Report of International Internship

In Thailand, Kasetsart University, Satellite station
Research of Engineering, major of information engineering 1st degree

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Reason

I have been lived in Thailand for 4 weeks and I worked in Satellite station of Kasetsart University. Because I want to get working experience in foreign country. When I get job, this experience will be big advantage.

Place

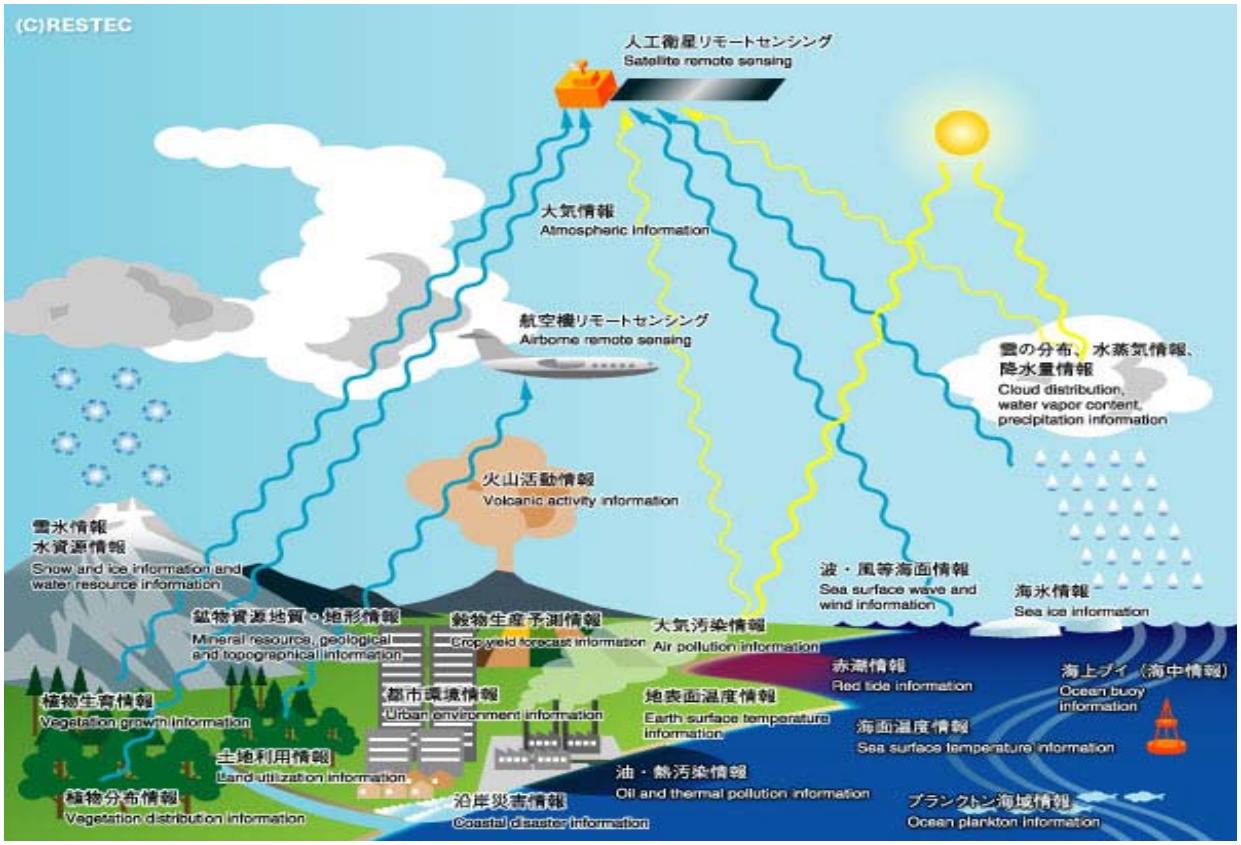
I have been worked at Satellite station in Kasetsart University, Bangkok.
The station is exist in faculty of engineering.
This station related to JICA project. This Satellite station using China's Satellite. Satellite name is "China Star".

