

Safeguarding urban areas confronting climate trends and extreme weather by means of a trans-disciplinary approach



WWW YES, PARIS

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Content

Motivation + Aim

Methods + processes

Modifying land use by WSUD

Model scenarios

Mathematical + numerical results

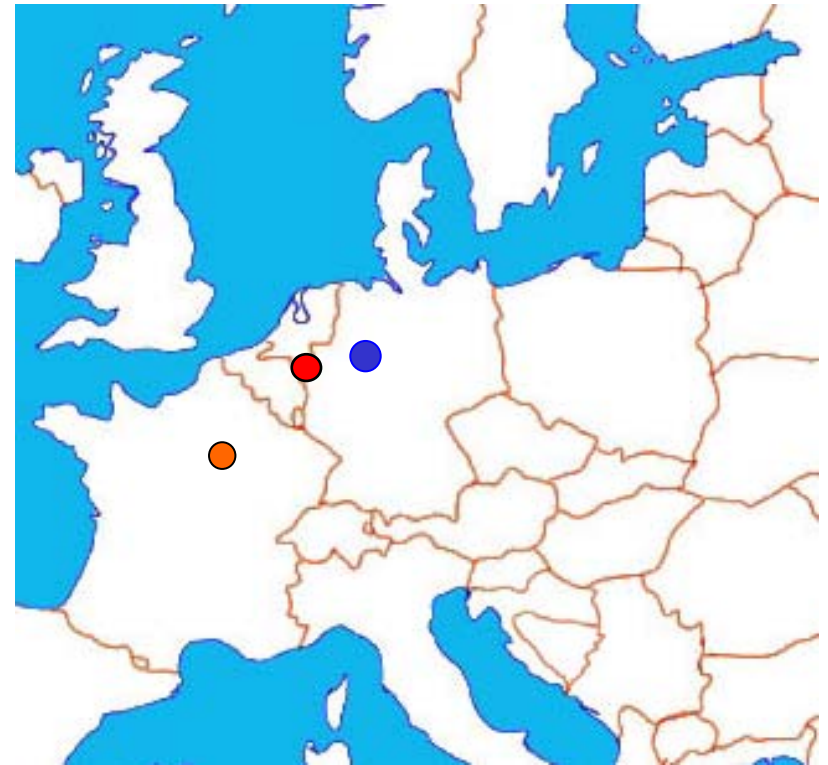
More to come

Members of the network (Acknowledgement)

