HAMBURG WASSER

Cultural Heritage and Water Management
8th and 9th June 2010 - Bergen, Norway

Local Effects of Global Climate Change on the Urban Drainage System of Hamburg

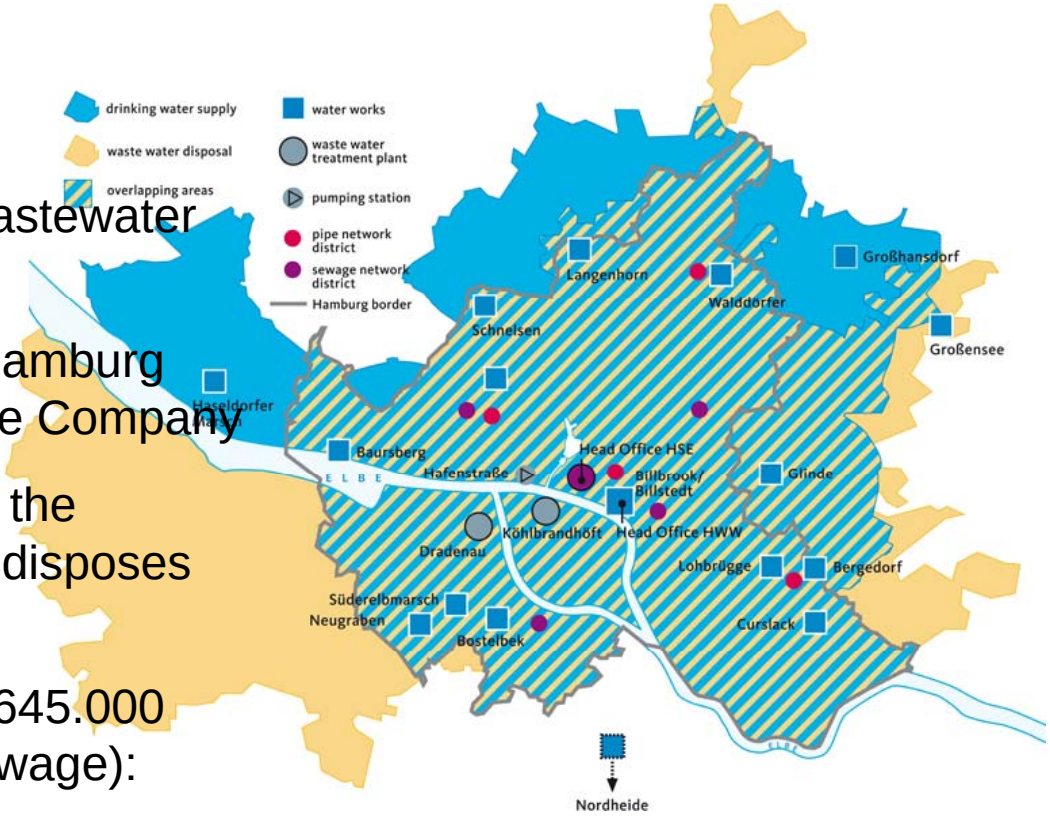
Klaus Krieger, Hamburg Water, Head of Water Management

Outline

1. Facts about Hamburg Water
2. Future challenges for urban drainage management in Hamburg
3. Mitigation measures in Hamburg
4. Effects of climate change on the urban drainage system of Hamburg
5. Adaptation measures

A few facts about Hamburg Water

- Largest public owned water supply and wastewater disposal company
- Created 2006, through the unification of Hamburg Water Works and Hamburg Public Sewage Company
- Supplies 2 million people in Hamburg and the metropolitan area with drinking water and disposes the waste water
- Number of connected housholds (water): 645.000
  Number of house service connections (sewage): 202.000
- Total length of water supply network 5,416 km
  Total length of sewer network 5,548 km
- Water produktion 109 million m³/a
  Treated waste water 165 million m³/a
- Investments in sewer network 60 million €/a
  (depreciation 77-125 years)



