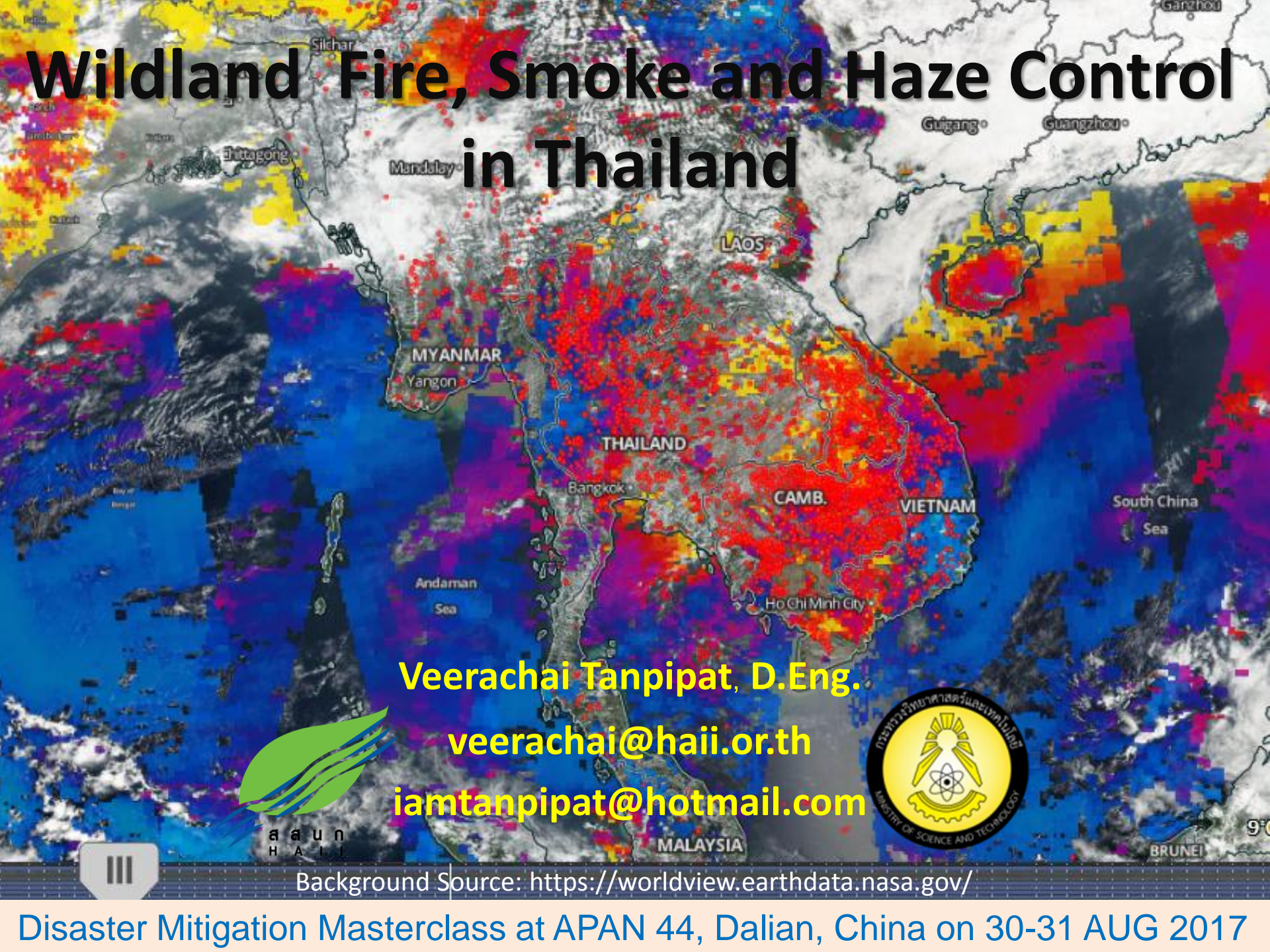


# Wildland Fire, Smoke and Haze Control in Thailand



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iamtanpipat@hotmail.com



ส ส น  
H A I I



กระทรวงวิทยาศาสตร์และเทคโนโลยี  
MINISTRY OF SCIENCE AND TECHNOLOGY

Background Source: <https://worldview.earthdata.nasa.gov/>

Disaster Mitigation Masterclass at APAN 44, Dalian, China on 30-31 AUG 2017

# Contents

- Wildland (Forest) Fire Control in Thailand
- 6 Steps and more
- Establishment of Upper ASEAN Wildland Fire Research Center
- Conclusions and Challenges
- Useful free Fire, Smoke and Haze data and information through Internet
- Early Warning System-Fire Danger Rating System

**Established in 1980 within Royal Forest Department and more than 80% of the task force relocated to Department of National Parks, Wildlife and Plant Conservation in 2002.**



**Source: Forest Fire Control Division, DNP**

**Forest Fire Control Division**

**Department of National Parks, Wildlife and Plant Conservation**

**Ministry of Natural Resources and Environment**

**Disaster Mitigation Masterclass at APAN44 on 30-31 AUG 2017**

# Department of National Parks, Wildlife and Plants Conservation (DNP)

Forest Fire Control  
Division

21 Protected Forest  
Regional Offices

15 Forest Fire  
Coordination  
Centers

4 Forest Fire  
Training  
Regional  
Centers

1 Forest Fire  
Research  
Center  
1 Forest Fire Control  
Development Center

140  
Forest Fire  
Control  
Stations

# What we need to cover in order to deal with Natural Disasters, especially forest fires?

## 6 Basic steps, Thailand is using:

1. Prevention
2. Monitoring
3. Prediction (Forecasting, Modeling)
4. Warning
5. Response
6. Recovery, Assessment, Mitigation

# What we need to cover in order to deal with Natural Disasters, especially forest fires?

## **1. Prevention (The Most Important Task!!!!)**

### **A. Rising Awareness through**

- **Public Relations and Propaganda**
- **Training**
- **Fire break activities with locals**
- **All local cultural and traditional events**

### **B. Community Based Fire Management (CBFiM)**

### **C. Short term: “no burning prohibited period,” etc.**

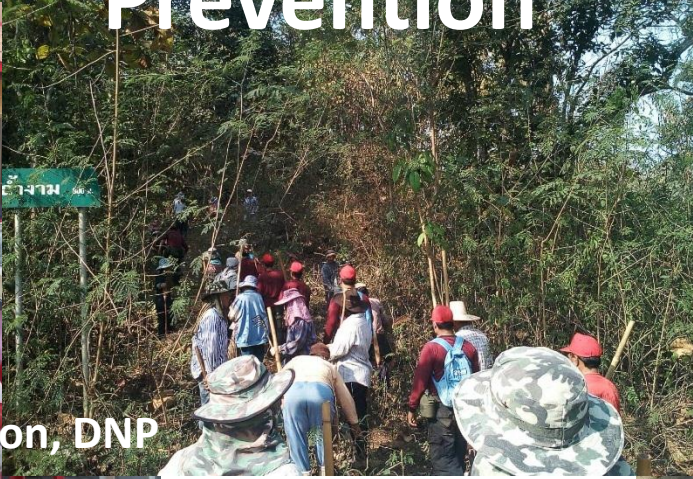
# Prevention



Source: Forest Fire Control Division, DNP



# Prevention



Source: Forest Fire Control Division, DNP

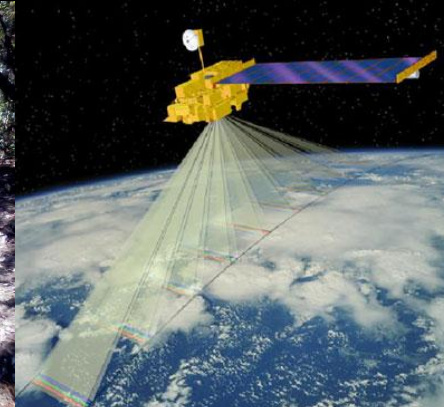


# What we need to cover in order to deal with Natural Disasters, especially forest fires?

## 2. Monitoring

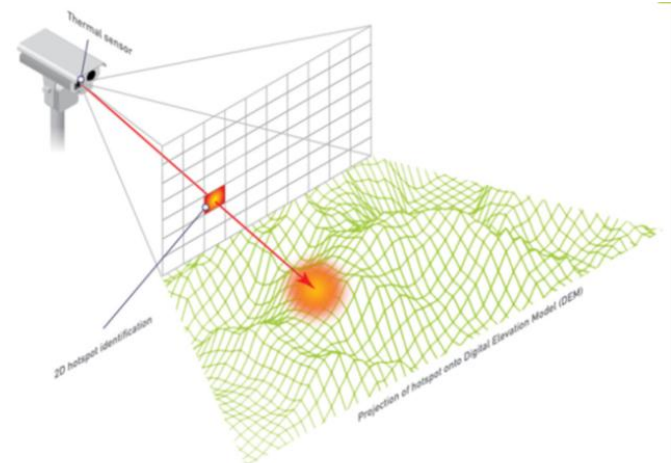
- A. Watch-out tower, different vehicles (car, SUV, motorcycle, and bicycle), helicopters, fixed wings, EOS, UAV (unmanned aircraft vehicle), CCTV with both visible and thermal infrared camera
- B. Public Network – 1362 Hotline
- C. Etc.

# Monitoring tools



Public Report

1362



HKK Wildlife Sanctuary



# CCTV System



Source: [http://www.fire.uni-freiburg.de/iffn/country/pt/pt\\_4.htm](http://www.fire.uni-freiburg.de/iffn/country/pt/pt_4.htm)

# Thermal Imaging Camera for FIRE DETECTION



thermal cameras with embedded fire detection solutions can detect a fire up to 4 miles, (6 km.) away and are versatile, reliable and effective fire detection systems which enhance the safety and security of infrastructure, equipment and personnel. Popular applications of this fire detection solution include private property, recycling plants, waste management depots, critical infrastructure and more.

Source: <http://hopewish.en.made-in-china.com/product/AqkmbTocYwUf/China-Fire-Alarm-System-Thermal-Imaging-Camera.html>

# Thermal and Visible Camera

Source: <http://www.insightrobotics.com>



**Visible lens:** smoke and flame detection, accurate secondary confirmation



**Thermal lens:** temperature detection, it can be found sources of ignition and hidden danger in earlier time



Licheng, Jinan, Shandong, China



Guangzhou, Guangdong, China



Hong Kong



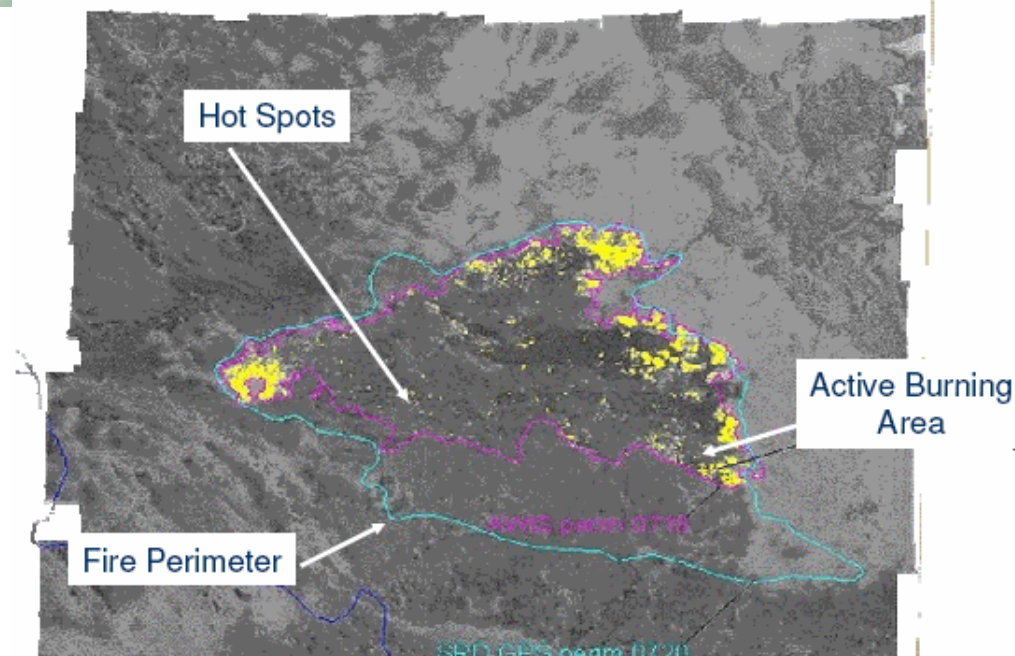
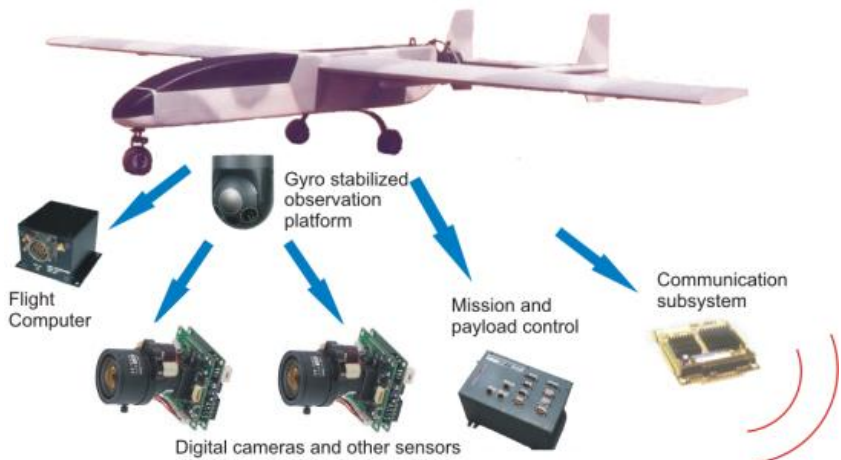
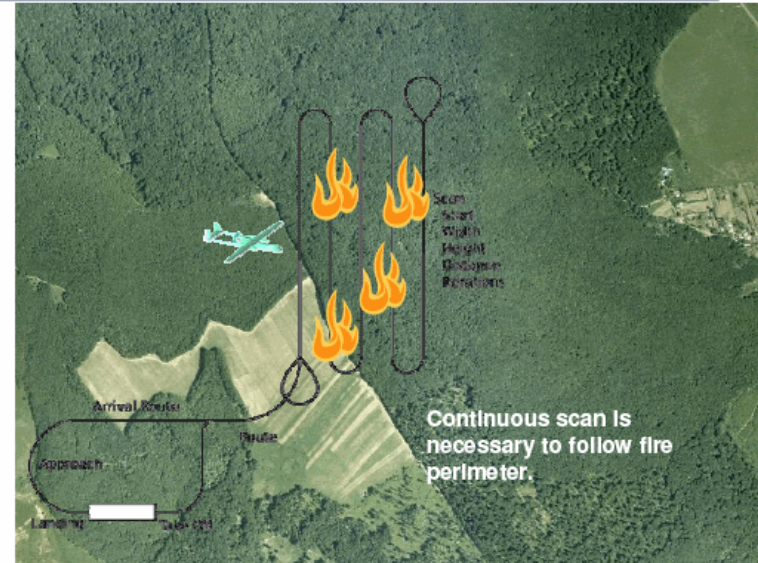
South Africa

# Unmanned Aircraft Vehicle

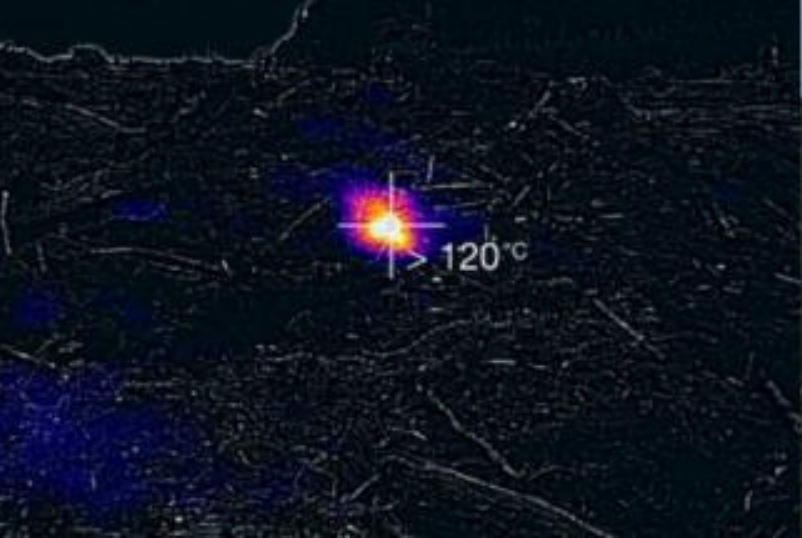
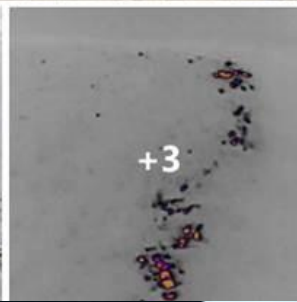
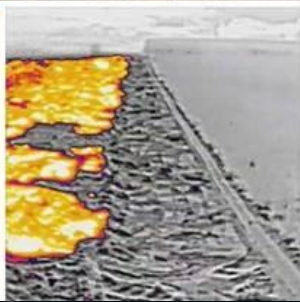
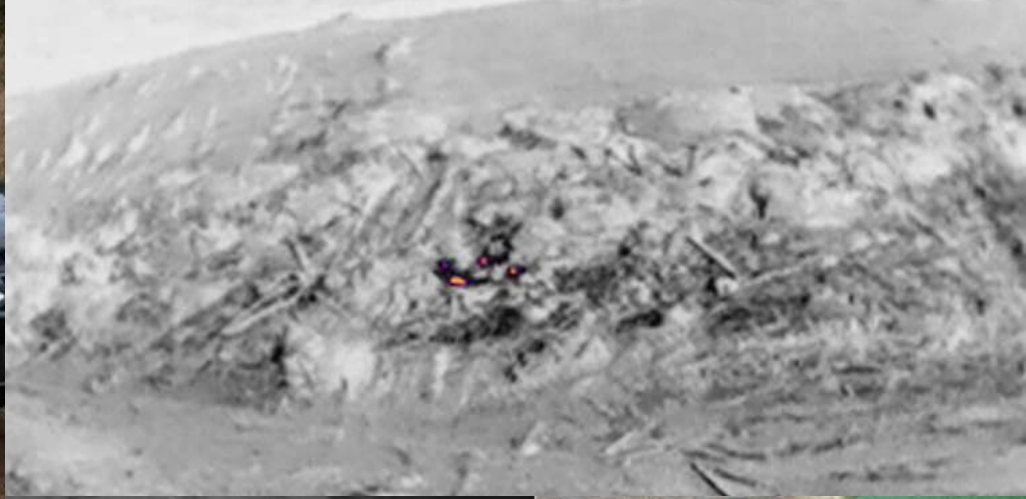
## THE SOLUTION



## Mission control



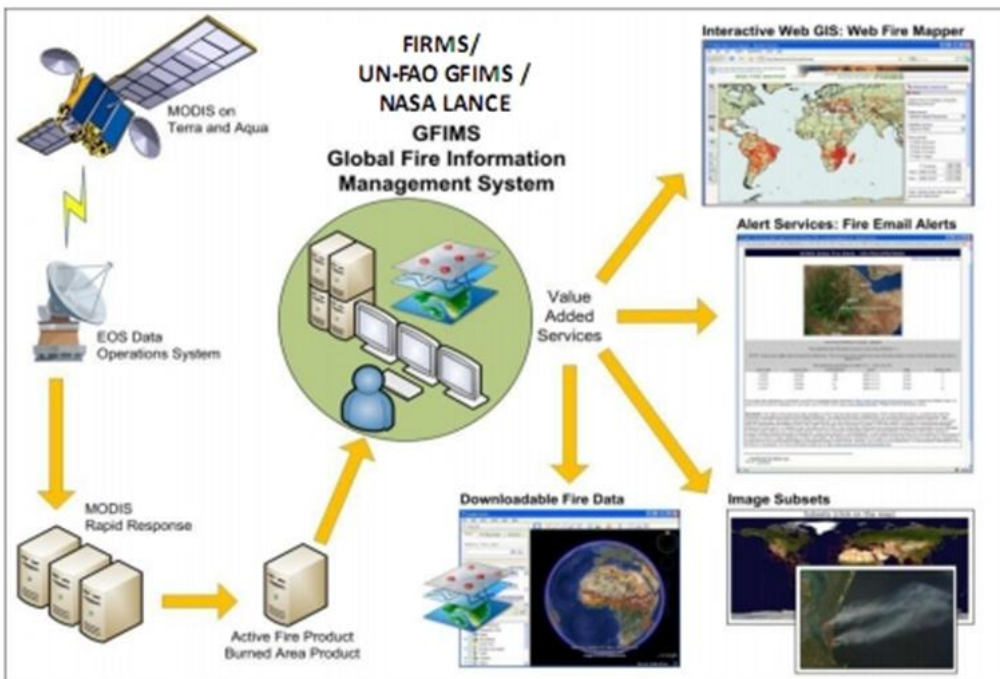
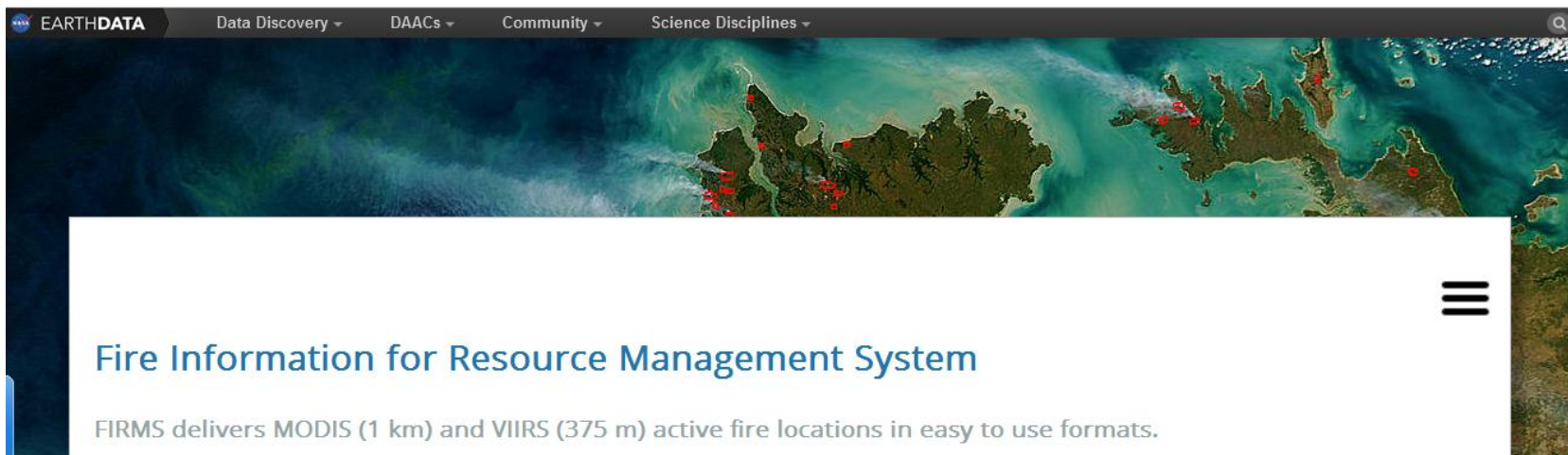
Source: <https://www.icarus.upc.edu/en/research/unmanned-aerial-systems-uas>



# UAV

Source:  
<http://www.interpine.co.nz/news/default.aspx>


# EARTHDATA Fire Information for Resource Management System



- Interactive Web GIS
- Email alerts
- Subsets of MODIS images
- Active fire data downloads (KML, Shape, Text files and plug-ins for Google Earth and NASA World-Wind)
- Fire Archive Download Tool

 Web Fire Mapper

 Email Alerts

 Active Fire Data

 Archive Fire Data

 Web Services

 FIRMS FAQ 

Source: <https://firms.modaps.eosdis.nasa.gov/>

By Jeff Schmaltz, Diane Davies, Minnie Wong, Gary Fu (NASA-LANCE-Earthdata-FIRMS)





NASA (National Aeronautics and Space Administration) | [https://worldview.earthdata.nasa.gov/?p=geographic&l=VIIRS\\_SNPP\\_CorrectedReflectance\\_TrueColor](https://worldview.earthdata.nasa.gov/?p=geographic&l=VIIRS_SNPP_CorrectedReflectance_TrueColor)

Most Visited | Getting Started | Suggested Sites | Web Slice Gallery

### NASA WORLDVIEW

- Layers
- Events
- Data

- (Day and Night) Aqua / MODIS
- Fires and Thermal Anomalies (Day and Night) Terra / MODIS
- Place Labels © OpenStreetMap (license), Natural Earth
- Coastlines / Borders / Roads © OpenStreetMap (license), Natural Earth
- Coastlines © OpenStreetMap (license)

#### BASE LAYERS

- Corrected Reflectance (True Color) Suomi NPP / VIIRS
- Corrected Reflectance (True Color) Aqua / MODIS
- Corrected Reflectance (True Color) Terra / MODIS

+ Add Layers

A satellite view of Asia, showing a dense concentration of red dots representing fire hotspots across the continent. The map includes a scale bar for 500 km and 500 mi, and a coordinate display of 4.8479, 70.9457-EPSC:4326. The interface includes a left sidebar with layer controls and a bottom timeline showing the date 2017 FEB 07.

Source: <https://worldview.earthdata.nasa.gov/>

By Jeff Schmaltz, Diane Davies, Minnie Wong, Gary Fu (NASA-LANCE-Earthdata-FIRMS)









**Earth Observation Group**

- EOG Home
- DMSP Archive Description
- Description of DMSP Sensors
- Data Availability
- Data Services and Pricing
- Data Download
- Online Maps and Web Services
- Nighttime Lights Posters
- Presentations
- Publications
- News & Media
- Items of Interest

## VIIRS Nightfire (Flares Only Version)

VIIRS is unique in the recording of near-infrared and short-wave infrared data at night. This includes the M7, M8, and M10 spectral bands. With sunlight eliminated, combustion sources are readily detected, particularly in the M10 band. The recorded signal can be fully attributed to the combustion source. In our analysis we use data from all of the VIIRS bands collecting data at night. The M10 band data are used to detect combustion sources. To eliminate noise, confirmation is sought in the Day/Night Band (DNB), M7, M8 and M12. Plank curve fitting is performed to estimate the temperature of background and heat source. Results are distributed in form of CSV files and KMZ files. The KMZ has data from the local maxima detected in the M10 band. Filtering is used to eliminate the bow tie effects from the identification of local maxima. The CSV has data from all of the pixels with radiances above background noise in the M10 band. Atmospheric correction is performed with MODTRAN parameterized with temperature and moisture profiles processed from the simultaneously acquired CrIS and ATMS sensors. Readme file is also available in case of situations out of BAU. Note that the processing algorithms have been evolving over time. Once the processing algorithms are stabilized we will reprocess the 2012 archive.

Place mark color legend:

					
White	Purple	Blue	Green	Yellow	Red
Non-conforming detections	400 < T < 1000	1000 < T < 1200	1200 < T < 1400	1400 < T < 1600	1600 < T < 3000

Note: The white place marks designate combustion source detections are deemed non-conforming. The most common type of non-conformance are the dim sources that are detected in M10 and DNB only. In this case the Planck curve fitting fails. In this case we assume that the wavelength of maximum radiance is in the M10 band. The temperature is set to 1810 K and the analysis proceeds. Pixels with unusually high (over 3000 K) or low (under 500 K) temperature estimates are also coded with white placemarks.

