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OPERATIONAL WEATHER SYSTEMS FOR NATIONAL FIRE DANGER RATING

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ABSTRACT

The Indonesia Initiative for FDR system commenced in April 2000 with the development of a central FDRS. It's being designed to support Indonesian central agencies in monitoring fire conditions and in developing national level actions to support prevention, monitoring and mitigation activities at a provincial level. In late 2001, the central-level FDRS will also be adapted and operated electronically and manually in two provinces in Indonesia (Riau Province in Sumatra and in West Kalimantan Province).

Earlier, in 2002 (10th February) the handover from the FDRS Project to BMG for operated a daily Fire Danger Rating System for whole National Region began, based on daily weather observation. Operations and application of FDRS outputs in Indonesia will also be important activities in year two. For Indonesia, the Meteorology and Geophysical Agency (BMG) is responsible to collect record and disseminate daily weather information at national and local levels.

In 2004 BMG produced daily FDR Prediction (3 days) base on France NWP (Synergy module). This implementation is collaboration between BMG and Meteo France International (MFI). R&D of BMG developing FDR Calculation and The Air Pollutant Model (Include smoke from forest fire) base on Numerical Weather Prediction from CSIRO (Using CCAM Output) in late of 2007. The Air Pollutant Model for smoke trajectory runs by using the hotspot information from MoF (Sipongi Output Programs).

Keywords : Fire Danger Rating System, Fire weather index, The Air Pollutant Model, Smoke Trajectory, Drought code, Forest fire manajemen, Smoke

ABSTRAK

Prakarsa Indonesia untuk sistem FDR dimulai pada bulan April 2000 dengan pengembangan pusat FDRS. Ketika itu FDRS dirancang untuk mendukung lembaga – lembaga sentral di Indonesia yang berkompeten dalam memantau kondisi-kondisi kebakaran dan untuk mengembangkan tindakan tingkat nasional untuk mendukung tindakan pencegahan, pemantauan dan kegiatan mitigasi pada tingkat provinsi. Pada akhir tahun 2001, FDRS tingkat pusat juga akan diadaptasikan dan dioperasikan secara elektronik dan manual di dua provinsi di Indonesia (Provinsi Riau di Sumatra dan di Provinsi Kalimantan Barat).

Sebelumnya, pada tahun 2002 (10 Februari) serah terima dari Proyek FDRS kepada BMG untuk mengoperasikan Sistem Peringkat Bahaya Kebakaran harian untuk seluruh wilayah nasional dimulai, berdasarkan pada pengamatan cuaca harian. Pengoperasian dan aplikasi output FDRS di Indonesia juga akan menjadi kegiatan penting di tahun kedua. Untuk Indonesia, Badan Meteorologi dan Geofisika (BMG) bertanggung jawab *untuk mengumpulkan data dan menyebarluaskan informasi cuaca harian di tingkat nasional dan lokal.*

Pada tahun 2004 BMG membuat prediksi FDR harian (3 hari) berbasis pada NWP Perancis (modul Sinergi). Implementasi ini adalah kerjasama antara BMG dan Meteo France International (MFI). Pusat Penelitian dan pengembangan BMG membangun Perhitungan FDR dan Model Polutan Udara (termasuk asap dari kebakaran hutan) berdasarkan Numerical Weather Prediction dari CSIRO (menggunakan Output CCAM) pada akhir tahun 2007. Model polutan udara untuk lintasan asap dijalankan dengan menggunakan informasi hotspot dari Dephut (Sipongi Output Program).

Kata kunci: Sistem Peringkat Bahaya Kebakaran, indeks cuaca kebakaran, Model Polutan Udara, Lintasan asap, kode Kekeringan, manajemen kebakaran hutan, Asap

1. INTRODUCTION

Overview of Country/Region Fire Conditions, Fire Management and Need for FDR

Indonesian tropical rainforest is second largest area in the world after Brazillian. Result of remote sensing study from Forestry Departement shown that forest landcover in 1993 decrease about 92.4 million hactares, include log over concession area about 20.6 million hectares. Finally, Indonesian forest landcover decrease about 1.3 million hectares per year during 10 years latest and area of national park is 13 % from the forest existing.