Schedule

First when I came Thailand, I attend and hearing presentation of JICA's member. (8/5)
And I went to fieldwork of JICA'S project. (8/6～8/7)
I have been worked at satellite station for 3 weeks. (8/8～8/29)
First day is orientation of internship and introduction of satellite station. (8/8)
Processing satellite image using ENVI (8/9～8/30)
Attend seminer of satellite image processing (8/25)
Processing satellite image of Japan that is damage of earthquake and TSUNAMI on 3/11. (8/26～8/30)
Prepare for my presentation of international internship. (8/28～8/29)
Presentation of international internship and satellite image processing (8/30)
Departure for Japan (9/2)

Remote censing

Remote censing is mean "　without touching directly"
Observation of using satellite remote sensing can see following



So,Today the technology is very important and useful.
This time, I processed image by using satellite remote sensing.
Satellite Remote Sensing has 4 features.

1. Can be viewed at one time a wide range.

Status of land use in each region, differences in the distribution of plant.

2. It is possible to observe the same area over a long period

Can learn over time due of changes in the environment.

3. Directly without going to the field, can see the status

Can see change area was damaged by disasters happened.

4. Human eye can't see (such as temperature) can be known information

Mechanism of remote censing

Satellite has some censor. Censor can receive electromagnetic waves such as visible light, infrared, and microwaves. All of material on the earth has

reflectance characteristics and radiometric characteristics. So Every material show different response. Plant has different reflectance of the plant health. Growth is also too.

Satellite

This time, I processed satellite image taken by HJ-1A. HJ-1A made by China.

HJ-1A has two CCD camera and HIS(Hyper Spectral Imager)

HJ-1A spec table

Satellite	Payload	Band no.	Spectral range (μm)	Spatial resolution (m)	Swath width (km)	Side-looking ability	Repetition cycle (days)	Data transmission rate (Mbps)
HJ-1A	CCD	1	0.43～0.52	30	700		4	120
		2	0.52～0.60	30				
		3	0.63～0.69	30				
		4	0.76～0.9	30				
	HIS	—	0.45～0.95 (110-128 bands)	100	50	±30°	4	

The difference is shown in the table here. This time, I used CCD image.

Image processing

My main work is 4 processing.

1. Geometric Correction
2. Radiometric Correction
3. Atmospheric Correction
4. Classified

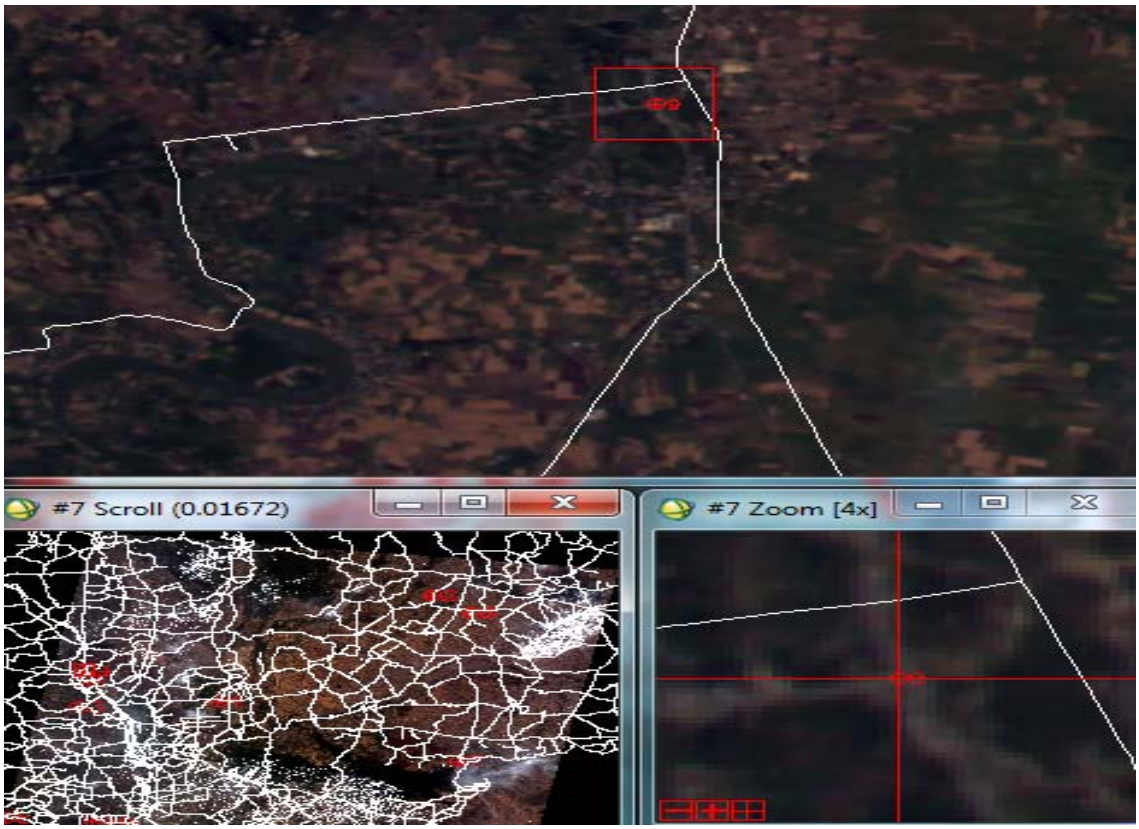
If using satellite picture, satellite picture must path these processing.

