# ETHzürich

# Methods for Dam Behaviour Analysis



Punt dal Gal dam in Switzland
(Photo: M. Bühlmann, VAW)

Concrete dam related long-term processes, such as valley deformation, concrete ageing, alkali aggregate reaction and changes in seepage flow can lead to damage or even failure of the structure. The consequences of a failure are serious. Thus, dam monitoring is essential to recognise abnormal behaviour at early stage. The safety assessment can be done by a comparison between observed and predicted behaviour indicators (e.g. radial pendulum displacement at crest level). The predicted value can be calculated using a model based on input variables such as environmental conditions (e.g. water level, temperatures). Basically, there are two modelling approaches; the deterministic method links the behaviour of the structure and input variables on the basis of physical laws, and the statistical method links it by regression analysis. For statistical models, multiple linear regression models with a least square approach are commonly used for approximation.

The application of common statistical modelling approaches is not straightforward. For a behaviour analysis, a regressor model equation that approximatively describes the relationship between the environmental conditions and the behaviour of the structure has to be defined. The model accuracy and the prediction capability particularly depend on the chosen model equation. The most difficult part is to choose functions which consider the effect of temperature on the displacement. There are various approaches in the literature. Many of them work well for some dams, whereas they may lead to physically meaningless results for other dams. The consideration of the thermal inertia seems to be important, because a change in temperature acts with a certain delay onto the structure.

Firstly, established procedures for dam behaviour analysis and models from literature considering the influence of temperature will be studied and evaluated. Secondly, new approaches considering the temperature influence shall be developed and tested. The focus of the current research project lies on statistical models predicting the crest displacement on concrete dams. The investigation is based on measurement data from different concrete dams in Switzerland.

| Keywords: | dam safety, concrete dams, prediction of behaviour, multiple linear regression |
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**Laboratory of Hydraulics, Hydrology and Glaziology**
Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie