



# **Achievements of the on-going JST-JICA “Wildfires and Carbon Management in Peat Forest in Indonesia: Fire Detection and Fire Prediction System Component” Project**

**Orbita Roswintiarti**

**Indonesian National Institute of Aeronautics and Space (LAPAN)**

- **Introduction on JST-JICA “Wildfires and Carbon Management in Peat Forest in Indonesia: Fire Detection and Fire Prediction System” Project**
- **Fire Detection and Fire Prediction System (FF) Component**
- **Accomplishments form FF Component**
- **Future plan**

# Wildfires and Carbon Management in Peat Forest in Indonesia

- **Executing agencies:**

- Indonesia: National Standardization Agency of Indonesia (BSN)
- Japan: JICA is responsible for the implementation of the Project in-closed cooperation with JST.

- **Implementation agencies:**

1. Hokkaido University
2. University of Palangka Raya (UNPAR)
3. Indonesian Institute of Sciences (LIPI)
4. Indonesian National Institute of Aeronautics and Space (LAPAN)
5. Forest Research Development Agency, Ministry of Forestry (FORDA)
6. Ministry of Research and Technology



- **Project sites:**

Block C and Forest Research Development Agency, Ministry of Forestry's site of Block B of Ex-Mega Rice Project site in Central Kalimantan





# Wildfires and Carbon Management in Peat Forest in Indonesia

- **Activities:**

- 1. Fire Detection and Fire Prediction System Component (FF: Fire Detection and Fire Prediction)**
2. Carbon Assessment Component (CA: Carbon Assessment)
3. Carbon Management Component (CM: Carbon Management)
4. Integrated Peat Management Component (PM: Peat Management)



# Structure of FF Component

FF: Fire Detection and Fire Prediction System

- Toshihisa Honma
- Agus Hidayat
- Ratih D. Dimiyati

General Coordination

- Hendrik Segah
- Atsushi Ono
- Orbita Roswintiarti
- Aswin Usup

FF-1 : Wild/Peat Fire Control System

- Kazuya Kaku
- Atsushi Ono
- Orbita Roswintiarti
- Aswin Usup

FF-1-1 Fire Detection

- Koji Nakau
- Masami Tokuno
- Keiji Kushida
- Fajar Yulianto

FF-1-2 Wildfire Local Validation

- Toshihisa Honma
- Koji Nakau
- Aswin Usup

FF-1-3 Met. Modeling and Fire Simulation

- Keiji Kimura
- Orbita Roswintiarti

FF-1-4 Peat Moisture Estimation

- Wataru Takeuchi
- Parwati Sofan

FF-1-5 Fire Information via SMS

- Nakau Koji
- Hendrik Segah

FF-2 : Mapping and Modeling Land Cover

- Hendrik Segah
- Kustiyo

FF-2-1 Land Coverage Map

- Keiji Kimura
- Agus Kristiyono
- Kustiyo, Bambang Trisakti

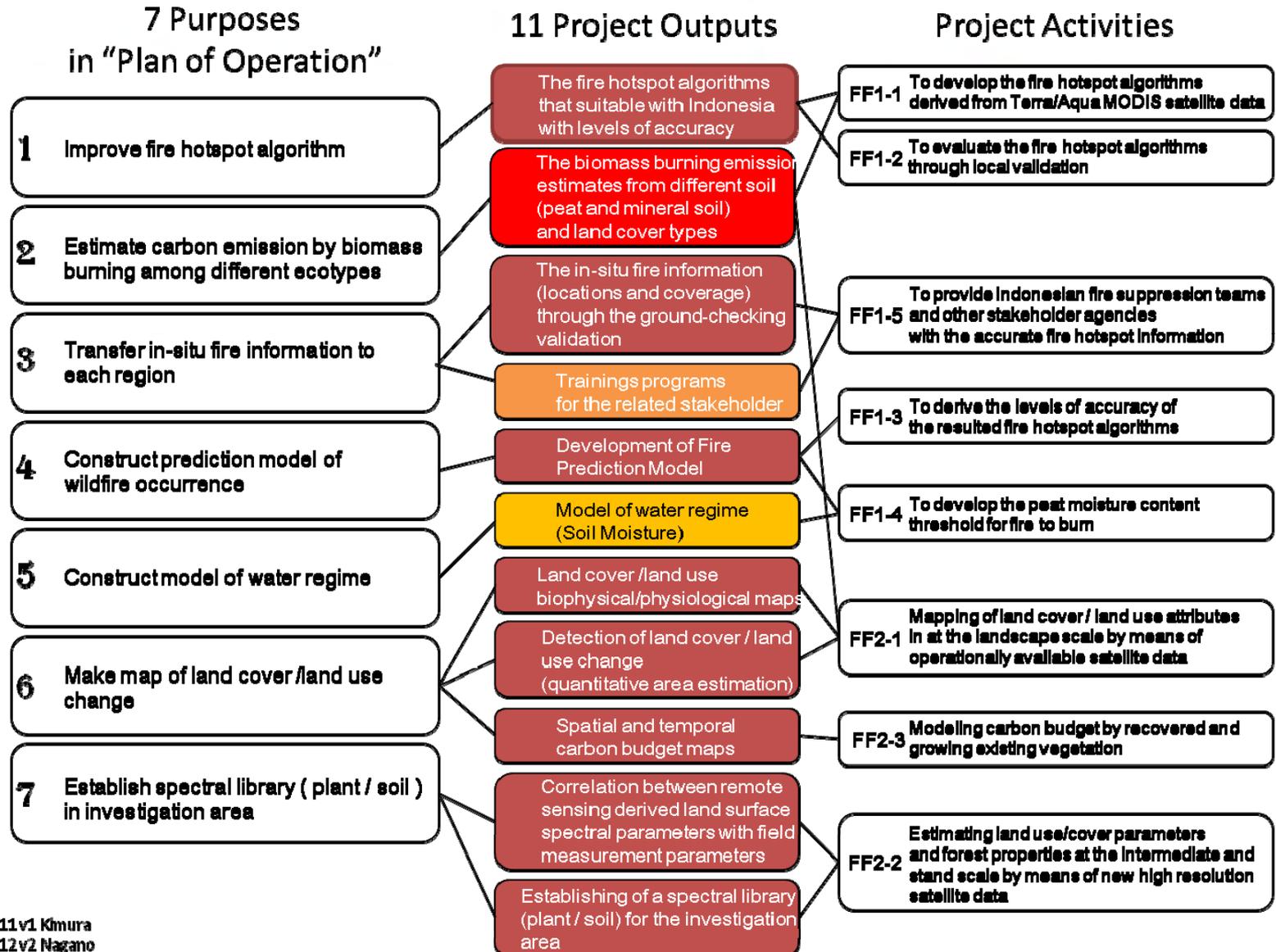
FF-2-2 Spectrum Library (plant/soil)

