Identifying water quality hotspots for contacts with contaminated surface waters

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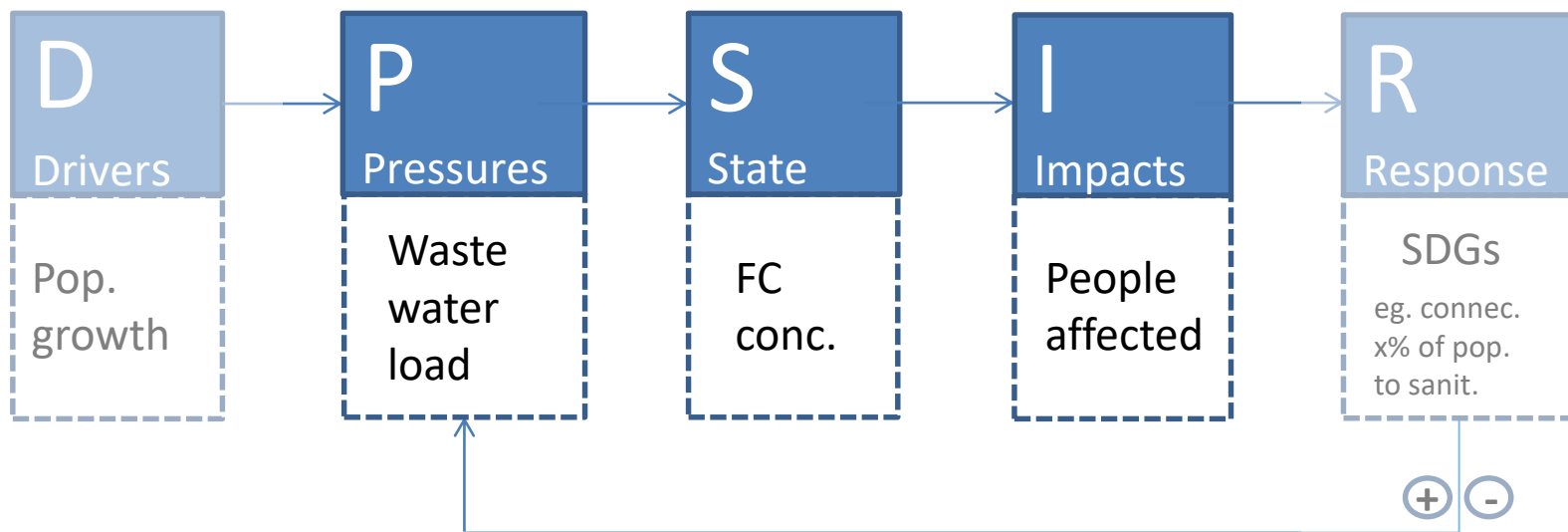Helmholtz Centre for Environmental Systems Research – UFZ

Stockholm Water Week 2017 Seminar
'Wastewater and health – managing risks, seizing opportunities'

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The water quality challenge

- Wastewater production at least doubling by 2050 → Sewerage connections increasing

- But if not wastewater treatment → More untreated wastewater to rivers and lakes

- Risk to human and ecosystem health as well as food security

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D	P	S	I	R
Drivers	**Pressures**	**State**	**Impacts**	**Response**
Pop. growth	Waste water load	FC conc.	People affected	SDGs eg. connec. x% of pop. to sanit.

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Objectives of the WWQA pre-study

- Develop and test a parallel **model and data driven analysis** methodology

- Identify current **"hotspots"** with focus on developing countries

  - of **deteriorating freshwater quality** (focus on rivers, focus on BOD, FC, TDS, totN/totP)

  - **types, intensity and sources** of water pollution

  - of **potential impacts** relating to human health and food security (freshwater fishery)

