

# *Early provision of flood information by using satellite monitoring data of GSMaP*



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***March 16, 2012***

***6<sup>th</sup> World Water Forum, Marseille, FRANCE***

# *Contents*

- 1. Global Flood Alert System (GFAS) through International Flood Network (IFNet)*
- 2. GFAS development – Case study on Vietnam*
- 3. Analysis of satellite precipitation data on the Chao Phraya River basin*
- 4. Conclusion and Way forward*

# Background

## *Problems of hydrological observation and data collection for flood warning and forecasting*

- × Difficulty to get real-time hydrological data on the river basin
- × Insufficient installation and maintenance of ground observatory stations with real-time information network (rainfall, water level, flood discharge...).
- × Lack of data and model for flood warning and forecasting.
- × Limited budget and human resources for installation and maintenance of observatory station, flood warning and forecasting.
- × Insufficient framework to enhance technical skill and capacities.

**-> Satellite monitoring can supplement and/or substitute ground observation for flood warning and forecasting, applicable to anytime, anywhere of the world.**



Rainfall observation by hand

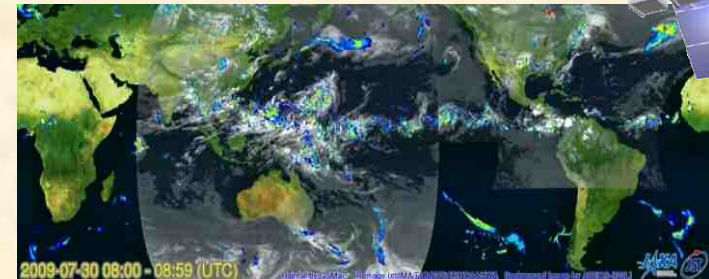
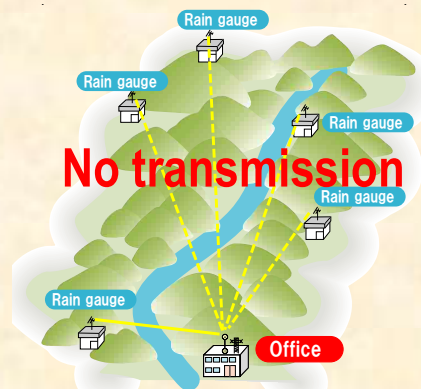


Image Source : JAXA



# *IFNet (International Flood Network)*

## *Background*

- ◆ *Rising trend of flood damages*
- ◆ *View of flood issues as locally limited problems*
- ◆ *Few networks that dedicated to flood issues*
- ◆ *Necessity to give priority to flood issues*

*IFNet was set up as an open network everyone can join on the flood day of WWF3 in 2003.*

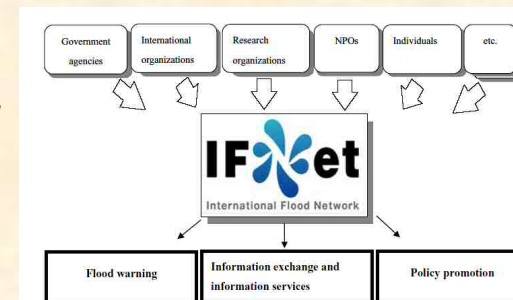
## *Objectives*

*To contribute to flood disaster reduction by:*

- ◆ *Sharing knowledge and lessons,*
- ◆ *Promoting good practices,*
- ◆ *Raising awareness on flood risk among policy makers & citizen.*

## *Membership*

- ◆ *IFNet is an **open, free network** to everyone, currently 617 registered from 81 countries (as of 31 March, 2010).*
- ◆ ***Advantage:** Opportunity to receive **GFAS** information*



# *GFAS (Global Flood Alert System)*



## *1. Project Concept*

- Attempt to utilize **satellite precipitation data** for flood early warning*
- Support for **existing flood early warning** wherever necessary*
- Promoted both by Ministry of Land, Infrastructure and Transport (MLIT) and by Japan Aerospace Exploration Agency (JAXA)*

## *2. Development through collaboration among:*

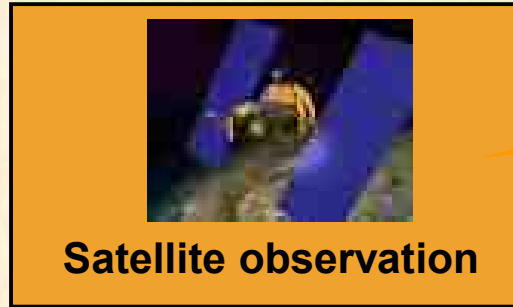
- JAXA** as satellite precipitation data provider*
- IDI** as system developer and operator*
- IFNet** as flood early warning transmission network*
- Hydrological/ Meteorological Authorities, Disaster Management Sections, and River Managers of any part of the world** as users of flood early warning and forecasting, by supplementing and/or substituting ground observatory stations of very limited numbers*

# Schematic figure of GFAS

## i) Space agencies

NASA Homepage

```
Connected to server...
Obtain data from
Data list obtained:
013842RT 20050105T1044Z
023842RT 20050105T1044Z
033842RT 20050105T1044Z
043842RT 20050105T1044Z
053842RT 20050105T1044Z
063842RT 20050105T1044Z
073842RT 20050105T1044Z
083842RT 20050105T1044Z
093842RT 20050105T1044Z
103842RT 20050105T1044Z
113842RT 20050105T1044Z
123842RT 20050105T1044Z
133842RT 20050105T1044Z
143842RT 20050105T1044Z
153842RT 20050105T1044Z
163842RT 20050105T1044Z
173842RT 20050105T1044Z
183842RT 20050105T1044Z
193842RT 20050105T1044Z
203842RT 20050105T1044Z
213842RT 20050105T1044Z
223842RT 20050105T1044Z
233842RT 20050105T1044Z
243842RT 20050105T1044Z
Lastest data check
WWW Latnet data check
02050105 14:10:37
```



Heavy rainfall in the river basin



River

## ii) IDI-Japan

Download of data



Data processing

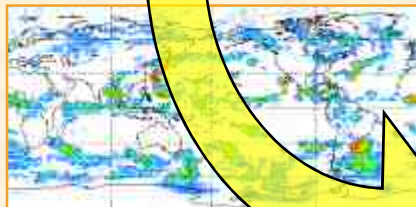


Mapping, Email



System development

iv) Hydrological service to river authorities



## iii) IFNet

1. IFNet Homepage
2. Email of heavy rain information to IFNet members in charge of flood forecasting and warning

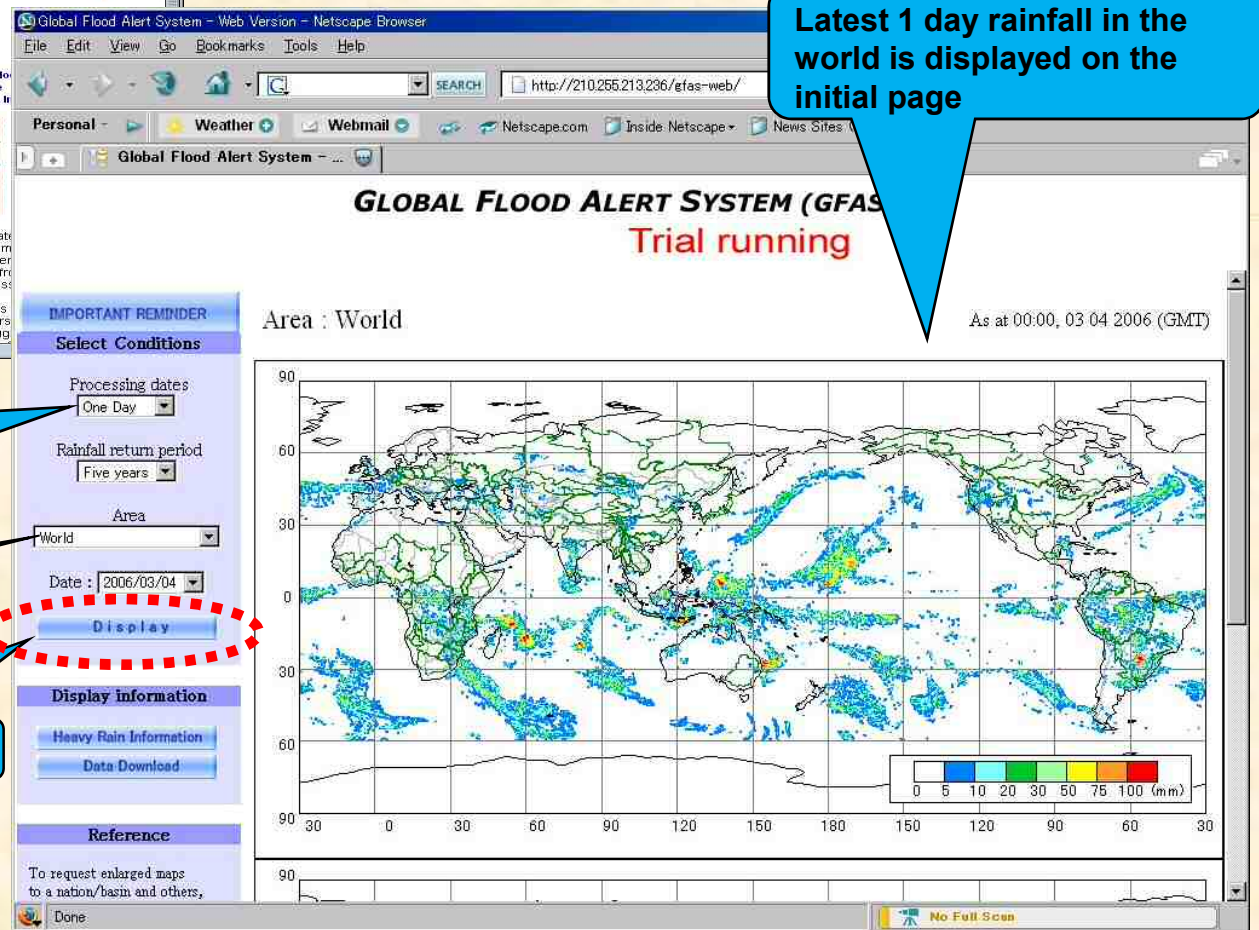
Flood warning and forecasting by using GFAS Information etc.

