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METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Testbed data in climate applications

- Climate service
- Applied climate research

Testbed Course 12-16 Feb 2007

Reija Ruuhela

Operational climate service

- **Weather >< Climate**
- **Climate statistics**
  - Statistics of 30-years normal period, (1971-2000)
  - Records and extreme weather events
- **www.ilmatieteenlaitos.fi -> Sää ja ilmasto -> Ilmastotilastot**
  - Ilmastokatsaus
  - Monthly press release
  - Press release in extreme weather situations

    - How exceptional…, how often…?

    - climate change?

…Operational climate service

- **Data delivery**
  - For commercial purposes - Ecomet rules
  - For research, authorities - free of charge
  - Variety of needs;

    - parameters, length of the time series, spatial resolution

    - both measured and value-added data (e.g. heating day degrees)
- **“Data quality control”!!**
- **Expert’s statements**

Feasibility of Testbed data in Climate Service

- **long time series** — **no**
- **spatial resolution** — **OK**
- **time resolution** — **OK**
- **continuity** — **no**
- **data base and interface** — **OK**
  no
- **data quality** — **no**
- **parameters** — **OK?**
  - always use for more…
- **case studies** — **YES**
  - **expert's statement**

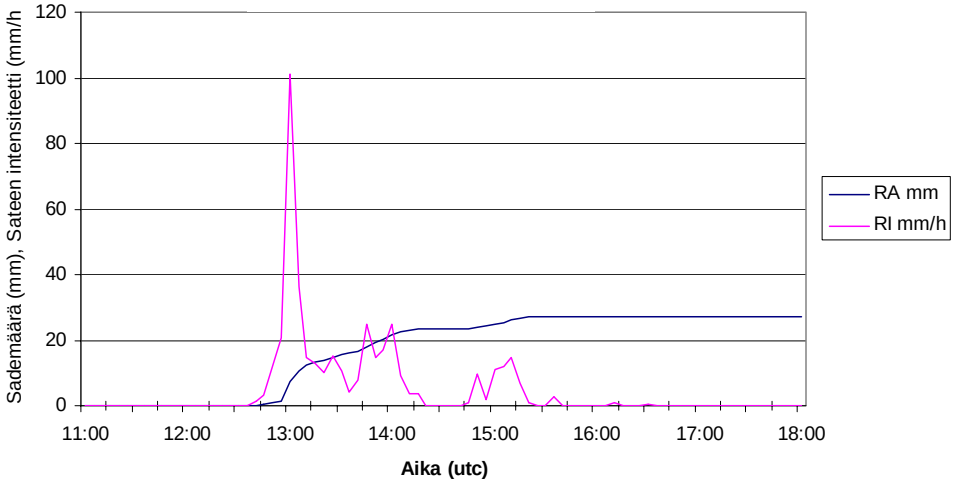
Useful especially in case studies of heavy rain(showers)

Case

- **Water damages in a row house**

Daily precipitation

- **HKI-Vantaa 19 mm**
- **HKI-Kaisa 18 mm**
- **Oulunkylä 27 mm (Testbed)**
- **Max. intensity 100 mm/h**
  - 1,7 mm/min
  - Instructions for dimensioning 1,0 mm/min!

