NASA LCLUC Virtual Science Team Meeting
October 19-21st, 2020

Vietnam National Space Center (VNSC) LCLUC Activities

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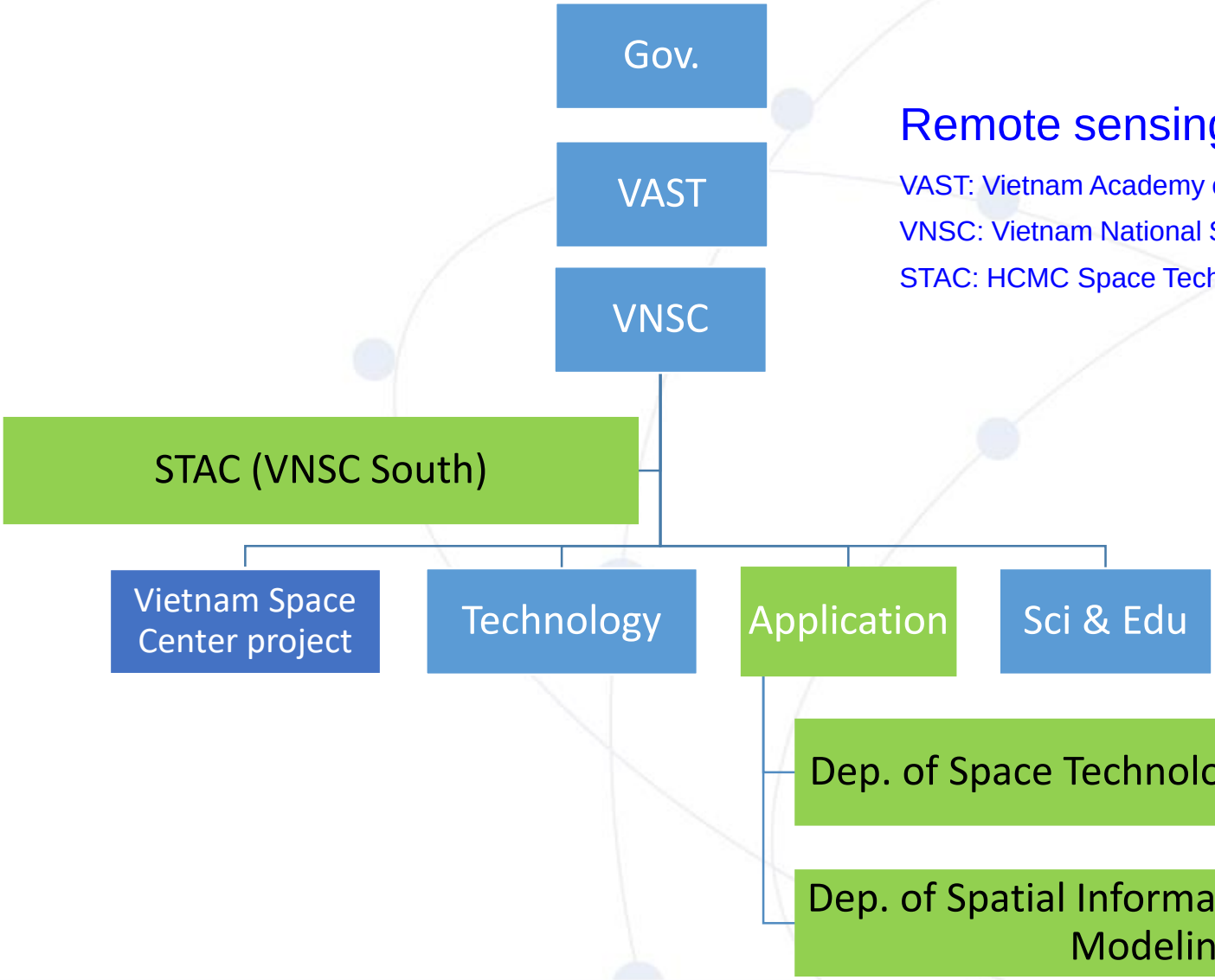
Introduction



Remote sensing in VNSC

VAST: Vietnam Academy of Science and Technology

VNSC: Vietnam National Space Center

STAC: HCMC Space Technology Application Center

Introduction

- On-going National-level research projects:
  - SAR applications (oil spill, forest monitoring, flood monitoring, 3D mapping) – 2017-2020
  - Rice monitoring at the Mekong and Red river delta (VNRice) – 2017-2020
  - Potential of solar energy – 2018-2021
  - River basin environment – 2018-2021
- Other remote sensing activities.

2019 CEOS Chair Initiatives

VNSC CEOS Chair 2019

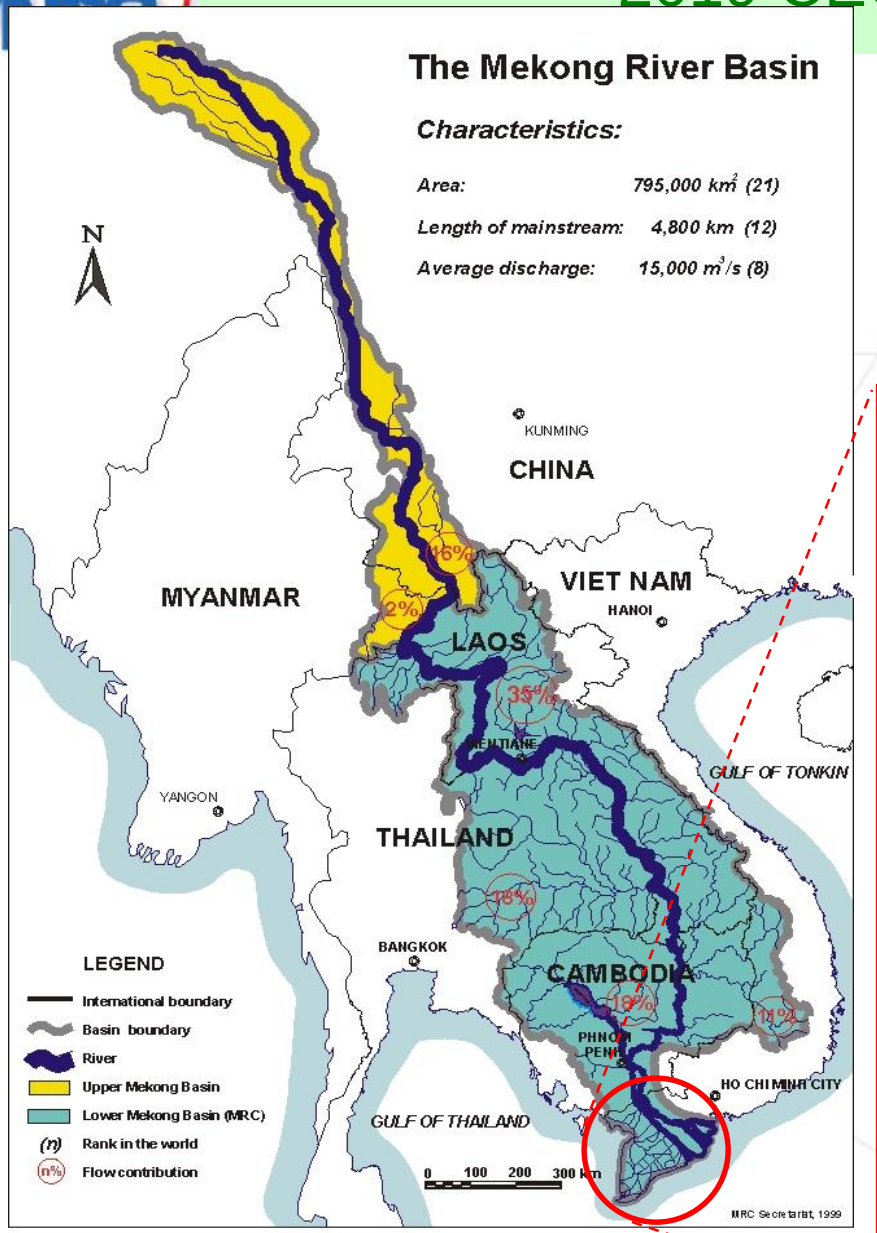
- Application Focused Initiatives
  - Carbon Observations (forested regions)
  - Observations for Agriculture (rice)

- Regional Observatory can be built with ready application built-in such as forest monitoring and rice monitoring for Mekong river area.

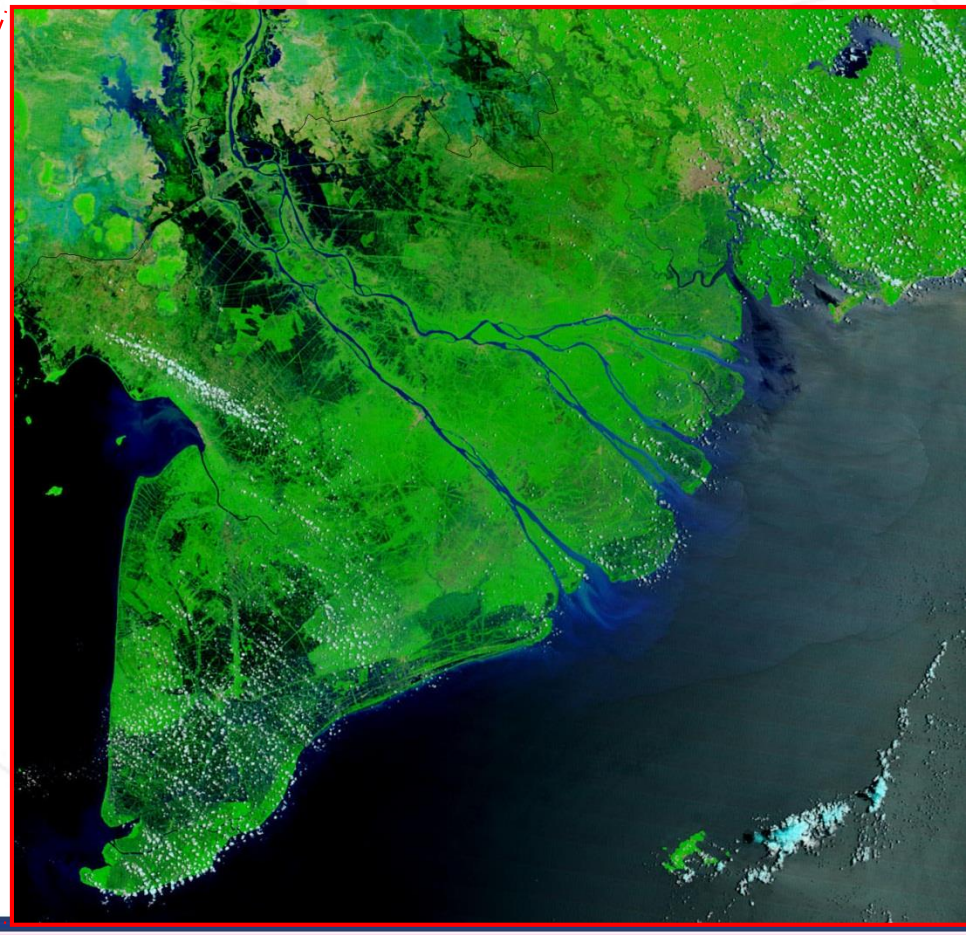
- Rice monitoring initiative:
  - VNSC/STAC: VNRice project
  - CNES/CESBIO: GEORice project
  - JAXA&RESTEC

  → Cross validation of the results made by 3 teams.