Place mark size legend:

<b>Large</b>	Log10(Radiant Heat)>7
<b>Medium</b>	7>Log10(Radiant Heat)>6
<b>Small</b>	Log10(Radiant Heat)<6

CSV Readme File: [Download](#)

Note: This readme file is valid for files made in 2013/03/18 - present

[CSV Readme File \(Outdated\)](#) [Download](#)

### VIIRS Nightfire Thailand National Parks Daily Summary



NCEI@jetsam.ngdc.noaa.gov

Today, 7:42 AM

Undisclosed\_Recipient@jetsam.ngdc.noaa.gov

#### VIIRS Nightfire Thailand National Parks Daily Summary 2017-07-24

[\[CSV\]](#) [\[KML\]](#)

Total detections: 0

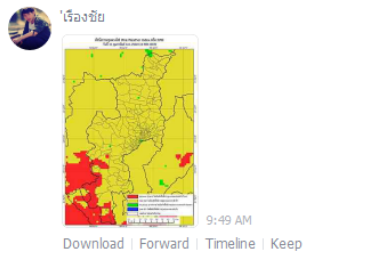
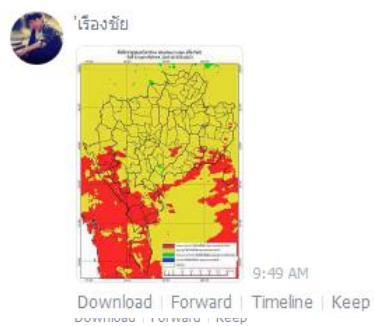
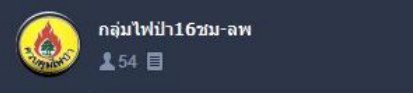
Alert is forced to reissue.



**By Kim Baugh and Chris Elvidge, NCEI-NOAA**

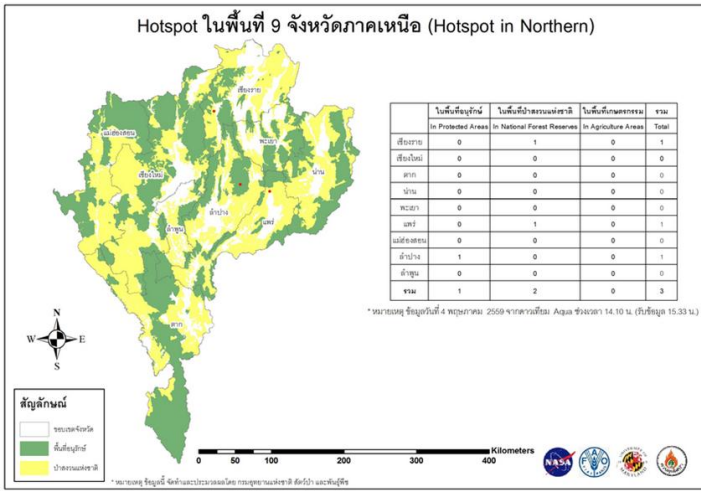
**Source:** <https://www.ngdc.noaa.gov/eog/viirs/>

# Daily report to the main forest fire control task forces by using rapid and daily fire hotspot alert emails, www FDRS, and a smart phone applications (e.g. LINE) by Department of National Parks, Wildlife and Plant Conservation (DNP)



**ข้อมูล Hotspots ในพื้นที่ป่าอนุรักษ์ ประจำวันที่ 21 กุมภาพันธ์ 2559**

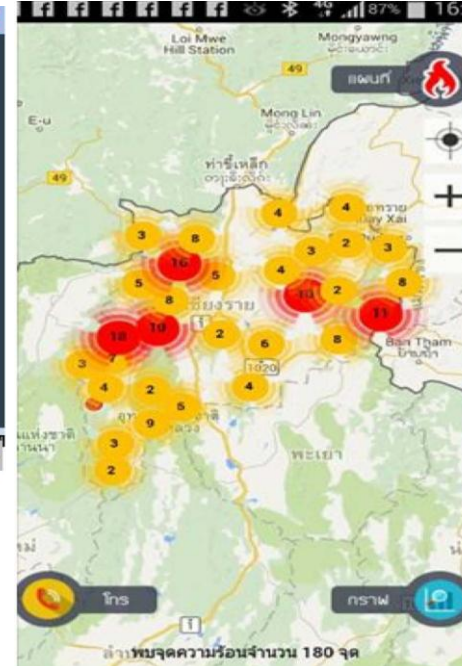
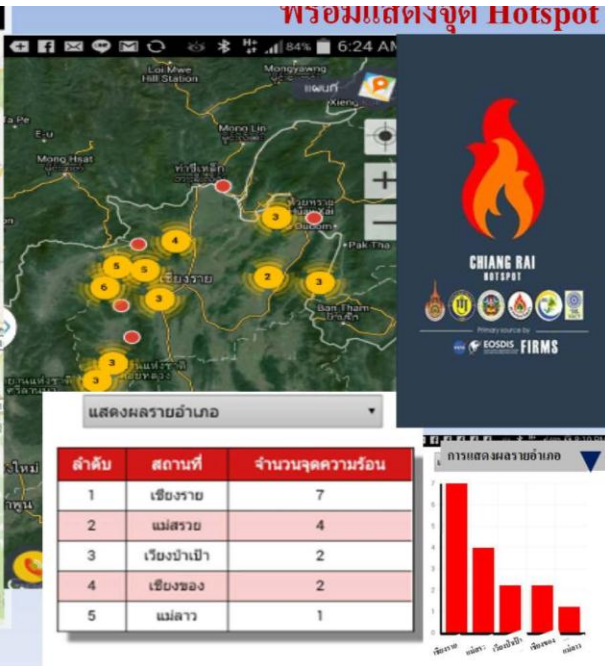
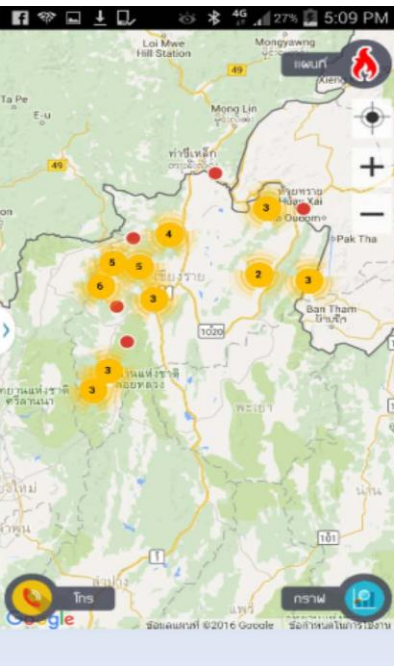
ว/ด/ป	เวลา	LAT	LONG	POINT_X	POINT_Y	ดาวเทียม	ตำบล	อำเภอ	จังหวัด	ชื่อพื้นที่	สถานที่รับผิดชอบ
21/2/2016	14.15	15.955	101.539	771788	1765614	Aqua	แหลมทอง	ภักดีชุมพล	ชัยภูมิ	ไทรทอง	สถานีควบคุมไฟป่าไทรทอง
21/2/2016	14.15	15.963	101.547	772634	1766510	Aqua	ห้วยแย้	หนองบัวระเหว	ชัยภูมิ	ไทรทอง	สถานีควบคุมไฟป่าไทรทอง
21/2/2016	14.15	18.188	98.429	439616	2011079	Aqua	บ่อหลวง	สอด	เชียงใหม่	แม่เมาะ	
21/2/2016	14.15	18.192	98.437	440463	2011519	Aqua	บ่อหลวง	สอด	เชียงใหม่	แม่เมาะ	
21/2/2016	14.15	14.922	98.942	493762	1649700	Aqua	ชะแล	ทองผาภูมิ	กาญจนบุรี	ลำคลองงู	
21/2/2016	14.15	18.371	97.717	364456	2031711	Aqua	เส้าหิน	แม่สะเรียง	แม่ฮ่องสอน	สาละวิน	
21/2/2016	14.15	15.260	99.328	535220	1687110	Aqua	คอกควาย	บ้านไร่	อุทัยธานี	ห้วยขาแข้ง	สถานีควบคุมไฟป่าห้วยคด
21/2/2016	14.15	15.268	99.331	535540	1687995	Aqua	คอกควาย	บ้านไร่	อุทัยธานี	ห้วยขาแข้ง	สถานีควบคุมไฟป่าห้วยคด



**A Daily Report by DNP**

Where? Which forest fire control responsibility!

# Chiangrai Hotspot & Early Burning Application



รายงานการกำจัดเชื้อเพลิงรายตำแหน่ง

พิกัด: 20.0037701 99.749556  
 สถานที่: อ.เมืองเชียงราย ต.แม่ยาว  
 ขนาดพื้นที่: 500 ไร่  
 วัน - เวลา: 2017-02-09 10:44:13  
 สถานะ: กำลังกำจัดเชื้อเพลิง

รูป แผนที่ หน้าหลัก



Sirimongkonlertkun, N. and Yanawongsa, E., 2016

# Development of Information Supports Forest Fire and Smoke Management for Northern Thailand Application by

Passakorn Juipiam, Siraprapa Boonrat, Arthorn Luansodsai (Department of Mathematics and Computer Science Faculty of Science, Chulalongkorn University) and Veerachai Tanpipat



จุฬาลงกรณ์มหาวิทยาลัย  
Chulalongkorn University

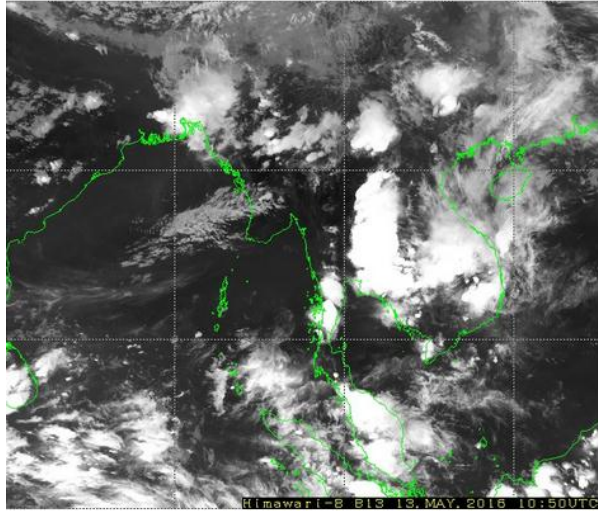
Information expect to be included are

1. Active fire information from NASA-LANCE-FIRMS
2. Forecast FFMC and FWI from Geoinformatics Division DNP
3. Forecast Smoke by 7SEAS
4. PM10 information by PCD

Himawari Real-Time Image

The RGB composite imagery is produced by composing satellite images colored in red, green and blue.  
 User's Guide to RGB composite imagery (Himawari RGB Training Library)

Select Area Southeast Asia 1 Band B13 (Infrared)  
 Time 10:50 UTC 13 May 2016 Prev Next Animation Last 1 Hour Play Stop



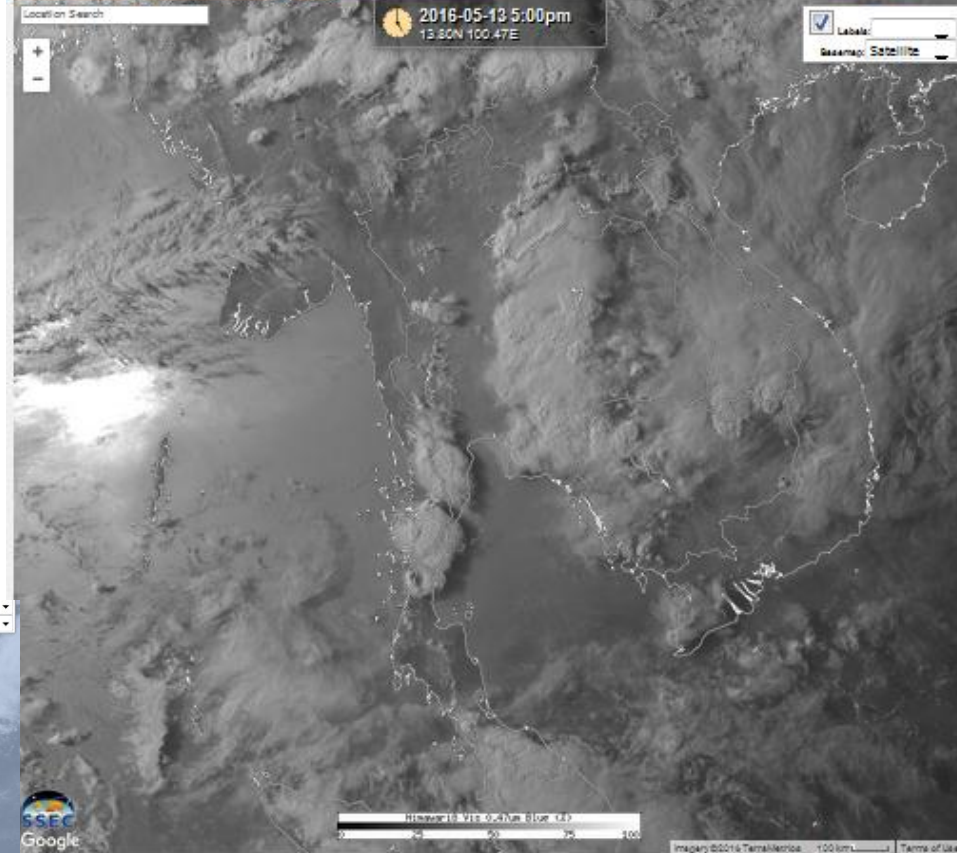
# Monitoring Transport of Biomass Burning Aerosols Himawari-8 Geostationary Monitoring

## Thai Himawari-8 Imagery Display: Vis 0.47 micron [Blue].

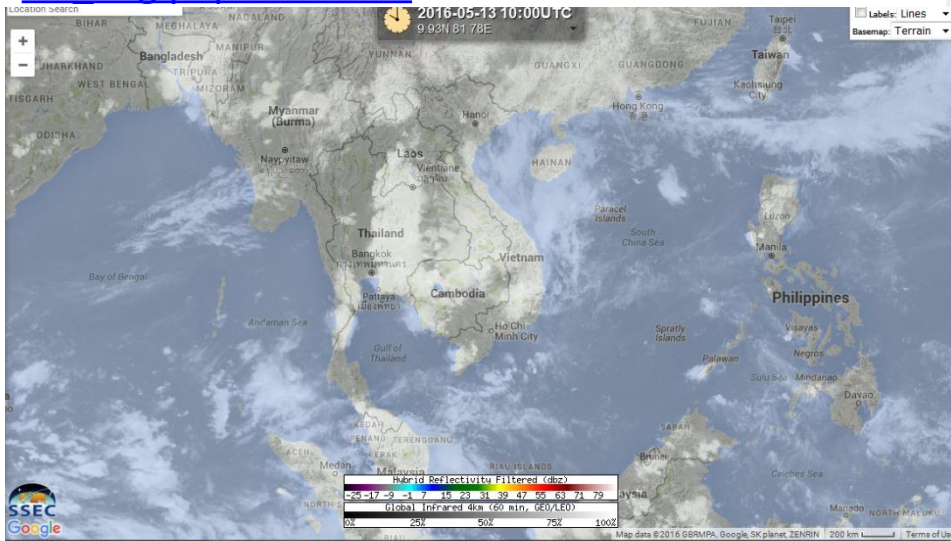
Always check currency of Images

Blue Green Red Near IR 2.2µ Fire WV WV Thermal Real Base

Note: (1) 2.2micron band can see fires at night. (2) Fire band now picking up hot ground as well as fires - most effective at night.  
 Auto-refresh after 10 minutes. Rick McRae, ACT Emergency Services Agency, rick.mcrae@act.gov.au, 7th Dec 2015. Data from SSEC & JMA.  
[Overview material](#) | [Explanation material](#) | [Videos](#)



[http://www.data.jma.go.jp/mscweb/data/himawari/sat\\_img.php?area=se1](http://www.data.jma.go.jp/mscweb/data/himawari/sat_img.php?area=se1)



[http://www.highfirerisk.com.au/imr/Thai\\_H8\\_01.htm](http://www.highfirerisk.com.au/imr/Thai_H8_01.htm)

By Rick McRae and Richard Woods, Risk Analyst,  
 Emergency Management, Risk and Spatial Services,  
 ACT Emergency Services Agency, Australia

<http://realearth.ssec.wisc.edu/>

# JAXA Himawari Monitor

## P-Tree System

JAXA Himawari Monitor  
P-Tree System

User Registration User Guide

日本語 Last Update: 24 Jul 2017 14:20:25 UTC

Date: 2017 / 7 / 24 4 : 40~49 UTC Search

-1da -1ho -10m Latest Im +10i +1hd +1d

Layer Menu

Overlay:

- Coastline (1:50m)
- Coastline (1:10m)
- Latitude/Longitude
- Major River

JAXA Products:

- Sea Surface Temperature
- Sea Surface Temperature (Night Mode)
- Aerosol Optical Thickness
- Short Wave Radiation
- Chlorophyll-a

RGB (Himawari)

Layer Opacity Control

Full Screen

10 min 1 Hour Ave./Integ.

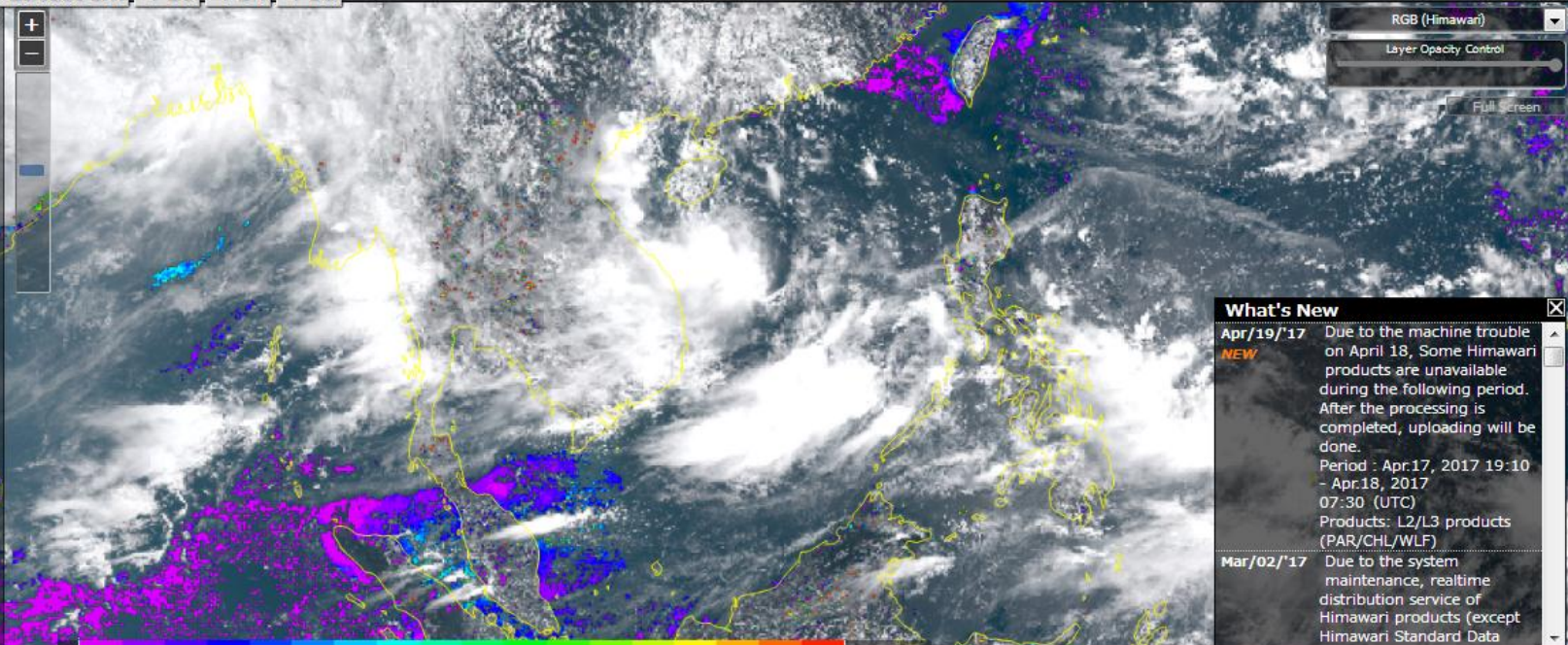
What's New

Apr/19/17  
**NEW**  
Due to the machine trouble on April 18, Some Himawari products are unavailable during the following period. After the processing is completed, uploading will be done.  
Period : Apr.17, 2017 19:10 - Apr.18, 2017 07:30 (UTC)  
Products: L2/L3 products (PAR/CHL/WLF)

Mar/02/17  
Due to the system maintenance, realtime distribution service of Himawari products (except Himawari Standard Data

JAXA EORC Copyright © Japan Aerospace Exploration Agency, Earth Observation Research Center, All rights reserved.

What's New Contact Us



**Can register and access data!!!!**

Source: <http://www.eorc.jaxa.jp/ptree/>

# What we need to cover in order to deal with Natural Disasters, especially forest fires?

## **3. Prediction** (Forecasting and Modeling)

- A. Fire behavior software (Prometheus Canada)**
- B. Smoke and haze monitoring and forested system (7 SEAS and ECMWF-CAMS, Himawari-8)**
- C. Early Warning System for fire (EWR-Fire) based on Fire Danger Rating System (FDRS) such as GFEWS, EFFIS, UATFFDRS, INFFDRS, Robert Field's work**



# Fire Behavior Software “Prometheus”

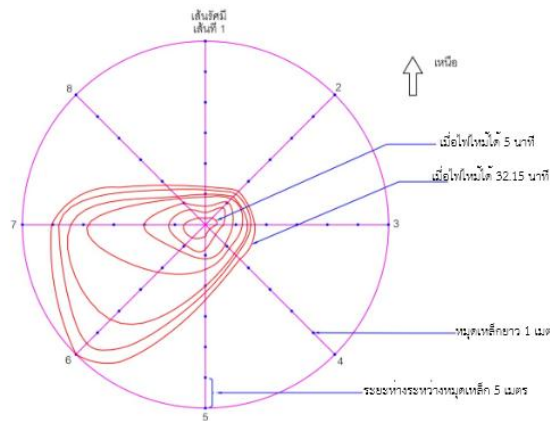


## Overview

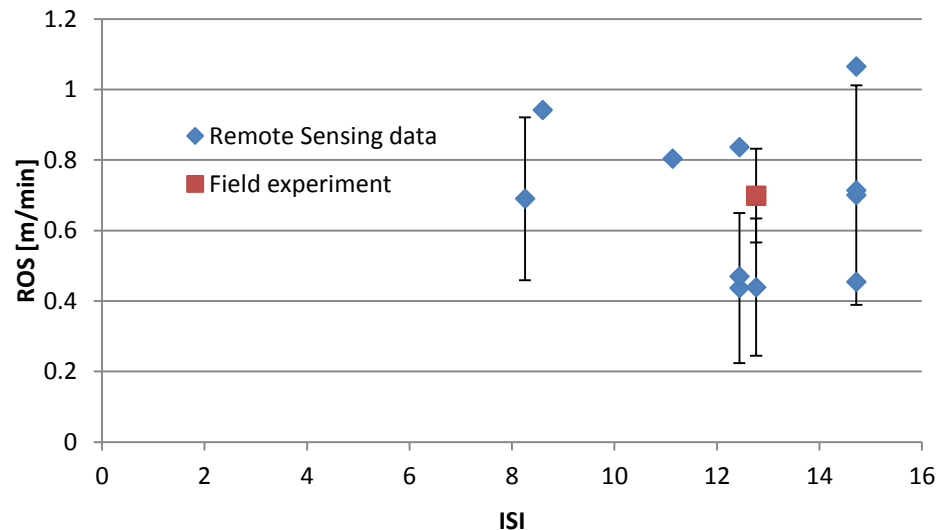
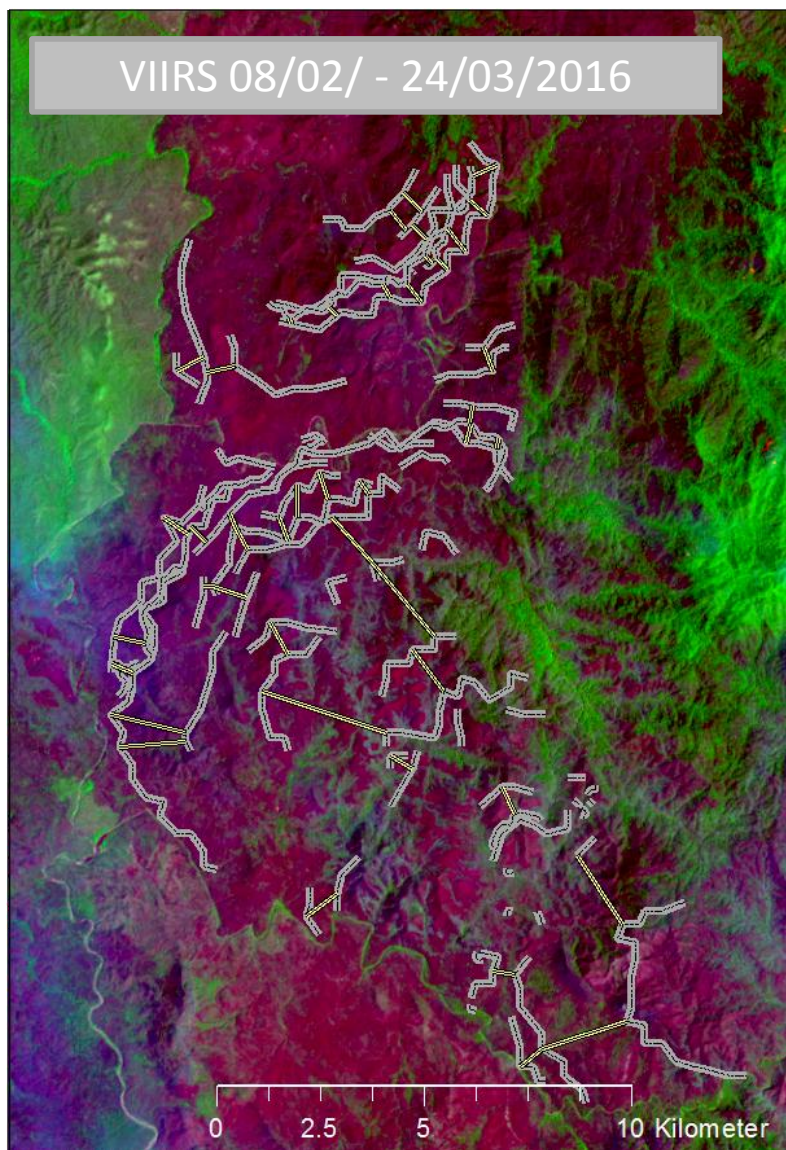
Prometheus is a deterministic wildland fire growth simulation model based on the Fire Weather Index (FWI) and Fire Behaviour Prediction (FBP) sub-systems of the Canadian Forest Fire Danger Rating System (CFFDRS). The model computes spatially-explicit fire behaviour and spread outputs given heterogeneous fuel, topography and weather conditions. All spatial outputs are compatible with Geographic Information Systems. [Learn more...](#)



The **calibration process** of the software to suit deciduous and dry dipterocarp forest in Thailand by using 10 years of HKK fire experiment data and other related data such as FWI, weather data, etc. **have been working by Gernot Rucker and his team at ZEBRIS GbR, Geoinformation systems and consulting services (<https://firemaps.net/>) , Germany.**