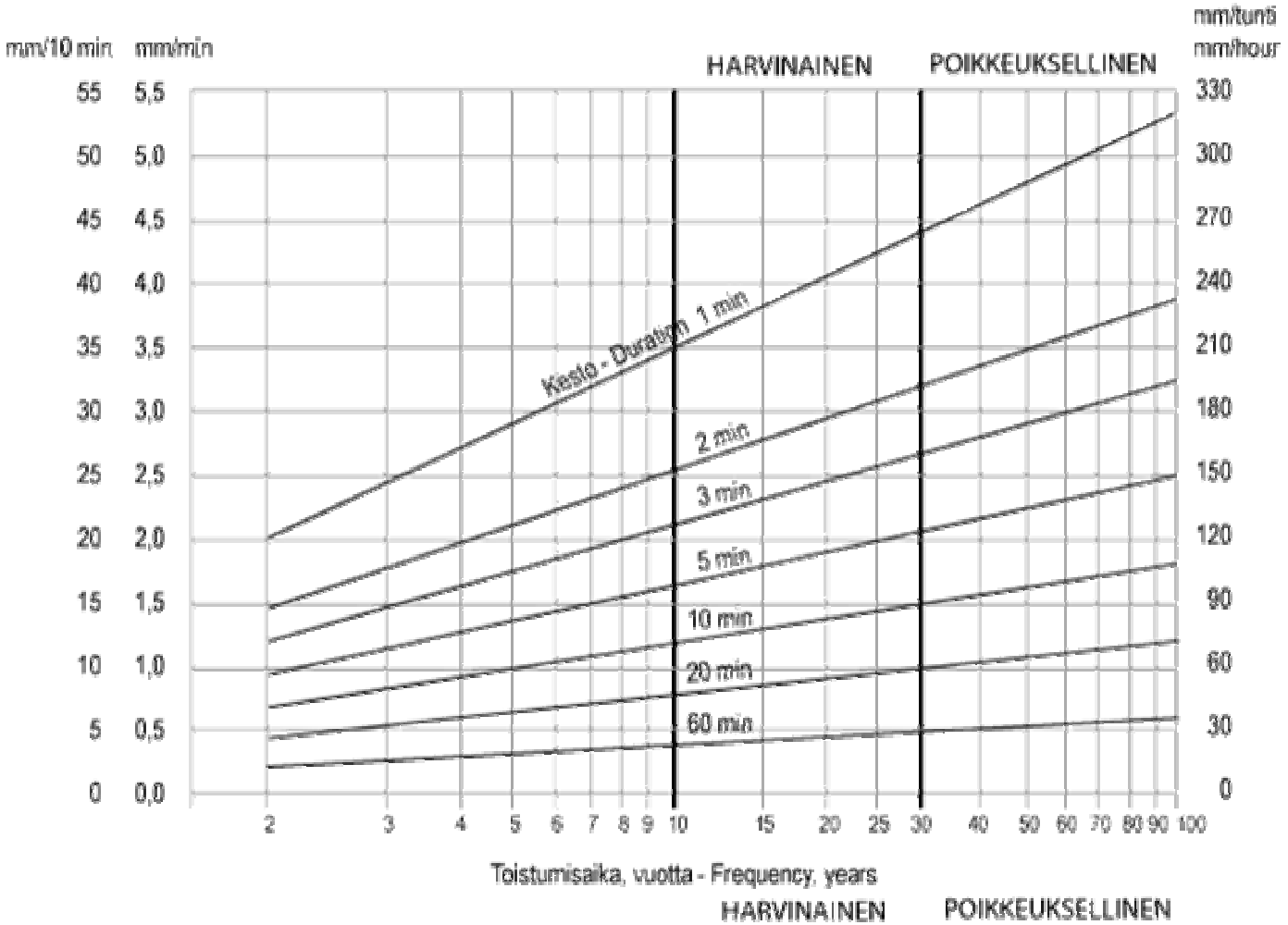


Heavy rain in Finnish Climate

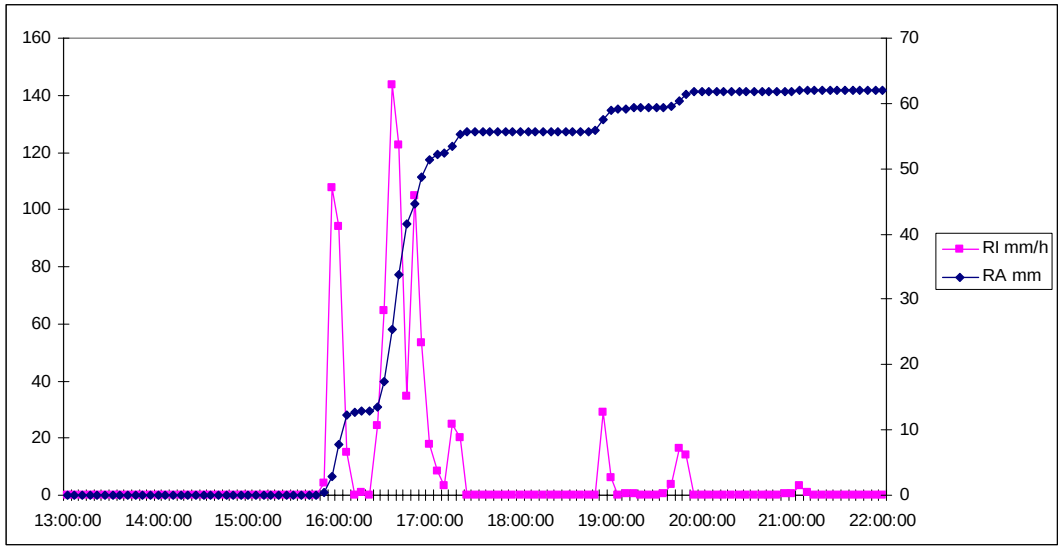
Time	Rain (mm)
5 min	2,5
30 min	5,5
60 min	7,0
4 h	10
12 h	15
24 h	20

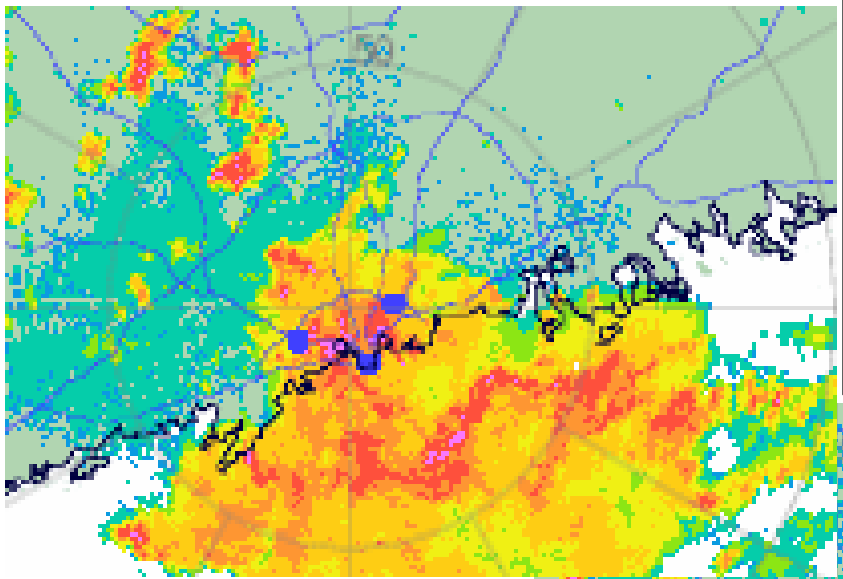
How often can this happen?

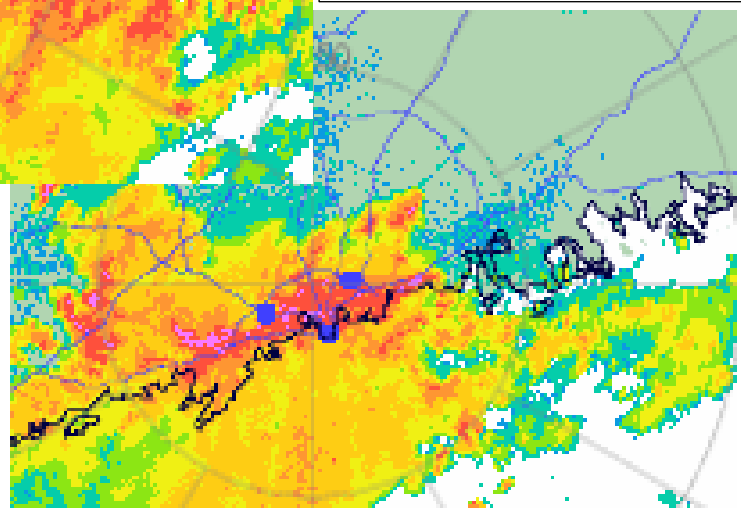
Eri pituisten sateiden rankkuus ja toistumisaika Suomessa
Intensity and frequency of precipitation of different duration in Finland



