

REMOTE SENSING APPLICATIONS



IN THE MEKONG DELTA, VIETNAM



Lam Dao Nguyen

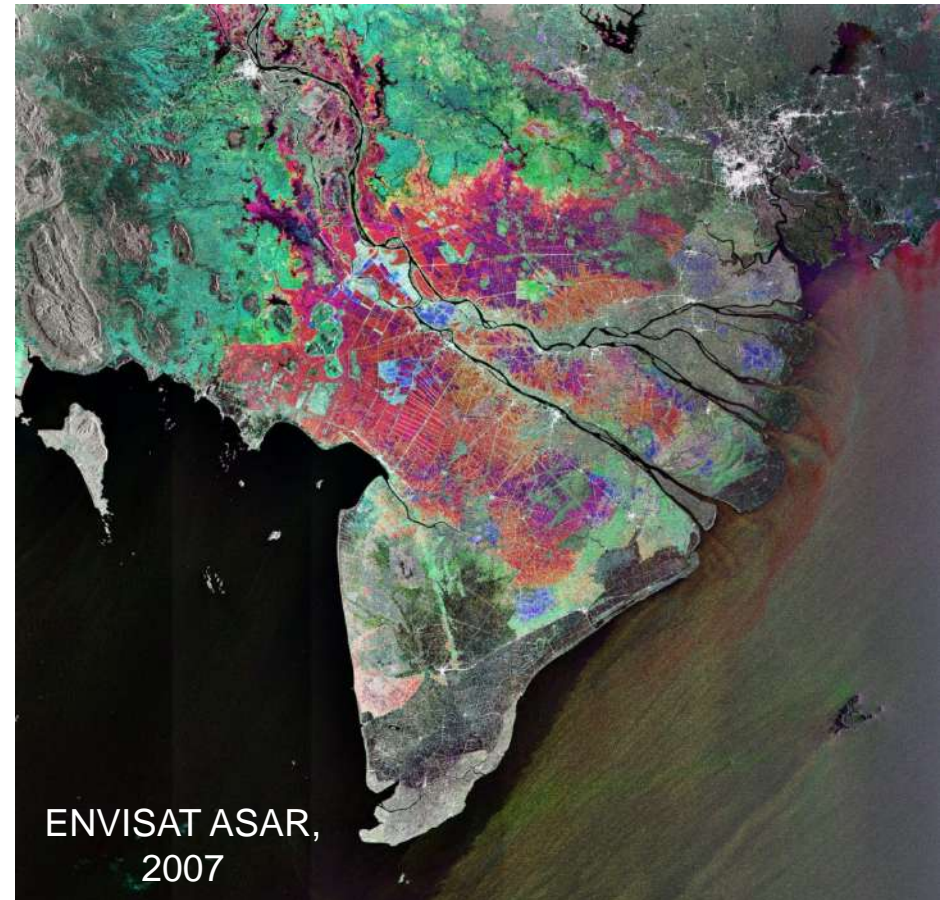
Pham Thi Mai Thy

HCMC Space Technology Application Center (STAC)

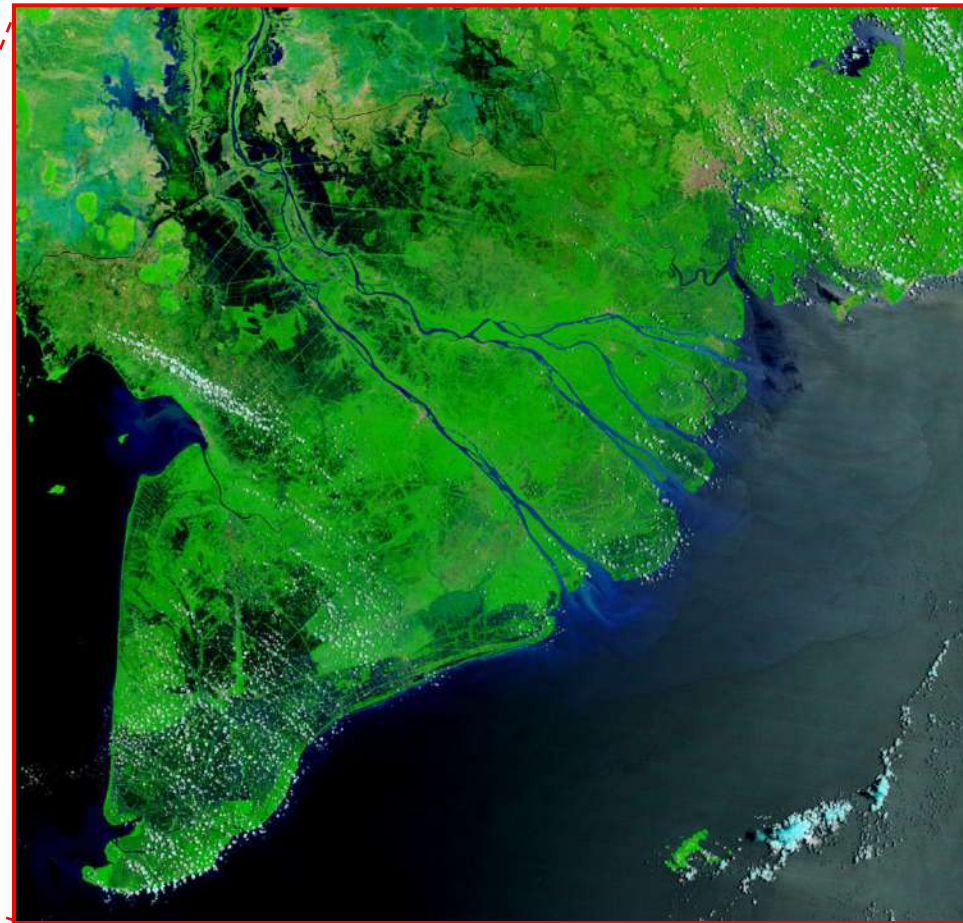
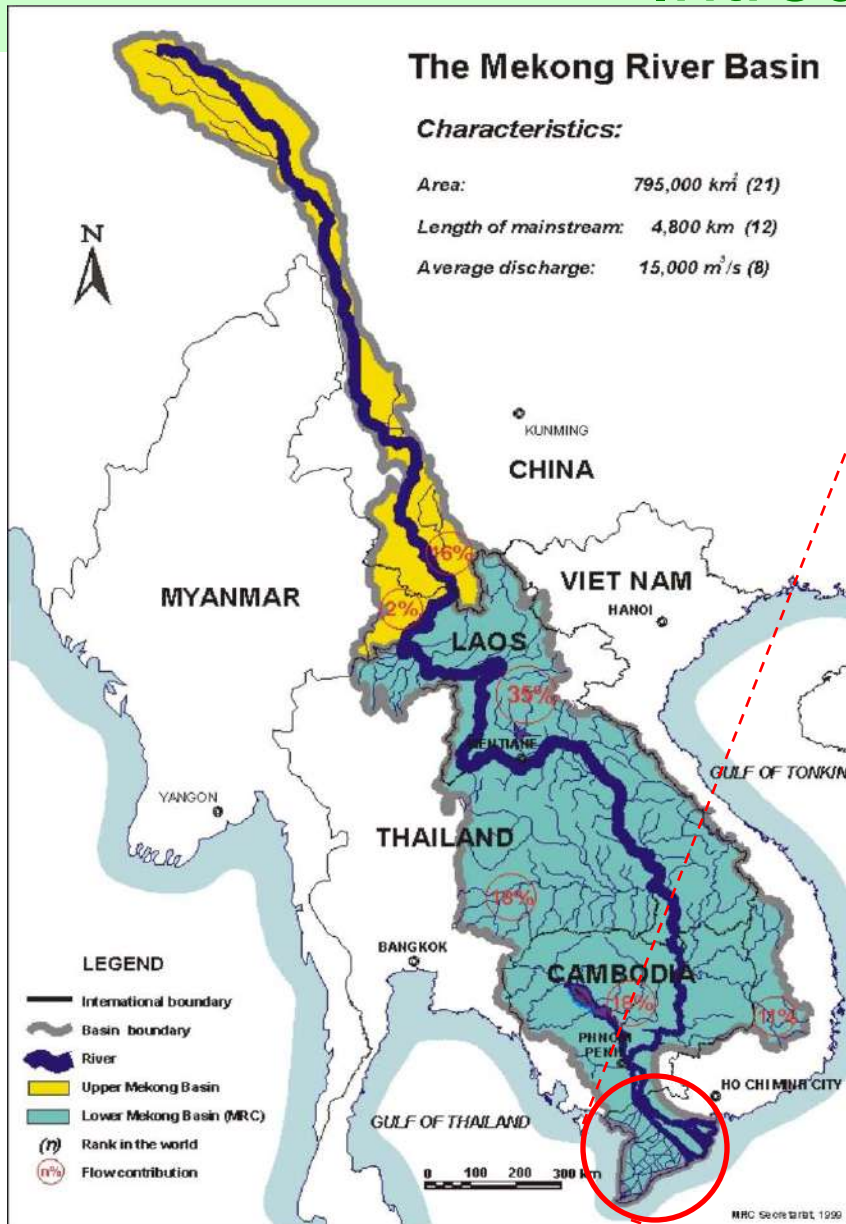
Vietnam National Space Center (VNSC) – VAST

CONTENT

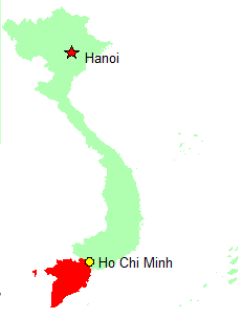
1. Introduction
2. Land cover / land use (Mangrove, rice, etc.)
3. Urban development
4. Disaster (Inundation, erosion, etc.)
5. Others



Introduction



Introduction



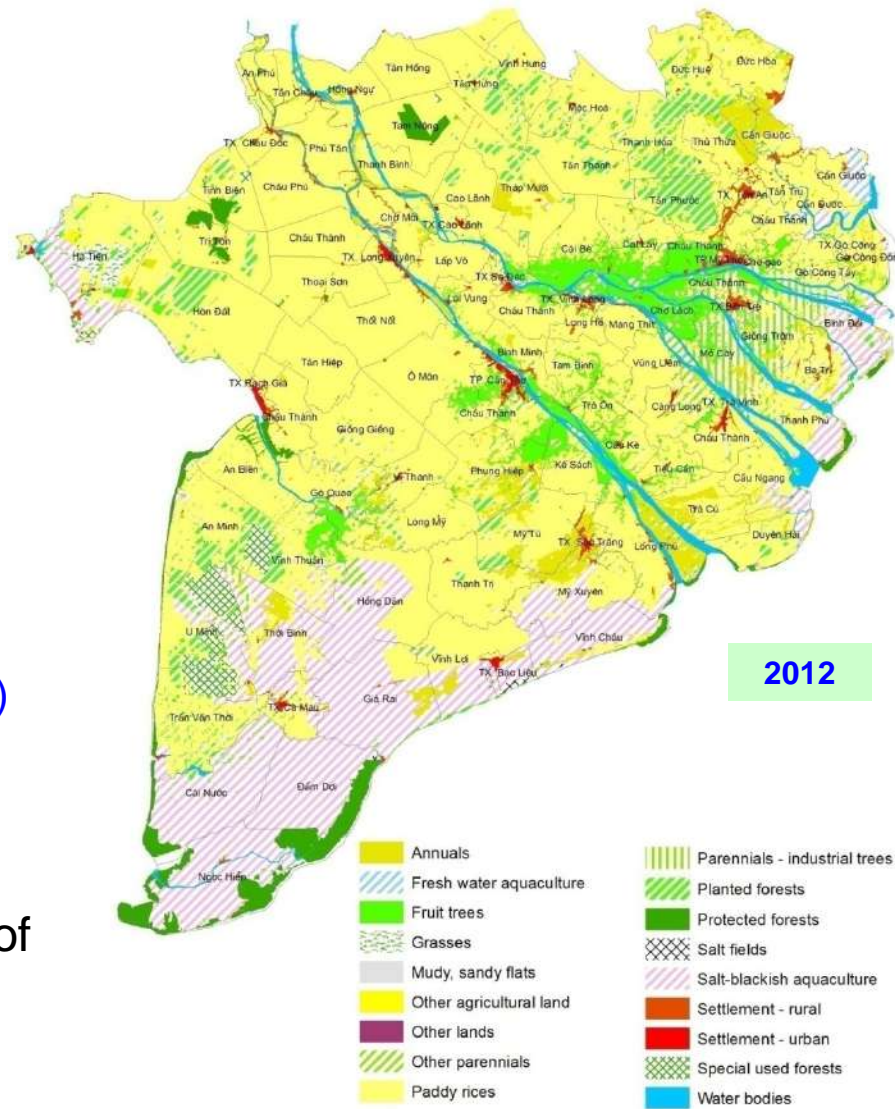
Source: Parry, M.L. et al., 2007

Mekong Delta (Source: GSO, 2015)

- Area: 40,576 Km² (1/8)
- Population: 17.590 M (~1/5)
- MD accounts for more than half (25.7 / 45.2 Mt) of the country's rice production (>1/2)

→ Food security

The Mekong Delta, South of Vietnam is one of the most affected regions in the world by global warming.



2012

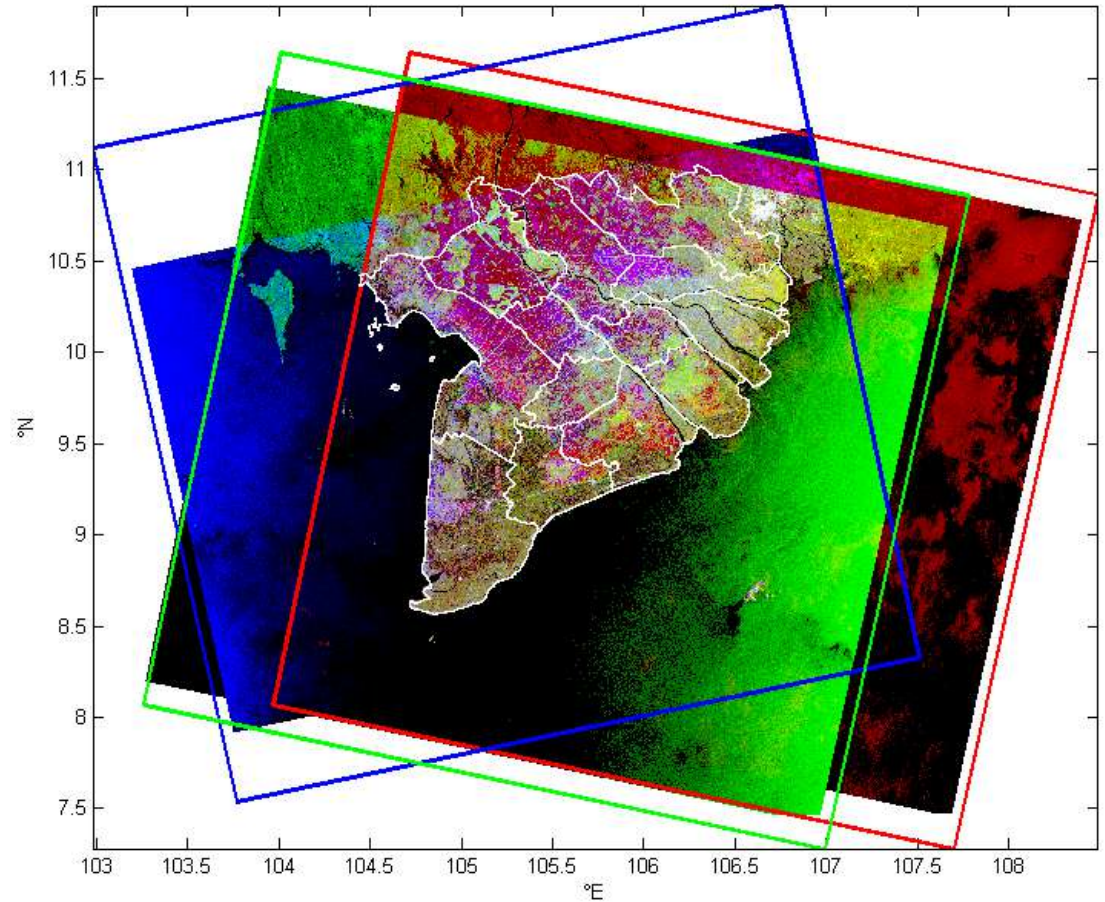
Introduction

- ◆ Mekong Delta is one of the **most affected regions** in the world by **global warming** e.g. ocean warming, rise in sea level, typhoons, storm surges;
 - Coastal, river and inland flooding, salt water intrusion, coastal erosion and sedimentation
 - Degradation of biodiversity, changes in the population and habitat of plants and animals.
- ◆ Studies need to be conducted 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.