2019 CEOS Chair Initiatives

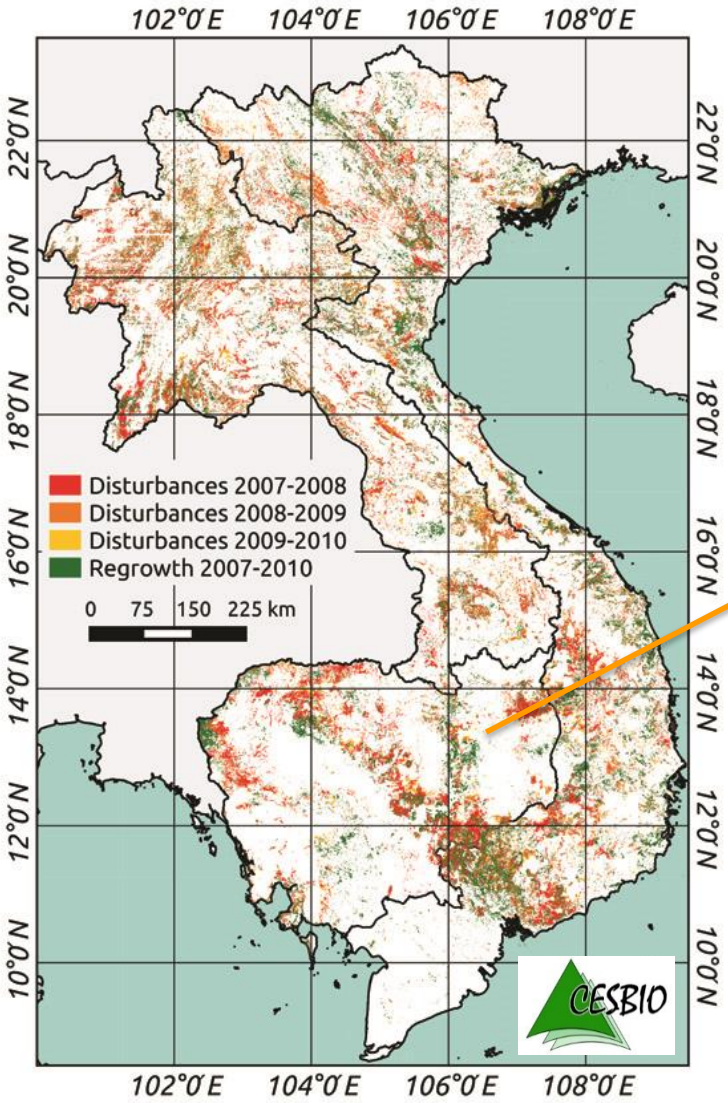


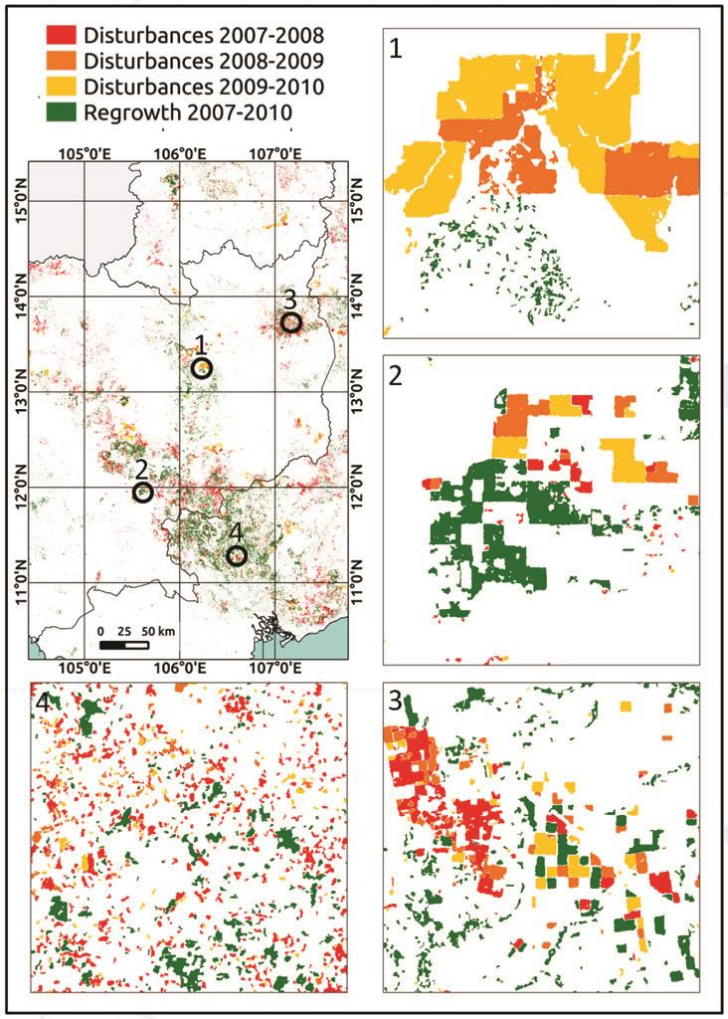
Mekong basin



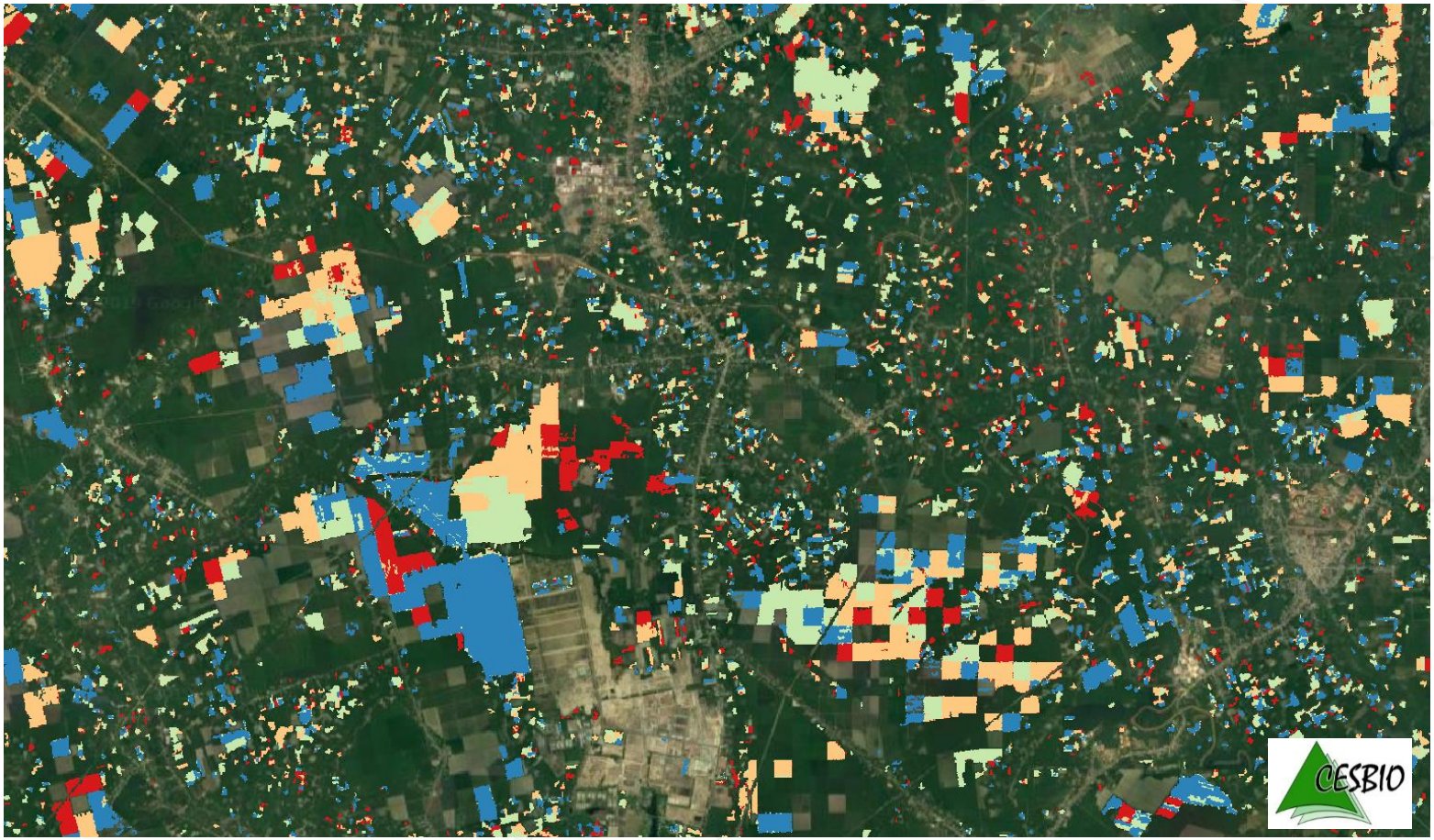
Forest monitoring

Forest cover change using ALOS-PALSAR





Forest monitoring



2016
2017
2018
2019 (until July)

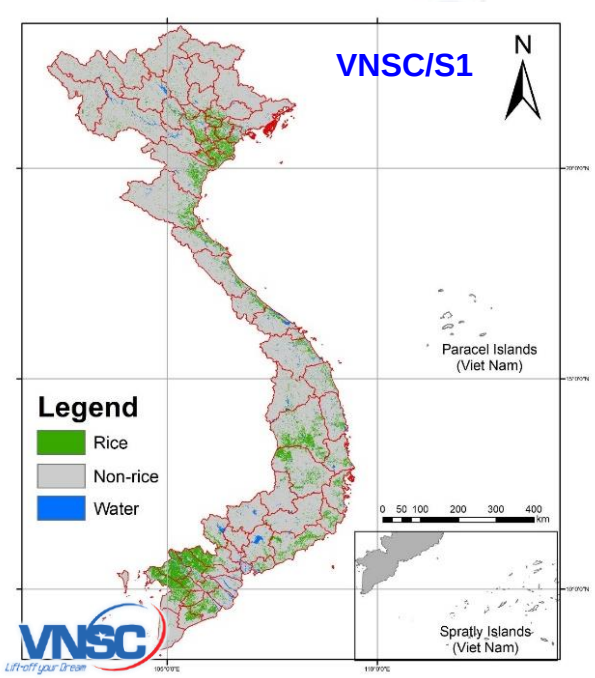
Forest cover change using Sentinel-1, 2016-2019

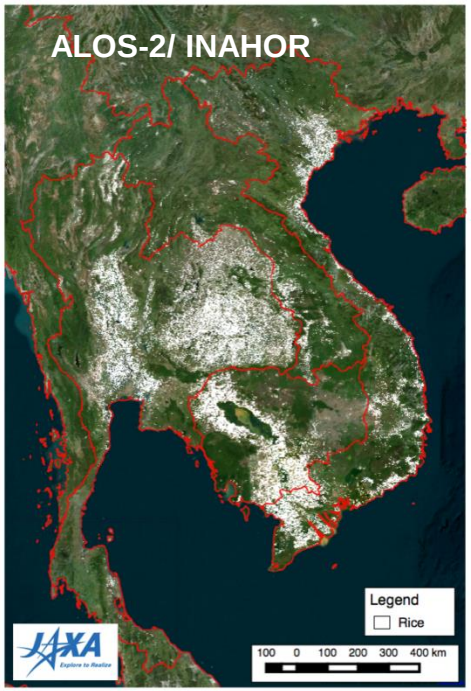
Background image: Google Earth (optical image 24 Feb 2016)

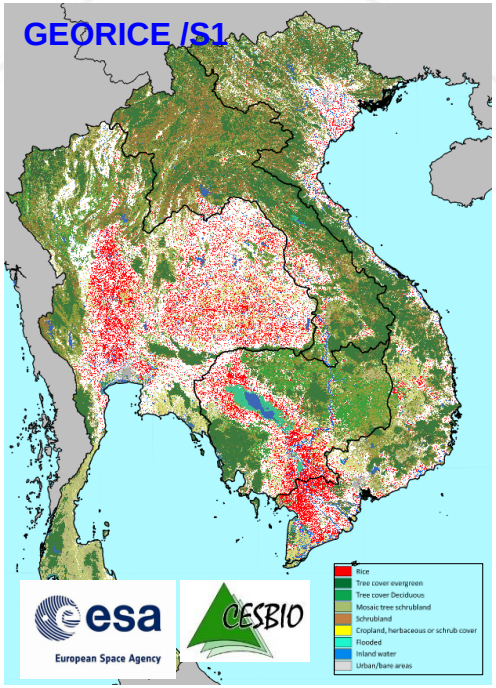
Rice monitoring

Cross comparison among rice maps of Mekong region by VNSC (using S1), JAXA (ALOS-2) and CESBIO (S1) in cooperation with respective countries (space agencies and ministries of agriculture) under APRSAF SAFE and other regional framework.

Asia-RiCE
Crop Estimation and Monitoring

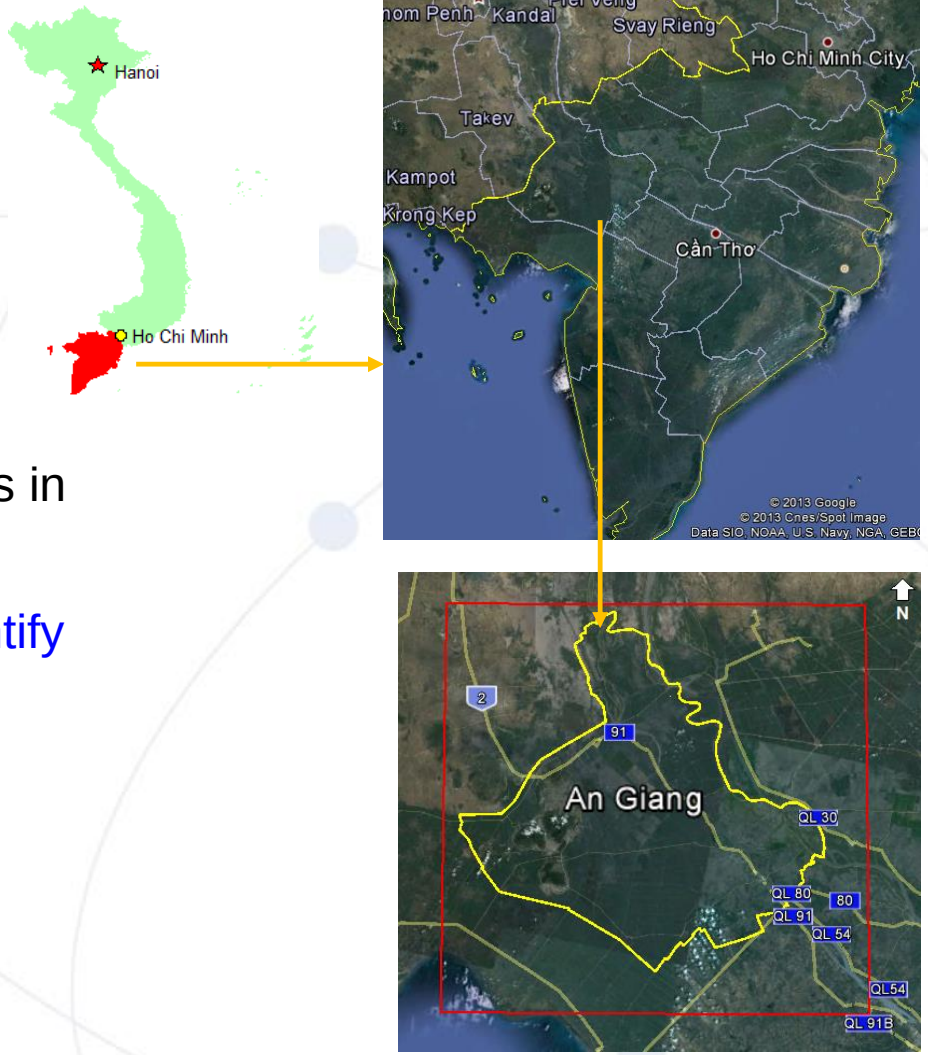






Rice monitoring – Asia-RiCE (2013-)