Testbed and radar data complete each other







HKI-Van 11 mm/d
HKI-Kaisa 25 mm/d

Climate variability and climate change

Climate risks

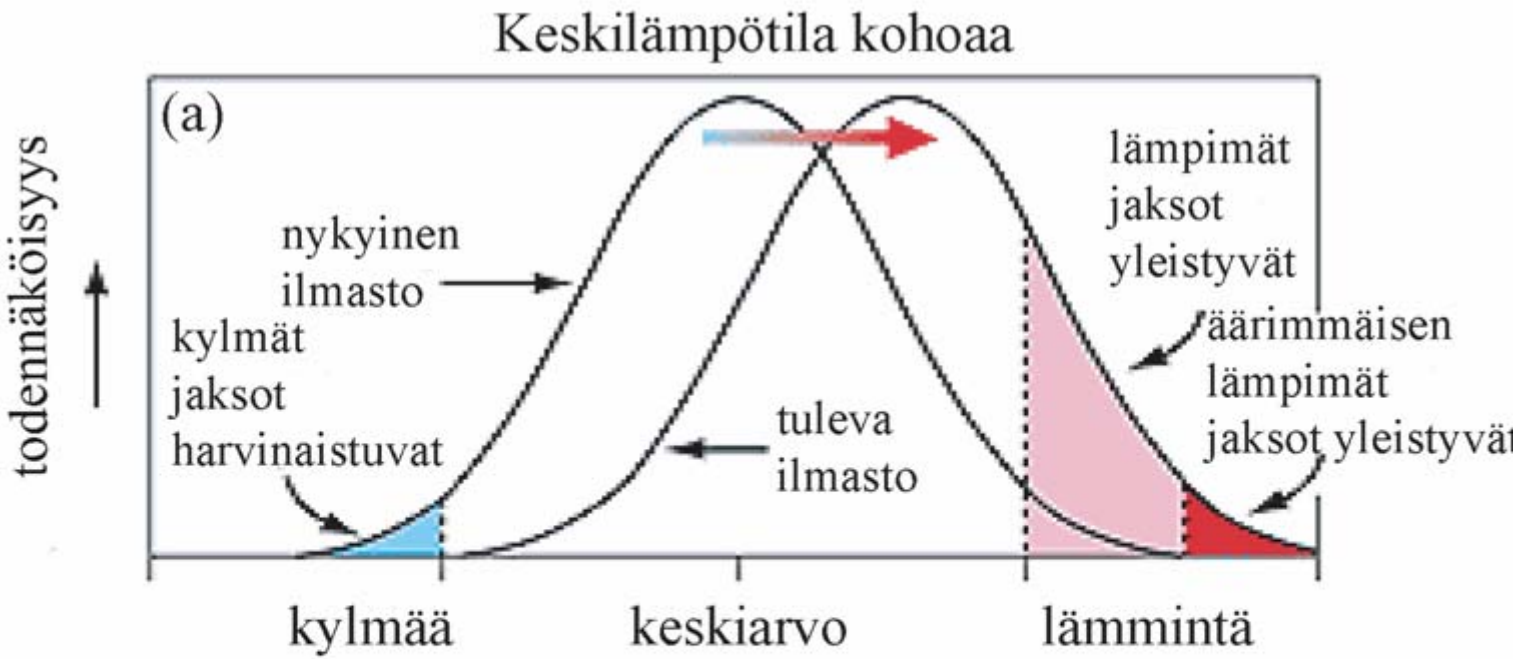
are changing

in changing climate

Risks should be updated

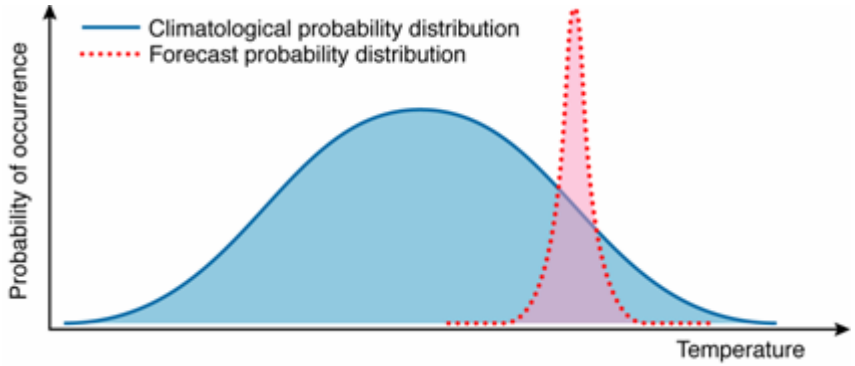
in many sectors of society

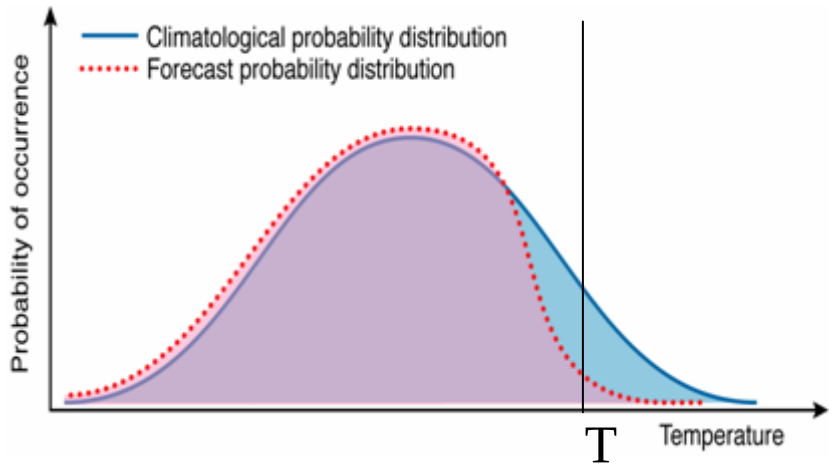
Climate change and extremes



Seasonal forecasting in Finland?

- **No ENSO teleconnection in Finland… but seasonal forecasting is gradually developing**
- **Feasibility depends on the needs of the users…**
- **Spatial downscaling using statistical methods**

