



Climate Change in Urban Planning

Finland's Environment Cluster Research Programme
Finland's National Strategy for Adaptation to Climate Change
Astra Workshop February 15-17, 2007
Pirkanmaa Regional Environment Centre, Tampere, Finland

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Environmental Cluster Programme

- A collaborative programme between researchers, the business sector, public authorities and funding organisations
- Aims at raising the level of environmental know-how, improving the state of the environment, and integrating environmental issues more closely into the Finnish system of innovation
- The main financiers of the programme are the Ministry of the Environment, the Ministry of Trade and Industry, the Ministry of Agriculture and Forestry, the Ministry of Transport and communications, the National Technology Agency, and the Academy of Finland. The Finnish Ministry of Environment is responsible for the coordination of the programme
- The central issues are [the control of the climate change](#), prevention of waste production, recycling, promotion of a good and healthy environment, sustaining biodiversity, economic instruments and their effectiveness, and the anticipation of environmental technology.

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Environmental Cluster Programme

The fourth phase 2006-2009

• The theme of the fourth phase is "Ecoefficient Society" and the programme has been divided into five sectors:

- Nature and natural resources
- Communal structure and habitat
- Production and consumption
- Climate change
- New material technologies for construction of infrastructures

-> www.ymparisto.fi

Finland's National Strategy for Adaptation to Climate Change
Research Programme for Apaptation to Climate Change

-> www.mmm.fi



Climate Change in Urban Planning Background

- Control of climate change is a major international and national goal.
- Research concerning control of climate change in urban development and planning have been made at VTT, Technical Research Centre of Finland, from early 1990's.
- Adaptation to climate change has been considered i.a. in research projects by VTT and TEKES, FINADAPT, EXTREMES and COSTC14.
- This project consideres climate change issues in urban planning from **both control and adaptation** points of view.



Objectives

- The aim of the project is to promote **adaptation to and control of** climate change in urban planning and thereby i.a. reduce damages caused by floods and storms as well as reduce greenhouse gas emissions.
- The project **analyses plans** at different levels: regional, master and detailed plans.
- The basis for analyses are **estimations about essential impacts of climate change in the case localities**.
- Next issues are analysed: How climate change risks have been taken into account? How climate change mitigation has been realised? How impacts of climate change have been assessed? Are there conflicts between measures for climate change mitigation and adaptation? How to develop impact assessment and control of climate change?
- Results of the project are **recommendations of practical procedures and means** for taking climate change into account in urban planning and impact assessment.



Climate change predictions

- Based on simulation and extremes analysis methods developed by EXTREMES I (2004 – 2005) and II (2006 – 2008) projects
- Natural hazards to infrastructure in a changing climate
- VTT (**Lasse Makkonen**), University of Helsinki, Rosby Centre (Sweden)

- A new empirical probabilistic method to estimate the return periods of natural hazards

