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Spatial Variability of Brahmaputra River Flow Characteristics

Hemant Kumar

***Abstract*—**Brahmaputra River is known according to the Hindu mythology the son of the Lord Brahma. According to this name, the river Brahmaputra creates mass destruction during the monsoon season in Assam, India. It is a state situated in North-East part of India. This is one of the essential states out of the seven countries of eastern India, where almost all entire Brahmaputra flow carried out. The other states carry their tributaries. In the present case study, the spatial analysis performed in this specific case the number of MODIS data are acquired. In the method of detecting the change, the spray content was found during heavy rainfall and in the flooded monsoon season. By this method, particularly the analysis over the Brahmaputra outflow determines the flooded season. The charged particle-associated in aerosol content genuinely verifies the heavy water content below the ground surface, which is validated by trend analysis through rainfall spectrum data. This is confirmed by in-situ sampled view data from a different position of Brahmaputra River. Further, a Hyperion Hyperspectral 30 m resolution data were used to scan the sediment deposits, which is also confirmed by in-situ sampled view data from a different position.

***Keywords*—**Spatial analysis, change detection, aerosol, trend analysis.

I. Background

THE Brahmaputra river emerges from the great Himalayas. It is a Tibet plateau, and it covers near about 2900 km length & 5,80,000 Sq.km of area. With the name Yarlung Tsangpo origin & during entire flow it is known as the same name in China. Entering India in the aisle and crossing a U-turn to the Namba and Warwa peaks, it enters Arunachal and becomes a Diang or Deih. Diwang & Lohit meet Brahmaputra in Arunachal Pradesh. When Yarlung Tsangpo enters Assam, it is known as the Brahmptotra. And finally, when it enters Bangladesh, it becomes Jamuna [1], [4].

Tributaries of Brahamptra (about 10 km wide) in lower Assam the water flow across spreads and create river island called Majuli [8], the biggest river island across the basin. Diwang, Lohit, Subhanshree, Tista, Manas are major associates of Brahmaputra river basin & give huge out-flow to the Brahmaputra. Teesta & Meghna meet the Brahmaputra in Bangladesh; Brahmpatra meets to the Padma & flows with the same name until it emerges to Meghna. Further Meghna flows & finally outflows through the Mouth of the Ganges in the Bay of Bengal [1].

II. Problems Identified

Significant rate of sediment falls towards south-west direction from Brahmaputra Hydrology. The extent and variable flow, coupled with its rapid channel elevation and accelerated rates of basin depreciation, is its unpredictable mass destruction flow. The deepening of the Bengal Basin due to erosion increases the hydraulic radius, and allows for the huge accumulation of sediment load discharge from the Himalayas. The Brahmaputra flow has two high-water seasons. The first in early summer due to snowfall in the mountains, and the second season of summer due to runoff from monsoon rains. Melting of ice and glacier contributes about 1/3 of basin discharge to the total annual runoff. The basin of Brahmaputra flow is 651 334 km^2. And it has a good example of a hanging river and makes very few bars and often sand bars. It has an area of significant tectonic activity.

Hemant Kumar is with the BIT Mesra, India (e-mail: hemant.kr1981@gmail.com).

Discharge: The Ganges-Brahmaputra forms the third-largest average discharge system among the world's rivers - about 57,929 m^3 per second (average) and the Brahmaputra river alone supplies about 19,800 m^3 per second of total discharge. Rivers with suspended sediment load of about 1.87 billion tonnes per year are the highest discharges in the world [2]. Rising temperatures due to global warming are a major cause of ice melting on the upper Brahmaputra catchment. The discharge of the Brahmaputra is highly affected by the melting of ice in the upper part of its catchment area in the Himalayas. The intensity of river flow affects the flow of the river due to melting of ice in the Brahmaputra Basin River. This increase in discharge due to a significant retreat of ice leads to serious catastrophic problems such as flooding and erosion. That particular signature shows the amount of soil arrangement, size, and design due to biotic homogenization, the mottling process, and the surround coating, beds, and maturing. The results of current and future research, local parts of the local soil with flood prevention proposals, such as local breakwaters that increase the sheer depth of water outside of the waterline area, cascading floods can be changed [3]. Throughout the year, bars, scroll bars, and dunes are built at the edge of the flood plain due to deposition. Cravus splay is a sedimentary flavial deposit that forms when a stream breaks its natural or artificial levees and deposits sediment deposited on a floodplain. This is often caused by a breach in the dike, forming a lobe of remains. It proceeds on the adjacent floodplain [5], [4].

