Earth Observation Technologies for Crop Monitoring: A Workshop to Promote Collaborations among GEOGLAM/JECAM/Asia-RiCE 2018
17-20 September 2018 – Taichung, Taiwan

Vietnam Data Cube

Lam Dao Nguyen
HCMC Space Technology Application Center (STAC)–VNSC–VAST
Vu Anh Tuan, Loc Thi Thuy Linh
Vietnam National Space Center (VNSC)–VAST

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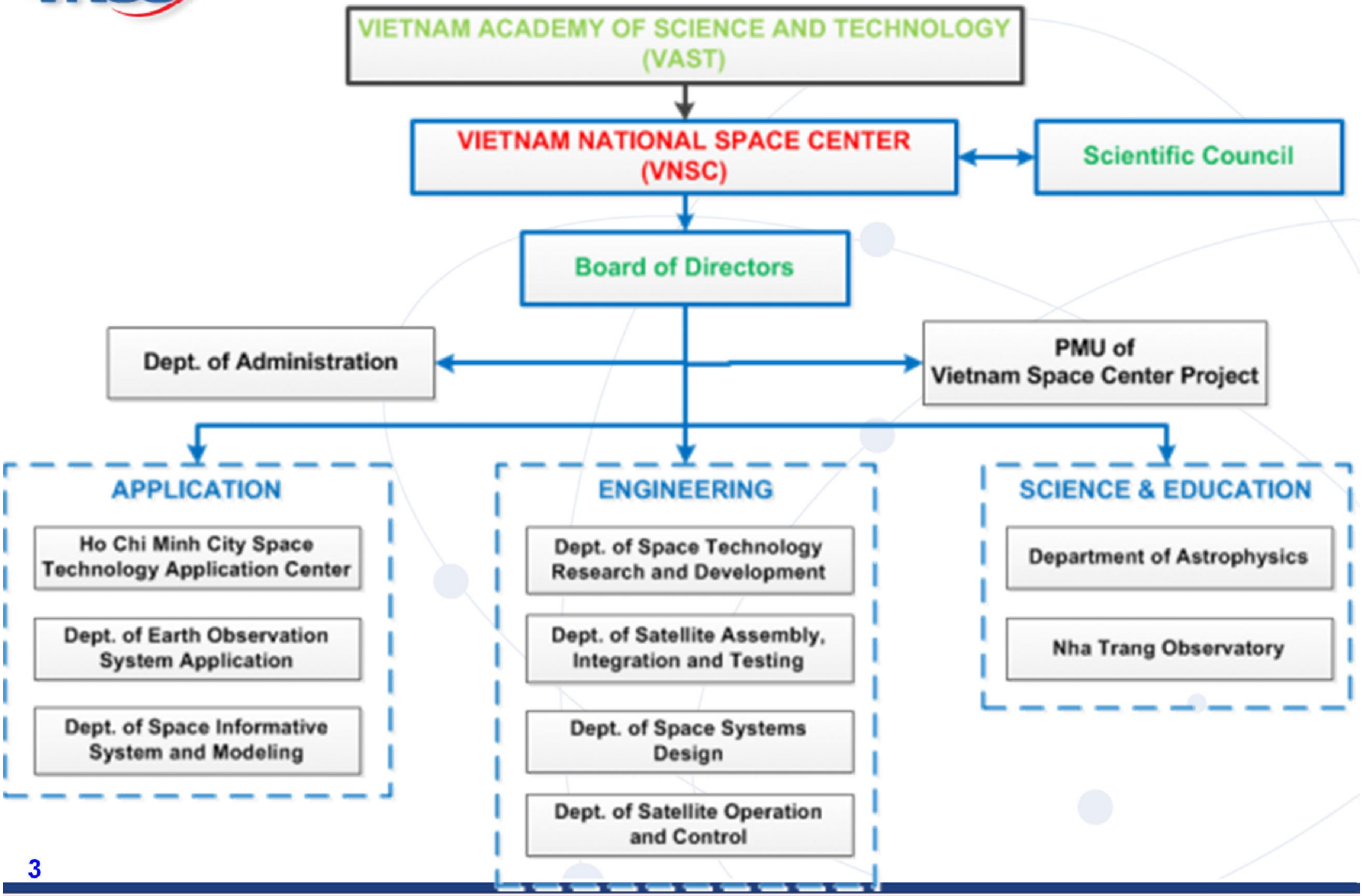
Welcome to the Vietnam Open Data Cube

Vietnam National Space Center is using the power of the Open Data Cube to help address the needs of satellite data users, giving them a better picture of their land resources and land change.

- Ease of use and access to satellite-based data
- Multiple dataset interoperability and spatial consistency
- Use of "Analysis Ready" Data Products
- A Shift in Paradigm from Scenes to Pixels

Log In

Introduction



Introduction

Trung tâm PT nhân lực &
Chuyển giao CNVT tại Hà Nội
(2017)

Trung tâm Vũ trụ VN tại
Hòa Lạc
(2019)

Trung tâm Ứng dụng
CNVT Tp. HCM
(2020)

Đài thiên văn Nha Trang
(2017)

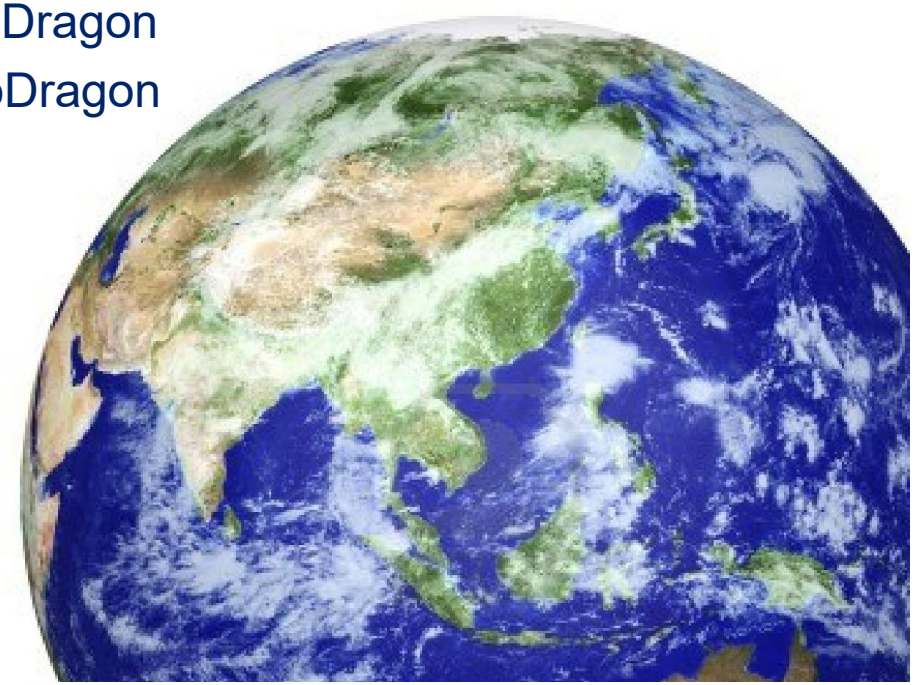
Introduction

Earth Observation Satellites of Vietnam up to 2020

2013:
VNREDSat-1
PicoDragon

2018-2020:
NanoDragon
MicroDragon

2020-2023:
LOTUSat-1&2



Introduction

Ha Noi

Ho Chi Minh City

VNREDSAT-1 Images

Remote sensing data used in Vietnam

- Source of Data:
  - Free and open data: Sentinel, Landsat
  - Comercial satellite data: SPOT
  - Vietnam's satellite: VNREDSat 1
  - Others
- Some characters:
  - More optical than radar
  - More free data than commercial data
  - More specific than general in application approach

Remote sensing data used in Vietnam

- Applications
  - Forest monitoring: by FIPI and FPD
  - Land use/ Land cover mapping: by MONRE
  - Others: Environment, Planning, Agriculture, Disaster management, Water management
- Some characters:
  - More research than operational
  - Small user than big (and stable) user
  - Project depended

Introduction

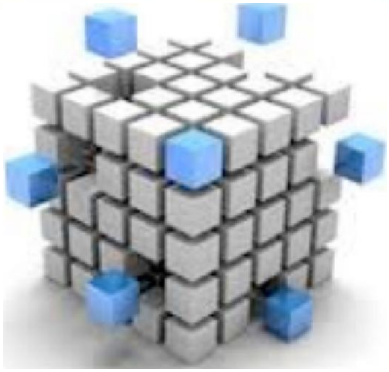
The latest trends in international geospatial & satellite data

- Free and open data
- Growing data volumes
- Improved computing technologies
- Open source software
- Pre-processed products

Why Data Cubes?

Primary problems for users are data access, data preparation, and efficient analyses

- Users want to minimize the time and capacity required to obtain and prepare satellite data
- Users want free and open source solutions.
- Users want to perform time series analyses
- Users want to use multiple datasets together
- Users want to use their common GIS tools
- Users want to "own" the data and keep it locally
- Users want customer service and help



- Our goal is **NOT** to sell a product or give out a tool …
- Our goal is to provide a **SOLUTION** that has **VALUE** and increase the **IMPACT** of satellite data.

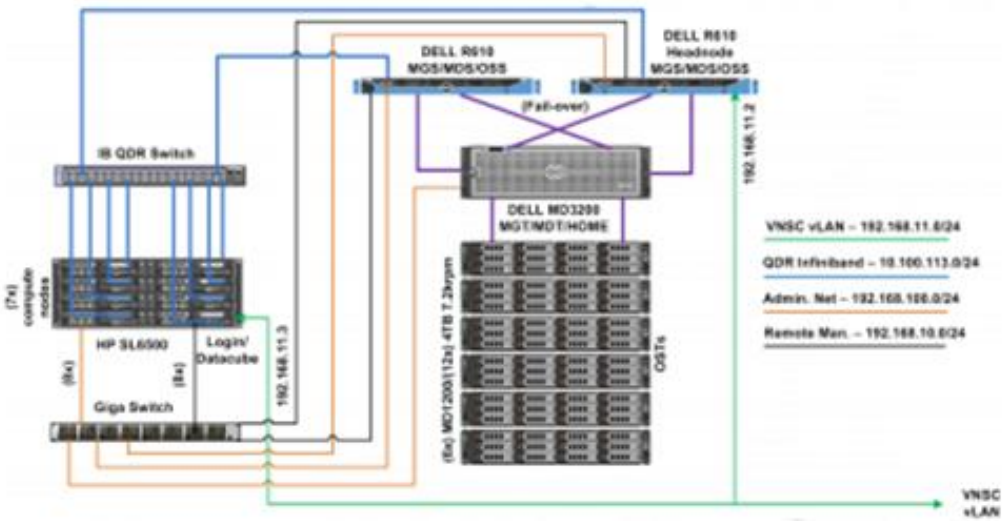
Vietnam Data Cube

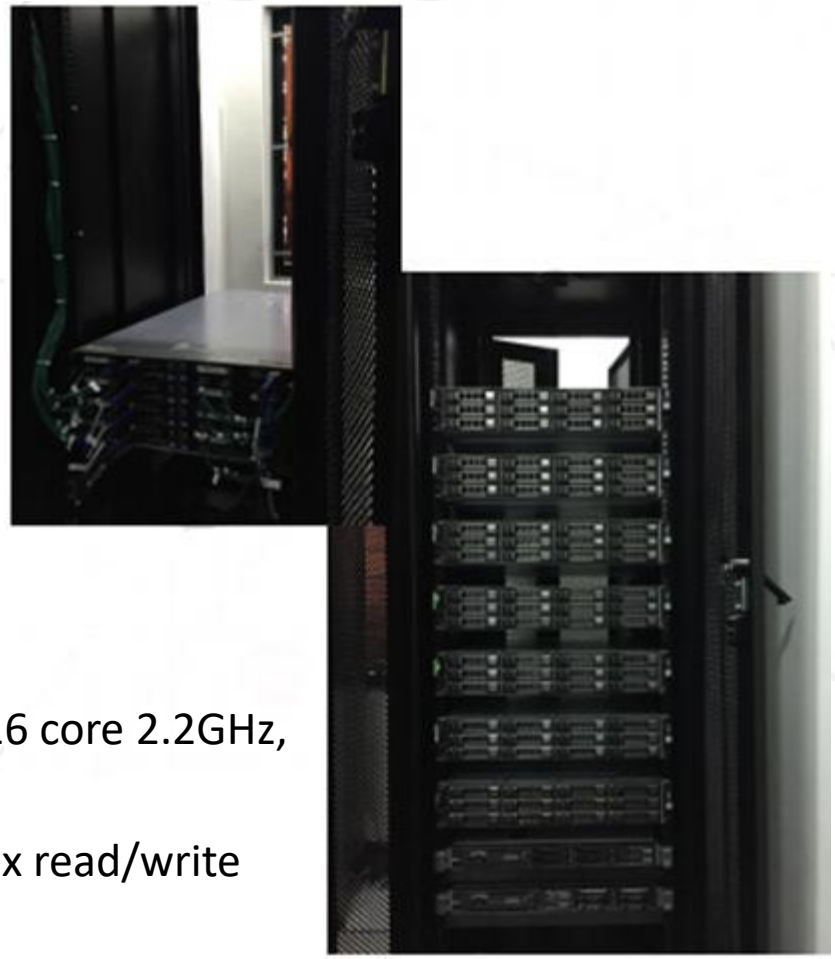
Progress

- Setup the system
  - Setup hardware: July 2017
  - Install Data Cube System: September 2017
  - Data collection and ingestion: 2017 -
- Develop applications
  - Forest monitoring: Early 2018
    Rice monitoring: Early 2018
  - Water monitoring: Early 2018
- MOU signed
  - Signed MOU with FIPI (will test and report the result of forest monitoring)
  - Signed MOU with JAXA (ALOS-2 data providing)

Vietnam Data Cube

Vietnam Data Cube





1 head node, 1 login node, 7 compute nodes (each: 16 core 2.2GHz, 64GB RAM), 40Gb/s Infiniband Interconnect network

Full redundant parallel storage – LustreFS: 195TB, max read/write speed 1.9GB/s

Total storage capacity (including work, home, local): ~ 220TB

Can be expanded to hundreds of compute nodes, hundreds of TBs of storage

Vietnam Data Cube

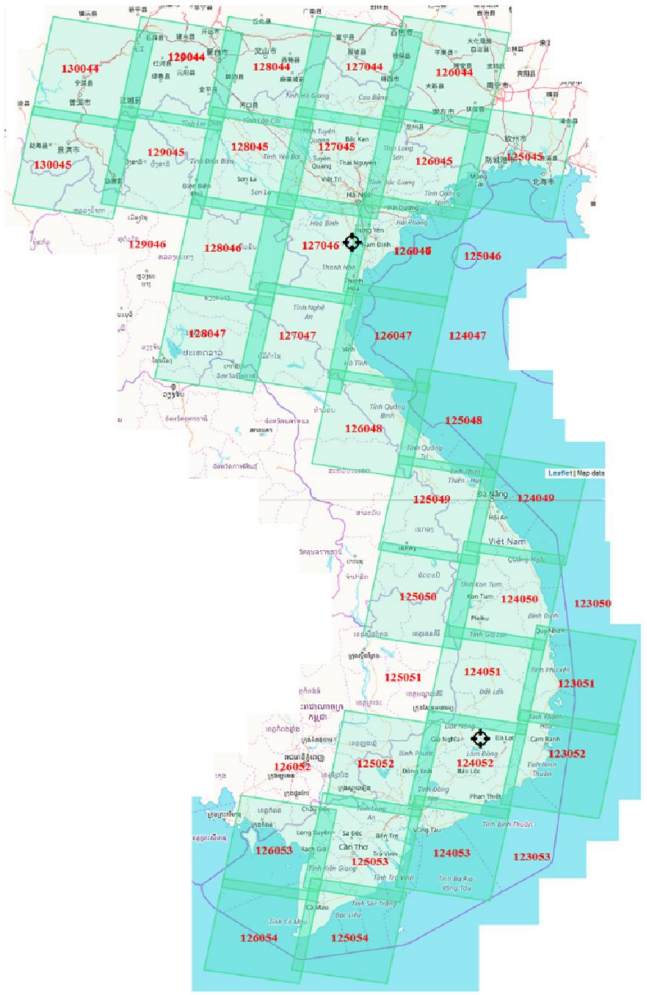
Software environment

- Packed with Software dedicated to Data cube and Satellite data analysis
- Support both operations and research tasks
- Parallel computing environment, support tens to 100 concurrent users
- Analysis time on the order of seconds or minutes

Vietnam Data Cube

- Data
  - Optical data: Landsat, Sentinel-2
  - Radar data: JERS, ALOS/PALSAR, Sentinel-1
- Source of Data: USGS (Landsat), ESA (Sentinel), JAXA (JERS and ALOS)
- Still in collection progress
- ARD available
- Free and Open (data from JAXA is free of charge for governmental users)

Vietnam Data Cube



Landsat

- 36453 images (Landsat 4, 5, 7, 8)
- Time: from June 1986 to January 2018

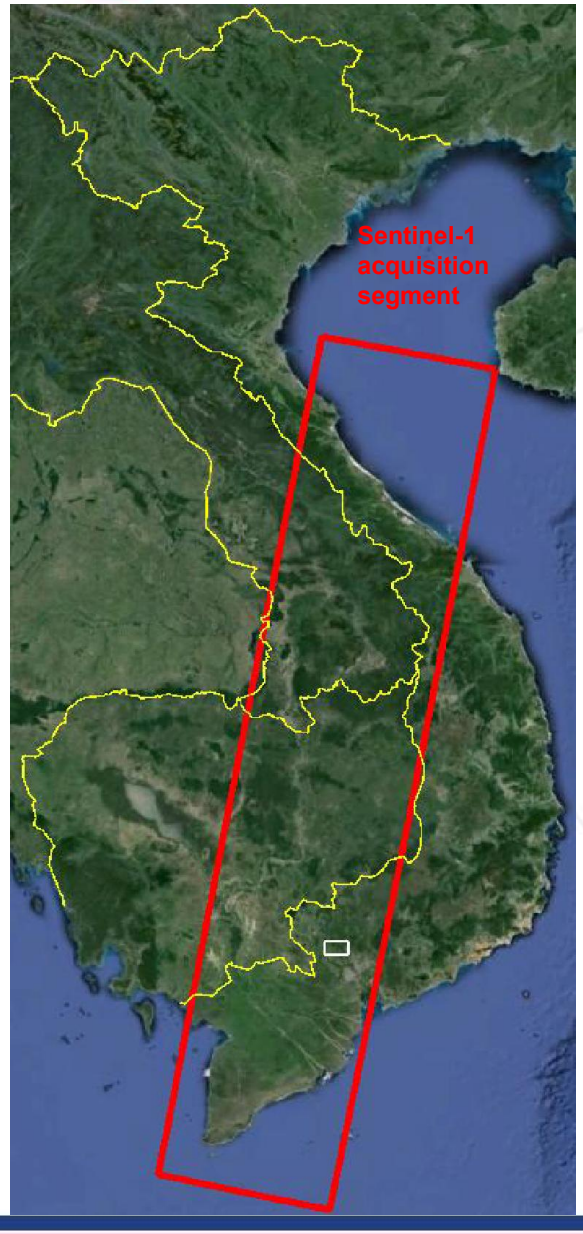
ALOS-2

- 1507 images
- Time: from November 2016 to April 2018

Terra ASTER GDEM

- For the whole territory of Vietnam

Vietnam Data Cube



Sentinel-1:

- S-1 images (VH and VV polarisation)
- Time: from January 2015 to March 2018
- Swath width: 250 km, pixel size: 10 m x 10 m
- Constantly update new data

Vietnam Data Cube

- Data cube will be VNSC's core data architecture for becoming EO provider in Vietnam
- VNSC will be an agency supplying 3 types of data sharing:
  1. Raw data as from providers: free
  2. Analysis ready Data (ARD): free
  3. Value added products to end users

Vietnam Data Cube

- Applications
  - Forest monitoring: in collaboration with FIPI, CESBIO/CNES, CSIRO
  - Rice monitoring: in collaboration with CESBIO/CNES
  - Water management: in collaboration with CSIRO
- Future applications

Vietnam Data Cube

Application	Year	Data used
Forest monitoring	2018	Landsat, Sentinel, ALOS-2
Rice monitoring	2018	Sentinel, ALOS-2, LOTUSat
Water monitoring (in land water surface)	2018	Landsat, Sentinel, ALOS-2, LOTUSat
Other crop monitoring (coffee, rubber, etc.)	2020	Landsat, Sentinel, ALOS-2, LOTUSat

Future work

- Vietnam Data Cube is facing with some challenge: funded by VNSC (limited); no budget for pilot project of application; lack of expert in running/management the system; expert in Python programming
- Technical future work:
  - Continuing of data collection and ingestion
  - Complet the current application
  - Technical transferring/workshop for users
  - Develop new application in collaboration with users
- Other future work:
  - Establish a community of Vietnam Data Cube users
  - Looking for stable fund for system operation and application

Vietnam Data Cube

Vietnam Open Data Cube | Home | Data Cube Manager | Tools | Task Manager | Submit Feedback | Log In

Welcome to the Vietnam Open Data Cube

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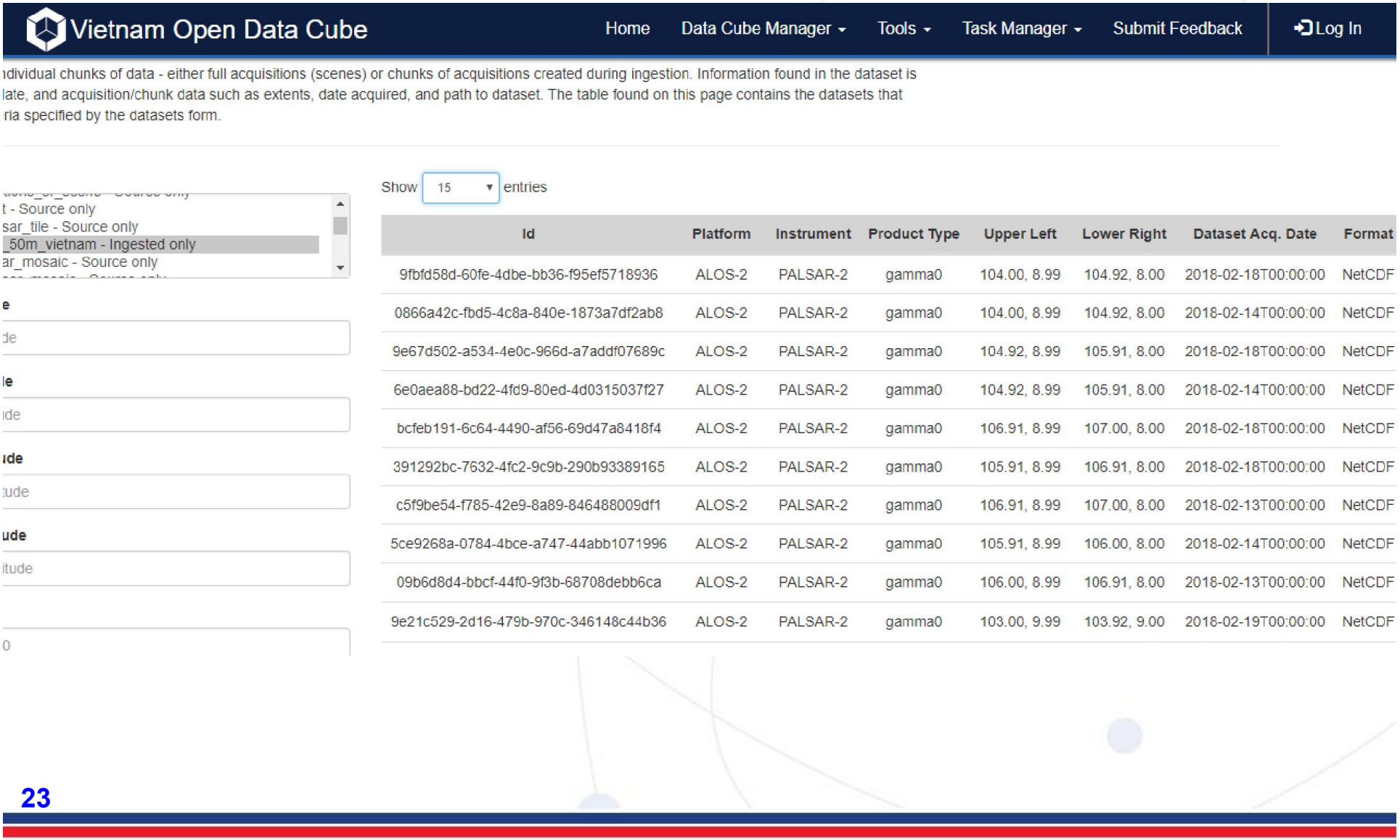
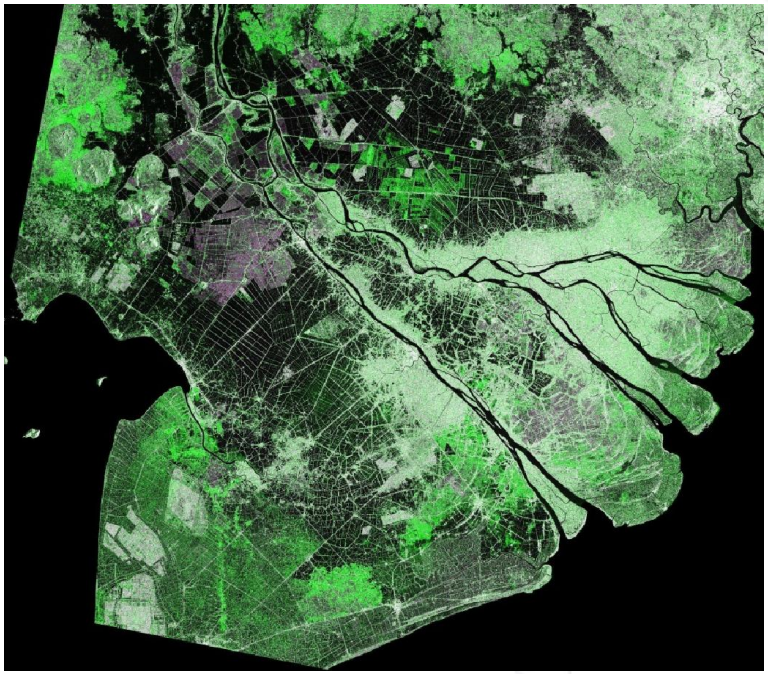
Vietnam Data Cube

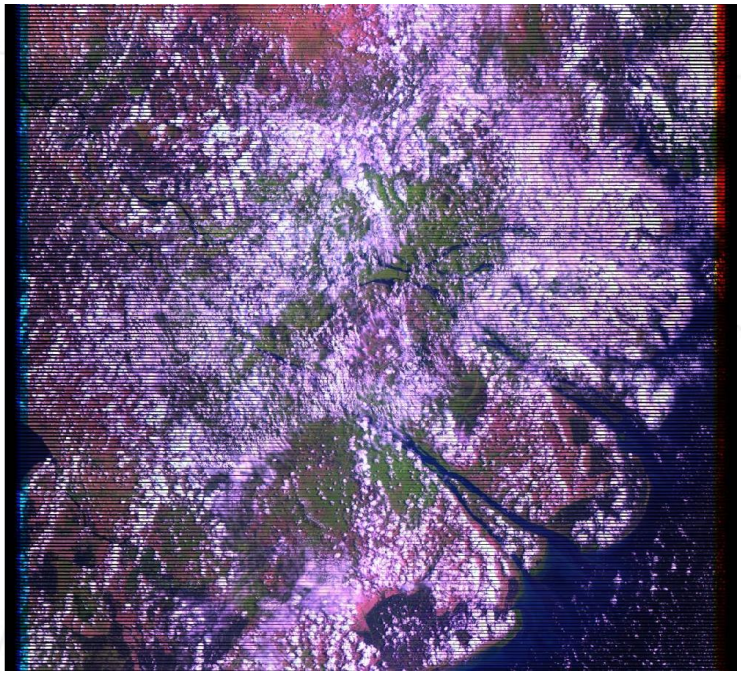


Vietnam Data Cube – Radar data

‘ *all-weather* ’ imaging system

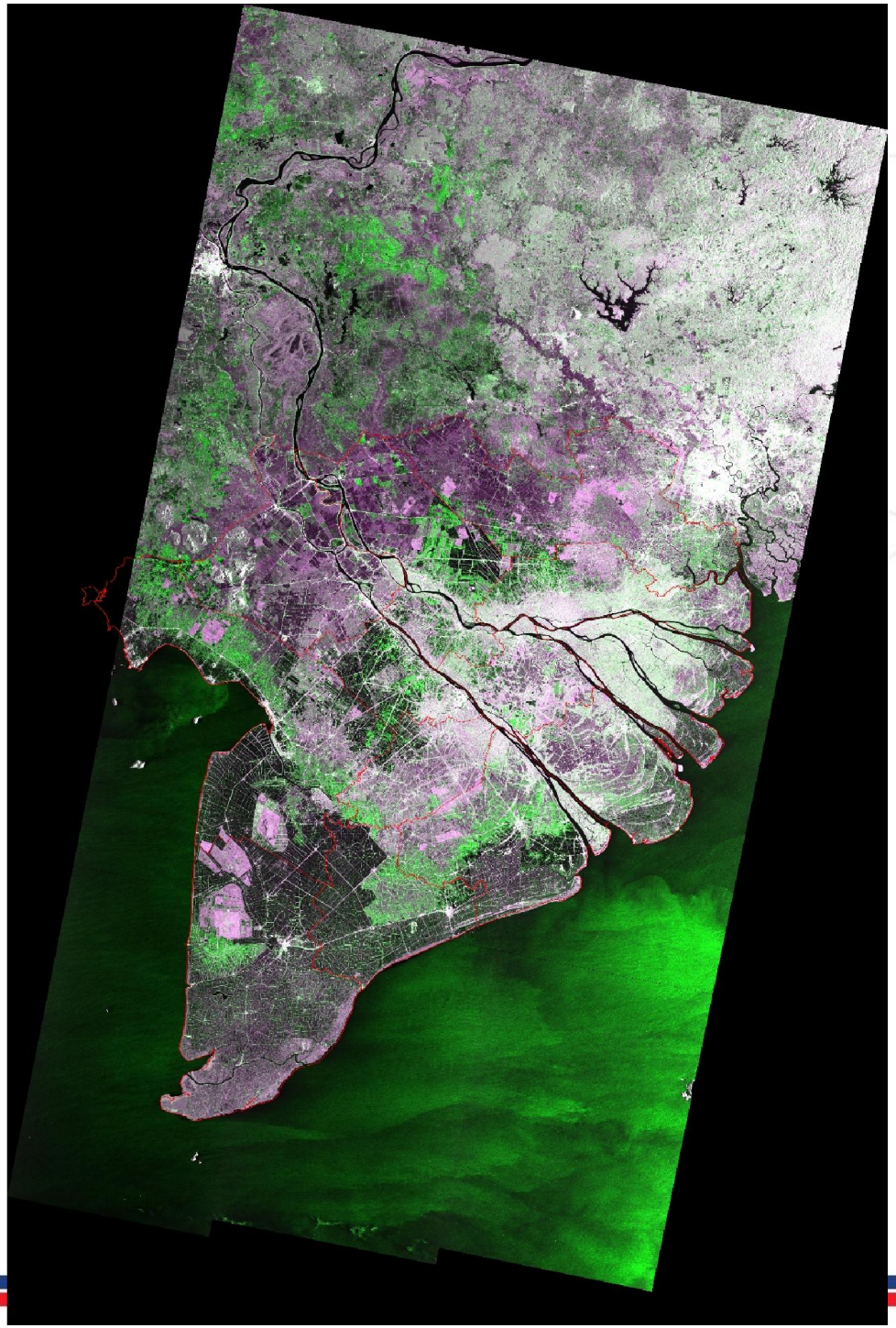


Radar data
1 Nov. 2017

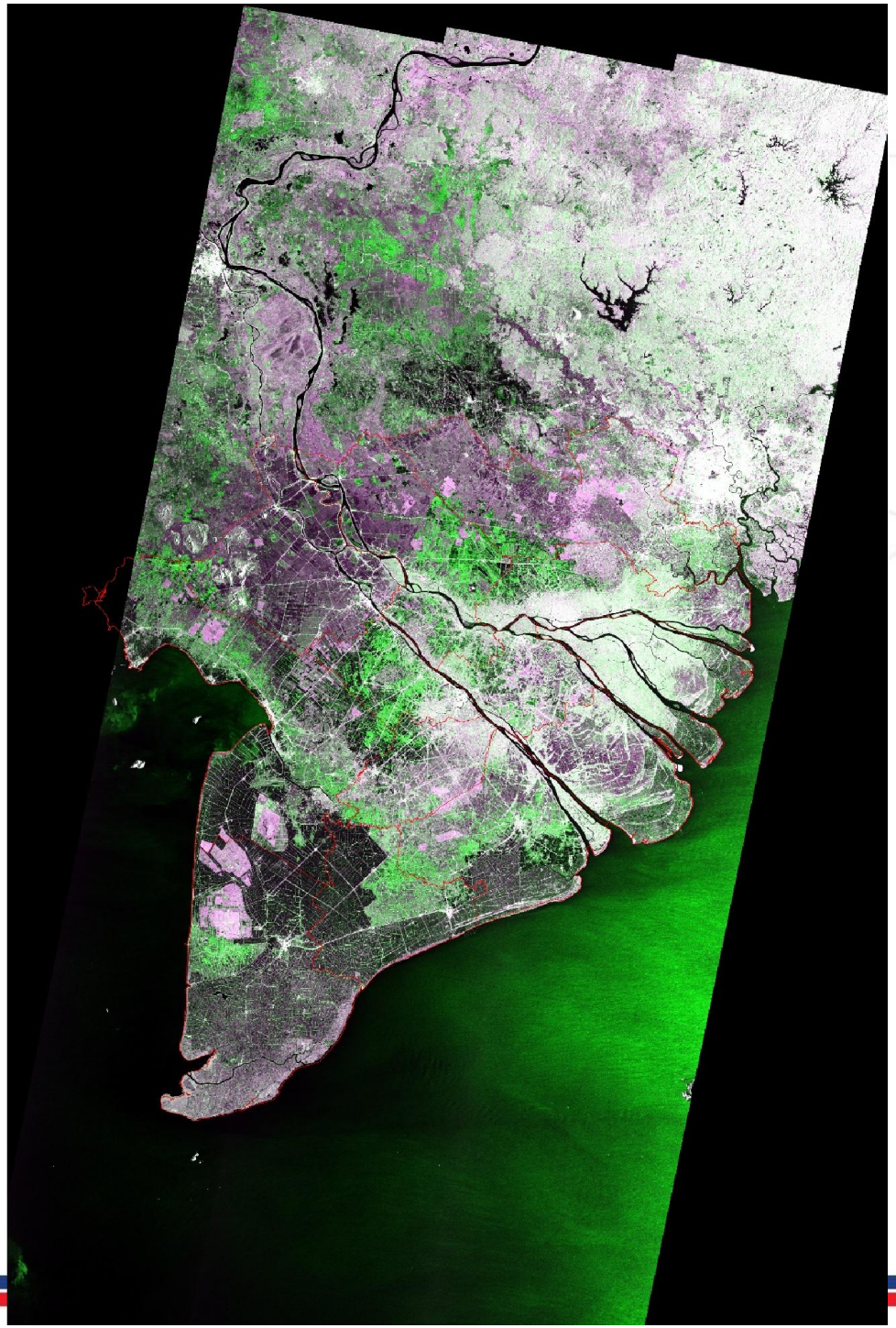


Optical data

Mekong Delta, Vietnam



July 05, 2018



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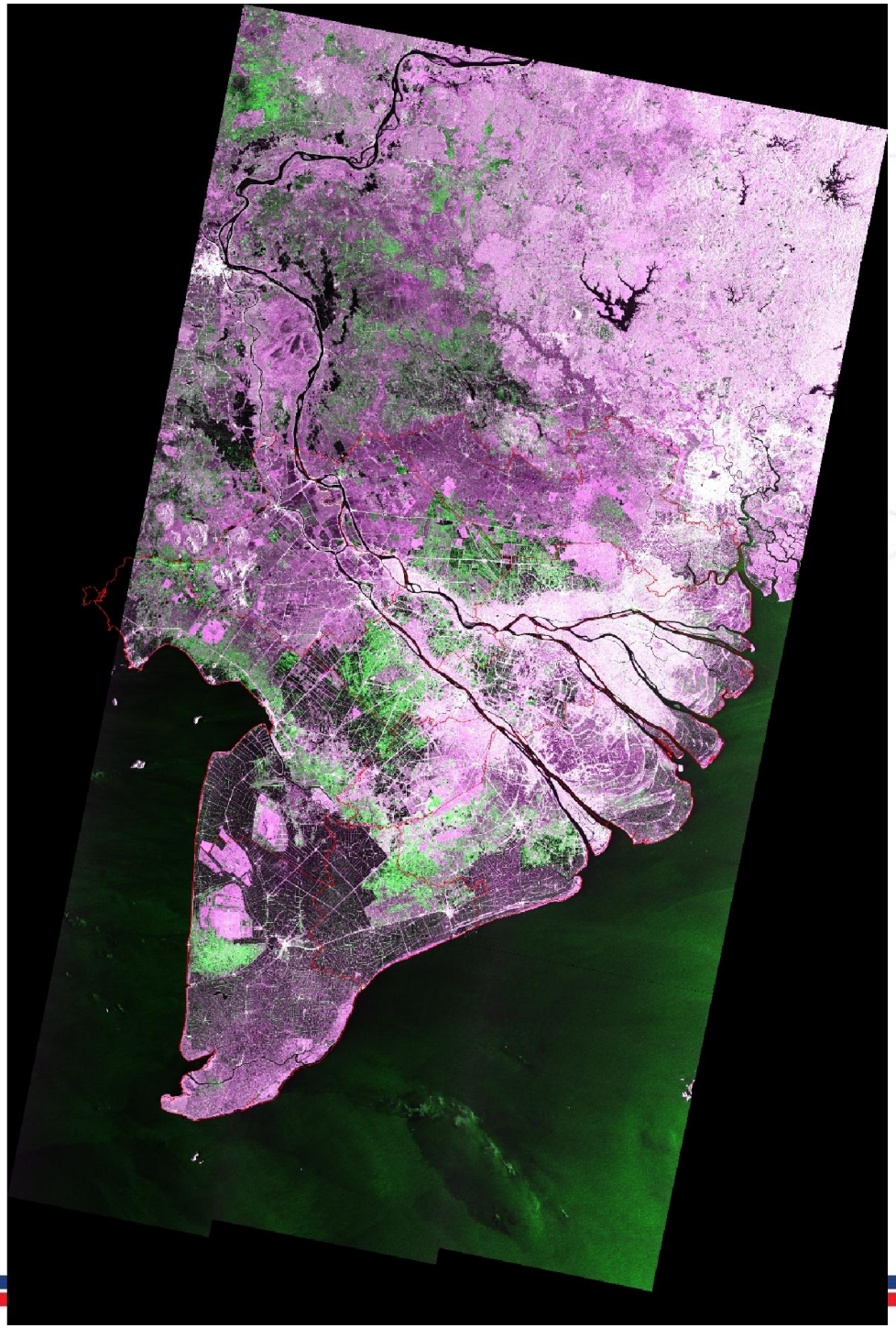

