CHARM – CHAllenges of Reservoir Management

The project:

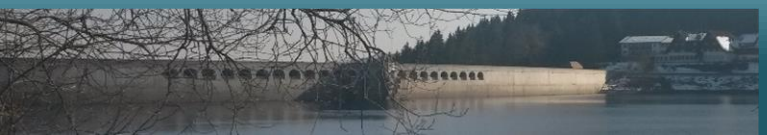
Reservoirs serve essential purposes like securing water and energy supply, flood protection and recreation. The importance of reservoirs is expected to rise worldwide due to climate change and future demographic development. A sustainable management of reservoirs poses a challenge for our society in many respects. CHARM addresses five of these challenges: Sediment deposition, development and stabilizing effects of biofilms, growth and distribution of cyanobacteria, greenhouse gas emissions, societal acceptance and potential conflicts surrounding the reservoir system.

Schwarzenbach reservoir

The project represents a research partnership between the natural, engineering and social sciences located at the Universities of Stuttgart, Konstanz and Freiburg.

The cooperation within the consortium provides an integrated and holistic assessment which is necessary to evaluate the complex reservoir system while generating additional benefit through transdisciplinary workflows.

Kleine Kinzig reservoir



The water research network Baden-Württemberg:

WASSERNETZWERK
BADEN-WÜRTTEMBERG

The Water Research Network aims at improving the interdisciplinary and multi-locational integration of water related scientific activities within the federal state of Baden-Württemberg. The initiative was founded by the Ministry of Science, Research and the Arts (MWK Baden-Württemberg) in 2016.
Three interdisciplinary scientific work groups form the networks main component, each incorporating several local universities, namely: CHARM, DRIeR and Eff-Net.

www.wassernetzwerk-bw.de

Funding organization:

Baden-Württemberg
MINISTERIUM FÜR WISSENSCHAFT, FORSCHUNG UND KUNST

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Imprint: Editing: T. Haas, K. Stork (University of Freiburg)
Layout: T. Haas
Images: CHARM-Team, aerial image Schwarzenbach reservoir: ENBW AG

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Universität Stuttgart

CHARM

CHAllenges of **R**eservoir **M**anagement

Meeting environmental and social requirements

WASSERNETZWERK
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CHARM – CHAllenges of Reservoir Management

Meeting environmental and social requirements

Sediments

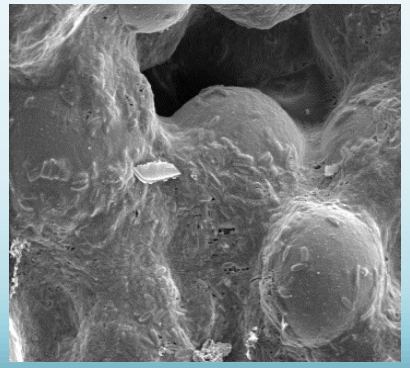
Reservoir sedimentation represents a huge challenge for sustainable reservoir management. Depositions not only reduce the storage volume available, but may also result in a loss of flood control or, in the worst case, block intakes and outlets.

Reservoir sedimentation

Within CHARM, the sediment stability and erosional behaviour of fine sediments will be investigated in both the laboratory and in the field. In the second phase, algorithms will be developed and implemented in numerical models. These models will then be used to predict reservoir sedimentation and to serve as a tool to develop sustainable reservoir management.

Microbial biostabilisation

Microbial organisms inhabiting fine sediment secrete polymers that bind the grains together and can significantly influence the erosional resistance of sediment (known as 'biostabilisation').



Biofilm under the microscope

The role of biostabilisation on fine sediment behaviour will be investigated using both field observations as well as manipulative experiments to examine the influence of abiotic conditions such as light, hydrodynamics, temperature and nutrients.

Cyanobacteria

Many reservoirs experience high nutrient input which can favour harmful cyanobacteria blooms leading ultimately to decreased water quality. Within CHARM the objective is to explore the physicochemical and biological factors triggering bloom formation to establish future management strategies. Our main focus is the toxin production of cyanobacteria, and monitoring water level fluctuations and mixing events due to the reservoir management and climatic influences.

Cyanobacterial bloom in a reservoir

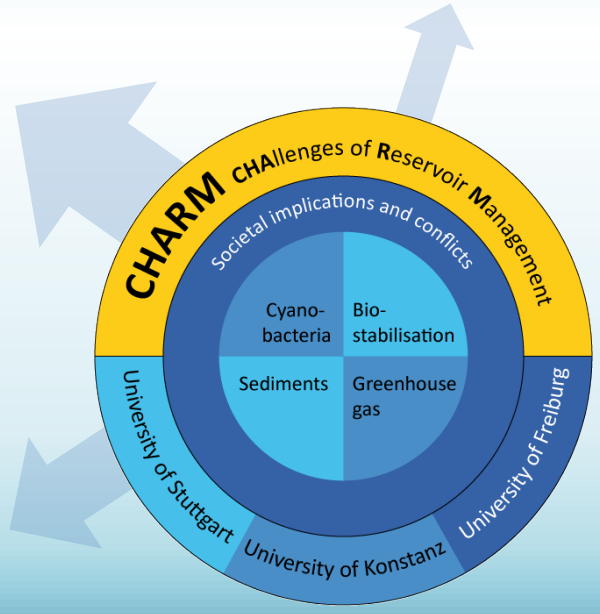
Greenhouse gas

Reservoirs store sediments and the organic material within sediments is decomposed by bacteria leading to an accumulation of the greenhouse gases Carbon dioxide (CO_2) and Methane (CH_4). These gases may eventually be released from sediments. In CHARM we will measure the dynamics and distribution patterns of CO_2 and CH_4 in reservoirs and quantify the emissions of these gases to the atmosphere. A specific focus is to assess the influences of reservoir management on production and storage, and on emissions and emissions pathways of CO_2 and CH_4.

Gas bubbles on sediment

Society

The construction of dams as well as their operation are often times accompanied by dissent between different interest groups. The societal implications and conflicts connected to reservoirs will be analyzed with respect to regional examples and incorporated into an integrated, cross-linked management concept. This framework has to take new developments into account while striving for a sustainable management of the reservoir based on more consensual agreements between stakeholders.



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