Influence of periodic variations in water level on regional seismic activity around a large reservoir. Filed data and model

T. Matcharashvili (1,2), **J. Peinke** (2), B. Ahrens (2), T. Chelidze (1,3), J. Gogiashvili (1), O. Lursmanashvili (3), Z. Javakhishvili (1)

(1) Institute of Geophysics of Georgian Academy of Sciences, 0193 Tbilisi, Georgia, (2) Institute of Physics, University of Oldenburg, D-26111 Oldenburg, Germany, (3) Tbilisi State University, 380028,Tbilisi, Georgia

The reservoir-induced changes of the regional seismic activity around the Enguri high dam reservoir in western Georgia are found to be influenced by the water level of the reservoir. The water level variations of the Enguri high dam reservoir and the seismic data sets recorded by the local network have been analyzed by means of statistical, linear, nonlinear and phase synchronization analysis methods. It is shown that seismic activity increases during the flooding period, according to the well-known concepts of reservoir-induced seismicity (RIS). As a new result we see that the released energy value essentially decreases when the variation of the water level in the reservoir becomes periodic. Furthermore acoustic emission data obtained during laboratory stick-slip experiments with superimposed weak periodic perturbations have been investigated as a model of natural seismicity as well as a periodical driven sand avalanches model. We conclude that the decrease in seismic activity around Enguri high dam is induced by periodic changes of water level in the reservoir. Based on the field and laboratory and model data analysis we have generalised our conclusion and suppose that probability of decrease of strong earthquakes' occurrence around large reservoirs may be explained by the phase synchronization effect between the complex seismic process and small periodic influences related to changes in water level.