

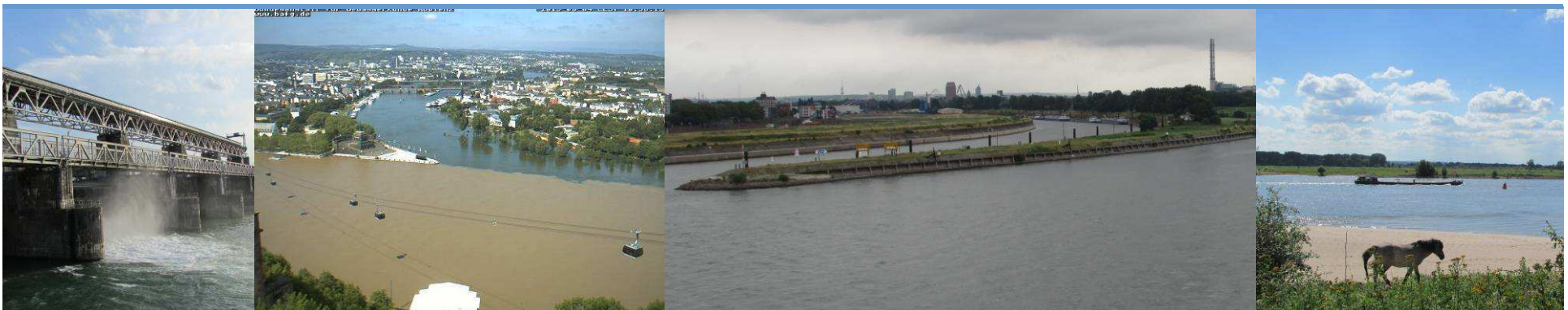


# From source to mouth, a sediment budget of the Rhine River



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# Research project (2011 – 2014)

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Funded by BfG 

Supported by CHR, advisory board



Project team:

- BfG + external partner RWTH Aachen University



# Research project (2011 – 2014)

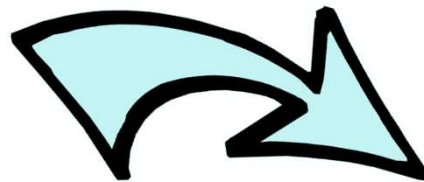
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## Goal:

- Quantification of downstream fluxes of sediments through the Rhine
- Determination of sources and sinks of these sediments
- Sediment budget of the Rhine River – from source to mouth
- Time period: 1991 – 2010
- several grain size fractions



Lake Toma



Nieuwe Waterweg



M. Minderhoud, 2005



# WHY sediment budgets?

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## Navigation:

- sedimentation: navigational problems during low-flow periods
- erosion: infrastructure (bridge piers, ports)

## Interaction of sediment and biota:

- habitat suitability
- WFD

## Sediments carrying substances:

- nutrients
- contaminants

## Flood protection:

- sedimentation: loss of storage volumes

## further aspects:

- erosion: groundwater levels (ecology, drinking water wells)
- ...