I used image process software ‘’ENVI’ when I process satellite picture.

Geometric Correction

First, I have to process geometric correction because Satellite picture has geometric distortion. This problem caused that satellite move every time and

distortion by censor lens and surface of the earth is not flat. Also satellite image coordinate is different from real coordinate. To process geometric correction, have to know real coordinate from already existing map (such as vector file or Google map). At first to process geometric correction, select and put GCP (Ground Control Point). Select satellite image coordinate and find out real coordinate. When select GCP, widely and scatter is better as possible This image show example



After put GCP at least 5, ENVI show RMS (Root Mean Square) error.
In other words, RMS error is mean Measure of accuracy.
So when put new GCP, have to check RMS error change and this value must under 0.6.
Put GCP over 10 and RMS value under 0.6, create new image.
And compare before image and after image. If new image adjusted, moving next image processing.

Radiometric Correction

Next have to process Radiometric Correction. Because Sun ray strength and angle is different every day and distance between sun and earth different

every year. And calibration coefficient using censor is different in every year, also satellite angle different too. And each CCD camera has different value. To processing radiometric correction, have to know Sun Elevation. When download satellite image, this image include many information of satellite and satellite image information. Calculate sun reflection use Excel.

Show example and satellite data and how to calculate sun reflection.

・Satellite data

<productId>488520</productId>
<sceneId>485827</sceneId>
<satelliteId>HJ1A</satelliteId>
<sensorId>CCD1</sensorId>
<recStationId>MYN</recStationId>
<productDate>2011-02-24 10:11:45</productDate>
<productLevel>LEVEL2</productLevel>
<pixelSpacing>30.000</pixelSpacing>
<productType>Standard</productType>
<sceneCount>1</sceneCount>
<sceneShift>0</sceneShift>
<overallQuality>6</overallQuality>
<satPath>428</satPath>
<satRow>68</satRow>
<satPathbias />
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<sceneRow>68</sceneRow>
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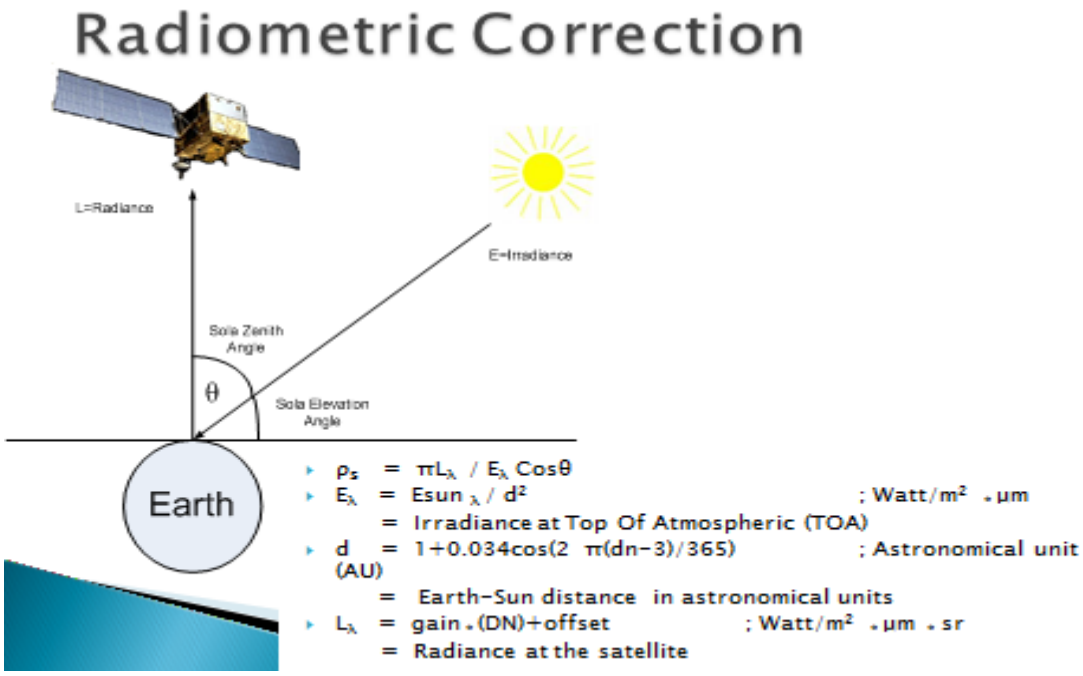
<sceneRowbias />
<direction>D</direction>
<sunElevation>39.810</sunElevation>
<sunAzimuthElevation>340.706</sunAzimuthElevation>
<sceneDate>2011-02-24 01:32:22.32</sceneDate>
<sceneTime>225595942.322630</sceneTime>
<instrumentMode>IMGMODE</instrumentMode>
<imagingStartTime>2011-02-24 01:31:56.10</imagingStartTime>
<imagingStopTime>2011-02-24 01:32:48.53</imagingStopTime>
<gain>2.000000,2.000000,2.000000,2.000000</gain>
<satOffNadir>0.000</satOffNadir>
<mirrorOffNadir>0.000</mirrorOffNadir>
<bands>1,2,3,4</bands>
<absCalibType>(gain2,Fielddata,L=DN/g+L0,W*m^(-2)*sr^(-1)*um^(-1))B1:g 0.7768, L0 7.3250; B2:g 0.7796, L0 6.0737; B3:g 1.0312, L0 3.6123; B4:g 1.0049, L0 1.9028</absCalibType>
<mtfcProMode>None</mtfcProMode>
<radioMatricMethod>StatData</radioMatricMethod>