v) Residents/ NGOs/ Community leaders

# Website of IFNet & GFAS

## Precipitation data of the world from satellite monitoring

GFAS website: <http://gfas.internationalfloodnetwork.org/gfas-web/>

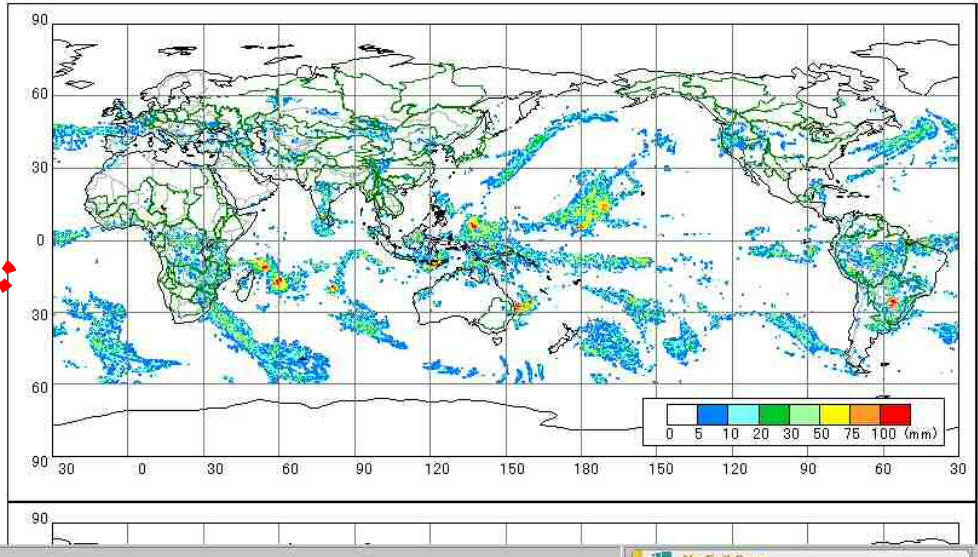


Latest 1 day rainfall in the world is displayed on the initial page

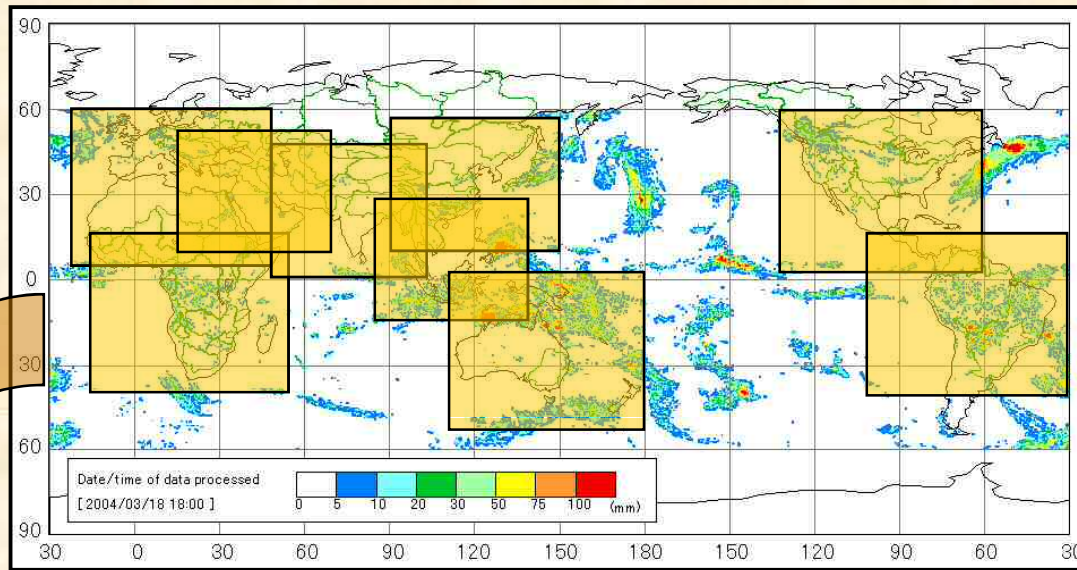
You can select 1 or 3-day rain fall from pull-down menu here.

You can select from 9 regions

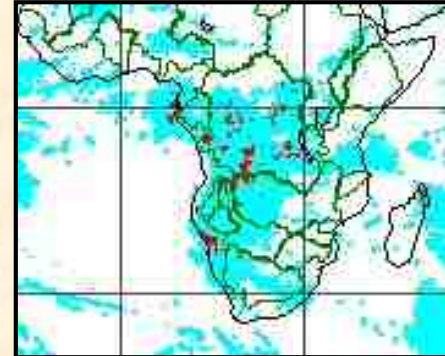
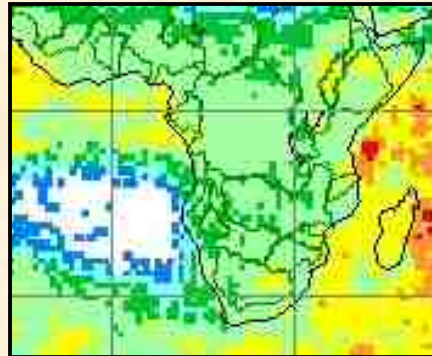
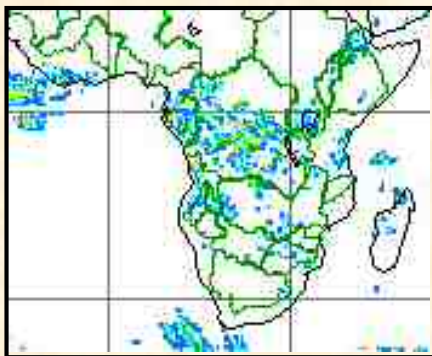
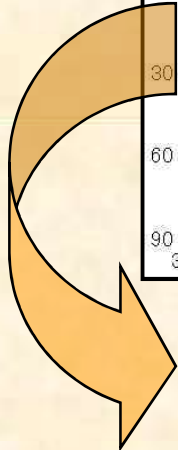
Then, click here for display.