Indonesian fire and haze disaster of 1997-1998 affected the economies and health of populations in two Islands (Sumatra and Kalimantan). Estimated damages exceeding US$ 8.4 million have been reported, exclude direct losses of plantations, timber and biodiversity. Smoke and haze caused by wild land fires burning in forests, plantations and agricultural areas in Kalimantan and Sumatra. Early 1998 from fires in Kalimantan, Large numbers of fire suppression personnel were mobilized but their effectiveness was limited by a lack of reliable, current information on locations of the fires and the environmental conditions promoting their ignition, fuel type, current and prediction of weather condition.

In response to this crisis situation and in an attempt to prevent losses of such magnitude ever occurring again, the Environment Ministers in the region have approved a Regional Haze Action Plan (RHAP). The RHAP adopted in December 1997 commits the countries to a regional approach to reducing the probability of fires and when fires do occur to combining fire suppression resources to fight the fires. Lead responsibilities are assigned to Indonesia (for mitigation), Malaysia (prevention), and Singapore (monitoring). One of the monitoring mechanisms proposed for implementation as part of the Regional Haze Action Plan, is a regional Fire Danger Rating System (FDRS). The FDRS is a forecasting tool that measures the risk of wildfires starting and spreading. Forecasts are based on daily meteorological observations, which are modified by analysis of vegetation as potential fuel. Finally, we need to develop FDR system to prevent and control forest fire. It's also give early warning system and mitigate the fire hazard, specially for seriuos smoke from the forest fire

2. THEORETICAL BASIC OF FDRS

2.1. Fire Weather Index (FWI)

Fire Weather Index (FWI) is sub system from The Canadian Forest Fire Danger Rating System (CFFDRS) was introduce since 1970. FWI function calculate the weather parameters impact related to the forest fuel and evaluate weather condition (present adn last weather condition). Fire Weather Index consist of six component, they are three components for fuel mointure code (Fine Fuel Moisture Code, Duff Moisture Code and Drought Code) and three components for fire behavior indexs (Initial Spread Index, Buildup

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Index and Fire Weather Index). Generally, high value for every code and index are reflect to easily fire to ignite. In original version, FWI system is a set of computerize formulation which can calculate by easily and sophisticated, it's different with first version of FWI and calculate by manually. FWI system develope to provide maximum information from minimum weather parameters input, depend on weather parameters input (Hourly, daily and monthly). FWI system also can use in sparately component and combination from some components as FWI output. In FWI there are three fuel moisture codes for the forest floor in different depth and area. FFMC *(Fine fuel moisture code)*, a numerical rating of the moisture content of surface litter and other cured fine fuels on the forest floor, this code reflect to how easily the fire will ignite. DMC *(Duff moisture code)*, a numerical rating of the average moisture content of loosely compacted organic layers of moderate depth in the forest floor. DC *(Drought code)*, a numerical rating of the average moisture content of deep, compact organic layers in the forest floor. FWI also provide three components for fire behavior indexs (Initial Spread Index, Buildup Index and Fire Weather Index). ISI *(Initial spread index)*, a numerical rating of the expected rate of fire spread. BUI *(Buildup index)* a numerical rating of the total amount of fuel available for combustion. FWI *(Fire weather index)*, a numerical rating of fire intensity that is used as a general indicator of fire danger.