Introduction

- ◆ Area of investigation:
Mekong Delta
- ◆ 13 cities and provinces
- ◆ Rainy season: May-Nov
- ◆ Dry season: Dec-Apr



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



Utilisation of SAR data for rice crop monitoring

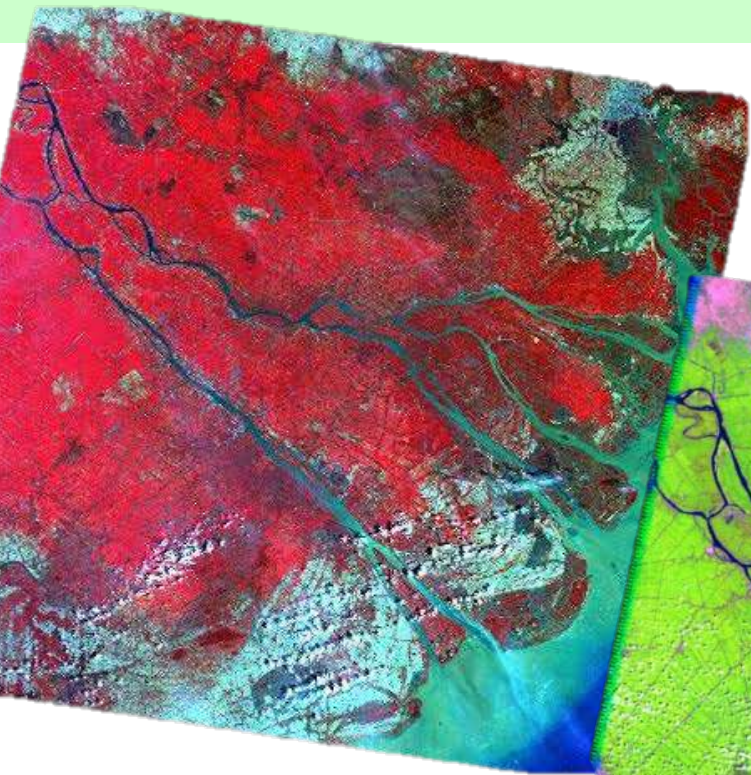
Mekong River bank erosion monitoring

Estimating the mangrove forest biomass

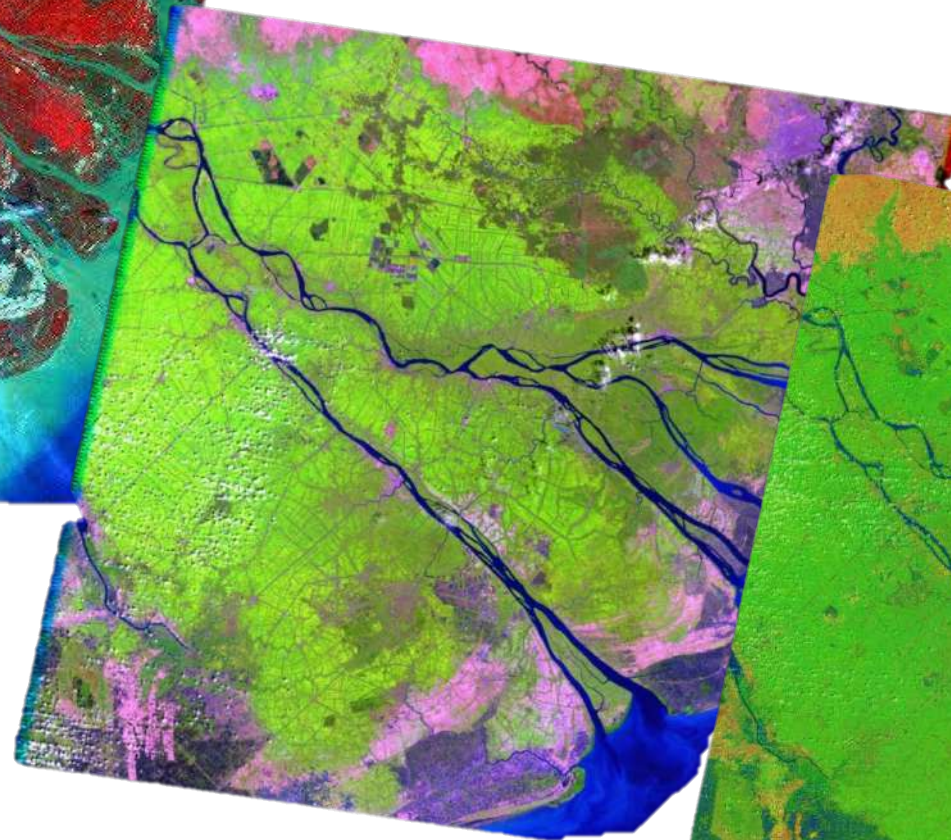


Urban expansion monitoring

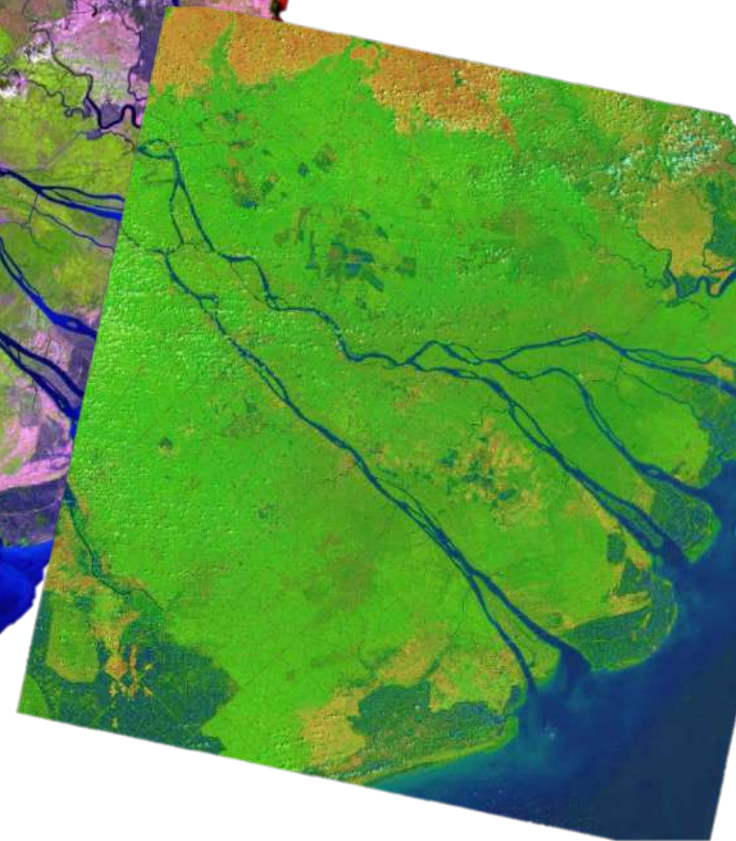
Land use / Land cover



Landsat 5, 21/2/1996

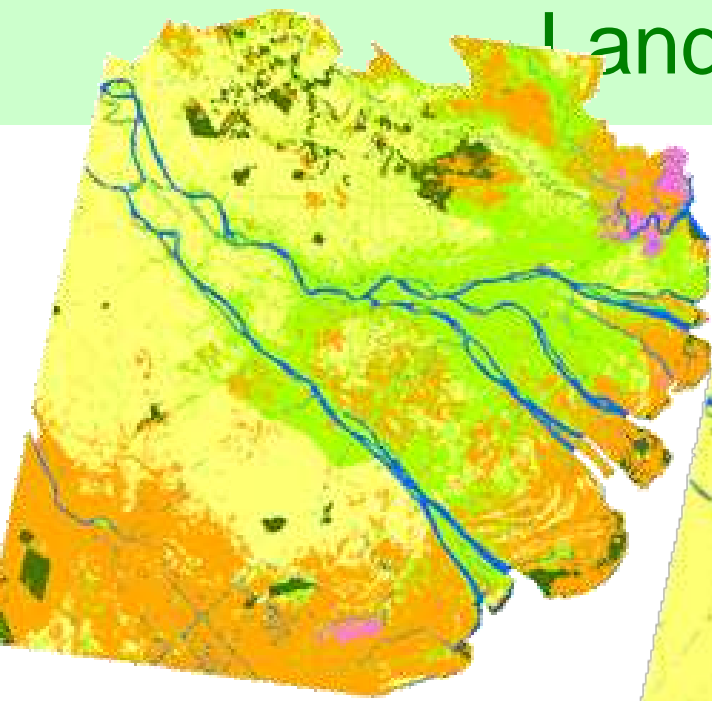


Landsat 7, 20/01/2005

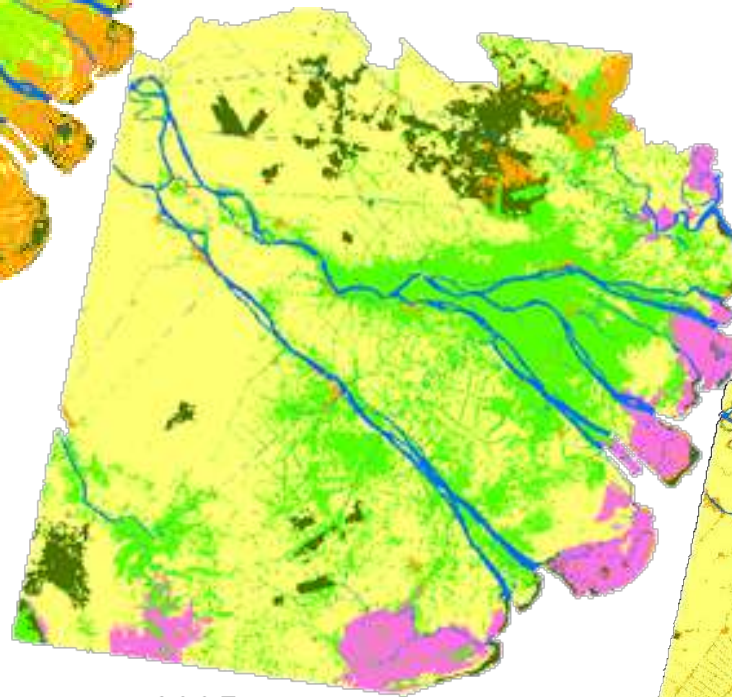


Landsat 8, 27/2/2014

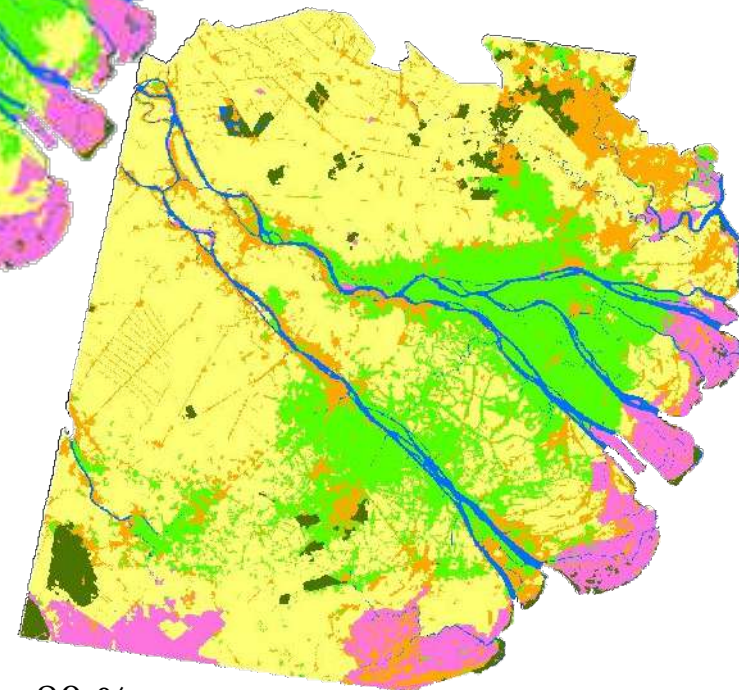
Land use / Land cover



1996



2005



Overall Acc.: 80 % 2014

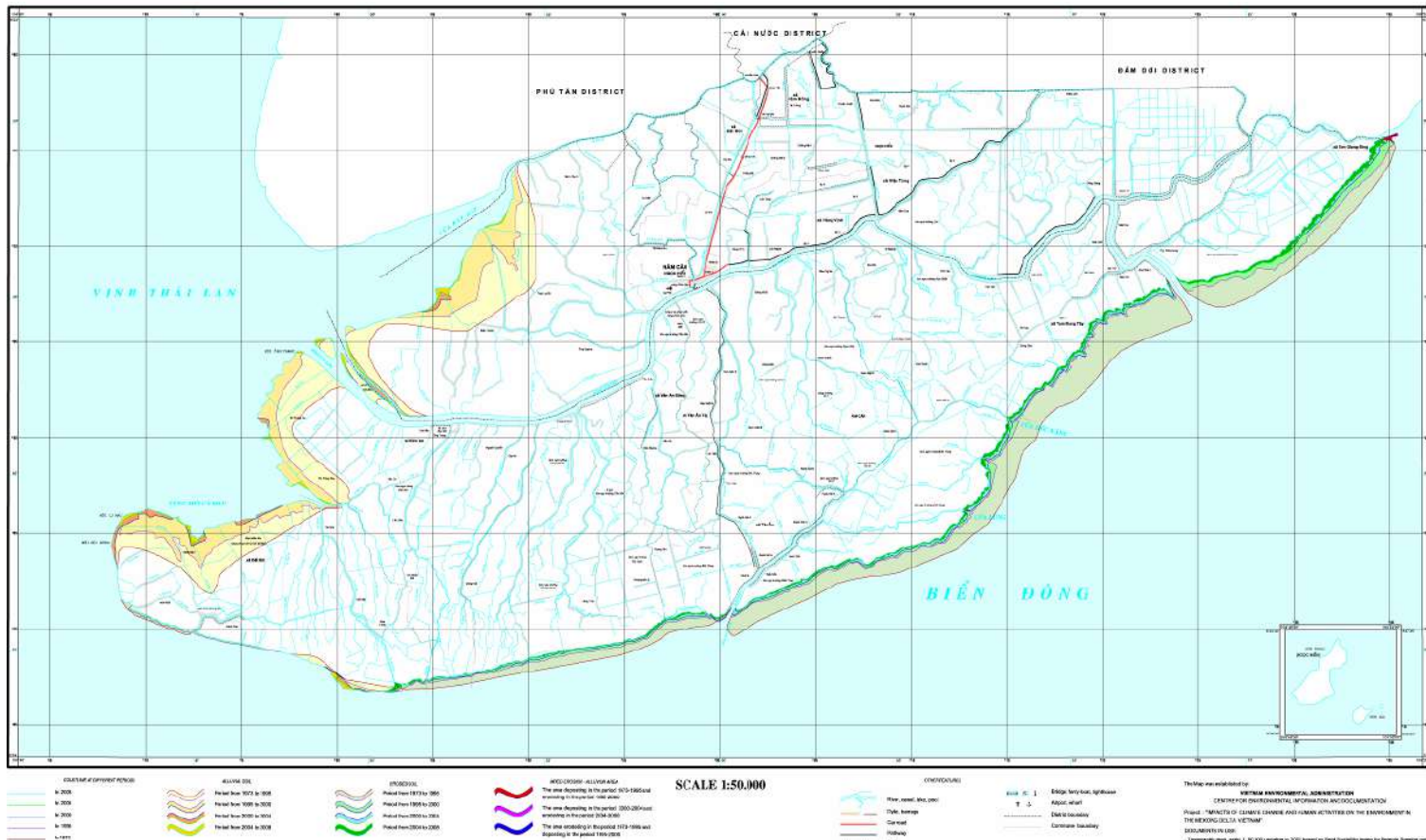
Kappa: 0,75

- 1 - Rices
- 2 - Others
- 3 - Water
- 4 - Fruit trees
- 5 - Aqua.
- 7 - Forests

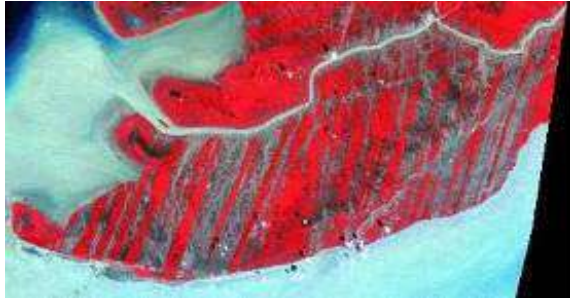
Mangrove monitoring (Planet Action)

Coastal erosion and aquafarming.