# Why SEDIMENT BUDGETS?

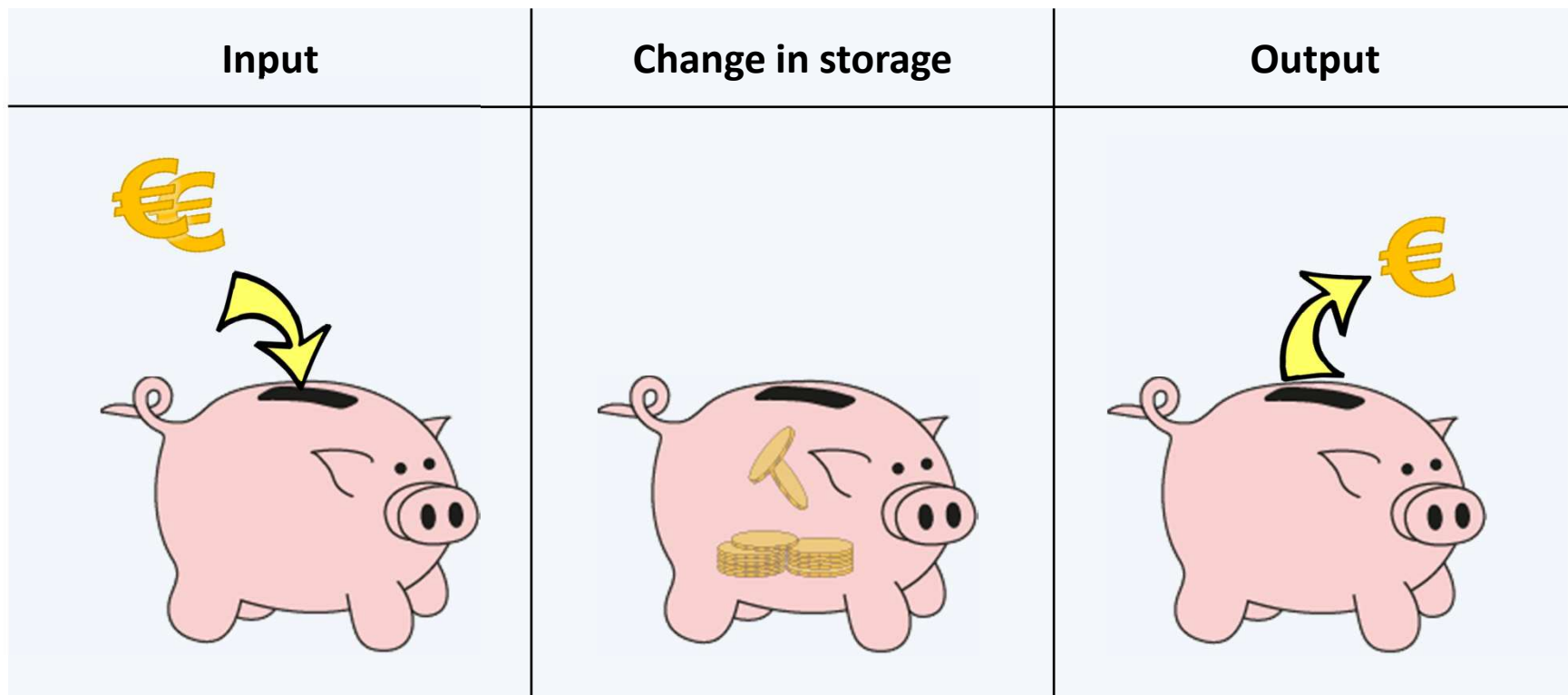
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## instead of „just“ interpreting sediment loads and/or bed evolution?

- identify sources and sinks of sediments
- connection between processes upstream and downstream (→ important for sediment management!)
- estimate sediment loads in case there are no measurements
  
- Examples:
  - Identification of sources of contaminants
  - River management: effects of local gravel feeding on downstream reaches

# Budgeting

- Define control volume and time period
- Balance input and output



# Budgeting sediments

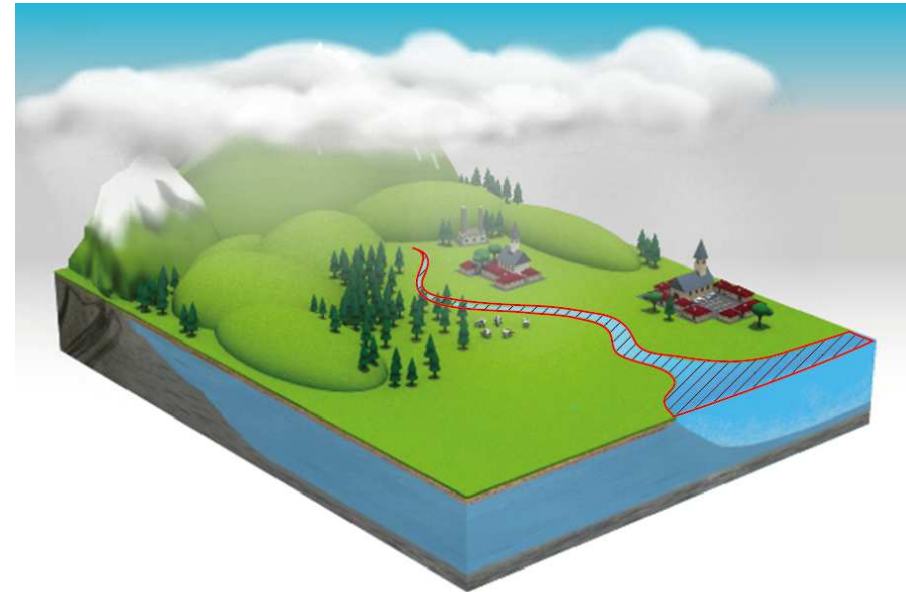
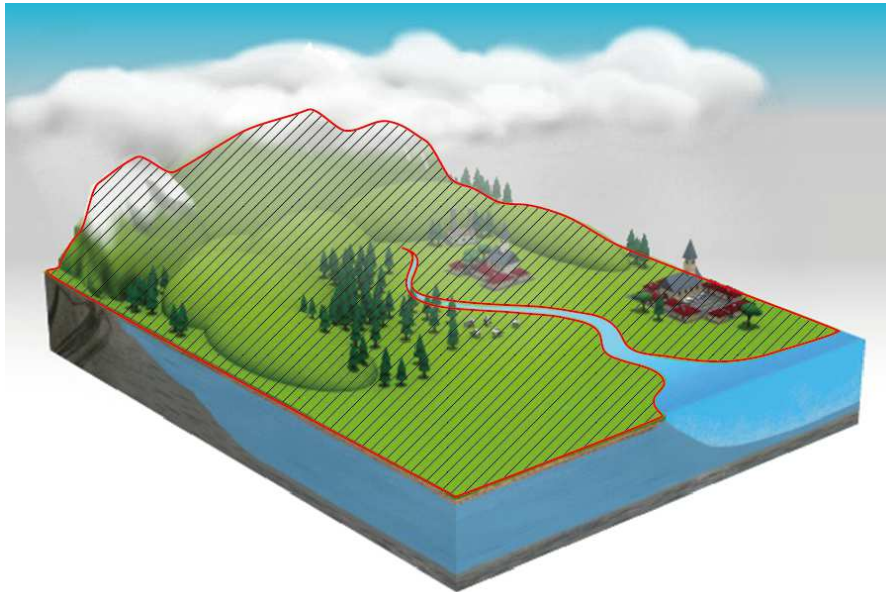
## Definition of control volume

