Salinity Intrusion and Water Availability under changing climate in the Coastal Ganges Delta in Bangladesh

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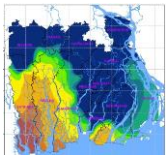
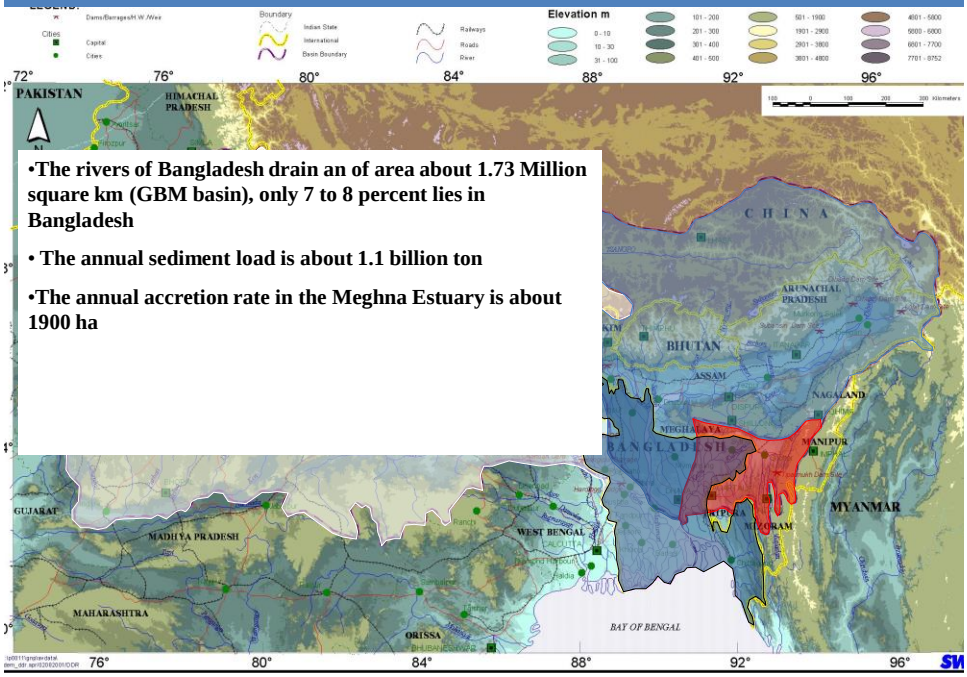
Zahir-ul Haque Khan



