APPLICATION OF AIRSAR DATA IN LAND USE / LAND COVER CLASSIFICATION

Nion Sirimongkalerkal [1] , Banjerd Phalakarn [1] and Chaowalit Silapathong[2]

[1]Geo-Image Technology Research Unit

Department Survey Engineering , Chulalongkorn University

http://www.geoimage.eng.chula.ac.th

[2]Geo-Informatics and Space Technology Development Agency (GISTDA)

http://www.gistda.or.th

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ABSTRACT

The objective of this research is to study the potential of AIRSAR data which was recorded on 6 December 1996 using frequency Band L and Band P and electromagnetic polarization type HH , VV and HV with 10 m. pixel resolution. The objective of this research is to compare the difference of radar back scattering in terms of gray level value and to study the potential of AIRSAR classification for 8 ground reflectance classes namely, salt pan, shrimp farm, mixed orchards, mangrove, coconut plantation, rice paddy field the growth stage and the blossom stage and built up area in Banlaem and Muang District Petchburi Province, Thailand.

The result of this study indicates that each land cover class gives different value of back scattering radar signal in the term of gray level value for each frequency, polarization and characteristics of ground cover. It can be found that somewhat less rough surface or smooth surface give low radar signal scattering or low gray value level i.e. shrimp farm and salt pan. On the other hand, rough surface or mixture of plantation gives high gray value level i.e. building area, coconut plantation, mangrove, and mined orchards. Rice paddy gives medium gray value level as the result of the homogeneous pattern or less mixed orchards including the regularity of rice tip ends.

The classification of AIRSAR Band L and Band P (with all polarization directions) using the supervised classification by Maximum Likelihood technique. The result yields the overall accuracy of 80 percent. It can be found that built up area resided in the study area is very limited. It distributed near roadside and within the orchards area. As the result, the back scattering of radar signal is similar to coconut plantation Therefore image fusion technique is introduced using IHS (Intensity: Hue: Saturation) Color composite between LANDSAT 5 TM (Band 453) and AIRSAR. It can be found that using LANDSAT 5 TM (Band 453) and AIRSAR Band L with HH polarization gives high percentage is 85 percent of the overall accuracy.

1. THE INTRODUCTION

Land used and land cover classification from SAR data is an important and continually developing application of microwave remote sensing. Advances in microwave technology have provided and improved measurement capability, allowing development of employing multiple-frequencies and multi-polarization. The characterization and classification of land cover using polar metric SAR data has been extensively invested and reported on Chaowalit Silapathong. et al, 2002 ; Dumrong Buanprasubkul . et al, 2002 ; Enrico, C. P. et al, 1998 and Laili, N. et al, 1995 has discriminated the

land used and land cover with polarization. Recently, Lee, K. et al, 2001 and Prakoso, K.U., 2001 analyzed the radar respond of crop types to frequency and polarization for classification. The classification with multi band an multi polarization gives the best overall accuracy .This paper focuses on the multi band and multi polarization of land used and land cover from AIRSAR image. Different frequency and polarization extraction of blckscatter in terms of grey level value have been implemented and compared.

2. OBJECTIVE OF THE STUDY

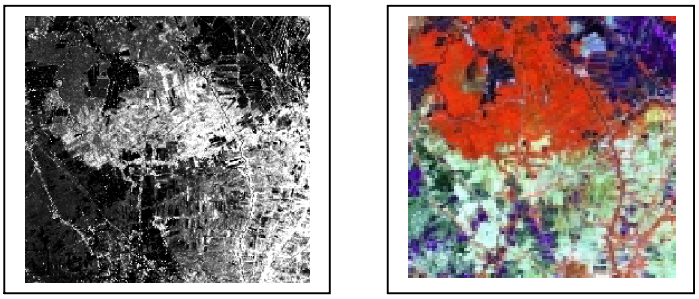
1. To compare the difference of back scattering signal in terms of grey level value of 8 land use/land cover namely salt pan, shrimp farm, mixed orchards, mangrove, coconut plantation, rice paddy field the growth stage and the blossom stage and built up area using AIRSAR data in difference band frequency and polarization.
2. To study the potential of classification of AIRSAR data.

3. STUDY AREA AND DATA SET

The study area is situated in Banlaem and Muang District (figer1) , Petchburi province, latitude 13°00' N and longitude 99°45'-100°00' E covering the area of 152,500 rai (224 sq.km.). The area is lower basin along the coastal line located along the Gulf of Thailand in the eastern part of the study area. The Petchburi river runs through the area in N-S direction. The agriculture cultivation is mainly rice paddy field situated along the Petchburi river plain. The built-up area and mixed orchards are distributed along the river banks and the coastal area is covered by mangrove and mud area. It is now facing landuse changes along the coastal line as a rich mangrove area is now being converted into salt pan and shrimp farm.

