



Hydro and Agro Informatics Institute

Hydroinformatics for Water Management in Thailand by HAI, Ministry of Science and Technology

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Disaster Mitigation Masterclass,
APAN 44, Dalian, China, 30-31 August 2017

Contents

- Intro to HAI
- Vision and Missions
- Activities
- Conclusions



**Masterclass on Disaster Mitigation,
APAN 44, Dalian, China, 30-31 August 2017**



Hydro and Agro Informatics Institute

Collaborated with the National Agriculture Research Organization (NARO)-Japan on **Telemetering Research (Field Server)**



Collaboration on Community Water Resource Management (CWRM) with private sectors such as Coca – Cola, SCG and PTT



1 January 2009
The Royal Decree on the establishment of Hydro and Agro Informatics Institute (Public Organization) B.E. 2551 was in effective.



Awarded for the Patent of “The Process of Data Display and Map for Geography Resources Management”

“Thailand Water Resources Management Network” was initiated by H.M. The King

- Developed **Terabyte Server** for large scale data repository and data backup
- Started the **Agro Informatics Network Project**

27 December 2008
The Royal Decree on the establishment of Hydro and Agro Informatics Institute (Public Organization) B.E. 2551 was promulgated.

16 January 2004
Hydro and Agro Informatics Institute (HAI) was established under NSTDA , Ministry of Sciences and Technology



Vision & Missions

Vision

Developing and applying **science and technology knowledge for agricultural and water resource management** in order to cope with critical climate change; and expanding the accomplishment through the design and development of strong and effective networking

Missions

- Developing and applying **S&T** for agricultural and water resource management
- **R&D** in water management technology and system
- **Expanding services** and disseminating the R&D outcomes
- Promoting S&T research and development **collaborations**



Research Focuses

**Real time
monitoring,
Forecasting
& Operating
system**

- Telemetering system
- Precipitation Observation by Satellite
- Surveying technology
- Weather forecasting system (WRF-ROMs)
- Modeling system (Flood , Water resource, Coastal)
- Decision Support System (DSS)

**System
Integration**

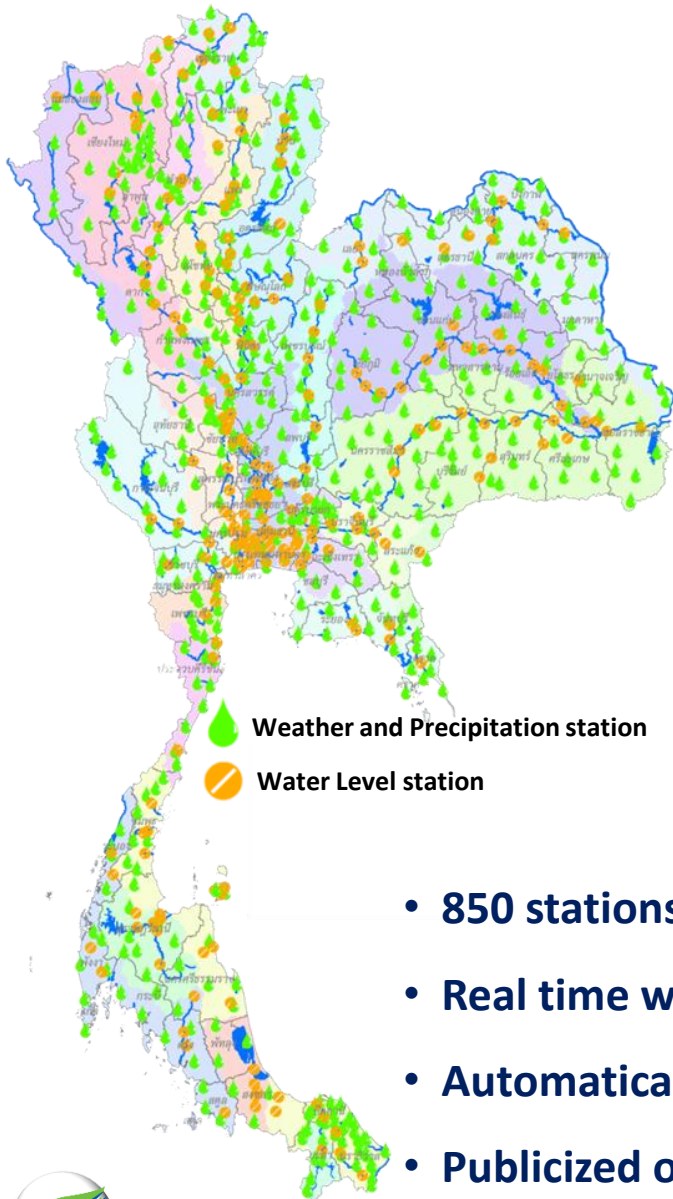
- Open architecture / Open source
- HPC, GPU, MIC
- Big Data
- Cloud
- New Technology

**Climate
change,
Adaptation
and Good
practices**

- Climate change scenarios and related effects
- Seasonal prediction
- Small scale water resource management
- Adaptation using S&T
- Good practice : Community Water Resource Management

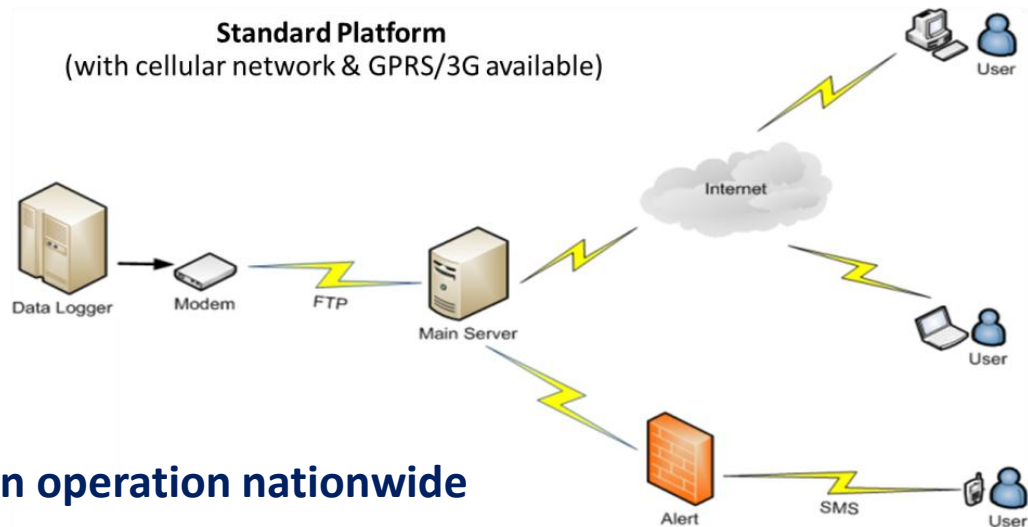


Telemetry System



Data Transmission Network

Standard Platform
(with cellular network & GPRS/3G available)



- 850 stations in operation nationwide
- Real time weather and water level monitoring
- Automatically links all data through GPRS or satellite
- Publicized on www.thaiwater.net

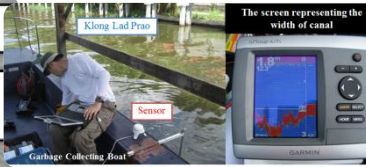
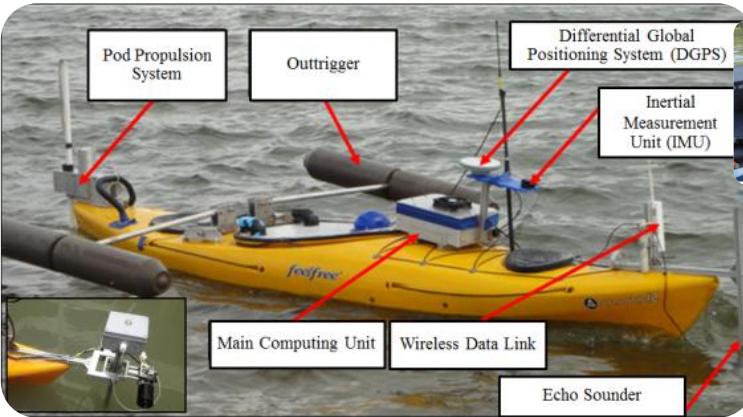


Surveying Technology

Unmanned Aerial Vehicle



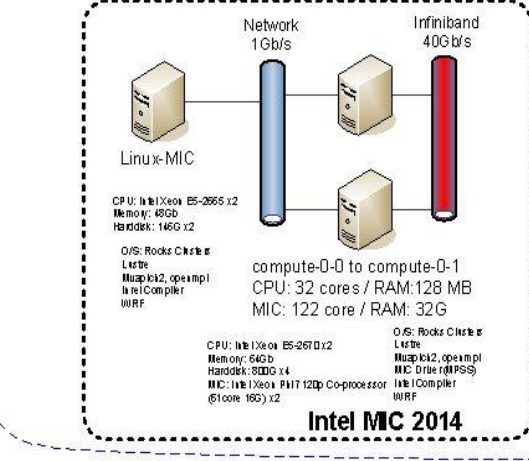
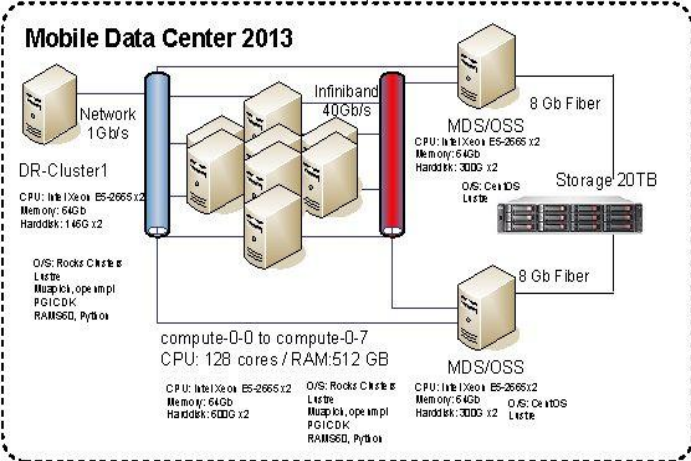
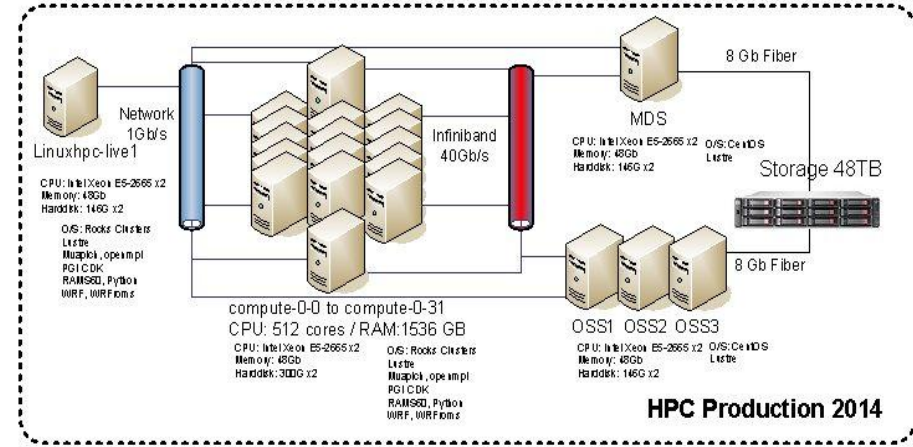
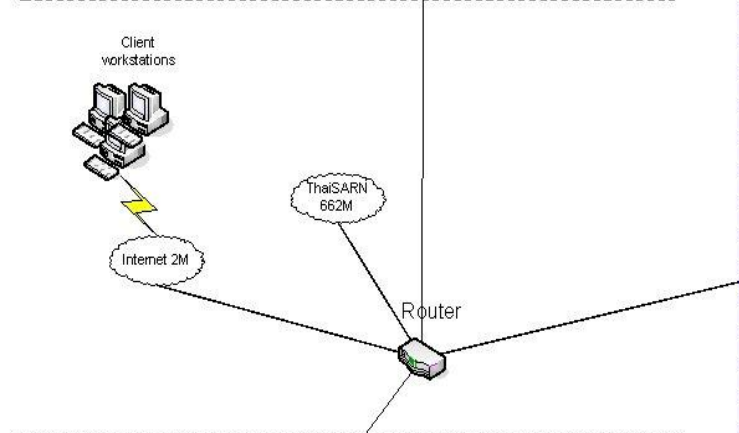
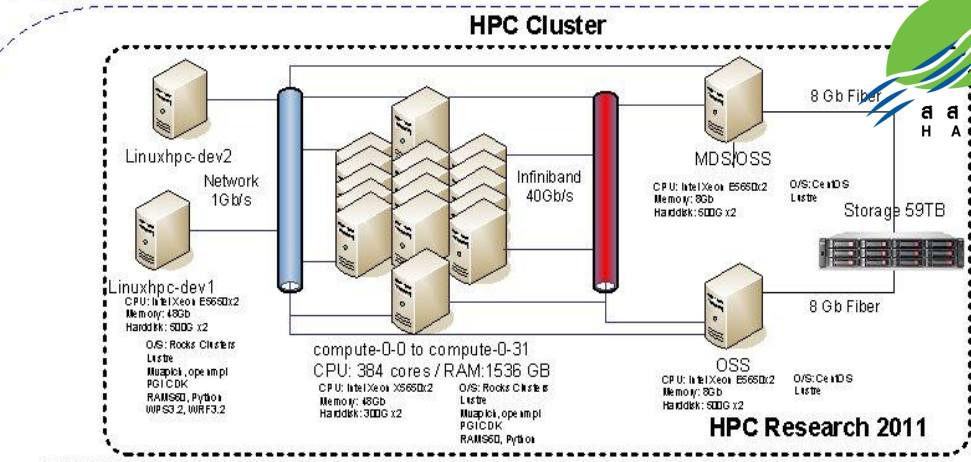
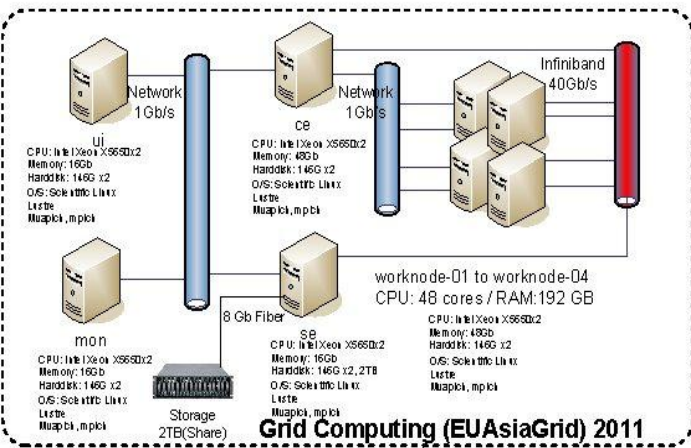
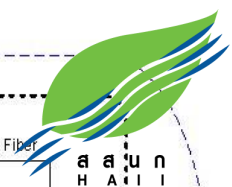
Mobile Mapping System



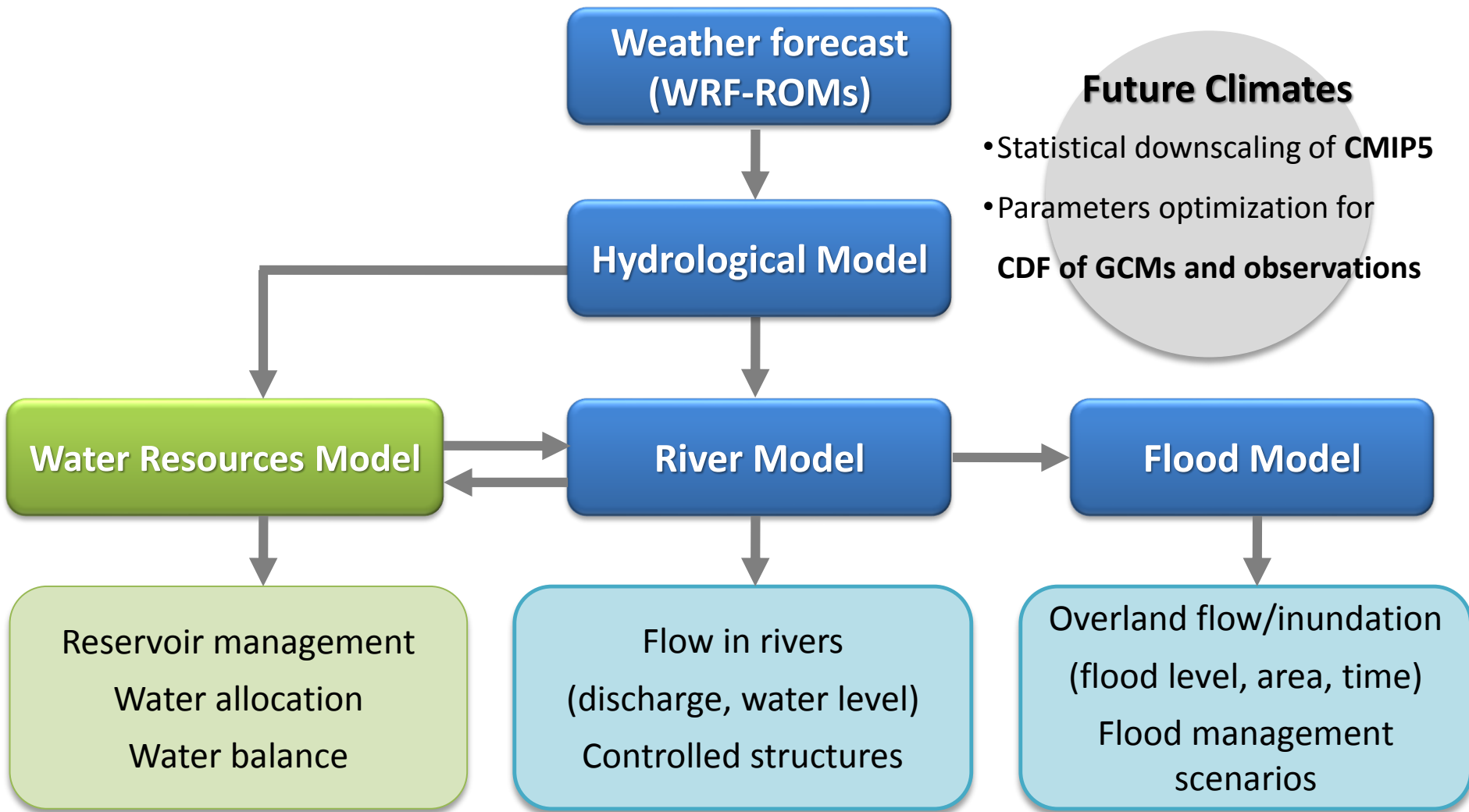
Automatic Boat



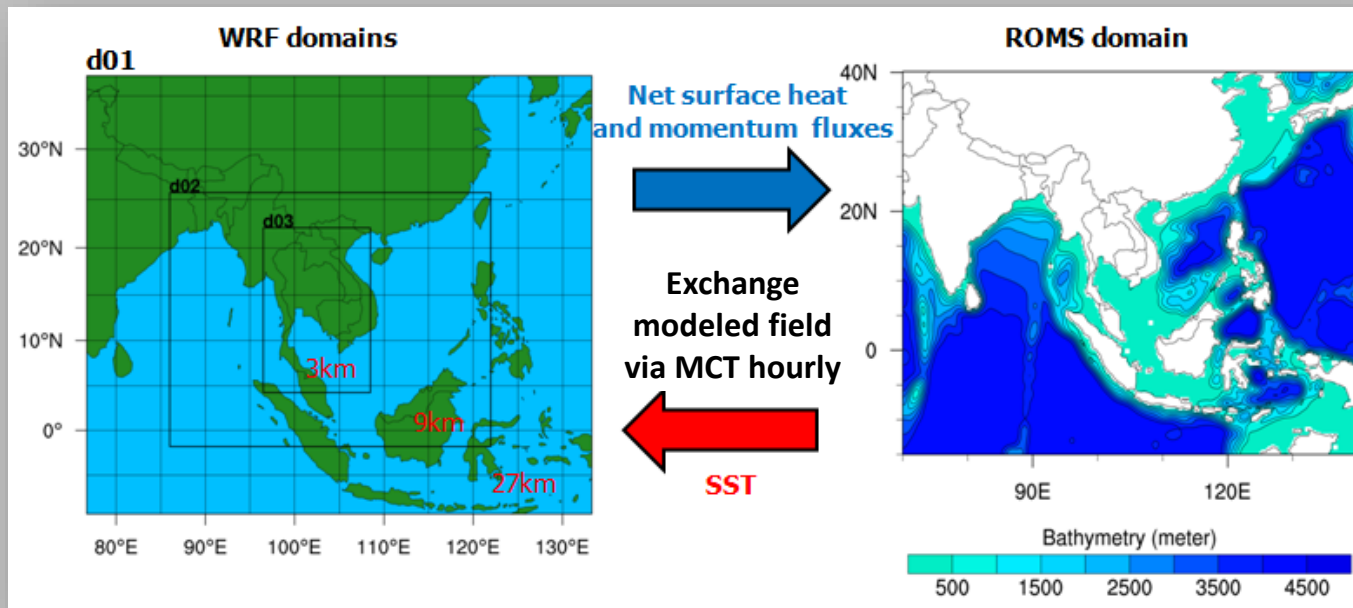
HAI'S High Performance Computing Facilities 2016