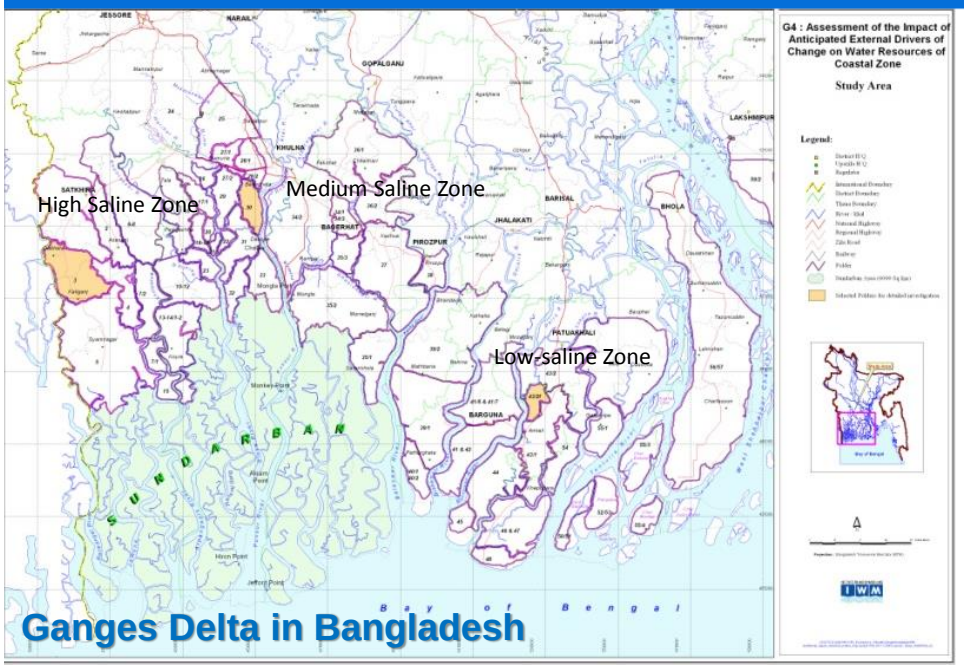

Physical Setting of Bangladesh

THE GANGES, BHRAMMAPUTRA AND MEGHNA BASINS



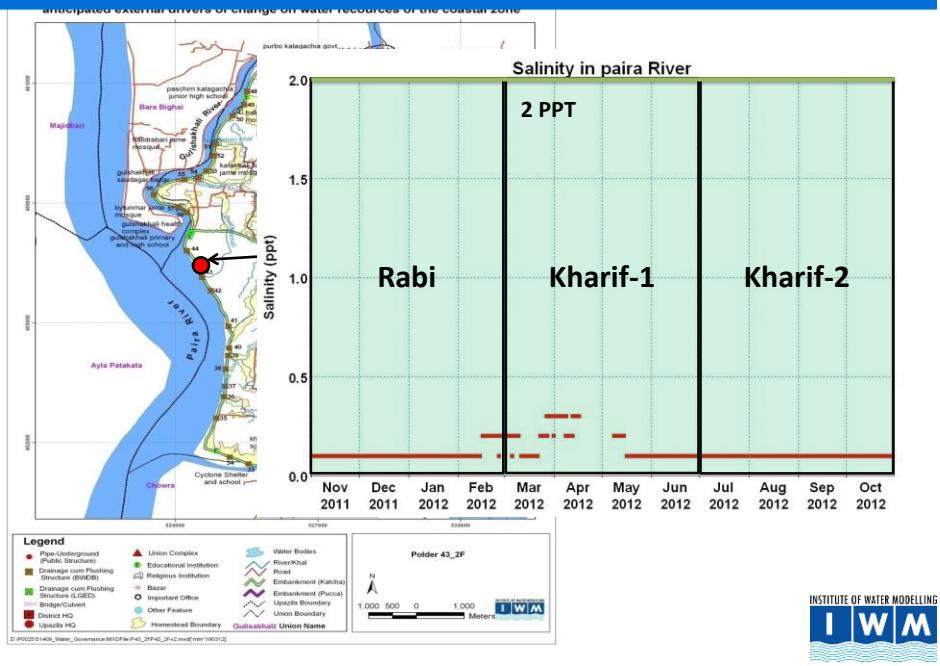
- **The rivers of Bangladesh drain an of area about 1.73 Million square km (GBM basin), only 7 to 8 percent lies in Bangladesh**
- **The annual sediment load is about 1.1 billion ton**
- **The annual accretion rate in the Meghna Estuary is about 1900 ha**

Study Area



Ganges Delta in Bangladesh

Temporal variation of Salinity: Low saline zone



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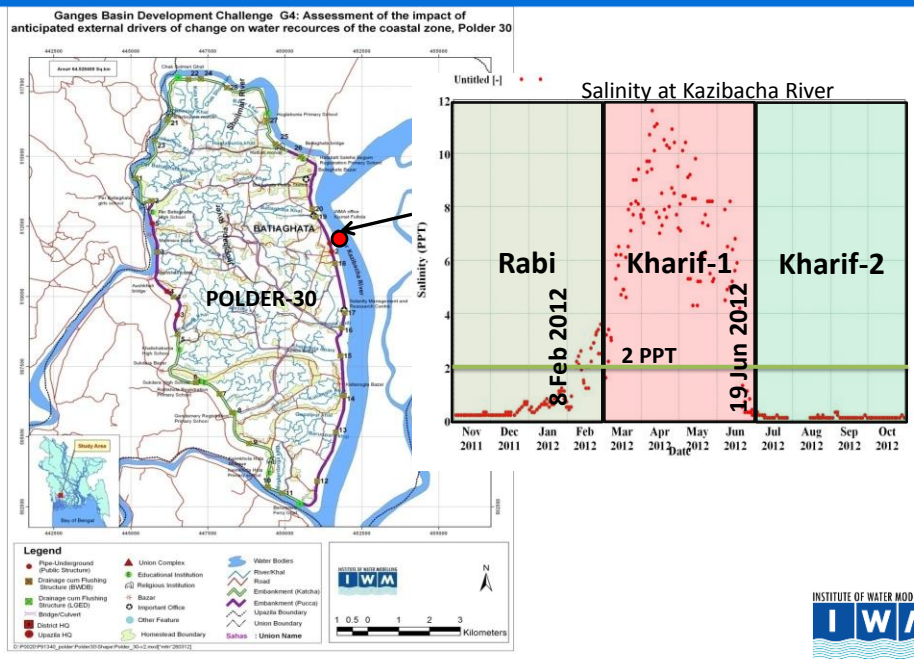
Temporal variation of Salinity: Medium saline zone



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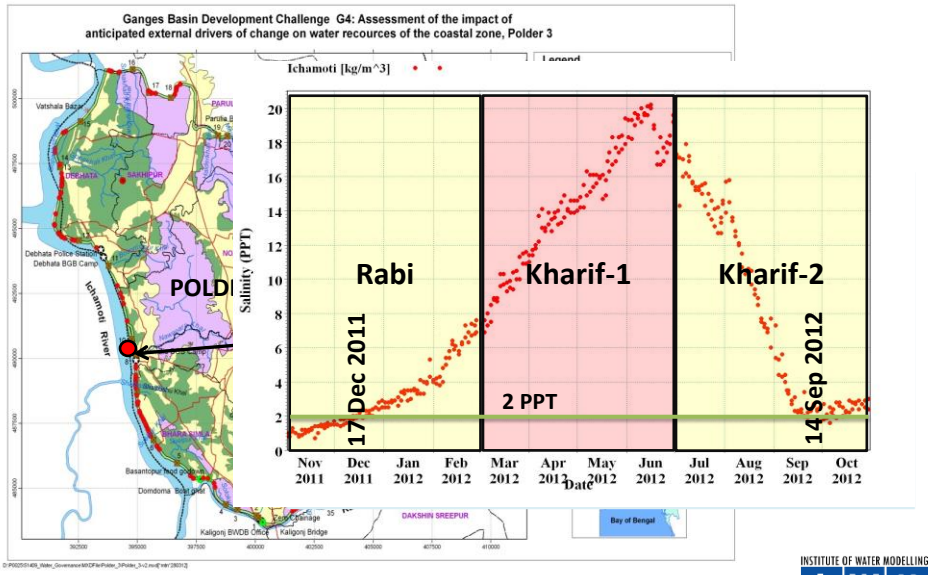
Temporal variation of Salinity: High saline zone



