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ANALYSIS OF RELATIVE TECTONIC ACTIVITY USING MORPHOMETRIC PARAMETER OF THE REJU KHAL DRAINAGE BASIN OF COX'S BAZAR, BANGLADESH

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ABSTRACT

This study aims to determine the relative tectonic activity using morphometric parameter of the RejuKhal Drainage Basin. Digital Elevation Modeling (DEM) data and GIS software has been used to study the morphometric parameter of the area. For this study, the Reju Khal Basins are sub-divided into four sub-basins named Northern Sub-basin, Central North Sub-basin, Central South Sub-Basin and Southern Sub-basin based on its drainage pattern. The quantitative geomorphic indices such as asymmetric factor (Af), Index of mountain front sinuosity (Smf), hypsometric integral (Hi), index of drainage basin shape (Bs), Transverse topographic symmetry factor (Tp) have been used to find out the index of relative active tectonic (IRAT) of the sub-basins. IRAT index represented a summary and average of the given geomorphic indices. IRAT index represented a summary and average of the given geomorphic indices. Central North Sub-basin is belonging to high active tectonic zone. Central South Sub-Basin belongs to moderate active tectonic zone where Northern Sub-basin and Southern Sub-basin belonging to low active tectonic zone. Different field observation and record shows that the southern part of Inani anticline has been affected by major and minor fault and structural disturbance. So, it can be concluded that the basins and sub-basin of the RejuKhal Drainage belongs to moderate to high tectonically active area.

Keywords: Morphometric parameter; Relative active tectonic; Reju khal; Drainage basin.

INTRODUCTION

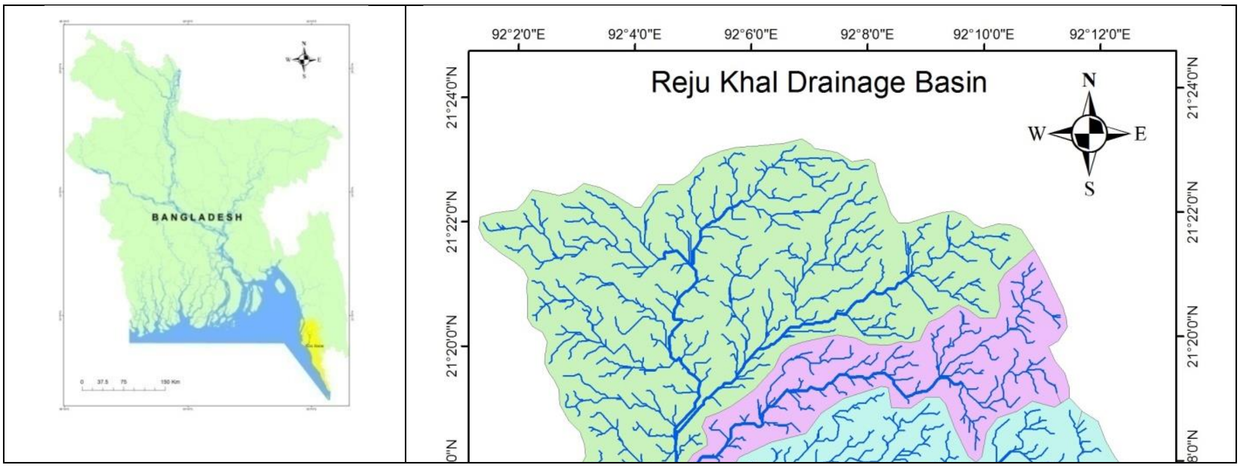
Tectonic activity plays an important role in developing drainage pattern and controlling river behavior (John and Schumm, 1999;Sinha-Roy, 2001;Valdiya and Narayana, 2007) that can be described both qualitatively and quantitatively (Hare and Gardner, 1985;Keller and Pinter, 2002). Geomorphic indices are useful tools in evaluating tectonic activity in any area. Tectonics plays very important role in the morphological evolution of any drainage basin and is well reflected by structural, fluvial and morphotectonic parameters (Keller 1986). Based on analysis of the rivers and related drainage networks by the use of geomorphic indices one is able to attain valuable information about tectonic history of the area (Toudeshki and Arian 2011). It is impossible to quantify the tectonic impact on any drainage sub-watershed by any single geomorphic parameter. However, a group of parameters with their assessment relative to one another allows one to address the issue successfully and identify particular characteristics of a drainage sub-watershed, its vulnerability to tectonic deformation and level of tectonic activity (Keller, 1986;Keller and Pinter, 1996;Demoulin,1998). So, it has been used group of quantitative geomorphic indices such as asymmetric factor (AF), Index of mountain front sinuosity (Smf), hypsometric integral (Hi), index of drainage basin shape (Bs), and index of relative active tectonic (IRAT) to identify areas experiencing tectonic activity.

