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Sinuosity analysis of Barak River from Fulertal to Badarpur Ghat and its significance in project planning

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Aim

- The study aims to analyze the morphological changes of the Barak region and understand the morphological changing behaviour of river Barak by computing segment-wise sinuosity index using remote sensing data.

- To compare the changes in sinuosity with respect to time in the river reach selected based on a visual analysis of the stability of the centrelines in the period 1990-2020.

- A reference year (1990) was chosen.

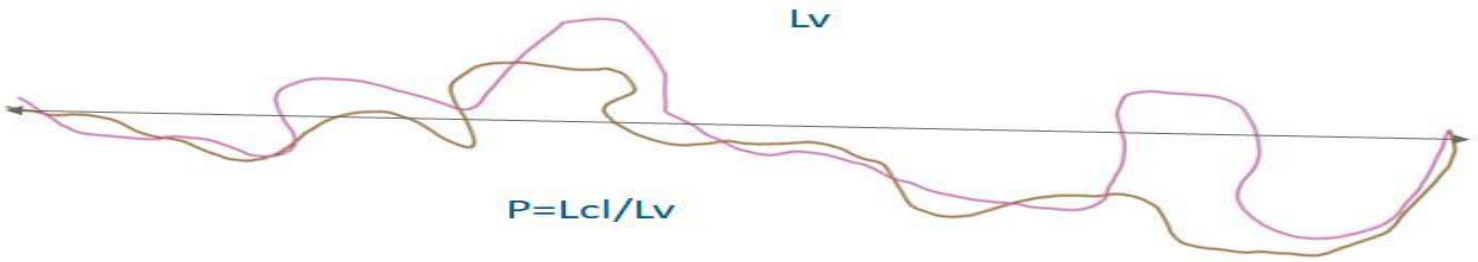
- Sinuosity for different years based on the chosen reference year and river reaches. Inputs are centrelines at start and end points of the reaches.

Meandering

- Meandering of rivers - flow of rivers in sinuous curves
- Cause of meandering – Loss of transport Capacity of Rivers due to flat slope resulting reduced flow speed
- Sinuosity - used to define the degree of meandering of a riverbed for classification geomorphological river types.

Sinuosity

- The sinuosity is defined as the ratio between the length of the river centreline and the length of the valley axis (*Leopold, 1963*).



- Channels classification based on Sinuosity
- Straight channels (P < 1.05)
- Sinuous channels (P = 1.05–1.5)
- Meandering channels (P > 1.5) (Das, 2014).

Use of Sinuosity Analysis

- Flood and drought management
- Land/floodplain management
- Management of river erosion and sedimentation
- Management of river ecology and habitat suitability
- Management of water infrastructures for drinking water agriculture, water transport, (dams, reservoirs, barrages, canals, inland waterways)

Barak River

- Barak is one of the major rivers of North Eastern India that originates from Japvo mountain of Manipur hills at an altitude of 3,015 m.
- It lies between East longitudes 90º00’ to 94º30' and North latitudes 22º48' to 25º48’.
- From the origin to the Indo-Bangladesh border, the Barak River flows for 564 km.
- The drainage area of the sub-basin lying in India is 47,439.86 sq km.

S.No	River name	Approximate Length of River (in km)	Highest Elevation Point (in m)	Lowest Elevation Point (in m)	Difference in Elevation (in m)	Longitudinal Slope	
1	Barak upto Fulertal	379	1000	27	973	1 in	390
2	Fulertal to A P Ghat	55	27	22	5	1 in	11000
3	A P Ghat to B P Ghat	61	22	16	6	1 in	10167

Data used

- In the study Google Earth Engine (GEE) platform and the Geographic Information Systems (GIS) technique, remote sensing images/Landsat images are used to analyse the channel planform features of the freely meandering river channel in the Barak River in selected reach from Fulertal to Badarpur Ghat (BP Ghat).

Methodology

- Analysis is based on advanced remote-sensing data (satellite images) processing techniques and ground measurement data complemented with expert judgement.
- The methodology for meandering reaches is summarized as follows:
  - Determination of river centreline
  - Determination of meandering parameters like Sinuosity, River width, Centreline and Bank shifting of *Barak river*