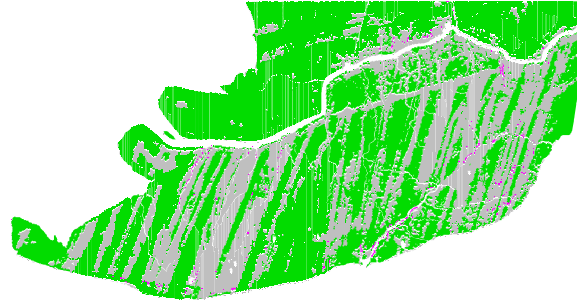
COASTLINE CHANGE MAP IN NGOC HIEN AND NAM CAN COMMUNE OF PERIOD 1973-1995-2000-2004-2008



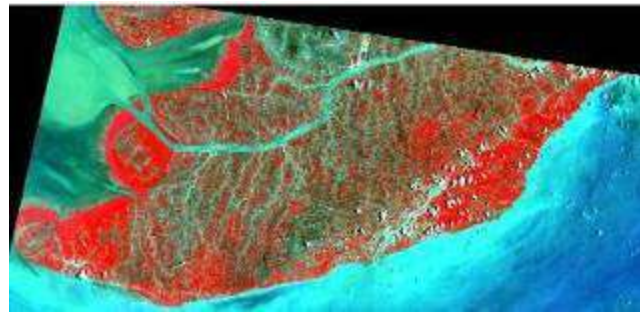
Mangrove monitoring (Planet Action)



Landsat MSS, Jan 1973



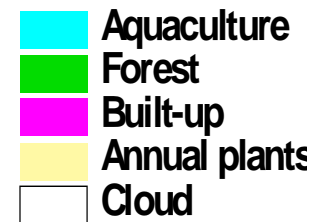
Land cover map, 1973



SPOT, April 2000



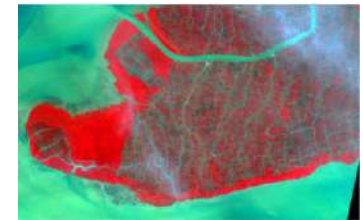
Land use/cover map, 2000



SPOT, Mar 2008

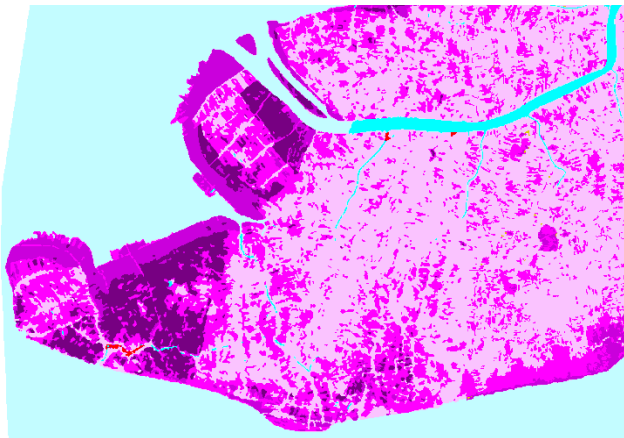


Land cover map, 2008

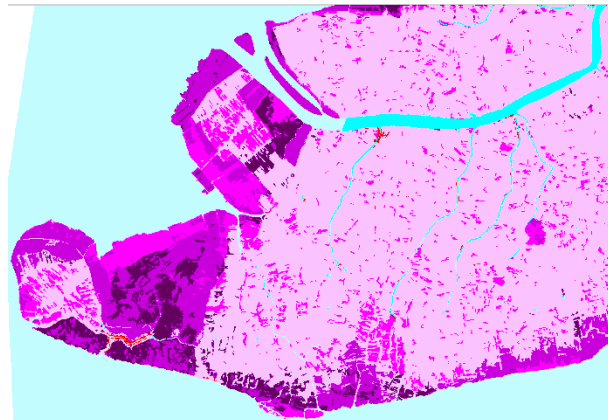


Landsat, Jan 2014

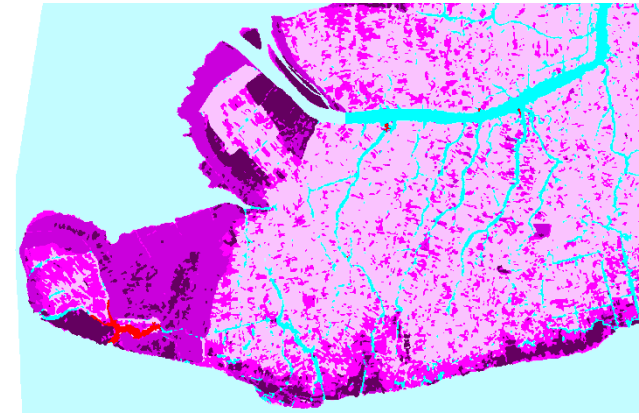
Mangrove monitoring (RICEMAN)



2000



2005



2010



- ◆ Mangrove maps in 2000, 2005, 2010;
- ◆ Change detection from 2000 – 2010;
- ◆ Using multitemporal remote sensing data

Agriculture monitoring (Planet Action)

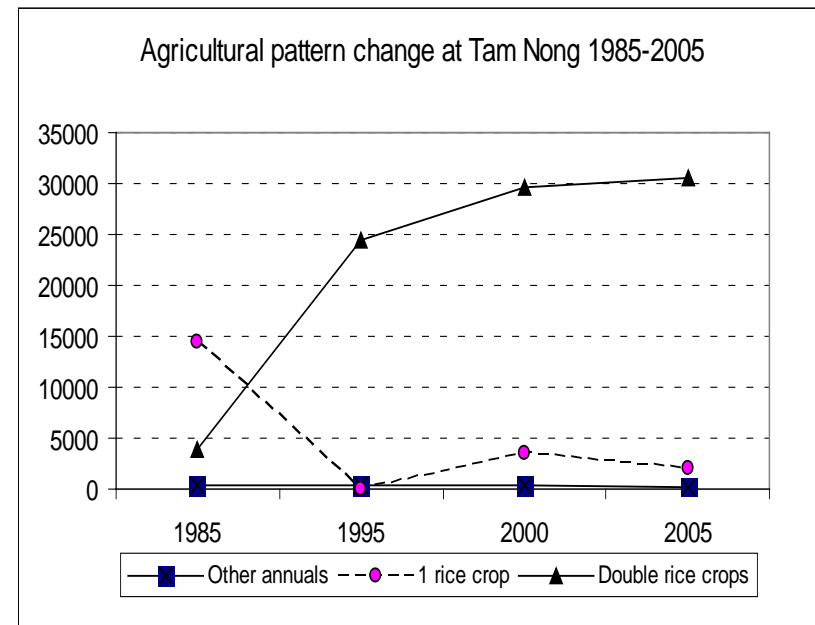
Study site: [The Plain of Reeds](#)

Problems:

- ◆ [Melaleuca](#) and [grasses](#) -> [rice fields](#);

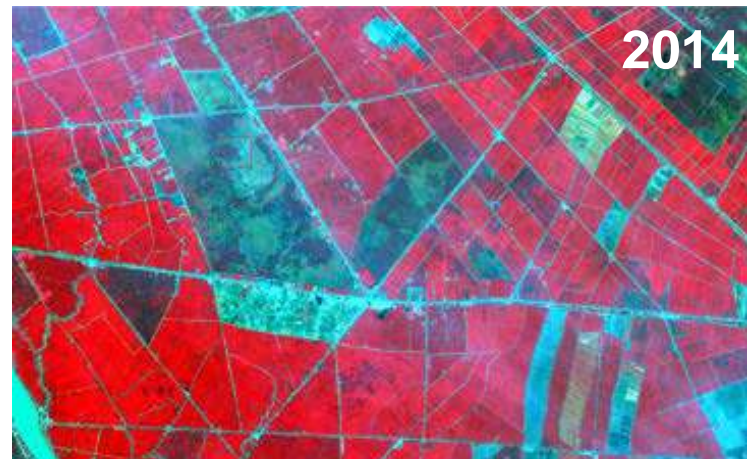
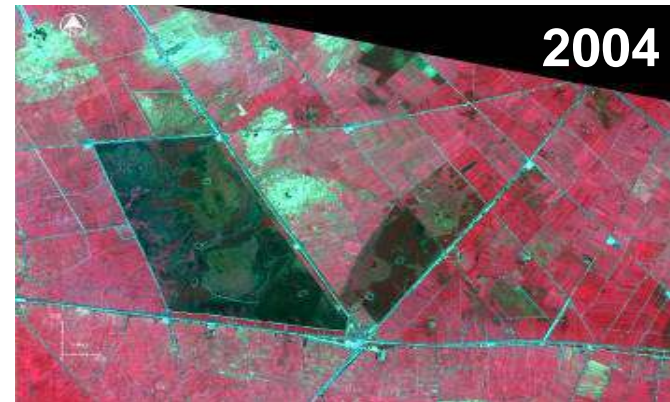
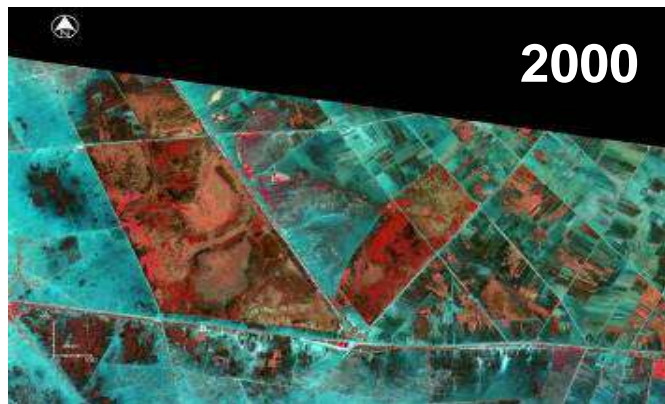
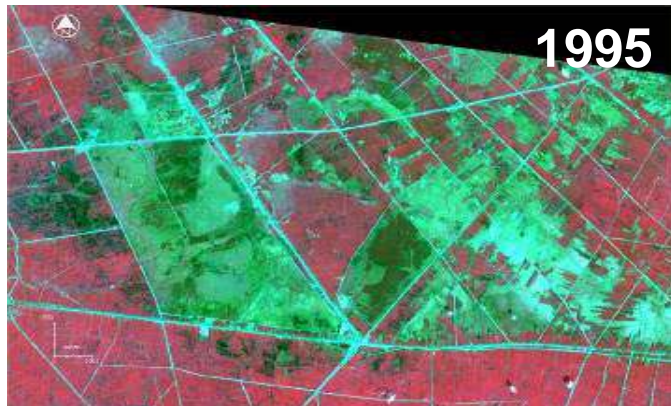
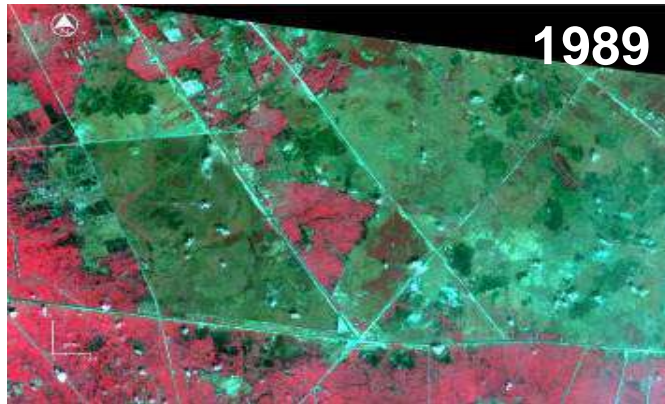
Monitoring:

- ◆ Early 1980s, [wild land](#) (grass-marshes and melaleuca forest), covering [> half of the area](#)
- ◆ 2005, [cultivated land](#) covered [90% area](#)
- ◆ Since 1990s, [double rice crops](#) replacing single crops
- ◆ 1985 – 2005: [double rice crop](#) increasing [8 times](#)



Agriculture monitoring (Planet Action)

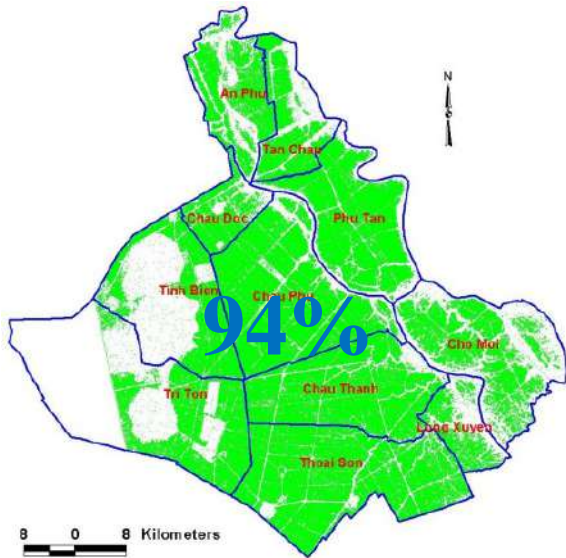
Tràm Chim – Đồng Tháp Province



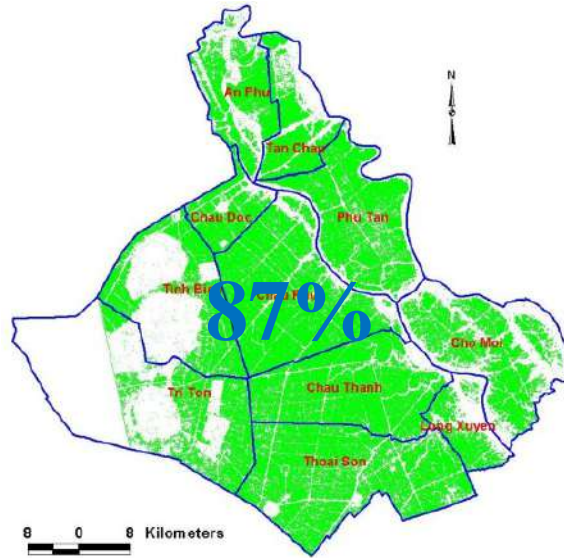
Rice monitoring

Rice cropping system in 2007, An Giang

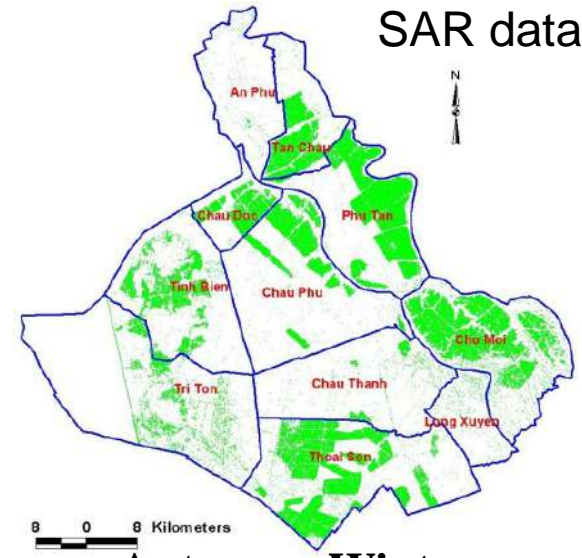
The use of SAR data



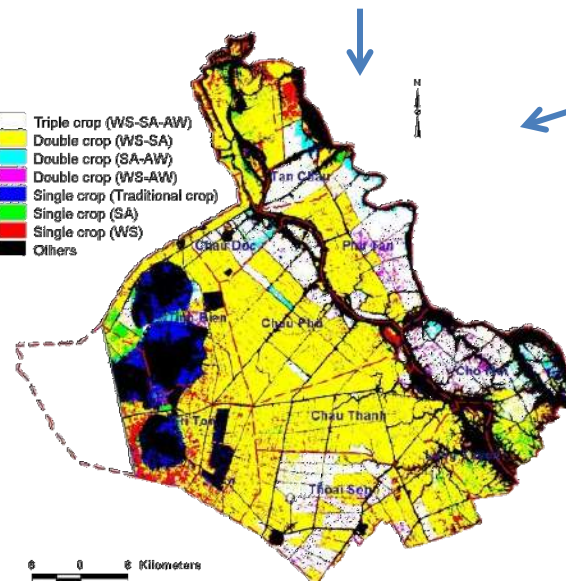
Winter - Spring



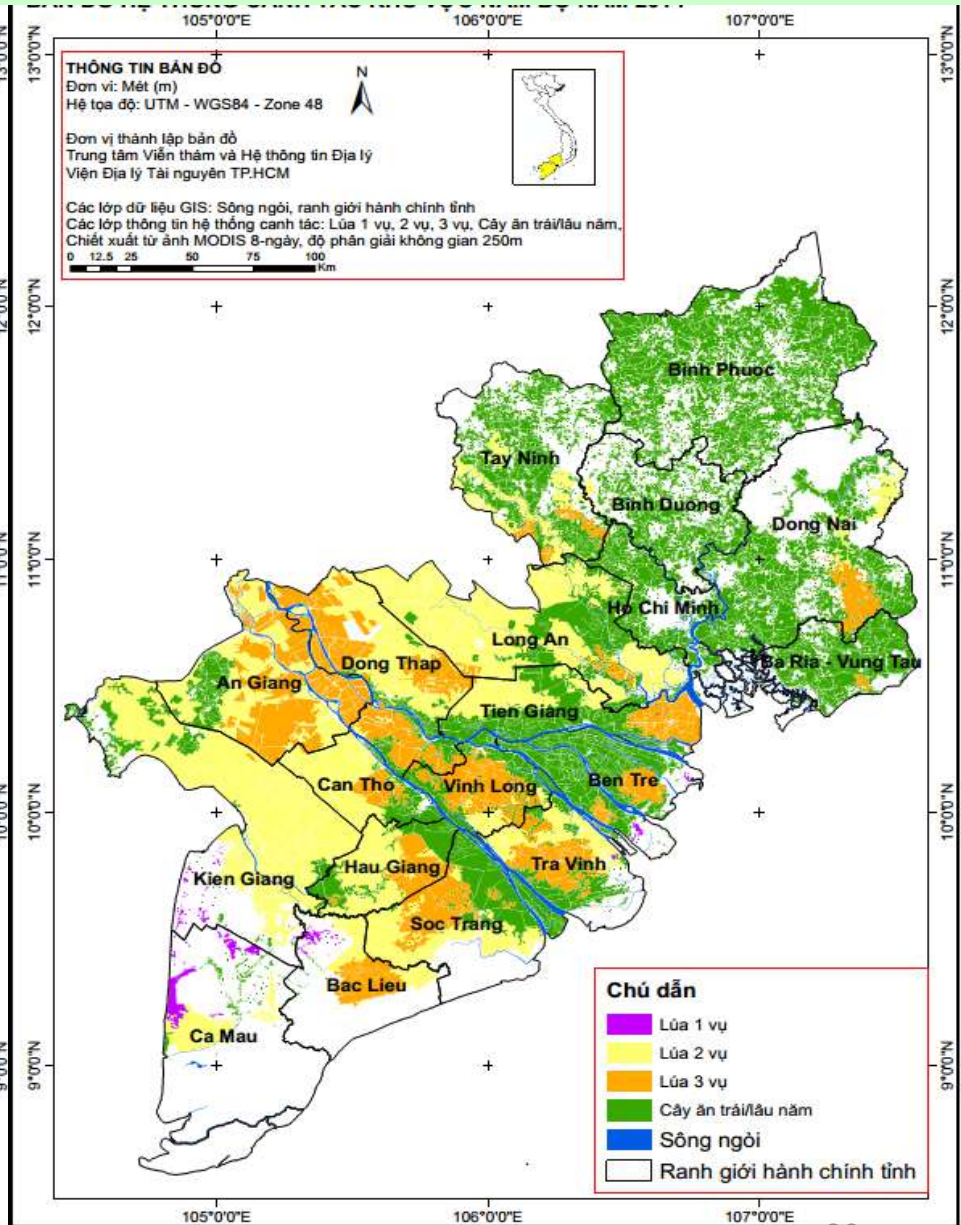
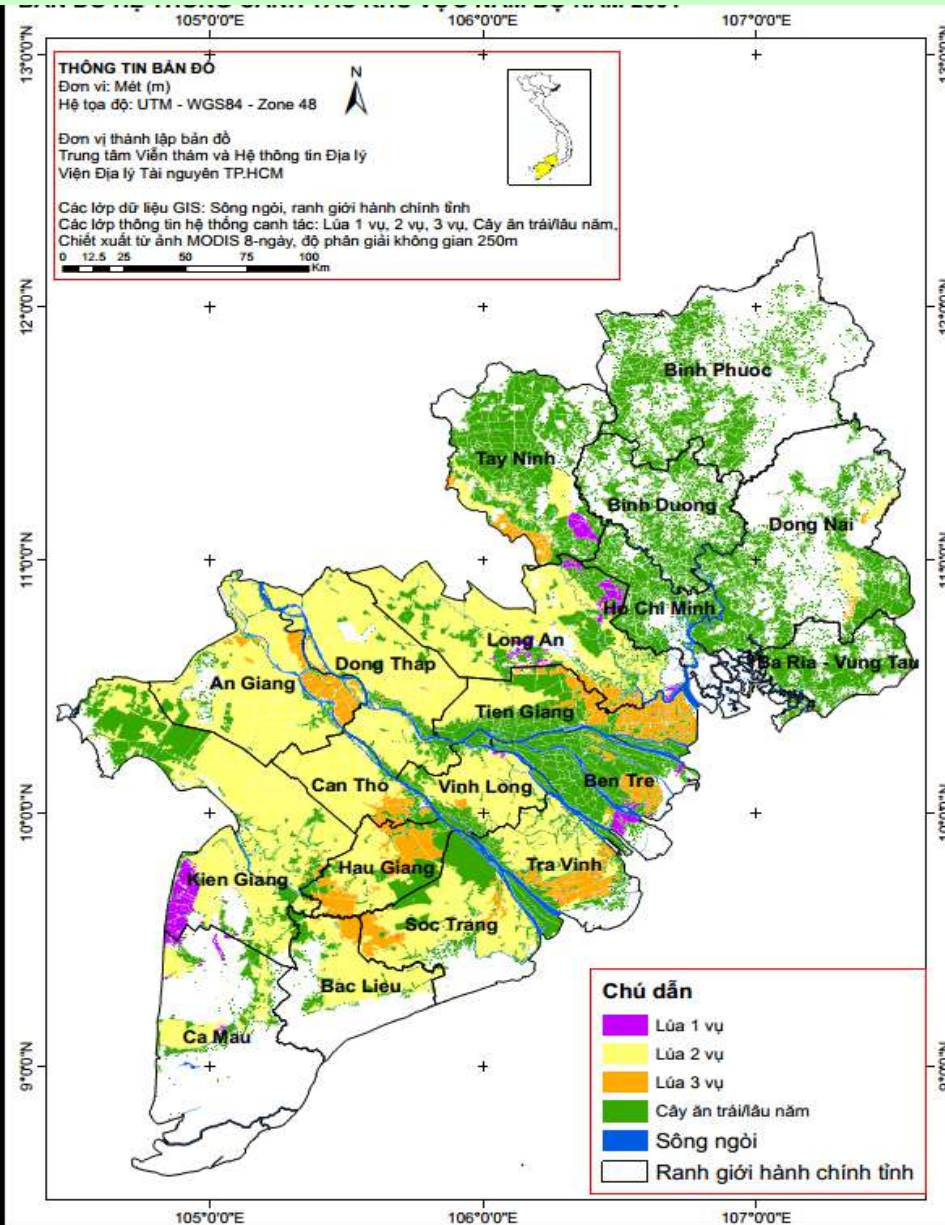
Summer - Autumn



