



Salinity in Coastal Bangladesh: Present-Day-Condition & Future-Scenario

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Abstract

Increase of salinity levels in river and estuaries of Bangladesh is one of the major concern in coastal region and further climate change will worsen the situation. In this study, Delft3D salinity model was applied to predict salinity levels of end of twenty-first century due to changed upstream flow and sea level rise. Salinity maps were prepared for comparing present-day-condition and end-century scenario to generate an overview on the level of future landward salinity intrusion. Results generated from the model provided a good estimate of the future salinity levels in the estuaries of the region. Estuarine salinity will increase and propagate landwards by the end-century, compared to the condition of present-day.

Introduction

The flow generated in the upper catchment of the Ganges-Brahmaputra-Meghna (GBM) basins is drained through the estuarine systems of the Delta. Changed upstream flow and rising sea level due to global climate change increases the salinity of estuaries through salt water intrusion. Considering the volume of freshwater and saltwater carried by the estuarine system and unique hydro morphological characteristics, the estuarine system of the Ganges-Brahmaputra-Meghna (GBM) delta was divided into three parts namely the Eastern Estuarine System (EES), the Central Estuarine System (CES), the Western Estuarine System (WES) (Fig. 1). In this study, Delft3D model was applied to predict salinity levels of end (2092) of twenty-first century, after calibration and validation using currently available data. Change of salinity values indicates increase of landward salinity intrusion by the end century.

Result

The maximum salinity had been found in pre monsoon season (February to June) and most of the observation stations had maximum salinity during late April to May and June. The result of the model showed:

1. The salinity of most of the EES & WES increased by 0-8 ppt (Fig. 4)
2. Whereas, CES had faced significant salinity intrusion (up to 20 ppt) by the end century. It is like a propagation of salinity from Meghna that intrudes further deep of CES. (Fig. 3 & 4)

