Philippine Space Agency

Ministry of Natural resources and Environment

Using ALOS 2 satellite image data combined with geographical data for flood monitoring in Vietnam

MA. Vu Huu Liem
Director of Center for Environmental Resource Monitoring and Climate change
National Remote sensing Department – MONRE

Quezon City, Philippines - 11/2024

CONTENTS

1. Brief introduction to the NRSD
2. Disaster management frame work in general
3. Applying remote sensing and National Topographic Database to assist disaster management
4. Comments and suggestions

NATIONAL REMOTE SENSING DEPATMENT

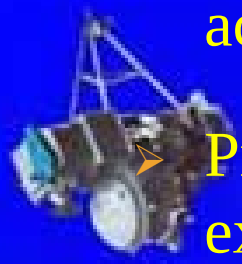
MAIN FUNCTIONS AND DUTIES

National Remote Sensing Department is an organization under the Ministry of Natural Resources and Environment with functions as state management and implementation of public services for remote sensing field according to Law regulations of Vietnam;

With main functions and duties:

- Establishment, providing guideline and implementation of mechanisms, policies, legal documents, strategies, planning, programs, schemes, projects, standards, technical regulations, economic-technical norms and procedures for remote sensing field;

- Providing guideline and implementation on application of remote sensing data for ENRM, natural disasters monitoring, climate change and other fields for state management, development of socio-economic and security-defense in accordance with Law regulations.



- Preparing and publishing reports on monitoring of the exploitation and use of natural resources, environmental pollution and climate change by remote sensing technology;
- Construction, management and exploitation of Ground Receiving Station, storage and processing systems

- Providing guideline, checking and implementation on establishment, updating, management and operation of national RS database; collecting and publishing RS metadata.
- Providing guideline and management of RS activities of organizations and individuals; collecting situation of application and development of RS in the whole country;
- Establishing and updating topographic map, thematic map, thematic database, geographic information database and national geospatial data infrastructure by RS technology;
- Application of RS and geo-informatics in basic investigation, surveying, collection, analysis and processing of spatial information data for state management and social demands;

- Validation and acceptance of remote sensing works and products;
- Scientific research, application, development and transfer of remote sensing technology; training and knowledge transfer on remote sensing;

HUMAN RESOURCES

Total staffs: 214 personnel

- Doctors: 07
- Masters: 48
- Engineers: 140
- Others: 19

ORGANIZATION FLOW CHART

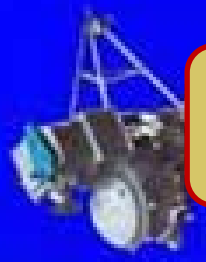
DIRECTOR BOARD

DIVISION OF ADMINISTRATION

DIVISION OF REMOTE SENSING INFRASTRUCTURE AND TECHNOLOGY

DIVISION OF GENERAL PLANNING

DIVISION OF REMOTE SENSING ACTIVITY MANAGEMENT



Central Remote Sensing Station

Center for Environment Resource Monitoring and Climate Change

Center of Remote Sensing Data and Information

Center of Remote Sensing for Product Validation and Technology development

WORK LOCATION

1. Headquarters (workplace of administrative departments and departments doing management work)

Address at 83 Nguyen Chi Thanh Street, Dong Da District, Hanoi capital

WORK LOCATION ...

2. Four **Application centers that carry out the application of remote sensing technology**

Address at 79 Van Tien Dung **Street**, Bac Tu Liem **District, Hanoi capital**


National Remote Sensing department (2)
GROUND RECEIVING STATION
~ 10 km
National Remote Sensing department (HEAD QT)
Cục Viễn Thám Quốc Gia

VIETNAM GROUND RECEIVING STATION (VNGS)

- Built in 2005
- Data acquisition:
  + SPOT 2,4, Envisat (2007-2012)
  + SPOT 5 (2008-2015)
  + VNREDSat-1 (from 5/2013)
  + SPOT 6/7 (from 10/2020)

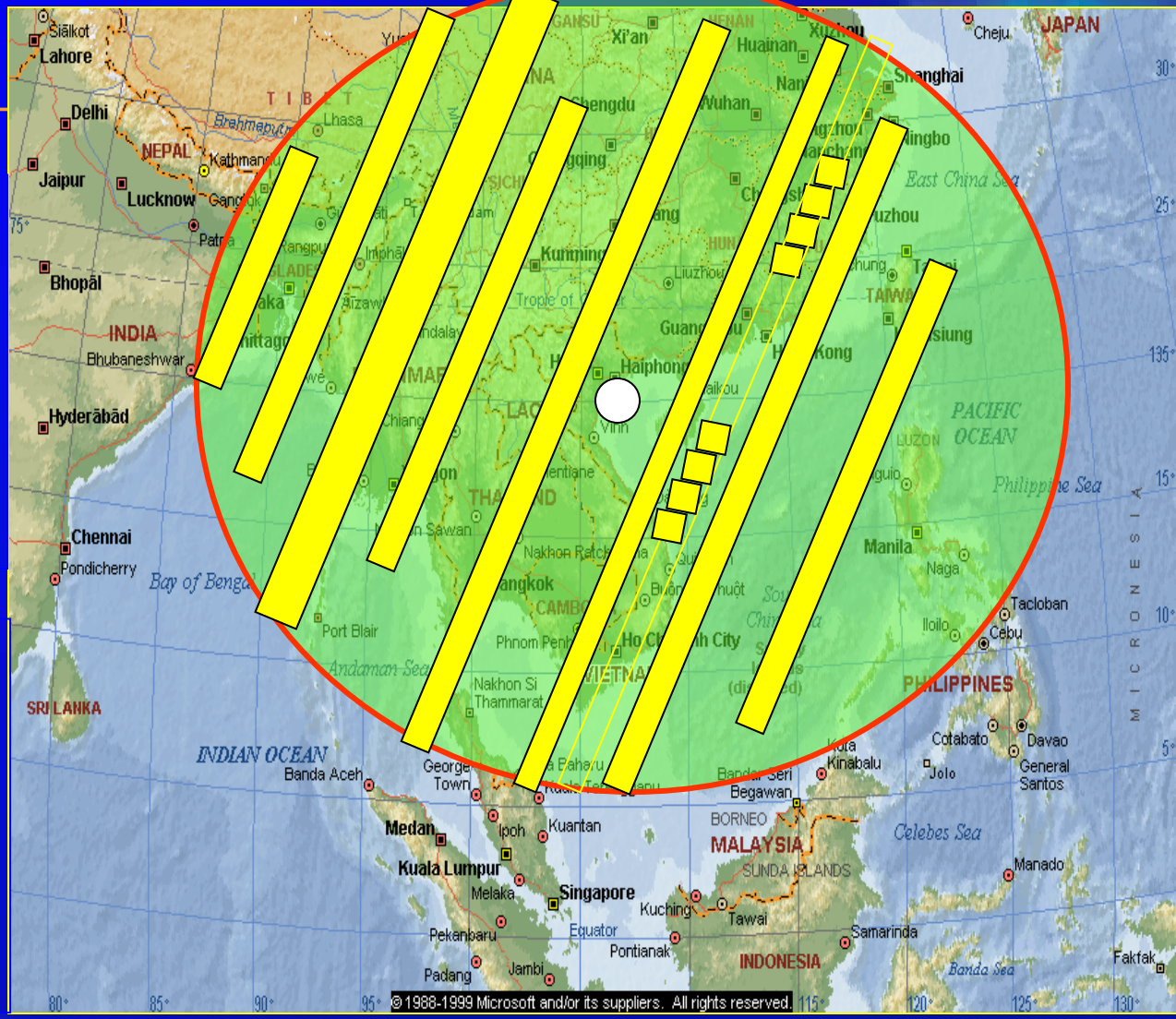
Receiving circle diameter exceeds 4600 km