Motivation

Climate Change

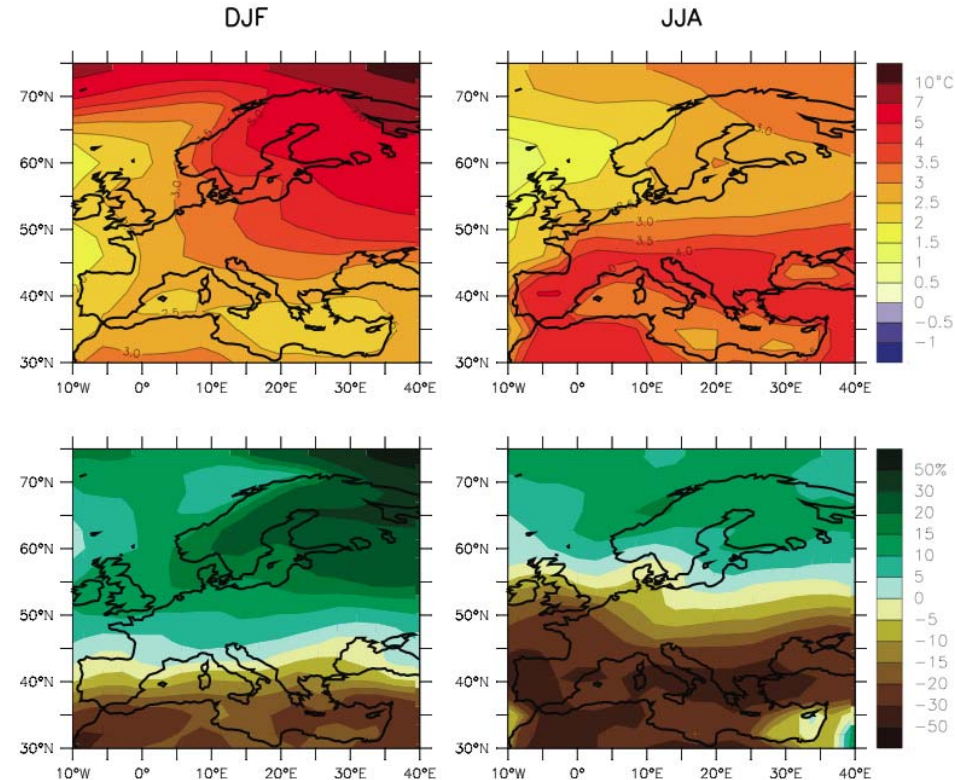
Demographic Change



- Paris
- Aix la chapelle (Aachen)
- Ruhrarea

Climate Change

- ➔ Temperature [°C]
 - Winter: +3.0
 - Summer: +1.5 up to +3.5
- ➔ Precipitation
 - Winter: +5 up to +20 %
 - Summer: ±0 up to -15 %
