REMOTE SENSING APPLICATIONS ON LAND USE, LAND COVER AND AIR POLLUTION IN SOUTH VIETNAM

LAM DAO NGUYEN¹, PHAM BACH VIET²

¹GIS AND REMOTE SENSING RESEARCH CENTER – HCMIRG – VAST
²GEOGRAPHY FACULTY – UNIVERSITY OF SOCIAL SCIENCES AND HUMANITIES – VNU-HCM
1. Introduction
2. Land use / land cover changes (forest, agriculture, urban)
3. Air pollution mapping from EO data
4. Conclusions
Introduction

GIS and Remote Sensing Research Center - GIRS

• Researchers were graduated in fields of RS, GIS, Informatics, Geography, Geology, Environment, Natural resources management, etc.

• Cooperation with experts and scientists from:
  – Universities
  – Research institutions

• International cooperation projects: UNDP, UNEP, ESCAP, ESA, DLR, CESBIO/CNES, WWF, etc.
Fields of application:

- Natural resources and environment monitoring;
- Agriculture and forestry;
- Urban management and planning;
- Natural disaster, climate change, etc.
Introduction

Research projects:

**WISDOM**: Water related information system for the MD, Vietnam

**RICEMAN**: Rice & Mangrove monitoring in Southern Vietnam

**Planet Action**: Impacts of climate change and human activities on the environment in the MD, Vietnam

Utilization of SAR data for rice crop monitoring

Estimation the mangrove forest biomass

Change detection of Mekong river bank & coastline
The Mekong Delta, South of Vietnam is one of the most affected regions in the world by global warming e.g. ocean warming, rise in sea level, typhoons, storm surges;

→ These are expressed in intensive flooding at coastal zones and inland, salinity intrusion, coastal erosion, and degradation of biodiversity.

Studies need to be carried out to quantify the changes observed by satellites in land use / land cover, in coastline, riverbank, in flood extent and duration, and in cultural practices, etc.
Mekong Delta, Vietnam:
- Area: 40,500 Km$^2$ (1/8)
- Population: 17.3 M (1/5)
- MD accounts for more than half (21.6 / 40 Mt, 2010) of the country’s rice production (1/2)

Why Satellite RS ?
- Synoptic measurements on large areas;
- Near real time;
- Low cost;
- etc.
Introduction

Long Xuyen Quadrilateral

Plain of Reeds

Ca Mau Peninsula

ENVISAT ASAR
Mangroves at the coastal area

Site: Ca Mau

Problems:
The issue of coastal land conversion for commercial shrimp farming
• Typical land cover is mangrove, which has changed by human activities.
Mangroves at the coastal area

1961 – 1971: this area was suffered a mass destruction by defoliants

From satellite images => rate of mangrove forest change
Mangroves at the coastal area

Sites: Soc Trang, Bac Lieu, Ca Mau

Mangrove change 2000 – 2011 from satellite images

- w/o mangroves
- Mangroves unchanged
- Mangroves changed to others
- Others to mangroves
Inland wetland area

Land cover change at Tam Nong – Dong Thap (Plain of Reeds) → landscape changes: forest cover rate

Natural wetland remained, with forest and grassland.
Before 1980s, natural wetland covered more than 1/2 land area

1985 → 2005 rice area of 2-3 crops increased 8 times

2005: cultivated land cover 90% of Plain of Reeds.

Natural forest just a few.

(Data source: SubNIAPP)

Forest biomass assessment using EO data for Reducing Emissions from Deforestation and Forest Degradation (REDD)
Rice crops (using ASAR APP)

WS 2007 crop

WS 2008 crop

WS 2011 crop

SA 2007 crop

AW 2007 crop

AW 2010 crop

Site: An Giang
Rice cropping system (using ASAR APP - 2007)

Estimated rice yield of SA 2007 crop
Rice paddy mapping using MODIS (2010)

Source: Pham Duy Tien, AGU
Methane emission from rice fields

Source: Thuy Le Toan, CESBIO
Monitoring straw burning from MODIS

Pham Duy Tien, AGU
Monitoring straw burning from MODIS

Source: Pham Duy Tien, AGU

1 ha with 7 ton straw = emission of 9,1 ton CO$_2$, 798 kg CO, etc.