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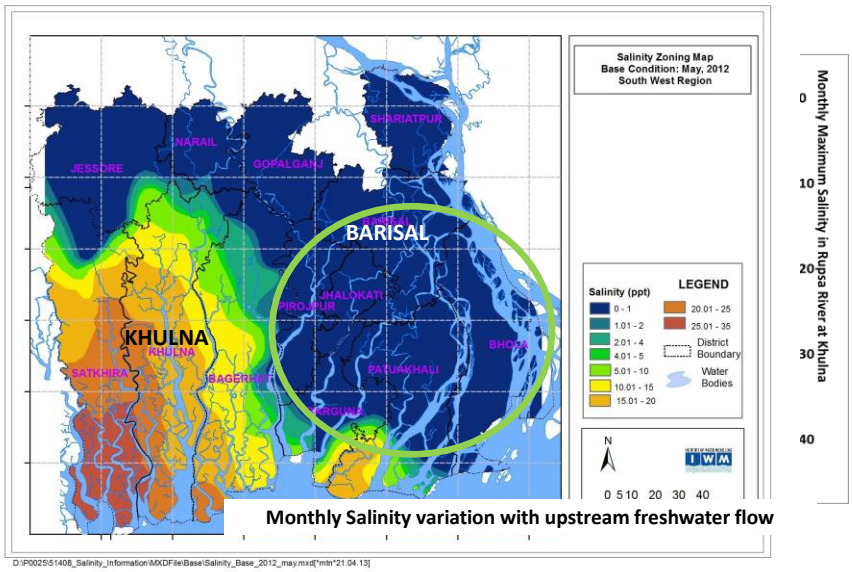
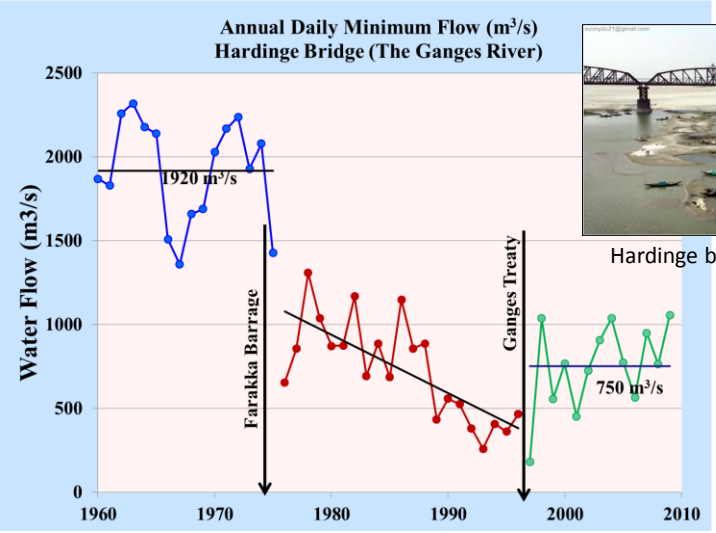
Spatial and Seasonal Variation of Salinity in the Coastal Ganges in Bangladesh

May, 2012 **Base Year: 2012**



Historical Trans-boundary Flow in the Ganges

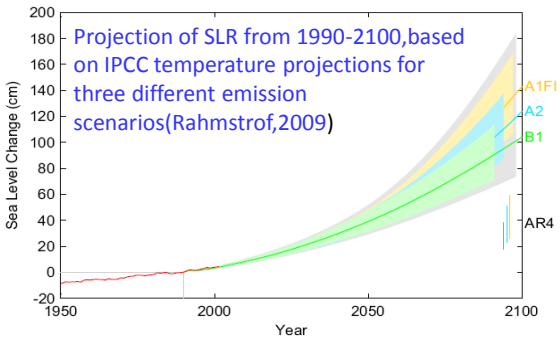
Transboundary Flow



Hardinge bridge in dry season

Driver: Sea Level Rise

Relative Mean Sea Level (RMSL) = Global SLR + Local Effect



Rahmstorf (2009) prediction for Global SLR is 124cm, A1B in 2100 over 1990 water level