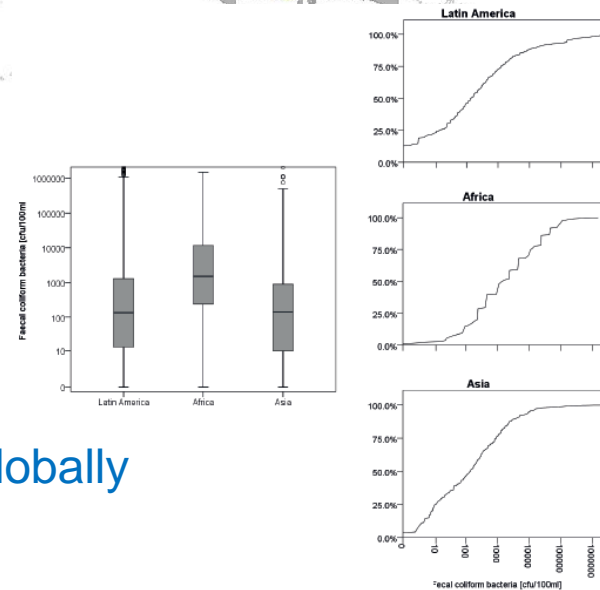- Identify main water quality **data and information gaps**

Data driven analysis
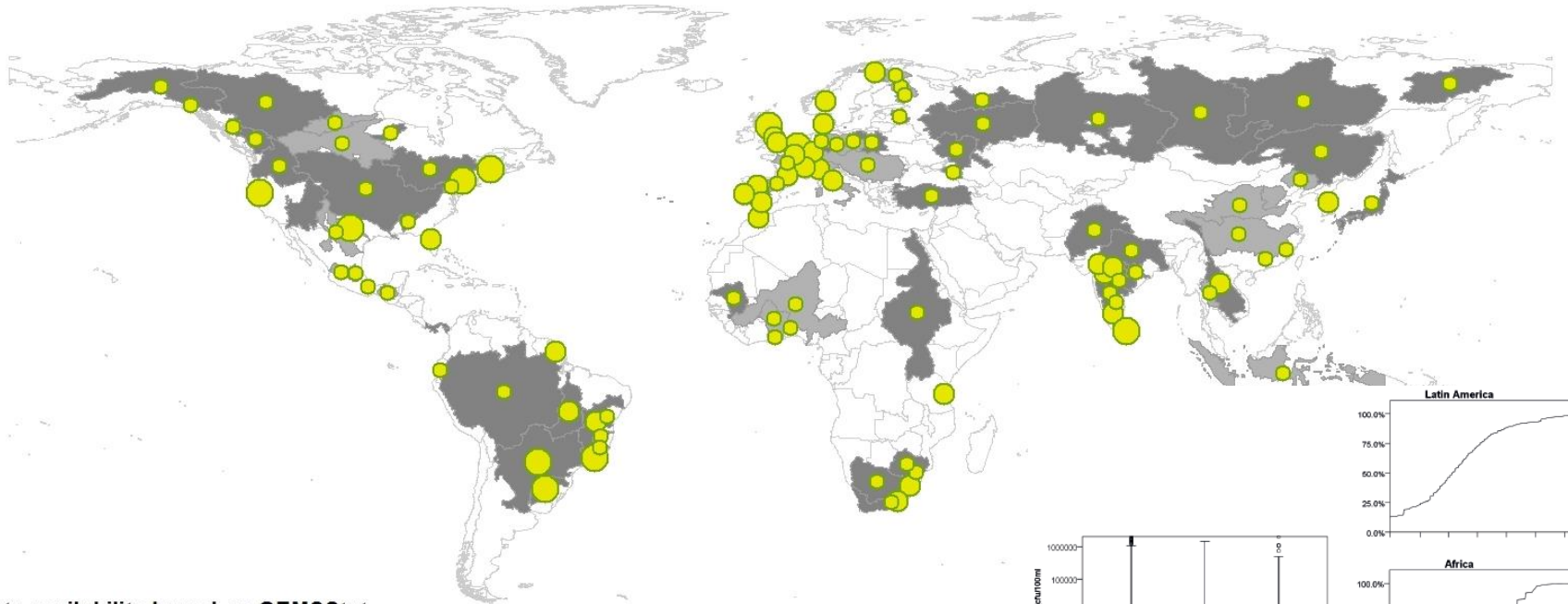
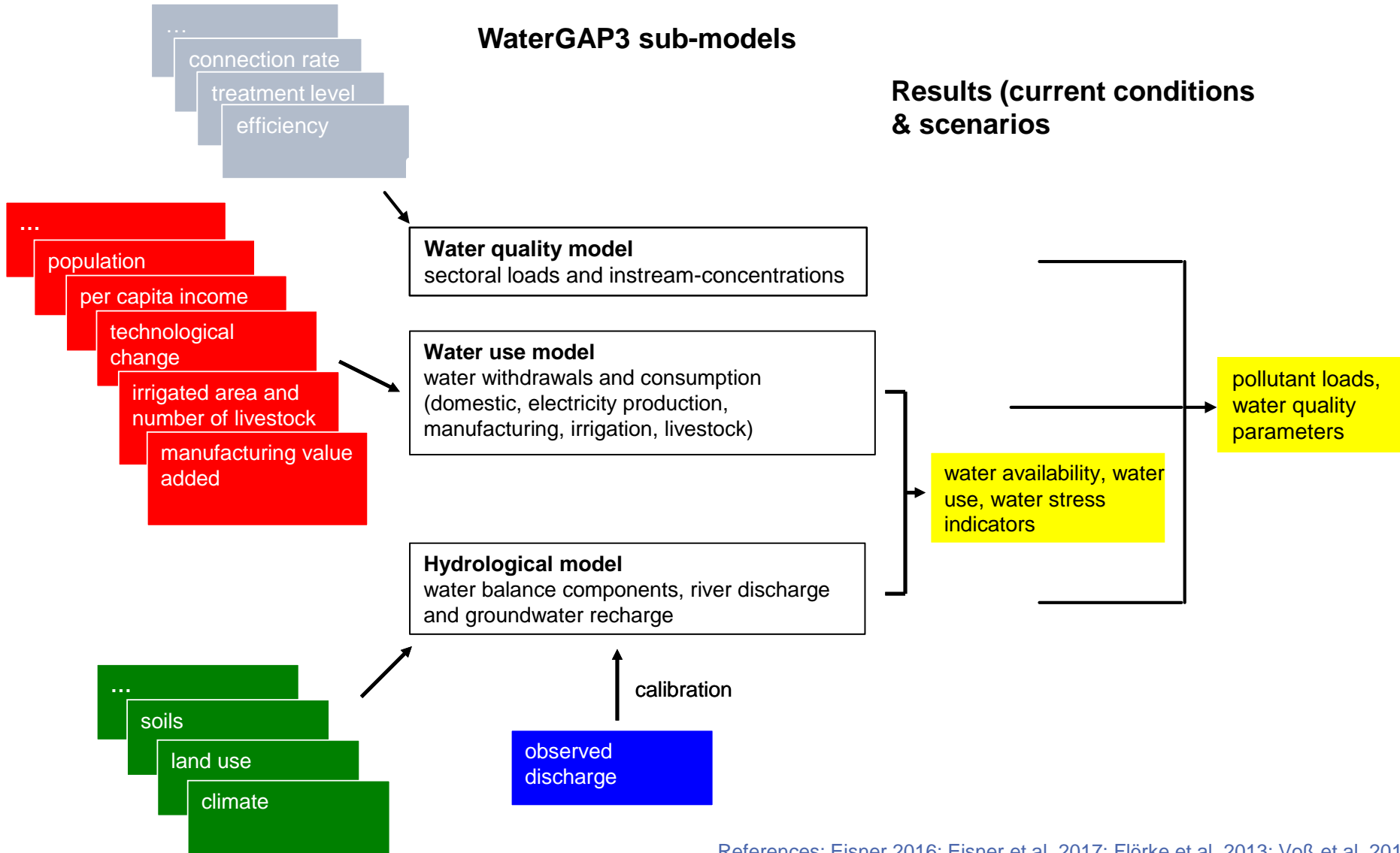Data availability based on GEMSStat
(temporal coverage)