Autumn - Winter



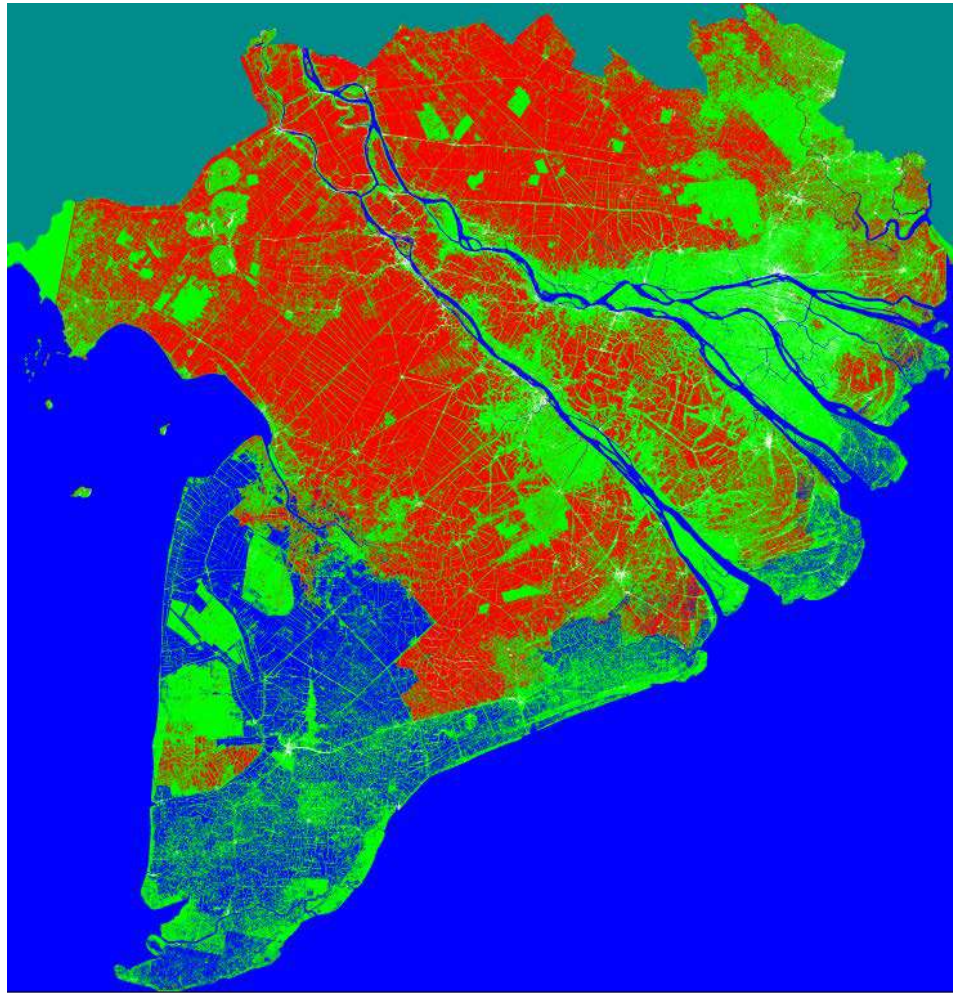
Rice monitoring



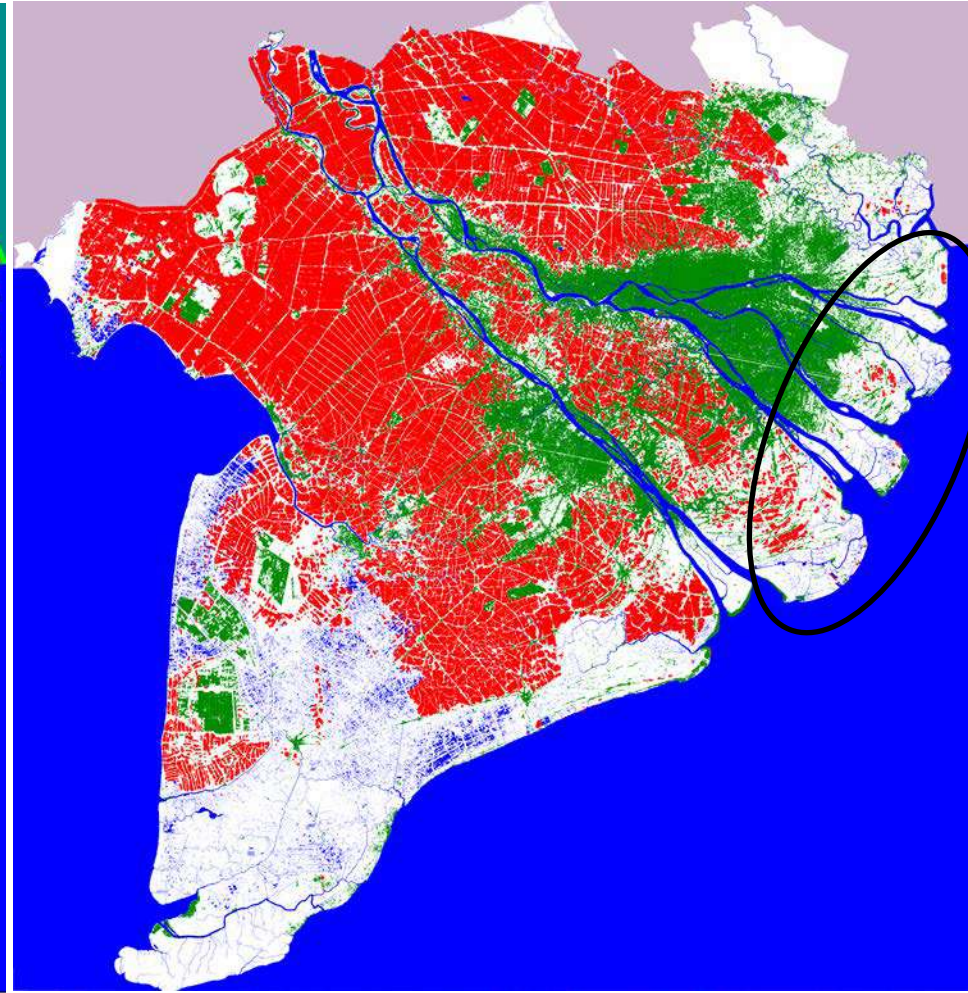
Cultivation system in 2001 and 2014

Rice monitoring in the Mekong Delta

Map of WS Rice 2015



Map of WS Rice 2016

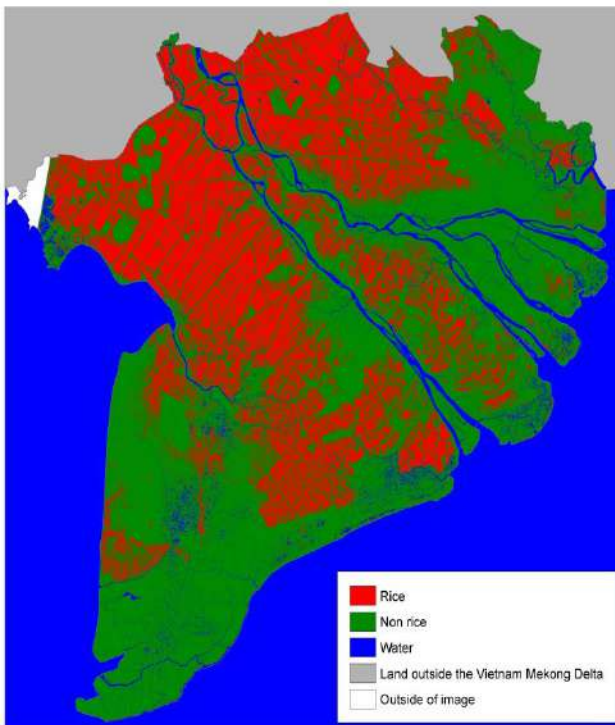


Reduced area in 2016 caused by shortage of water and saline water intrusion

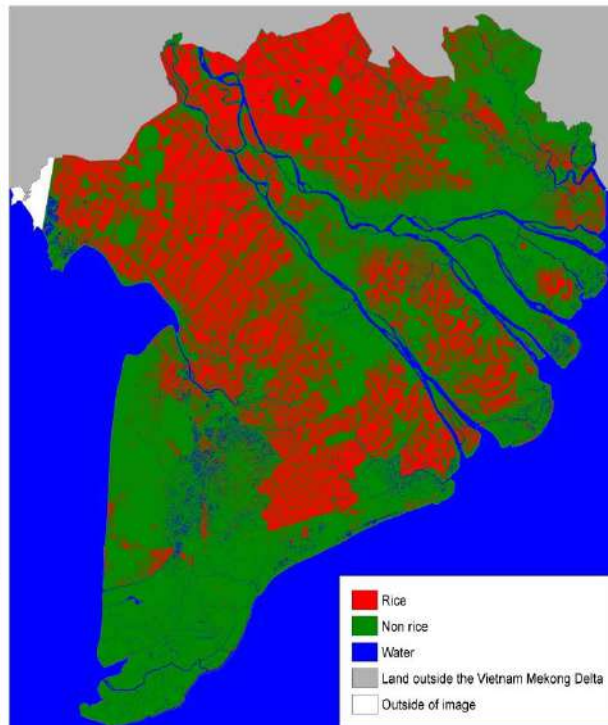
Rice monitoring in the Mekong Delta

In Vietnam Data Cube

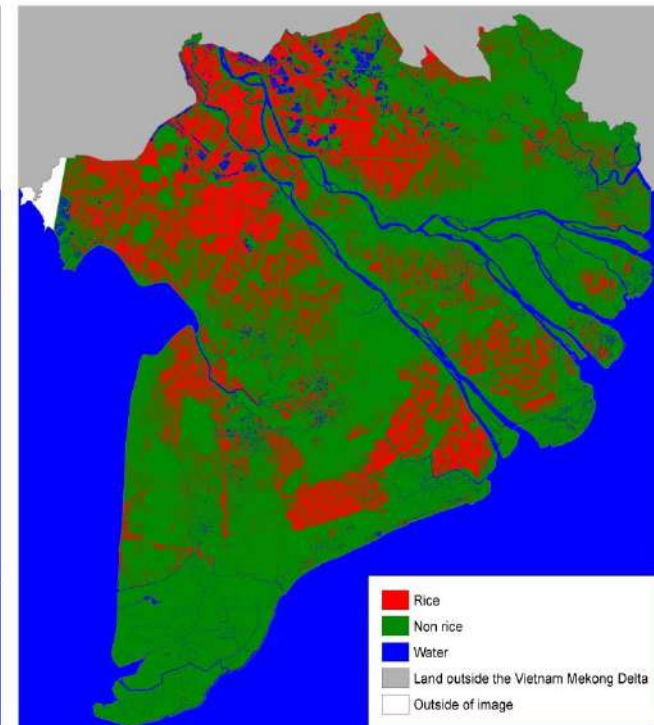
Map of WS Rice 2017



Map of SA Rice 2017



Map of AW Rice 2017

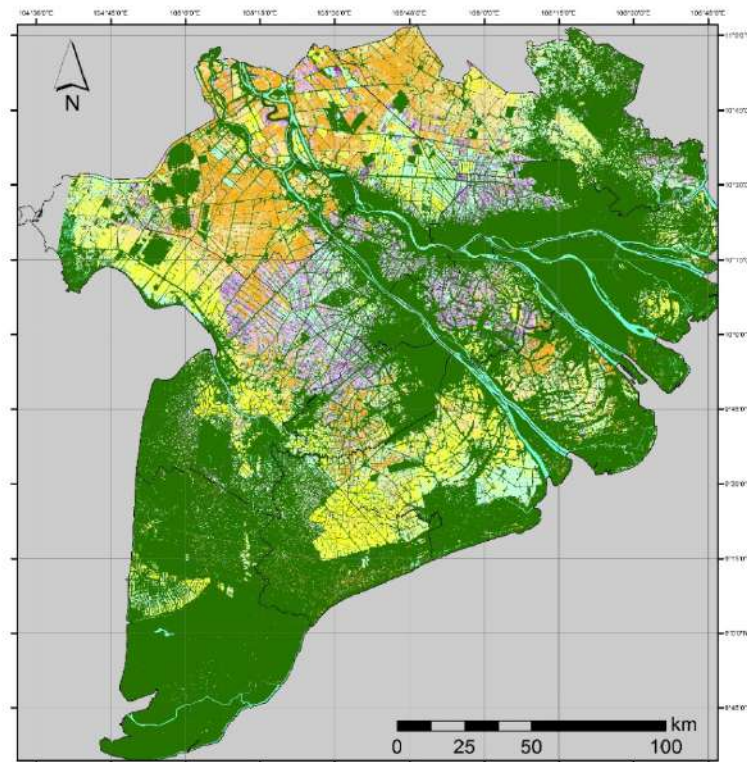
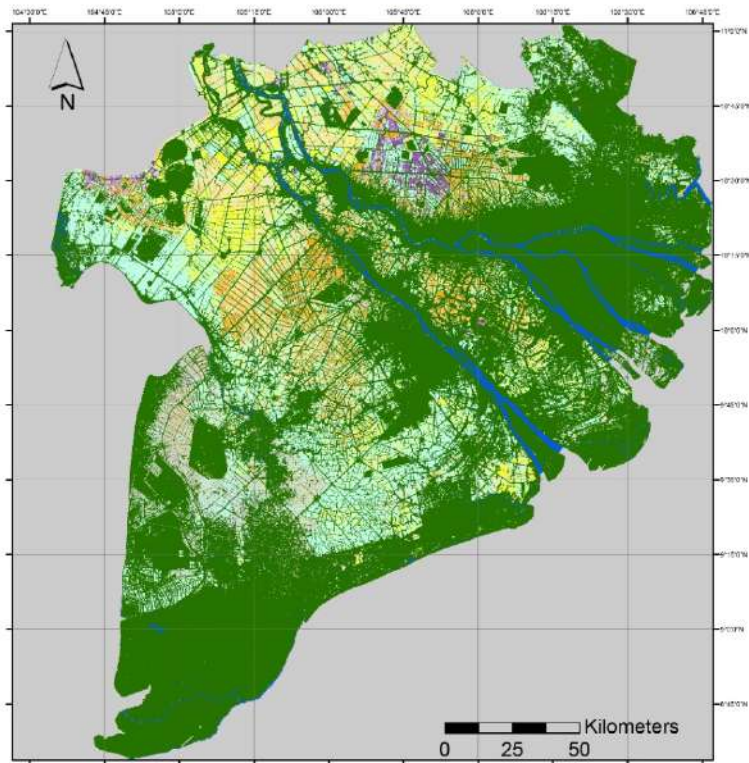