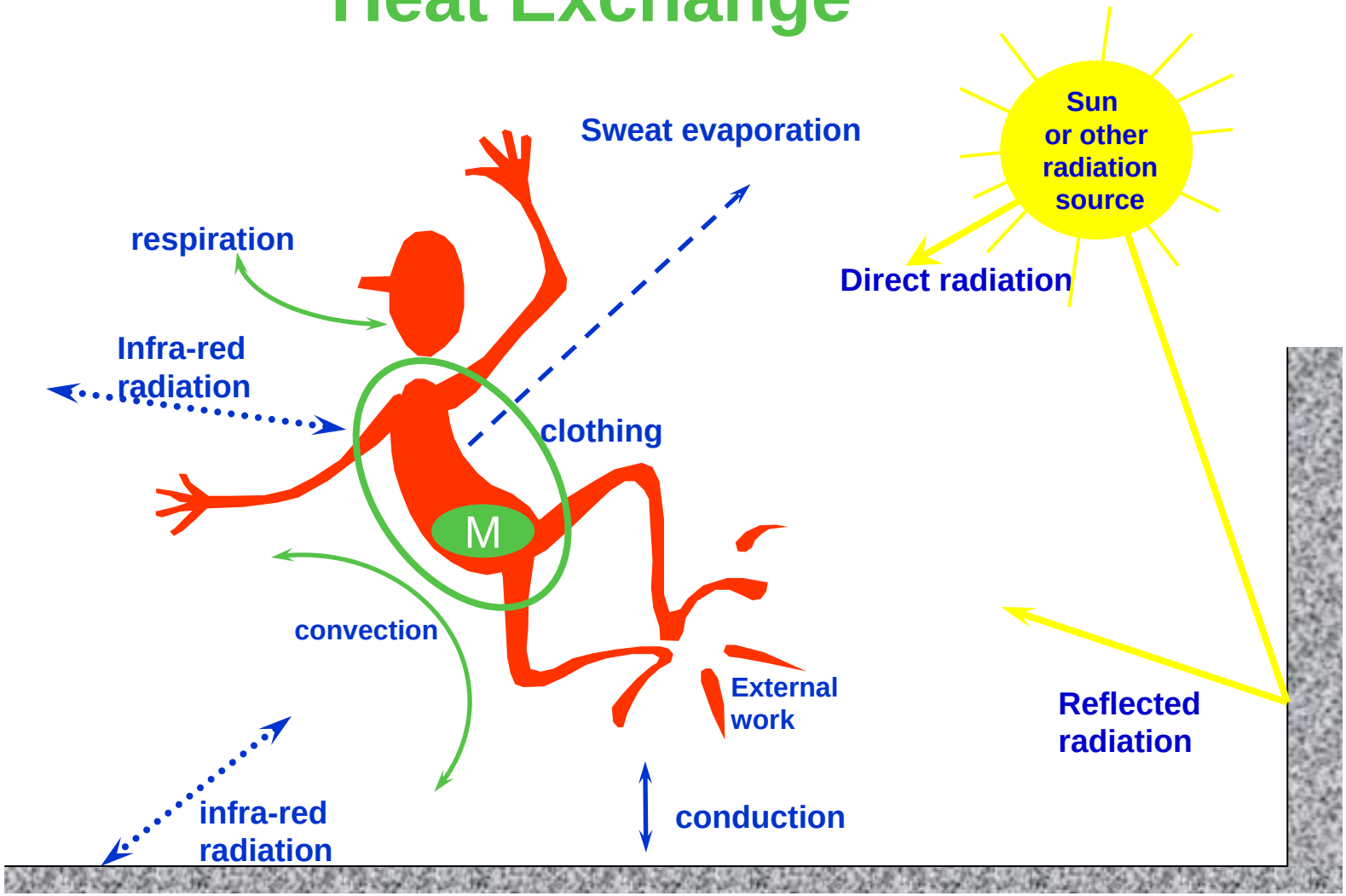




Applied climate research

- **Potentially interesting in many applications**
- **E.g. inter-disciplinary research**
  - Impacts of weather and climate on human health
- **Slipping accidents**
  - Remarkable differences in pavement conditions in Testbed area
- **Heat stress**

Heat Exchange



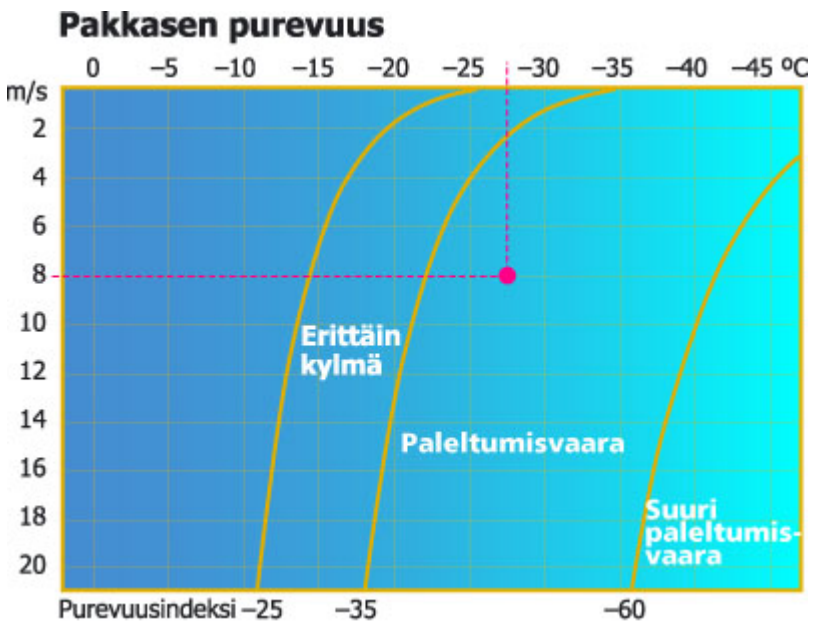
Havenith, 2003

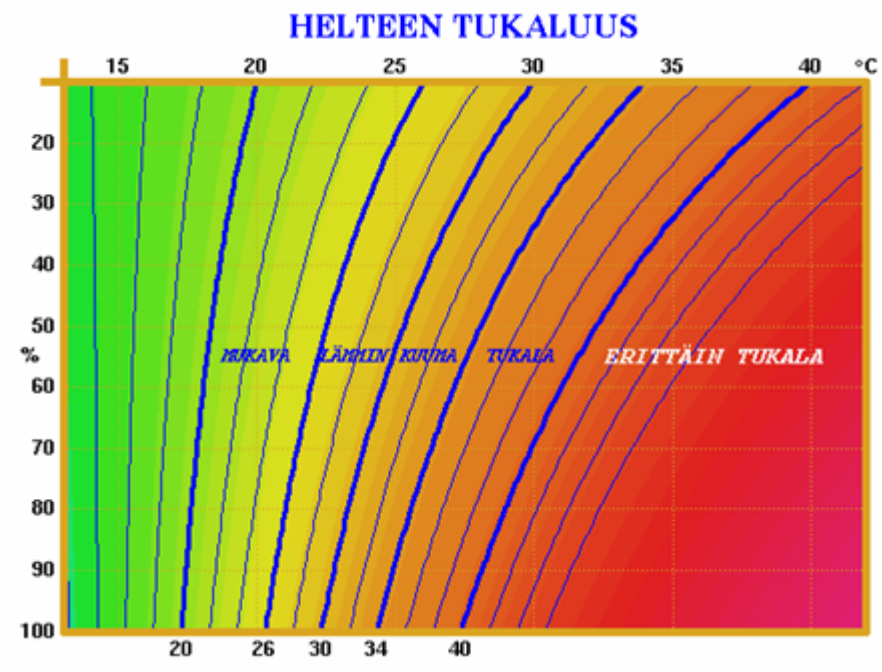
The human heat budget

- **M + W + Q* + QH + QL + QSW + QRe + S = 0**

- **M Metabolic rate**
- **W Mechanical power**
- **Q* Radiation budget (Tmrt,v)**
- **QH Turbulent flux of sensible heat (Ta,v)**
- **QL Turbulent flux of latent heat (diffusion water vapour) (e,v)**
- **QSW Turbulent flux of latent heat (sweat evaporation) (e,v)**
- **QRe Respiratory heat flux (sensible and latent) (Ta,e)**
- **S Storage**