Direct receiving area and corresponding coverage from HANOI (SPOT)

Acquisition of separate images

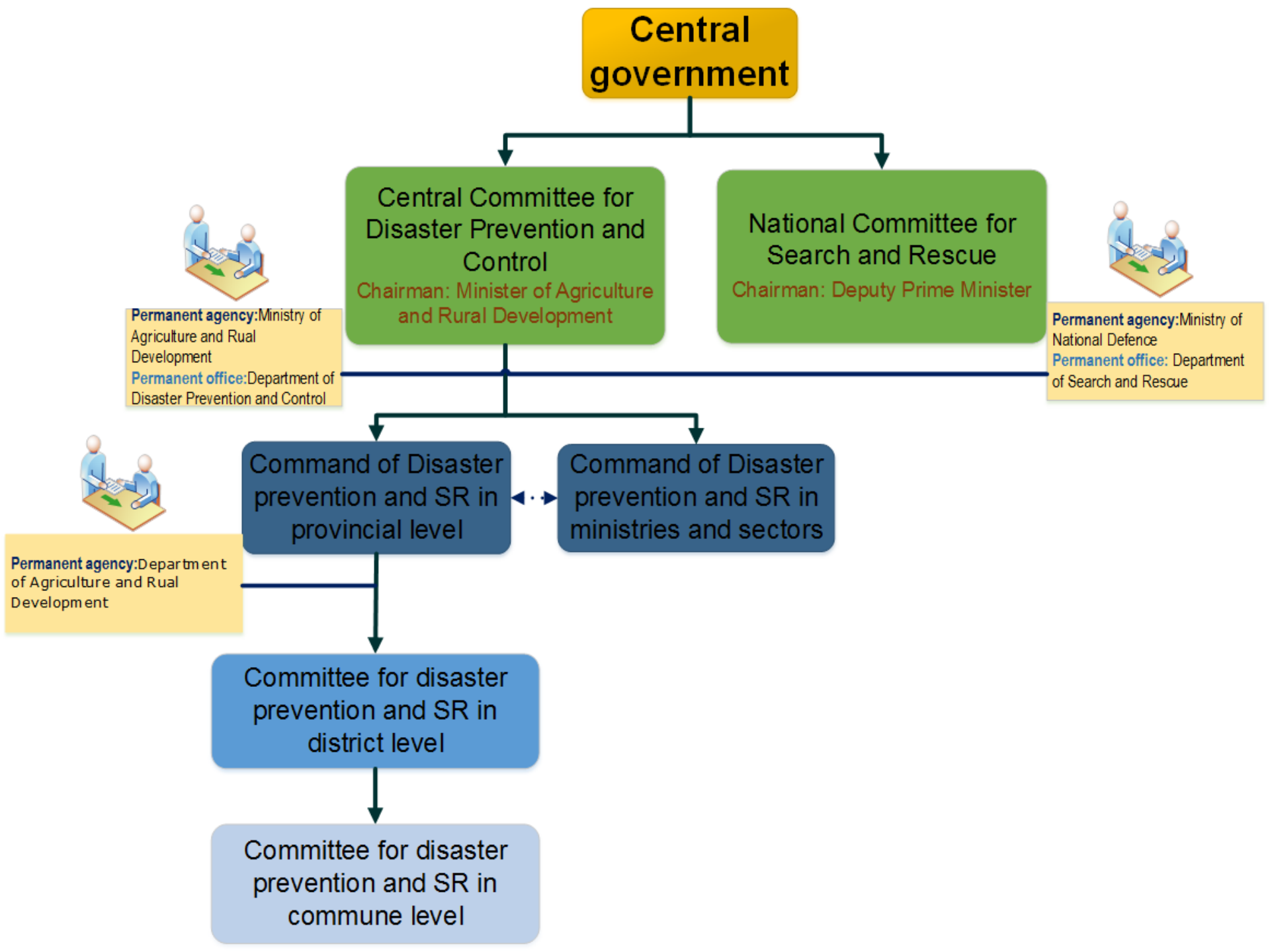
or

By continuous strips



Acquirsition Area of VNGS installed in Ha noi

DISASTER MANAGEMENT FRAME WORK IN GENERAL


Central government
Central Committee for Disaster Prevention and Control
Chairman: Minister of Agriculture and Rural Development
National Committee for Search and Rescue
Chairman: Deputy Prime Minister
Permanent agency:Ministry of Agriculture and Rual Development
Permanent office:Department of Disaster Prevention and Control
Permanent agency:Ministry of National Defence
Permanent office: Department of Search and Rescue
Command of Disaster prevention and SR in provincial level
Command of Disaster prevention and SR in ministries and sectors
Permanent agency:Department of Agriculture and Rual Development
Committee for disaster prevention and SR in district level
Committee for disaster prevention and SR in commune level

I.1. Natural disaster in Vietnam

- Vietnam is prone to natural disasters, including typhoons, storms, floods, droughts, landslides, and.... The poorest people in society are the most vulnerable.
- More than one million people require emergency relief each year
- Climate change and natural disasters are big challenges to the development and poverty reduction in Vietnam
- It is estimated the damages cause by disasters such as hurricanes, floods, and cyclones were about 1-2% of the annual GDP.

