



Lao PDR Country Report

Status of Space Technology Application for DRR in Lao PDR"

by

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Contents

- Introduction;
- History related to Space Technology and Application for DRR in Lao PDR;
- Main Activities;
- Organization; and National Disaster Management Systems;
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Introduction

- Based on the Decree on the Implementation of the Ministry of Natural Resources and Environment (MONRE), Vientiane, Ref. 573/PM, Dated 20 September 2021.
- The country has declared the need for environmental protection law



Introduction

- To formulate the 9th National Socio-Economic Development Plan(NSEDP) 2021-2025, National Strategy on Disaster Risk Reduction (NSDRR) 2021-2030, and National Strategy on Climate Change toward 2030 and make accurate decisions. Early Warning for All Road Map 2024-2027. Remote sensing and GIS technology are efficient tools.
- Keys Institutions concerned with Space Technology and Applications are the following:

Introduction/ Keys institutions:

1. Remote Sensing Center, Natural Resources and Environment Institute (NRERI) Ministry of Natural Resources and Environment (MONRE)
2. Department of Meteorology and Hydrology (DMH), MONRE
3. Department of Water Resources, MONRE
4. Lao National Mekong Committee (LNMC), MONRE
5. National Geographic Department (NGD)
6. Department of Agriculture Land Management (DALAM), MAF
7. Department of Forestry (DOF), MAF
8. National Agriculture and Forest Research Institute (NAFRI), MAF
9. Ministry of Technology and Communication
10. Ministry of Education and Sport
11. Ministry of Labor and Social Welfare
12. National University of Lao (NUL)
13. Ministry of Public Work and Transport
14. Lao Statistics bureau

Hazard and Disaster in Lao PDR;

I. Natural Disaster

- **Flood** (river flood and flash flood)
- **Drought**
- **Tropical cyclones;**
- Landslide
- Earthquakes
- Epidemic (human and animal disease)

Man-made

- UXO
- Fire (Forest fire)



History: related to Space Technology and Application for DRR in Lao PDR/Sentinel Asia

August 2008 Flood Map of Laos

Details of Satellite images

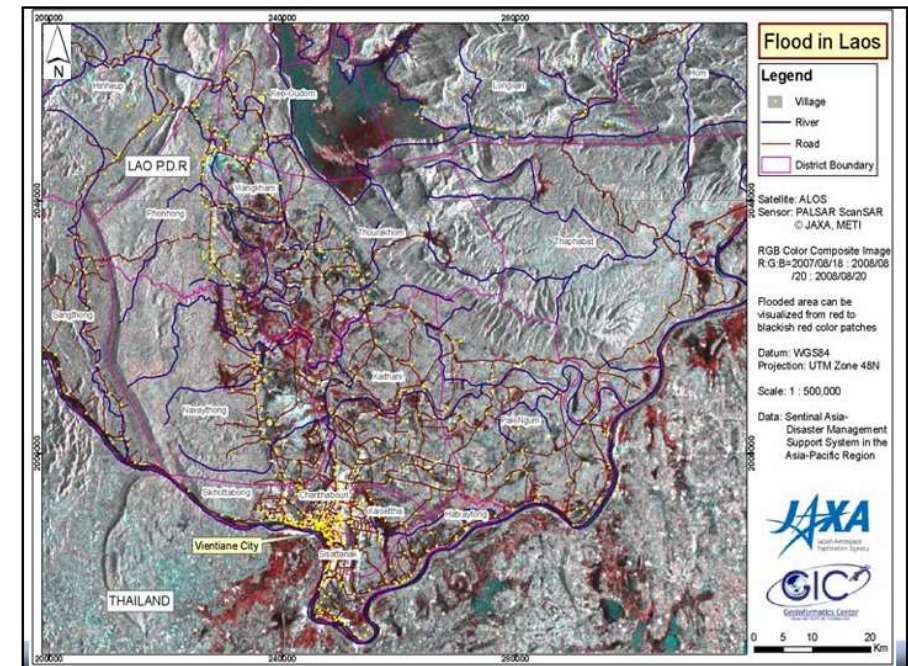
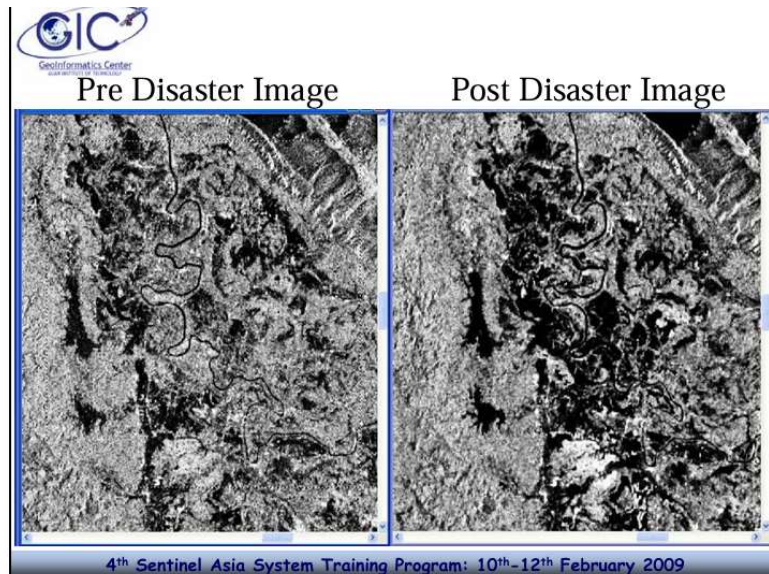
Satellite: ALOS

Sensor: PALSAR ScanSAR

Resolution: 100m

Dates of acquisition: 2008/08/20(post) and 2007/08/18(pre)

Data source : JAXA.METI



Histories of RSMD

SAFE Prototype for Forest Monitoring and Management in Laos



3rd SAFE workshop in Vientiane Capital, Lao PDR, 2011 June



Stakeholder Meeting in Lao PDR, 2011 September

Field Survey in Khammoune province



2009 Dec 5: visited Dongphusoy protected area



NRERI-MONRE
of Lao PDR

Activities in stakeholder meeting

Introduced overview of SAFE prototype and lectures on:

- GPS Photo Database.
- LCMAP generation and update with QGIS.
- Training with using MODIS and ALOS data of Laos.
- Hard and Soft copies of tutorials, with also USB

Trainees discussed and exchanged learning with trainer about RS technology, satellite image and application.



JAXA/AIT/ Mini-Project: Flood Monitoring using RS&GIS 2006-2008



Field survey surrounded the flood damage area in Vientiane Capital of Laos on 11-15 August 2008.



+

NRERI-MONRE of
Lao PDR

On-the-Job training materials

Introduced SAFE data and software package:

- GRASS open-source land cover classification software working on MODIS and ALOS.
- Linux live system on DVD or USB.
- MODIS and ALOS data of Laos.
- Hard and Soft copies of tutorials

Trainees were trained to process GPS Photos and do land cover classification



Flooding in 2008, Vientiane Capital of Lao PDR

Disaster Research: Flood Monitoring

1. The RSC/WERI/WREA responsible of the National Working Group of the flood information in Lao PDR.
2. Monitor and access the area of flood/Real time/before/after