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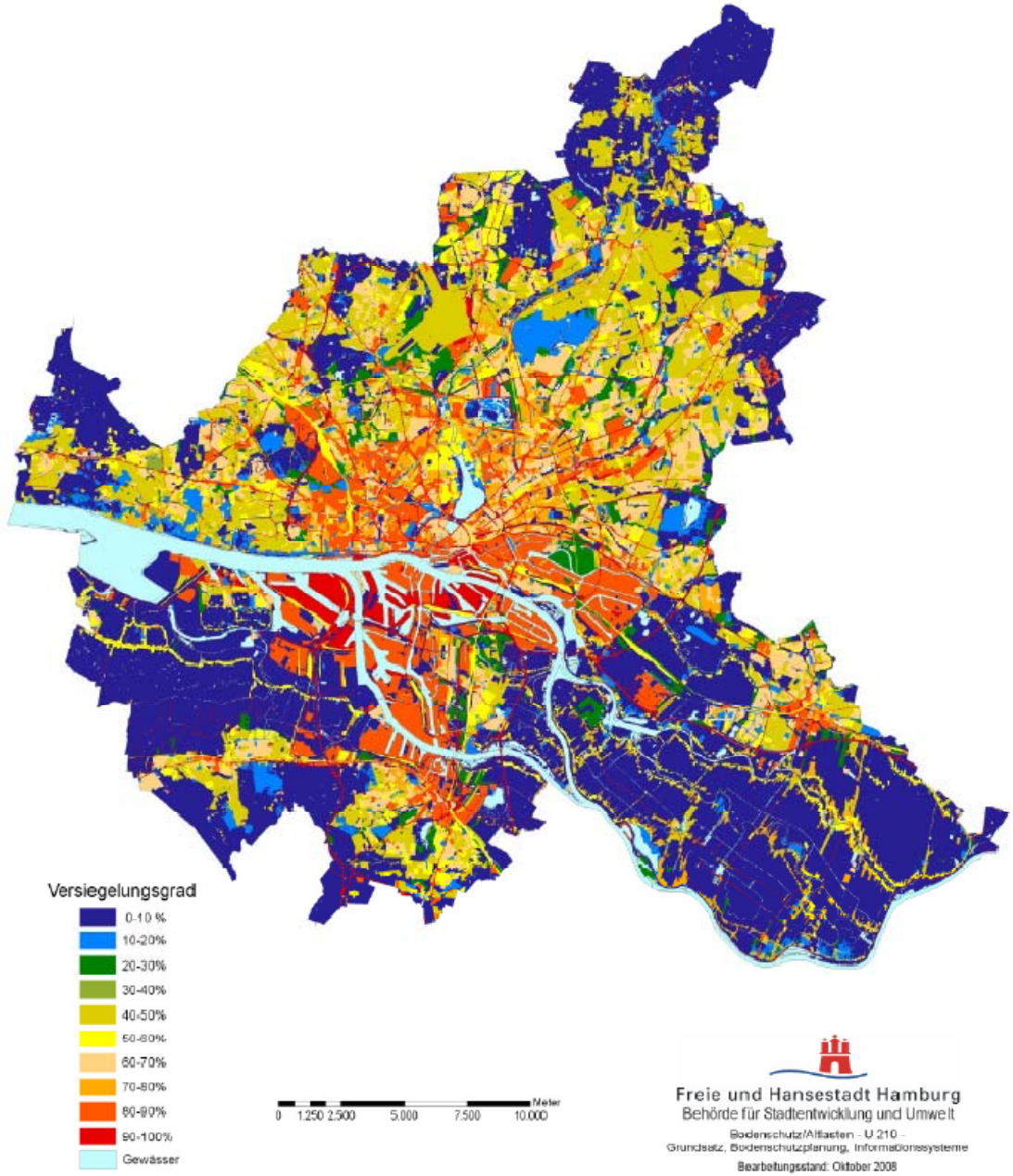
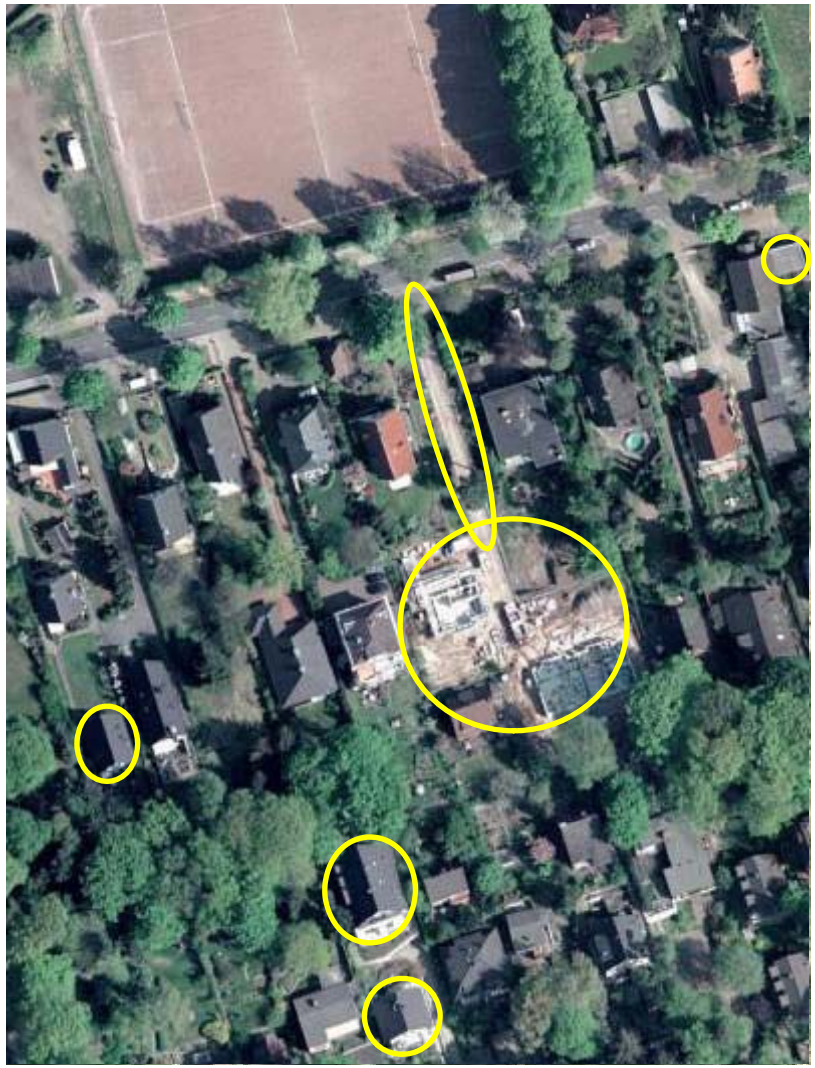
Increase in sealed area

- total area of Hamburg: 755 km² (75.500 ha)
- percentage of sealed area: 37 % that is 280 km² sealed area
- increase of sealed area per year: 1 km² (1% between 1999 and 2006: 750 ha)

