Megacities - Megarisks

Munich Re media conference
11 January 2005

Münchener Rück
Munich Re Group

Agenda

Münchener Rück
Munich Re Group

The climate in megacities
Impact on the health of the population and on life and health insurance

Prof. Peter Höppe

Münchener Rück
Munich Re Group

What features characterise an urban climate?

Münchener Rück
Munich Re Group

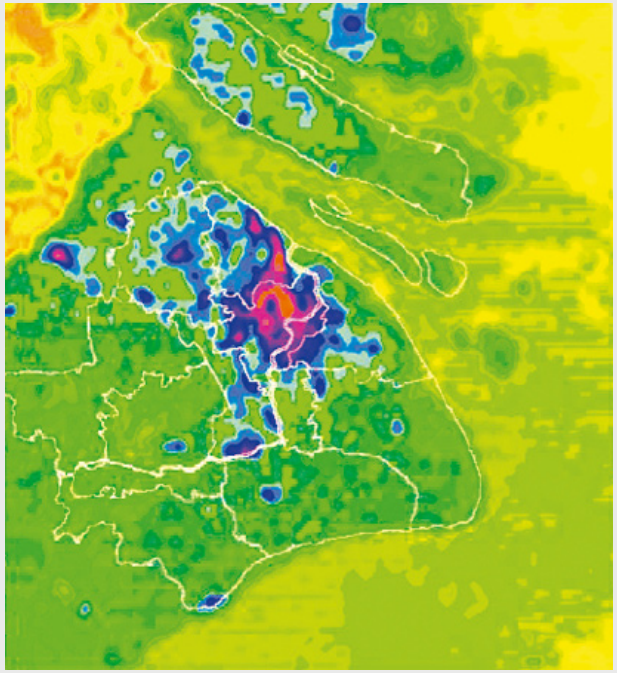
- Higher air temperatures (above all evenings and nights)
- Lower air speeds
- Higher risk of torrential rain in the lee area of the city
- Greater risk of thunderstorms (lightning strokes)
- Increased air pollution (ozone, dust, soot)