Rice in Vietnam mainly grown in the Mekong Delta and Red River Delta

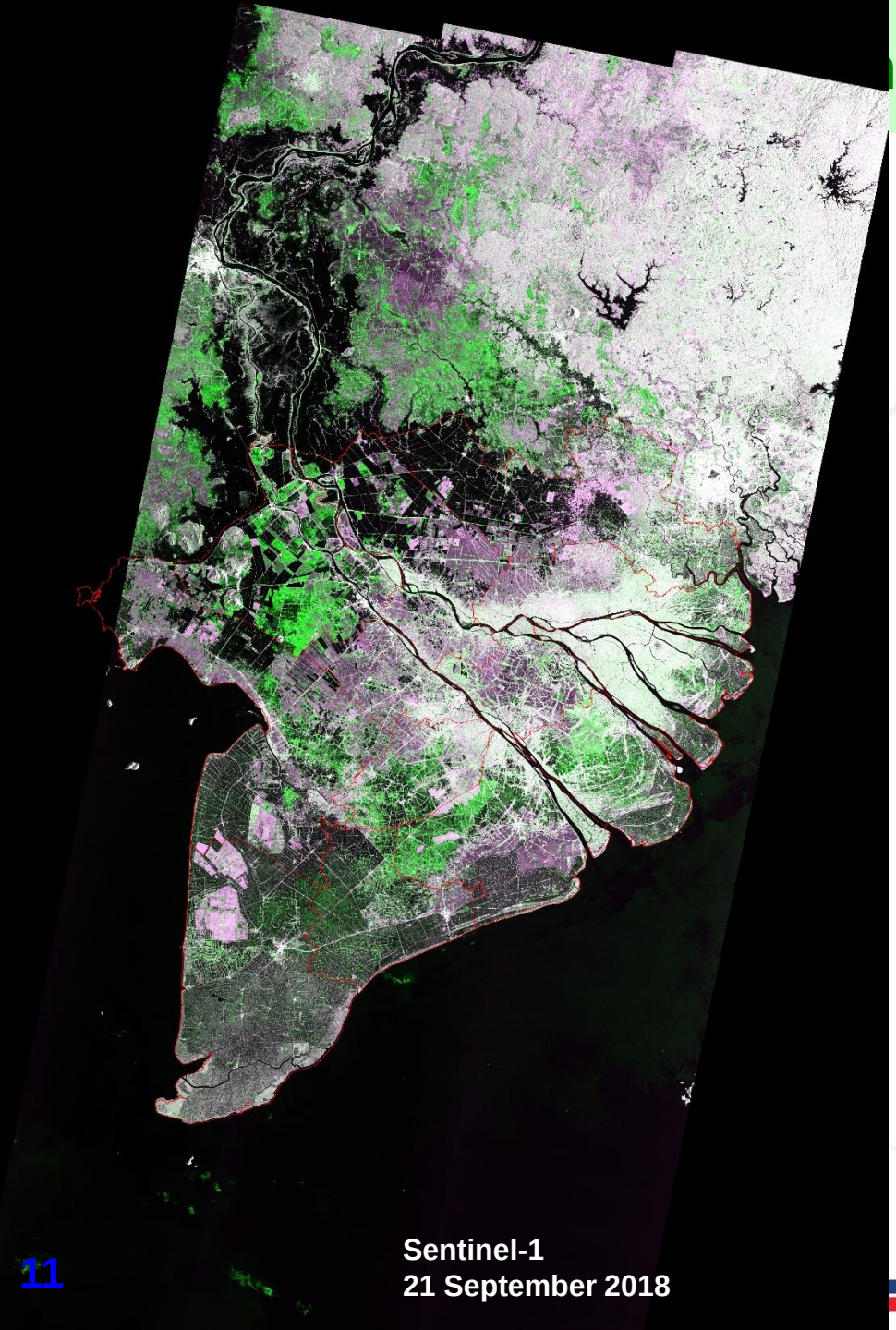


MD is one of the most affected regions in the world by global warming.

Studies need to be conducted to quantify the changes observed by satellites in LULC, in cultural practices, etc.

→ **Food security**

Technical Demonstrator Site – Mekong Delta, VN



itoring – Asia-RiCE

SAR data received:

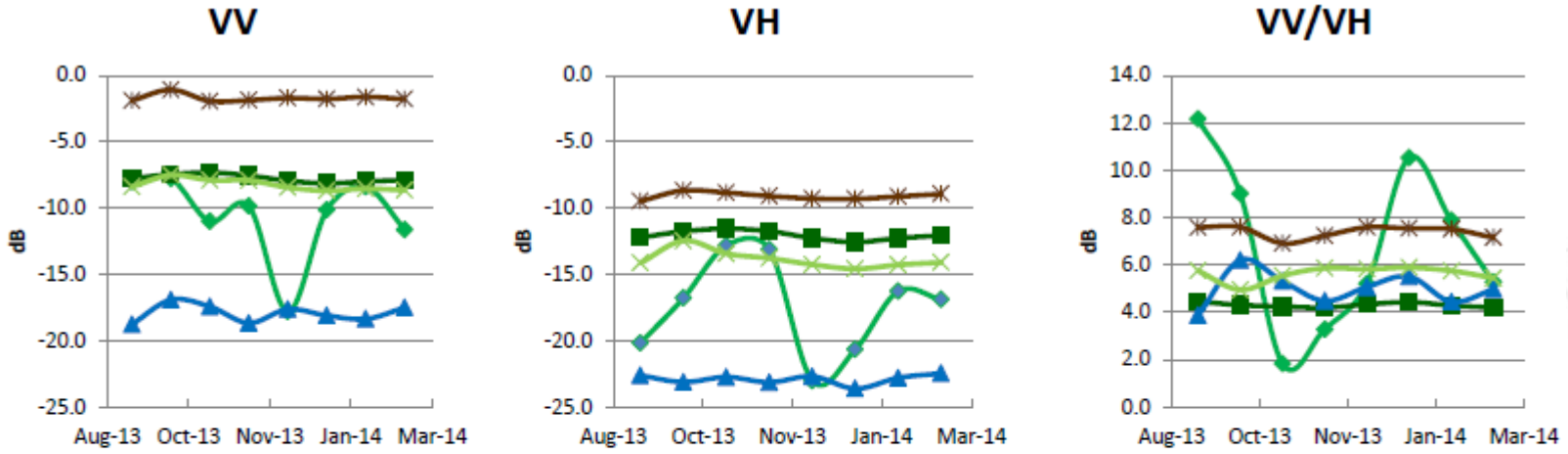
COSMO-SkyMed data:
- Band: X
- Polarisation: HH&VV
- Resolution: 20 m (StripMap PINGPONG)

RADARSAT-2 data:
- Band: C
- Polarisation: VV&VH
- Resolution: 10 m (Wide Fine)

Sentinel-1 data:
- Band: C
- Polarisation: VV&VH
- Resolution: 20 m (IW)

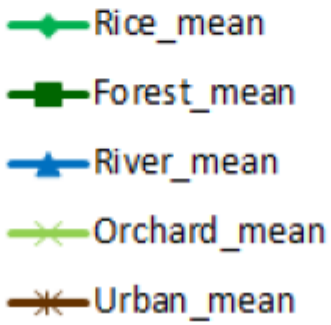
ALOS-2 data:
- Band: L
- Polarisation: HH&HV
- Resolution: 50 m (WS) & 12.5 m (Fine)

Rice monitoring – Asia-RiCE



ID	Target Agricultural Products
P1	**Rice Crop Area Estimates/Maps**
P2	**Crop Calendars/Crop Growth Status**
P3	**Crop Damage Assessment**
P4	**Agro-meteorological Information Products**
P5	**Production Estimation and Forecasting**

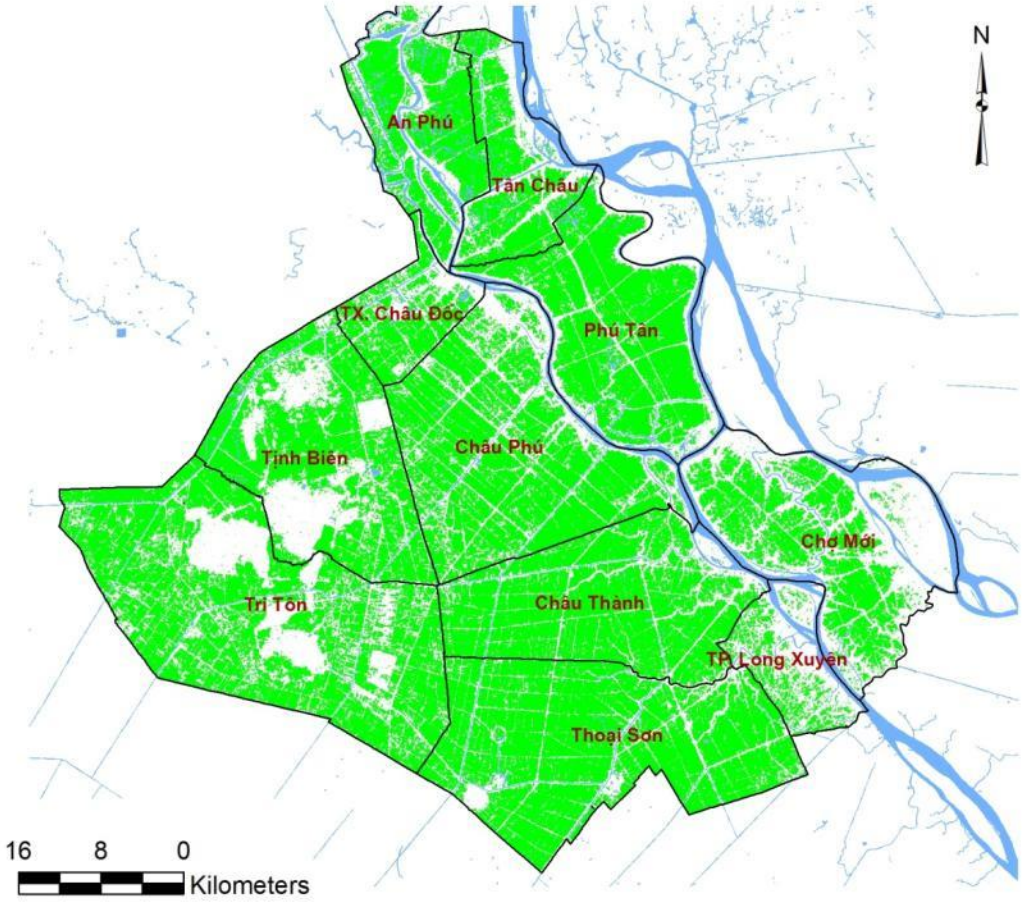
Asia-RiCE products



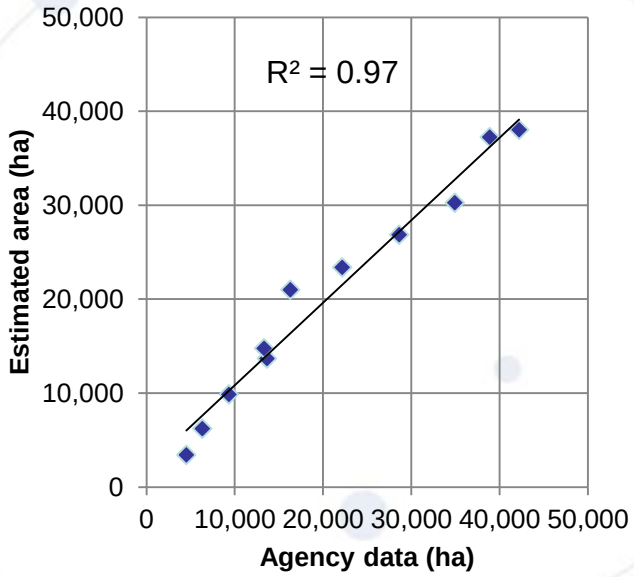
RADARSAT-2 data:
- Band: C
- Polarisation: VV&VH
- Resolution: 10 m (Wide Fine)

