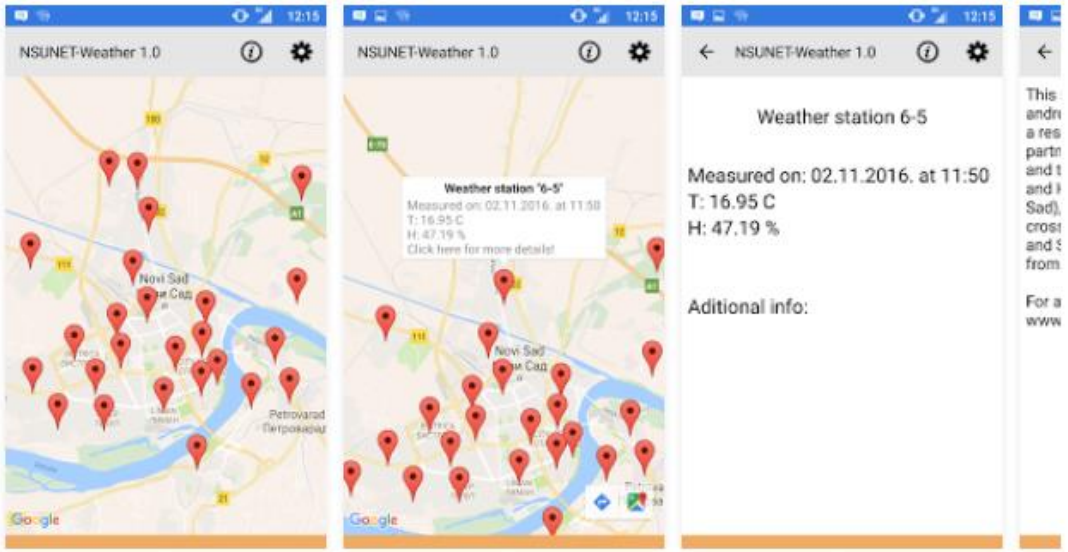
NSUNET-Weather

PMF informatika Weather

★★★★☆ 45

PEGI 3

Add to Wishlist Install



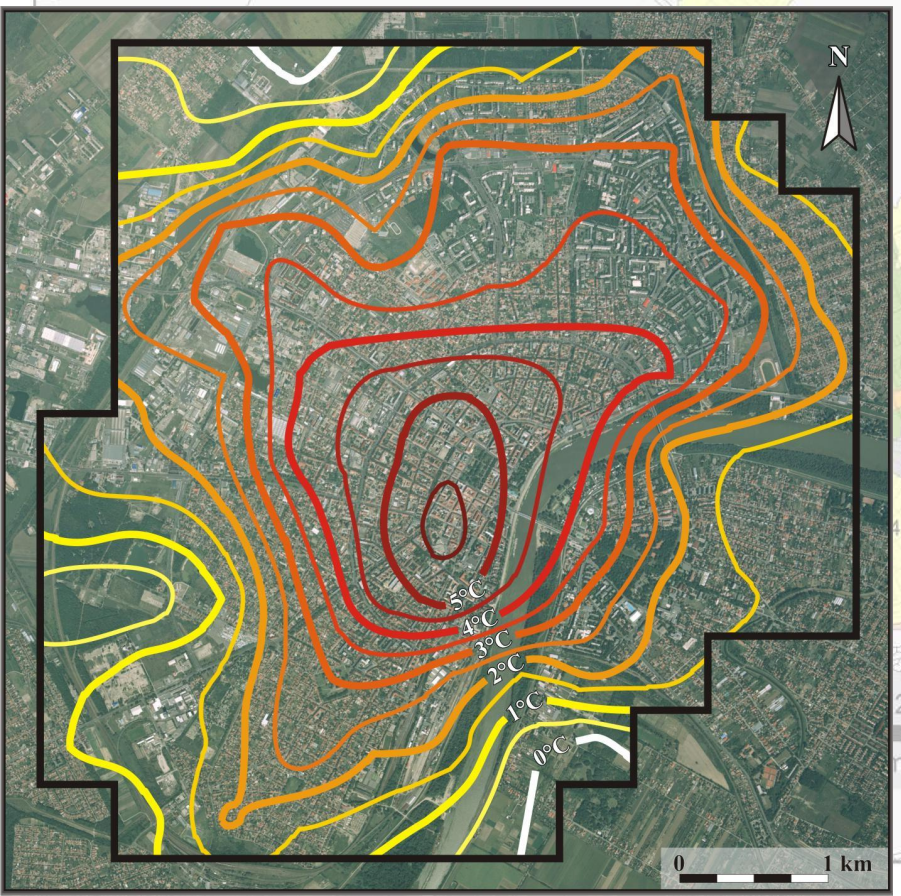
NSUNET-Weather presents hourly air temperature and relative humidity measurements from 28 meteorological stations within NSUNET system, installed in urban area of Novi Sad (Serbia). The NSUNET system is result of the project Evaluation and public display of URBAN PATterns of Human thermal conditions – URBAN-PATH, financed by IPA HU-SRB cross-border program. The URBAN-PATH project is realised by Department of Climatology and Landscape Ecology, Faculty of Sciences (University of Szeged, Hungary) and Climatology and Hydrology Research Centre, Faculty of

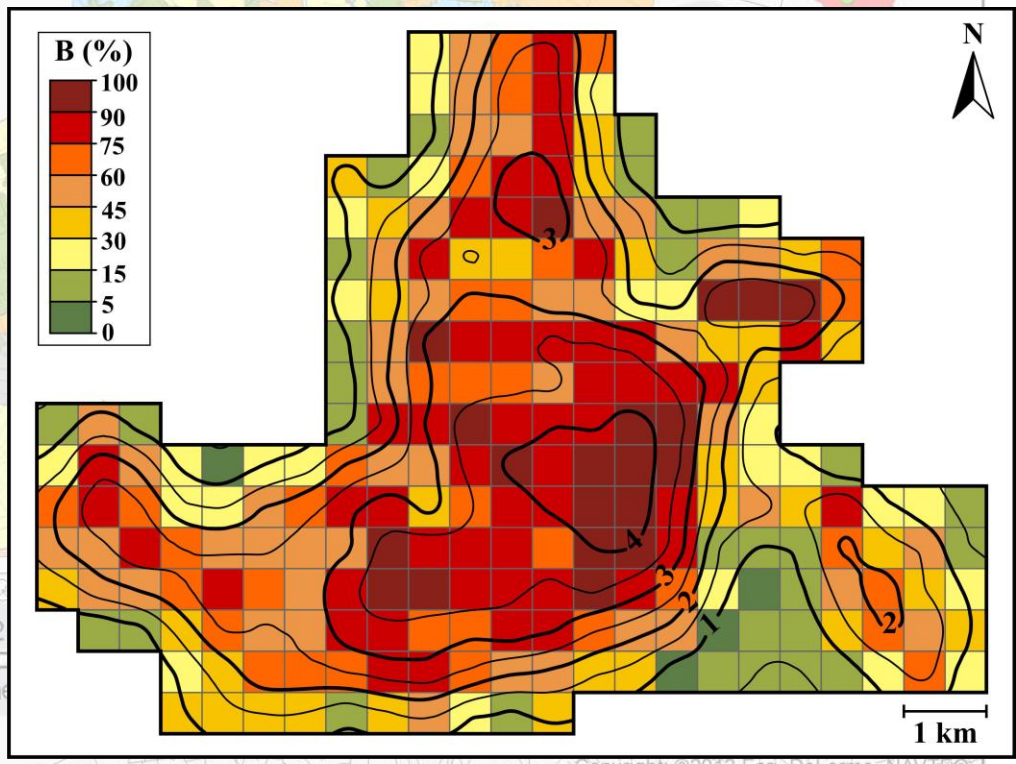
READ MORE

SPATIAL PATTERN OF UHI

Urban temperature modification presented by urban heat island (UHI):
-area of higher urban temperatures compared to those in surrounding (non-urbanized) areas

UHI intensity = ΔT_{u-r}



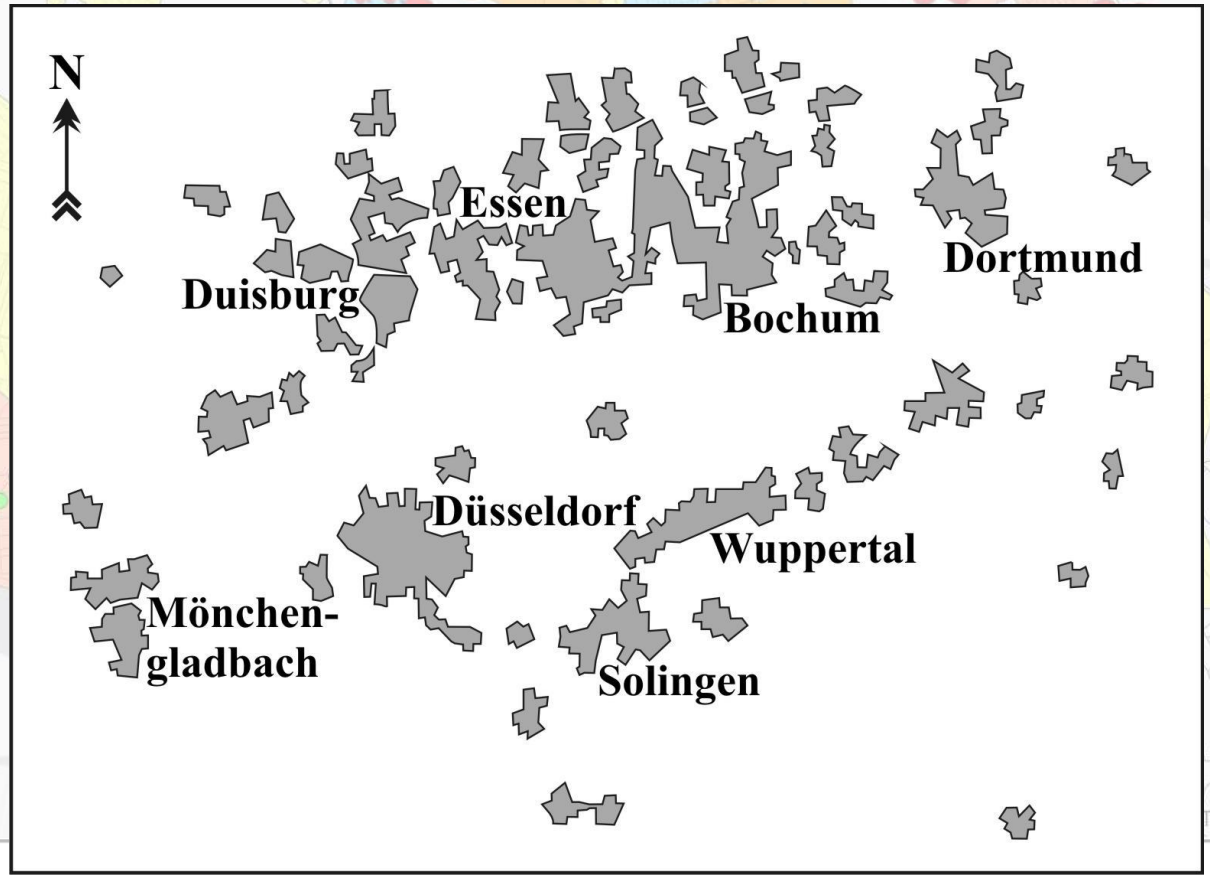


SPATIAL PATTERN OF UHI

Acceleration of urbanization:

- 17-18th centuries − large development of European settlements − onset of industrial revolution
- first part of 20th century − striking American development
- last decades − development of different agglomerations worldwide

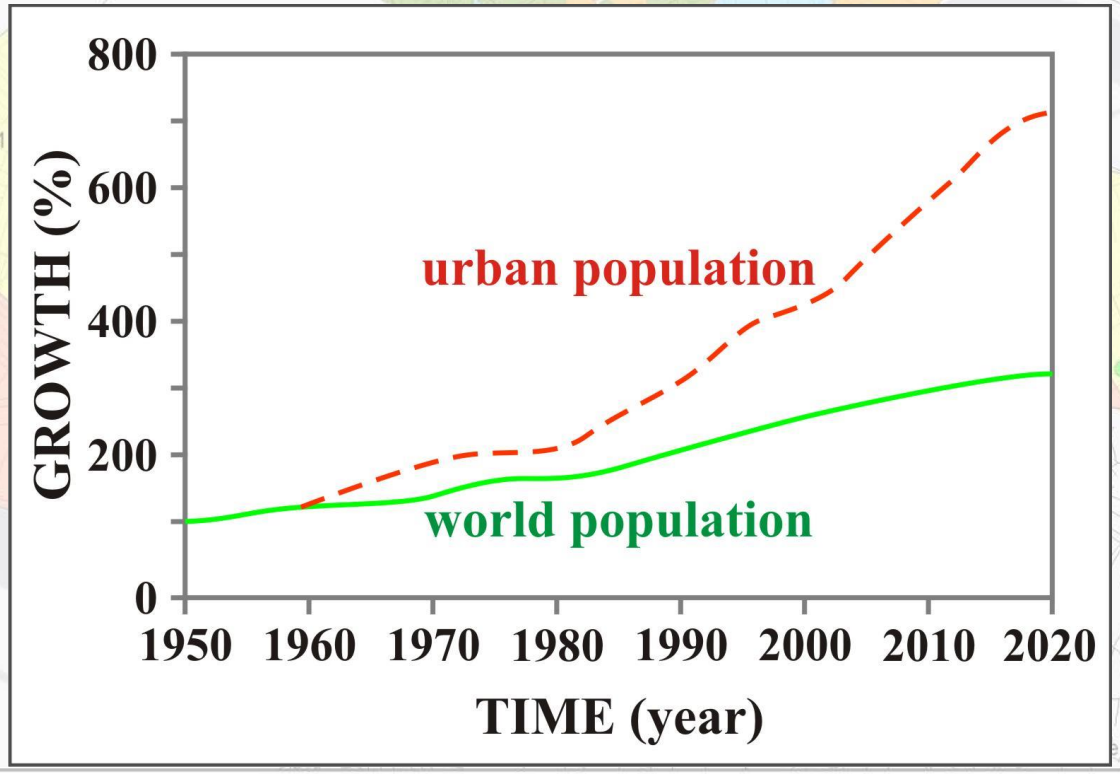
Angglomeration of Ruhr-area



SPATIAL PATTERN OF UHI

- Luk Hauard, chemist and meteorologist – 1820 firstly noticed the differences in air temperature
- 1958, start to use UHI term