# ***GFAS : Enlarged maps for 9 regions of the world***



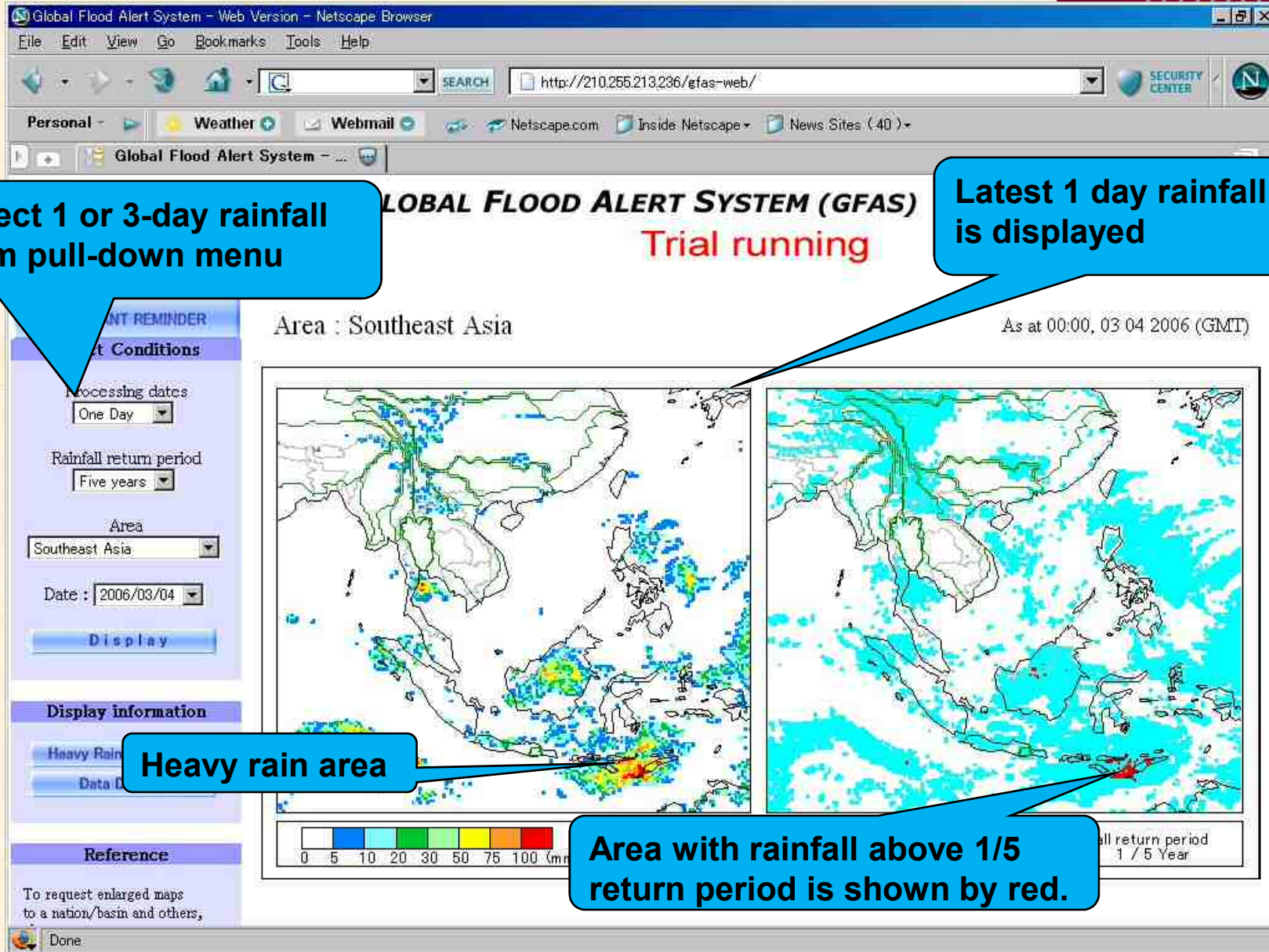
- Europe & North Africa***
- Middle East***
- South Africa***
- South Asia***
- Southeast Asia***
- East Asia***
- North America***
- South America***
- Oceania***



***Sample of regional map (South Africa)***



# GFAS : Daily precipitation data - Example of Southeast Asia



Select 1 or 3-day rainfall from pull-down menu

Latest 1 day rainfall is displayed

Heavy rain area

Area with rainfall above 1/5 return period is shown by red.

# *GFAS Up-grading 3B42RT >>> GSMaP*

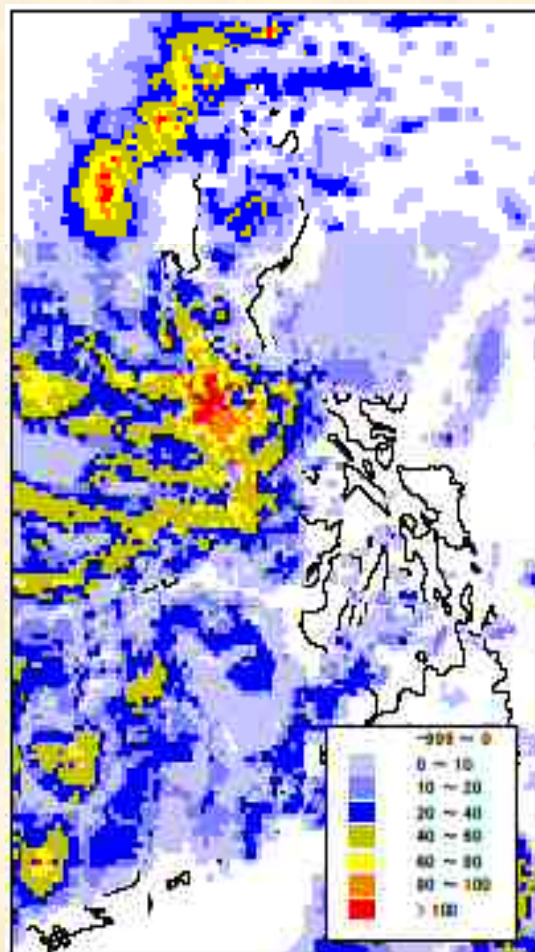
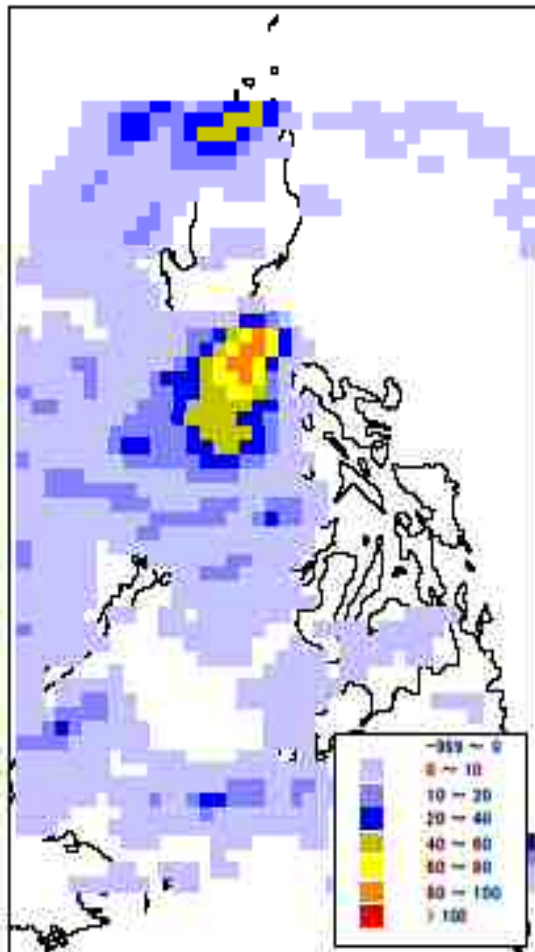
## *Typhoon Ketsana on the Philippines (2009/09/26 daily)*

### *3B42RT (1998-2008)*

- *Mesh size: 0.25°*
- *data delay: 10 hours*

### *GSMaP (2007-)*

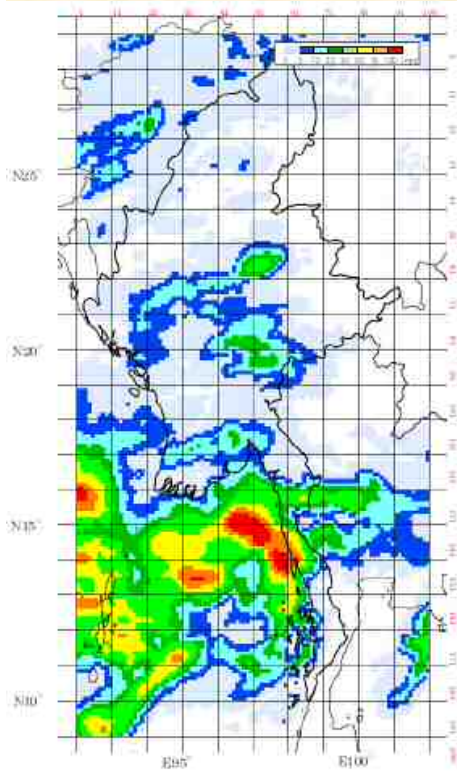
- *Mesh size: 0.1° (10x10 km<sup>2</sup>)*
- *data delay: 4 hours*