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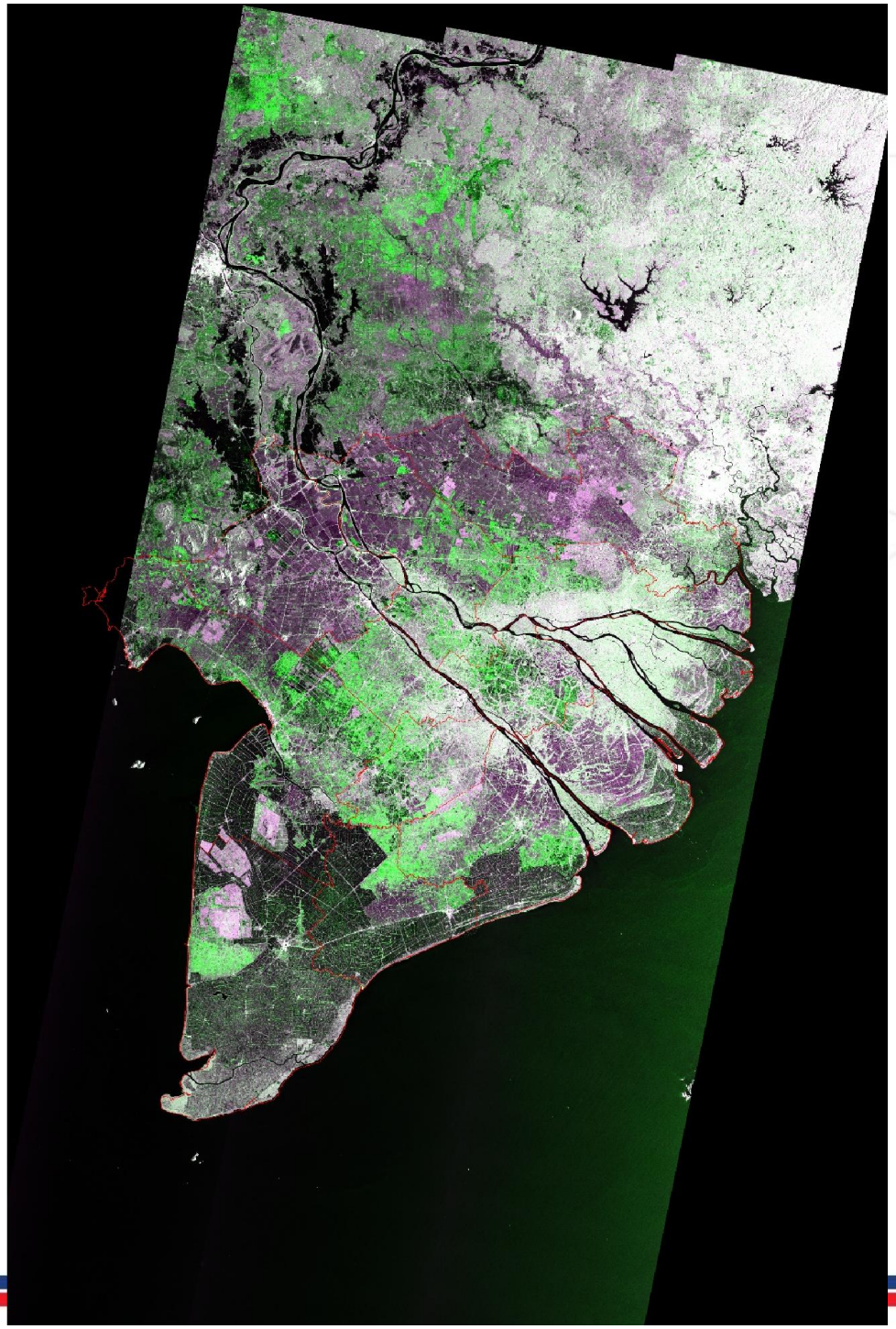

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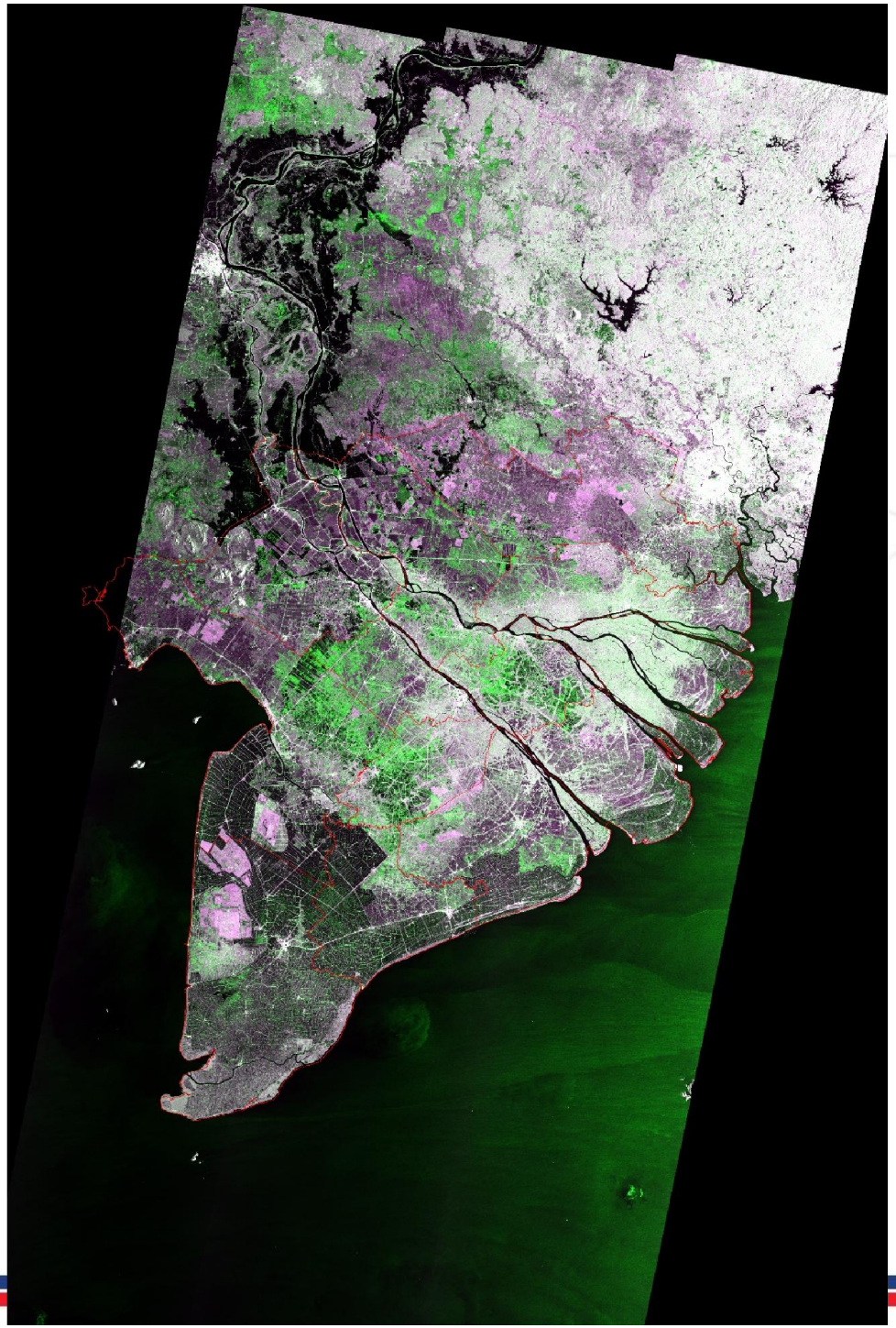

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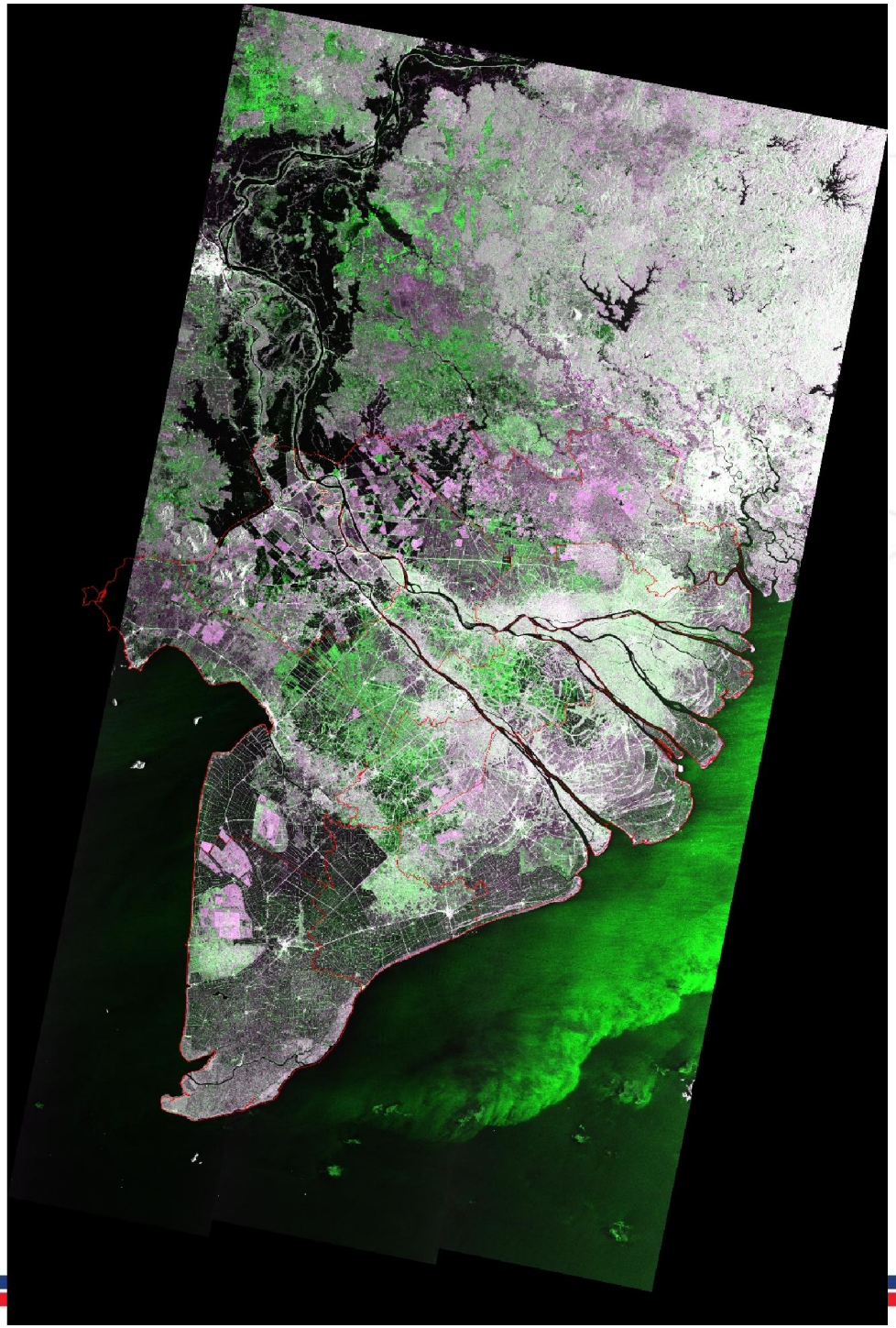

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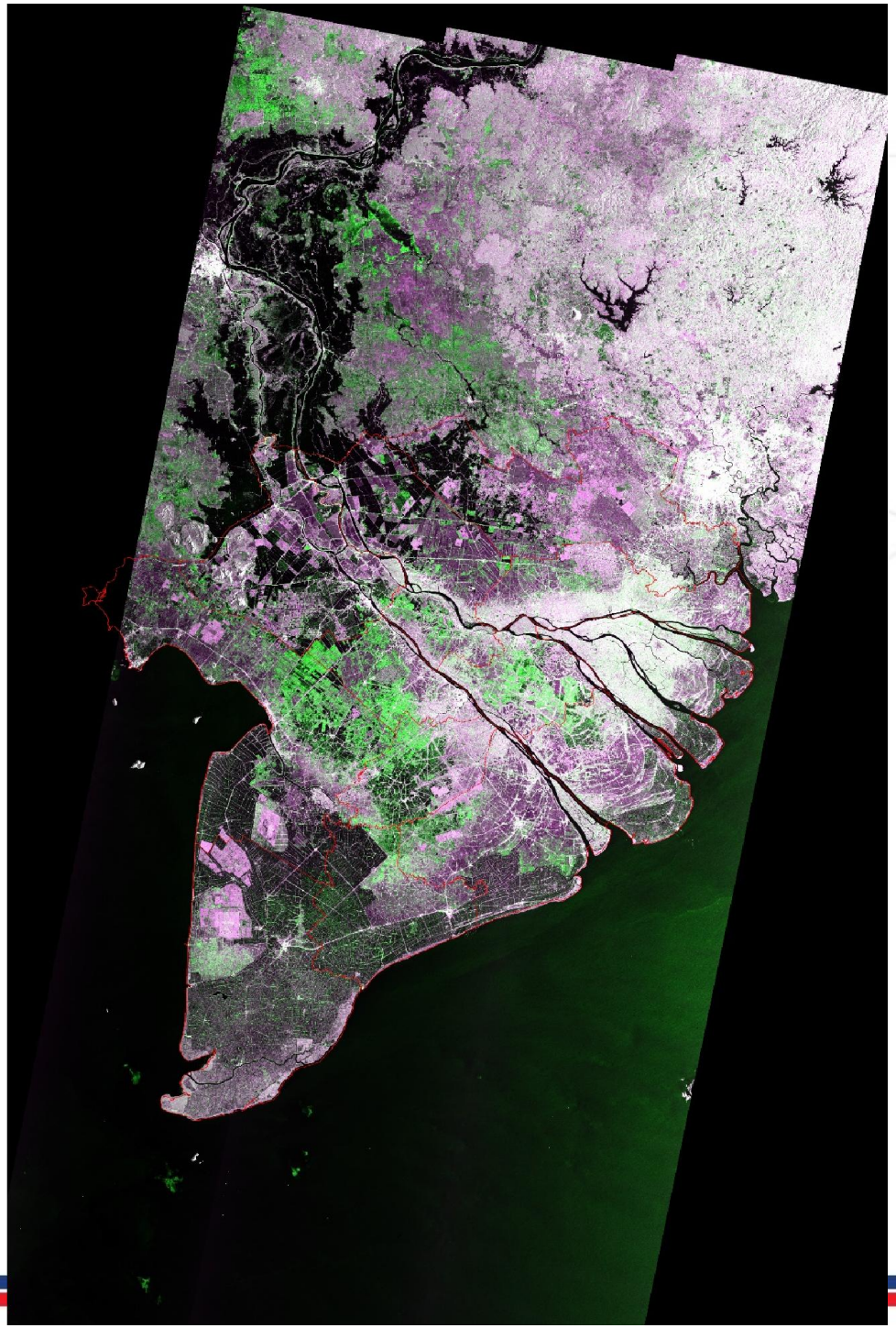

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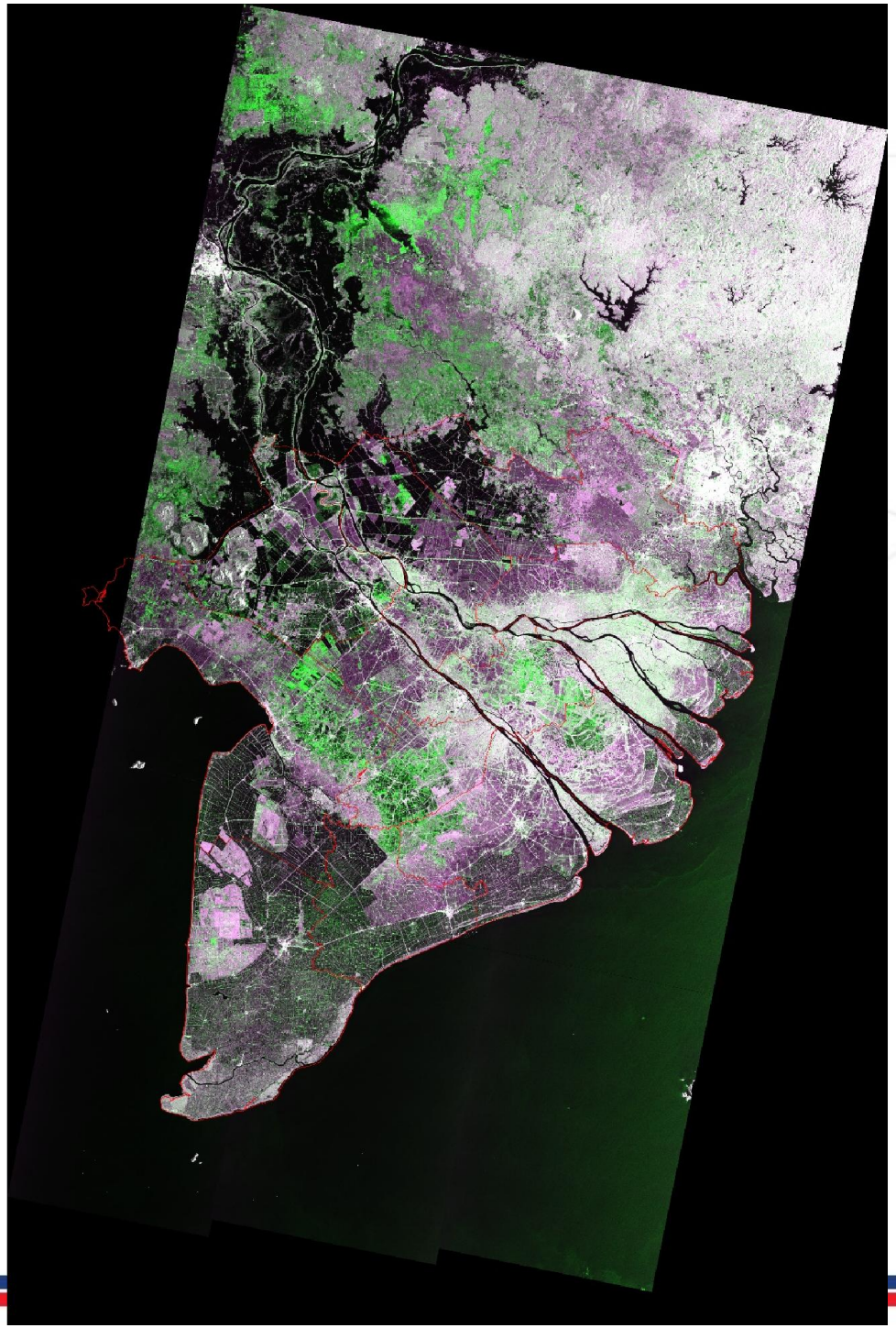