World and urban population growth between 1950 and 2020



LAYERS IN THE URBAN ATMOSPHERE

UCL – Urban canopy layer:
-air among the buildings
- its height - average building height
- its pecularities - governed by micro-scale processes

UBL – Urban boundary layer:
-its basic - near the roof level
- its pecularities - governed by the general urban surface
- its height - depended on the roughness conditions significantly

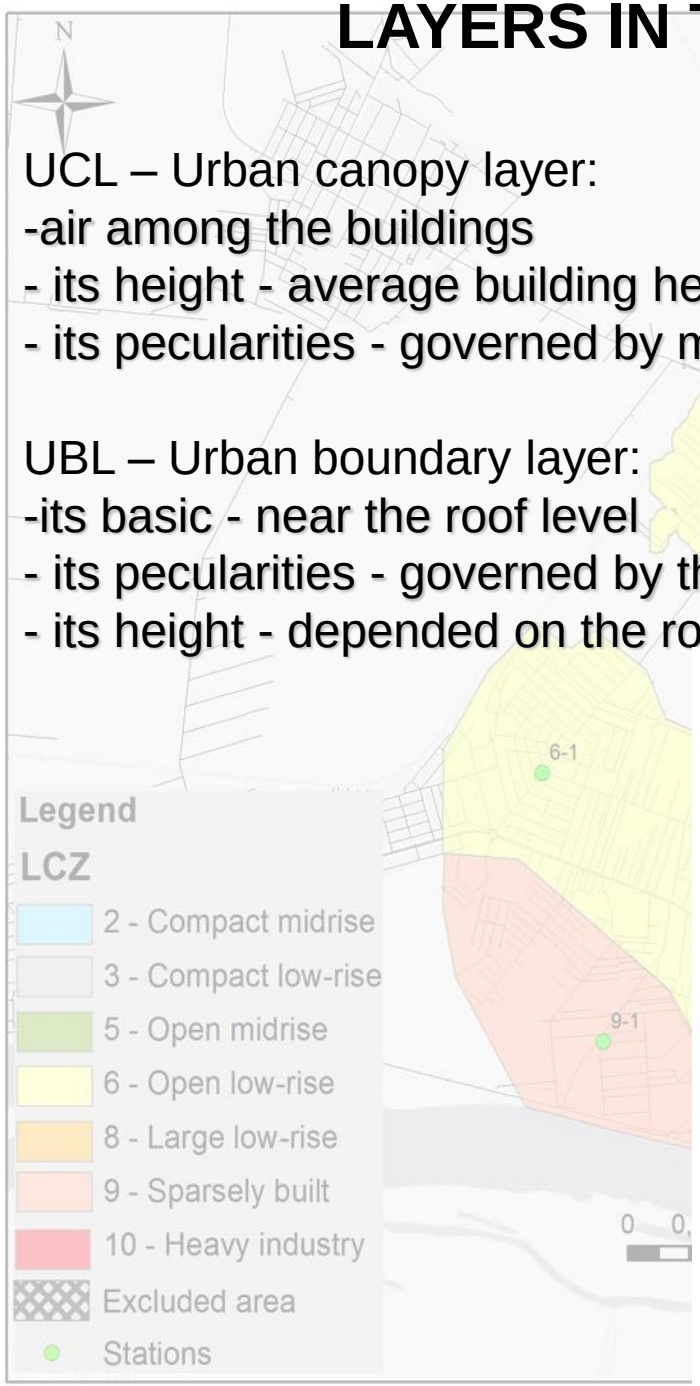
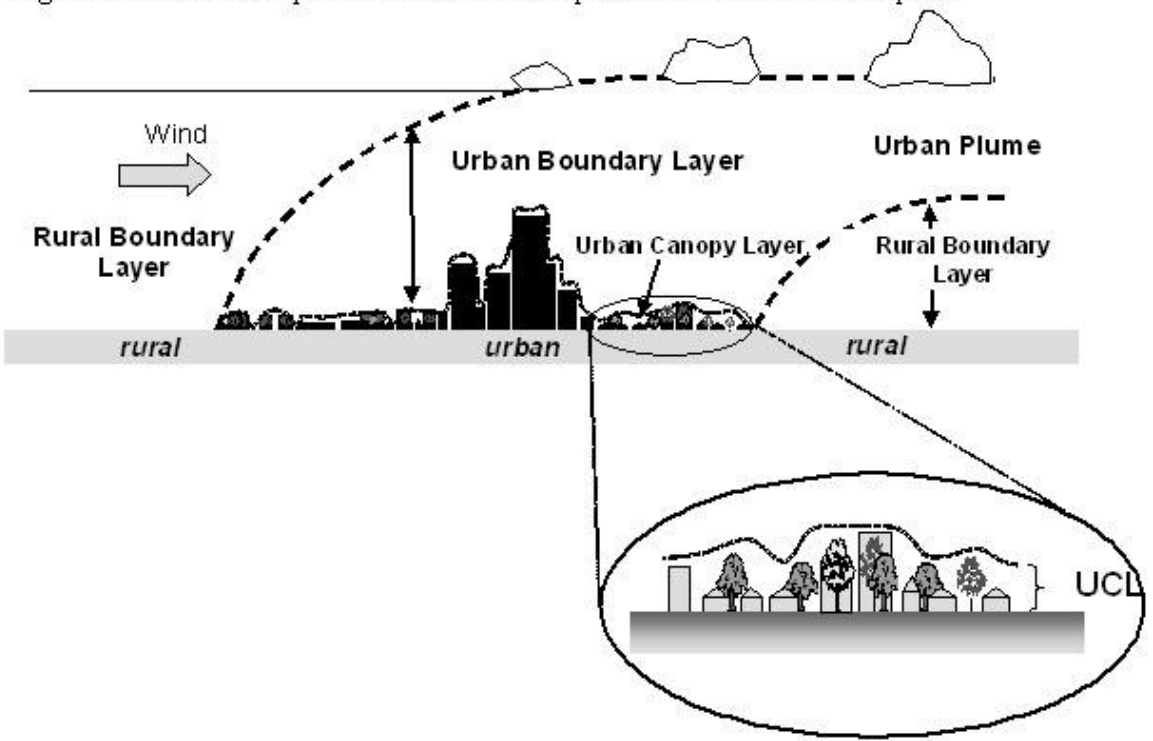


Figure 1. Schematic depiction of the main components of the urban atmosphere.



SPATIAL PATTERN OF UHI

Characteristics of urban areas:

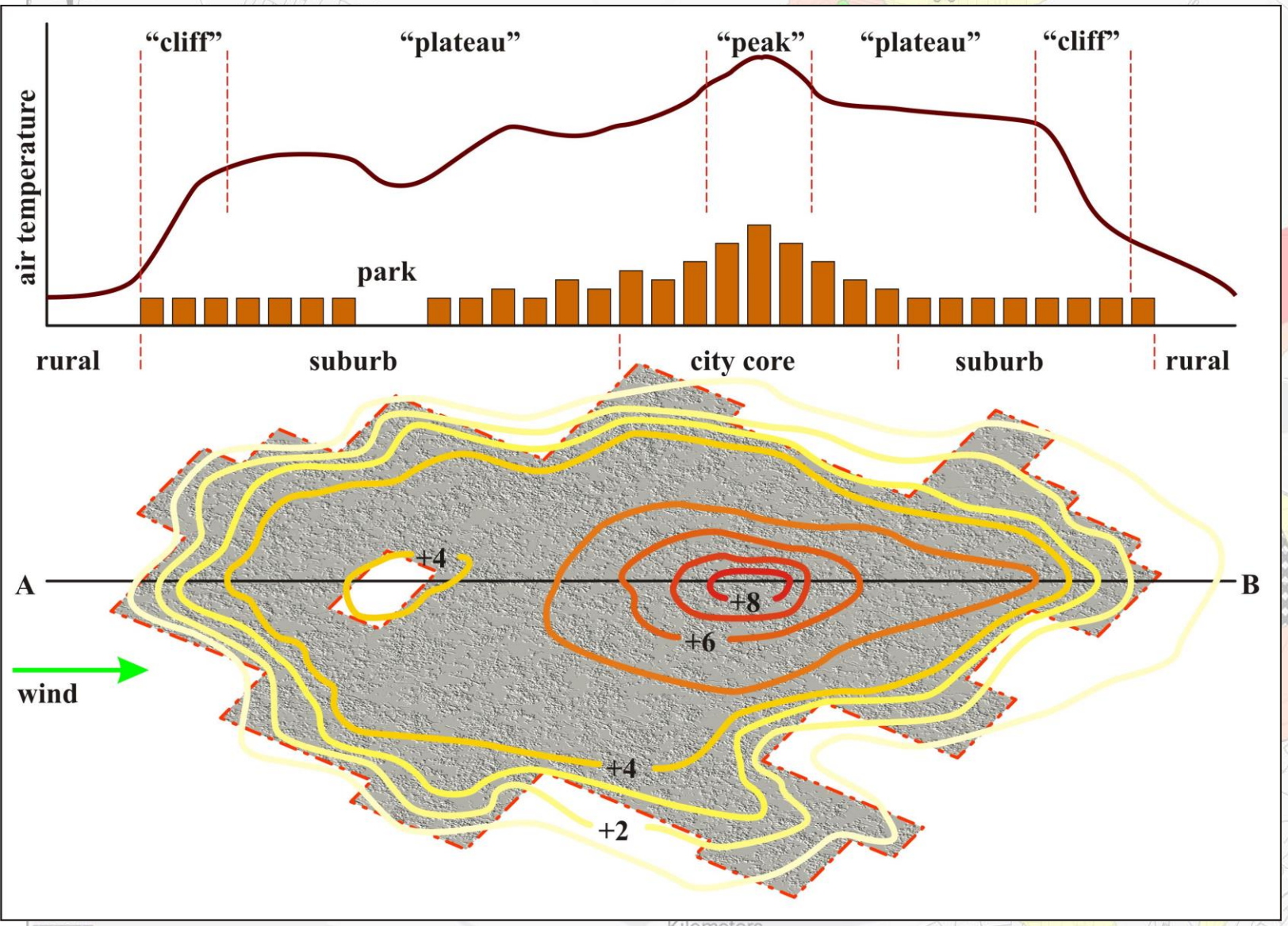
- huge population concentration in the small area

- air pollution: water vapour, gases, smoke and other solid pollutants released by heating, traffic and industrial processes

- anthrophogenic heat production: heat produced by human activities (industry, traffic, heating) and realesed into the environment

- urban roughness (thermal modifications and reduced sky view factor)

