Federal Ministry of Education and Research

YANGTZE PROJECT

Application of SWAT to a data scarce catchment in the Three Gorges Region, China

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Outline

Introduction

Construction of the Three Gorges Dam

Risk of Eutrophication

Land use change

Erosion and landslides

Project collaboration

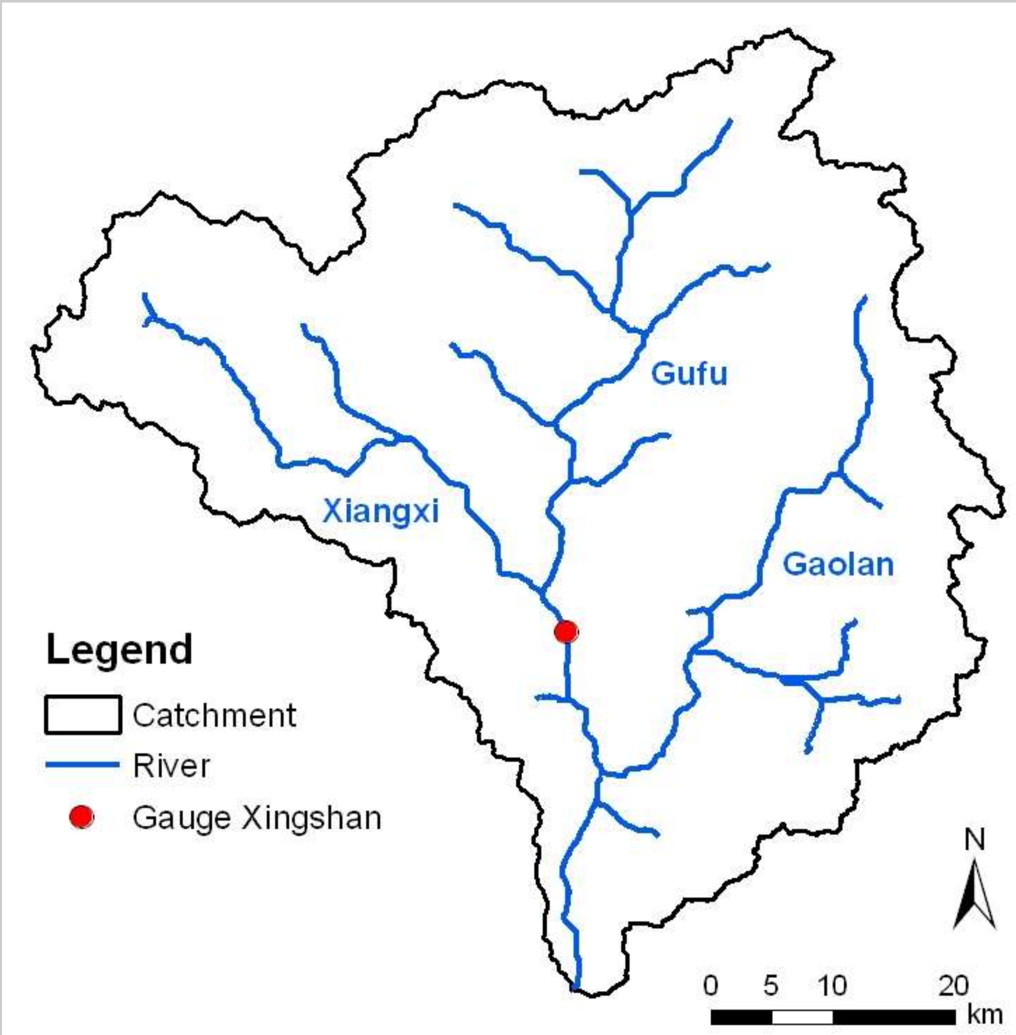
YANGTZE-Project:
land use change, erosion, mass movement, diffuse inputs

Coordination: Research Centre Jülich

Remote Sensing Potsdam	Land use change Giessen	Erosion Tübingen	Landslides Erlangen	Diffuse sediment and P inputs Kiel
Assessment of mass move-ments using remote sensing techniques	Classification of land use and assessment of vulnerability	Assessment and analysis of soil erosion	Assessment and analysis of landslides	Analysis of sediment and phosphorus inputs to rivers using SWAT

Aim:
Analysis of land use change and vulnerability, risk assessment of mass movements, soil erosion and diffuse inputs to rivers