Typical sediment budgets  
in literature:

- focusing on sediment yield

Our focus:

- processes within channel



# Budgeting sediments

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*[...] researchers often assume that sediment budgeting is a time-consuming exercise [...] However, we have routinely constructed sediment budgets [...] (requiring) **no longer than two months** of field work and analysis.*

*[...] methods of budget construction are relatively **uncomplicated**.*

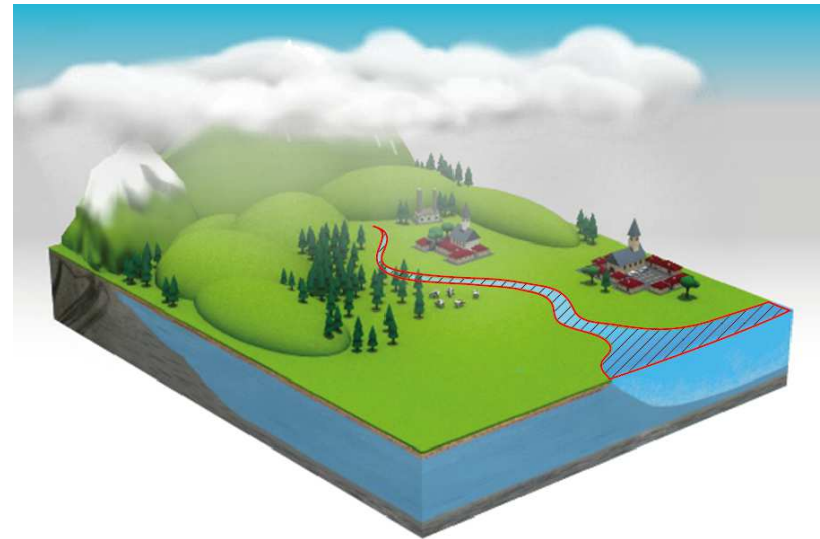
*The **most difficult aspects** of a sediment budget to quantify are those involving transport and storage of sediment **in channels**.*

*(Reid & Dunne, 1993, Rapid Evaluation of Sediment Budgets)*



# Features of our sediment budget

- focus on processes within the channel
- basin-scale
- all grain sizes included
  - clay & silt
  - sand
  - fine gravel
  - coarse gravel
  - stones
- strongly data-based
- data integration (several countries, several methods)
- detailed accuracy analysis



# Agenda

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## Today:

- Introduction to Rhine catchment
- Method of sediment budgeting
- Results of our research project
  - selected results on sink/source terms
  - sediment budget of the Rhine

## Tomorrow:

- Discussion of gaps in knowledge
- Use of sediment budgets
- Conclusions, topics for future research



# Thank you!

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