Building a flood hydrograph caused by the volcanic eruption of Baekdusan in Cheon-ji caldera lake

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Recent reports pointed out the Baekdusan volcano that is located between the border of China and North Korea as a potential active volcano. Since Millennium Eruption around 1000 AD, smaller eruptions have occurred at roughly 100-year intervals, with the last one in 1903. The volcano is showing signs of waking from a century-long slumber recently and the volcanic ash may spread up to the northeastern of Japan. The development of various forecasting techniques to prevent and minimize economic and social damage is in urgent need. Floods from lake-filled calderas may be particularly large and high. Volcanic flood may cause significant hydrologic hazards for this reason. This study focuses on constructing a hygrograph triggered by the breach failures of the caldera lake and/or uplift of lake bottom in the Baekdusan volcano. A physically-based break and uplift model was developed to compute the amount of water and time to peak flow. The ordinary differential equation was numerically solved using the finite difference method and Newton-Raphson iteration method was used to solve nonlinear equation. The final goal of the study stresses the potential flood hazard represented by the huge volume of water in the caldera lake, the unique geography, and the limited control capability. Only a flood hydrograph is built as an upper boundary condition and channel routing downstream is not considered in this study. The study will contribute to build a geohazard map for the decision-makers and practitioners.

Keywords: Volcanic flood, Volcano, Caldera lake, Dam break, Hazard

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