Integrated modeling structure



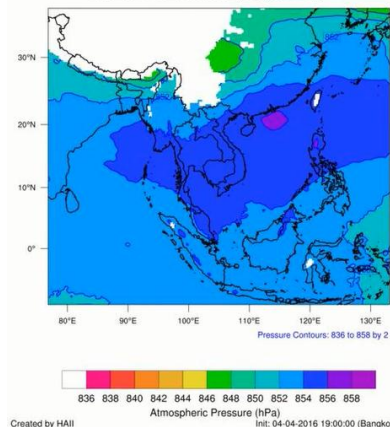
WRF-ROMs : 2-Way Coupled Models



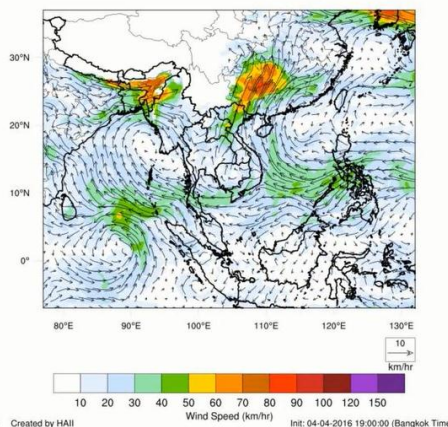
Weather Research Forecasting Model (WRF)

Regional Ocean Modeling System (ROMs)

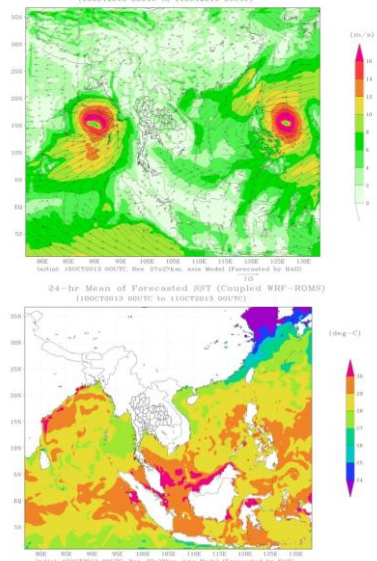
WRF-ROMs, Atmospheric Pressure at 1.5 km above Sea Level
Valid: 09-04-2016 09:00:00 (Bangkok Time)



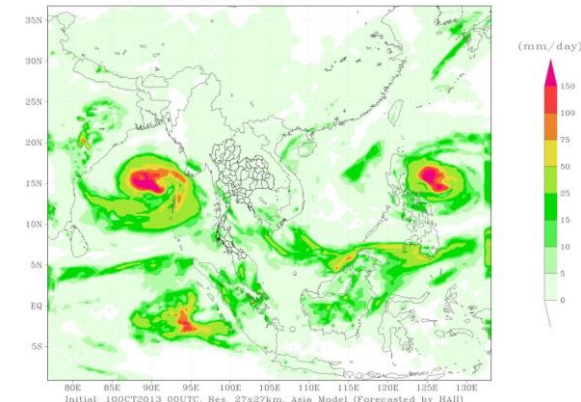
WRF-ROMs, Wind Speed and Direction at 1.5 km. above Sea Level
Valid: 09-04-2016 09:00:00 (Bangkok Time)



Wind Speed and Direction Forecasted by Coupled WRF-ROMs
(10OCT2013 00UTC to 11OCT2013 00UTC)



24-hr Rainfall Forecasted (Coupled WRF-ROMs)
(10OCT2013 00UTC to 11OCT2013 00UTC)



Source:

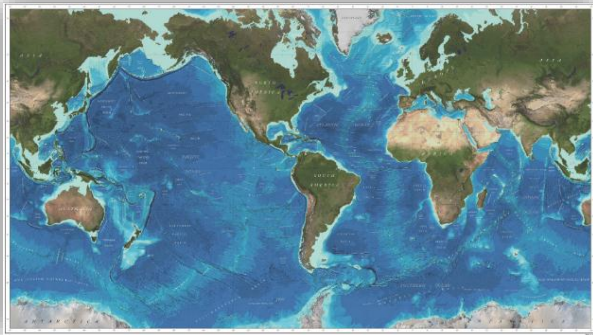
<http://www.thaiwater.net/web/index.php/weatherinfo.html>



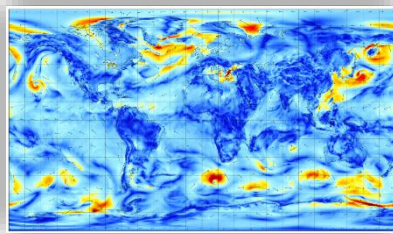
SWAN : Wave Forecasting Model

Input data for SWAN model

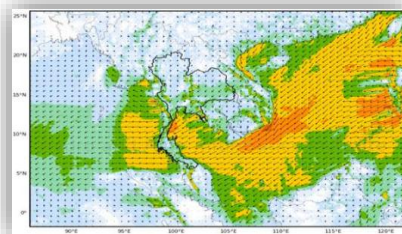
Data	Resolution	Frequency	Source
GEBCO30 Bathymetry	0.92 km	-	BODC
NAVGEM wind field (Hindcast period)	55 km	6 hrs	US Navy
WRF-ROMS wind field (Forecast period)	9 km	1 hr	HAI



GEBCO30 Bathymetry



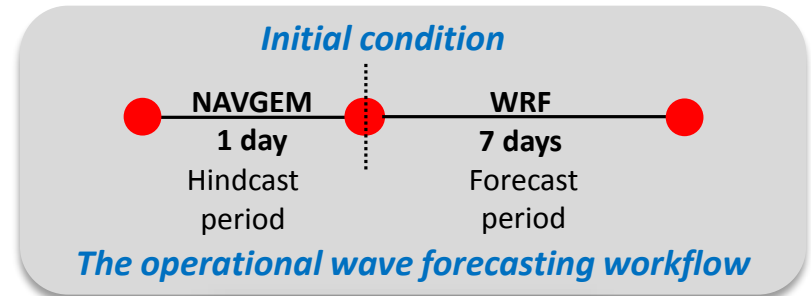
NAVGEM wind field



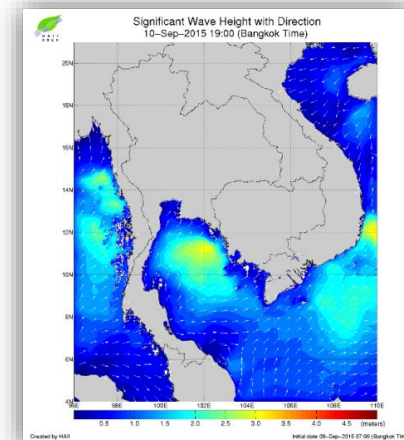
WRF-ROMS wind field

Workflow

- High performance computing
- Linux operating system
- Runs automatically one time per day at 5.30 a.m.
- Simulate 7 days wave forecast take 2 hours

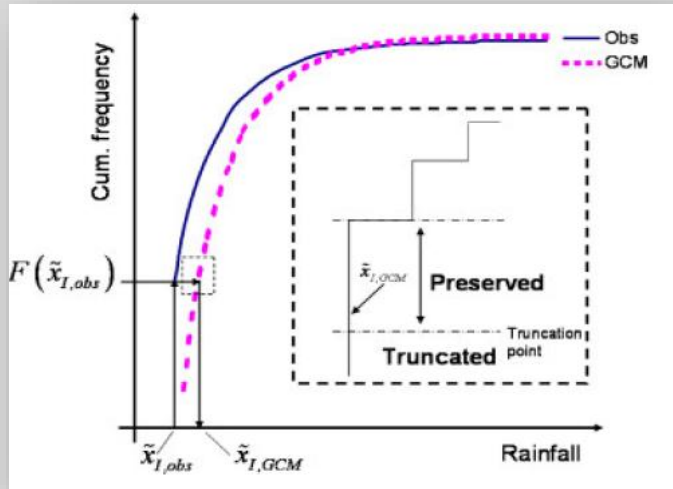


The operational wave forecasting workflow



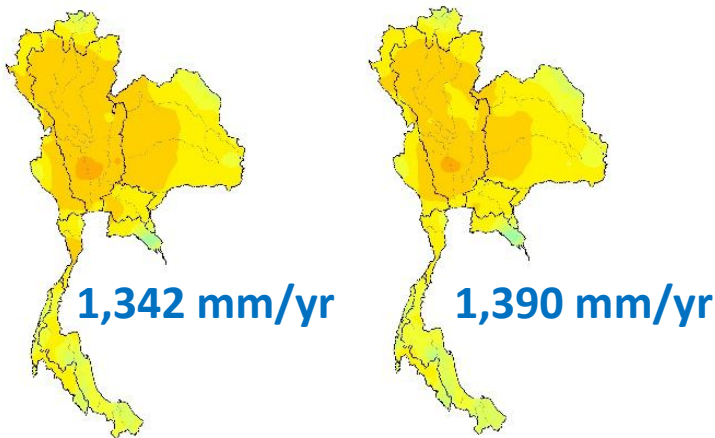
Significant wave height with direction

Statistical Downscaling for Global Climate Models



The statistical bias correction of GCM rainfall by **Gamma-gamma transformation method** is exploited to downscale the global to river basin scale. This method can reduce biases in terms of frequency and quantity at rain gauge station's position.

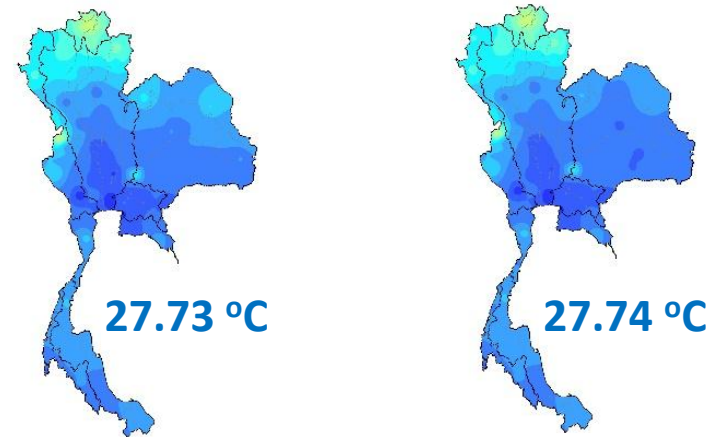
Annual Rainfall



(a) Observed

(b) Bias corrected
BCC GCM

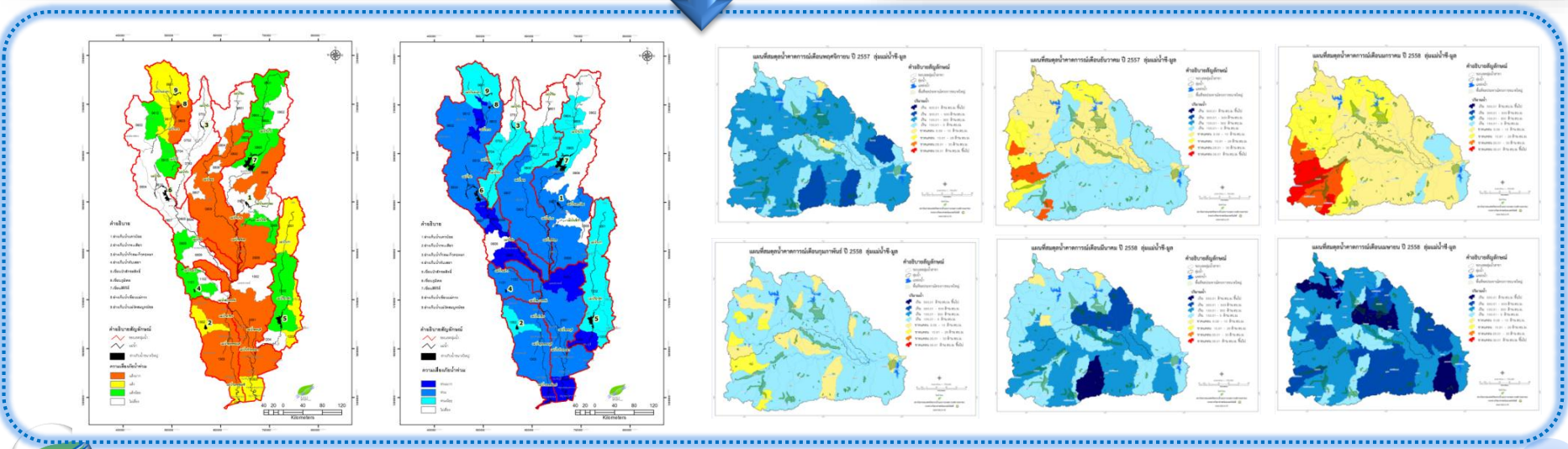
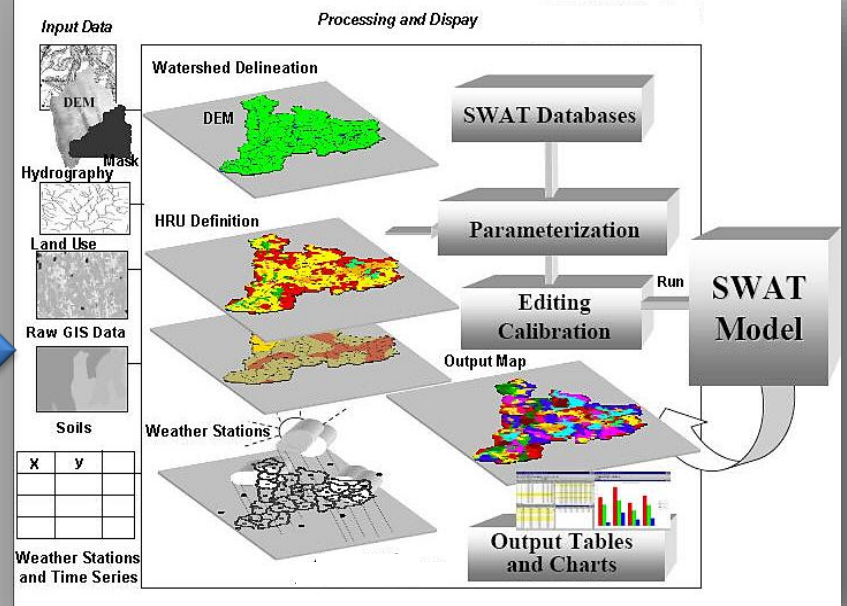
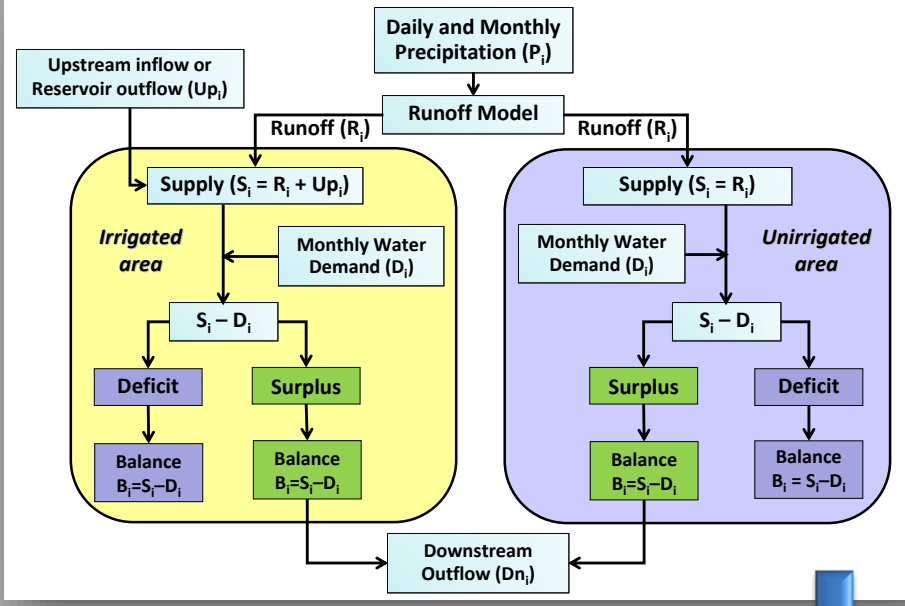
Annual average temperature



