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MONITORING OF INDUCED SEISMICITY IN DARIYAN DAM

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In general, induced seismicity refers to seismic events that are a result of human activity. There are many different ways in which human activity can cause induced seismicity including geothermal operations, reservoir impoundment (water behind dams), waste water injections, and oil and gas operations such as hydraulic fracturing. Energy technology activities known to have produced induced seismicity, whether significant enough to be felt by humans or so small as to be detected only with sensitive monitoring equipment, are fluid injection and withdrawal as well as purposeful fracturing of rocks. For each of these activities the critical components required to produce induced seismicity are the presence and orientation of existing faults, the state of stress of the Earth's crust, the rates and volumes of fluid injection or withdrawal, and time. Understanding these components gives some confidence in being able to draw conclusions about what seismicity might be induced in the future, and under what conditions. It is important that the right tools are used to monitor induced seismicity to accurately observe the number of seismic events associated with reservoir and most importantly, their location and magnitude. In particular, it is important to record events of high magnitude that locate near the reservoir or are associated with a known fault in the area of interest. An important aspect of the monitoring project is answering the knowledge gaps regarding induced seismicity processes with the aim of reducing the potential seismic hazard from these earthquakes. It is founded that, in areas with moderate tectonic strain, injection may temporarily increase the local seismic hazard, but over an extended period, widespread injection-induced earthquakes may deplete the available tectonic moment, reducing regional seismic hazard. As early as 1931, the first reservoir induced seismicity (RIS) has been detected in Marathon Reservoir of Greece, following more than 100 reservoirs were detected to trigger earthquakes in succession, several earthquakes exceed 6 to cause severe results. Therefore, the prediction is of great significance for RIS.

The local seismic Network for Dariyan Dam was designed by four stations by International Institute of Earthquake Engineering and Seismology (IIEES). We associated more than 80 earthquakes with local magnitude range of 1.0 to 4.5, during July 2015 - May 2016 (Figure 1). Figure 1 shows that after impounding the dam, local seismicity increases.

Large ground-motion amplitudes have been observed at short distances (< 5 km) from some induced events, despite small-to-moderate magnitudes, because of their shallow depths. For example, peak ground acceleration of > 0.1 g often occurs from events with magnitude of ~3 (Babaie and Kao, 2018).

REFERENCES

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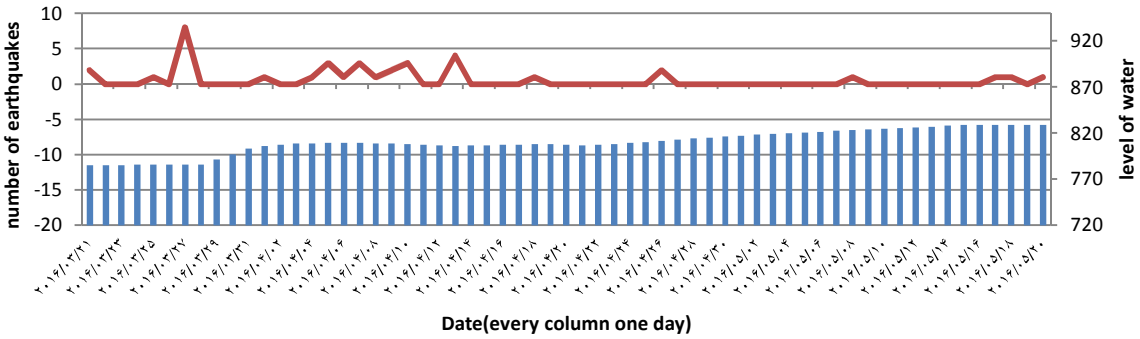

Figure 1. Temporal variation of seismicity and water level in the Dariyan Dam.

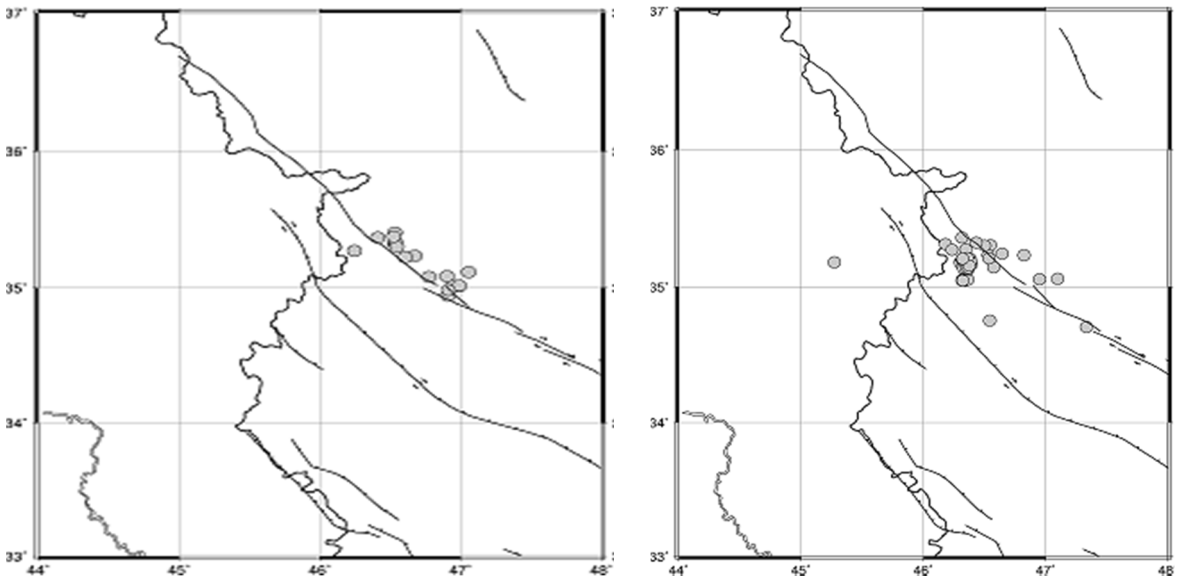

Figure 2. Sesimicity around Darian dam before (left) and after (right) the impounding.