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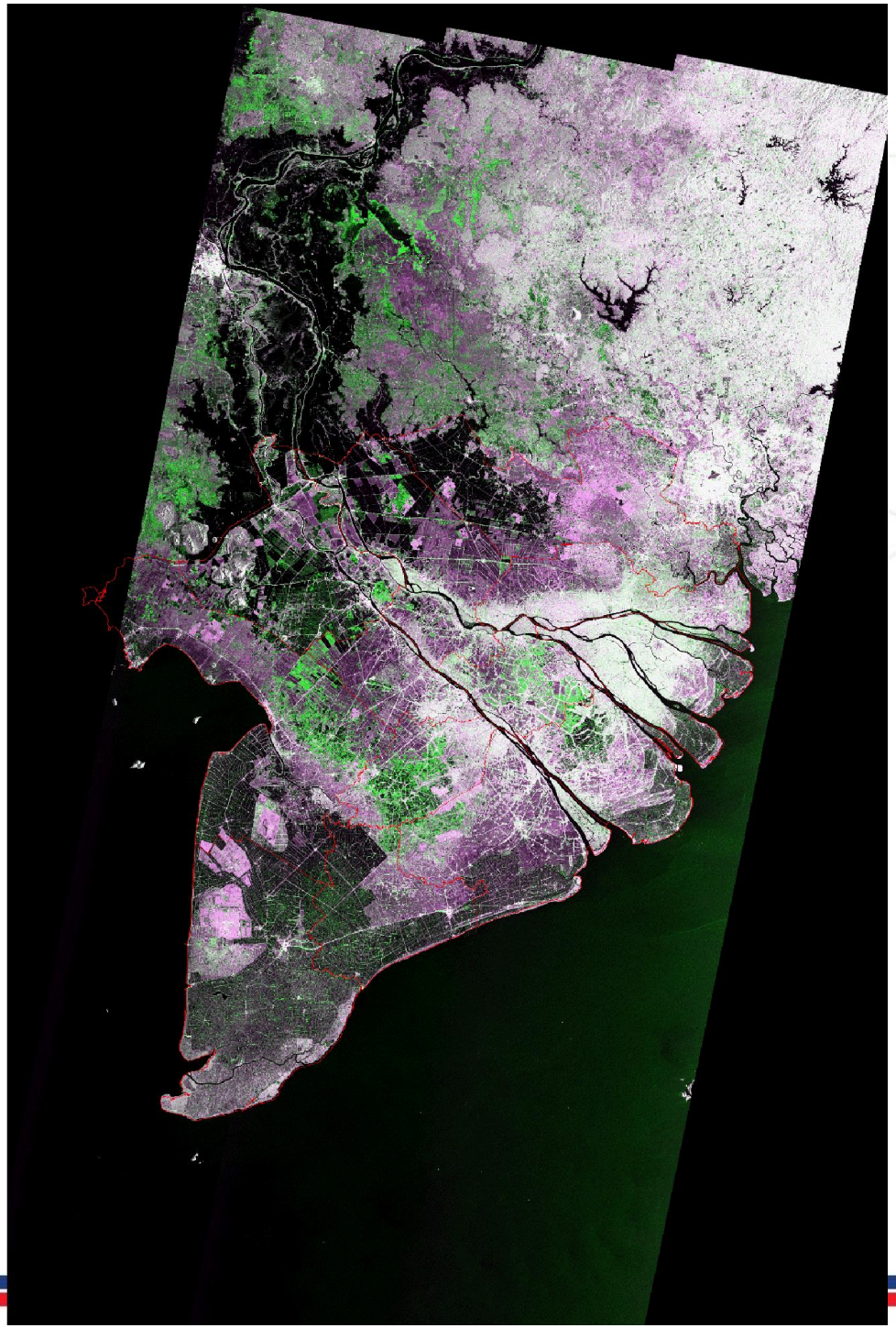

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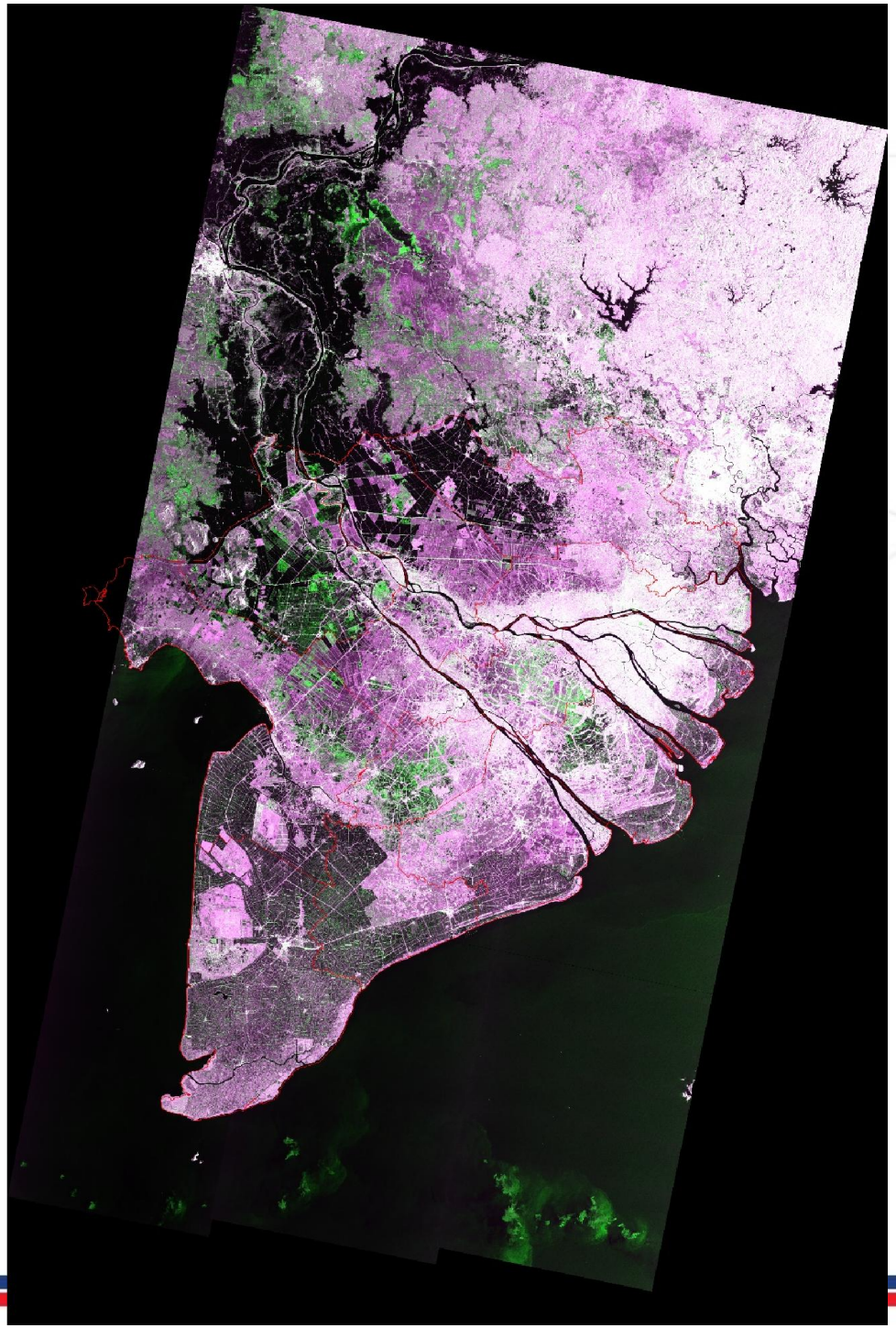

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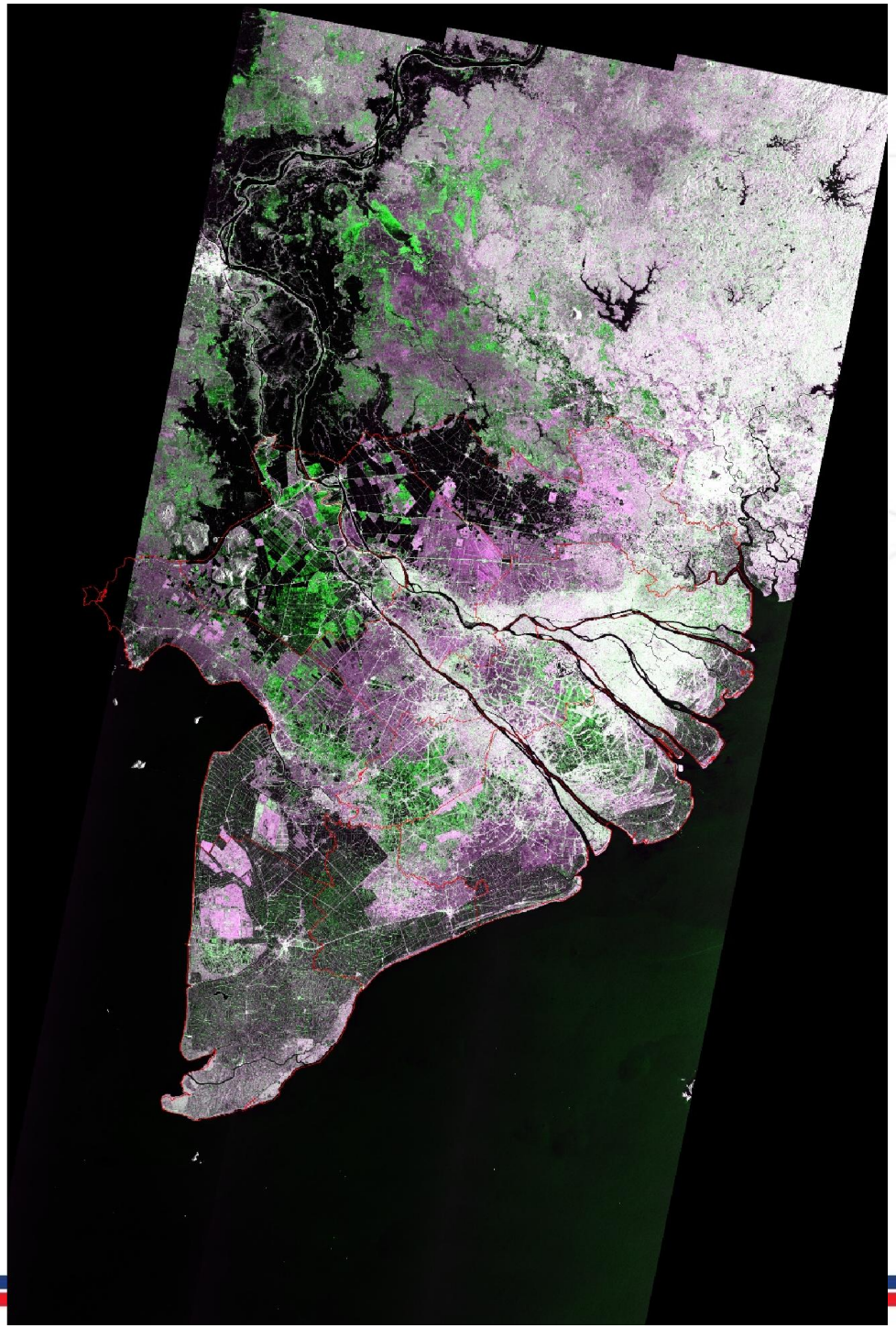

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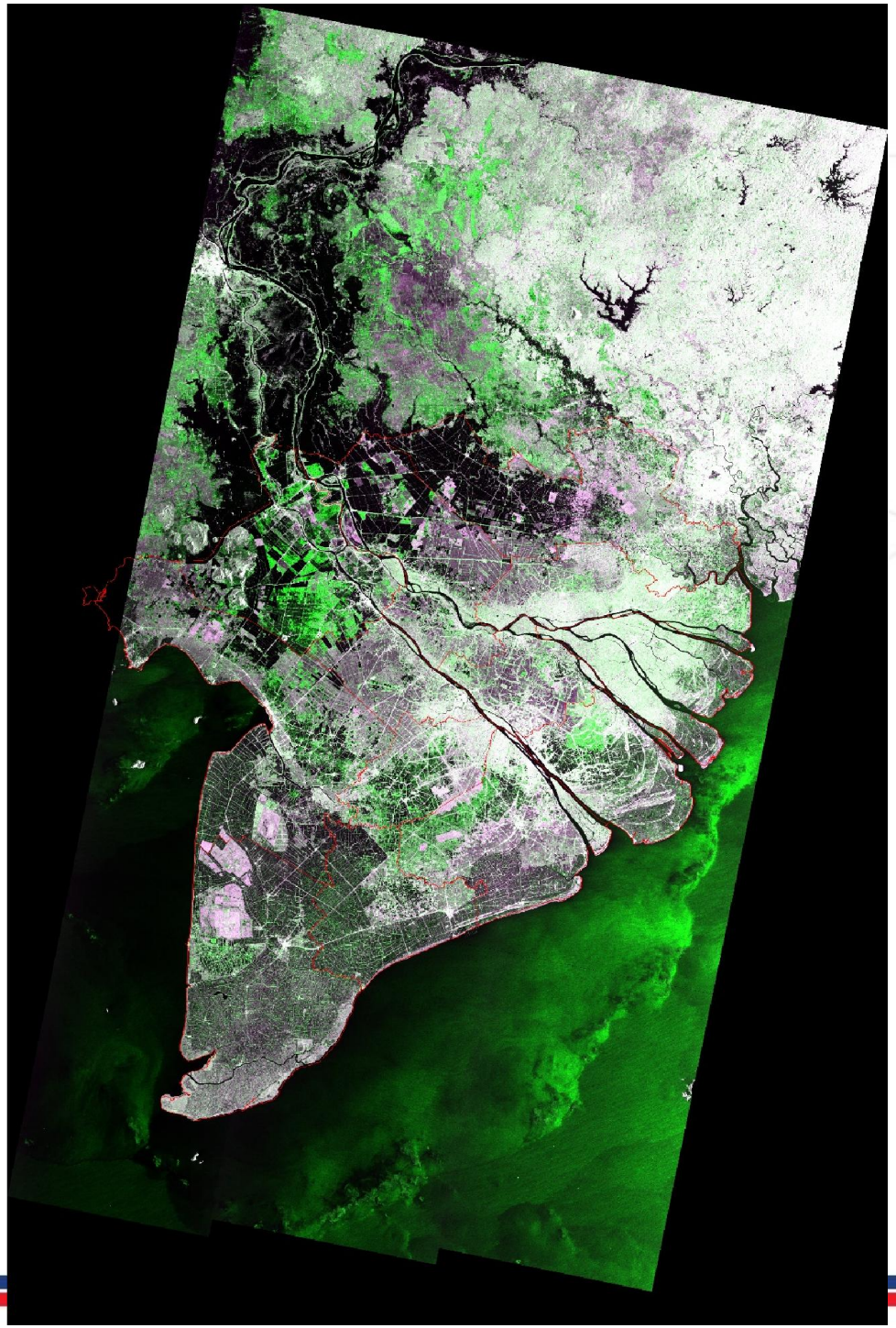

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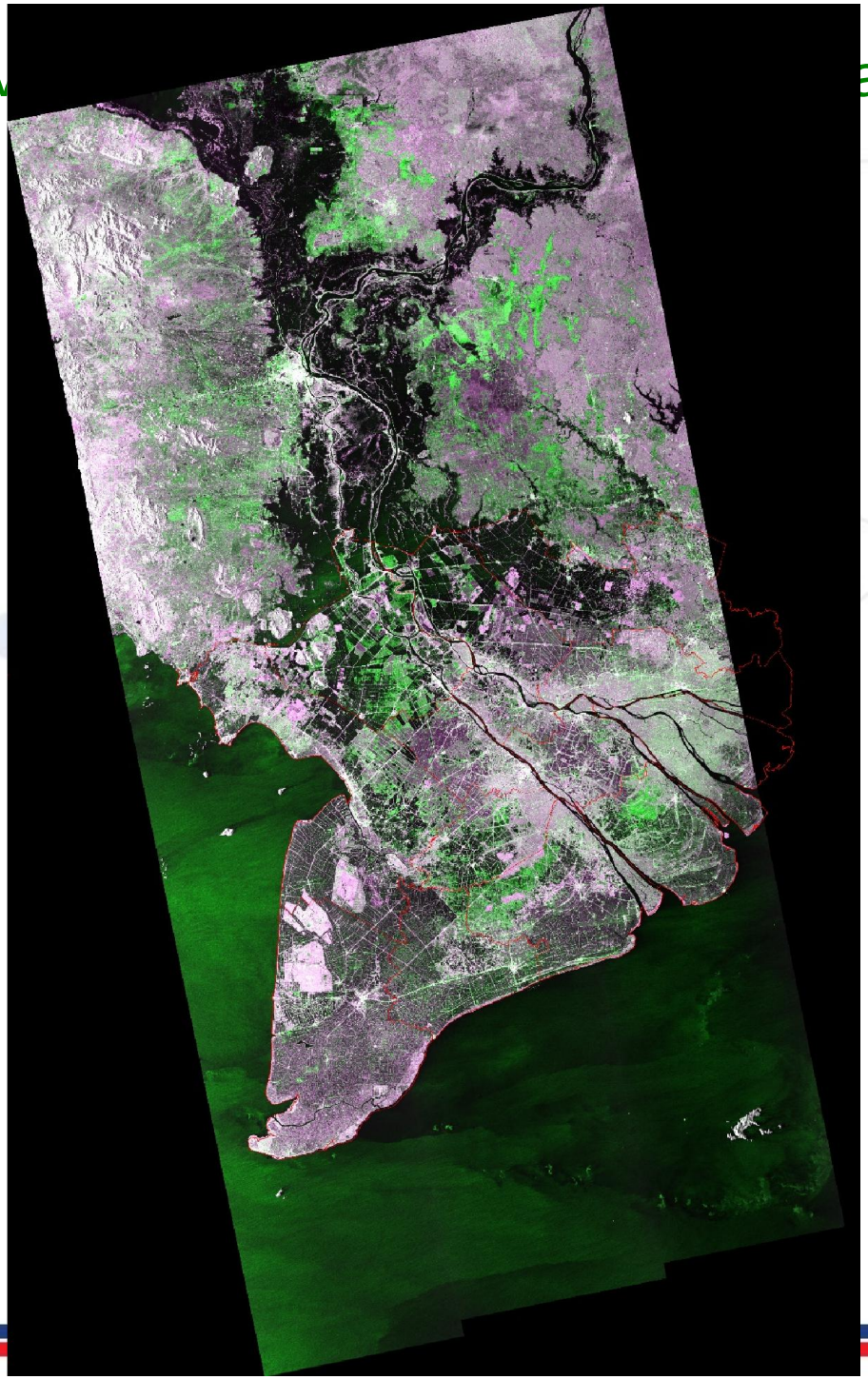
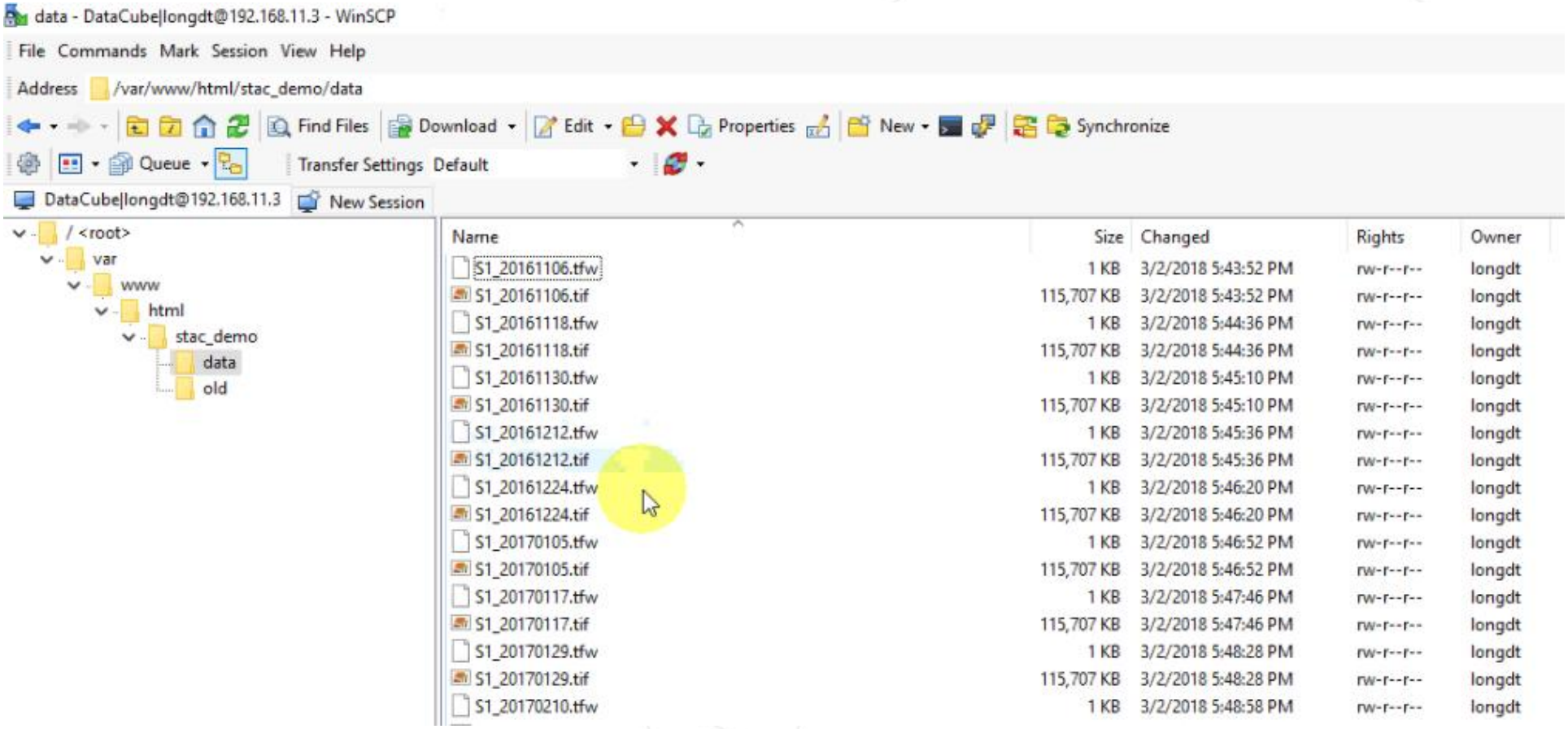