Lat: 17° 51' N; Long: 102° 34' E

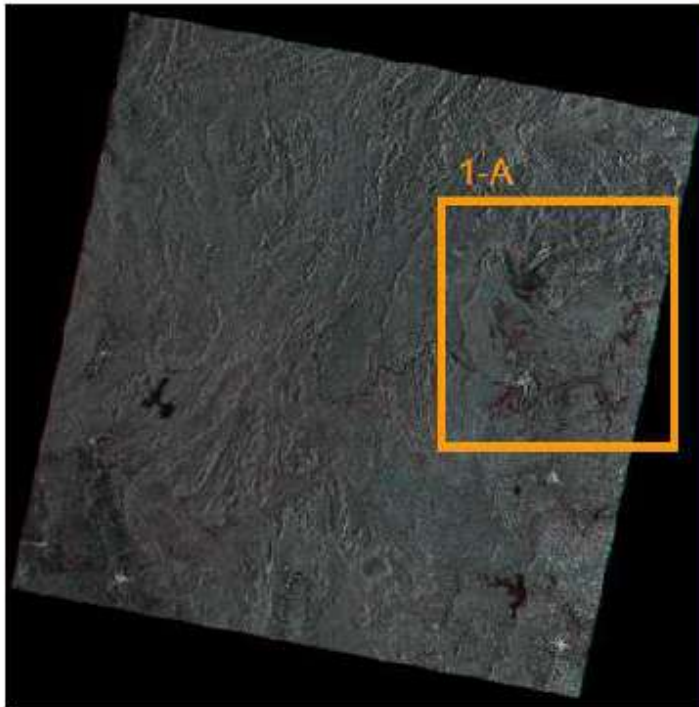
Nov 14, 2008. Bo-O, Vientiane

Flood Monitoring/ Sentinel Asia

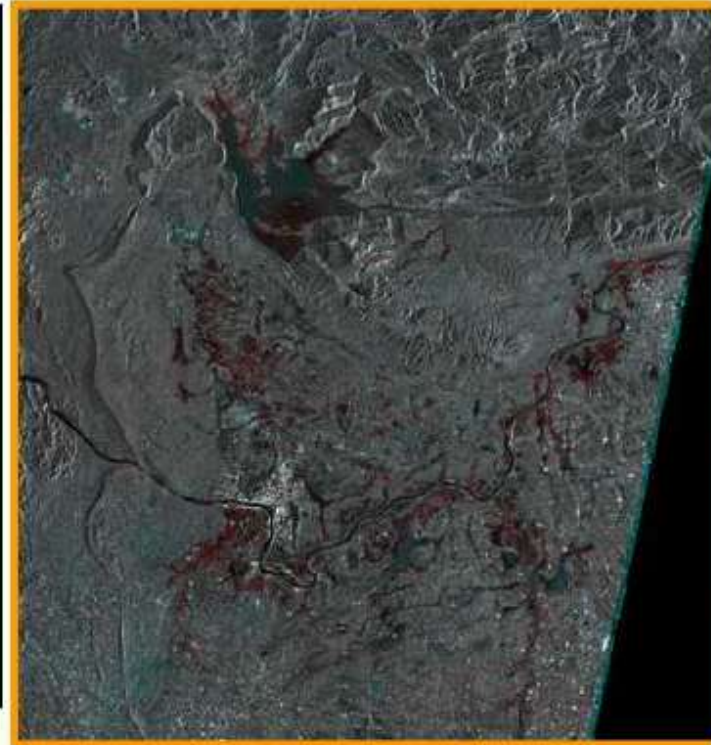
1. RSC, NRERI, MONRE Responsible for the National Working Group of the flood information in Lao PDR
2. Data sharing between line government agencies, and international organizations.
3. Monitor and Access the area of flood/real time/before/after

Request Sentinel Asia in case emergency: Coordinate, Pictures, sharing data information...

Flooded area detected from ALOS PALSAR ScanSAR

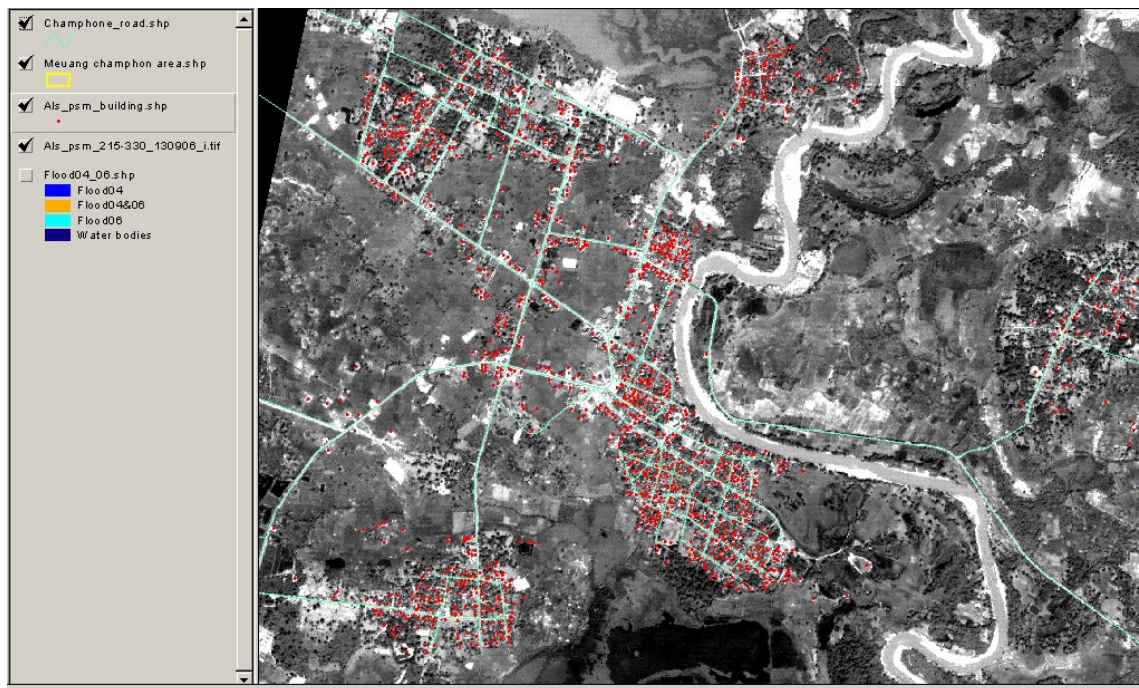


RGB color composite image of PALSAR ScanSAR.
R:G:B=2007/08/18:2008/08/20:2008/08/20
(R:G:B=pre-:post-:post-disaster)

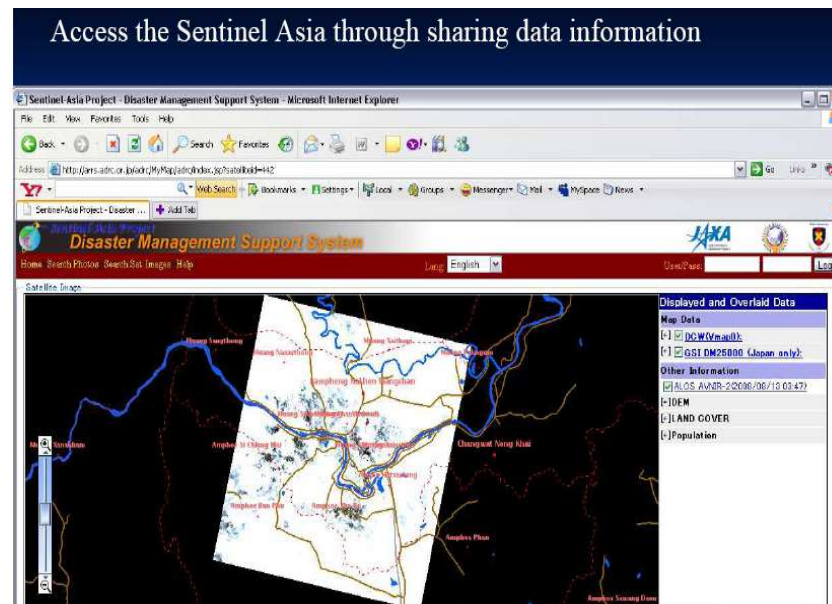
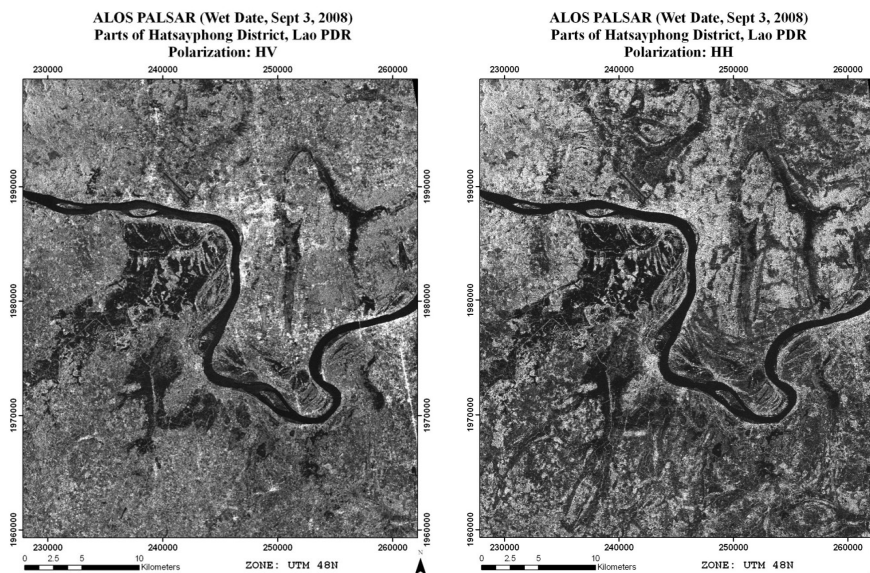


Enlarged view of area 1-A
Flooded area can be estimated as red colored area.