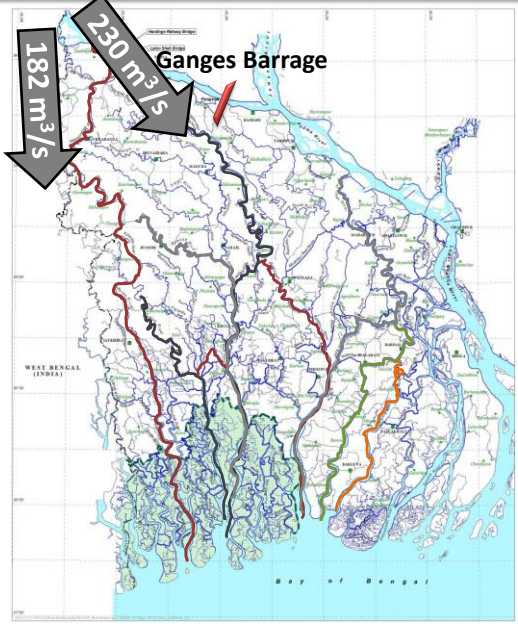
Local effect (from past studies and WL trend analysis) is about 5mm/yr

Considering Global and local effects the SLR is 22cm in 2030 and 52cm in 2050 above 2011-2012 WL

Temperature ranges and associated sea-level ranges by the year 2100 for IPCC emission scenarios

Scenario	Temperature range, °C above 1980–2000	Model average, °C above 1980–2000	Sea-level range, cm above 1990	Model average, cm above 1990
B1	1.4–2.9	2.0	81–131	104
A1T	1.9–3.8	2.6	97–158	124
B2	2.0–3.8	2.7	89–145	114
A1B	2.3–4.3	3.1	97–156	124
A2	2.9–5.3	3.9	98–155	124
A1FI	3.4–6.1	4.6	113–179	143

Driver: Infrastructure development (Ganges Barrage)

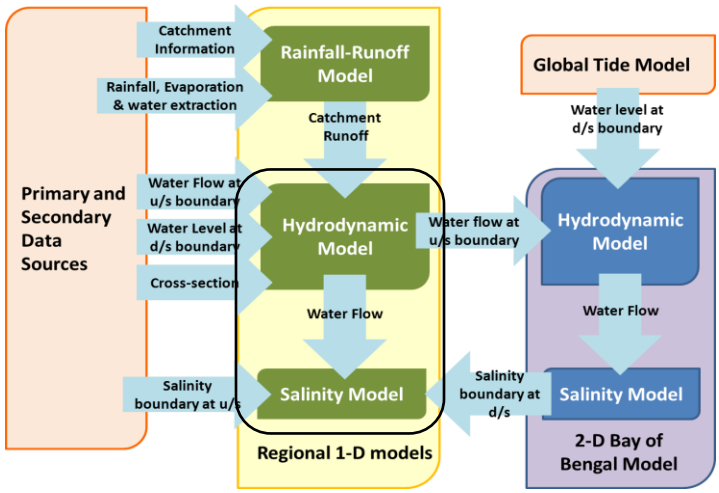


1. Hisna ~ Mathavanga ~Kobadak ~ Kholpetua
2. Kobadak ~ Sibsa
3. Bhairab ~ Rupsa ~ Pussur
4. Gorai ~ Rupsa ~ sholmari ~ Sibsa
5. Gorai ~ Nabagonga ~ Atai ~ Rupsa ~ Pussur
6. Gorai ~ Madhumati ~ Baleswar
7. Arial Khan ~ Baleswar
8. Arial Khan ~ Biskhali
9. Arial Khan ~ Buriswar