CONTROL SIMULATIONS 1961 - 1990

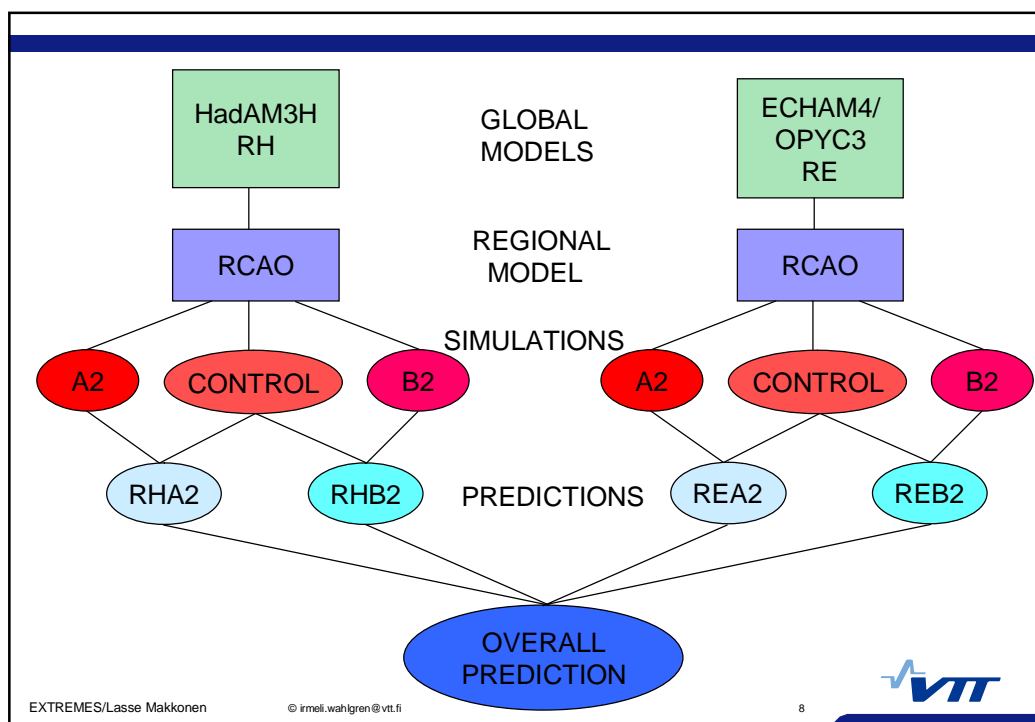
INPUT: MEASURED ATMOSPHERE

SCENARIO SIMULATIONS 2071 - 2100

INPUT: IPCC EMISSION SCENARIOS A2 AND B2

PREDICTION RANGE 110 YEARS

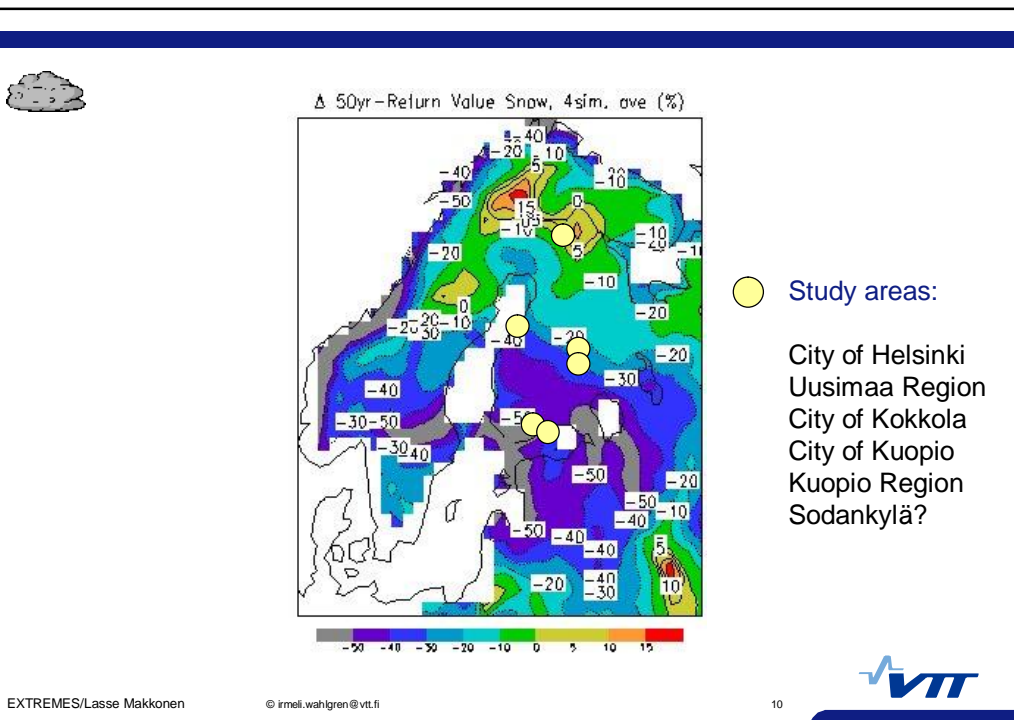
PREDICTION FROM TODAY 80 YEARS

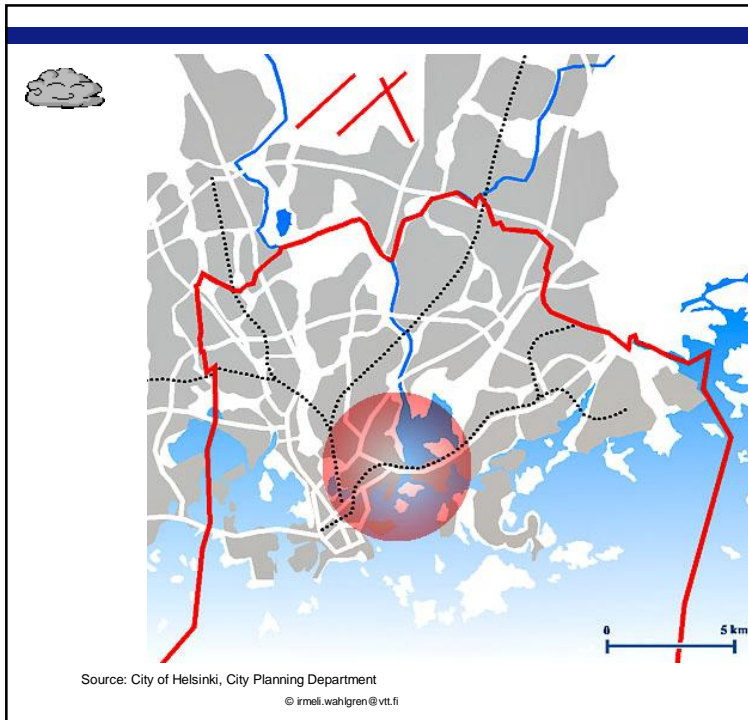


The Weibull formula is the only correct plotting formula when estimating return periods by the extreme value analysis

$$P = \frac{i}{n + 1}$$

Makkonen, L., 2005: Plotting positions in extreme value analysis. *Journal of Applied Meteorology and Climatology* 45: 334-340.







Climate change in urban planning

Study area 1:
Sörnäistenranta-
Hermanninranta
(Kalasatama, Fish
Harbour),
City of Helsinki

Source: City of Helsinki, City Planning Department
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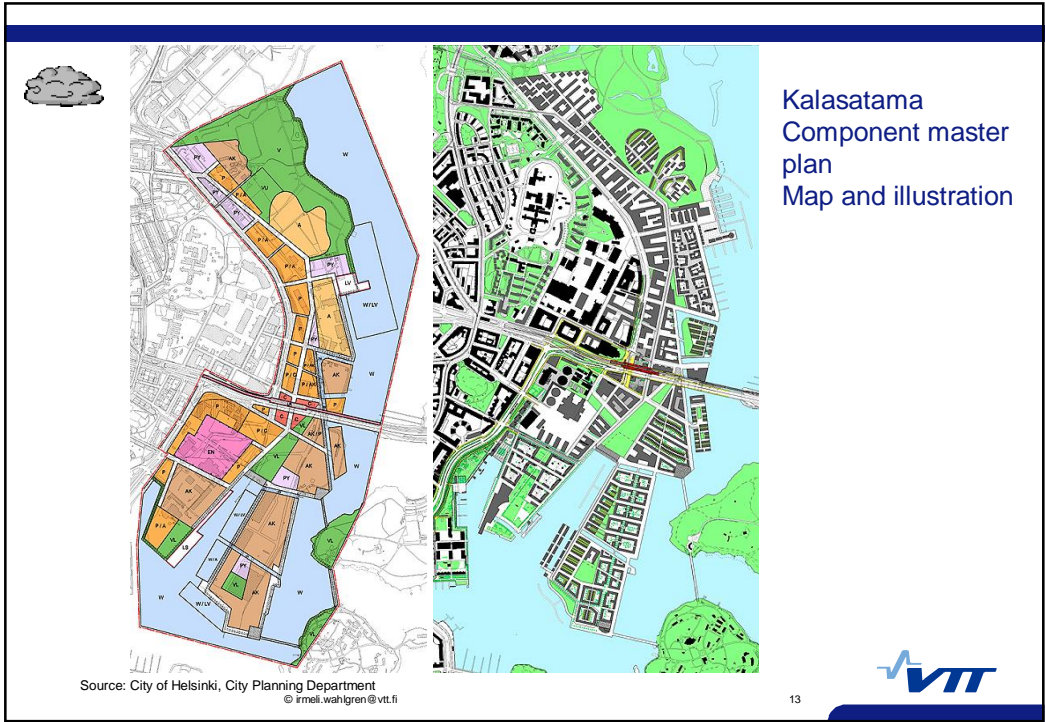
Kalasatama (Fish Harbour)

- Former harbour and industrial areas into a new waterfront city quarter
- 15 000 residents
- 5 000 – 7 000 apartments
- 6 000 – 7 000 jobs
- Primarily planned around the use of public transport: metro, tram, bus
- Walking and cycling

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Kalasatama
Component master
plan
Map and illustration

Source: City of Helsinki, City Planning Department
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VTT

This slide features two maps of the Kalasatama area in Helsinki. The left map is a technical planning map with various colored zones (orange, pink, green, blue) and street layouts. The right map is a more illustrative version showing buildings, green spaces, and water bodies. A small cloud icon is in the top left corner. The VTT logo is in the bottom right corner.



