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Flood Risk and Resilience Assessment for London

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ABSTRACT

Flood risk and resilience assessment have gained increased attention in recent years due to substantial flood impacts. However, computational efficiency remains a huge challenge for researchers and practitioners involved in flood risk modelling, especially for a growing number of mega cities. In this paper, a two-dimensional model based on cellular automata principles is developed and applied to assess flood risk and resilience for the whole London for the Global Innovation Initiative (GII) project. This approach was implemented in a parallel environment, which enables flood risk/resilience modelling over the entire area (1,572 km2) to be undertaken while also considering a large number of storm events. The use of the Graphical Processing Unit (GPU) approach significantly improves computational performance, while achieving required accuracy. Flood risk is calculated as a product of the multiple storm events with different maximum flood depths and probabilities and flood resilience is calculated using different measures based on flood duration and magnitude. Flood simulations were run at a 5m x 5m resolution, resulting in a total of 62.9 million computational cells. The simulation time for the entire London area is about 20.3 hours (Intel Xeon 3.20GHz, 18GB of main memory and GeForce GTX TITAN graphics card with 3072 cores and 12GB of memory). Maps are generated to reveal the spatial distribution of flood risk and resilience. The results obtained from London provide an in-depth understanding of the relationship between risk and resilience and help develop appropriate mitigation strategies.