Data set at provincial scale

District name	Agency data (ha)	Estimated area (ha)	Percentage error (%)
An Phu	13,640	13,679	0.3
Cho Moi	13,304	14,784	11.1
Chau Phu	34,940	30,274	-13.4
Chau Thanh	28,630	26,857	-6.2
Phu Tan	22,151	23,382	5.6
Tinh Bien	16,288	21,000	28.9
Chau Doc	6,315	6,218	-1.5
Long Xuyen	4,518	3,427	-24.1
Thoai Son	38,882	37,236	-4.2
Tri Ton	42,210	38,042	-9.9
Tan Chau	9,321	9,874	5.9
Total	**230,199**	**224,774**	**-2.4**

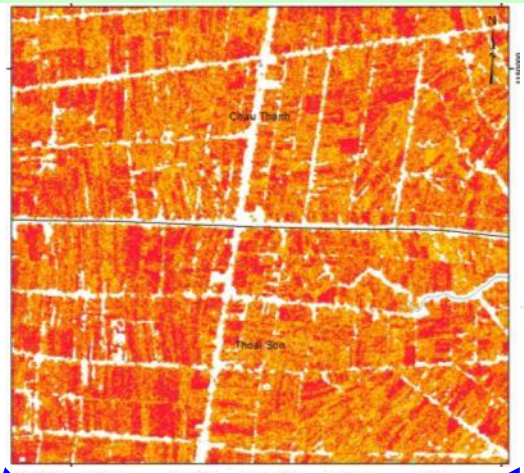


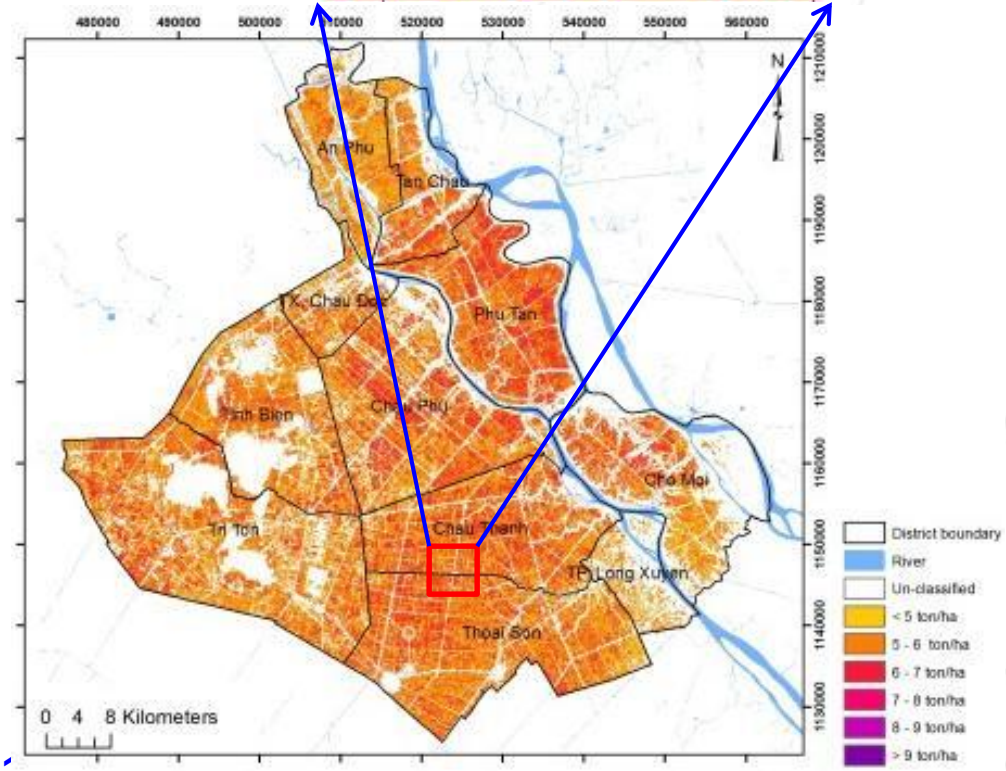
SA 2016 crop from RADARSAT-2
(15 Apr, 09 May, 02 Jun, 26Jun, 20 Jul & 13 Aug)

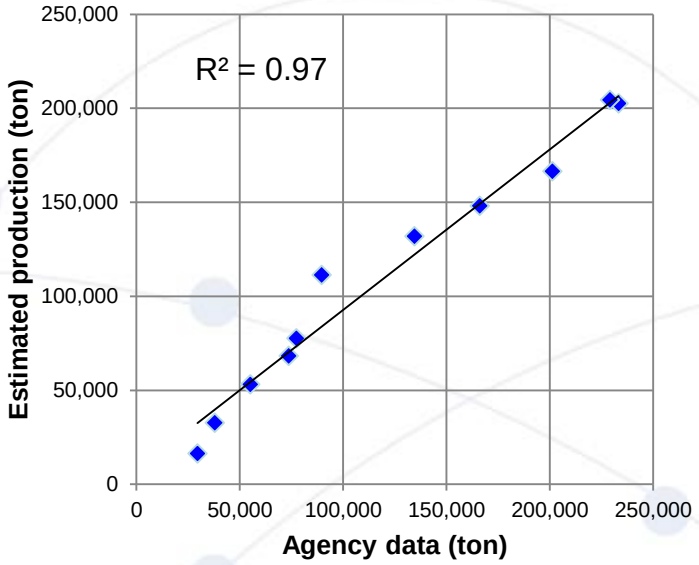


Data set at provincial scale

A distribution map of estimated rice yield of An Giang in SA 2016 crop using RADARSAT-2 data



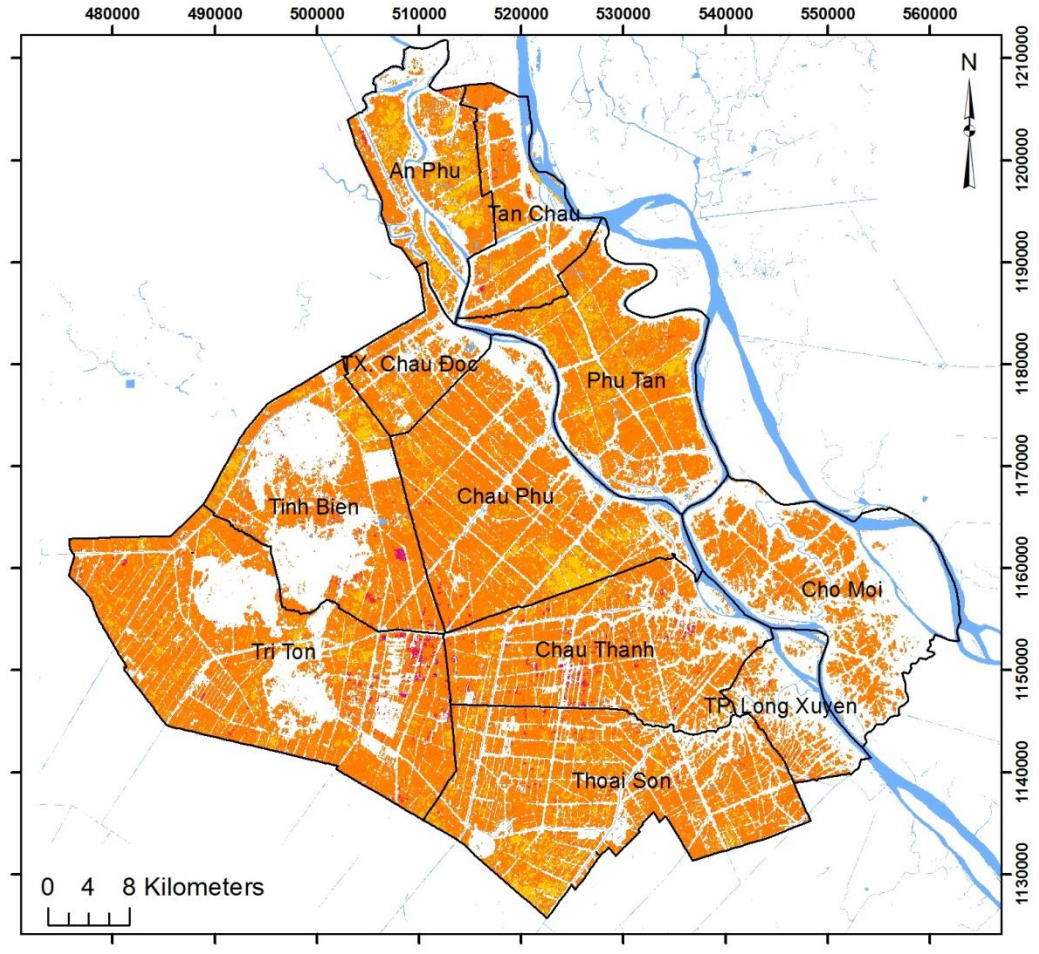




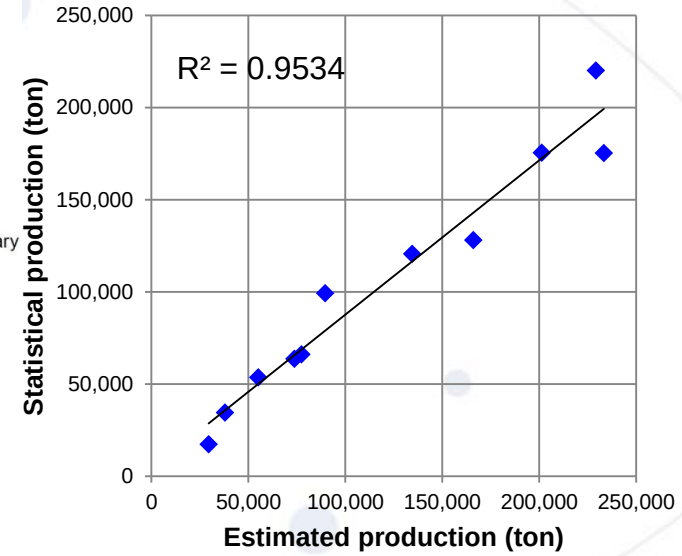
District name	Agency data (ton)	Estimated production (ton)	Percentage error (%)
An Phú	73,656	68,296	-7.3
Chợ Mới	77,296	77,720	0.5
Châu Phú	201,254	166,581	-17.2
Châu Thành	166,054	148,199	-10.8
Phú Tân	134,457	132,012	-1.8
Tịnh Biên	89,584	111,364	24.3
Châu Đốc	37,890	32,798	-13.4
Long Xuyên	29,503	16,456	-44.2
Thoại Sơn	233,292	202,704	-13.1
Tri Tôn	229,200	204,518	-10.8
Tân Châu	54,994	53,099	-3.4
Total	**1,325,946**	**1,213,746**	**-8.5**

Data set at provincial scale

A distribution map of estimated rice yield of An Giang in SA 2016 crop using ALOS-2 data

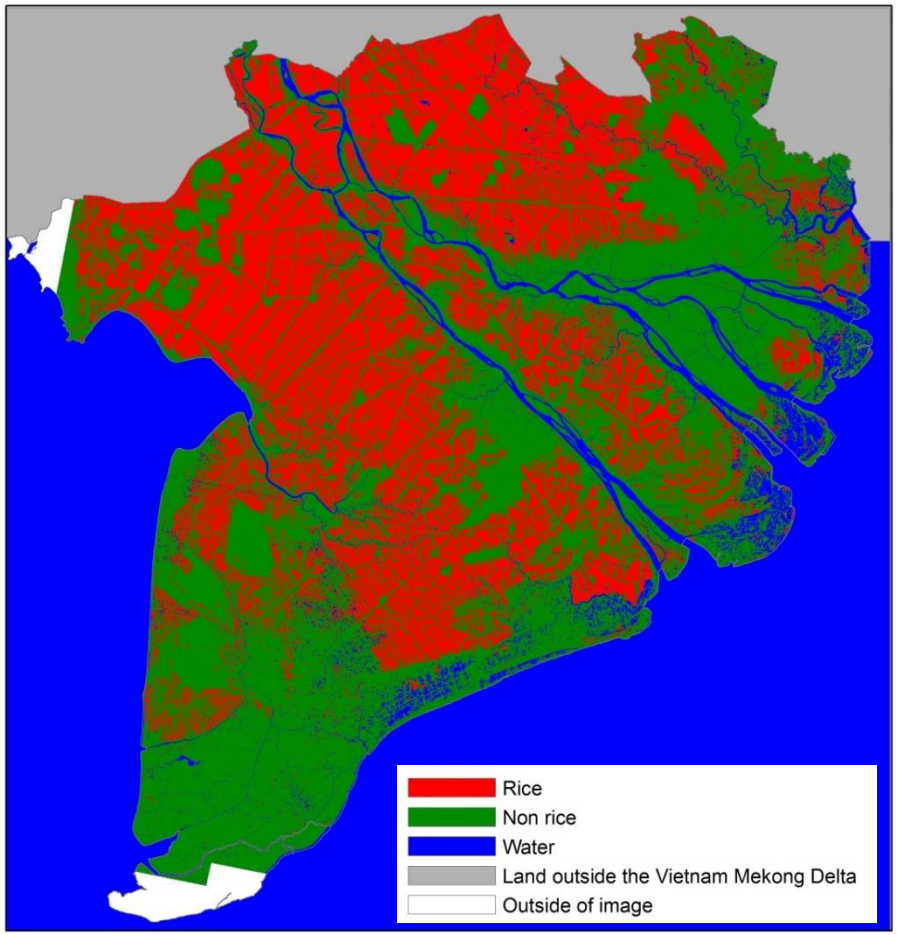


District name	Agency data (ton)	Estimated production (ton)	Percentage error (%)
An Phú	73,656	63,717	-13.5
Chợ Mới	77,296	66,103	-14.5
Châu Phú	201,254	175,556	-12.8
Châu Thành	166,054	128,187	-22.8
Phú Tân	134,457	120,703	-10.2
Tịnh Biên	89,584	99,328	10.9
Châu Đốc	37,890	34,638	-8.6
Long Xuyên	29,503	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**

