

Temporal Mapping and Monitoring of Migratory Behaviour of Kali River Using Remote Sensing and GIS Technology

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Abstract - Rivers are lifeline of the planet earth. It has been seen that ancient civilizations were developed along the river but in the current scenario most of the development is being done along the roads or highways but still depends on river. Rivers changes its course over time due to sediment load, erosion activity and huge amount of water. In the present investigation river channels have been digitized in different years for temporal mapping and monitoring by overlaying the layers which results in identifying the pattern of changing course of Kali River with the help of multivariate satellite data using GIS software and places have been identified which have drastic migration of river channel. After identifying places, ground verification has been carried out. Results describe where is migration have maximum and minimum and its impact on land use, settlement and agricultural land.

Key Words: Temporal changes, Migration, Multivariate satellite data, GIS.

1. INTRODUCTION

Kali river originated from Anthawada town Jansath tehsil of Muzaffarnagar district in Uttar Pradesh. This river ventures a distance of almost 498 Km from its origin point and goes through Muzaffarnagar, Meerut, Ghaziabad, Bulandsahar, Aligarh, Etah, Farukhabad and Kannauj prior to merging into Ganga River upstream of Kannauj, in which study area covers only 4 districts which are Etah, Mainpuri, Farrukhabad and Kannauj and covers a distance of 168.2 Km along in this stretch of river, 5 points have been identified which demonstrate maximum migration in the area alongwith their different direction because the path of river is in zig-zag pattern. It is also known as serpentine structure present in the study area.

Fig -1: Location Map

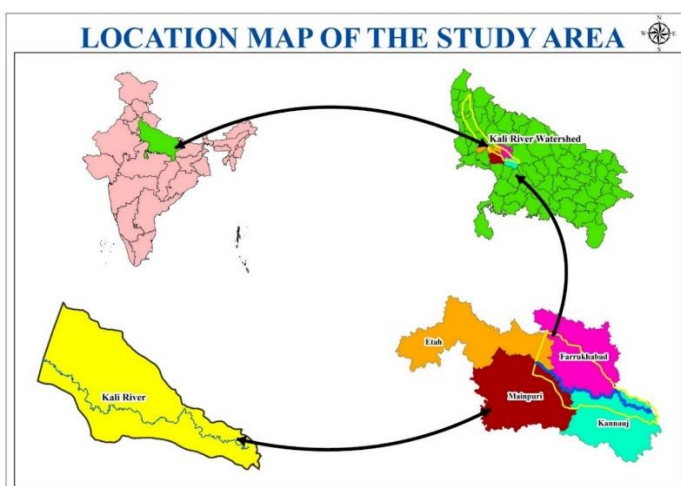
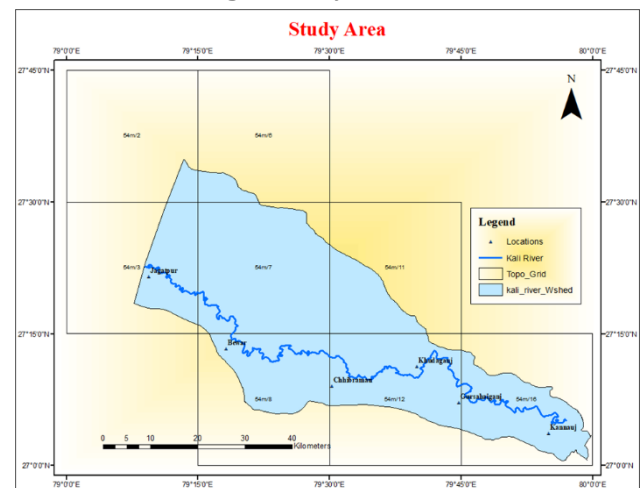


Fig -2: Study Area



2. DATA AND SOFTWARE USED

- Survey of India Topographical Sheets: Corresponding to 54M/2, 54M/3, 54M/6, 54M/7, 54M/8, 54M/11, 54M/12)
- Multivariate Landsat satellite data for the year 1990, 2000, 2010, 2015 and 2020.
- Arc GIS Software
- Erdas Imagine Software

