ASSESSMENT OF SHORELINE CHANGES AROUND SENDAI PORT FOLLOWING THE GREAT NORTH EAST JAPAN TSUNAMI, 2011

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1. INTRODUCTION

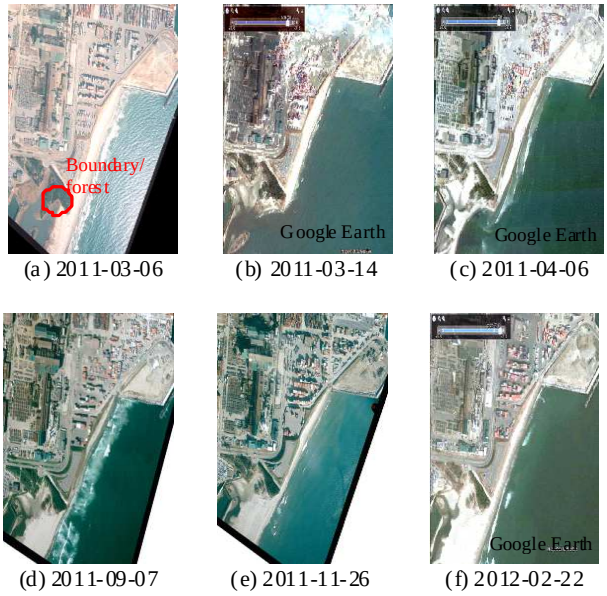
The Great North East Japan Tsunami of 2011 had caused the drastic shoreline changes. Severe shoreline retreat was observed in area with sandy beach such as in Sendai coast (Tanaka et al. 2012). The shoreline retreat was soon followed with the recovery process to achieve a new balance of the shoreline. It is important to understand this process for reconstruction of the coastal area.

The 2011 Tohoku Earthquake Tsunami Joint Survey Group (2011) reported around 10 meter of tsunami wave height in this area. The tsunami propagation on land and in river behave differently (Tanaka et al. 2012). It was reported that the sand formation in front of the Nanakita river mouth in this area was completely flushed due to the tsunami and the Gamo Lagoon, located nearby was severely damaged (Adityawan et al. 2012). In addition, the recovery process of the sand formation was studied in details. It was shown that the recovery process causes the complete closure of the river mouth.

The shoreline in Sendai coast had reached its balance as reported by (Pradjoko and Tanaka, 2010). They analyzed the long term shoreline changes and behaviors based on aerial photos. However, the 2011 tsunami has caused severe changes to the coastline. Therefore, it is necessary to conduct further study to assess the shoreline behaviors following the 2011 tsunami. This study analyzed the shoreline changes in the Sendai Port area, Japan, due to The Great North East Japan Tsunami of 2011, based on aerial photos.

2. RESULTS AND DISCUSSIONS

Aerial photos and satellite images were collected during the period of March 2011 to February 2012. The acquired images are shown in Fig. 1. The satellite images contain geo-spatial reference. However, the aerial photos required rectification prior to the analysis.



