

ABSTRACT

The proper understanding of river pattern changes of alluvial rivers and meander development is of vital importance for citing varied river valley development and water hazard control structures in the backdrop of proliferation of human settlements in the flood plains. River morphology changes with time and is affected by river discharge, velocity, sediment load, sediment characteristics and the composition of bed and bank material apart from varied geological controls. Prediction of when and where future erosion will occur and the extent of such erosion are very uncertain because of the many interacting factors involved. Conventional measurements of planform characteristics of meandering rivers are a time consuming, laborious and expensive procedure. Their main disadvantage however is that they provide information only at a particular point and instant of time. On the other hand, remote sensing techniques are capable of providing information through time and space which can never be appreciated from the ground. Further, satellite remote sensing presents an expedient, reliable and cost effective alternative method for demarcation of rivers at suitable time-space intervals to establish the stability or otherwise of their channels. Advantages of the information acquired by satellite remote sensing are of synoptic coverage and repetivity.

In the present study, evaluation of the shifting characteristics of a reach of the river Ganga between Ara to Patna, having a length of 66 km, was carried out using the data of 1974-76 (SOI toposheet), 1989 (IRS-1A LISS-II data), 1996 (IRS-1C LISS-III data), 1998 (IRS-1C LISS-III data) and 2000 (IRS-1C LISS-III data). The shifting characteristics have been studied by evaluating the following aspects viz. (i) shifting course of river Ganga between Ara to Patna from 1974-76 to 2000 and identification of the critical locations where shifting has occurred, (ii) details of the shifting characteristics of river Ganga at the identified critical locations using IRS-1C PAN data, and (iii) shifting pattern of river Ganga at the identified critical locations as obtained from the data of 1974-76, 1989, 1996, 1998 and 2000. The shifting characteristics were evaluated for the entire reach both on the right as well as left banks of the river course. Based on this analysis, the critical locations along the river course where major shifting has occurred were identified as Neknamtola, Jirakhantola and Daudpur on its right bank and Ami and Hajipur on its left bank. In order to study the extent of erosion and the population affected in the identified critical locations, detailed study was carried out using IRS-1C PAN data, having a spatial resolution of 5.8 m, for the years 1996 and 2000 along with SOI toposheet of the scale of 1:50,000 for the year 1974-76. The places/townships which have been affected/washed away and those are likely to be affected in the near future were identified. These analyses were supplemented using merged IRS-1C LISS-III and PAN data for the year 2000. Further, the shifting pattern of the river Ganga has been studied in detail at the five identified critical locations. It is observed that the total shift of river Ganga at Neknamtola is 2.76 km, at Jirakhantola is 1.22 km, at Daudpur near Danapur is 1.45 km, at Dighwara is 2.18 km and at Hajipur is 2.43 km over a period of about 25 years from 1974-76 to 2000. Further, during this period there is an increase of 3.8 km in the width of the river Ganga at Daudpur. The magnitude of the year wise shifts and the rate of shifting have also been evaluated for each of the five locations.