Simple thermal comfort indices

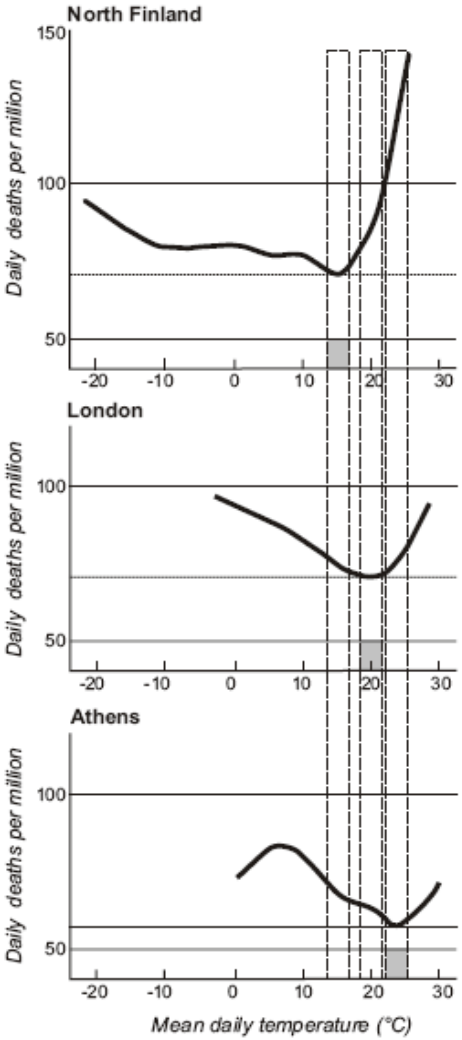




http://www.ilmatieteenlaitos.fi/tuotteet/kauppa_14.html

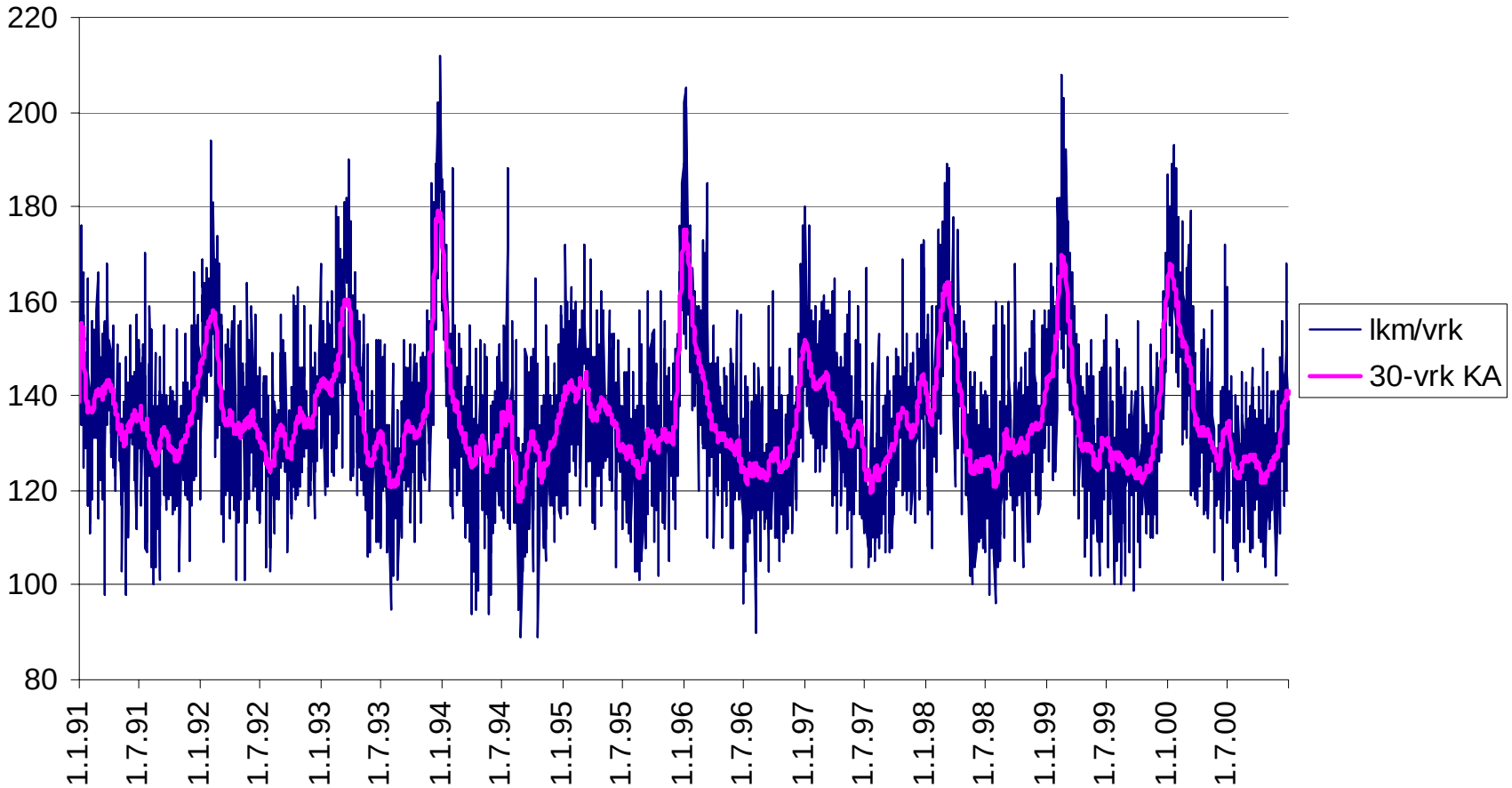
Mortality depends on temperature …

- **People acclimatize – in certain limits**
  - behaviour and physiological acclimatization
- **Finns have acclimatized to cold climate better than e.g. Greeks**
- **and suffer from hot weather in lower temperatures than Southern Europeans**