Show example calculated Excel data.

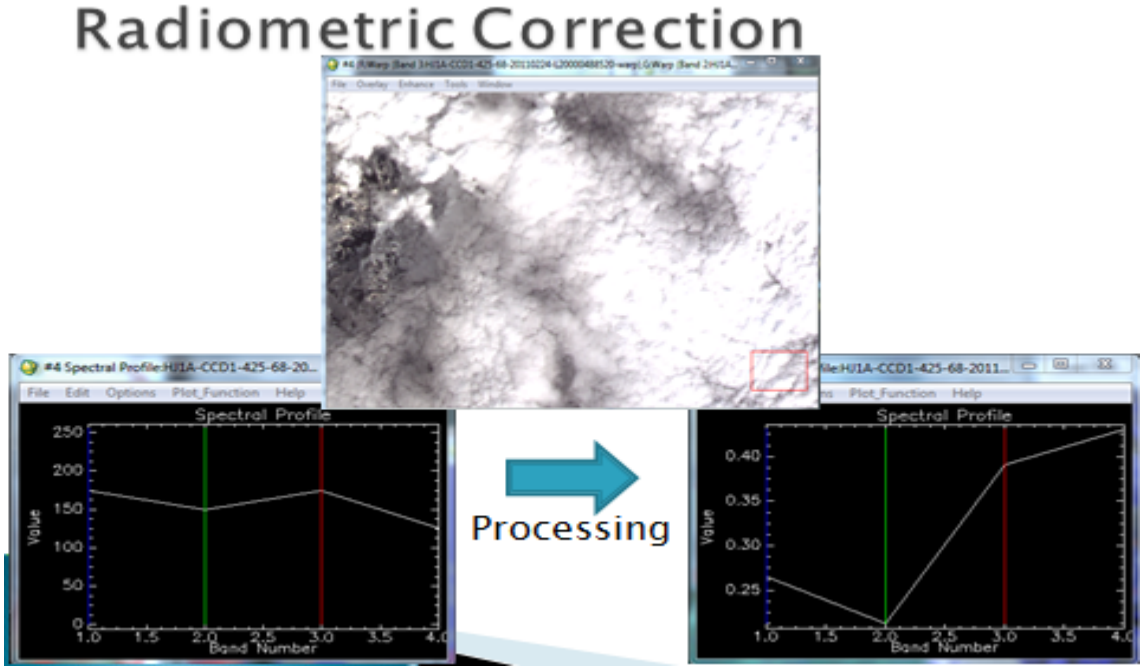
Esun_Fix	1914.324	1825.419	1542.664	1073.826
a_In	1.0123	1.1465	1.5145	1.3503
CountDay_IN	55	55	55	55
d_Auto	0.7768	0.7796	1.0312	1.0049
E_lamda_Auto	3172.46625	3003.43962	1450.72647	1063.37935
Elevation_in	39.81	39.81	39.81	39.81
A_Auto	0.00152791	0.00142499	0.00223331	0.00341732

After calculate, use A_Auto data to adjust spectral value.

