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Analysis of flooding impact with multi-risk hazards scenario by using physically-based model

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Recently, increases in natural disasters due to climate change have been continuously reported, and future socio-economic damage is expected to increase further. Damage caused by natural hazards can be initiated by a single event, however, two or more hazardous events can affect an area in a complex way, increasing the severity of the damage. In order to account for these unforeseen potential impact, scenarios of compound disaster must be identified and evaluated with adequate method. In the case of floods, effects considering multi-risk hazards yields different outcomes from damages caused by a single flooding event. For example, a cascading effect due to the collapse of an existing reservoir in a catchment during a heavy rainfall will cause more severe damage to a neighboring community than simple flash flooding. The purpose of this study is to analysis the flooding impact with physically-based model by considering the effects of multi-risk hazards and to provide basic information for spatial planning and mitigation measures. In this study, we used the OpenLISEM Hazard model to simulate the flooding with cascading effect by collapse of an embankment of reservoir. OpenLISEM Hazard is a physically-based numerical model with the purpose of event based runoff, flooding and landslide modelling on a catchment scale. As a study area, we selected a catchment located in South Korea, where a reservoir collapsed due to heavy rainfall by typhoon in 2007, and the simulation result was validated using the flood inventory map produced by the local government. For the analysis, three different scenarios were considered, which are the case of flash flood by the storm rain, the case of reservoir collapse during no rainfall and the case of cascading effect by reservoir collapse during the storm rain. As a result, it was analyzed that the impact by the cascading flooding effect is more significant than floods by single events. This modelling approach allowed to simulate the dynamic change of groundwater pressure head by properties of topography, soil, vegetation and rainfall, and amplification of flooding in the catchment was examined. The methodology of this study can be a basis in analyzing the potential risks by compound disaster of flooding that can not be identified with single event scenario, and it may useful for land use planning where rainfall intensity is expected to increase in future.