(a) 2011-03-06 (b) 2011-03-14 (c) 2011-04-06

(d) 2011-09-07 (e) 2011-11-26 (f) 2012-02-22

Figure 1. Satellite Images

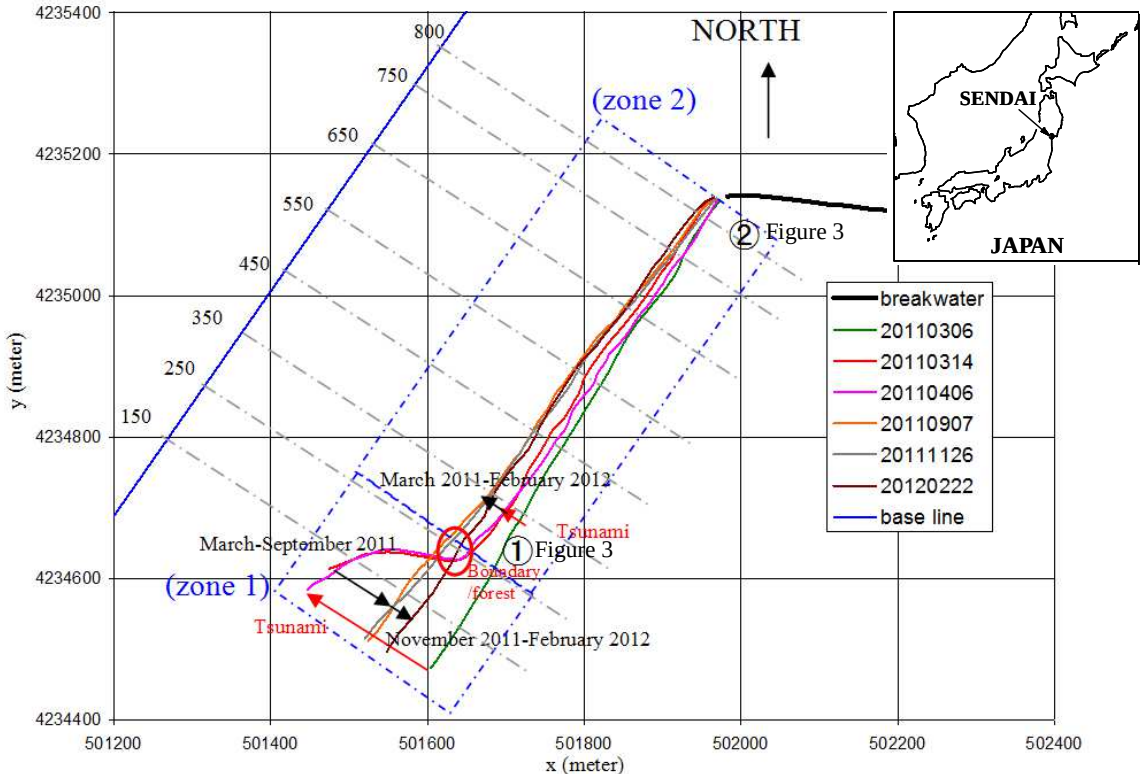


Figure 2 Shoreline changes in Sendai port

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Figure 3. Sandy coast erosion

The images were converted into UTM WGS 84 zone 54 N. The shorelines were digitized and calibrated with the tidal level (Fig. 2). The photographs showing the erosion in this area are given in Fig. 3. The shoreline changes and behaviors in this area can be classified into two zones, separated by the forest, based on the extracted shoreline analysis.

The zone 1 is the area at the south of the forest. It suffered from severe erosion, with 200 meter of shoreline retreat as shown in cross section 150 in Fig. 4. This zone had rapid recovery during the period of March to September 2011 with shoreline advancement of 100 meter that continued until February 2012 by another 25 meter.

The zone 2 is the area at the north of the forest. The erosion was not as severe as in the zone 1. The shoreline retreated varied from 10-25 meter due to the tsunami of 2011, as shown in cross section 350 to 800 (Fig. 4). The shoreline continued to retreat until February 2012 with the total shoreline retreat varied from 25-70 meter.

3. CONCLUSSIONS

The shoreline changes in the Sendai Port was classified in to two zones. Severe erosion was found in zone 1, followed with quick recovery process. However, there was no recovery process in zone 2, in which erosion still occurs. This study provides valuable information, which will be very useful for reconstruction process and future disaster prevention.

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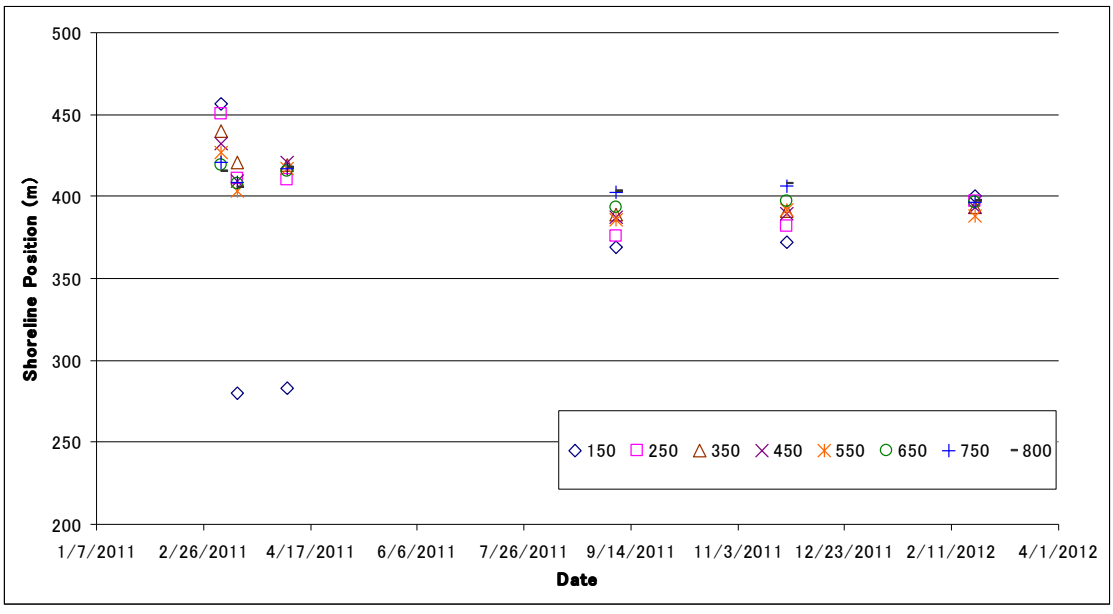

Figure 4. Temporal variation of shoreline position