The study area lies in the north of the Cox’s Bazar district and comprises the part of Ramu and Ukhia Upazila (Fig.1). The area is bounded by N 21°10'38.1532" to N 21°23'18.8188" latitudes and E 92°1'7.547234" to E 92°13'11.40643" longitudes. Most of the area is covered by Inani anticline structure. The Inani structure is represented by NNW-SSE trending low hillocks attaining maximum 542 feet elevation above sea level. The elongated Inani structure is bisected into two major parts by Reju Khal across the northern plunging area. Topographic sheet indicates 84 C/3 for this area.

It is known that landslide, earthquake, flash flood,river or drainage management, place for major engineering construction and many otherdevelopment activities are directly related and affected with tectonic activity of an area. So, thisstudy will be helpful to make prediction for natural occurrence (such as landslide, flash flood etc.) which will help to make prior decision to performany development activities in this region. Recently Zakaria*et al*. (2016)studied themorphometric analysis of RejuKhal drainage basin using GIS & SRTM data. In the presentstudy, an attempt has been made to evaluate the geomorphic indicators of active tectonicsin RejuKhal Drainage Basin through remote sensing and GIS approach.

GEOLOGICAL SETTINGS

The study area lies in the Eastern Folded Belt of Bengal Basin. The eastern Folded Belt exposes mainly geosynclinals molasse sediments of Neogene age, comprising alternating shale, mudstone, siltstone and sandstone in varying proportions. This succession has been lithostratigraphically subdivided into Surma (Bhuban and Bokabil), Tipam and DupiTila Groups following the classification of Evans (1932). Most of Bangladesh is covered by Tertiary and Quaternary sedimentary deposits which thicken to the south, where they locally exceed 20,000 m in thickness (Curray, 1991).



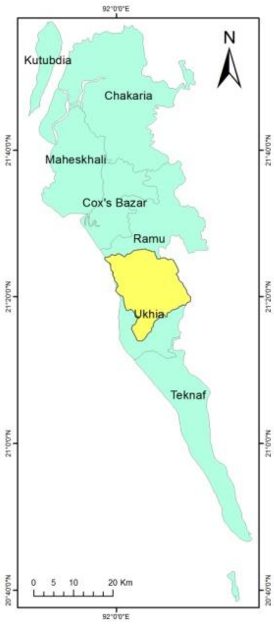


Figure 1: Drainage map of the Reju Khal drainage basin & its sub-basins of the study area.

The strata are deltaic to shallow marine in the north, but become progressively more marine to the south (Alam, 1989). The evaluation of landforms and soils of the Cox's Bazar and adjoining areas in a part of the coastal region of the north–south trending fold belt of Bangladesh during the Late Quaternary Period (Khan *et al.*, 2005).

The deposits of the Inani Anticline have been divided into Middle and Upper Boka Bil, Tipam Sandstone, Girujan Clay and Dupi Tila Formations. Inani is a narrow and elongated structure in which the Tipam Sandstone Formation is characterized by steep zone in both the flanks (Fig.2). The Tipam Sandstone Formation is unconformably underlain by the Boka Bil Formation in a gradual low dip. The oldest exposed rock is the Boka Bil Formation (BAPEX. 1980). After recent deposit Bokabil Formation has been found in the western side of the Cox's Bazar city (Zakaria *et al.,* 2015). Inani anticline is elongated, broad crest, steep flank, box-like and asymmetrical anticline. It is characterized by monotonous alternation of arenaceous and argillaceous beds with subordinate intra-formational conglomerates in the older exposed sequence. The entire western flank has been washed away by the sea except a segment of Middle Boka Bil Formation in the axial part (BAPEX 1980). From the Figure 2, it has been delineated that major regional fault existed in the northern part (Maheshkhali anticline) and NNW-SSE directed fault in the Inani anticline.

