

CONTRIBUTION OF LARGE RIVER SYSTEM ON WATER LEVEL DUE TO A STORM

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INTRODUCTION

Bangladesh is a riverine country in South Asia, which contain about 700 big or small rivers. The major Ganges-Brahmaputra-Meghna river system makes the coast of Bangladesh more complex and disaster vulnerable area. This river system may or may not have its impact on the height of the water level due to a storm. This area is a suitable place for research, but there is no such mention of suitable research conducted in this area. Worth mentioning works done by some scholars are Dube et al. (2004), Agnihotri et al. (2006). All the works are important to the Bay-River interaction for the storm surge simulation, but these studies were also limited by the lack of a representation of proper geometry of the river system. Some of them considered idealized river system with constant water depth and some of them did not consider the proper tidal resume. The present study is a step towards the development of an operational surge forecasting nonlinear Bay-River interaction model that incorporates the major river system with realistic geometry. Both the bay and river model equations are discretized by finite difference method with central in space and forward in time and are solved by a conditionally stable, semi-implicit manner on a staggered Arakawa C-grid system. A stable tidal condition was made by forcing the sea level with the most energetic tidal constituent, M_2 , along the southern open boundary of the parent model (Bay model). The developed model was applied to foresee sea-surface elevation associated with the catastrophic cyclone 1991 and a recent cyclone MORA 2017 along the coast of Bangladesh. We also investigated how the river influences the sea surface elevation with and without fresh water discharge. We also intend to investigate the effect of river discharge with sediment. It is observed that the water levels are found to be influenced by the river system.

MODEL RESULTS

This present study has found that a large river has a significant role in the Bay-River interaction phenomena. We have investigated that the Ganges-Brahmaputra-Meghna system reduces the overall maximum water level 31% near the interaction point due to the penetration of piled up water inside the Meghna river. This study also found a negligible impact on the water level at the far distance from the river mouth. That's why, we have found a negligible impact on river systems at the Coxbazar tide station. We have also investigated that the maximum water level reduces (2-3) % due to the length of the breath of the river at the junction point. Cyclone MORA has a small effect on the Ganges-Brahmaputra-Meghna system due to the path of the cyclone and landfall location. Figure 1 explains the different purport of the influence of river on water level due to a storm surge. We have found that the simulated data agree well with the observed data, but the scarcity of observed data is very high due to the disastrous weather. The circle mark represents the observed data that equivalent to the simulation results. The other color mark and lines

indicate the different category result. Figure 2 represents the result of recent cyclone MORA 2017.

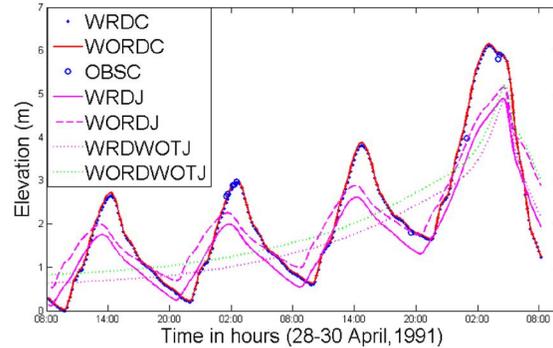


Figure 1 - Water level due to the April 1991 cyclone, WRDC indicates Water level with river discharge effect at the Coxbazar tide station. Similarly, Water level without river discharge (WORDC), Observed (OBSC), Water level with river discharge at Junction point (WRDJ), Water level without river discharge (WORDJ), Water level with river discharge at Junction point without tide (WRDWOTJ), Water level without river discharge and without tide (WORDWOTJ)

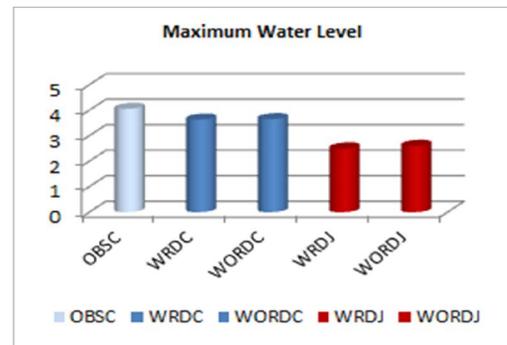


Figure 2 - Maximum Water level due to the cyclone MORA,

ATTENTION

The inclusion of the river in our model shows a decrease in the maximum surge level up to 31% at the location of the river mouth. Thus, the response of a river on the storm surge development is appreciable and cannot be ignored for storm surge prediction purposes.

REFERENCES

- Dube SK, Chittibabu P, Sinha PC, Rao AD (2004): Numerical modeling of storm surge in the head Bay of Bengal using the location specific model, Nat Hazards, 31:437-453.
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