- 1990-1999
- 2000-2010
- no data

- Very sparse data on in-stream FC conc. available globally

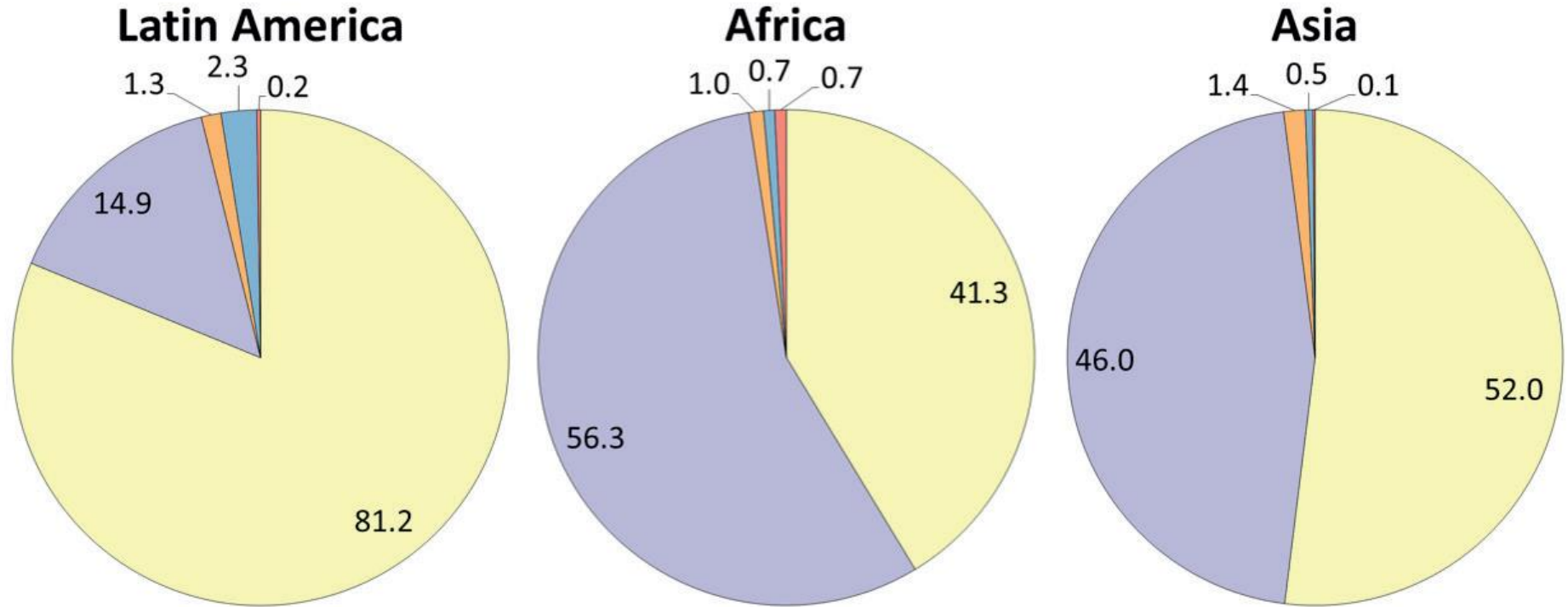- Simple statistical data analysis possible

Modelling approach

WaterGAP3 input

...
connection rate
treatment level
efficiency

WaterGAP3 sub-models

Results (current conditions & scenarios)

...
population
per capita income
technological change
irrigated area and number of livestock
manufacturing value added

Water quality model
sectoral loads and instream-concentrations

Water use model
water withdrawals and consumption
(domestic, electricity production,
manufacturing, irrigation, livestock)

Hydrological model
water balance components, river discharge
and groundwater recharge

pollutant loads, water quality parameters

water availability, water use, water stress indicators

...
soils
land use
climate

calibration

observed discharge

References: Eisner 2016; Eisner et al. 2017; Flörke et al. 2013; Voß et al. 2012

FC bacteria loading, estimated for 2010 [%]

