COVER ARTICLE

Photonirvachak
Journal of the Indian Society of Remote Sensing, Vol. 31, No. 1, 2003

Course of River Ganga Over a Century Near Kanpur City Based on Remote Sensing Data

NETRAMANI HARIJAN[1], ARUN KUMAR[1], SANJEEB BHOI[2] AND VINOD TARE[1]
[1]Department of Civil Engineering, Indian Institute of Technology, Kanpur – 208016, India.
[2]CEOSR, George Mason University, Fairfax, Virginia, USA.

Ganga river is one of the longest rivers in the world which originates in the Himalayas and flows across the Indogangetic plains before meeting in the Bay of Bengal. The Indian plate is dynamic plate, which has present motion of 5-6 cm/year. Due to dynamic nature of the Indian plate the river Ganga is known for its migration and changing course. The migration and changing characteristic of rivers can be easily studied using satellite remote sensing data.

Fig. 1 shows the panchromatic image of ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) acquired in the year 2001, in the near infrared region (0.76-0.86 μm). In the present study ASTER image is used because of its high spatial resolution (15 m). Fig. 1 shows the river Ganga flowing between Kanpur and Unnao. Kanpur is located on the right bank and Unnao on the left bank of the Ganga. Across the total length of the river, a wide flood plain is clearly seen. This is because of the meandering nature of the river. Numerous paleo channels are clearly seen in the Image. These paleo channels are indicators of migration of the river or shifting of the river course. The road network of Kanpur along with the national highways are shown (Fig. 1).

Knowledge of geomorphological features along the rivers is very important in understanding the migration, as well as the sedimentation patterns in the past and in the future. Efforts have been made to study these patterns produced by different rivers along different sections by numerous scientists (Singh *et al.*, 1996). Kanpur region shows a drastic shifting of the river Ganga which is governed by the fluvial dynamics of the river Ganga. Various geomorphological units and their mutual relationship (Fig. 1) clearly shows the presence of two distinct geomorphic zones associated with the two major episodes of changes in the sedimentation pattern of the river (Srivastava and Singh, 1999). The darker areas represent the latest stage of the development of meander scars, sloughs, ox-bow lakes. Eastern part of the river Ganga shows overlapped paleochannels. This is indicative of the younger flood plains being surrounded by the older flood plains. According to Singh (1996) the latest episode of migration which took place in the Middle-Late Holocene is characterized in this region by geomorphic features such as ox-bow lakes, meander scars, sloughs indicating migration of the river Ganga in the north-east direction. This phase was accompanied by the decreased water discharge and increased sediment load due to climatic changes.

The shifting pattern of the river Ganga

during different periods of time is shown in Fig. 2. Old and latest toposheets and satellite images of the same region are helpful in studying the change in course pattern of the river Ganga. The shifting direction of the river varies throughout the course of the river. At some places, it is shifting westward and at some places it is shifting eastward which is controlled by the subsurface structure and water flood pattern (Srivastava and Singh, 1999). Very clearly it can be seen that between Kanpur and Unnao, the river is scouring the left bank and the river is shifting towards Unnao drastically. The study of meandering of the river Ganga between Kanpur and Unnao reveals the fact that historically Ganga was flowing nearer Kanpur and slowly migrated towards Unnao. This shifting in the course of river Ganga between Bithoor and Janan (Fig. 1) has been a matter of great concern for Kanpur and Unnao. The shifting of Ganga river from Kanpur towards Unnao has caused flood threats and in the past severe floods have occurred.

In the past, Kanpur city used to draw water from the Bhaironghat (Fig. 1), intake along river Ganga about 9 decades back. But the river Ganga continuously shifted towards Unnao, as a result it has now become difficult to draw water and supply to the Kanpur city. At present, none of the important Ghats are on the main river course, which has become a threat to the residents of Kanpur. The shifting of Ganga river towards Unnao, has destroyed a large portion of agricultural land due to flood.

To restore the course of river Ganga near Kanpur and to save the people of Unnao from floods, an ambitious project of constructing a barrage is underway. Fig. 3 shows the barrage site and new channel path for river Ganga after completion of the project. As per the project plan and design, the river course will be made to pass through the barrage, which is being built near Kanpur city. Thus, the new channel of Ganga will help both Kanpur and Unnao, by solving the problem of water scarcity in Kanpur and saving the lives and agricultural crops due to severe floods towards Unnao side.

With the completion of the barrage, the river will probably flow on the ghats of Kanpur and give much relief to residents of Kanpur in terms of improved water supply and save the residents of Unnao from the trauma of floods every year.