# Wildfire and Experimental fire in HKK Wildlife sanctuary



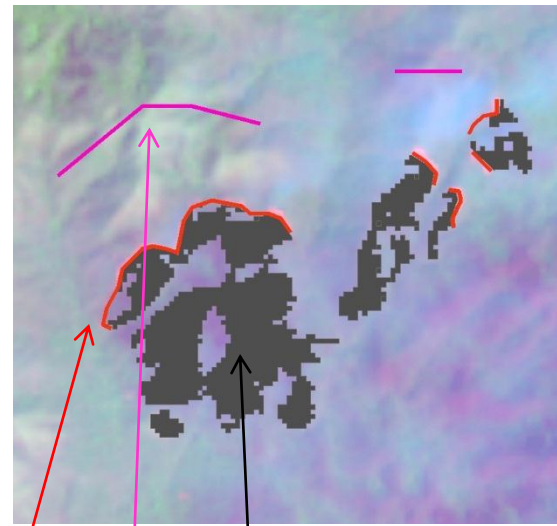
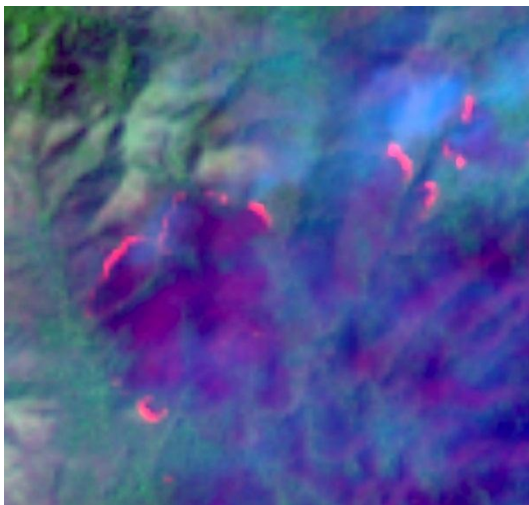
- > 40 manual spread measurements February/March 2016, no difference between head & back fires
- Plot shows only day -> night pairings
- Slow spreading fire burning at low ISI values
- Field experiment in same area on 22<sup>nd</sup> February confirms spread rates



# Test case HKK fire 2016



## Satellite images

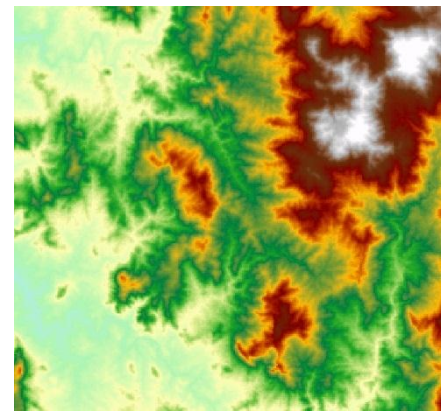


Landsat 8 OLI:  
15.02.2016  
03:43:29

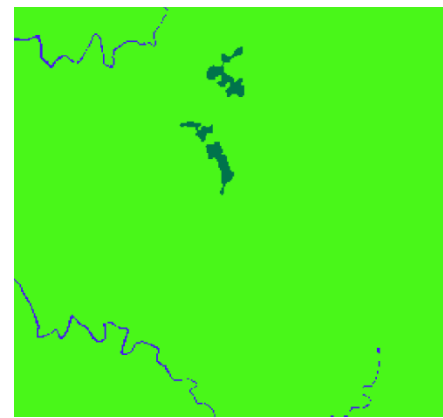
**Fire fronts:** ignitions for model  
Previously burned areas by LS8 OLI:  
non-fuel for model  
(prevents fire from burning backwards)

**Second observation of fire fronts:**  
Stop time for model by Suomi NPP VIIRS

## DEM (SRTM, 30 m)



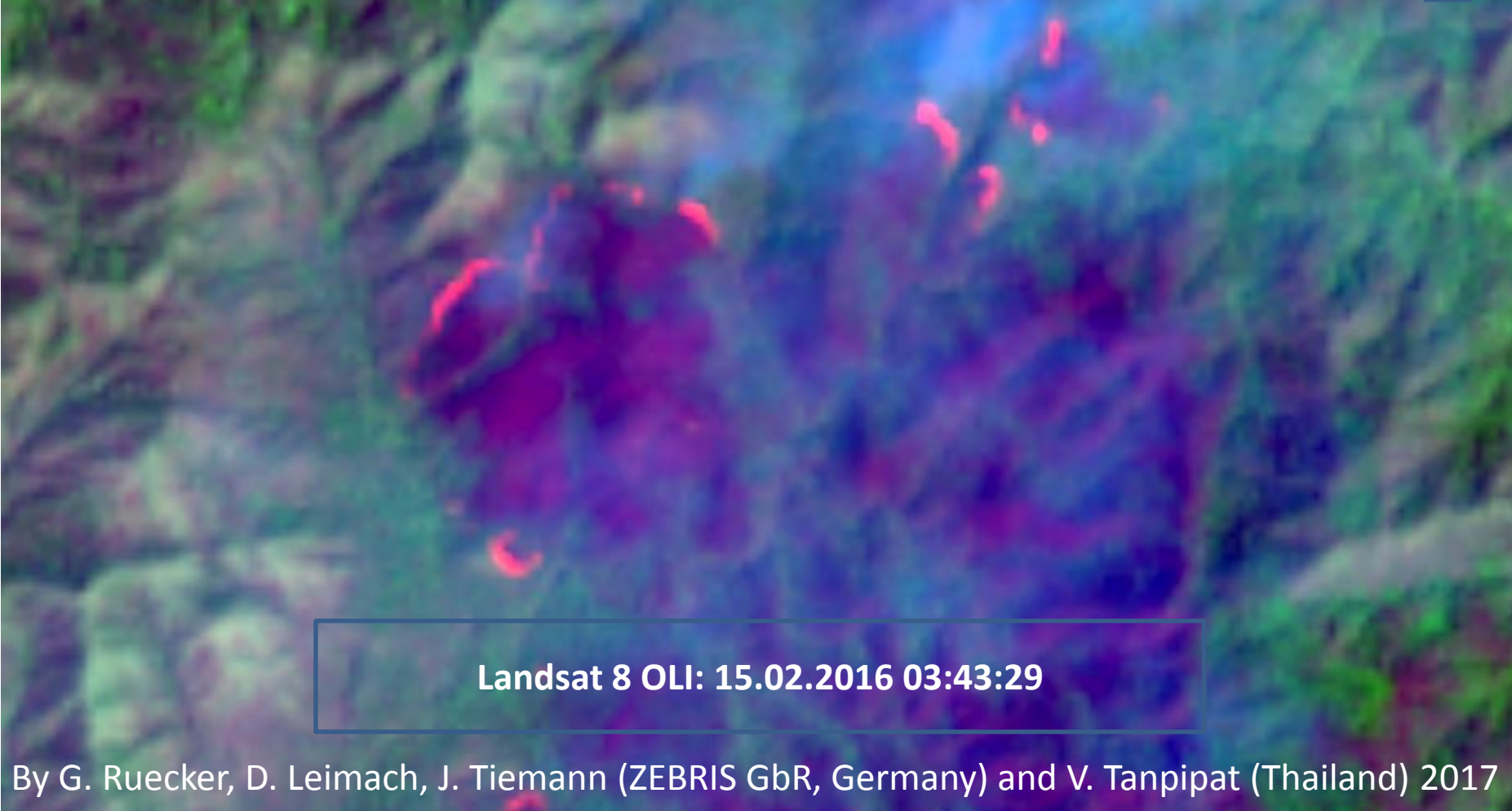
## Fuel types (from land cover LDD 2015)



# Test Case: HKK Fire 15-02-2016



0 250 500 1.000 1.500 2.000 Meter

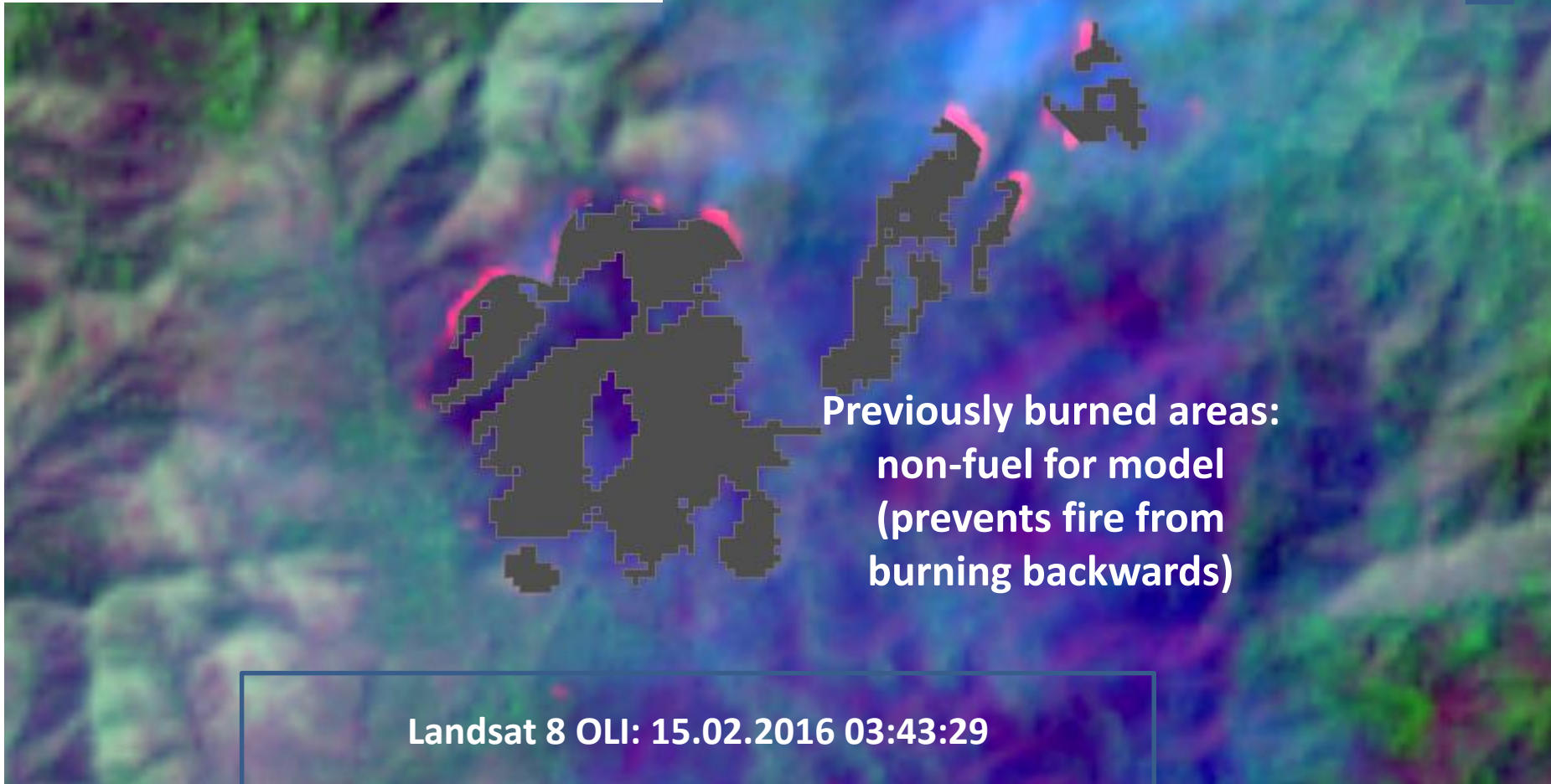


Landsat 8 OLI: 15.02.2016 03:43:29

# Input Data



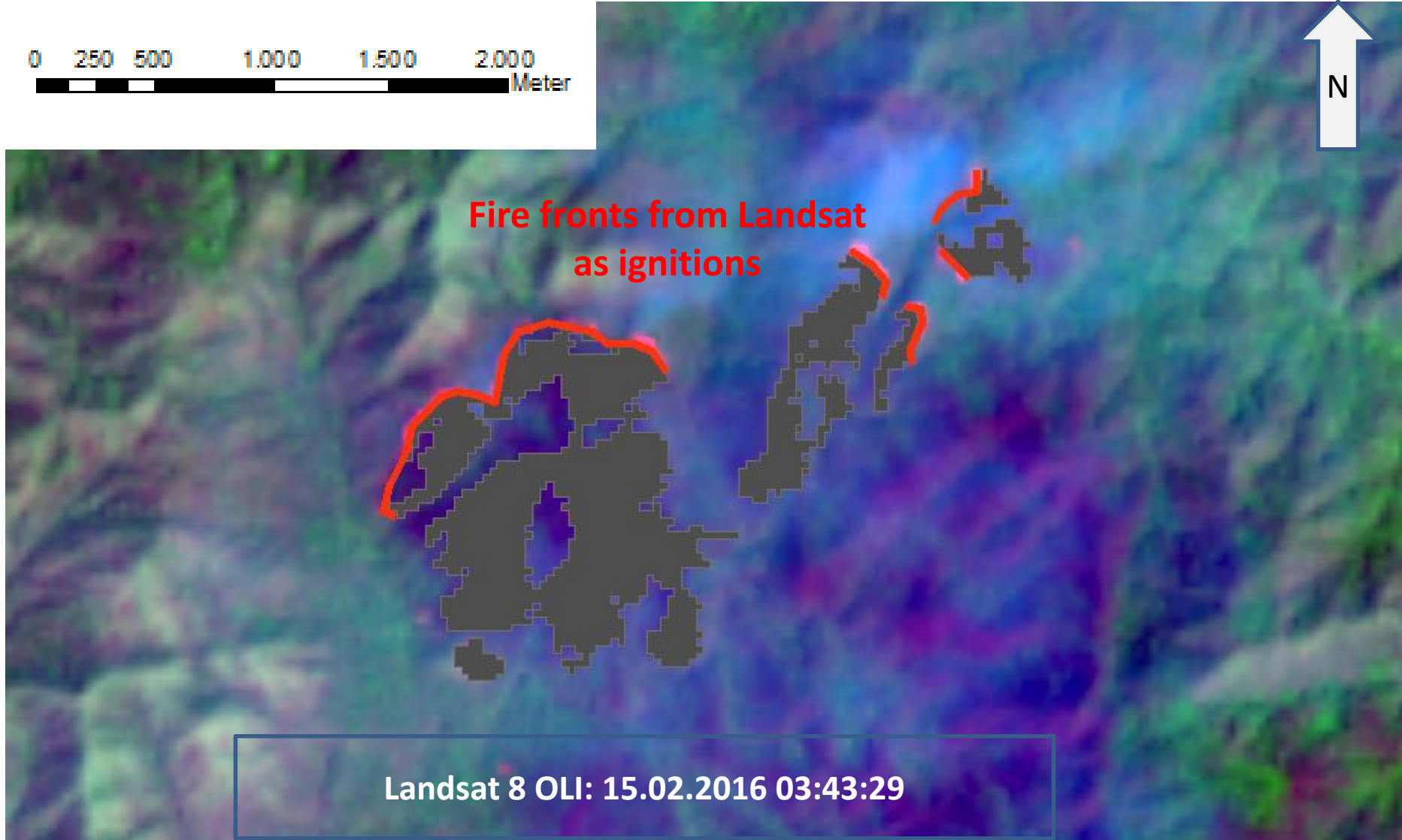
0 250 500 1.000 1.500 2.000  
Meter



Previously burned areas:  
non-fuel for model  
(prevents fire from  
burning backwards)

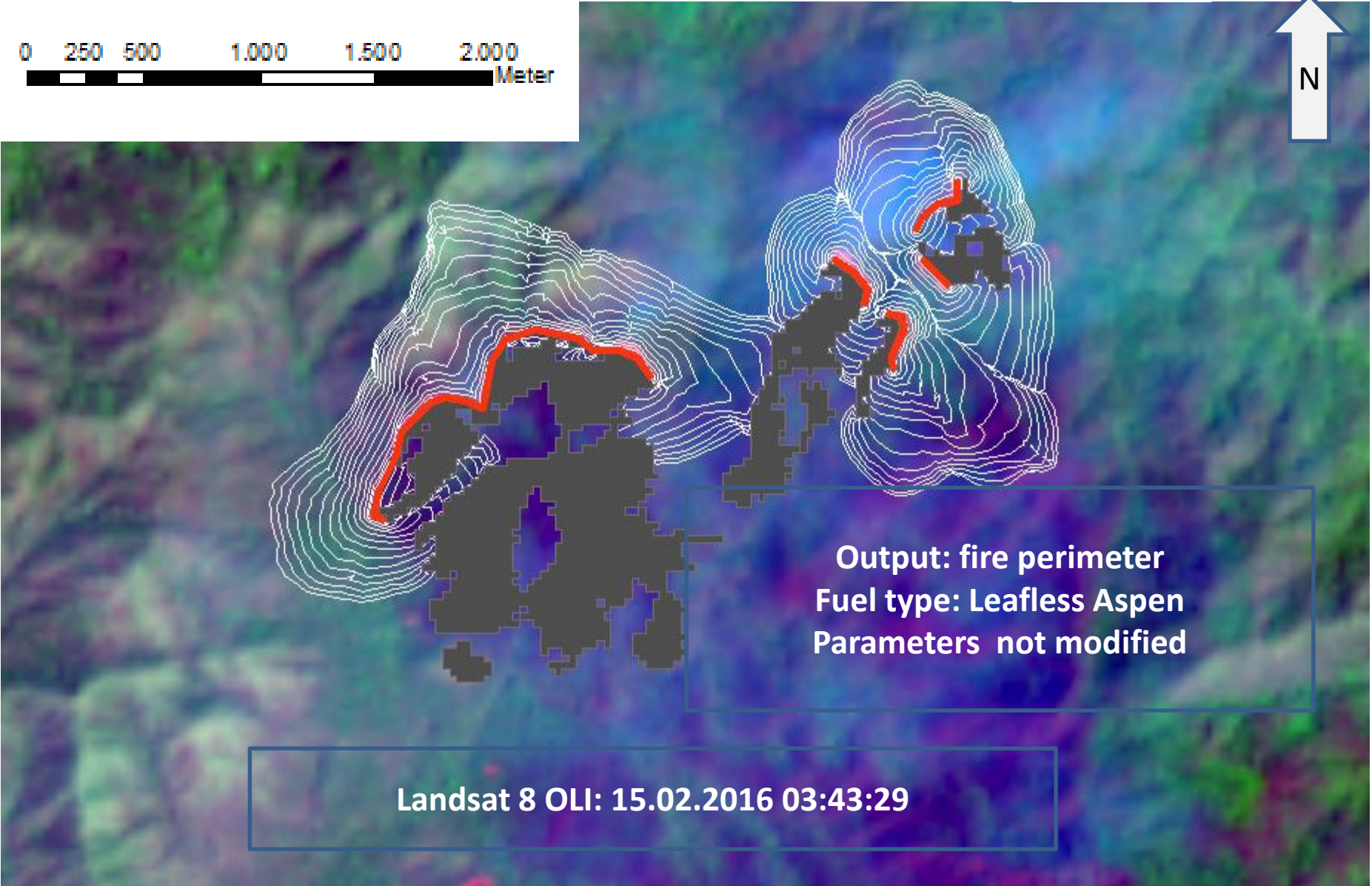
Landsat 8 OLI: 15.02.2016 03:43:29

# Input data



Landsat 8 OLI: 15.02.2016 03:43:29

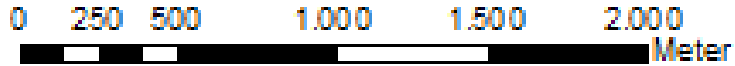
# Simulation process



**Output: fire perimeter**  
**Fuel type: Leafless Aspen**  
**Parameters not modified**

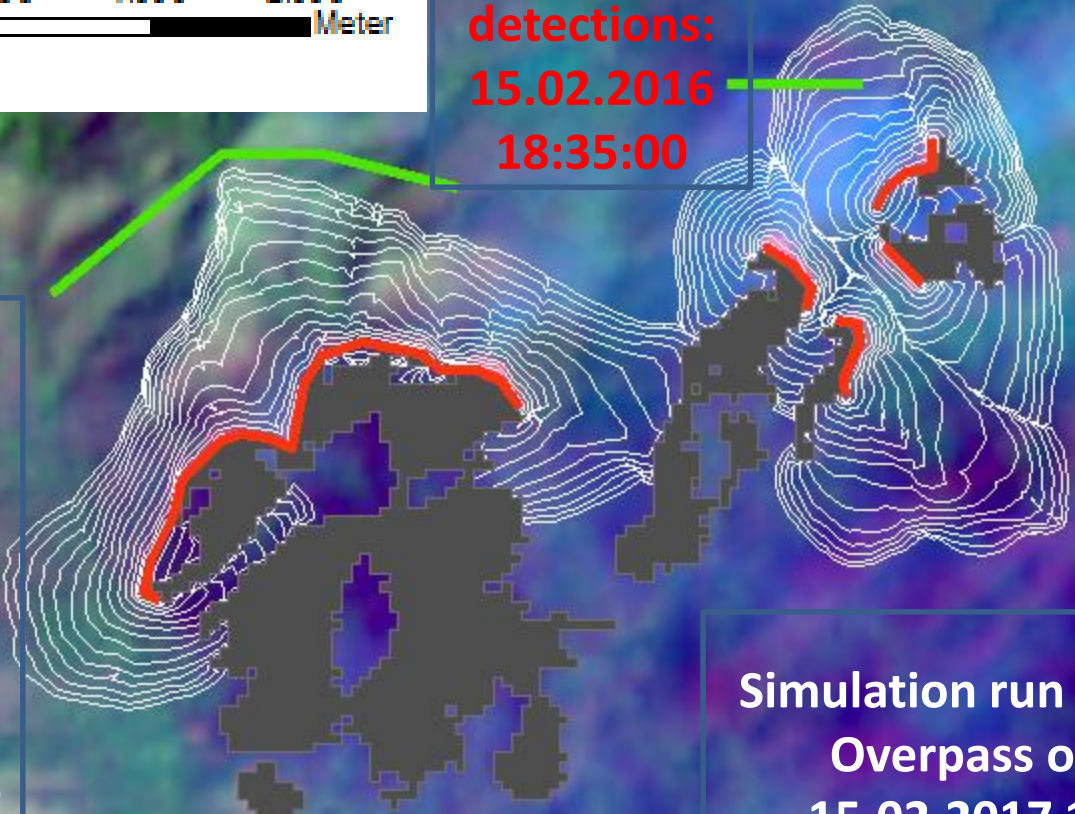
**Landsat 8 OLI: 15.02.2016 03:43:29**

# Simulation process



**NPP fire  
detections:  
15.02.2016  
18:35:00**

**Output: fire  
perimeter  
Fuel type:  
Leafless  
Aspen  
Parameters  
not modified**



**Simulation run stop time =  
Overpass of NPP =  
15.02.2017 18:35:00**

**Simulation start time: Overpass of Landsat 8 OLI: 15.02.2016 03:43:29**

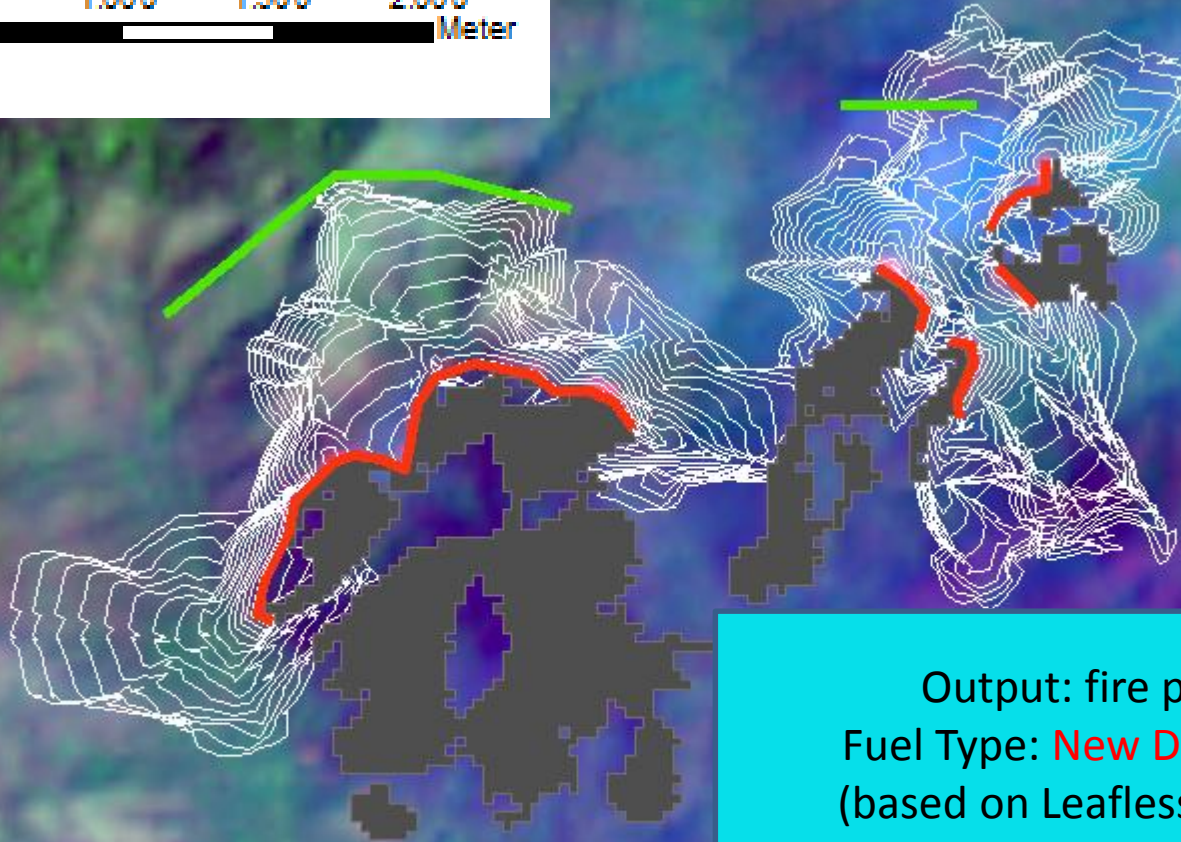


# Simulation process



0 250 500 1.000 1.500 2.000 Meter

N



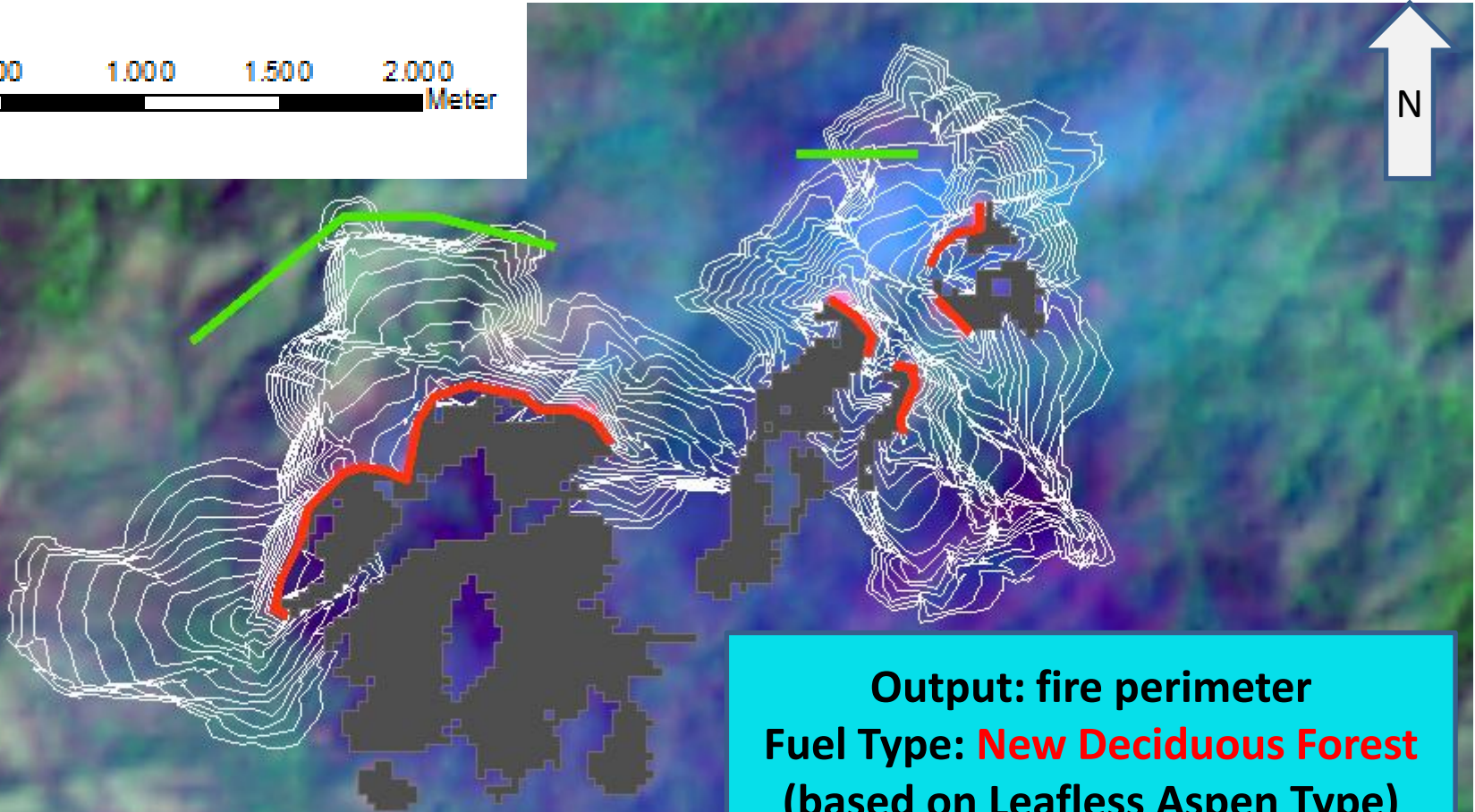
Landsat 8 OLI: 15.02.2016 03:43:29

Output: fire perimeter  
Fuel Type: **New Dry Deciduous**  
(based on Leafless Aspen type)  
Parameter: **Custom from ISI-ROS regression**  
a: 3.2 / b: 0.000068 / c: 0.16

# Simulation process



0 250 500 1,000 1,500 2,000  
Meter



**Output: fire perimeter**  
**Fuel Type: New Deciduous Forest**  
**(based on Leafless Aspen Type)**  
**Parameter: Custom from ISI-ROS**  
**regression tuned for faster spread**  
**a: 5 / b: 0.0001 / c: 0.2**

Background Landsat 8 OLI: 15.02.2016 03:43:29

# Fire Intensity Output



0 250 500 1.000 1.500 2.000  
Meter

550 kW/m  
75 kW/m

N

Background: SRTM 30 Meter

Output: fire intensity  
Fuel Type: **New Deciduous**  
(based on Leafless Aspen Type)  
Parameter: **Custom from ISI-ROS**  
regression tuned for faster spread  
a: 5 / b: 0.0001 / c: 0.2

# Smoke and Haze Monitoring By 7 SEAS



Welcome to the 7 SEAS Data Repository!

