Ⅱ－437 Shoreline change monitoring using remotely sensed data

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1.0 Introduction

Coastal areas are of important economic and recreational value. However, these areas plagued with problems of wind and wave erosion are very dynamic in nature and need repeated inventories. Information on coastal erosion trends is particularly useful if coastal development is to be accomplished with due regard for the changing beach, with adequate safety, and in most economical manner from the stand point of all concerned. Data collection on coastal erosion is not a simple task. Existing methods of collection typically employ either extensive field measurements that are very expensive or historical observations that may be of questionable accuracy. There are several existing methods that can be utilized to investigate changes in the shoreline. In this study the results of utilizing remotely sensed data in shoreline movements is reported.

2.0 Background of Study Area and Data Used.

The study area is located near Miyazaki Port. Here the Oyodo River which flows through the centre of Miyazaki empties itself into the Pacific ocean. Fig.1 shows a schematic sketch of Oyodo River mouth area.

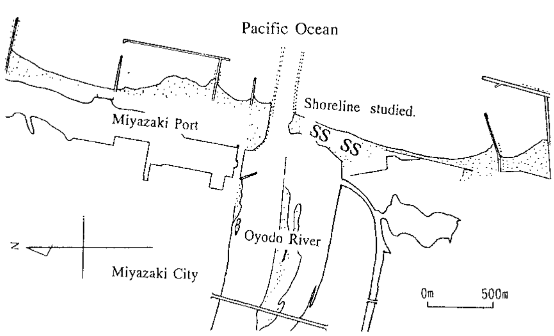

Fig.1 Schematic sketch of Oyodo River Mouth.

Using aerial photographs and remotely sensed data to conduct coastal survey has advantages over conventional field survey or chart comparison method. The usefulness and efficiency of using aerial photographs to study coastal changes has been documented by Dietz, Shepard, Tanner, Sonu, El Ashry and Wanless. Aerial photographs are often unavailable for many areas and cost constraints also hinder periodic aerial photographing. These problems may efficiently be handled by utilizing remotely sensed data.Table 1 shows data analyzed.

Table 1 Data characteristics

Sensor SPOT HRV	Date surveyed	Aerial Photo Date Surveyed
XS,P	20/12/88	20/12/88
XS	06/04/90	17/12/89
XS	04/09/90	04/09/90

3.0 Methodology

To investigate the applicability of remotely sensed data in shoreline movements, the section marked 'SS' in fig.1 was extracted from SPOT HRV data and the results compared with results from aerial photographs.

Band 3 of SPOT HRV which can particularly distinguish land from water bodies was separately combined with bands 1 and 2 in the analysis. Appropriate threshold values were chosen such that land and water bodies were distinctly marked. These values together with the remotely sensed data were used as input data to a computer program written in basic language to output character maps of the area. A character map is a map on which features of interest are represented by characters. From the character maps the respective UTM (Universal Transverse Mercator) coordinates were taken with a digitizer and then transformed into computer graphics coordinate system. Similarly, the UTM of the same area from aerial photographs were taken and transformed into the same coordinate system. These results are as shown in fig.2a and 2b. From fig.2 it can be seen that the shoreline generally retreated landward between 1988 and 1990. Fig.3 compares the shoreline change measured at sixteen points at equi-distance spacing alongshore captured by SPOT HRV and aerial photography during this period.The results were adjusted to the mean sea level to reduce the tidal effect.

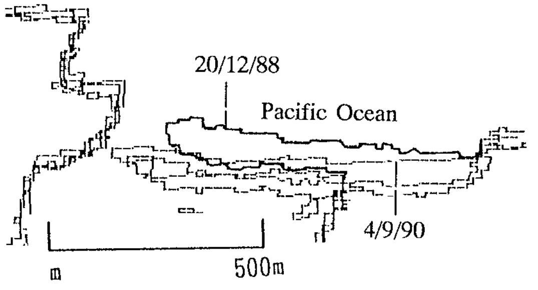

Fig.2a Shoreline movements from SPOT HRV

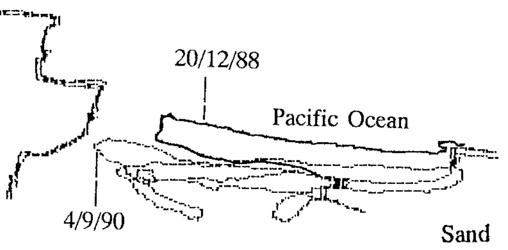

Fig.2b Shoreline movements from aerial photo

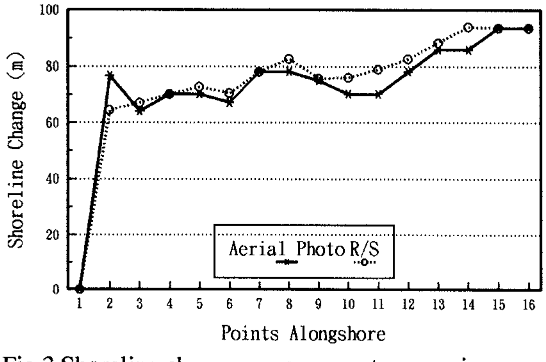

Fig.3 Shoreline change measurement comparison.

4.0 Sediment Transport Rate.

An important limitation of coastal erosion data obtained from remotely sensed data and aerial photographs is that only areas of change can be determined and not volumes of materials eroded or accreted. Volumes of material involved in coastal changes are not necessary in a reconnaissance survey of coastal erosion, but in more detailed coastal engineering studies, to remedy erosion effects the volume of material is usually an important characteristic.

From fig.4, the rate of change of volume is given by $\Delta v/\Delta t=D_s\Delta X_s\Delta y/\Delta t=\Delta Q$ or $D_s\Delta X_s/\Delta t=\Delta Q/\Delta y=\Delta q$ q:rate of change of

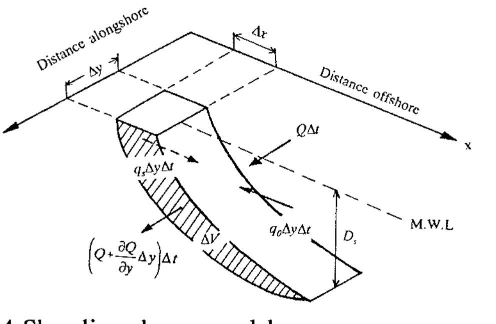

Fig.4 Shoreline change model

volume per unit width of beach. D_s=berm's height plus D_c, where $D_c=(2.28-10.9H_0/L_0)H_0$ H_0 and L_0 are the deep water wave height and wavelength respectively.Wave data for the area was statistically analyzed to obtain H_0 and L_0. Table 2 compares the estimated q values from remotely sensed data and area photographs.

Table 2 calculated q values.

	A.Photo	R/S	%Error
Time	20/12/88 - 4/9/90	20/12/88 - 4/9/90	
Average Erosion:m	77.18	78.49	1.7
q:m^2/yr	664.74	676.02	1.7

5.0 Conclusion

As reported above remotely sensed data can be cost-effectively applied in reconnaissance survey of coastal erosion. These data is relative cheap to acquire, periodic in nature and wide area can be surveyed at a time may provide good data source for such engineering studies.

6.0 Acknowledgement

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7.0 References

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