- ➔ Increasing Extremes
 - Rainfall intensity
 - Temperature
 - Duration of events
- ➔ Increasing probability of extremes



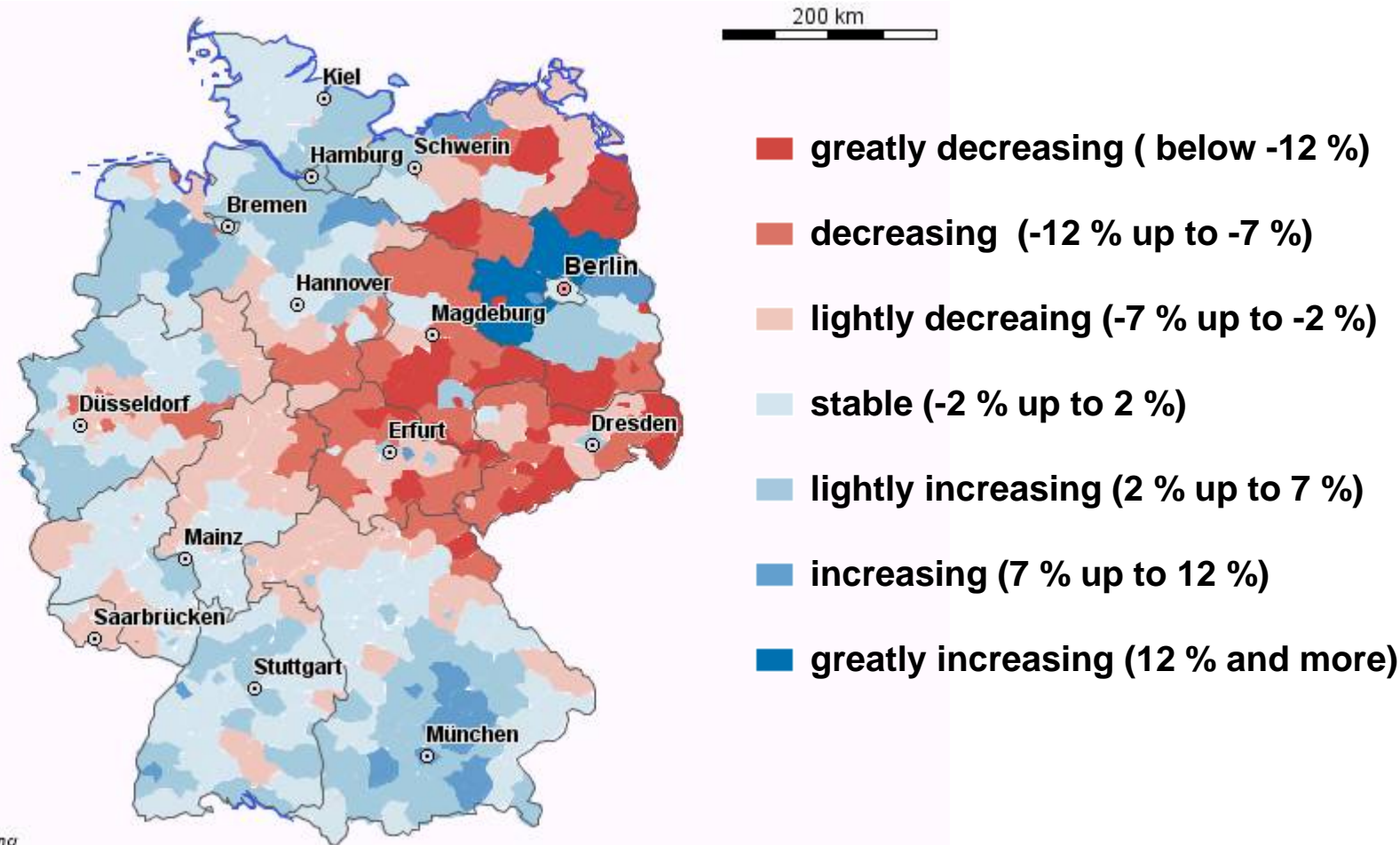
Prognosticated changes of temperature and des precipitation in Europe as result of the MMD-A18 simulations (IPCC, 2007)