I. 2. Natural disasters typical in Vietnam

- Storms: the annual number of storms is quite large (8-9) and intensity with an increasing trend, especially in the last three decades. 80 - 90% of the Vietnamese population affected by the storm.

- Flooding: River flooding occurs annually in all areas. Flooding is most serious in the Mekong Delta - primarily from the upstream of the Mekong River and is directly affected by the tide. Flood season lasts for long time from 4 to 5 months of the year, flooding almost the entire Mekong River Delta.

- Flash floods, mudflows: Flash floods occur within the limited geographical areas, but very intense and often cause serious loss of life and property.
- Drought and desertification: Droughts occur in all parts of the country. Drought has reduced from 20 to 30% yields, reduced food production, causing serious effects on livestock and subsistence of the people.
- Landslide: Climate change is also one of the causes of increased landslides and rockfalls, and extreme weather patterns are also causing rainfall in tropical countries like Vietnam to increase sharply.

- Salinity: salinity occurs along the coast with different levels. The South West coastal provinces are those of most affected area of serious salinization with 1.77 million hectares, accounting for 45% of the land area

- Earthquakes have occurred in Vietnam, but only at low levels. The tsunami has not yet appeared in Vietnam, many Vietnamese coasts are still at risk of tsunami affected by potential earthquake risk in the region

Disaster relative frequency in Vietnam

Table: Disaster relative frequency in Vietnam

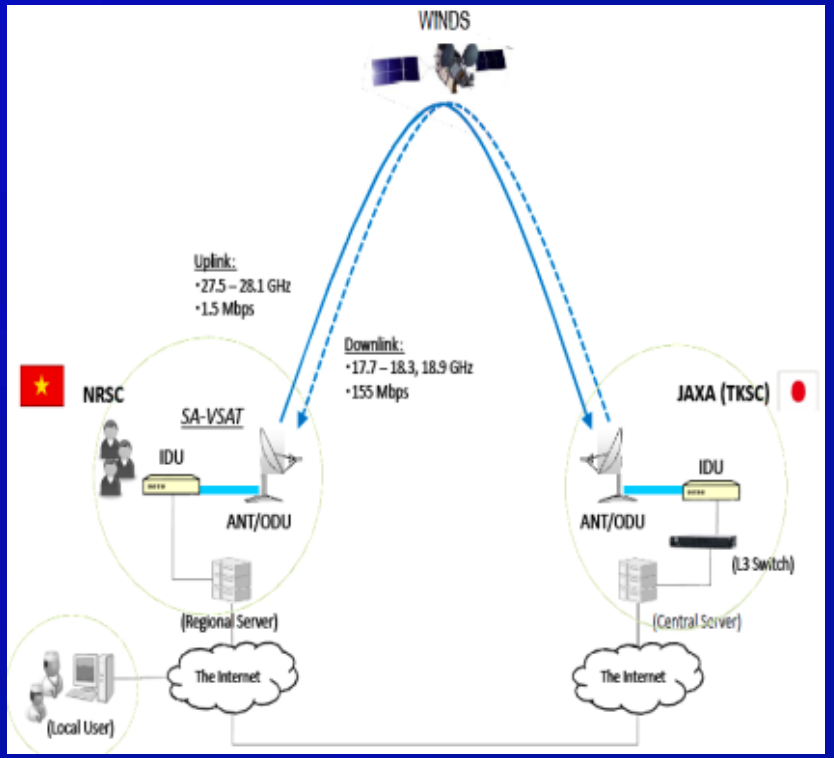
High	Medium	Low
Flood,	Landslide	Earthquake
Storm, Tropical depression	salinity intrusion	
Flash flood		
Drought		

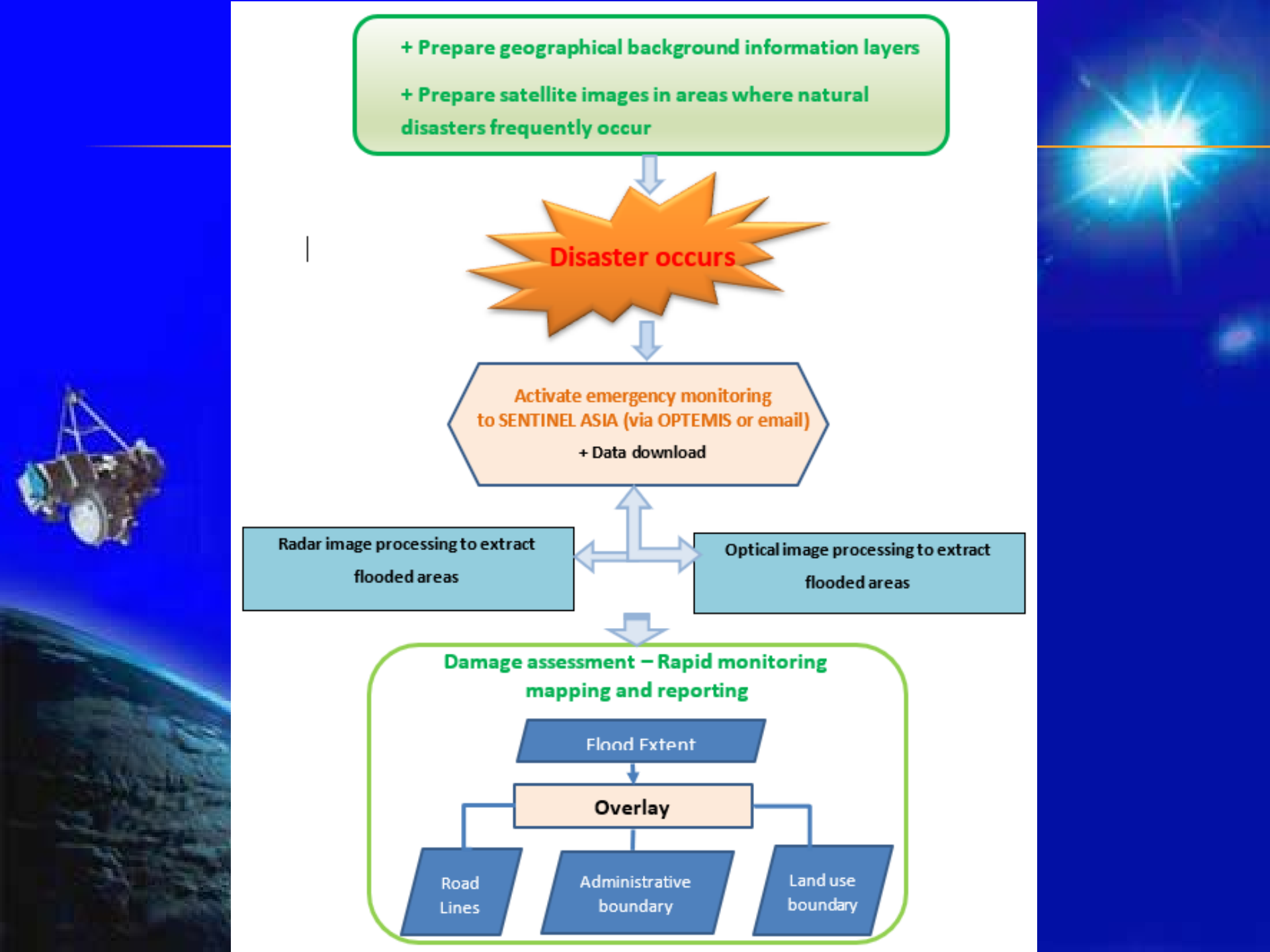
(Source: National report on natural disaster reduction in Vietnam)