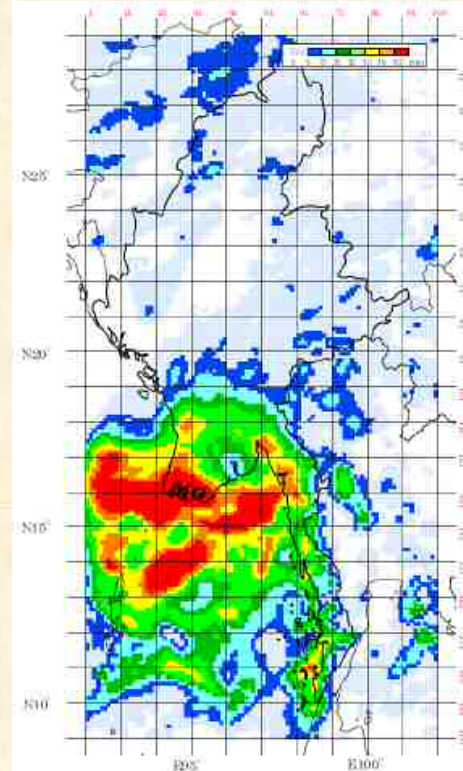
*Up-grading from 3B42RT to GSMaP enabled more detailed and more rapid transmission of precipitation data.*

# GFAS for Ayeyarwady River in Myanmar

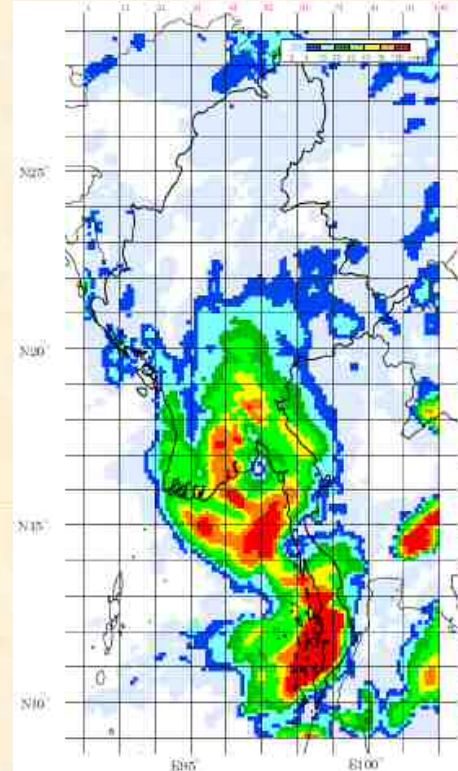
*Heavy rain caused by Typhoon Nargis (using GSMaP data)*



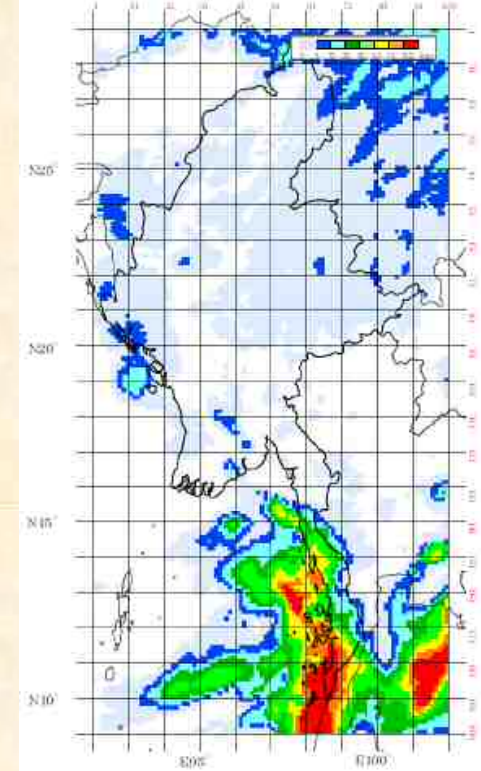
01 May 2008



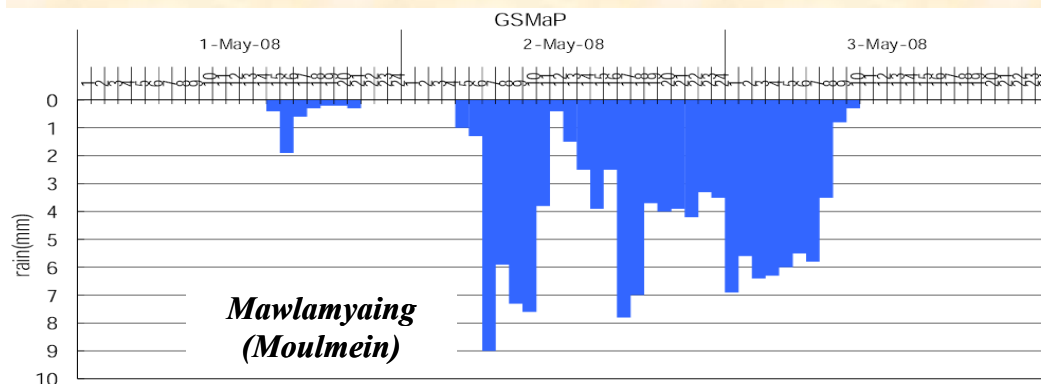
02 May 2008



03 May 2008



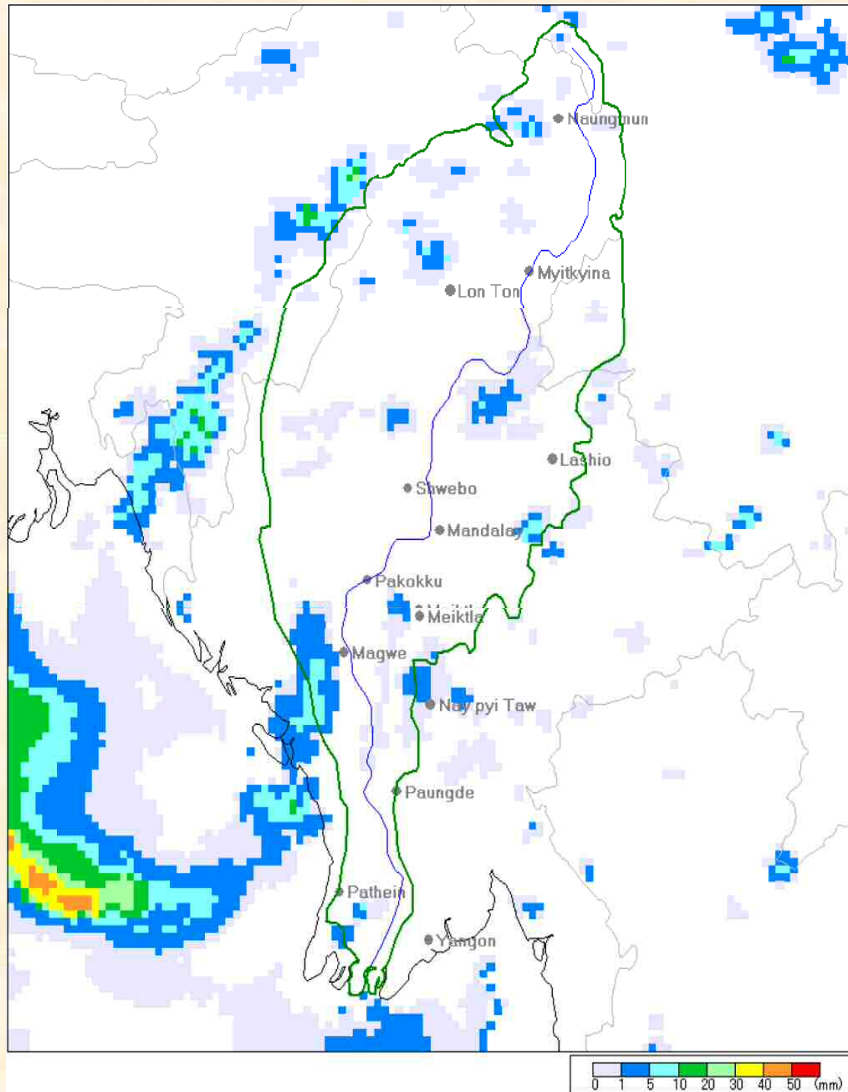
04 May 2008



*From any parts of the world, hourly precipitation data of any place (mesh) can be obtained even though ground observations are not available.*

# GFAS for Ayeyarwady River in Myanmar

<http://gfas.internationalfloodnetwork.org/n-gfas-web/>



## ❖ Available data

- maximum hourly rainfall data within 24 hours
- 1-day, 3-day or 1-week rainfall data

time	biggest[time]	spot name
24-hours within biggest	10.8mm [14:00 - 15:00]	Nyaungdo

time	Basin average[time]	biggest[time]	spot name
1-Days cumulative	8.81mm	44.23mm	Nyaungdo
2-Days cumulative	18.15mm	77.96mm	Nyaungdo
3-Days cumulative	55.82mm	237.2mm	Nyaungdo

## ❖ Alert message by E-mail

### E-mail SAMPLE:

Heavy rain information to ZZ area at ---.

