CHANGES OF BEACHES ADJACENT TO CUA DAI RIVER MOUTH, CENTRAL VIETNAM

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1. INTRODUCTION

Retreat of coastline has been observed at Cua Dai River mouth, Quang Nam province in the central of Vietnam. The erosion has been getting more serious in the recent years (Tanaka et al., 2015). In this study, shoreline changes of the river delta coasts on both sides of Cua Dai River mouth will be examined based on the analysis of satellite images. Shoreline change rates are also determined for analyzing the volume change rate of sediment in the study area.

2. STUDY AREA AND DATA COLLECTION

Cua Dai is the estuarine of the Thu Bon River flowing into the Pacific Ocean (Fig. 1). Severe erosion at this river mouth has been studied in the recent years. Viet et al. (2015) carried out research on morphological change of Cua Dai Beach by extracting shoreline positions from Google Earth images. Tanaka et al. (2015) pointed out the possible erosion mechanism at this river mouth and also made discussion on the propagation to the north of the sandy beach wedge toe.

Although there have been studies about erosion at the Cua Dai River mouth, these studies focused only on the most severe erosion region around the river mouth. In this study, shoreline changes of this delta coasts in a larger area (22km to the north and 40km to the south) will be analysed to discuss the volume change rate of sediment in this area.

Google Earth images in 2001, 2002, 2004, 2011, 2012, 2014, and 2015 are collected for the analysis. All images are re-rectified using a baseline which is 144.94 degree counter clockwise from the north and an original point (x=0) with the coordinates 217289.08 E and 1754078.07 N in World Geodetic System 84 (WGS-84). Shoreline positions are detected at every 20m interval along the coasts. Image processing method used in this study can be found in Pradjoko and Tanaka (2010). Moving averaging is used to reduce the effects of beach cusps. Once the effects of beach cusps have been reduced, all shoreline positions will be corrected to tidal levels.

One of the problems when making tidal correction for shoreline positions extracted from Google Earth images is that there is no information about the exact capturing times of the images. Hoang et al. (2016) proposed a method for tidal correction when using undated satellite images for shoreline analysis. Based on this method, datum-based shoreline can be easily determined since the problem with unknown capturing time has been overcome.

3. RESULTS AND DISCUSSIONS

3.1. Shoreline changes

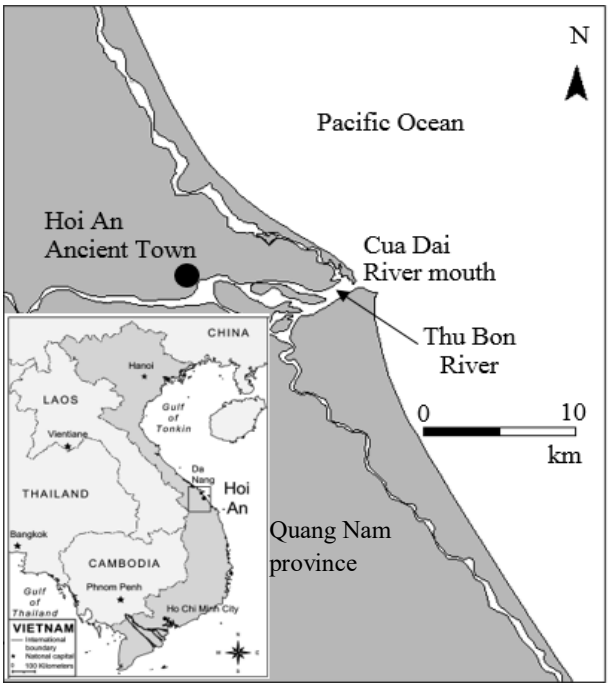

Figure 1. Location map of study area

Figure 2 shows the shoreline changes on both sides of the Cua Dai River mouth from 2002 to 2015 for the northern part and from 2001 to 2014 for the southern part. The shoreline changes are plotted separately due to the difference in the initial years as follows:

For the northern part:

$$\Delta y = y(x,t) - y(x,2004) \quad (1)$$

For the southern part:

$$\Delta y = y(x,t) - y(x,2011) \quad (2)$$

Where Δy: shoreline change, $y(x,t)$: shoreline positions in the t year, $y(x,2004)$: shoreline position in 2004, $y(x,2011)$: shoreline position in 2011.

Concerning the shoreline change in the northern part presented in Figure 2a, the shoreline retreated significantly around the river mouth and advanced in a wide area far from the river mouth. On the other hand, the shoreline change of the coast in the southern part is quite small compared to the north (Fig. 2b).

3.2. Shoreline change rate

In order to make discussion on the volume change rate of the sediment (Rosati, 2005), the shoreline change rate which is denoted by a (m/y) is plotted in Figure 3. In this study, the shoreline change is considered to be linear through time. Hence, shoreline change rate at one point will be determined as the slope of the fitting line drawn based on all shoreline positions at this location. The trend line can be described as follows:

$$y = at + b \quad (3)$$

Where y: shoreline position (m), a: shoreline change rate (m/y), t: year, b: intercept point.