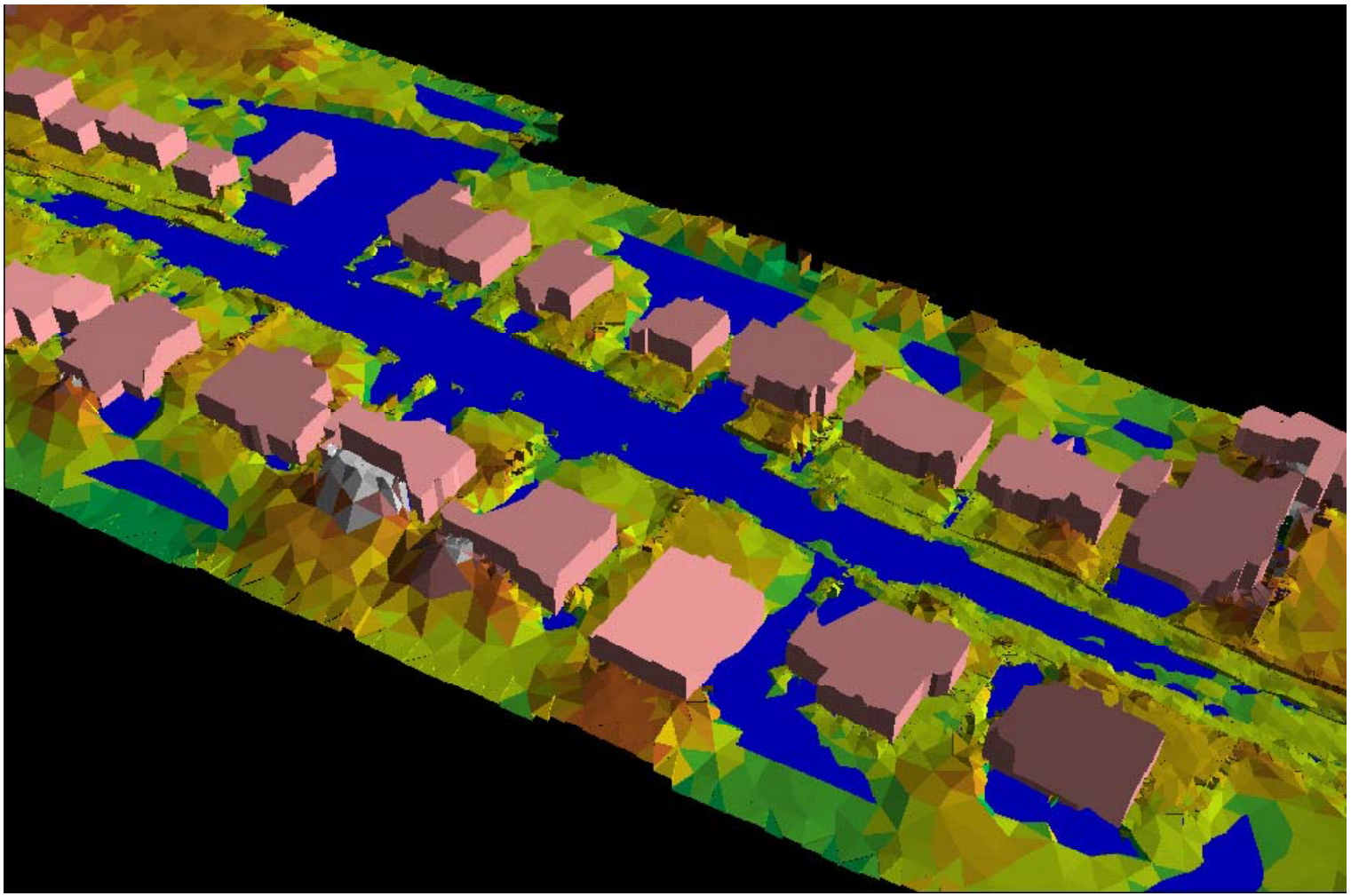


Hamburg - Bahrenfeld / Othmarschen, „Othmarschen Park“

Hamburg - Eißendorf, Ehestorfer Weg



Hamburg - Marienthal, Claudiusstieg



Global change of precipitation patterns

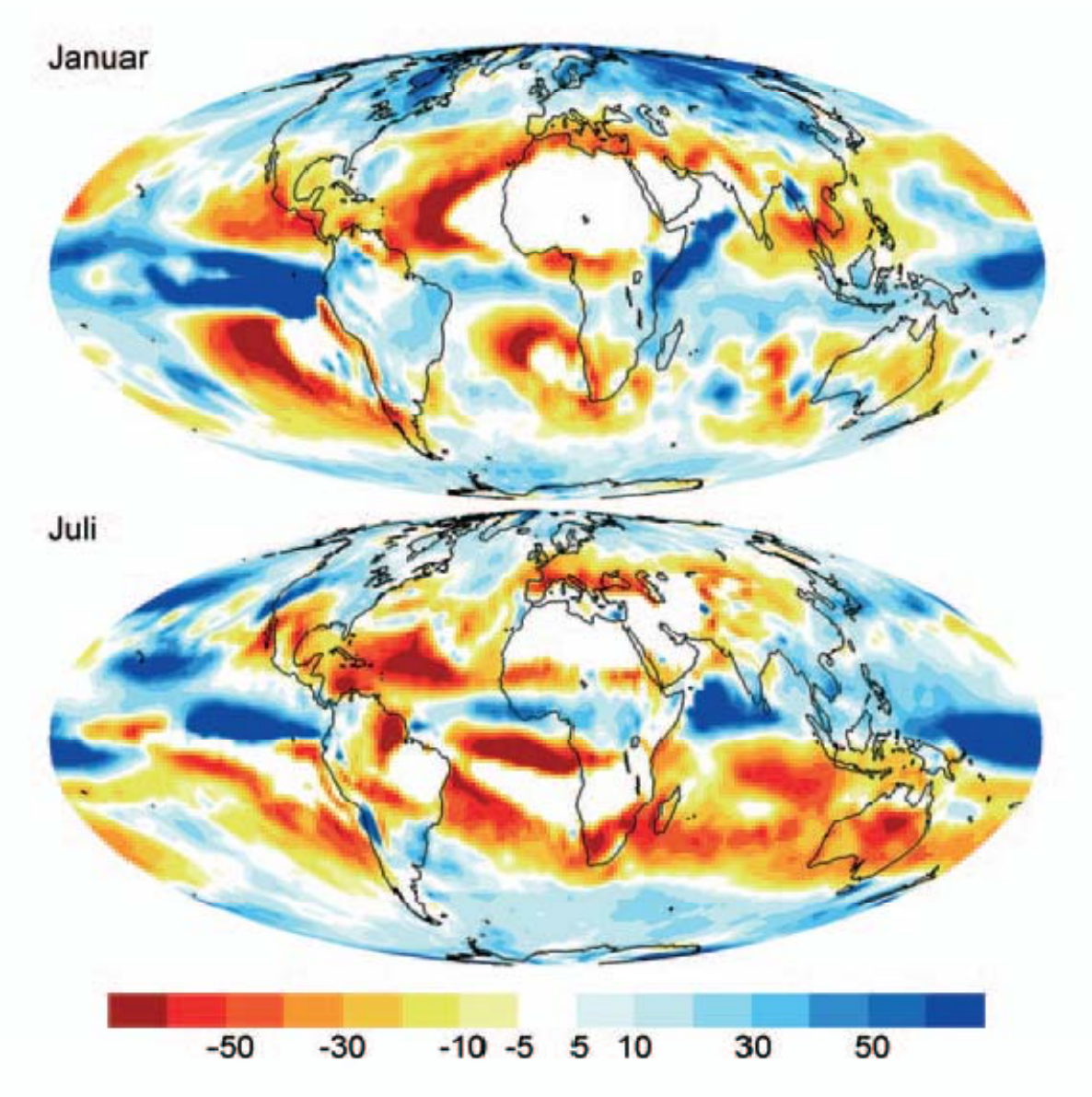


Abbildung 10. Niederschlagsänderungen im Januar und Juli für das Szenario A1B. Gezeigt sind die relativen Änderungen (%) im Zeitraum 2071-2100 bezogen auf die Mittelwerte der Jahre 1961-1990.

What will happen ?

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HOCHWASSER FORSCHER SAGEN MEHR SINTFLUTARTIGE REGENFÄLLI

Ist der Klimawandel schuld?

Die Sommer werden immer trockener. Aber wie pas Trend zu den jüngsten Rekord-Niederschlägen? Ein Experte erklärt die Zusammenhänge.

Die Auswirkungen des Klimawandels bedrohen auch den Chianti

5 Umwelt-Nachrichten, die uns schockieren

Bild.de

Mehr zum Thema

Jetzt amtlich!
Dieser Winter war der wärmste aller Zeiten!

Hamburg – **Am 1. März ist für die Mete Winter vorbei.**

Jetzt amtlich – es war in Deutschland der Zeiten!

HAMBURGER MORGEN POST
www.mopo.de

EU beschließt Strategie gegen den Klimawandel

Brüssel - Die Europäische Kommission beschließt heute ei Maßnahmenpaket gegen die Klima-Erwärmung. Die Brüss Behörde will den 27 EU-Staaten konkrete Vorgaben zum A erneuerbarer Energien machen.

Außerdem sind national unterschiedliche Obergrenzen für Ausstoß gefährlicher Treibhausgase geplant. Zahlreiche Pu des Pakets sind politisch umstritten, darunter der Plan, verstärkt auf Biokraftstoffe zu setzen.

Damit Vorschläge der Kommission Wirklichkeit werden, müssen die Mitgliedstaaten und das

Klimawandel

In der Arktis wachsen Bäume

Der Klimawandel in der Arktis – er lässt komplett neue Wälder entstehen!

In der einstigen Tundra (Gräser, Moose, Flechten) wachsen langsam Bäume.

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Ein Blick in die Klima-Zukunft

Extremwetterkongreß: 450 Experten beraten in Hambur Schneechaos, Sturmfluten, Überschwemmungen - und w Mensch dagegen tun kann.