Source: City of Helsinki, City Planning Department
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VTT

This slide shows an aerial architectural rendering of the Kalasatama development. It depicts a dense urban layout with various building heights and colors, situated along a waterfront with a bridge and a harbor area. The VTT logo is in the bottom right corner.



Source: City of Helsinki, City Planning Department

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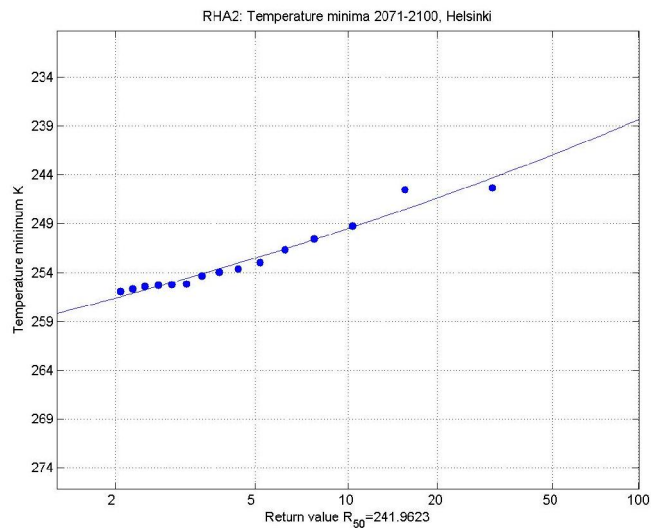
Component master plan of Kalasatama(Fish Harbour)

- Predicted climate change in Helsinki based on simulation results of a regional climate model
 - The regional atmosphere-ocean climate model RCO of Rossby Centre, Sweden
 - Extremes by University of Helsinki and VTT, Technical Research Centre of Finland
 - Simulations with boundary conditions of two global models and using two emission scenarios by IPCC
 - Results concerning changes describe mean values of four simulations at a counting point by Helsinki, which responds 50 km x 50 km area in the model.
 - "Present condition" by control simulations 1961-1990 and "prediction" by scenario simulations 2071-2100
 - Extremes or maxima and minima describe on average once in a 50 year period exceeding (or going below) values

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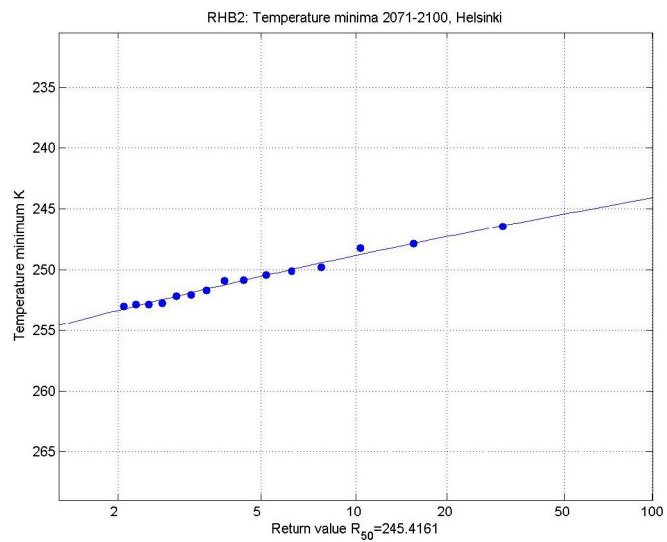