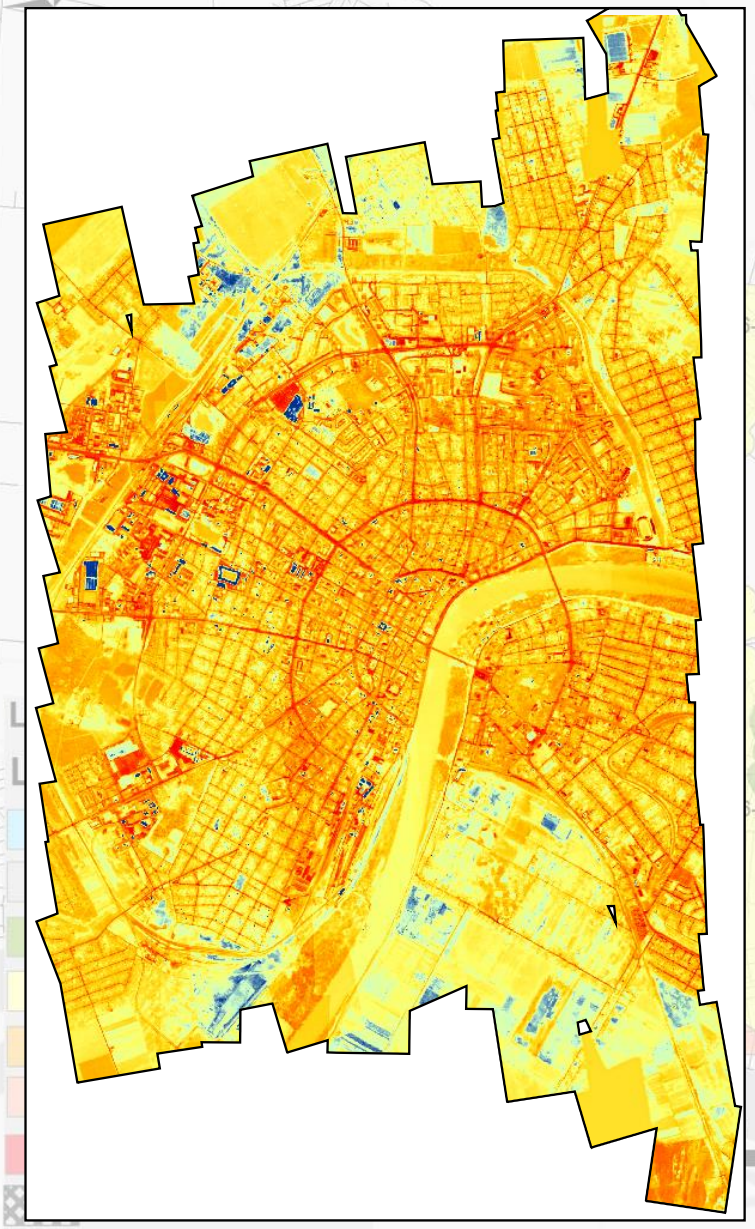
SPATIAL PATTERN OF UHI

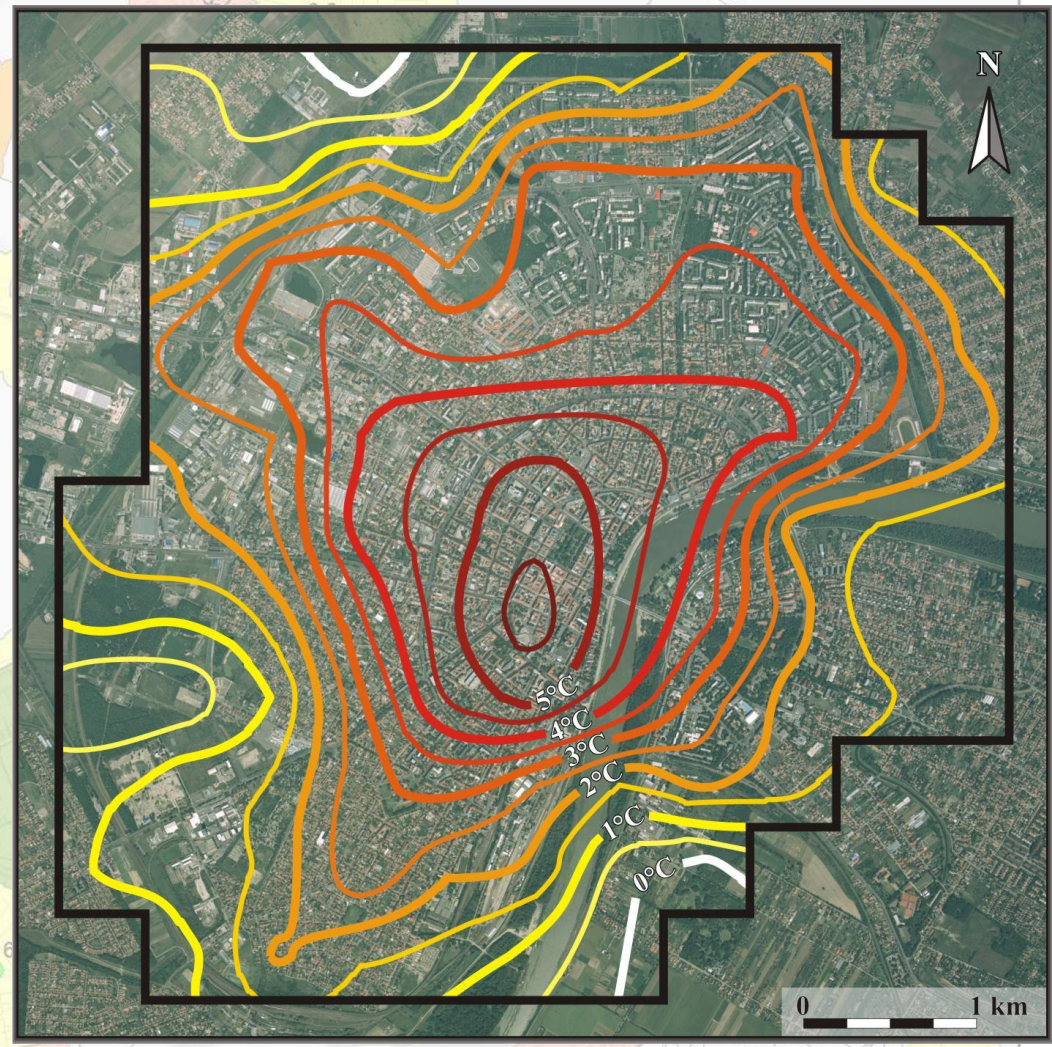


UHI intensity

Spatial pattern of UHI along a cross-section (AB) and its horizontal structure

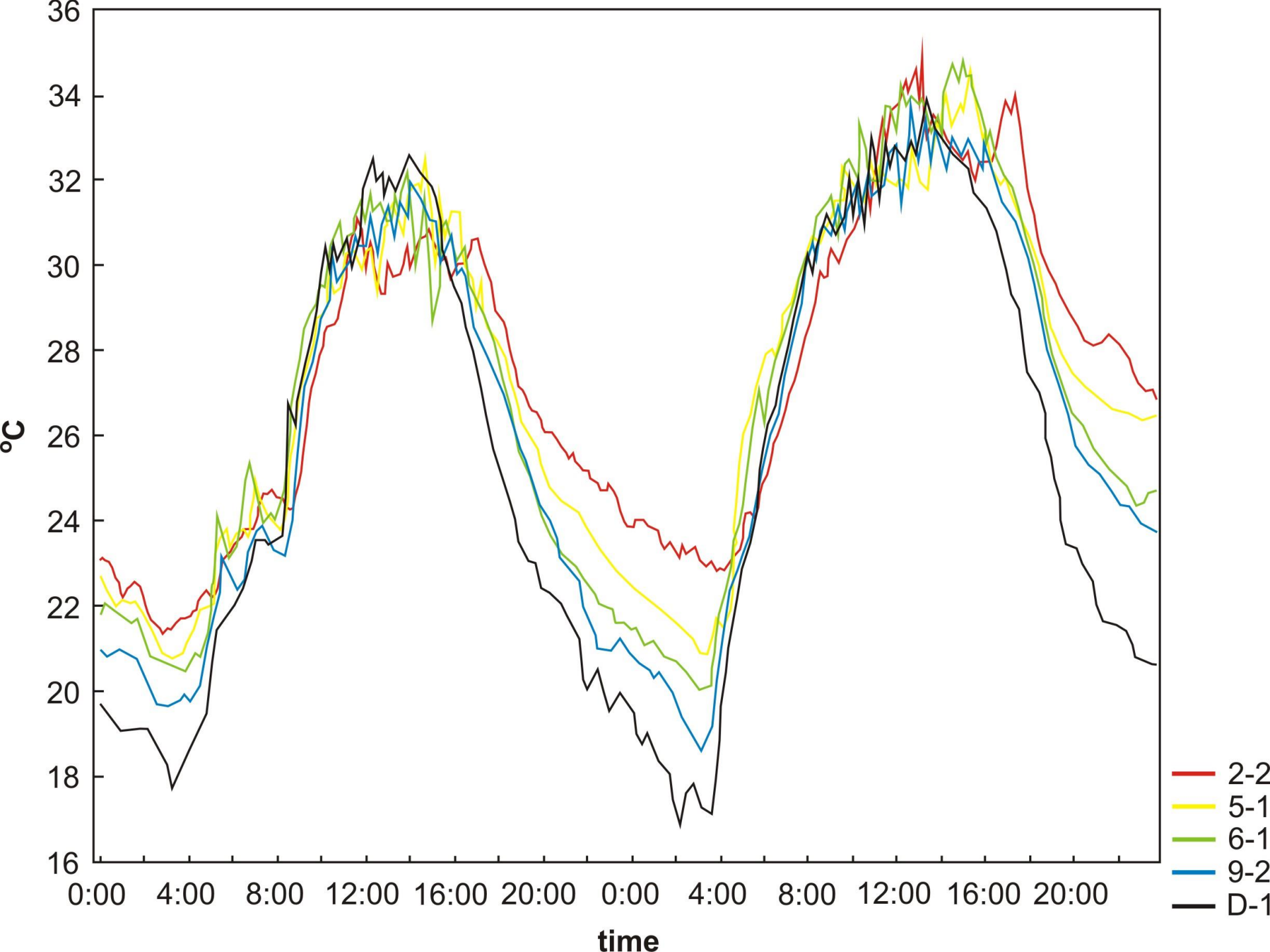
SPATIAL PATTERN OF UHI

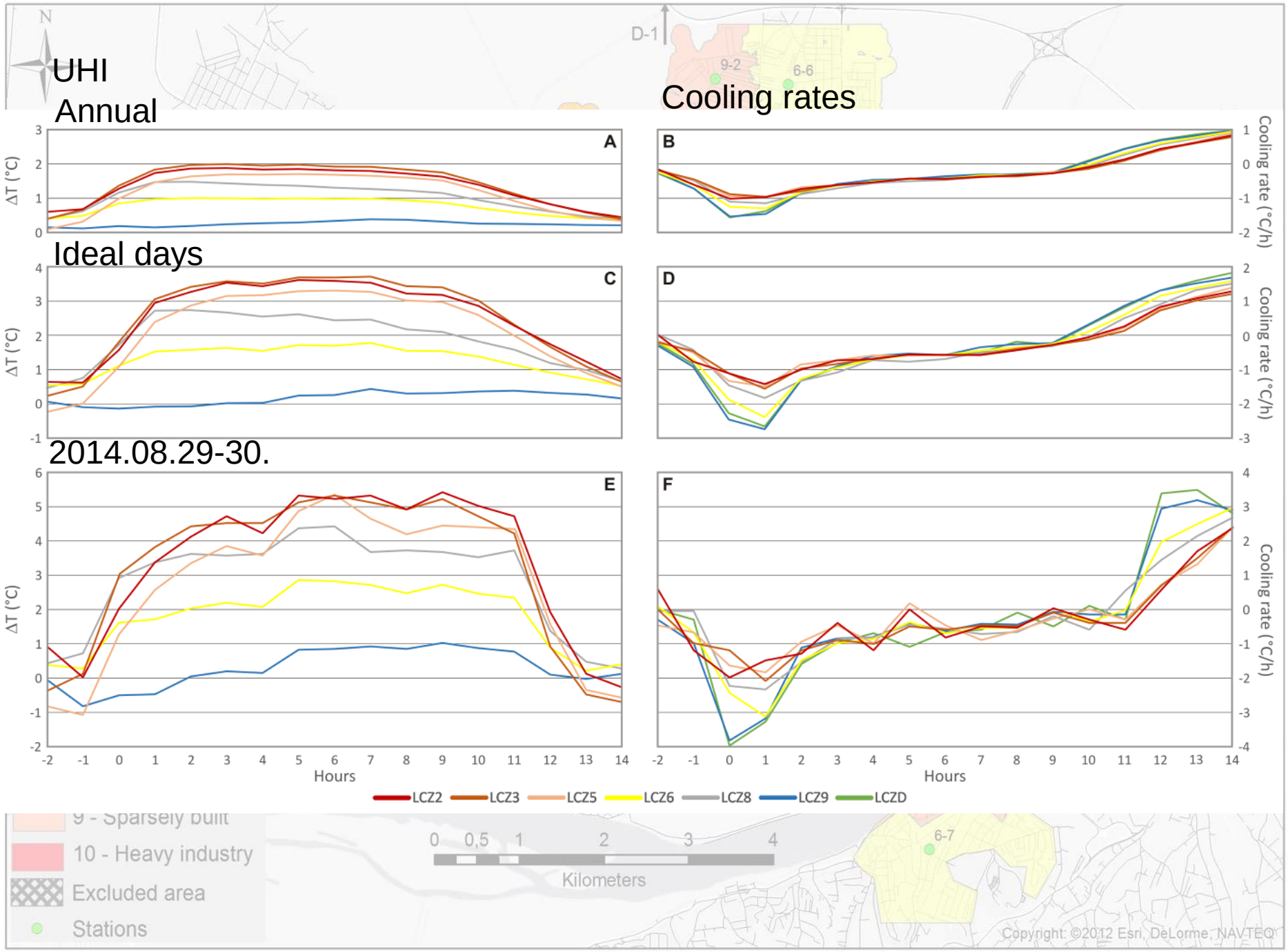




Nocturnal UHI intensity distribution (Szeged, 25.03.2003)

Nocturnal surface temperature pattern (Szeged, 14.08.2008)