Show picture, how to calculate sun reflection.



Radiometric Correction before-after



Band 1

Atmospheric Correction

Next processing is Atmospheric Correction. I wrote, “All of materials of the earth has different characteristic”. Also atmosphere has too.

So atmosphere scatter and refletct sun ray. To solve this problem, need atmospheric correction.

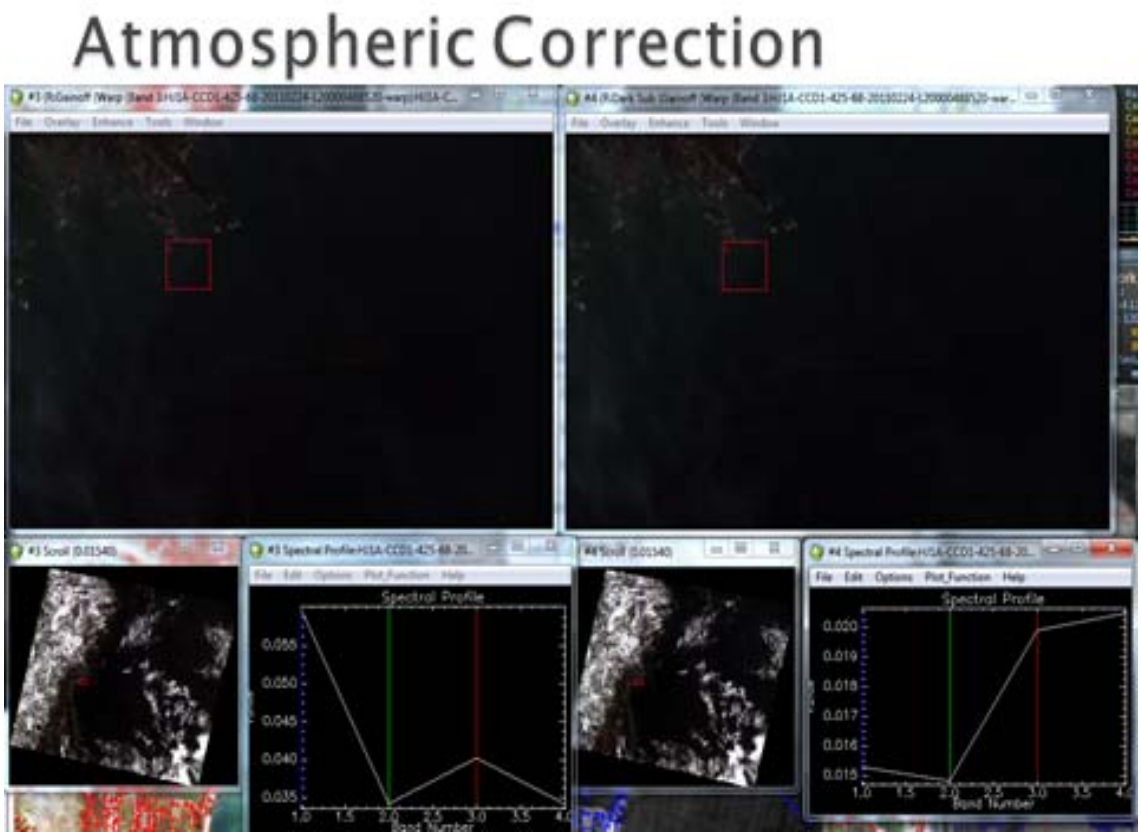
First, process “Dark subtract” using ENVI.

Dark subtract use Dark object (like water) and adjust spectral parameter.