Example:
RHA2

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Example:
RHB2

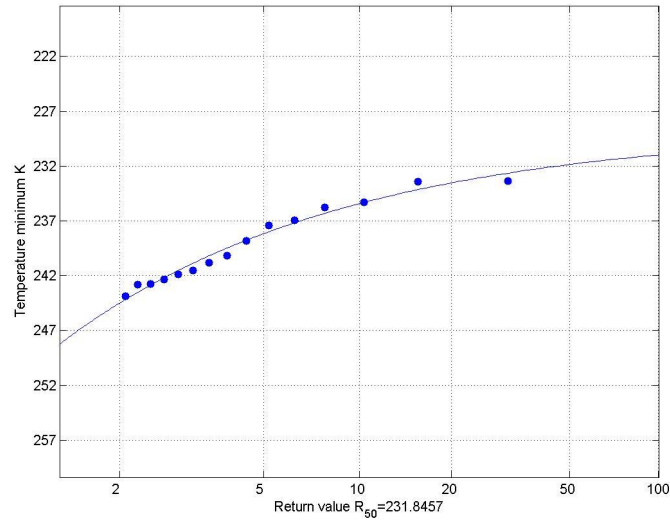
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RHC: Temperature minima 1961-1990, Helsinki



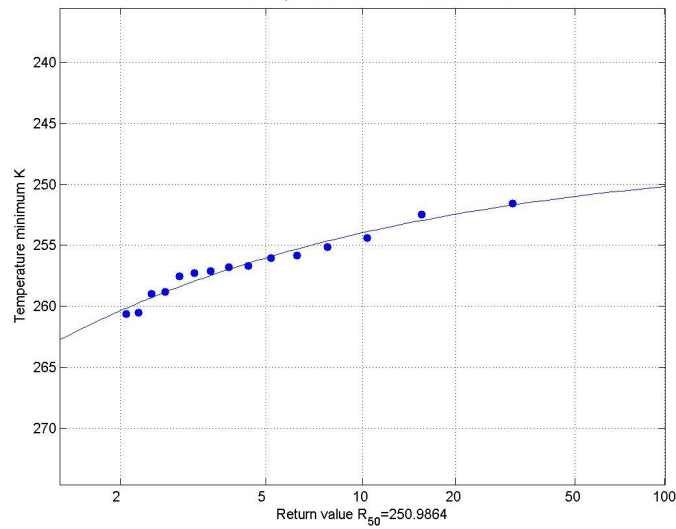
Example:
RHC

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REA2: Temperature minima 2071-2100, Helsinki

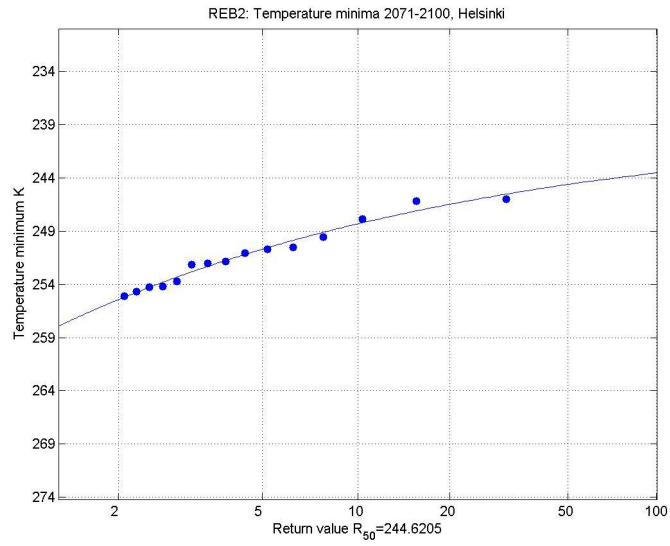


Example:
REA2

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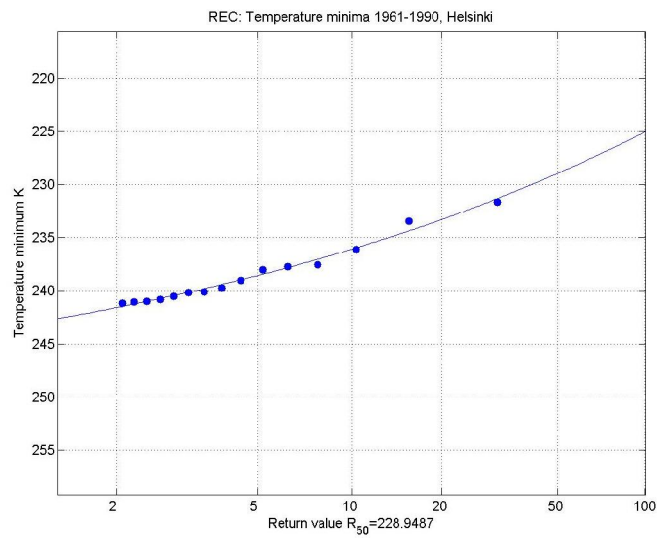