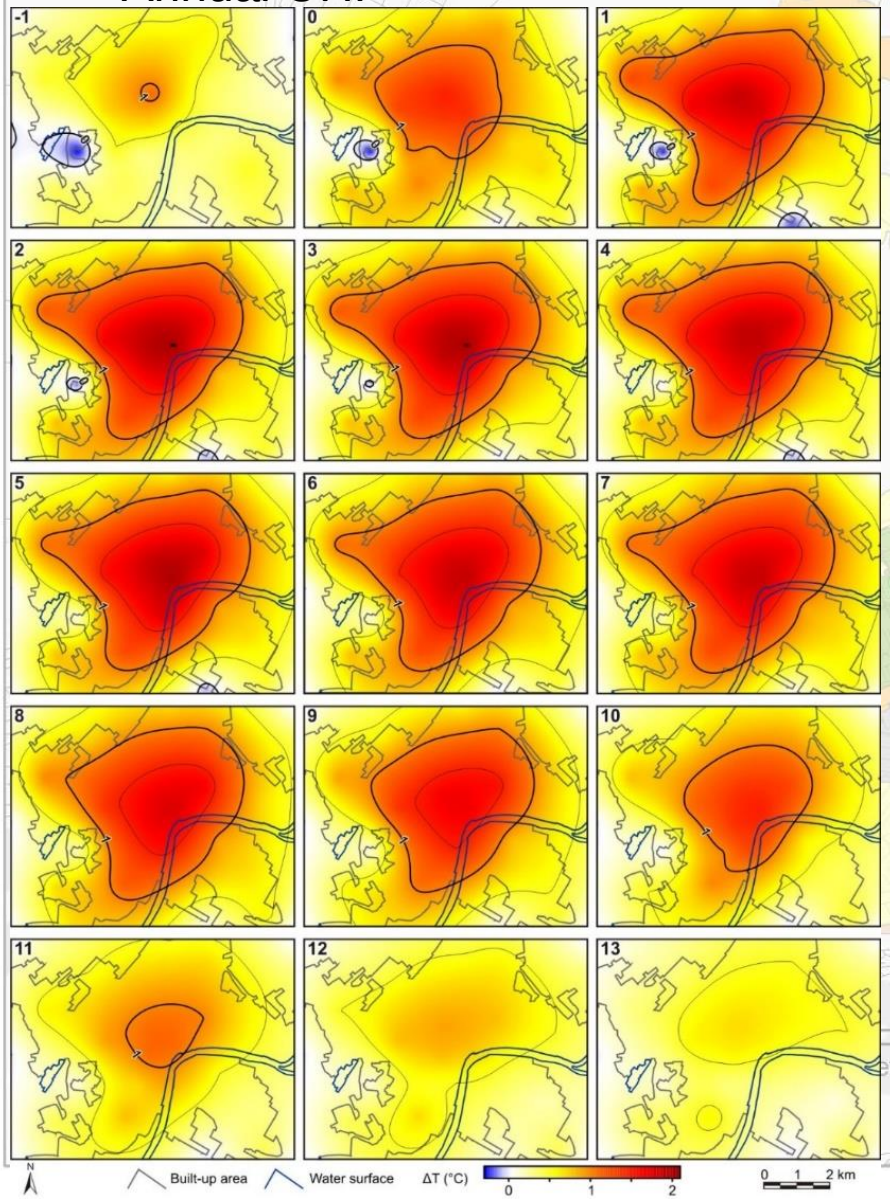

36
34
32
30
28
26
24
22
20
18
16
°C
0:00
4:00
8:00
12:00
16:00
20:00
0:00
4:00
8:00
12:00
16:00
20:00
time
2-2
5-1
6-1
9-2
D-1


UHI
Annual
Cooling rates
Ideal days
2014.08.29-30.
A
B
C
D
E
F
ΔT (°C)
Cooling rate (°C/h)
Hours
LCZ2
LCZ3
LCZ5
LCZ6
LCZ8
LCZ9
LCZD
9 - Sparsely built
10 - Heavy industry
Excluded area
Stations
Kilometers
Copyright: ©2012 Esri, DeLorme, NAVTEQ

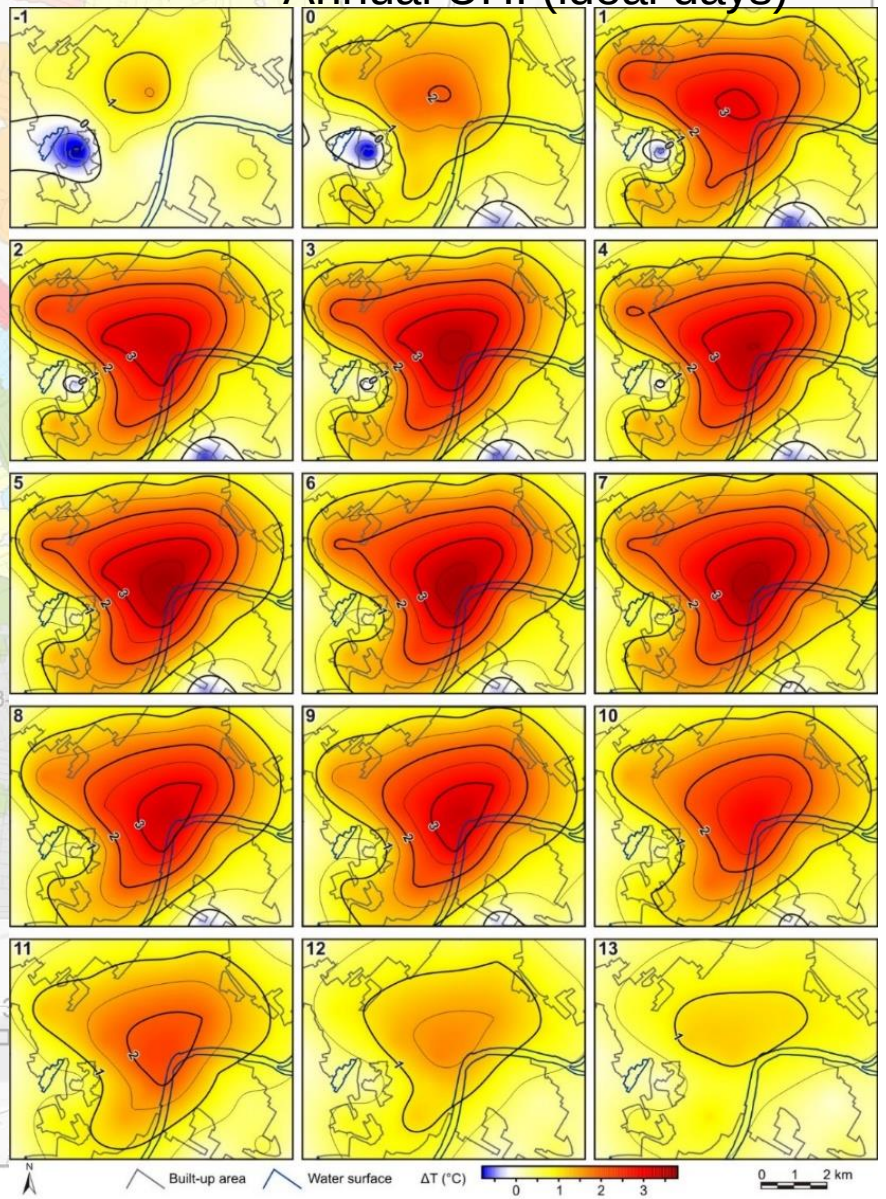
SPATIAL AND TEMPORAL PATTERN OF UHI

1 hour before sunset – 13 hours after sunset

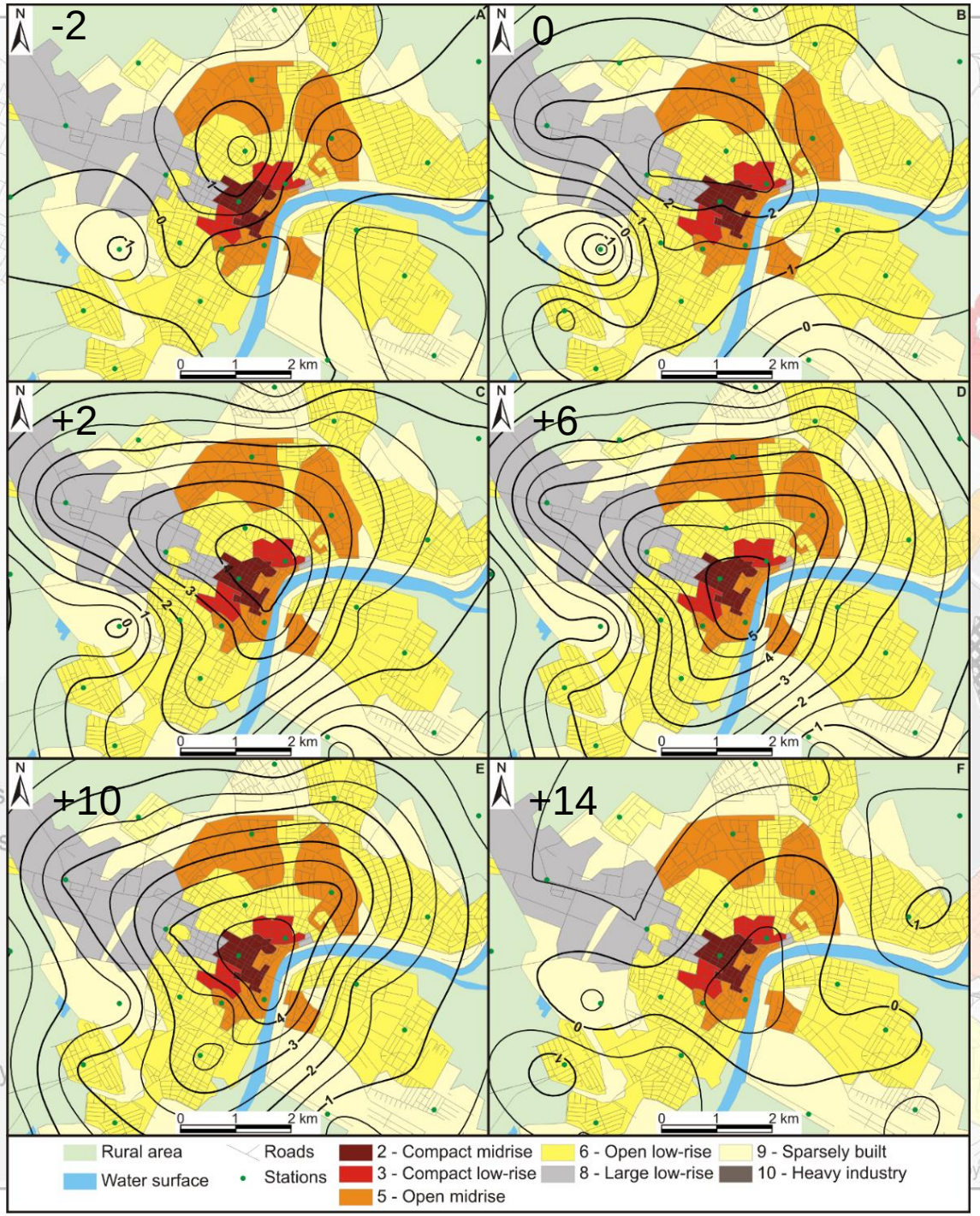
Annual UHI

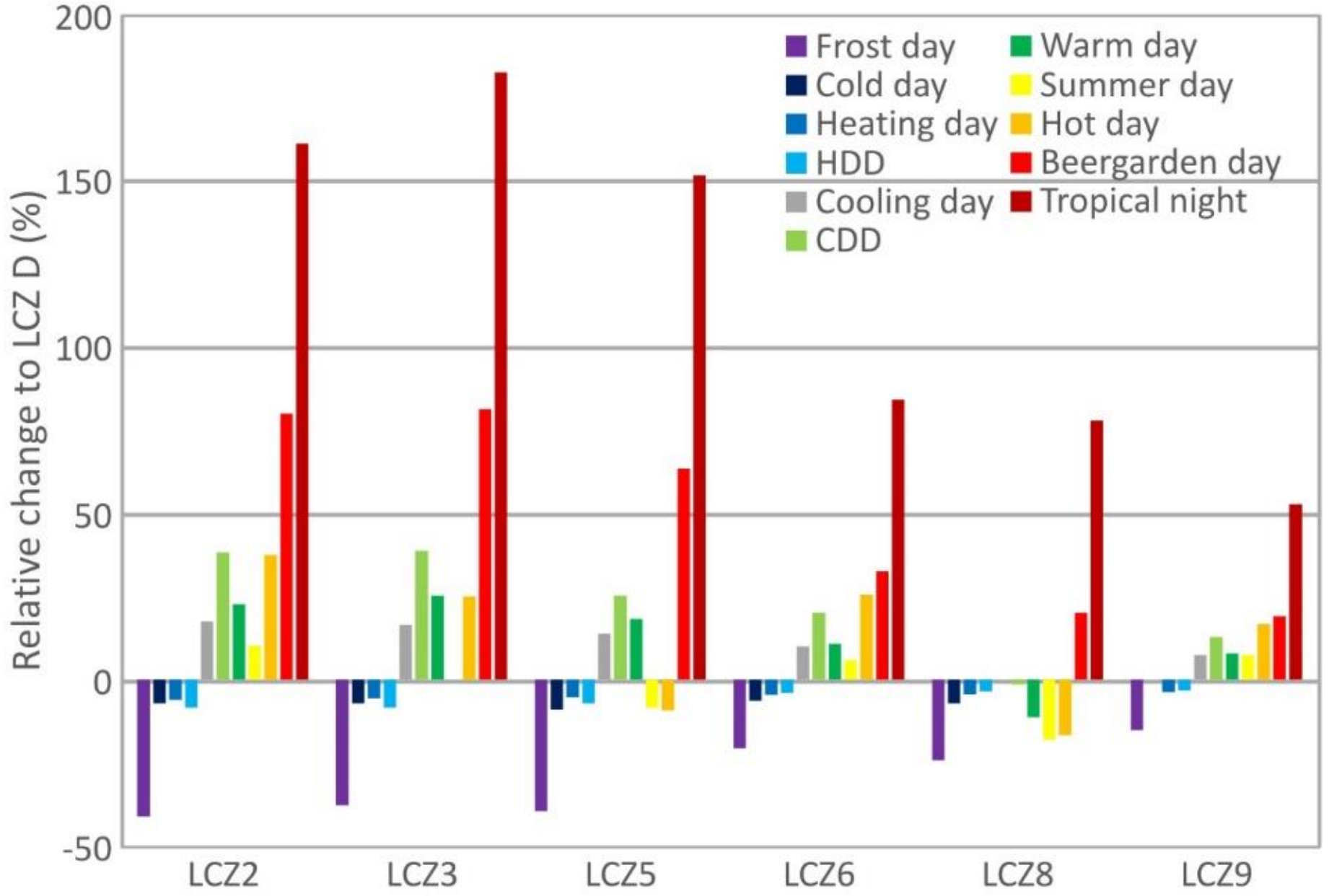


Annual UHI (ideal days)