**Mean basin precipitation** of Ayeyarwady is **XX mm/day**. Please check on IFNet website!

<http://xxxxxxxxxxxxxxxxxxxxxxxxxxxx>

# GFAS Communication

from Tokyo



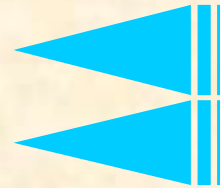
to Vietnam

Alert mail  
(sample)

**Mua to tren *30mm/gio* o vung thuong  
nguồn lưu vuc song Huong va song Thu  
Bon.  
Vao ngay trang web theo dia chi  
[http://gfas.internationalfloodnetwork.org  
/n-gfas-web/](http://gfas.internationalfloodnetwork.org/n-gfas-web/)  
Lien he van phong So NN&PTNT.**



to Tokyo



from Vietnam

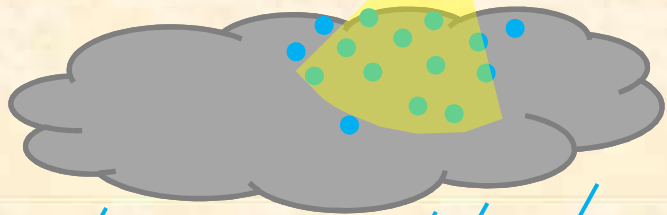
Request mail  
(sample)

**Set up a new interface for \*\*\*\* City.**

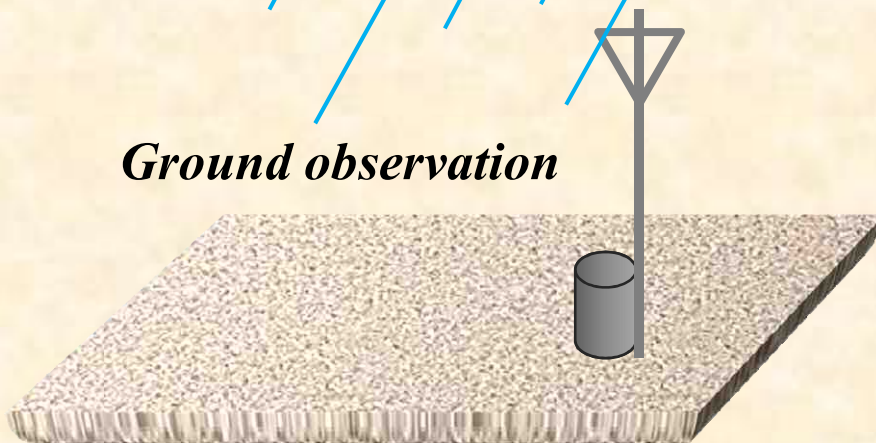
**The alert is so frequent that you should reset the alert  
level as 50mm/h.**

# ***GFAS Development (1): Correlation between satellite monitoring and ground observation***

*Satellite Monitoring*



*Ground observation*

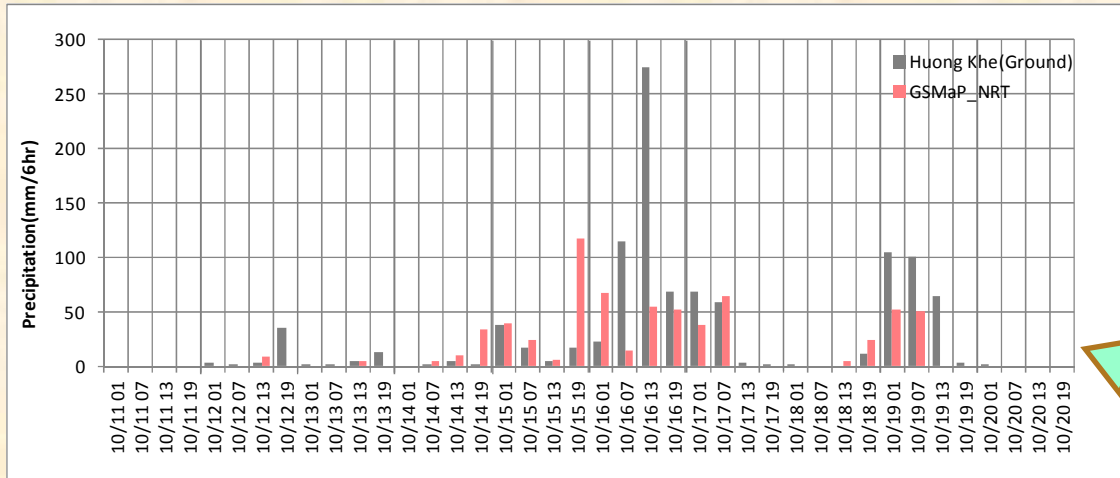


*In order to estimate ground precipitation, correlation between satellite monitoring data and ground precipitation data has been studied.*

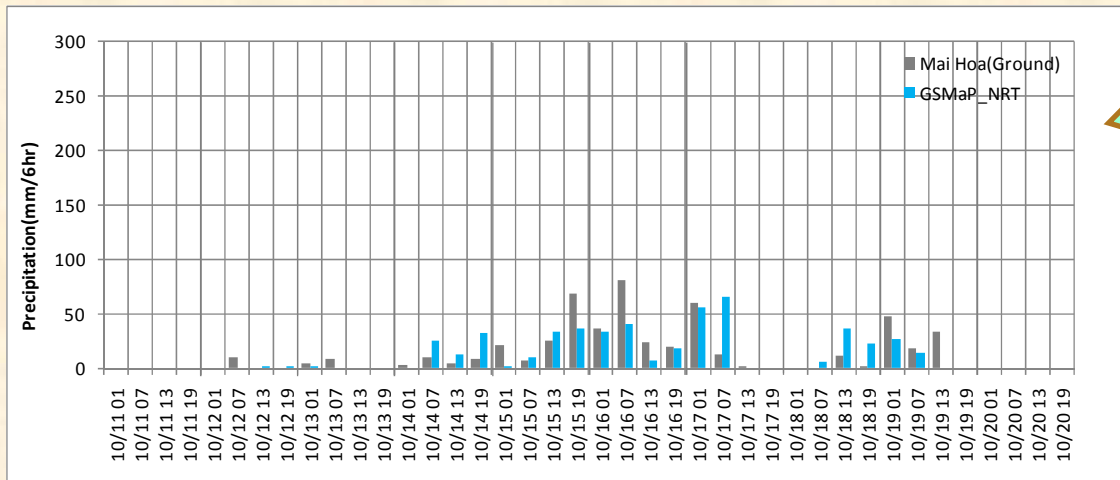


***Pilot study areas:  
Huong Khe (Ha Tinh),  
Mai Hoa (Quang Binh)***

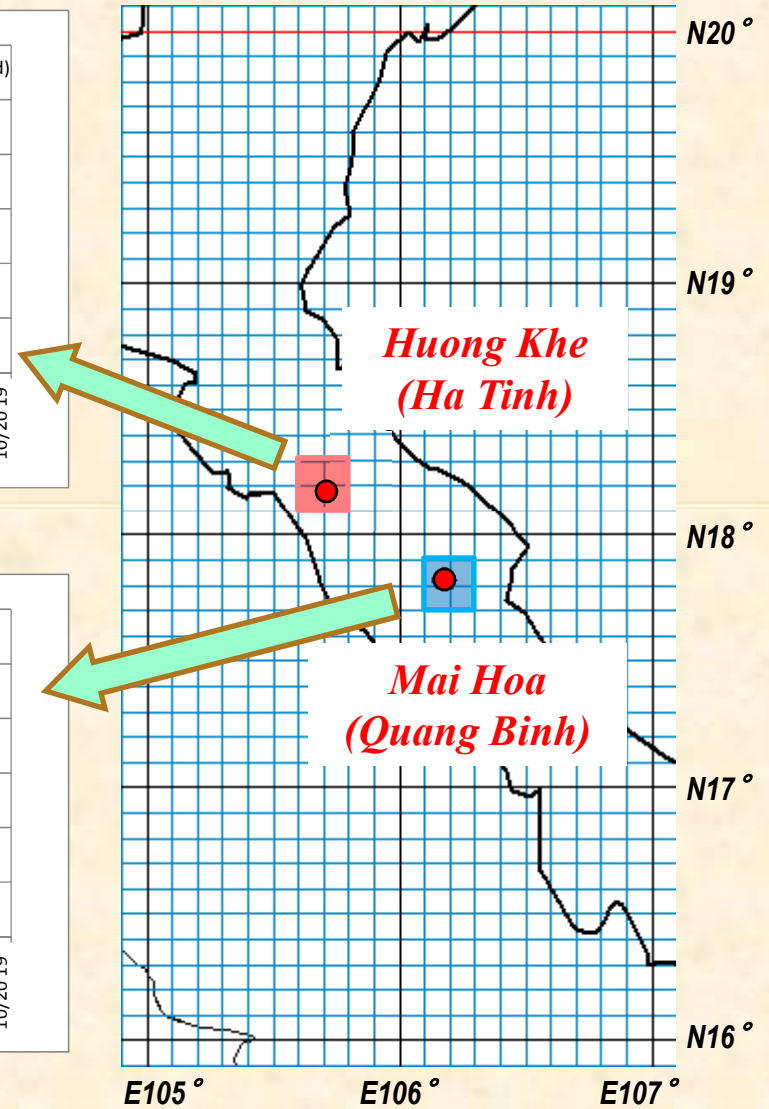
# 6-hours precipitation 2010/10/11-10/20