Überschwemmte Landstriche, Schneechaos, Hitzewellen und Hurrikans mache Menschen weltweit zu schaffen. Sind das nur Wetterkapriolen oder Anzeichen globalen Klimawandels? Auf Deutschlands erstem Extremwetterkongreß in Ha

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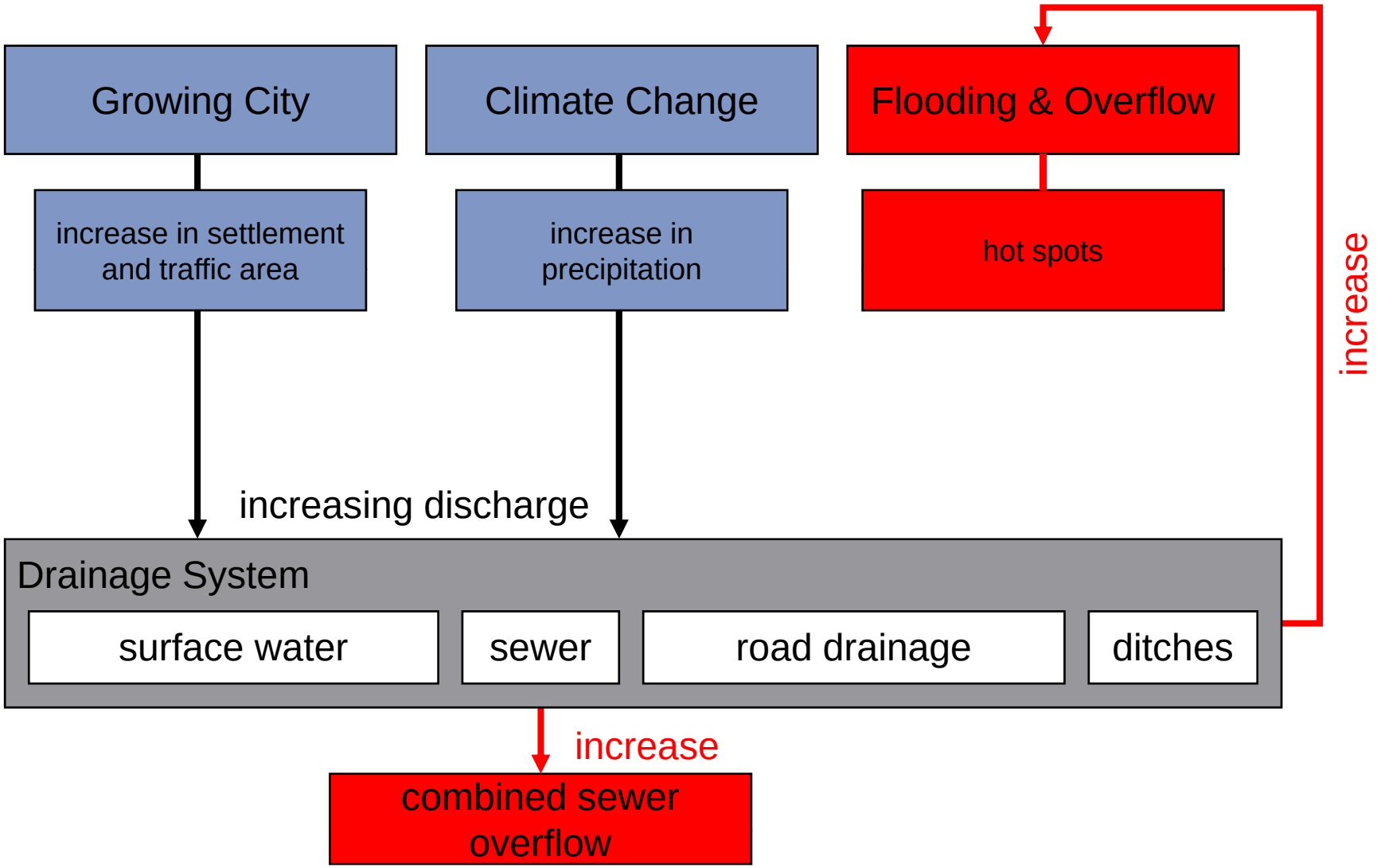
Nur noch Bilderbuchsommer

Klima: Die bisher präziseste Prognose für Hamburg. Forscher des Max-Planck-Instituts sagen detailliert Temperaturen und Niederschläge bis zum Ende des Jahrhunderts voraus - auch für kleine Regionen.

Von Angela Grosse

Im Winter wird es in Hamburg Ende des Jahrhunderts zweieinhalb bis dreieinhalb Grad wärmer sein als heute, im Sommer immerhin noch 1.8 bis 2.8 Grad, je nachdem, wie

Causes and effects



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Definitions

Mitigation: Avoiding the unmanageable

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Estimation: Predicting the unknown

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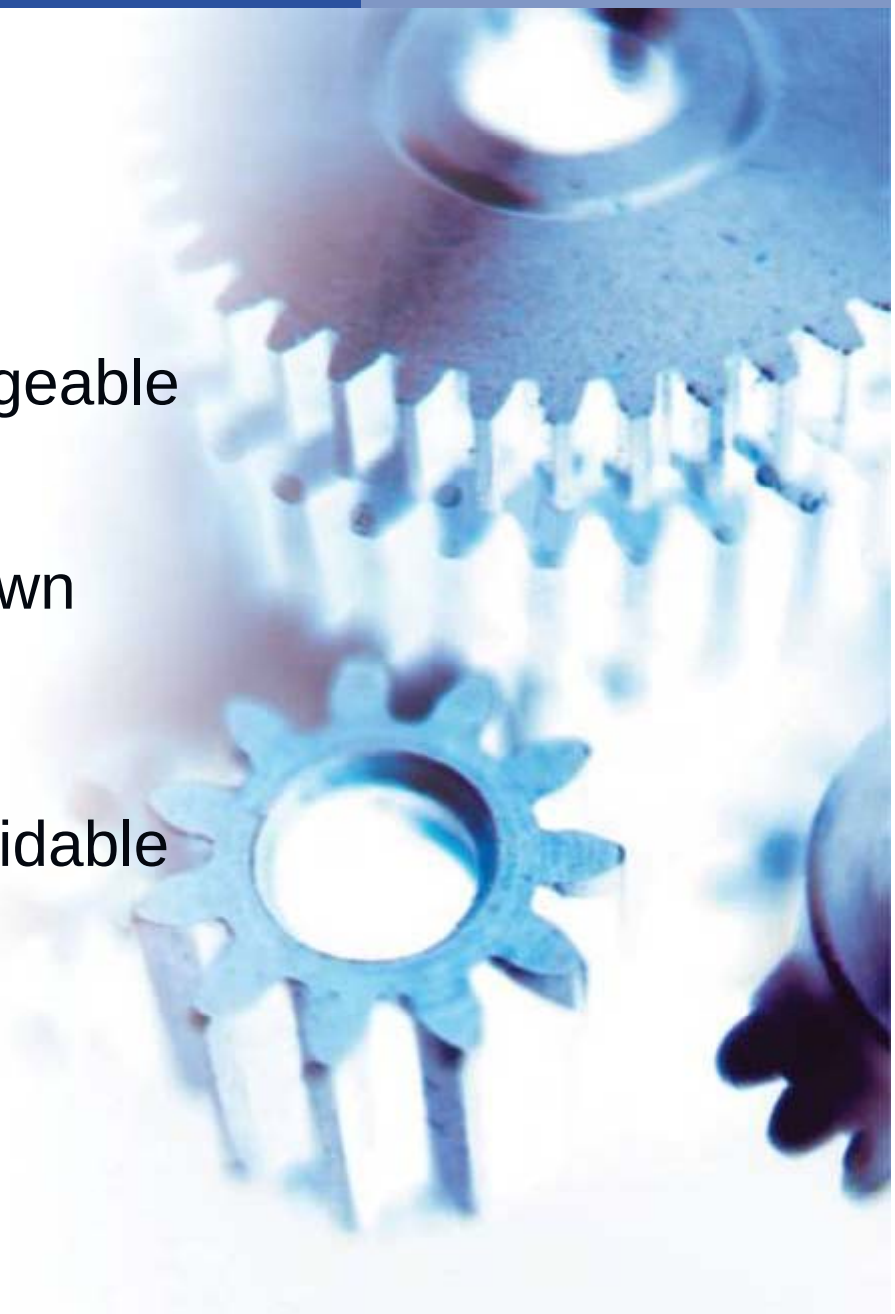
Adaptation: Managing the unavoidable