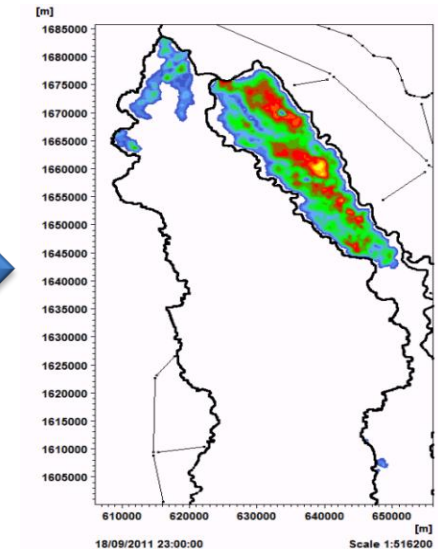
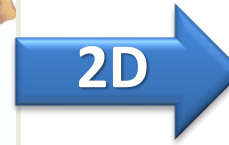
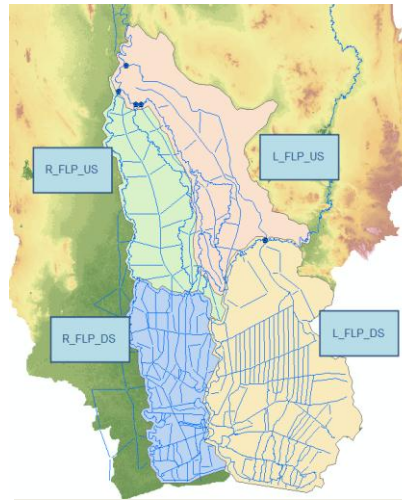
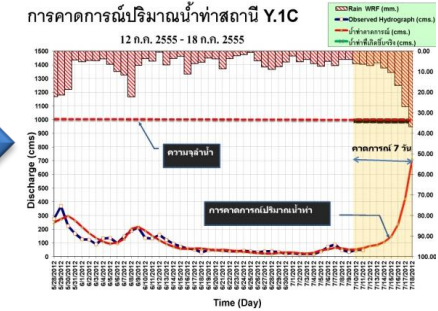
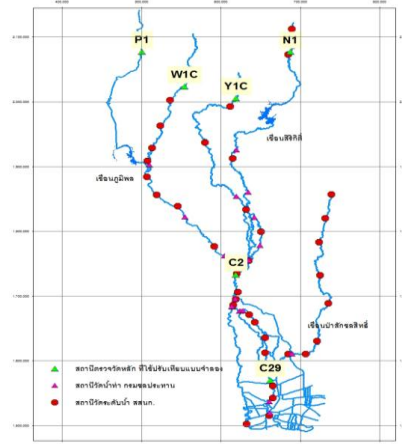
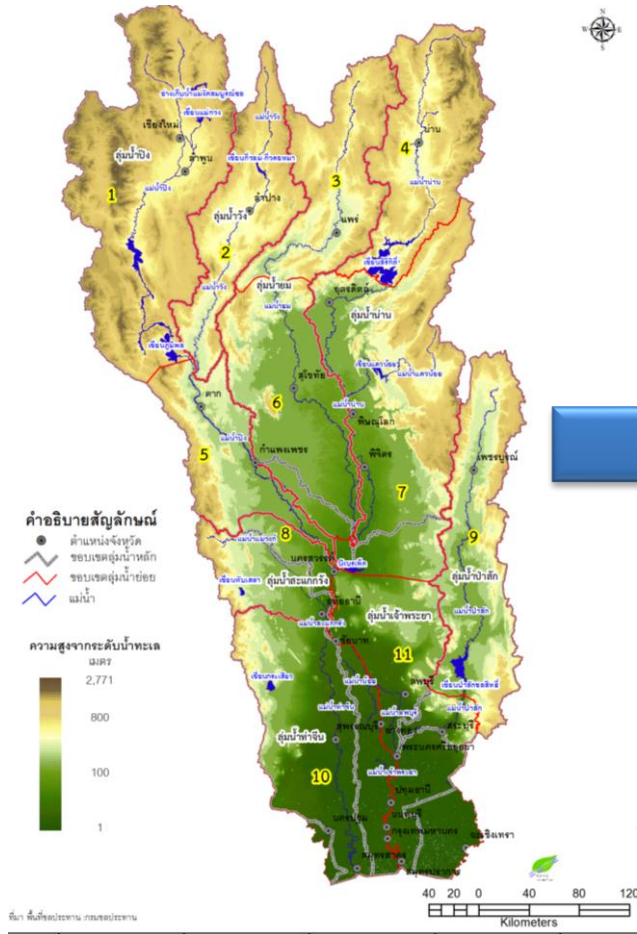
(a) Observed

(b) Bias corrected
BCC GCM

Water Balance Model



Flood Forecasting Model



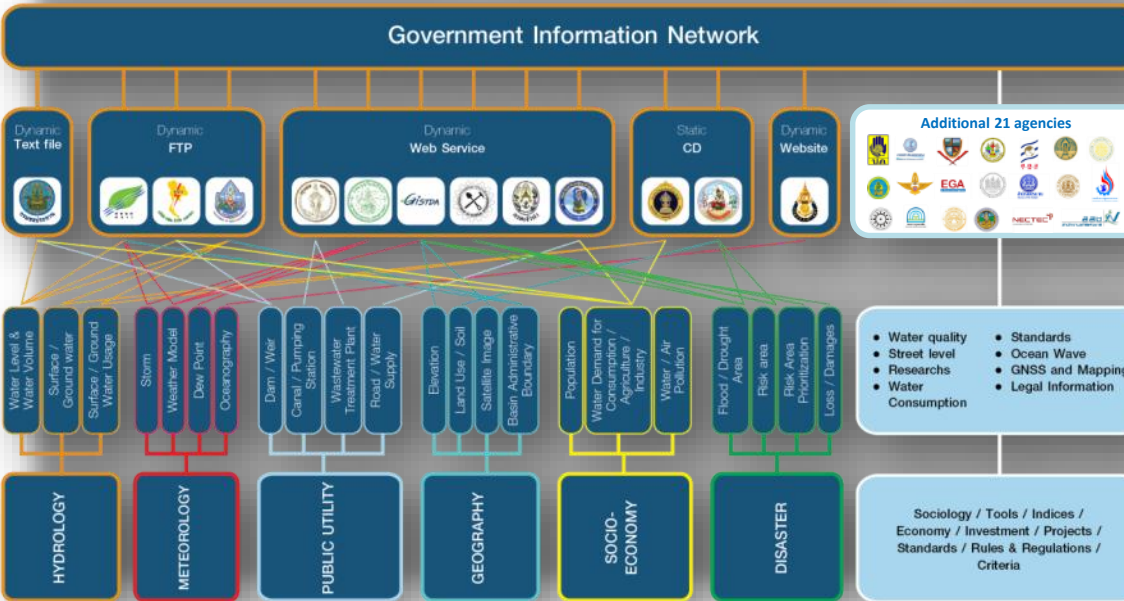
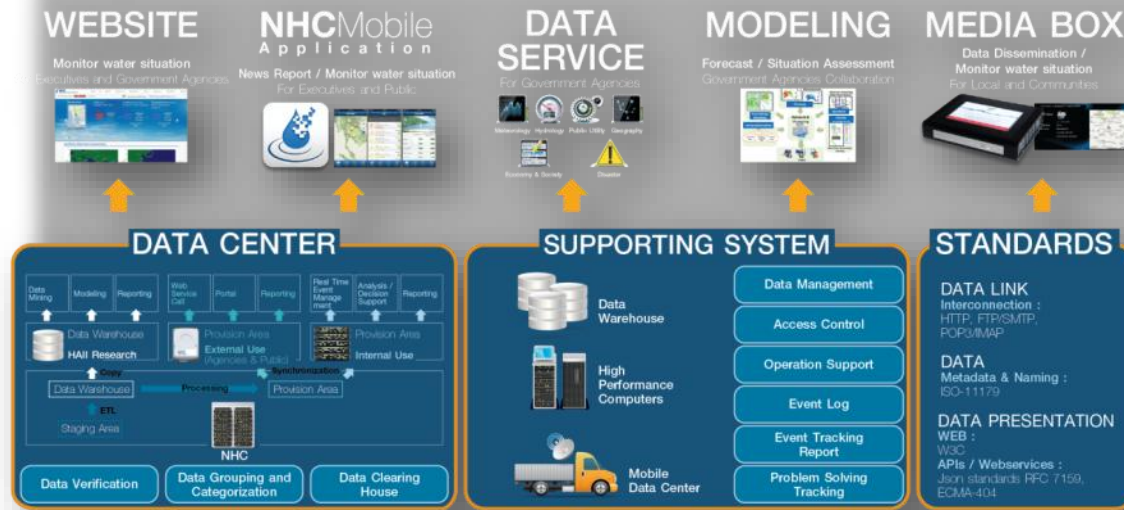
Flood forecasting models combine the use of **1D river model** and **2D overland flow model** together

By coupling these two models with **WRF**

Flow & flood conditions can be predicted **7 days in advance**



National Hydroinformatics and Climate Data Center

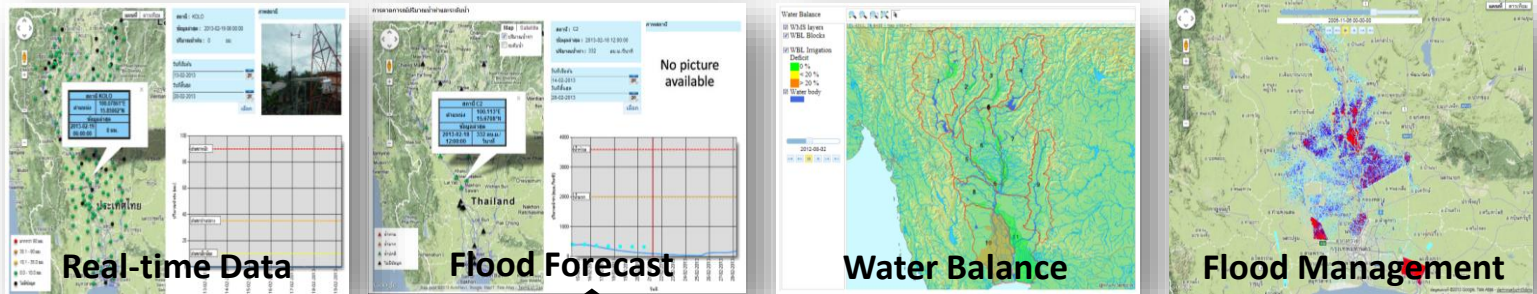


- **Decision Support Information System**
- **Processing and analysis of water management information**
- **Data integration and exchange among water related agencies**
- **Single and standardized information pool for monitoring, analysis and forecast of water situation**
- **Unified water management system for both normal and crisis situation**
- **Houses 380 data items from 34 agencies since 2012**



Decision support system

Multi-user Interfaces



Data Management

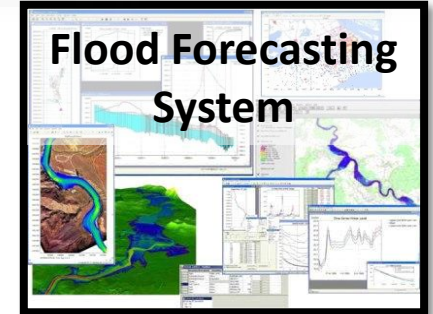


Analysis

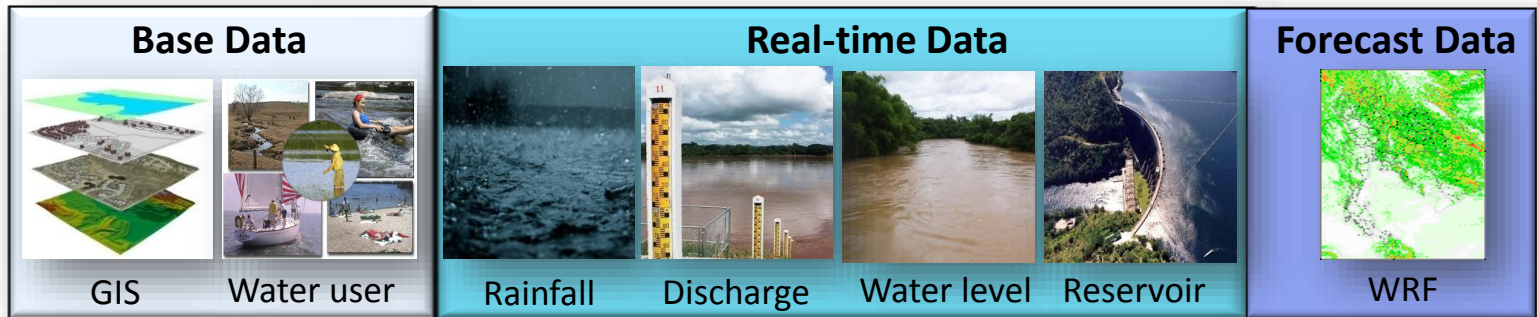


Output

Flood Forecasting System



Multiple Data Sources

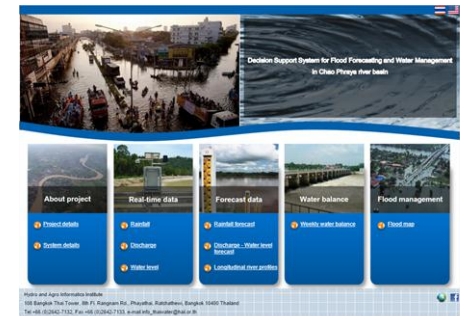
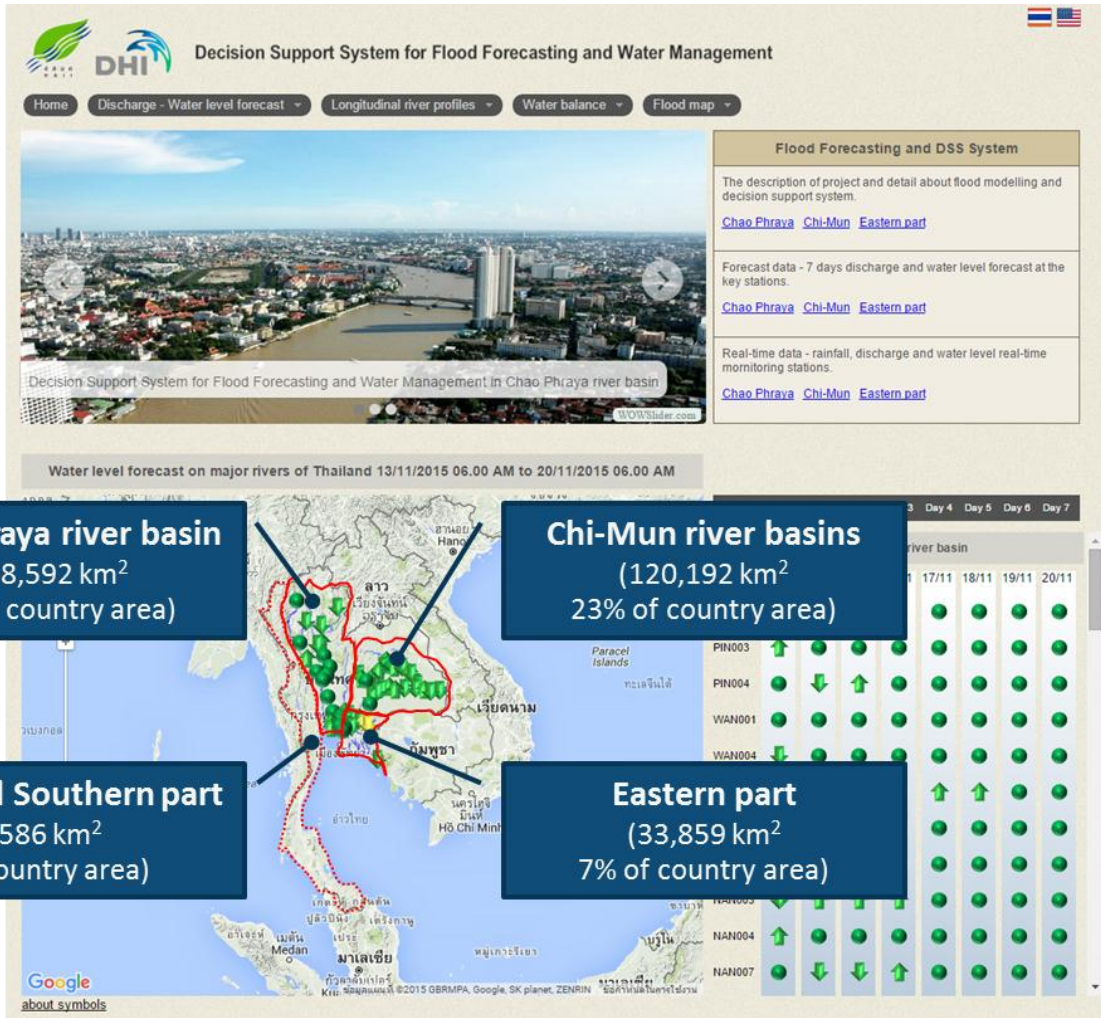


National Hydroinformatics and Climate Data Center

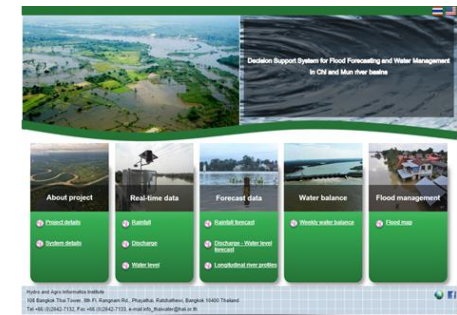


Hydro and

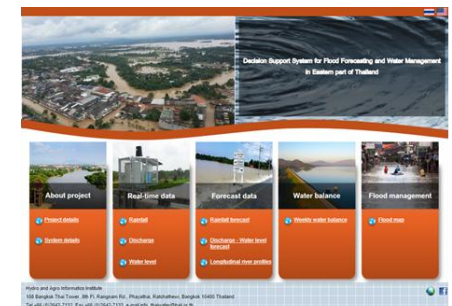
Decision support system for flood forecasting and water management



2012
Chao Phraya river basin
(Central part of Thailand)



2014
Chi-Mun river basins
(North-Eastern part of Thailand)



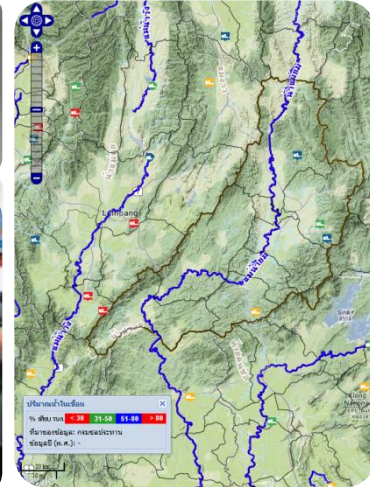
2015
Eastern part of Thailand


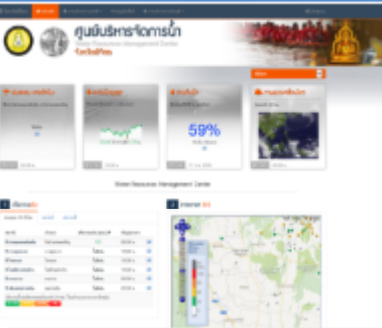


Operation during Normal Situation

Provincial Water Management Operation Center

Using area specific information to monitor and manage water situation locally



Phrae	Sukhothai	Phayao	Phichit
			
http://nhc.in.th/phrae.html	http://nhc.in.th/sukhothai.html	http://nhc.in.th/phayao.html	http://nhc.in.th/phichit.html



