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Structural health monitoring using multi-parameter information: Case of the Kurpsai dam in the Kyrgyz Republic

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Given the plans to construct hydroelectric dams in the Kyrgyz Republic, and the need to ensure the integrity of existing structures, techniques for gaining rapid and robust information about the health of such structures and the surrounding slopes are required. This is especially important given the earthquake and landslide-prone nature of the country. Such techniques would be used to establish monitoring systems that will support the decision-making process in the event of an emergency.

The MI-DAM project (MultI-parameter monitoring and risk assessment of hydro-electric DAMs in the Kyrgyz Republic) is setting out to develop, install and test a robust, cost-effective and flexible monitoring system at the Kurpsai Hydropower Station (HPS) in Western Kyrgyzstan. This system is intended to allow multi-parameter risk assessments with respect to earthquakes and landslides, focusing on the structural integrity of the dam by structural health monitoring using multiple parameters. The structural health monitoring of the Kurpsai dam considers two time scales: long-term monitoring of static deformations of the dam over days, months and years, and the short-term monitoring of the structure's response to earthquake shocks and extreme operational conditions. The focus of this contribution will be on the short-term monitoring, which involves the installation of multi-parameter sensors placed at characteristic points of the structure and the surroundings, exploiting a fully decentralised approach.

The continuous recording of seismic noise, i.e. the persistent vibration of the ground due to a range of natural and anthropogenic causes, allows for the ongoing assessment of the mechanical characteristics of the dam (i.e. the fragility curves) and/or nearby potential landslide bodies and the early detection of any changes. Our approach will also allow for the dam structure's fragility curve to be directly integrated into on-site calculations, allowing some degree of decision-making without the necessity of a remote centre.