[7SEAS Main Page](#)

[Data Use Policy](#)

[Privacy Policy](#)



Images and data shown for **Latest**

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[Previous Day](#)

[Next Day](#)

[Reset](#)

Related links:

Aerosol Forecasting:

[NAAPS](#)

[COAMPS0-OS VE](#)

Remote Sensing:

[NEXSAT Satellite Imagery \(7SEAS\)](#)

[AERONET \(Sun photometry\)](#)

[AERONET BAMGOMAS \(Synergy tool\)](#)

[MODIS RGB Near Rapid Response Sets \(Imagery\)](#)

[NRL Remote Sensing \(Imagery\)](#)

[MISR Data Collects for VBBE](#)

[VBBE COAMPS Plots](#)

[NASA LaRC FlashFlux](#)

[NASA/NRL/CRISP MPLNET](#)

[NASA Worldview \(requires Firefox\)](#)

[CALIPSO Browse Imagery](#)

[MODIS Southeast Asia subsets](#)

Weather:

[FNMOG NOGAPS Forecasts West Pacific](#)

[NCEP/GFS Forecasts E Asia](#)

[FNMOG NOGAPS Forecasts SW Asia](#)

[NCEP/GFS Forecasts Indian Ocean](#)

[FNMOG WW3 Forecasts SW Asia](#)

[Malaysian Meteorological Department](#)

[Environment Agency](#)

[More Weather Links](#)

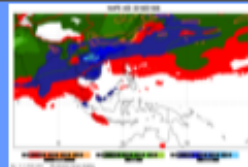
By Jeff Reid and Edward Hyer, NRLMRY-US NAVY

## Forecast Products

To download data and graphics for these products see the [GODAE data portal](#).

**NAAPS**

AOD



Current Data:

[00](#)

[06](#)

[12](#)

[18](#)

[Forecast Graphic](#)

[Archived Data](#)

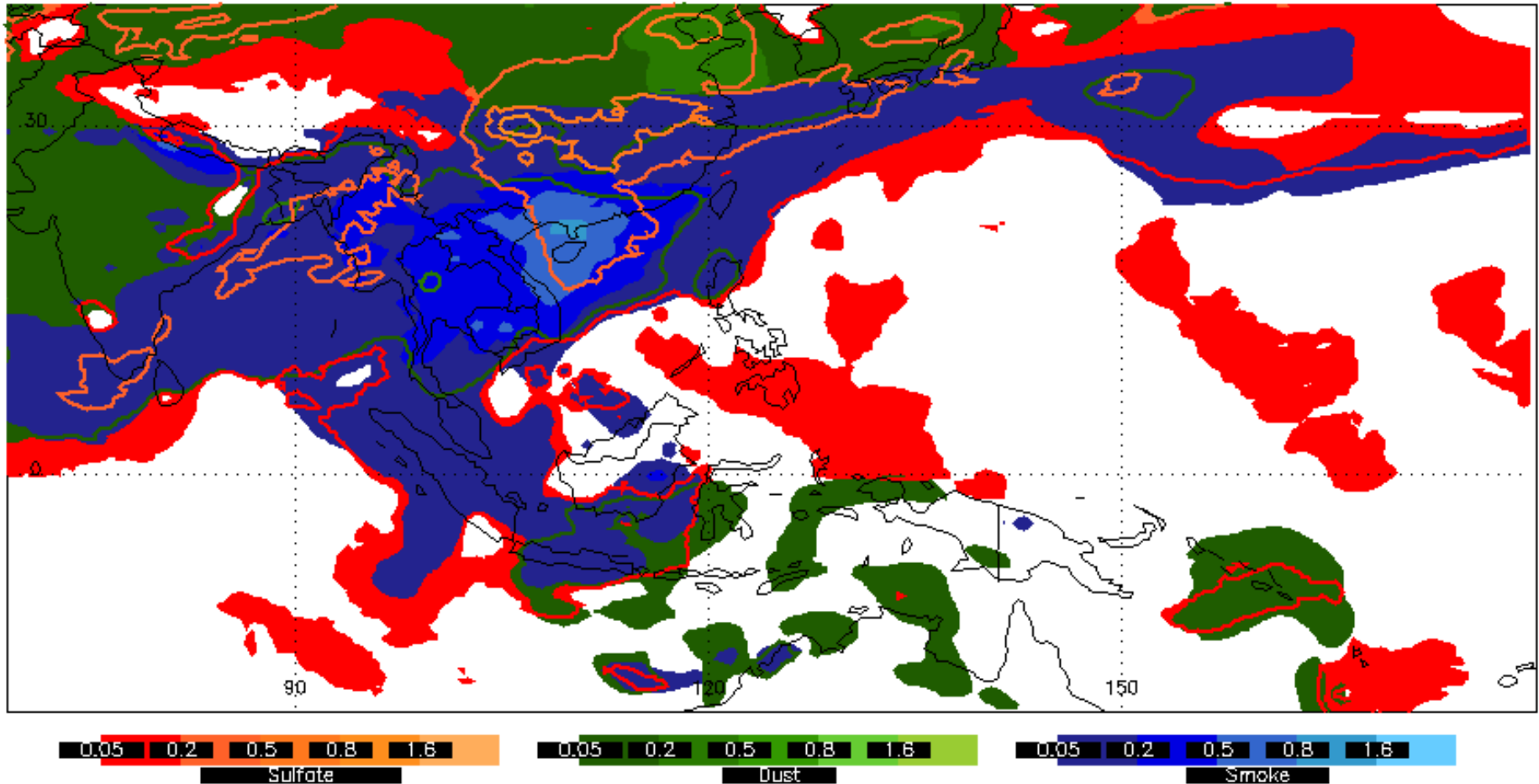
[Archived Graphics](#)

Source: [http://www.nrlmry.navy.mil/aerosol\\_web/7seas/7seas.html](http://www.nrlmry.navy.mil/aerosol_web/7seas/7seas.html)

# Forecasted Smoke and Haze By 7 SEAS

## Aerosol Optical Depth

NAAPS AOD 2016042406



Apr 25 11:16:15 2016 NRL/Monterey Aerosol Modeling

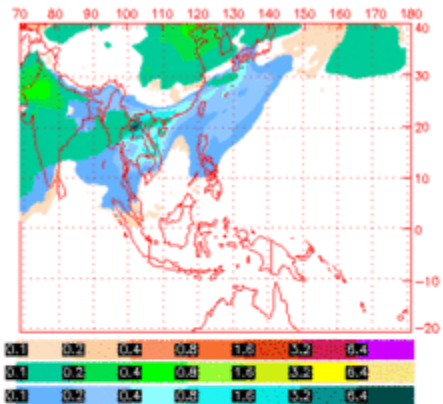
By Jeff Reid and Edward Hyer, NRLMRY-US NAVY

24-30 April 2016

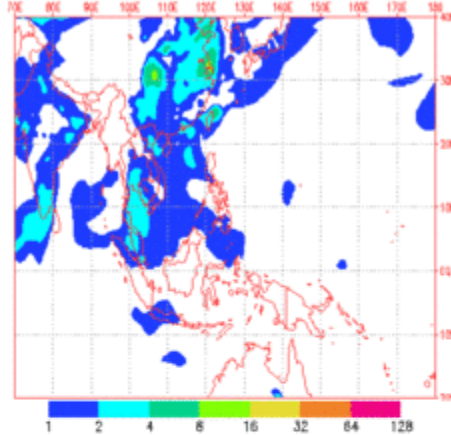
Source: [http://www.nrlmry.navy.mil/aerosol\\_web/7seas/7seas.html](http://www.nrlmry.navy.mil/aerosol_web/7seas/7seas.html)

# Forecasted Smoke and Haze By 7 SEAS

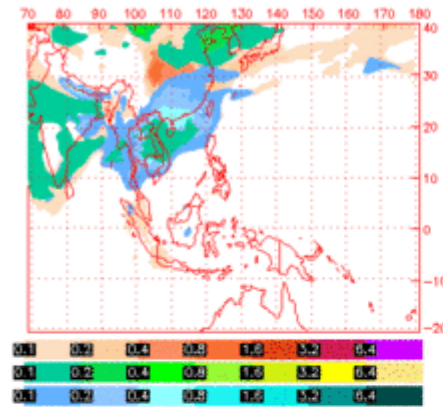
NAAPS Total Optical Depth for 00:00Z 18 Apr 2016  
Sulfate: Orange/Red, Dust: Green/Yellow, Smoke: Blue



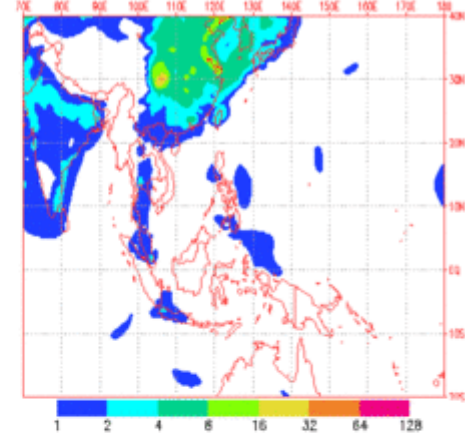
Sulfate Surface Concentration ( $\mu\text{g}/\text{m}^3$ ) for 2016041800



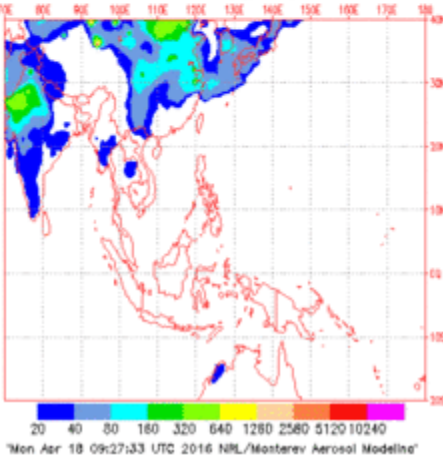
NAAPS Total Optical Depth for 00:00Z 25 Apr 2016  
Sulfate: Orange/Red, Dust: Green/Yellow, Smoke: Blue



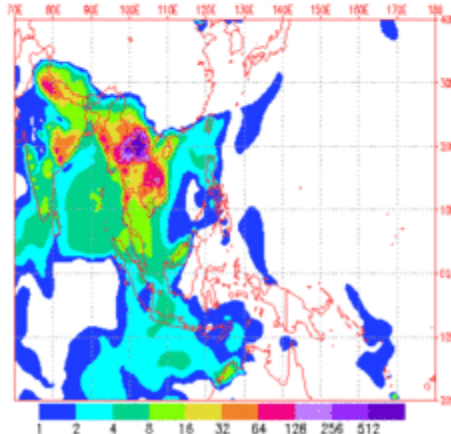
Sulfate Surface Concentration ( $\mu\text{g}/\text{m}^3$ ) for 2016042500



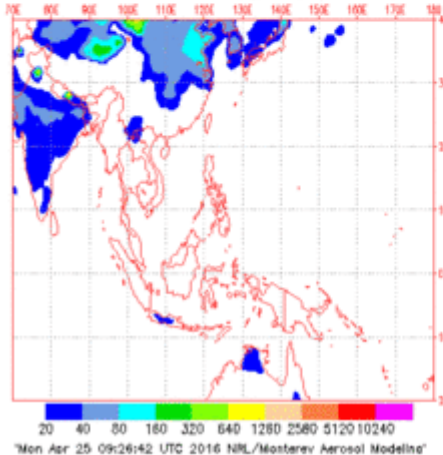
Dust Surface Concentration ( $\mu\text{g}/\text{m}^3$ ) for 2016041800



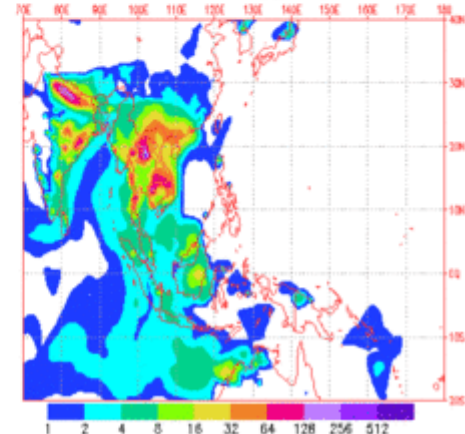
Smoke Surface Concentration ( $\mu\text{g}/\text{m}^3$ ) for 2016041800



Dust Surface Concentration ( $\mu\text{g}/\text{m}^3$ ) for 2016042500



Smoke Surface Concentration ( $\mu\text{g}/\text{m}^3$ ) for 2016042500



18-22 April 2016

25-29 April 2016

By Jeff Reid and Edward Hyer, NRLMRY-US NAVY

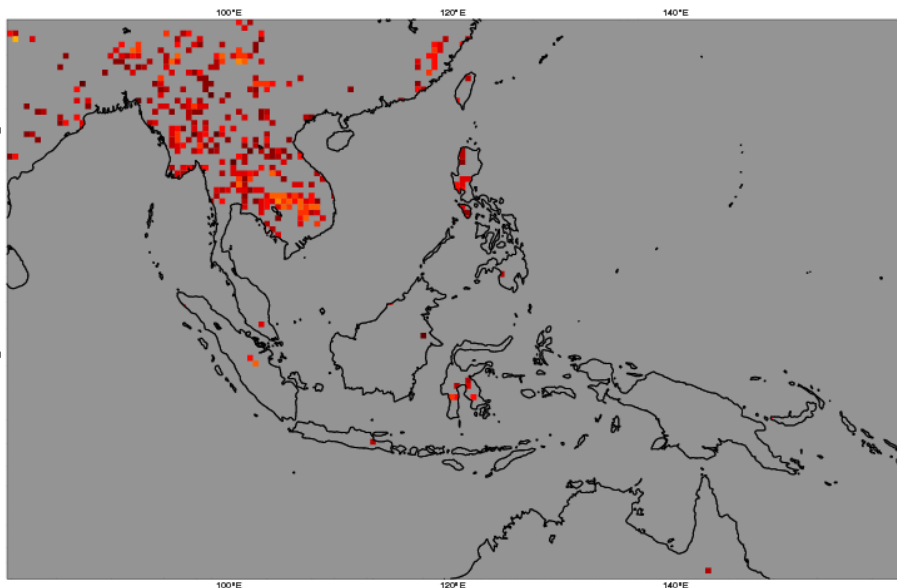
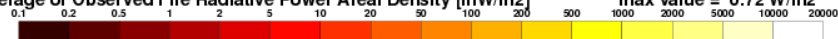
Source: [http://www.nrlmry.navy.mil/aerosol\\_web/7seas/](http://www.nrlmry.navy.mil/aerosol_web/7seas/)

# Fire Radiative Power – Aerosol Optical Depth by Copernicus Atmosphere Monitoring Service (CAMS) and Copernicus Climate Change Service (C3S), implemented by ECMWF.

CAMS GFAS Daily Fire Products Tuesday 07 February 2017

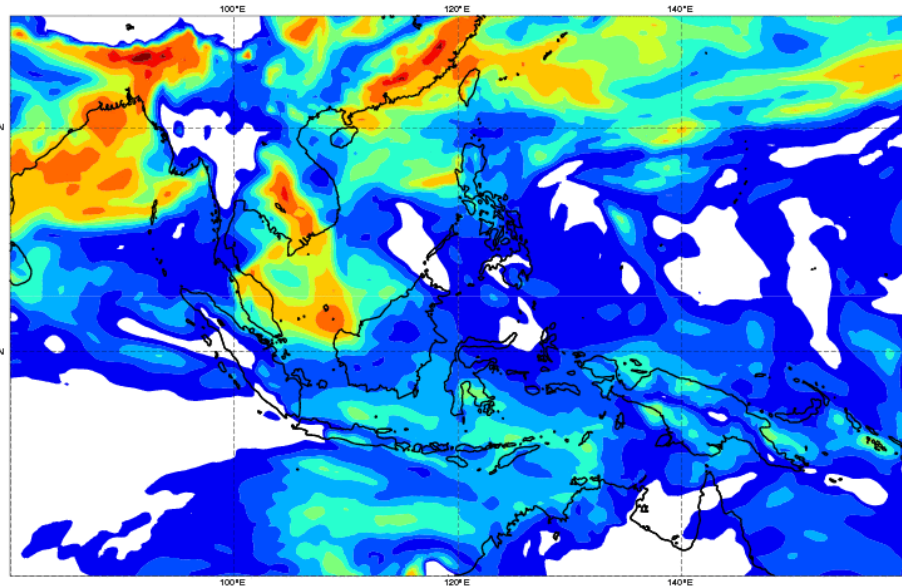
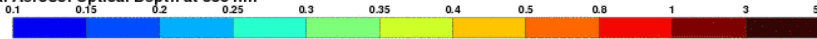
Average of Observed Fire Radiative Power Areal Density [mW/m<sup>2</sup>]

max value = 0.72 W/m<sup>2</sup>



Wednesday 08 February 2017 00UTC CAMS Forecast t+003 VT: Wednesday 08 February 2017 03UTC

Total Aerosol Optical Depth at 550 nm

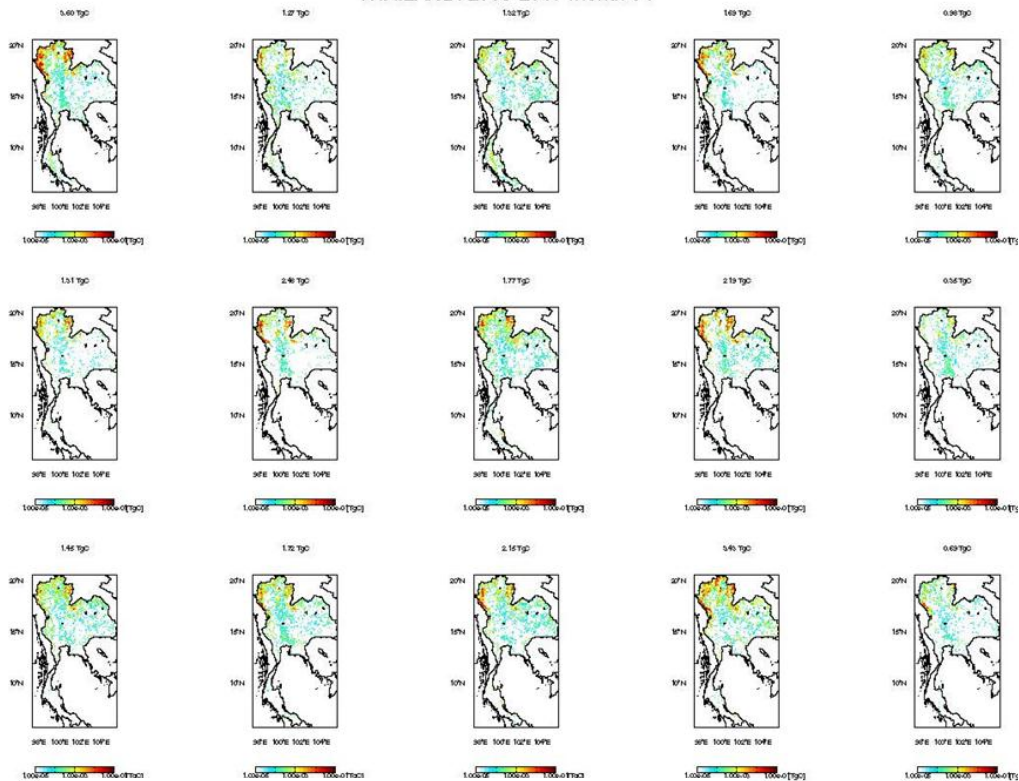


Source: [http://macc.copernicus-atmosphere.eu/d/services/gac/nrt/fire\\_radiative\\_power!SE%20Asia!Fire%20Radiative%20Power!macc!od!enfo!fire\\_radiative\\_power!2017020700!/](http://macc.copernicus-atmosphere.eu/d/services/gac/nrt/fire_radiative_power!SE%20Asia!Fire%20Radiative%20Power!macc!od!enfo!fire_radiative_power!2017020700!/)

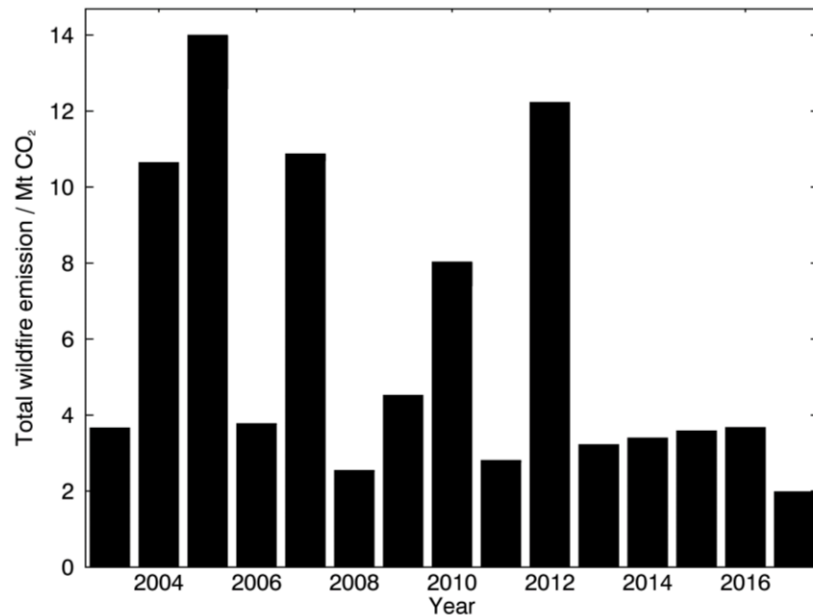
Source: [http://www.gmes-atmosphere.eu/d/services/gac/nrt/nrt\\_opticaldepth!03!Total!SE%20Asia!macc!od!enfo!nrt\\_opticaldepth!2016121400!!/](http://www.gmes-atmosphere.eu/d/services/gac/nrt/nrt_opticaldepth!03!Total!SE%20Asia!macc!od!enfo!nrt_opticaldepth!2016121400!!/)

# Carbon Emission by Mark Parrington CAMS-ECMWF-COPERNICUS

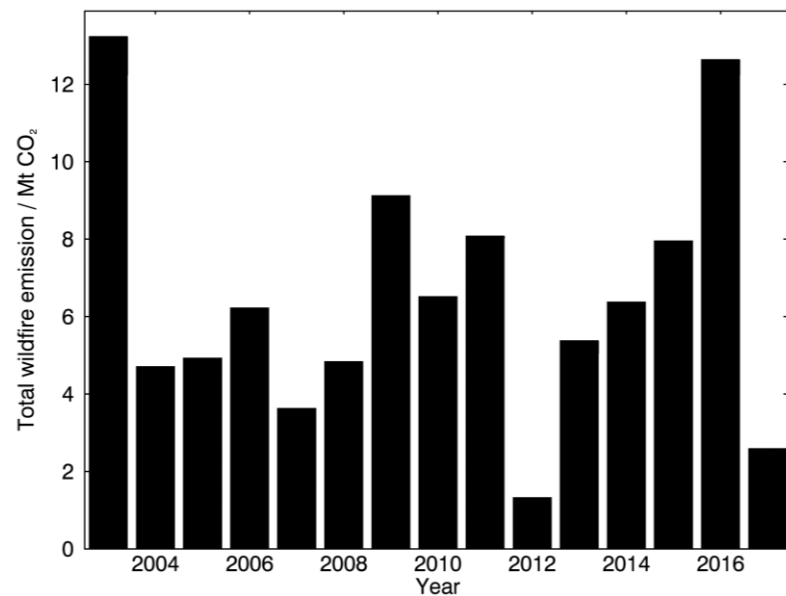
THAILAND: 2003-2017 month 04



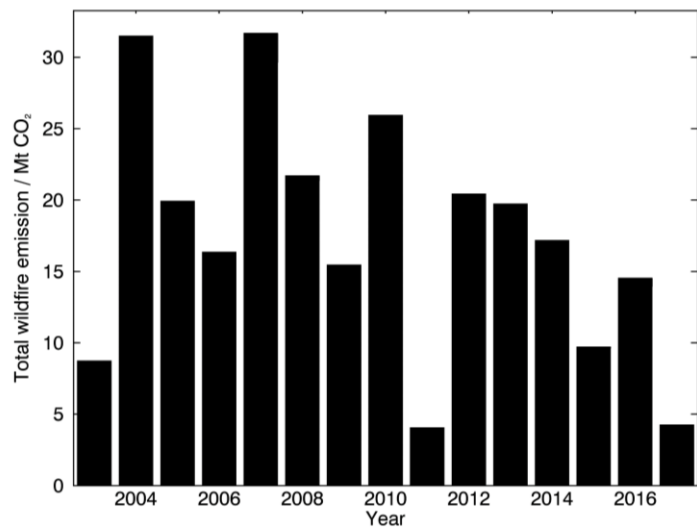
CAMS GFASv1.2 February wildfire CO<sub>2</sub> emissions for Thailand