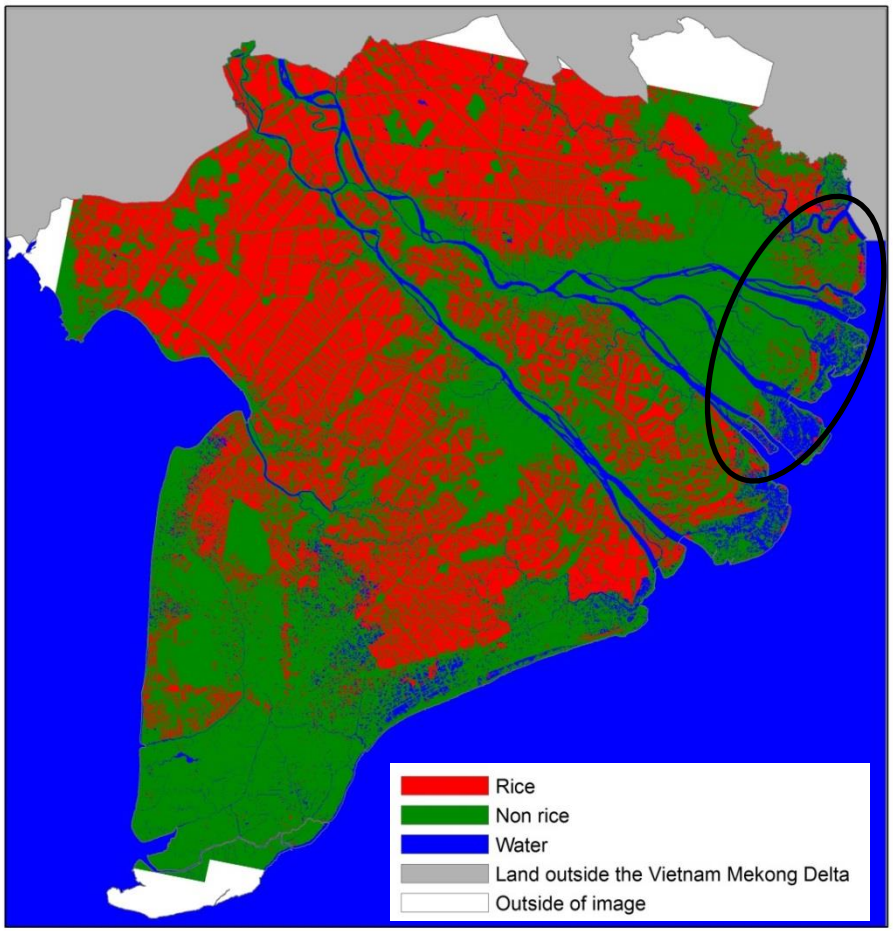


Data set at regional scale

Map of WS Rice 2015 using Sentinel-1



Map of WS Rice 2016 using Sentinel-1

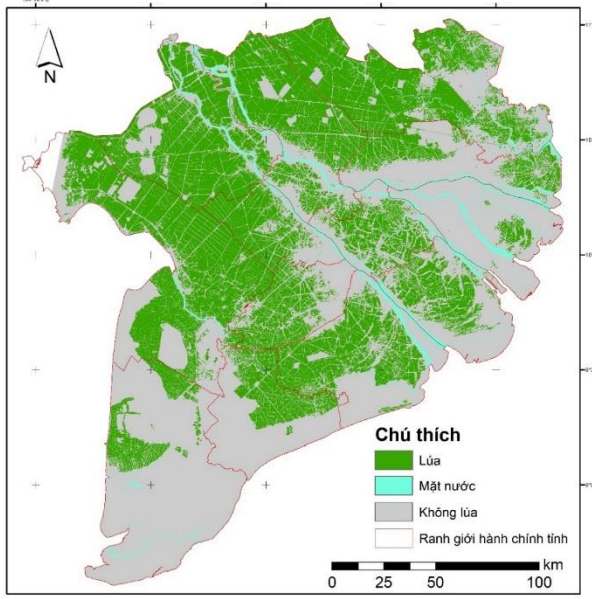


Reduced area in WS crop 2016 caused by shortage of water and saline water intrusion

VNRice (2017-): Rice/Non-rice maps

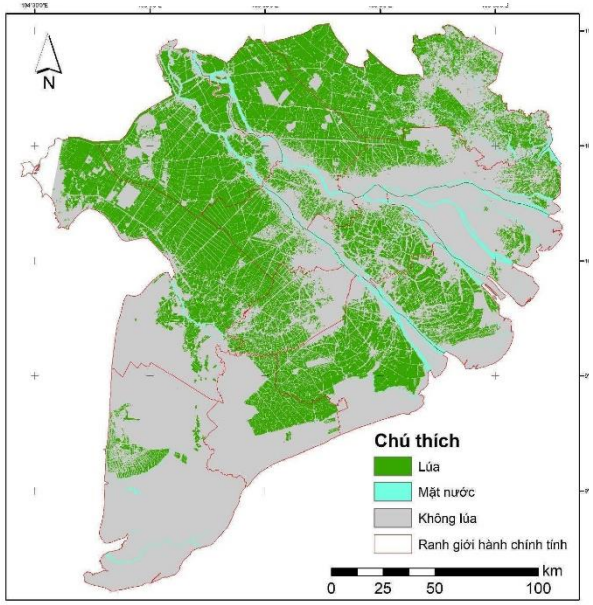
Applied research on the multi-temporal, multi-resolution **optical and radar remote sensing data for rice** planted area monitoring and rice yield, production estimation in the **Mekong Delta and Red River Delta** (VNRice)

Map of WS Rice 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)

Map of SA Rice 2018



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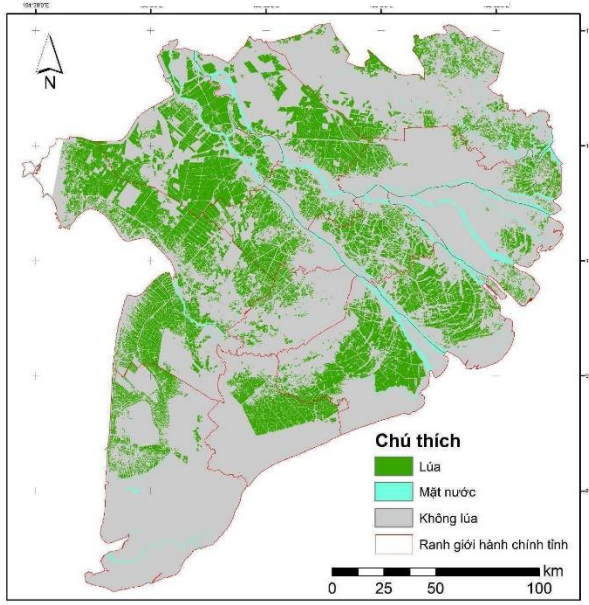
Viện Hàn lâm Khoa học và Công nghệ Việt Nam (VAST)

Map of AW Rice 2018



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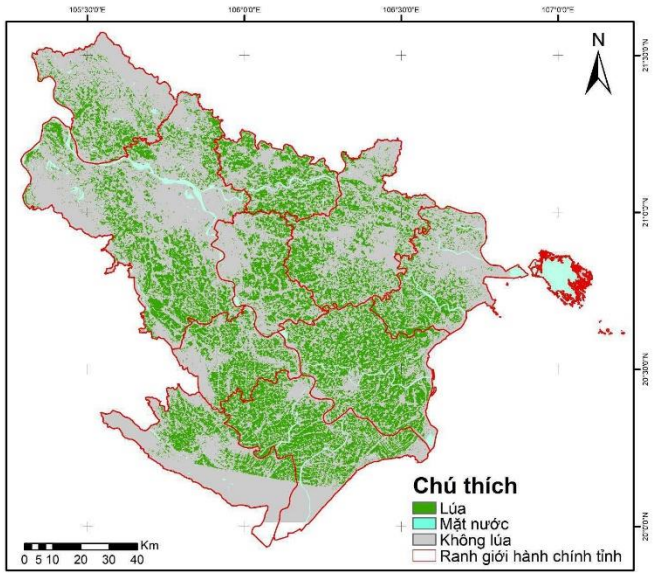
Rice crop maps in the Mekong Delta, Vietnam

VNRice (2017-): Rice/Non-rice maps

Map of WS Rice 2018



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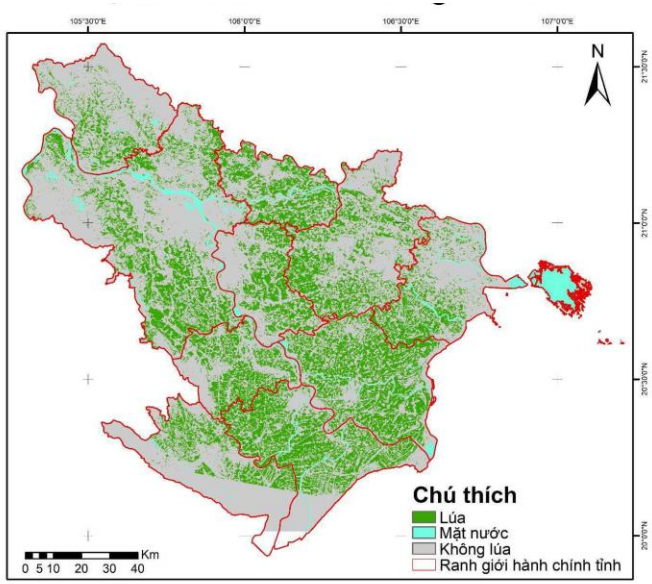
Map of Autumn (Mua) Rice 2018



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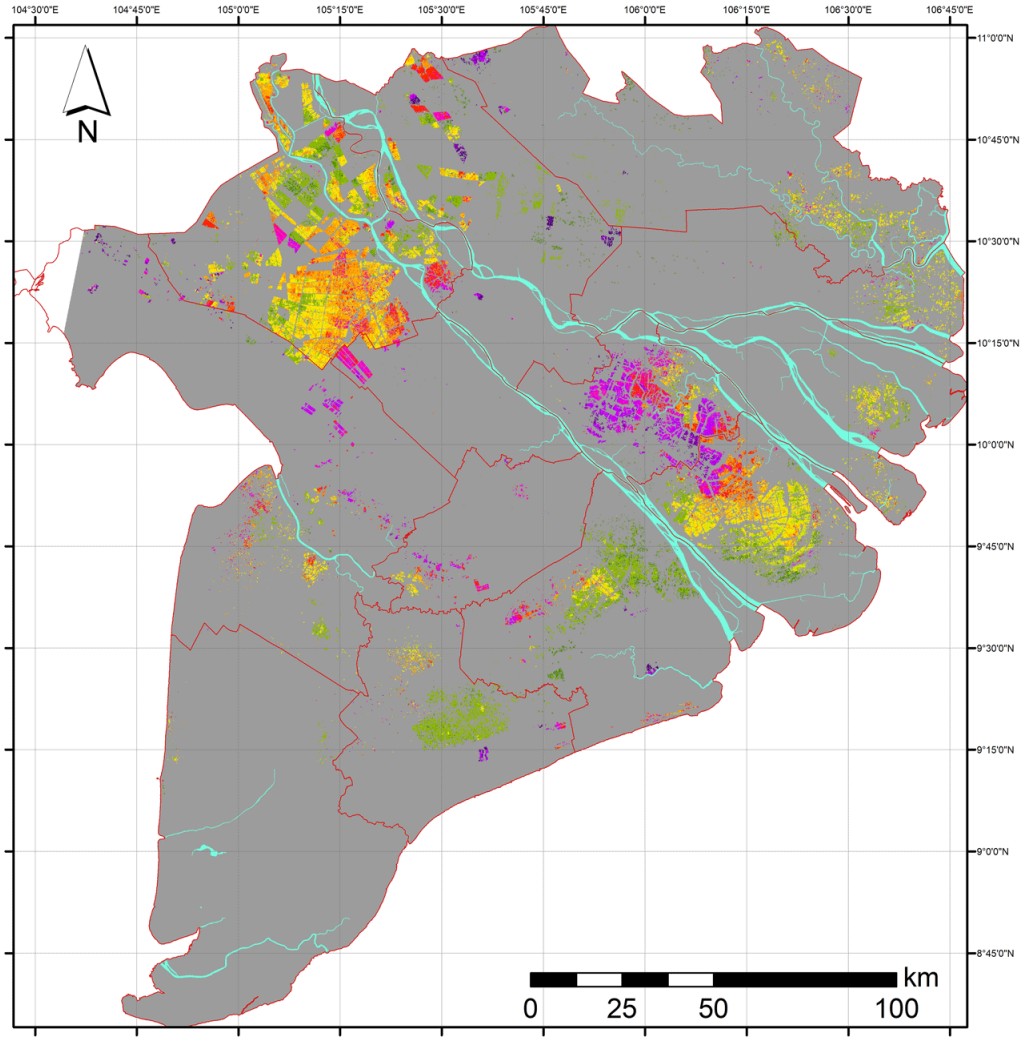
Rice crop maps in the Red River Delta, Vietnam