Rice monitoring in the Mekong Delta

In Vietnam Data Cube

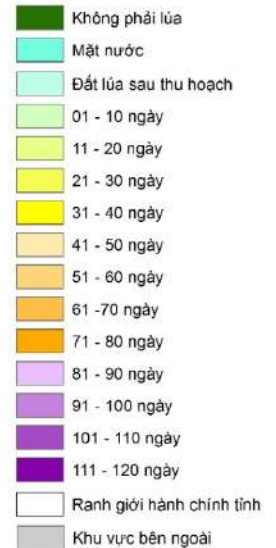
June 11, 2018

July 11, 2018



Bản đồ ngày sau
(11/07/2018)

Ngày sau khi sạ/cấy



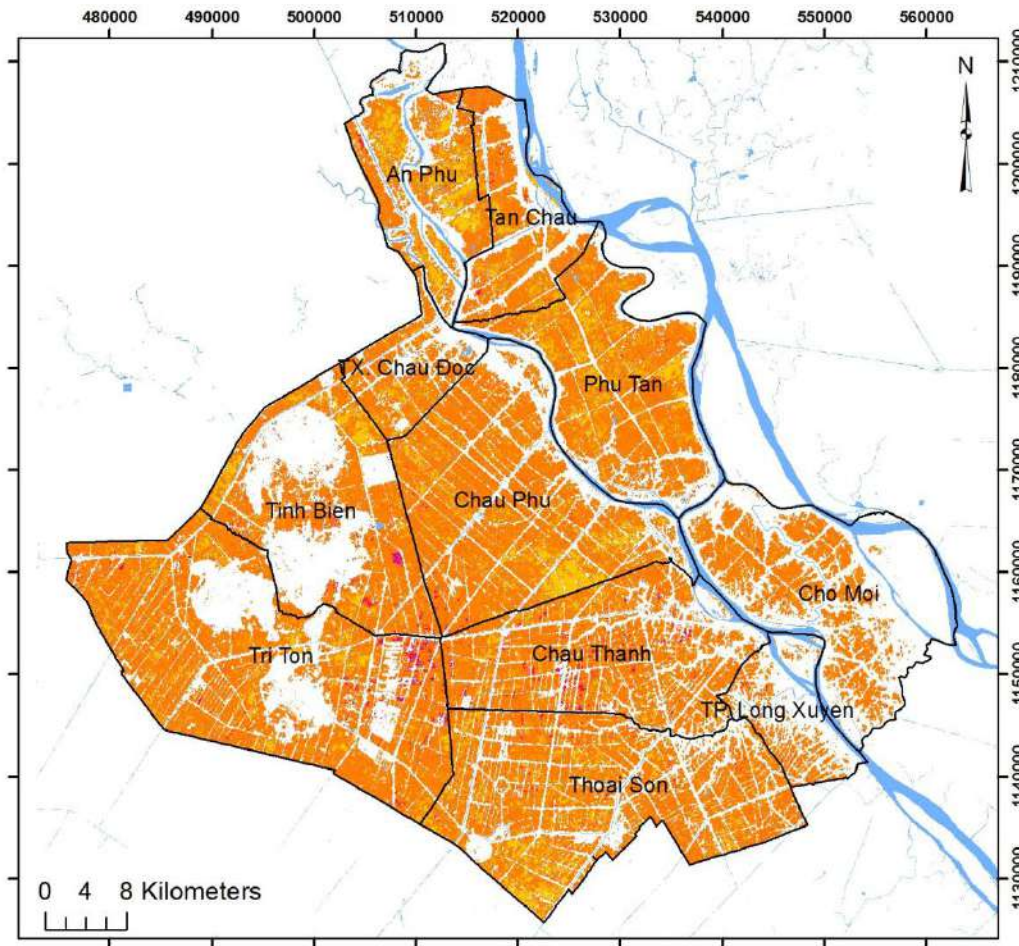
Cơ quan thực hiện:
Trung tâm Ứng dụng Công nghệ Vũ trụ TP. Hồ Chí Minh (STAC)
Trung tâm Vũ trụ Việt Nam (VNSC)
Viện Hàn lâm Khoa học và Công nghệ Việt Nam (VAST)

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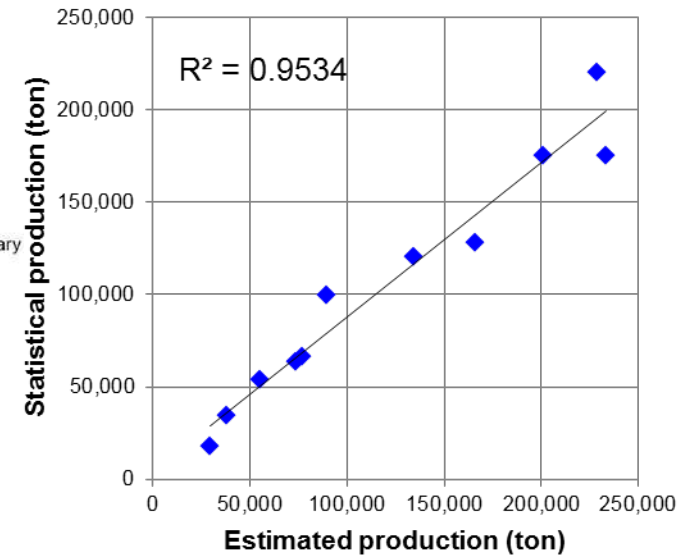
Map of rice age in WS 2018 crop

Rice monitoring in the Mekong Delta

Estimating rice yield of An Giang in SA 2016 crop using ALOS-2 data

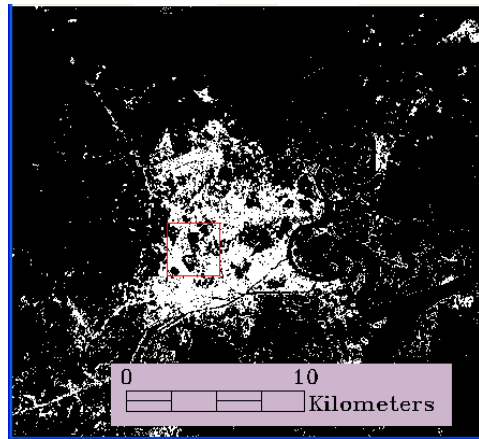


District	Agency data (ton)	Estimated production (ton)	Percentage error (%)
An Phú	73,656	63,717	-13.5
Chợ Mới	77,296	66,103	-14.5
Châu Phú	201,254	175,556	-12.8
Châu Thành	166,054	128,187	-22.8
Phú Tân	134,457	120,703	-10.2
Tịnh Biên	89,584	99,328	10.9
Châu Đốc	37,890	34,638	-8.6
Long Xuyên	29,503	17,422	-40.9
Thoại Sơn	233,292	175,277	-24.9
Tri Tôn	229,200	220,147	-3.9
Tân Châu	54,994	53,576	-2.6
Total	1,325,946	1,154,655	-12.9

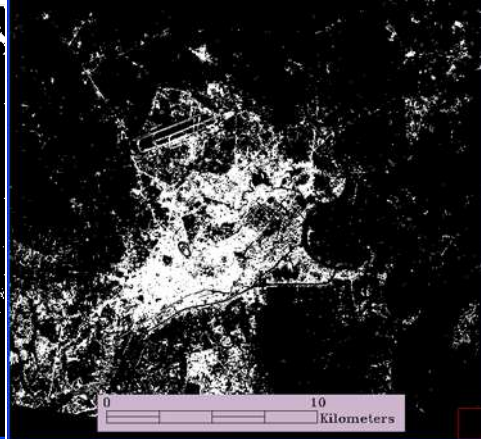


Urban expansion

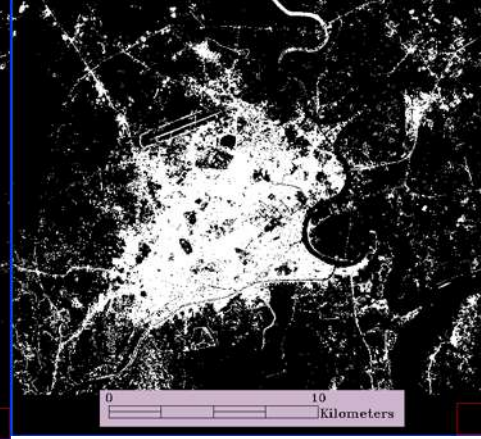
Ho Chi Minh City



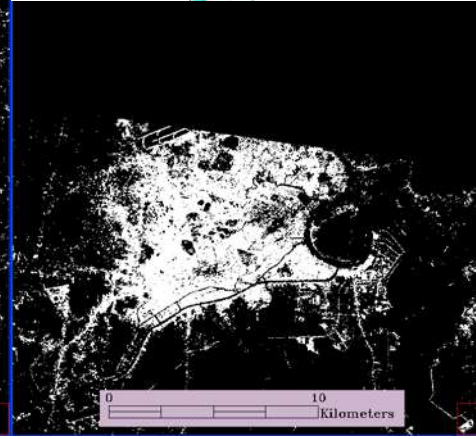
1975



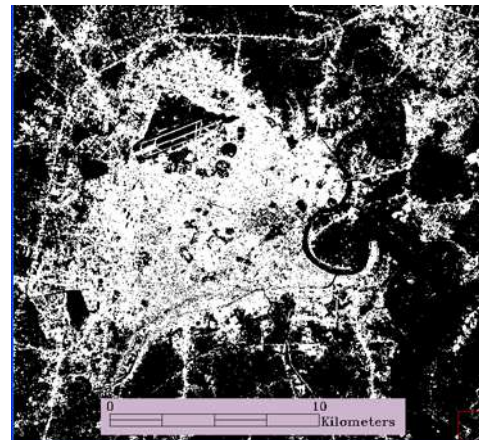
1990



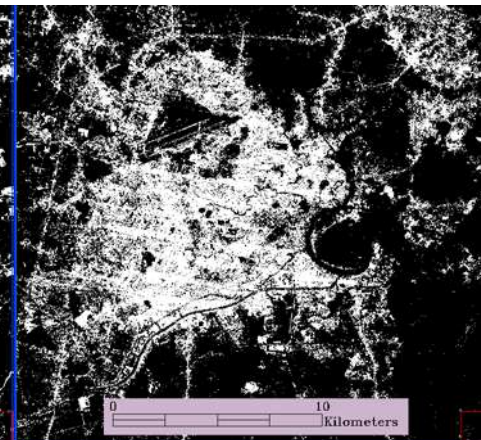
1993



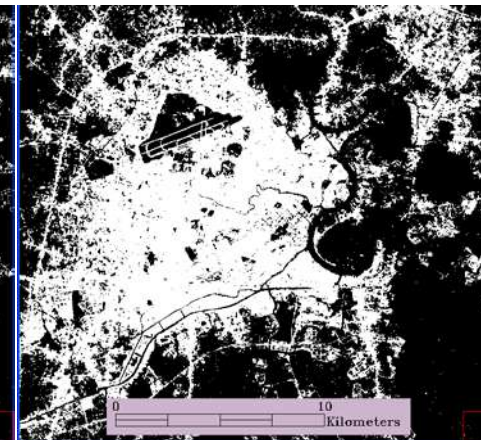
1997



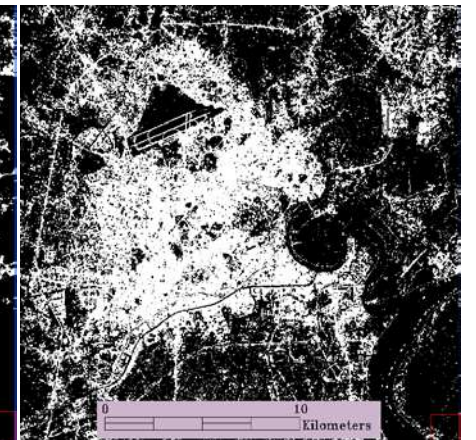
2002



2004

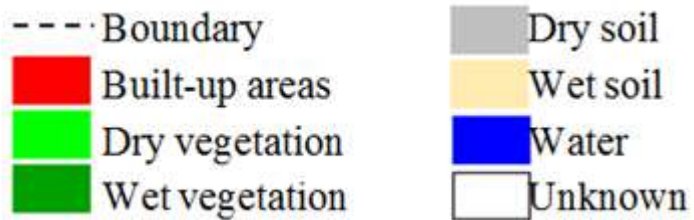
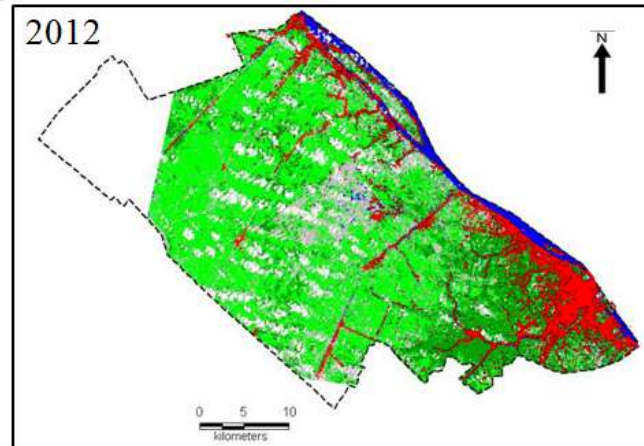
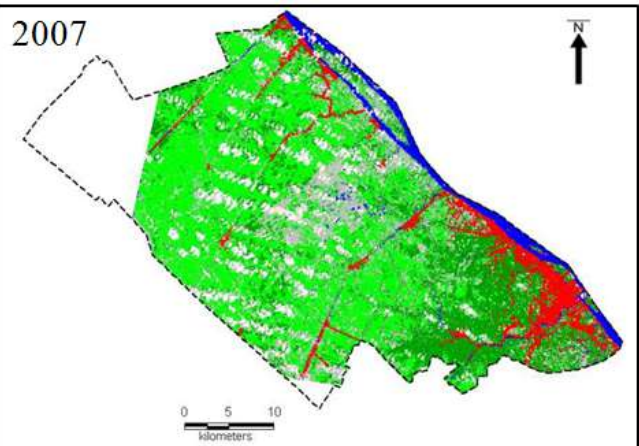
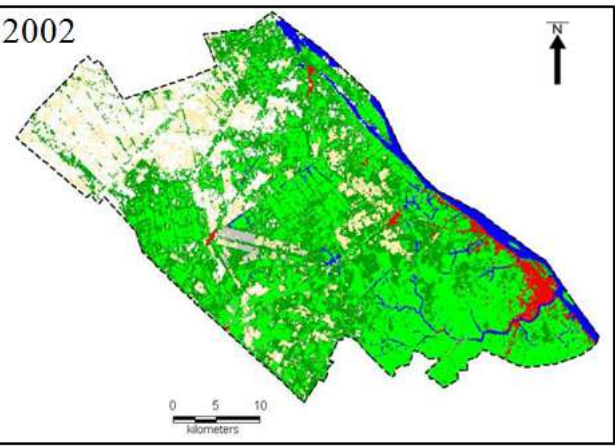
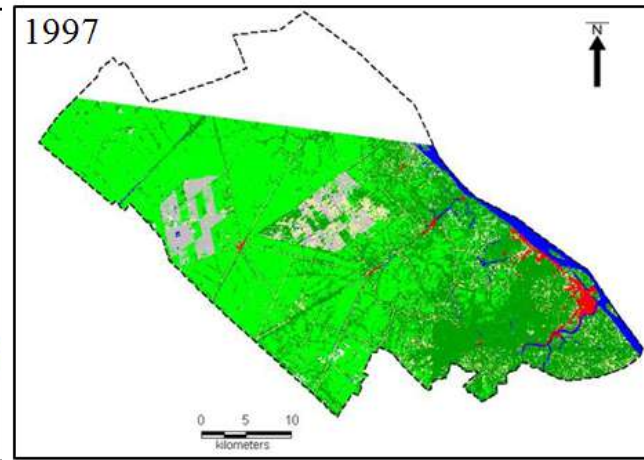
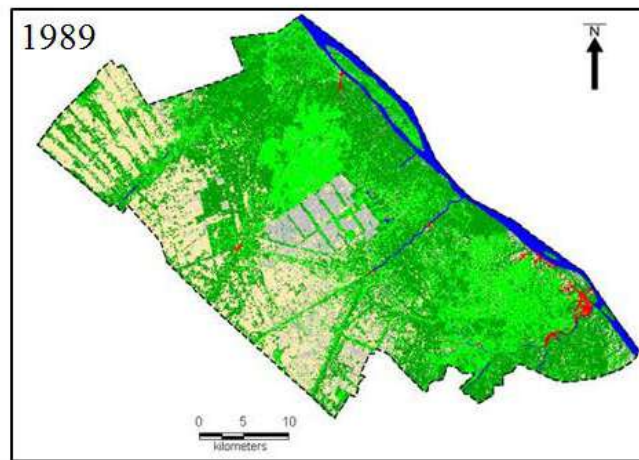
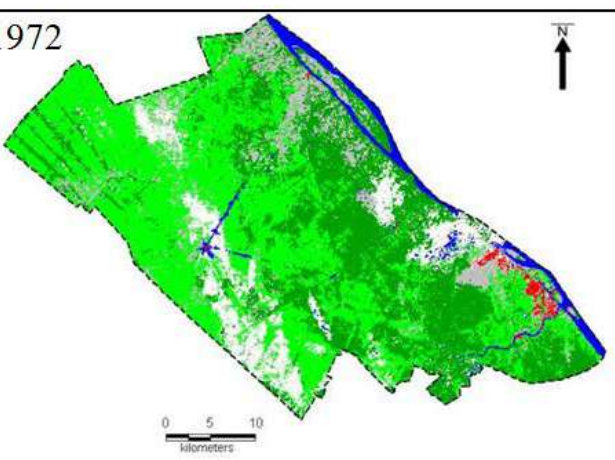