APPLYING REMOTE SENSING AND NATIONAL TOPOGRAPHIC DATABASE TO ASSIST DISASTER MANAGEMENT

Sentinel Asia and JAXA providing the WINDS Station

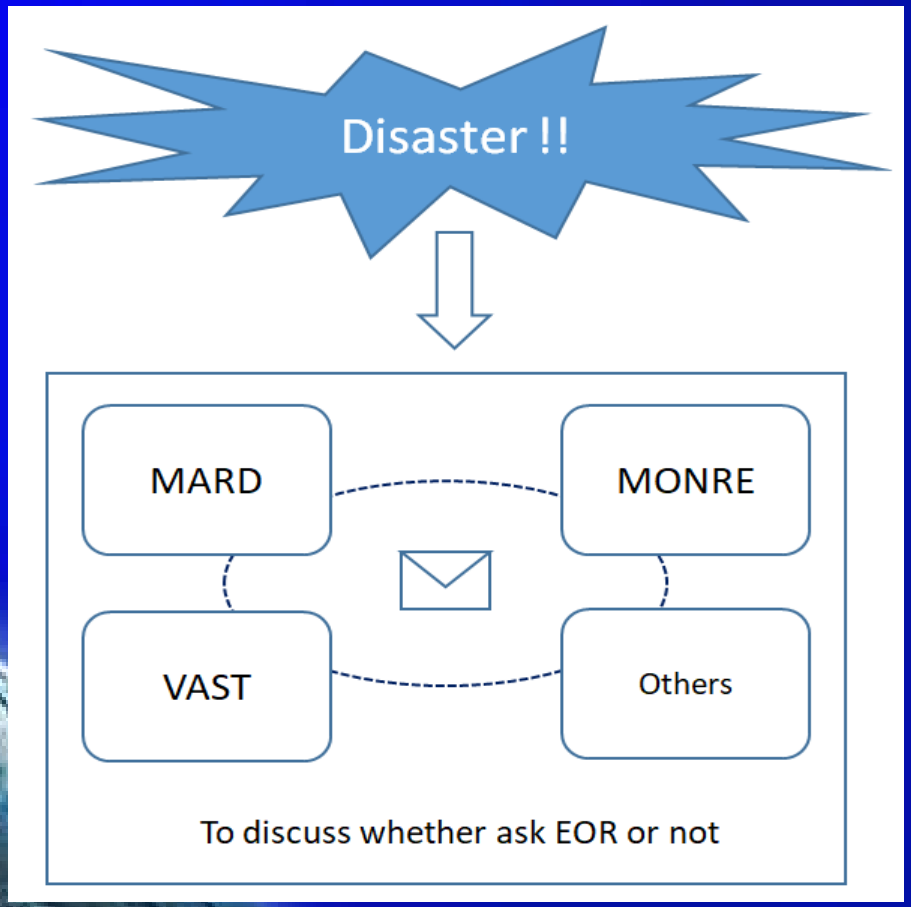
- *Thanks to SENTINEL ASIA,JAXA, though the WINDS station and Vietnam Ground Station, VNRSC can receive satellite image in case of disaster occurred*
- *Processing and providing data to agencies in Vietnam.*
- *Data receiving: ALOS 2, Rainfall, meteorology data, Etc…*




+ Prepare geographical background information layers
+ Prepare satellite images in areas where natural disasters frequently occur
Disaster occurs
Activate emergency monitoring to SENTINEL ASIA (via OPTEMIS or email)
+ Data download
Radar image processing to extract flooded areas
Optical image processing to extract flooded areas
Damage assessment – Rapid monitoring mapping and reporting
Flood Extent
Overlay
Road Lines
Administrative boundary
Land use boundary