CAMS GFASv1.2 April wildfire CO<sub>2</sub> emissions for Thailand



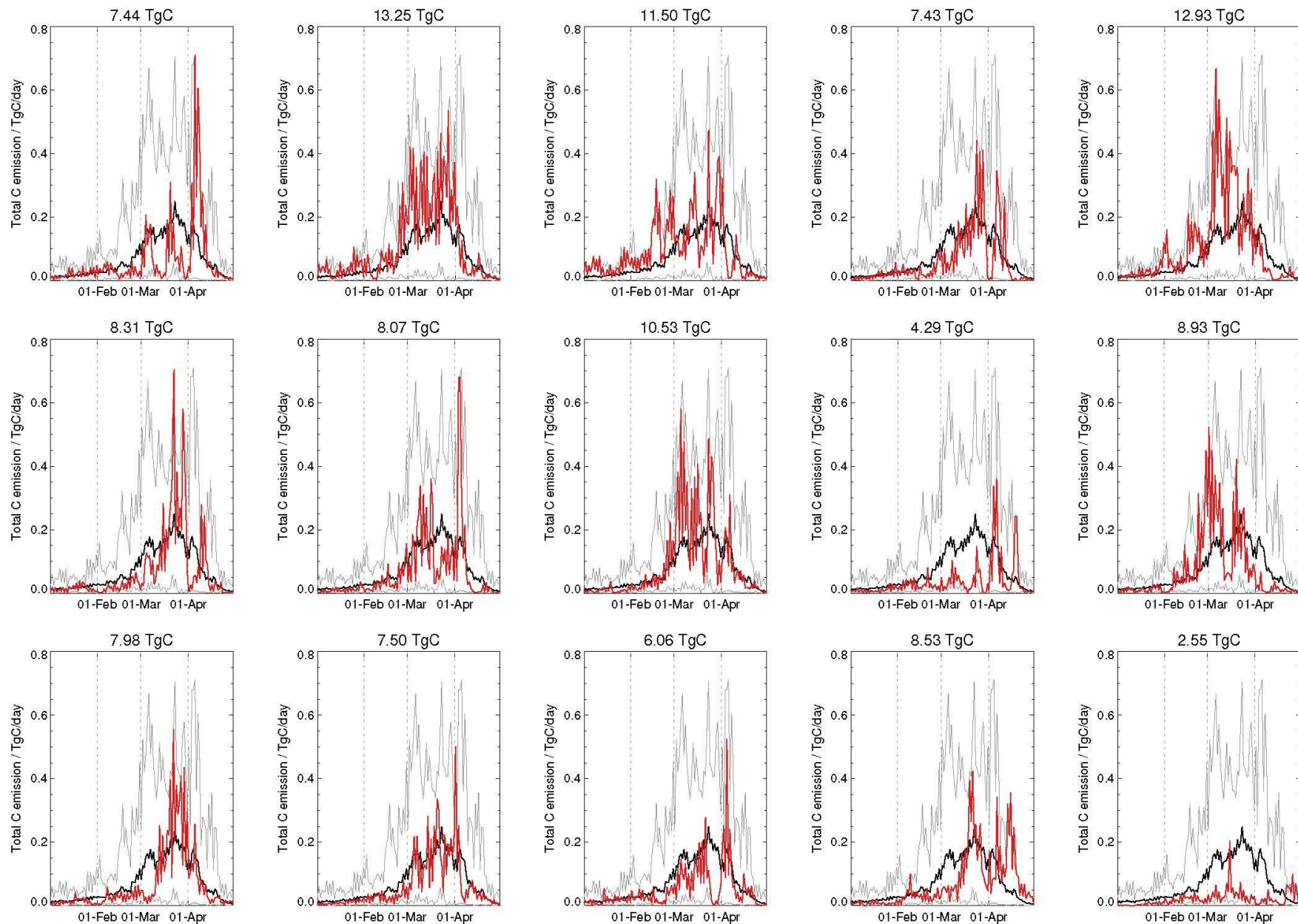
CAMS GFASv1.2 March wildfire CO<sub>2</sub> emissions for Thailand





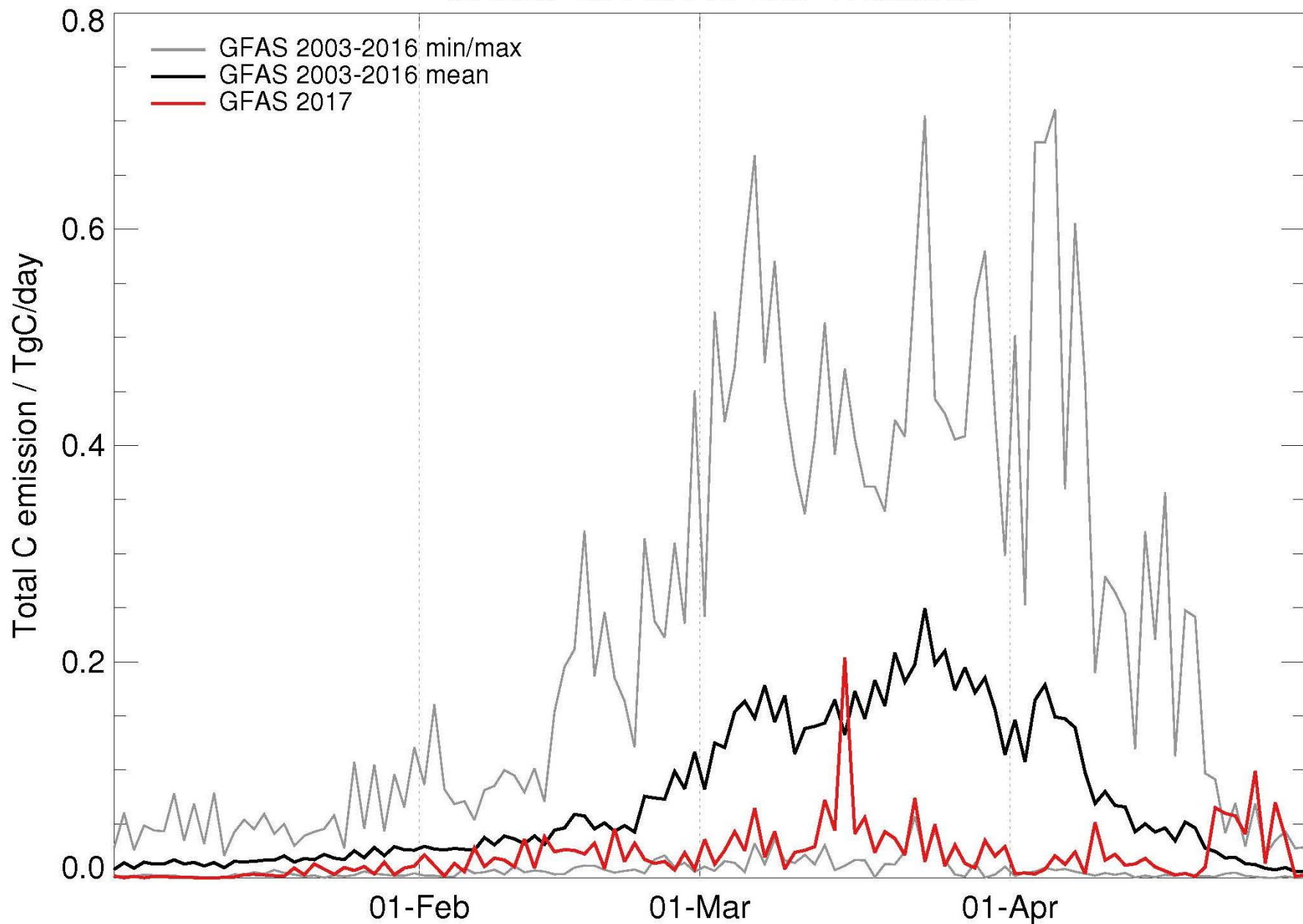
# Carbon Emission by Mark Parrington CAMS-ECMWF-COPERNICUS

THAILAND: 2003-2017, 01/01 - 30/04



# Carbon Emission by Mark Parrington CAMS-ECMWF-COPERNICUS

## CAMS GFASv1.2 for Thailand



# Forecast Fire Danger Rating for Upper ASEAN and Thailand



Geo-Informatics Division

Protected Area Development and Rehabilitation Office  
Department of National Parks, Wildlife and Plant Conservation

By Manomaiphiboon, K., Tanpipat, V., Nhuchaiya, P., Jaroonrattanapak, N., Buaniam, C. (2017)

DNP

DNP GIS

Source: <http://www2.dnp.go.th/gis/FDRS/FDRS.php/>

## การพยากรณ์ระดับชั้นอันตรายของไฟที่ความละเอียดสูง

Fine-Resolution Forecast Products of Fire Danger Rating

คำดัชนีไฟป่าประจำวันเพื่อปรับป้าย  
FDRS Table for Fire Risk Signs

เอเชียตะวันออกเฉียงใต้ตอนบน  
Upper Southeast Asia

คณะทำงาน  
Working Group

ข้อมูลประกอบ  
Supplemental Info

ภาคเหนือตอนบนของประเทศไทย  
Upper Northern Thailand

จังหวัดเชียงใหม่  
Chiang Mai

เอกสารอ้างอิง  
References

กิตติกรรมประกาศ  
Acknowledgements

ประเทศลาว  
Laos

ประเทศกัมพูชา  
Cambodia

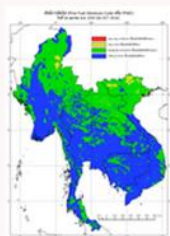
รวมลิงค์  
Useful Links

## เอเชียตะวันออกเฉียงใต้ตอนบน Upper Southeast Asia

6 ตุลาคม 2559  
6 October 2016

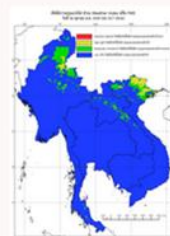
ความละเอียดกริด 3 กม.  
3-km Grid Resolution

ดัชนีการติดไฟ  
FFMC



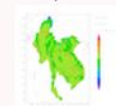
Google Earth KMZ

ดัชนีความรุนแรงไฟ  
FWI

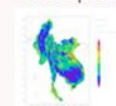


Google Earth KMZ

อุณหภูมิ  
Temperature



ความเร็วลม  
Wind Speed



ความชื้นสัมพัทธ์  
Relative Humidity



ฝน  
Precipitation

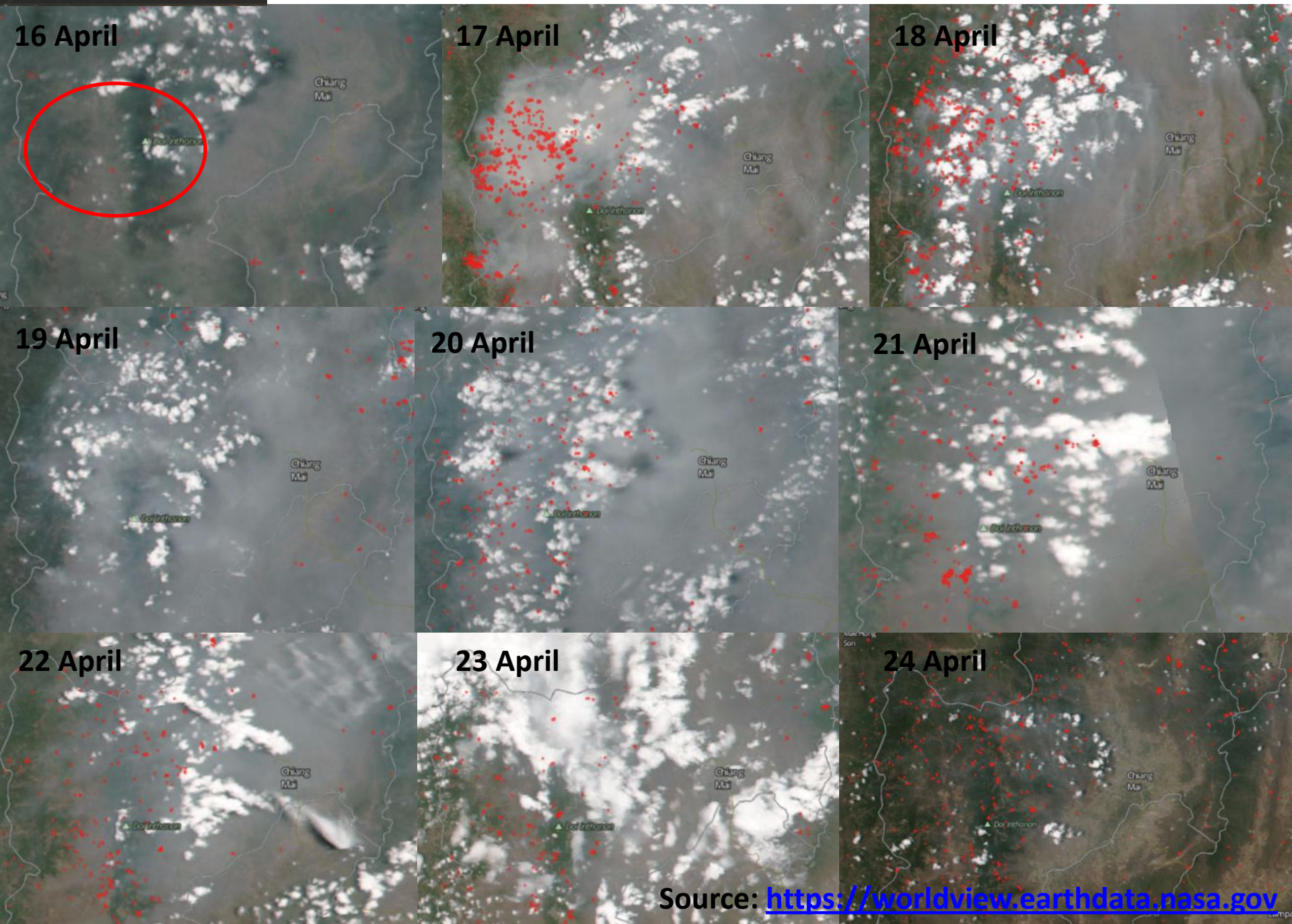




# What we need to cover in order to deal with Natural Disasters, especially forest fires?

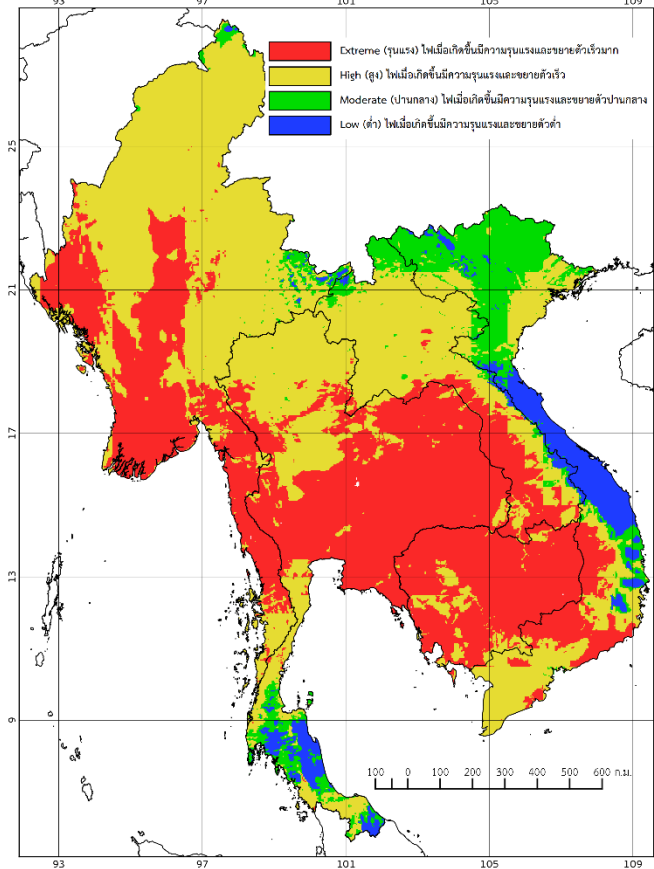
## **4. Warning** FIRMS active fire or fire hotspot alert emails:

- A. Review historical fire related by EOS directly in WorldView for overall situation**
- B. Forecast Fire Danger Rating System (FDRS)**
- C. Risk maps**
- D. Daily fire fuel survey**
- E. Weather condition**
- F. Fire Radiative Power**
- G. Etc.**

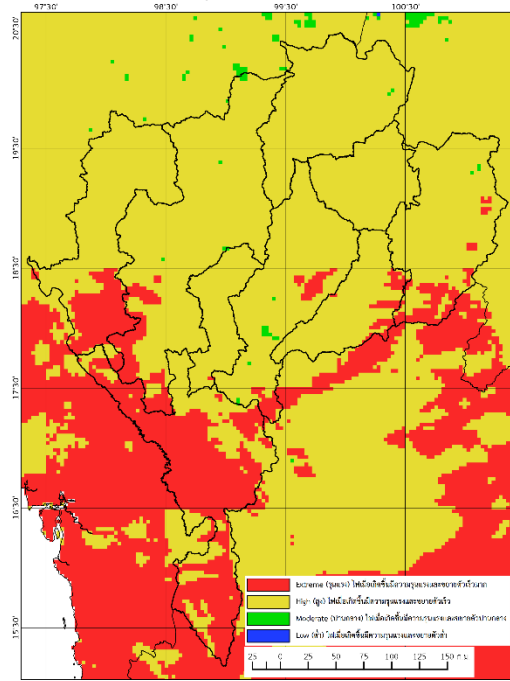


# Fire Weather Index

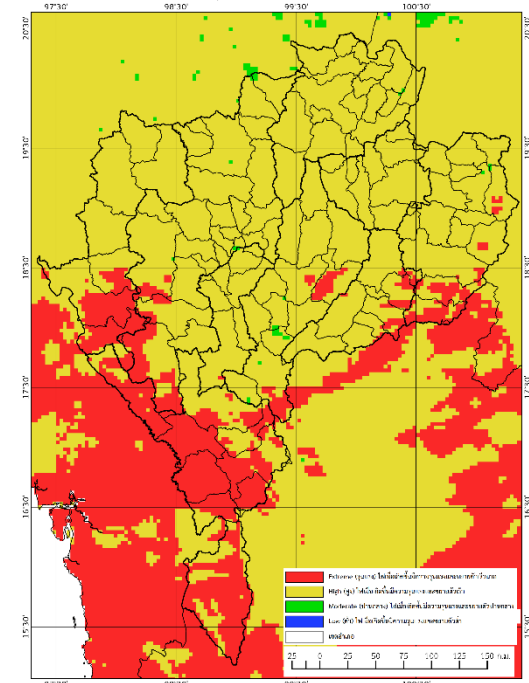
ดัชนีความรุนแรงไฟ (Fire Weather Index หรือ FWI)  
วันที่ 13 กุมภาพันธ์ พ.ศ. 2560 (13 FEB 2017)



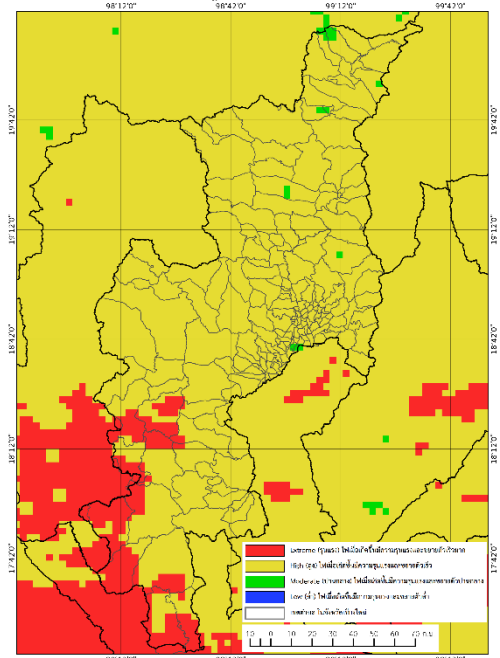
ดัชนีความรุนแรงไฟ (Fire Weather Index หรือ FWI)  
วันที่ 13 กุมภาพันธ์ พ.ศ. 2560 (13 FEB 2017)



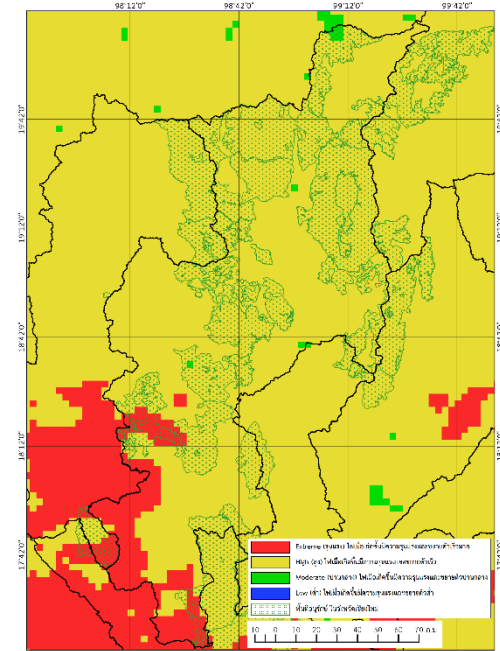
ดัชนีความรุนแรงไฟ (Fire Weather Index หรือ FWI)  
วันที่ 13 กุมภาพันธ์ พ.ศ. 2560 (13 FEB 2017)



ดัชนีความรุนแรงไฟ (Fire Weather Index หรือ FWI)  
พยากรณ์ วันที่ 09 กรกฎาคม พ.ศ. 2559 (Forecast 09 JUL 2016)



ดัชนีความรุนแรงไฟ (Fire Weather Index หรือ FWI)  
วันที่ 13 กุมภาพันธ์ พ.ศ. 2560 (13 FEB 2017)



By Manomaiphiboon, K.,  
Tanpipat, V., Nhuchaiya, P.,  
Jaronrattanapak, N., Buaniam, C.  
(2017)  
Source:  
<http://www2.dnp.go.th/gis/FDRS/FDRS.php/>

# New calibrated Thresholds being used by Global Fire EWS for upper ASEAN (Bill De Groot & Alan Cantin, Natural Resources Canada, Canadian Forest Service) with Global FWI Monthly Forecast for 9 Months for Planning Prescribe Burning and Others

Program for Climate, Ecosystem and Fire Applications

Products

CANSAC

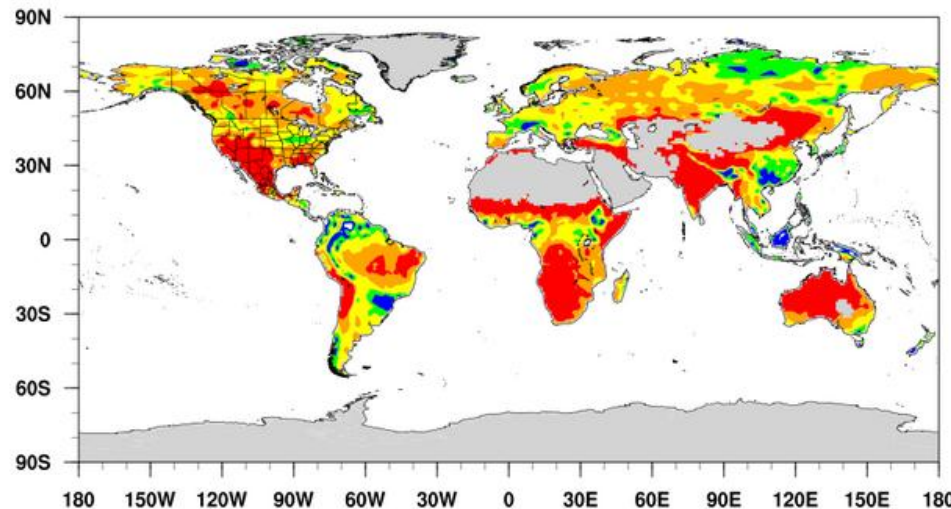
About CEFA

Links

CFSv2 Forecast Grid Initialization: 2016/05/07

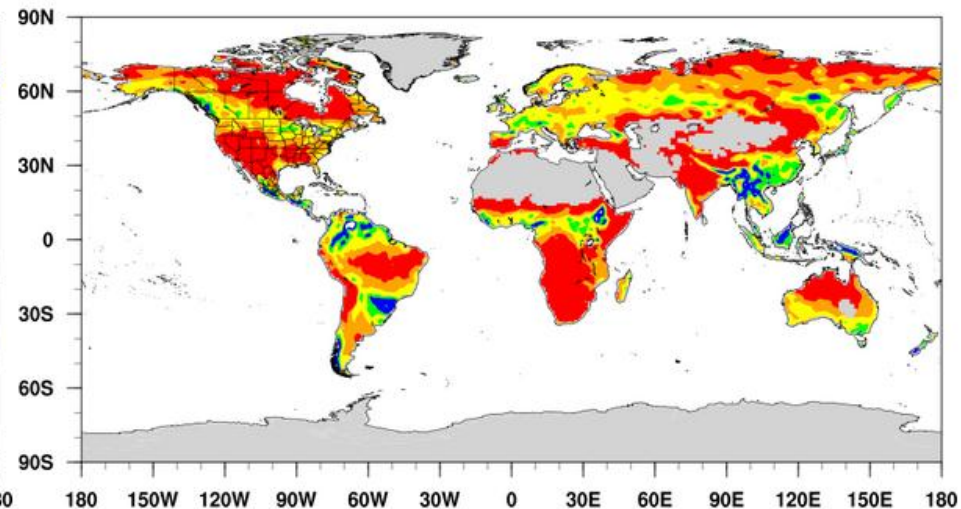
Fire Weather Index

CFSv2 Initialization: 2016-05-07, Forecast Period: 2016-05-07 -> 2016-06-06



Fire Weather Index

CFSv2 Initialization: 2016-05-07, Forecast Period: 2016-06-06 -> 2016-07-06



Fire Weather Index



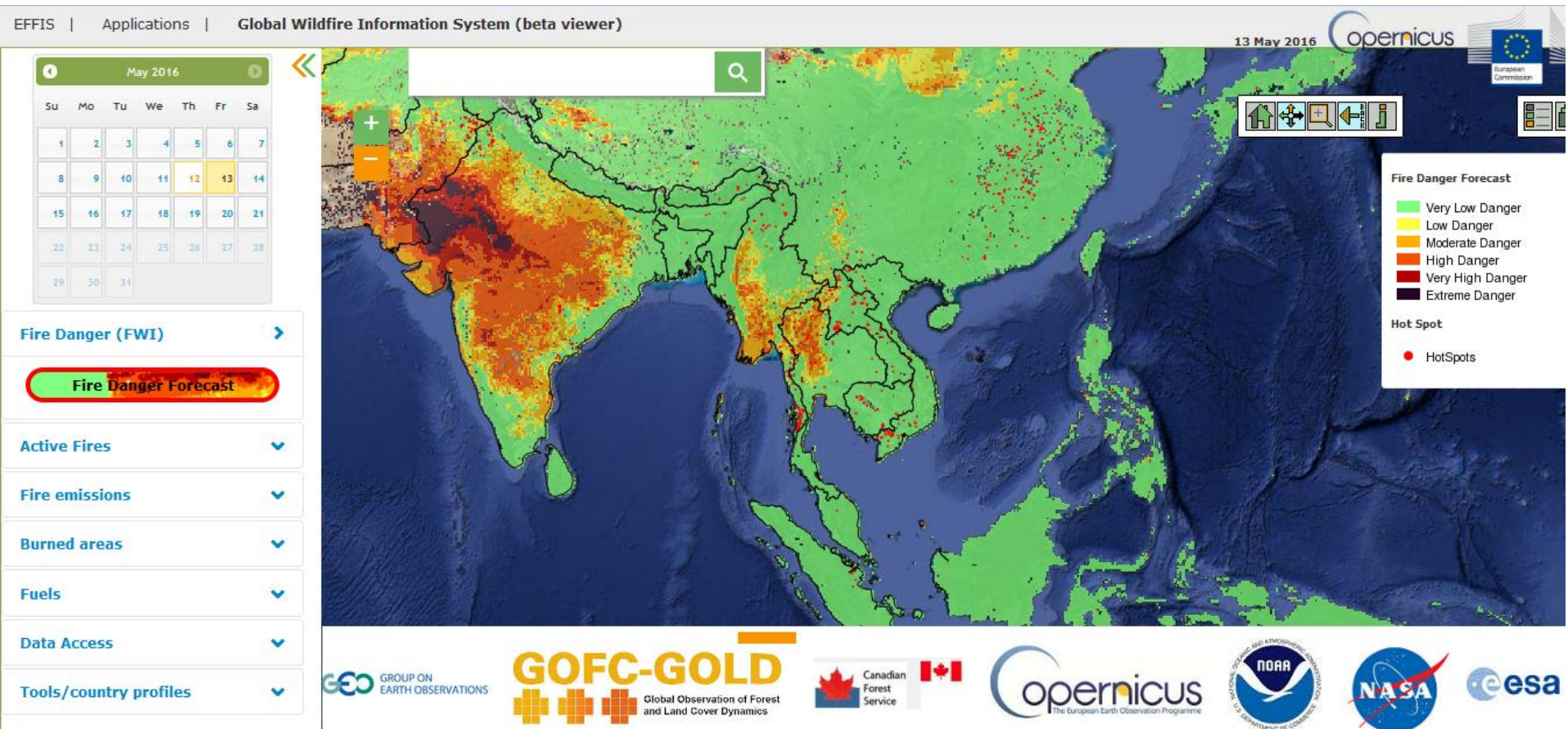
Fire Weather Index



Source: <http://www.cefa.dri.edu/CFS/fwi.php> and : [http://www.fire.uni-freiburg.de/gwfews/forecast\\_ews.html](http://www.fire.uni-freiburg.de/gwfews/forecast_ews.html)