Acknowledgement

The authors thank Dr. Ramesh P. Singh for fruitful discussion and extending his lab facilities to carry out this study. One of us (Netramani Harijan) is thankful to U.G.C. for the award of Junior Research Fellowship.

References

Singh, I. B. (1996). Geological evolution of Ganga plain-an overview. Journal of the Paleontological Society of India, 41:99-137.

Singh, I. B., Ansari, A. A., Chandel, R. S. and Mishra, A. (1996). Neotectonic control on drainage system in gangetic plain, Uttar Pradesh. Journal Geological Society of India, 47:599-609.

Srivastava, A. and Singh, R. P. (1999). Surface manifestation over a subsurface ridge. Int. J. Remote Sensing, 20:3461-3466.

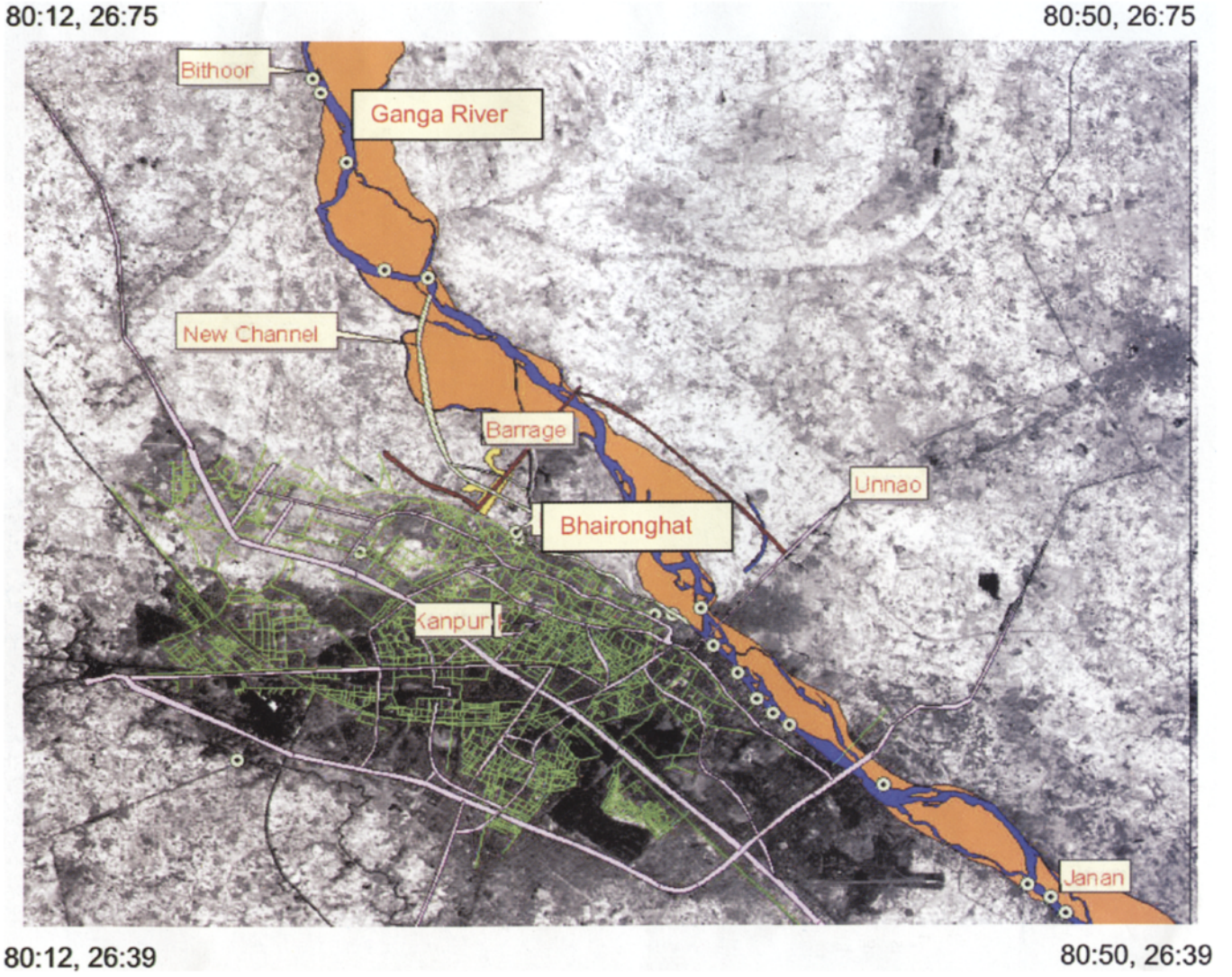

Fig. 1. NIR band (0.76-0.8μm) of Aster Image showing the Course of River Ganga between Kanpur and Unnao