3. METHODOLOGY

For the identification of changing pattern of Kali River during the year 1990 to 2020, Multidate Landsat satellite data of the study area for 1990, 2000, 2010, 2015 and 2020 has been downloaded from USGS. After downloading the data layer stack, mosaic and image enhancement techniques have been applied and AOI (Area of Interest) has been extracted from the data in the Erdas Imagine software. After that online digitization of river channel for the different years have been carried out using ArcGIS software. By the overlaying the different layer of river channel of various years we have identified the changes in the course of river channel from 1990 to 2020 and identified the places where the maximum migration of river channel has been taken place. Total 5 places have been identified with drastic changes in this study of the river channel.

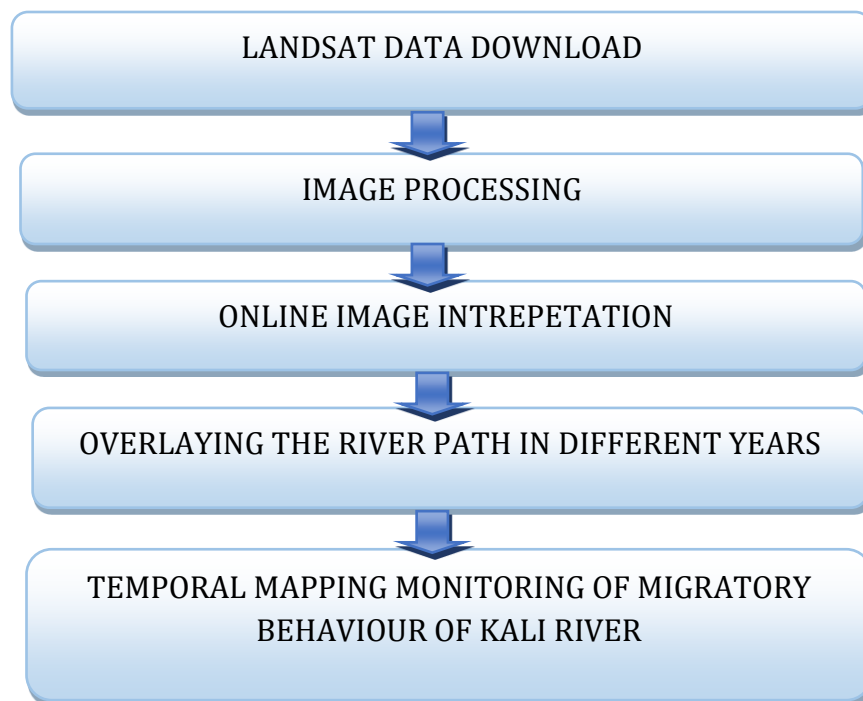


Fig -3: Flow diagram of methodology

4. RESULT AND DISSCUSSION

The map demonstrates the changes in river configuration from the year 1990 to 2020. During these years river changes its channel several times. With the help of temporal monitoring some of the places have been identified at which course of river drastically migrated. Migration of river can create havoc to livelihood along its course.