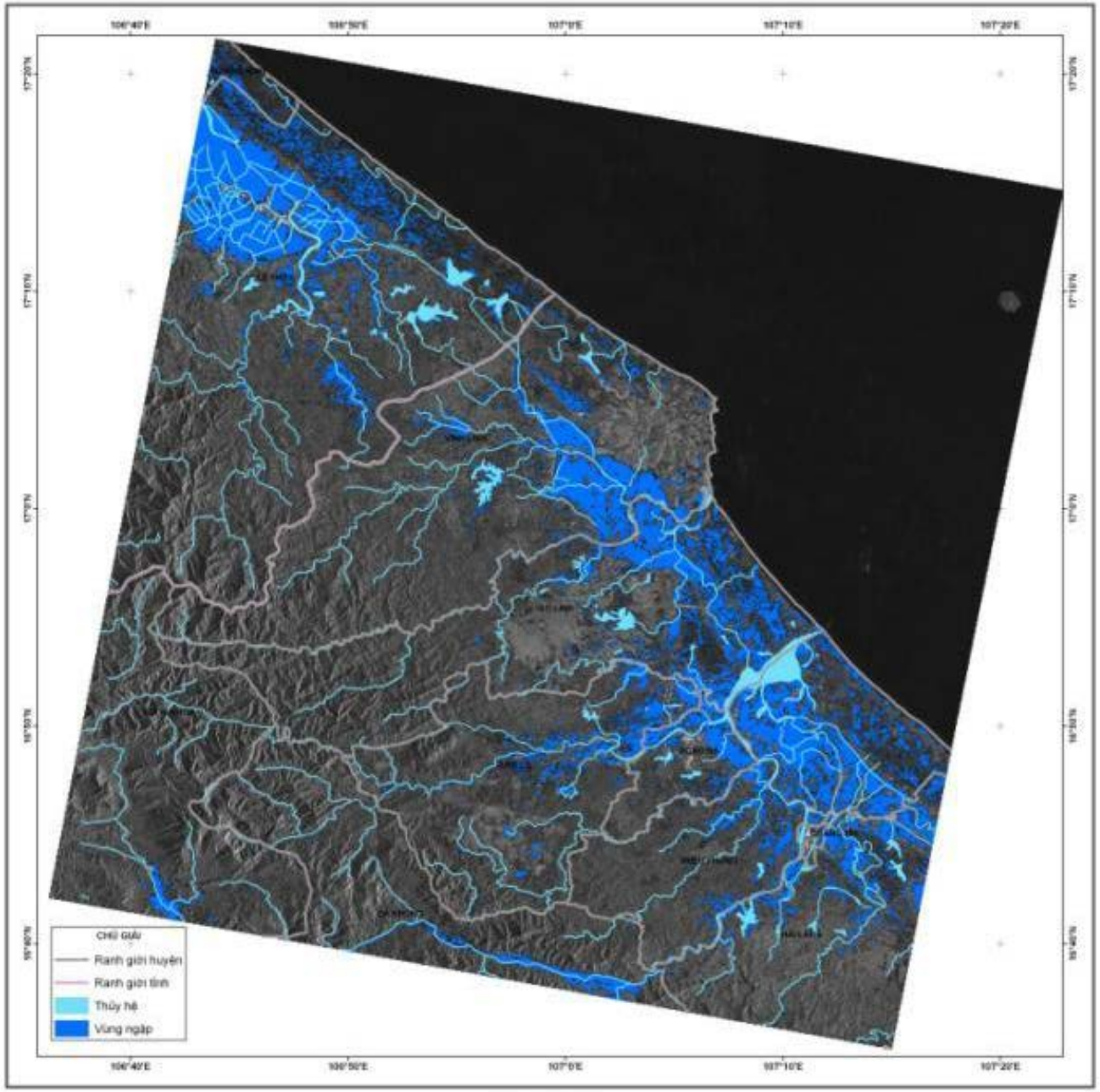
Collaborate with specialized agencies to provide disaster information and data

- The Joint Project Team members and Disaster Management Organizations in Vietnam have agreed on a Standard Operation Procedure in the event of natural disasters.



Prepare geographical background information layers

FLOOD RAPID SPACE MAP IN BINH DINH PROVINCE, VIETNAM USING ALOS PALSAR RADAR IMAGES FROM 2010



TỶ LỆ 1 : 170.000

Trung tâm Viễn thám Quốc gia - Bộ Tài nguyên và Môi trường
Địa chỉ: 108 Chùa Láng, Đống Đa, Hà Nội
Điện thoại: 04-3834 3811

Bản đồ được thành lập từ ảnh vệ tinh ALOS-PALSAR

Statistics of flooded area by district as of June 13, 2022 caused by storm No. 02

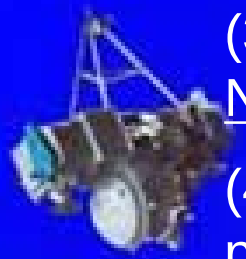
STT	Commune	Provice	Flooded area (ha)
1	Yên Khánh	Ninh Bình	1,132.36
2	Tiền Hải	Thái Bình	90.54
3	Vũ Thư	Thái Bình	799.97
4	Kiến Xương	Thái Bình	680.26
5	Thái Thụy	Thái Bình	1,556.28
6	T.x. Sầm Sơn	Thanh Hóa	11.55
7	T.P. Thanh Hóa	Thanh Hóa	78.34
8	Ngọc Lặc	Thanh Hóa	173.43
9	Cẩm Thủy	Thanh Hóa	1,473.16
10	Thạch Thành	Thanh Hóa	1,540.74
11	Hậu Lộc	Thanh Hóa	1,782.17
12	Thường Xuân	Thanh Hóa	32.19

Summary of 2023 results through SA system activation

(1) 18/07/2023: Monitoring flash floods and landslide in central coast region, Vietnam

(2) 05/08/2023: Monitoring flash floods and landslide in Mu Cang Chai district, Yen Bai Province

(3) 16/08/2023: Monitoring Landslide in Nghia Thanh Ward, Gia Nghia City, Dak Nong Province



(4) 12/09/2023: Monitoring flash floods and landslide in Lao Cai province

(5) 26/09/2023: Monitoring Flood cause by heavy rains in Central Vietnam

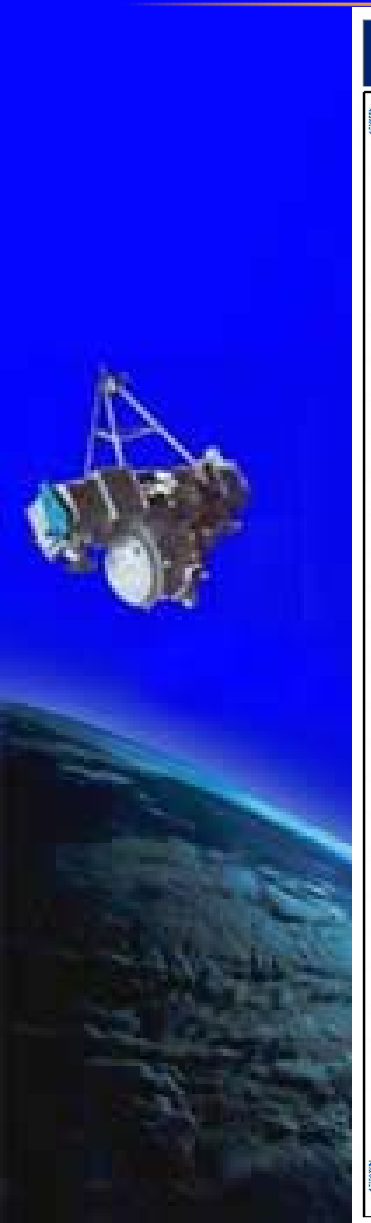
(6) 13/10/2023: Monitoring floods and landslide in central Vietnam