Operation during Crisis Situation

Extreme Event

Emergency Mobile Data Center

Providing information and analysis for decision making



Co-operative flood prevention and mitigation in Southern Thailand
3 – 10 October 2014

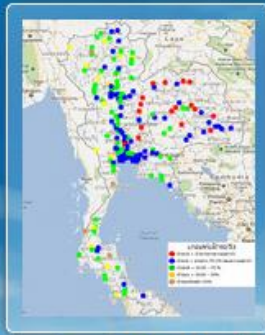


Emergency Mobile Data Center to support water management operation during Crisis

- 24 hours situation monitoring
- Identifying risk area and promptly issuing warning
- Effective and prompt situation management planning
- Preventing and alleviating damages and impacts from flooding into households and economically critical areas

National Hydroinformatics and Climate Data Center

3 of 6
แผนที่ระดับน้ำ



31 Jul 2017

ป่าดิว ไร่ระบบ
ต. เชียงเพ็ง อ.ป่าดิว จ.ยโสธร



ระดับน้ำ
น้ำล้นตลิ่ง

31 Jul 2017 09:20 น.

คูเมือง ไร่ระบบ
ต. ประเคียบ อ.คูเมือง จ.บุรีรัมย์



ระดับน้ำ
น้ำล้นตลิ่ง

31 Jul 2017 09:30 น.

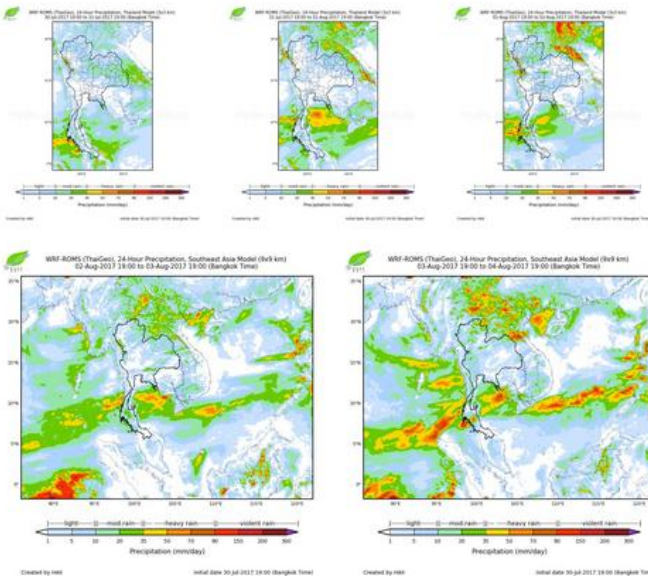
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ต. หล่มสัก อ.หล่มสัก จ.เพชรบูรณ์



ระดับน้ำ
น้ำล้นตลิ่ง

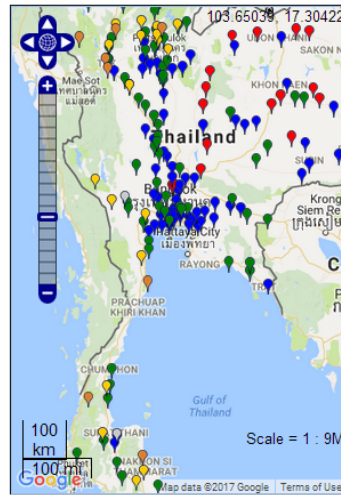
31 Jul 2017 09:30 น.

<http://www.nhc.in.th/web/>



ระดับน้ำในแม่น้ำ ประจวบชายน้ำ

ภาพรวม ภาคเหนือ ภาคตะวันออกเฉียงเหนือ ภาคกลาง ภาคใต้



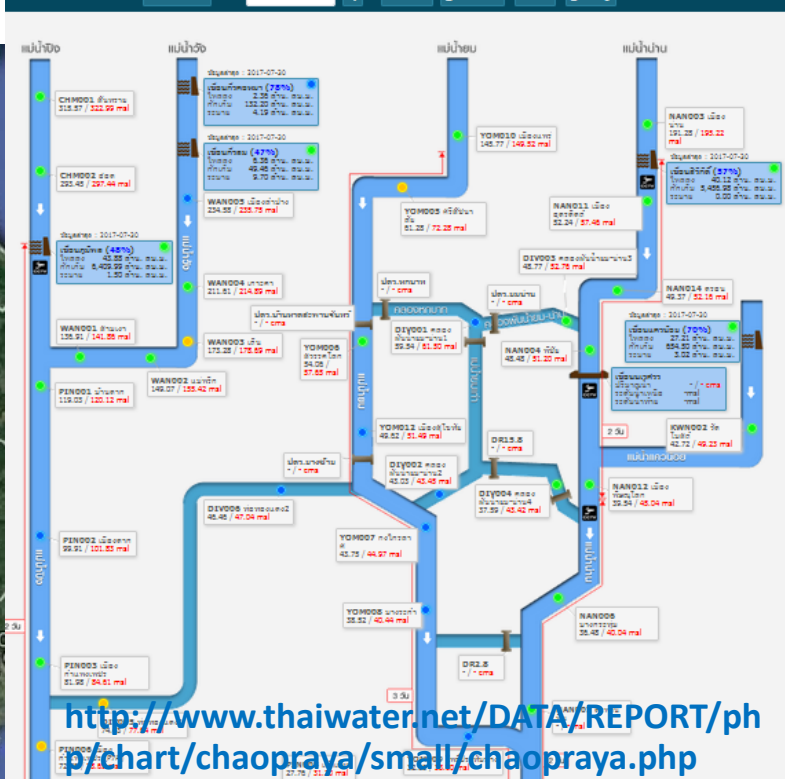
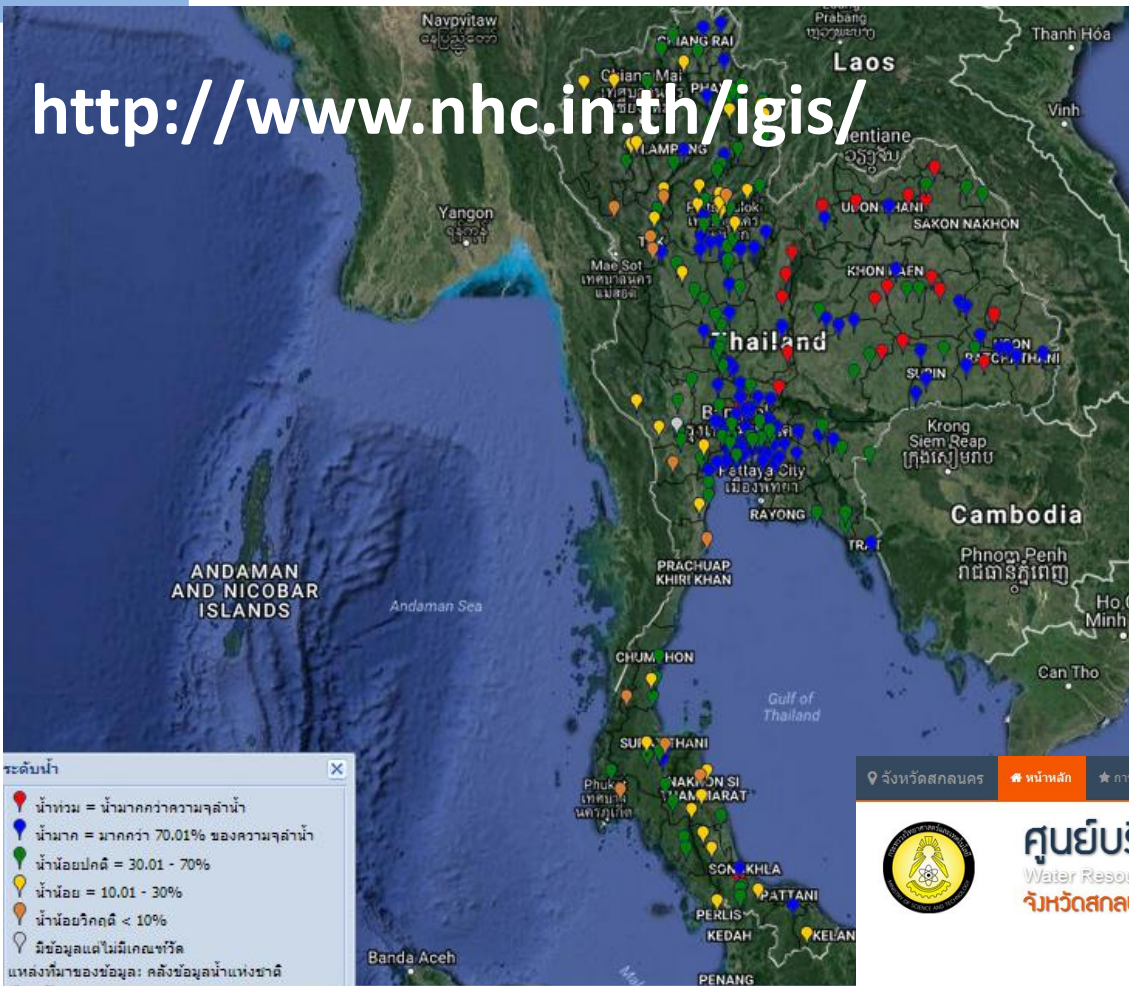
สถานี	ระดับน้ำ (ม.รทก.)	วันที่	เวลา	สถานะ
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คูเมือง	109.72	31 ก.ค. 2017	08:30	น้ำล้นตลิ่ง
สุวรรณคูหา	198.91	31 ก.ค. 2017	08:20	น้ำล้นตลิ่ง
หล่มสัก	144.97	31 ก.ค. 2017	08:30	น้ำล้นตลิ่ง
สว่างแดนดิน	158.07	31 ก.ค. 2017	08:30	น้ำล้นตลิ่ง
ชัยบาดาล	44.76	31 ก.ค. 2017	08:20	น้ำล้นตลิ่ง
บ้านคูดุง	162.73	31 ก.ค. 2017	08:20	น้ำล้นตลิ่ง
หนองไผ่	94.15	31 ก.ค. 2017	08:20	น้ำล้นตลิ่ง
ยางตลาด	124.79	31 ก.ค. 2017	08:20	น้ำล้นตลิ่ง
จังหวัด	136.71	31 ก.ค. 2017	08:20	น้ำล้นตลิ่ง

%ความจุลำนน้ำ <=10 น้อยวิกฤต >10-30 ปานกลาง >30-70 ปานกลาง >70-100 นานมาก >100 ใช้งานแล้ว

อ่านต่อ >>

Water Monitoring System

<http://www.nhc.in.th/igis/>



<http://provinces.nhc.in.th/web/public/provinces/47>

ศูนย์บริหารจัดการน้ำ
Water Resources Management Center
จังหวัดสกลนคร

ฝนสะสม รายชั่วโมง: ฝน 17.00 มม.

ระดับน้ำสูงสุด: น้ำล้นตลิ่ง 120% กักเก็บ (%ทรง)

อ่างเก็บน้ำ: 30 ก.ค. 2560

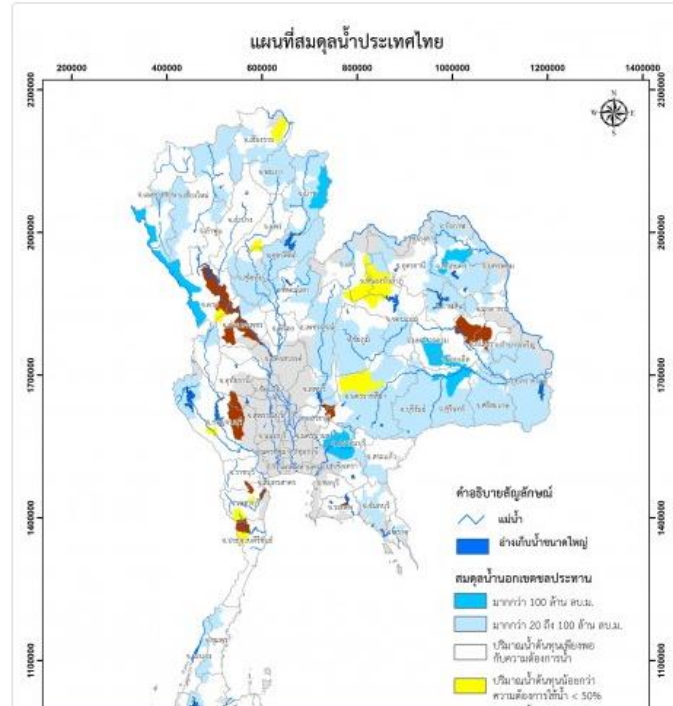
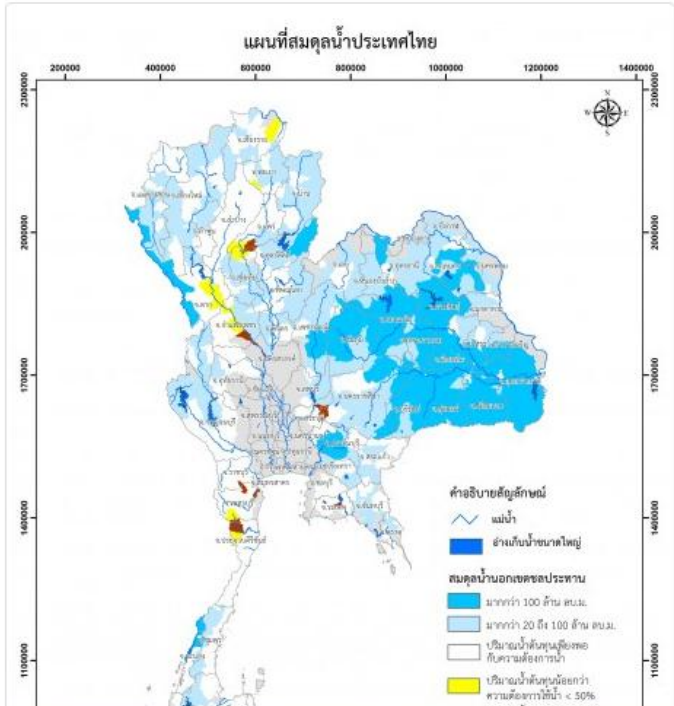
ภาพแบบเคลื่อนไหว: ย้อนหลัง 24 ชม.



Drought Monitoring System

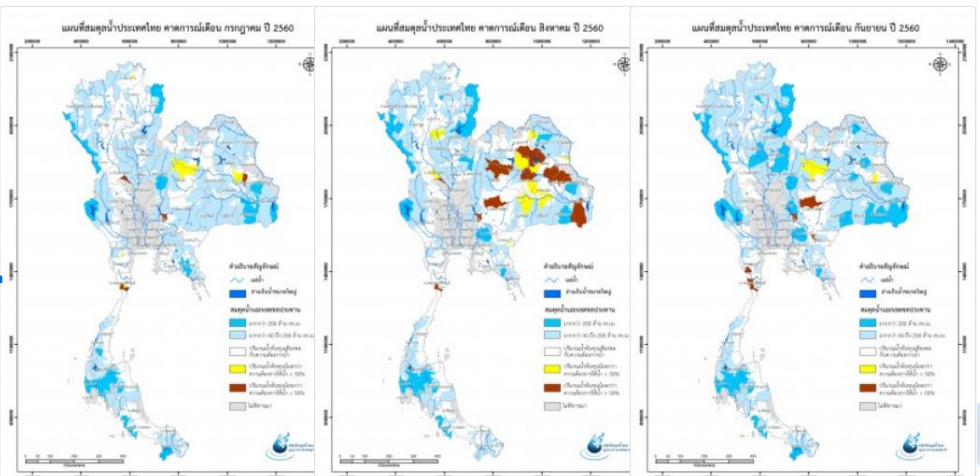
สมดุบน้ำนอกเขตชลประทาน รายสัปดาห์
สมดุบน้ำที่ผ่านมา สมดุบน้ำที่ผ่านหน้า

- ปริมาณฝน แสดงปริมาณฝน
 - อ่างเก็บน้ำ ข้อมูลระดับน้ำในอ่างเก็บน้ำ
 - ระดับน้ำ ข้อมูลระดับน้ำ
 - การเพาะปลูก แสดงพื้นที่เพาะปลูก
 - ความชื้น แสดงความชื้นในพื้นที่
 - น้ำเค็มรุกล้ำ ข้อมูลน้ำเค็มรุกล้ำ
 - พยากรณ์ ข้อมูลพยากรณ์
 - พื้นที่เสี่ยงภัย จากสมดุบน้ำ
- สมดุบน้ำนอกเขตชลประทาน รายสัปดาห์
- สมดุบน้ำนอกเขตชลประทาน รายเดือน



Weekly-Monthly Water-Balance

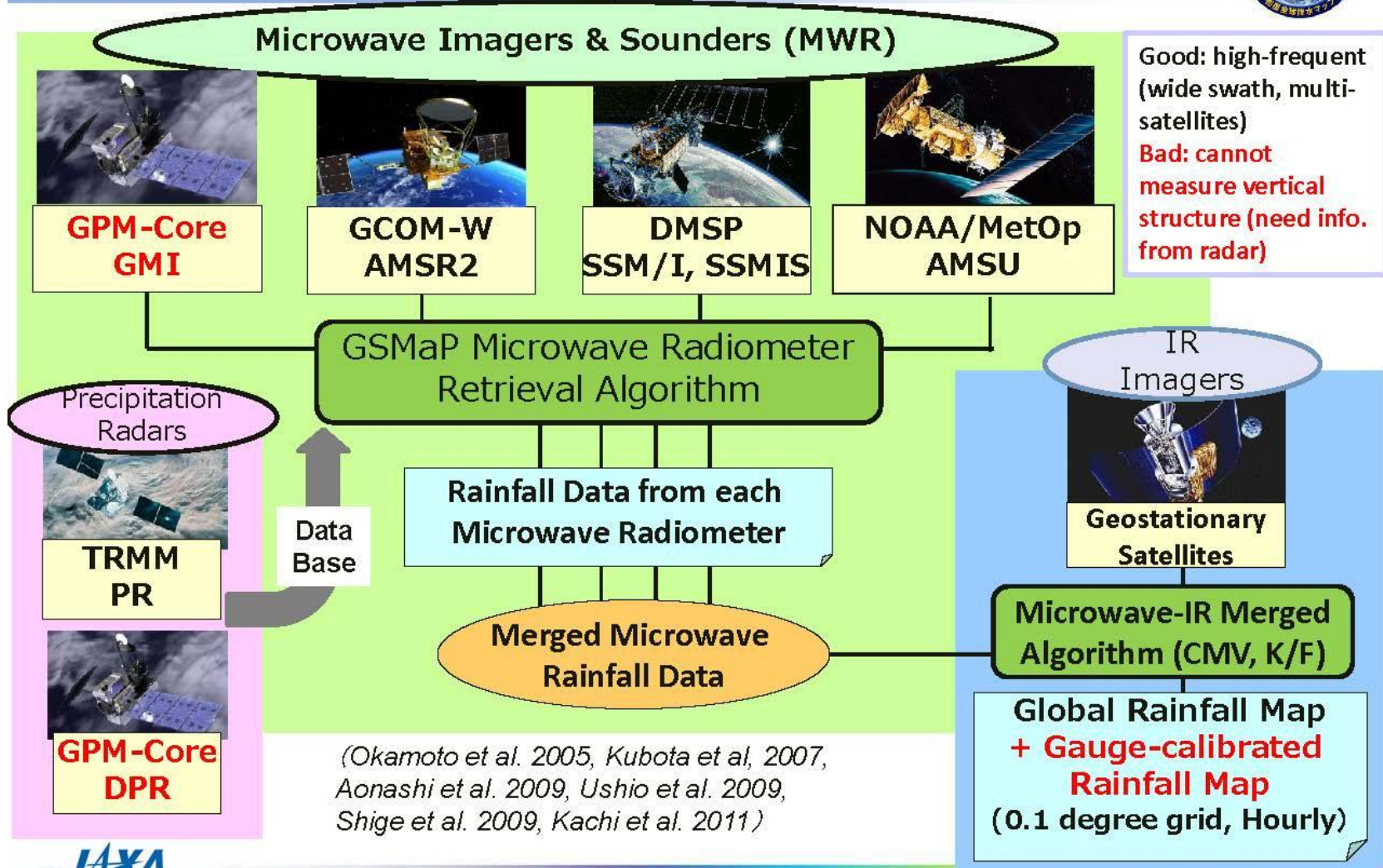
สมดุบน้ำนอกเขตชลประทาน รายเดือน



<http://watersituation.thaiwater.net/v1/public/report>



Joint Research with JAXA/RESTEC to improve GSMaP NRT Products for Flash Flood Warning System Production of GSMaP by multi-satellite