3.1 Data and Equipment

The data used in this study was provided by GISTDA. The POLSAR data, with L-(25 cm) and P(68 cm) bands in full polarization (HH,HV,and VV) was acquires using the AIRSAR instrument on-board a DC-8 aircraft during the PACRIM-1 mission on 3rd December 1996. It is projected into ground range with a ground pixel spacing of 10 meters. Landsat 5TM on 17 February 1996 and we used Landsat 5 TM at the same area (figer1).The software has been used is ENVI 3.2



(a) (b)

Figure 1 – show study area in Banlaem and Muang District , Petchburi province.

© AIRSAR Image Copyright 1997 Gistda. (a) AIRSAR L-HH (b) Landsat 5TM (453)

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3.2 Related Information Source

- Topographic Map 1: 50000, Department of Royal Thai Survey Army, series 4931 II
- Ground truth of Petchburi Province data year 1996 from AIRSAR Application Project by Department of Land Development , Ministry of Agriculture and Co-operation

4. Methodology

4.1 Decompress-Synthesized Images

Polimetric radar data typically comes as compressed scattering matrix format that, can not easily be viewed by most image processing software. ENVI'S synthesize function provide an easily-to-use and flexible means of generating and combination of transmit/receive polarization images directly from JPL AIRSAR compressed Stoles matrix data or from SIR-C scattering matrix compressed data. This includes the standard HH,HV,VV and Total power image for each frequency.

4.2 Image Processing

The AIRSAR data processing for this study can be divided into five parts : geometric correction and co-registration , speckle noise reduction by LEE method with window filter size 7x7 and repeat the filtering twice, Analysis of Back Scattering In Terms of Grey Level Value of 8 land use/land cover, supervised classification by maximum likelihood technique is used to recheck ground truth classification result and assess the result by confusion matrix and post-classification processing.

5. RESULT AND DISCUSSION

5.1 The result of the difference of back scattering signal in terms of grey level value of 8 land use/land cover using AIRSAR data in difference band frequency and polarization.

It can be found that the grey level value for each ground reflectance gives values differently based on 2 main factors as radar system parameter such as wavelength and polarization and object parameter such as surface roughness and dielectric properties as seen in Figure 2.

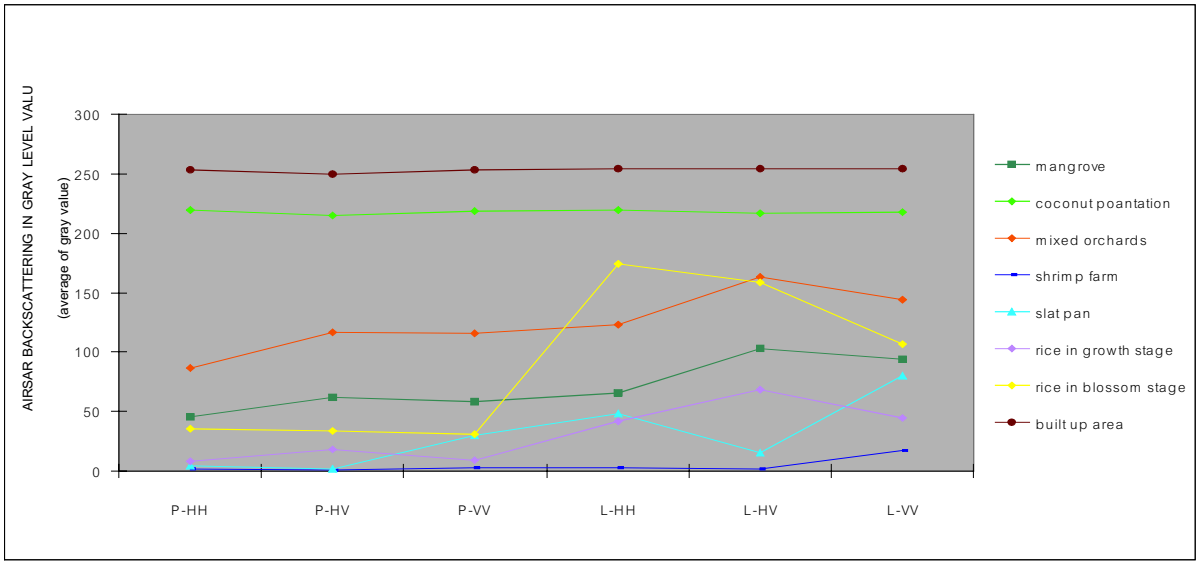

Figure 2. Averaged backscatter scattering In Terms of Grey Level Value of Land Use/Land Cover from AIRSAR Data