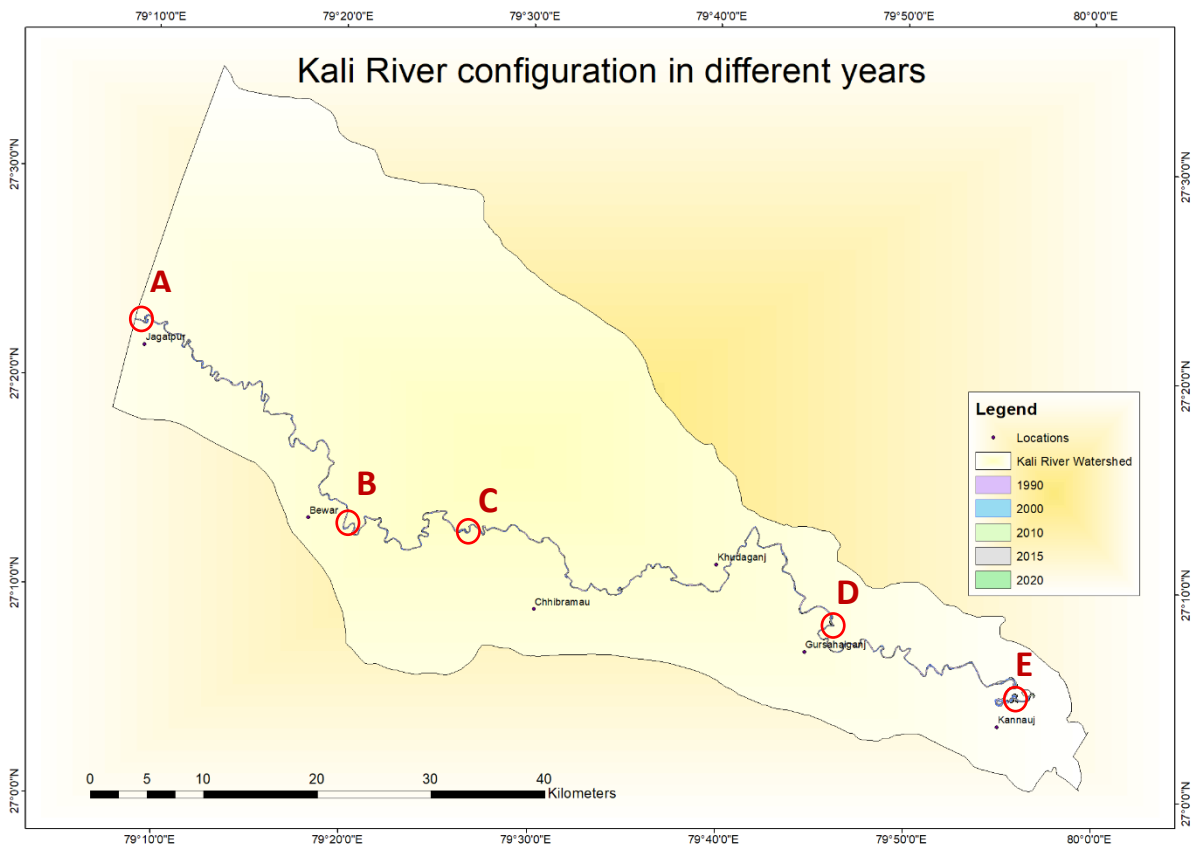


Fig -4: Kali River configuration in different years

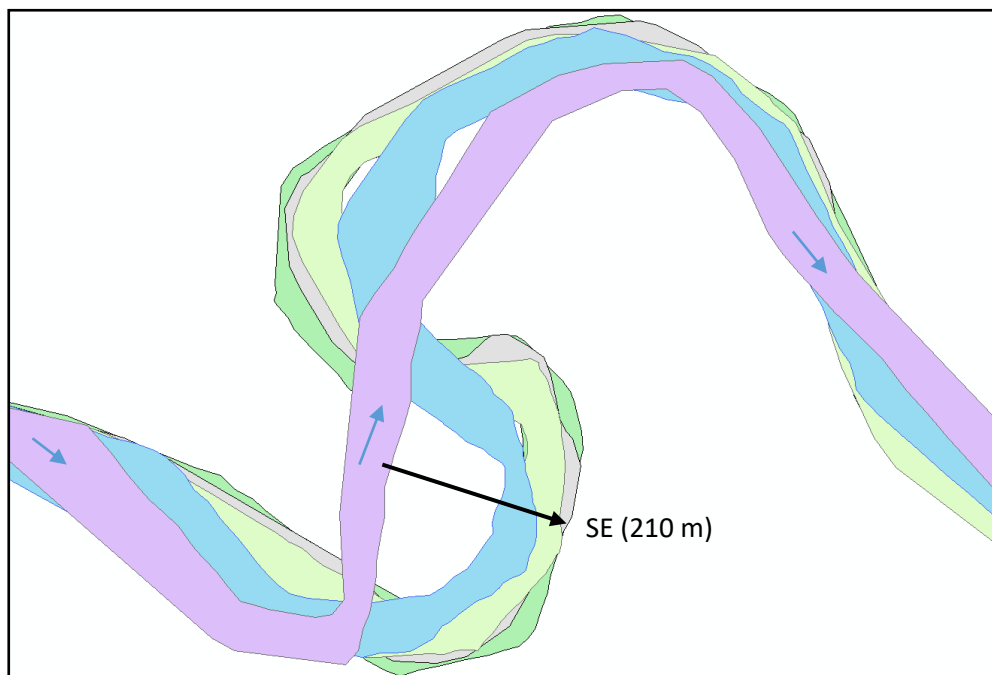


Fig -5: Kali River at Point A

At point A stream course shifted around 210 meters towards South-East direction during 1990 to 2020. Point A is Located at the border of village Bhanau and Ramnagar close to Mainpuri - Aliganj road in the river bank of Kali River. After 450 meters there is a village Katka in the South-East direction of point A. If the migratory trend continues, it will affect the settlement in near future.

