Geophysical Research Abstracts
Vol. 15, EGU2013-11018, 2013
EGU General Assembly 2013
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Flood characteristics of the Haor area in Bangladesh

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In recent years the world has experienced deaths, large-scale displacement of people, billions of Euros of economic damage, mental stress and ecosystem impacts due to flooding. Global changes (climate change, population and economic growth, and urbanisation) are exacerbating the severity of flooding. The 2010 floods in Pakistan and the 2011 floods in Australia and Thailand demonstrate the need for concerted action in the face of global societal and environmental changes to strengthen resilience against flooding.
Bangladesh is a country, which is frequently suffering from flooding. The current research is conducted in the framework of a project, which focuses on the flooding issues in the Haor region in the north-east of Bangladesh. A haor is a saucer-shaped depression, which is used during the dry period (December to mid-May) for agriculture and as a fishery during the wet period (June-November), and thereby presents a very interesting socio-economic perspective of flood risk management. Pre-monsoon flooding till mid-May causes agricultural loss and lot of distress whereas monsoon flooding brings benefits. The area is bordering India, thereby presenting trans-boundary issues as well, and is fed by some flashy Indian catchments. The area is drained mainly through the Surma-Kushiyara river system. The terrain generally is flat and the flashy characteristics die out within a short distance from the border.
Limited studies on the region, particularly with the help of numerical models, have been carried out in the past. Therefore, an objective of the current research was to set up numerical models capable of reasonably emulating the physical system. Such models could, for example, associate different gauges to the spatio-temporal variation of hydrodynamic variables and help in carrying out a systemic study on the impact of climate changes. A 1D2D model, with one-dimensional model for the rivers (based on MIKE 11 modelling tool from Danish Hydraulic Institute) and a two-dimensional model (based on MIKE 21 modelling tool from Danish Hydraulic Institute) for the haors were developed. While the 1D model was calibrated well the calibration of 2D model was an issue due to the non-availability of measured data. The flood extent of the 2D model was calibrated to a limited extent with the remote sensing images. In order to keep the computing load within feasible limits the most-flood prone area of the region, often loosely defined as the deeply flooded area, consisting of about 15 haors was chosen as the model domain. Based on the simulation results corresponding to the 2004 pre-monsoon and monsoon floods the flood propagation within the model domain was studied and the characteristics of rivers (and areas) with fast and slow responses to flood waves were identified.
The following three characteristics of a flood hydrograph were considered: i) rising curve gradient ii) flood magnitude ratio (in terms of the average discharge) and iii) time to peak. The parameters were normalised in a scale of 0 to 1 and summed up to compute the normalised flood index. The normalised flood index is an aggregated indicator based on the flood hydrograph characteristics. The spatial and temporal distribution of the index have been studied. Initial studies on climate change indicate substantial impact on the region. Future studies will evolve around making use of remotely sensed data in improving the understanding of the hydro-meteorological characterisation of the area.

Keywords: flood characteristics, flood index, Haor, Bangladesh.