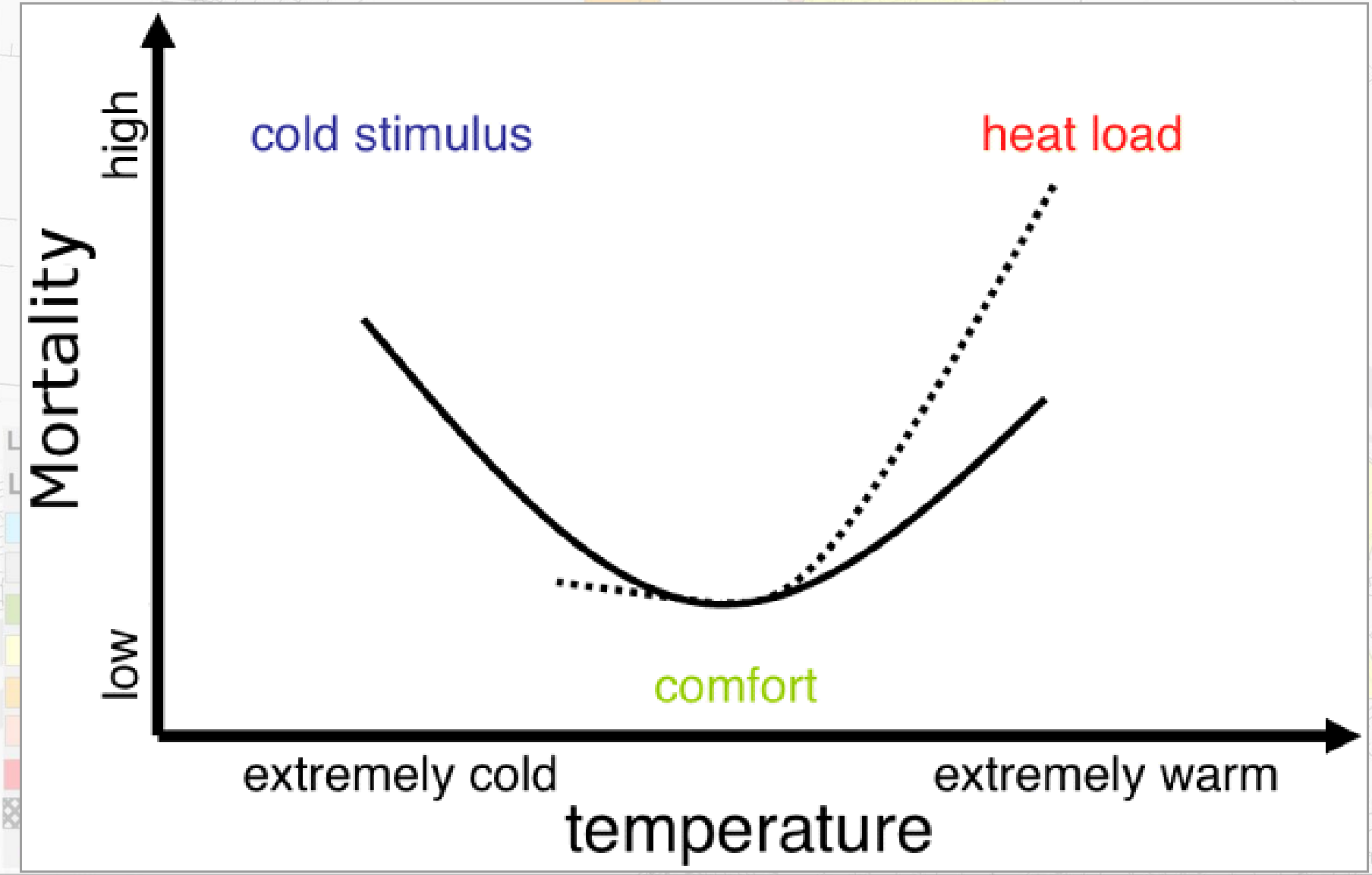


2014.08.29-30.

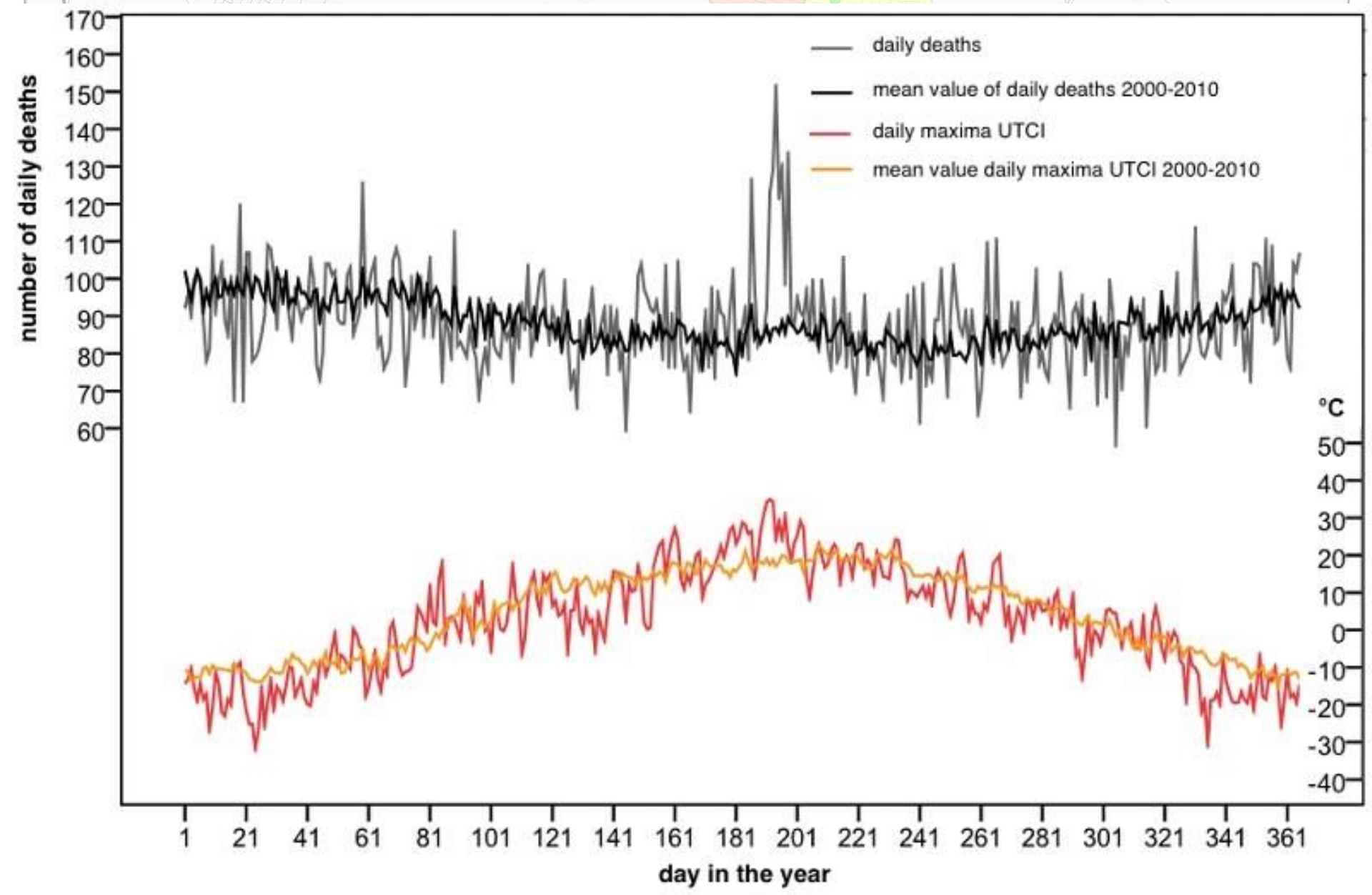

-2
0
+2
+6
+10
+14
A
B
C
D
E
F
N
0 1 2 km
Legend
LCZ
2 - Compact midris
3 - Compact low-ris
5 - Open midrise
6 - Open low-rise
8 - Large low-rise
9 - Sparsely built
10 - Heavy industry
Excluded area
Stations
Rural area
Water surface
Roads
Stations
2 - Compact midrise
3 - Compact low-rise
5 - Open midrise
6 - Open low-rise
8 - Large low-rise
9 - Sparsely built
10 - Heavy industry
A-1
10-1
6-8
6-9
9-3
yright: ©2012 Esri, DeLorme, NAVTEQ

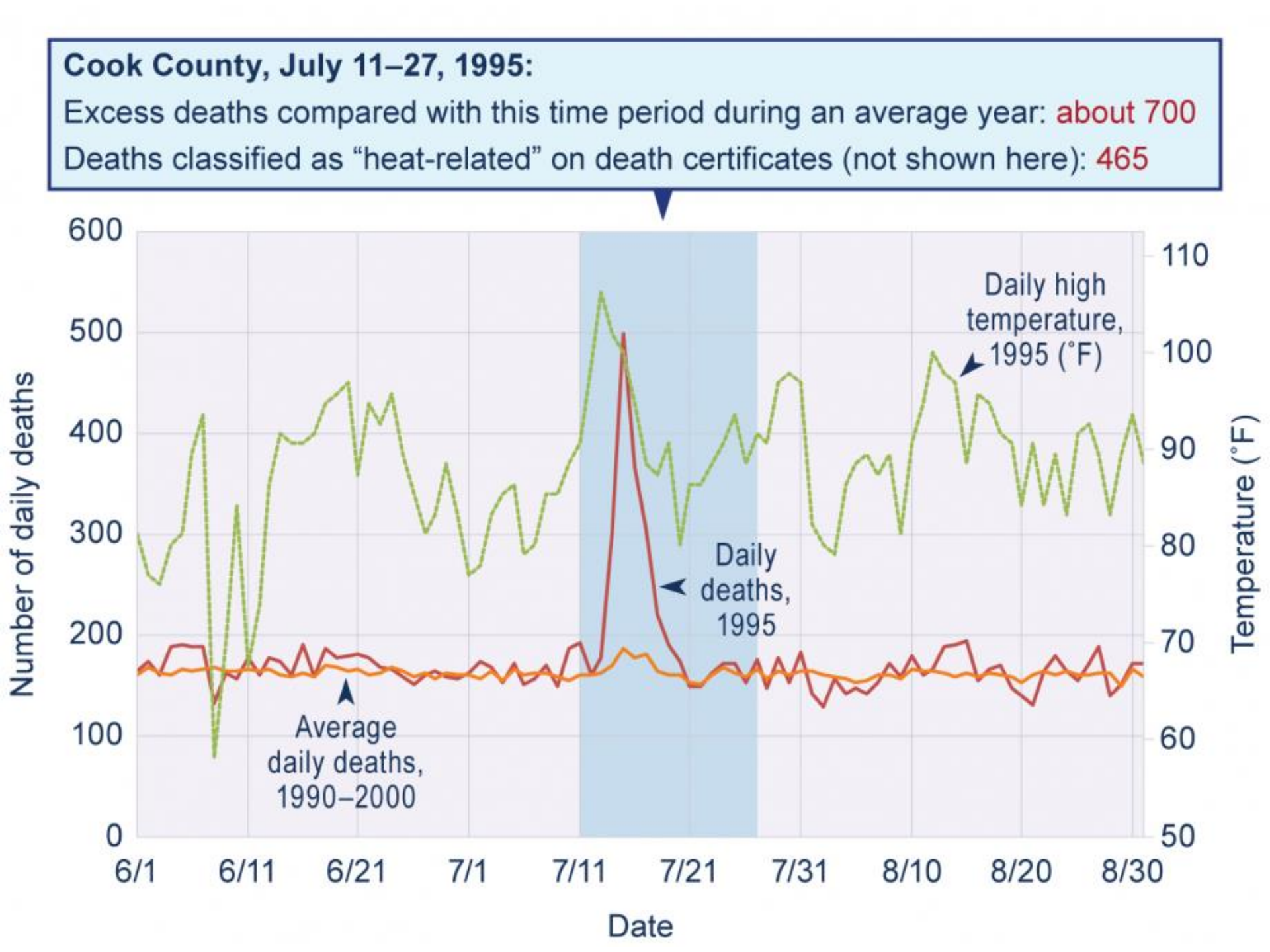

Relative change to LCZ D (%)
200
150
100
50
0
-50
Frost day
Cold day
Heating day
HDD
Cooling day
CDD
Warm day
Summer day
Hot day
Beergarden day
Tropical night
LCZ2
LCZ3
LCZ5
LCZ6
LCZ8
LCZ9