III. Analysis

Through Rainfall Data & Spatial Data

The analysis revealed annual, as well as monsoon rainfall reduction, spatial and temporal trend [1] variations in the Brahmaputra valley. There was a significant decrease in monsoon rains the previous year as well as the previous period. This was due to a significant decrease in rainfall in July and September, and this trend was found to be consistent with the aforementioned spatial scales. Information on the spatial and temporal variations of rainfall helps in understanding the hydrological balance at the regional scale. Thus studies on changes in rainfall patterns are particularly important due to its greater impact on agriculture [1], [4].

The MODIS (Fig. 1) and Hyperion (Fig. 4) data were collected during the entire process number.

Raw MODIS Data

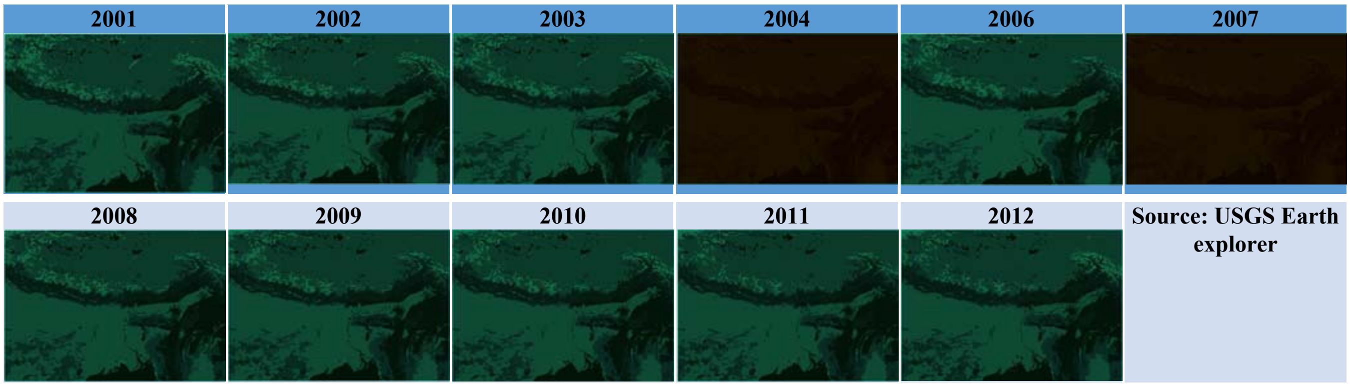


Fig. 1 No. of raw MODIS data taken of consecutive in a case for change detection analysis [14]

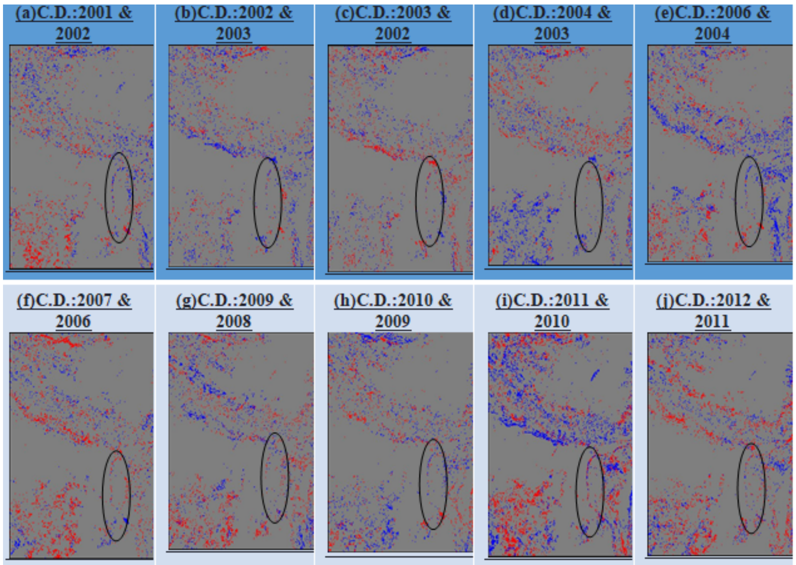
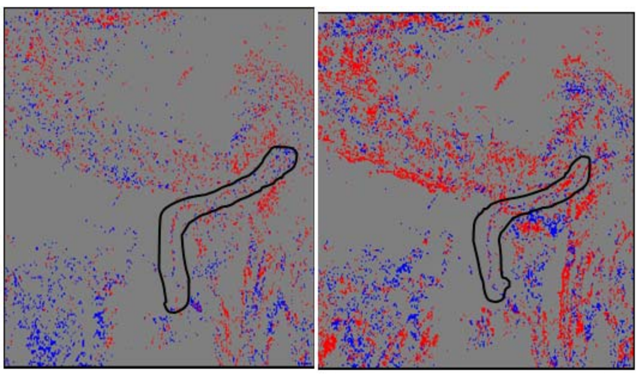