Mitigation measures

Hamburg:

European Green Capital in 2011
Reduction of CO_2-emissions by 40 % until 2020
Reduction of CO_2-emissions by 80 % until 2050
(referring to 1990)

Hamburg Water:

Energy neutral wastewater treatment plant until 2011
Energy neutral company until 2018

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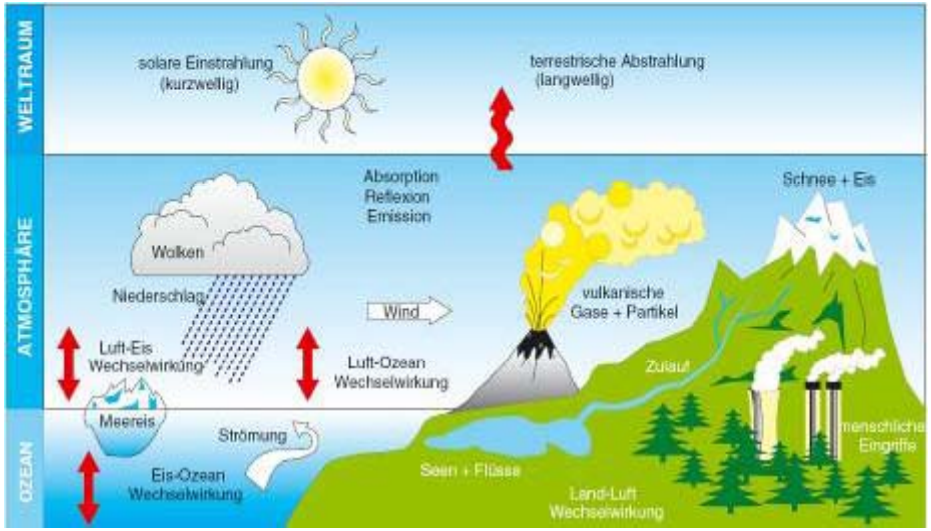
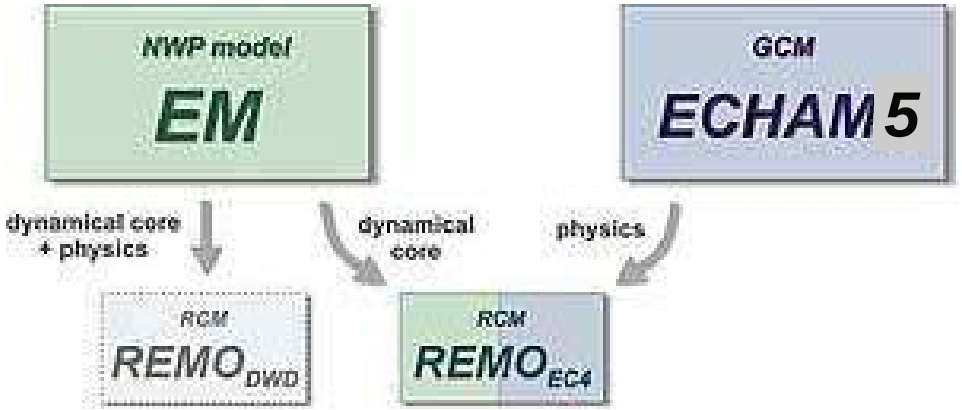
The REMO climate model

- REMO = dynamc regional climate model from MPI-M Hamburg for Germany, Austria and Switzerland
- Based on the numeric weather prediction model of DWD (German weather service)
- Uses data of the linked ocean-atmosphere-model ECHAM 5 as physical basis, for initialisation and as edgewise drive
- Regards 3 climate scenarios of IPCC (Intergovernmental Panel on Climate Change)

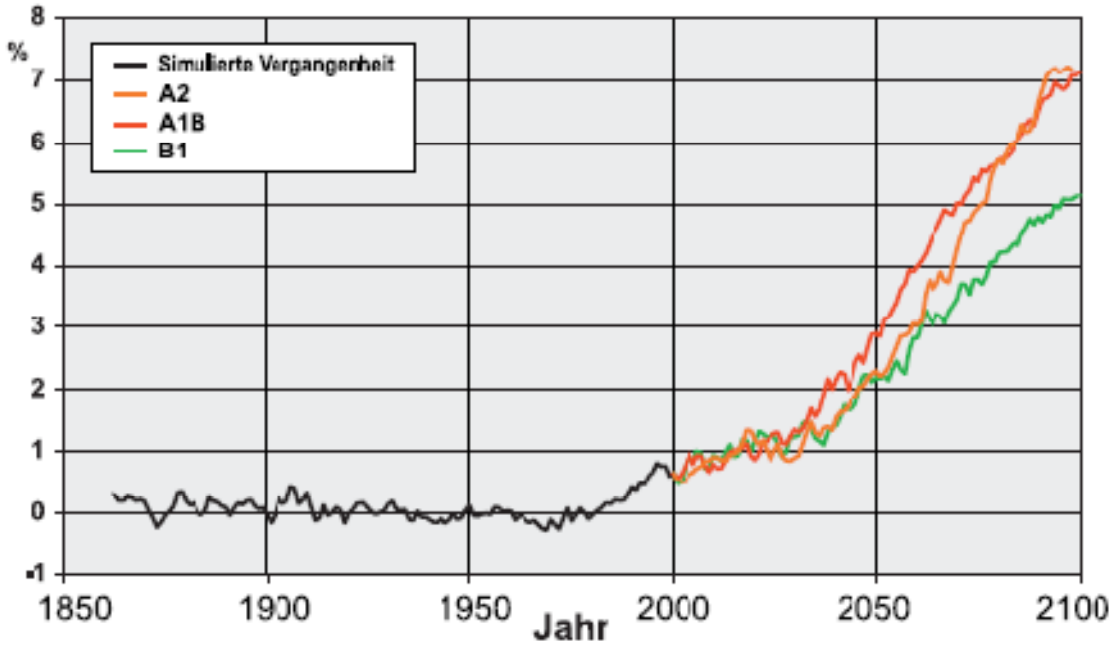




Klimasystem und Klimamodell REMO (MPI)