Bản đồ ngày sau sạ/cấy khu vực ĐBSCL (14/10/2017)

Rice age map of the Mekong Delta

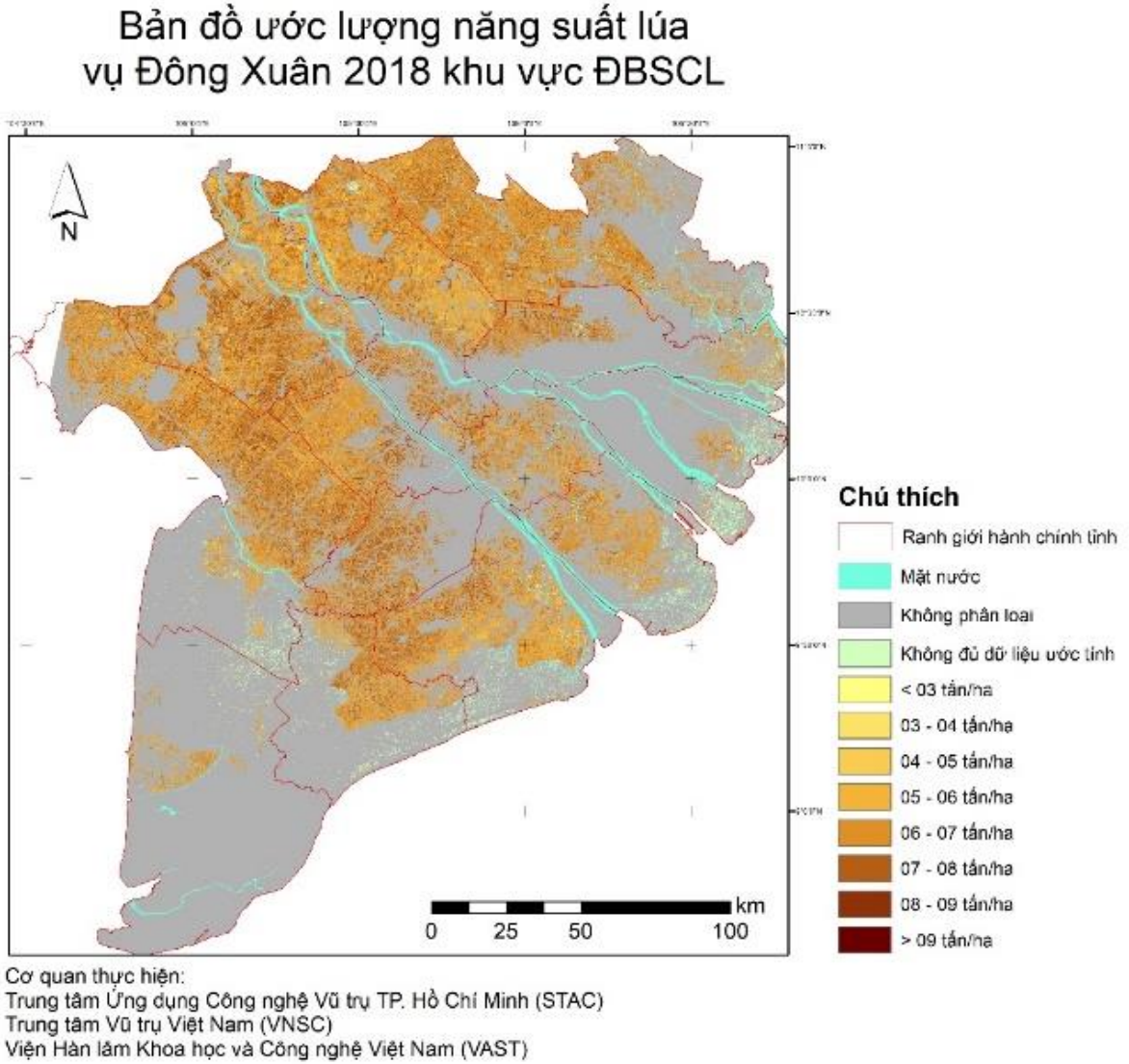
Chú thích (Legend)

- Không lúa (Non-rice)
- Mặt nước (Water bodies)
- Lúa (Rice) 01 - 10 ngày (days)
- Lúa 11 - 20 ngày
- Lúa 21 - 30 ngày
- Lúa 31 - 40 ngày
- Lúa 41 - 50 ngày
- Lúa 51 - 60 ngày
- Lúa 61 - 70 ngày
- Lúa 71 - 80 ngày
- Lúa 81 - 90 ngày
- Lúa 91 - 100 ngày
- Lúa 101 - 110 ngày
- Lúa 111 - 120 ngày
- Ranh giới hành chính tỉnh (Provincial boundary)

Cơ quan thực hiện (Prepared by):
Trung tâm Ứng dụng Công nghệ Vũ trụ TP.HCM (HCMC Space Technology Application Center)
Trung tâm Vũ trụ Việt Nam (Vietnam National Space Center)
Viện Hàn lâm Khoa học và Công nghệ Việt Nam (Vietnam Academy of Science and Technology)

Days after rice sowing/transplanting in the Mekong Delta (Nov. 2017 – Mar. 2018)

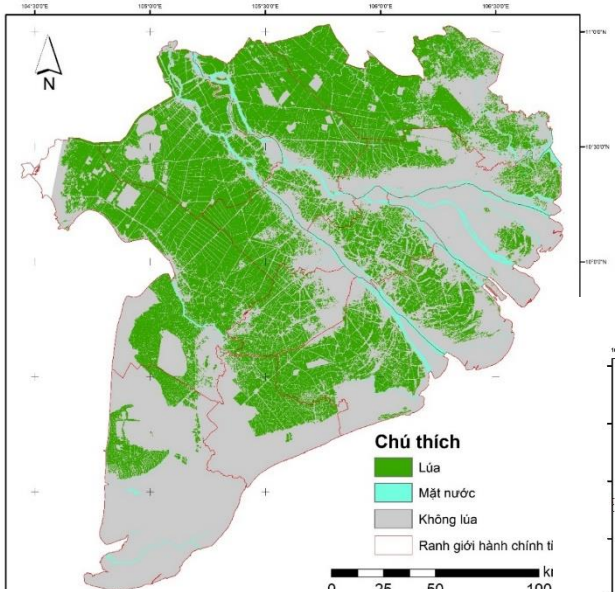
VNRice (2017-): Rice yield maps

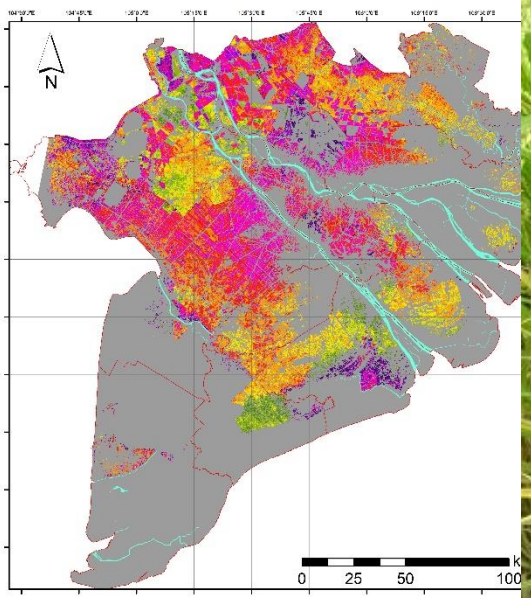


A distribution map of estimated rice yield of WS 2018 in the Mekong Delta

Towards a National crop monitor

Bản đồ phân bố khu vực trồng lúa
vụ Đông Xuân năm 2018 vùng ĐBSCL





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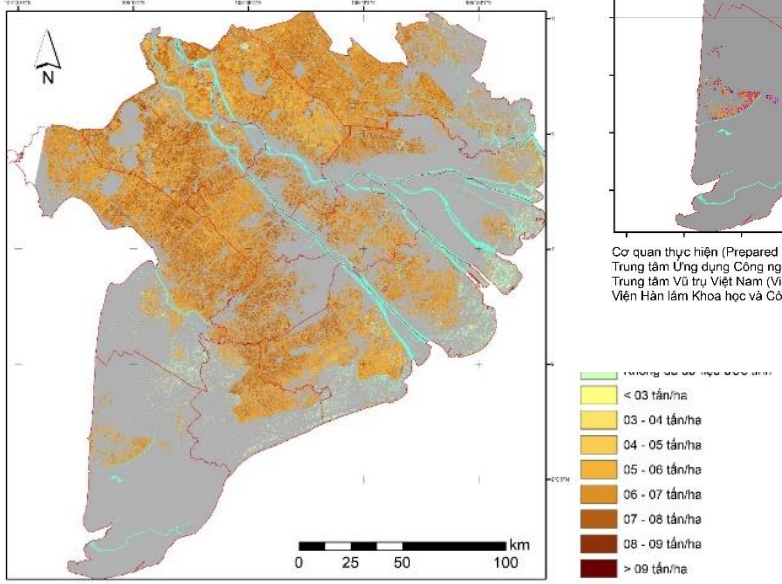
Viện Hàn lâm Khoa học và Công nghệ Việt Nam (Vietnam Academy of Science and Techno

Bản đồ ước lượng năng suất lúa
vụ Đông Xuân 2018 khu vực ĐBSCL



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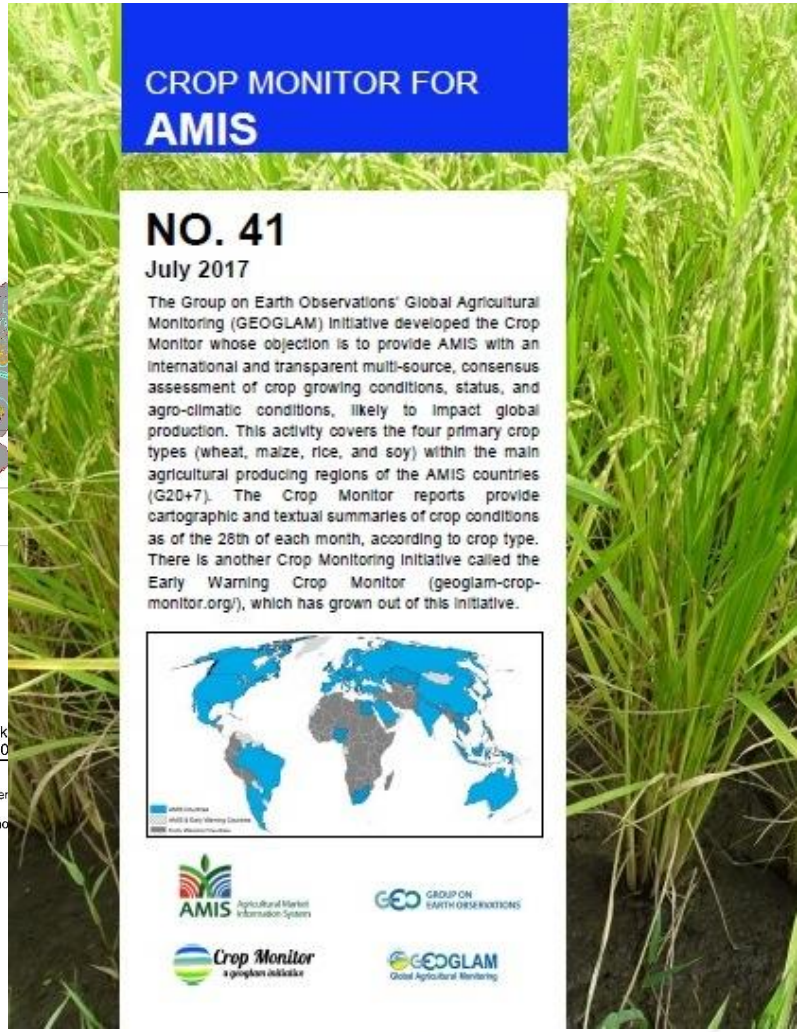
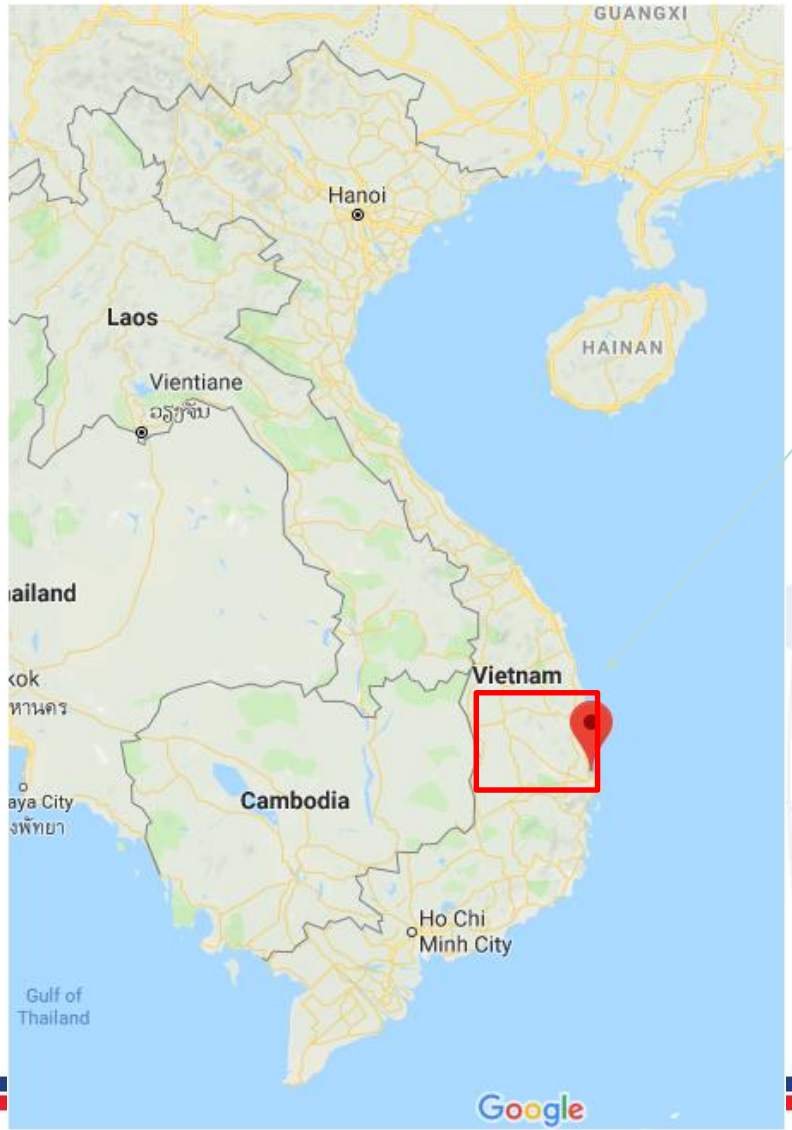