2005



2008

Urban expansion



Can Tho City

Urban expansion



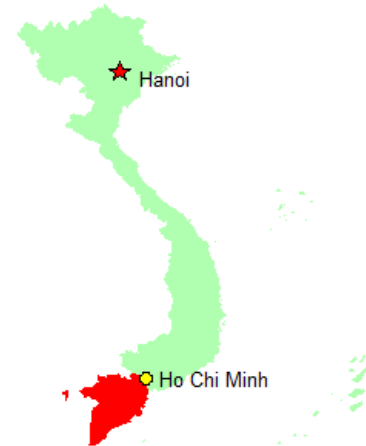
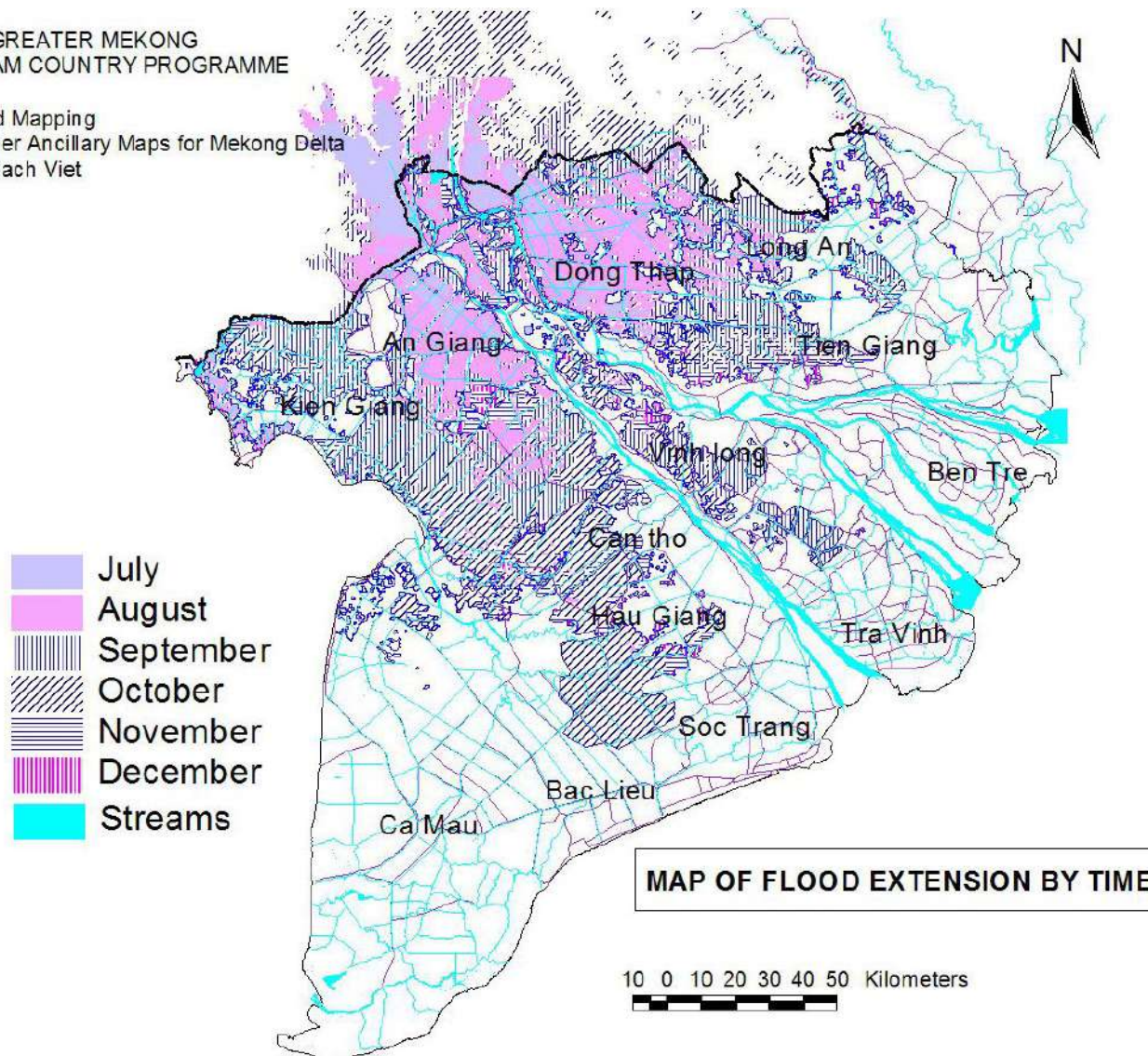
- ◆ Canal filling
- Output: geomatics tools for canal monitoring.

Disaster: Flood monitoring

At Mekong Delta (using radar and optical data)

WWF GREATER MEKONG
VIETNAM COUNTRY PROGRAMME

Wetland Mapping
and Other Ancillary Maps for Mekong Delta
Pham Bach Viet

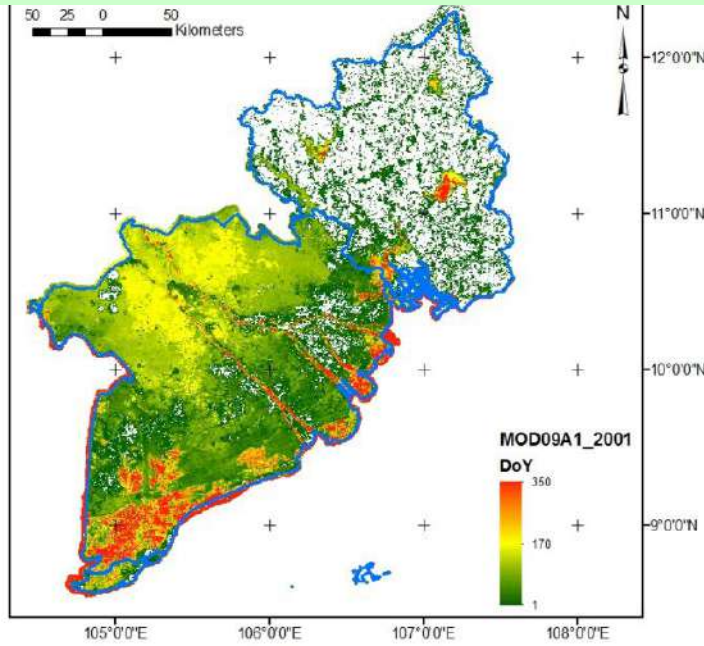


MAP OF FLOOD EXTENSION BY TIME

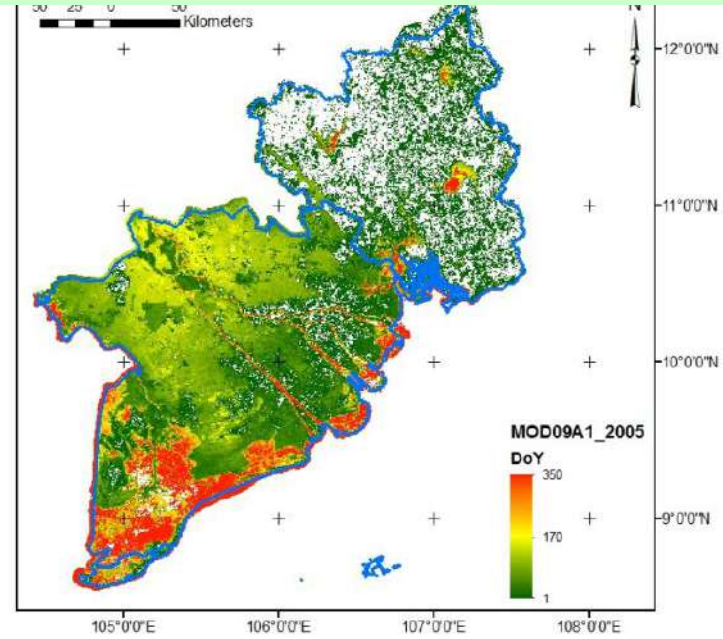
10 0 10 20 30 40 50 Kilometers

Flood monitoring

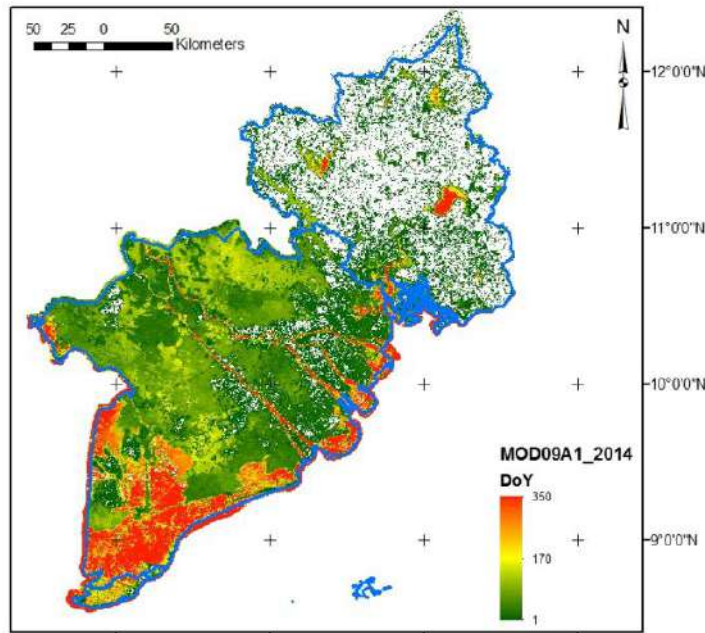
2001



2005



2014

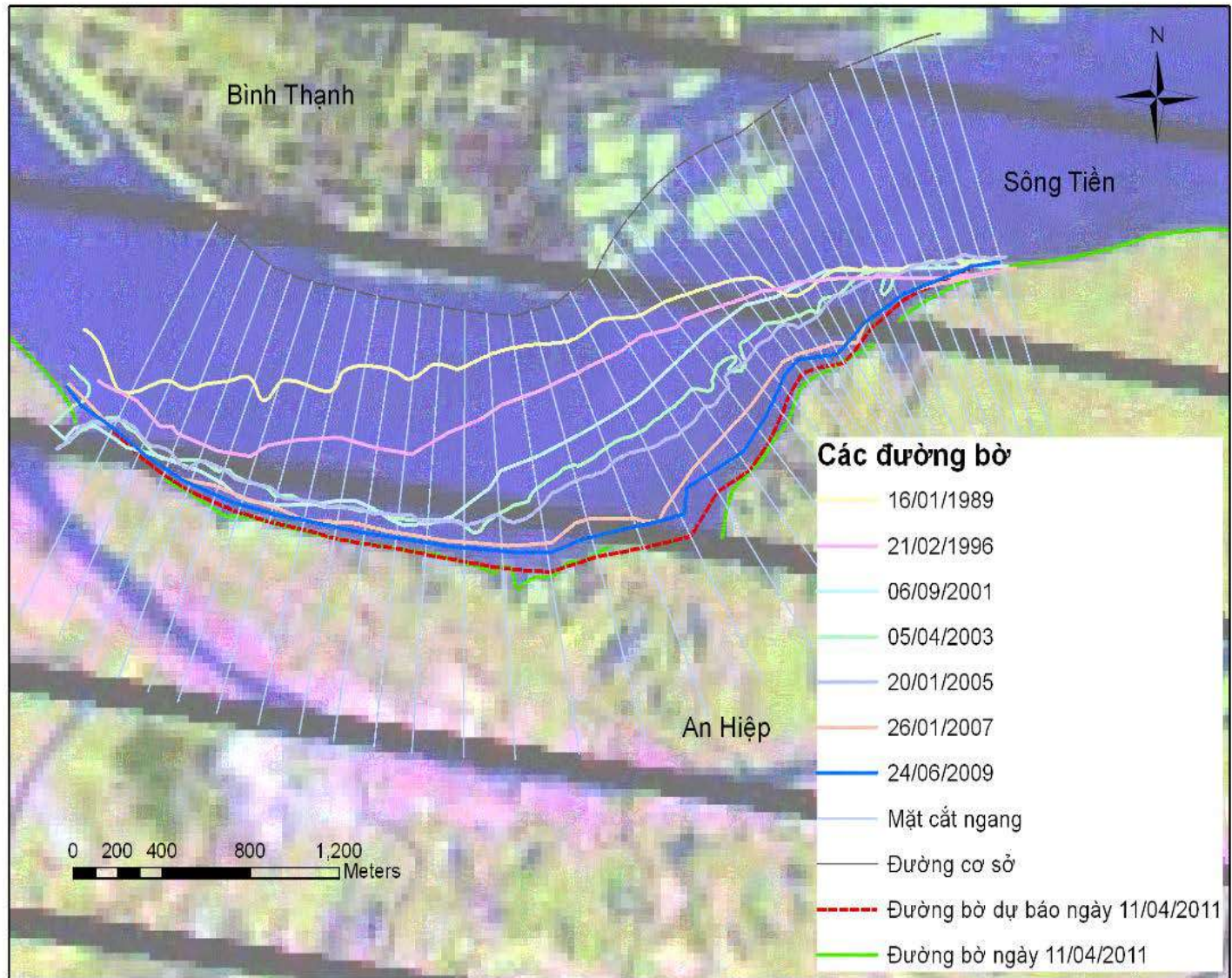


Number flooding days
Using MODIS

Erosion of Mekong Riverbank

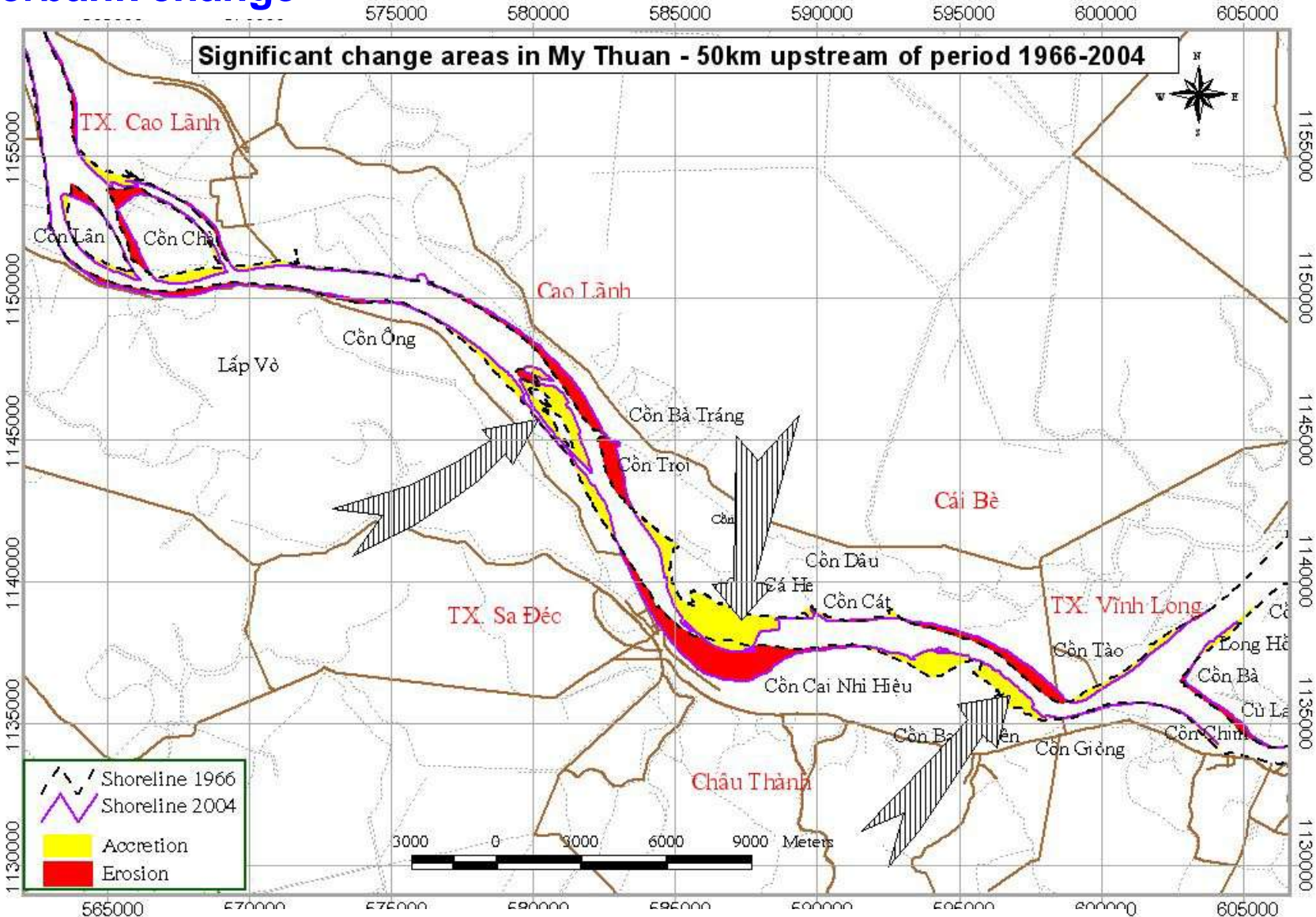


Erosion of Mekong Riverbank



Eroded riverbank in Sa Dec (Site 1)

Riverbank change



At Tien river from the part of Cao Lanh to My Thuan
 red: erosion yellow: accretion