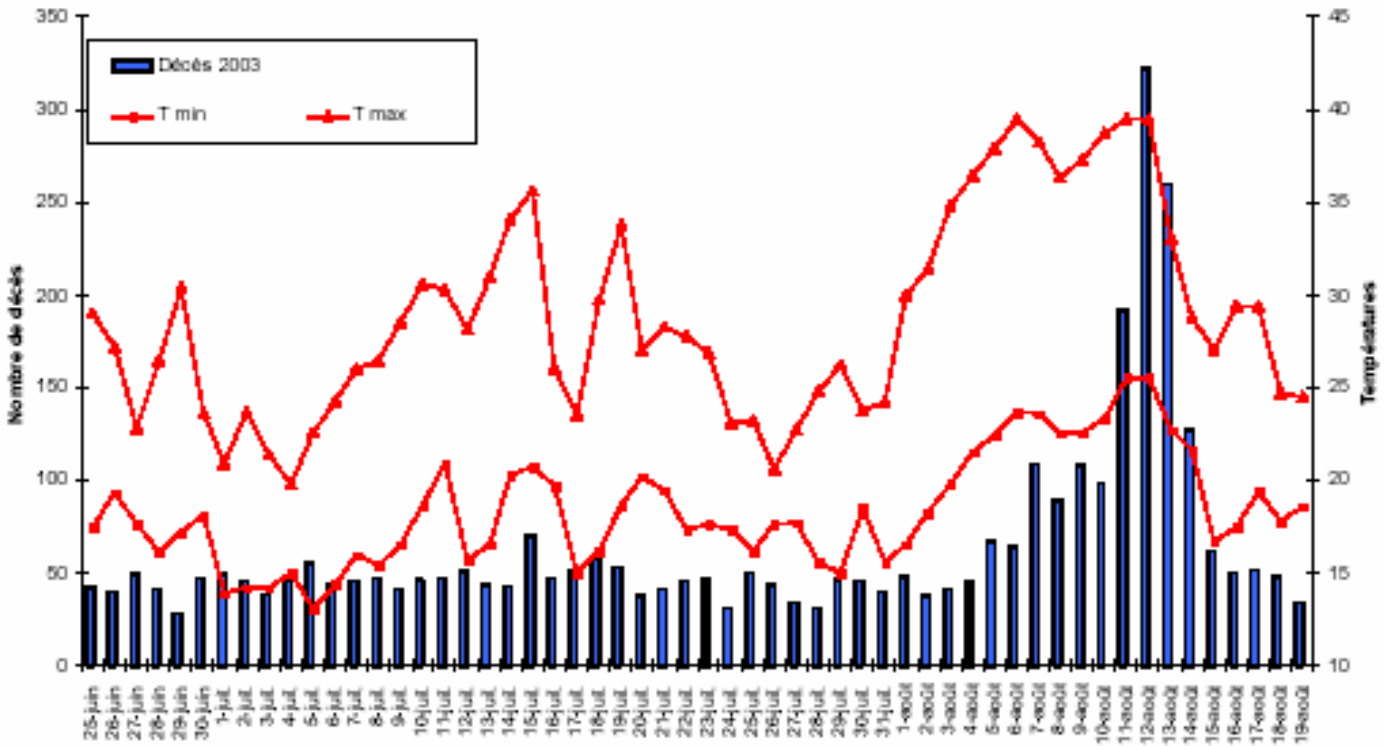
- Näyhä, 2005
- Keatinge et el. 2000

… and season… daily mortality in Finland 1991-2000

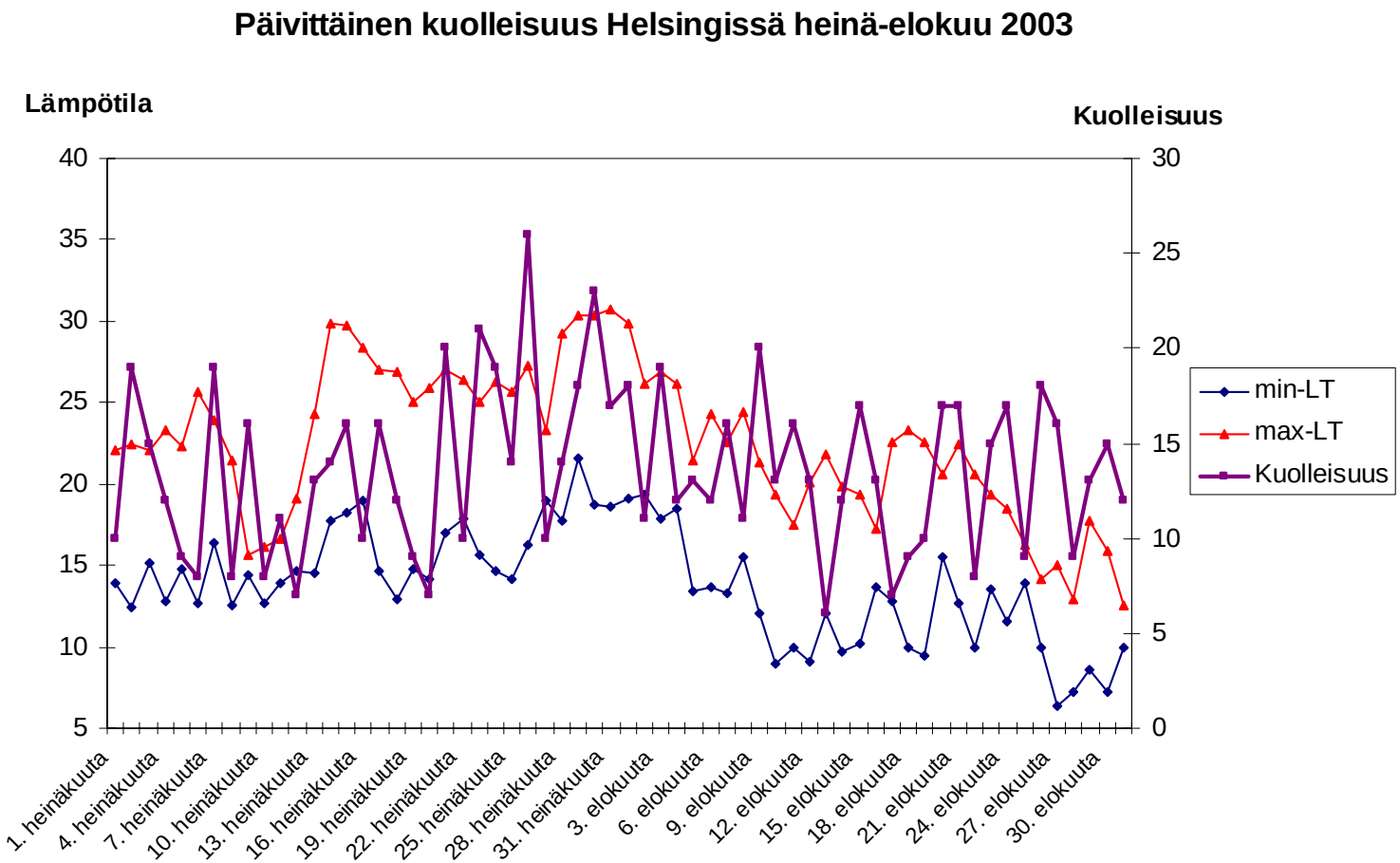


30 000 extra deaths in Europe, 15 000 in France during the heat wave 2003

Graphique n°1 : Nombre de décès journaliers à Paris et températures minimales et maximales entre le 25 juin et le 19 août 2003

