A study on detecting the change of environment in west Seohan bay, North Korea using satellite Image

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Abstract : In this study the micro landform of tide flat in west Seohan bay, North Korea was classified and the change of this environment was detected by using Landsat TM, ETM+, KOMPAST. For this, ISODATA method of the unsupervised methods was used to classify the micro landform while tasseled cap method was used to detect the change of environment in west Seohan bay, North Korea by passing years.

This study shows the possibility that the topography analysis and change especially in unapproachable area could be detected and monitored by using satellite images.

Keywords: Tide flat, Landsat TM and ETM+, KOMPAST, ISODATA method, Tasseled cap method

1. Introduction

In case of Korea, a tidal flat of inter tidal zone has been the main residential grounds as marine products cultivating for people in the west and south coast as well as reclaimed for the use of fertile cultivation land, industrial land and urban area.

Jo H. R. and Jo M. H (1999) studied to classify the micro-landform into 3 topographical classes such as mudflat, mixed flat, sand flat in Joolpo bay tide flat, Jella province based on ISODATA method of unsupervised classification by using Landsat TM.

In order to analyze the spatial distribution of floating sand in a lake, which has a coast area and vase range watermark area, Jung J. C (1999) studied extracting reflection value acquired by submarine optical equipment having SeaWiFS band range.

However, as you know, it is so difficult not only to research in the tidal flat study but also to approach to the coast environment in North Korea from the political point of view this situation.

So, in order to detect the change of tide flat in North Korea and clarify the characteristic of costal environment, this study shows the possibility that satellite images such as Landsat TM, ETM+ and KOMPSAT could be used to monitor analyze unreachable area as shown in Fig. 1.

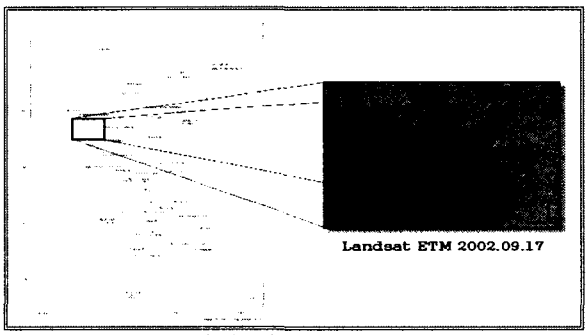

Fig. 1. The Study area, Seohan bay, North Korea

2. Materials and method

Seohan bay where is a shaped a triangle between cheolsan bay in Pyongbok and Janghyon bay in Hawnghae was selected for the study area and KOMPSAT EOC on 18th of September 2001 and Landsat TM on 16th of August 1999 and ETM+ on 17th of September 2002 ancient topography map and were used as study materials.

Tidal flat distribution maps based on the ancient topography and satellite images data, which was applied to unsupervised classification, were prepared

to a suitable study purpose.

Fig. 2. The study flow chart

In addition, a study in detecting the change of environment in west Seohan bay, North Korea was performed by using the coefficient of tasseled-cap and unsupervised classification method. Fig. 2 shows the entire step for study flow.

3. Preparing the tidal flat distribution map based on the ancient topography map

GIS database was constructed by drawing the tidal flat distribution map based on the 33 ancient topographical map sheets, which conversed the entire Seohan bay in North Korea. As the result of analyzing the tidal flat area in study area, marsh and salt marsh, are spread on yong-am bay of the upper stream along the costal and kwang-ryang bay of lower stream, did not exist.

The areas of sand flat, mud flat, and salt farm were clarified as 278.97㎢, 671.23㎢, 6.33㎢, respectively and most area was composed of sand flat and mud flat.