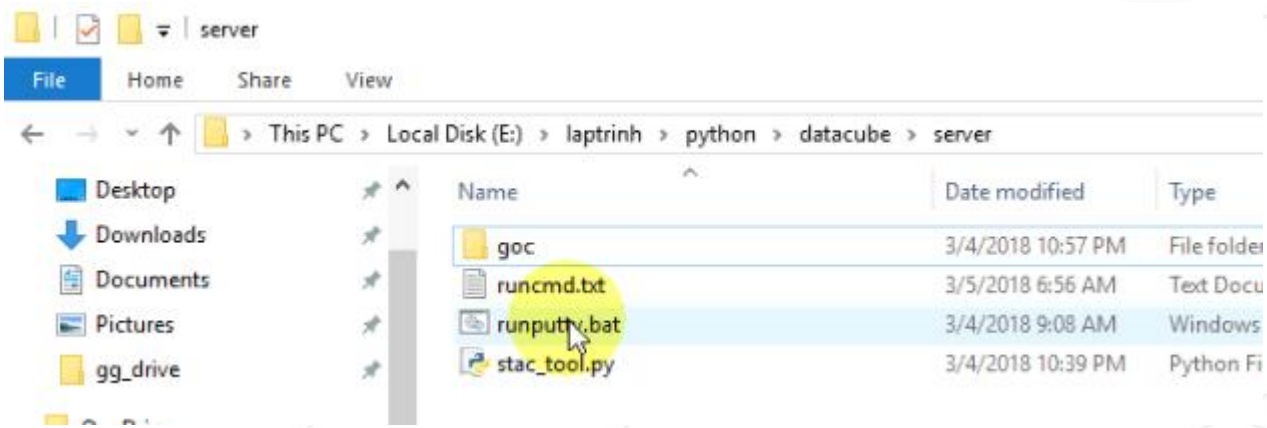
Sep 16, 2018

VDC demonstration - Rice monitoring

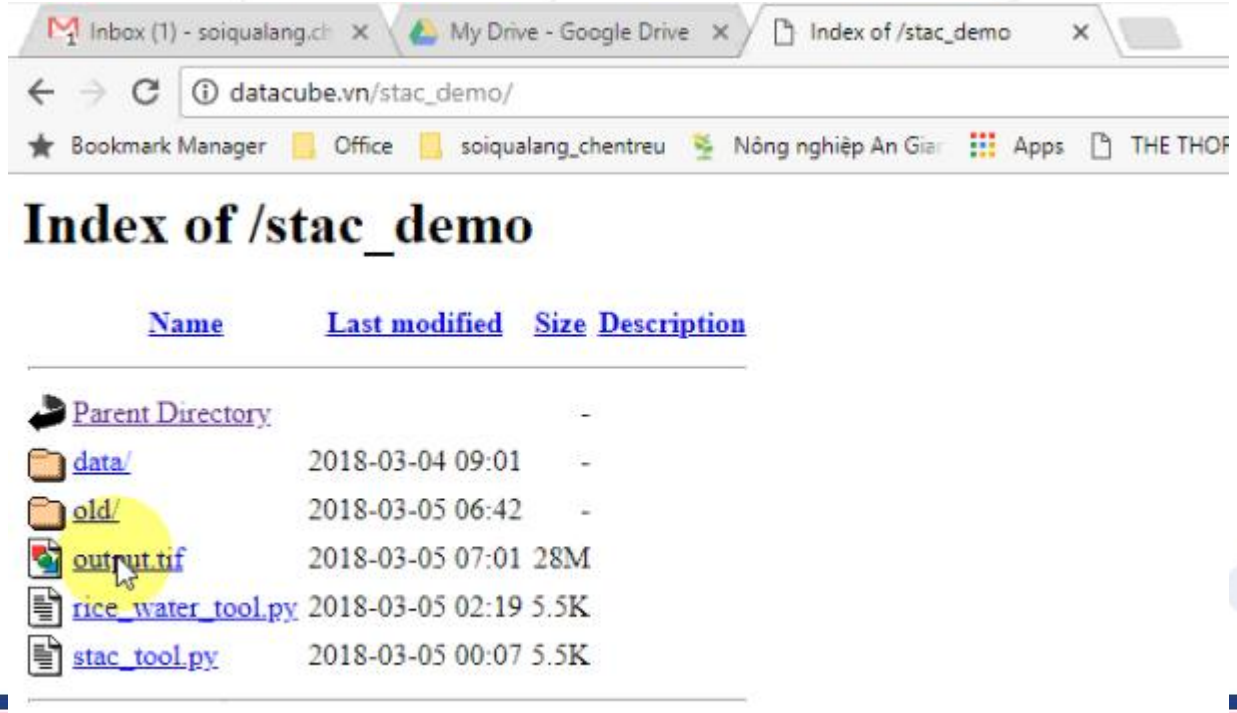


Sentinel-1 data on Vietnam data cube

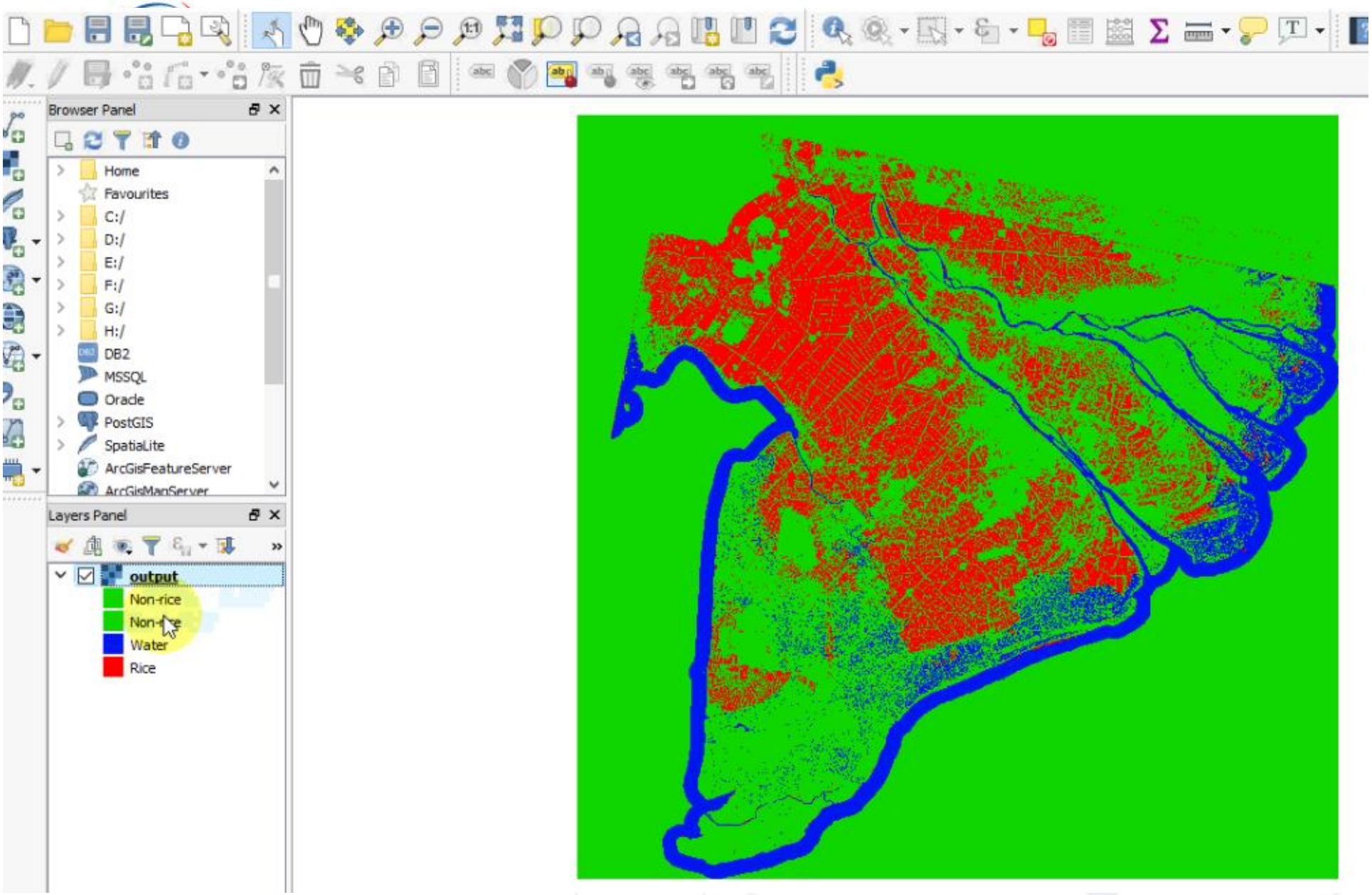
VDC demonstration - Rice monitoring



Tool



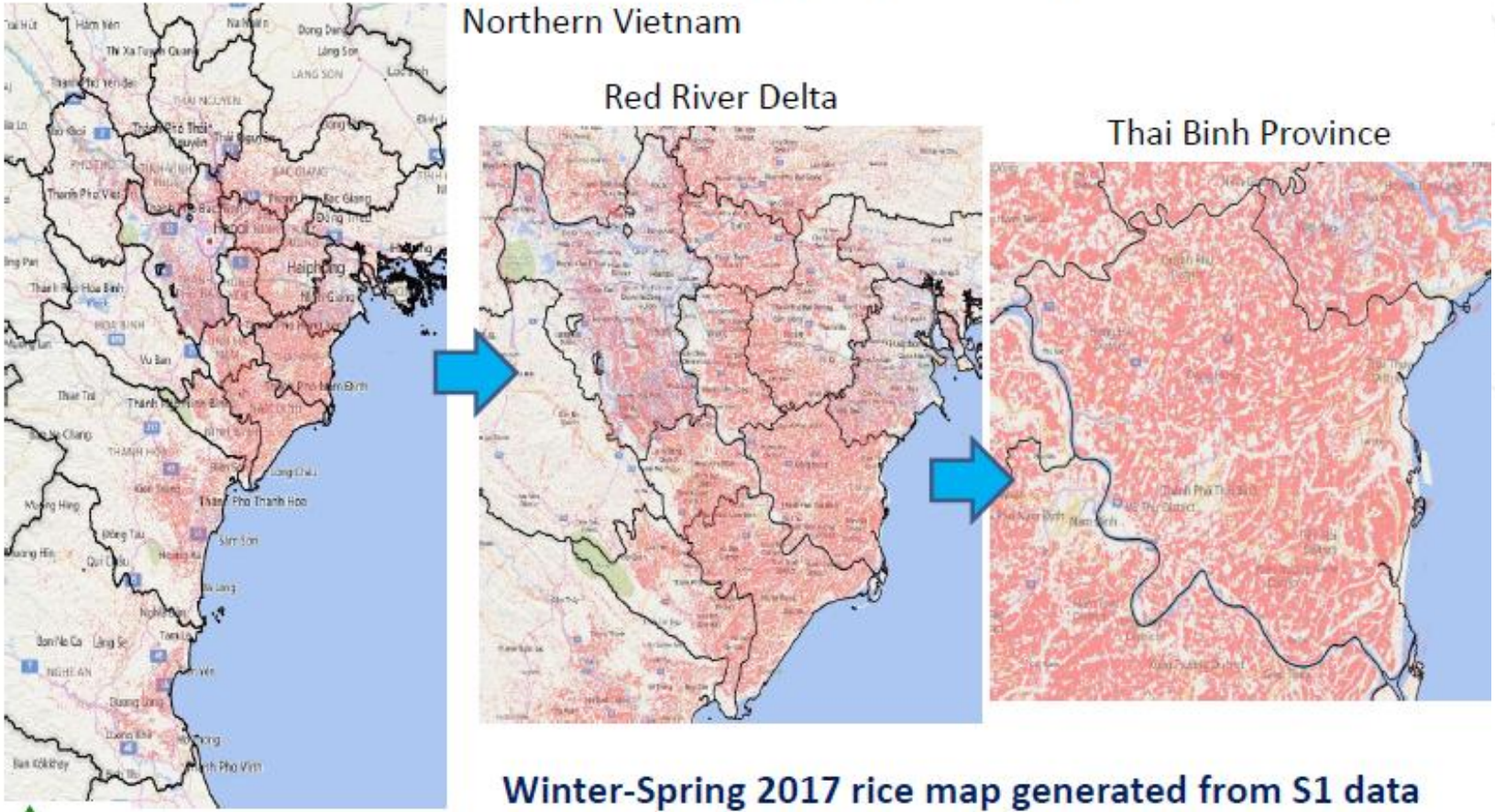
Output



Display classified image on QGIS

VDC demonstration - Rice monitoring

Demonstration of Rice mapping using VN Datacube

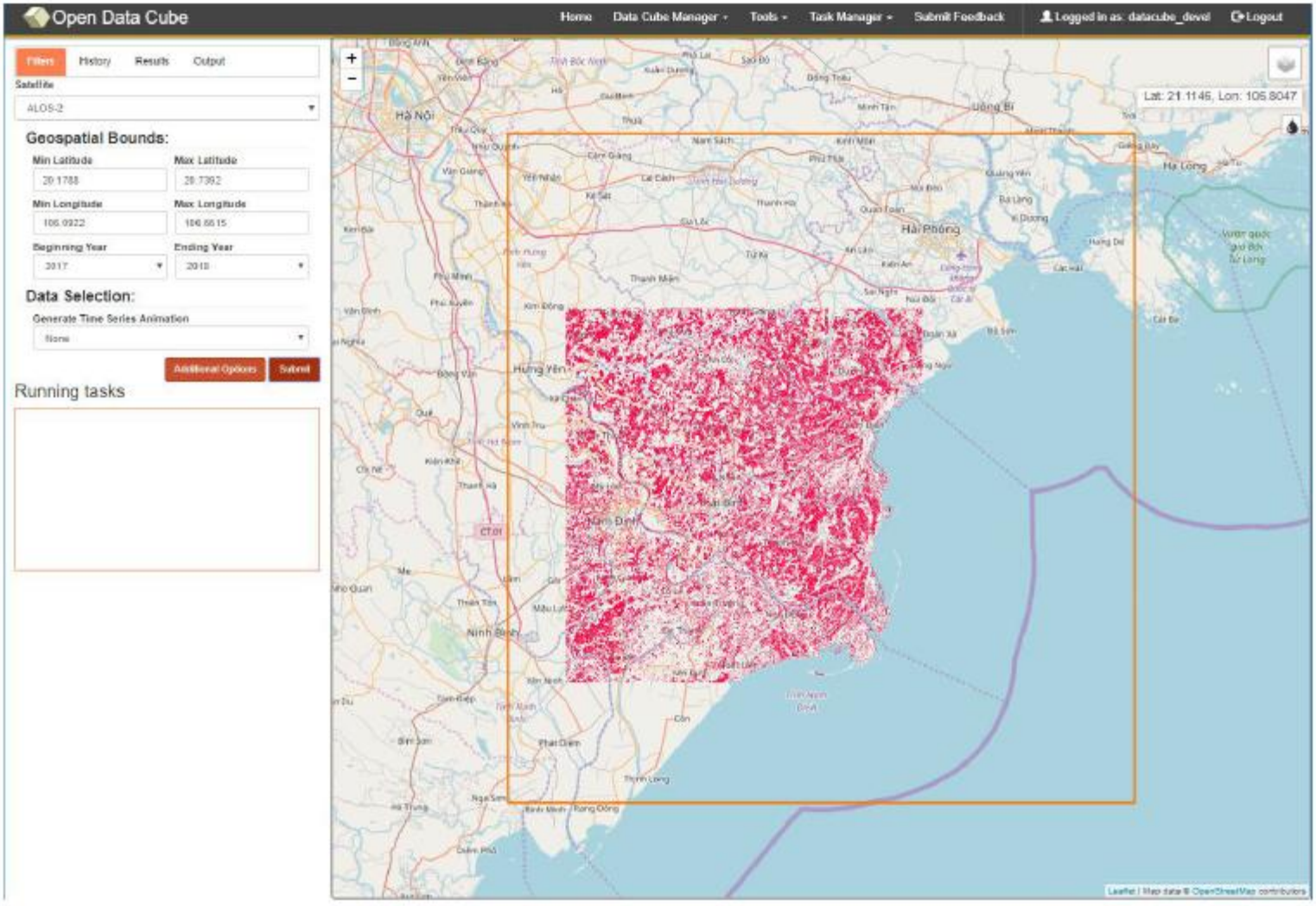


Winter-Spring 2017 rice map generated from S1 data using VN DataCube

CESBIO/CNES demonstration for rice monitoring on VDC using S-1

VDC demonstration - Rice monitoring

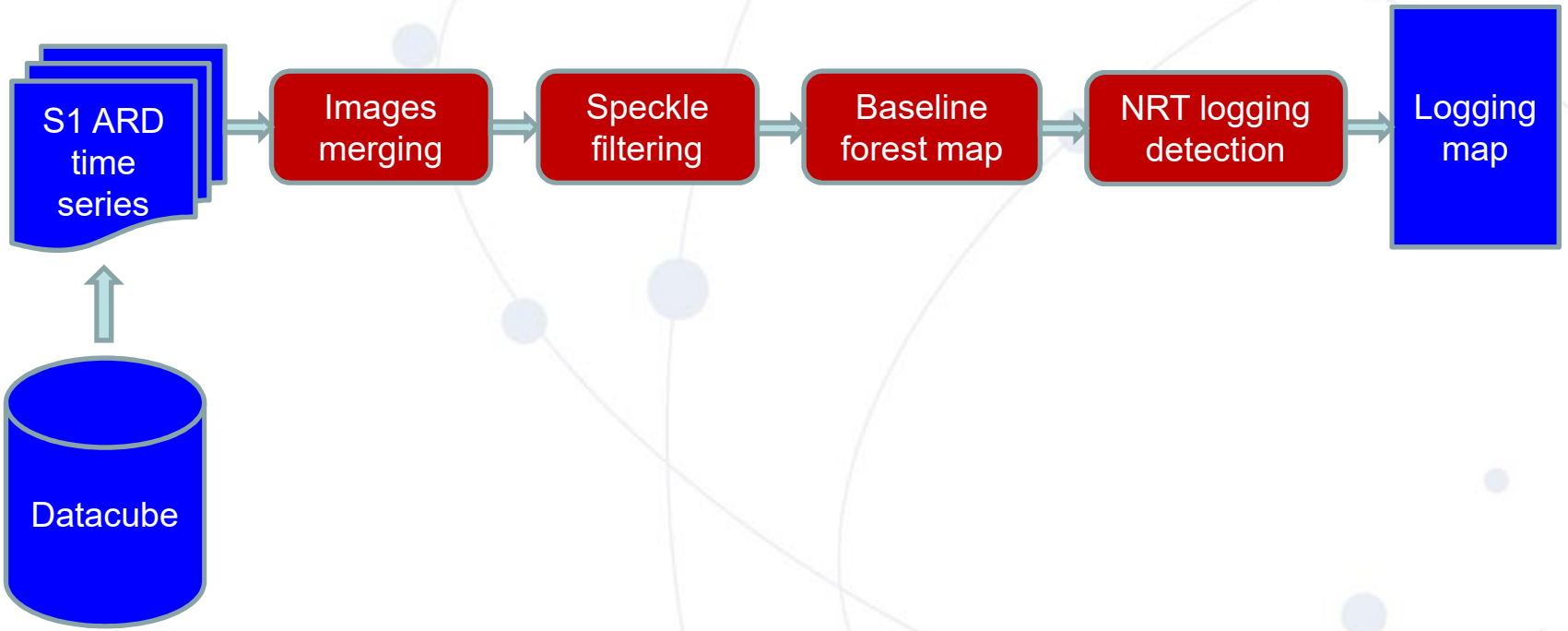
Demonstration



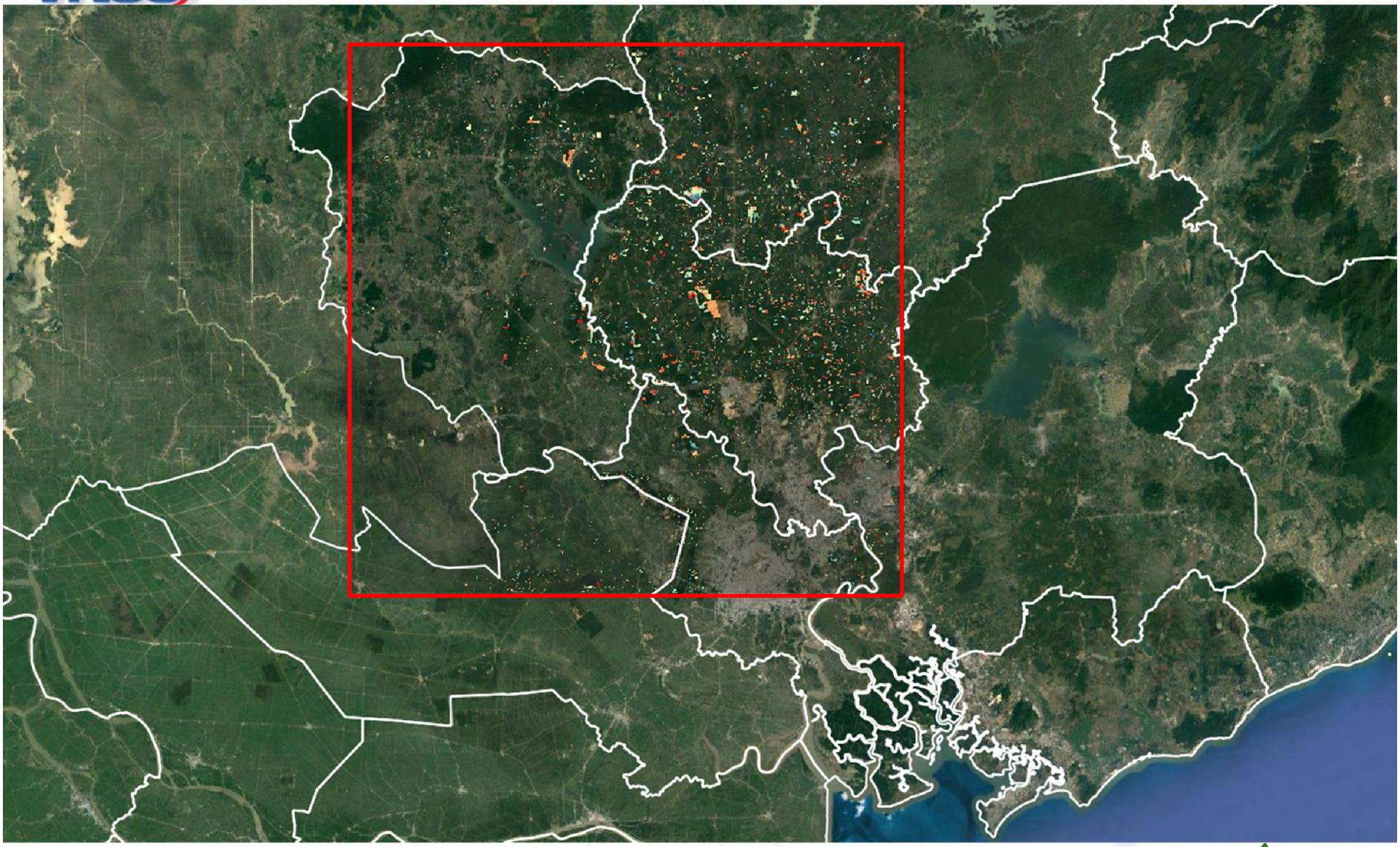
JAXA & RESTEC demonstration for rice monitoring on VDC using ALOS-2

VDC demonstration - Forest monitoring

- Forest monitoring
- Objectives: Generate a forest map and forest logging detection using Sentinel-1 time series

