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Research Paper

Channel Avulsion in Jiadhol River of Brahmaputra Basin

Geography

KEYWORDS : Channel Avulsion, Jiadhol river, Floods, River Planform

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ABSTRACT

Jiadhol river system is one of the most dynamic rivers flowing out of the foothills of Himalaya in Arunachal Pradesh and joining mighty Brahmaputra in Dhemaji district of Assam. This river has created flood havoc in the District of Dhemaji due to frequent avulsion over the decades. The focus of this study is to understand the pattern of channel avulsion in the Jiadhol River. For the analysis the data on river planform are collected from the survey of India toposheets and a number of satellite imageries. The time series of river planform is used to analyze the pattern of channel avulsion. The analysis shows that before 1973, the Jiadhol River had tendency to shift from west to east, from 1973 to 1993 the shift was from east to west and after 1993 till present time the channel avulsions are from west to east. The distance between the new and the old course has reduced over time.

INTRODUCTION

Channel avulsion is rapid abandonment of a river channel and formation of new river channel. According to Grade (2006), it is a sudden abandonment of part or whole of the stream for a new course at a lower level of floodplain. It occurs as a result of reduction in channel gradient of the existing channel due to aggradations. The mechanism of evolution of the present day avulsive systems includes (i) aggradation of channel and floodplain by the accumulation of bed-load and suspended load, (ii) increasing but never the less subtle topographic differences and flood overspills; and (iii) avulsion due to over spilling and stream capture (Richards et al. 1993). Most of the avulsion activities are associated with those rivers which have high sediment load and lesser gradient (Jones and Schumm 1999). Many of the Himalayan Rivers, which have very high sediment load and witness drastic decrease in the gradient on crossing the Himalayas show rapid avulsion of channels in the lower catchments. According to Mitra et al. (2005) channel aggradations causes reduction of the channel gradient and reduced water carrying capacity of the channel, hence reduction in the velocity and sediment transporting capacity of the stream, which further enhances the silting up of the channel. The above sequence of events results in the abandonment of the existing course by the stream to seek a new course where it would get a greater hydraulic advantage. The stream initially becomes quite stable in its new path, as it is flowing along a topographically low area. However, with time the process of aggradations will proceed along this route also, making it vulnerable to avulsion. Eventually it will become a topographic high and a new avulsion will become progressively more likely. These alternate periods of stability and instability may last from a few tens of years to a few hundred years. The location and timing of avulsions are highly unpredictable. Similar concepts are also available in the works of Brizga and Finlayson (1990) on Channel avulsion the Thompson River and Mc Carthy and others (1992) on Okavango.

The Jiadhol or Jiya Dhol river brings heavy sediments to the plains as it flows through the Himalayas and gives rise to a frequently avulsing river system alone the foot hills and an established an anabranching pattern. Every flood season brings many changes in the channel of the river in the plains. This paper is aimed at visualizing the pattern of avulsion and channel changes in this river with the help of satellite imageries and toposheets of the area. The methodology of comparing the relative position of channels on different time using remote sensing and Geographical Information System has been used by many scholars to understand the pattern of avulsion and channel changes in rivers such as Vishwamitri river (Raj et al. 2004), Sarda River (Mitra et al. 2005), Burhi Dihing River (Sarma et al. 2007), Kosi river (Sinha 2009), Netravati and Gurpur rivers (Kumar et al. 2010), Subansiri river (Gogoi and Goswami 2014), etc. Thus, in this paper the channel avulsion of river Jiadhol is studied by comparing the position of the channel on different time.

STUDY AREA

The Jiadhol or Jiya Dhol River is one of the north bank subtributaries of the Brahmaputra River that empties in Charikoria River. Charikoria is one of the anabranches of Brahmaputra like Kherkutia Suti. Basin of the Jiadhol River extends from 27˚15′ N to 27˚45′ N latitudes and 94˚15′ E to 94˚40′ E longitudes, covering an area of 1094.93 sq km, of which 38% (416.07 sq km) lies in Arunachal Pradesh and 62% (677.86 sq km) in Assam. The river flows through West Siang district of Arunachal Pradesh and Lakhimpur and Dhemaji District of Assam. Though the river originates in the Arunachal Himalaya, yet it is not fed by snow melt, instead rainfall contributes to its runoff. The three main tributaries of Jiadhol in upper catchment are Siri, Sido and Sika rivers these rivers meet at a place called Tinimukh in the Arunachal Himalaya and the combined flow downstream is known as the Jiadhol. Hence, the three tributaries contribute most of the runoff and sediment to the Jiadhol River. After crossing a gorge near Jiadholmukh, it debouches on to the Brahmaputra plains, where the course of the river becomes very broad. In the plains, the river is divided in to several branches which rejoin again downstream. This area is very dynamic in terms of channel avulsion of Jiadhol and resulting floods. The demarcation of the Jiadhol river basin in the south eastern part is very difficult to its frequent channel avulsion. All most all the scholarly works done on this basin have used different shape of the basin. Along the southern slope of the foothill many small streams combine together and flow further south in the name of No Noi or Dihingia River, it is the most important tributary of Jiadhol in the plains of Assam. In the plains the river is sometime known as Sampara and sometime as Kumatia depending on the location of the channel. After flowing further down the channel of the river became stable and retains the name Sampara. Ultimately, it flows into Charikoria after crossing many swamps and wetlands.

