



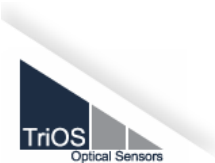
# MuDak-WRM

## Multidisciplinary Data Acquisition as Key for a Globally Applicable Water Resource Management

Midterm Workshop 2019, Frankfurt



WUPPERVERBAND  
für Wasser, Mensch und Umwelt



This project is sponsored by the Federal Ministry of Education and Research (BMBF) as part of the funding measure „Water as a Global Resource” (GRoW).

# Motivation and Initial Situation

## Land use changes and reservoir quality are intrinsically linked

- Numerous powerful models for terrestrial and aquatic ecosystems are available
- In most cases the models are complex and data demanding
- Adaptation to specific questions is often complicated
- Availability of input and validation data is generally limited
- Representation of local to regional characteristics is restricted

- ➡ Nutrient, sediment inputs
- ➡ Water demand
- ➡ .....

➡ **Simple and supportive solution**



# Goals and Needs

- Implementation of **overall applicable model tools**
  - **Simplicity**: reduction of model complexity and data demand, use of remote sensing data
  - **Flexibility**: modifiable input data, resolution and calculation algorithms
  - **Transparency**: Complete documentation
  
- Definition of **minimum monitoring strategies**
  - **Boundary conditions**: catchment characteristics and development
  - **Key parameter**: determining the long-term system status
  
- Clear **problem statement**
  
- Profound **understanding of key processes**
  
- Accurate **identification of key parameters**

# Three Reservoirs, Three Focus Areas - Approach



## Große Dhünn Reservoir:

- Equipment tests
- Methods proof
- Model development

Model Transfer 1



## Passauna Reservoir:

- Process identification
- System understanding
- Model operationalization

Model Transfer 2

## Piraquara 2 Reservoir:

- Model application
- Analysis of eutrophication
- Proof of transferability



# Activities and Progress

- **Monitoring**
  - Two campaigns in Germany
  - Four extensive campaigns in Brazil
  - Monthly monitoring
  
- **Workshops**
  - Two status workshops in Germany and Brazil
  - Two user workshops in Brazil (Sensorweb, data management)
  
- **Communication**
  - Regular Tele-conferences (monthly)
  - Skype meetings on demand
  
- **Formalized Co-operations**
  - MOU with Sanpepar
  - MOU with UFPR
  - MOU with The Nature Conservancy

# Activities

## Kick Off Meeting, Nov 2017



## Midterm Meeting , Feb 2019



More than 60 participants during the Workshops



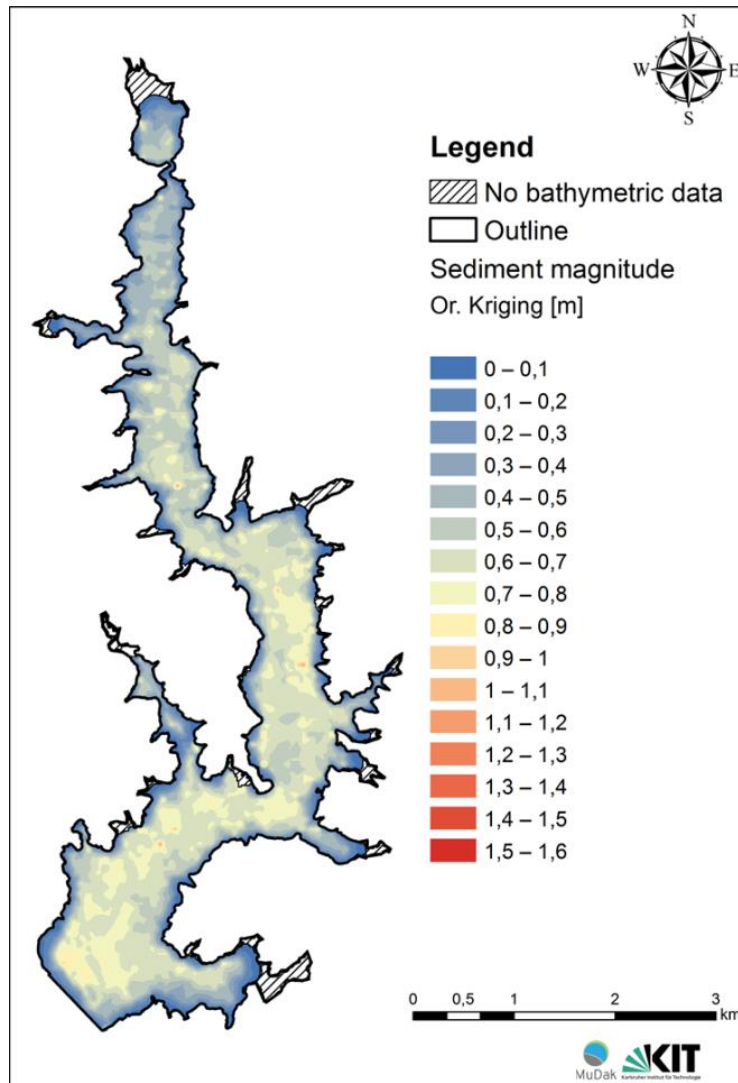
17 PhD students actively involved in MuDak