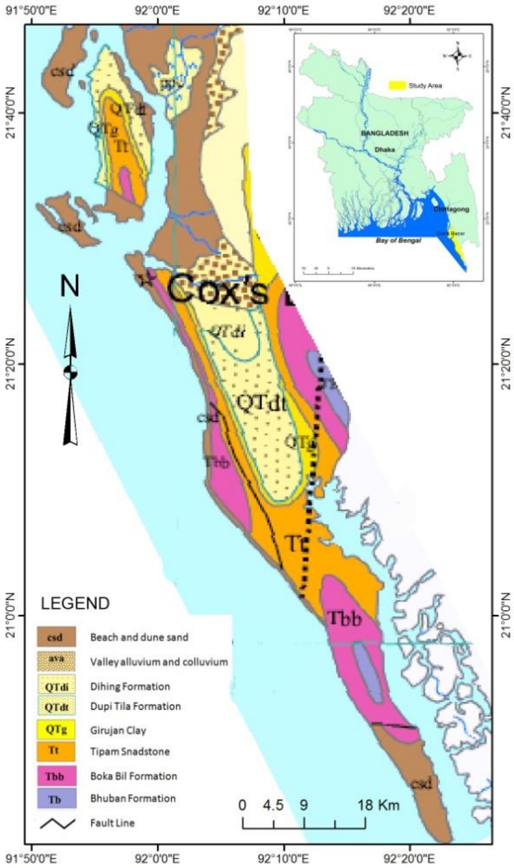


Figure 2: Surface Geology map of Cox's Bazar, Bangladesh (Alam *et al.*, 1990).

MATERIALS AND METHODS

In the field of tectonics geomorphology and landscape evolution, the use of GIS is relatively recent. The availability of the DEM has produced a great revolution in this field. It has replaced old topographic maps, allowing for better and faster analysis of topographic parameters (Perez Pena,2009). In this study, we tried to measure the required parameters using SRTM Digital Elevation Model with 30 meter resolution at ArcGIS software. In order to identify the hypsometry indices, it has been used surface geology, lithology, geomorphology and structural maps. In fact, the purpose of this study is to use the procedure and the information of geology and geomorphology to understand the hypsometry properties of the study area. Surface geological map of this area is taken from USGS website.

Della-Seta *et al.* (2008) believed that IRAT index was an indicator of morphotectonic features and landforms useful in the interpretation of tectonic events of an area.

Bull and McFadden (1977) utilized the valley width to valley height ratio (VF) and an index of mountain sinuosity (SMF) in the evaluation of the IRAT. Similarly, Silva *et al.* (2003) linked tectonic activity in southern Spain to the VF, SMF and basin shape (BS) indices. Recently, El-Hamdouni *et al.* (2008) developed and applied a model that included the hypsometric integral (Hi), the stream length–gradient index (SL), the IRAT and the previously developed indices. Habibi and Gharibreza (2015) estimated relative tectonic activity using different morphometric indices such as river length–gradient index (SL), drainage basin asymmetry (AF), transverse topographic symmetry factor (Tp), hypsometric integral (HI) and the drainage basin shape index (BS).

In this study, the quantitative geomorphic indices such as asymmetric factor (Af), Index of mountain front sinuosity (Smf), hypsometric integral (Hi), index of drainage basin shape (Bs), Transverse topographic symmetry factor (Tp), and index of relative active tectonic (IRAT) were used to identify areas experiencing tectonic activity. Geographical Information System (GIS) has been used to delineate these morphometric indices data preparation, data manipulation and analysis of data. The Digital Elevation Model (DEM) with 30 m spatial resolution has been used as a base map. At first fill, flow direction and flow accumulation grid have been delineated to find drainage basin using Hydrology tool in ArcGIS.

Index of mountain front sinuosity (Smf)

Mountain front sinuosity was defined by Bull and McFadden (1977) as: Smf = Lmf/Ls, where Smf is the mountain front sinuosity, Lmf is the length of the mountain front along the foot of the mountain and Ls is the straight – line length of the mountain front (Kellerand Pinter, 2001). Lmf and Ls measured using measuring tool of ArcGIS on DEM map.