Qualitative Impacts of Climate Change

	Extreme weather	Shift in the water balance
Water supply surface water ground water	- o	- -
Urban drainage	-	o
Combined sewage	-	o

- negative; o open, + positive

Demographic change



Bertelsmannstiftung (2006)

Basic Idea:

Today's and future changes of urbanization facing migration and demographics in order to initiate adaptation with regard to climate change

→ Water Sensitive Urban Design

Benefits

- Taking actions now (Stern Report)
- Implementation Water Framework Directive
 - good ecological condition
- Synergies adapting urban design
 - aging population
 - extreme weather (heat and precipitation)
 - land use
 - development of old industrial sites
 - sustainability
- “No regret” measures

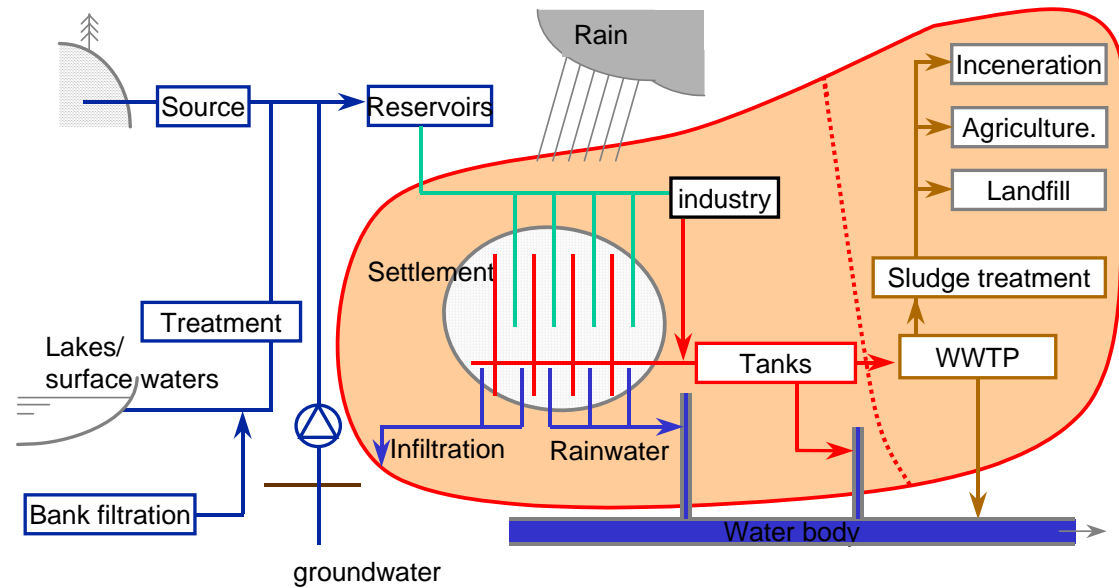


Benefits

- Water in the city
 - appearance
 - micro climate
 - cooling agent, rising evatranspiration
 - recreation (bathing water quality)
- High wage locations
- today's standards
 - flooding
 - water quality
 - system reliability

Multi-disciplinary approach

- ➔ Urban planning and urban mobility
- ➔ Urban water management
- ➔ Water supply
- ➔ Social Scientists
 - Risk awareness
 - Implementation



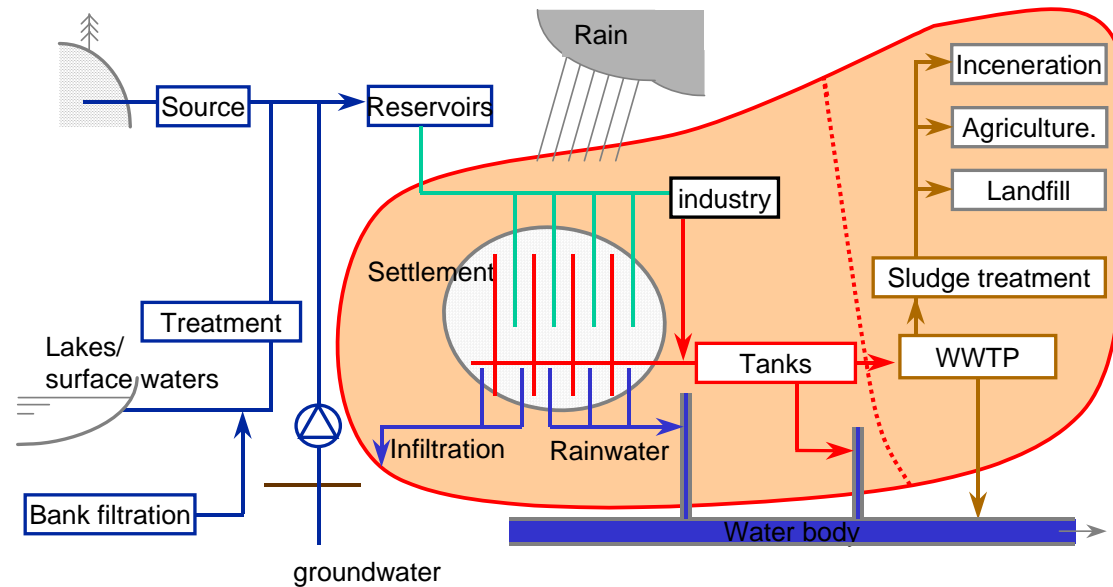
Gujer (2002)

Multi-disciplinary approach

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Trans-disciplinarity

- ➔ Politics
- ➔ Administration
- ➔ Individual



Gujer (2002)

Predictability of change

Social studies:

$$O(t) = \Delta B \cdot (I - r)$$

with:

O	Output
I	Input
B	Intelligence (brain)
r	resistance

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Outcome depends on e.g. teamwork