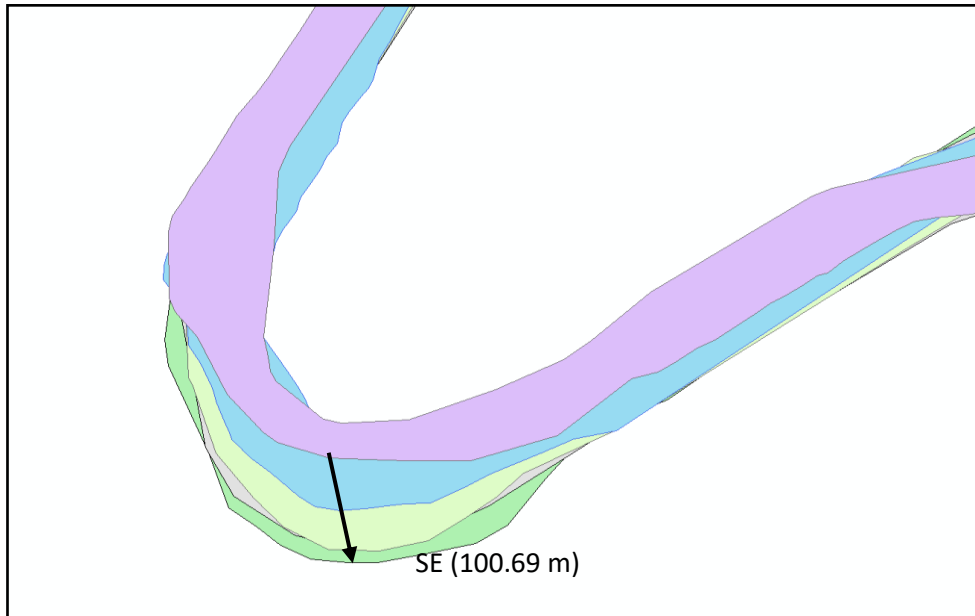


Fig -6: Kali River at Point B

At point B river channel shifted about 100.69 m towards South-East direction from 1990 to 2020. Point B is situated close to village Saket Bewar. This point is principally encircled by rural regions, however, a significant settlement is located in South-East direction at around 500 meters. If the channel keeps on migrating the same way, it can affect the village.