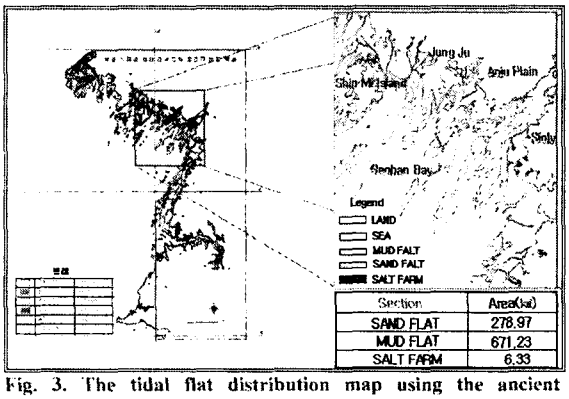

Fig. 3. The tidal flat distribution map using the ancient topography map (1918)

4. Constructing the tidal flat distribution map based on the satellite images data

The tidal flat was detected through the Landsat TM and ETM+ and KOMPSAT EOC on 16th of August 1999 and 17th of September 2002 and 18th of September 2001, respectively.

For this, the ISODATA clustering method based on minimum spectral distance of unsupervised classification method was performed to construct the tidal flat distribution map.

Through the result of this, the area size of sand flat and mud flat were clarified as 405.90㎢ and 450.80㎢, respectively on Landsat ETM+ while the area size of sand flat and mud flat were clarified as 328.6㎢ and 338.84㎢, respectively on Landsat TM as shown in Fig. 4.

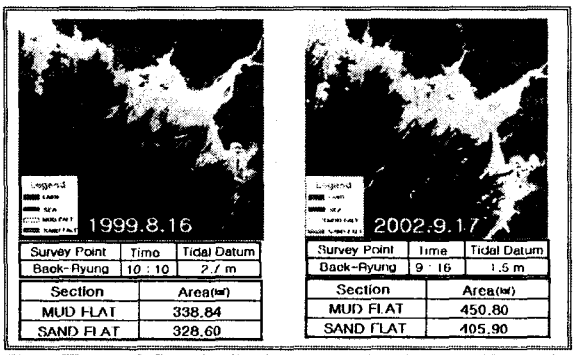

Fig.4. The tidal flat distribution map using Landsat TM and ETM+ images

In order to extract the tidal flat on Kompsat EOC image the unsupervised classification method was performed after mosaicking 4 scans and masking land. The area size of sand flat and mud flat on KOMPSAT EOC image were clarified as 40.97㎢ and 166.22㎢, respectively as shown in Fig.5.

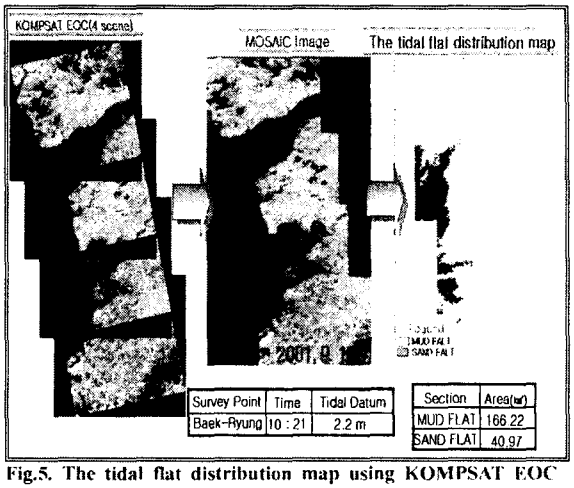

Fig.5. The tidal flat distribution map using KOMPSAT EOC images

5. Detecting the change of the land-cover

The change of land-cover was detected and analyzed by using two periods of satellite images on 1999. 8. 16 and 2002. 9. 17. The area size of forest has been decreased and while the area size of urban and aqua farm has been increased as you can see in Fig.6 and Table 1.

