DAMAST-Transfer Workshop

Resilience & Sustainability
AI-based Early Warning Systems for Dam Safety

25th-27th September at Tbilisi State University (TSU), 1 Ilia Tchavtchavadze Avenue, Academic Building I, Room N115, 0179 Tbilisi, Georgia

Registration until 15th of September: S.S. Ottenburger, ottenburger@kit.edu

This workshop aims to present a concept of an early warning system for large dams based on a prototypical software application developed at KIT and furthermore, against the background of climate change, to shed light on its importance for the resilience of renewable energy systems.

The underlying concept was devised as part of the DAMAST project, which was funded by the German Federal Ministry of Education and Research. DAMAST had two main objectives: to enable extended monitoring of the Enguri Dam in Georgia and to develop an early warning system for dam safety. The project created unique conditions to better understand correlations between factors such as water level shifts, stress fields, dam deformations, pore pressure, sedimentation, induced seismicity, and meteorological elements.

In the context of extreme weather events, a new approach was developed to predict dam deformation based on weather forecasts, hydrological models, and environmental measurements. This approach uses a machine learning module that employs a deep neural network architecture to identify relationships between dam displacements and the aforementioned factors.

This approach provides a new basis for scientific investigations (dam stress, induced seismicity, risk prediction) and for the development of innovative early warning systems.

Agenda

Monday, 25th September

9.00-9.15	1	Sustainability Development Goals (SDGs) and Early Warning	Presentation
9.15-9.45	2	Early Warning System: Modular Concept: Safe dam operation, Resilient energy system/civil protection	Presentation
9.45-10.15	3	Discussion: On the way to an integrated (monitoring and early warning) system for research and agency	
Coffee break			
10.45-11.45	4	AI-assisted correlation analysis, dam deformation, and first results	Presentation
11.45-12.45	5	Discussion I: • New possibilities and critique (e.g. sufficient measurement data – type and amount) • Neural networks and models	
Lunch break			
14.30-15.30	6	Discussion II: • New possibilities and critique (e.g. sufficient measurement data – type and amount) • Neural networks and models	

Tuesday, 26th September

9.00-11.00	7	Early Warning System – a first scientific demonstrator I: Design & functionalities – dam deformation forecast for risk analysis (focus on precipitation)	Presentation, demonstration
Coffee break			
11.30-12.30	8	Discussion/Questions: Missing topics • Integrating dam fragility models (e.g. based on FE-method) for robust risk forecasting • Generation of synthetic data (e.g. extreme and rare events)	
Lunch break			
14.00-15.00	9	Early Warning System – a first scientific demonstrator II: Design & functionalities – how to work with it in research?	Presentation, demonstration
Coffee break			
15.15-16.00	10	Discussion III: • Data organization • Applying modularity for integrating improved or new functionalities	

Wednesday, 27th September

9.00-10.00	11	Early Warning System – a first scientific demonstrator III: Further development and future collaboration	Presentation
Coffee break			
10.15-11.00	12	Final discussion/questions and next steps: • Integrating dam operation and its impact on the energy system • Integrating civil protection	
End of workshop			