Fig. 2 Change detection (CD) analysis performed, for the volumetric land cover of water detection in case of Brahmaputra flow [14]



(a) Change Detection: 2002_2001, (b) Change Detection: 2012_2001

Fig. 3 The change detection shows the significant change of Brahmaputra flow during the year [14]

Spatial Analysis [10]-[13]

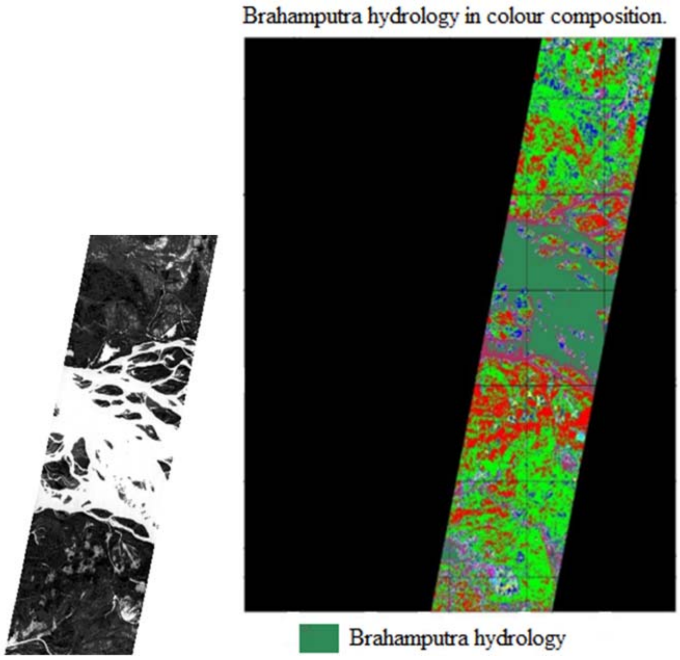
Change detection: The volume of the spray is in the literature [1] and the rain load related to its moisture content was clearly shown.

All curves are dark black showing spray deposits due to the water content of Brahmaputra. The lesser deposits are showing the low power (Fig. 3 (a)) of water content on the surface, whereas the high content of deposits shows the high content of water on the surface of the massive flood (Fig. 3 (b)) during the tenure.

IV. Trend Analysis

Trend analysis [1] is derived from a study that showed it as 2001-2006 (Fig. 2), and reveals trend changes in 2004-2006 (Fig. 2) and 2001-2002 (Fig. 2) is slightly less, but correspondingly constant during 2002-2003 (Fig. 2 (b)) and 2003-2004 (Fig. 2 (d)), due to minute change in trend. Also this type of substantial change carried out in 2001-2012 (Fig. 3 (b)) change detection by taking care of polynomial characteristics trend. The same pattern occurs in 2001-2002 (Fig. 2 (a)) due to the minute class of polynomial trend characteristics. So in this way, it is possible the number of trend analysis can be possible by acquiring the spatial data, which had been done here.

Hyperion 30 m resolution data show the river flow characteristics (Fig. 4) after in-situ analysis from different co-ordinate positions: The grey image verifies the dense Brahmputra flow characteristics out flow entire flow.



(a) Five band data (b) Classified Map

Fig. 4 (a) The 30 m resolution data of Hyperion showing the deposits of Brahmputra flow, (b) Associated color composition in detailed map [14]

V. Proposed Solutions and Conclusion

(1) The construction of a dam on Brahmaputra interferes with excessive exports of hydrology related issues of Brahmaputra in this way. (2) Also, some protective design structure can prevent the river erosional effect. The regular maintenance can stabilize these sections & prevent the impact of the river current. (3) The creation of bridge can carry traffic, gas supply, power & communication supply lines during flooded seasons [3], [4]. (5) Also, spatial analysis can give outstanding effort towards preventing these types of problem [1]-[9], [13].

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