A02

Impact of river-damming and sand-mining on bank erosion in the Vietnamese Mekong Delta

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Recently, the lives and economy of local people in the Vietnamese Mekong Delta (VMD) are threatened due to increasing river bank (RB) erosion, coastline retreat, subsidence and other changes in the region. Among various causes for these processes, the reduction in the sediment supply from the upper Mekong River due to sediment trapping by hydropower dams together with large-scale aggregate mining in the riverbed and its tributaries is to highlight. While the impacts of the dams in sediment reduction in the VMD have been investigated by some researchers, the associated impacts of such sediment reduction on RB erosion and the pernicious effects of sand mining in the VMD has little known.

The present study analyses in a first step the performance of different RB extraction methodologies in the context of the VMD for Landsat imagery. The selected methodologies include NDVI, NDWI, MNDWI, WNDWI and $AWEI_{nsh}$. They are based on spectral indices which are the result of two or more spectral bands to enhance the discrepancy between water bodies and land. To segment their outputs finally into water and land, three different segmentation methods are applied: default thresholding, Otsu method and an approach based on mathematical morphological technique. These approaches are applied to extract the RB of the Mekong river within a 20 km long segment in the VMD for the years 2014 and 2019. The extracted RB is then divided into 200 m long segments for each approach for both years. The surface change between the two years is calculated for each of those segments after the procedure illustrated in Figure 1.

The resulting surface change between the two years for each RB extraction approach is then compared to the one obtained from a geometrically corrected Google Earth data set. In this reference data set, the RB of the study site was digitized manually for 2014 and 2019 and the surface change between the two years was calculated using the same approach as for the Landsat data set (Figure 1). The best performing RB extraction approach is identified.

Finally, to further increase the accuracy of the extracted RB position, spectral mixture analysis is performed on the before identified, best performing RB extraction technique. Its basic idea is to identify the amount of water contained in a pixel square around the extracted RB and to shift the RB position accordingly. This procedure results in a sub-pixel accuracy. The result is validated comparing it again to the reference data set.

In a second step, the identified RB extraction technique is used to analyze the RB dynamic within a 100 km long segment of the Mekong river in the VMD from 1982 to 2019. Based on the results, the impact of dam construction and sand mining activity in the VMD on RB erosion is analyzed.

REFERENCES

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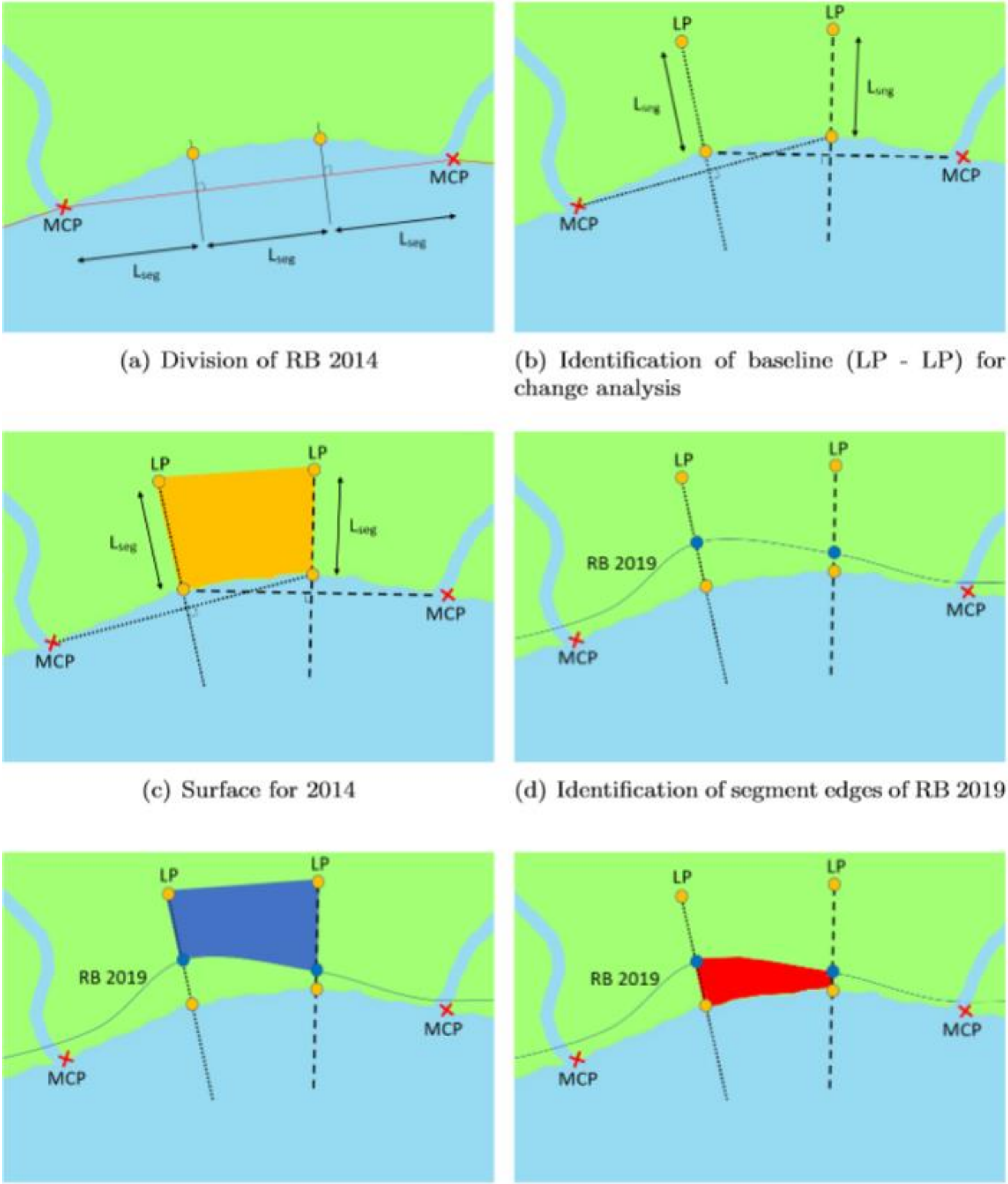

(a) Division of RB 2014

(b) Identification of baseline (LP - LP) for change analysis

(c) Surface for 2014

(d) Identification of segment edges of RB 2019

(e) Surface for 2019

(f) Surface change between 2014 and 2019

Figure 1: Schematic illustration of the surface change analysis procedure for one segment. Green represents land, blue represents water. The background image is from 2014. The same MCP's are manually selected in each data set at location which are easy identifiable (f.ex. river mouth). L_{seg} = 200 meters.