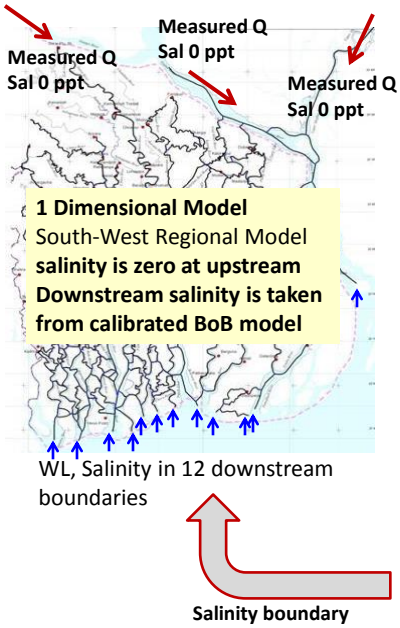
Salinity Modelling

Methodology

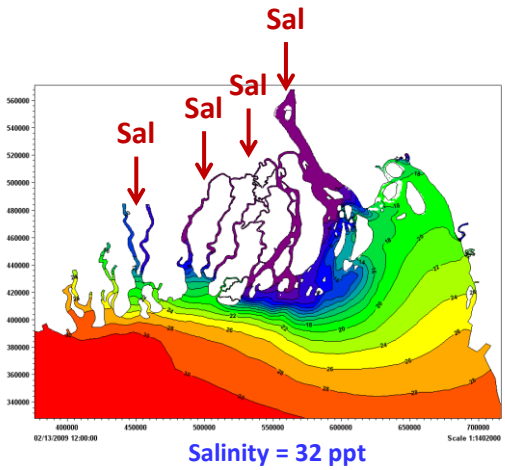
South-West Regional Salinity Model



Boundary Generation

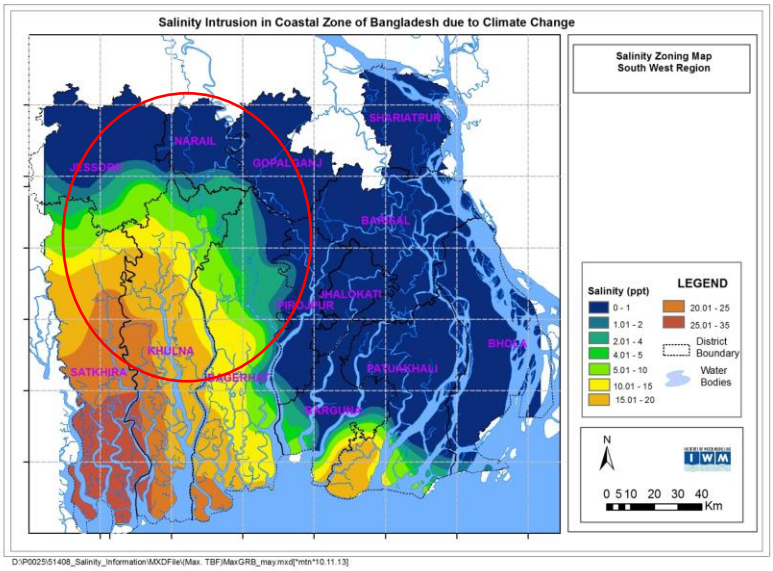


2 Dimensional Model (Bay of Bengal Model)
Measured salinity at upstream boundaries
Sea Salinity = 30 to 35 ppt



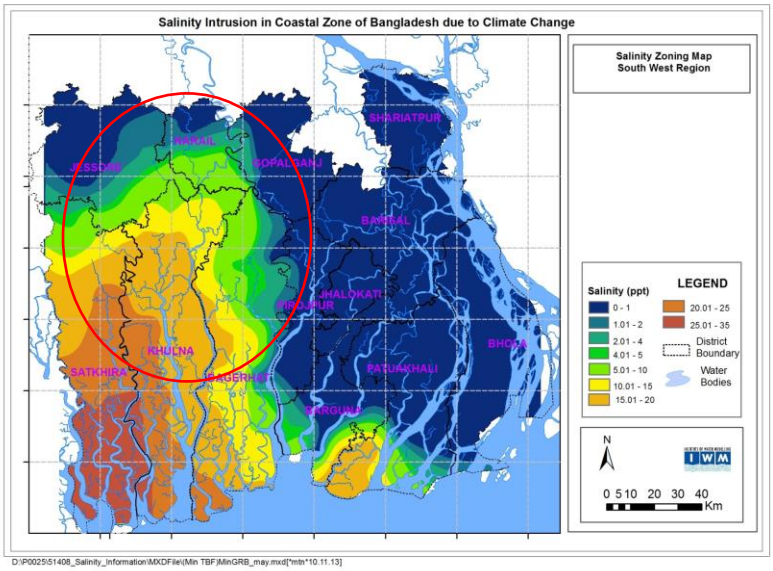
Effect of Transboundary Flow :South-west Zone of Bangladesh

May, Base condition with maximum Transboundary flow under Ganges Treaty



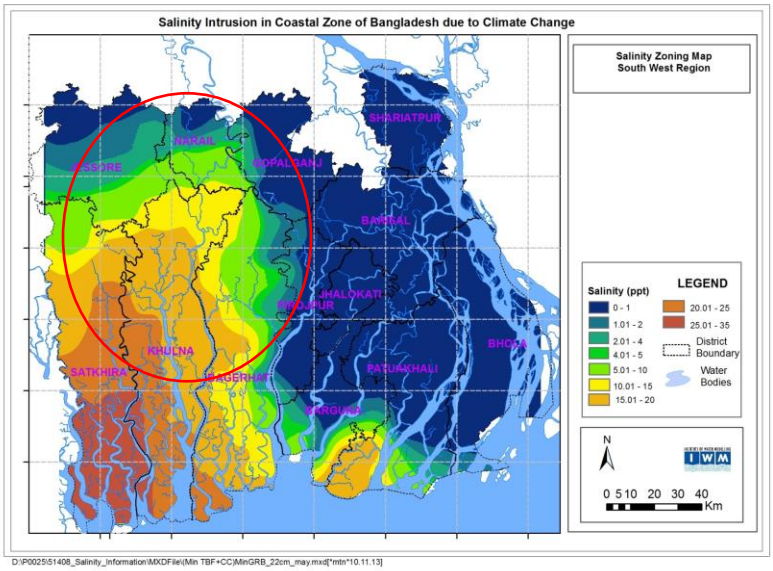
Effect of Transboundary Flow :South-west Zone of Bangladesh

