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Seismic hazard Analysis for Aswan High Dam Reservoir (Egypt)

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Earthquake activity and seismic hazard analysis are important components of the seismic aspects for very essential structures such as major dams. The Aswan High Dam (AHD) created the second man-made reservoir in the world (*Lake Nasser*) and is constructed near urban areas pose a high-risk potential for downstream life and property. The Dam area is one of the seismically active regions in Egypt and is occupied with several cross faults, which are dominant in the east–west and north–south. Epicenters were found to cluster around active faults in the northern part of Lake and AHD location. The space-time distribution and the relation of the seismicity with the lake water level fluctuations were studied. The Aswan seismicity separates into shallow and deep seismic zones, between 0 and 14 and 14 and 30 km, respectively. These two seismic zones behave differently over time, as indicated by the seismicity rate, lateral extent, *b*-value, and spatial clustering. It is characterized by earthquake swarm sequences showing activation of the clustering-events over time and space. The effect of the North African drought (1982 to present) is clearly seen in the reservoir water level. As it decreased and left the most active fault segments uncovered, the shallow activity was found to be more sensitive to rapid discharging than to the filling. This study indicates that geology, topography, lineations in seismicity, offsets in the faults, changes in fault trends and focal mechanisms are closely related. No relation was found between earthquake activity and both-ground water table fluctuations and water temperatures measured in wells located around the Kalabsha area. The peak ground acceleration is estimated in the dam site based on strong ground motion simulation. This seismic hazard analyses have indicated that AHD is stable with the present seismicity. The earthquake epicenters have recently took place approximately 5 km west of the AHD structure. This suggests that AHD dam must be analyzed with high priority and redesigned to increase the safety of the embankments and their appurtenant structures, if necessary. peak ground acceleration changes within a wide range (0.011 g and 0.564 g) for the dam sites of the basin. A seismic hazard map showing the equivalent PGA (peak ground acceleration) values was developed so as to use for the preliminary analysis of dam structures, which will be designed in the basin. The total risk analyses depending on the seismic hazard rating of dam site and risk rating of the structure have concluded that fifteen large dams have high-risk class in the basin. These dams must be analyzed with high priority and redesigned to increase the safety of the embankments and their appurtenant structures, if necessary.

Keywords

Dam; Earthquake; Euphrates basin; Potential risk; Seismic hazard