Example:
REB2

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Example:
REC

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Component master plan of Kalasatama

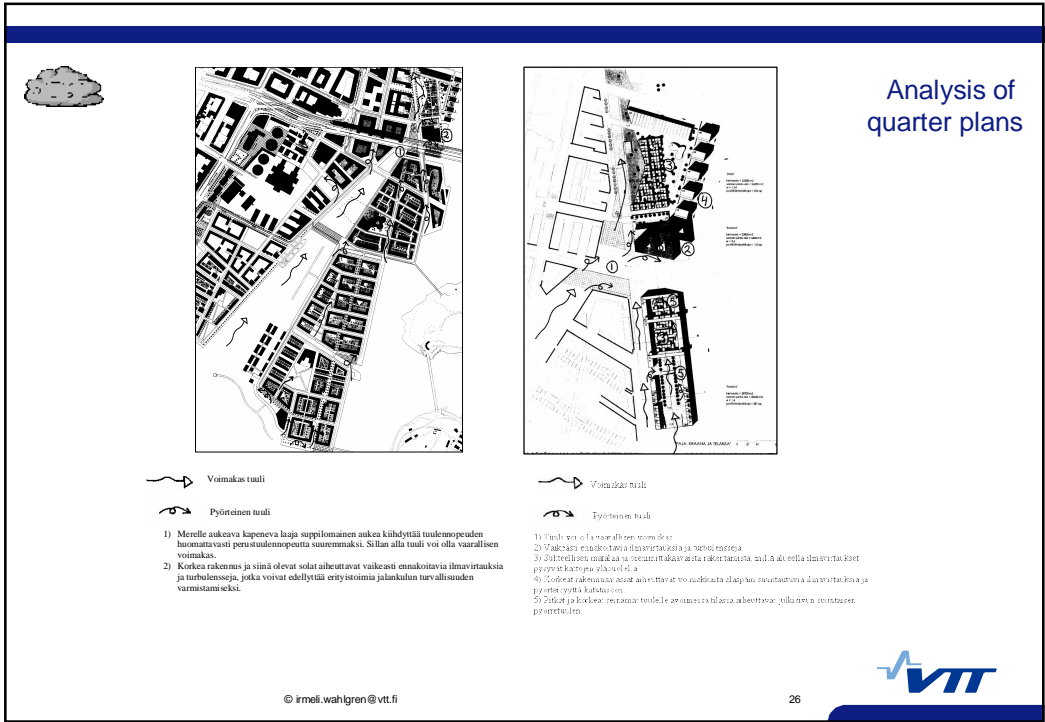
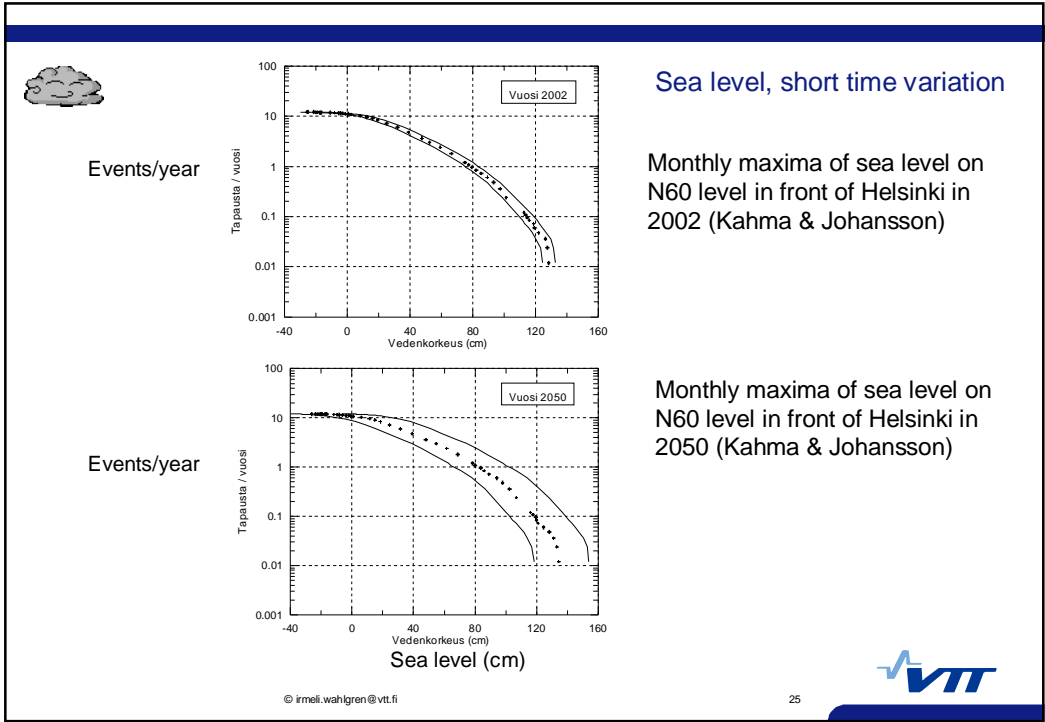
- Predicted changes:
 - Mean temperature of a year +4 °C
 - Temperature maximum +4 °C
 - Temperature minimum +16 °C
 - Melting-freezing cycles - 40 %
 - Mean wind speed of a year +2 %
 - Wind speed maxima +15 %
 - Precipitation of a year +15 %
 - Precipitation maximum 6 h 0 %
 - Precipitation maximum 5 d +15 %
 - Snow precipitation maximum - 60 %
 - Snow precipitation maximum 6 h 0 %
 - Snow maximum - 50 %
 - Duration of snow cover - 70 d
 - Duration of ice cover of sea - 120 d