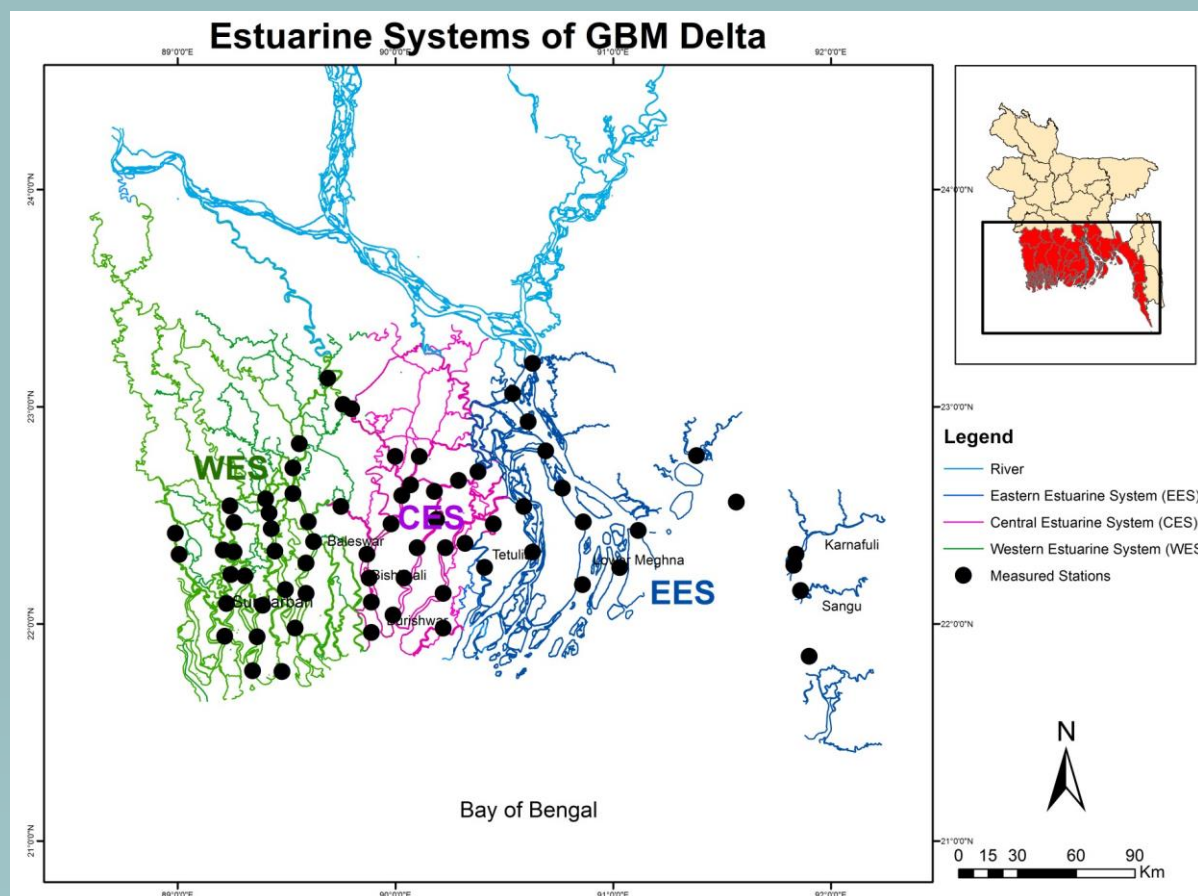


Fig. 1: Study Area with Model Validation Locations

Model Description, Calibration and Validation

Upstream boundaries (Bangladesh Water Development Board (BWDB) for the year 2011 and INCA model for future scenario of 2092) were specified as measured discharges, and downstream boundaries were specified as tidal water levels (GCOMS) at sea. The year of 2011 was selected as base year as measured salinity data for maximum number of different stations for this year were available in BWDB's data archive. Spatially variable roughness, eddy viscosity and diffusivity were used for calibration and Validation.

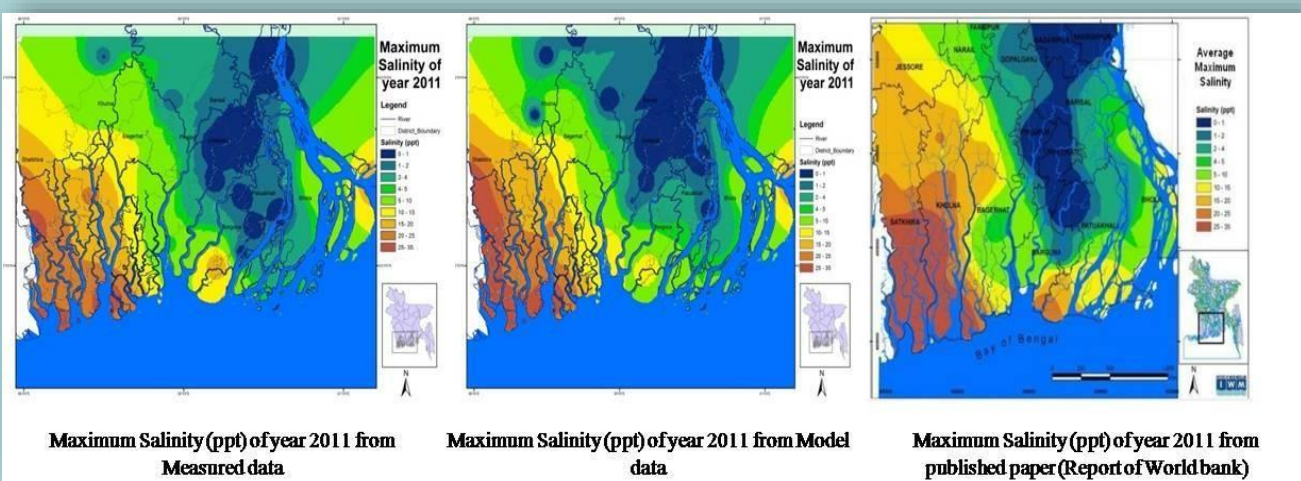


Fig. 2: Validation of model by comparing model data with measured data, and World Bank study