Available Imagery

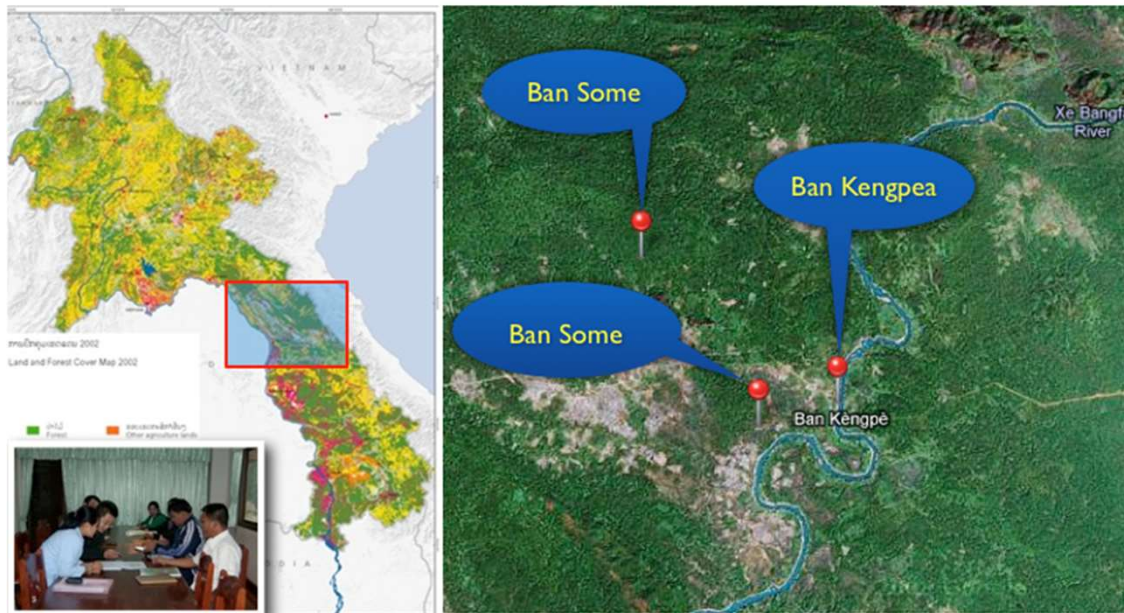


ALOS –PRISM13 September 2006
Champhone District, Savannakhet Province



Successful Project: SAFE prototype in Lao PDR

🍏 Dec. 5, 2009: visited Dongphousoy protected area



SAFE prototype for forest monitoring and management in Laos PDR

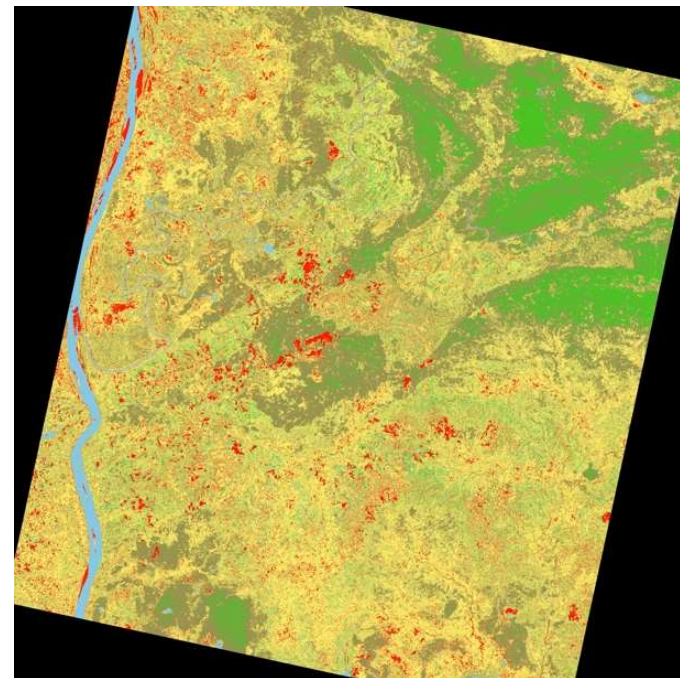
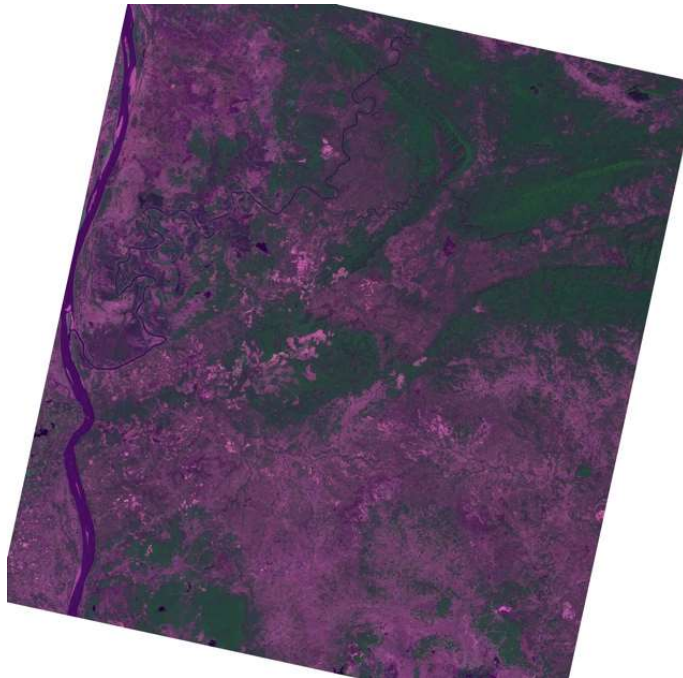
Field trip in Khammouane



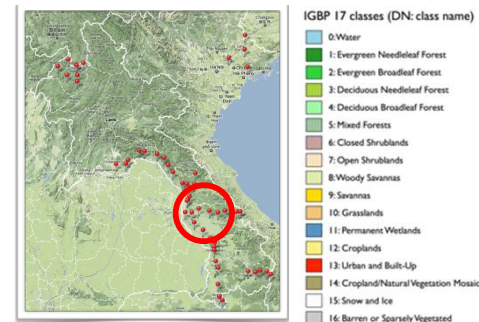
- Photos
- Longitude, Latitude, Altitude
- Wind speed
- Air temperature
- Soil temperature
- Relative Air Humidity (RAH)
- VWC (Volumetric Water Content)
- Main species



ALOS AVNIR2 land cover map of Khammouane province in 2009



- Acquisition date: 2009 Feb 20
- Scene center: 16.93N, 105.06E
- Covering: Khammouane province
- Validated with GPS Photo



Sentinel Asia STEP 2



The 4th Sentinel Asia System Operation Training was held on 10-12 February 2009 in Vientiane

- Sponsor by JAXA
- Organized by RSC/WERI/WREA
- attended by 13 Asia Pacific countries including 6 ASEAN Member States namely Indonesia, Lao PDR, Malaysia, Philippines, Thailand and Viet Nam.



The 5th Sentinel Asia System Operation Training was held in Colombo, Sri Lanka in 22 – 26 February 2010.

The 6th SAS Operation Training was held in July, 2010, Bangkok, Thailand..

ASEAN COOPERATION PROJECT ON UTILIZATION OF SPACE-BASED TECHNOLOGIES FOR DISASTER RISK MANAGEMENT

One day Seminar in Vientiane and 5 days of Technical Training in Vientiane

- **Dated:** 16th July 2010
Organized by WREA, Lao PDR in collaboration with ADRC and GIC, AIT.
- **Venue:** Settha Palace Hotel
- **Participants:** about 70
from different agencies (government, international national university)
- **Technical training dated:** 19-23 July 2010
Organized by WREA, Lao PDR in collaboration with ADRC, GIC/ AIT.
- **Participants:** about 25 from different line agencies and the National University of Laos



Main Activities:

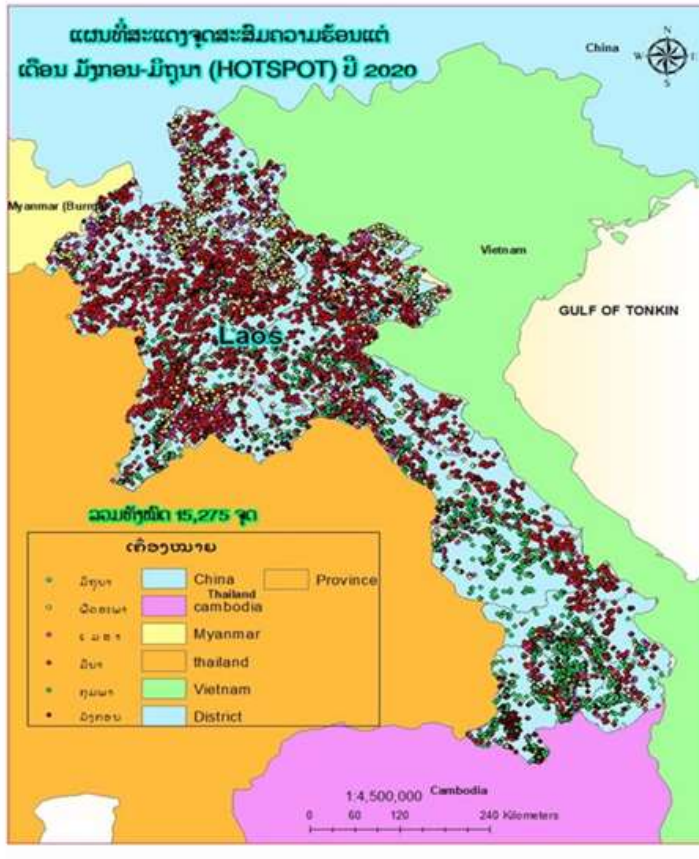
RSC, NRERI:

- Emergency observation in case of major disasters by ALOS + ...
- Wildfire monitoring by MODIS: Technology transfer from GIC/AIT
- Flood monitoring:
- Research/Training/Mini-project for utilization of satellite images for environment monitoring and disaster monitoring.
- Space Application for Environment

DMH:

- Radar satellite
- Forecasting Meteorology and Hydrology
- Agro Climate
- Earthquake information

Main Activities, RSMD



ແຫຼ່ງຂໍ້ມູນ: ຕາມໂຫຼດຂໍ້ມູນຈາກເວັບໄຊ <https://firms.modaps.eosdis.nasa.gov/map>
 ຈັດຕັ້ງປະຕິບັດ ໂດຍ: ມະແນນເສີຍຍິງທາງໄຮ ແລະ ແຜນທີ່
 ສະຖາບັນຄົ້ນຄວ້າ ແລະ ສະຖິຕິ ຊີ້ນະຍາ ເອກທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ
 ະເຊວງ ຊີ້ນະຍາ ເອກທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ

ເສັ້ນສະແດງ ແລະ ຕາຕະລາງສະຫຼຸບຂອງເນີ້ງົດຂຶ້ນຫຼາຍ:

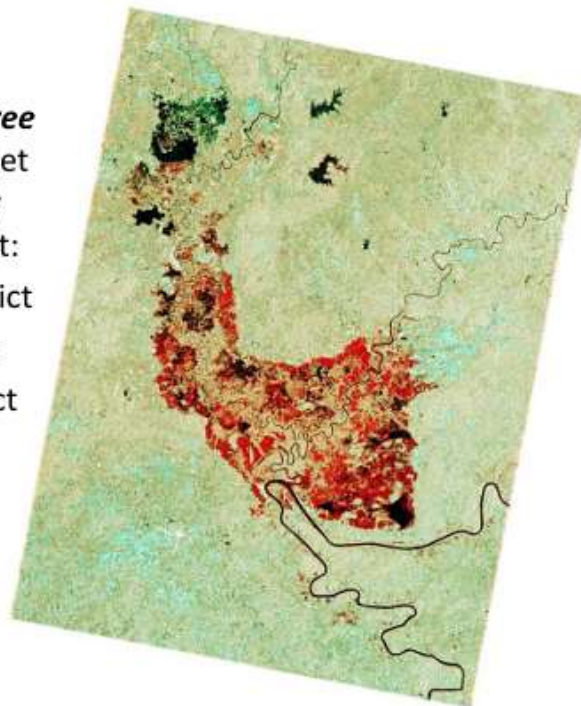


ລ/ດ	ຊື່	ມັງກອນ	ກຸມພາ	ມີນາ	ເມສາ	ພຶດສະພາ	ມິຖຸນາ	ລວມ
1	ຫຼຽມຜາງ	73	97	2291	29	294	1	2785
2	ຫົວພັນ	54	80	898	39	299	13	1304
3	ອຸດົມໄຊ	11	35	883	54	139	1	1123
4	ໄຊຍະບູລີ	85	194	779	9	29	0	1096
5	ວຽງຈັນ	88	107	629	85	92	2	1003
6	ຜົງສາລີ	38	23	509	210	152	3	935
7	ບໍລິຄໍາໄຊ	80	309	373	106	47	6	921
8	ຊຽງຂວາງ	88	206	551	15	30	9	899
9	ຈໍາປາສັກ	276	400	92	18	15	4	805
10	ສະຫວັນນະເຂດ	67	326	224	20	11	1	649
11	ອັດຕະນີ	98	320	137	50	21	13	639
12	ຫຼວງນໍ້າທາ	30	26	474	56	37	4	627
13	ບໍ່ແກ້ວ	7	6	421	76	73	7	590
14	ຄຳມ່ວນ	70	226	250	9	10	1	566
15	ສາລະວັນ	56	228	147	8	2	1	443
16	ໄຊຊຶມບູນ	43	111	206	8	15	1	384
17	ເຊກອງ	24	123	111	5	2	1	266
18	ນະຄອນຫຼວງ	43	37	72	18	7	3	180
ລວມທັງໝົດ		1,231	2,854	9,047	815	1,275	71	15,275

Flood Monitoring

ແຜນທີ່ສະແດງນ້ຳຖ້ວມ

ພາບຖ່າຍດາວທຽມ Sentinel 1



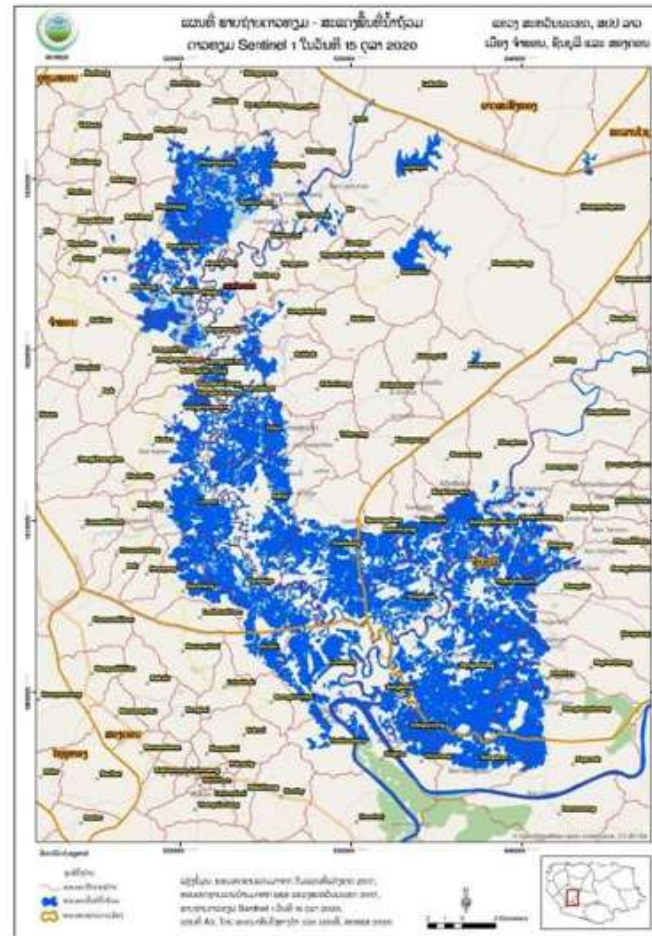
Flood monitoring, **Three** districts of Savannakhet Provinces, affected by climate change impact:

- Champhone district
- Xonboursy district
- Songkhone district


ຄຳອະທິບາຍ:

ການສະແດງພາບຖ່າຍດາວທຽມ Sentinel 1 ຈື່ງ 2 ຊ່ວງເວລາ ກ່ອນການເຮັດ ພະຍາດຖ້ວມ ແບບຖ້ວມກະທັນມາດເປັນຄື:

- **ສີດຳ:** ພາບຖ່າຍດາວທຽມ Sentinel 1 ຂອງວັນທີ 10 ສິງຫາ 2020 ເປັນຊ່ວງໄລຍະເວລາກ່ອນການເຮັດນ້ຳຖ້ວມ.
- **ສີແດງ:** ພາບຖ່າຍດາວທຽມ Sentinel 1 ຂອງວັນທີ 15 ຕຸລາ 2020 ເປັນຊ່ວງໄລຍະເວລາພາຍໃຕ້ນ້ຳຖ້ວມ.