Heat island Shanghai: Centre 6°C warmer than the surrounding region

Satellite image in visible range

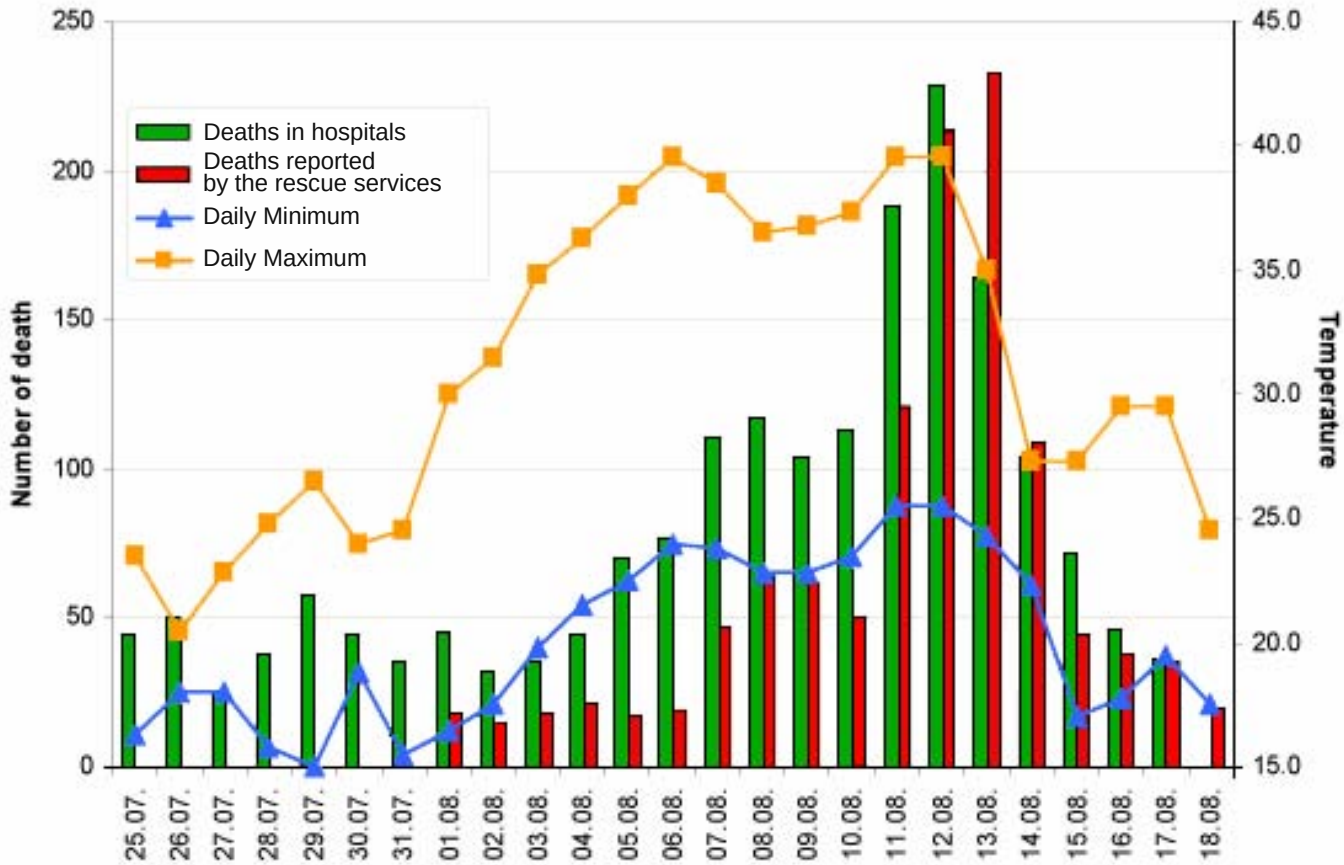
Source: GEOSPACE Verlag, Salzburg

Thermal image



Source: Zhou and Ding, 1998

Significant increase in deaths in Paris during the heat wave in the summer of 2003



Source: Climate Change Impacts in Europe: Today and in the Future, European Environmental Agency, Copenhagen, 2004.

Ozone values: In Los Angeles almost five times higher than in Munich

Münchener Rück
Munich Re Group

Ozone (peak values)	
Los Angeles	1160µg/m³
Mexico City	860µg/m³
Tokyo	760µg/m³
Melbourne	460µg/m³
Munich	270µg/m³

Particles (TSP)	
Beijing	377µg/m³
Mexico City	279µg/m³
Mumbai	240µg/m³
Sydney	54µg/m³
Munich	40µg/m³

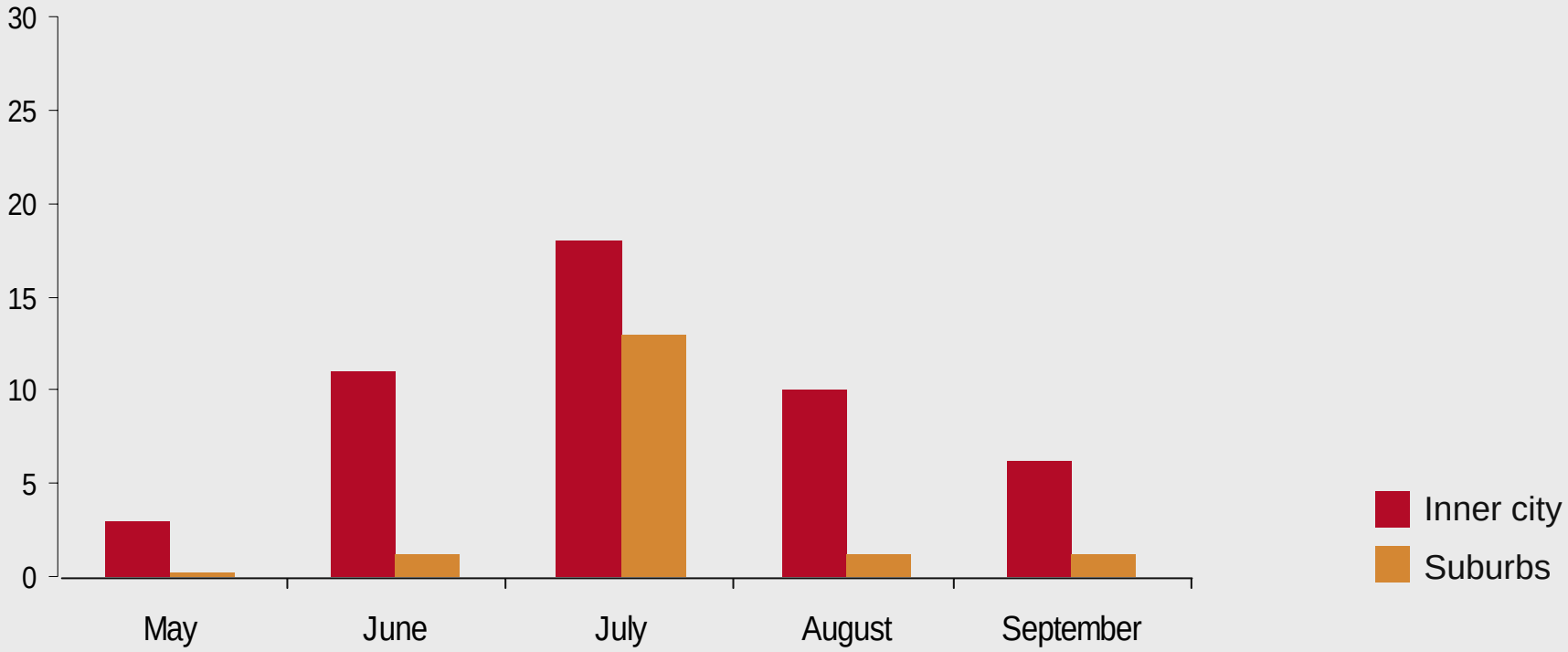
Examples of air pollutant concentrations in cities of different sizes.