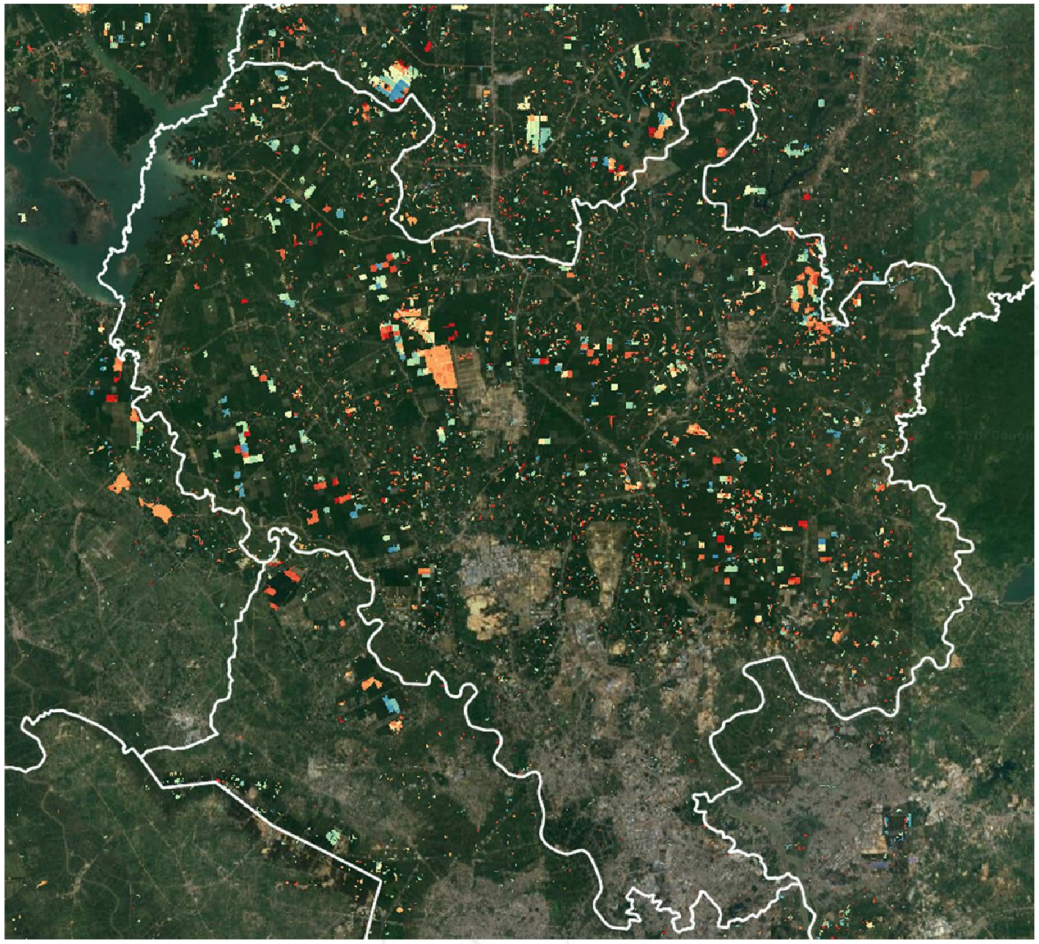


VDC demonstration - Forest monitoring



VDC demonstration - Forest monitoring

Bình Dương province



VDC demonstration - Forest monitoring

Both large and small plantations.

VDC demonstration - Forest monitoring

Background: The 2nd cloud free Sentinel-2 since April 2016

Logging date from Sentinel-1

24 Dec 2015
9 Apr 2016
26 Jul 2016
10 Nov 2016
26 Feb 2017

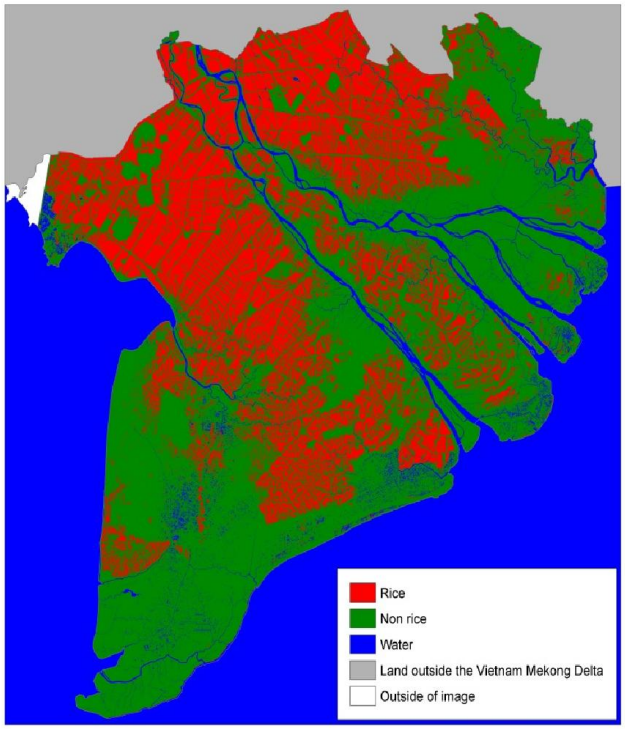
Sentinel-2 / 2nd March 2017

Vietnam Data Cube – potential applications

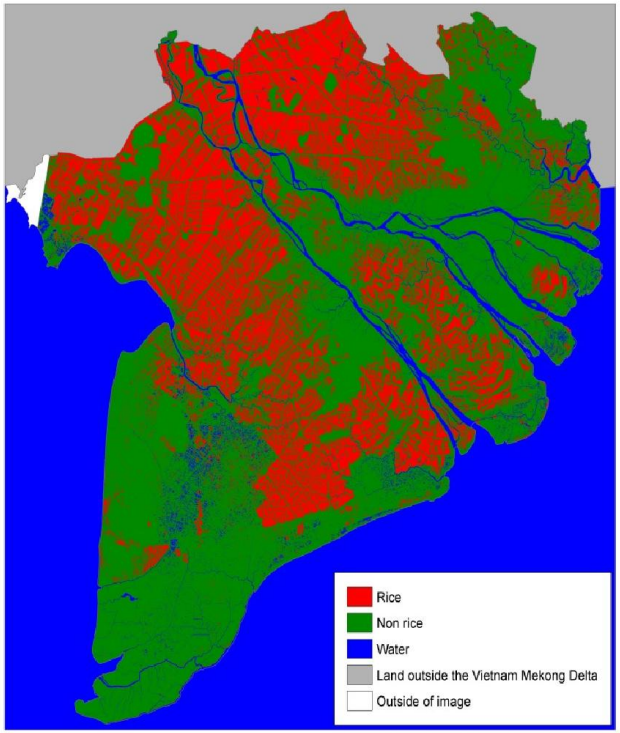
- Forest monitoring
- Agriculture monitoring
- Water management
- Flood monitoring
- Erosion monitoring
- Urban development
- Etc.

Rice monitoring

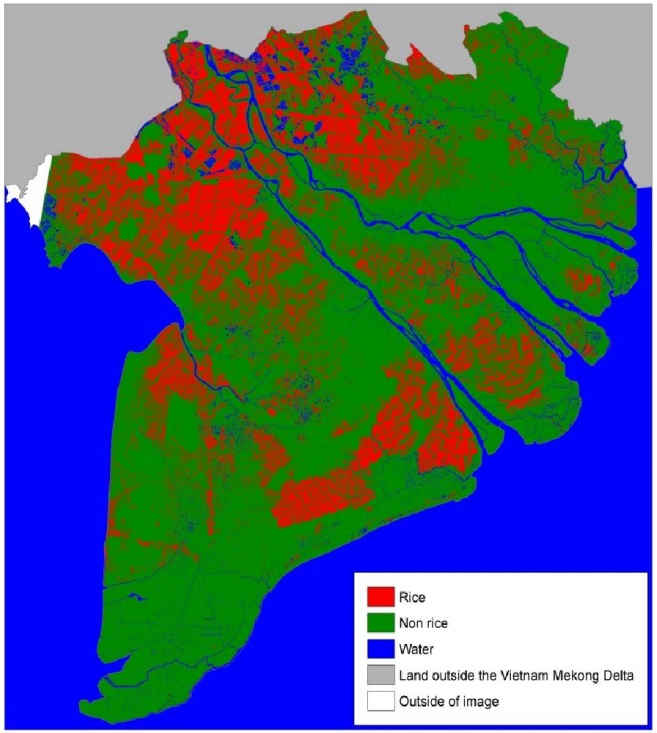
Map of WS Rice 2017



Map of SA Rice 2017

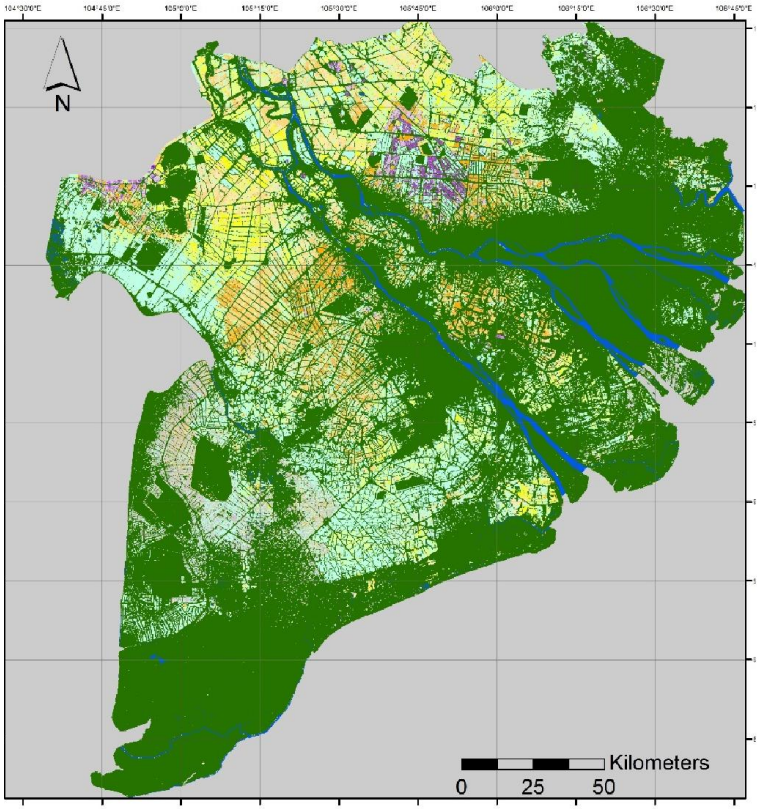


Map of AW Rice 2017



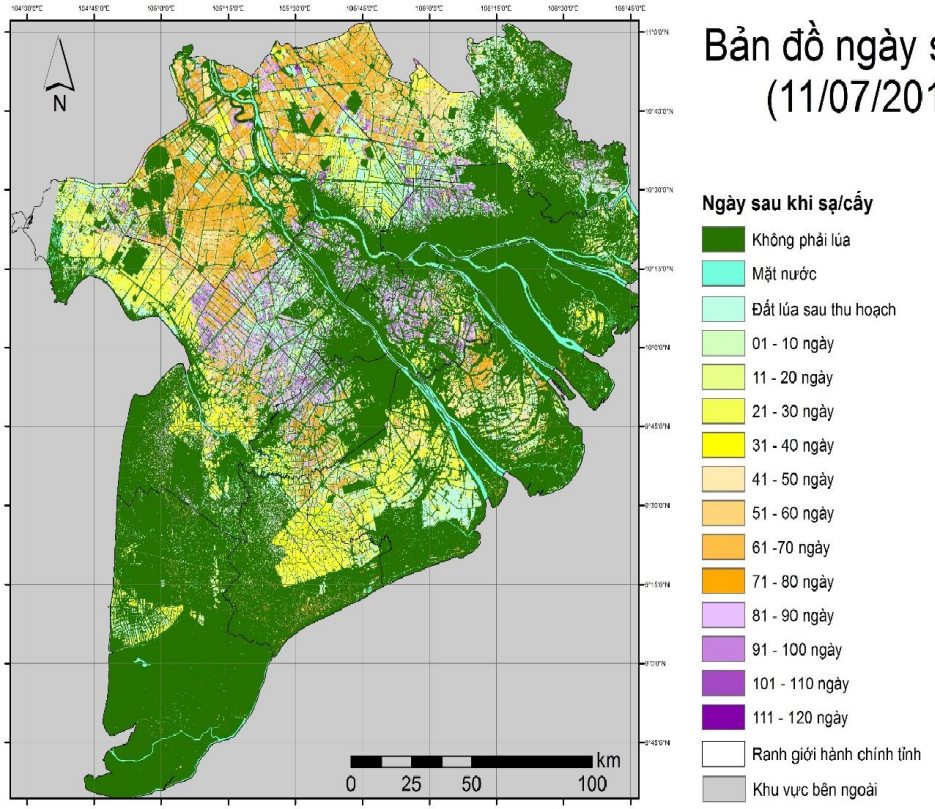
Rice monitoring

June 11, 2018



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)