- Hiroshi Tani
- Hendrik Segah

FF-2-3 Carbon Budget Estimation

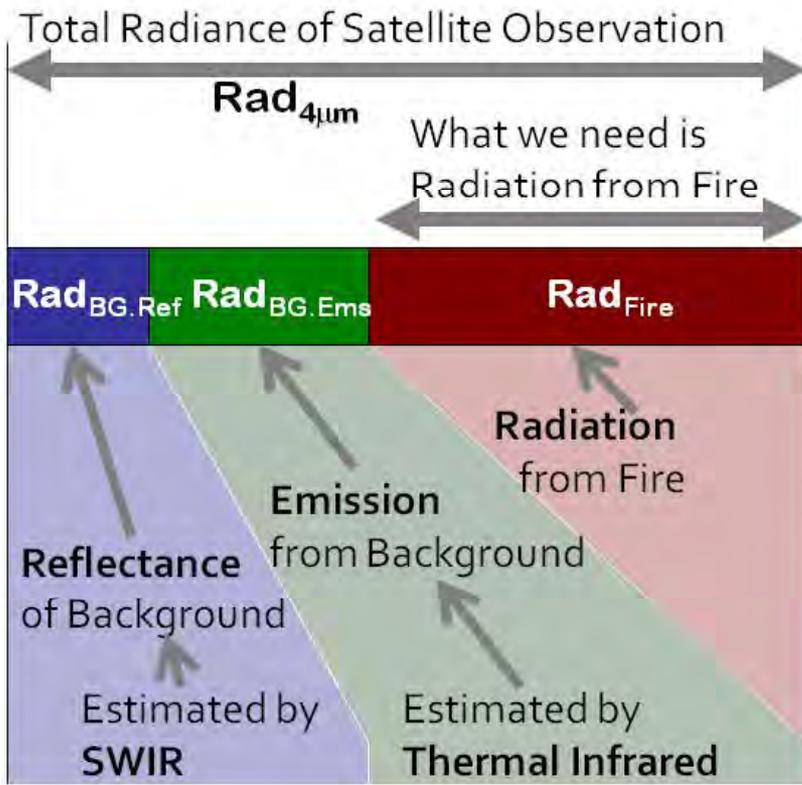
- Wataru Takeuchi
- Yenni Vetrta

# Outputs of FF Component



# Fire hotspot algorithm

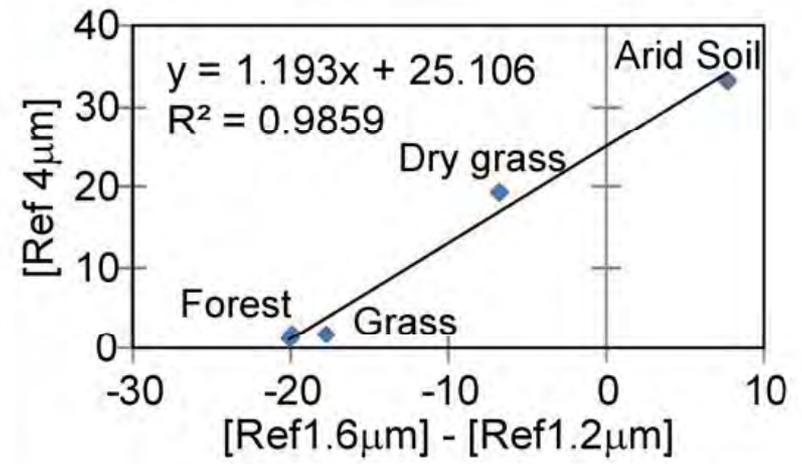
We need to estimate radiation from fire to detect fire.



$$Rad_{4\mu m} = Rad_{Fire} + Rad_{BG.Ems} + Rad_{BG.Ref}$$

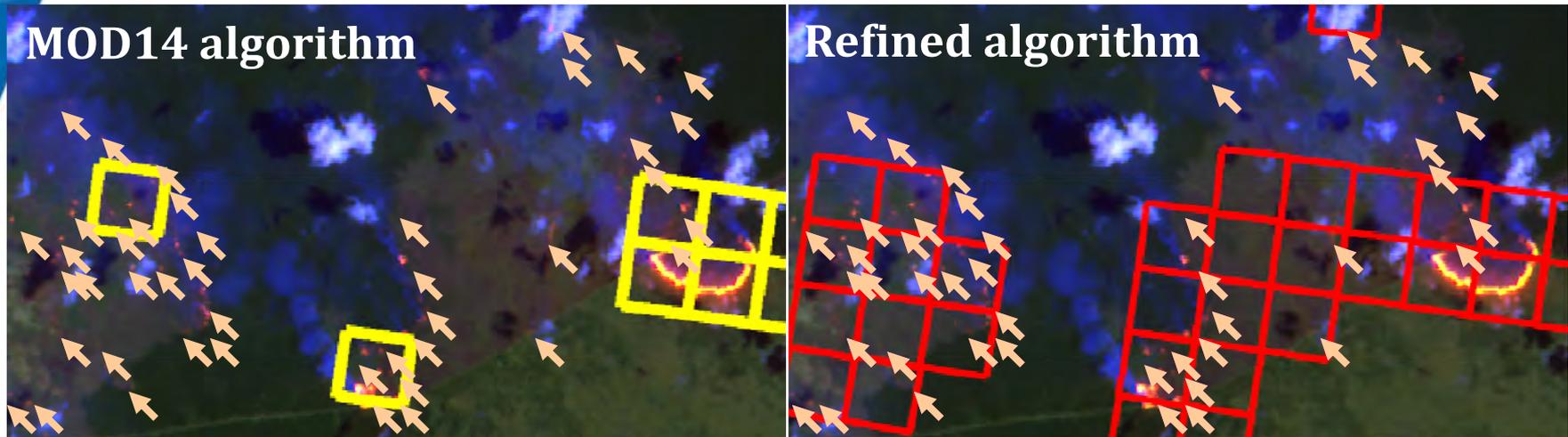
$$Rad_{BG.Ems} = I(4\mu m, BT_{11\mu m})$$

$$Ref_{BG} = 1.193(Ref_{1.2\mu m} - Ref_{1.6\mu m}) + 0.251$$



Source: ASTER Spectrum Library

# Fire hotspot algorithm (*cont.*)



Background image: ASTER false color R: 2.24 $\mu$ m G:1.65  $\mu$ m B: 0.66  $\mu$ m

Refined hotspot algorithm developed by by Dr. K. Nakau et al. (2008).