Study area: Xiangxi Catchment



- Catchment area:
  3200 km²

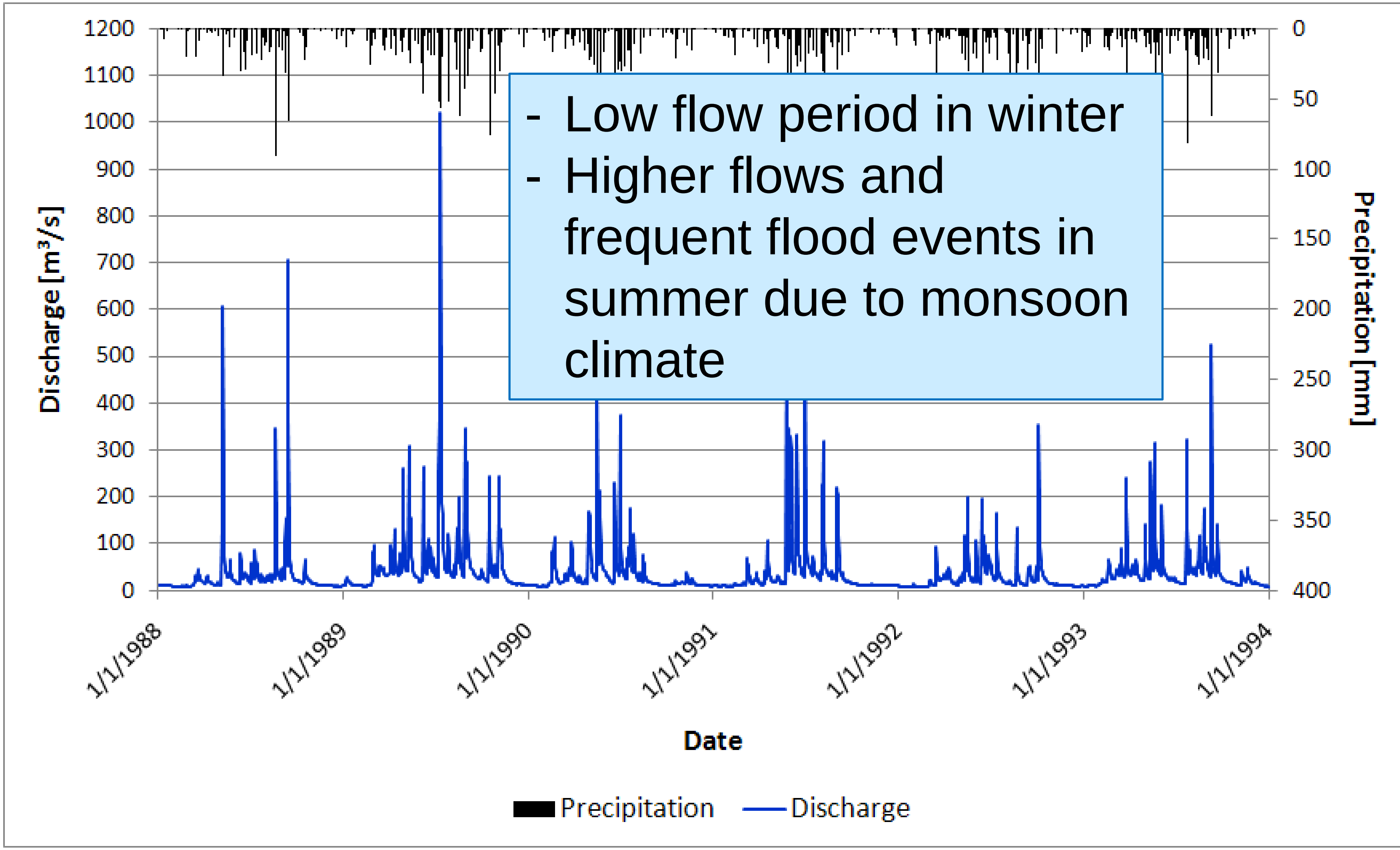
- Length of Xiangxi River:
  94 km

- Mean annual temperature:
  16,9° C

- Mean annual precipitation:
  1000 mm

- Discharge at Gauge Xingshan:
  36,4 m^3/s

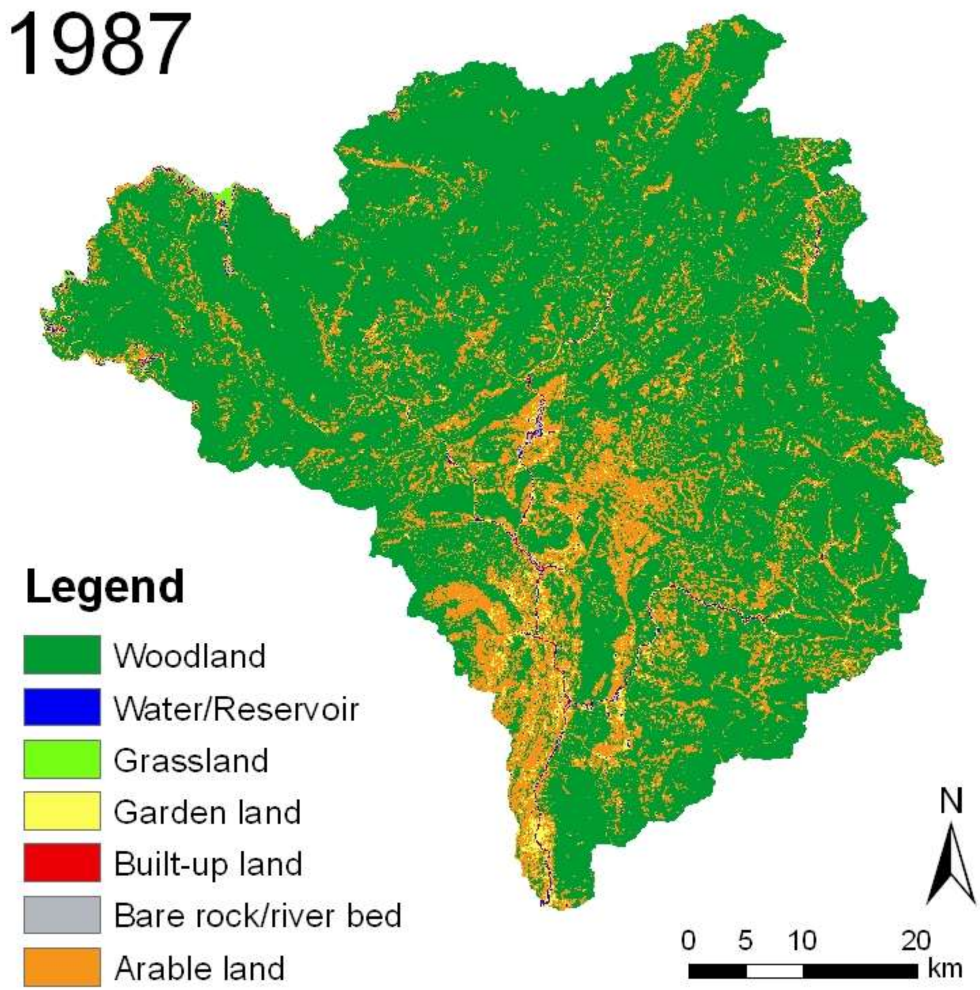
Seasonality of discharge

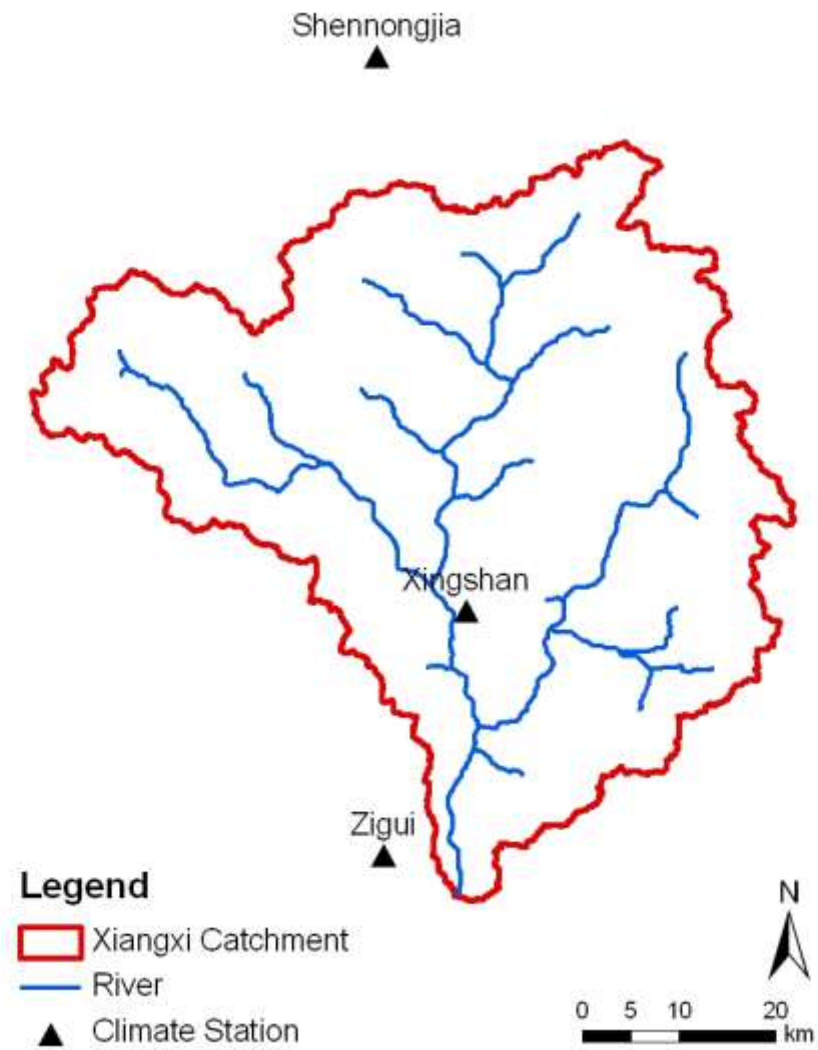


- Low flow period in winter
- Higher flows and frequent flood events in summer due to monsoon climate

