



## **Morphological change detection caused by seasonal monsoon and cyclones in the coast over time: a case study on Bangladesh delta**

Bishwajit Roy (1), Hasan Ahmed (2), and Gil Pessanha Penha-Lopes (1)

(1) Centre for Ecology Evolution and Environmental Changes, Faculty of Science, University of Lisbon, Lisbon, Portugal (gpenna-lobes@fc.ul.pt), (2) Department of Forestry and Environmental Science, Shahjalal University of Science and Technology, Sylhet, Bangladesh (hasan.sylh3t@gmail.com)

Coastal areas in Bangladesh undergo different morphological changes not only just by the climate change induced different disasters and sea level rise but also human induced changes. Furthermore, being situated in tropical area, the country receives lot of rain during the monsoon period. This study has been conducted in two coastal unions namely Banishanta and Sutarkhali under Dacope upazila of Khulna district in Bangladesh. During the year of 2007 and 2009, these areas had been severely affected by two consecutive cyclones. Several studies have been conducted on this big delta to understand the rate of morphological changes over time mostly in terms of land accretion or erosion mainly. However, whether this monsoon period and cyclones have an influence in coast has not received due attention yet. Therefore, the main objective of this study is to detect morphological changes occurred in the case study areas taking seasonal monsoon and cyclones into account through the analysis of satellite images. Two Landsat images (one for pre-monsoon (March) and another post-monsoon (November)) for every two years starting from 2005 to 2017 have been acquired from USGS earth explorer site. Then, several water indices namely NDWI, MNDWI1, MNDWI2, NDMI,  $WI_{2015}$ ,  $AWEI_{no-shadow}$  was used to extract the water and land feature from the images. OTSU method was applied on each index to determine water and non-water threshold by using IDL function from which a mean threshold value was generated to improve the accuracy of water and non-water. Amongst all those indices, NDWI performed most accurately to extract water and non-water surface for both case study areas in both pre and post-monsoon period. The results indicate an intense increasing trend in land surface area in pre-monsoon period than that of post-monsoon period for Sutarkhali union, but with almost no changes for Banishanta union in neither of these periods. Overall, the change detection analysis showed that the land area in Baniashanta union increased from 1995.48 ha to 2356.11 ha from 2005 (pre-monsoon) to 2017 (post-monsoon) and in Sutarkhali union it has been found from 1046.15 ha to 2832.12 ha from pre-monsoon 2005 to post-monsoon 2017. However, when two areas are compared with respect to two time period (e.g. 2005-10 and 2011-17), we found that during 2005-2009 period, Sutarkhali union suffered from land erosion (940.95 ha) compared to accretion (34.92 ha) while for Banishanta union amount of erosion (81.99 ha) is lower than that of accretion (395.19 ha) for the same time period. On the other hand, during 2011 to 2017, net amount of loss (42.75 ha) is higher than gain (30.96 ha) for Banishanta union. These findings lead us to conclude that in our case study areas natural disasters like cyclones have a significant contribution to bring changes in land surface area than that of seasonal monsoon. Further studies can be conducted to know the implications of these changes on land use and land cover in coastal areas.