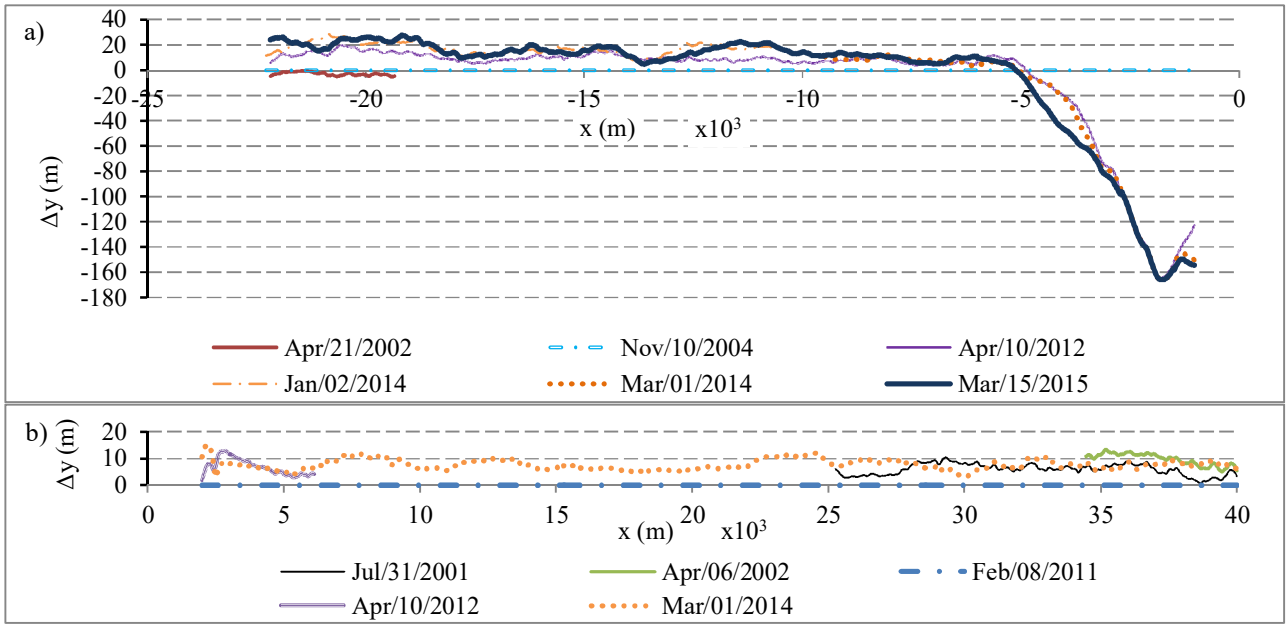

Figure 2. Shoreline changes in a) the northern part and b) the southern part

It should be noted that there is a gap from x=7x10^3 m to x=25x10^3 m in shoreline change rate diagram. The reason for this missing part is that there are only available images in 2001 and 2014 between x=7x10^3 m to x=25x10^3 m and the shoreline change rates obtained from these two years are very fluctuated compared to other parts with more available data. Therefore, the shoreline change rate values between x=7x10^3 m to x=25x10^3 m are not reliable and removed. As can be seen from the figure, shoreline variations of the two coasts are quite significant around the river mouth. Specifically, the maximum erosion rate in the northern part is about 160 m/y while coastline in the southern part advances with the velocity around 4 m/y. At the regions far from the river mouth, only the variation of the shoreline in the northern part can be easily recognized with the advance rate around 2 m/y. From the shoreline change rate diagram, it can be concluded that longshore sediment transport is predominant and sediment is moving to the north.

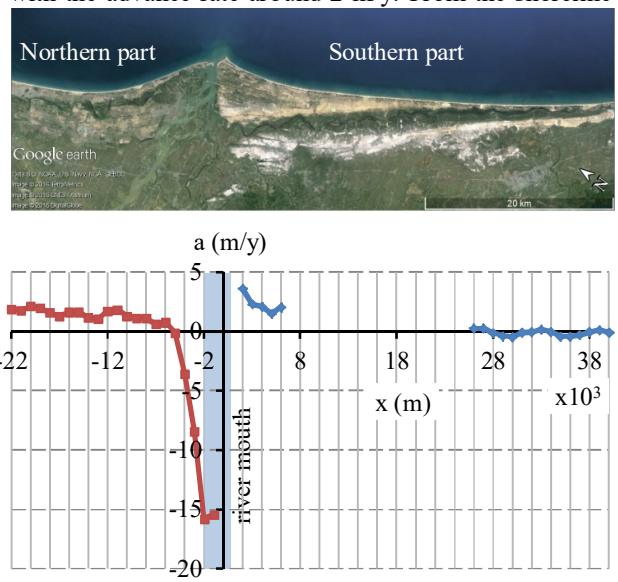

Figure 3. Shoreline change rate at the study area

4. CONCLUSION

Variations of shoreline positions with tidal correction in a large area were analyzed to make discussion on the volume change rate of sediment in the beaches adjacent to the Cua Dai River mouth. Beach changes are quite significant around the river mouth and in the northern part. Longshore sediment transport is predominant in this area and sediment is moving to the north.

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