**Huong Khe, Ha Tinh (R=0.158)**

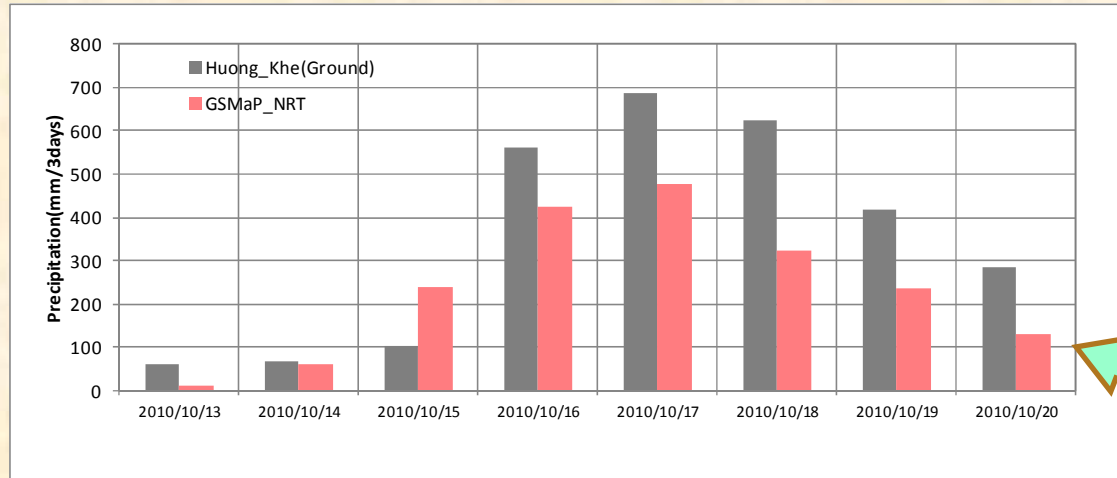


**Mai Hoa, Quang Binh (R=0.499)**

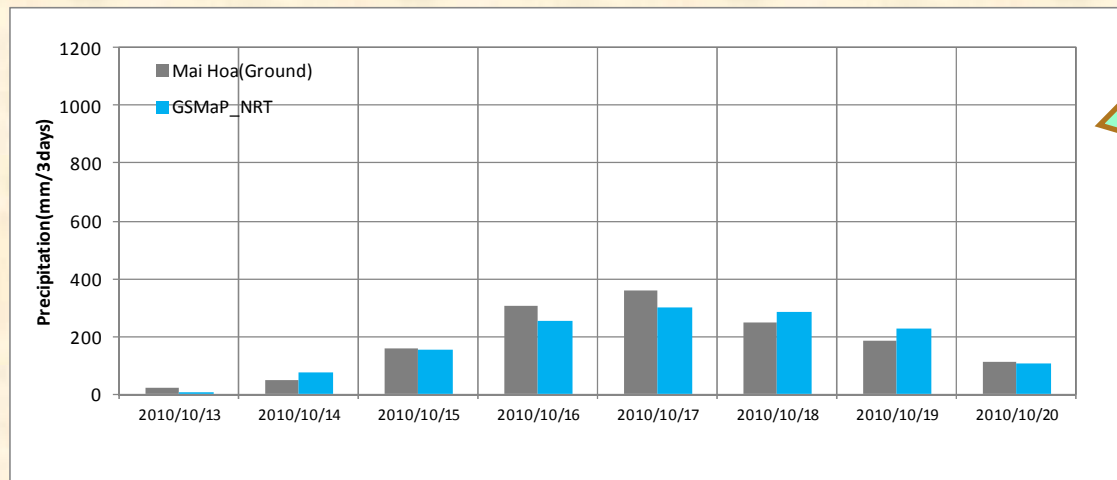


Note: GSMaP\_NRT data is the maximum one among the four mesh data. (□ □)

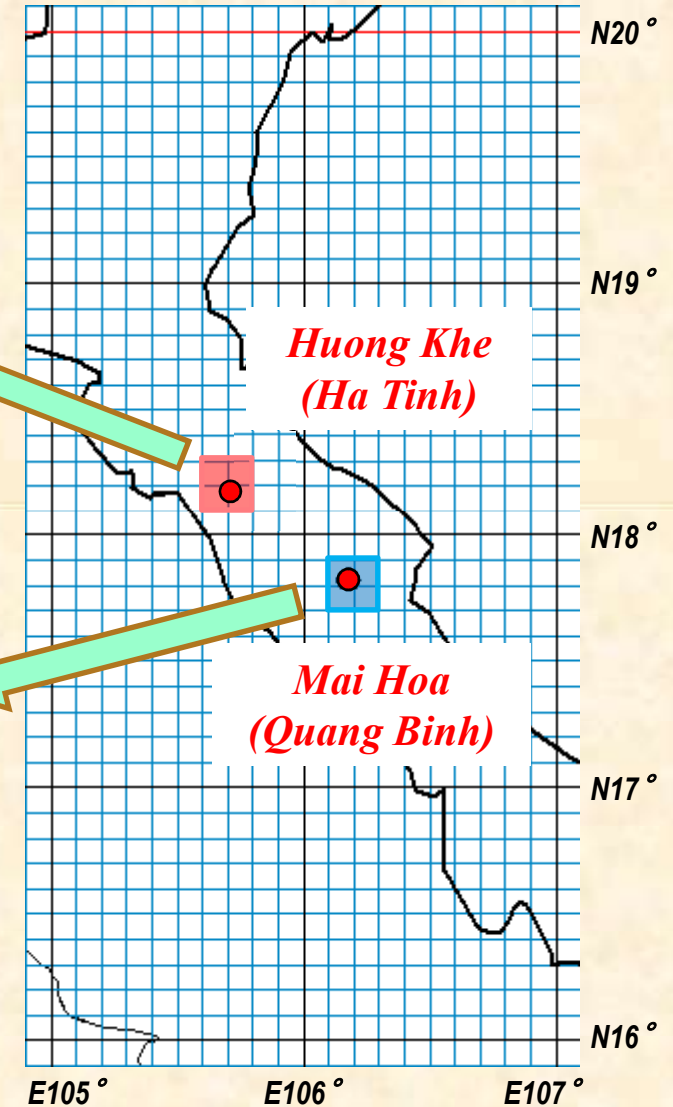
# 3-days precipitation 2010/10/11-10/20



***Huong Khe, Ha Tinh (R=0.881)***



***Mai Hoa, Quang Binh (R=0.942)***



Note: GSMaP\_NRT data is the maximum one among the four mesh data. (□ □)