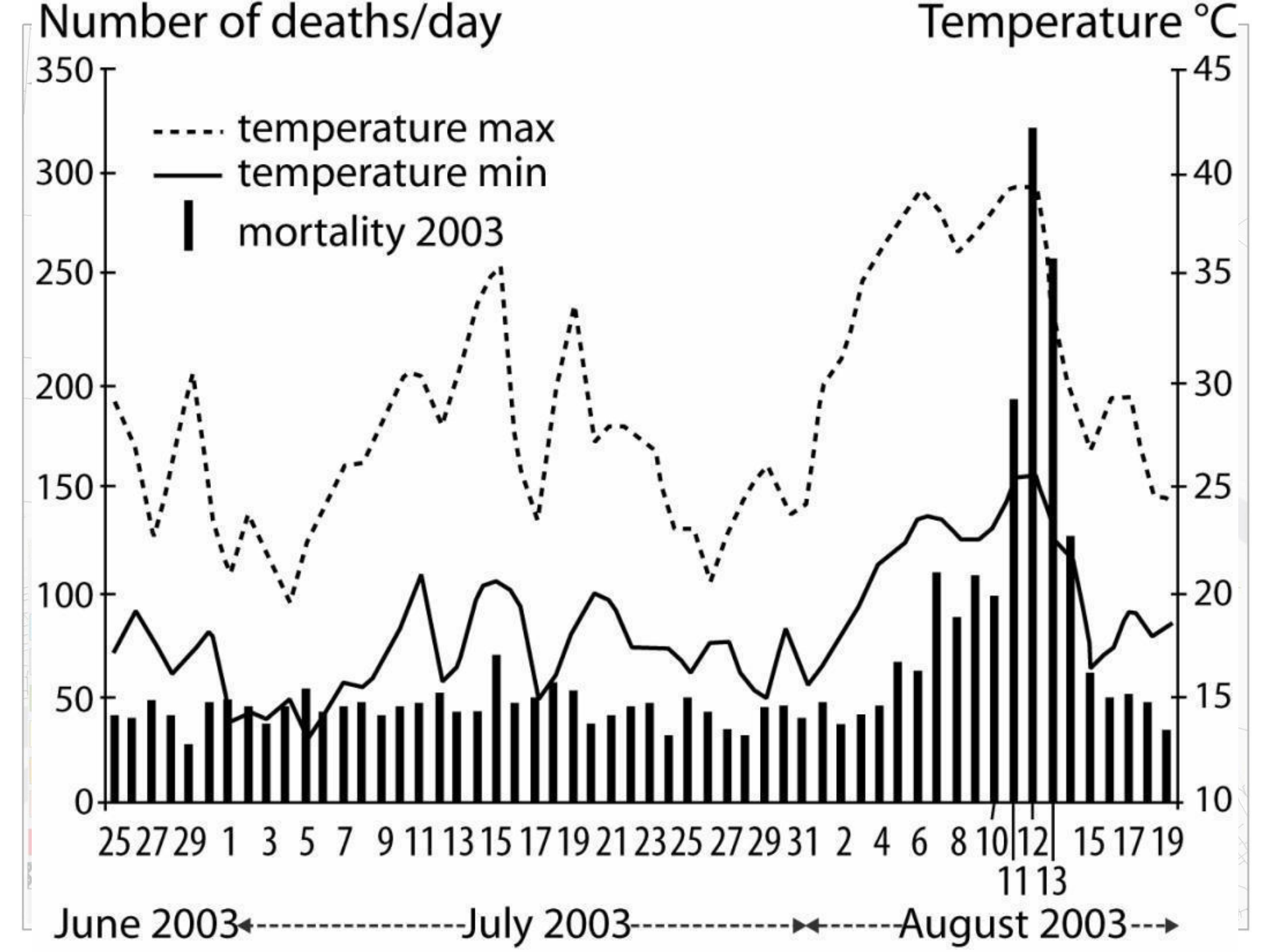
URBAN CLIMATE AND HUMAN MORTALITY

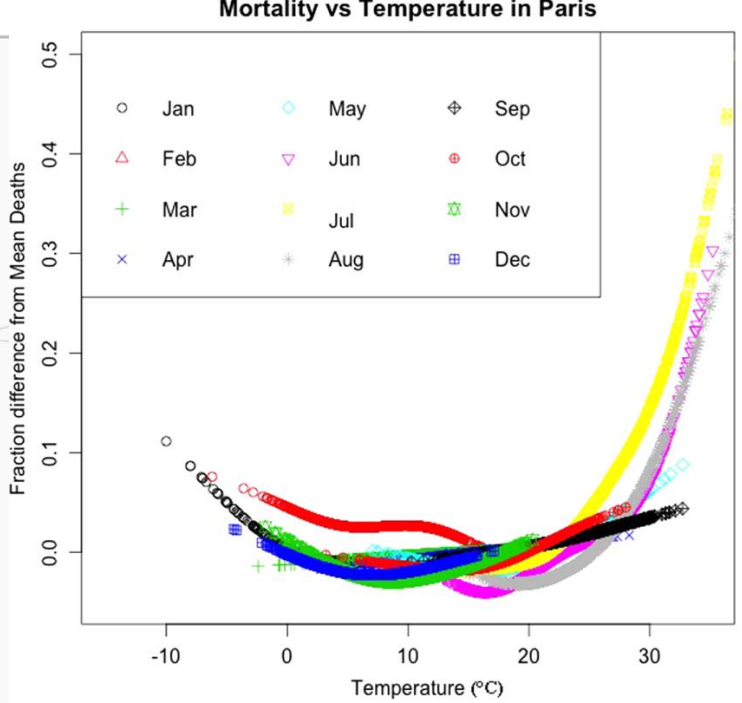


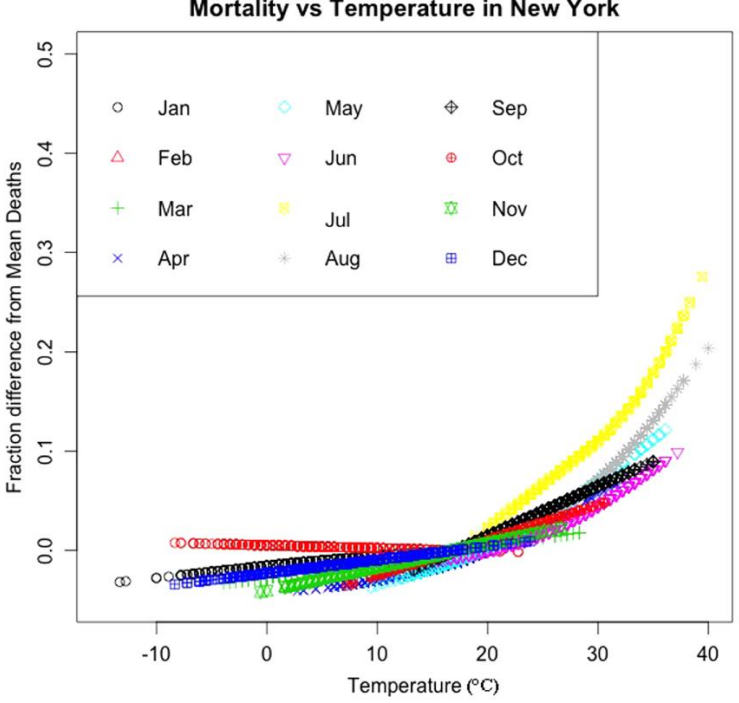
URBAN CLIMATE AND HUMAN MORTALITY

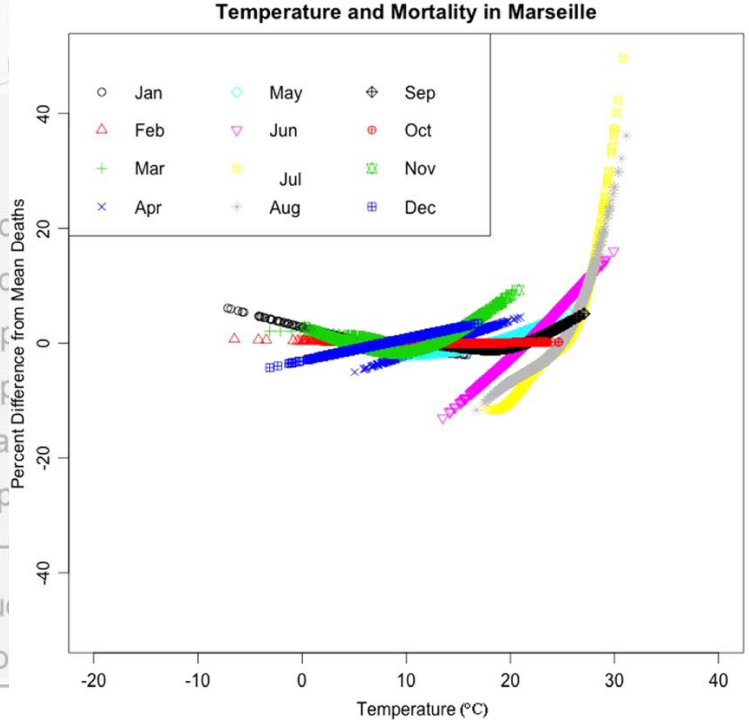


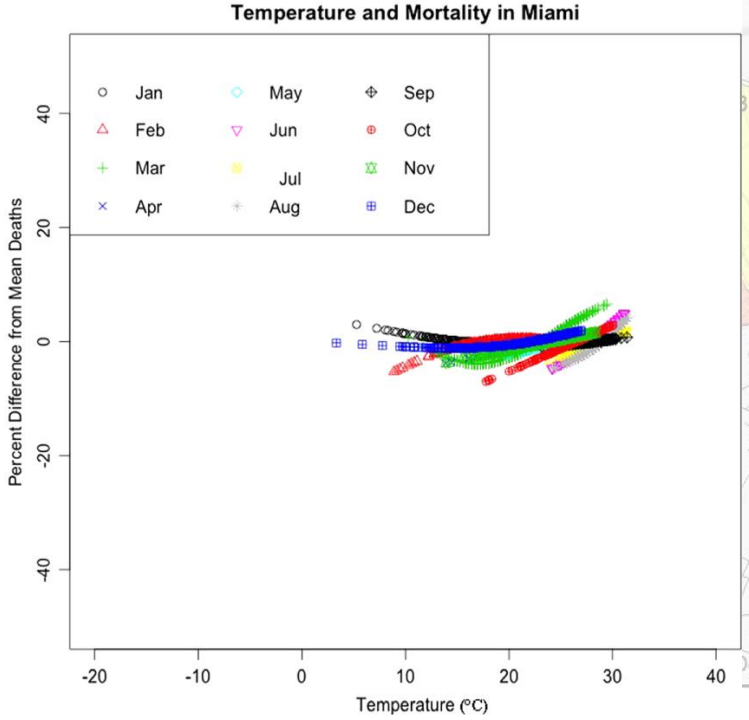

Cook County, July 11–27, 1995:
Excess deaths compared with this time period during an average year: about 700
Deaths classified as "heat-related" on death certificates (not shown here): 465
Number of daily deaths
600
500
400
300
200
100
0
Temperature (°F)
110
100
90
80
70
60
50
Daily high temperature, 1995 (°F)
Daily deaths, 1995
Average daily deaths, 1990–2000
6/1
6/11
6/21
7/1
7/11
7/21
7/31
8/10
8/20
8/30
Date


Number of deaths/day
Temperature °C
temperature max
temperature min
mortality 2003
350
300
250
200
150
100
50
0
45
40
35
30
25
20
15
10
25 27 29 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 2 4 6 8 10 12 15 17 19
11 13
June 2003
July 2003
August 2003


Mortality vs Temperature in Paris
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Fraction difference from Mean Deaths
Temperature (°C)


Mortality vs Temperature in New York
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Fraction difference from Mean Deaths
Temperature (°C)


Temperature and Mortality in Marseille
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Percent Difference from Mean Deaths
Temperature (°C)