Predictability of change

Urban hydrology:

$$Q(t) = \Delta \psi \cdot (Q_i - Q_o)$$

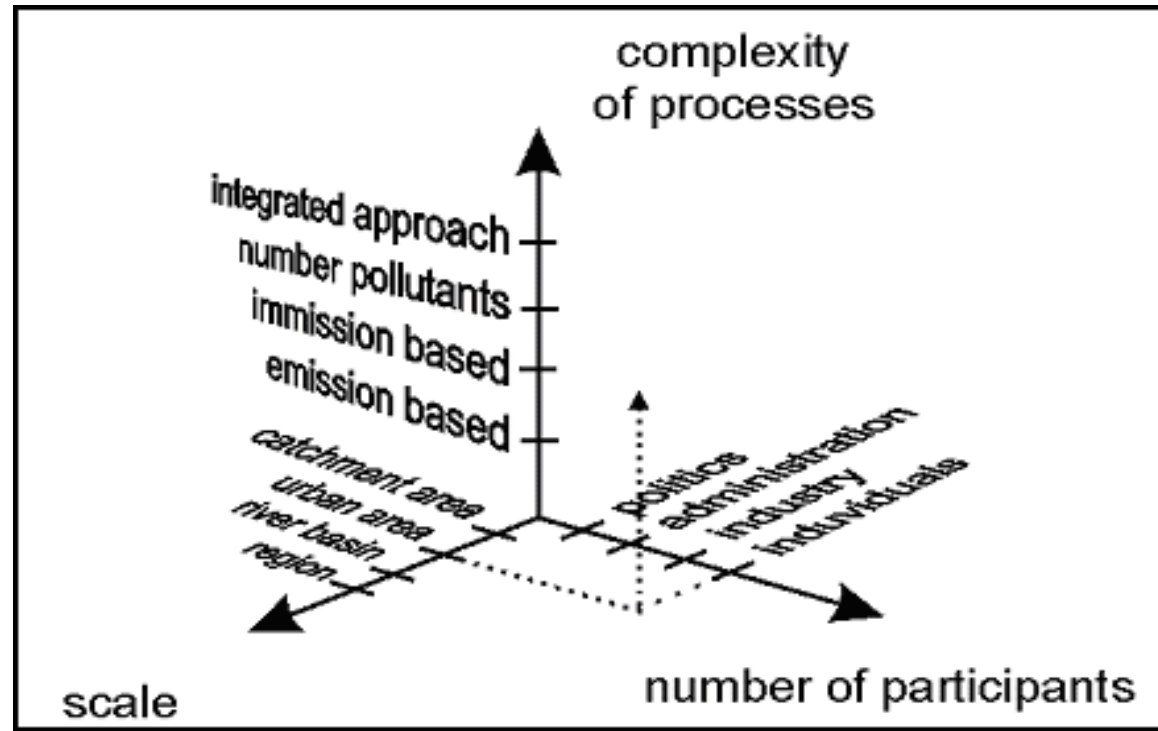
with:

O	Outflow
Q_i	Inflow (rain)
Q_o	int. Outflow (infiltration)
ψ	runoff coefficient

Outcome depends on e.g. landuse, people

Trans-disciplinary approach

- Stakeholders expectations
- Risk awareness
- Best management practices
- etc.



The trans-disciplinary paradigm

- trans-disciplinary integration and transfer of knowledge across all stakeholder parties
- implementation using processes on both levels emotional and cognitive
- context related examples, participation of individuals and supervision of success
- evolution of scenarios as subject for transfer of know-how and tuition concepts
- promotion of water sensitive urban design (WSUD)

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Results appear to be very simple

Climate models

- Efforts for regionalisation are in progress

First assessment

- *3to5-scenario* (rational method)
- hydrologic modeling

Combined sewer overflows

→ Szenario:

- Shift of the water balance from summer to winter of 15 %
- Increase of extreme precipitation of 15 % in summer
- constant annular precipitation
- changes in evapotranspiration neglected
- sedimentation during dry weather neglected