Mini Project (Lao Version) founded by MONRE


 ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ
 ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ


ກະຊວງ ສູນເອກະກອນທຳນະຊາດ ແລະ ສິ່ງແວດລ້ອມ
 ສະຖາບັນ ທີ່ບໍລິຫານເອກະກອນທຳນະຊາດ ແລະ ສິ່ງແວດລ້ອມ

ຄູ່ມື
 ທິດສະດີພື້ນຖານ ກ່ຽວກັບ ເຕັກໂນໂລຊີ 3S ແລະ
 ການນຳໃຊ້ໂປຣແກຣມ Google Earth



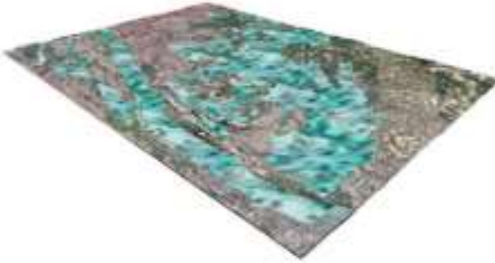
ຈົດໝົດໂດຍ: ສະຖາບັນ ທີ່ບໍລິຫານເອກະກອນທຳນະຊາດ ແລະ ສິ່ງແວດລ້ອມ, ກສສ
 ພະແນກສູງສູງວຽງຈັນ, 25 ກັນຍາ 2019

Fundamental Theories on 3S Technology and Google Earth Application


 ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ
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ກະຊວງ ສູນເອກະກອນທຳນະຊາດ ແລະ ສິ່ງແວດລ້ອມ
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ບົດລາຍງານວິຊາການ
 ການປະເມີນພື້ນທີ່ນ້ຳຖ້ວມໂດຍການນຳໃຊ້ເຕັກໂນໂລຊີພາບ
 ຖ່າຍດາວທຽມ ຢູ່ ເມືອງໜອງບົກ, ແຂວງຄຳມ່ວນ



ຈົດໝົດໂດຍ: ພະແນກ ສືບສຶງຄາງໄກ ແລະ ແຜນທີ່
 ສະຖາບັນ ທີ່ບໍລິຫານເອກະກອນທຳນະຊາດ ແລະ ສິ່ງແວດລ້ອມ, ກສສ
 ພະແນກສູງສູງວຽງຈັນ, 05 ສິງຫາ 2020

Satellite Imagery Technology-based Assessment of Flood Area. Case Study: Nongbok District, Khammouane Province


 ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ
 ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

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ບົດລາຍງານວິຊາການ
 ການສຶກສາລັກສະນະໂຄງສ້າງເສັ້ນຮອຍເລື້ອນເທິງໜ້າດິນ
 ໂດຍການນຳໃຊ້ເຕັກໂນໂລຊີພາບຖ່າຍດາວທຽມ
 ຢູ່ ເມືອງແກ້ວອຸດົມ, ແຂວງວຽງຈັນ



ຈົດໝົດໂດຍ: ສະຖາບັນ ທີ່ບໍລິຫານເອກະກອນທຳນະຊາດ ແລະ ສິ່ງແວດລ້ອມ, ກສສ
 ພະແນກສູງສູງວຽງຈັນ, 29 ຕຸລາ 2020

Estimating Lineament in Keo Oudom District, Vientiane Province


??

FLOOD EARLY WARNING SYSTEM Supported by Rep. of Korea (NDMI)

Real-Time Monitoring | Observed Data Management | Station Management | Watershed Information

Datetime 2021-04-19 17:20 Reference for Flood

Flood years
 ON / OFF
 100 years



Water Level Station

Station	Current WL (ELm)	Alert (ELm)	Alarmwl (ELm)	Critical (ELm)
Nam Xong	WL-1 267.922	269.680	270.660	271.470
	WL-2 288.219	290.430	291.330	292.140
Nam Beng	WL-1 0.000	532.450	532.820	533.150
	WL-2 460.450	465.930	466.410	466.830
Nam Mao	WL-1 822.374	824.090	825.110	826.130

Rainfall Station

Station	RF 10min [mm]	RF 1H [mm]	RF 3H [mm]	RF 6H [mm]
Nam Xong	RG-1 0.0	0.0	0.0	0.0
	RG-2 0.0	0.0	0.0	0.0
Nam Beng	RG-1 0.0	0.0	0.0	0.0
	RG-2 0.0	0.0	0.0	0.0
Nam Mao	RG-1 0.0	0.0	0.0	0.0

Warning Post

Station	Datetime	Signal	Execution
<input type="checkbox"/> Nam Xong-WP-1	2018-07-20 11:01	Normal	
<input type="checkbox"/> Nam Xong-WP-2	2018-06-22 11:26	Normal	
<input type="checkbox"/> Nam Beng-WP-1	2018-05-14 13:32	Normal	
<input type="checkbox"/> Nam Beng-WP-2	2018-07-20 08:58	Normal	
<input type="checkbox"/> Nam Mao-WP-1	2019-07-19 14:22	Normal	
<input type="checkbox"/> Nam Hin-WP-2	2019-07-19 12:40	Normal	


Warning Signal

Normal | Alert | Alarm | Critical

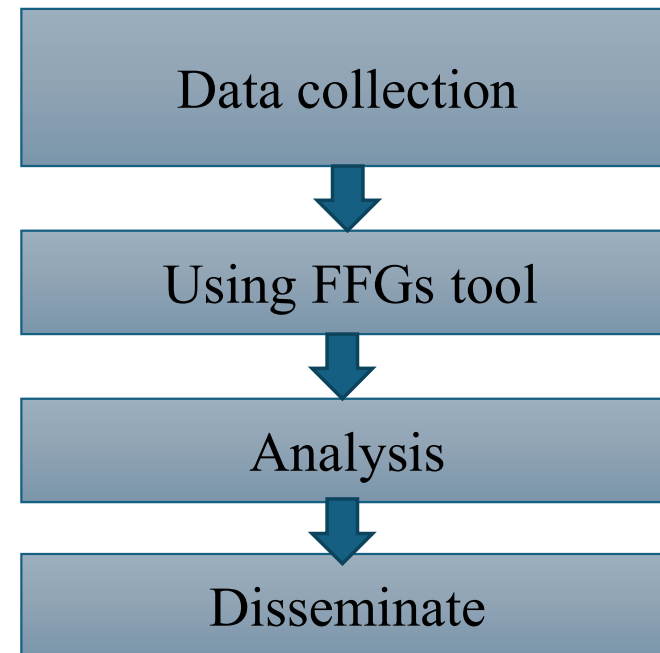
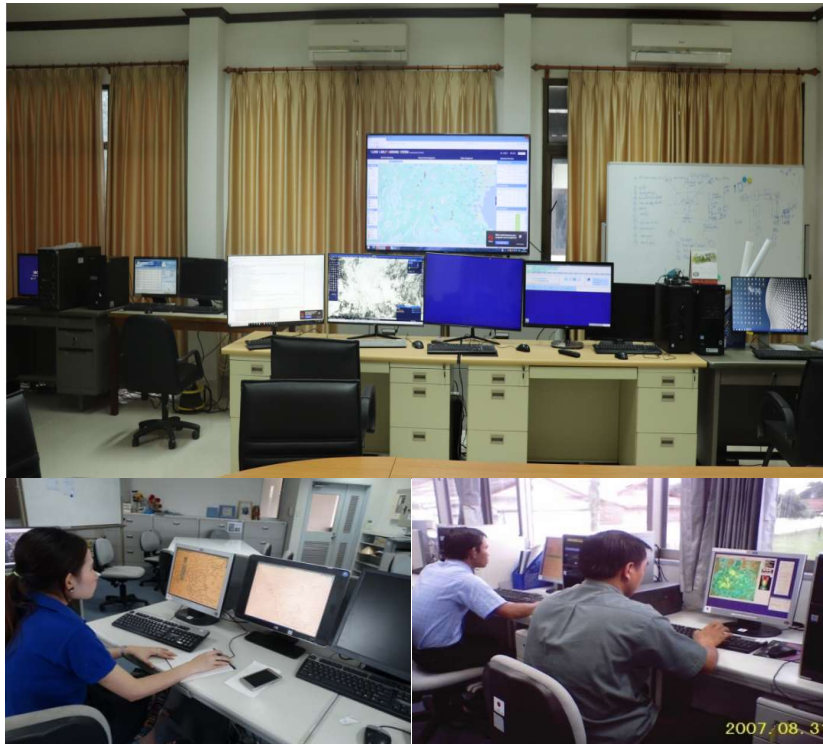
Send | Cancel

Warning signal

- Normal
- Alert
- Alarm
- Critical



Early warning: Flash flood



Early warning: Flash flood

Starting from June to October, recorded water level along the river basin and dam and warning before 02 days.