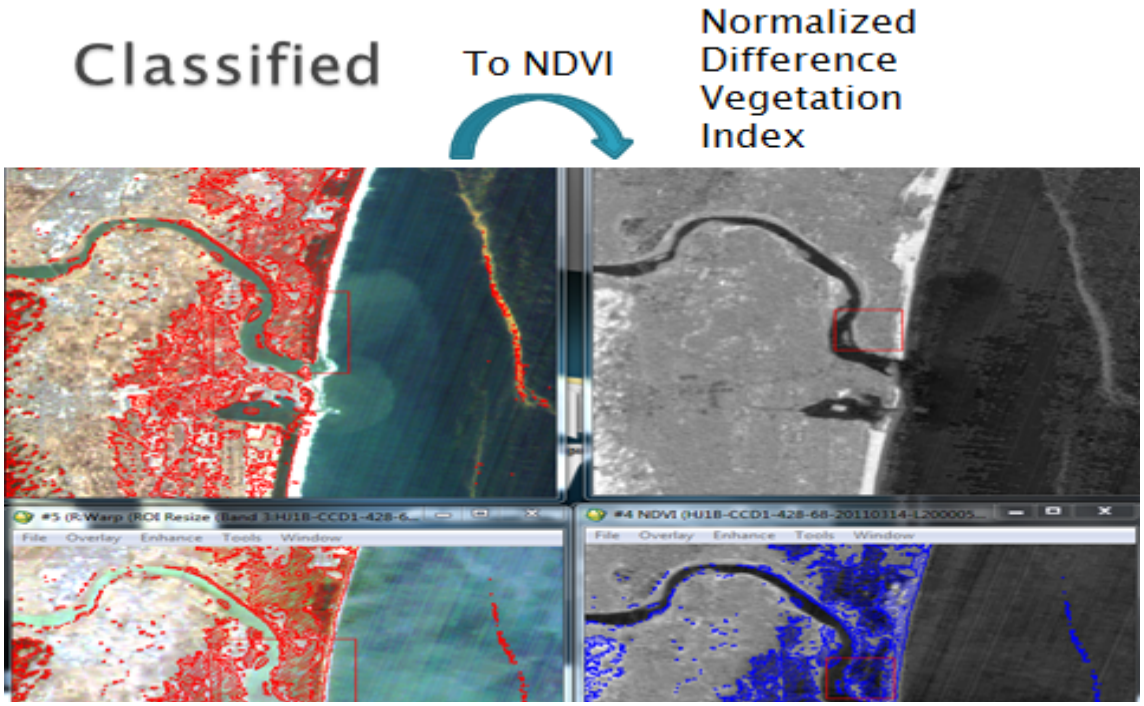
Because, water absorb and scatter sun ray.

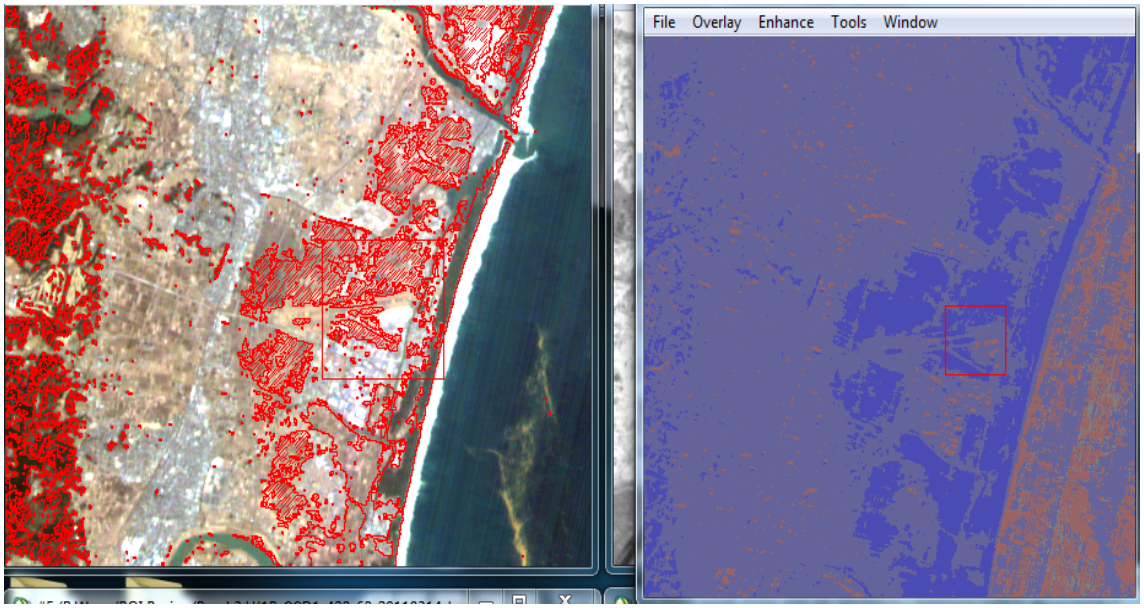
So water of satellite image must adjust spectral parameter to nearly 0.