May, Base condition with minimum Transboundary flow under Ganges Treaty



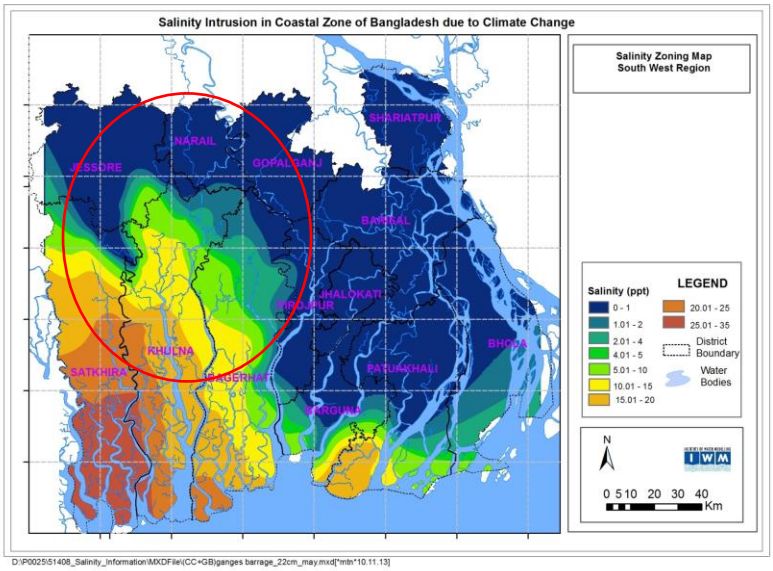
Effect of Climate Change and Transboundary Flow: South-west Zone

May, 2030 climate change (A1B) with minimum Transboundary flow under Ganges Treaty

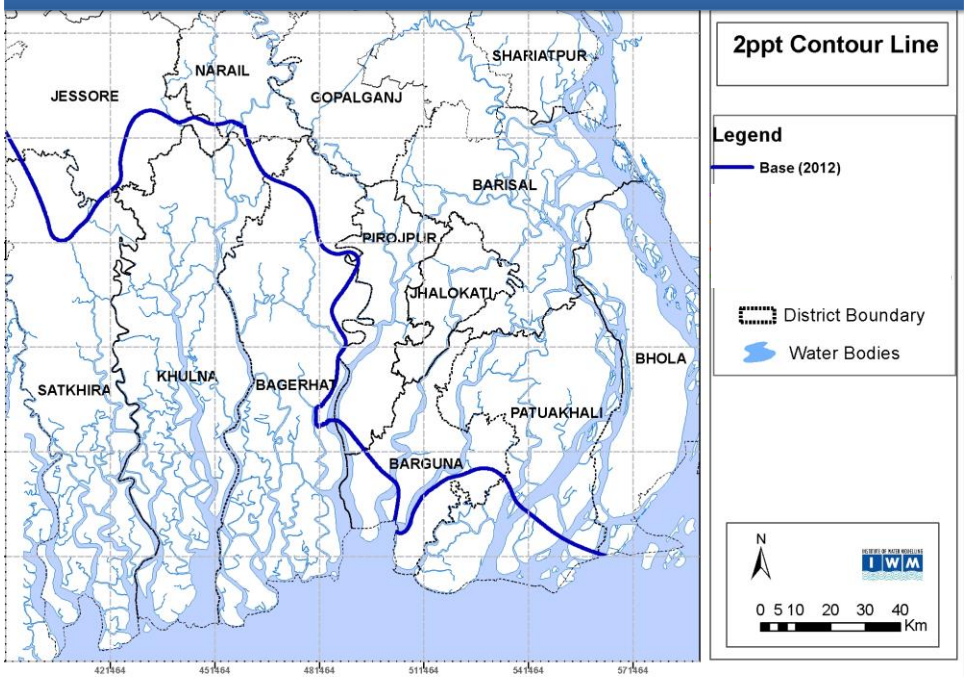


Effect of Infrastructure Development: Ganges Barrage

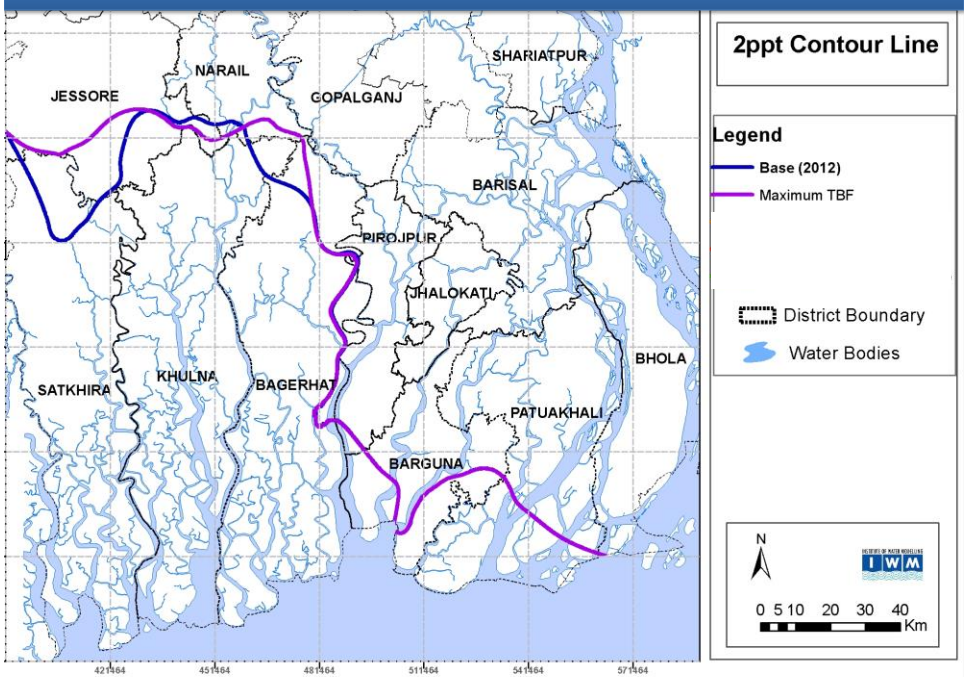
May, 2030 Climate change (A1B) with Ganges Barrage