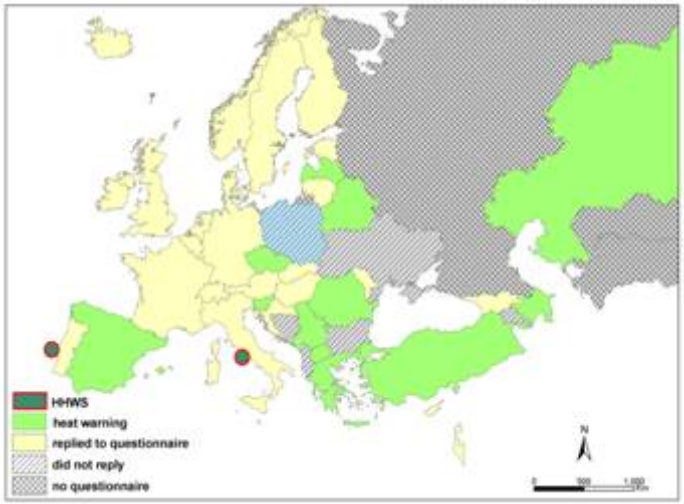


Daily mortality and max and min temperature in Helsinki, July-August 2003

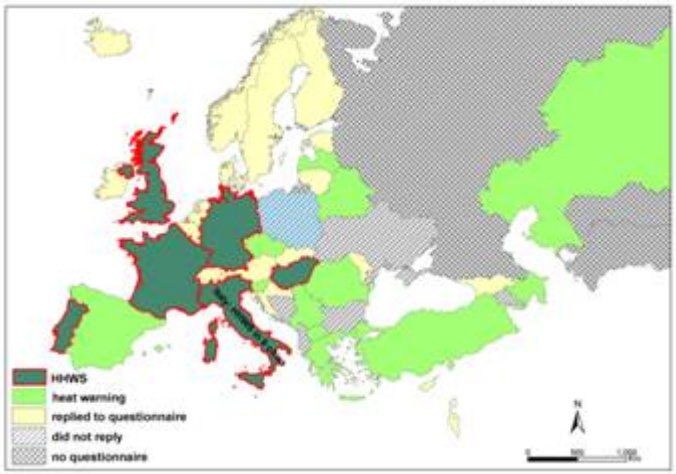


Heat Health Warning System – who needs it in Finland?

- **Risk groups**
  - Children
  - Elderly
  - People with cardiovascular on pulmonary diseases
  - …
- **Outdoor employees**
- **Health care in their preparedness**
- **Other authorities**



HHWS before and



after 2003

Lämsä-project, Finnish Institute of Occupational Health

- **17 roof and asphalt workers**
  - Health control and fitness tests
  - Heat stress tests in laboratory
  - Tests during the working days
    - Cool days
    - Hot days

Lämsä-project, FIOH

Measurements in field

- **Heart rate + variation**
- **Skin temperature (7) and internal body temperature**
- **Cortisol hormone**
- **Changes in weight, amount of food and drinks**
- **Measurements of temperature, humidity and wind**
  - Comparison to Testbed and FMI weather station data

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Lämsä-project and Testbed

Lämsä-tutkimus tutkimuskohde	päivä	säämittauspiste			
Soukka	30. 5. 2006	Kirkkonummi Ingels, WXT, testbed	Espoo Suvisaaristo, WXT, testbed	Kirkkonummi, MCN	Helsinki Kaisaniemi, FMI
Viikki	5. 6. 2006	Malmin lentoasema, WXT, testbed	Helsinki Kumpula, FMI		
Myyrmäki	6. 6. 2006	Vantaa Vantaanlaakso, WXT, testbed	Helsinki Malminkartano, MCN	Helsinki-Vantaa la FMI	
Tikkurila	6. 6. 2006	Vantaa Tikkurila, WXT, tesdbed	Vantaa Malminiitty, MCN		
Lassila	7. 6. 2006	Helsinki Ilmala, WXT, testbed	Helsinki Malminkartano, MCN	Helsinki Pitäjänmäki, MCN	
Käpylä	7. 6. 2006	Helsinki Ilmala, WXT, testbed	Helsinki Kumpula, FMI		
Lauttasaari	7. 6. 2006	Helsinki Kaisaniemi, FMI	Helsinki Kaivopuisto, WXT, testbed		
Kannelmäki	13. 6. 2006	Vantaa Vantaanlaakso, WXT, testbed	Helsinki Malminkartano, MCN	Helsinki Pitäjänmäki, MCN	
Viikki	13. 6. 2006	Malmin lentoasema, WXT, testbed	Helsinki Kumpula, FMI		
Käpylä	13. 6. 2006	Helsinki Ilmala, WXT, testbed	Helsinki Kumpula, FMI		
Järvenpää	13. 6. 2006	Nurmijärvi, FMI	Järvenpää Sorto, WXT, tesdbed		
Lauttasaari	14. 6. 2006	Helsinki Kaisaniemi, FMI	Helsinki Kaivopuisto, WXT, testbed		
Kruununhaka	14. 6. 2006	Helsinki Kaisaniemi, FMI	Helsinki Kruununhaka, MCN		
Järvenpää	16. 6. 2006	Nurmijärvi, FMI	Järvenpää Sorto, WXT, tesdbed		
Myyrmäki	19. 6. 2006	Vantaa Vantaanlaakso, WXT, testbed	Helsinki Malminkartano, MCN	Helsinki-Vantaa la FMI	
Tikkurila	19. 6. 2006	Vantaa Tikkurila, WXT, tesdbed	Vantaa Malminiitty, MCN		
Tikkurila	20. 6. 2006	Vantaa Tikkurila, WXT, tesdbed	Vantaa Malminiitty, MCN		
Järvenpää	20. 6. 2006	Nurmijärvi, FMI	Järvenpää Sorto, WXT, tesdbed		
Käpylä	20. 6. 2006	Helsinki Ilmala, WXT, testbed	Helsinki Kumpula, FMI		
Viikki	20. 6. 2006	Malmin lentoasema, WXT, testbed	Helsinki Kumpula, FMI		
Kaisaniemi	20. 6. 2006	Helsinki Kaisaniemi, FMI	Helsinki Kruununhaka, MCN		
Kannelmäki	21. 6. 2006	Vantaa Vantaanlaakso, WXT, testbed	Helsinki Malminkartano, MCN	Helsinki Pitäjänmäki, MCN	
Tikkurila	21. 6. 2006	Vantaa Tikkurila, WXT, tesdbed	Vantaa Malminiitty, MCN		
Myyrmäki	21. 6. 2006	Vantaa Vantaanlaakso, WXT, testbed	Helsinki Malminkartano, MCN		
Kallio	21. 6. 2006	Helsinki Kaisaniemi, FMI	Helsinki Talvipuutarha, MCN		