Show example atmospheric correction before after.



Classified





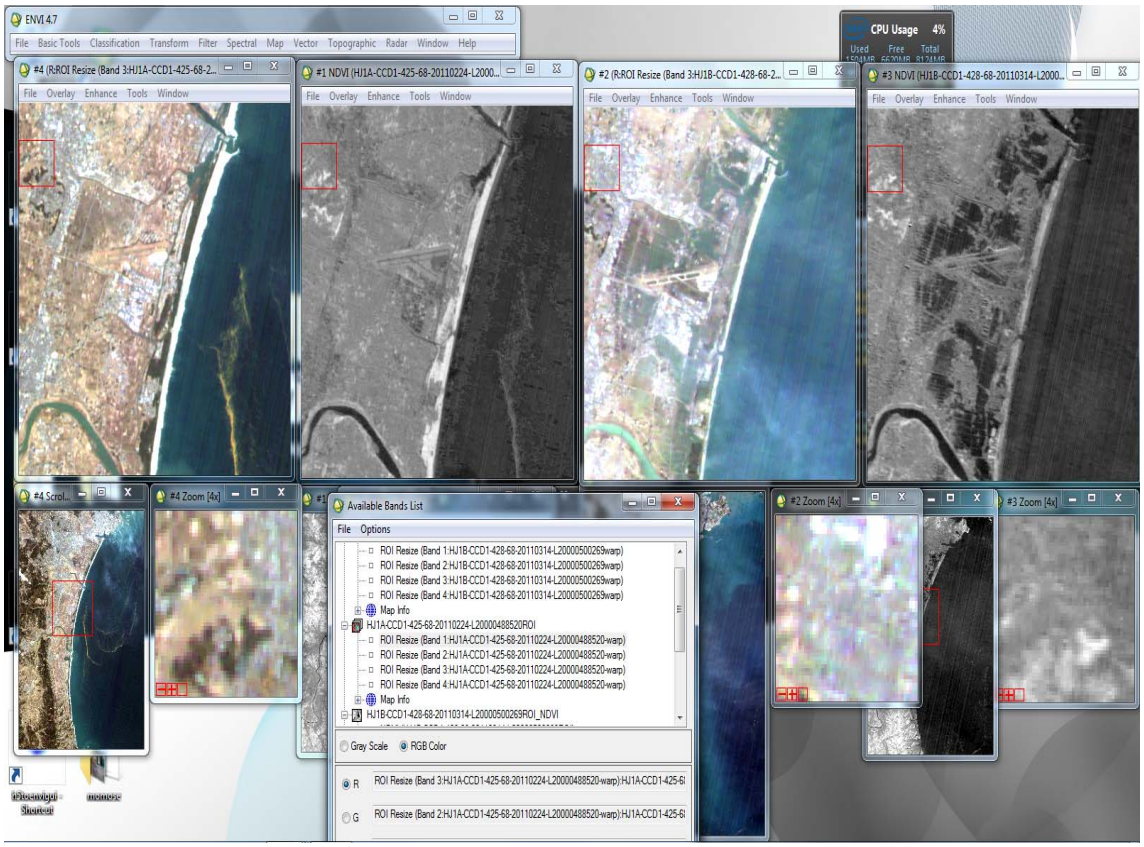
Processing classified, we can know to find area different and compare this area before and after. For example, national disaster, aging and so on.

After Normalized difference vegetation index, processing change detection.

This process more easy to know this image's difference.

Increase NDVI area more red. Decrease NDVI area more blue.

Sendai before after



In Japan, big earth quake cause on March 11 2011.
Tohoku region was big damaged by earth quake and Tsunami (big wave)
So we have to know the damage by big disaster.
I process this image during international internship.
This image is my result of international internship.
Right Gray scale picture darker than left picture.
This darkness is mean damage of tsunami.
Because, water has low reflectance of sun light.

Impression of international internship in Thailand and Acknowledge

I'm very enjoyed international internship in Thailand.
Every people very kind and interesting.
And professor and friends took me to various places.
I'm very thankful to everyone.
Also, I'm very thankful to Mie University which gave this opportunity.