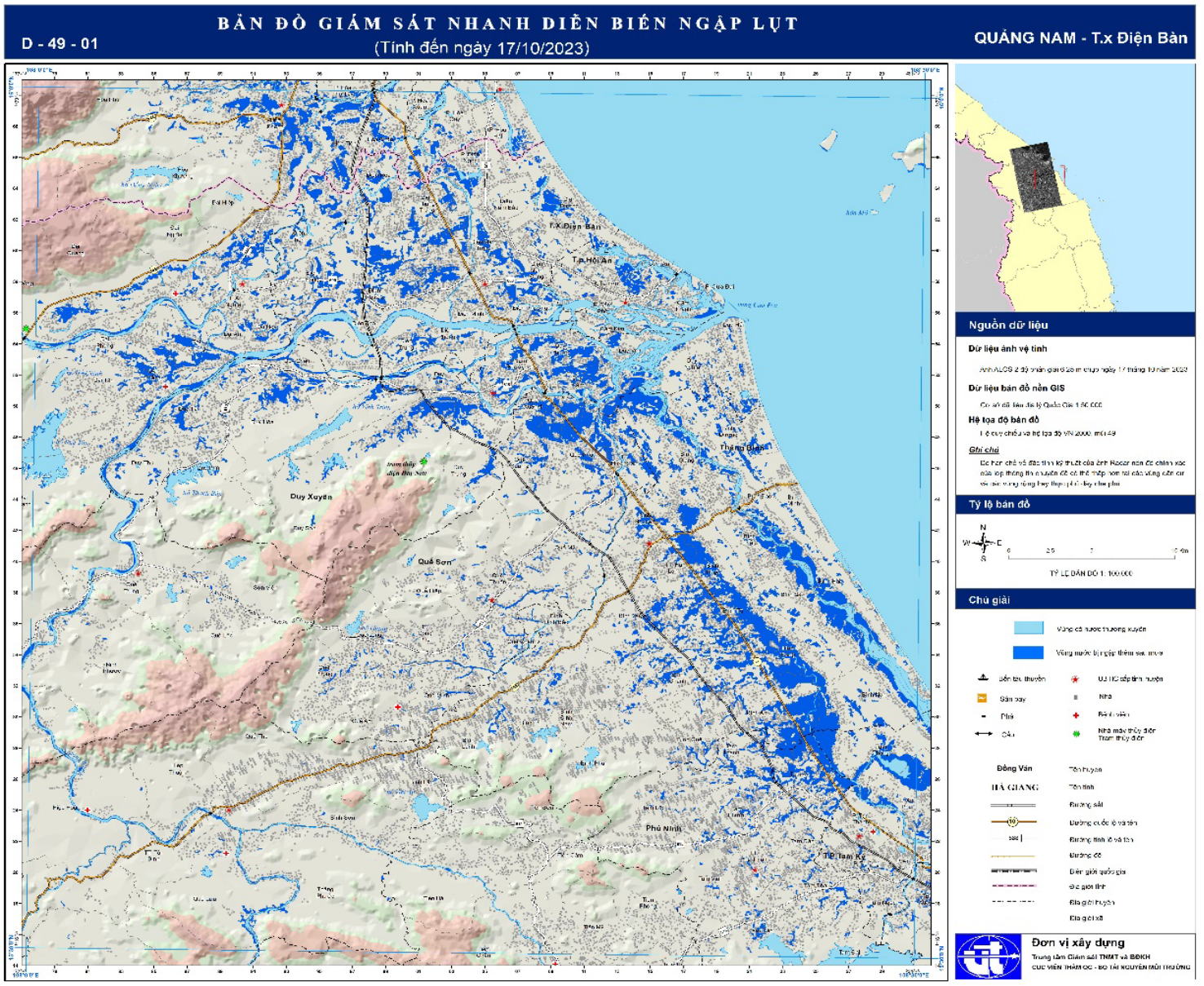
(7) 30/10/2023: Heavy Rains Flood in Ha Tinh province

(8) 15/11/2023: Monitoring floods and landslide in Thua Thien Hue province

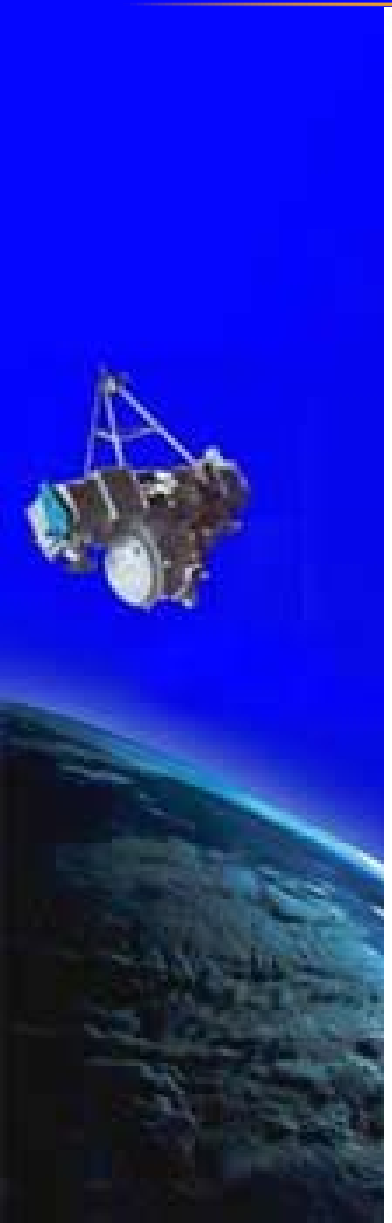
Field survey to check, evaluate and revise flood monitoring map products in some central provinces (22-24/9/2023)