Asymmetric factor (AF)

The asymmetric factor (Af) is a way to evaluate the existence of tectonic tilting at the scale of a drainage basin. The method may be applied over a relatively large area (Hare and Gardner,1985), (Keller and Pinter, 2002). Af is defined by, Af=100(Ar/At), where Ar is the area of the basin to the right (facing downstream) of the trunk stream and 'At' is the total area of the drainage basin. Areas of the basins are measured automatically by GIS tools.

Hypsometric integral (Hi)

Hypsometry describes area distribution at different elevations (Strahler,1952;Schumm, 1956) and can be estimated using the hypsometric curve or the hypsometric integral (HI). The hypsometric integral corresponds to the area below the hypsometric curve and therefore is correlated with the shape of this curve (Pikeand Wilson, 1971; Keller and Pinter, 2002). The hypsometric integral can be approximated by means of the following equation:

$$\text{HI}= \frac{\text{mean elevation - minimum elevation}}{\text{maximum elevation - minimum elevation}}$$

The elevation value of DEM has been used to find out the hypsometric integral for each basin in the study area. The drainage basin's boundary has been identified through Hydrology tool (fill, flow direction, flow accumulation, basin) in ArcGIS software using DEM model as input. Then the drainage basins and sub-basins value of HI has been calculated using ArcGIS directly. Programming in excel has been used to determine the hypsometric integral values showed in Tables 1 and 2. In order to generate the map of HI value, at first, wefind out the middle point of basins and sub-basins for HI value and then the spatial analyst has been used.

Finally, we classified the study area based on the classification of El Hamdouni *et al.* (2008) and Ramu and Mahalingam (2012).

Index of drainage basin shape (Bs)

Cannon (1976)and Ramirez-Herrera (1998) proposed using the Bs index for the horizontal projection of basin shape. The Bs index is expressed by the following equation:

$$Bs= Bl/Bw$$

WhereBl represents the basin length from the headwaters to the mouth and Bw represents the width at its widest point.

Transverse topographic symmetry factor (Tp)

The Tp index was introduced to evaluate the extent of tilting due to active tectonics (Alipoor *et al.*,2011). This index is represented as follows:

$$Tp=Da/ Dd$$

Where Da represents the distance from the midline of a basin to the main river axes and Dd represents the distance between the mid-line and the boundary of the drainage basin. The Tp value ranged between zero (minimum) and one (maximum).

RESULTS

In the study, the quantitative geomorphic indices such as asymmetric factor (AF), Index of mountain front sinuosity (Smf), hypsometric integral (Hi), index of drainage basin shape (Bs), transverse topographic symmetry factor (Tp), and index of relative active tectonic (IRAT) were used to identify areas experiencing tectonic activity.

Index of mountain front sinuosity (Smf)

Smf represents a balance between erosive processes tending to erode a mountain front, making it more sinuous through streams that cut laterally and into the front and active vertical tectonics that tend to produce straight mountain fronts, often coincidental with active faults or folds (Bull and McFadden, 1977; Keller, 1986).

The morphology of a mountain front depends upon the degree of tectonic activity along the front. Active fronts will show straight profiles with lower values of Smf, and inactive or less active fronts are marked by irregular or more eroded profiles, with higher Smf values (Wells *et al*., 1988). Mountain fronts associated with active tectonics and active uplift are relatively straight with low values of Smf; but if the rate of uplift is reduced or ceases, then erosional processes along the mountain front produce a more sinuous front and thus lower value of Smf (El-Hamdouni *et al.*,2008). Smf values lower than 1.4 indicate tectonically active fronts (Rockwell *et al.*,1985; Keller,1986) while higher Smf values (N 3) are normally associated with inactive fronts in which the initial range–front fault may be more than 1 km away from the present erosional front (Bulland McFadden, 1977). In the study area, we found that Smfvalue is1.36 for the Central North Sub-basinwhich indicates tectonicallyactive front and other sub-basins have values less than 3 and more than 1.4 which indicate moderately active font for those sub-basins (Table 1).

