**Probabilistic assessment for liquefaction potential of a flood-protection levee**

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**Abstract**

One of the main initial causes of earthen levees failures during an earthquake is liquefaction triggering which could lead to the levee dismantlement and breach. This phenomenon is well-known in water-saturated soils in which the build-up of pore water pressure during ground shaking could reduce the effective stress and trigger the liquefaction of specific layers of soils located in the structure body or in the foundation ground. Robust estimates of the seismic vulnerability of earthen levees with respect to the liquefaction are therefore crucial to define the necessary precautions.

This work provides a probabilistic assessment for liquefaction potential of an earthen flood-protection levee with consideration of groundwater level variations over time. A frequency analysis based on the Annual Maxima/Generalised Extreme Value (AM/GEV) approach is used to characterize the distribution of the water table extreme values. The simplified method currently used in engineering practice is then applied to estimate the factors of safety $FoS$ against liquefaction for different probabilistic groundwater level scenarios and to display the hazard curves.

Unlike the deterministic analysis, which uses a single scenario (often criticised as too conservative) and reveals a certain liquefaction risk of the levee with $FoS<1$ under ground shaking, the probabilistic analysis showed that liquefaction is unlikely to occur when the data quantiles are used with various return levels. These findings point out that different liquefaction risk levels may exist for the same $FoS$ value indeed. Consequently, and despite the inherent limitations of this study, these results demonstrate that the probabilistic approach may provide key information in engineering practice to take stock of the possibilities regarding liquefaction hazard or its consequences.