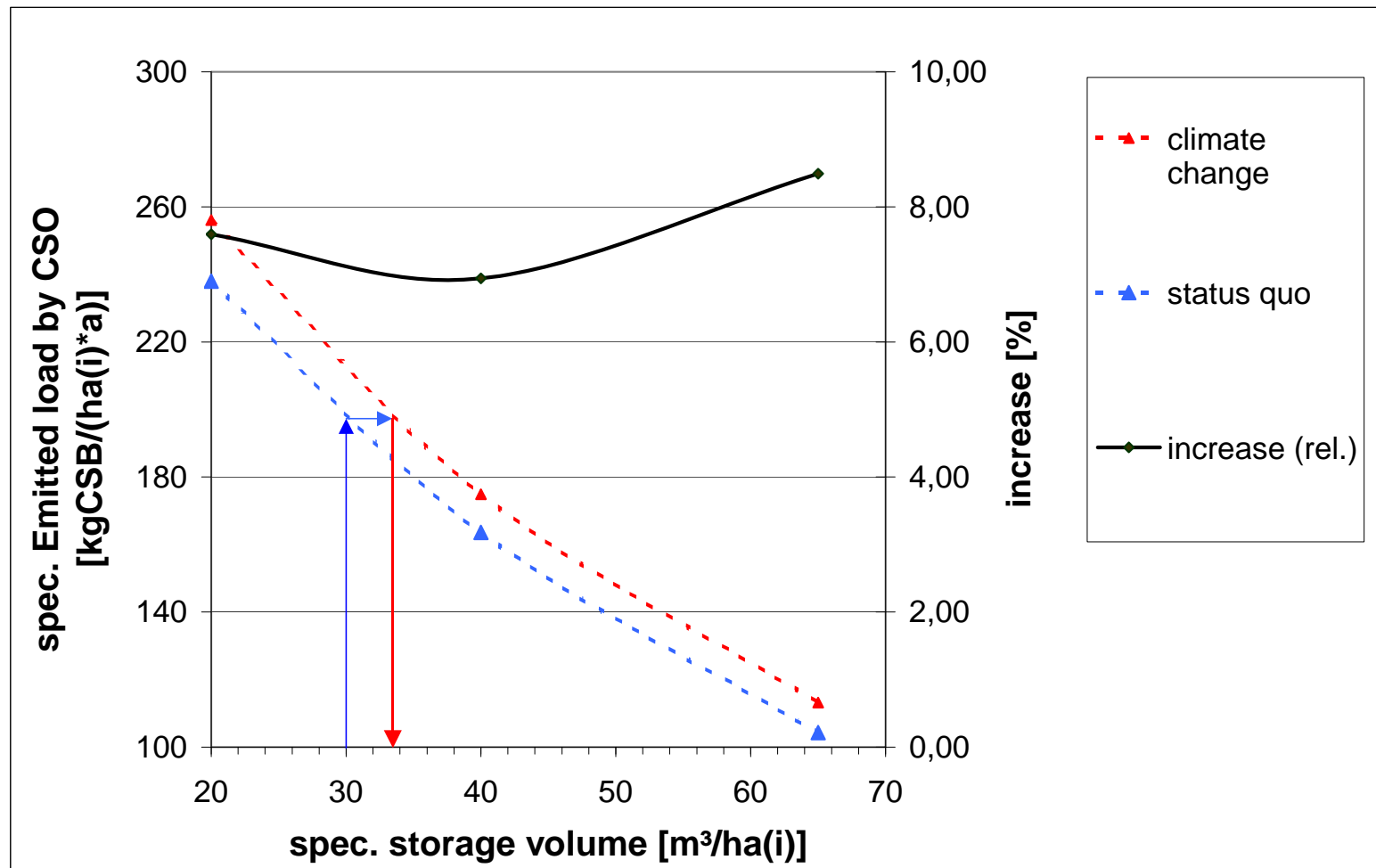
→ Catchment data:

- $A_{ca} = 31$ ha
- $A_i = 14$ ha
- 2.900 inhabitants – no industry

→ Hydrologic sewer quality model

- central basin approach
- Moment

Hydrologic modeling



3to5-scenario

→ 15 min design storm

■ current state: 143,5 l/(s*ha) = 0,86 mm/min

■ climate change: 159,8 l/(s*ha) = 0,96 mm/min

→ increase: about 11 %

Results

WSUD: Tables for measures for different disciplines

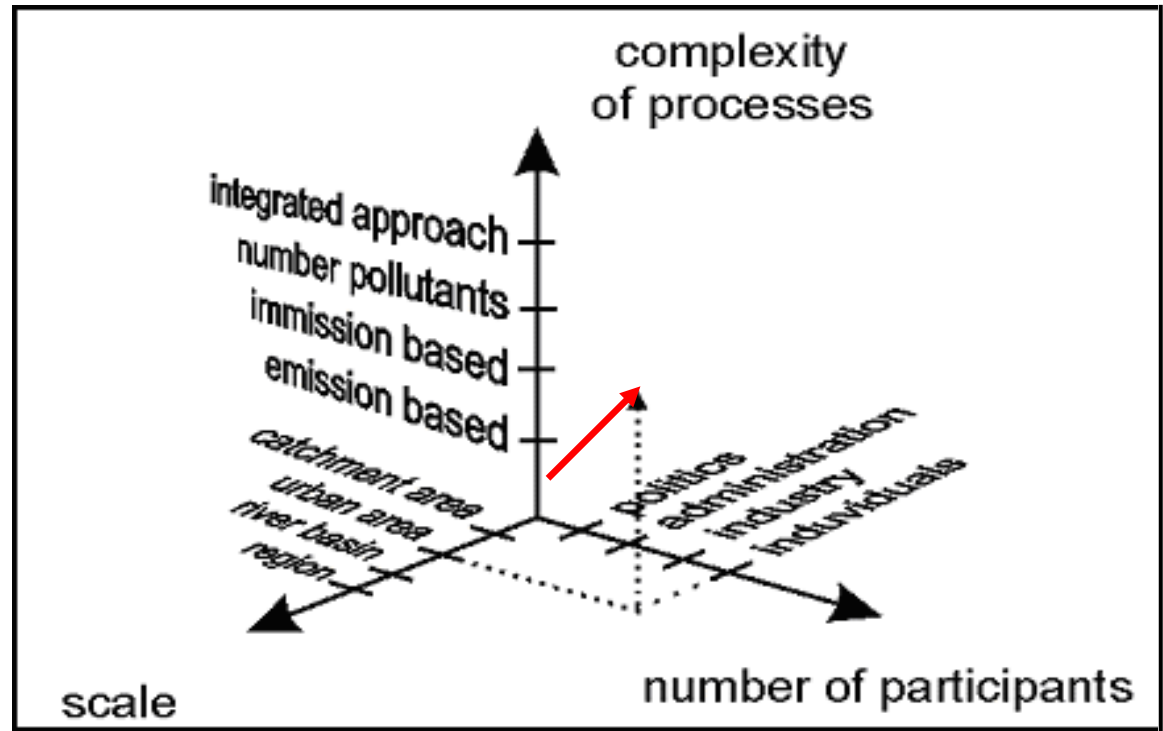
Landuse Activity	Rainwater Harvesting	Reservoir	Infiltration	Roofs
Constrains				
Effects Urban development Water management Climate/Environmental Residents/ Property owner Commune				

Conclusions

- Traditional solutions in concrete are not the most desirably methods.
- Economic and population changes demand flexible and sustainable solutions wherever possible.
- Adaptation will concern existing systems which are serving well for up to a hundred years.
- Points of interest have favorably to be located at the head to the sewer system. That way disconnection of surfaces, pollution control, retention and infiltration are more effective.
- A first assessment leads to an increase of max. discharge of 11%.
 - WSUD measure are feasible to achieve this goal

2nd phase has started

- Residential/ commercial area
- brown field development
- Inner City



Summary

- Climate change and demographics will lead to changes in urban development
- water management has to be an important part
- For this change people (individuals) need to be involved
- First assessment of the magnitude
 - design level
 - adaptation is possible
 - further research on rare events
- implementation and acceptance has just started

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