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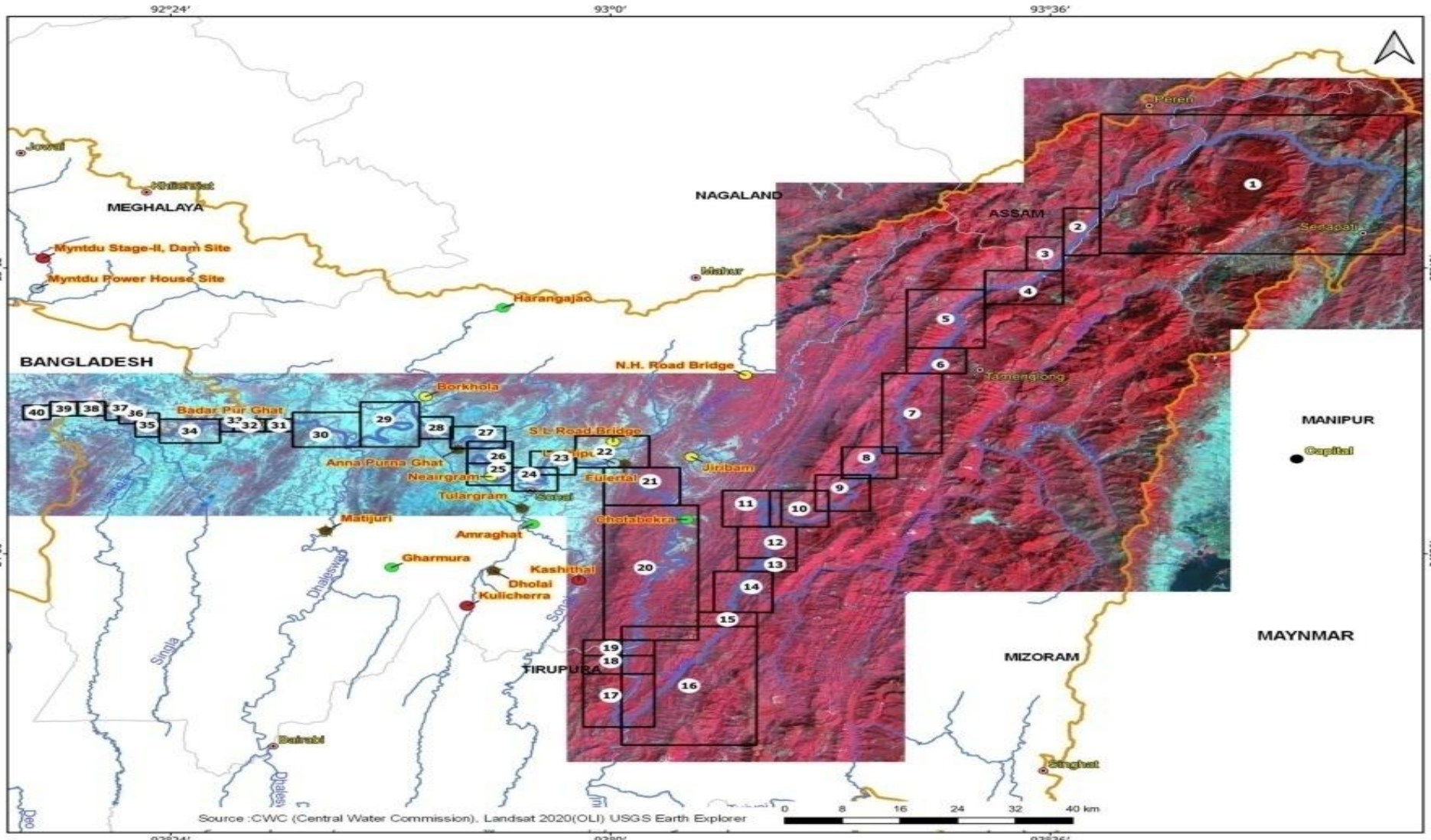

10-12 October 2022 at Jaipur, Rajasthan (India)

Sinuosity of River Barak in different Reaches

Reach No.	Reach Name	1990	2005	2020	No. of Bends	Remarks
21	Jirimukh to Nutan Fulertol	1.28	1.28	1.28	-	Stable Reach , no change in Sinuosity in 30 years
22	Nutan Fulertol to Cihirpar	1.08	1.08	1.08	-	Stable Reach , no change in Sinuosity in 30 years
23	Cihirpar to Kaptanpur I	1.59	1.61	1.66	2	Sinuosity has increased over a period o f 30 years, Meandering Reach
24	Kaptanpur I to Satkarakandi I	3.74	1.71	1.63	1	Sinuosity decreased from 3.74 to 1.71 due to cut off and straightening of reach. Meandering Reach
25	Satkarakandi I to Dhamalia	1.90	1.68	1.76	3	Meandering Reach

Reach No.	Reach Name	1990	2005	2020	No. of Bends	Remarks
26	Dhamalia to Kashipur	1.79	1.79	1.77	4	Meandering Reach
27	Kashipur to Tarapur	1.82	1.84	1.83	5	Meandering Reach
28	Tarapur to Ujangram	1.41	1.41	1.41	4	Stable Reach
29	Ujangram to Shridharpur	2.84	2.89	2.94	8	Meandering Reach
30	Shridharpur to Badarpur Town	1.39	1.42	1.45	3	Stable Reach

Out of the 10 reaches, 6 reaches show Meandering reach which may be morphologically active depending upon the variation in Sinuasoty Index over these 30 years.

Year	Fulertal To AP Ghat (River Length in km)	AP Ghat to BP Ghat (River Length in km)
1990	65	59
2005	55	60
2020	55	61

Temporal variation of Barak river length from Fulertal to BP Ghat

Conclusions

- Barak river is actively meandering river from Fulertal to BP Ghat reach where it flows through the alluvial floodplain
- The sinuous length of the river from Fulertal to BP Ghat is 115 km whereas the aerial distance is only 44 km
- The maximum sinuosity of the active reach is around 3
- There are nine oxbow lakes in the floodplain of Barak between Fulertal to BP Ghat.
- Series of cutoffs, translation, and shifting of meander bends can be observed. In left side tributaries such as Sonai, Dhaleswari, Manu, Khowai, and Gumati are meandering rivers. The Channel shifting of Barak is arrested by the dissecting hills at places.

Conclusions

- The top width of the Barak river in the alluvial plain is more or less the same for the entire stretch of 115 km
- Flood embankments and bank erosion protective measures are also influencing the planform changes of these rivers by disconnecting the river and floodplains
- Currently, Reach No. 29 of mainstream Barak with 8 bends in the river is actively meandering.
- There is no in-channel/braiding pattern of erosion and sedimentation observed from the satellite imageries in the Barak river
- In the active reaches as identified in the study, there is need to give due attention for planning of river protection work, planning of water resources projects, safety of inhabitations and river stabilisation works

THANK YOU!!