Double S/N ratio (as compared with MOD14):

- 80% more HS and 10% less false alarm
- Smoldering, small fire, or slash and burn
- Geographic distribution is completely different
- Suitable to decide firefighting strategy and confirm extinction

# Fire hotspot validation

To verify the hotspot data obtained by satellites, aerial photographs were taken by the electrically-powered unmanned aerial vehicle (UAV) equipped with optical camera and infrared camera.

RGB

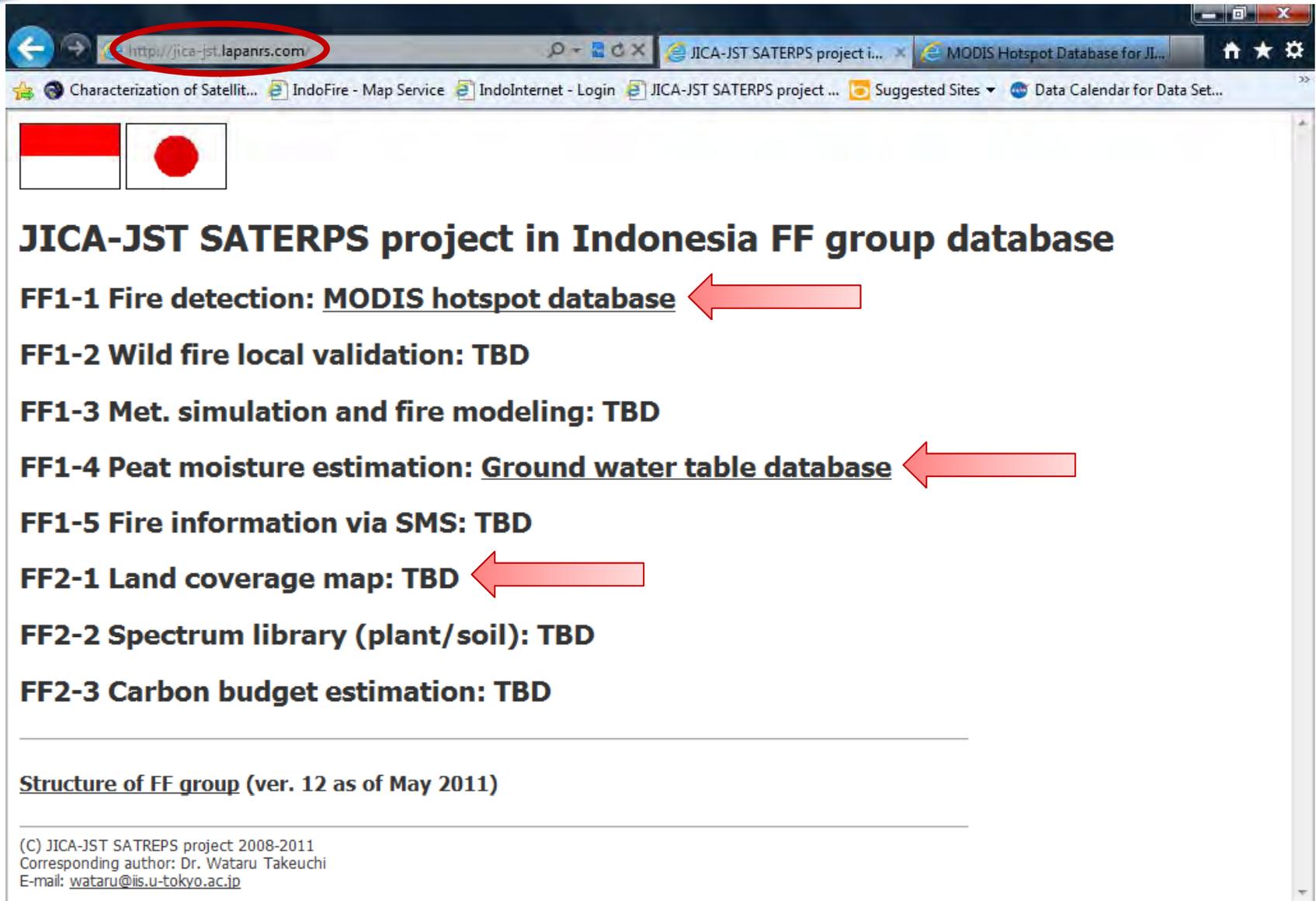


IR



Example of thermography images of flight observation

# JST-JICA FF Component Website



The screenshot shows a web browser window with the address bar containing <http://jica-jst.lapanrs.com>. The page content includes the Indonesian and Japanese flags, followed by the title "JICA-JST SATERPS project in Indonesia FF group database". Below the title, a list of components is shown, with red arrows pointing to specific items: "FF1-1 Fire detection: MODIS hotspot database", "FF1-4 Peat moisture estimation: Ground water table database", and "FF2-1 Land coverage map: TBD". At the bottom, there is a section titled "Structure of FF group (ver. 12 as of May 2011)" and a copyright notice: "(C) JICA-JST SATREPS project 2008-2011, Corresponding author: Dr. Wataru Takeuchi, E-mail: [wataru@iis.u-tokyo.ac.jp](mailto:wataru@iis.u-tokyo.ac.jp)".

<http://jica-jst.lapanrs.com>

Characterization of Satellit... IndoFire - Map Service IndoInternet - Login JICA-JST SATERPS project ... Suggested Sites Data Calendar for Data Set...