Xiangxi River from source to mouth

Model setup: input data





Availability of time series for calibration

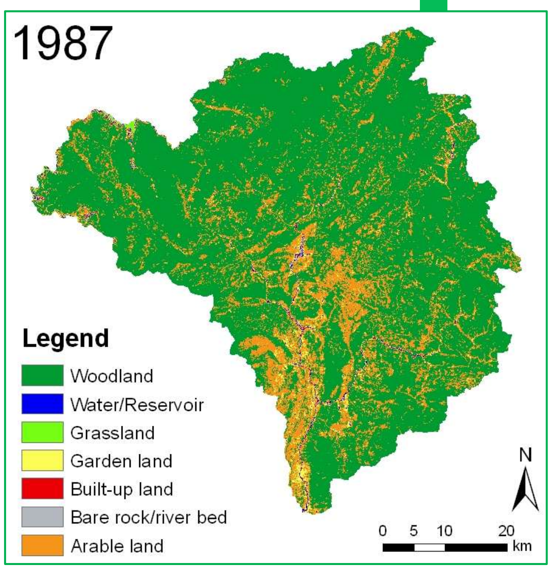
1970 ---> 2010

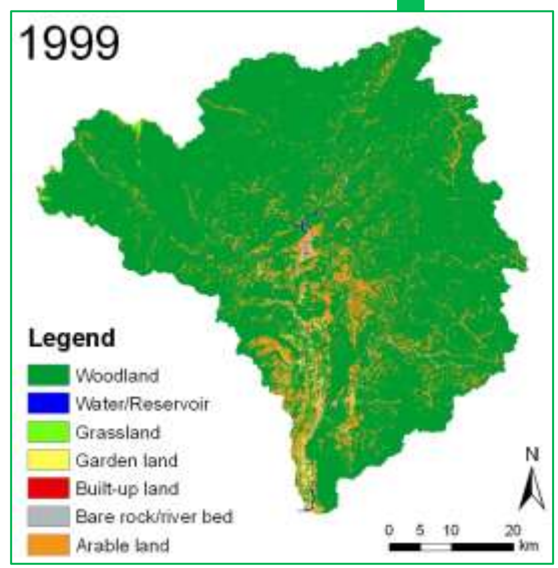
Climate: 1970-2007

Q: 70-74 | Calibration 1976-1986 | Validation 1988-1998

Sed: 70-74 | Calibration | Validation

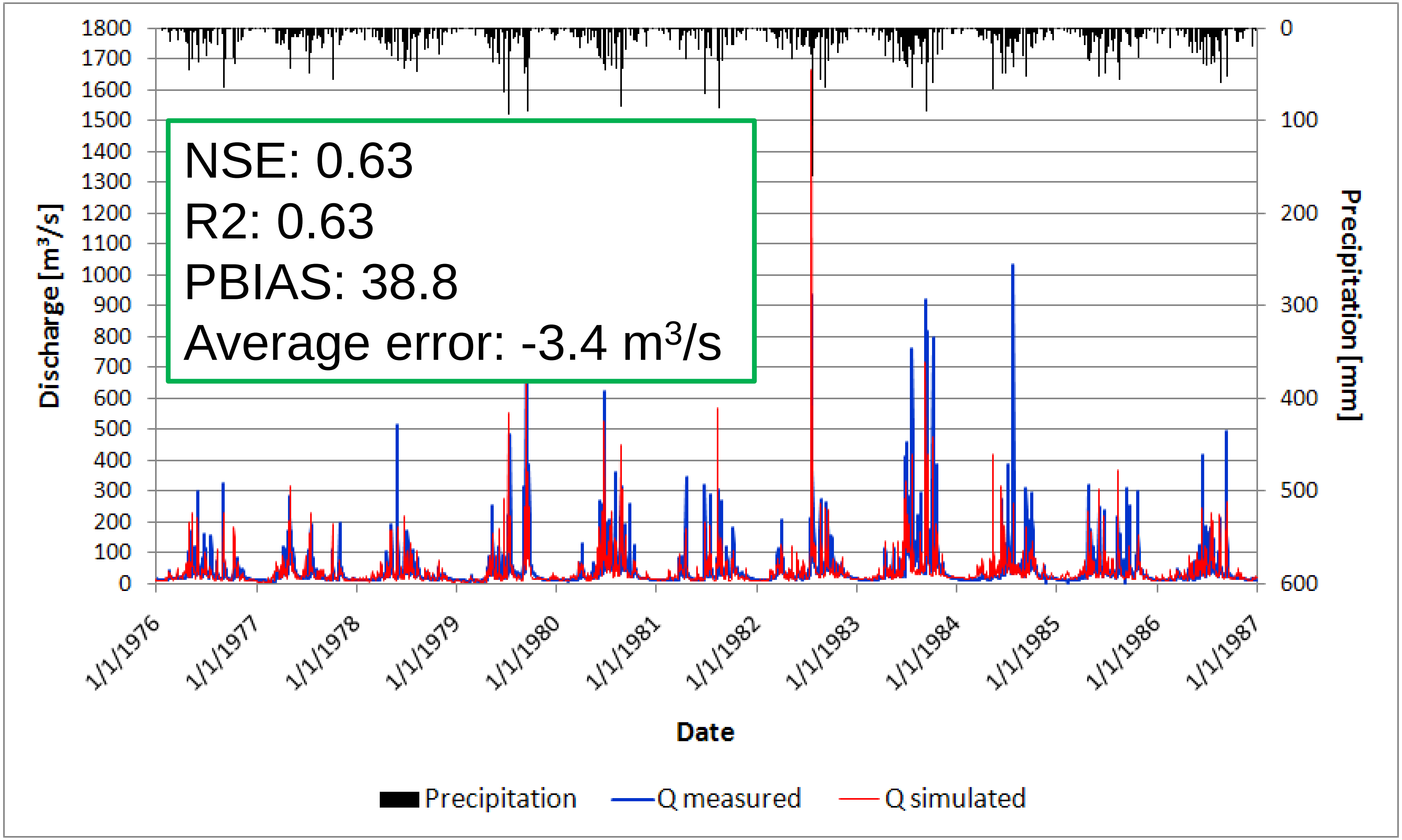
Phosphorus: 2001-2010





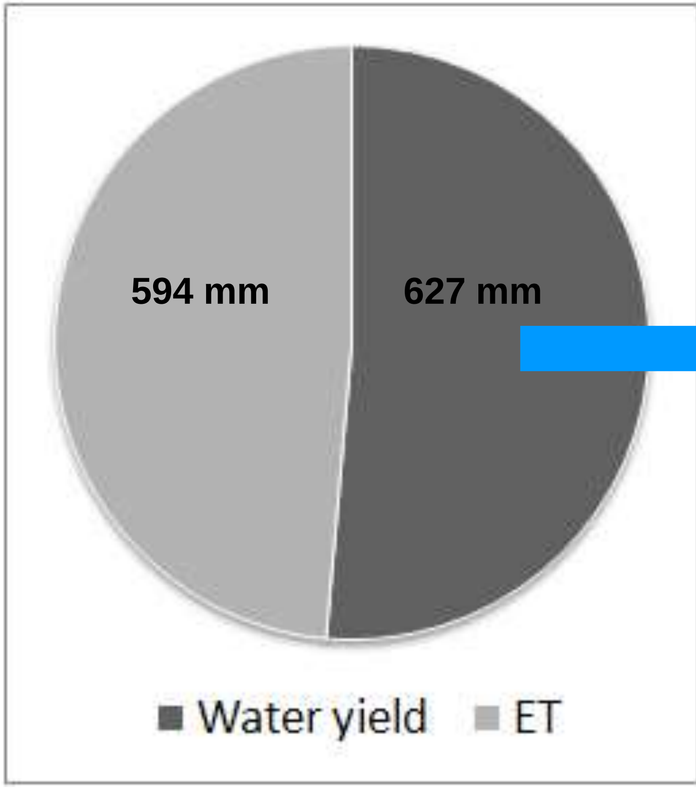
1999:
New land use map
+
1 reservoir implemented at Gufu River