Table 1: Index of mountain front sinuosity (Smf) of the basins and sub-basins of Inani and Dakshin Nhila Anticline of Cox's Bazar

Basin Name	Lmf (m)	Ls (m)	Smf=Lmf/Ls	Class
Northern Sub-basin	48,591.07	18,420.90	2.64	2
Central North Sub-basin	4,428.99	3,246.35	1.36	1
Central South Sub-basin	7,946.35	3,401.90	2.34	2
Southern Sub-basin	30701.73	11656.17	2.63	2

Asymmetry Factor (Af)

If a basin has developed under stable conditions with little or no tilting, the Af factor is close to 50. The index is sensitive to change in inclination perpendicular to the channel direction. An Af factor above or below 50 may result from basin tilting, resulting either from active tectonics or lithologic structural control differential erosion, as for example the stream slipping down bedding plains over time (El-Hamdouni *et al.*, 2008).

Lari *et al.*(2016) classify drainage basin on the basis of Asymmetry factor for tectonic activity such as: Af-50 < 7 for inactive, 15 > Af-50 > 7 for semi-active and Af-50 > 15 is placed in active class. In the study area, we found that Af-50 value ranges from -8.56 to 16.19 for those sub-basins (Table 2). According to Lari *et al.* (2016) classifications, Central North Sub-basin have Af-50 value greater than 15 which indicates that the basins are in active class (class: 1),Central South Sub-basin has the values between 7 and 15 indicating semi-active basin (class: 2),Northern Sub-basin and Southern Sub-basinhave the value less than 7 indicating inactive basin(class: 3).

Table 2: Asymmetry Factor (Af) of the basins and sub-basins of Inani and Dakshin Nhila Anticline of Cox's Bazar

Basin Name	Ar (sq m)	At (sq m)	Af=100 (Ar/At)	Af-50	Class
Northern Sub-basin	44690000	89080000	50.17	0.17	3
Central North Sub-basin	19170000	28960000	66.19	16.19	1
Central South Sub-basin	27790000	45410000	61.20	11.20	2
Southern Sub-basin	36670000	88480000	41.44	-8.56	3

Hypsometric Integral (HI)

Hypsometry is affected principally by tectonic, lithologic, and climatic factors. Masek*et al*. (1994)proposed a climatological effect on hypsometry by comparing two large-scale drainage basins in the central Andean plateau. Lifton and Chase (1992)pointed to the influence of lithology in the hypsometric integral at small scales (100 km^2) and an influence of tectonics at larger scales (1000 km^2). They also showed, through a numerical model, that the hypsometric integral is positively correlated with the uplift rate. Chen *et al.* (2003) used values of the hypsometric integral to differentiate morphotectonic provinces in the foothills of Taiwan.

According to El Hamdouni*et al.*(2008), the hypsometric integral does not relate directly to relative active tectonics. High values of the index generally mean that, not as much of the uplands have been eroded and may suggest a younger landscape, perhaps produced by active tectonics. High values of Hi could also result from recent incision into a young geomorphic surface produced by deposition. High values of the index are possibly related to young active tectonic and low values are related to older landscapes that have been more eroded and less impacted by recent active tectonics. High value of Hi are generally >0.5, intermediate values are generally between 0.4 and 0.5 and lower values are <0.4.

Ramu and Mahalingam (2012) classified the Hi values as following. If the result value was between 0.6 and 1; it indicates the youthful state of dissection; if the result value was between 0.3 and 0.60, it indicates a maturely dissected landform; and if the result was less than 0.35, then it indicates an equilibrium or old state of dissection. In this study area, hypsometric integral values are calculated ranging from 0.11 to 0.20 for the sub-basins (Table 3). All sub-basins are small because of coastal hilly area and the hills are parallel to the beach. All of the sub-basins have less than 0.4 Hi value. According to Dehbozorgi *et al.*(2010), Class 1 iswith convex hypsometric curves (Hi ≥0.5); Class 3 iswith concave hypsometric curves (Hi<0.4); and Class 2 iswith concave–convex hypsometric curves (0.4≤Hi<0.5) and all sub-basins lies in the class 3.