# Results & Products

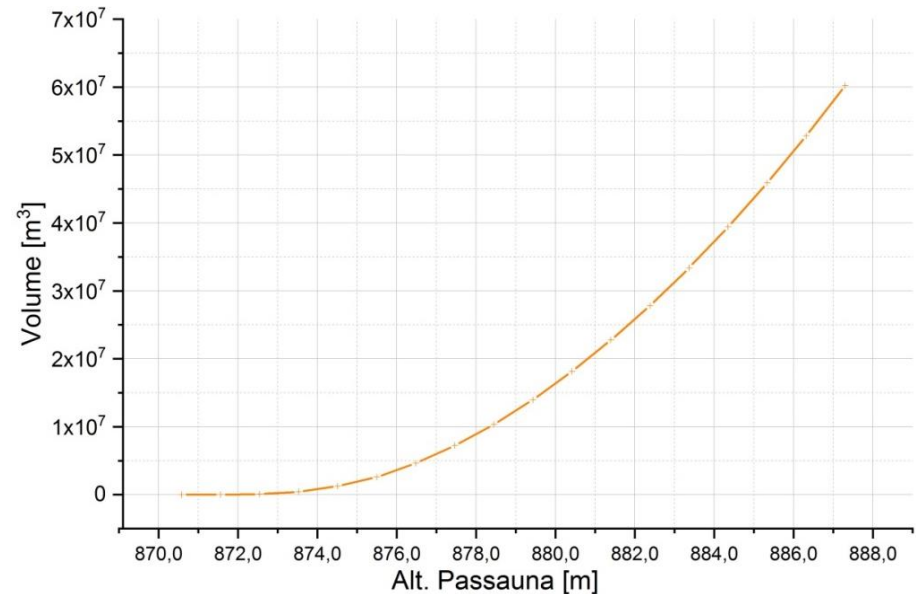
- Data acquisition completed
  - One year of high resolution water quality measurements in Passauna reservoir
  - More than one year of continuous sediment transport measurements
  - Installation of water quality sensors (Nitrate, Chlorophyll-a, CDOM and Cyanobacteria)
- Models (LARSIM, MoRE, Delft 3D) are running and ready for simplification and scenario testing
- Sensorweb online (secure access) for Große Dhünn and Passauna Reservoir (extra talk tomorrow during the Breakout Session)



# Sediment Accumulation (IWG-SWW)



## New depth – volume curve for the operator



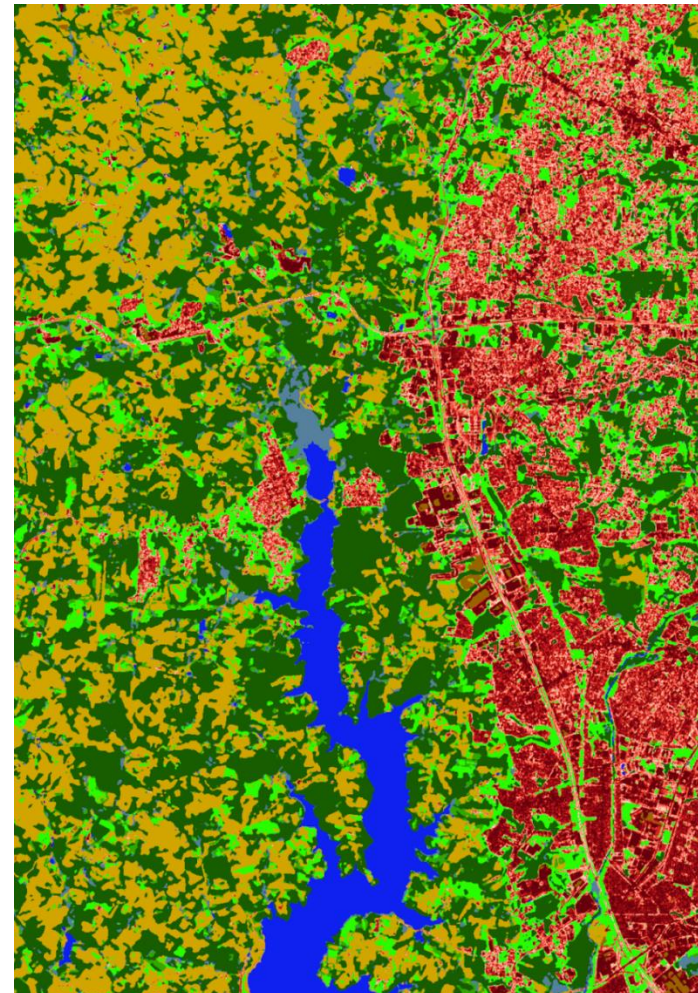
3.7 hm<sup>3</sup> volume loss in 30 years ~ **6 %** of the initial volume

(conservative estimation without silted buffer parts and based on echo-data)



# Remote Sensing and Modeling (EFTAS)

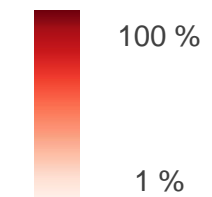
- Landuse / Landcover (LULC)  
Available (refinement in progress)
- Urban soil sealing  
Available (refinement in progress)
- Leaf Area Index (LAI)  
Available (refinement in progress)
- Surface Albedo  
Available (refinement in progress)
- Soil moisture  
Research in progress
- Chlorophyll and Turbidity  
Research in progress



Landuse /  
Landcover

- 1 - Urban
- 2 - Urban\_informal
- 3 - Cropland
- 4 - Pasture/meadow
- 5 - Bare soil
- 6 - Forest
- 7 - Scrubland/grasland
- 8 - Water
- 9 - Wetland

Urban soil sealing



**Location:**

Passauna study site

**Date:**

07/2018

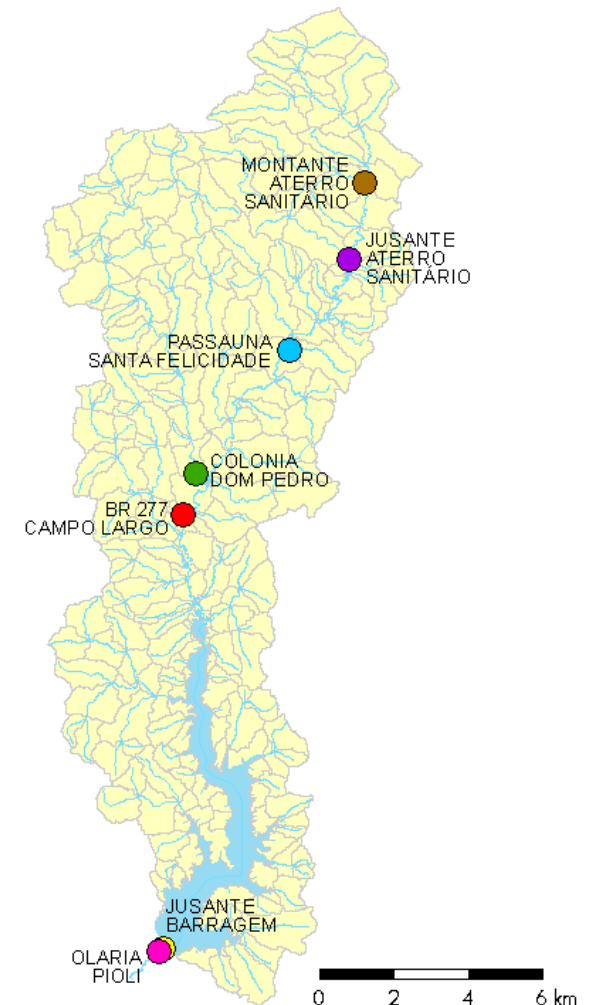
**Processing:**

Atmospheric correction  
Supervised classification  
Soil sealing estimation

**Data source:** Sentinel-2 annual time series (cloud-free selection)

# Water Balance Modelling (HYDRON)

- Setup and successful validation of:
  - State of the art water balance model for Große Dhünn (→ benchmark model)
  - Model of reduced complexity adapted to data availability for Passaúna
  
- Model outputs:
  - Discharge (water availability for reservoirs)
  - Spatially distributed runoff generation within the watersheds (→diffuse emission of nutrients)
  - River water temperatures (Passaúna)
  
- Proof of model transferability (for Passaúna):
  - Parameterization of evapotranspiration with globally available remote sensing data
  - Land use / land cover based on global available data
  - Simplified parameterization of soil, using adequate Pedo-Transfer-Functions



# Outlook

- Step wise simplification of the models
  - Excluding irrelevant parts, reducing data demands / temporal resolution
- Breaking down of the major findings for the management
  - Data integration and aggregation
  - Transfer to the reservoir operators
- Objectives & roadmap for 2019
  - Readjust the planning, if necessary
  - **Adapted models**
  - **Minimum-monitoring strategies**
  - **Relevant management questions**
- Future collaborations/projects
  - Extending to large scale application in Paraná; creation of a fully integrated Sensorweb
  - Modeling of land develop scenarios for different reservoirs
  - Transfer of the tools to other regions



# Thank you for your attention!