Calibration of daily discharge

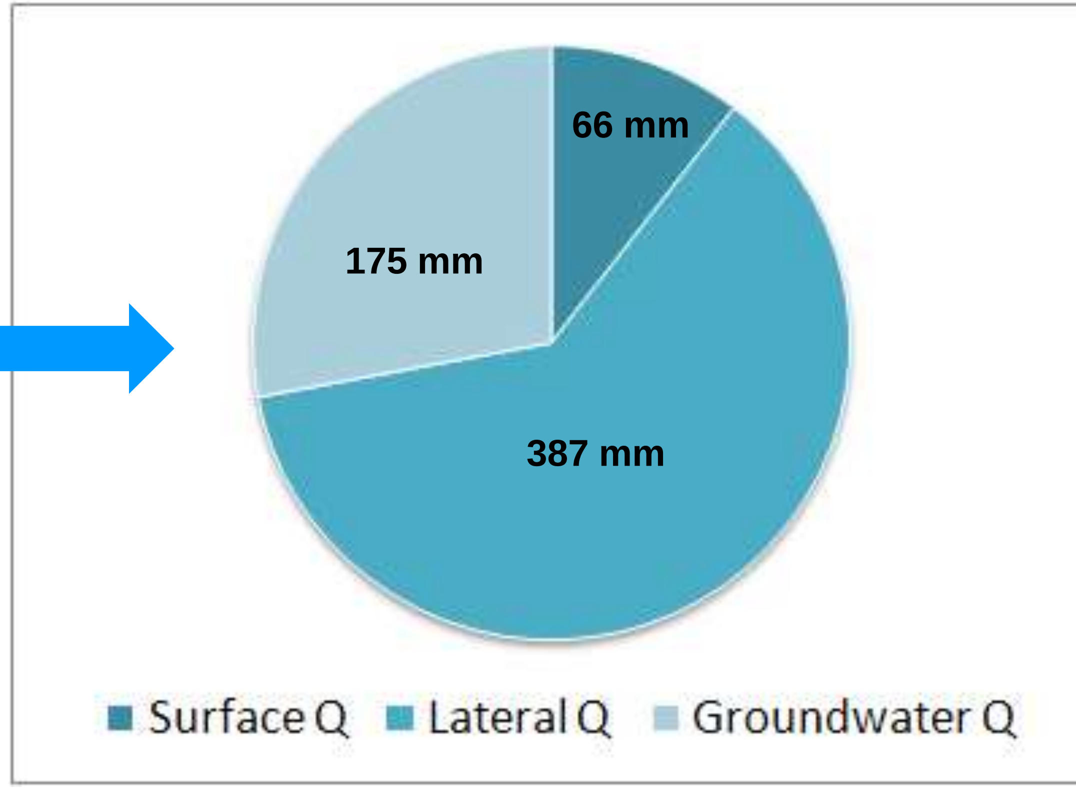


Water balance

Division of precipitation into ET and water yield:

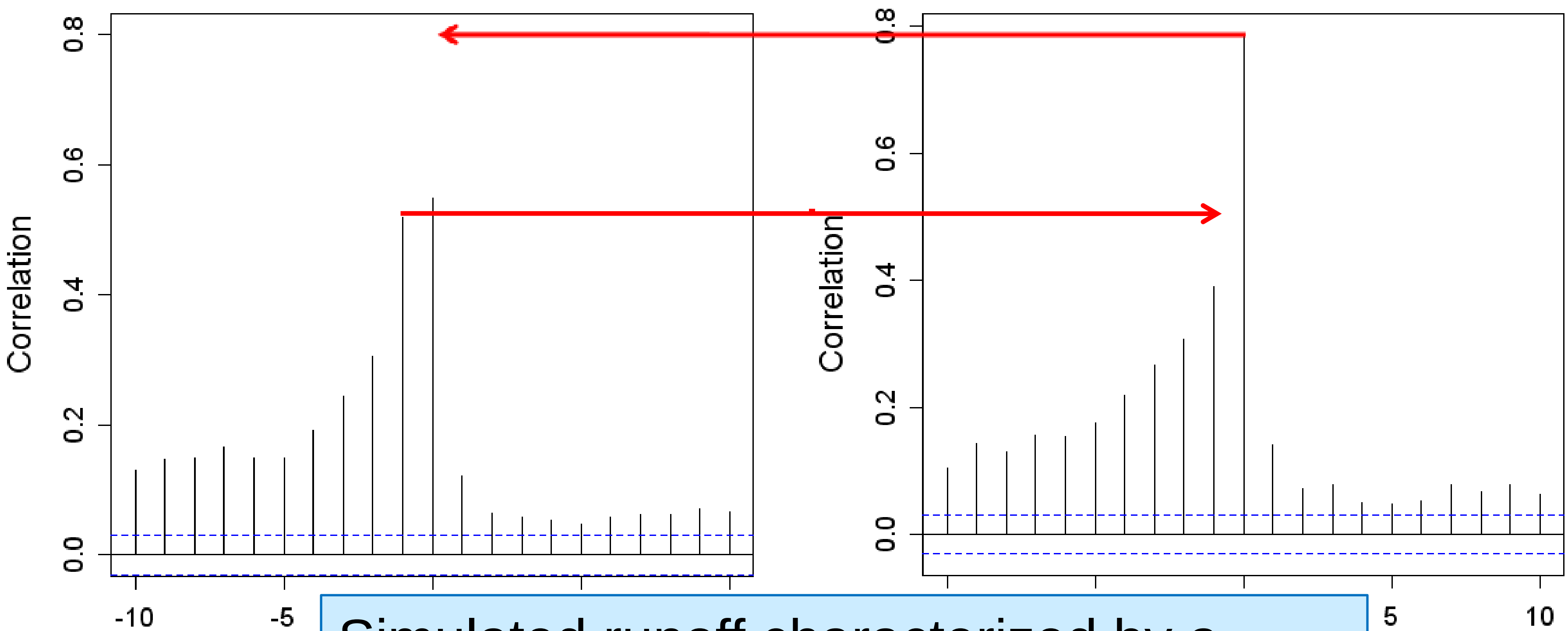


Proportions of different flow components:



Auto- and cross correlations

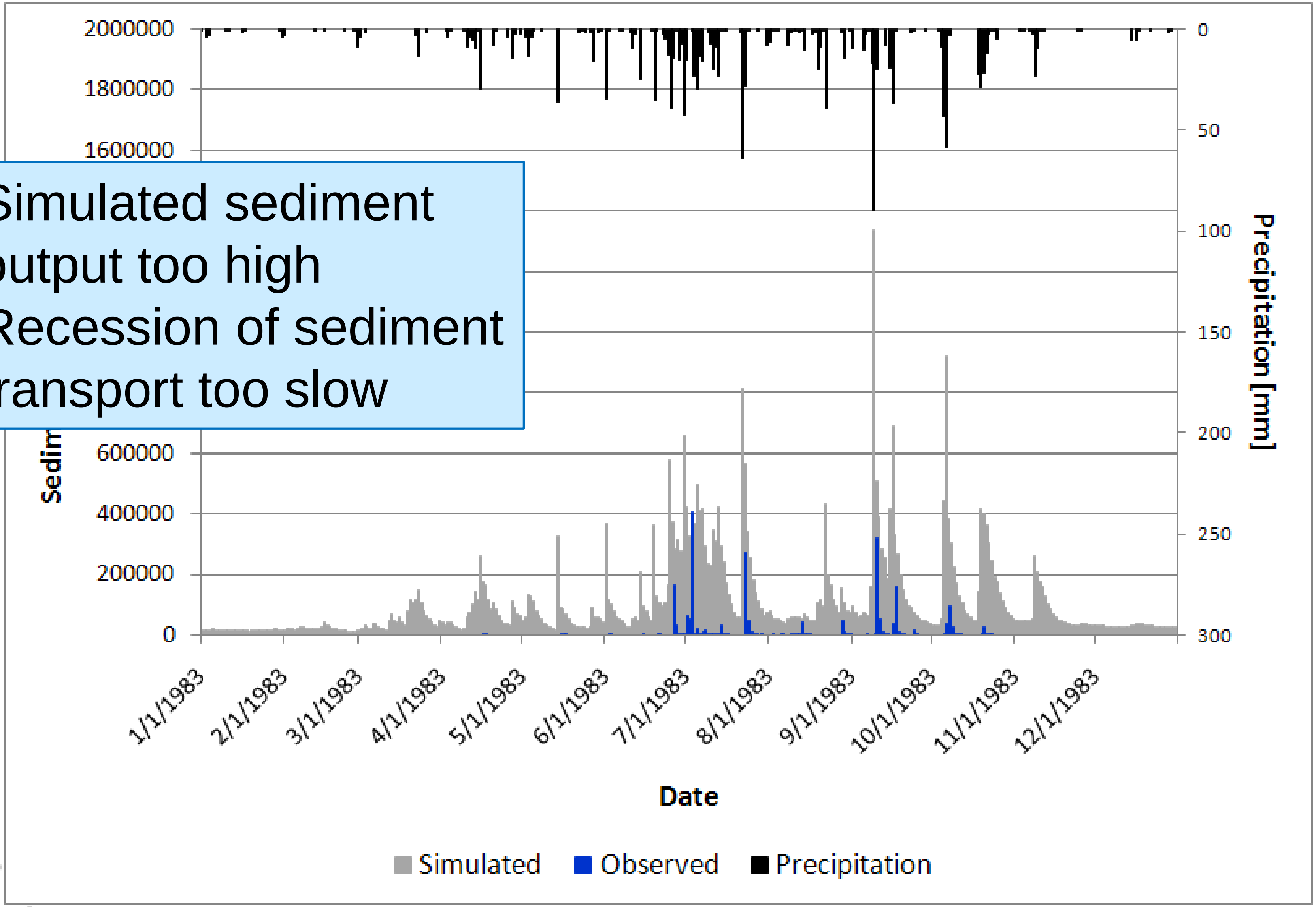
Precip and Q observed | Precip and Q simulated



Simulated runoff characterized by a faster response to precipitation events than observed runoff