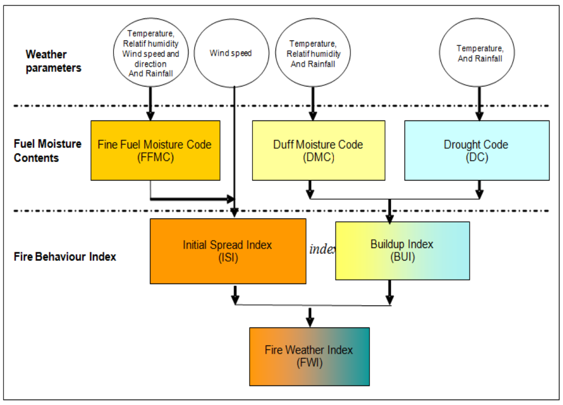

Figure1. Basic Structure of Fire Weather Index

The Fire Danger Rating System is a forecasting tool that measures the risk of wildfires starting and spreading. Forecasts are based on daily meteorological observations, which are modified by analysis of vegetation as potential fuel. The approach is based on the Canadian Forest Fire Danger Rating System, developed by the Canadian Forest Service (CFS) and widely adopted for use in ASEAN Region and Indonesia (National Level). The Fire Danger Rating System (FDRS) is a predictive system, which provides early warning of wildland fire danger conditions so that regulatory authorities can take actions designed to minimize the risk of fires in these danger prone areas. This information also can be used to plan the positioning and use of fire suppression resources for responding to new fires. The FDRS provides real time products to allow authorities to initiate preparedness and strategic and tactical planning to manage land and forest fire incidents (wildfires). Ultimately such predictive systems can be used as the basis of fire permitting.

The FDRS is composed of three main components: Fire Weather Index System (FWI), the Fire Behavior Predictions System (FBP), and the Wildfire Threat Assessment (WTA) System. The basis of the FDRS is the FWI which can be implemented as a stand alone system. Indonesia and ASEAN region only use FWI system as a tools to monitor the fuel moisture content and forest fire bahaviour. Development of the FBP and the WTA is the next logical step in implementation of the FDRS. Operation of each of these components requires continuous input of data on meteorological conditions, weather forecasts, and fuel or vegetation conditions. All FDRS calculations required can now be completed in a timely manner on standard personal computer. Alternatively the calculations can be completed manually,for single meteorological stations, with the aid of tables in field books.

ASEAN and Indonesia Fire Danger Rating System could be designed and implemented, initially with the following series of modules:

- Fire Weather Index System
- Fuel classification and maps
- Fire Behavior Prediction System, and
- Fire history

The Fire Weather Index (FWI) is the original component of FDRS and is still used as the only component in some Indonesian provinces, specially for Single FDR Calculation. It performs quite adequately in this stand alone role but in Provinces with serious fire situations it is augmented with the Fire Behavior Prediction (FBP) module. To calibrate the FWI it is essential to have sufficient measures of fire history, which in Southeast Asia can only be provided from the 1997 and later hot spot data. The Fire Behavior Prediction system module adds essential information concerning the behavior of wildfires in the fuel types of Indonesia.

Fire weather index maps are calculated based on meteorological observations. The indices are cumulative and are interpolated to produce weather surfaces covering the entire area of interest. GIS technology is the basis for this analysis. Ideally, meteorological reports are obtained from weather stations spaced about 50 km.

Outputs from the Fire Weather Index system are used to determine the appropriate responsive action in potential, and actual, fire situations. Interpretation of detailed fire weather information is accomplished either directly by highly trained technical experts or by other technical staff and decision-makers through the assistance of decision support and visualization tools. General information is made available to the public in simple-to-understand terms, describing the degree of fire danger, for example: extreme, high, medium, low.

2.2. Hotspot Monitoring

Ministry of Forestry and JICA already developed the forest fires monitoring using Satellite. Land and forest fire is complexicity problem caused by natural disaster and human error. It's indicator by hotspot. Hotspot as a forest fires indicator in region that using remote sensing sattelite, like NOAA Satellite. Sattelite censor catch the region temperature increase in 1 km square area (1 km resolution). They use thermal censor and visible to detect hotspot with threshold about 315 Kelvin (42 celcius), beside groundtruth in the field.

2.3. Smoke Trajectory Tool

To strengthen capacity for forest fires early warning system, Indonesian Meteorological and Geophysical Agency continued operate FDRS (Handover from Canadian Forest Service). For national level, we have agreement between 3 goverment agencies (BMG, LAPAN And Ministry Of Forestry) with different responsible and system, but same goal. The main problem from the forest fire is smoke and haze, It's became regional issues when the locate of forest fire in country border and issues of smoke transboundary will arise. To decrease transbounday smoke problem, BMG use The Air Pollutant Model (CSIRO model) to monitor smoke trajectory base on numerical weather prediction. We optimize the output of Conformal Cubic Atmospheric Model. There five weather parameters from the CCAM output that use as input of TAPM to identify of Smoke Trajectory. The weather parameters are temperature, wind speed and wind direction, relative humididty, rainfall and surface pressure.