Effect of Drivers: Trans-boundary flow, Climate Change and Ganges Barrage



Effect of Drivers: Trans-boundary flow, Climate Change and Ganges Barrage



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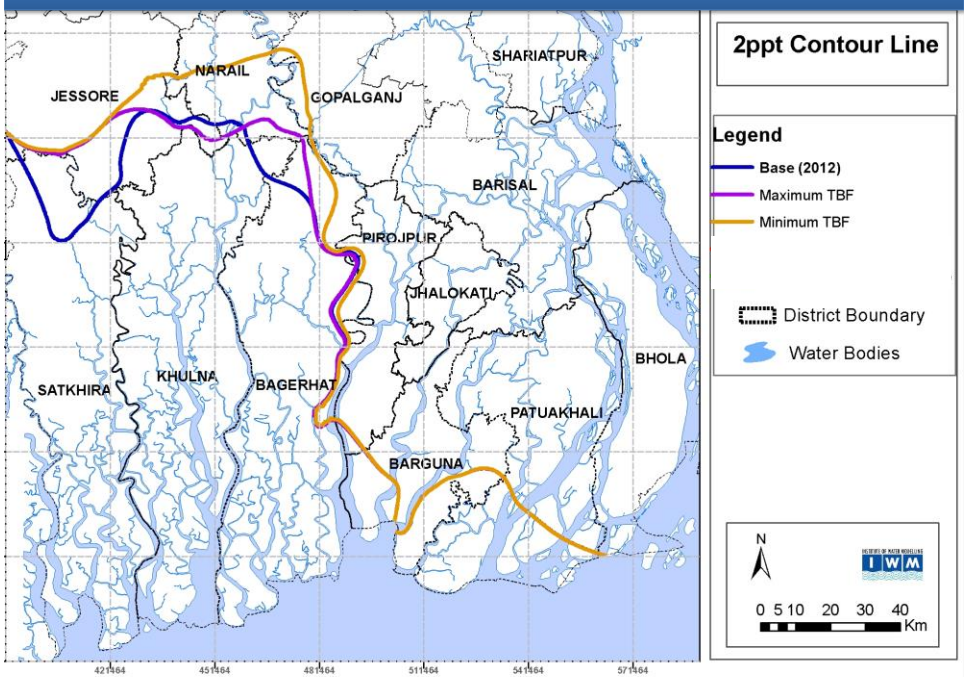
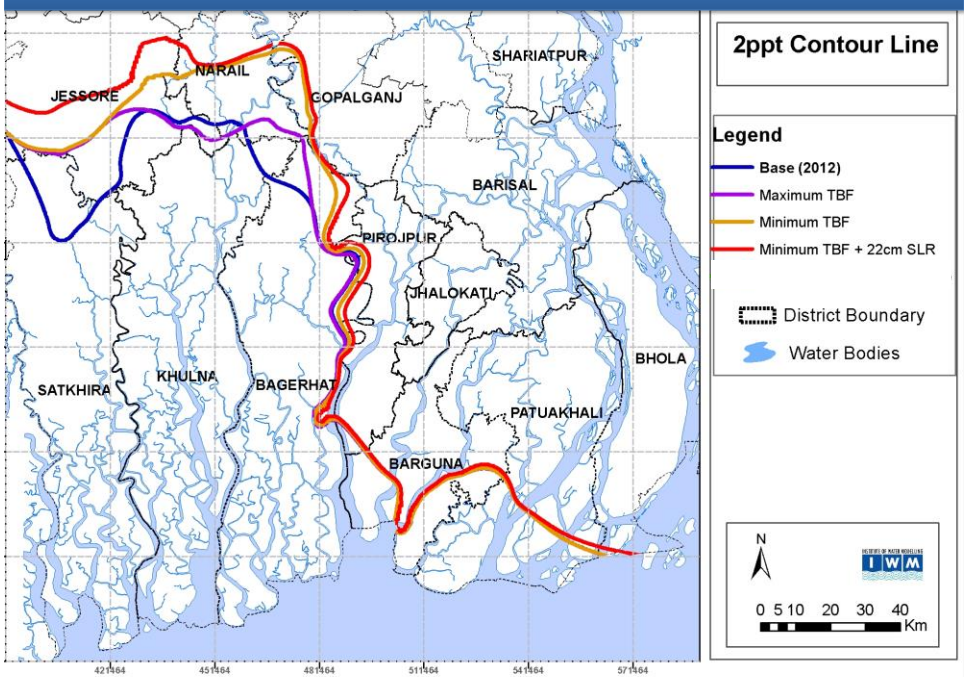
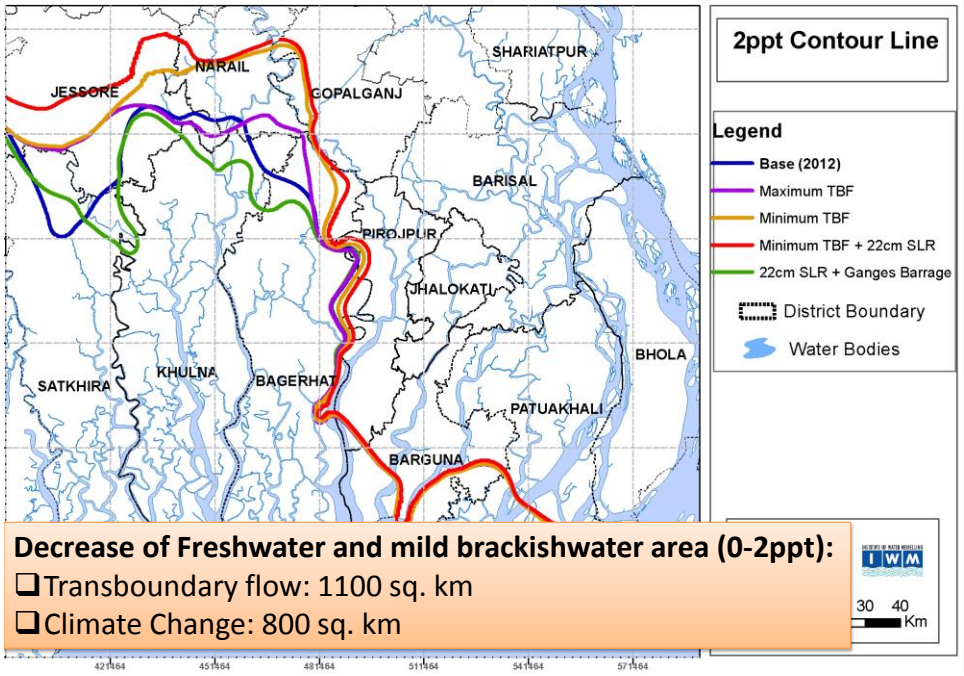


