

Long term topography changes on Hitotsuba Beach, Miyazaki, Japan

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I. INTRODUCTION

Hitotsuba Beach locates on the north side of Miyazaki Port and close to Hitotsuba Toll Road in Miyazaki Prefecture, see Figure 1.

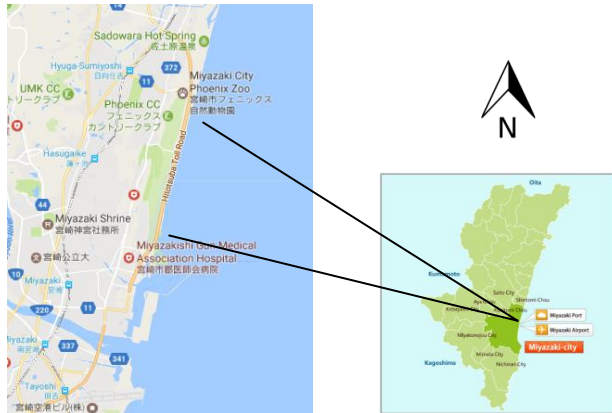
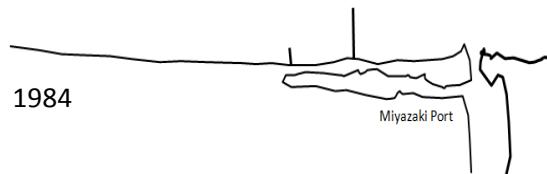
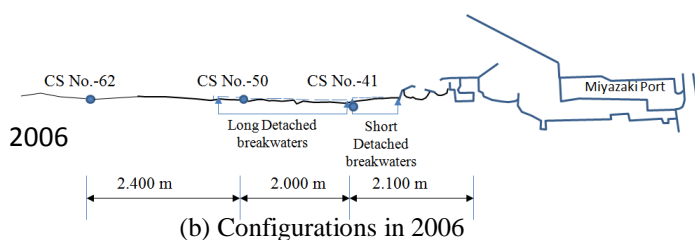


Figure 1. Hitotsuba Beach location (From Google Map, 2016)

Coastal erosion has been occurred at several points along the Hitotsuba beach. On the other hand, Miyazaki Port has sedimentation problem in navigation channel that affect port operational. Hitotsuba Beach retreated since 1990 when the transportation infrastructures was developed massively, such as coastal road, port breakwaters and extended airport runways¹⁾, as shown in Figure 2.



(a) Configurations in 1984



(b) Configurations in 2006

Figure 2. Configurations of Hitotsuba Beach in 1984 and 2006

Coastal protection structures, such as detached breakwater, seawall and groin, were constructed to the coastline in along Hitotsuba Beach in order to controll the sediment transport.

Researchs about sediment transport behavior in this beach are needed to understand the characteristics of the Hitotsuba Beach before and after Miyazaki port construction.

II. RESEARCH METHOD

Beach profile data were obtained for 33 years from 1982 up to 2015. Cross section profile at No.-41, No.-50 and No.-62 are used in this research, see Figure 2. The dominant direction of the longshore current in this location is considered from north to south²⁾. This research is based on comparative analysis to define stable dynamic condition and shoreline change for each cross section. Beach profile data on 1982 and 2015 are used to define initial and final profiles. Before 1993, the Miyazaki Port started its operations using extend infrastructure. Beach profile data between 1988-1993 are not available, so beach profile that taken in 1993 is used to compare the sediment transport behavior before and after port operations.

III. RESULTS AND DISCUSSIONS

(a) Long term change of cross section on Hitotsuba Coast

Typical cross-shore profiles are shown in Figure 3 up to Figure 5 along with the zones denoting wave processes.