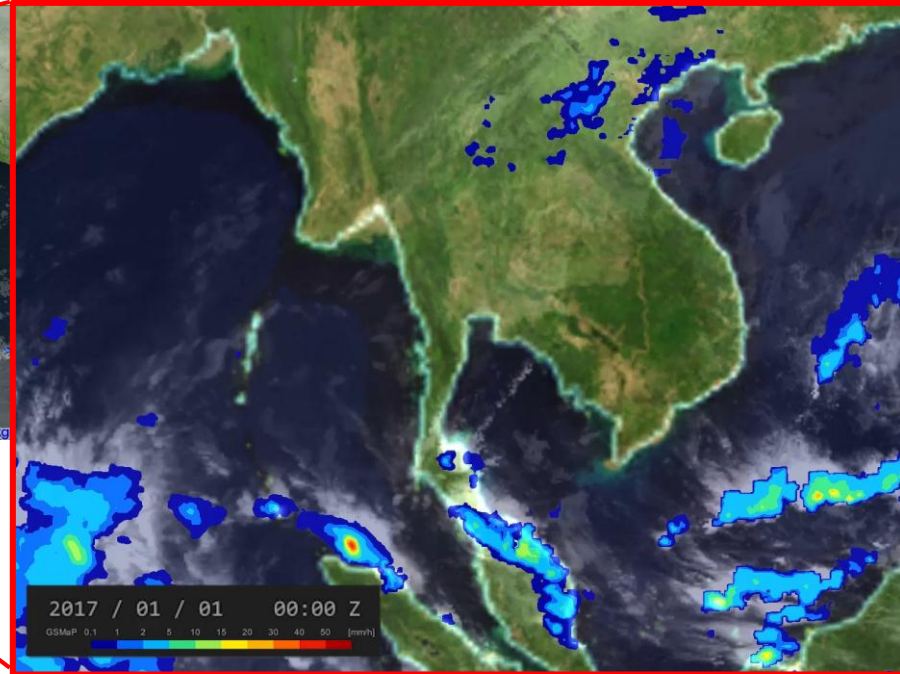
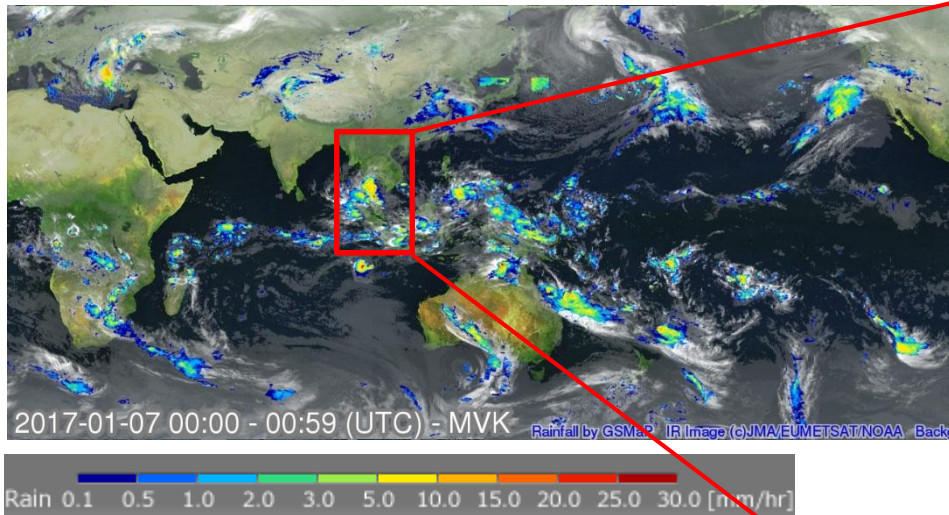
<http://sharaku.eorc.jaxa.jp/GSMaP/>



Global Satellite Mapping of Precipitation (GSMaP)



GSMaP_NRT hourly rain with Himawari-8 cloud (1-12 Jan 2017)



<http://sharaku.eorc.jaxa.jp/GSMaP/>

- GSMaP is a blended Microwave-IR product and has been developed in Japan toward the GPM mission.
 - GSMaP (v6) data since Mar. 2000 period was reprocessing as reanalysis version (GSMaP_RNL), and was open to the public on Apr. 2016.
 - New version, GSMaP (v7) was released on 17 Jan. 2017.

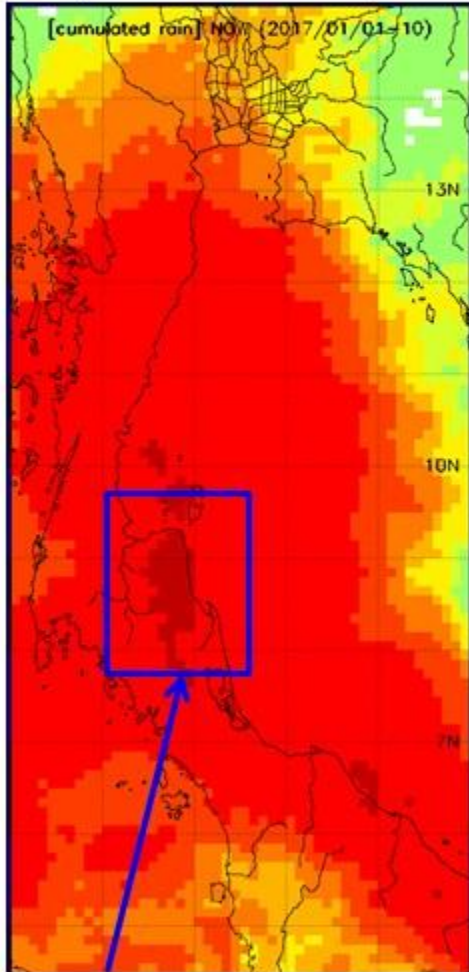


Heavy rain over Thailand during early Jan. 2017

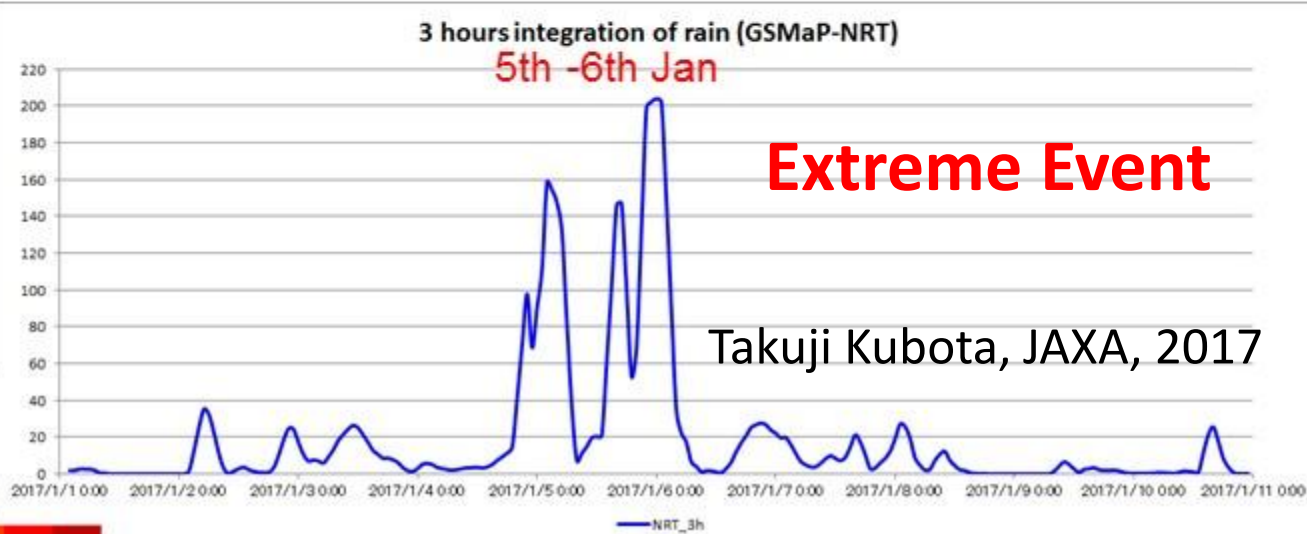
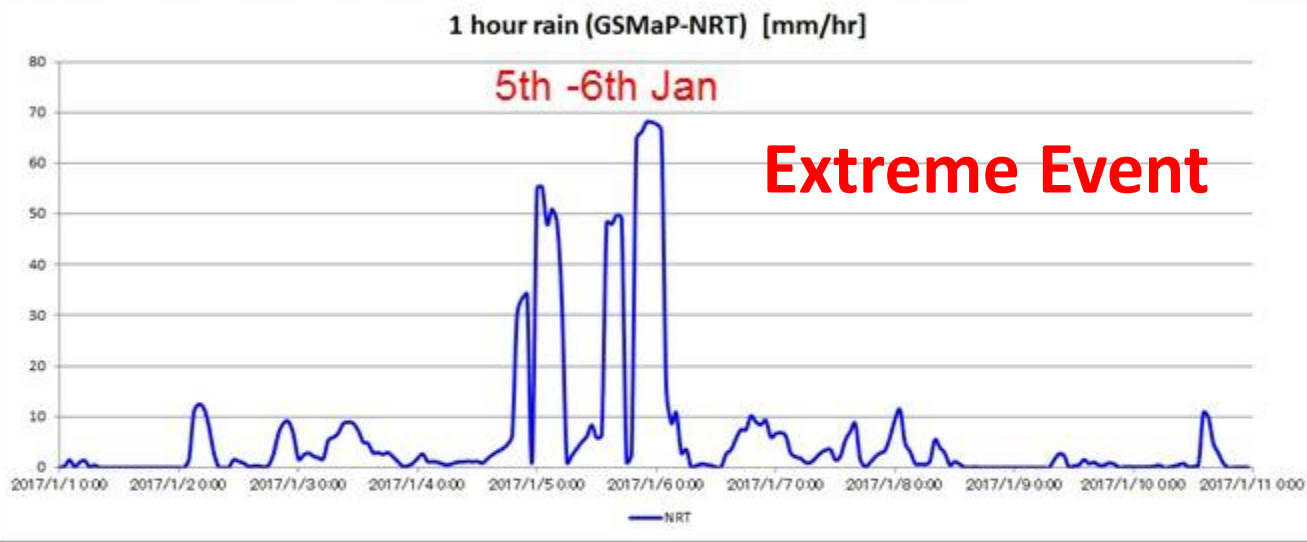
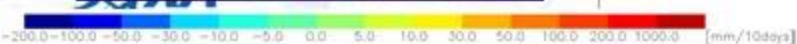


10days accumulation
(1-10 Jan. 2017)

Time series of GSMaP_NRT surface rain over heavy rain areas of the **Nakhon Si Thammarat Province**

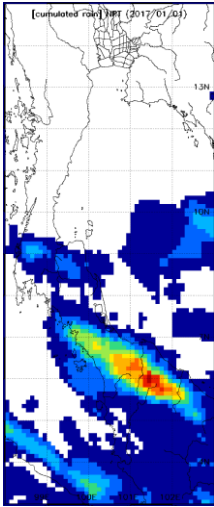


Nakhon Si Thammarat Province:
10-day-accumulation > 1000mm

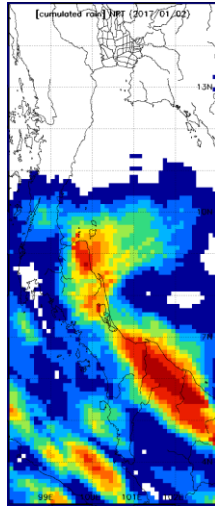


Extreme Event: Daily rainfall amount from the GSMaP-NRT

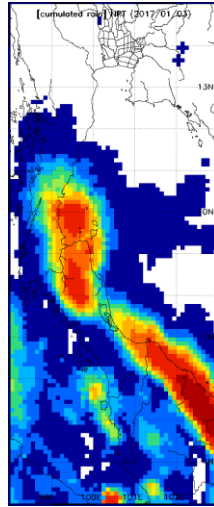
01 Jan 2017



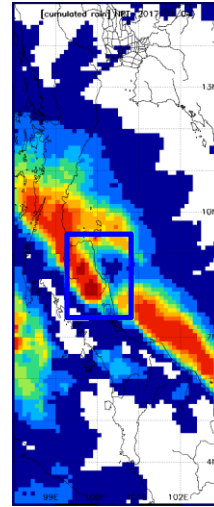
02 Jan 2017



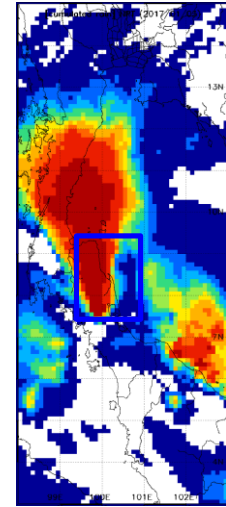
03 Jan 2017



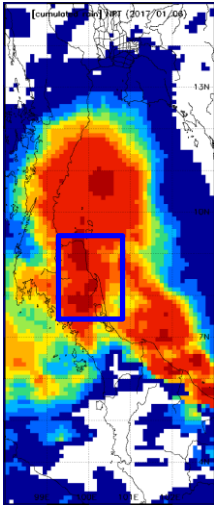
04 Jan 2017



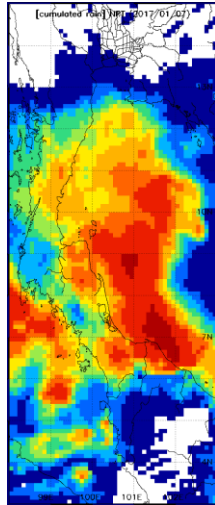
05 Jan 2017



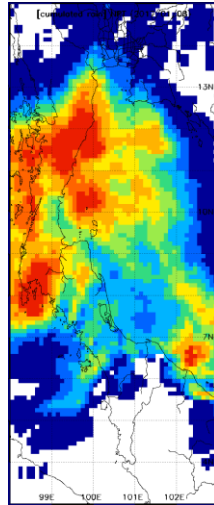
06 Jan 2017



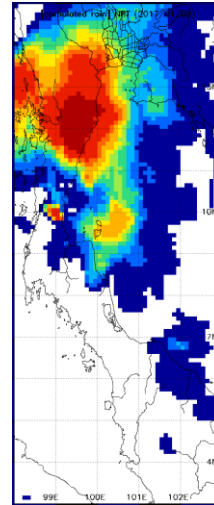
07 Jan 2017



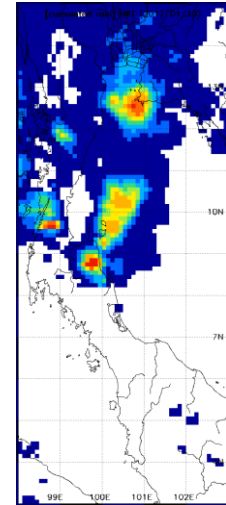
08 Jan 2017



09 Jan 2017



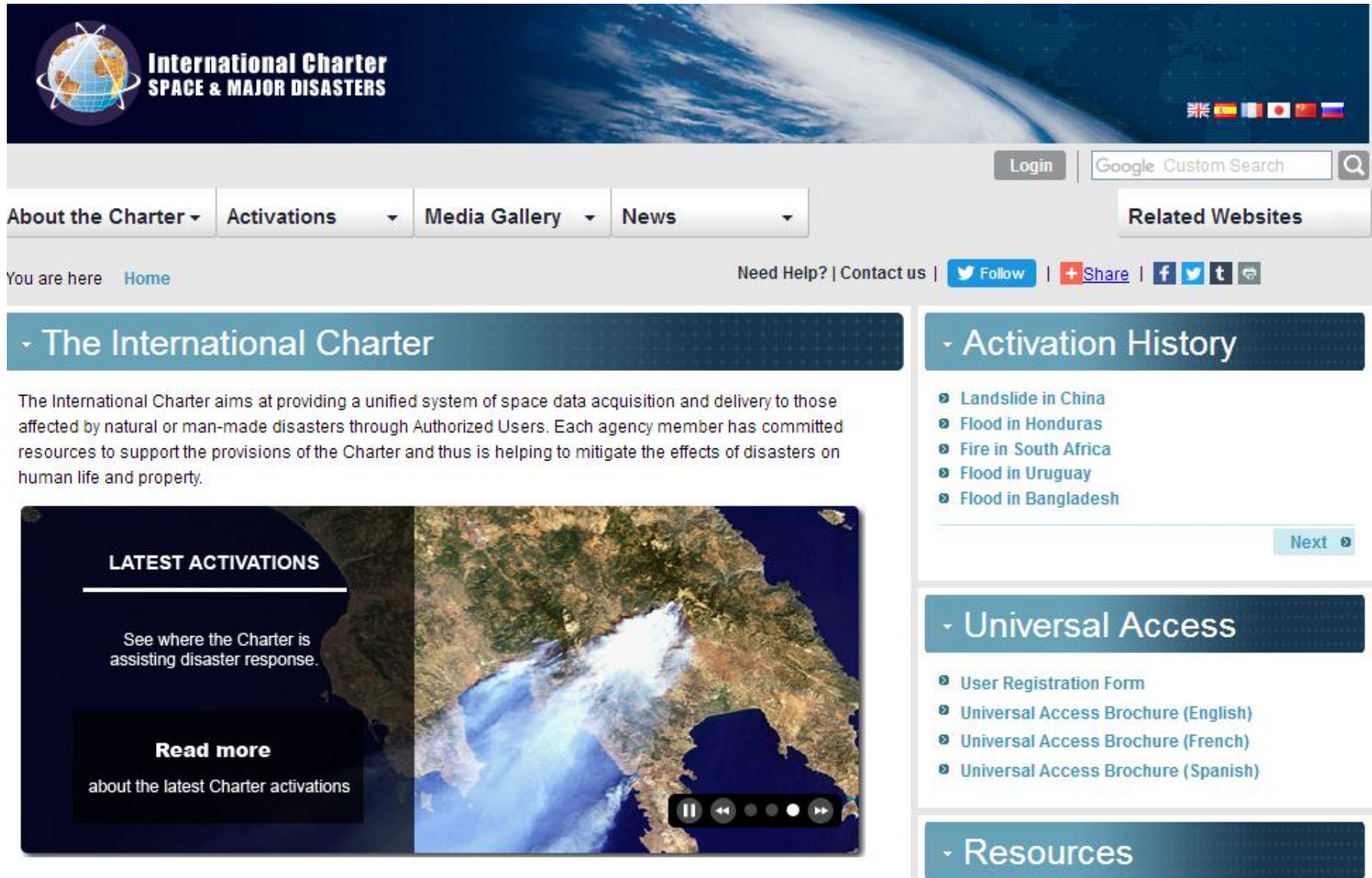
10 Jan 2017



GSMaP



Takuji Kubota, JAXA, 2017



The screenshot shows the homepage of the International Charter website. The header features the logo and title "International Charter SPACE & MAJOR DISASTERS" on the left, and a navigation bar with "Login" and a "Google Custom Search" box on the right. Below the header is a main navigation menu with "About the Charter", "Activations", "Media Gallery", and "News". A secondary navigation bar includes "You are here Home", "Need Help? | Contact us |", and social media links for Twitter, Facebook, and YouTube. The main content area is divided into several sections: "The International Charter" with a descriptive paragraph, "Latest Activations" with a video player showing a satellite image of a disaster area and a "Read more" link, "Activation History" with a list of recent events, "Universal Access" with links to registration forms and brochures, and "Resources".