Serious impact from the forest fire smoke to people is larynx lines infection. It's also destroy animal popullation and land degradation. Mainly, the forest fires cause by natural disaster and human error. People use the fire for land clearing and land preparataion for plantation, agriculture and forest consesion industri. Beside that, the weather condition also suppor the forest fires become bigger and bigger, for example El Nino event.

Mostly Indonesian Forest fires happen in peatland area, in Borneo and Sumatera Island. Peatland area have biggest Carbon when forest fire occured. Peatland area have specific characters, like water content. There is different water content depth, during the dry season the peatland area easily to ignite as long as there is ignition agent (People or natural disaster). In the peat fires will provide a bigest Carbon concentration, and It's one of factor causes a global warming event.

The Air Pollutant Model will show the smoke trajectory from fires spot in some area base on topografi and meteorological/weather parameters. Generally the air pollutant model follow the formulation from Gaussian Model to determine area from the pollutant distribution. We have 2 kind of TAPM output, in raw data (Weather parameters and pollutant parameter) and Spatial data (2 Dimension and 3 Dimension). The Gaussian model formulation show :

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$$C = \frac{Q}{2\pi U \sigma y \sigma z}\left[\exp - \left(\frac{Y^2}{2\sigma y^2}\right)\right]\left\{\exp\left[\frac{-(z-H)^2}{2\sigma z^2}\right] + \exp\left[\frac{-(z+H)^2}{2\sigma z^2}\right]\right\}$$

Where:

C = Pollutant concentration (Ugr/m^3) at ground level

Q = Emission rate (gr/det)

U = Windspeed at emission active level (m/det)

H = Height of efective chimney emission

$\sigma y, \sigma z$= diffusion coefisien in y and z direction

The general equation to calculate σy,σz value:

$\sigma y = a X^b$

$\sigma z = c X^d + f$

where:

X = Distance of pollutant distribution from chimney (m)

a, b, c, d, f = Constanta value base on atmosphere stability.

3. DATA PROCESSING METHODS

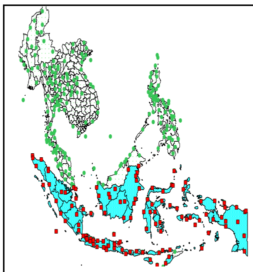
3.1. Role of Weather Networks, Data Systems and Other Data Inputs

The weather data as input of Indonesian FDR system are coming from all ASEAN Countries and organized by WMO using Global Telecommunication System. Indonesian Meteorological and Geophysical Agency is one member of WMO, it's mean we can access meteorological data from other country under WMO data exchange agreement. WMO have a standard of measurements, reporting dan data distribution to all WMO members and meteorological data under world weather watch program technical comission, this programs close to forest fire management program. The World Weather Watch Program have responsible about Global Observing System (GOS), Global Telecommunication System (GTS) dan Global Data Processing System (GDPS).

Meteorological data is one of responsible for Indonesian Meteorological and Geophysical Agency(BMG), so for FDRS operationalisation BMG have 331 meteorological station for whole ASEAN countries (See below, Picture of ASEAN and Indonesian weather station network).

FDRS data input are coming from synoptic meterological data network for all ASEAN countries in Global Telecommunication System, totally 331 meteorological stations. All data collected in Database computer server every 04.00 PM Western Indonesian Time. The synoptic data consist of 3 hourly data for 24 hour in a day.

We use Microsoft Access software for FDRS database management system since 10th February 2002. A list of WMO bulletins and the stations appearing in each is found in *WMO Publication 9 Volume C*. Bulletins used for the ASEAN region are shown in the following table.