Effect of Drivers: Trans-boundary flow, Climate Change and Ganges Barrage



Effect of Drivers: Trans-boundary flow, Climate Change (2030, A1B) and Ganges Barrage

Salinity Intrusion in Coastal Zone of Bangladesh due to Climate Change

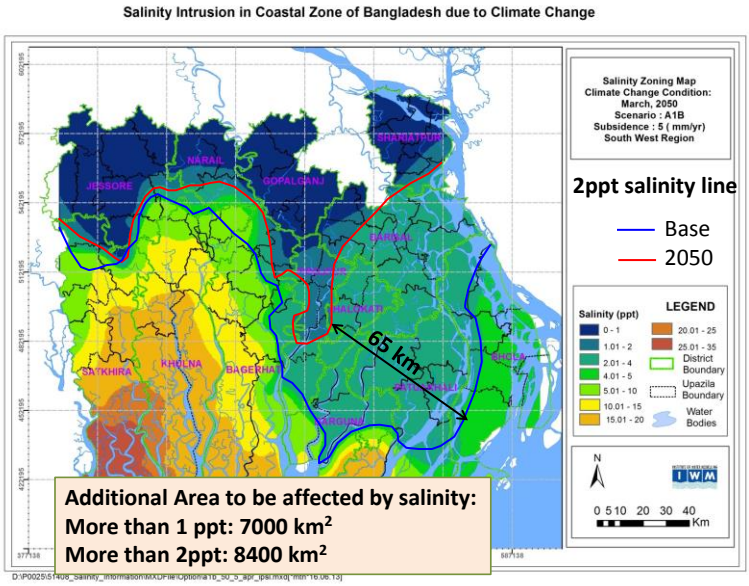


Decrease of Freshwater and mild brackishwater area (0-2ppt):

- ❑ Transboundary flow: 1100 sq. km
- ❑ Climate Change: 800 sq. km

Effect of Sea Level on 2ppt Salinity contour (A1B,2050)

A1B scenario, March 2050



CONCLUSIONS

- The present fresh water pocket in the south central zone (Barisal) is likely to be lost with 52cm sea level rise, which would have effect on irrigated agriculture, freshwater fish habitat and drinking water

- Regional Cooperation is crucial for trans-boundary flow sharing for salinity Control in the changing climate
- Adaptation measures like Ganges Barrage is important for water security under climate change
- New salt tolerant cropping technology needs to be introduced


Thank You