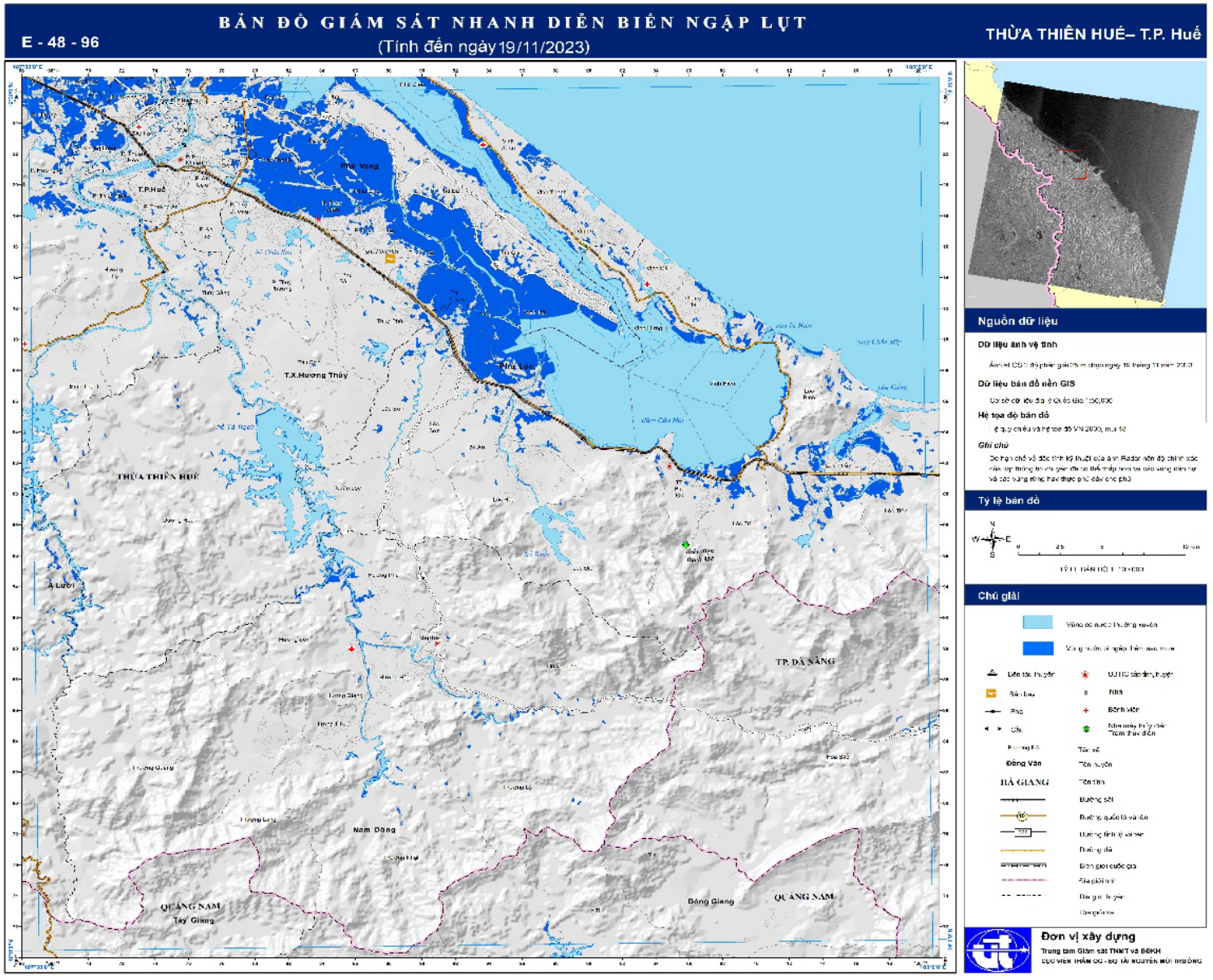
Quick monitoring map of flooding in Hoi An city, Quang Nam province on October 17, 2023 (inundated area information is extracted from satellite image ALOS 2).



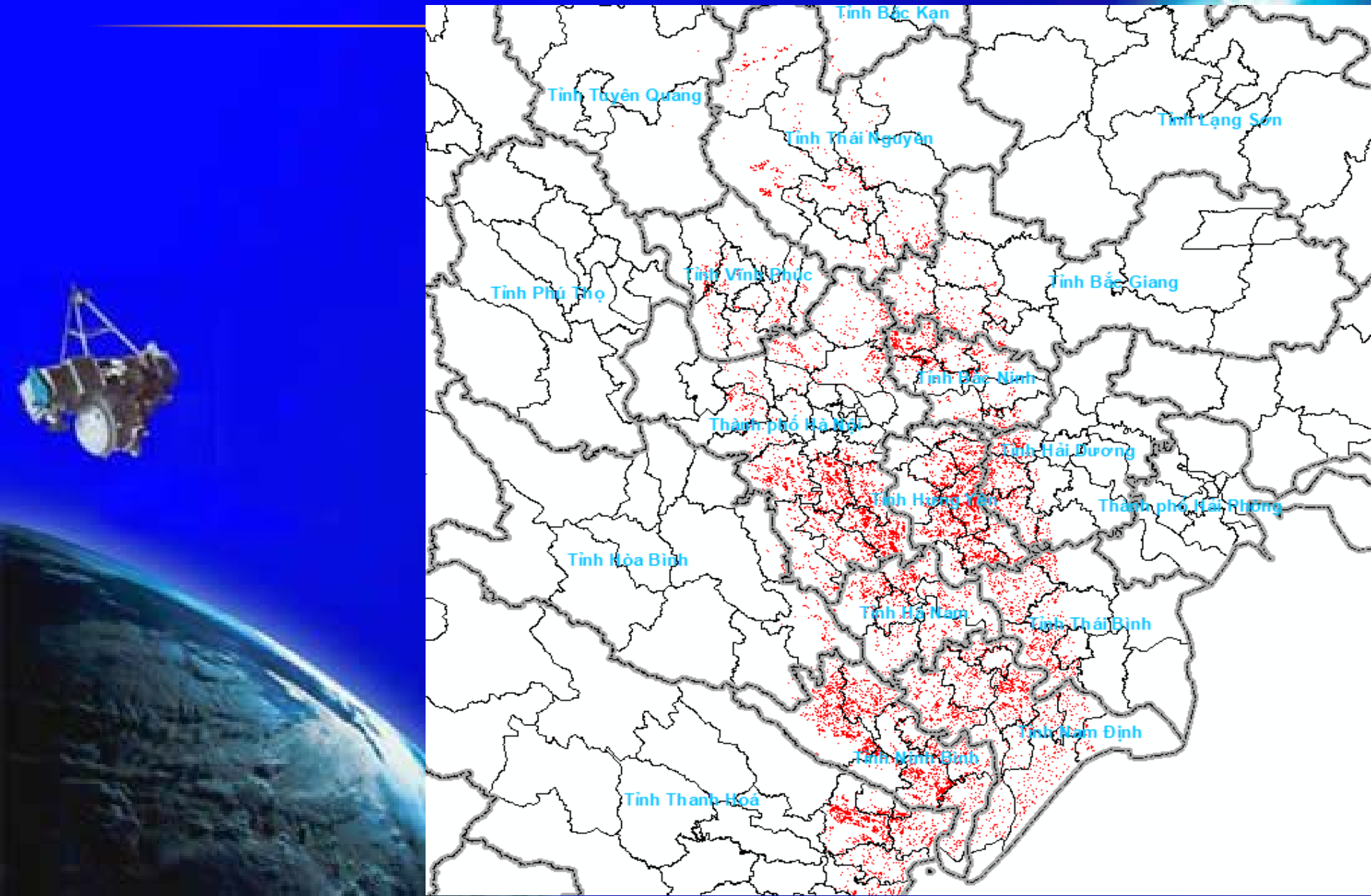


Quick monitoring map of flooding in Hue city, Thua Thien – Hue province on November 19, 2023.