**JICA-JST SATERPS project in Indonesia FF group database**

**FF1-1 Fire detection: MODIS hotspot database** ←

**FF1-2 Wild fire local validation: TBD**

**FF1-3 Met. simulation and fire modeling: TBD**

**FF1-4 Peat moisture estimation: Ground water table database** ←

**FF1-5 Fire information via SMS: TBD**

**FF2-1 Land coverage map: TBD** ←

**FF2-2 Spectrum library (plant/soil): TBD**

**FF2-3 Carbon budget estimation: TBD**

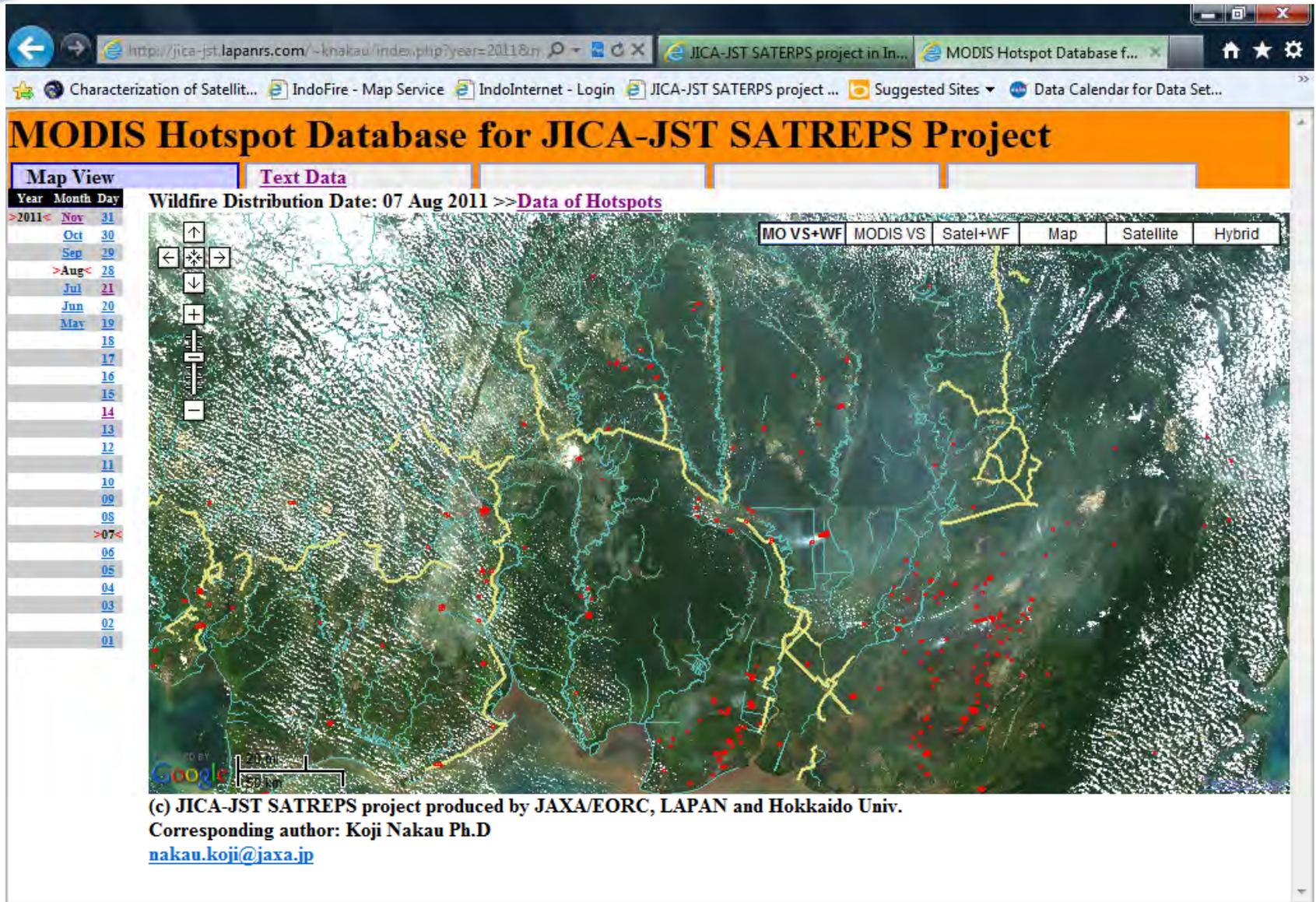
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**Structure of FF group (ver. 12 as of May 2011)**

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(C) JICA-JST SATREPS project 2008-2011  
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E-mail: [wataru@iis.u-tokyo.ac.jp](mailto:wataru@iis.u-tokyo.ac.jp)

# FF1-1 MODIS Hotspot Database



MODIS Hotspot Database for JICA-JST SATREPS Project

Map View | Text Data

Wildfire Distribution Date: 07 Aug 2011 >> [Data of Hotspots](#)

MO VS+WF | MODIS VS | Satel+WF | Map | Satellite | Hybrid

Year Month Day

>2011<	Nov	31
	Oct	30
	Sep	29
	>Aug<	28
	Jul	27
	Jun	26
	May	25
	18	
	17	
	16	
	15	
	14	
	13	
	12	
	11	
	10	
	09	
	08	
	>07<	
	06	
	05	
	04	
	03	
	02	
	01	

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# FF1-1 MODIS Hotspot Database (cont.)

MODIS Hotspot Database for JICA-JST SATREPS Project

Map View | Text Data

Year	Month	Location	Date	Data	Pilang Fire information			Map		
					Latitude	Longitude	Distance from Road	Distance from village	Orientation from Village	
2012	Dec	>Pilang<								
	>2011<	Nov								
2010	Oct									
2009	Sep									
	>Aug<									
	Jul									
	Jun									
	May									
	Apr									
	Mar									
	Feb									
	Jan									
			2011-08-01	csv	No fire Found					<a href="#">Map</a>
			2011-08-02	csv	No fire Found					<a href="#">Map</a>
			2011-08-03	csv	No fire Found					<a href="#">Map</a>
			2011-08-04	csv	No fire Found					<a href="#">Map</a>
			2011-08-05	csv	No fire Found					<a href="#">Map</a>
			2011-08-06	csv	No fire Found					<a href="#">Map</a>
			2011-08-07	csv	-2.374	114.146	221m	13193m	Toward PKY	<a href="#">Map</a>
					-2.365	114.144	875m	14202m	Toward PKY	<a href="#">Map</a>
			2011-08-08	csv	No fire Found					<a href="#">Map</a>
			2011-08-09	csv	No fire Found					<a href="#">Map</a>
			2011-08-10	csv	No fire Found					<a href="#">Map</a>
			2011-08-11	csv	No fire Found					<a href="#">Map</a>
			2011-08-							

# FF1-1 MODIS Hotspot Database (cont.)

Characterization of Satellit... IndoFire - Map Service IndoInternet - Login JICA-JST SATERPS project ... Suggested Sites Data Calendar for Data Set...