July 11, 2018



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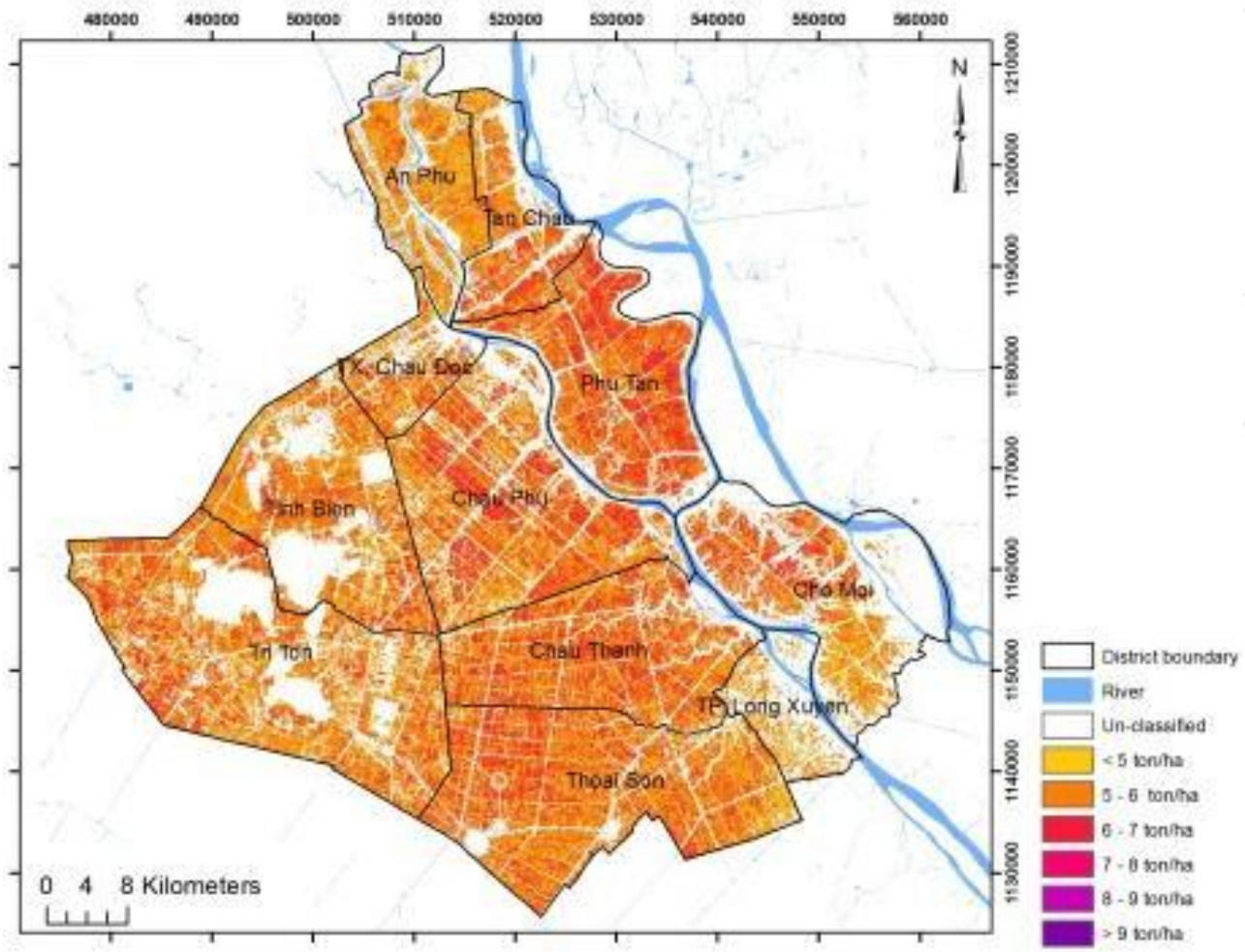
Trung tâm Vũ trụ Việt Nam (VNSC)
Viện Hàn lâm Khoa học và Công nghệ Việt Nam (VAST)

Map of rice age

Rice monitoring

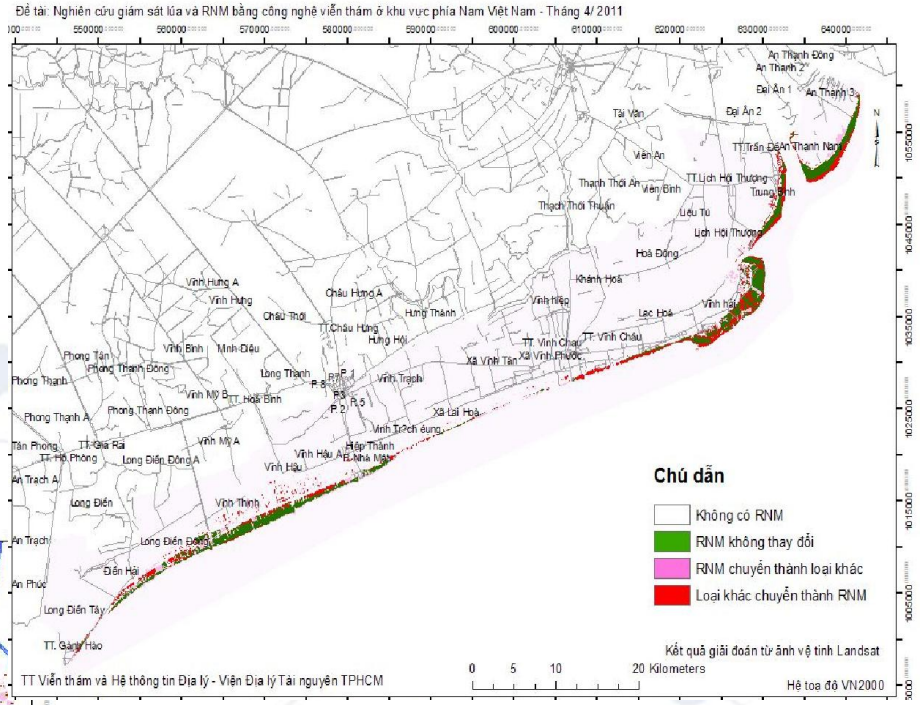


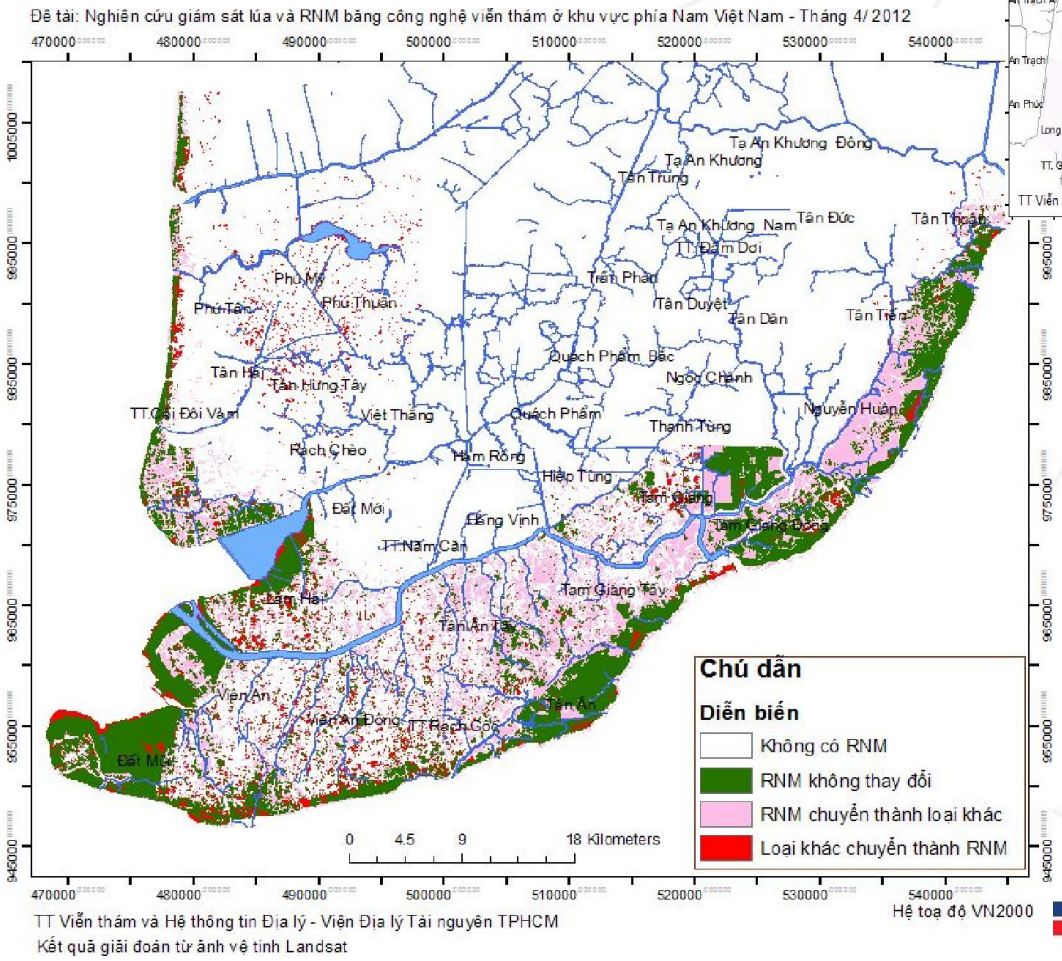
A distribution map of estimated rice yield

Forest monitoring

Mangrove forest change: 2000 – 2011

by time-series satellite images

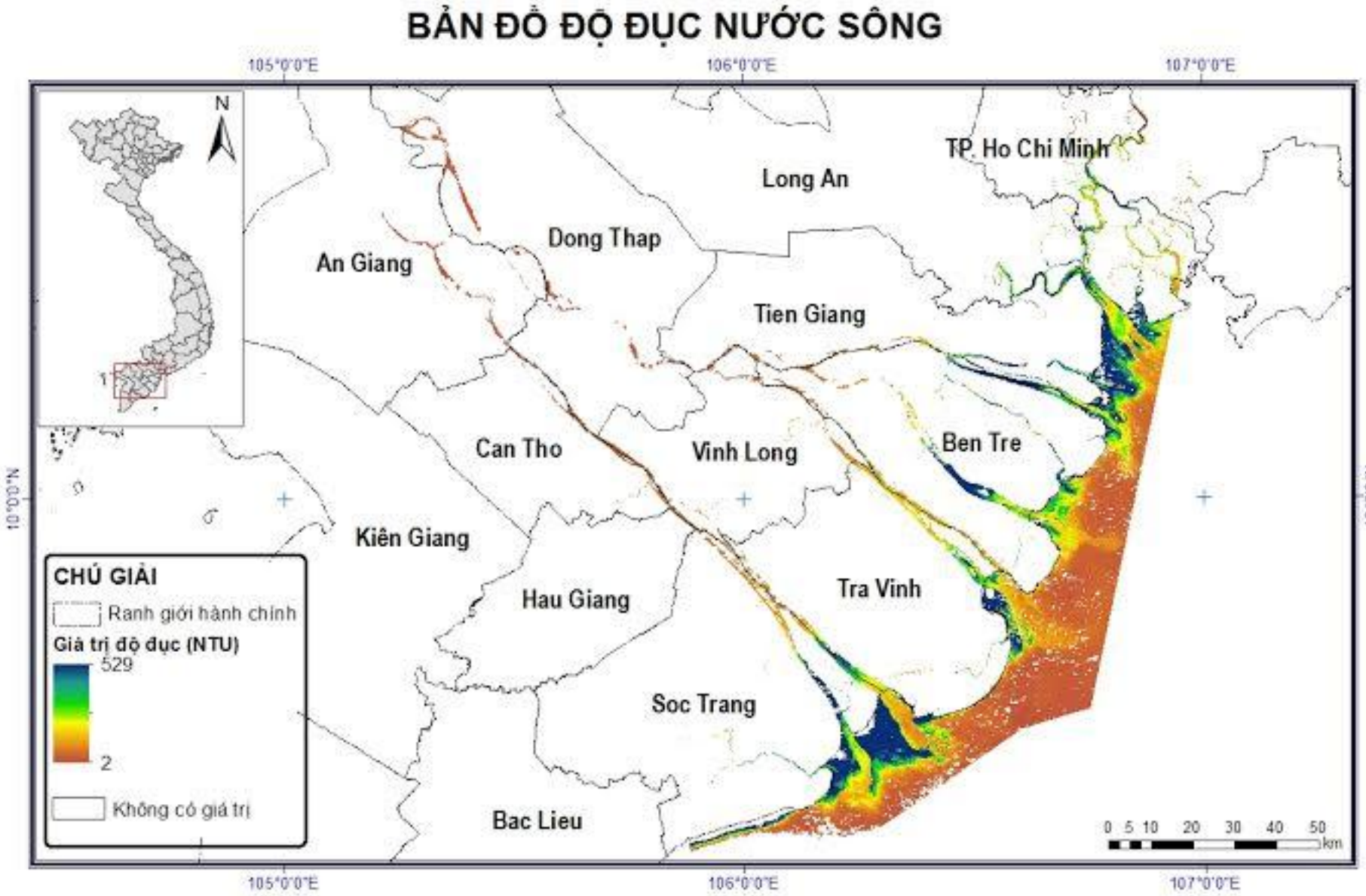


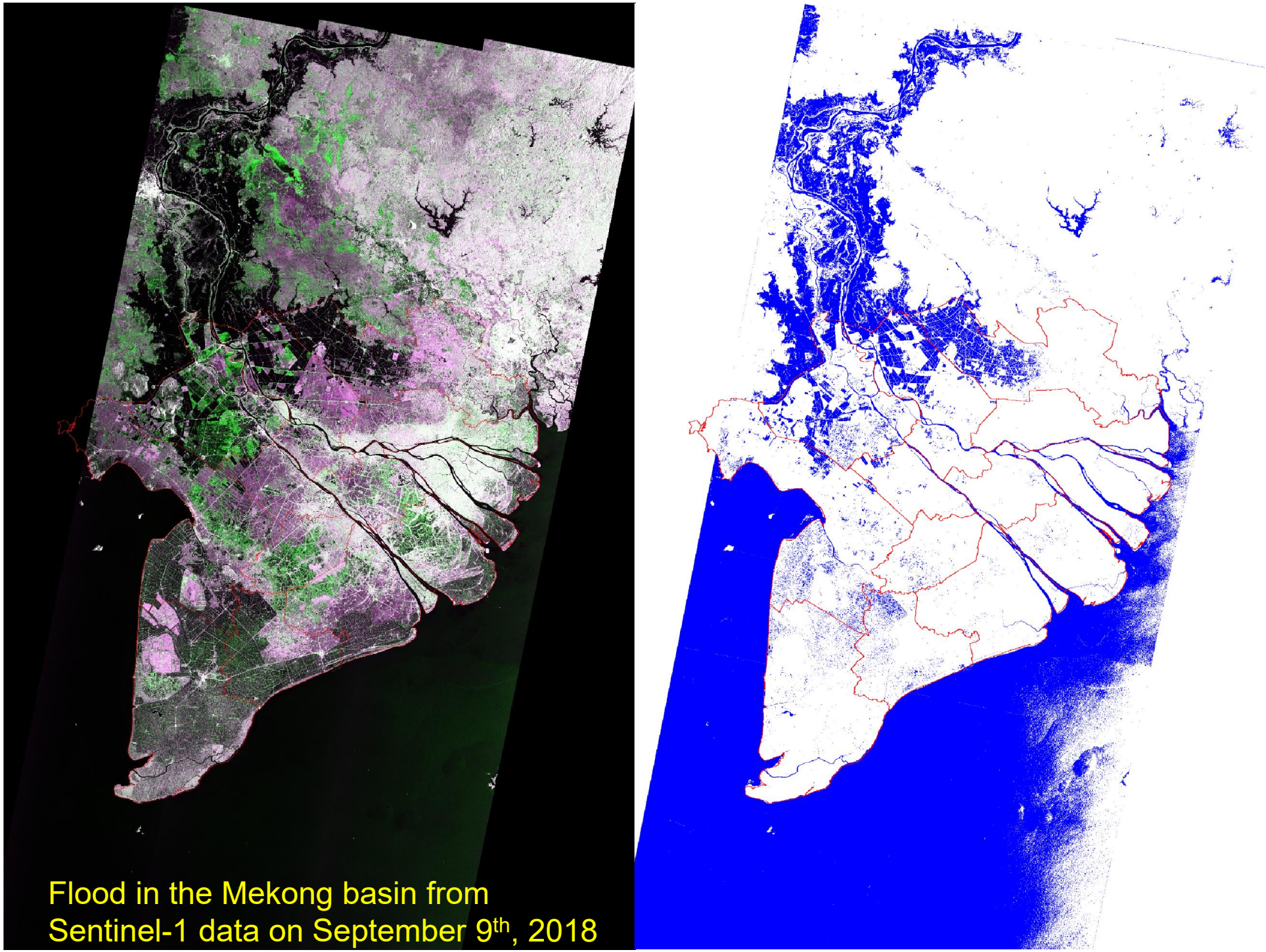


Soc Trang, Bac Lieu, Ca Mau Province

- Non-forest
- No change forest
- Mangrove Forest → Other land use
- Other land use → Mangrove Forest