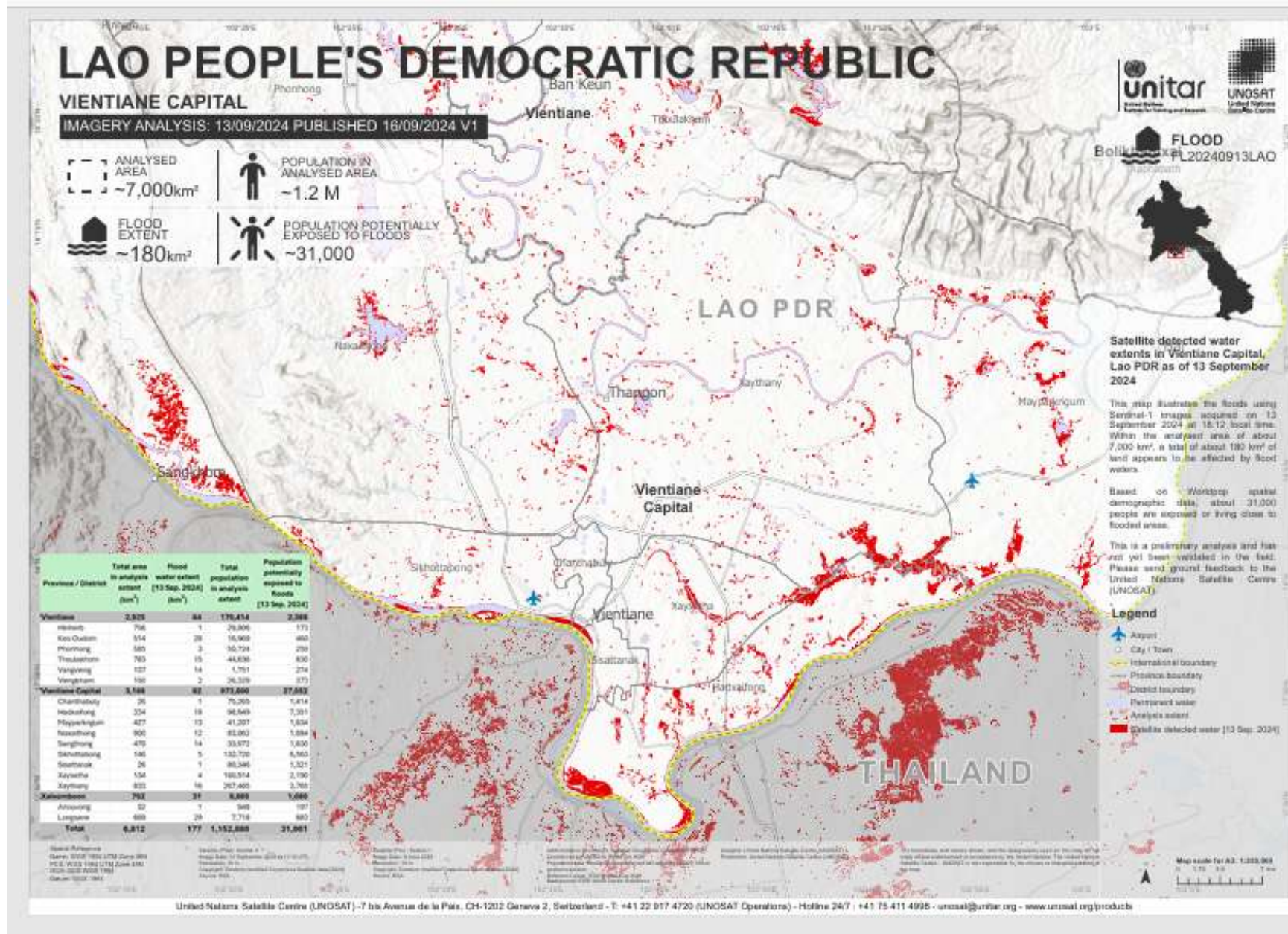
ພະຍາກອນລະດັບນໍ້າແມ່ນໍ້າຂອງ ແຕ່ວັນ 07 - 08 ມິຖຸນາ 2022

ລ/ດ	ຊື່ສະຖານີ ແລະ ແມ່ນໍ້າ	ຜົນ 24 ຊົ່ວໂມງ	ລະດັບນໍ້າ (໔ມັດ)			ລະດັບ ເຕືອນໄພ (໔ມັດ)	ລະດັບ ອັນຕະລາຍ (໔ມັດ)	ພະຍາກອນລະດັບນໍ້າ	
		06/06/2022	05/06/2022	06/06/2022	ຄ່າແຕກຕ່າງ			07/06/2022	08/06/2022
1	ຫຼວງພະບາງ (ນໍ້າຂອງ)	0.0	10.46	10.50	0.04	17.50	18.00	↓ 10.24	↓ 9.98
2	ວຽງຈັນ (ນໍ້າຂອງ) ຫຼັກ4	0.0	4.76	4.91	0.15	11.50	12.50	↑ 5.00	↑ 5.09
3	ປາກຊັນ (ນໍ້າຂອງ)	4.7	5.99	5.97	-0.02	13.50	14.50	↑ 6.05	↑ 6.09
4	ທ່າແຂກ (ນໍ້າຂອງ)	0.1	6.42	6.34	-0.08	13.00	14.00	↑ 6.37	↓ 6.33
5	ສະຫວັນນະເຂດ(ນໍ້າຂອງ)	0.0	3.83	3.63	-0.20	12.00	13.00	↓ 3.59	↓ 3.57
6	ປາກເຊ (ນໍ້າຂອງ)	0.0	4.74	4.77	0.03	11.00	12.00	↓ 4.66	↓ 4.59
7	ມະຫາໄຊ (ເຊບຶ້ງໄຟ)	0.0	5.80	5.62	-0.18	14.00	15.00	↓ 5.50	↓ 5.47
8	ຂົວເຊບຶ້ງໄຟ (ເຊບຶ້ງໄຟ)	0.0	10.00	9.77	-0.23	17.50	18.50	↓ 9.55	↓ 9.50
9	ໜ້າເຂື່ອນນ້ຳງື່ມ 1	0.0	203.17	203.09	-0.08	212.00	212.31	↓202.99	↓202.95
10	ຫຼັງເຂື່ອນນ້ຳງື່ມ 1		168.40	168.20					
11	ນໍ້າໄຫຼເຂົ້າອ່າງນ້ຳງື່ມ 1 (m ³ /s)		429.30	362.01					
12	ນໍ້າໄຫຼຜ່ານກົງຫັ້ນ (m ³ /s)		730.82	663.53					
13	ນໍ້າຜ່ານປະຕູນ້ຳລົ້ນ (m ³ /s)								

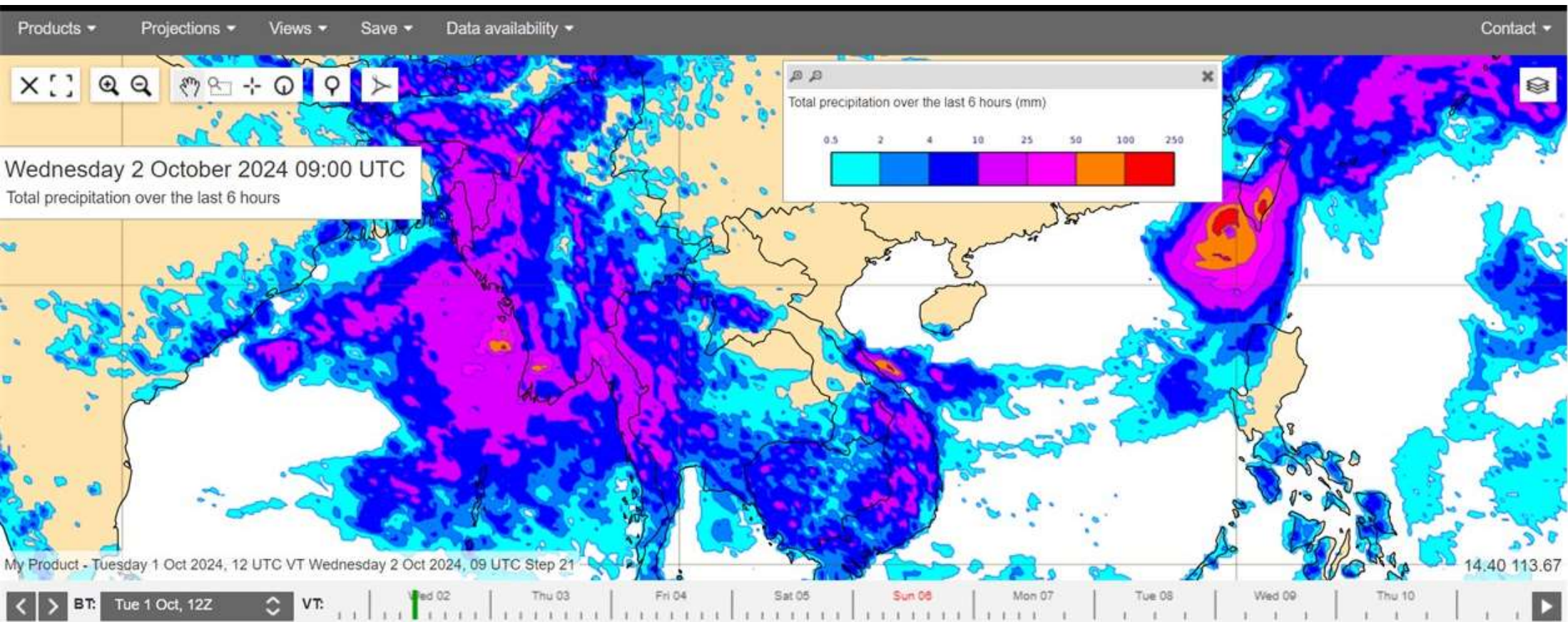


	□□□□□□□	The monitoring water level is lower than the warning level
	□□□□□□□□□□□□□□	The water level continues to rise → □□□□□□□□□□□□□□
	□□□□□□□□□□□□□□	The monitoring water level is continues to rise above the dangerous level → □□□□