Latin America
- 1.3
- 2.3
- 0.2
- 14.9
- 81.2

Africa
- 1.0
- 0.7
- 0.7
- 41.3
- 56.3

Asia
- 1.4
- 0.5
- 0.1
- 46.0
- 52.0

Legend:
- ☐ Domestic sewered
- ☐ Domestic non-sewered
- ☐ Manufacturing
- ☐ Urban surface runoff
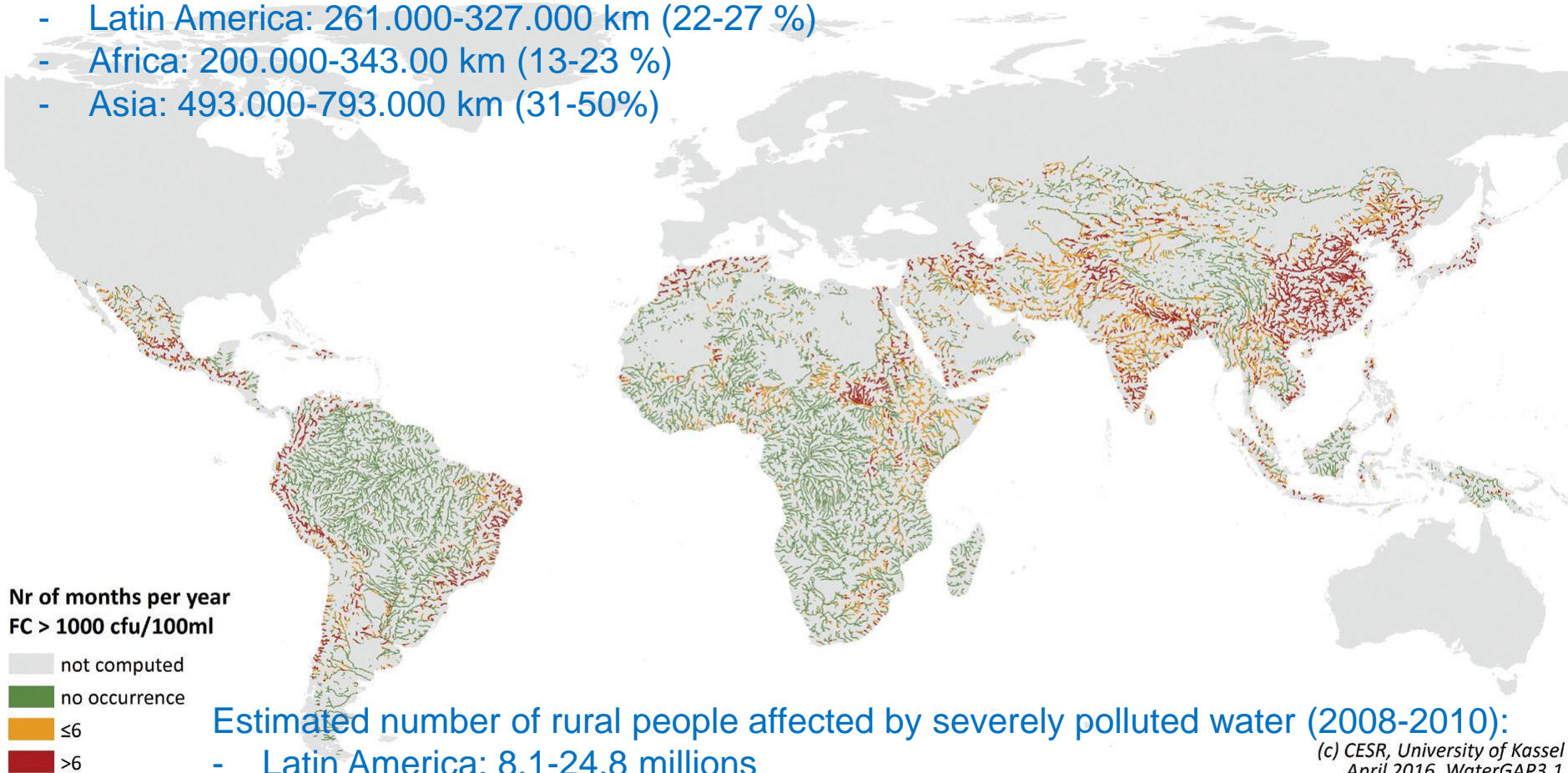- ☐ Agriculture - livestock wastes