Table 1. The change of land-cover

Section \ Year's	1999	2002	Change of area(㎢)
Forest	317.03	130.46	-186.57
Paddy, Aqua farm	240.62	247.33	+6.71
Dry field, Barren	209.87	357.92	+148.05
Urban	20.45	50.13	+29.68
Total	787.97	785.84	

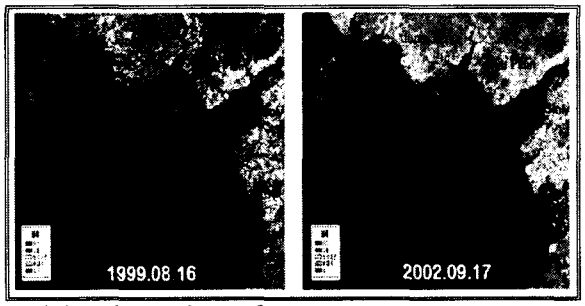

Fig.6. Detecting the change of land-cover

6. The analysis of surface characteristic using the coefficients of tasseled-cap

Table 2 shows the result of general tasseled-cap transformation. In fact, it is difficult to analyze the result value of tasseled-cap transformation because the each constant value of GVI, NWI, and SBI are applied by one matrix. The characteristic and correlation of surface could be easily analyzed by applying the individual constant values of GVI, NWI and SBI.

As the result of this, the area having higher brightness index is proven to have the correlation with SBI because the geographical distribution of vegetation in this area is barely shown. The area having higher Greenness index is prove to have the correlation with GVI while the area having higher water index is prove to have the correlation with NWI.

Table 2 The coefficients of tasseled-cap

band \ index	band 1	band 2	band 3	band 4	band 5	band 7
Green Vegetation Index	-0.334	-0.354	-0.456	+0.697	-0.024	-0.263
None-SuchWetness Index	+0.263	+0.214	+0.093	+0.066	-0.763	-0.539
Soil Brightness Index	+0.081	-0.050	+0.195	-0.133	+0.575	-0.778

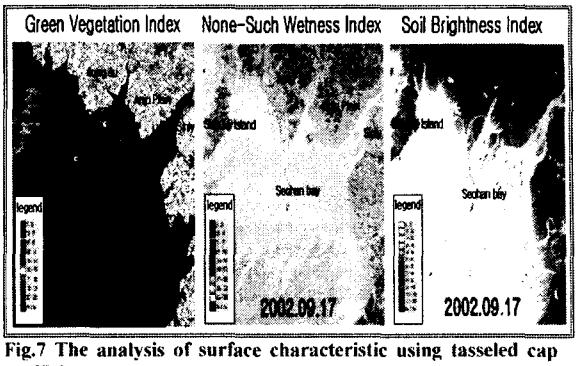

Fig.7 The analysis of surface characteristic using tasseled cap coefficients

7. Conclusion

This study shows the possibility that satellite images and ancient topography map could be used to monitor analyze unreachable area such as North Korea from the political point of view.

Through this, the coast environment in North Korea could be detected by using ISODATA method of unsupervised classification by using Landsat TM and ETM+ and KOMPSAT EOC.

1. As the result of comparing each tidal flat distribution map based on the ancient map and satellite map, 126.93㎢ of sand flat was detected increasing and 215.43㎢ of mud flat was detected decreasing. Thus, the area of land was increased from 945.3㎢ up to 1049.1㎢.

This result might have been caused the nature reconstruction project in North Korea, which has been undertaken since 1981. The change of land use could be monitored through the GIS overlay analysis by using the ancient topography map and satellite images.

2. As the result of comparing each tidal flat distribution map based on Landsat TM and ETM+ images, 77.3㎢ of sand flat has been increasing and 111.96㎢ of mud flat has been increasing. In addition, as the result of processing KOMPSAT the 166.22㎢ of mud flat and 40.97㎢ of sand flat were detected on KOMPSAT image.

3. Trough applying GVI, NWI, and SBI using tasseled cap coefficient, the characteristics analysis of surface could be performed.

In near future, other various satellite images such as MODIS(36 band) and IKONOS are expected to be used to verify this study and derive the result of more exact analysis.

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