The result of the study reveals that back scattering pattern of coconut trees and built up area has similar characteristic. It is caused by cutting some bad part of the image resulting in smaller built up area. In addition, the left image is situated in a countryside and built up area is distributed along roadside and in a plantation area. So the back scattering of coconut trees and built up area has similar pattern. Therefore, the image fusion techniques is introduced using HIS (Intensity: Hue: Saturation) Color Composite between Landsat 5TM (Band 453) and AIRSAR. Then the back scattering pattern is analyzed again as the result shown in Figure 3.

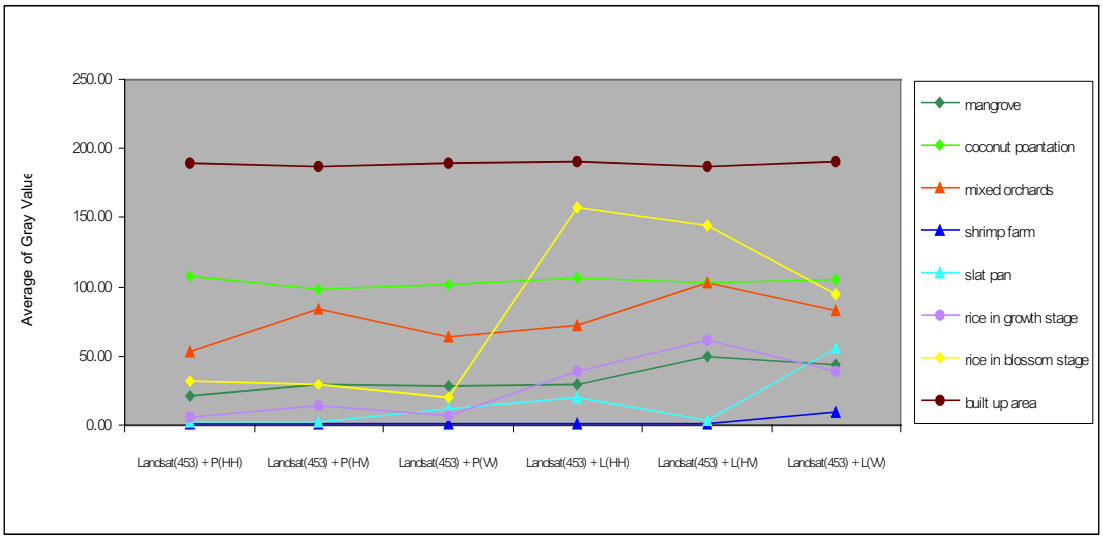

Figure 3. Averaged of the Reflectance of The Land use/Land cover from IHS with AIRSAR Data and Landsat Band (453)

5.2 The result of the supervise classification by maximum likelihood shown in Figure 4 and the accuracy assessment summary for classification with 8 land cover shown in table 1