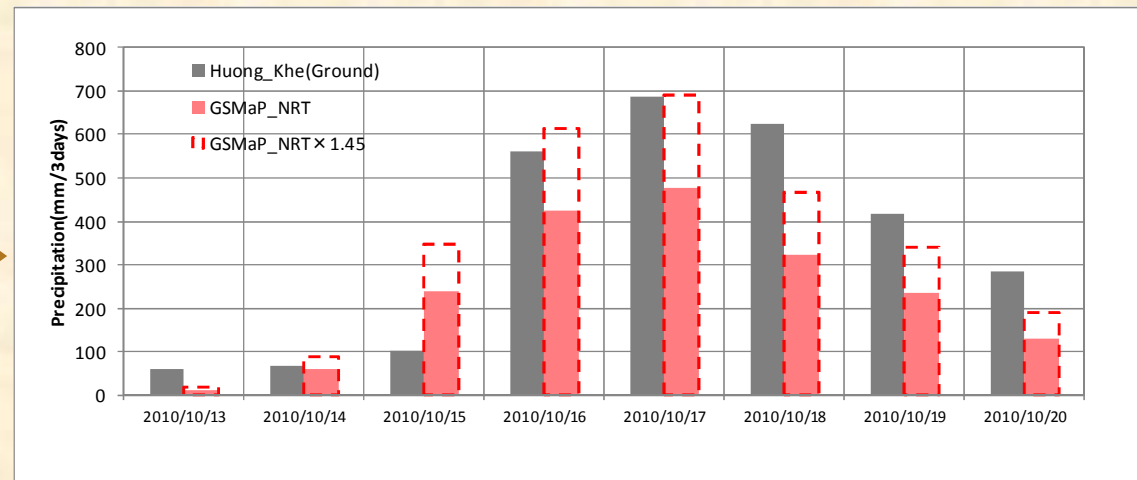
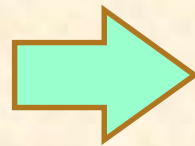
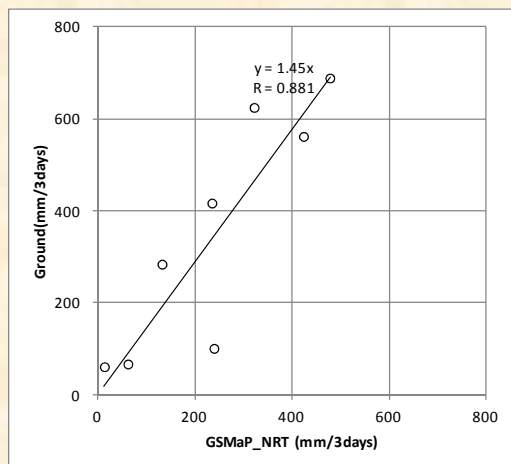


# *Estimation of ground precipitation by using satellite monitoring data*

*correlation coefficient between ground data and satellite data*

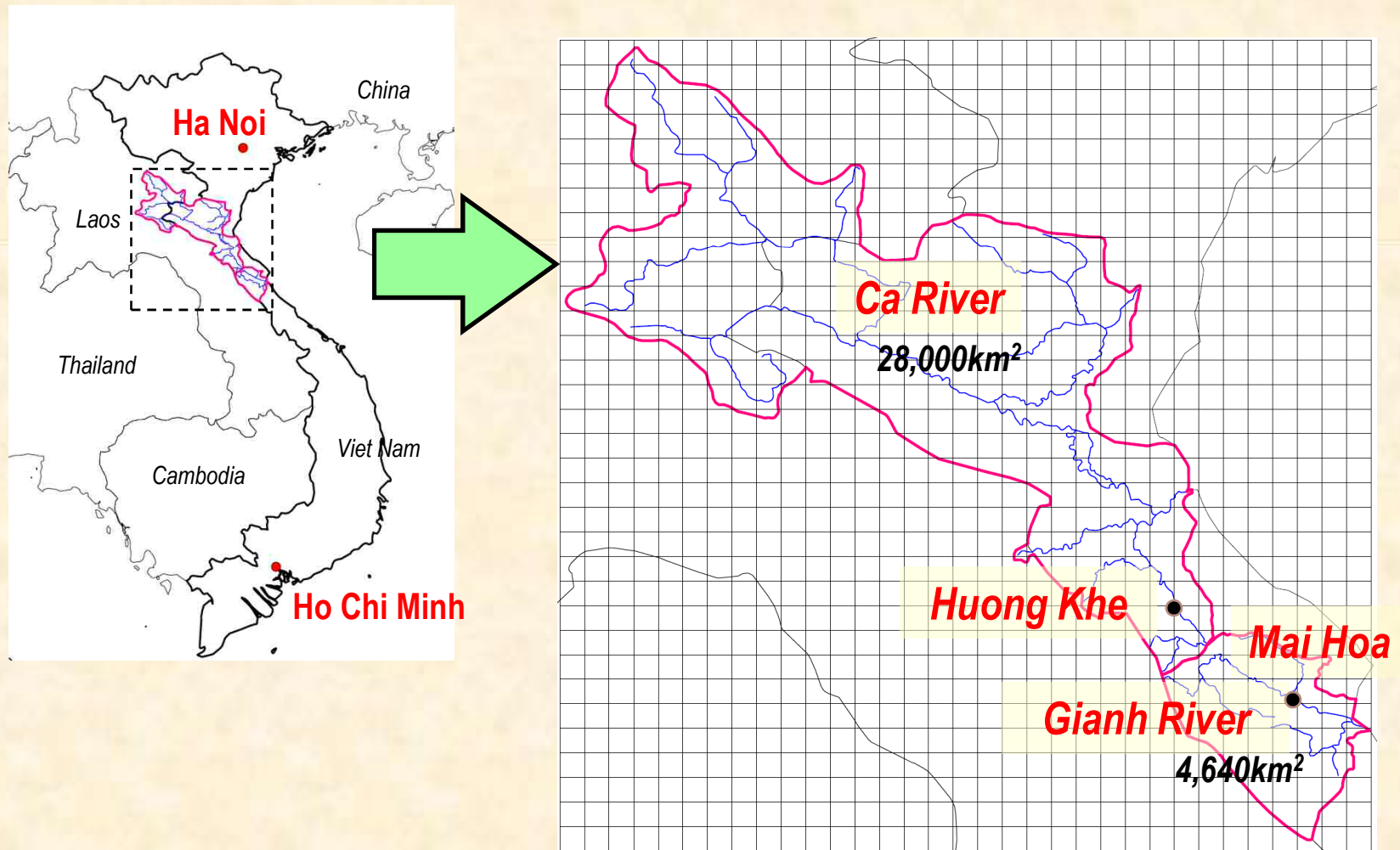
	Huong Khe	Mai Hoa
6-hours precipitation	0.158	0.499
1-day precipitation	0.598	0.306
<b>3-days precipitation</b>	<b>0.881</b>	<b>0.942</b>

*Ground precipitation can be estimated by using the satellite monitoring data, considering the high correlation coefficient of 3-days precipitation data.*