Table 3: Hi value of the basins and sub-basins of Inani and Dakshin Nhila Anticline of Cox's Bazar.

Sub-basin Name	Mean Elevation	Min Elevation	Max Elevation	HI	Class

	(m)	(m)	(m)		
Northern Sub-basin	29.04	-9	232	0.16	3
Central North Sub-basin	47.50	0	238	0.20	3
Central South Sub-Basin	40.87	-1	395	0.11	3
Southern Sub-basin	31.46	-11	358	0.12	3

Drainage basin shape index (Bs)

Relative active tectonic of an area is an indicator of the drainage basin shape (Bs) (Bulland McFadden,1977). Higher Bs indices represented a stretched basin. Conversely, a circular basin presented few reactive tectonic effects or a more mature basin. The following classes are included in the Bs groups (El-Hamdouni *et al.*, 2008): Class (1), elongate basin with Bs>4; Class (2), semi-elongate basin with 3≤Bs<4; and Class (3), circular basin with Bs<3. In this study area, drainage basin shape index (Bs) values are calculated ranging from 0.97 to 3.27 for basins and sub-basins (Table 4). Only Central North Sub-basin has 3.09Bs value which indicates as semi-elongated basin. Rest of the sub-basins have value less than 3, which indicate the sub-basins of the study area are mostly circular in shape.

Table 4: Drainage basin shape index (Bs) of the basins and sub-basins of InaniandDakshinNhila Anticline of Cox's Bazar.

Basin Name	Bl	Bw	Bs=Bl/Bw	Class
Northern Sub-basin	11,289.37	16,340.18	0.69	3
Central North Sub-basin	12,981.28	4,205.31	3.09	2
Central South Sub-basin	12,570.50	5,620.92	2.24	3
Southern Sub-basin	8,941.51	15,546.32	0.58	3

Transverse topographic symmetry factor (Tp)

According to Alipoor *et al.,* (2011), a Tp index of 1 indicates the area with the greatest tectonic activity. The study area has been classified into three classes on the basis of Tp value. The value greater than 0.60 isconsidered as tectonically active basin (class: 1) because it has been found that the Central North Sub-basin has greater than 15 Af-50 value which indicates active basin also. Besides, Central North Sub-basin has less than 1.4 Smfvalue which indicates active basin also. Similarly, the value 0.30-0.60 isconsidered as semi active basin (class: 2) and the value less than 0.30 isconsidered as inactive basin and sub-basins (class: 3). In this study area, the Tp values are calculated ranging from 0.18 to 0.88 (Table. 5). Central North Sub-basin and Central South Sub-Basinhas the Tp value more than 0.60(Class 1) and rest two sub-basins have the value less than 0.30 (Class 3).

Table 5: Transverse topographic symmetry factor (Tp) of the basins and sub-basins of Inani and Dakshin Nhila Anticline of Cox's Bazar

Basin Name	Da	Dd	Tp=Da/Dd	Class

Northern Sub-basin	970.62	5438.43	0.18	3
Central North Sub-basin	956.47	1328.36	0.72	1
Central South Sub-Basin	1694.10	1924.65	0.88	1
Southern Sub-basin	701.79	3007.15	0.23	3

DISCUSSIONS

Morphotectonic analysis by the use of geomorphic indices serves as a tool of recognition in regions with active tectonic deformation. Landforms in active deformation area are created from interaction of tectonic and surfacial processes. One of the most important landforms in ground is rivers that are very sensitive to tectonic movements especially uplift and tilting (Toudeshki and Arian,2011).

It has been found from the results of morphometry parameter that Smf value is 1.36 for the Central North Sub-basin, which indicates tectonically active front and other sub-basins have values less than 3 and more than 1.4 which indicate moderately active front for those sub-basins. Central North Sub-basin have Af-50 value greater than 15 which indicates that the basins are in active class (class: 1), Central South Sub-basin has the value between 7 and15 indicating semi-active basin (class: 2), Northern Sub-basin and Southern Sub-basinhas the value less than 7 indicating inactive basin (class: 3). All of the sub-basins have less than 0.4 Hi value and according to Dehbozorgi *et al.* (2010), all sub-basins lies on the class 3. Central North Sub-basin has 3.09 Bs values which indicated as semi-elongated basin. Rests of the sub-basins have values less than 3, which indicate the sub-basins of the study area are mostly circular in shape. Central North Sub-basin and Central South Sub-Basin have the Tp value more than 0.60 (Class 1) and rest two sub-basins have the values less than 0.30 (Class 3).