International Charter
SPACE & MAJOR DISASTERS

Login | Google Custom Search

About the Charter | Activations | Media Gallery | News

Related Websites

You are here [Home](#) | Need Help? | Contact us | [Follow](#) | [Share](#) | [f](#) [t](#) [v](#)

- The International Charter

The International Charter aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through Authorized Users. Each agency member has committed resources to support the provisions of the Charter and thus is helping to mitigate the effects of disasters on human life and property.

LATEST ACTIVATIONS

See where the Charter is assisting disaster response.

Read more
about the latest Charter activations

- Activation History

- [Landslide in China](#)
- [Flood in Honduras](#)
- [Fire in South Africa](#)
- [Flood in Uruguay](#)
- [Flood in Bangladesh](#)

[Next](#)

- Universal Access

- [User Registration Form](#)
- [Universal Access Brochure \(English\)](#)
- [Universal Access Brochure \(French\)](#)
- [Universal Access Brochure \(Spanish\)](#)

- Resources



THE INTERNATIONAL CHARTER 'SPACE AND MAJOR DISASTERS'

Implementing Universal Access

International Charter Space and Major Disasters Universal Access - Registration Form

<https://www.disasterscharter.org>

Introduction

Charter members, conscious of the need to improve Charter access globally, have adopted the principle of Universal Access: *Any national disaster management authority will be able to submit requests to the Charter for emergency response. Proper procedures will have to be followed, but the affected country will not have to be a Charter member.*

This form is part of a registration process for a national authority to request to participate in the Charter as an "Authorized User". Authorized Users can access the Charter directly to request support for emergencies caused by major natural or technological disasters in their own country, or in a country with which they cooperate for disaster relief.

The following criteria must be met by the authority requesting to become an Authorized User:

- a) **The entity must be a national disaster management authority or its delegated agency in that country* ;**
- b) **The entity must have the capacity to download and utilize maps;**
- c) **The entity must be able to submit and pursue its activation requests in English.**

* the delegated agency must have a national mandate to coordinate emergency response in the respective country and must provide a letter to that effect from the responsible national disaster management authority with this registration form.

The Authorized User must be able to provide basic information for an activation request including: date and time of disaster occurrence, affected area with geographic coordinates (Latitude/Longitude), type of hazard, and name of the contact person for any communication with the Charter.

The Charter may provide either remotely sensed imagery or derived mapping products such as damage assessment maps in response to the activation.

Charter members are also interested in learning about other organizations, in the same country as the national entity, with the capacity to analyze and exploit satellite data for emergency mapping. These organizations could become recipients of data in the instance of Charter activation in the country.



Thailand DEC 2016 – JAN 2017 Southern Flood

Early warning and real time decision making

Flood sensorweb

Forecast & modeling

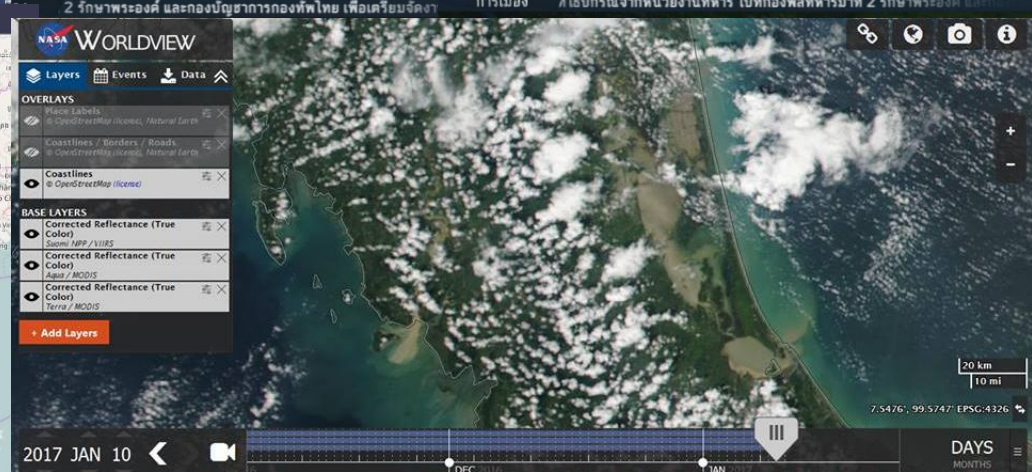
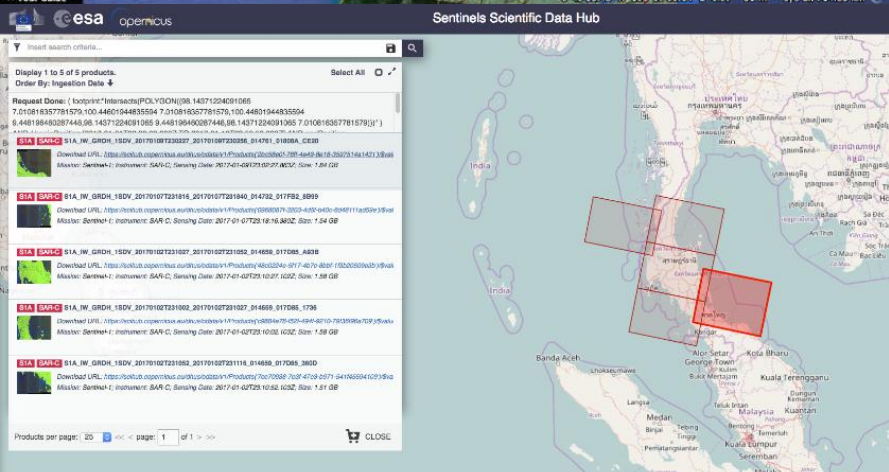
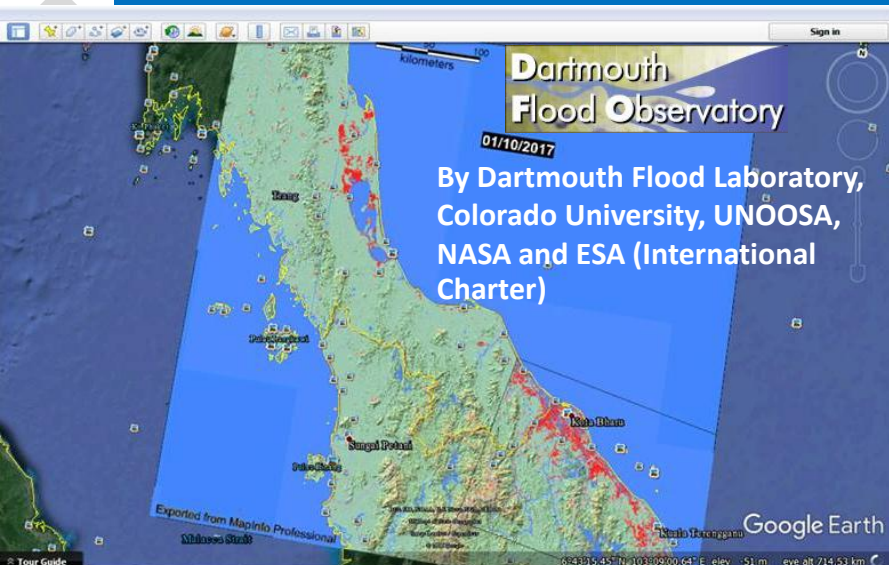
Networking & cluster

Flash flood & landslide warning

Reservoir networking

Data warehouse

Integration of technology for data analysis and flood management



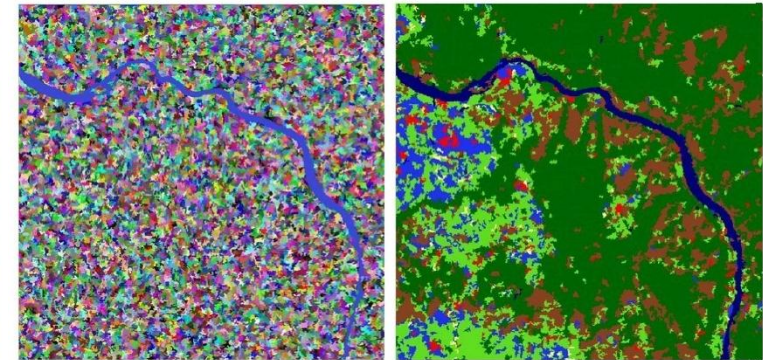
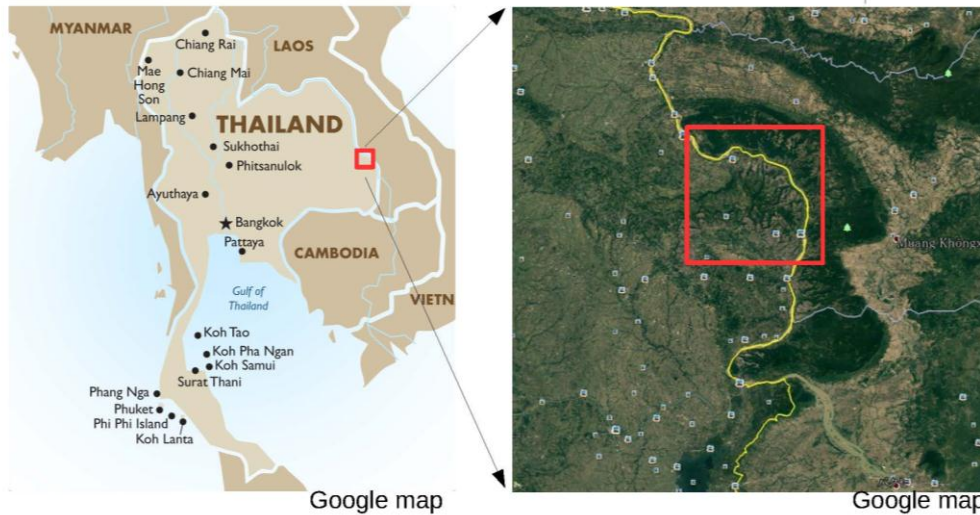
Land Use and Land Cover Change Studies by Microwave (SAR) and Optical RS Data for better Water Management (JAXA/Tsukuba U.)

20 HALL meeting, Kenlo Nishida Nasahara, Univ Tsukuba / JAXA



2017/07/20 HALL meeting, Kenlo Nishida Nasahara, Univ Tsukuba / JAXA

Region of Interest



landcover

- water
- urban
- rice paddy
- cassava
- forest
- rubber
- rockout

0 1 2 3 4 5 km

Kenlo Nasahara & Seiya Ishibashi (JAXA / Univ Tsukuba)
ALOS-2/PALSAR-2
ScanSAR multi-temporal
IGSIB segmentation
Python random forest
Overall Accuracy = 0.80

In the last meeting, on Dec 2016, we decided to set ROI

Location info(Lat/lon): N(15.50° ~ 15.80°), E(105.40° ~ 105.70°)
Area : about 30 km × 30 km

3.Training area

- field trip on 30-31 Nov 2016
- Google earth
- ภาพถ่ายดาวเทียม



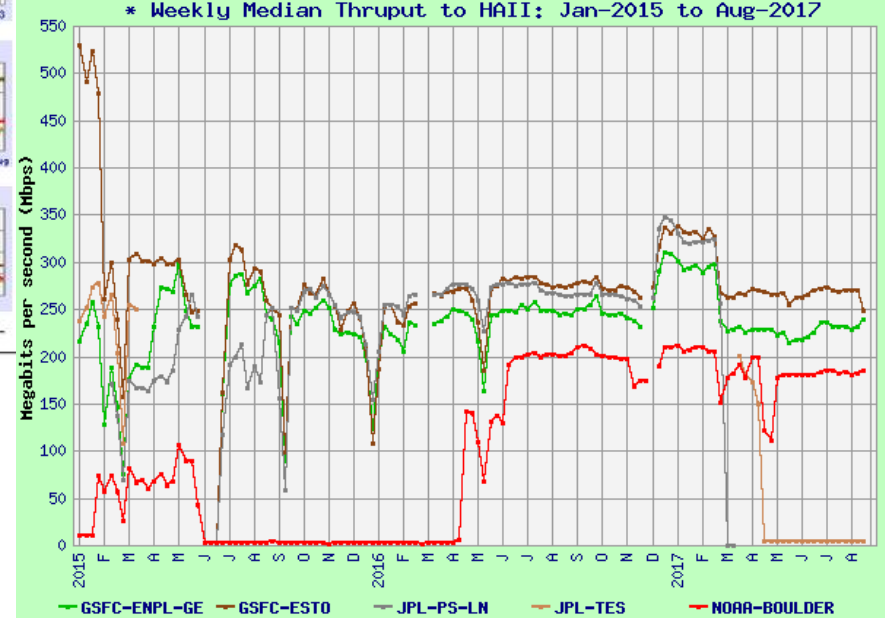
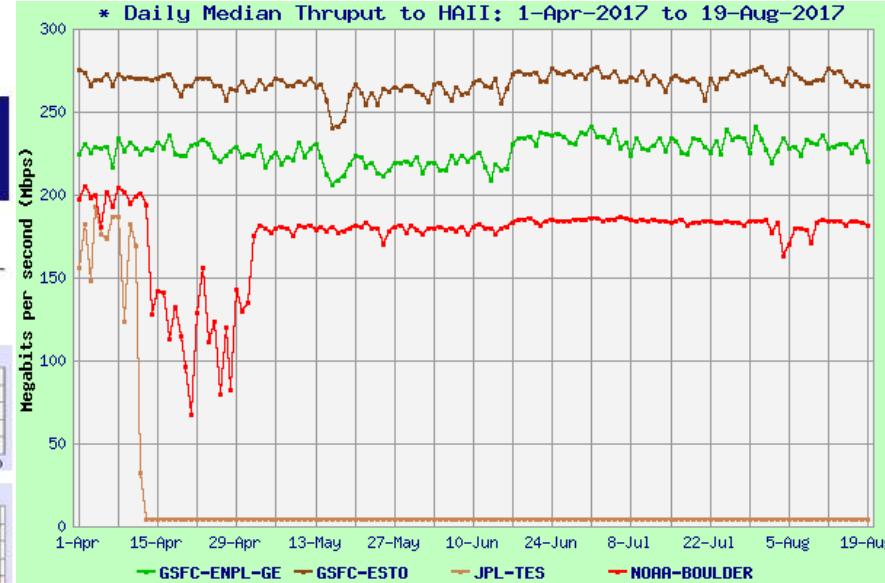
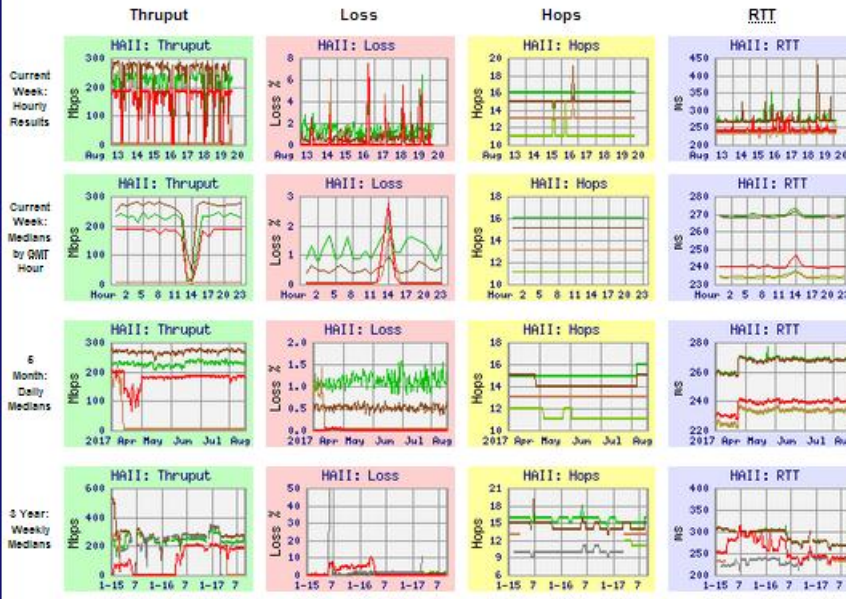
APAN Network Testing with NASA-GSFC

Home Aqua Aura **CEOS** DAAC JET Production Terra Other

EOS Active Network Testing
CEOS Destination: HAI

Hydro and Agro Informatics Institute
 Bangkok, Thailand

- Argentina: [CONAE](#)
- Canada: [CCRS](#)
- England: [GÉANT-London](#)
- Germany: [ESA ESOC](#)
[EuMetSat](#)
[GÉANT-Frankfurt](#)
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[WDCC](#)
- Israel: [Tel Aviv U](#)
- Japan: [JAXA](#)
[Tokai Univ](#)
[Tokyo Univ](#)
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- Netherlands: [GÉANT-Amsterdam](#)
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[HAI](#)
- USA-NASA: [GSFC ENPL](#)
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 For questions regarding web content or Active Testing, please contact: [Andy Germain](#), ASRC Inc.
[Privacy Policy and Important Notices](#)

Source: <https://ensight.eos.nasa.gov/Organizations/ceos/HAI.shtml>

APAN Network Daily Usage

1. download gfs 0.5 degree from
ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/gfs/pr
od/gfs.2017081500/ : 4.5GB at 11:45 and 23:45
2. download gfs 0.25 degree from
ftp://ftpprd.ncep.noaa.gov/pub/data/nccf/com/gfs/pr
od/gfs.2017081500/ : 11GB at 11:45 and 23:45
3. download hycom-data from
ftp://ftp.hycom.org/datasets/GLBa0.08/latest/data/
8GB at 01:00
4. download GSMAP from hokusai.eorc.jaxa.jp : 20MB
Hourly
5. Daily total data download is **39GB 480MB**



Sciences & Technology Adaptation for Strengthening Local Economy in Sustainable Development

S&T Application

- Apply S&T for community survey
- Identify problems and solutions
- Water balance analysis
- Area-based analysis



Engineering/ Innovation

- Simple infrastructure design suitable for the socio-geographical condition
- Systematically plan the work process, management and maintenance
- Local innovation



Sustainable Agriculture

- 3 forests, 4 benefits
- Integrated agriculture
- Water quality management



Success

- Self-sufficiency
- Food security
- Expand the success to other communities



To prevent economic loss from flood and drought, Thailand needs good water management system at **every level**, nationally or locally.