## MODIS Hotspot Database for JICA-JST SATREPS Project

Map View **Text Data**

Wildfire Distribution Date: 07 Aug 2011 >> [Data of Hotspots](#)

MO VS+WF MODIS VS Satel+WF Map Satellite Hybrid



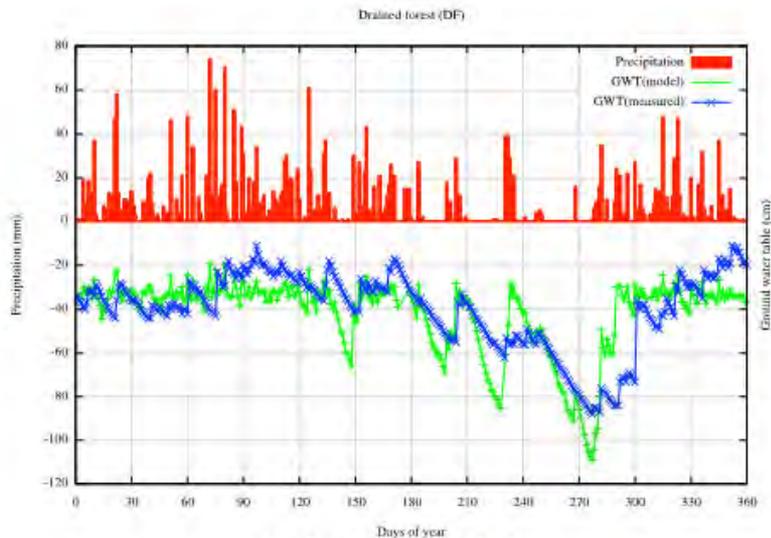
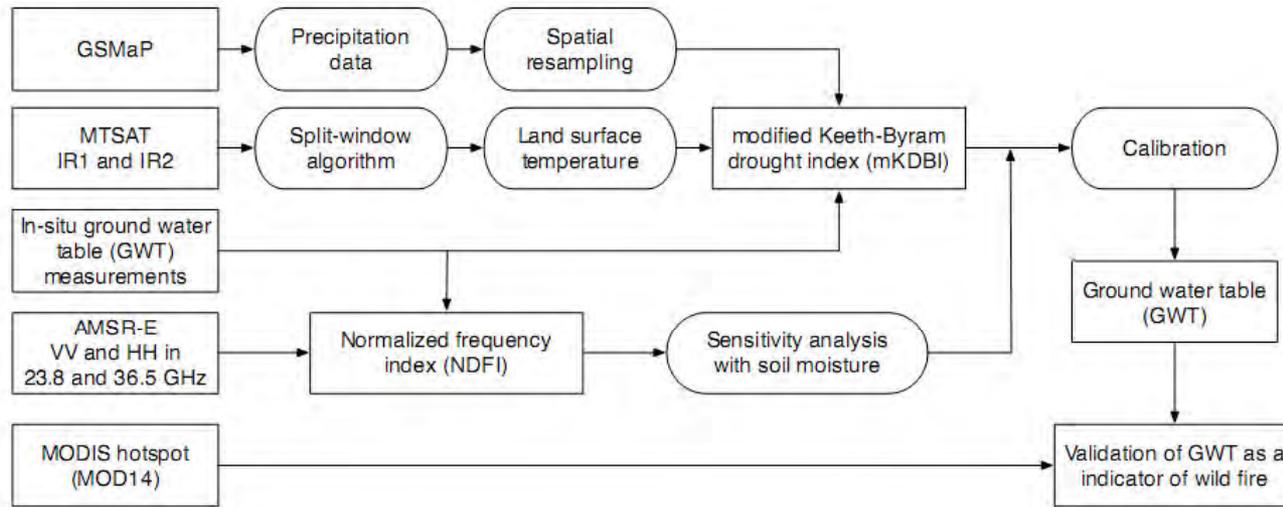
Year Month Day  
>2011< Nov 31  
Oct 30  
Sep 29  
>Aug< 28  
Jul 27  
Jun 20  
May 19  
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POWERED BY Google 10 mi 10 km

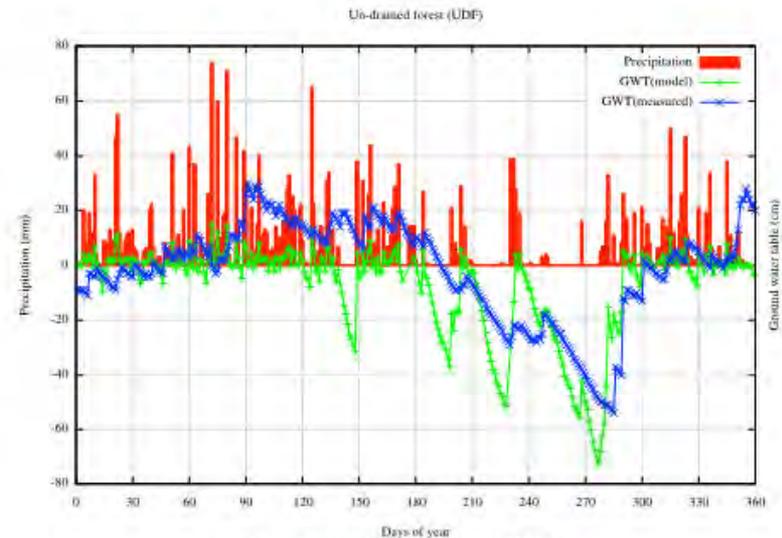
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Corresponding author: Koji Nakau Ph.D  
[nakau.koji@jaxa.jp](mailto:nakau.koji@jaxa.jp)