Total loading in 2010   ca. 15   ca. 4   ca. 75   [10^{20} cfu/a]

Severe in-stream pollution and people affected

River stretches in severe pollution class (2008-2010):
- Latin America: 261.000-327.000 km (22-27 %)
- Africa: 200.000-343.00 km (13-23 %)
- Asia: 493.000-793.000 km (31-50%)

Nr of months per year
FC > 1000 cfu/100ml

- not computed
- no occurrence
- ≤6
- >6

Estimated number of rural people affected by severely polluted water (2008-2010):
- Latin America: 8.1-24.8 millions
- Africa: 31.7.-164.3 millions
- Asia: 30.6-133.7 millions

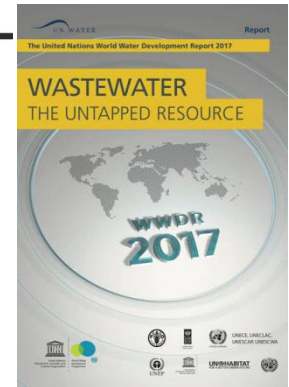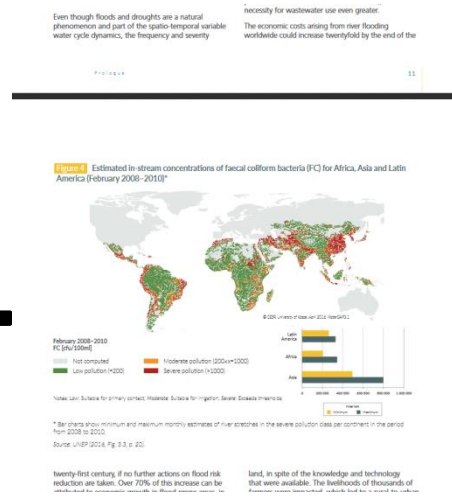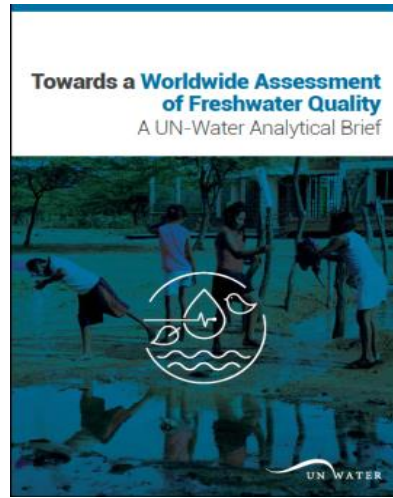*(c) CESR, University of Kassel*
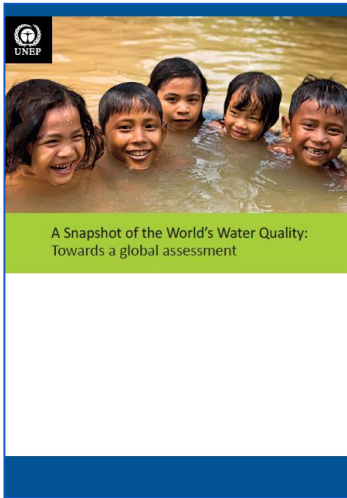*April 2016, WaterGAP3.1*

Summary

- The **data and model driven methodology** can be used to point out potential hot-spot areas and reasons behind the pollution

- Severe pathogen pollution already affects around **one-third** of all river stretches in Latin America, Africa and Asia and **millions** of people on these continents

- Although water pollution is serious, the majority of rivers are still in **good condition**, and there are great opportunities for short-cutting further pollution

- A **wide range of management and technical options** are available to developing countries for water pollution control

- **Monitoring and assessment** of water quality are essential for understanding the intensity and scope of the global water quality challenge => yet the coverage of available data in many parts of the world is still inadequate for this purpose

WWQA

http://www.wwqa-documentation.info

A Snapshot of the World's Water Quality:
Towards a global assessment

Towards a Worldwide Assessment of Freshwater Quality
A UN-Water Analytical Brief

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