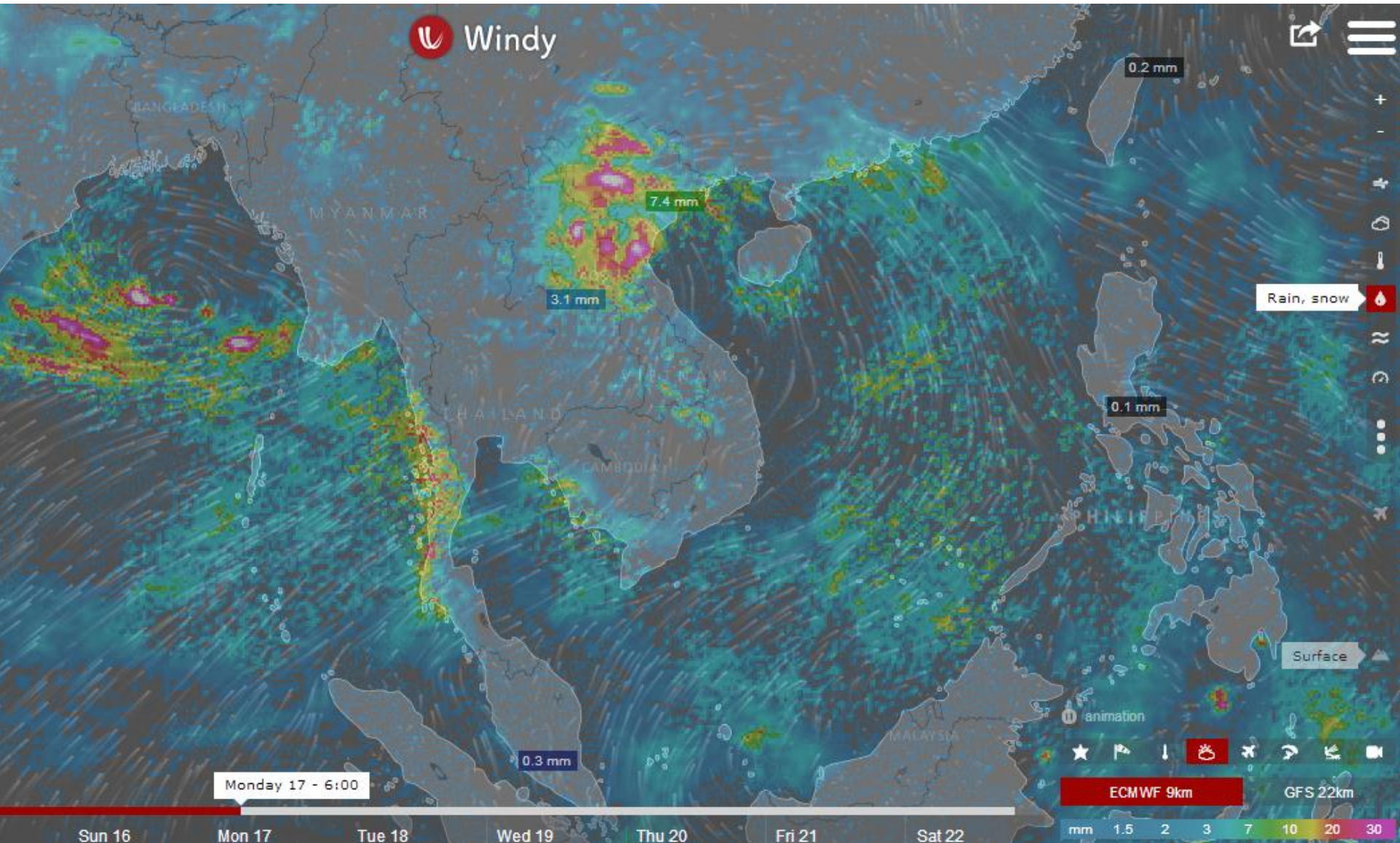
# Global Wildfire Information System by The European Forest Fire Information System (EFFIS)



Source: <http://forest.jrc.ec.europa.eu/effis/applications/global-viewer/>

# –Weather (wind, precipitation, etc.)

- Windy (<http://www.windyty.com>)



# What we need to cover in order to deal with Natural Disasters, especially forest fires?

## 5. Response

- A. Forest fire suppression units
- B. Related agencies and collaborated local communities
- C. Etc.



**Slip-on Tank**



**Water Tank**



**Fire Tender**



**Farm Tractor**



**Helicopter with Water Bucket**



**CL-215 (Amphibian)**



**Source: Forest Fire Control Division, DNP**

# What we need to cover in order to deal with Natural Disasters, especially forest fires?

## 6. Recovery, Assessment and Mitigation

A. Burn Severity Index (BSI)

B. Burn Area

C. Emissions

D. Reforestation

E. Public Relation

F. Etc.

# Burned Areas Detection using Burn Severity Index (BSI)

← → ↻ <https://code.earthengine.google.com/534a658310bca3db542e0db0c1a367e3> 🔍 ☆ 🌐 🌐

Google Earth Engine Search places and datasets... 🔍 Help ▾ ChannTanpipat ▾

Scripts Docs A Link 534a658310bca3db542e0db0c1a367e3 Get Link Save Run Reset ⚙️

Inspector Console Tasks

Use print(...) to write to this console.

Start and end dates: JSON  
▶ Date (2010-01-02 00:00:00) JSON  
▶ Date (2016-12-31 00:00:00) JSON

Acquiring Sentinel 2 JSON  
Adding Sentinel 2 cloud mask using cl... JSON  
Adding Sentinel2 cloud mask using a t... JSON  
Running shadow shift method JSON  
Acquiring TOA Landsat JSON  
▶ ImageCollection LANDSAT/LC8\_L1T\_TOA ... JSON

```
Imports (1 entry)
  ▶ var sa: Polygon, 13 vertices
1
2 var sa = sa;
3 //Main code body written by: Ian Housman, Karis Tenneson, and Carson Stam
4 //CloudScore function originally written by: Matt Hancher
5 //Cloud shift function originally written by: Gennadii Donchyts
6 //
7 //Purpose: Mask clouds and cloud shadows in Landsat and/or Sentinel 2 data and export composi
8 //Sensor options include: Landsat 5, 7, and 8 with the option of not using Landsat 7, and Sent
9 //For Landsat, TOA and SR options are supported
10 //For Landsat SR, Fmask, as well as the Google cloudScore/TDOM/shadowShift methods are support
11
12 //RedCastle Resources, Inc.
13
14 //Working onsite at:
15 //USDA Forest Service
16
```

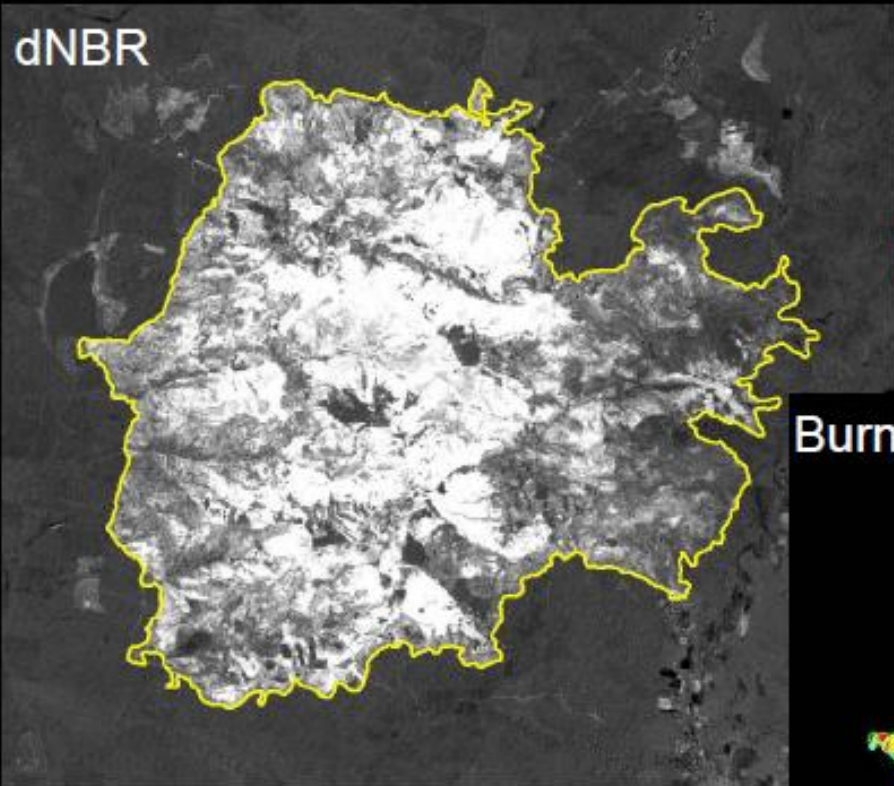
Geometry Imports Layers Map Satellite

```
49 //Export parameters
50 var exportName = 'Ubon_Ratchathani'; // Give the study area a descriptive name. This name is used for output composites file names.
51 var reducerPercentile = 50; // Reducer for compositing
52 var resolutionLandsat = 30; //Landsat should be set to 30. Sentinel 2 should be set to 10, 20, or 60 depending on which bands are of interest. Hybrid can be set t
53 var resolutionS2 = 10; //Landsat should be set to 30. Sentinel 2 should be set to 10, 20, or 60 depending on which bands are of interest. Hybrid can be set to 10,
54 var crs = 'EPSG:32648'; // EPSG number for output projection. 32651 = WGS84/UTM Zone 51N. For more info- http://spatialreference.org/ref/epsg/
55 var noDataValue = -32678; //Choose a value that is not a real value in any exports
56 var exportBands = ['blue', 'green', 'red', 'nir', 'swir1', 'swir2', 'NDVI', 'NBR']; //Bands to export
57 //////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////////
```

Houseman, Ian et al. 2017, USFS-RSEC

# Burned Areas Detection using Burn Severity Index (BSI)

## Change Detection

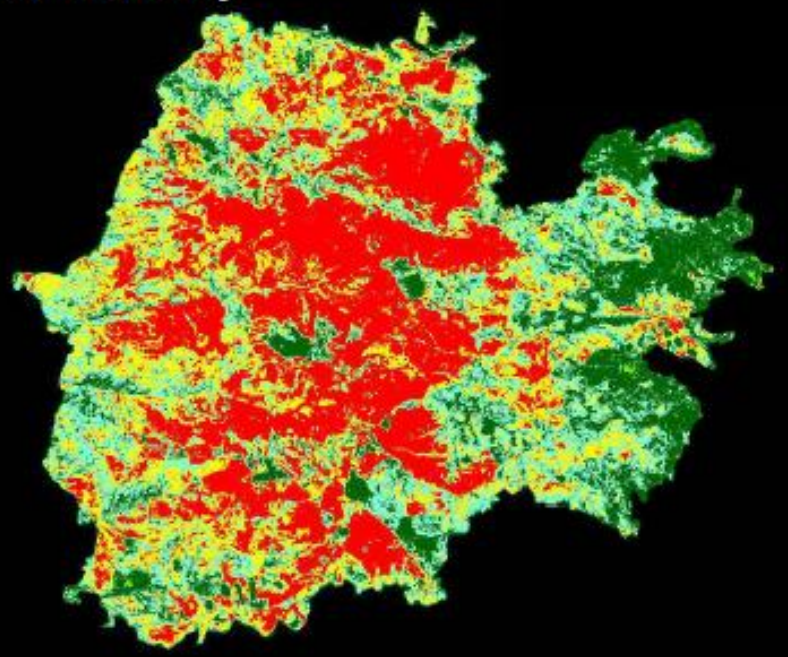


Identify dNBR grayscale patterns to determine the low/moderate/high severity thresholds



*brighter = higher severity*  
*darker = lower severity*

Burn Severity



Atmospheric composition

Reanalysis  
Near-real-time

Global Fire Assimilation System

About

Conditions of use  
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Job list

See also...

Access Public Datasets  
General FAQ  
WebAPI FAQ  
Accessing forecasts  
GRIB decoder

# CAMS Global Fire Assimilation System

Please [login](#) before retrieving data from this dataserver.

Select date

Select a date in the interval 2003-01-01 to 2017-02-11

Start date:  End date:

Select a list of months

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2004	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2005	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2006	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2007	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2008	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2009	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2010	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2011	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2012	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2013	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2014	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2015	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2016	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2017	<input type="checkbox"/>	<input type="checkbox"/>											<input type="checkbox"/>	<input type="checkbox"/>										

Select All or Clear

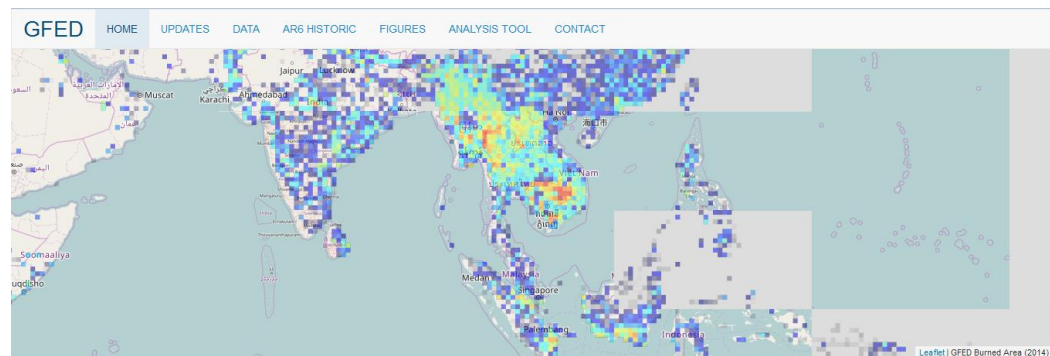
Source:

<http://apps.ecmwf.int/datasets/data/cams-gfas/>

# Emissions

Select parameter

- Altitude of plume top
- Wildfire Flux of Acetaldehyde (C2H4O)
- Wildfire Flux of Ammonia (NH3)
- Wildfire Flux of Butanes (C4H10)
- Wildfire Flux of Dimethyl Sulfide (DMS) (C2H6S)
- Wildfire Flux of Ethanol (C2H5OH)
- Wildfire Flux of Formaldehyde (CH2O)
- Wildfire Flux of Hexanes (C6H14)
- Wildfire Flux of Higher Alkanes (CnH2n+2, C>=4)
- Wildfire Flux of Isoprene (C5H8)
- Wildfire Flux of Octene (C8H16)
- Wildfire Flux of Pentenes (C5H10)
- Wildfire Flux of Propene (C3H6)
- Wildfire Flux of Toluene (C7H8)
- Wildfire Flux of Xylene (C8H10)
- Wildfire flux of Black Carbon
- Wildfire flux of Carbon Monoxide
- Wildfire flux of Methane
- Wildfire flux of Nitrous Oxide
- Wildfire flux of Organic Carbon
- Wildfire flux of Sulfur Dioxide
- Wildfire flux of Total Particulate Matter
- Wildfire overall flux of burnt Carbon
- Mean altitude of maximum injection
- Wildfire Flux of Acetone (C3H6O)
- Wildfire Flux of Benzene (C6H6)
- Wildfire Flux of Butenes (C4H8)
- Wildfire Flux of Ethane (C2H6)
- Wildfire Flux of Ethene (C2H4)
- Wildfire Flux of Heptane (C7H16)
- Wildfire Flux of Hexene (C6H12)
- Wildfire Flux of Higher Alkenes (CnH2n, C>=4)
- Wildfire Flux of Methanol (CH3OH)
- Wildfire Flux of Pentanes (C5H12)
- Wildfire Flux of Propane (C3H8)
- Wildfire Flux of Terpenes (C5H8n)
- Wildfire Flux of Toluene\_lump (C7H8+ C6H6 + C8H10)
- Wildfire combustion rate
- Wildfire flux of Carbon Dioxide
- Wildfire flux of Hydrogen
- Wildfire flux of Nitrogen Oxides NOx
- Wildfire flux of Non-Methane Hydro-Carbons
- Wildfire flux of Particulate Matter PM2.5
- Wildfire flux of Total Carbon in Aerosols
- Wildfire fraction of area observed
- Wildfire radiative power



## Global Fire Emissions Database

Fires are an important source of atmospheric trace gases and aerosols and they are the most important disturbance agent on a global scale. In addition, deforestation and tropical peatland fires

Contact:

For questions regarding burned area (not small fire burned area), please contact [Louis Giglio](#).

Source: <http://www.globalfiredata.org/index.html>



# Fire and Smoke Decision Support System (FSDSS)

*Socioeconomics, social dimension maps, statistics, weather, models, topographic maps*

**GIS**

*EOS imageries, weather, climate, monitoring, detection, condition,*

**RS**

**FSDSS**

**GPS**

*Location identifying technologies, accuracy, GNSS*

**ICT**

*Communication technologies, related information & knowledge (research, publication,*

# **Additional Steps to build Resilience for the Climate Change and Disasters**

- 1. Explore Hazards**
- 2. Assess Vulnerability & Risks**
- 3. Investigate Options**
- 4. Prioritize & Plan**
- 5. Take Action**

**More Information of HOW at  
<https://toolkit.climate.gov/>**

# Establishment of Upper ASEAN Wildland Fire Research Center at Faculty of Forestry, Kasetsart University

- 1. Fundamental fire research:** Fire Ecology, Fire Behavior, Fire Emissions, Smoke and Haze behaviors
- 2. Advanced tools for fire early warning, monitoring and impact assessment:** Fire Early Warning and Detection System
- 3. The human dimension of vegetation fires:** Socio-economics of fire, Impact of fires on human health, security and private & public assets, and Community involvement and empowerment in fire management
- 4. Fire management:** Fire investigation and fire statistical databases, Fire management information systems and planning and Training
- 5. Fire management policies**
- 6. Cross-boundary cooperation in fire management**

# Conclusions and Challenges

- Be prepared and ready by following those 6 fundamental steps (Prevention, Monitoring, Prediction, Warning, Response and Mitigation); especially *“Prevention”*
- Need to put fire early warning (Forecast FDRS) information into forest fire control planning process and daily operation
- Need to develop better and higher accuracy of high resolution medium range weather forecast inputs (DA and Ensemble) for FDRS, so we can plan further ahead more efficient.

# Conclusions and Challenges

- Need to get Fire Behavior Software Prometheus ready to use by 2017 forest fire season
- Need to study and understand smoke behavior in the Upper ASEAN Region (not enough knowledge)
- Need to have reliable and scientific proved Fire Decision Support System (FDSS)
- Need to understand people who use fire as a tool behaviors better for more efficient prevention
- Need to find feasible alternatives incomes for people, so they can reduce their fire ignition habit

# Conclusions and Challenges

- Need to find easier and simpler communication schema to deliver scientific information to decision and policy makers or so call Science-Policy Interface (SPI) and be able to educate them including the people!!
- Make Upper ASEAN Wildland Fire Research Center at Kasetsart University visible and deliver impacts to support SPI including others related issues
- Creating free access to digital wildland fire, smoke and haze knowledge library for all

# Acknowledgements

Dr. Jeff Schmaltz (NASA/GSFC-LANCE-Rapid Response),  
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Somsak Preedapirat, Chief Prayoonyong Nuchaiya and Chief Narin  
Jaronrattanapak (DNP)  
Ian Houseman, Dr. Ken Brewer and Carl Albury (USFS-RSEC)

**Disaster Mitigation Masterclass at APAN44 on 30-31 AUG 2017**

# Useful Links

## Active fire hotspots:

- Fire Information for Resources Management System (FIRMS) (<https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms> or <https://firms.modaps.eosdis.nasa.gov/>); Terra/Aqua-MODIS and Suomi NPP-VIIRS
- Suomi NPP VIIRS Active Fire (<http://viirsfire.geog.umd.edu/>)
- NOAA-18 AVHRR ([http://data.globalforestwatch.org/datasets/091ee6aa2bbb4d0da92e0e9367241372\\_9](http://data.globalforestwatch.org/datasets/091ee6aa2bbb4d0da92e0e9367241372_9)) and (<http://asmc.asean.org/asmc-hotspot/>)
- Global Forest Watch Fire (<http://fires.globalforestwatch.org>)
- VIIRS Nightfire - Nighttime Detection and Characterization of Combustion Sources ([http://ngdc.noaa.gov/eog/viirs/download\\_viirs\\_fire.html](http://ngdc.noaa.gov/eog/viirs/download_viirs_fire.html))
- Thai Himawari-8 Imagery Display ([http://www.highfirerisk.com.au/imr/Thai\\_H8\\_01.htm](http://www.highfirerisk.com.au/imr/Thai_H8_01.htm)) or RealEarth-SSEC/Google (<http://realearth.ssec.wisc.edu/>)



# Useful Links

## Earth observation satellite imageries:

- WorldView (<https://earthdata.nasa.gov/labs/worldview/>)
- LANCE MODIS Subsets (<http://lance-modis.eosdis.nasa.gov/imagery/subsets/?subset=Indochina2>)
- Earthdata Near Real Time (orbit Swath) Images
  - MODIS (<http://lance-modis.eosdis.nasa.gov/cgi-bin/imagery/realtime.cgi>)
  - VIIRS (<http://lance-modis.eosdis.nasa.gov/cgi-bin/imagery/viirs.cgi>)

## Smoke monitoring:

- 7SEA US Naval Research Laboratory ([http://www.nrlmry.navy.mil/aerosol\\_web/7seas/7seas.html](http://www.nrlmry.navy.mil/aerosol_web/7seas/7seas.html))
  - Global Ocean Data Assimilation Experiment (<http://www.usgodae.org/cgi-bin/datalist.pl?generate=summary>)
- Air4Thai-PCD- (<http://air4thai.pcd.go.th/web/>)
- ASEAN Haze online (<http://haze.asean.org/>)
- ASEAN Specialized Meteorological Center (<http://asmc.asean.org/asmc-gis-portal/>)
  - Thai Himawari-8 Imagery Display: ACT High Fire Risk ([http://www.highfirerisk.com.au/imr/Thai\\_H8\\_01.htm](http://www.highfirerisk.com.au/imr/Thai_H8_01.htm))
  - RealEarth-SSEC/Google (<http://realearth.ssec.wisc.edu/>)
  - JMA/MSM ([http://www.data.jma.go.jp/mscweb/data/himawari/sat\\_img.php?area=se1](http://www.data.jma.go.jp/mscweb/data/himawari/sat_img.php?area=se1))
- Comparing Smoke Seen by Aqua and Terra, June 21, 2015 (<http://earthobservatory.nasa.gov/IOTD/view.php?id=86086&src=ea-iotd>)

# Useful Links

## Smoke monitoring:

- 7SEA US Naval Research Laboratory  
([http://www.nrlmry.navy.mil/aerosol\\_web/7seas/7seas.html](http://www.nrlmry.navy.mil/aerosol_web/7seas/7seas.html))
  - Global Ocean Data Assimilation Experiment (<http://www.usgodae.org/cgi-bin/datalist.pl?generate=summary>)
- Air4Thai-PCD-(<http://air4thai.pcd.go.th/web/>) ASEAN Haze online (<http://haze.asean.org/>)
- ASEAN Specialized Meteorological Center (<http://asmc.asean.org/asmc-gis-portal/>)
  - Thai Himawari-8 Imagery Display: ACT High Fire Risk ([http://www.highfirerisk.com.au/imr/Thai\\_H8\\_01.htm](http://www.highfirerisk.com.au/imr/Thai_H8_01.htm))
  - RealEarth-SSEC/Google (<http://realearth.ssec.wisc.edu/>)
  - JMA/MSC ([http://www.data.jma.go.jp/mscweb/data/himawari/sat\\_img.php?area=se1](http://www.data.jma.go.jp/mscweb/data/himawari/sat_img.php?area=se1))
- Comparing Smoke Seen by Aqua and Terra, June 21, 2015  
(<http://earthobservatory.nasa.gov/IOTD/view.php?id=86086&src=eo-a-iotd>) Copernicus Europe's Eyes on Earth: Forecast of Aerosols Optical Depth ([http://www.gmes-atmosphere.eu/d/services/gac/nrt/nrt\\_opticaldepth!03!Total!SE%20Asia!macc!od!enfo!nrt\\_opticaldepth!2016121400!/](http://www.gmes-atmosphere.eu/d/services/gac/nrt/nrt_opticaldepth!03!Total!SE%20Asia!macc!od!enfo!nrt_opticaldepth!2016121400!/))
- Copernicus Europe's Eyes on Earth: Fire Radiative Power ([http://www.gmes-atmosphere.eu/d/services/gac/nrt/fire\\_radiative\\_power!SE%20Asia!Fire%20Radiative%20Power!macc!od!enfo!fire\\_radiative\\_power!2016121300!/](http://www.gmes-atmosphere.eu/d/services/gac/nrt/fire_radiative_power!SE%20Asia!Fire%20Radiative%20Power!macc!od!enfo!fire_radiative_power!2016121300!/))

# Useful Links

## Weather (wind, precipitation, etc.):

- Global Fire WEather Database (GFWED); <http://data.giss.nasa.gov/impacts/gfwed/>)
- Natural Earth wind maps (<http://earth.nullschool.net>)
- Windyty (<http://www.windyty.com>)
- Thailand weather:
  - Thai Water, Hydro and Agro Informatics Institute (HAI), [http://www.thaiwater.net/web/index.php?option=com\\_content&view=article&id=226&Itemid=400020](http://www.thaiwater.net/web/index.php?option=com_content&view=article&id=226&Itemid=400020)
  - Thai Meteorological Department (TMD, <http://www.tmd.go.th/>)
  - Thailand Water Data ([www.thaiwater.net](http://www.thaiwater.net))
- JAXA Realtime Rainfall Watch-GSMAP ([http://sharaku.eorc.jaxa.jp/GSMaP\\_NOW/](http://sharaku.eorc.jaxa.jp/GSMaP_NOW/))
- Meteorological Satellite Center (MSC) of Japanese Meteorological Agency (JMA) - Himawari Real-Time Image ([http://www.data.jma.go.jp/mscweb/data/himawari/sat\\_img.php?area=se1](http://www.data.jma.go.jp/mscweb/data/himawari/sat_img.php?area=se1))
- GMS Satellite-based Agriculture Support System (SASS) - ADB (<http://sass.gms-eoc.org/#>)