River basin environment



LCLUC at Ba river basin

Image processing on GEE platform:

- Satellite: Landsat 5, 8 (30 m)
- Year: 2005, 2010, 2017, 2019 (January-July)

Commercial forestry

Paddy in Phu Yen

Cassava

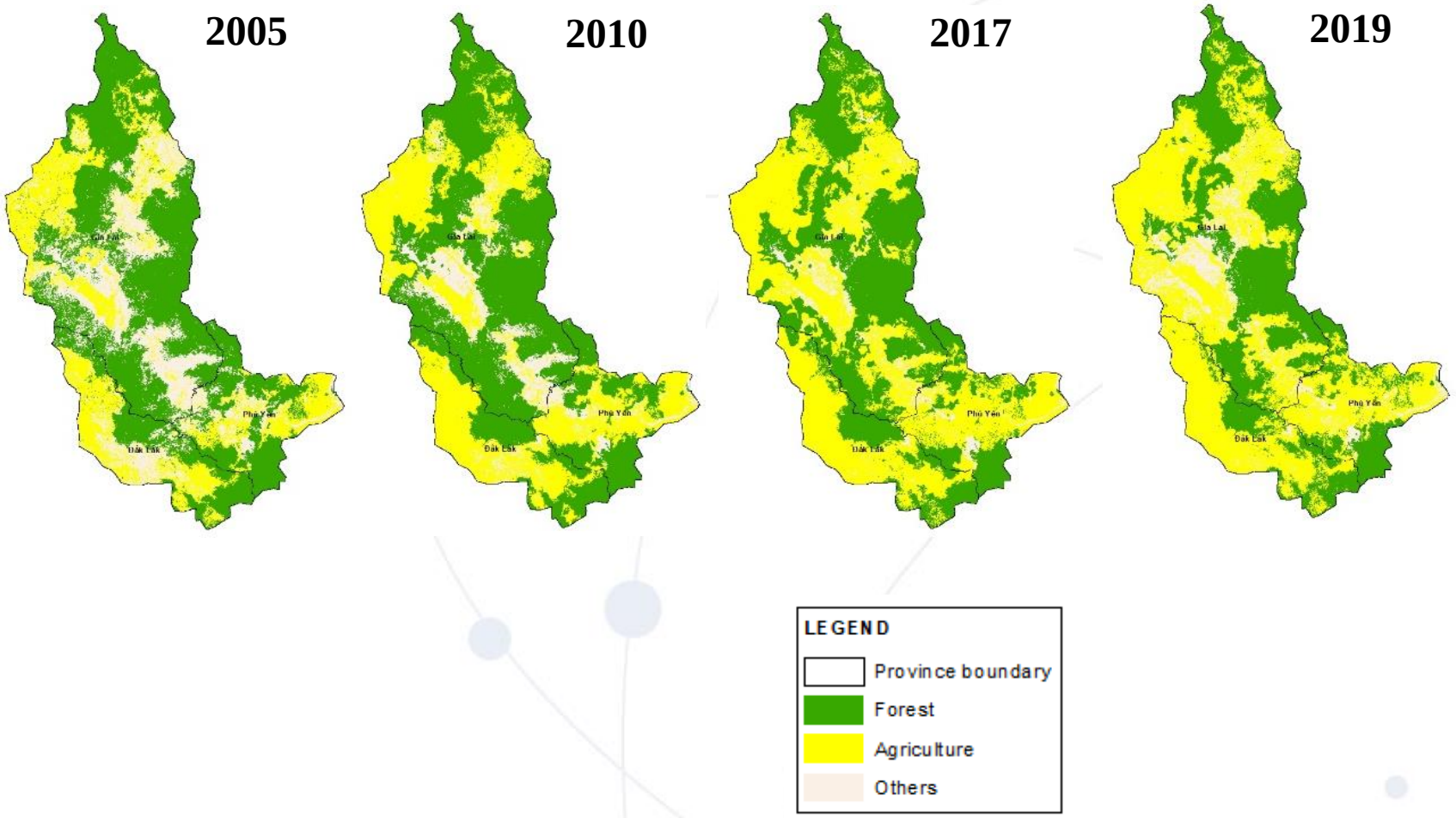
Pepper

Sugarcane

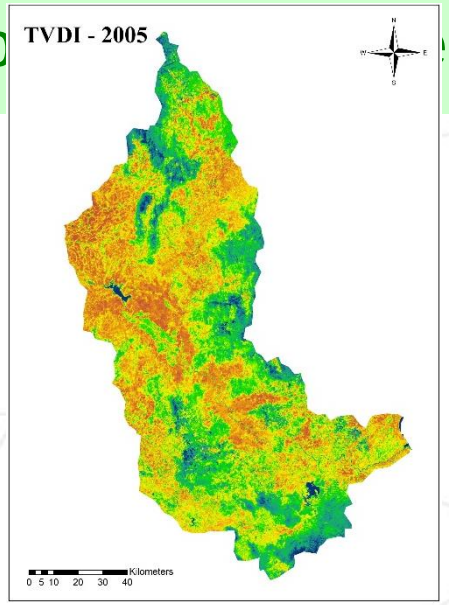
Corn

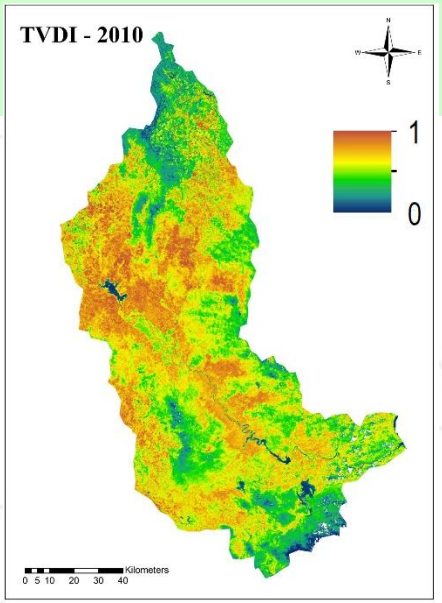
Vegetation cover at the Ba river basin

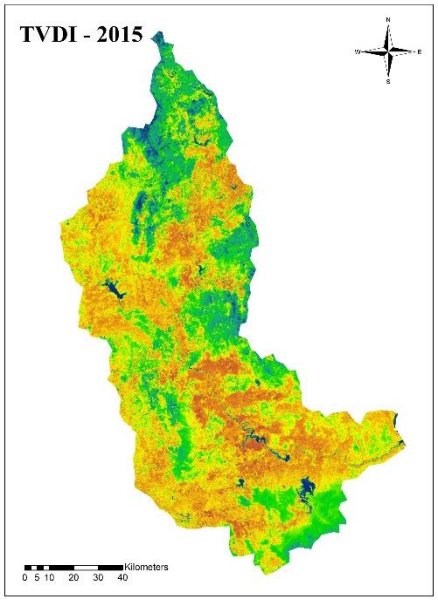
River basin environment

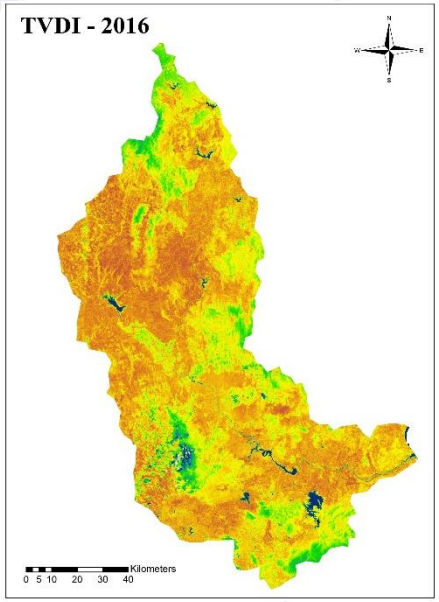


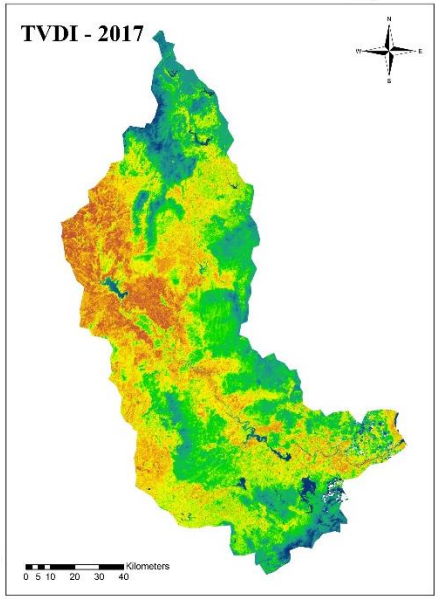
River b

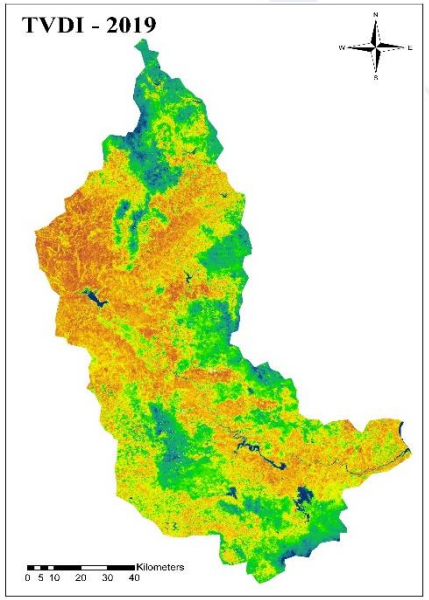








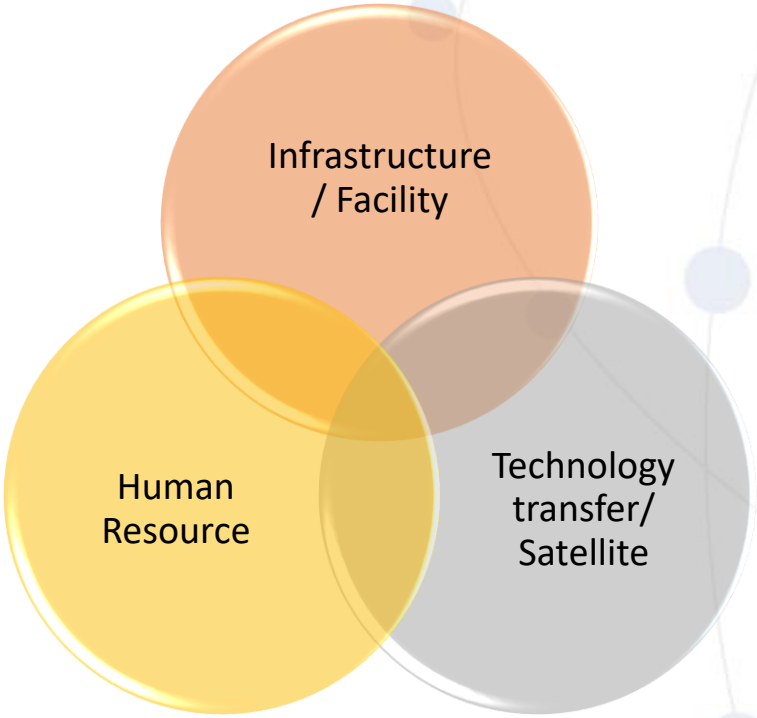




Temperature Vegetation Dryness Index (TVDI)