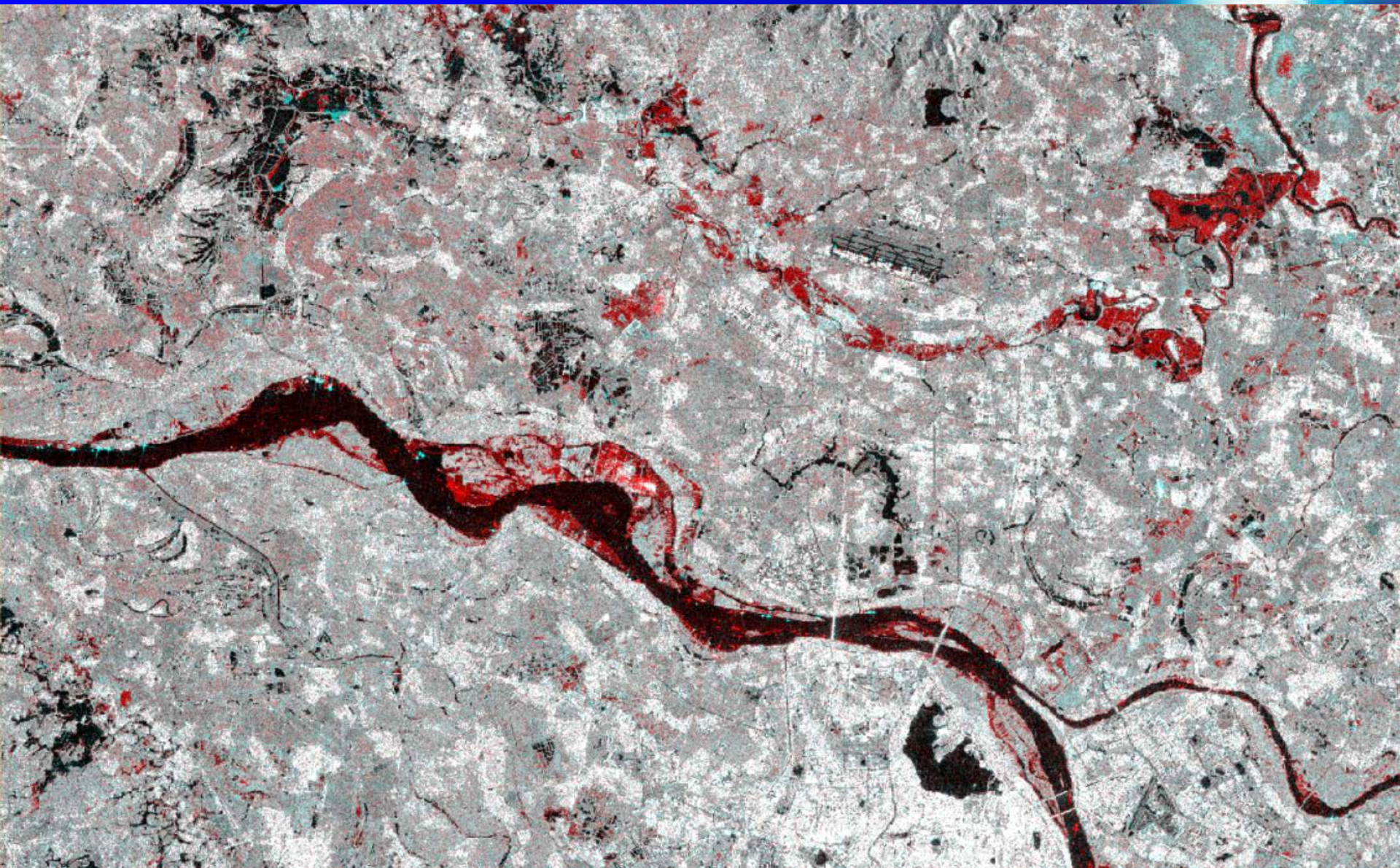
Flood layer extracted from 07 ALOS2 satellite image scenes taken on September 8, 2024 (Tropical Storm YAGY)



Flooded area statistics by district-level administrative unit from 07 ALOS2 satellite images taken on September 8, 2024 in the Northern provinces

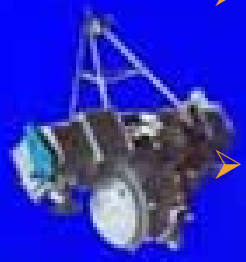
STT	Provice	Flooded area (ha)	Noted
1	Hà Nội	24.529,4	Including 21 district units
2	Bắc Giang	4.240,5	Including 6 district units
3	Bẫc Kạn	927,1	Including 5 district units
4	Bắc Ninh	8.012,0	Including 8 district units
5	Cao Bằng	176,2	Including 2 district units
6	Hà Giang	110,2	Including 1 district units
7	Hà Nam	7.969,9	Including 6 district units
8	Hải Dương	6.907,5	Including 5 district units
9	Hòa Bình	1.390,9	Including 4 district units
10	Hưng Yên	15.716,1	Including 10 district units
11	Nam Định	16.234,0	Including 10 district units
12	Ninh Bình	18.800,0	Including 8 district units
13	Thái Bình	8.125,8	Including 6 district units
14	Thái Nguyên	5.847,4	Including 9 district units
15	Thanh Hóa	11.180,9	Including 10 district units
16	Tuyên Quang	512,6	Including 5 district units
17	Vĩnh Phúc	3.233,3	Including 8 district units

RGB color composite image of Hanoi city area before (August 31) and after heavy rain (September 12) caused by storm Yagy



COMMENTS AND SUGGESTIONS

- Limitation of satellite observation for SAR data should be recognized by end-users. Ex: Urban Flood, Radar shadow, Data noise, etc.
- More frequent monitoring may be possible by constellation of satellite observation and collaboration with space agencies.
- Need building the database that include base map and other geographical maps to serve for disaster management.
- Combining technological solutions to provide highly reliable information on flood depth
- Training and technology transfer to support monitoring and relief work during natural disasters as well as post-disaster recovery for other types of dangerous natural disasters such as flash floods and landslides.



Philippine Space Agency

SENTINEL ASIA

JAXA

THANK YOU FOR YOR ATTENTIONS !!!