Central North Sub-basin has low value for Smf, greater values Af-50 and Tpindicates active basin. Central South Sub-Basin has higher Tp value whichindicates active basin but middle Smfand Af-50 value indicates moderate active basin. High Af-50 and Tp values of Central North Sub-basin and Central South Sub-Basin indicate that the basin is very tilted and asymmetric indicative of tectonically active basin. In case of Northern Sub-basin and Northern Sub-basin, the values of Af-50 are moderate but other morphoparameter shows inactive features. The both sub-basins have low Hivalue indicative mature stage of dissection and high weathering effect.

Rockwell *et al.*(1985)suggested that lower uplift rates of 0.4–0.5 m/ka were sufficient to keep Smf values down to 1.4. So, the Central North Sub-basin has the active mountain frontand an uplift rate is about 04-05 m/ka. Besides, thisCentral North Sub-basin has greater Af value indicative for strongly asymmetry in nature. Hi values have been calculatedfor each drainage basin but hypsometric curve has not drawn. Only Hi value is considered to calculate result for tectonic activity where all sub-basins show lower value and indicate that the basins may be inactive. Most of the sub-basins of the study area are circular in shape, but Central North Sub-basin has semi-elongated basin shape. Tpvalues are mostly related to the value of Af. It is found highest Tp value for Central North Sub-basin and Central South Sub-Basin indicates highest tilting because of tectonic activity.

Relative active tectonics index (IRAT)

In many previous researches, the most important and widely used geomorphic index was that of the relative active tectonics (IRAT) (El-Hamdouni *et al.*, 2008; Alipoor, 2011; Mahmood and Gloaguen, 2012). This index represented a summary and average of the given geomorphic indices that were used in a study as follows: IRAT= S /N, where S represents the sum of the previous indices and N represents the number of selected indices.

The IRAT index was developed by El-Hamdooni *et al.*(2008) for different studies based on the topographic conditions of a basin. The following classes were used in the IRAT index: Class (1), very high with 1.0≤IRAT<1.5; Class (2), high with 1.5≤IRAT<2.0; Class (3), moderate with 2.0≤IRAT<2.5; and Class (4), low with IRAT<2.5.

Table 6: Relative active tectonics index (IRAT) of the basins and sub-basins of Inani and Dakshin Nhila Anticline of Cox's Bazar.

Basin Name	**Class of**					**S/N**	**IRAT Class**
	Af-50	**Smf**	**Hi**	**Bs**	**Tp**		
Northern Sub-basin	2	3	3	3	3	2.8	4
Central North Sub-basin	1	1	3	2	1	1.6	2
Central South Sub-Basin	2	2	3	3	1	2.2	3
Southern Sub-basin	2	3	3	3	3	2.8	4

In the Table 6, it has been found that the IRAT class of Central North Sub-basin is 2.00 which belonging to high active tectonic class. Central South Sub-Basin belongs to moderate active tectonic class; Northern Sub-basin and Southern Sub-basin belonging to low active tectonic class (Fig.3). Zakaria *et al*. (2016) studied on morphometric parameter of the RejuKhal Drainage basin based on linear, aerial and relief aspects. They showed the influence of structural control on the drainage network of the RejuKhal Basin and the basin is subjected to erosional feature, variation of topography and lithology. They also showed that the influence of structural control on the development of the drainage network in the basin, low and very gentle slope basinand soft or weak rocks unprotected by vegetation of the basin and revealed that the area belongs to very young topography. So the Sub-basins in the Reju Khal Drainage Basin are controlled by tectonic activity and upliftment occurring in the basin. Also it can be assumed that the rate of tectonic upliftment may be 3-4 mm/year.