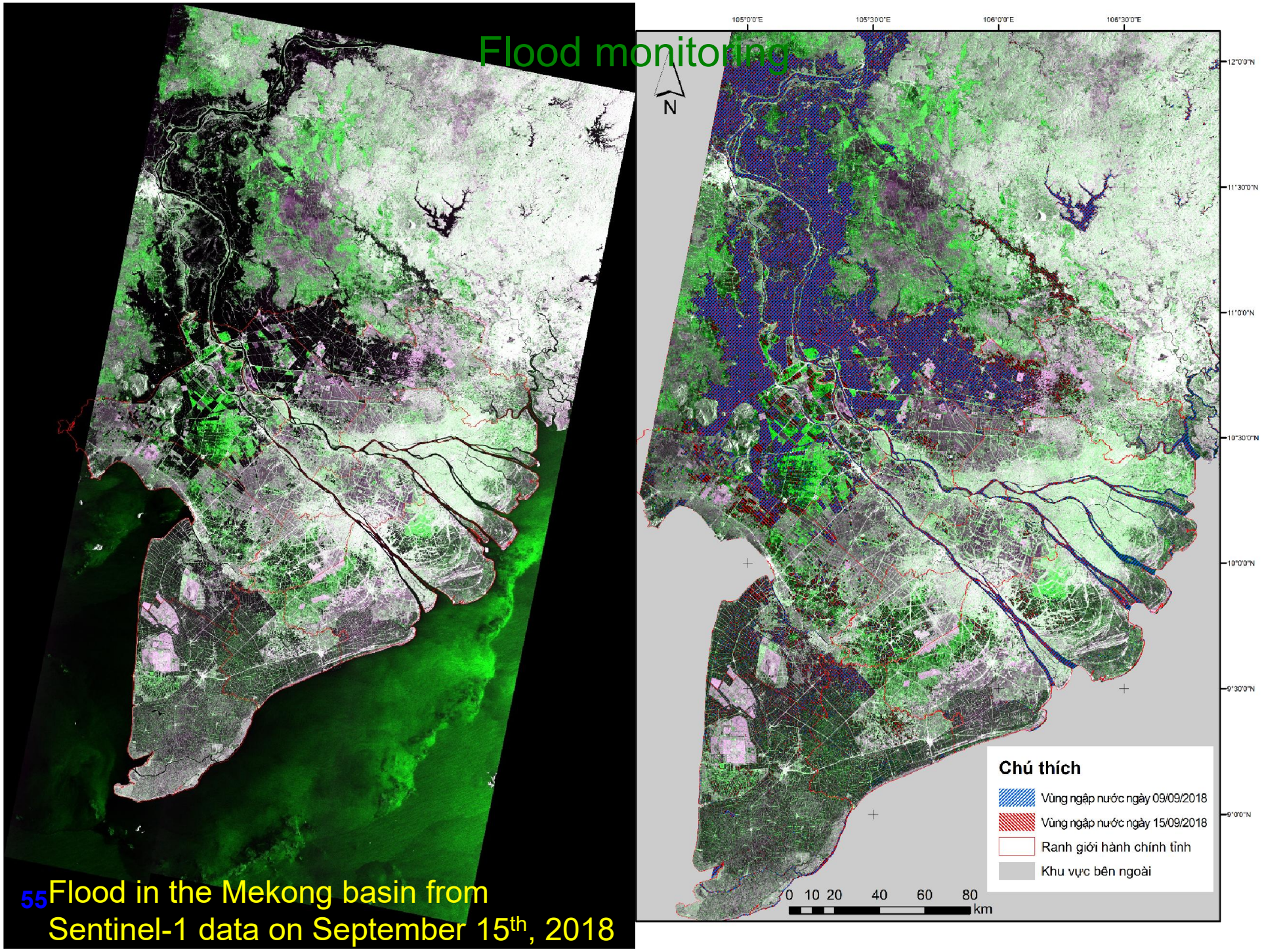
Water quality monitoring





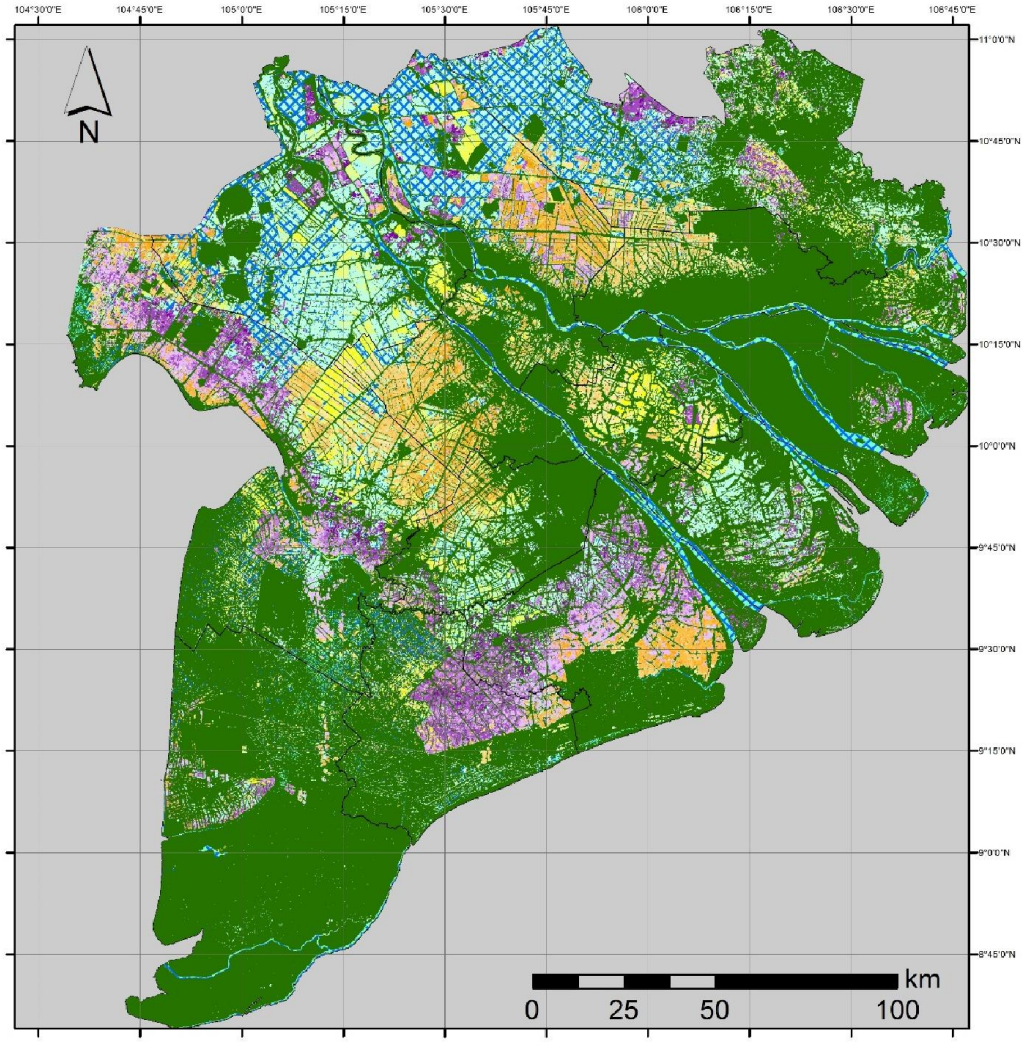
Flood in the Mekong basin from Sentinel-1 data on September 9th, 2018

Flood monitoring



55 Flood in the Mekong basin from Sentinel-1 data on September 15th, 2018

Flood monitoring



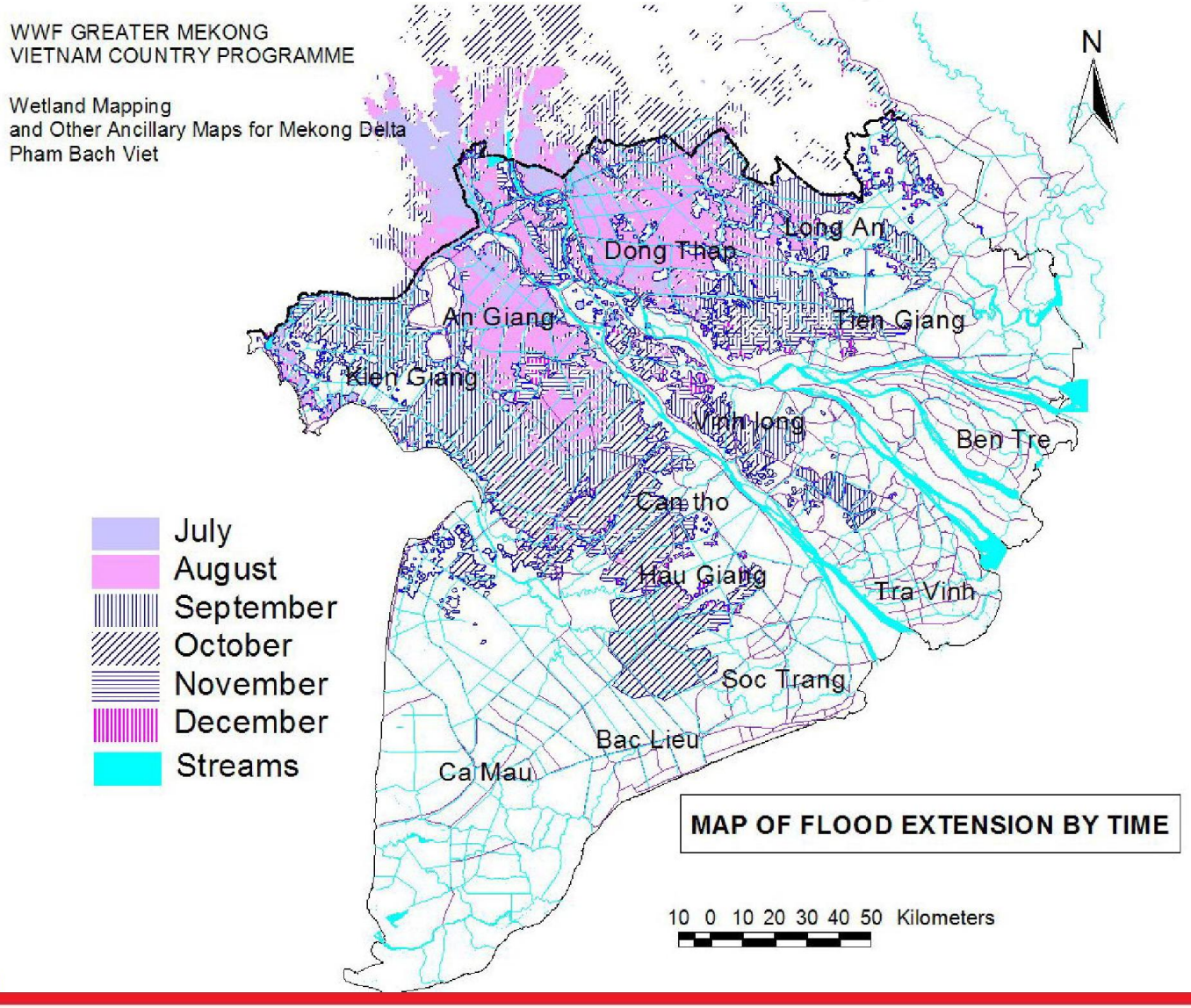
Bản đồ ngày sau khi sạ/cấy khu vực ĐBSCL (09/09/2018)

Chú thích

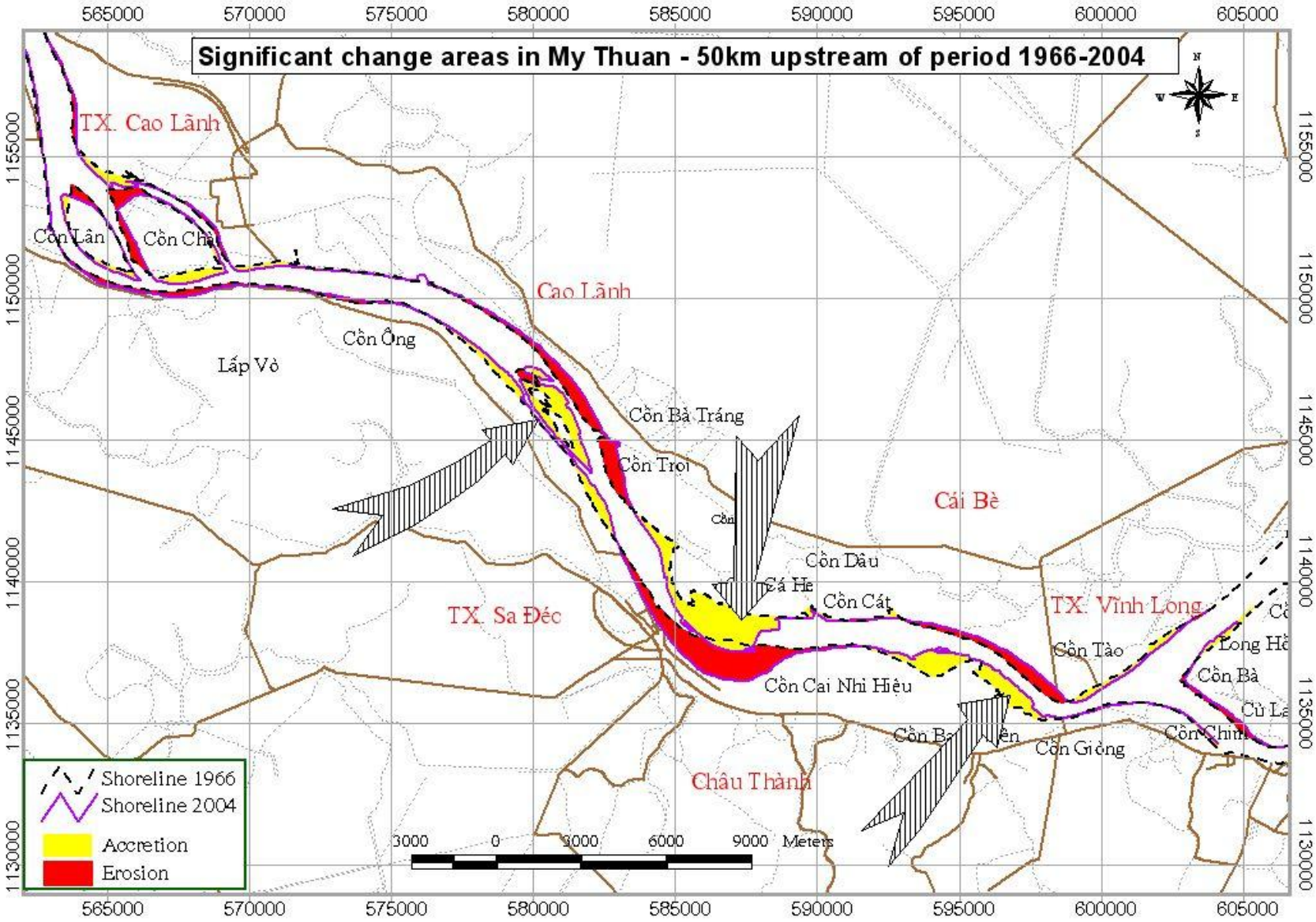
- Không phải lúa
- Mặt nước
- Vùng ngập nước
- Đất lúa sau thu hoạch
- 01 - 10 ngày
- 11 - 20 ngày
- 21 - 30 ngày
- 31 - 40 ngày
- 41 - 50 ngày
- 51 - 60 ngày
- 61 -70 ngày
- 71 - 80 ngày
- 81 - 90 ngày
- 91 - 100 ngày
- 101 - 110 ngày
- 111 - 120 ngày
- Khu vực bên ngoài
- Ranh giới hành chính tỉnh

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)

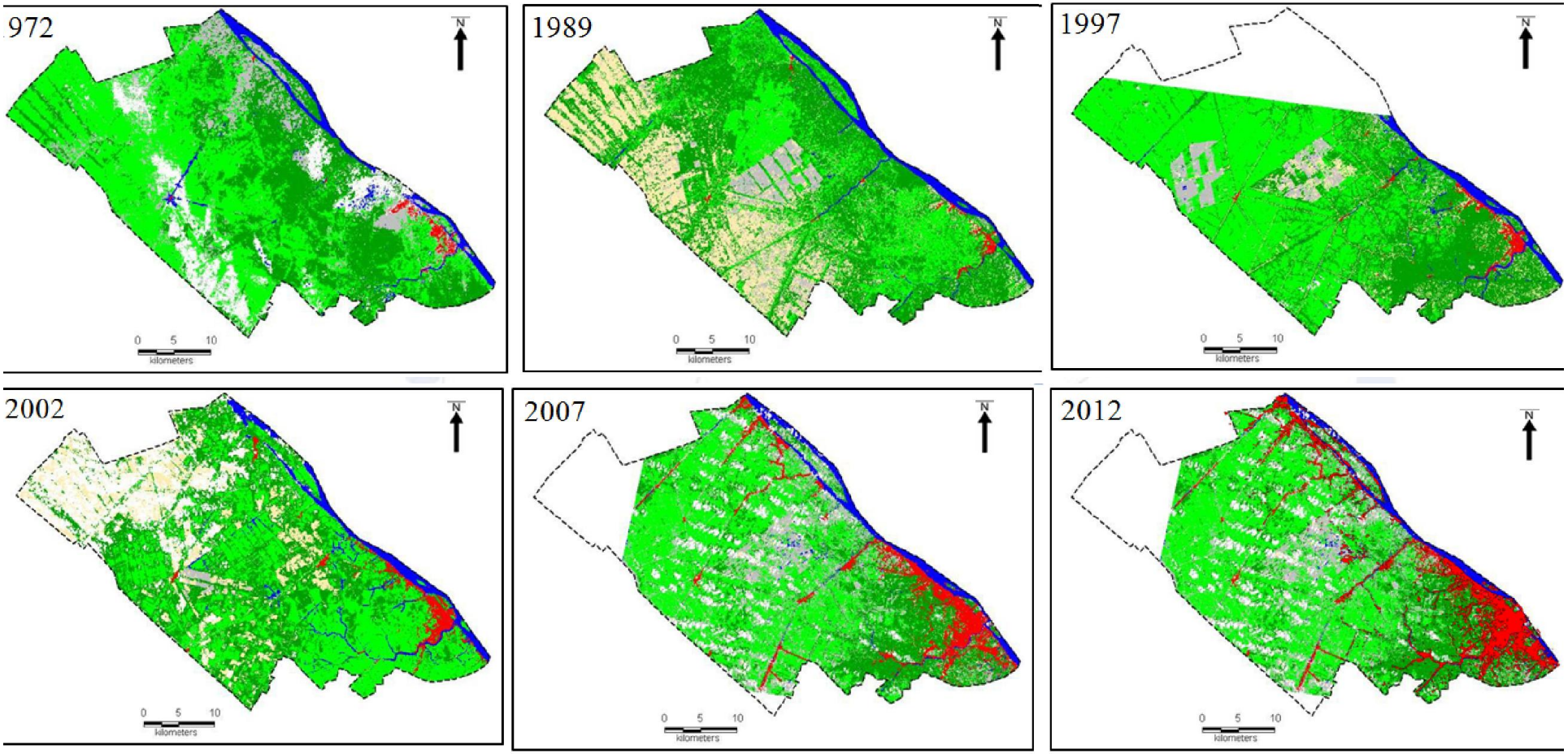
Flood monitoring



Erosion monitoring

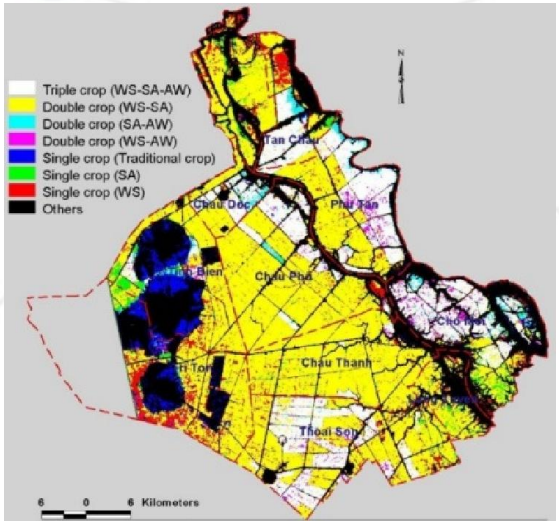


Urban development



Urban expansion of Can Tho City

Thank you



Lam Dao Nguyen
HCMC Space Technology Application Center
Vietnam National Space Center
ldnguyen@vnsc.org.vn