Natural disaster

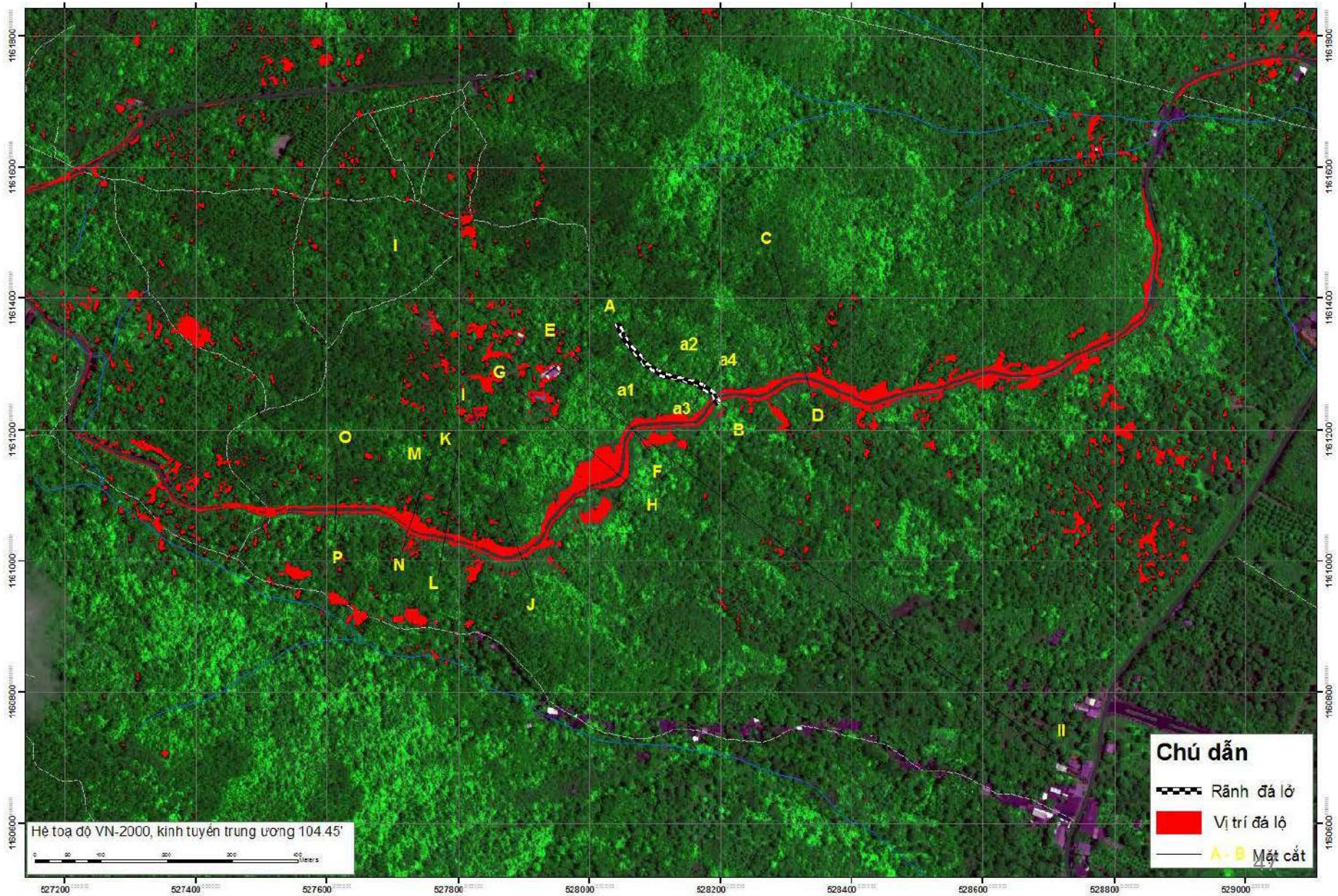
DETECT ROCK



Accident: 5 May 2012

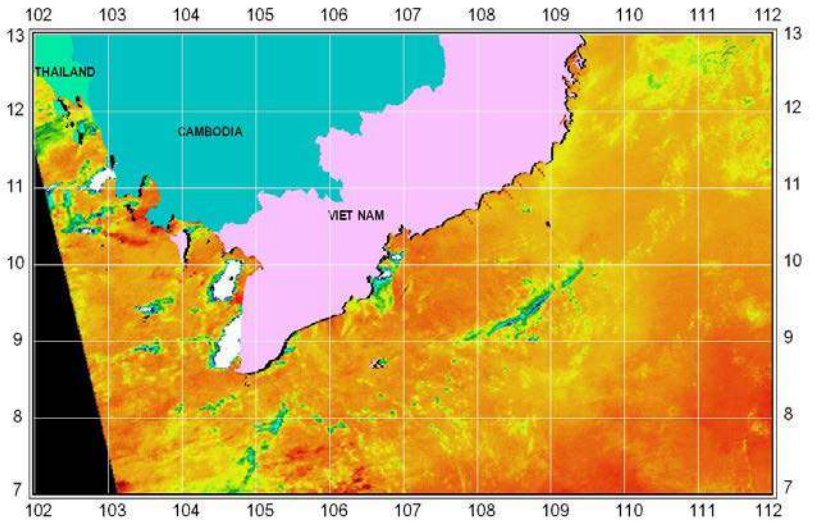
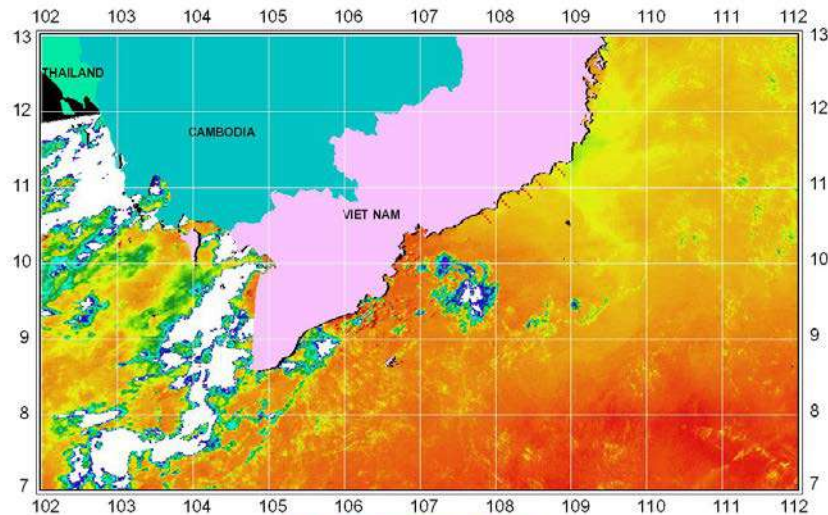
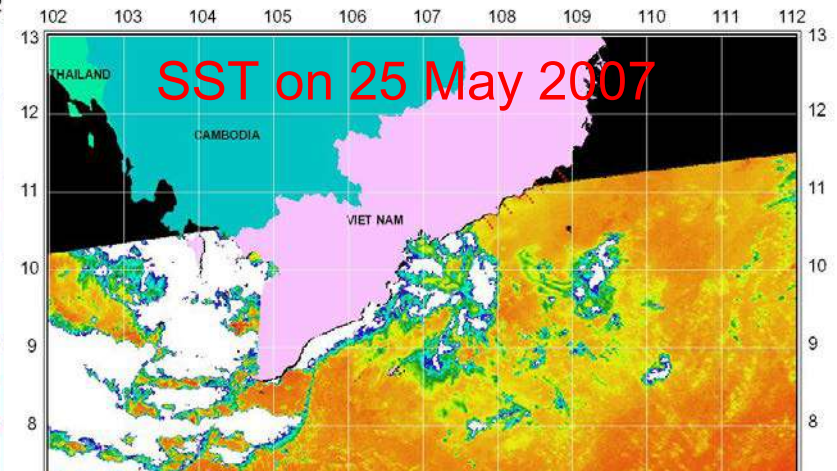
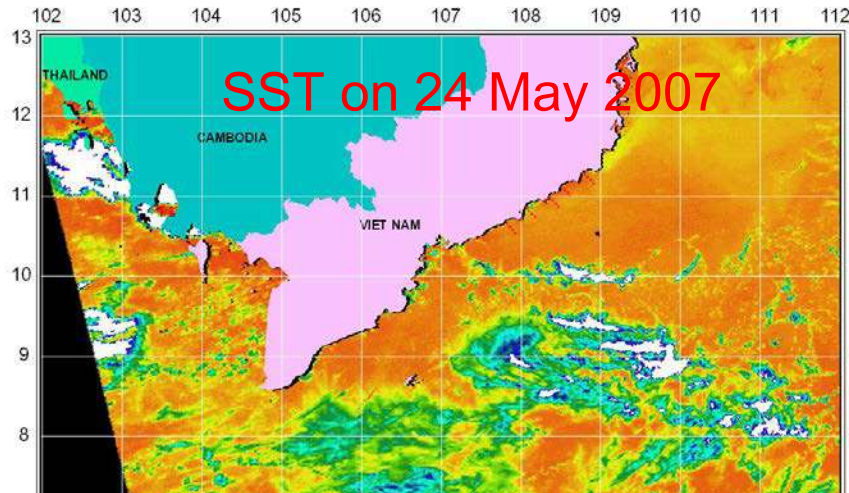
(QuickBird, 0,6 m) 5 August 2011

ROCK MAP



OTHERS

SEA SURFACE TEMPERATURE (SST) from MODIS



A2008145060500_East_Sea_Viet_Nam_SST (Celcius degree)

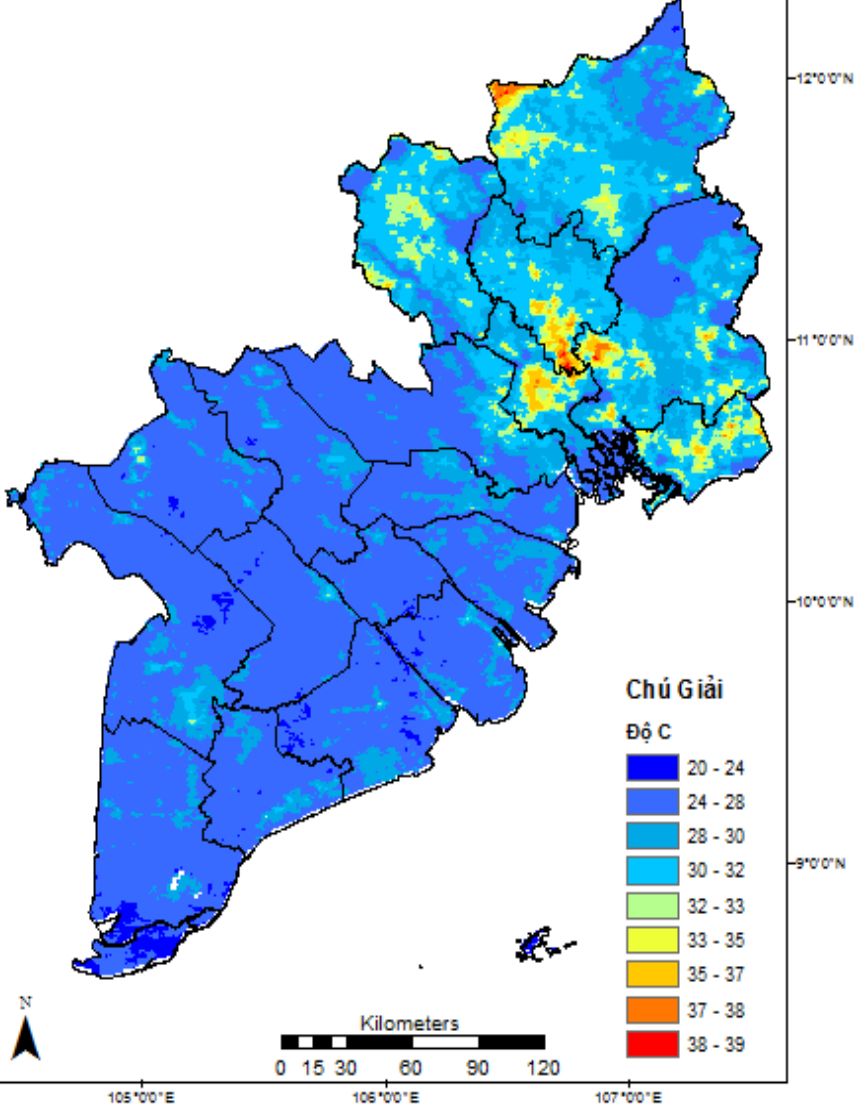
SST on 24 May 2008

A2008147055500_East_Sea_Viet_Nam_SST (Celcius degree)

SST on 26 May 2008

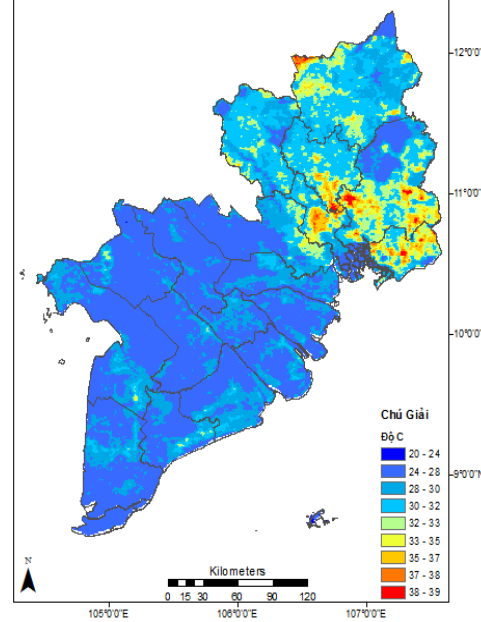
LAND SURFACE TEMPERATURE (LST) from MODIS

**BẢN ĐỒ NHIỆT ĐỘ BỀ MẶT ĐẤT, TỔ HỢP 8 NGÀY
KHU VỰC NAM BỘ NGÀY 02/02/2014-09/02/2014**

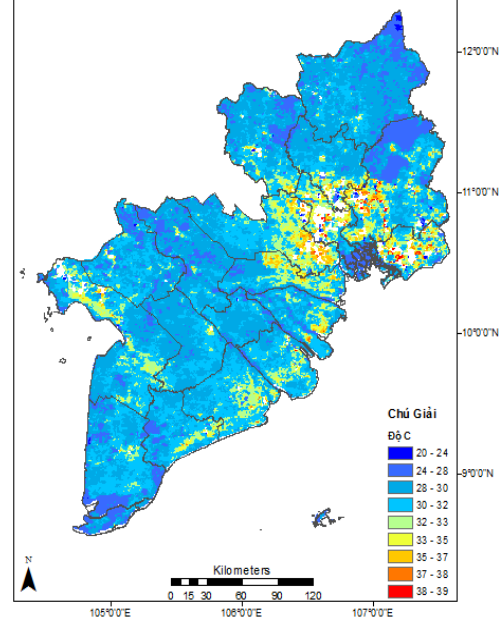


LST in 8 days (02-09/02/2014)

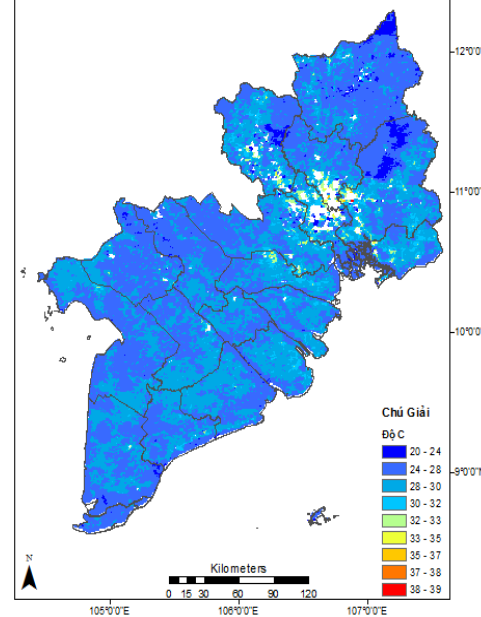
**BẢN ĐỒ NHIỆT ĐỘ BỀ MẶT ĐẤT TRUNG BÌNH
QUÝ 1 NĂM 2014**



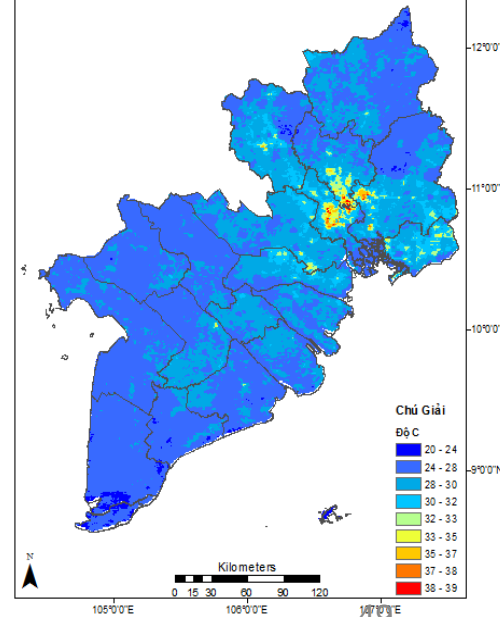
**BẢN ĐỒ NHIỆT ĐỘ BỀ MẶT ĐẤT TRUNG BÌNH
QUÝ 2 NĂM 2014**