# Ground Water Table

Framework of Ground Water Table (GWT) mapping using drought index

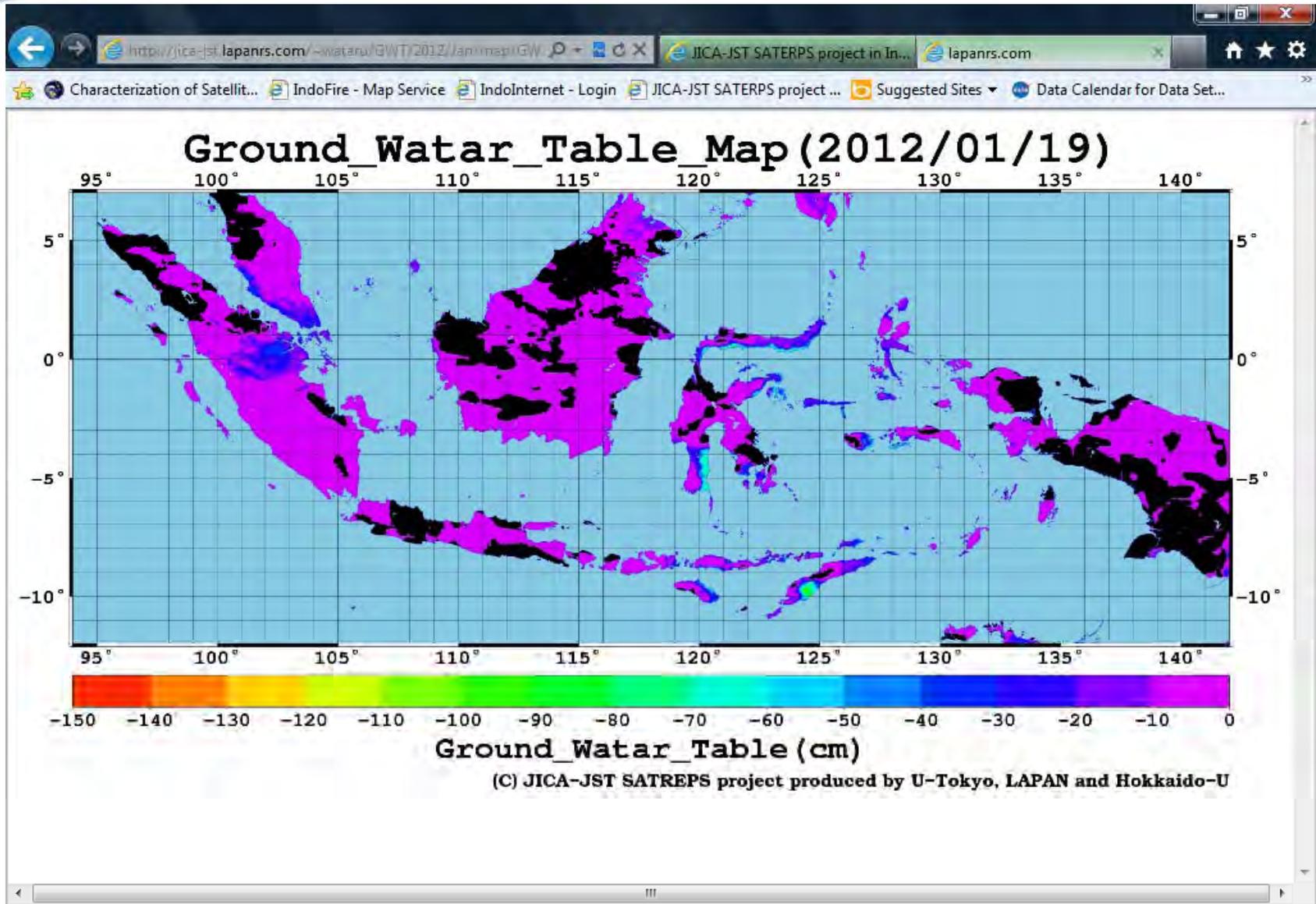


(a) Drained forest (DF)



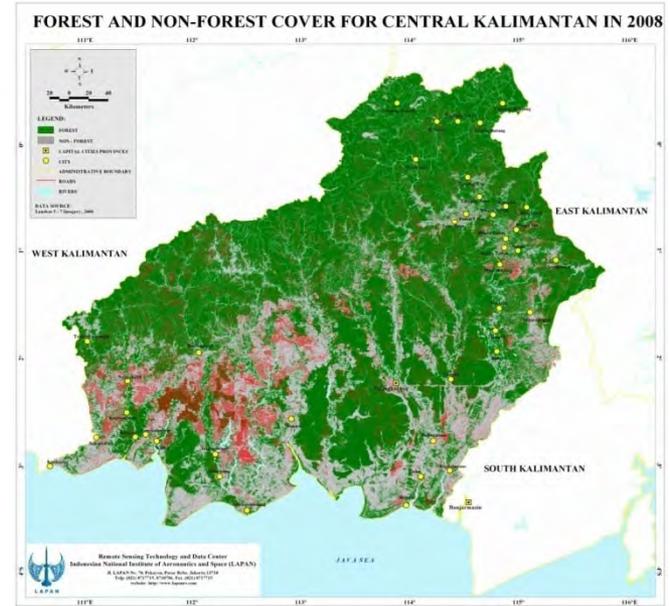
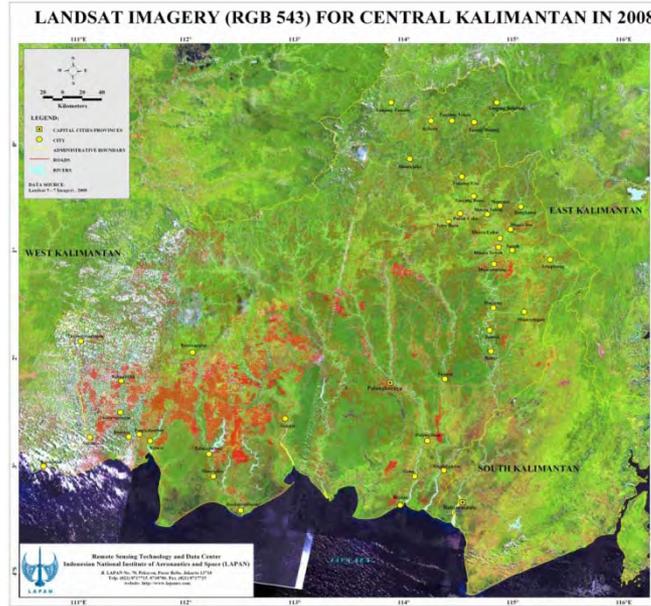
(b) Un-drained forest (UDF)

# FF1-4 Ground Water Table Database *(cont.)*

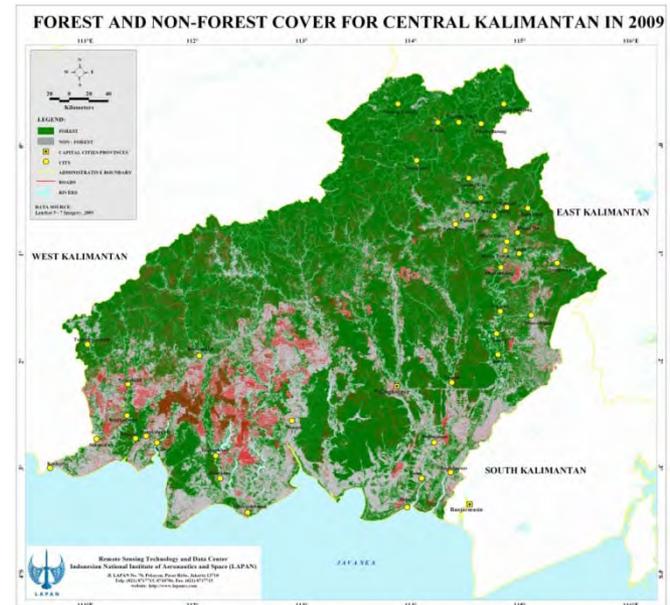
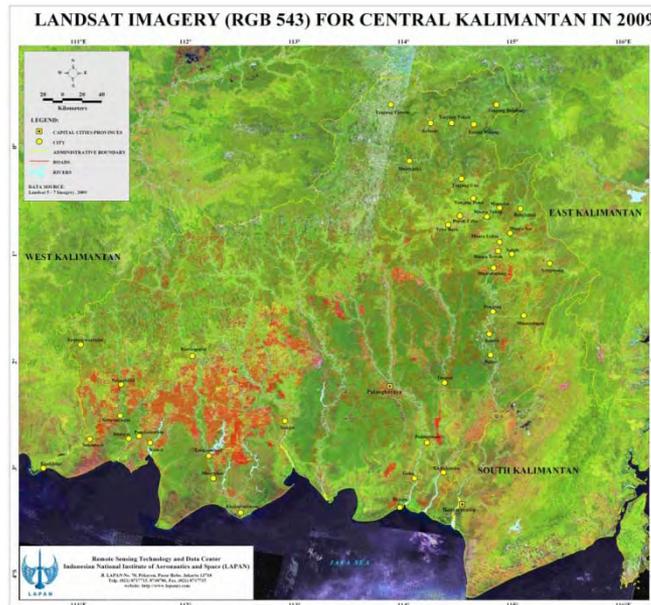