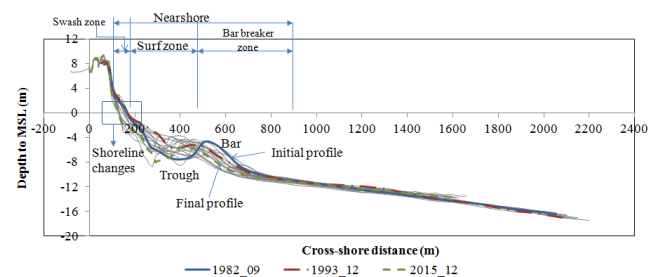


Figure 3. Dynamic changes of cross section at No.-41

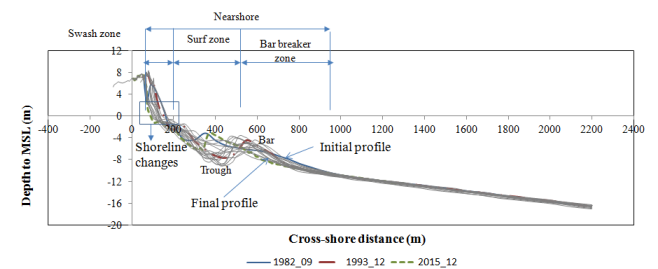


Figure 4. Dynamic changes of cross section at No.-50

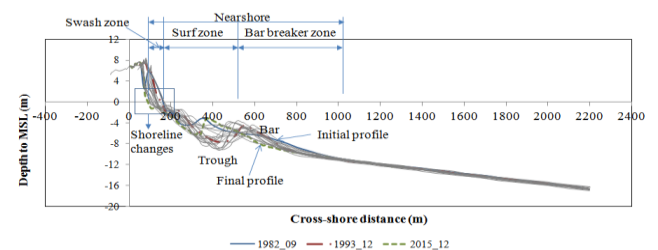


Figure 5. Dynamic change of cross section at No.-62

The width of nearshore zone in cross section No.-41 is about 900 m from the shoreline, in cross section No.-50 is around 950 m, and in cross section No.-62 is 1070 m. Mostly³⁾, sediment move from north to south. This condition has been affecting the performance of the Miyazaki Port. Because the sediments are carried by the current flow towards the south, where mouth of breakwater directly facing south. The averaged depth inside the port as well as its navigation channel gradually has been decreasing over time due to this process.

The form of the nearshore profile of Hitotsuba Beach is commonly one sand bar and associated troughs landward of the bar. In 1982, both cross section at No.-50 and No.-62, there were two bars formation with mild trough. However after 1993, there were only one bar with deeper trough. This condition occurred where breaker zones associated with each bar crest. The bar and trough seems to be migrated to offshore or onshore depending on the wave and wind. Seaward sediment transport occurred on and around bar crests, whereas shoreward sediment transport occurred in trough regions⁴⁾. In this case, the bar and trough positions on Hitotsuba coast were migrated to onshore. The shoreline was retreated due to this condition.

(b) Shoreline changes trend between 1982 - 2015

Figure 6 shows that the beach suffered erosion due to lack of sediment supply. The sediment supply decreased due to several reasons. The first reason is a lack of sediment supply from rivers flow onto the coast. Some structures on the upstream of relating watershed have been trapping grate amount of sediments that might be transported to the beach. This effect can be seen in cross section No.-62 where the upstream of sediment transport on the beach. The second reason is a long jetty that was constructed at Hitotsuse River mouth, north of Hitotsuba beach. The long jetty at the Hitotsuse River mouth has been disturbing the littoral drift from north to south on Miyazaki coast.

To protect Hitotsuba Beach from severe beach erosion and wave attack, the local government seven detached breakwaters on the northern side of old detached breakwaters. And in 2014, national government put a groin on the north of detached breakwater after cross section No.-50.

(c) Shoreline response to coastal structures

Table 1 shows some medium term shoreline changes before and after the Miyazaki Port constructed. At the cross section No.-41, the beach suffered the erosion due to its position at the gap of detached breakwaters. At the cross section No.-50, the beach was protected from the erosion by the detached breakwaters. There are salient and tombolo formation behind detached breakwaters. At cross section No.-62, the beach significantly suffered the erosion. In order to check more retreatment, a line of seawall with gentle slope was installed along this section. The sandy beach scarcely appear in front of

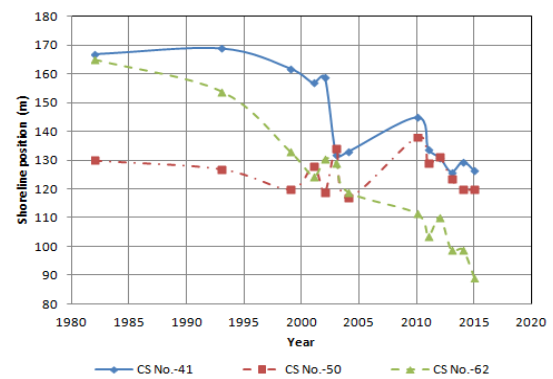


Figure 6. Shoreline changes on Hitotsuba Beach
Table 1. Medium-term shoreline changes

Year	Retreated (m)		
	CS No.-41 2.1 km*	CS No. -50 4.1 km*	CS No.-62 6.5 km*
1982-1993	-5.0	-10.0	-32.0
1993-2003	-37.0	7.0	-25.0
1993-2015	-42.5	-7.0	-64.8

* Cumulative distance from Miyazaki Port

the consecutive seawall on this beach in spite of the seawall installation.

IV. CONCLUSIONS

This study discussed the long term topography changes on Miyazaki coast with using bottom sounding data. The changes were summarized as follows;

- (1) The width of nearshore zone are between 900-1000 m from the shoreline.
- (2) There is a bar formation on the coast, and the location of the bar are different from year to year at each cross section.
- (3) Sediment movement from north to south affects the silting in navigation channels. This condition disturbs activity of port operations.
- (4) The beach erosion threatens the existence of toll road at several points along this beach.

ACKNOWLEDGMENT

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