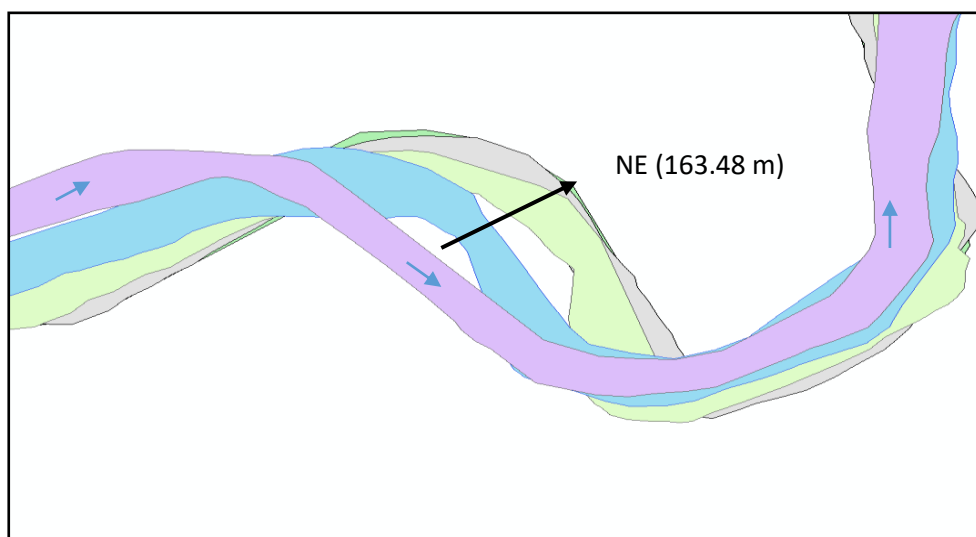


Fig -7: Kali River at Point C

At point C stream channel has been moved about 163.48 m towards North-East direction since last 30 years. Point C is situated close to village Doogar pur. This point is encircled by agricultural land. The stream migrated radically now from 1990 to 2020. The stream has effectively annihilated a gigantic rural land region and constantly influences the agricultural land.