- National Weather Data Service *http://www.bmg.go.id*
- International Weather Data Service *http://www.wmo.ch*
- ASEAN Countries weather data distribution (40 % in Indonesia):
- Indonesia --127
- Brunei -- 2
- Malaysia -- 27
- Singapore – 4
- Philippines -- 59

Figure 2. ASEAN and Indonesian Weather Station Network

Table 1. A List of WMO station in ASEAN region

Country	WMO Region	Bulletin	Collection Centre
Brunei	96	smbd01	wbsb
Indonesia	96(Western) 97(Eastern)	smid01 smido2, smid20, smid21	wiix wiix, wiix, wiix
Laos	48	smla01	vliv
Malaysia	48	smms01	wmkk
Myanmar	48	smbm01	vbrr

Table 1 continued

Philippines	98	smph1, smph20	Rpll, RPMM
Singapore	48	smsr01	wsss
Thailand	48	smth01, smth02, smth40	Vtbb, vtbb, vtbb
Vietnam	48	smvs01	vnnn

These weather stations may be listed in a file and database table. If a table is used, a file with similar content should be created with the first line containing column names. Mandatory columns include station name, identifiers (at least one of WMO number, IATA/ICAO airport identifier, or regional identification string), province or state, longitude and latitude in decimal degrees, elevation in metres, time zone correction (TZ=UTC-LST), and instrumentation. Columns such as bulletin names or reporting times may be included. One or two types of station identifiers may be null – the weather decoders allow users to specify the primary identifier, with which all other information is selected and ordered.

The following procedures and assumptions have been implemented in the decoding of synoptic reports:

- Precipitation amounts reported in excess of 500 mm in 24 hours are assumed to be erroneous, and the missing value (-99) is substituted. This may need revision, as 500 mm 24-hour rainfalls can occur in rain forests.
- Dewpoint and dry bulb temperature are exchanged if the dewpoint exceeds the dry bulb value and relative humidity is not reported in the dewpoint block
- Visibility is assumed reported in tenths of kilometres if VV< 50 and whole kilometres if VV> 50. Although weather descriptions are available, no effort has been made to differentiate between low visibility resulting from lithometeors [dust or smoke] and hydrometeors [precipitation or fog], or geographic features that may limit vision.

3.2. Operational Features of FDR

There are three agencies operates FDR system, The Indonesian Meteorological and Geophysical Agency (BMG), National Space Agency (LAPAN) and Ministry Of Forestry (MoF). LAPAN operates National FDR system for numerical weather prediction using remote sensing data (Derivative weather data from satellite images) and Hotspot monitoring. MoF operates local FDR system for single weather station (Automatic weather station) using XLFWI calculation and hotspot monitoring. BMG operates National FDR system for near real time weather data (GTS) and numerical weather prediction for FDR prediction (Synergy and CCAM, 3 days ahead), the flowchart of FDRS processing at BMG can following :

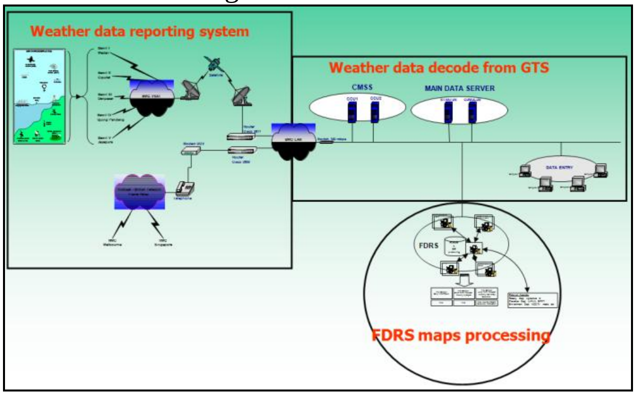


Figure.3. Flowchart of FDRS processing

BMG FDR system produce some moisture code (FFMC, DMC and DC) and fire behavior indexs (BUI, ISI and FWI), base on Indonesian adaptation we only use 3 maps from FDRS output (FFMC, DC and FWI) in any scale (National, province and special request). FFMC will reflect to how easy the fire will ignite. DC reflect to long period dry condition and smoke potential also very difficult to control the fire. FWI is general weather condition related to fire.