In dry season 2011
Urbanisation and environment

Built-up area rapidly increased – case of Can Tho city

Urban area: increased > 7 times (1989: 2.59 km² → 2007: 20.11 km²)

Source: Pham Thi Mai Thy, GIRS
Urbanisation and environment

Urban area of Can Tho city using multitemporal satellite images

Source: Pham Thi Mai Thy, GIRS
Urbanisation and environment

(a) before 1960

(b) Hòa Bình Street (2011)

Ground filling for urban development
Inundated as loss of sewage way

Source: Pham Thi Mai Thy, GIRS
Urbanisation and environment

Source: Nguyen The Duong  
– http://ngoisaonet.net

Site: Ho Chi Minh city
Urbanisation and environment
Urbanisation and environment


2010  2012
Urbanisation and environment

22/10/1972

40 năm

2012
Urbanisation and environment
Urbanisation and environment
PM10 distribution map in Ho Chi Minh City

Landsat7 ETM+ band 1
24-02-2006

Landsat7 ETM+ band 3
24-02-2006

Source: GeoC
PM10 Distribution map in Ho Chi Minh City

Landsat7 ETM+ band 1 & 3 composition

24-02-2006

Source: GeoC
PM10 Distribution map in Ho Chi Minh City

Displaying on HCMC base map

Source: GeoC
Air pollution concentration of components in Hanoi

Site: Ha Noi

Source: Luong Chinh Ke, RSC
Air pollution concentration of components in Hanoi

Source: Luong Chinh Ke, RSC
Air pollution concentration of components in Hanoi

Source: Luong Chinh Ke, RSC
Ongoing and further research works


- Distinguishing some objects of mangroves from radar data
- Analyzing radar scattering characteristics of mangroves correlating with forest biomass.
- Developing algorithms for classification, mapping and calculating biomass by active microwave remote sensing.
Ongoing and further research works

INTEGRATED SYSTEM OF REMOTE SENSING, GIS AND MATHEMATICAL MODEL FOR ASSESSING CLIMATE CHANGE IN SOUTHERN VIETNAM (2013-2015, MOST – NATIONAL LEVEL)

- Identifying the changes of sea level
- Applying mathematical models and GIS tools to quantify the changes caused by human activities (land cover/land use, agricultural, irrigation, forest cover, etc.) and the changes related to a number of climatic factors (temperature, humidity, evaporation, precipitation, etc.), and natural hazards (erosion, flooding, drought, salinity, etc.);
Ongoing and further research works

UTILISATION OF SATELLITE IMAGERY (VNREDSAT-1 OR EQUIVALENT) FOR MONITORING AGRICULTURAL LAND COVER/LAND USE OF MEKONG DELTA, VIETNAM (2013-2015, MOST – NATIONAL LEVEL)
Ongoing and further research works

RICE CROP MONITORING IN THE MEKONG DELTA, VIETNAM (2013-2015, SAFE PROJECT)

Legend
- Green: Rice area
- Yellow: Non rice area

GEOGLAM
GEO Global Agricultural Monitoring

Asia-RiCE
Asian Rice Crop Estimation and Monitoring
Remote sensing technique provide a useful tool and satellite data gives an objective view at large scale.

The projects have been carrying out in Vietnam in order to monitor dynamic changes of LULC and others using time series of EO data for their management needs.

Applying remote sensing for mapping air pollution in Vietnam yields preliminary reasonable results.

MODIS data with coarse resolution can be efficiently used to monitor straw burning of rice paddy fields in the study site.
What we expect from the Workshop:

- Capacity building;
- Exchanging scientific information, data, publications, and other materials;
- Developing research proposals;
- Networking;
- Etc.
Thank you

Contact:
GIS & RS Research Center
HCMC Inst. of Resources Geography
VAST

Dr. Lam Dao Nguyen
ldnguyen@hcmig.vast.vn
nlamdao@gmail.com

Mr. Pham Bach Viet
phambachviet@gmail.com