# Useful Links

## Fire Danger Rating System:

- Malaysian FDRS (<http://www.met.gov.my/web/metmalaysia/climate/fdrs/malaysia>)
- Indonesian FDRS (<http://www.bmkg.go.id/>)
- ASEAN FDRS (<http://www.met.gov.my/web/metmalaysia/climate/fdrs/southeastasia> and <http://haze.asean.org/fire-danger-rating-system-fdrs-for-southeast-asia/>)
- Upper ASEAN and Thailand Forecast FDRS (<http://www2.dnp.go.th/gis/FDRS/FDRS.php>)
- GFMC Wildland Fire Early Warning Portal (<http://www.fire.uni-freiburg.de/fwf/fwf.htm>)
- Global Fire Early Warning System (<http://www.fire.uni-freiburg.de/gwfews/index.html>)
- Global Forecast Fire Weather Index (<http://www.cefa.dri.edu/CFS/grid.php?dvar=fwi&length=8&zoom=fwi>)

# Useful Links

## Fire Emissions:

- Fire Monitoring, The Global Fire Assimilation System (GFAS); <http://www.gmes> Global Fire Emissions Database (GFED); <http://www.globalfiredata.org/>)
- IPCC (<http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html>)
- Monitoring Atmospheric Composition & Climate (MACC), Copernicus, Atmosphere Monitoring Services (CAMS), FIR Global - [atmosphere.eu/about/project\\_structure/input\\_data/d\\_fire/](http://atmosphere.eu/about/project_structure/input_data/d_fire/))

## Forest Cover and Forest Cover Change:

- Global Forest Watch (<http://www.globalforestwatch.org/>)
- Global Forest Change 2000–2015 (Hansen et al., 2013) ([http://earthenginepartners.appspot.com/science-2013-global-forest/download\\_v1.2.html](http://earthenginepartners.appspot.com/science-2013-global-forest/download_v1.2.html)) and <https://earthenginepartners.appspot.com/science-2013-global-forest>)

## Earth Observation Satellite Tracking and Prediction:

- The CEOS Visualization Environment (<http://www.ceos-cove.org/>)
- Live Real Time Satellite Tracking and Prediction (<http://www.n2yo.com>)

# Useful Links

## Examples of Wildland/Forest Fire Information Management System:

- Canadian Wildland Fire Information System (<http://cwfis.cfs.nrcan.gc.ca/home>)
- United States: LANDFIRE (<http://www.landfire.gov/>)
- Wildland Fire Decision Support System (WFDSS)  
([http://wfdss.usgs.gov/wfdss/WFDSS\\_Home.shtml](http://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml))
- The Northwest Interagency Coordination Center (NWCC; <http://gacc.nifc.gov/nwcc/>)
- Monitoring Trends in Burn Severity: Burn Scars  
(<http://www.mtbs.gov/methods.html>)
- USDA Forest Service: Active Fire Mapping Program (<http://activefiremaps.fs.fed.us/>)
- USDA Forest Service: Interagency Real Time Smoke Monitoring  
(<https://app.airsis.com/USFS/>)
- USFS Wildland Fire Assessment System (WFAS): <http://www.wfas.net/>
- Australian Landgate SRSS; <http://srss.landgate.wa.gov.au/fire>
- Australian ACT Emergency Services Agency (<http://esa.act.gov.au/>)
- South Africa: Advanced Fire Information System (AFIS,  
<http://southernafrica.afis.co.za/>)
- NOAA National Weather Service: Fire Weather (  
<http://www.srh.noaa.gov/ridge2/fire/>)
- Forest Fire Monitoring and Forecast System (FireCast,  
<http://firecast.conservation.org/>)

# Useful Links

## Other Interesting Links:

- Fire Information from Space at your Fingertips (<https://firemaps.net/>)
- EuroFire: Forest Fire Training Modules (<http://www.euro-fire.eu/>)
- World Wide Daily Drought Risk Maps  
(<http://www.eldoradocountyweather.com/climate/world-maps/world-drought-risk.html>)
- Prometheus Canada ([http://firegrowthmodel.ca/prometheus/software\\_e.php](http://firegrowthmodel.ca/prometheus/software_e.php))
- USDA Forest Service: BehavePlus (<https://www.frames.gov/partner-sites/behaveplus/software-manuals/>)
- USDA Forest Service: FARSITE (<https://www.firelab.org/project/farsite>)
- USDA Forest Service: Active Fire Mapping Program  
(<https://fsapps.nwcg.gov/afm/>)
- Open Wildland Fire Modeling E-Community  
(<http://www.openwfm.org/wiki/WRF-Fire>)
- NOAA-US: Hazard Mapping System Fire and Smoke Product  
(<http://www.ospo.noaa.gov/Products/land/hms.html>)
- Google Earth Engine: A planetary-scale platform for Earth science data & analysis Powered by Google's cloud infrastructure  
(<https://earthengine.google.com/>)

# Useful Links

## Other Interesting Links:

- Global Drought Information System (<https://www.drought.gov/gdm/content/welcome> and <http://sac.csic.es/spei/index.html>)
- MODIS Global Terrestrial Drought Severity Index (<http://www.ntsg.umd.edu/project/dsi>)
- NCAR/UCAR-CPC Unified Gauge-Based Analysis of Global Daily Precipitation (<https://climatedataguide.ucar.edu/climate-data/cpc-unified-gauge-based-analysis-global-daily-precipitation>)
- JAXA Global Rainfall Watch: GSMaP (<http://sharaku.eorc.jaxa.jp/GSMaP/>)
- NRT Global Flood Mapping (<https://floodobservatory.colorado.edu/index.html> and <http://oas.gsfc.nasa.gov/floodmap/>)
- Global Imagery Browse Services, GIBS, (<https://earthdata.nasa.gov/about/science-system-description/eosdis-components/global-imagery-browse-services-gibs>)
- Copernicus Atmosphere Monitoring Services (<http://macc.copernicus-atmosphere.eu/catalogue/#list?>)
- UCAR, Wildfire, Weather and Climate (<https://www2.ucar.edu/news/backgrounders/wildfires-weather-climate>, [https://www.meted.ucar.edu/training\\_detail.php?topicSorting=6&pagination=no](https://www.meted.ucar.edu/training_detail.php?topicSorting=6&pagination=no))



**Early Warning System for Forest Fire or Wildland Fire (EWS-Fire)** is a system that will allow forest fire managers and related people to mitigate fire-related problems, to know fire fuel conditions, to reduce fire suppression costs and to enhance more efficient fire control. Forest and land management agencies, as well as land owners and communities, **require early warning of extreme fire danger conditions that lead to uncontrolled wildfires.**



Wagner, V., 1987

Development and Structure  
of the Canadian Forest Fire  
Weather Index System

**Fire danger rating (FDR) is a mature science and has long been used as a tool to indicate the potential of fire start, spread and impact.**

Fire danger rating is the systematic assessment of fire risk and potential impact, and it is the cornerstone of contemporary fire control and management program. **It does not provide where a fire will occur.**

# Fire Danger Rating System (FDRS):

– **Use weather data at noon as inputs** (Van Wager, 1987, Lee et al. 2002, Amiro et al., 2004, de Groot et al., 2006, Taylor and Alexander, 2006 and FAO, 2006)

- 1. Temperature**
- 2. Humidity**
- 3. Wind Speed**
- 4. Amount of 24 Hours Precipitation**

CFFDRS software can be downloaded at

<http://www.lakestatesfiresci.net/SciLibrary/FireDanger.htm> and  
<http://rpackages.ianhowson.com/cran/cffdrs/man/fwi.html>

# **Fire Danger Rating information is used for many operational reasons:**

- 1. to determine suppression resource levels (fire fighters, equipment, helicopters, fixed wing air tankers), mobilization, and strategic prepositioning;**
- 2. to define safe and acceptable prescribed burn prescription criteria;**
- 3. to establish fire management budgets based on long-term fire danger statistics; and**
- 4. to justify increased funding during times of wildfire disaster.**

# FDRS History

- Began in U.S. in 1919; Canada in 1925; Russia in 1949
- In Canada began with field data collection of how trees were responded to fire
  - Have a system in used in 1960
  - in 1987 Van Wagner developed into a better easy to use system



# Global Fire EWS

A Global Early Warning System for Wildland Fire

- 1. new longer term predictions of fire danger based on advanced numerical weather models**
- 2. common global fire danger metrics to support international fire management cooperation, including resource-sharing during times of fire disaster**
- 3. a fire danger rating system for the many countries that do not have a national system in place**

**1. Long-term** early warning products (or seasonal forecasts) provide an indication of anticipated global trends in fire danger over the course of the upcoming fire season.

**2. Medium-term** early warning products (1-2 weeks) provide information for large-scale tactical decision-making that requires 'spool-up' time to implement fire management action plans such as arranging the transfer of helicopters, fixed-wing air tankers, or fire fighters and equipment across international borders.

**3. Short-term of 1-5 days provides information for strategic decision-making, such as pre-positioning suppression resources in the most critical areas to most effectively control new fires and contain on-going fires.**

**Fire danger is calculated with Global Forecast System data from the U.S. National Centers for Environmental Prediction (NCEP) or The European Centre for Medium-Range Weather Forecasts (ECMWF).**



# Forecast fire danger provides early warning of future trends in fire potential, allowing fire managers to plan/implement fire control strategies in advance.

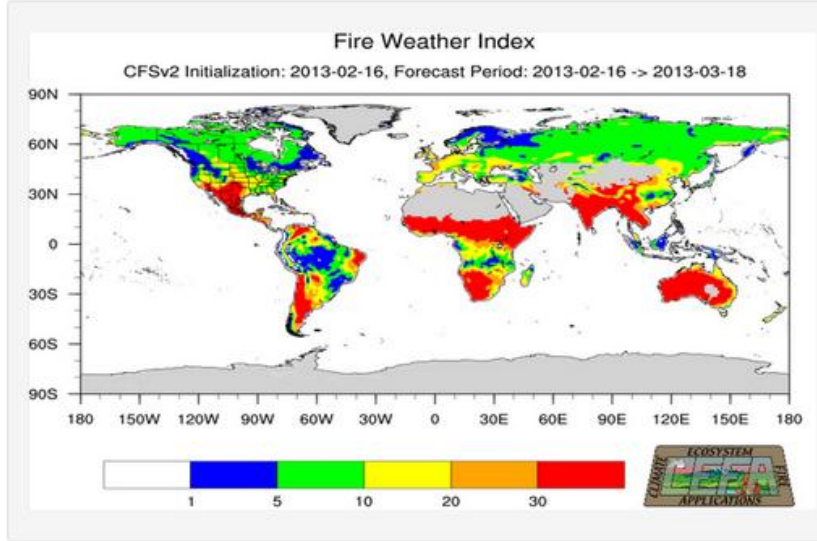
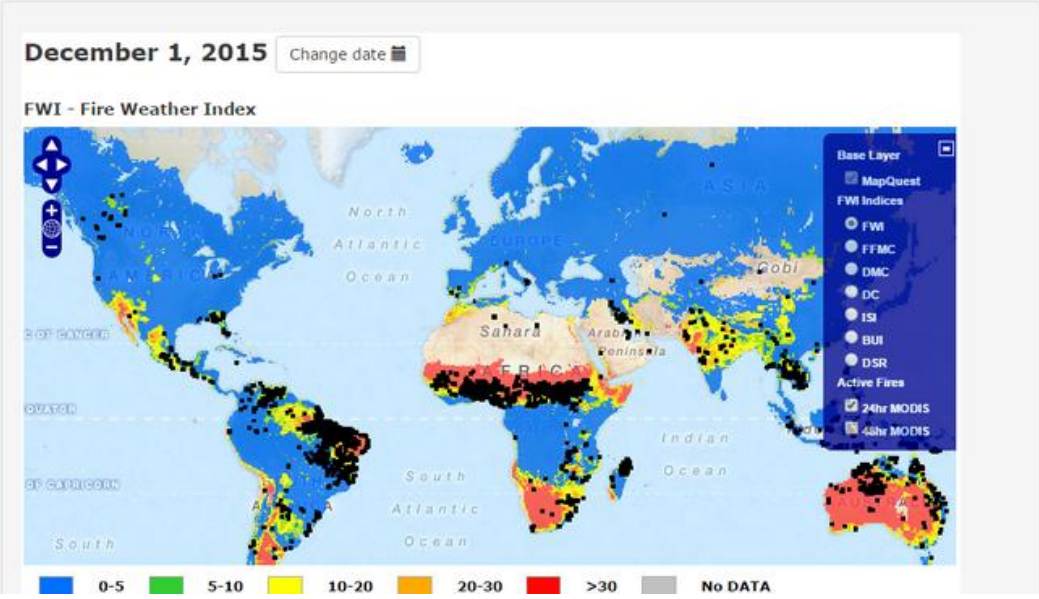


## Global Fire EWS

A Global Early Warning System for Wildland Fire

- Home
- Forecast Maps
- Overview
- Further Information & Contacts
- GFMC EW Portal

### Mapping Products



Source: <http://www.fire.uni-freiburg.de/gwfews/index.html>

# ASEAN FDRS History

- El Nino 1997-8 caused severe smoke and haze problem in Indonesia and neighboring countries
- ASEAN signed agreement in 2002
- 2002-2005 System Development through Canadian Forest Service support
- 2006 started running the system at Malaysian Meteorological Department

# ASEAN System by Malaysian Meteorological Department



## HAZE ACTION ONLINE



HOME ABOUT ▾ AREAS OF COOPERATION ▾ RESOURCES ▾ NEWS EVENTS CALENDAR MEMBER ▾ CONTACT

### Upcoming Events

There are no upcoming events.



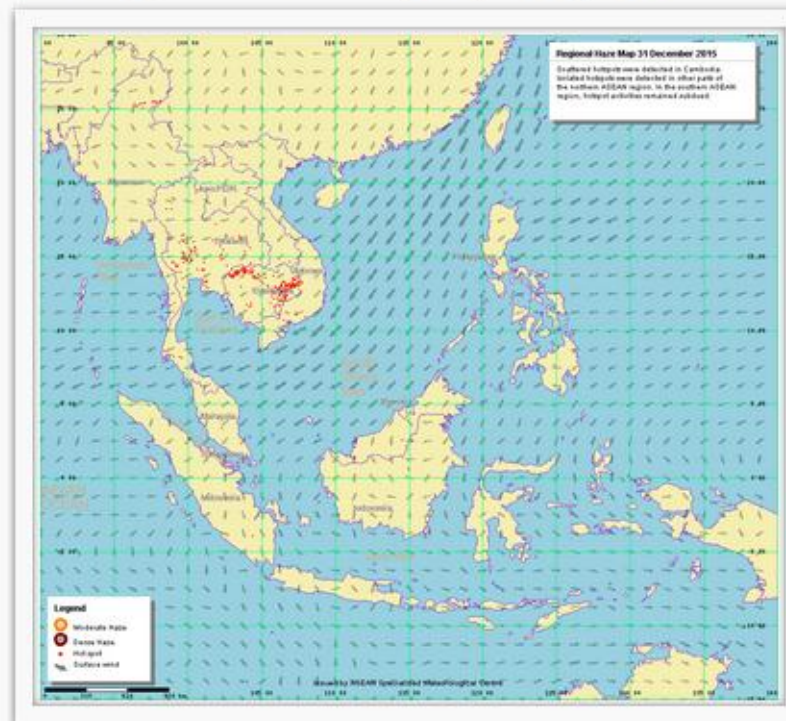
### Quick Links



HAZE AGREEMENT

### Haze Hotspot Map Today

Hover to magnify, scroll to re-size, click on the picture to go to the original source



### Recent News



MEDIA RELEASE: 11th Meeting of the Conference of the Parties to the ASEAN Agreement on Transboundary Haze Pollution

Haze Pollution



Media Release: 5th Meeting of the Sub-Regional Ministerial Steering Committee on Transboundary Haze Pollution in the Mekong Sub-Region

in the Mekong Sub-Region



Media Release: 17th Meeting of the Sub-Regional Ministerial Steering Committee (MSC) on Transboundary Haze Pollution

Fire Danger Rating System for Southeast Asia

Source: <http://haze.asean.org/#>

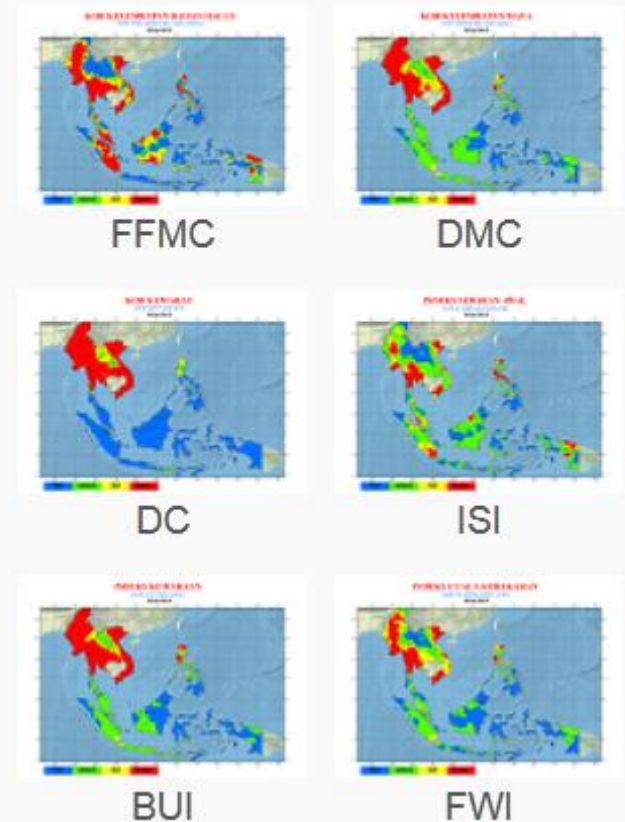
# ASEAN System by Malaysian Meteorological Department

1. The hotspots depicted in the map are derived from the NOAA-18 satellite. Hotspots go undetected when the area is not covered in the satellite pass or under cloudy / overcast conditions.
2. The surface winds (depicted by arrows in the map) are valid for 0600 UTC on the date indicated in the map. The length of the arrow represents the relative wind speed – longer arrows correspond to stronger winds.
3. This map is updated by 1000 UTC (6 pm SGT) daily.

Share this:





## Fire Danger Rating System for Southeast Asia



Source: <http://haze.asean.org/#>

# ASEAN System by Malaysian Meteorological Department

 **Kementerian Sains, Teknologi dan Inovasi (MOSTI)** | Laman Web Rasmi Jabatan Meteorologi Malaysia (MetMalaysia) | 

Laman Utama | Info MetMalaysia ▶ | Perkhidmatan | Tinjauan ▶ | Gempa Bumi ▶ | Pencerapan ▶ | **Iklim ▶** | Penerbitan ▶ | Pendidikan ▶ | Hubungi Kami ▶

Awam ▼ | Kerajaan ▼ | Swasta ▼ | Warga MetMalaysia ▼

Laman Utama / Iklim / Sistem FDRS / Asia Tenggara

## Fire Danger Rating System (FDRS) for Southeast Asia

Halaman: 1 2

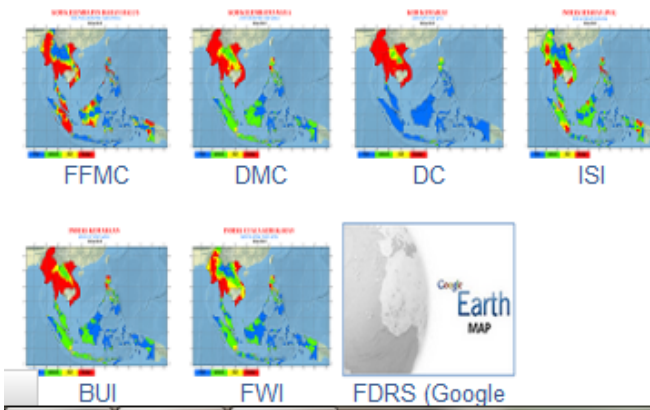
Sebelumnya Berikutnya

### Introduction

In 1997/98, extensive forest fire in one of the ASEAN country caused widespread haze in the SEA region. This significantly affected the tourism industries, the health of the population and the environment. The total loss was estimated to be US\$9 billion. In response to this environmental disaster, the SEA Environment Ministers initiated a Regional Haze Action Plan. As part of this Action Plan, a monitoring and warning system for forest/vegetation fires need to be developed and implemented. Adopted from the Canadian Forest Fire Danger Rating System, the SEA Fire Danger Rating System (FDRS) was subsequently developed and implemented.

Initially the SEA Fire Danger Rating was produced daily by the Canadian Forest Service (CFS). Starting from the middle of September 2003, this responsibility is handed over to the Malaysian Meteorological Service (MMS). Since then, MMS has been producing SEA Fire Danger Rating products on a daily basis.

Please click on the icon or text to view the South East Asian latest map for each individual index:

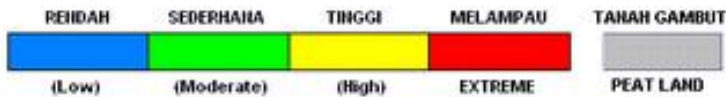
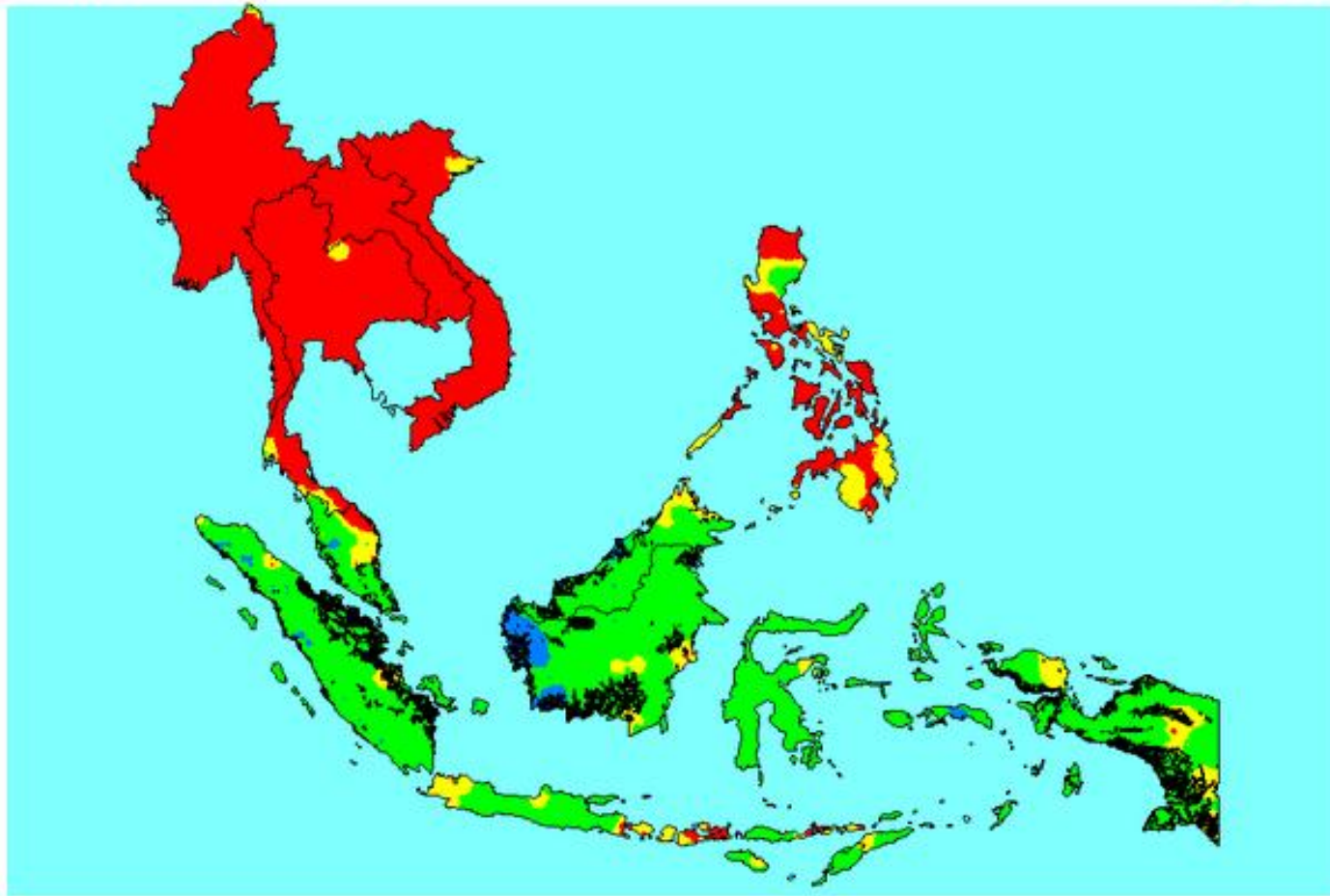


# ASEAN System



JABATAN METEOROLOGI MALAYSIA

Duff Moisture Code  
12 May 2016 1400 MST



**ASEAN**



DNP

DNP GIS

# การพยากรณ์ระดับชั้นอันตรายของไฟที่ความละเอียดสูง

## Fine-Resolution Forecast Products of Fire Danger Rating



ค่าดัชนีไฟป่าประจำวันเพื่อรับชม  
FDRS Table for Fire Risk Signs

ภาคเหนือตอนบนของประเทศไทย  
Upper Northern Thailand

ประเทศลาว  
Laos

เอเชียตะวันออกเฉียงใต้ตอนบน  
Upper Southeast Asia

จังหวัดเชียงใหม่  
Chiang Mai

ประเทศกัมพูชา  
Cambodia

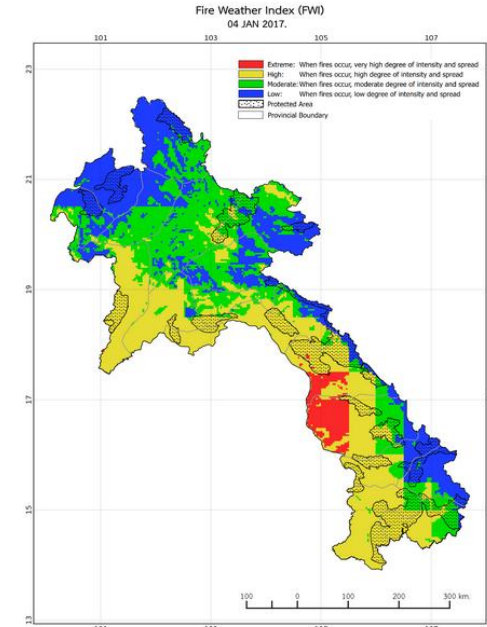
คณะทำงาน  
Working Group

เอกสารอ้างอิง  
References

รวมลิงก์  
Useful Links

ข้อมูลประกอบ  
Supplemental Info

กิตติกรรมประกาศ  
Acknowledgements

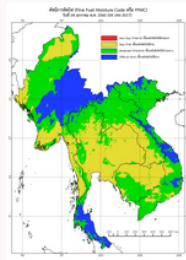


## เอเชียตะวันออกเฉียงใต้ตอนบน Upper Southeast Asia

4 มกราคม  
2560  
4 January 2017

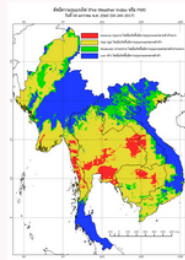
ความละเอียดกริด 3 กม.  
3-km Grid Resolution