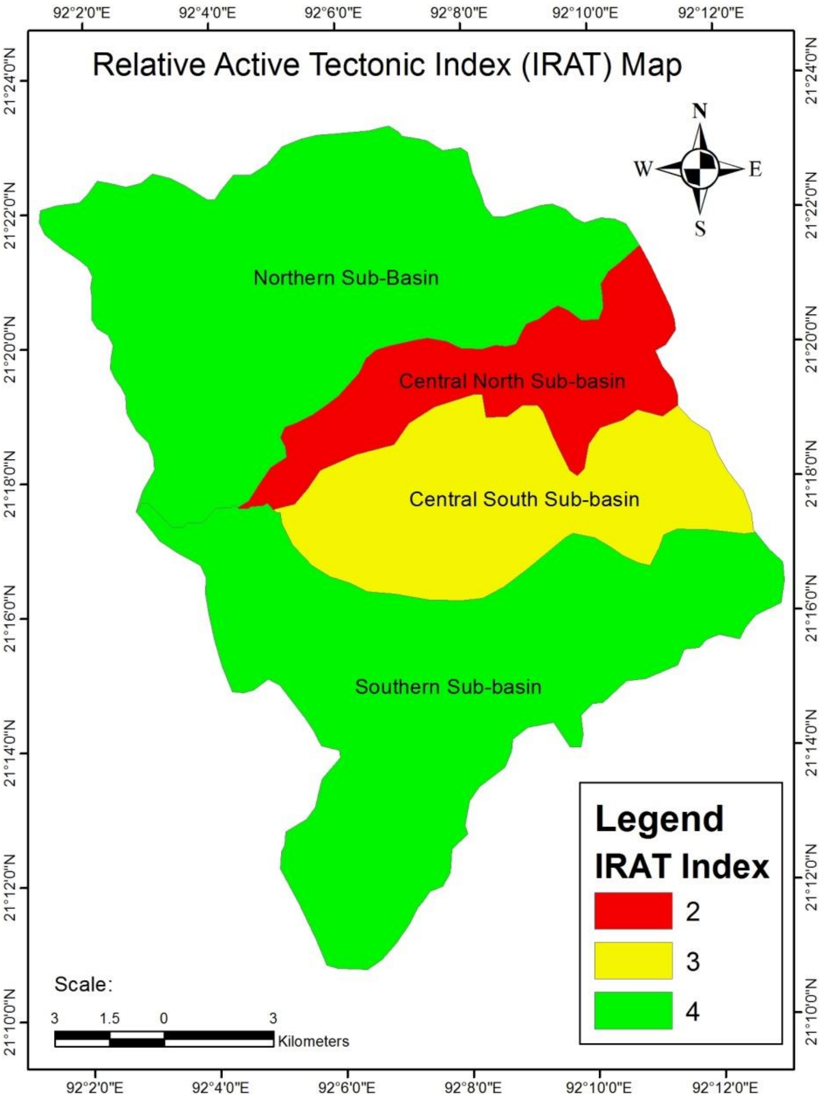


Fig. 3: Relative active tectonic (IRAT) index map of the Reju Khal Drainage basin & its sub-basins.

CONCLUSIONS

- The use of SRTM DEM and GIS software makes this study easy, faster and more accurate than conventional analysis. The quantitative geomorphic indices such as asymmetric factor (Af), Index of mountain front sinuosity (Smf), hypsometric integral (Hi), index of drainage basin shape (Bs), Transverse topographic symmetry factor (Tp) have been used to find out the index of relative active tectonic (IRAT) where IRAT index represented a summary and average of the given geomorphic indices.

- According to the IRAT class (Class 2), Central North Sub-basin is belonging to high active tectonic zone where Central South Sub-Basin belongs to moderate active tectonic zone (IRAT class 3).

- Central South Sub-Basin belongs to moderate active tectonic zone whereas Northern Sub-basin and Southern Sub-basin belong to low active tectonic zone.

- Northern Sub-basin and Southern Sub-basin are belonging to low active tectonic zone (IRAT class 4).

- The tectonic activity in this basin is not very strong. But different field observation and record shows that the southern part of Inani anticline has been affected by major and minor fault and structural disturbance. So, the RejuKhal Drainage Basin is tectonically active and the basins and sub-basin of the Reju Khal Drainage area belong~~s~~ to moderate to low mature basin.

- Reju Khal Drainage Basin belongs tectonically active to moderately active basins.

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