Sea level

- Analysis by the Finnish Institute of Marine Research
- In front of Helsinki once in 200 years sea level is + 2.30 m (City of Helsinki building code)
- In worst storm of a year waves 0.8 m high
- Highest single waves may be 1.50 m high

- In Kalasatama (and other new areas in Helsinki) floor level at least + 3.00 m over sea level





Main lines of developing plans

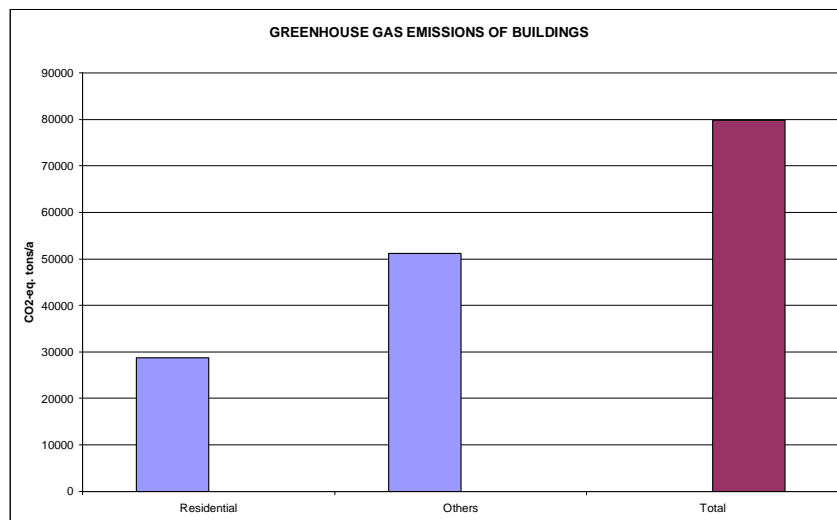
- in the southern part of the plan protection of outdoor areas against wind from the sea side
- in the northern part of the plan protection of outdoor areas against wind from north and east
- protection of buildings against winds from north
- energy saving measures against cooling impact of wind
- durability of structures against wind
- protection of buildings by waterfront against splash and wet
- protection of most important street spaces against wind
- plantings for wind protection

Furthermore recommended

- wind testing of the plan
- wind testing of certain buildings by waterfront
- experimental construction project of a "green street"