ดัชนีการติดไฟ  
FFMC

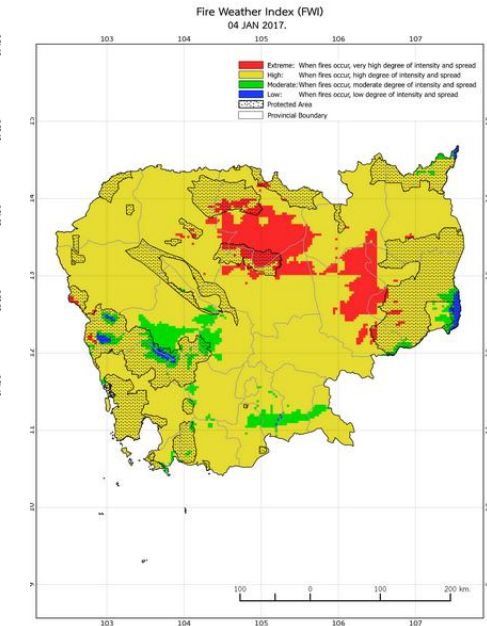
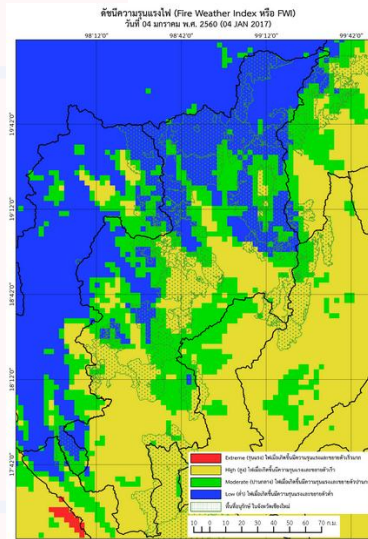


Google Earth KMZ

ดัชนีความรุนแรงไฟ  
FWI



Google Earth KMZ



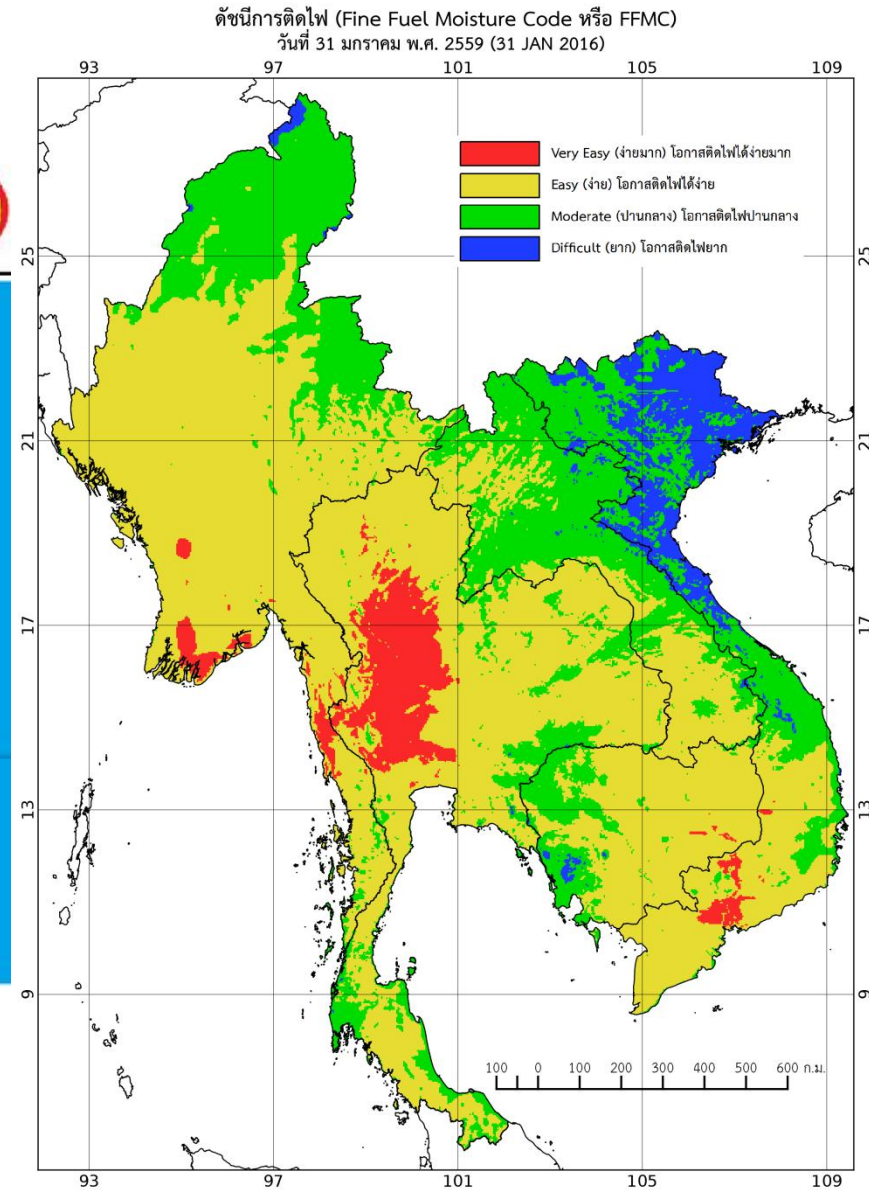
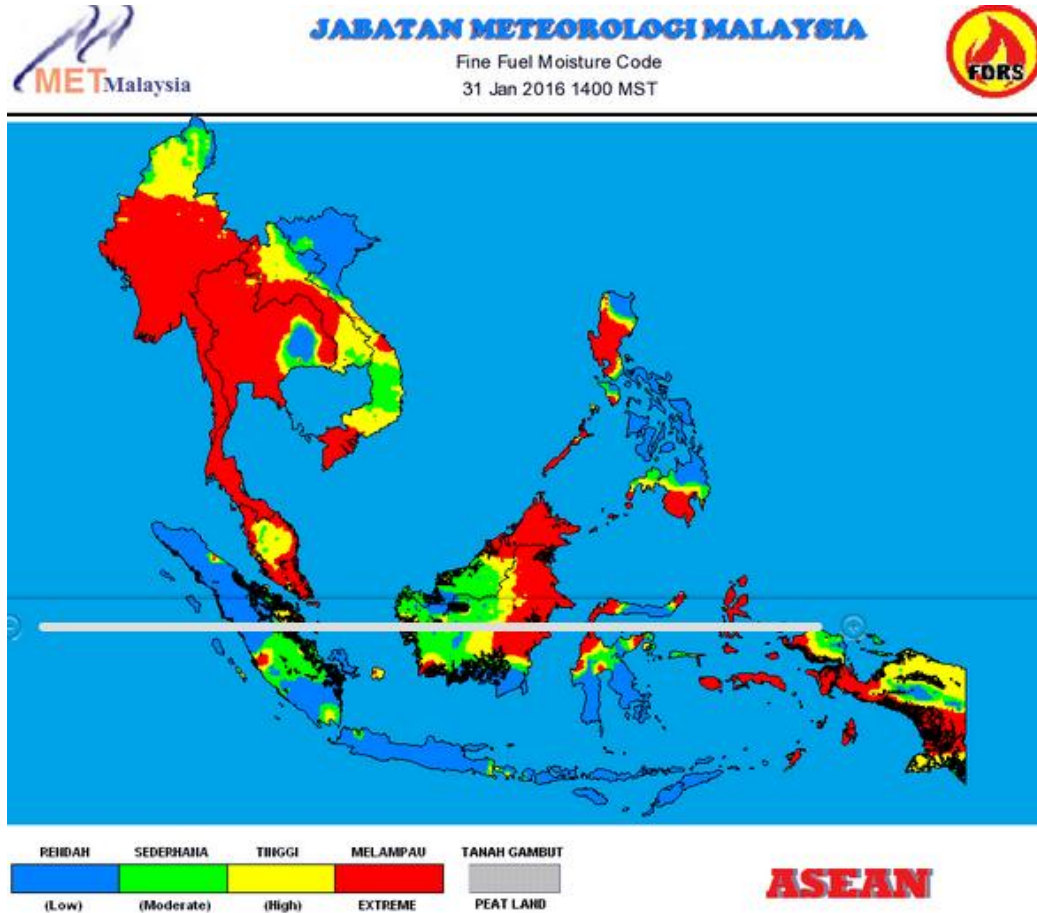
5 มกราคม 2560

ดัชนีการติดไฟ  
FFMC

ดัชนีความรุนแรงไฟ  
FWI

[v2.dnp.go.th/gis/FDRS/PNG/201701/20170104/FWI\\_Asia.png](http://v2.dnp.go.th/gis/FDRS/PNG/201701/20170104/FWI_Asia.png)

# Differences

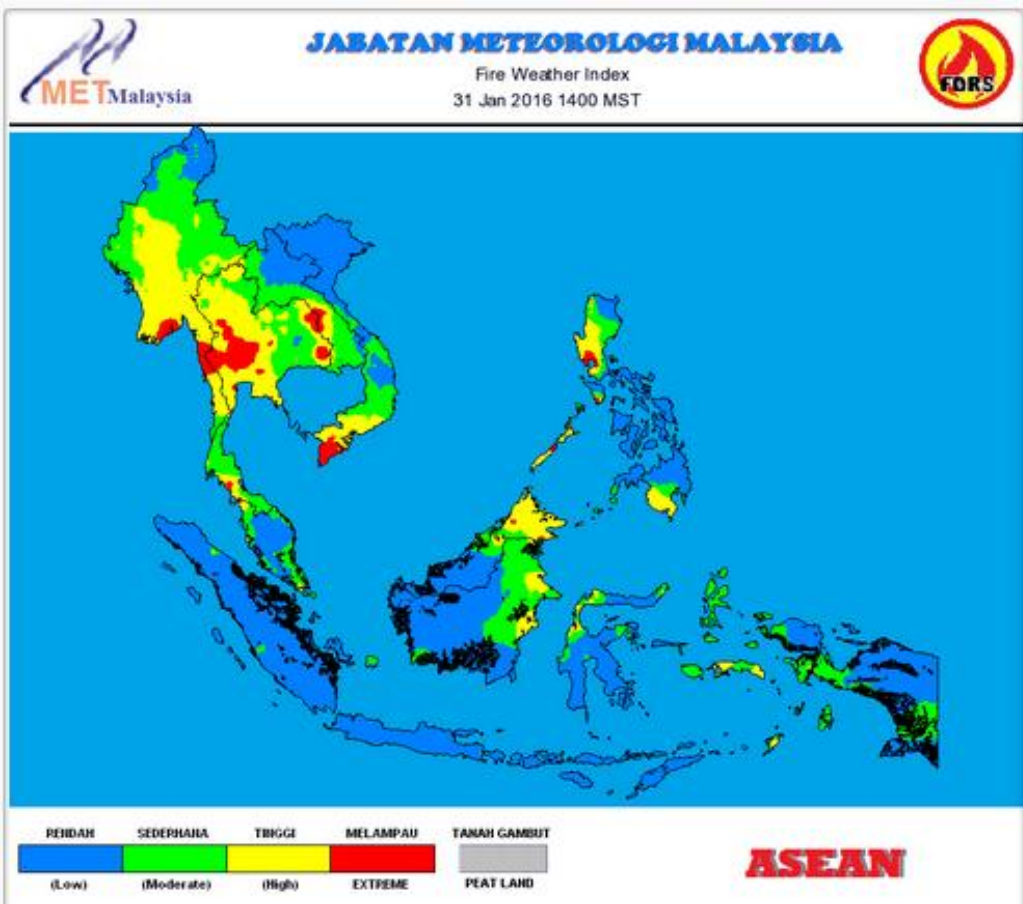


<http://haze.asean.org/fire-danger-rating-system-fdrs-for-southeast-asia/>

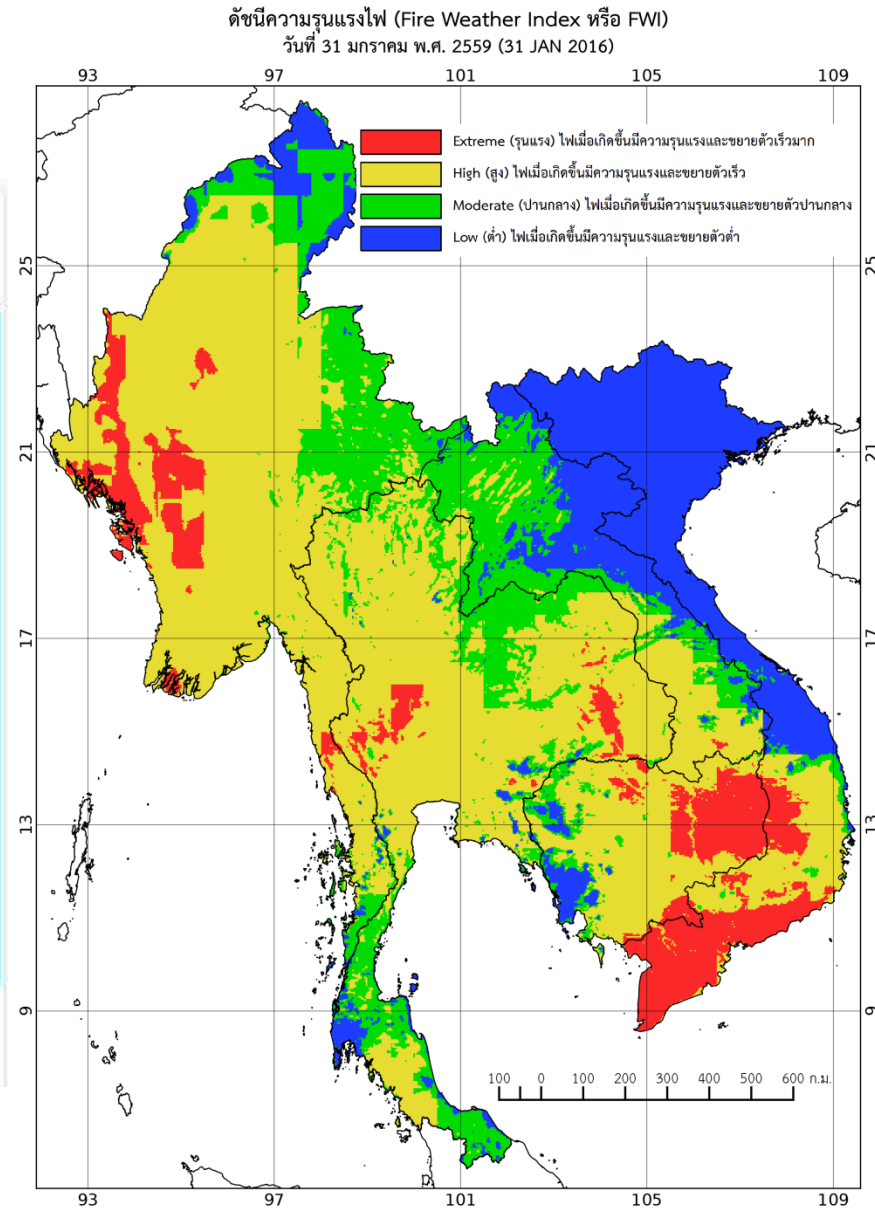
<http://www2.dnp.go.th/gis/FDRS/FDRS.php>



# Differences



<http://haze.asean.org/fire-danger-rating-system-fdrs-for-southeast-asia/>



<http://www2.dnp.go.th/gis/FDRS/FDRS.php>

# Flow Chart of Thailand Fire Danger Rating System and Fire Hotspot

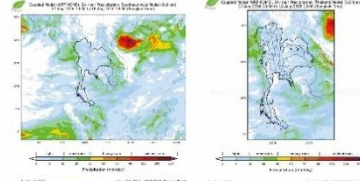


## Fire Information for Resource Management System (FIRMS)

- ข้อมูล fire hotspot หรือ active fire ตรวจพบหลังจากที่ไฟได้ติดขึ้นแล้ว และไม่สามารถบอกขนาดของพื้นที่ที่ไหม้ได้ เป็นแค่พิกัดกึ่งกลางของพิกเซล ส่งให้ผู้ใช้งานทั่วโลกโดย FIRMS ผ่าน ทางอีเมล เร็วสุดใช้เวลาไม่เกิน 2 ชม. หลังจากดาวเทียมบินผ่านประเทศไทยไปแล้วสามารถสมัครได้ที่ <https://firms.modaps.eosdis.nasa.gov>
- โดยจำเป็นที่จะต้องตรวจสอบดู ควบคู่ไปด้วยว่าดาวเทียม Terra และ Aqua ขดผ่านประเทศไทยนั้น มีข้อมูลหรือไม่ อีกทั้งมีเมฆหรือหมอกควมบดบังหรือเปล่า เพราะทุกๆ 2 ถึง 3 วัน โบลิตจะมีบริเวณที่ไม่สามารถบันทึกข้อมูลได้ เป็นผลให้ไม่สามารถตรวจพบ fire hotspot บริเวณนั้นได้ โดยสามารถตรวจสอบสภาพข้อมูลได้ที่ <https://lance.modaps.eosdis.nasa.gov/imagery/subsets/?subset=Indochina2> หรือ <https://worldview.earthdata.nasa.gov/> ทั้งนี้ขอรับรองดังกล่าวโดยถูกแก้ไขในเซ็นเซอร์เวียร์ส VIIRS แล้วส่งผลให้เวียร์สไม่มีปัญหาเรื่องไม่มีข้อมูลมาวิเคราะห์แต่ยังคงมีปัญหาร่องมีสิ่งบดบังอยู่ ซึ่งเป็นปัญหาของเซ็นเซอร์ประเภท Optical ทุกตัวจากการตรวจสอบภาคสนาม
- โมดิสสามารถตรวจเจอไฟเล็กสุดขนาด 25 ตารางเมตร
- เวียร์สสามารถตรวจเจอไฟเล็กสุดขนาด 4 ตารางเมตร
- โดยมีค่าเฉลี่ยความถูกต้องอยู่ที่ 94.5% (พ.ศ. 2552)

ข้อมูลภูมิอากาศจากแหล่งต่างๆ จากดาวเทียมอุตุนิยมวิทยาและดาวเทียมสำรวจทรัพยากร ร่วมกับข้อมูลที่วัดได้จากสถานีตรวจวัดอากาศ และข้อมูลที่เก็บปัจจัยในการรันโมเดลอื่นๆ

โมเดลพยากรณ์ภูมิอากาศผสมผสาน Coupled Model ระหว่างแบบจำลองสภาพอากาศ Weather Research and Forecasting Model (WRF) & แบบจำลองมหาสมุทร Regional Ocean Modeling System (ROMS) (<http://www.thaiwater.net/v3/>)



## Geo-Informatics Division

รับแบบจำลองทางคณิตศาสตร์ Fire Danger Rating System, FDRS ของประเทศแคนาดา ที่ได้ทำการปรับค่าของเทรชโฮลด์ (threshold) ที่เหมาะสมกับสภาพป่าและภูมิอากาศของภูมิภาคตะวันออกเฉียงเหนือตอนบน เพื่อผลิต แผนที่ดัชนีการติดไฟ (Fine Fuel Moisture Content, FFMC) และความรุนแรงไฟ (Fire Weather Index, FWI) สำหรับใช้เป็นข้อมูลพื้นฐานหลักประกอบการปฏิบัติงานประจำวันของหน่วยงานต่างๆที่เกี่ยวข้องกับการจัดการไฟป่า <http://www2.dnp.go.th/gis/FDRS/FDRS.php>

ทำการเพิ่มข้อมูลพื้นฐาน เช่น ตำบลละไร ห่างจากตำแหน่งหมู่บ้านเท่าไร ป่าประเภทไหน อยู่ในเขตรักษาชีวะอะไร ใกล้กับหน่วยดับไฟไหม เพื่อสะดวกในการใช้งาน



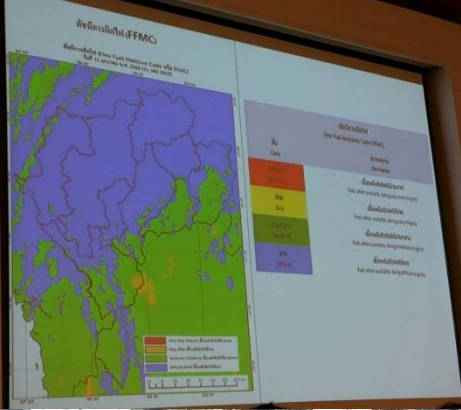
ดัชนีการติดไฟ FFMC และความรุนแรงไฟ FWI อยุ่ภายใต้คำว่า ค่าดัชนีทั้ง 2 ค่า หมายถึงว่าจะเกิดไฟไหม้ในอย่างไร และเป็นข้อมูลที่เรียกว่า บริเวณนั้นจุดไฟได้ง่ายหรือยาก และเมื่อเกิดไฟขึ้นแล้วมีความรุนแรง อีกทั้งมีการขยายตัวรวดเร็วขนาดไหน เท่านั้น

- ข้อมูลความร้อนที่ตรวจวัดได้จากดาวเทียม Terra (ผ่านช่วงเช้า) Aqua และ Suomi National Polar-orbiting Partnership (NPP) (ผ่านช่วงบ่าย) ถ่ายบันทึกไว้ขณะบินผ่านประเทศไทยด้วยความเร็วเฉลี่ย 7.5 กม.ต่อวินาที ที่ความสูง 705 กม. ดังนั้นข้อมูลตั้งแต่ที่ได้เป็นข้อมูลช่วงเวลาไม่กี่วินาทีขณะที่ดาวเทียม บินผ่านจุดนั้นๆเท่านั้น จึงใช้ข้อมูลของการเกิดไฟทั้งหมดเป็นแค่สถานการณ์ ภาพรวมของไฟป่า ขณะนั้นเท่านั้น
- โดยปัจจุบันเราใช้เซ็นเซอร์วัดความร้อน 2 รุ่น คือ โมดิส-MODIS รายละเอียดทางกายภาพ (พิกเซล) อยู่ที่ 1,000 เมตร ติดตั้งอยู่บนดาวเทียม Terra และ Aqua และ 375 เมตร เวียร์ส-VIIRS ติดตั้งอยู่บนดาวเทียม Suomi-NPP โดยภายในพิกเซลดังกล่าวอาจจะมีไฟมากกว่าหนึ่งจุดก็ได้แต่สามารถทำการรายงานได้เฉพาะพิกัดกึ่งกลางของพิกเซลนั้นเท่านั้น
- ประการสำคัญคือการทางคณิตศาสตร์ที่ใช้หา fire hotspot ใช้ขอหน่วยเป็นตัวกำหนด ดังนั้นสิ่งแนวไฟจะมีขนาดเล็กแต่ปลดปล่อยความร้อนออกมาสมากพอ ตัวสมการก็สามารถจับ fire hotspot ดังกล่าวนั้นได้เช่นกัน

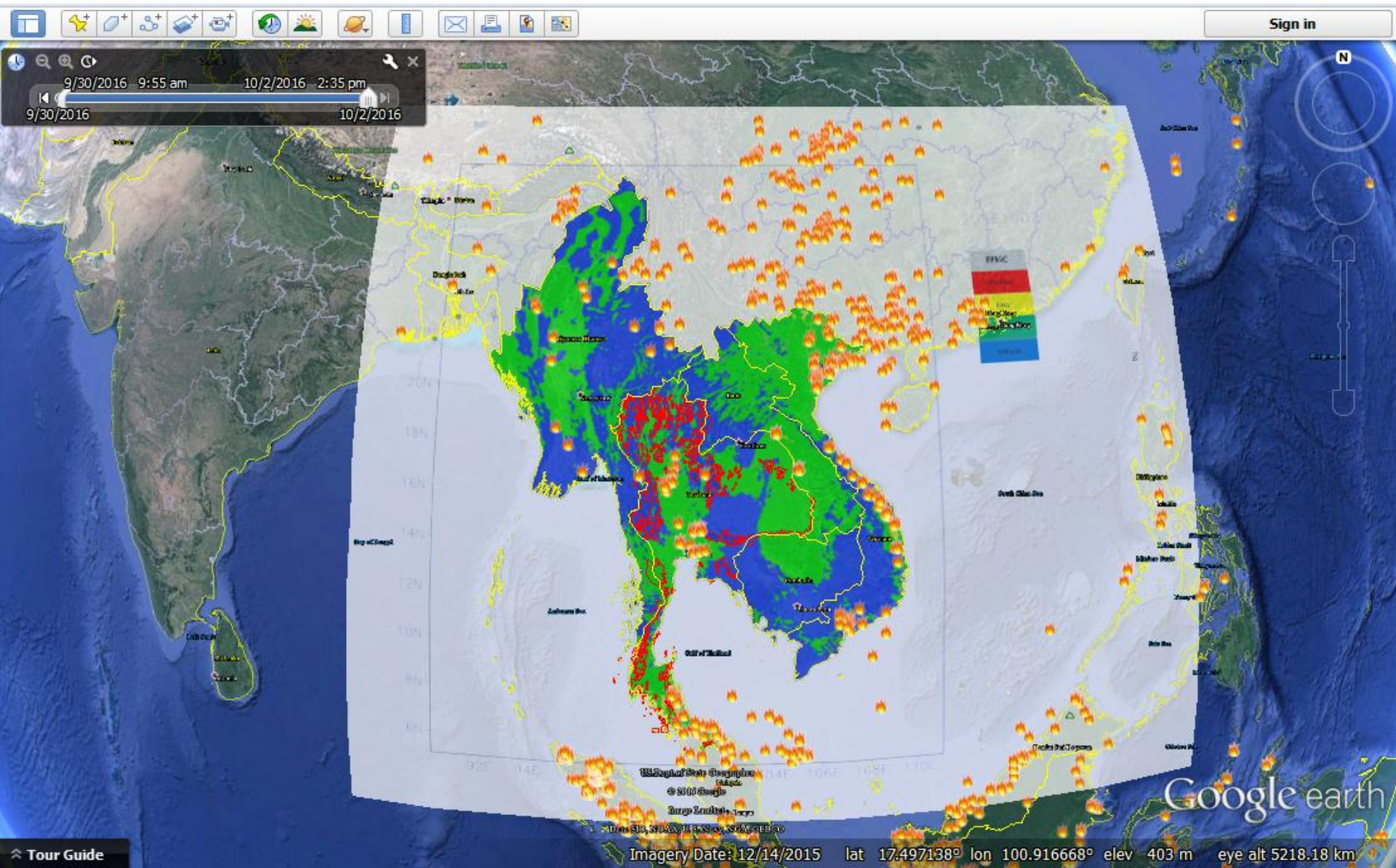
นำเสนอผ่านทางเว็บไซต์ (<http://www.dnp.go.th/forestfire/hotspot/hotspotmap.htm>) มีการตรวจสอบความถูกต้องภาคสนามโดย สบอ.ทั่วประเทศ เพื่อยืนยันความถูกต้องอย่างต่อเนื่อง ตั้งแต่ปี พ.ศ. 2549 และได้พิมพ์ผลงานทางวิชาการภายใต้ชื่อ MODIS Hotspot Validation in Thailand เมื่อปี พ.ศ. 2552 โดยมีค่าความถูกต้องเฉลี่ย 94.5%

ที่มา Hotspot ในพื้นที่ป่าเขตรักษาพันธุ์สัตว์ป่าห้วยขาแข้ง 2552

Year	Area	Hotspot	Validation	Accuracy
2009	1,000	1,000	1,000	94.5%
2010	1,000	1,000	1,000	94.5%
2011	1,000	1,000	1,000	94.5%
2012	1,000	1,000	1,000	94.5%
2013	1,000	1,000	1,000	94.5%
2014	1,000	1,000	1,000	94.5%
2015	1,000	1,000	1,000	94.5%
2016	1,000	1,000	1,000	94.5%
2017	1,000	1,000	1,000	94.5%
2018	1,000	1,000	1,000	94.5%
2019	1,000	1,000	1,000	94.5%
2020	1,000	1,000	1,000	94.5%



**Combining forecasted fire danger maps with historical fire hotspots will indicate critical areas where serious fire problem will occur if current fire activity persists.**



# Using FWI with fire hotspots on Google Earth