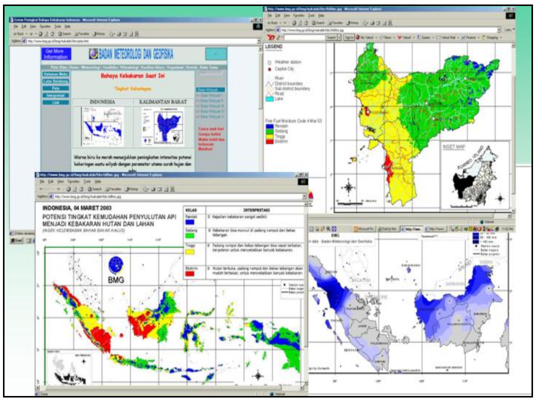


Figure 4. Type and scale of FDR maps, BMG

The others FDR information is firespot and smoke trajectory/concentration. Since 2008, BMG operate the smoke trajectory from the forest fire base on numerical weather prediction (Three days a head). Simple understanding the process, follow the flowchat below :

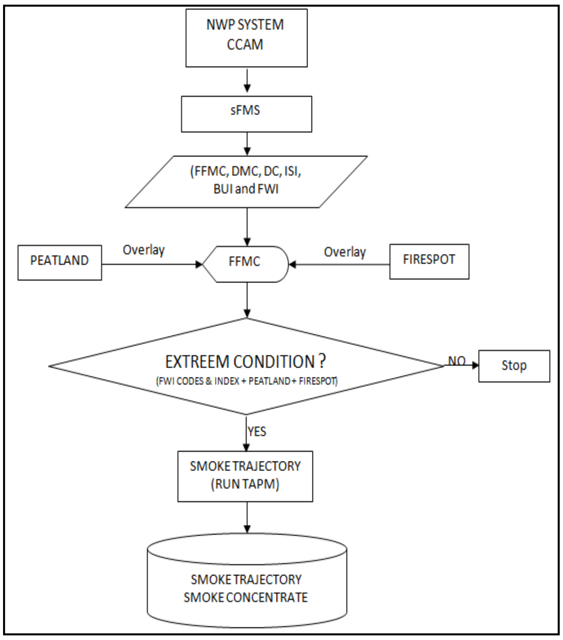


Figure 5. Smoke Trajectory Flowchart

The Air Pollutant Model (TAPM) shows prediction the trajectory and concentrate of smoke/haze from the forest fires in forward (3 days ahead). Input of TAPM can be following below :

- Land surface database, Global topography map in 1 km^2, Data source from US Geological survey, Earth Resources Observing System. System, Data Center Distributed Active Archive Center.
- Vegetation and landtype data, Dataosurce from US Geological survey, Earth Resources Observing System. System, Data Center Distributed Active Archive Center.
- Sea surface temperature and monthly average, US National Center for Atmospheric Research (NCAR)
- Synoptic meteorological analisis data, LAPS atau GASP Bureau of Meteorology Australia.

TAPM have some limitation causes from the earth surface characteristics :

- Maximum area can be analisis in horizontal less than 1000 x 1000 km
- Maximum area can be analisis in vertical less than 5000 km
- TAPM output not quite maximum in area with extreem different of height (Extreem of slope area)