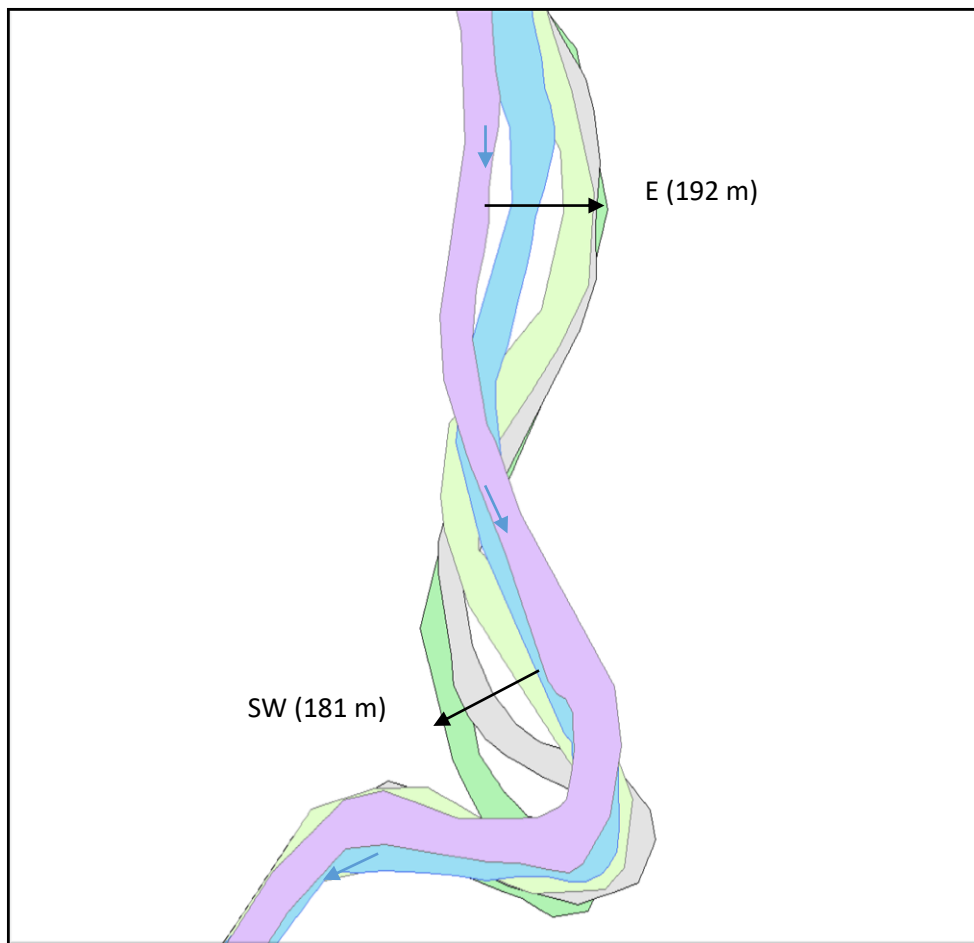


Fig -8: Kali River at Point D

At point D channel shifted around 192 m towards the east then after few meters again it migrated 181 m towards South-West direction. This point is situated close to village Patti Matehn which is located 300 meters from point D. This can make some landforms and can influence the settlement on either side of the channel of Kali River.

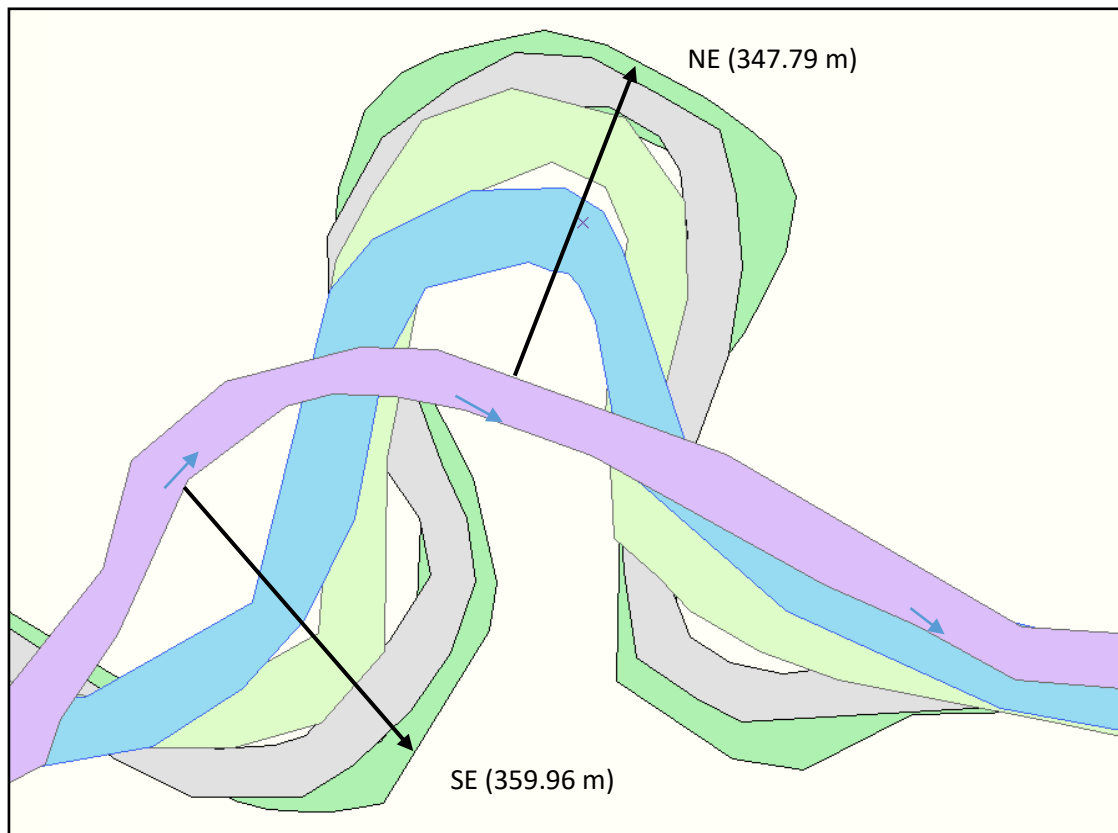


Fig -9: Kali River at Point E

At point E river channel has migrated 359.96 m towards South-East direction course and afterward again it migrated about 347.79 m towards North-East direction. Point E is situated close to Kannauj city. There is some settlement and the agricultural area is available around here near village Jagatpur which is located in the North-East direction of point E at a distance of 400 meters.