Missing TB-data

FMI	Ilmatieteen laitos
WXT, testbed	testbed-projekti
MCN	pääkaupunkiseudun ilmastollinen verkosto

Looking forward…

- Thermal stress mapping of Helsinki area
  - Case studies of heat wave
  - And cold spell episodes

July 2006 temperatures in Helsinki

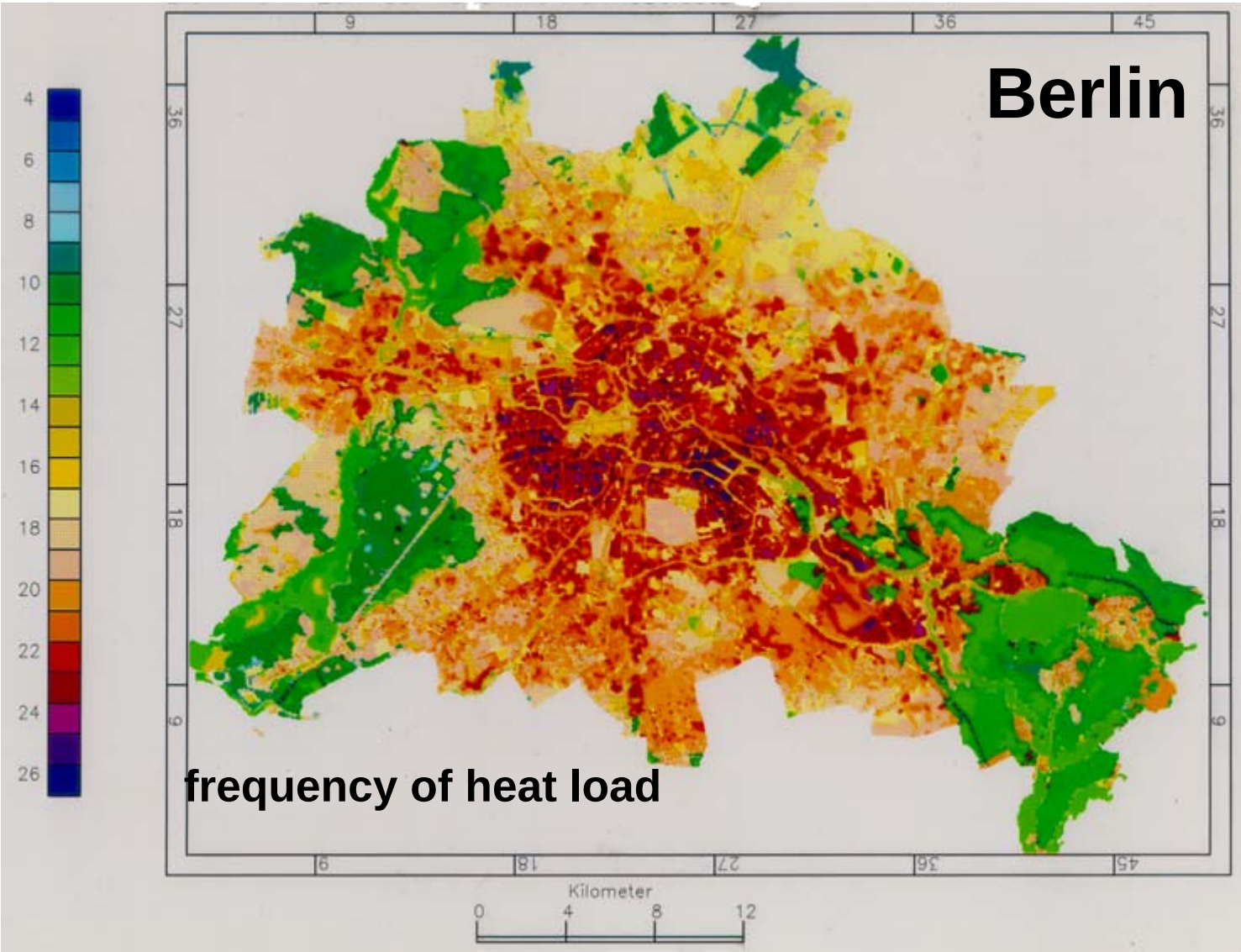
Asema	T	T-min	T-max	*T-min*	*T-max*	Hellevrk
Harmaja	17,0	12,2	24,5	14,6	20,2	0
Kaivopuisto [1]	18,7	12,0	26,8	14,8	22,0	4
Bulevardi	19,3	12,5	29,5	16,0	22,9	7
Mannerheimintie 7	19,9	12,3	30,6	16,0	24,5	10
Kaisaniemi	18,9	9,6	29,2	14,0	23,3	7
Hietaniemi	18,7	10,1	29,4	14,0	23,5	7
Sörnäinen	19,9	12,3	29,4	15,7	24,0	10
Roihupelto	-	-	-	-	-	-

Juho-Pekka Kaukoranta, 2006

February 2006 temperatures in Helsinki

Asema	T	T-min	T-max	*T-min*	*T-max*	Jäävrk x
Harmaja	-7,6	-20,9	0,4	-10,2	-5,1	27
Kaivopuisto [1] [2]	-7,9	-	1,8	-10,7	-5,6	-
Bulevardi [3]	-7,0	-21,2	-	-9,6	-4,5	-
Mannerheimintie 7	-6,5	-20,6	2,1	-9,1	-4,1	23
Kaisaniemi	-7,9	-22,8	2,4	-10,9	-5,1	26
Hietaniemi	-7,6	-22,2	2,4	-10,9	-4,6	24
Sörnäinen	-7,1	-21,5	2,7	-9,8	-4,5	26
Roihupelto	-8,2	-23,2	2,3	-11,3	-5,5	26

Juho-Pekka Kaukoranta, 2006


Berlin
frequency of heat load
4
6
8
10
12
14
16
18
20
22
24
26
9
18
27
36
45
Kilometer
0
4
8
12

Looking forward…

- Thermal stress mapping of Helsinki area
  - Case studies of heat wave
  - and cold spell episodes
- How urban heat island could be seen in Testbed data?
  - Need for reliable data!
  - Reference measurements?

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Thank You
for
Your Interest!

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