Science & Technology for Community Water Resource Management



Crop productions	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Upland rice												
Cabbage												
Broccoli												
Spinach												
Salad												
Coriander												
Celery												
Chayote												



S&T Adaptation for increasing Community's efficiency

GPS receivers

Satellite Images

Computer

Internet

Spreadsheet

Crop Calendar

The community could coordinate and manage their water resources **with partners and to be the ownership**



S&T Adaptation for Community Water Resource Management System

Water Supply

- Reforestation System
- Small Reservoir Management System
- Flood canal, canal street and monkey check System
- Large Reservoir Management

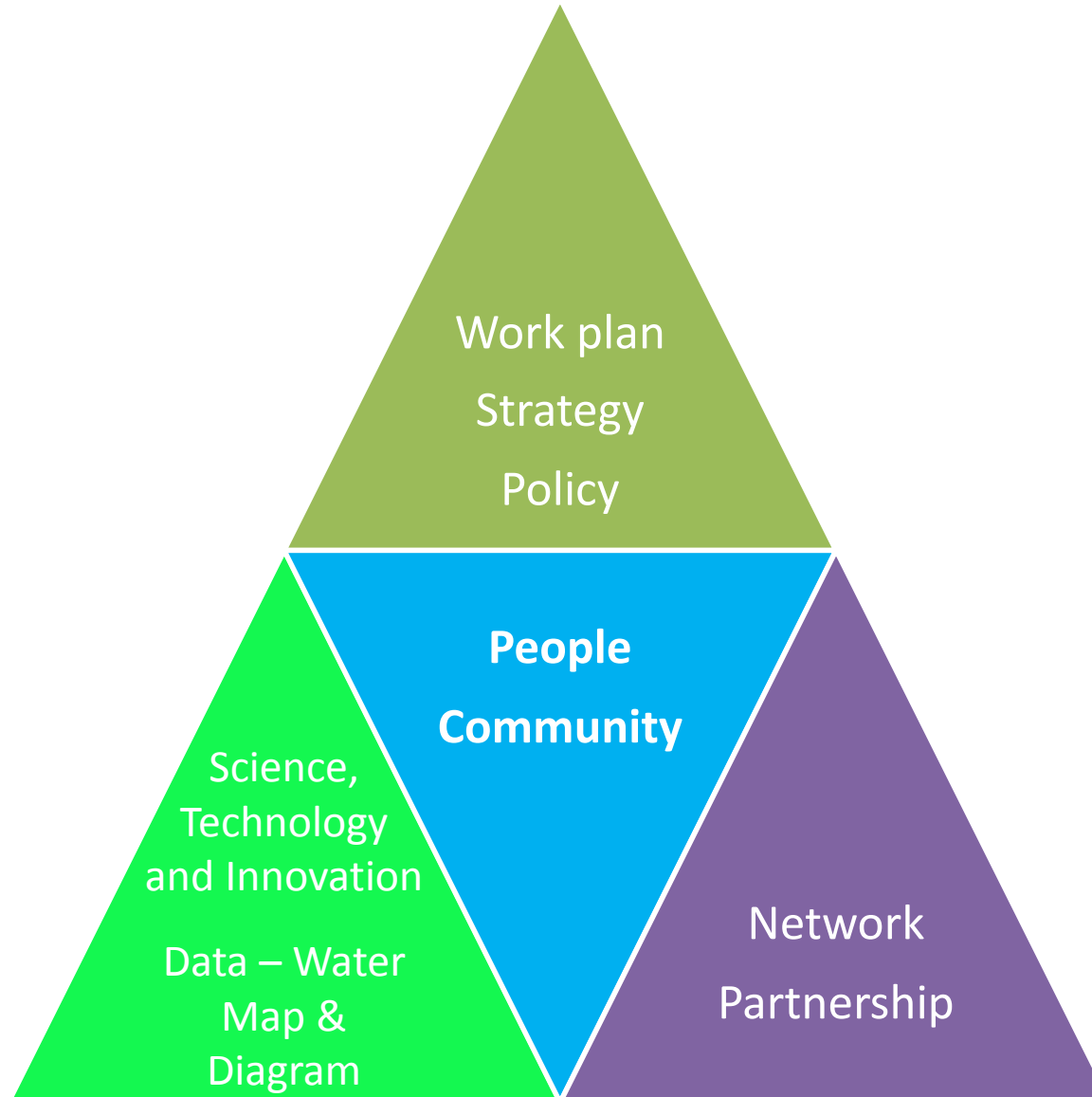
Water Usage

- Water Network System
- Sediment Trap System
- Sugarcane Water system
- Farm-base Water Distribution System
- Downstream Ecological System
- Water Rotation System (Reuse)
- Waste Treatment System

Water Management

- Water management system in 4 areas (Flood, Drought, Waste, and Brackish water)
- Water resource management plan - Sub-district level
- Water Resource Development Plan – Community issue
- Sub-district and Provincial Water Resource Management Center

Principle of S&T Adaptation for Community Water Resource Management



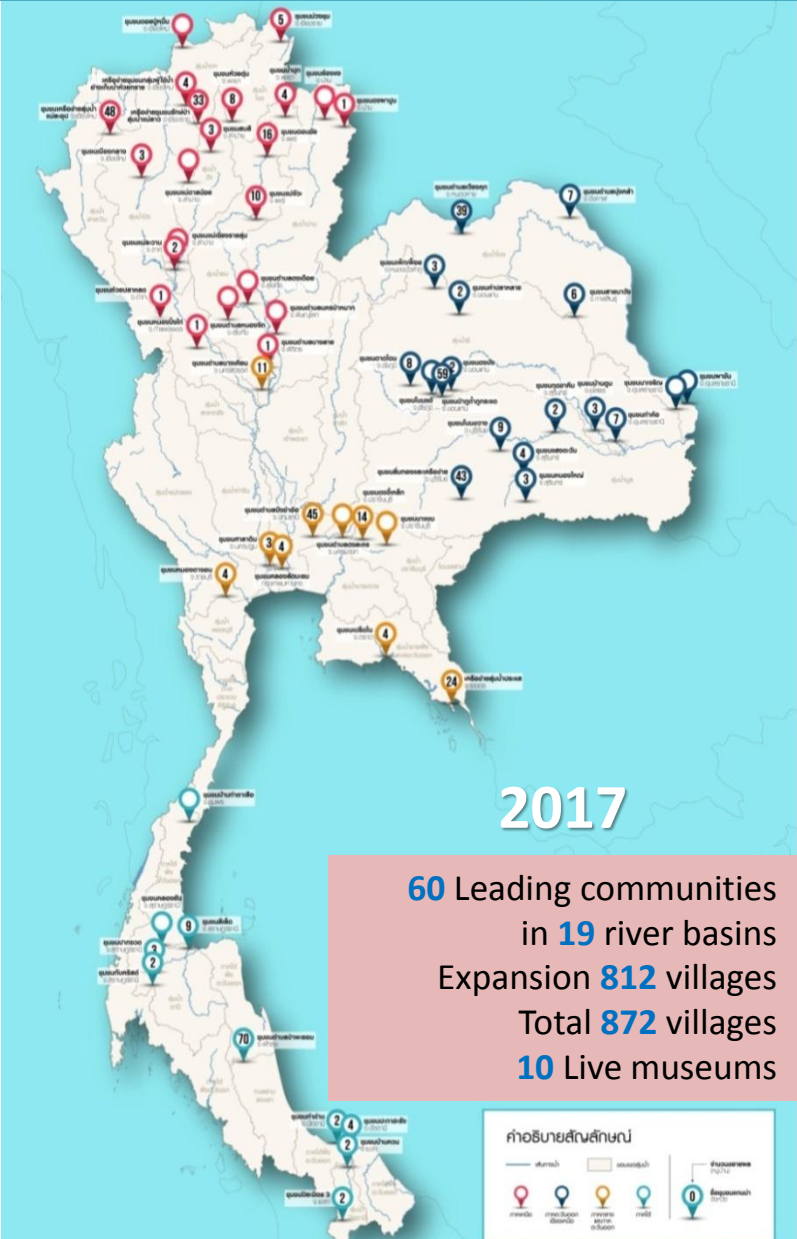
DSLMM



Water Resource Management aims to create understanding of local people about their water supply, water demand, waterway in the area, sustainable management using water table, and identify source of budgeting for management

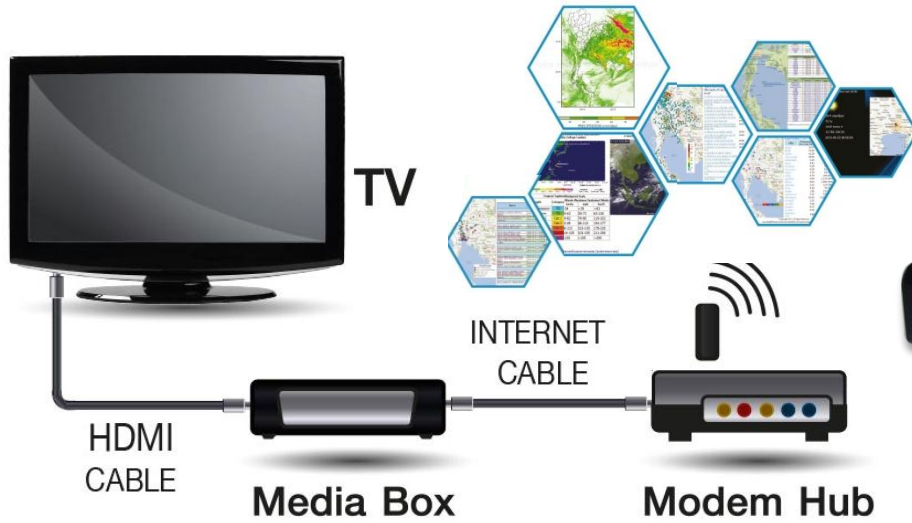
D	S	L	M	M
Water D emand	Water S upply	L ogistic of Management	Water M anagement	M oney (Budget of water)

Community Water Resource Management (CWRM)



- 2003** S&T application for surveying, created local data and community map in “Village that Learns and Earns” project
- 2007** “Thailand Water Challenge (TWC)”
- 2008** “Application of S&T for Community Water Resource Management (CWRM)” Project to develop people, community, data and knowledge management
- 2011** Expand the success to its network: “Water resource development in 142 communities for flood and drought management”

Media Box : Automated weather and water tracking tool



Broadcast water situation NEWS
Serve Local administration and Community



ThaiWater Application



ThaiWater



ฝน
Rainfall



อากาศ
Weather



เขื่อน
Dam



คาดการณ์
Forecast



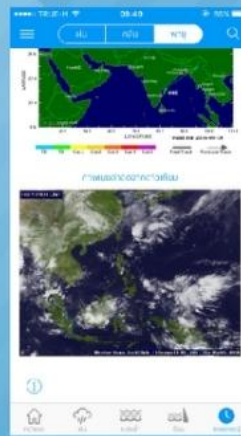
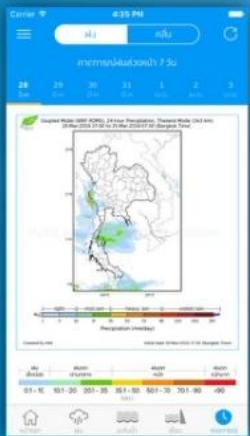
ฝน
Rainfall



คลื่น
Wave



พายุ
Storm



ANDROID APP ON
 Google play Available on the
App Store

NEWS Report / Water situation monitoring
Serve Executive and Public

Examples of Good Practices

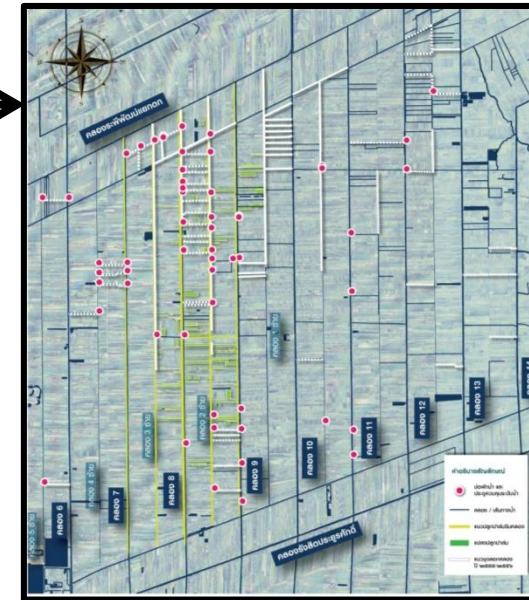
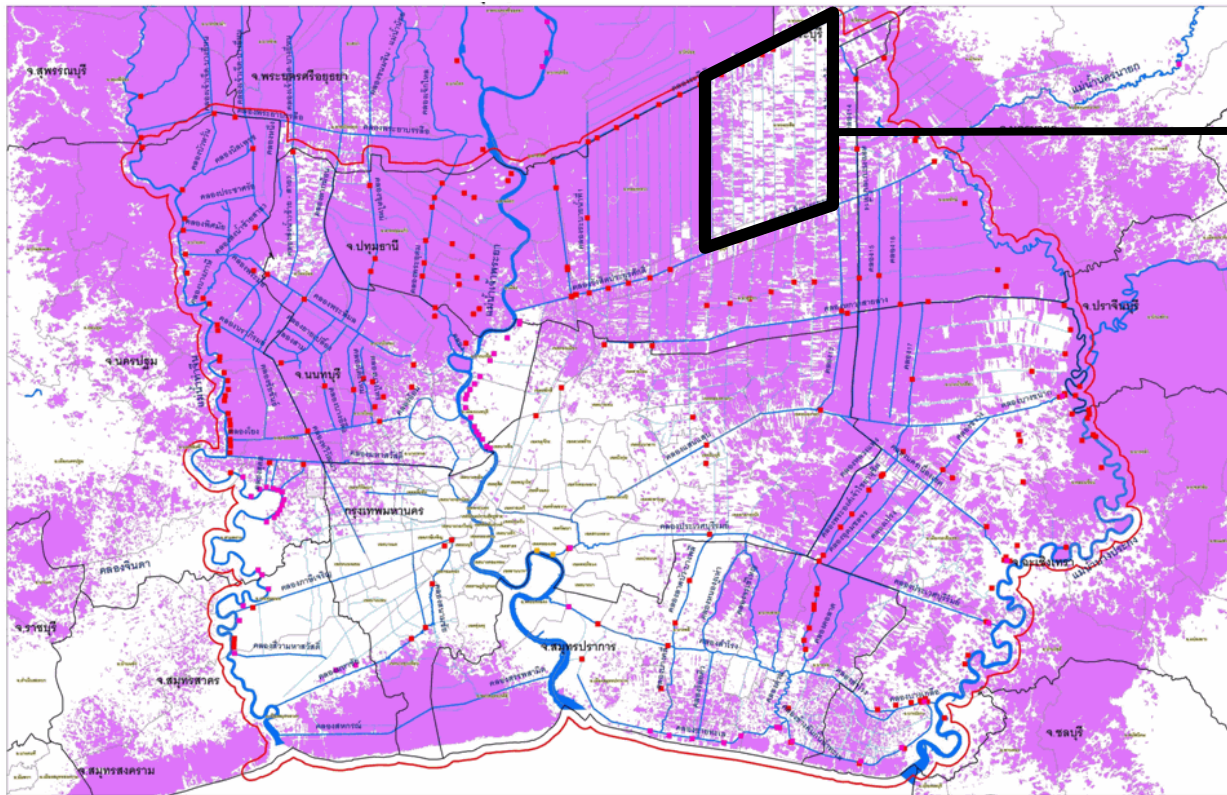
Irrigated area

The Development of Catchment Area in Rangsit Agricultural Area

Khlong Rangsit, Nongsue district, Pathum Thani Province, Thailand
Chao Phraya River Basin

The Development of Catchment Area in Rangsit Agricultural Area

Map shows **flood area (in pink)** of lower Chaophraya Basin during **Chaophraya Flood 2011**



Poor management during flood

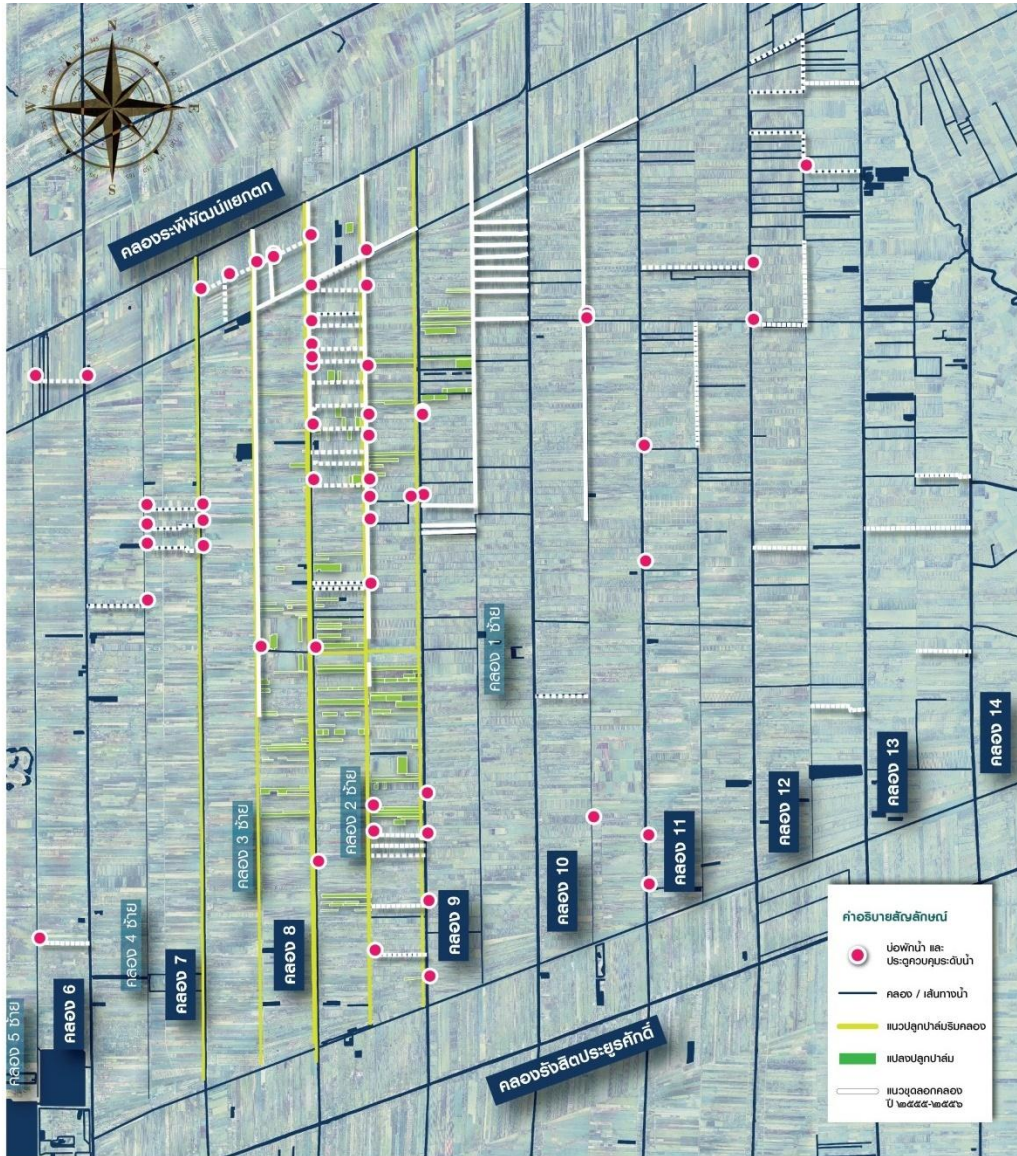


Poor storage during dry season



Problems and Solutions

*Build furrow and canal system to be **catchment area**
Diminish disaster risk and **Boost economy***