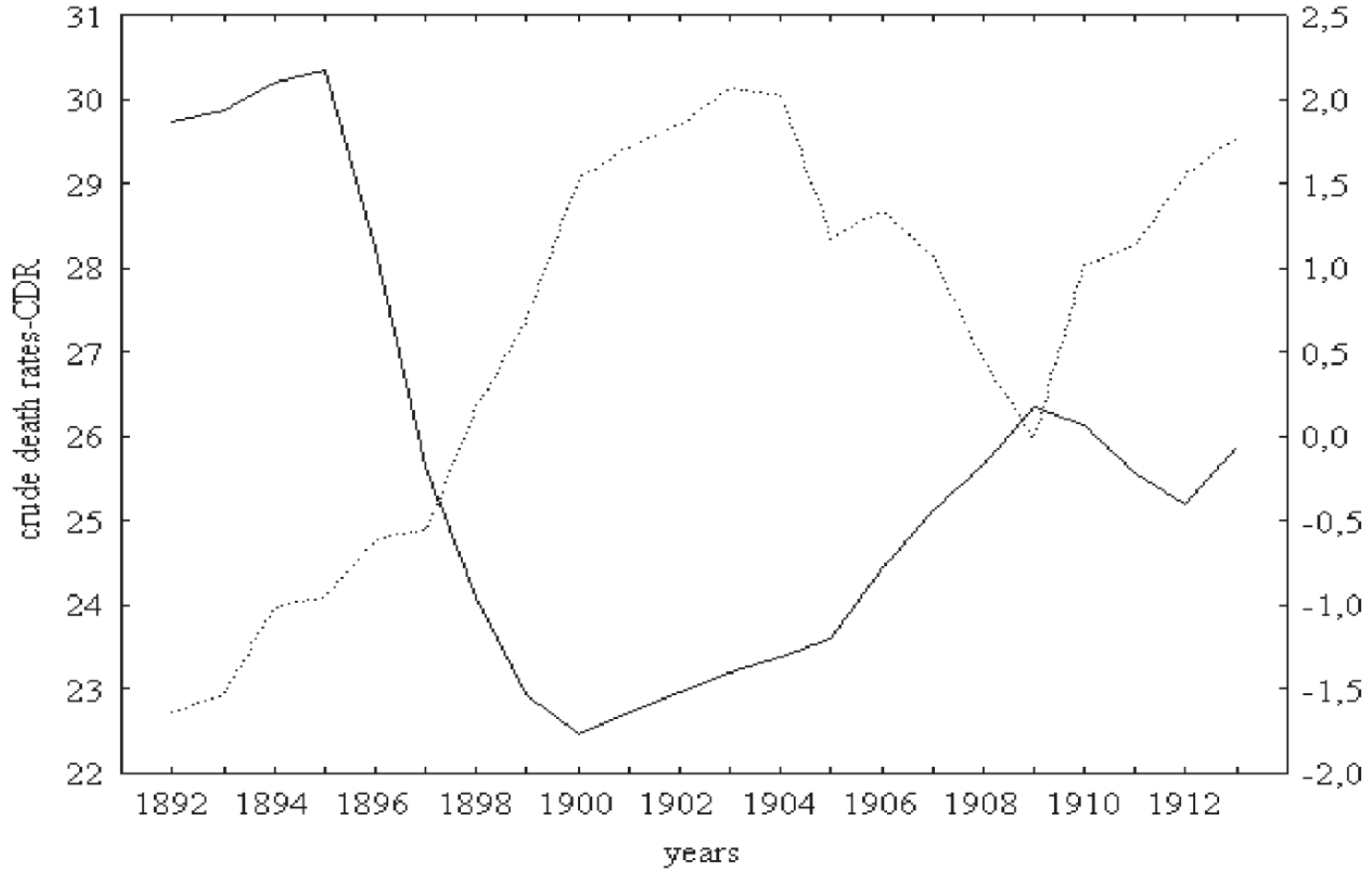

Temperature and Mortality in Miami
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Percent Difference from Mean Deaths
Temperature (°C)

Belgrade, 1888-2008

Time periods	CDR-Tsr	CDR-TsrW	CDR-TsrSp	CDR-TsrSm	CDR-TsrA
	r	r	r	r	r
1888-2008[a]	-0.60***	-0.53***	-0.43***	-0.27***	-0.37***
1888-1913	-0.80***	-0.86***	0.36*	0.57***	0.08
1919-1940	-0.12	0.35	0.34	-0.55**	-0.35
1946-2008	0.81***	0.48***	0.70***	0.73***	0.11

CDR
full line

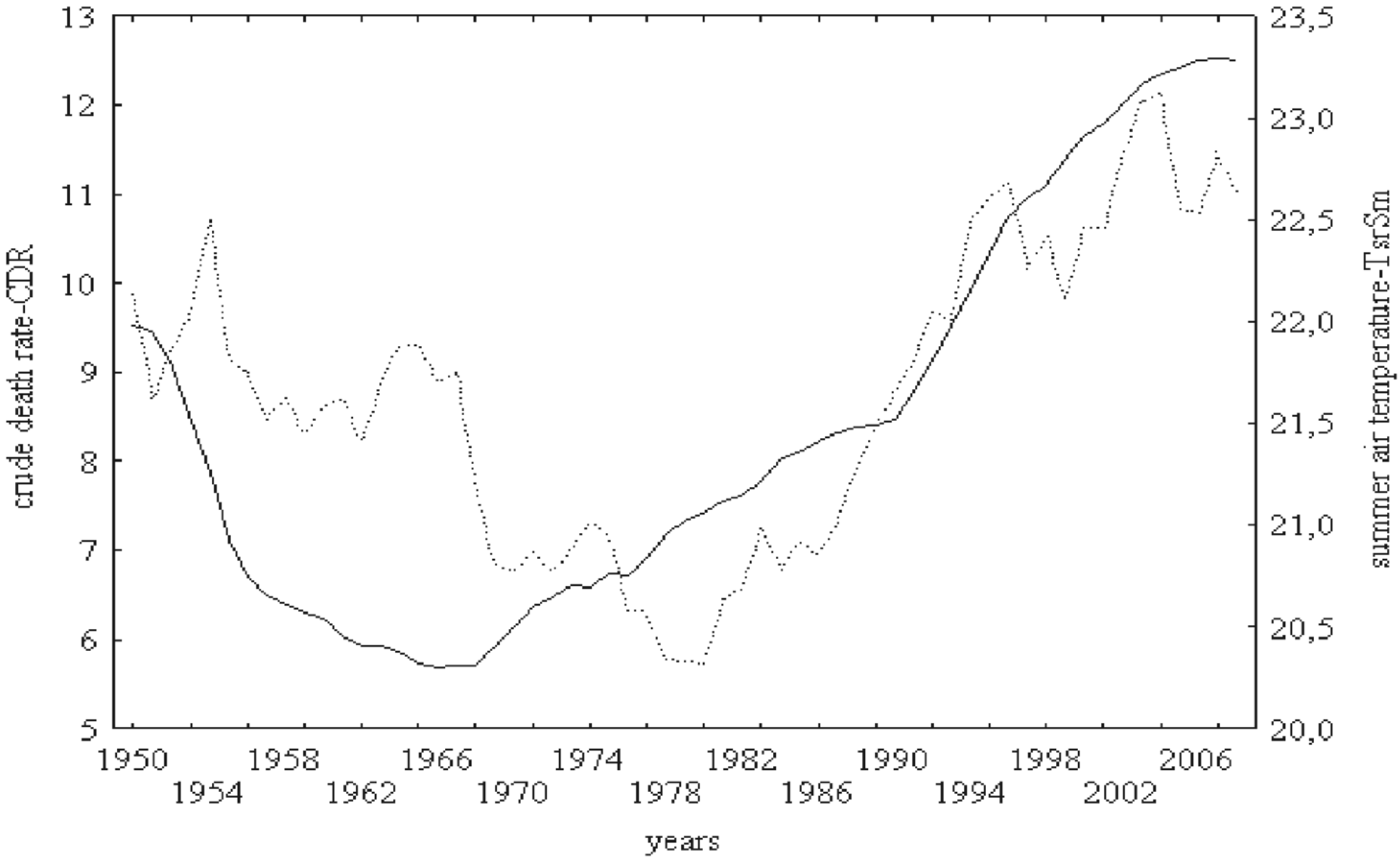
TsrW
dotted line



URBAN CLIMATE AND HUMAN MORTALITY

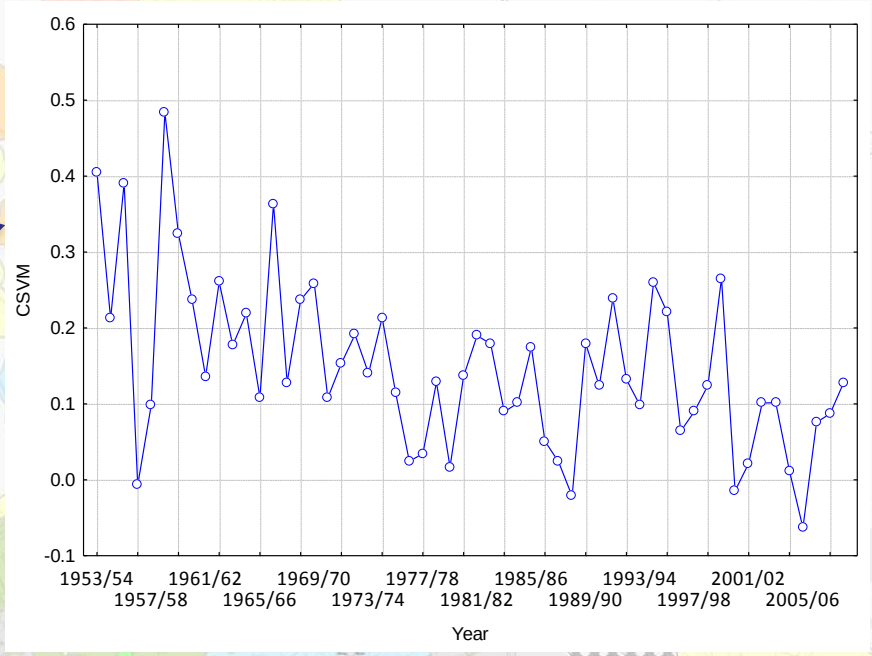
CDR
full line

TsrSm
dotted line



URBAN CLIMATE AND HUMAN MORTALITY

Coefficient of seasonal variation in mortality (CSVM), 1953/54-2008/09 Hovi Sad, Serbia



Period	CSVM
1953/54-1963/64	0.25
1964/65-1974/75	0.19
1975/76-1985/86	0.11
1986/87-1996/97	0.12
1997/08-2008/09	0.07

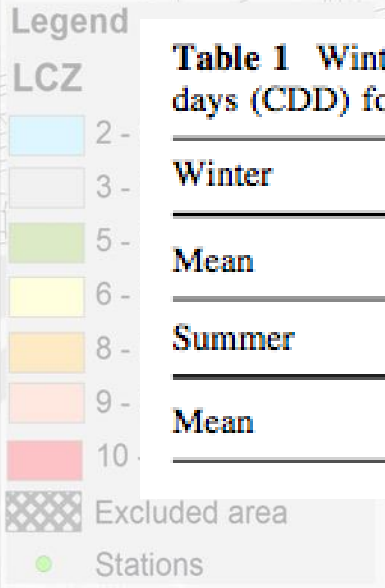
URBAN CLIMATE AND ENERGY CONSUMPTION

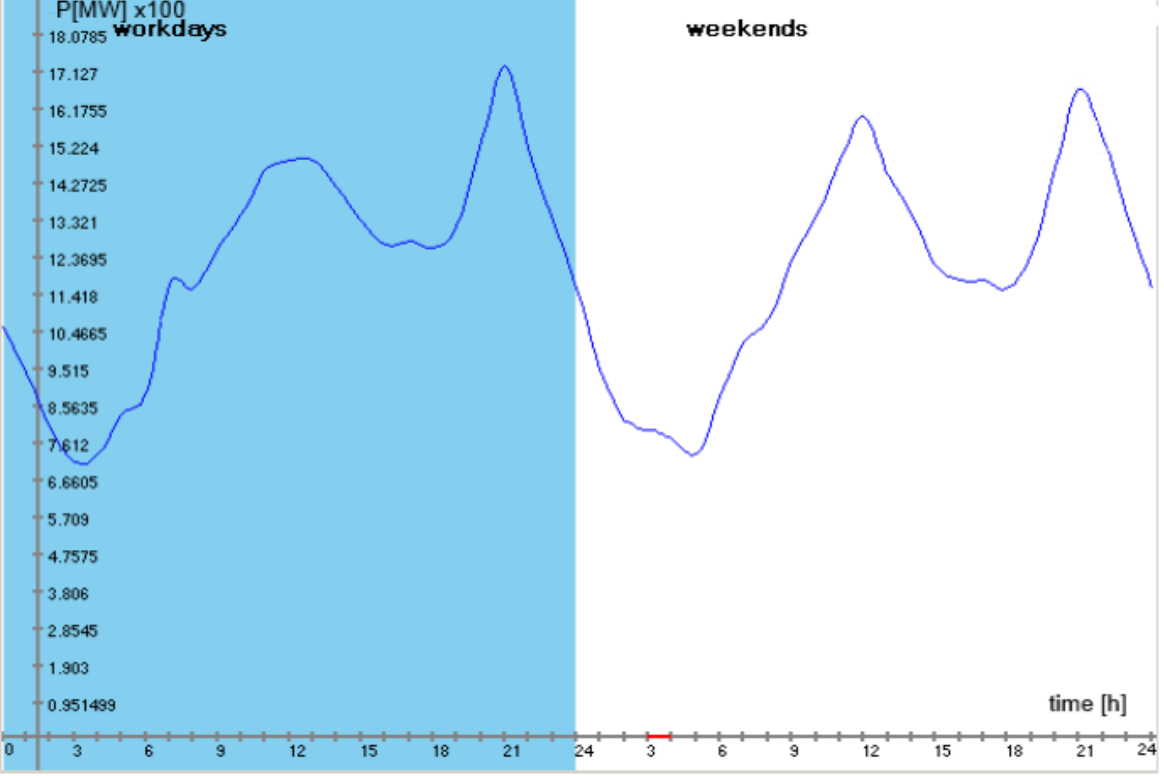
The summer seasons ratio of cold degree days (CDD) for the perod 2007-2012

