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Determination of adverse effects of landslide generated impulse waves in a dam reservoir by using empirical approaches: a case study from North Turkey

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Landslide induced wave occurrence in both artificial reservoir areas and natural lakes may cause adverse effects on to natural and man-made structures in and around reservoir area such as dam body, settlement and etc. To estimate possible wave characteristics such as wave propagation, wave run-up and overtopping may also prevent these adverse effects mentioned. In this study, a possible landslide induced wave characteristics and it's negative effects on to Kurtun (Gumushane, North Turkey) Dam body were investigated. The study area was selected as a case area due to the fact that it is a landslide prone area. For this purpose, empirical relations proposed by different researchers were used in the calculation procedures. In this context, a spread sheet macro prepared by Heller et al. (2009) was used. In this application, 2D and 3D analyses were carried out. Initially, the geotechnical properties such as cohesion (c), internal friction angle (φ) of the landslide material were determined so that these can be used as input parameters in the analyses. Then, some geometrical characteristics of the landslide mass such as slide thickness, slide width, slide impact angle and some topographic characteristics of the reservoir area were obtained. After obtaining these parameters, some structural properties of the Kurtun Dam body such as freeboard and crest width, and the distance between the landslide mass and dam body were also taken into consideration in the analyses. During these analyses, some limitations for the calculation of the impulse wave generation that are needed for a consistent analysis, were considered. At the end of the analyses, nineteen main results were obtained. Some of these results are wave height, wave amplitude, wave period, run-up height, overtopping volume per unit length dam crest, duration of overtopping, wave type, and horizontal and vertical forces on the dam body resulting from hydrostatic pressure. The results obtained revealed that the method applied in this study are simple and easy-to use for a purpose of rapid hazard prevention in similar problematic areas.