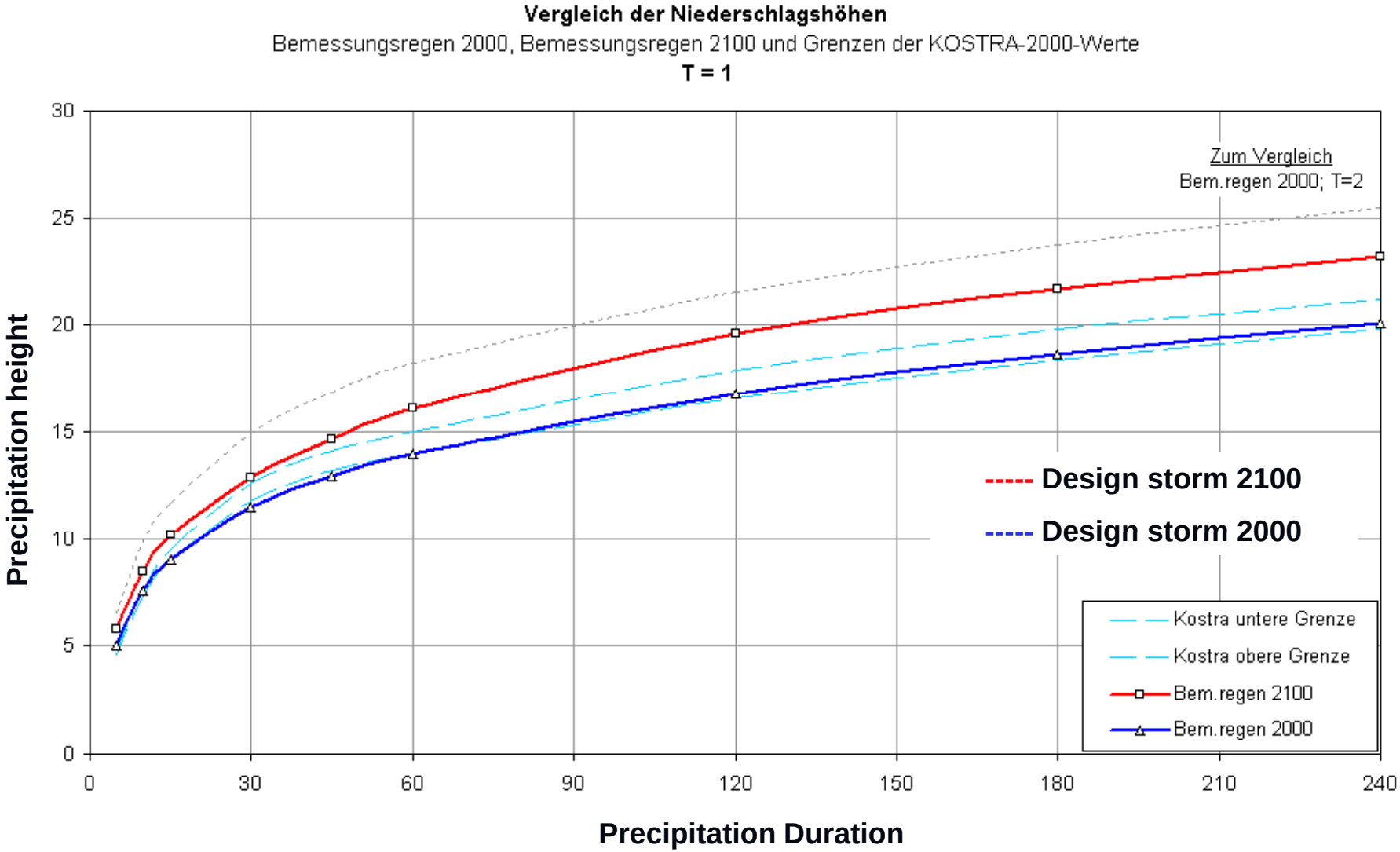
Basic conditions of climate modelling

- Selected Szenario A1B (moderate)
- Spatial resolution :
  10 km x 10 km (0,088°)
- Temporal resolution: 1 h
- Time horizon: 1950-2100
- Climate projections are based on possible scenarios for climate drives (no weather prediction, only statistical interpretation reasonable)

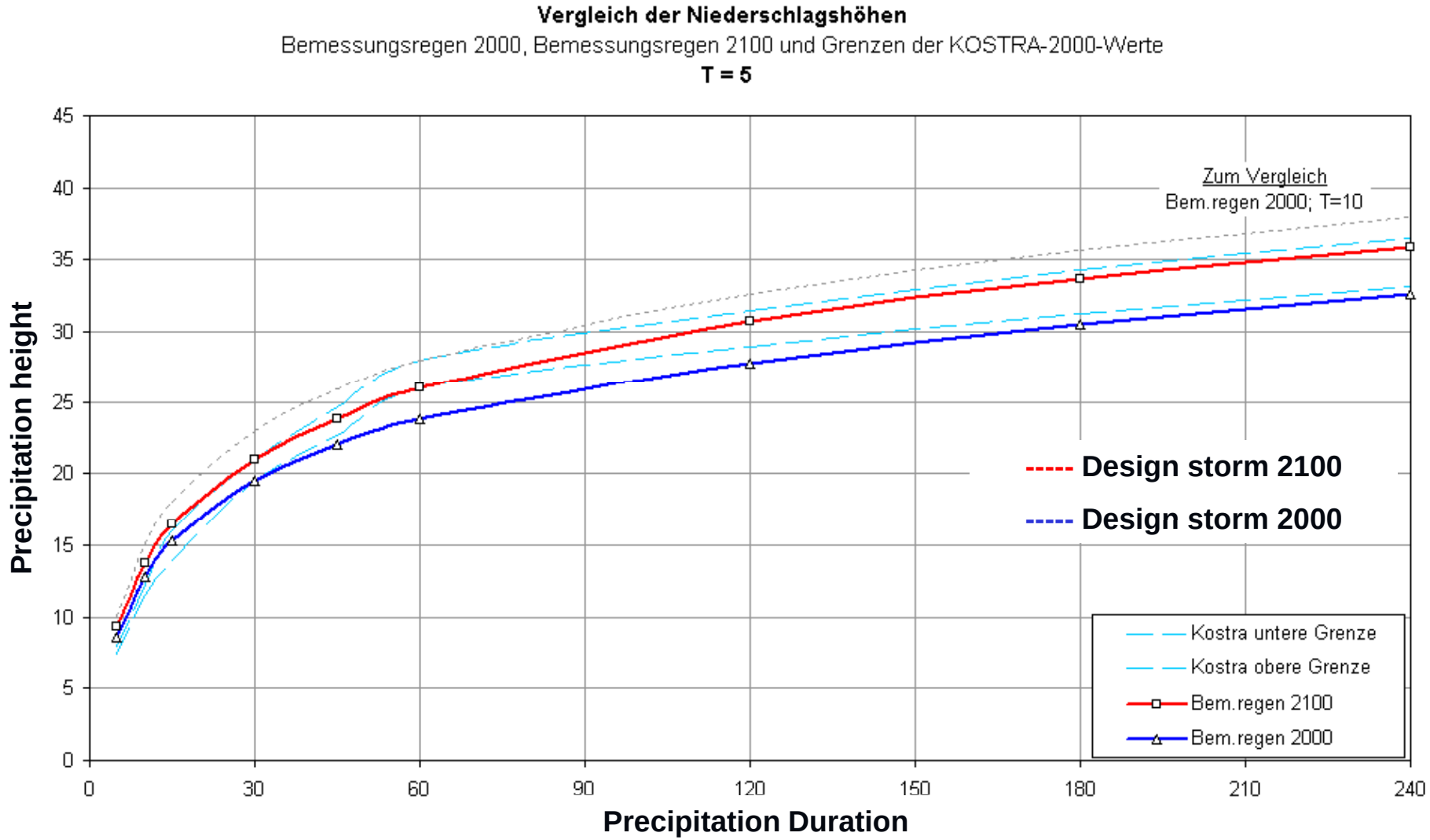


Zeitliche Entwicklung der global und jährlich gemittelten Niederschlagsänderungen bezogen auf den Mittelwert der Jahre 1961-1990 (MPI)