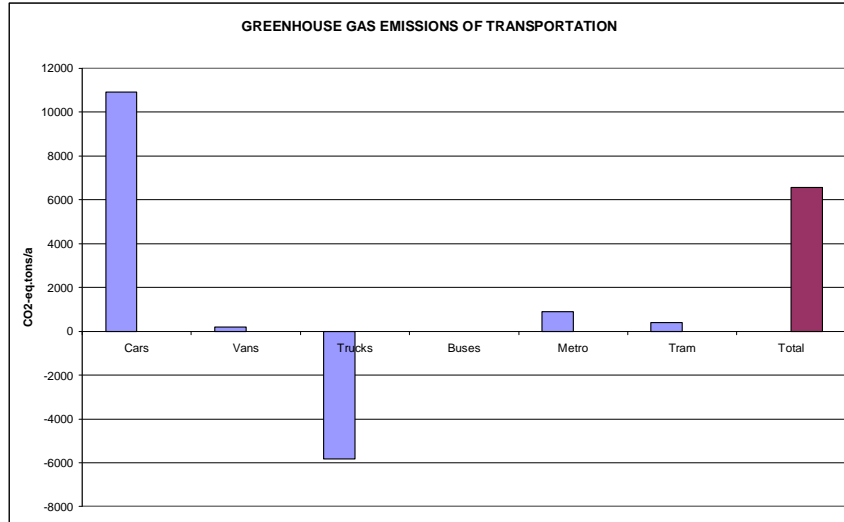


Greenhouse gas emissions





Greenhouse gas emissions

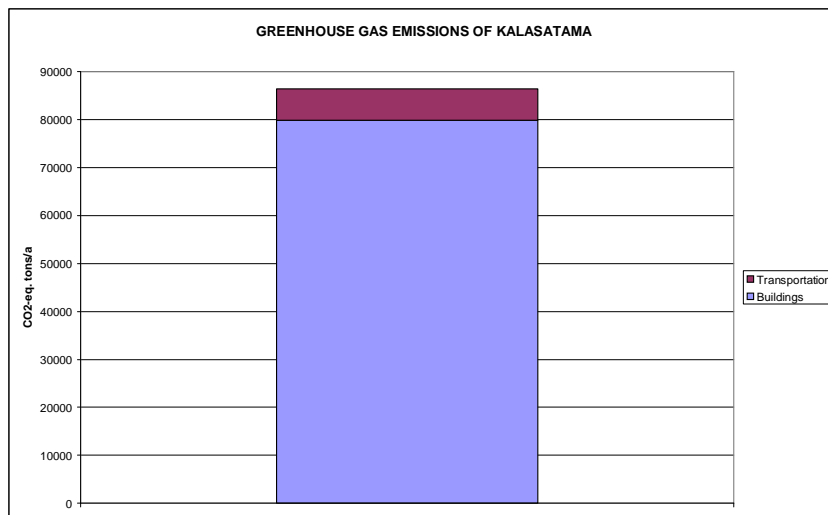


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Greenhouse gas emissions



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Greenhouse gas emissions

- Heating and use of electricity in buildings 80 000 CO₂-eq. tons/a
- 5,3 tons/inhabitant
 - 10 % of emissions of new buildings in the Master Plan of Helsinki
 - Helsinki Metropolitan Area: 6,7 tons/inhabitant in 2003
 - Uusimaa Region: 6,5 tons/inhabitant in 2003
- Transportation 6 600 CO₂-eq. tons/a
- 0,4 tons/inhabitant
 - 7 % of emissions of transportation in the Master Plan of Helsinki
 - Helsinki Metropolitan Area: 1,5 tons/inhabitant in 2003
 - Uusimaa Region: 1,9 tons/inhabitant in 2003



Results

- Impacts of climate change
 - Higher temperatures
 - More winds and storms
 - More rains
 - Less amount of snow, but snow storms may be harsh
 - Sea has ice cover only for a short time; more chop
- Adapting to climate change in urban planning
 - Special attention to increase of wind
 - Energy consumption may not reduce
 - Protection of buildings and outdoor spaces
 - Sizing of drainage
 - Protection against spatters
- Control of climate change
 - Greenhouse gas emissions relatively small, especially small from transportation
 - Central location in urban structure
 - District heating, effective energy production
 - Public transport, metro and tram
 - Walking and cycling
 - Possible to manage without private car



Conclusions and recommendations

- Climate awareness in planning
- Assessment of greenhouse gas emissions
- Kalasatama is a good area concerning control of climate change
- Wind testing of the plan and certain buildings and a green street experimental construction project are recommended



Other study areas

- City of Kokkola
 - A master plan
- Regional Council of Uusimaa
 - Regional plans
- Kuopio
 - City of Islands
- Regional Council of Pohjois-Savo
 - A regional plan?
 - A winter sport area?
- Sodankylä?



Thank you!

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