DATABASE AND METHODOLOGY

The study area is under the tropical monsoonal climate the landscape of the area shows rapid changes and so it is very difficult to detect detection of the peleo channels. For this reason the data on the channel position prior to the preparation of toposheets of survey of India is based on the knowledge of the local communities dwelling in the area. The data on channel position of the river at different time are extracted from the toposheets of Survey of India 83 I with RF 1:50,000 surveyed between 1963 and 1967. Satellite imageries were downloaded from the USGS Earth Explorer (http://earthexplorer.usgs.gov/). Imageries used in this paper are listed in Table I. With the help of the mentioned data, different courses of the river Jiya Dhol are digitized in ArcGIS 9.3 Software for analyzing the phenomenon of channel avulsion of the river. The different courses of the river

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Jiadhol from 1963 to 2014 are shown with the help of different colour in the Figure 1. The time series of the satellite imageries is shown in Figure 2.

Table I: Satellite Imageries used

Agency	Year	Date of Acquiring	Scale
LANDSAT MSS	1973	19.3.1973	60 m
LANDSAT TM	1993	30.9.1993	28.5 m
LANDSAT 7 ETM	2003	12.10.2003	28.5 m
LANDSAT 7 ETM	2013	9.10.2013	28.5 m
LANDSAT 8 ETM	2014	11.12.2014	28.5 m

ANALYSIS

According to the knowledge of the local residence of the area the Jiadhol (Live wave of water) River was flowing along the present Moridhol (Dead wave of water) along the extreme east and joined the Laiphulia-Charikuria and ultimately emptied on Brahmaputra along the Kharkutia Suti. Later the Moridhol Channel was abundant and the Eradhol (Left wave of water) became the main channel of Jiya Dhol. This channel cut across the present Dhemaji town. The exact time of these avulsions are difficult to state with certainty. But the trend was from east to west as the locality known as Moridhol is located along the eastern most edge of the present Jiadhol basin. The locality called Eradhol occupies the area between the Moridhol and the present Jiadhol.

The Figure. 1, shows that the most drastic avulsion too place in between 1963 to 1973, the course of the river shifted from west to east by approximately 12 kms. In Survey of India toposheets, Jiadhol River was first occupying the course along the present Dihingia River but in the satellite image of 1973 the main course of the river is along the present Moridhol River. Between 1973 and 1993 the shift was from east to west and the main course of the river occupy straighter route and the maximum distance of avulsion is 6 kms which is half of the value experience in the earlier decade. The period after 1993 till 2014 has evidence of short distance avulsion of Jiadhol River. These short distance and frequent avulsion has resulted into occurrence of severe floods in the region and development of anabranching planform. The course of the river has shown an eastward shift in 2003, 2013 and 2014 whereas the distance of avulsion is less as compared to the earlier avulsions.

For better understanding of channel avulsion in Jiadhol River the time series of satellite imageries are shown in Figure 2. The figure shows the changing position of the river course during different time. The presence of many abundant channels in the 1973 imagery indicated that the river has witnessed many avulsions in between 1963 to 1973. The trend of avulsion was from west to east during the period 1963 to 1973.

CONCLUSION

The Jiadhol River is one of the most frequently avulsing rivers origination in the sub Himalaya. Channel avulsion is occurs just after the river debouches into the plains of Brahmaputra. The courses of river in the lower catchment are stable compared to its upper section in the plains. The distance of avulsion was largest in the period between 1963 and 1973 and the trend of avulsion was west to east. The distance of avulsion has decreased over time and the trend of avulsion was east to west form 1973 till 1993. The distance of avulsion has further reduced in recent time and the recent trend is again from west to east. The rate of avulsion is high for the studied that is less than ten years for most of the time. The understanding of the trend of channel avulsion is helpful in proper flood management of the basin.

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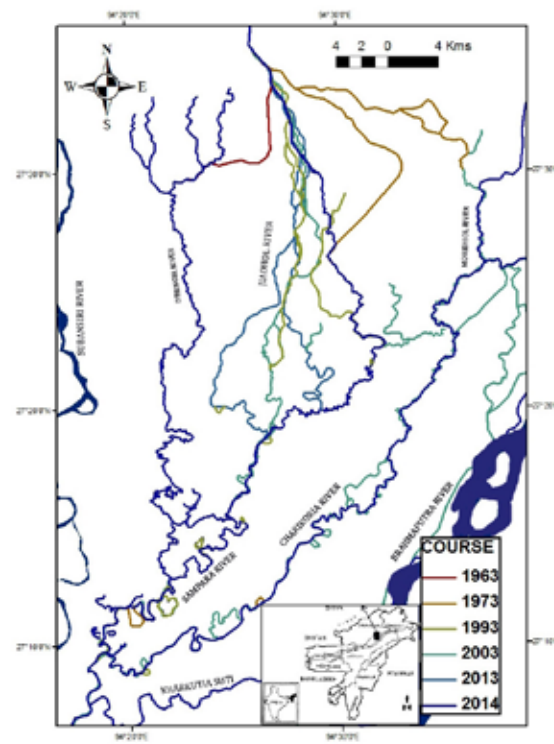

Fig. 1: Channel Avulsion of Jiadhol River.

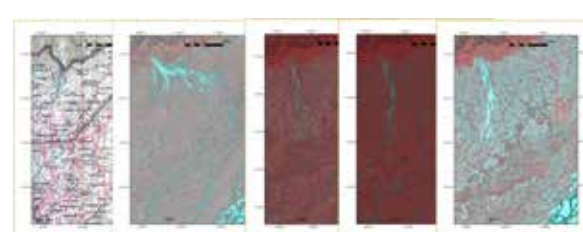

Fig. 2: Time Series of Satellite Imageries and toposheet showing channel avulsion in Jiadhol River.

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