Ozone: Mean value over one hour; Particles: Annual mean values

Urban climate - The positive effects

Münchener Rück
Munich Re Group

Monthly number of beer garden days with temperatures of at least 20°C at 9 p.m. in the city centre and in the suburbs of Munich



Source: Bründl and Höppe, Arch. Met. Geoph. Biocl., Ser. B. 35, 55-66, 1984

Climate in megacities: Threats to health

- Increased heat burden and higher mortality risks for megacity dwellers
- Megacities amplify the effects of global climate change
- Air hygiene situation with increased ozone and particle concentration can contribute to respiratory diseases and myocardial infarctions
- Bioclimatological effects can have an impact on life and health insurance

Megacities - Megarisks

Dr. Anselm Smolka

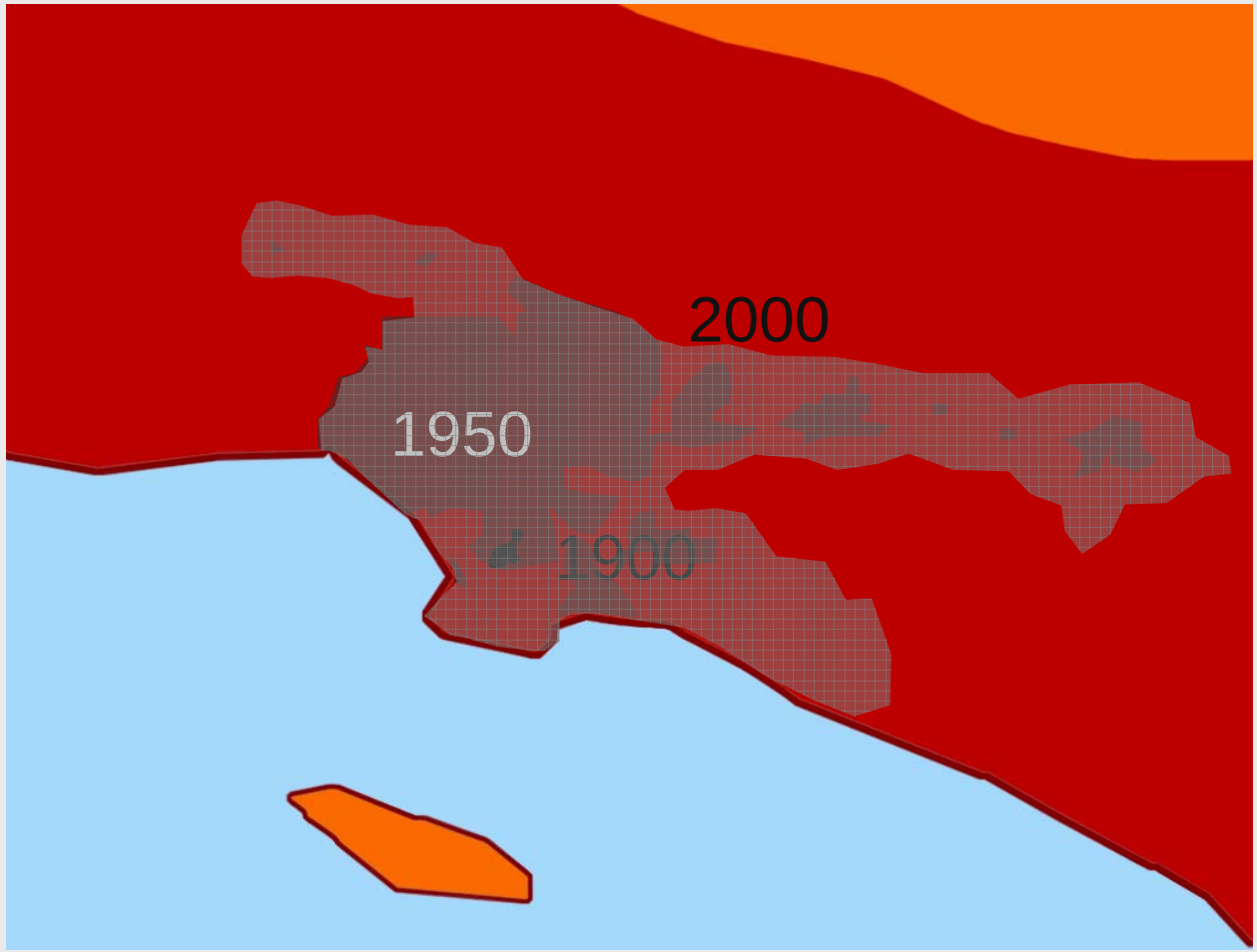
Münchener Rück
Munich Re Group

Major catastrophes in conurbations

- Lisbon earthquake in 1755 – The first global catastrophe
- San Francisco earthquake in 1906 – The greatest loss in the history of Munich Re measured against premium volume
- Kobe earthquake in1995 – Costliest natural catastrophe loss to date in economic terms
- World Trade Center in 2001 – Catastrophe in New York

Los Angeles: The growing threat

Münchener Rück
Munich Re Group



Los Angeles

Earthquake risk

high

very high

Particular challenge for insurers: The danger of accumulation

- Virtually all classes of insurance are affected:
  - Life, health and personal accident
  - Liability (e.g. industrial lines)
  - Property insurance (private, commercial, industrial lines; property losses and business interruption)
- Problem: With major events a large number of objects and several classes of business are affected at the same time (liability accumulation)

Unavoidable need to restrict (and prevent) risks

Approaches to solving or mitigating the accumulation problem:

- Risk evaluation
  - Assessment using appropriate scenarios and tools (computer models)
- Risk limitation
  - Limits of liability
  - Exclusion of risks (certain hazards, objects, areas)
- Balance of risks (regional)
  - growing need for insurance in metropolises in developing countries
- Risk prevention and reduction

Analysis: What events can affect megacities?

First step: Identify potential occurrences

- Natural catastrophes
- Technological catastrophes
- Terrorism
- Epidemics

Risk index and geocoding create transparency of risks

Second step: Risk assessment

- Risk index

  The natural hazard risk index for megacities - Looking at the whole picture

- Geocoding

  Record of the geographical position of insured objects - Looking at detail

Natural hazard risk index: A measure of loss potential

- Synoptic view of all relevant natural hazards
  - Earthquake + allied perils (incl. tsunami)
  - Windstorm
  - Flood
  - Miscellaneous (volcanism, bush fire, frost)
- Objective: comparative evaluation of the risk of material losses
- Index components:
  - Hazard
  - Loss susceptibility (vulnerability)
  - exposed values
  - Inclusion of rare and frequent occurrences
- Can be applied to other risks due to the modular structure (e.g. technological catastrophes)