← Map of Rangsit Agricultural Area,
Pathum Thani Province

Problems:

- No maintenance of watergate
- Canal become shallow
- Water structure become deterioration

Approach:

1. Increase capacity of water storage and drainage by using “Mire Suction Boat”
2. Increase capacity of water resource management by building “Clarifiers” and installing “Water gates”
3. Renovate waterside area by planting palm trees beside the canals

Water Resource Management

Conserve the waterside area prevent canal collapse and constructions along the canal, establish Community's Palm fund



Optimize water storage, drainage, and reservation renovate the furrow areas and local canals to store water



Optimize water resource management control inflow and outflow level, link water system between irrigated canals and sub-canals



Cultivation Adjustment

- **Change cultivation pattern** to align with local situation (i.e. rainfall)
- Cultivate **mixed plants**, expand small integrated agriculture area around public canals
- Decrease cultivated area in dry season and plant **trees that consume less water**

➔ Earn additional incomes all year

Within the area of
40 x 3 meters

Community can: 1) increase income THB 12,000/year
2) and reduce expenses in consumption by THB 6,000 /year

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Season	Dry					Raining					Dry	
Lettuce												
Sweet ivy gourd												
Kale												
Parsley												
Morning glory												

Trees: cannot cultivated in dry season
 Trees: appropriate with dry season
 Fruitful trees



Achievements

*During Gaemi Typhoon in 2012,
This area can prevent flood in Bangkok
and reserve 17 MCM of water for agriculture.*



Comparison	Rangsit	Other
Palm oil production (times/year)	24	19
Average Palm oil yield (tons/time)	8	4.5



Achievements

Water & Food Security (Increase water storage in canals and palm oil trees furrows for more than 3.5 MCM, enough for yearlong usage)

Collaboration → Prevent waterside encroaching and have additional incomes

Sustainability → Community's Palm Fund can increase income THB 656,000/village/year

Production → Increase palm oil productivity

Expand CWRM network from 4 to 9 sub-districts within 4 years

Rainfed area

Community Water Resource Management in Ban Limthong

Nangrong district, Buri Ram province,
Mun River Basin

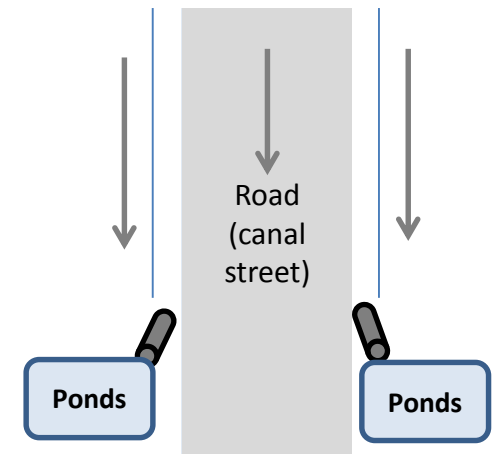
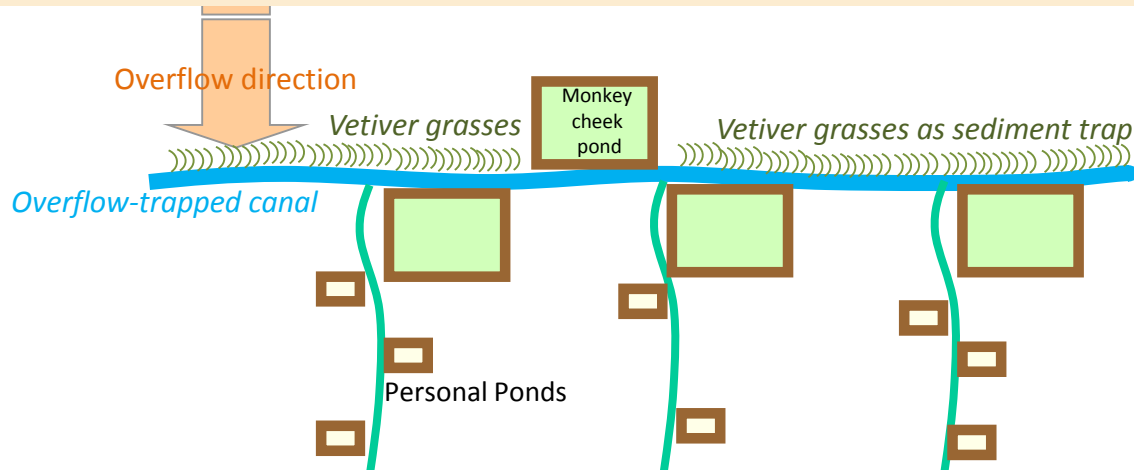
Problems

- Flood and drought for over 40 years
- Shortage of water for consumption and agriculture
- High cumulative debt
- Villagers left town



Approach

- Create **Pond Networks (Storage + Linkage)**
 - **Canals:** dredge/develop canals to trap overflow and connect water to ponds
 - **Ponds:** increase water storage by building small ponds
 - **Street:** Canal street (use street as a canal to control and deliver overflow to local catchment areas)
- **Change cultivation pattern** to follow integrated agriculture concept
- Set up **villager's group** for agricultural planning, production, and selling (price negotiation)

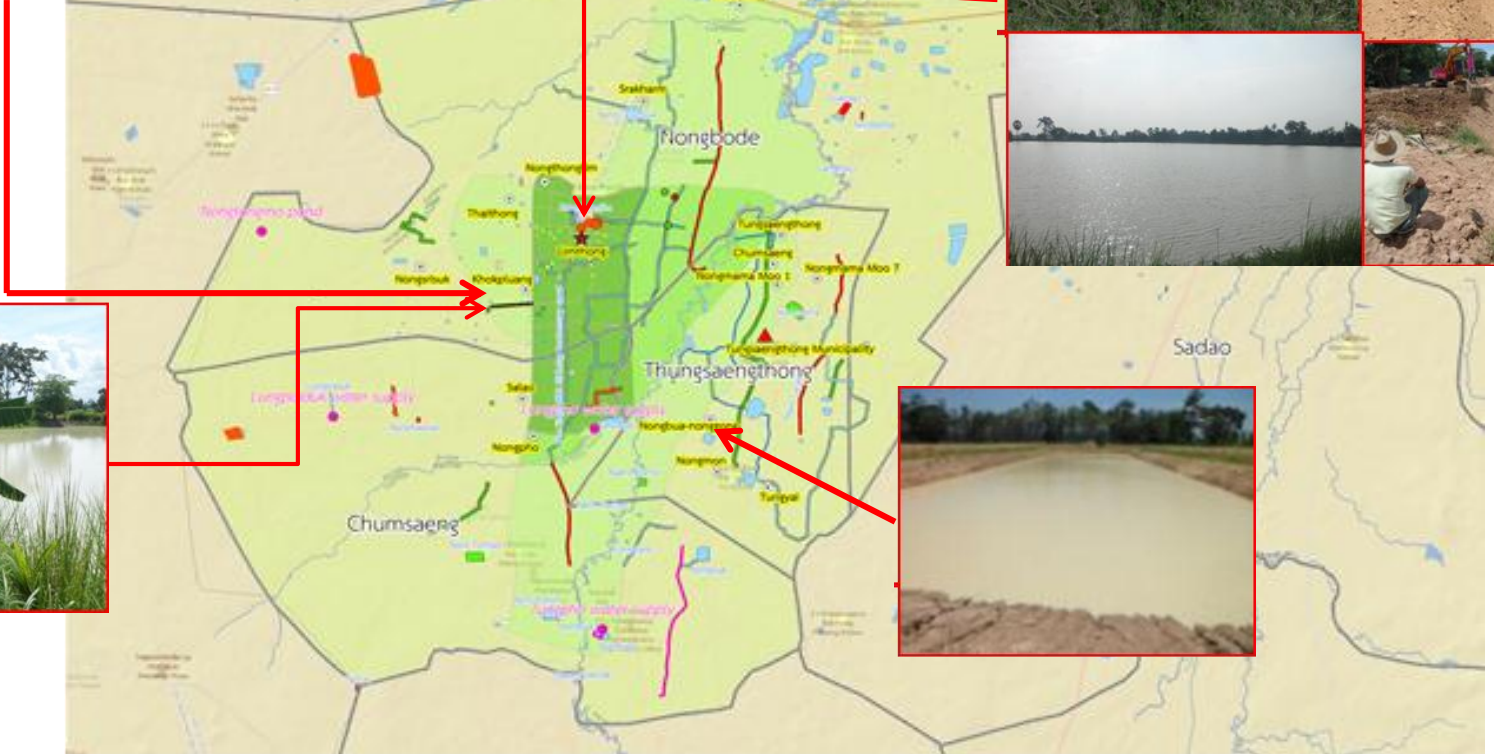


Past: flood in communities caused damages to roads, products, residences.

Present: "Canal Street" no damage to roads, products, and residences.



Network expansion: from 1 community to 5 sub-district (42 communities)



Achievements

Past

Flood and drought

Shortage of water for consumption and agriculture

High cumulative debt

Villagers left town



Water Management by S&T



Achievements

Water & Food Security (increase reservoir capacity)

Enough water for rain recession and plant trees that consume less water during dry season (*total 1,167,000 m³ increased*)

All year income:

- Income increased 2.6 times
- Properties increased 16 times
- Agricultural value increased in dry season around THB 9,720,000

Expand Integrated agriculture from **15 to 300** households

Expand CWRM network from **1 to 42 communities** (5 sub-district)

People return home 😊



Flood area

**Community Water Resource Management in
Ban Saladin**

Maha Sawat sub-district, Phutthamonthon district, Nakhon Pathom province
Thachin River Basin

Problems

Less favourable
of transportation
by canals



- Massive amount of weeds and water hyacinths
- Main and sub canals were clogged with household rubbish unable to drain out the flood water



Disposal of grease
from cooking
waste directly into
the canals



Nonfunctional
watergates making
water stagnant

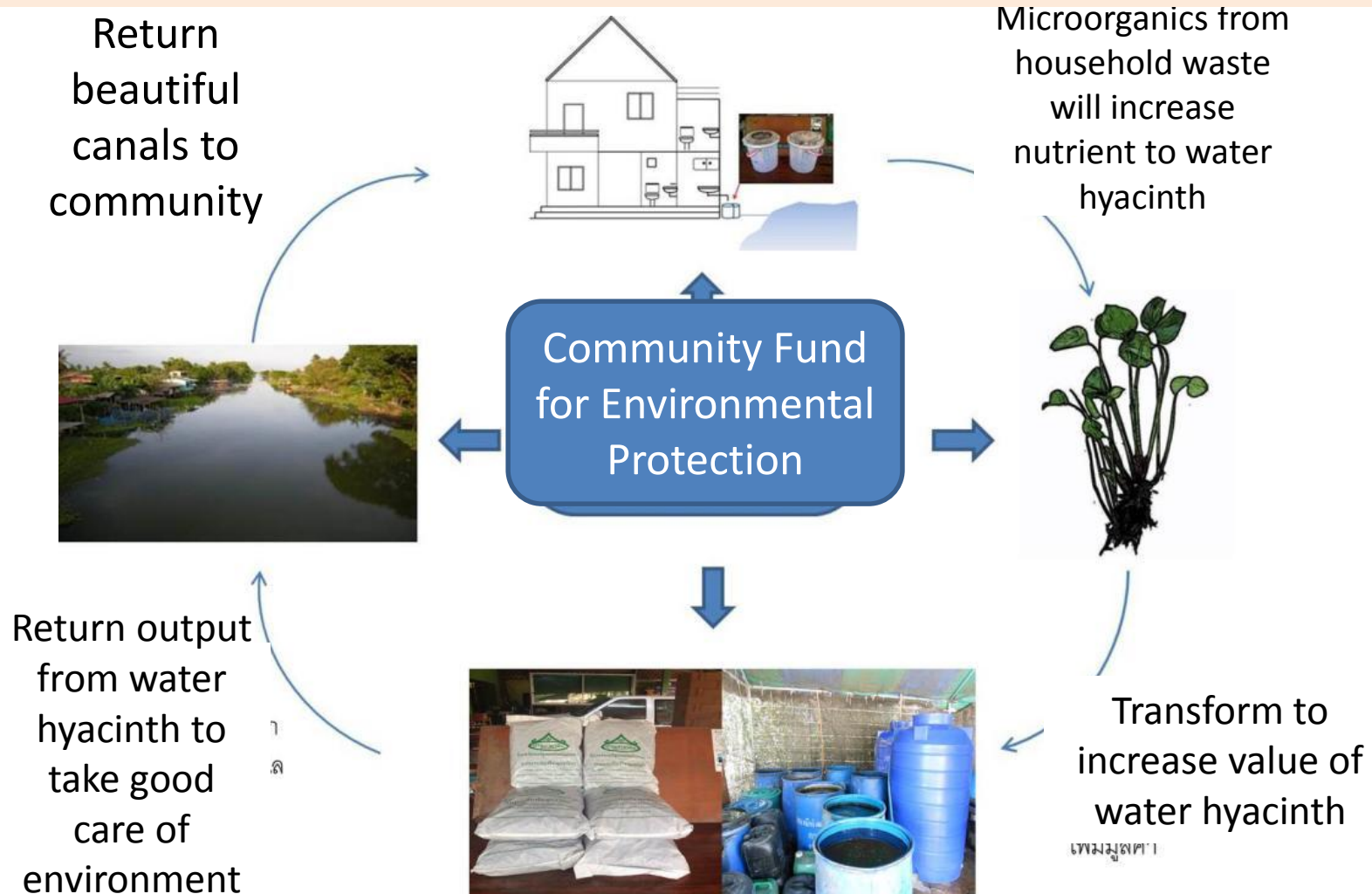


Agricultural
chemicals derived
from farming



Approach

- **Drainage & water storage improvement** by dredge up to increase depth of canals
- **Water treatment** by 1) installing household grease trap 2) developing solar turbines and 3) remove weeds from canals by added value to the weeds
- **Manage abandoned watergate** by community with collaboration from relevant agencies
- **Change cultivation pattern** to follow integrated agriculture concept



Achievements

Drainage improvement



Development of solar turbines



Ready-mixed soil



Water quality improvement



The New Theory Implementation



Return of water transportation



Achievements

Past

Flood and drought

Wastewater and
Brackish water



**Water
Management
by S&T**



Achievements

Water & Food Security: Drainage improvement (dredge canals to improve the ability of drainage)

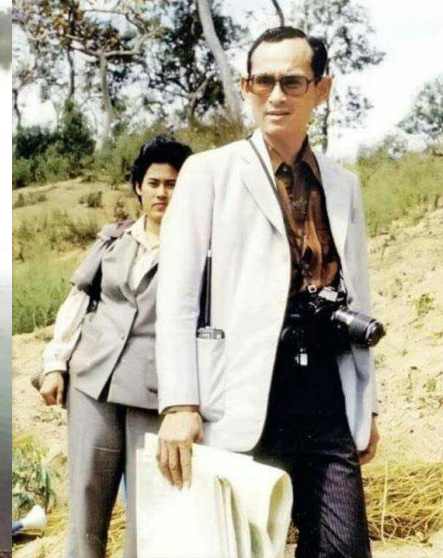
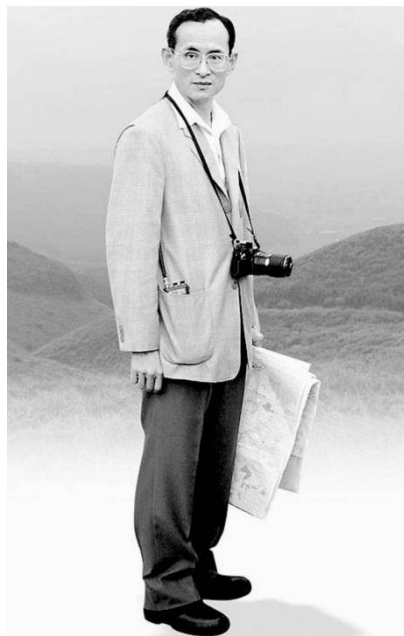
Quality of Water and Life

- Household grease trap
- Solar Turbines (increase oxygen in water)
- Add value of water hyacinth to be “Ready-mixed soil”

Integrated agriculture → all year income



“As I have said for many times, human life is frequented by suffering, danger and difficulty. No one ever live a normal, happy life for good. Therefore, all of us have to prepare our body and mind, and always get ready to encounter and cope with any troubles with vigilance, reasonableness, knowledge and harmony”



Royal Address by H. M. King Bhumibol Adulyadej On the Occasion of the New Year 31 December 2011, the Father of the Land and Water resources Management of Thailand.

Source: <http://www.tsdf.or.th/en/kingspeech.aspx>



Conclusions

HAI has been developing, researching, integrating and implementing science and technology for the better and stronger Thai society in a sustainable way following H. M. King Bhumibol Adulyadej the Great's "Sufficiency Economy" Concept and the "New Agricultural Theory Initiative."





H A I I

Hydro and Agro Informatics Institute

Ministry of Science and Technology, Thailand

SCIENCE & TECHNOLOGY
for better Agricultural &
Water Resource Management

www.haii.or.th ● www.thaiwater.net

Thank You Very Much!!
Questions??