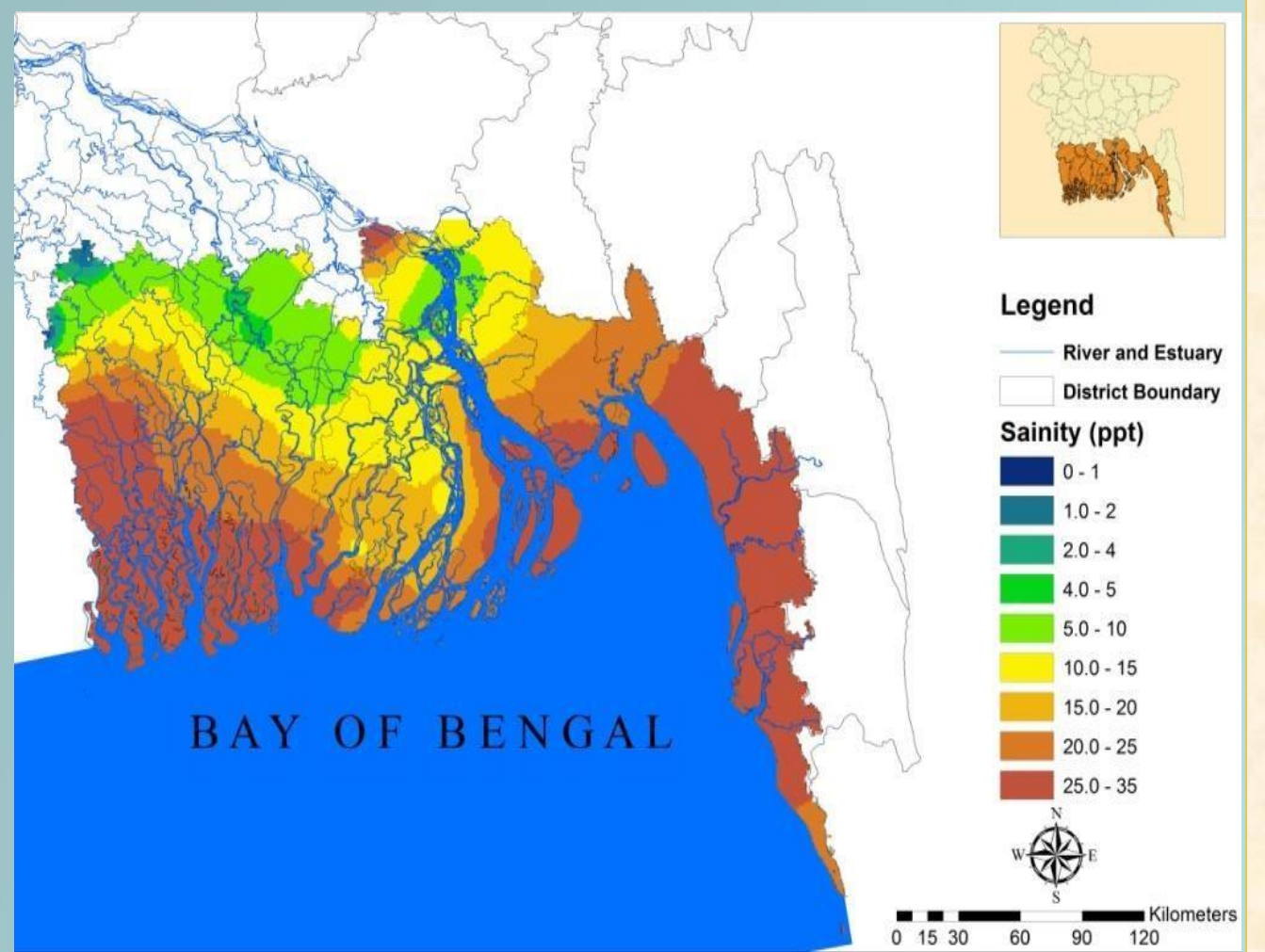


Fig. 3: Maximum salinity of year 2092

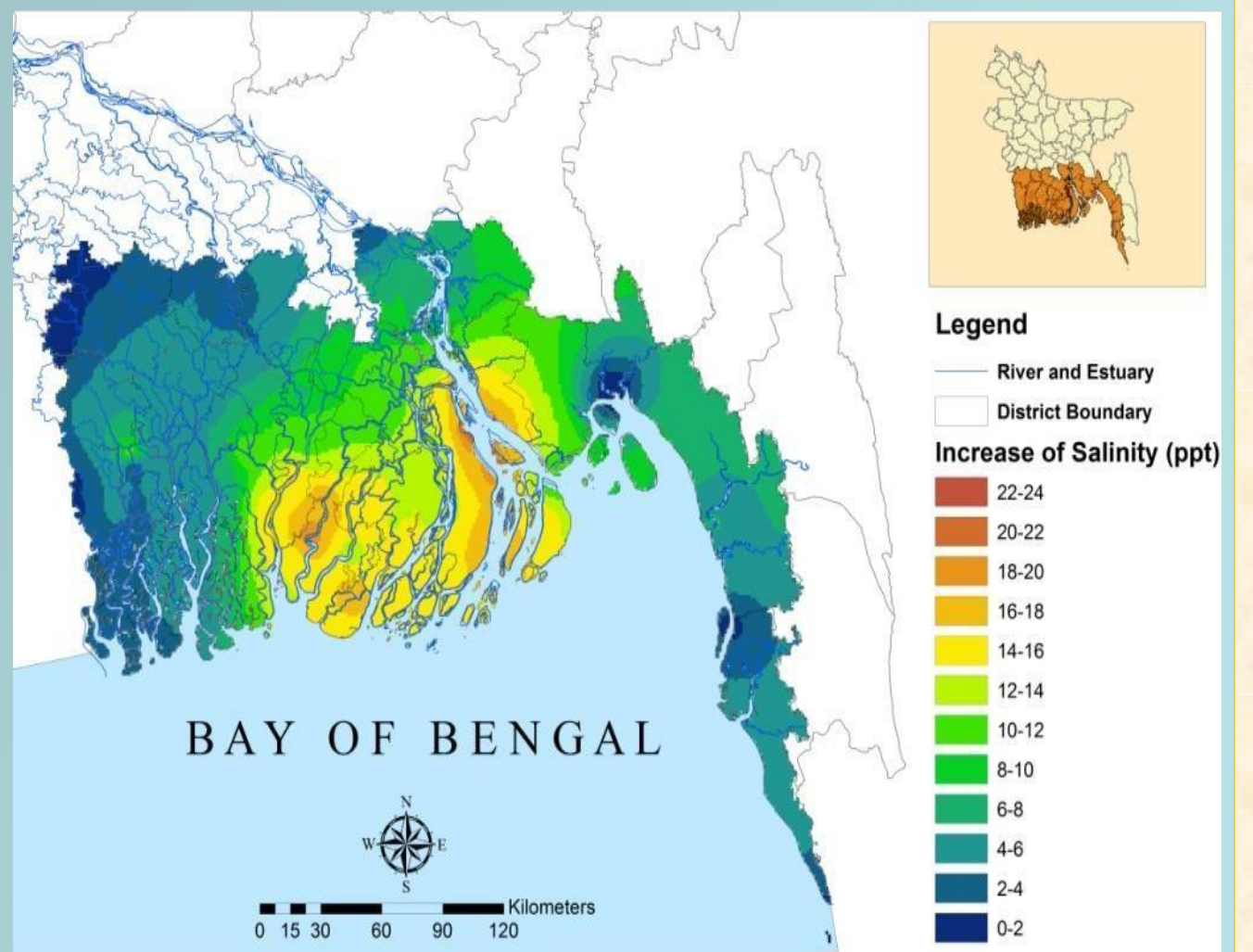


Fig. 4: Increase of salinity value compared to base year (2011)

Conclusion

From the results it was apparent that salinity intrudes spatially from EES gradually towards CES. At the end of the century, it is shown from the model result that WES will face salinity more than 25 ppt or more propagating aggressively inwards into the freshwater systems. However, it is alarming that the previously relatively fresh areas of EES and CES are facing drastic salinity intrusion (more than 15 ppt) by the end of century.