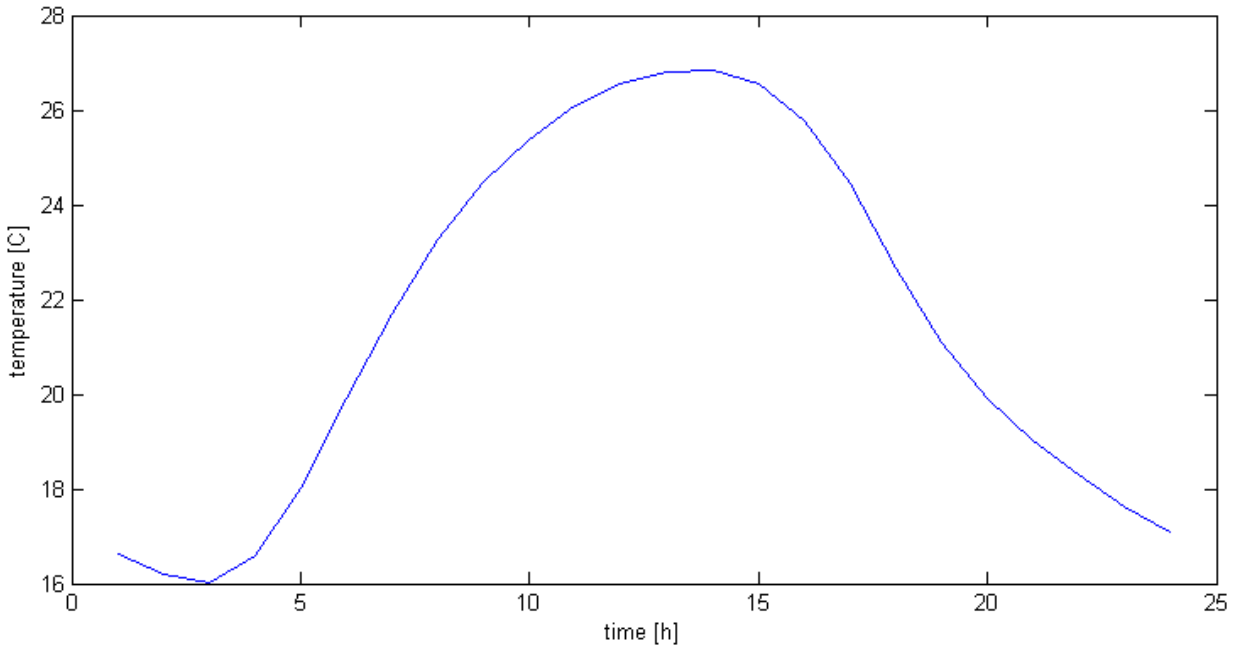
	2007	2008	2009	2010	2011	2012
2007	1	1.37	1.37	1.35	1.42	0.78
2008	0.73	1	1.00	0.99	1.04	0.57
2009	0.73	1.00	1	0.99	1.04	0.57
2010	0.74	1.01	1.01	1	1.06	0.58
2011	0.70	0.96	0.96	0.95	1	0.55
2012	1.28	1.75	1.75	1.73	1.83	1

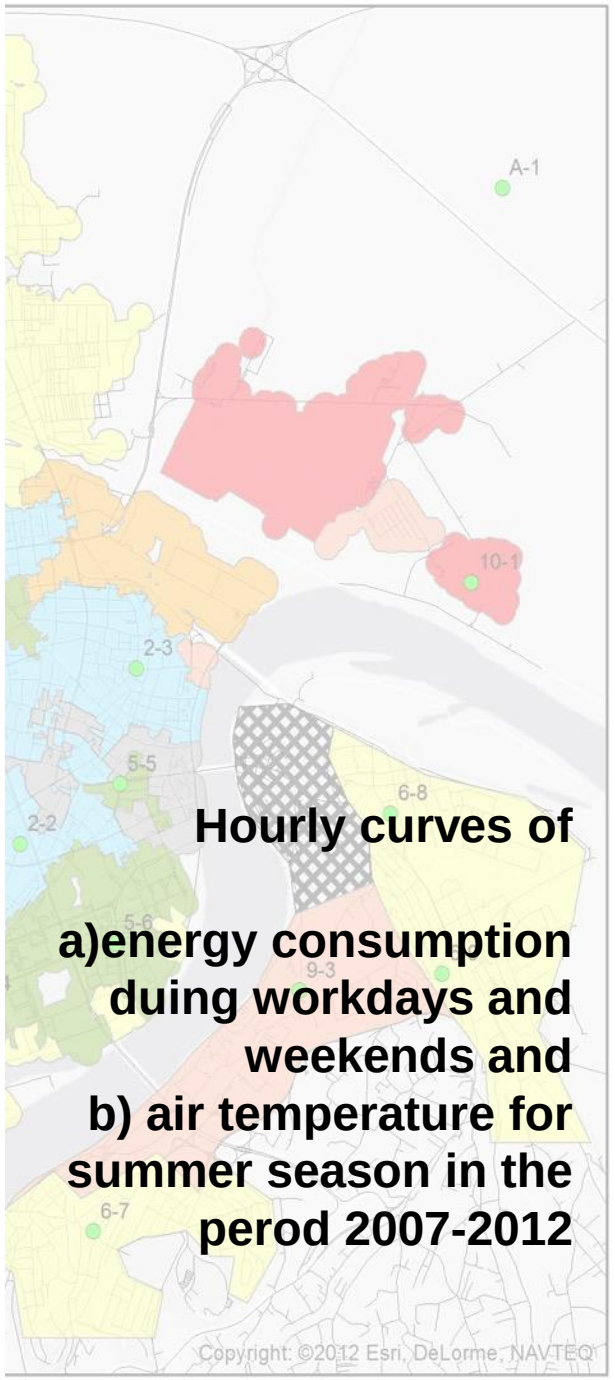
Table 1 Winter seasons ratio of heating degree-days (HDD) and summer seasons ratio of cooling degree-days (CDD) for the period 2007–2012; *mean*—averaged degree-days for the period 2007–2012

Winter	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012
Mean	0.96	0.97	1.00	1.02	1.04
Summer	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Mean	1.16	0.85	0.85	0.86	0.81	1.48



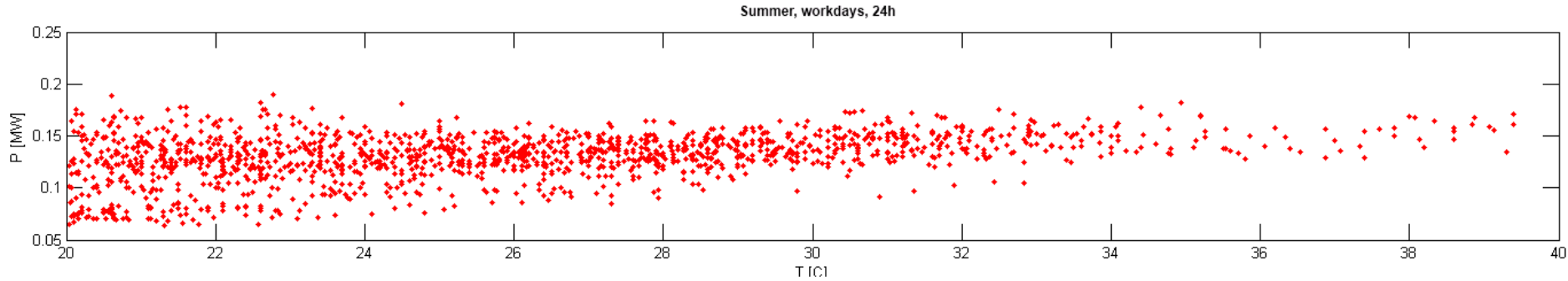


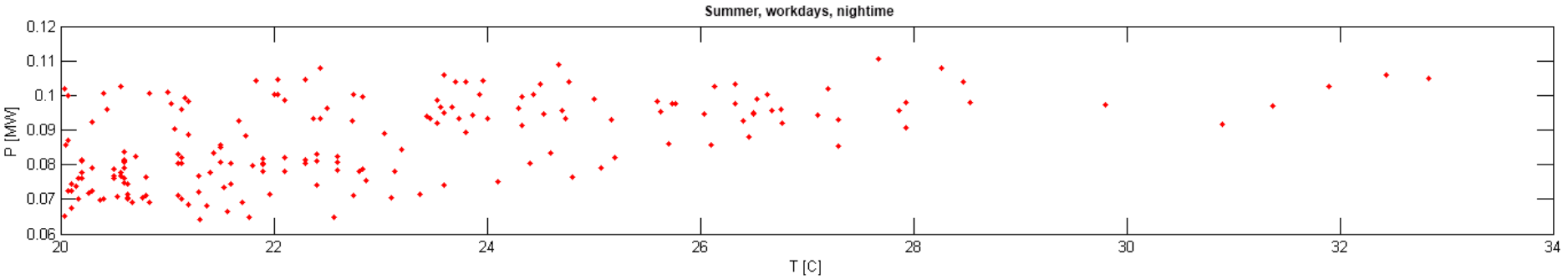


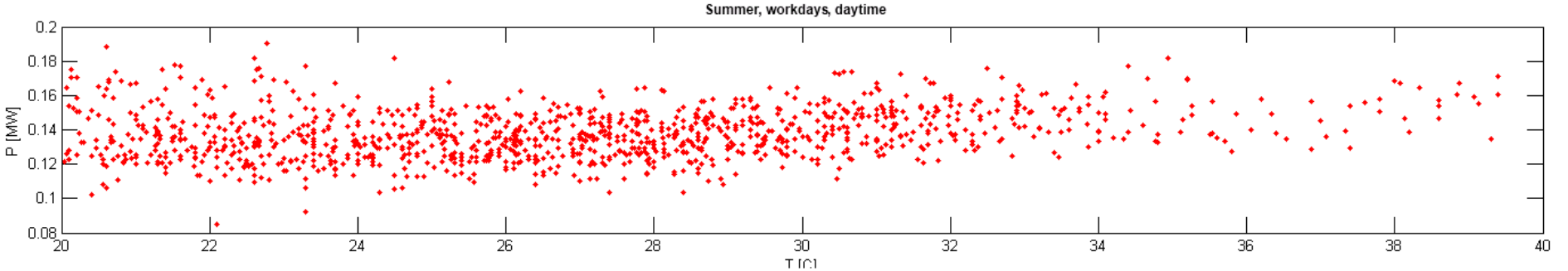


Hourly curves of

a)energy consumption duing workdays and weekends and
b) air temperature for summer season in the perod 2007-2012

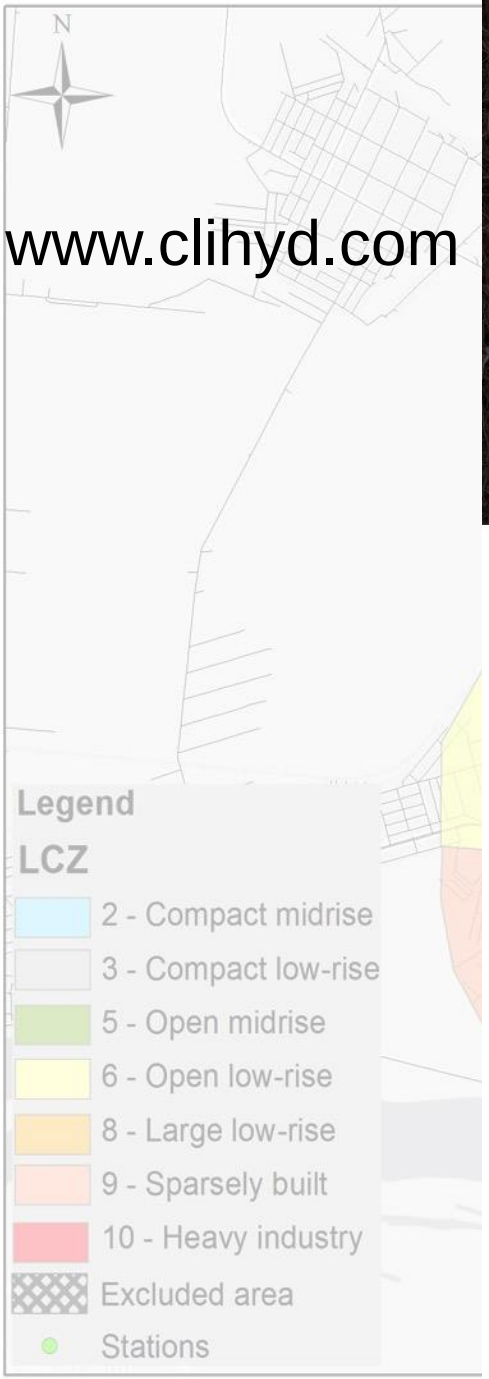






Correlation of electrical energy consumption and air temperature values for each hour during workdays in the summer period (24 hours, nighttime, daytime) in the perod 2007-2012

THANK YOU FOR YOUR ATTENTION



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CONTACT US

HAVE IDEAS AND WANT TO COLLABORATE? WE ARE LISTENING.

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