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Rapid Global River Flood Risk Assessment under Climate and Socioeconomic Scenarios: An Extreme Case of Eurasian region

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Causing widespread devastation with massive economic damage and loss of human lives, flood disasters hamper economic growth and accelerate poverty particularly in developing countries. Globally, this trend will likely continue due to increase in flood magnitude and lack of preparedness for extreme events. In line with risk reduction efforts since the early 21st century, the monitors and governors of global river floods should pay attention to international scientific and policy communities for support to facilitate evidence-based policy making with a special interest in long-term changes due to climate change and socio-economic effects.

Although advanced hydrological inundation models and risk models have been developed to reveal flood risk, hazard, exposure, and vulnerability at a river basin, it is obviously hard to identify the distribution and locations of continent-level flood risk based on national-level data. Therefore, we propose a methodological possibility for rapid global flood risk assessment with the results from its application to the two periods, i.e. Present (from 1980 to 2004) and Future (from 2075 to 2099). The method is particularly designed to effectively simplify complexities of a hazard area by calculating the differential inundation depth using GFID2M (global flood inundation depth 2-dimension model), despite low data availability.

In this research, we addressed the question of which parts in the Eurasian region (8E to 180E, 0N to 60N) can be found as high-risk areas in terms of exposed population and economy in case of a 50-year return period flood. Economic losses were estimated according to the Shared Socioeconomic Pathways (SSP) scenario, and the flood scale was defined using the annual maximum daily river discharge under the extreme conditions of climate change simulated with MRI-AGCM3.2S based on the Representative Concentration Pathways (RCP8.5) emissions scenario.

As a preliminary result, the total potential economic loss in the Eurasian region was identified as an upward trend proportional to projected vulnerable population based on distributed data of global population (Landscan 2009 by the Oak Ridge National Laboratory) coupled with SSP Gross Domestic Product (GDP) per capita in the future. The differences between Present and Future in physical exposure and potential economic losses are projected to increase approximately 305 million affected people and approximately 3 % of the total GDP (US$ 2400 billion) potential damage, respectively, in terms of climate change and socioeconomic impacts.