# FF-2-1 Land Cover Map

2008



2009





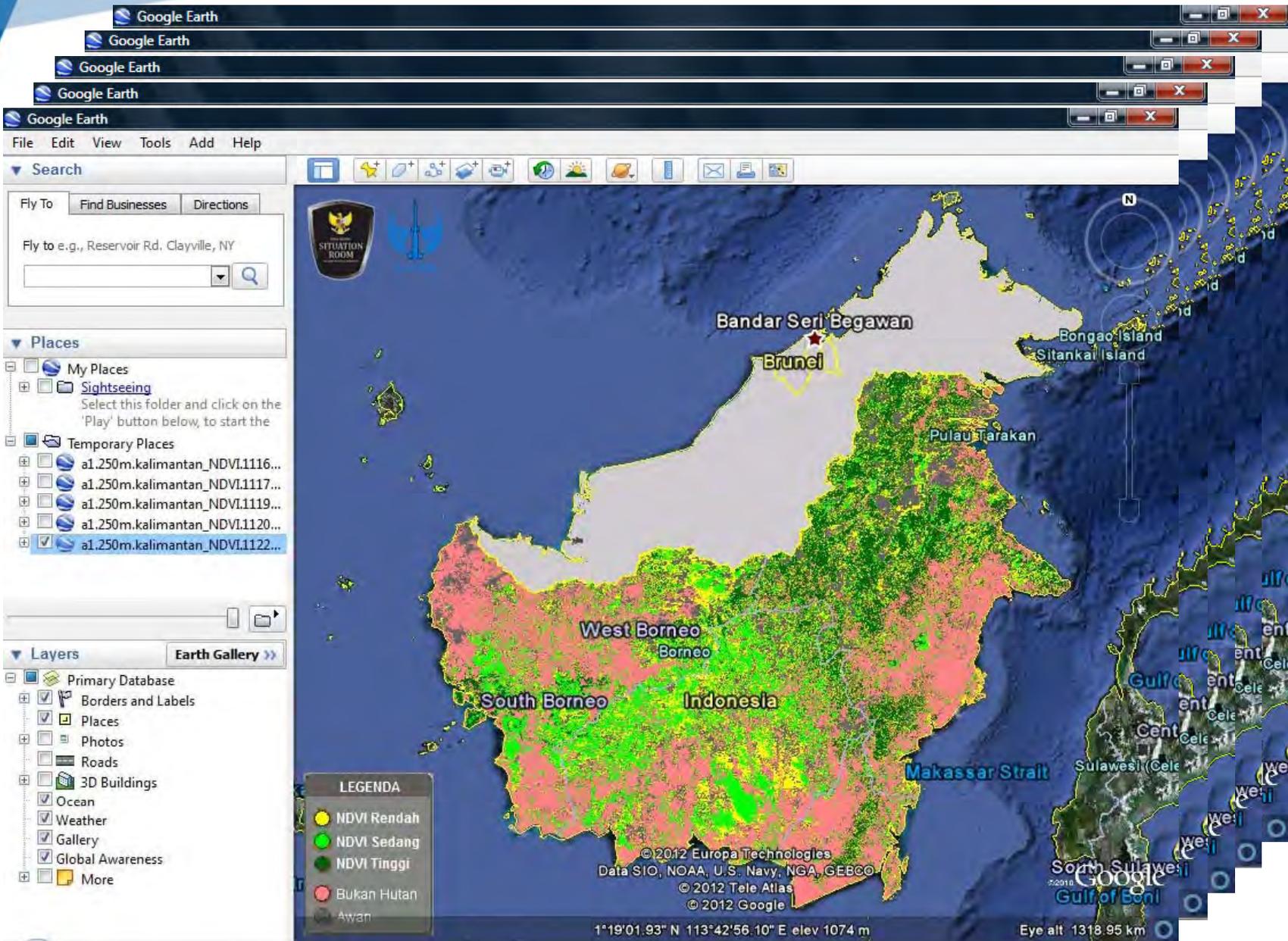
# FF-2-1 Land Cover Map (Cont.)

Year	Forest area (ha)	Forest area compared with area (%)	Forest change (ha)
2000	9,007,164	58	-
2001	9,047,939	59	40,775
2002	8,971,911	58	-76,028
2003	8,801,951	57	-169,960
2004	8,683,361	56	-118,590
2005	8,625,535	56	-57,826
2006	8,578,507	56	-47,028
2007	8,425,437	55	-153,070
2008	8,390,578	54	-34,859
2009	8,573,513	56	182,935

Note: Area of Central Kalimantan was 15,399,228 ha in 2008 (Source: Bakosurtanal)