Flood 13,
 Aug 2024
 Vientiane
 Laos
 Received from
 UNOSAT
 Unitar

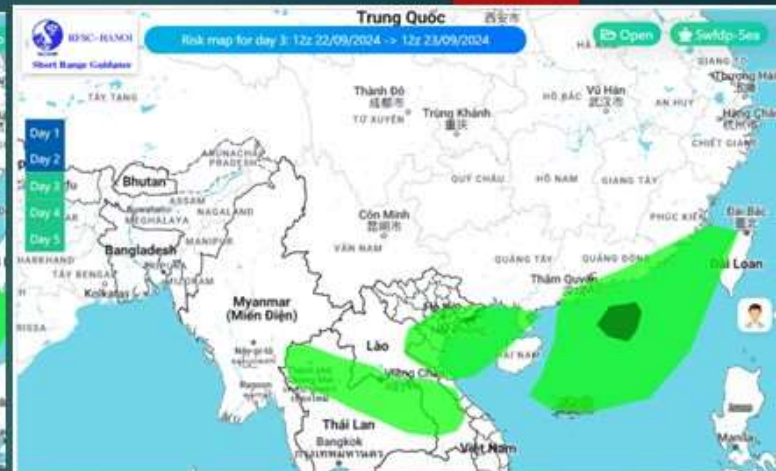
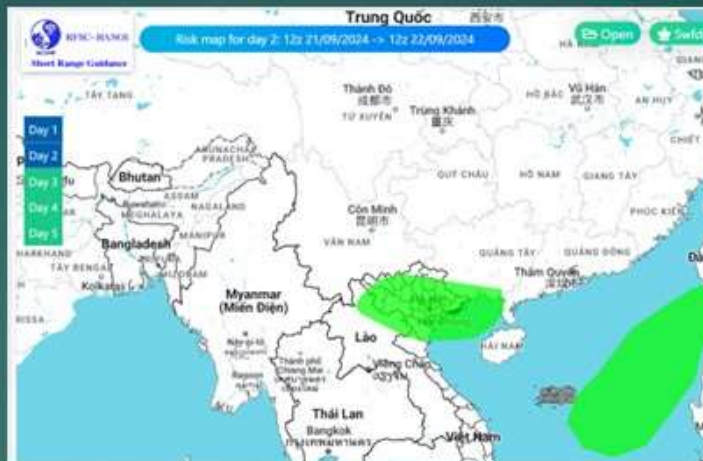


ECMWF Model / Precipitation, 02/10/2024



ຂໍ້ມູນພະຍາກອນປະລິມານນໍ້າຝົນ ວັນທີ 02/10/2024 ຈາກໂມເດວ ECMWF

ພະຍຸດີເປຣຊັ້ນ (SOULIK) ເປັນສາເຫດທີ່ພາໃຫ້ເກີດຝົນຄ່ອຍ ຫາຝົນຕົກໜັກ ວັນທີ20-22/9/2024

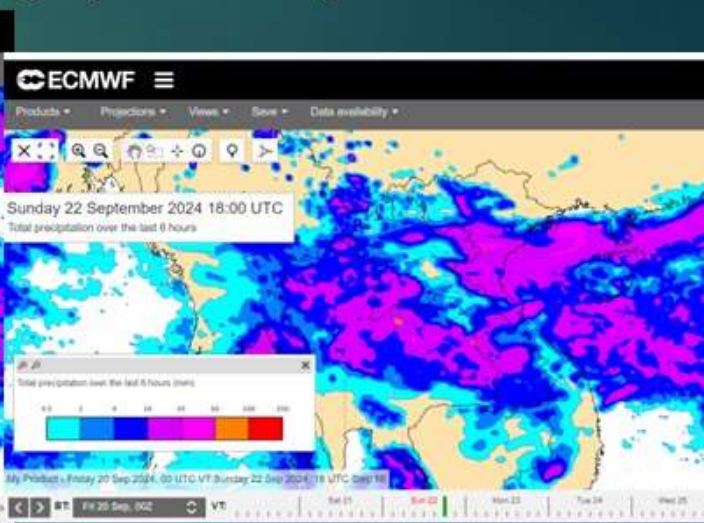
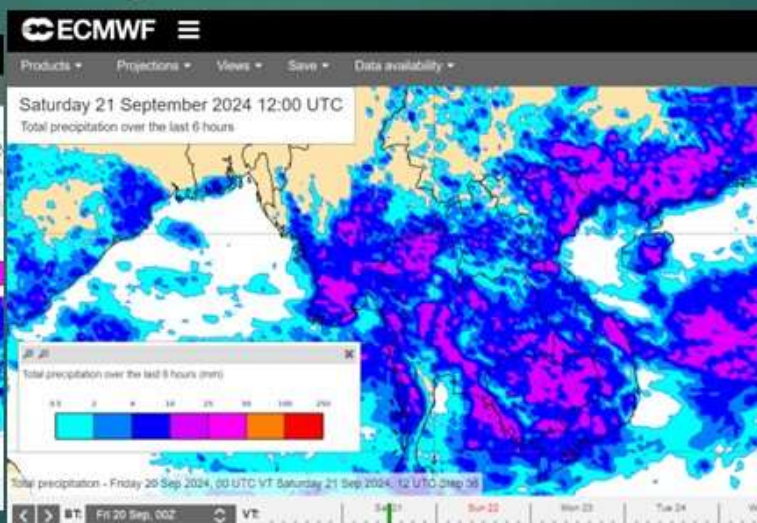
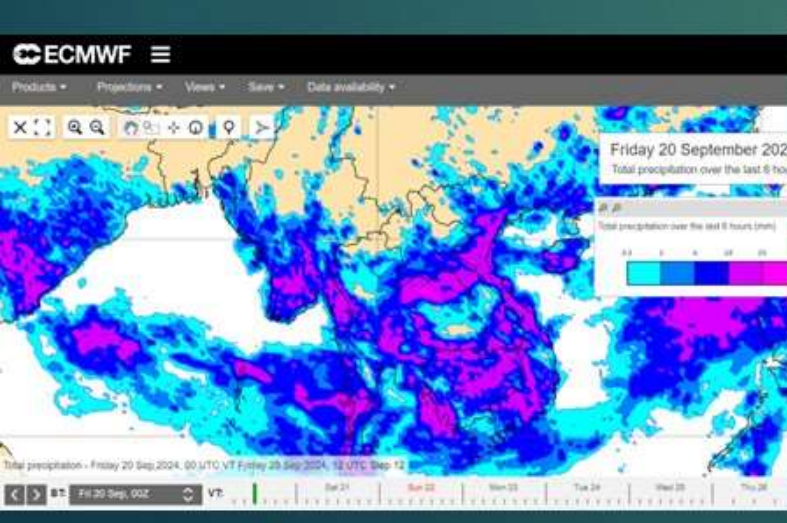