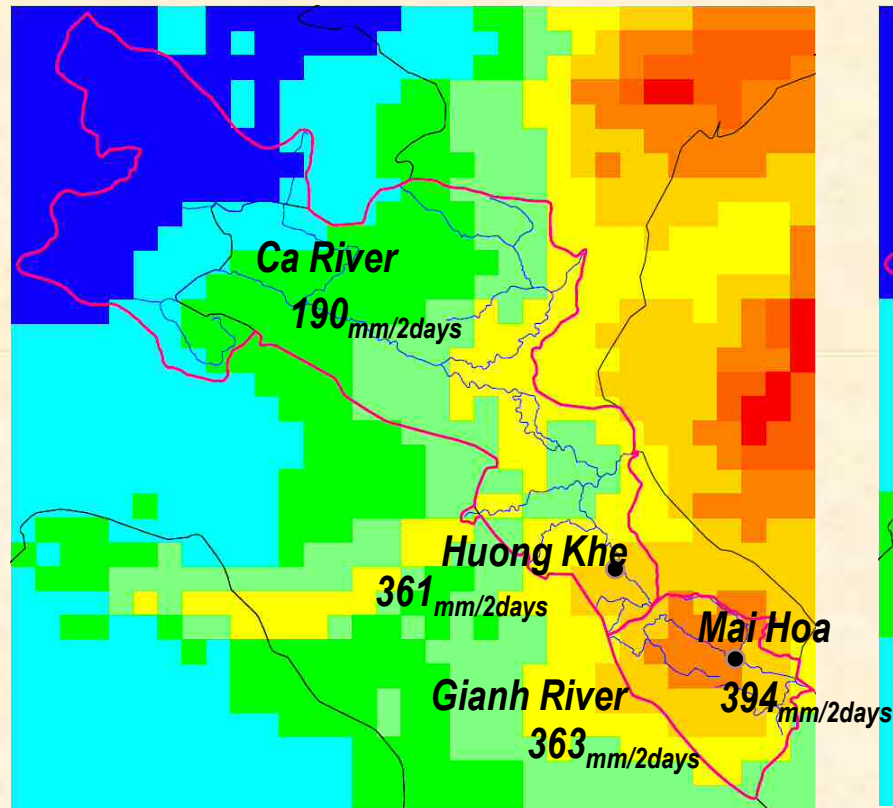


# *GFAS Development (2): Estimation of probable precipitation with return period (1/3, 1/5, 1/10...)*

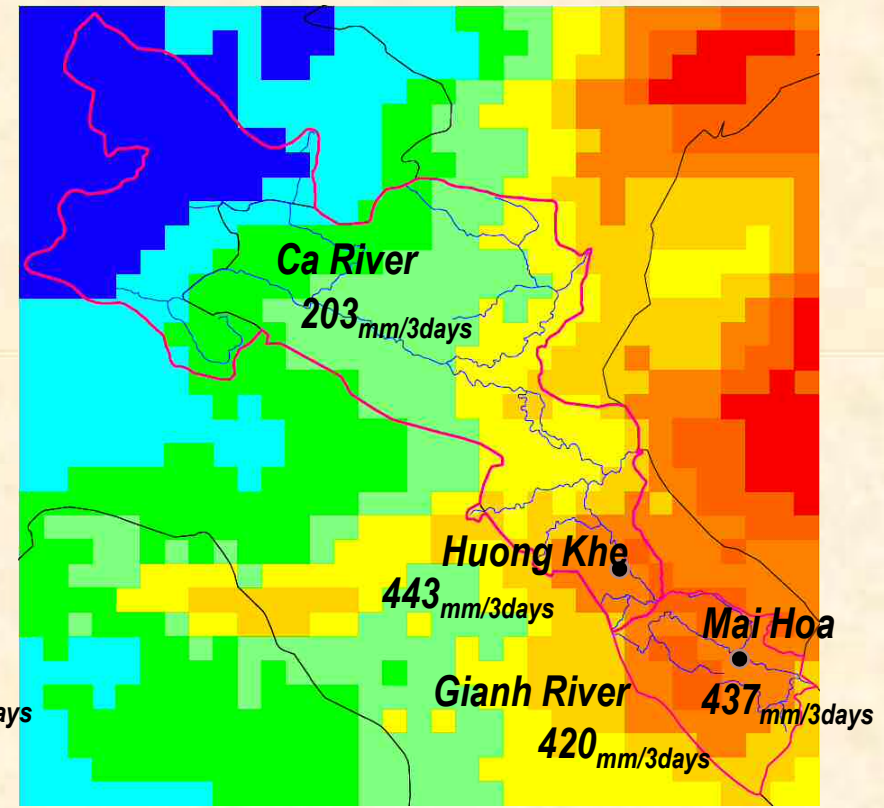
*Pilot Areas :Huong Khe, Ca River Basin  
Mai Hoa, Gianh River Basin*



# *2-days and 3-days precipitation of 10-years return period (1/10)*



**2-days precipitation**



**3-days precipitation**

Used Data: 2003-2011 (9 years)

# *Utilization of probable precipitation with return period for flood management*

Probable 3-days precipitation  
of 1/3, 1/5, 1/30... of each river

	Ca River	Gianh River
1/3	156 mm	252 mm
1/5	177 mm	317 mm
1/10	203 mm	420 mm
1/30	243 mm	633 mm
...	...	...

Probable precipitation (1/5, 1/10...) can  
be calculated from GSMaP data (2003-11)

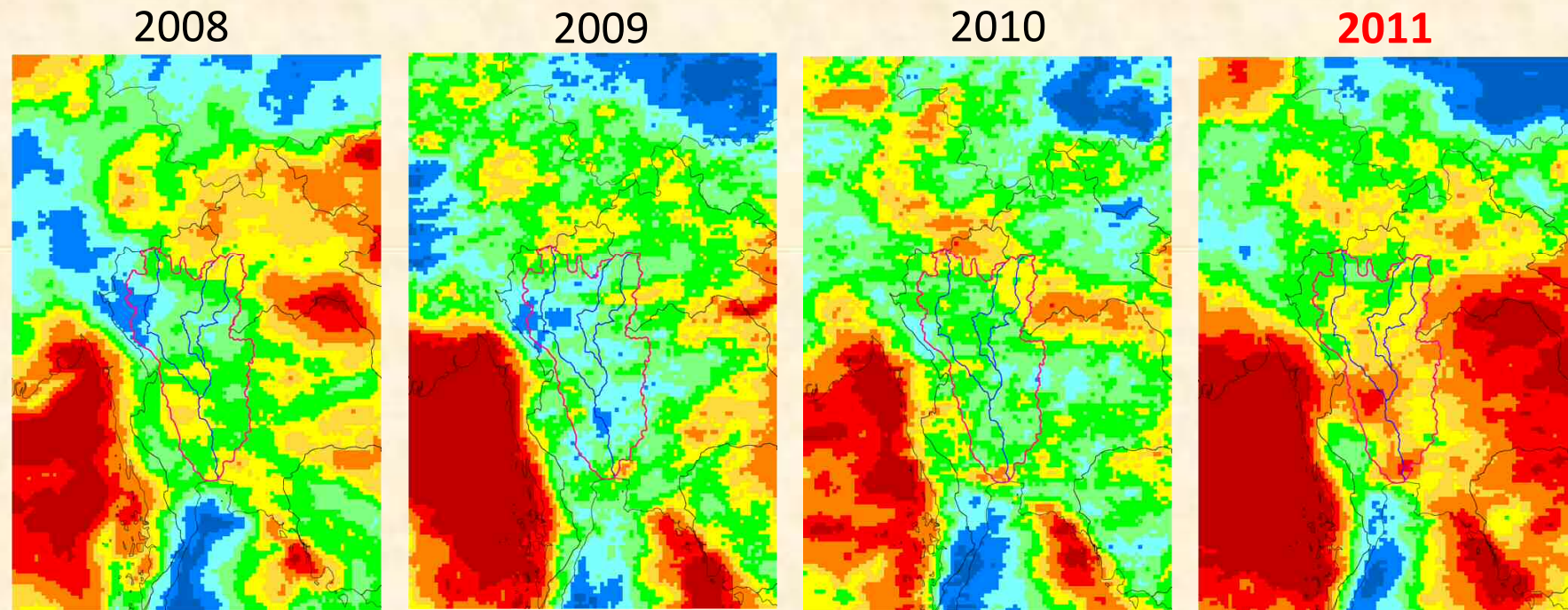
Alert level can be examined,  
much better be testified by  
using the ground observatory  
data, if available

*Flood Alert*

- Start of people's evacuation
- Preparation for flood defense activities

# Recent topic: Flood in 2011 on Chao Phraya River

By using satellite-monitoring data from GSMaP, 3 month's basin-mean precipitation (July-September of 2008-2011) were analyzed without using any ground observatory data.



Basin mean precipitation in Chao Phraya River Basin from July to September

518mm

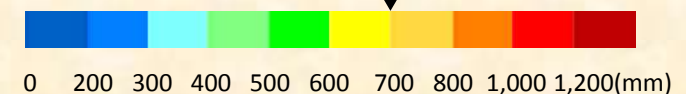
424mm

527mm

**710mm**

DATA/ GSMaP MVK(2008)  
GSMaP NRT(2009-2011)

Average(Bangkok)



## *Monthly precipitation of Chao Phraya River basin*

	2008	2009	2010	Average of 3 years (2008-2010)	2011 (compared to 3 years average)
July	164mm	128mm	147mm	146mm	205mm (140%)
August	164mm	151mm	217mm	177mm	225mm (127%)
September	190mm	145mm	162mm	166mm	279mm (168%)
Total rainfall in 3 months	518mm	424mm	527mm	490mm	710mm (145%)

*More rain in July-August of 2011 than those of the previous three years, and **much more rain in September.***

*At the end of August, we already knew **the precipitation of this year is bigger than the previous ones...***

*If we knew about this trend in advance, could we **foresee today's serious situation?** or **at least well prepared?***

# *Conclusion and Way forward*

- *Ground observation need lots of time and huge cost for installation, therefore satellite-monitoring precipitation can be supplemented and/or substituted for flood management (warning and forecasting).*
- *GFAS can be applicable with good accuracy to relatively large-scale river basin and for long-term prediction.*
- *Still they need to develop and improve, so we want to invite more countries/ organizations to participate in our activities through:
  - *Collaborating on case study or pilot project for actual river basin of the world (in expectation of a little bit funds...)*
  - *Sending suggestion and useful comment through IFNet for further improvement*
  - *Providing ground observation data to testify its accuracy**

*Thank you very much for your attention*

*Merci beaucoup pour votre attention*

*ご清聴、ありがとうございました*

*Please contact to [2bu01@idi.or.jp](mailto:2bu01@idi.or.jp):*

*IFNet: <http://www.internationalfloodnetwork.org>*

*GFAS: <http://gfas.internationalfloodnetwork.org/n-gfas-web/>*