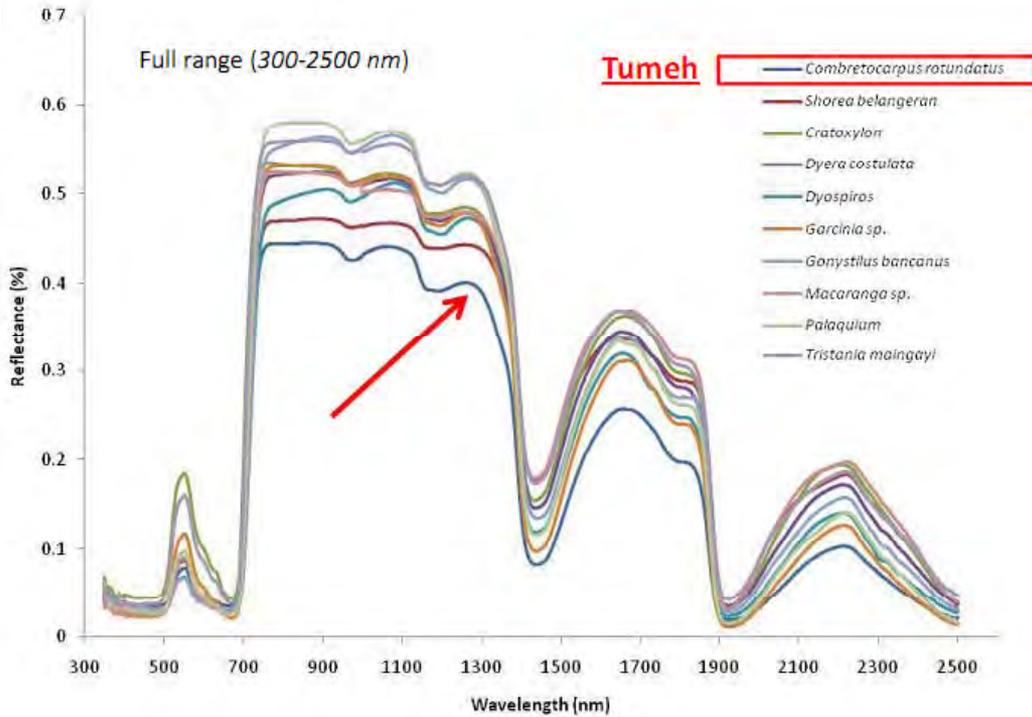
# 16-day NDVI (250meter resolution )



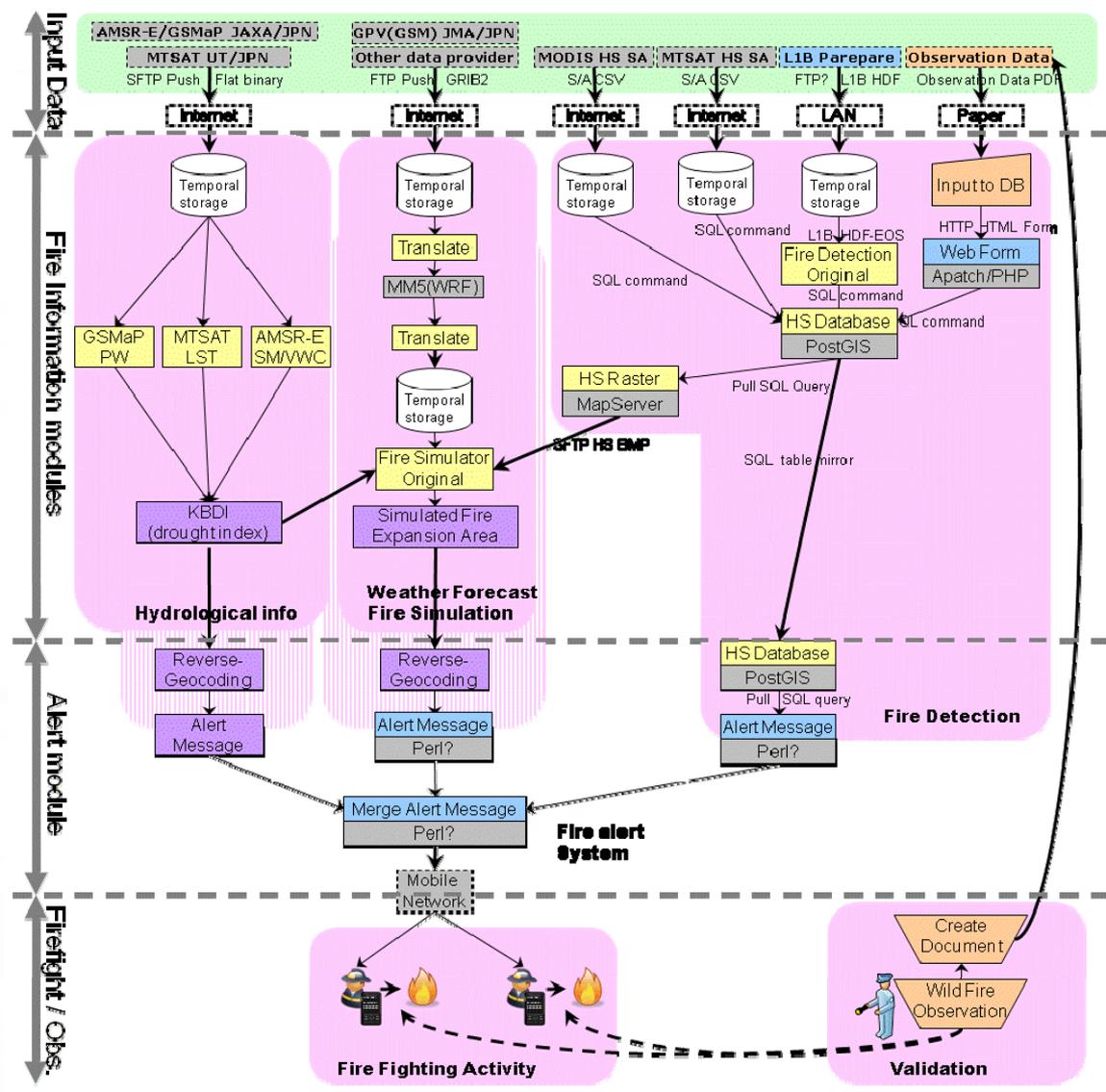
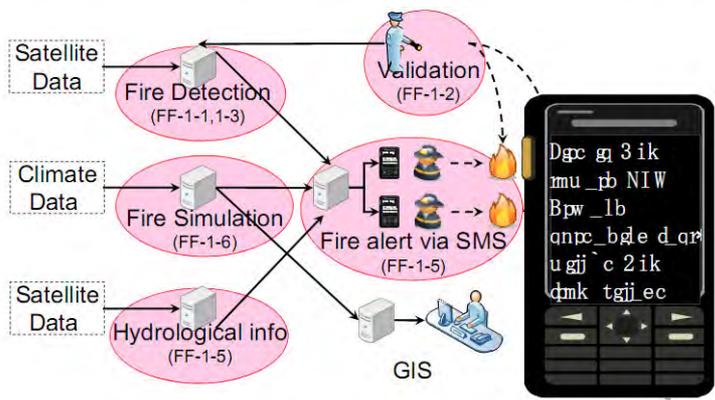
# FF-2-2 Spectrum Library

Data collection activities

Spectral reflectances from 10 dominant tree species in peat forest



- Detecting Hotspot
- Hotspot Data Transfer
  - Internet / Sentinel Asia
- Hotspot DB
- Output to SMS service





**Thank you**