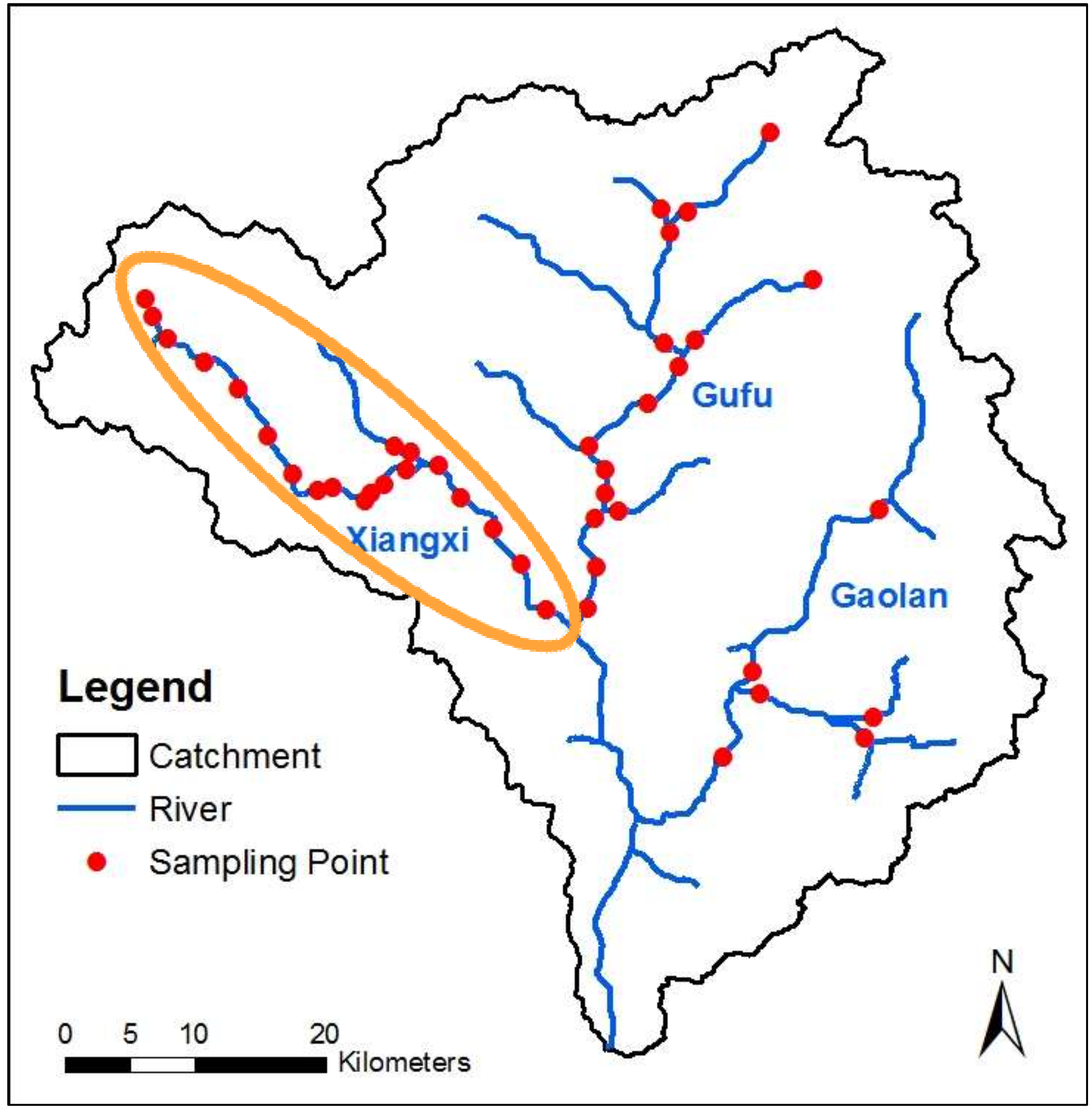
Sediment transport

- Simulated sediment output too high
- Recession of sediment transport too slow



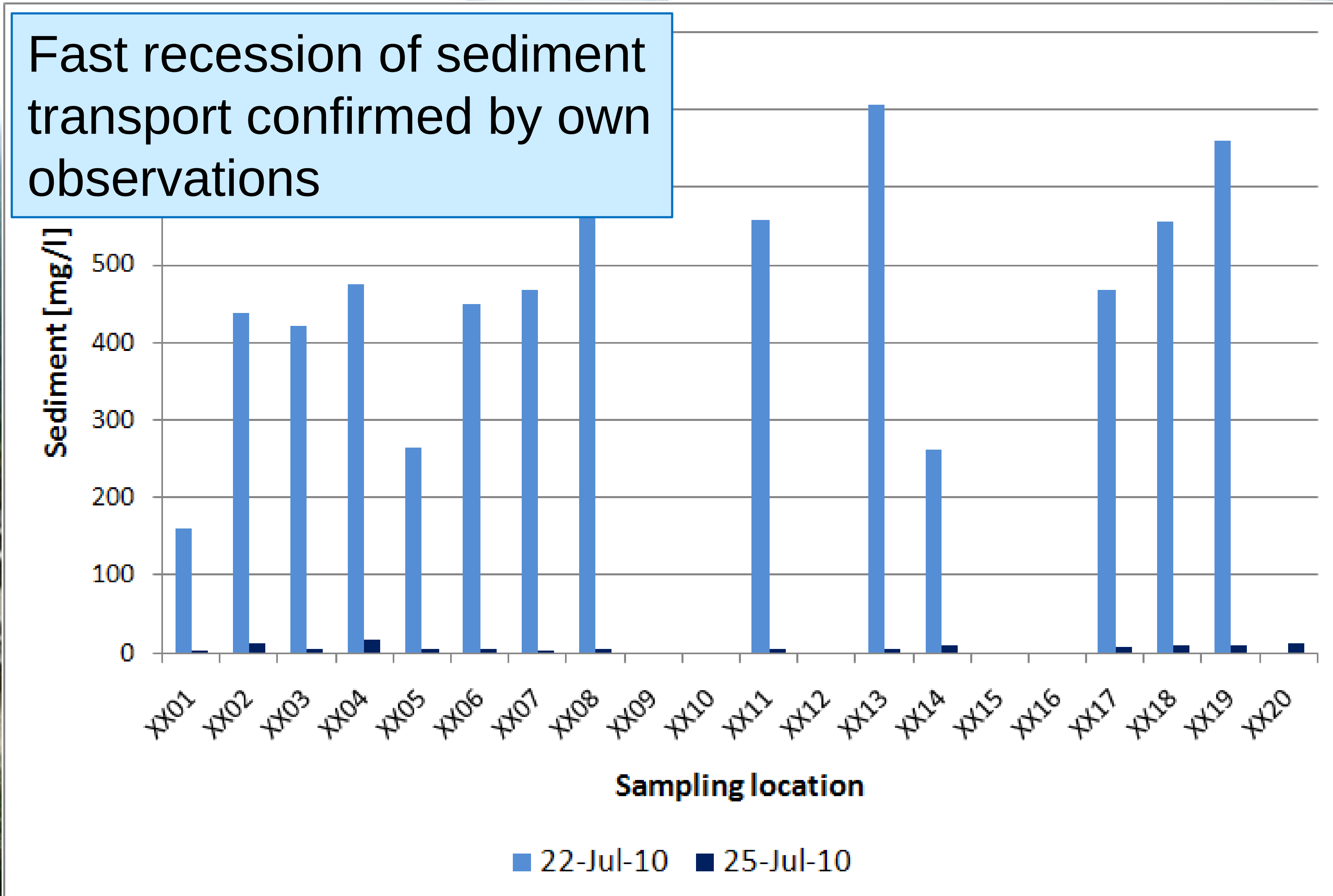
Spatially distributed sediment sampling

<u>Xiangxi River:</u>
22 and 25 July 2010
→ Contrasting flow conditions

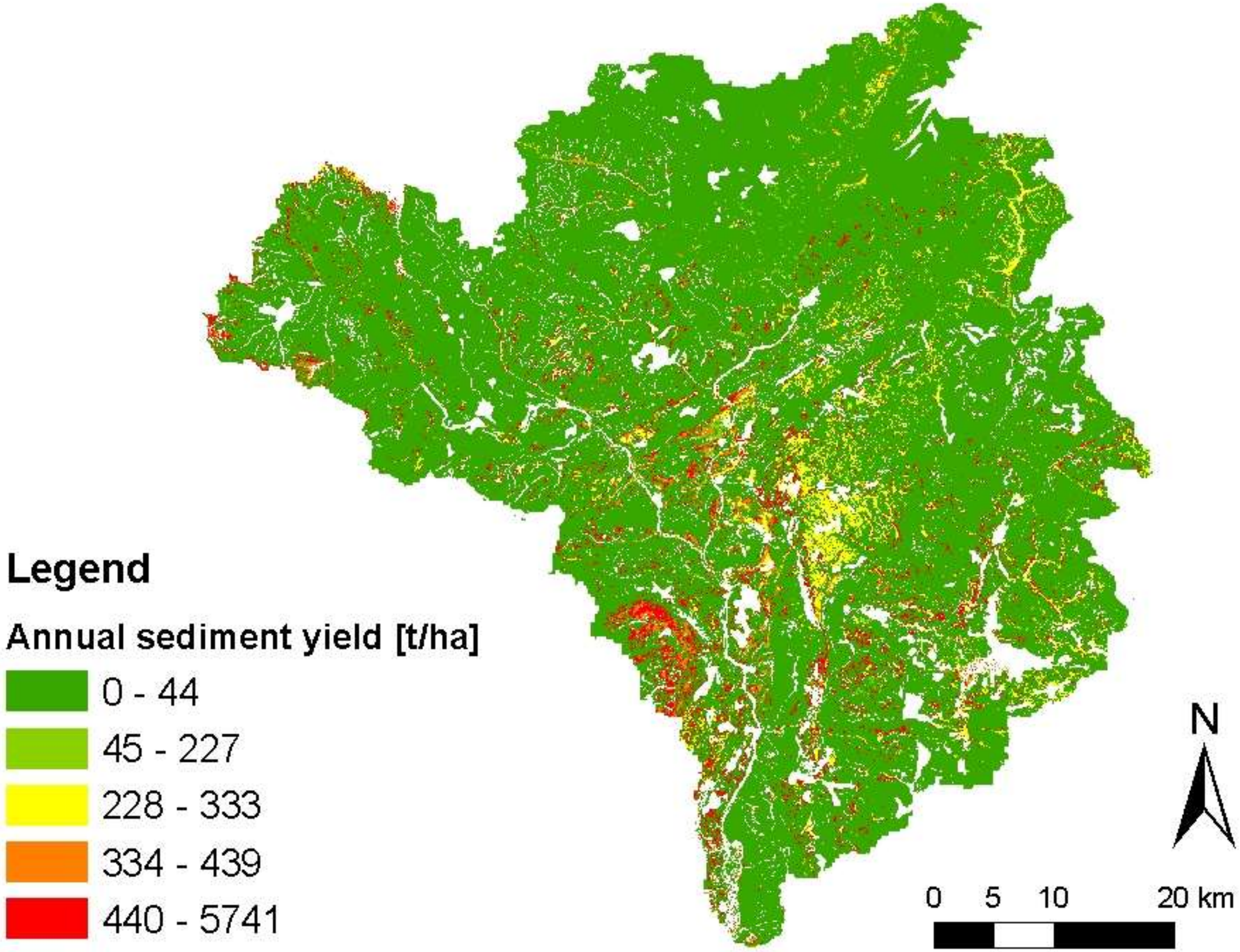


Sediment concentrations July 2010

Fast recession of sediment transport confirmed by own observations



Sediment yield of different land use classes



Reasons for overestimation of sediment yield

- Vegetation cover on agricultural areas (crop growth or USLE C Factor)
- Erodibility of soils (USLE K Factor)
- Peak rate adjustment factor for sediment routing
- Terraces not yet implemented in the model

Picture: C. Seeber 2009

Conclusions and outlook

- Average error for discharge very low
- Statistical criteria satisfactory
- Proportions of different flow components have to be revised

- Reduction of sediment yield from agricultural areas
- Reduction of recession time of sediment transport peaks

- Simulation of phosphorus transport
- Development of land use scenarios


Thanks for your attention!
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