Incorporation of sea level variation into a global river routing model and its impact assessment

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Global river routing models have been applied to river flood risk assessment such as in regions with poor data of topography observation, and global mapping of flood inundated areas and its interregional comparisons. In these years they have been developed in various research institutions around the world. However, since previous studies mainly focused on flood risk assessment in land areas, sea level variations have not been taken into consideration, and fluvial flood simulations in areas vulnerable to tides and storm surges have been underestimated.
The objective of this study is to elucidate the influence of sea level variation on fluvial flooding by employing a global river ruoting model capable of appropriately expressing the backwater effect, and a global reanalysis of tide and surge that was developed in recent years. First, we modified the river routing model to express sea level variation. Next, we developed a scheme for delivering sea level data from a global reanalysis of tide and surge to the global river routing model, conducted coupled simulation, and evaluated the influence.
Coupled simulation on the global scale revealed that river water levels increased by 0.5 m or more in comparison with the case without considering sea level variation. We found that the sea level fluctuation significantly affected fluvial flood simualtions. Time series of river water levels was analysed for large rivers with catchment areas larger than 160,000 km^2 in the Asian region. As a result, peak water levels increased by 1 m or more in some rivers, and the seasonal variation of river water levels were enhanced in others. In sum, it was clarified that sea level variation had a meaningful impact on fluvial flood simulations.

Keywords: Fluvial flooding, Storm surge, Global river routing model, Global reanalysis of tide and surge