Estimation of changes in precipitation patterns (1 year design storm)



Estimation of changes in precipitation patterns (5 year design storm)



Indicators for future changes in drainage flow

Flooding events

Number and amount of manhole overflows

Drainage safety

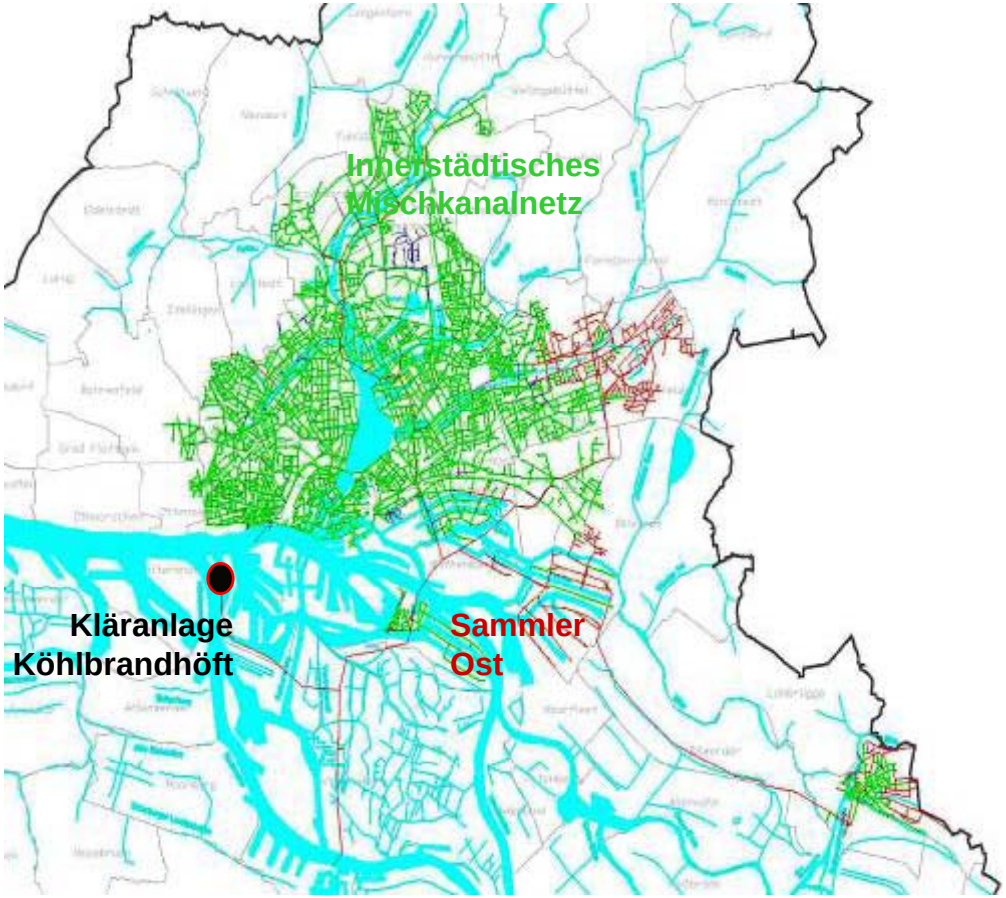
Pollution events

Number and amount of combined sewer overflows

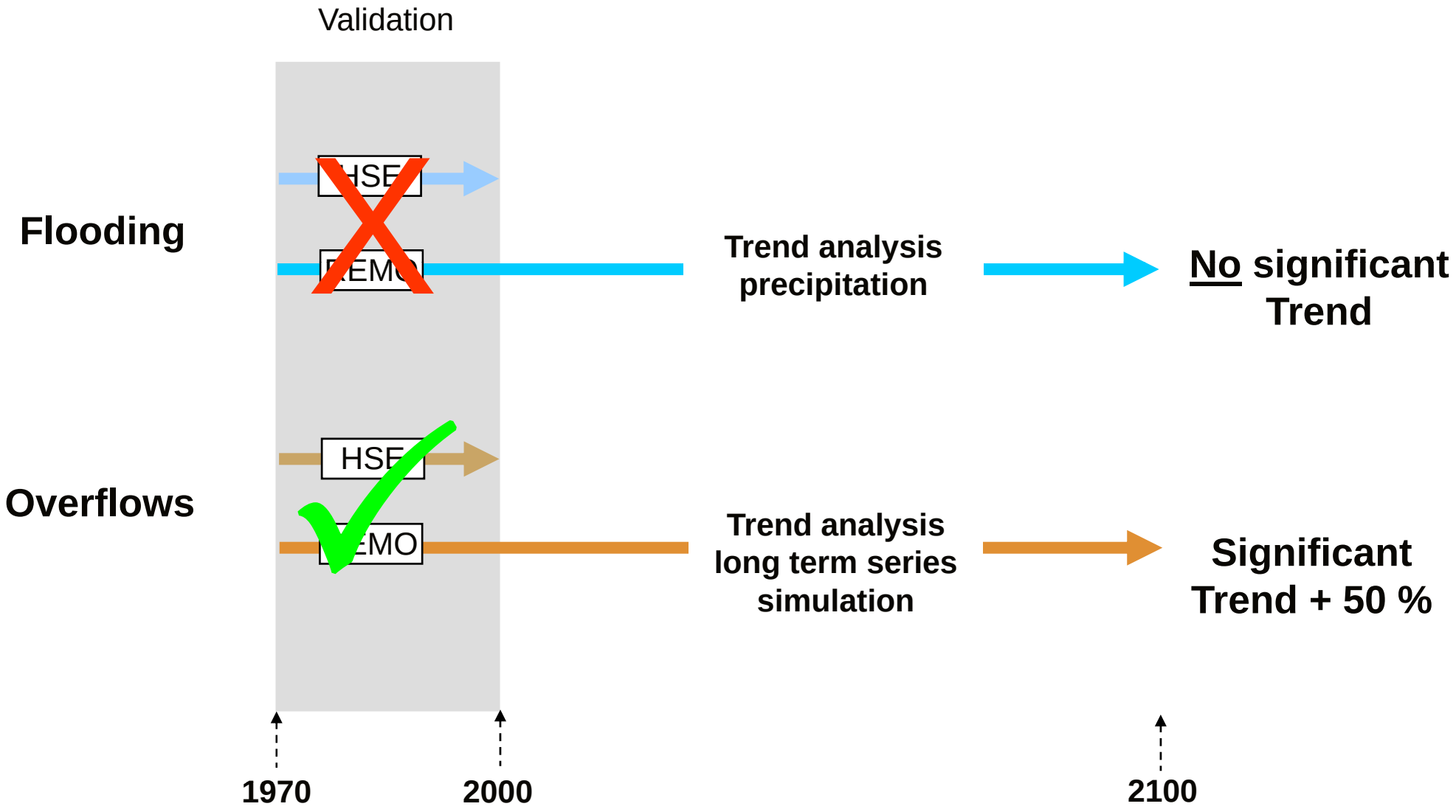
Water protection

Modelling future precipitation patterns

- Hydrodynamic modelling of inner city combined sewer system (approx. 840 km, 8.000 pipes, 115 CSOs)
- Validation by long term series simulation with real and REMO precipitation data for time range 1971-2000
- Analysis of sewer overflows into urban waters (Alster, Elbe und Bille) according to simulation with REMO data for time range 1971-2100 (710 incidents)
- Analysis of flooding incidents according to trend analysis of precipitation