5. CONCLUSION

The present investigation concluded that if this migration of river channel would increase bank erosion which will affect the settlement and agriculture land. It effectively have been seen as ox-bow lake and paleochannels close to Malha village during 1990-2020 which has caused the loss of agricultural land and settlement area. Moreover, geomorphic features, for i.e., ox-bow lake, cutoff meanders, paleochannels and abandoned river channel would make changes later on.

In this study based on river channel migration, areas with drastic migratory trend in river channel have been observed which demonstrate that the most migration of the river channel is situated close to Kannauj city which is about 359.96 m in the last 30 years towards South-East direction and the least migration is about 100.69 m towards South-East direction at town Saket Bewar.

6. REFERENCES

1. Chakraborty, S., Mukhopadhyay, S. (2015) An assessment on the nature of channel migration of River Diana of the sub-Himalayan West Bengal using field and GIS techniques Arabian Journal of Geosciences volume 8, pages5649–5661, 5649–5661 (2015).
2. Dhari, S., Arya, D.S., and Murumkar, A.R., (2015). Application of remote sensing and GIS in sinuosity and river shifting analysis of the Ganges River in Uttarakhand plains. Applied Geomatics, 7 (1), 13–21.
3. Debnath, J., Das (Pan), N., Ahmed, I., & Bhowmik, M. (2017). Channel migration and its impact on land use/land cover using RS and GIS: A study on Khowai River of Tripura, North-East India. The Egyptian Journal of Remote Sensing and Space Sciences, 20(2), pp: (197–210).
4. Gogoi, C., & Goswami, D. C. (2013), “A study on bank erosion and bank line migration pattern of the Subansiri River in Assam using remote sensing and GIS technology”, The International Journal of Engineering and Science, 2:9 (2013): 1–6.
5. Hedge, M., Mathur, V. K. and Mandal, P. S. (1989), Erratic meander shift of the river Ganga at Kanpur. In Proc. Third International Work-shop on Alluvial River Problems, Oxford and IBH, New Delhi, Vol 1, pp. 239–246.
6. J. D. Das and A. K. Saraf, (2007) “Remote Sensing in the Mapping of the Brahmaputra/Jamuna River Channel Patterns and Its Relation to Various Landforms and Tectonic Environment,” International Journal of Remote Sensing, Vol. 28, No. 16, pp. 3619-3631
7. J. N. Sarma, D. Borah and U. Goswami, (2007) “Change of River Channel and Bank Erosion of the Burhi Dihing River (Assam), Assessed Using Remote Sensing Data and GIS,” Journal of Indian Society of Remote Sensing, Vol. 35, No. 1, pp. 94-100.
8. L. Bhakal, B. Dubey and A. K. Sarma, (2005) “Estimation of Bank Erosion in the River Brahmaputra near Agyathuri by Using Geographic Information System,” Journal of Indian Society of Remote Sensing, Vol. 33, No. 1, pp. 81-84.
9. N. G. Roy and R. Sinha (2005) “Alluvial geomorphology and confluence dynamics in the Gangetic plains, Farrukhabad–Kannauj area, Uttar Pradesh, India”. Current Science, Vol. 88, No. 12, pp. 2000-2006.
10. N. Surian, (1999) “Channel Changes Due to River Regulation: The Case of the Piave River, Italy,” Earth Surface Processes and Landforms, Vol. 24, No. 12, pp. 1135- 1151.
11. NRSA, “Brahmaputra Flood Mapping and River Migration Studies-Airborne Scanner Survey,” National Remote Sensing Agency, Hyderabad, 1980
12. Pati, J. K., Lal, J., Prakash, K., & Bhusan, R. (2008). “Spatio-temporal Shift of Western Bank of the Ganga River, Allahabad City and its Implications”, Journal of the Indian Society of Remote Sensing, 36, pp: (289–297).
13. Paul F. Hudson, Richard H. Kesel, (2000), “Channel migration and meander-bend curvature in the lower Mississippi River prior to major human modification”, Geology 2000; 28 (6): 531–534.