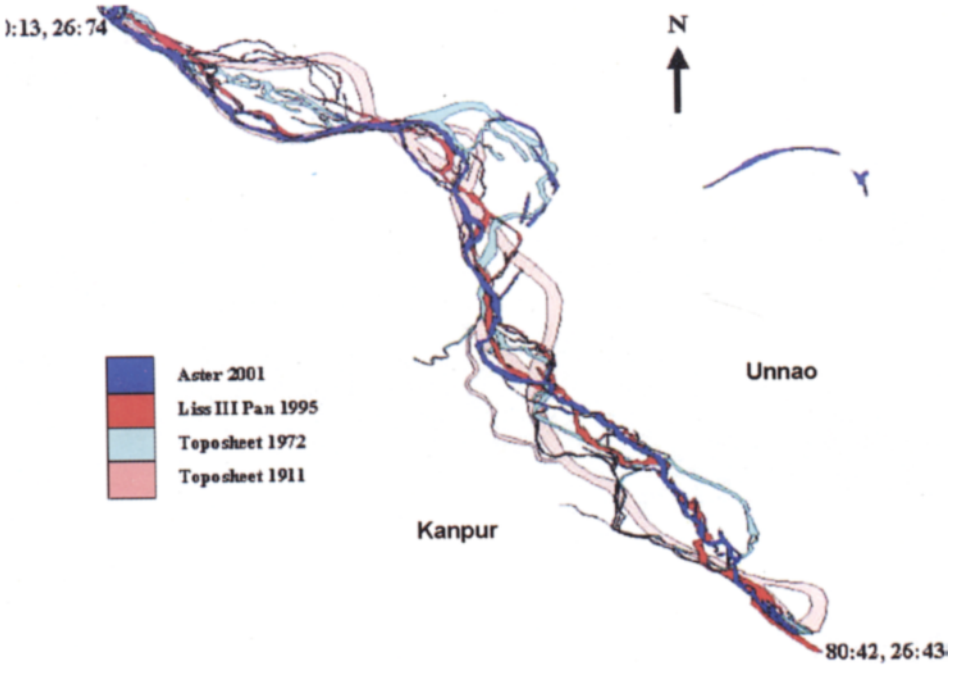

Fig. 2. Shifting pattern of the Ganga River

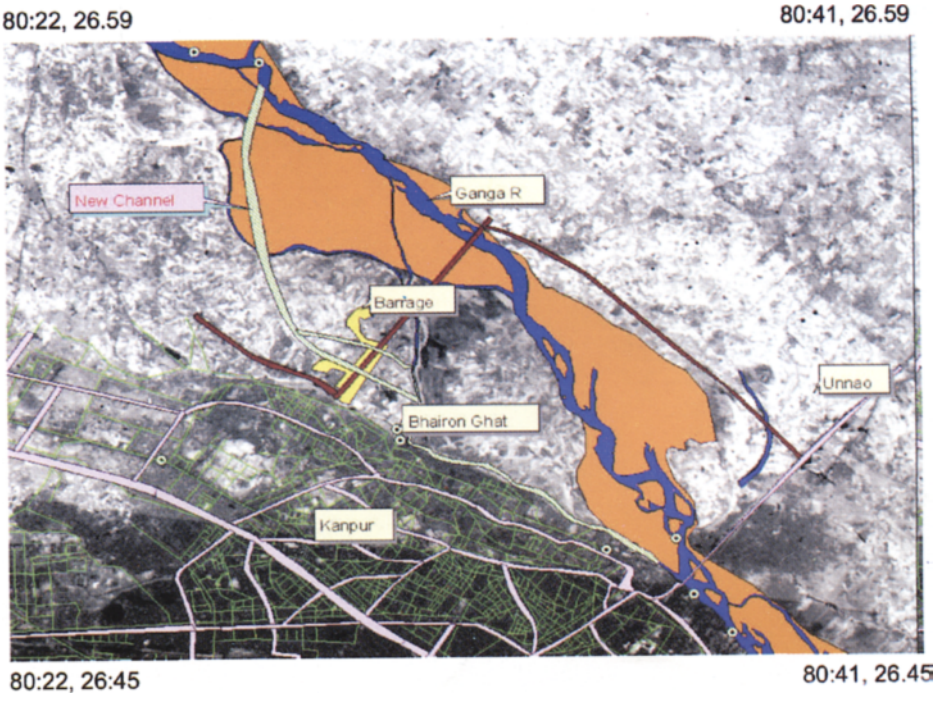

Fig. 3. Barrage and the new channel of River Ganga