Vietnam Space Center project

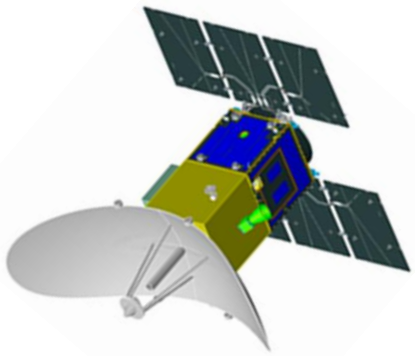
Management Center and S/C Control Center



Public Education Center

Vietnam Space Center project

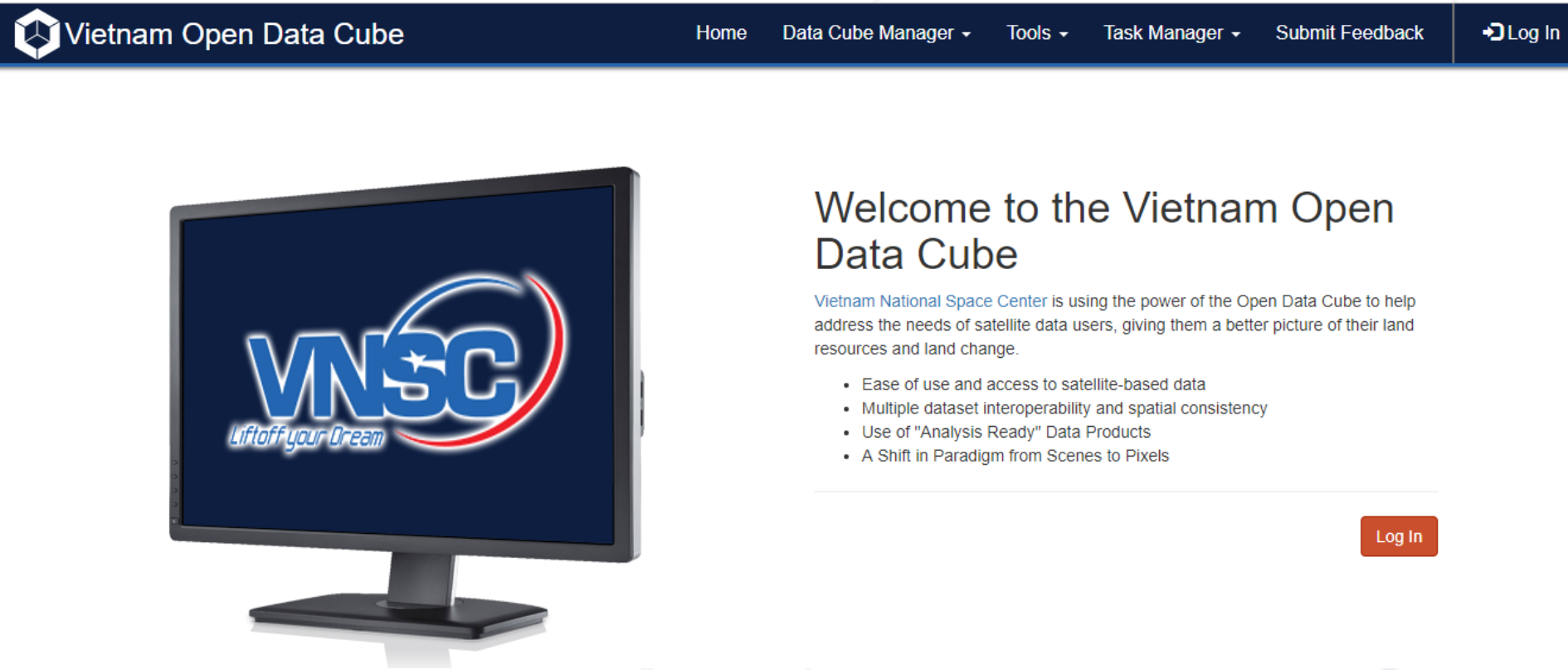
- **Human resource development**
  - Small satellite development
  - Remote sensing technology
- **Construction of infrastructure**
  - Assembling, integration & test facility of small satellite
  - Data image receiving and processing facility
  - Research and education facility
- **Technology transfer**
  - Small earth observation satellite
  - Satellite image data utilization



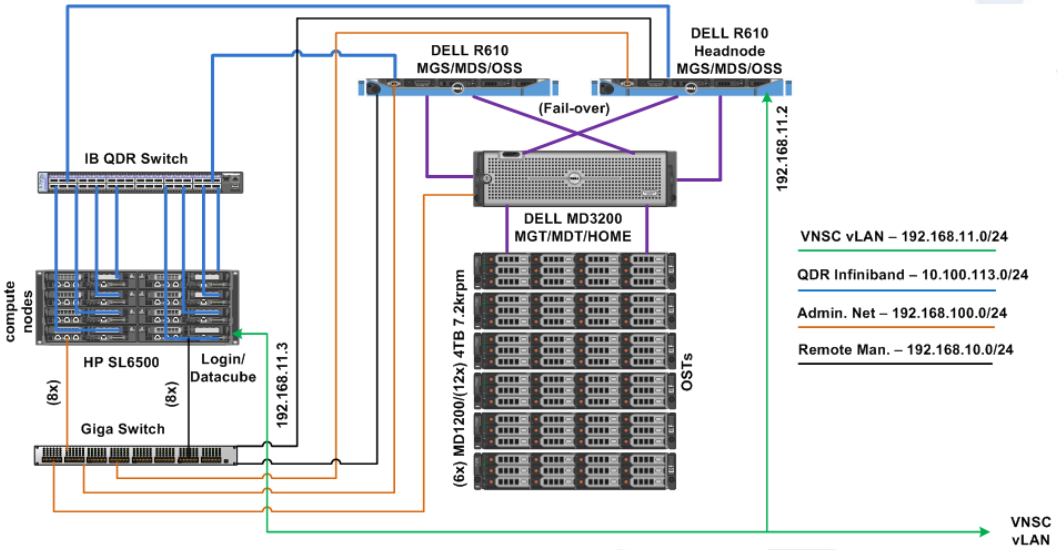
Vietnam Data Cube

- Infrastructure: by help of IMSG (I. M. Systems Group, Inc.)
- Software:
  - Supports from CSIRO&CEOS
- Satellite Data:
  - Landsat from USGS
  - ALOS from JAXA
  - Sentinel-1&-2 from ESA
- Priority applications:
  - Forest monitoring
  - Rice monitoring
  - Water monitoring.

Vietnam Data Cube



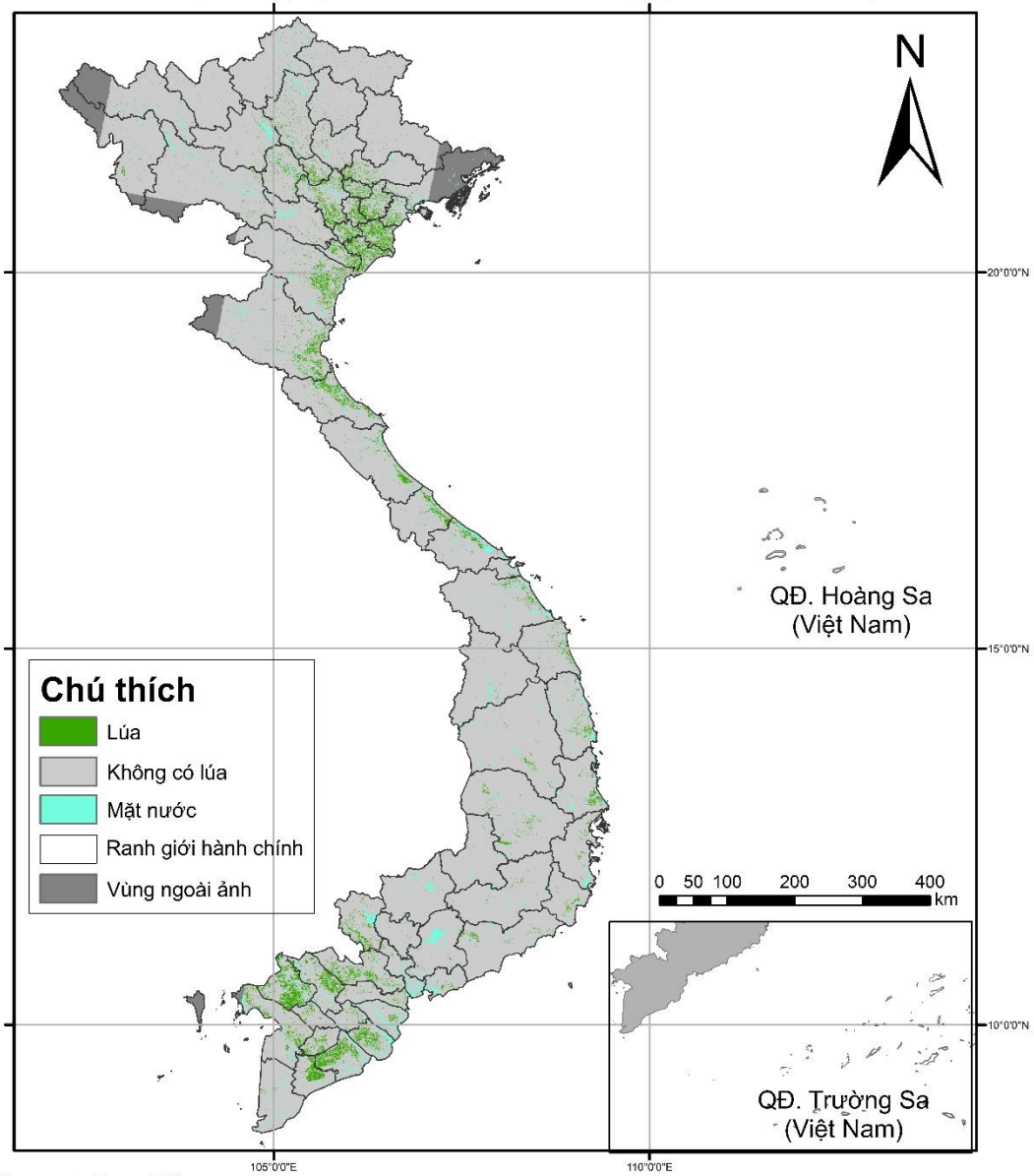
Vietnam Data Cube



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

BẢN ĐỒ LÚA VIỆT NAM

(Từ ngày 20/03/2019 đến ngày 31/03/2019)



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)

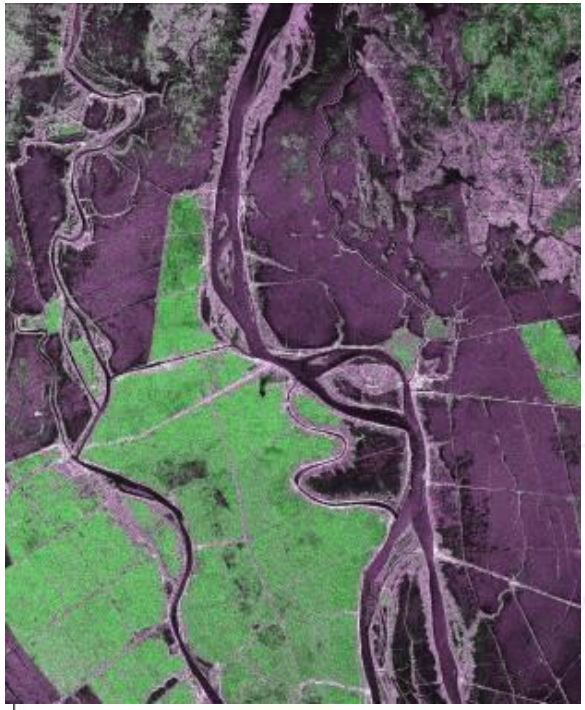
Rice / Non-rice map of Vietnam in March 2019

Conclusions

- Previous studies in VNSC had proven **remote sensing is an efficient tool for LCLUC** using various optical (Landsat, sentinel-2, MODIS) and SAR (RADARSAT-2, ALOS-2, Sentinel-1) data.

- On-going research projects have been doing for LCLUC to **validate the method at regional and national scale.**

- 2019 CEOS initiatives were focused on forest and rice monitoring in the Mekong region. VNSC has continuously been developing the **Vietnam Data Cube to provide critical inputs such as LCLUC for government decision-making.**



Thank you

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