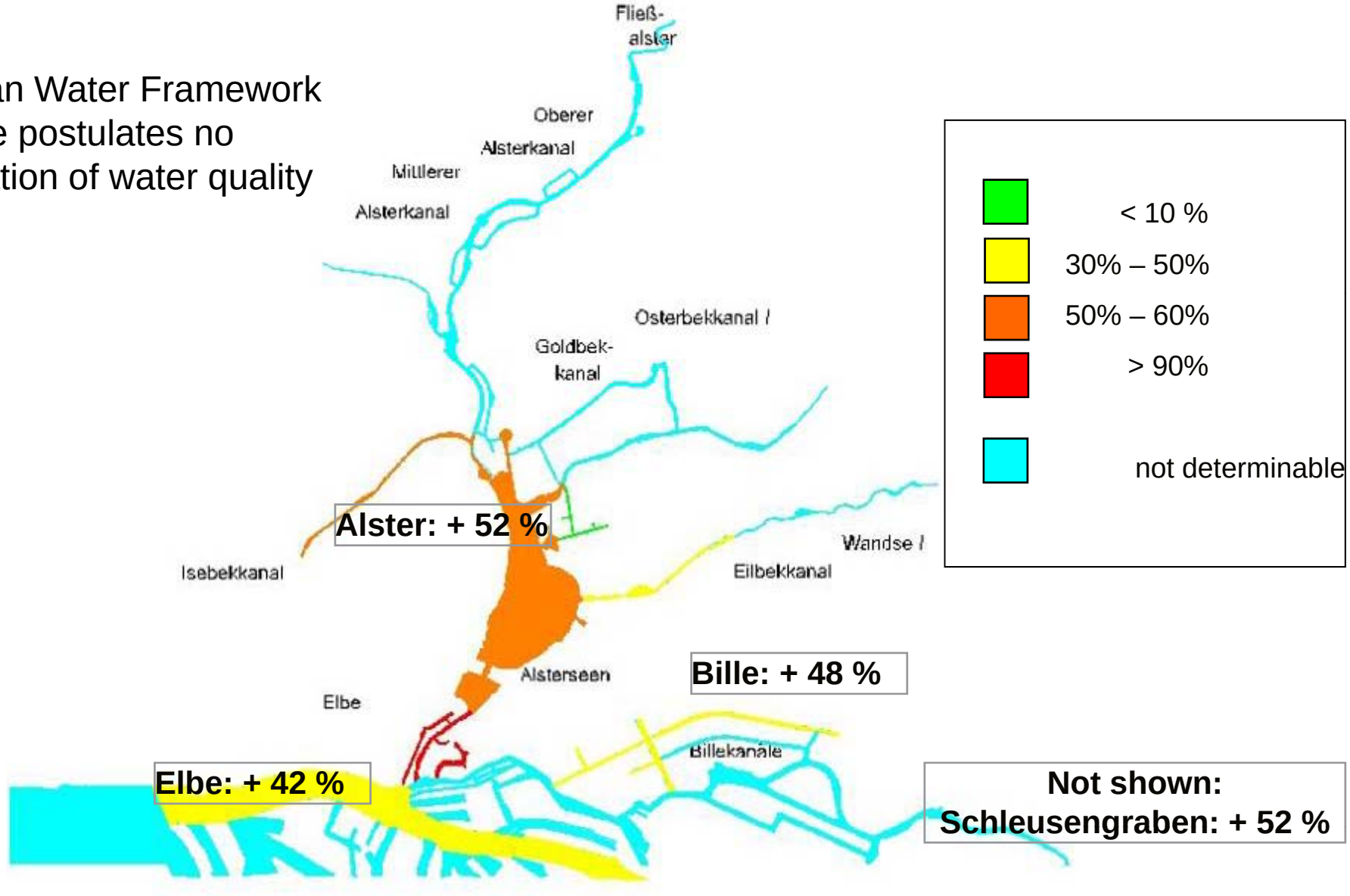


Effects on the urban drainage system



Increase in combined sewer overflows (2068-2100 compared to 2000-2032)

European Water Framework Directive postulates no degradation of water quality



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Strategy for adaptation to (possible) climate changes (1)

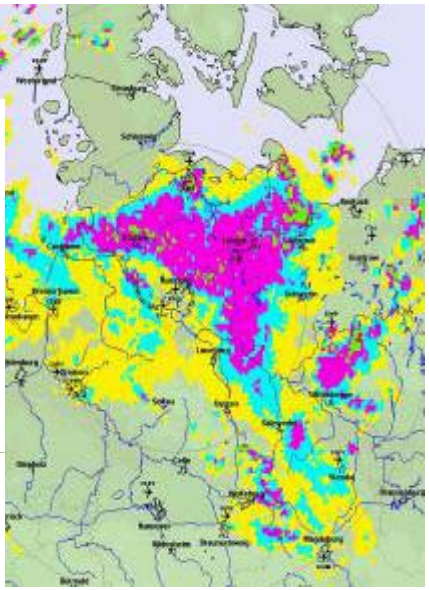
No nationwide extension of sewer capacities

- So far no sufficient data basis for adaptation of existing design critera like EN 752 (uncertanties in climate modelling and statistical interpretation of results)
- Nationwide extension of sewer capacities is extremely costly
- Construction in urban areas is extremely difficult

Strategy for adaptation to (possible) climate changes (2)

1. Monitoring of climate changes

- Continuous documentation and analysis of precipitation patterns
- Periodic updating of design storms
- Further investigations based on sophisticated climate models



2. Optimization of sewer networks

- Systematic optimization of hydraulic bottlenecks (e.g. pumping stations, inverted syphons)
- Optimized managment of existing network capacities by real time control measures (based on precipitation radar)

3. Sensitivity analysis for major changes of the sewer network

- Cost benefit analysis with regard to possible effects of climate changes (use of scenarios)
- Preference to extendable and flexible systems (no regret / low regret strategy)

Strategy for adaptation to (possible) climate changes (3)

4. Dezentralised storm water management

- Local retention, evaporation and infiltration of storm water (closing the natural water cycle)
- Minimum aim: compensation of growing surface seal (in Hamburg: 1 km²/a)
- Long term commitment

5. Risk analysis

- Identification of vulnerable areas and infrastructures in case of extreme rainfalls
- Use of traffic areas and open areas for discharge and retention of storm water (emergency water ways)
- Object protection measures

Need for teamwork

Co-operation of

Dipl.-Ing Kuchenbecker, Dipl.-Ing. Bischoff, Dipl.-Ing. Ziegler (HAMBURG WASSER)

Prof. Dr. Verworn (Leibniz Universität Hannover)

With support of Dr. Jacob, Dr. Göttel (MPI-M Hamburg)

Promoted by KompetenzNetzwerk HAMBURG WASSER

Thank You