20/09/2024

21/09/2024

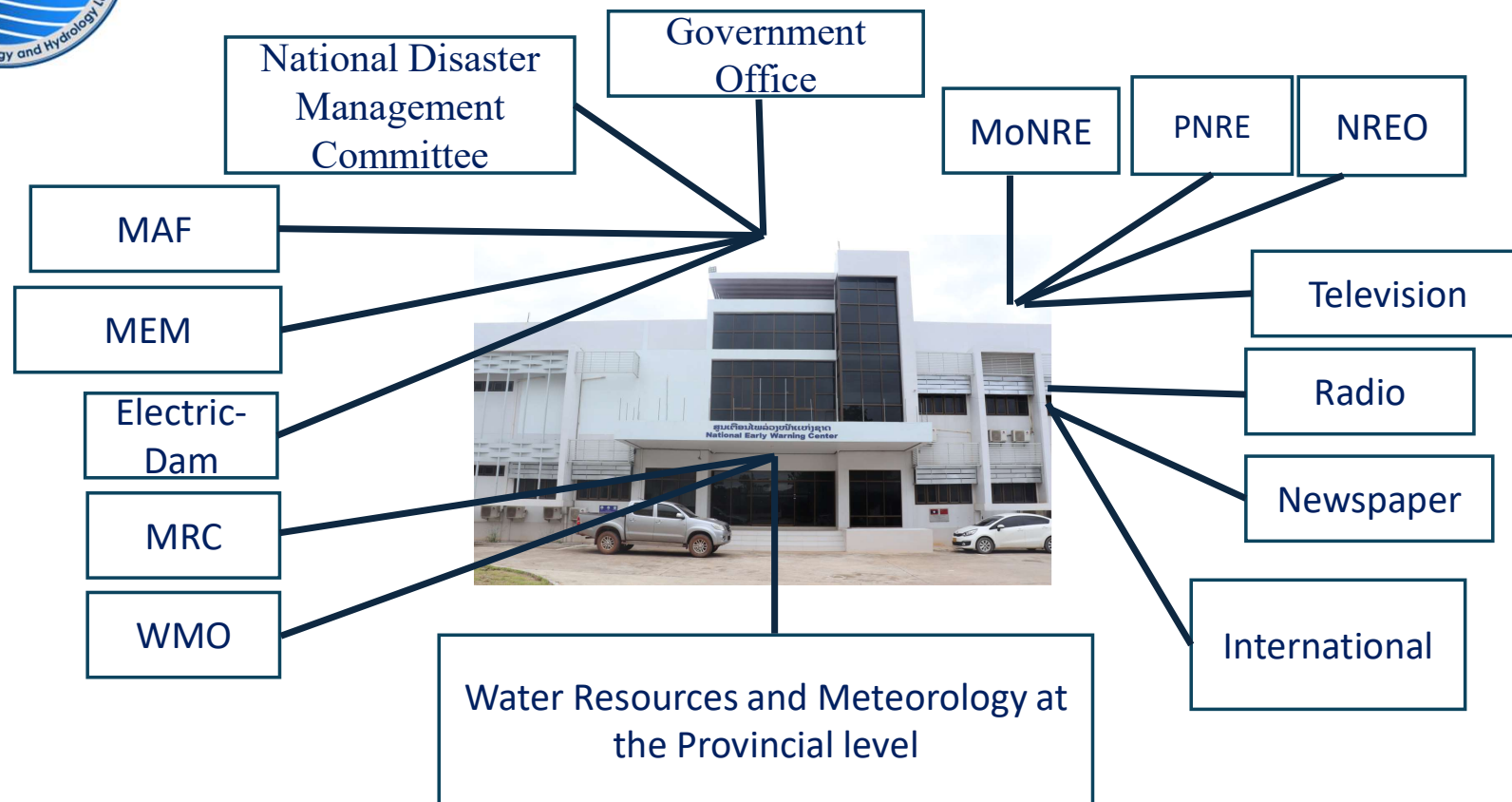
22/09/2024

Medium confidence of heavy rain >50mm/24h due to a high-pressure system.





Dissemination of Forecasts and Warnings



National Disaster Management Committee in Lao PDR

Based on decree No. 199/PM, signed by the Prime Minister dated 8 May 2023, provides for the establishment of a ministerial National Disaster Management Committee (NDMC) as a policy-making and coordination body. The NDMC consists of representatives from 13 key Ministries:

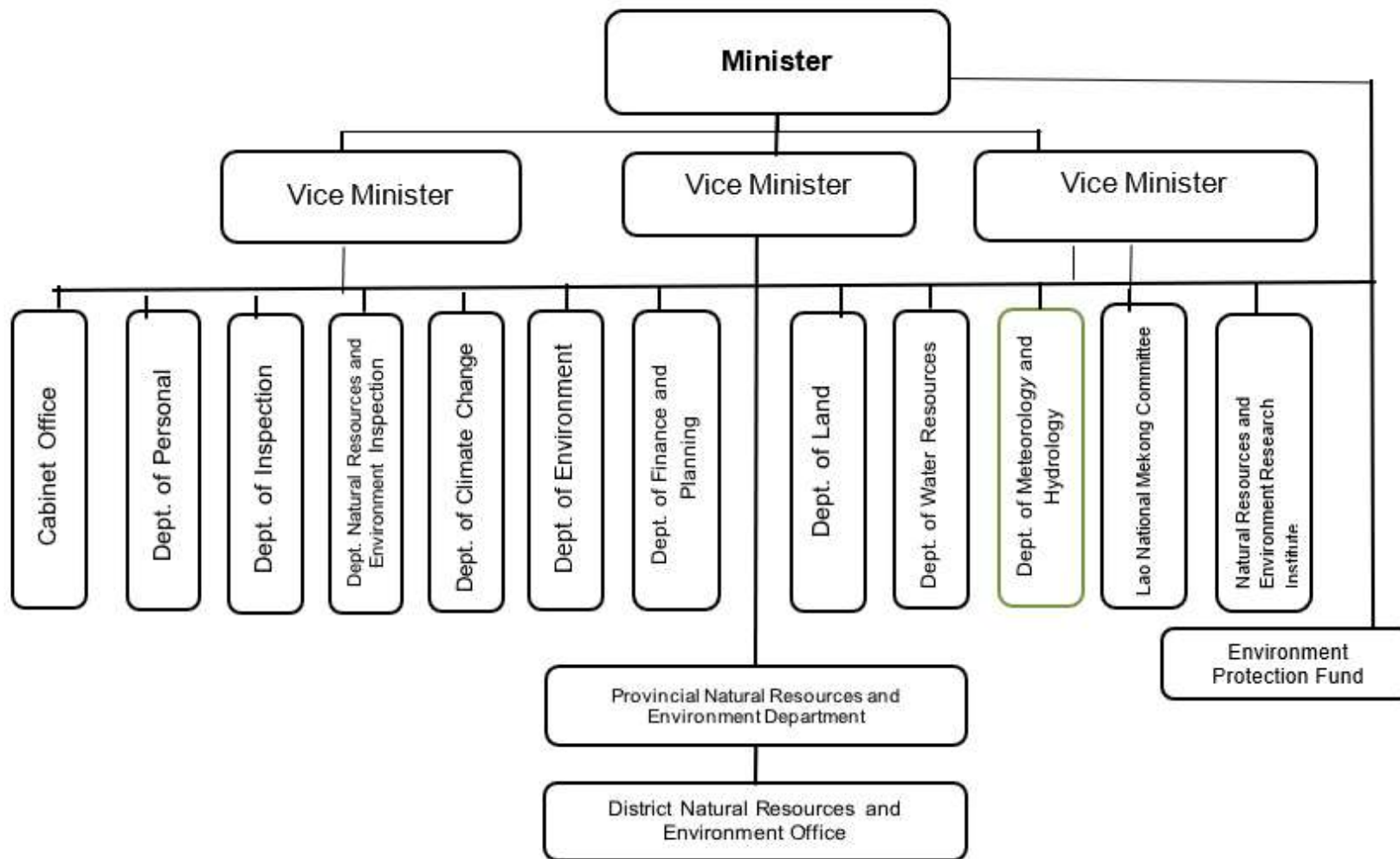
National level:

- | | |
|---|---------------|
| 1. Vice Prime Minister | Chairman |
| 2. Minister of Ministry of Labour and Social Welfare | Vice–Chairman |
| 3. Vice Minister, Ministry of Defence | Vice–Chairman |
| 4. Vice Minister, Ministry of Finance | Vice–Chairman |
| 5. Vice Minister, Cabinet Office, Prime Minister Office | Committee |
| 6. Vice Minister, Ministry of Health | Committee |
| 7. Vice Minister, Ministry of Agriculture and Forestry | Committee |
| 8. Vice Minister, Ministry of Public work and Transport | Committee |

National Disaster Management Committee in Lao PDR

- | | |
|---|-----------|
| 9. Vice Minister, Ministry of Education and Sport | Committee |
| 10. Vice Minister, Ministry of Public work and Transport | Committee |
| 11. Vice Minister, Ministry of Information and Culture | Committee |
| 12. Vice Minister, Ministry of Interior | Committee |
| 13. Vice Minister, Ministry of Planning and Investment | Committee |
| 14. Vice Minister, Ministry of Information and Culture | Committee |
| 15. Director General, Ministry of Information and Culture | Committee |
| 16. Provincial Level | |
| 17. District Level | |
| 18. Village Level | |

Organization's Structure (MONRE)



Conclusion and Suggestion Recommendation

- The space Technology and Application play very important role in the process of sustainable socio-economic Development and DRR in Lao PDR.
- However, it is still lack of resources persons to used the Space Technology and Application into the national sustainable development process and into the national environment protection and particularly in the environment and climate change monitoring and natural disaster risk reduction.
- There is a need to consider these followed activities:

1. Formulation of the national policy and regulation related to Space Technology and Application, such as the National Action Plan;
2. Promotion and development of the use of RS/GIS/Modelling in to Natural Disaster Risk Reduction and Sentinel Asia;
3. Application of Remote Sensed Satellite to estimate land surface temperature and soil moisture for climate and agro-meteorology; and
4. Creation of a national data network to ensure coordination. within the concerned institution;

Thank you Very Much