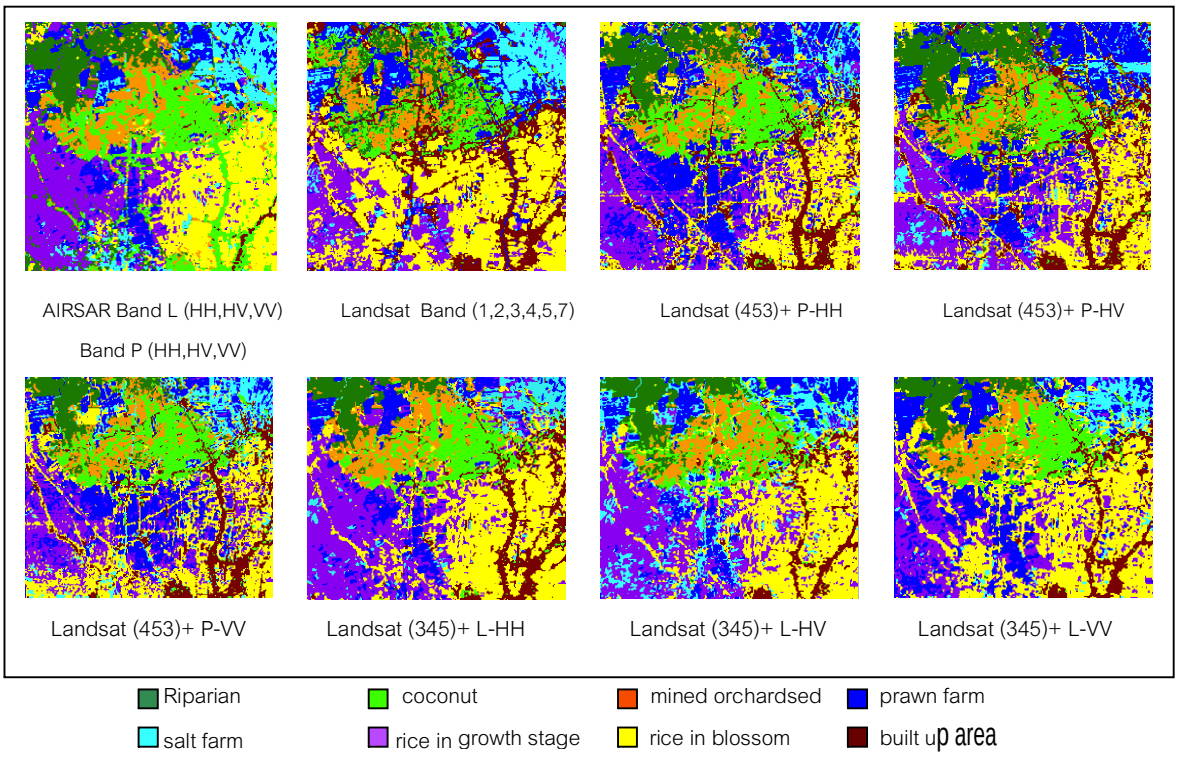

Figure 3 . Show the result of the supervise classification by maximum likelihood

Data	Riparian User Acc(%)	Coconut User Acc(%)	Mined orchardsed User Acc(%)	Prawn farm User Acc(%)	Salt farm User Acc(%)	Rice in growth stage User Acc(%)	Rice in blossom User Acc(%)	Built up area User Acc(%)	Overall %
AIRSAR	90	91	92	80	82	90	92	22	80
Landsat (123457)	35	33	36	82	86	81	86	92	65
Landsat + PHH	89	95	91	76	25	56	47	80	70
Landsat + PHV	94	91	88	71	14	58	37	80	67
Landsat + PVV	90	91	89	78	29	31	32	82	66
Landsat + LHH	88	91	86	88	61	90	92	85	85
Landsat +LHV	93	76	83	82	31	94	85	80	78
Landsat +LVV	90	83	85	92	65	73	74	82	80

Table 1. Show the accuracy assessment a summary for classification with 8 land use / land cover

6. **CONCLUSION AND RECOMMENDATIONS**

It can be concluded that each ground reflectance gives different grey level value for different band frequency and polarization. The classification of AIRSAR data can be categorized into 3 classes based on the roughness surface of ground reflectance as the following;

1. Smooth and somewhat smooth surface, gives low back scattering and low grey level value such as prawn farm and slat farm.
2. Medium roughness surface, gives medium back scattering and medium grey level value such as rice paddy field growth stage and blossom stage and riparian.
3. Rough surface gives high back scattering and high grey level value such as built up area and coconut plantation and mixed orchard

It can be stated that AIRSAR has high potential for classification ground reflectance as it yields the accuracy of 80% or better for each ground reflectance except built up area which gives only 22 % accuracy. As the result of the similar back scattering pattern between coconut trees and built up area. However, after the introduction of image fusion IHS using Landsat 5 TM (Band 453) and AIRSAR Band L (HH,VV,HV) and band P(HH,VV,HV), the results of some image yields better accuracy than using AIRSAR data alone. However, there are some image that gives lower accuracy than using AIRSAR data alone. It can be found that the fusion between Landsat 5TM(Band 453) and AIRSAR Band L (HH,VV,HV) gives better accuracy when using Landsat 5TM (Band 453) and AIRSAR Band P (HH,VV,HV). Especially, the fusion between Landsat 5TM(Band 453) and AIRSAR L-HH yields the classification accuracy of 85%.

Furthermore, it can be found that Band P gives better classification accuracy when study rough surface such as coconut trees, mined orchardsation or complex plant structure and riparian. However, Band L gives better classification accuracy when study rice paddy fields. The result of this study is conformed with the study of Chawalit Silapathong et all 2002.

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