Natural hazard risk index for megacities

Top 10 + Ruhr area

Münchener Rück
Munich Re Group

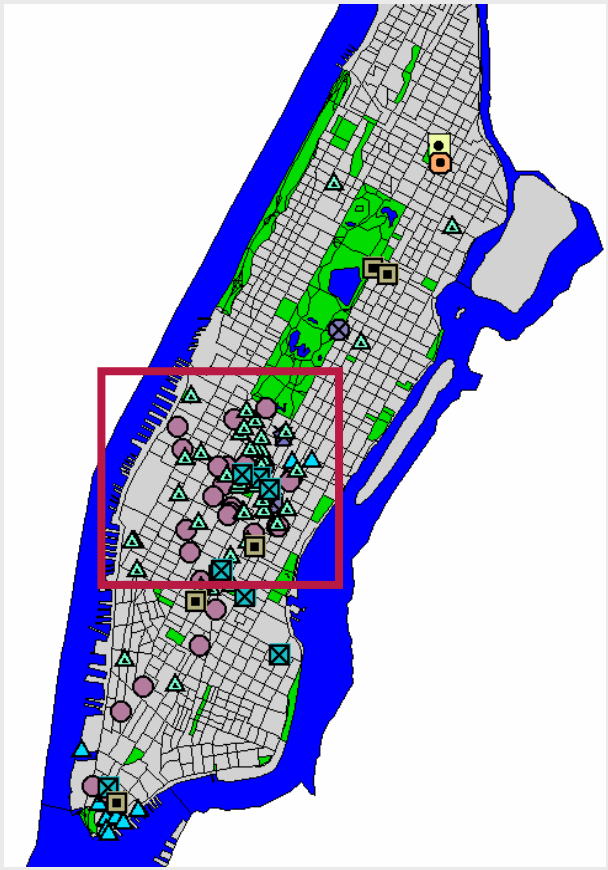
City	Index as a whole[1) 2)]	Hazard *)	Susceptibility to loss *)	Values*)
Tokyo	710	10	7.1	10
San Francisco	167	6.7	8.3	3
Los Angeles	100	2.7	8.2	4.5
Osaka	92	3.6	5	5
Miami	45	2.7	7.7	2.2
New York	42	0.9	5.5	8.3
Hong Kong	41	2.8	6.6	1.9
Manila	31	4.8	9.5	0.7
London	30	0.9	7.1	4.8
Paris	25	0.8	6.6	4.6
Ruhr area	14	0.9	5.8	2.8

[1]) Risk = Hazard *Loss susceptibility *Values

[2]) Total material loss, not the insured share

***) Normated to max. value 10**

Geocoding:
Helps for assessing the risk of terrorism, for example



Recording the geographical position of insured objects using postal code locations as a way of making liability transparent (accumulation control)

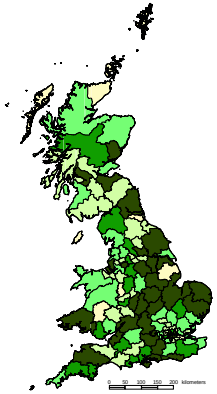
Computer models calculate the probability of losses

Münchener Rück
Munich Re Group

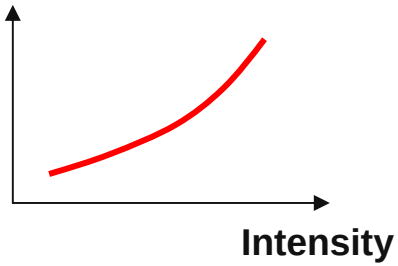
Third step: Calculation of the risk

Linking of risk components in the MRHazard computer model

Value distribution per location and risk type

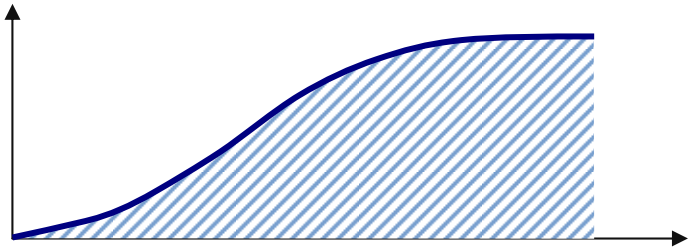


Vulnerability (% loss)



Hazard

Probable Maximum Loss (PML) - Curve (loss as a %age of the value)



Innovative insurance solutions are in big demand

Münchener Rück
Munich Re Group

- Bond insurance: to hedge investments in major projects
- ART – Alternative risk transfer
  - Additional capacity through CAT bonds, weather derivatives
  - Balance of risks through use of SWAPs
- Micro-insurance: Insurance to secure existence, e.g. smaller companies in developing countries

Thank you very much for your attention.

Megacities - Megarisks
Munich Re media conference
11 January 2005

Münchener Rück
Munich Re Group