Modelling floodplain inundation of the Mekong Delta using a regional hydrodynamic model with a view to future scenarios

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With a very flat, low-lying topography and immediate proximity to the coast, deltas are one of the most hazardous regions for flooding. Flooding does provide an important resource to distribute fertile sediment in these regions, but can also result in devastating loss of life and property, with perhaps the most potent recent example being the 2008 Irrawaddy Delta floods. Therefore, careful management of appropriate flooding is vital to ensure sustainable management of these delicate systems.
Deltas are becoming increasingly populous with an estimated 500 million people now living on them, with much of the growth in mega cities. Yet, these regions also provide an essential agricultural resource, resulting in a concentration of resources and people, and thus a high flood risk. This risk is growing disproportionately in developing countries, where most of the world’s most populous deltas are located. Future projections of sea level rise, subsidence and sediment delivery are predicted to significantly increase the risk in many of the world’s deltas. Flood inundation modelling of deltas at an appropriate scale can be applied to improve our understanding of the hazard. This work provides initial results of flood simulations on the Mekong Delta using a computationally efficient hydrodynamic model (LISFLOOD-FP) applied at the regional scale with freely available data.
The Mekong Delta, the world’s third largest delta, is densely populated and considered Southeast Asia's most important region for agricultural production. However, it is increasingly exposed to coastal erosion, subsidence and reduced sediment delivery, and thus there is a need to investigate the potential impact these pressures might have on future flood hazard. To enable this investigation it is first necessary to develop an efficient but sufficiently accurate hydrodynamic model of the delta.
Simulations were run across resolutions of 540m and 270m for a 6 year period between 2001 and 2007. Topographic data was taken from a custom bare earth version of SRTM developed at the University of Bristol, where a vegetation correction factor is obtained from ICEsat and MODIS data. River width data was supplied by the GWD-LR database. Further calibration data including gauge readings and bed elevation was supplied by the Mekong River Commission. Where bed elevation was unavailable a number of different methods were applied to estimate channel depth. These included a hydraulic geometry relationship approach and interpolating existing bed elevation along delta plain gradients. Tidal influences were considered by including several nearby gauges as downstream boundary conditions. Validation of results was achieved using satellite-derived flood inundation maps from the MODIS platform. Performance was also compared to other flood inundation models of the delta, including CaMa Flood. Results show that LISFLOOD-FP has considerable skill for the simulated period, with limitations largely occurring from terrain errors in the SRTM data.
This work demonstrates the potential of a regional scale hydrodynamic model to simulate flood hazard in deltas, providing an important resource towards assessing flood risk within these regions. It is envisaged that this work will enhance the representation of flood hazard in the risk portfolio of these complex systems. Further work is planned to run the model across a number of deltas under future scenarios that included sea level rise, subsidence, population growth, sediment delivery and runoff change.

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