**BẢN ĐỒ NHIỆT ĐỘ BỀ MẶT ĐẤT TRUNG BÌNH
QUÝ 3 NĂM 2014**

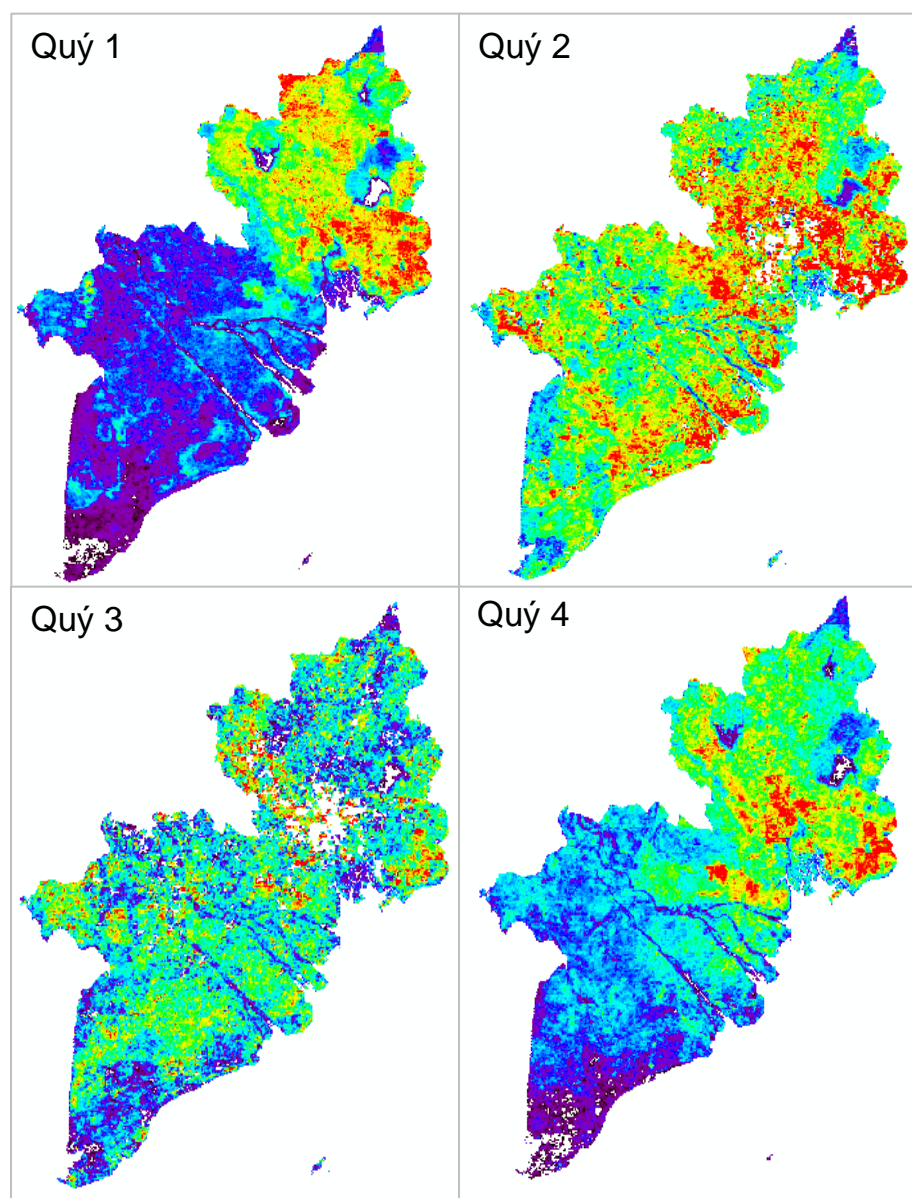
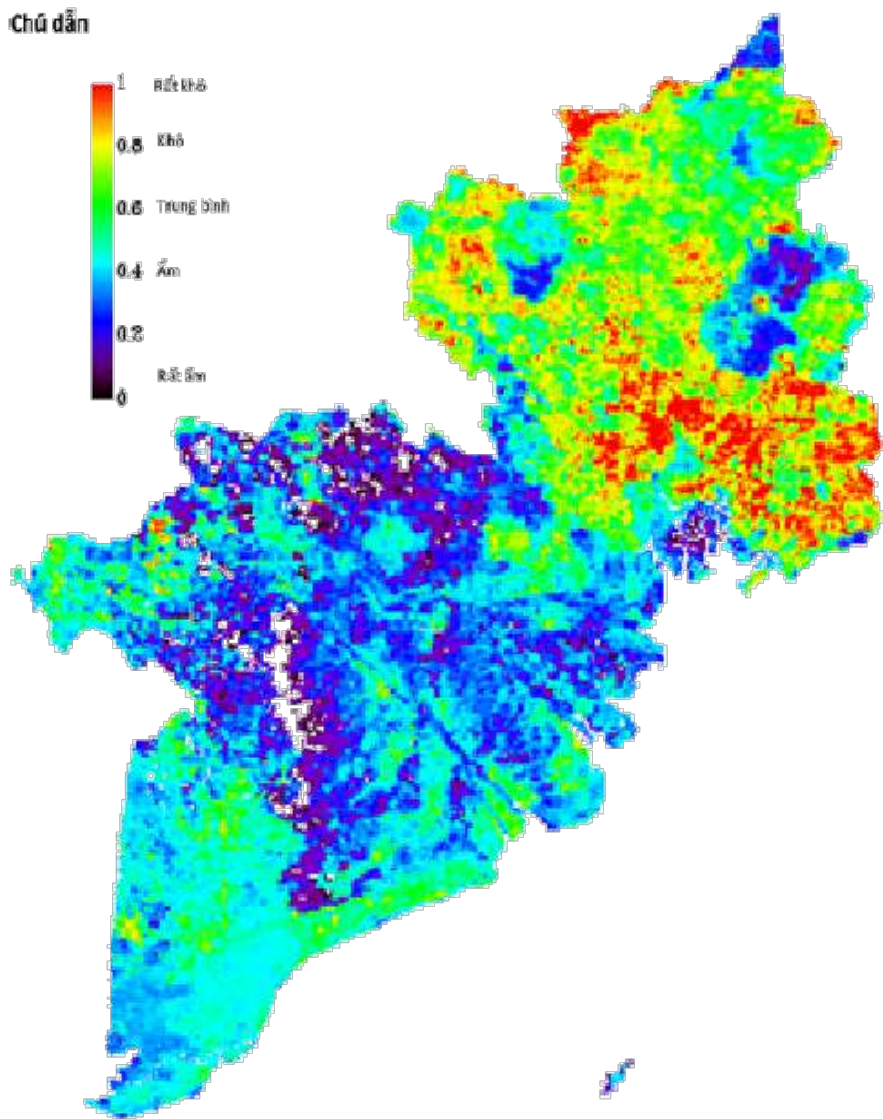


**BẢN ĐỒ NHIỆT ĐỘ BỀ MẶT ĐẤT TRUNG BÌNH
QUÝ 4 NĂM 2014**



LST quarters of year in 2014

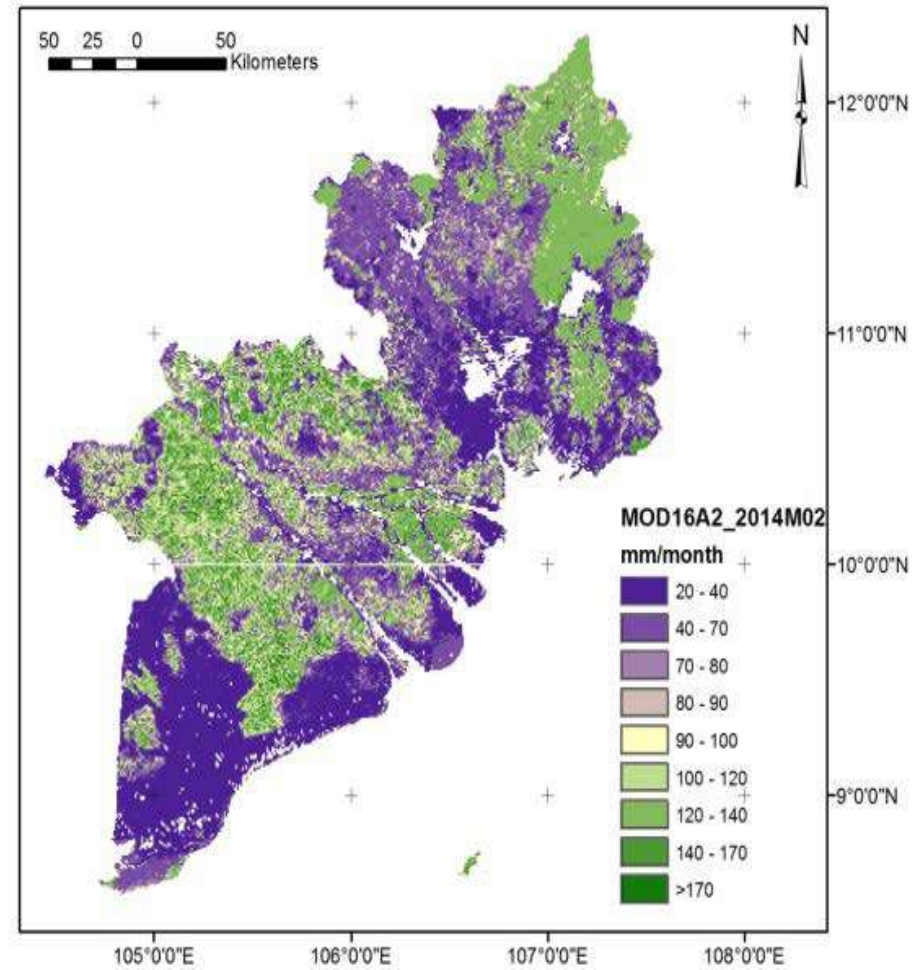
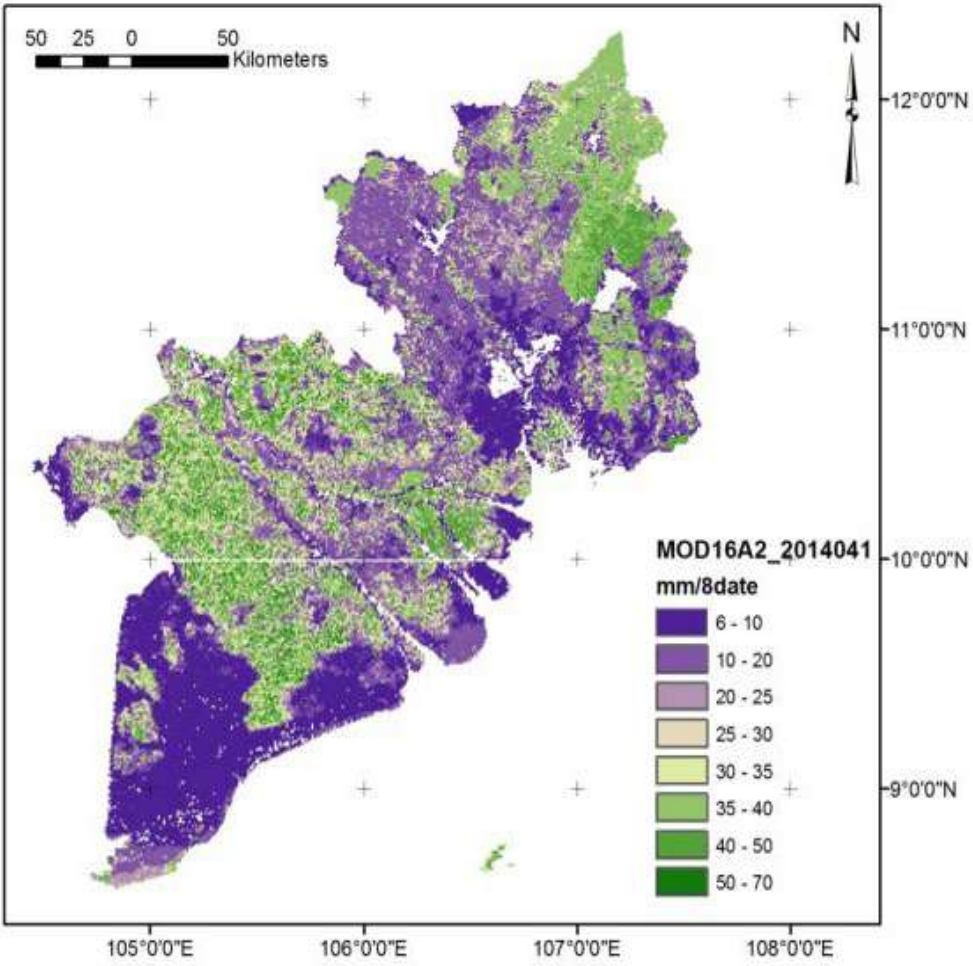
SOIL MOISTURE from MODIS



Soil moisture in quarters of year 2014

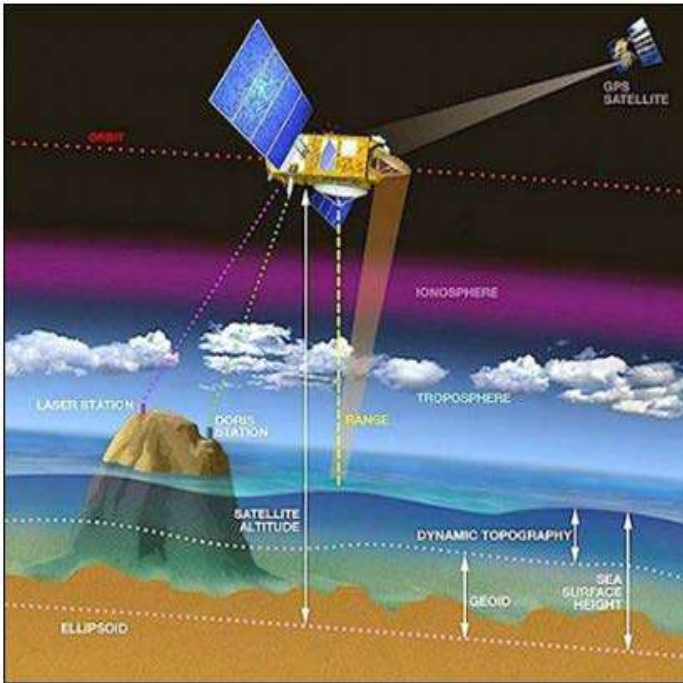
Soil moisture 8 days (03/3/2014)

EVAPORATION

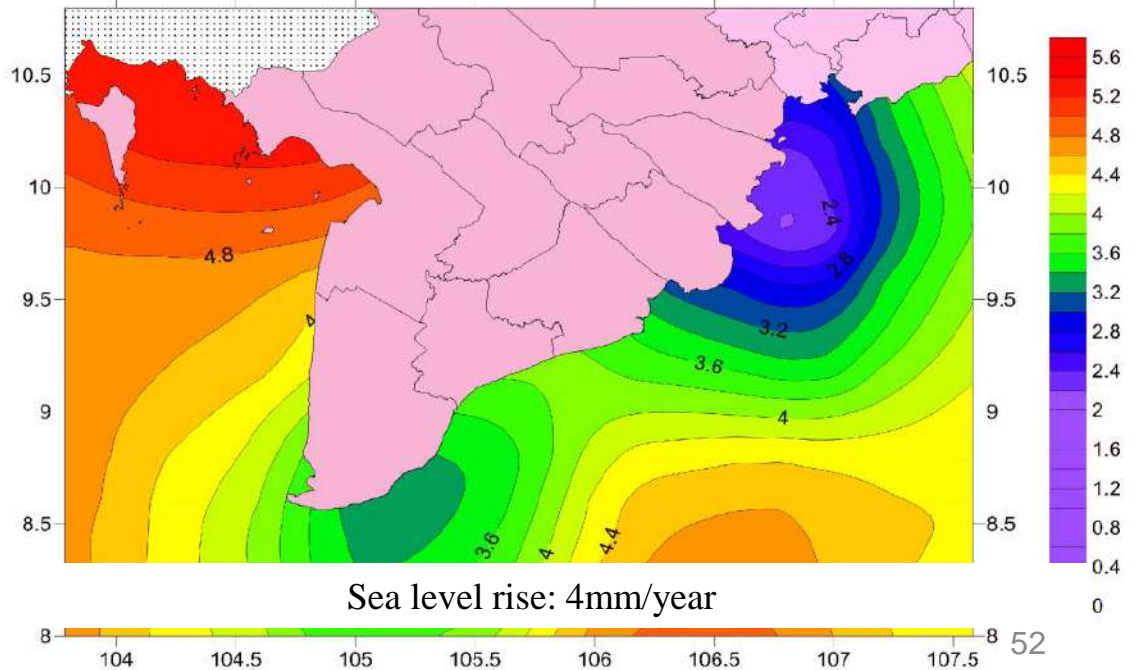
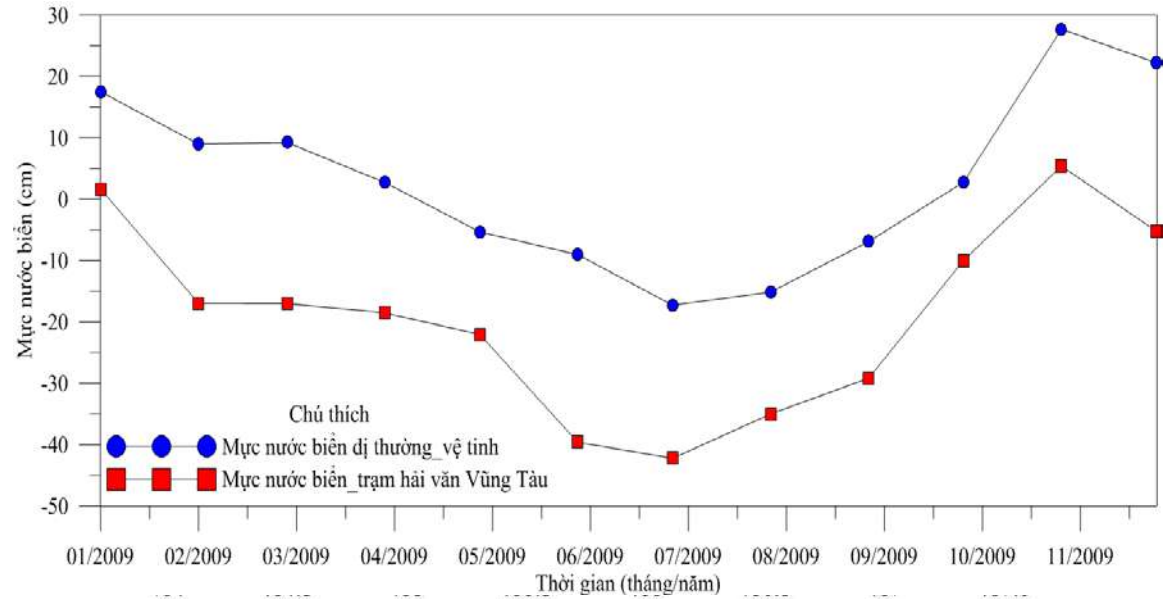


Evaporation (2014)

SEA LEVEL RISE 1992-2013



Altimetry data: Topex/Poseidon, Jason-1, Jason-2 satellites (11/1992 - 2013)





THANK YOU SO MUCH

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