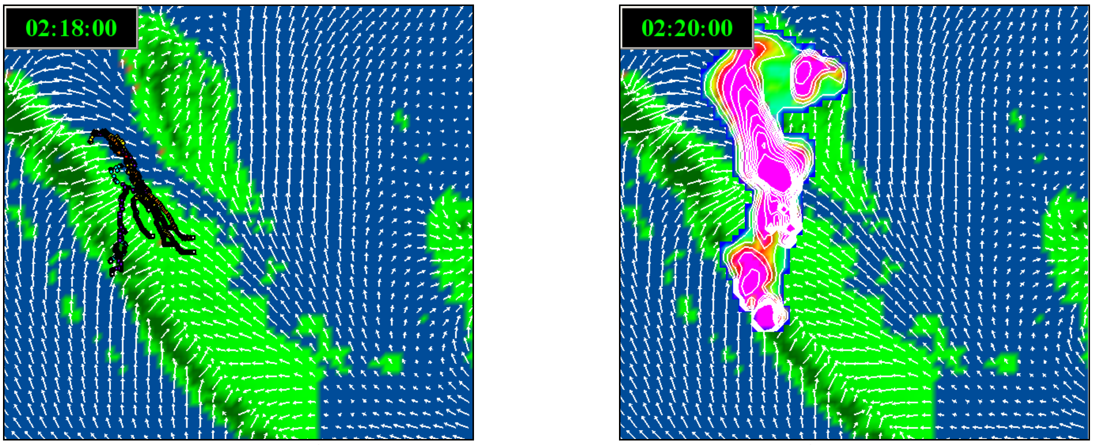


Figure 6a. Smoke Trajectory (left side) and Smoke Concentrate (right side) from some Fires in Padang and Riau - Indonesia

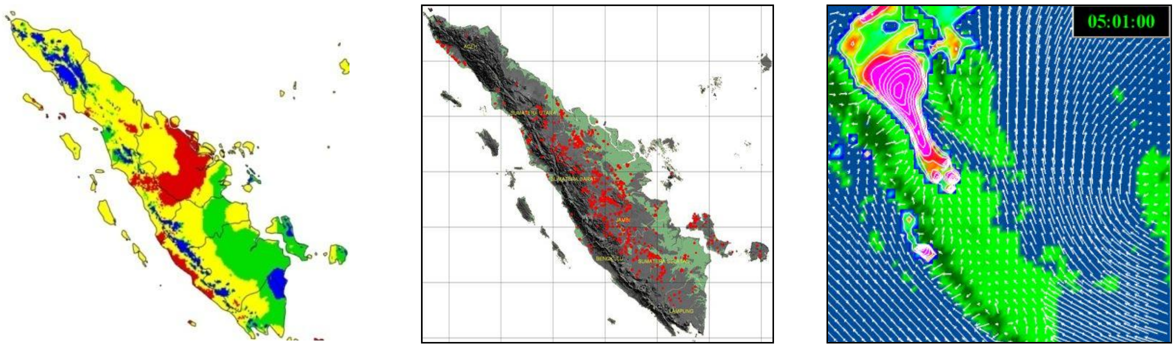


Figure 6b. Combine information between FDRS Index, Hotspot monitoring and Smoke from some Fires in Riau Province-Indonesia

Definition of Danger in Practical Uses

Fire danger base on FWI Indexs (FFMC, ISI and FWI) condition will danger if the danger level increase 2 level. For example : From low to high (Blue to yellow) or from middle to extreme (Green to Red). The other way to define declaration of danger is seven day continuous in high or extreme level.

Fire danger base on DC, the DC condition will danger if the danger level increase 2 level. For example : From low to high (Blue to yellow) or from middle to extreme (Green to Red). The other way to define declaration of danger is thirty days continuous in high or extreme level or there is no significant rainfal after thirty days.

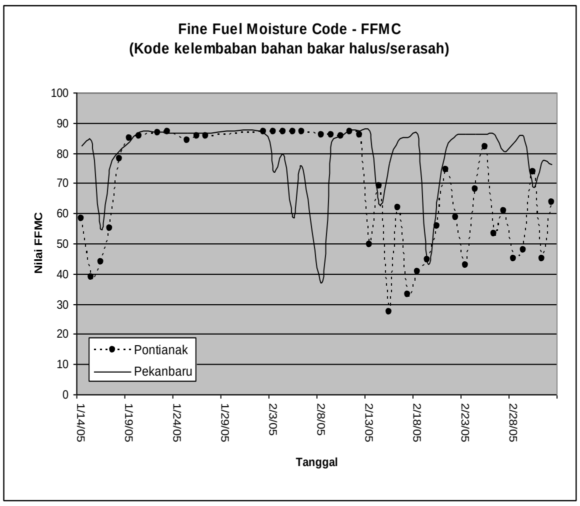


Figure 7. Graph of dangerous condition in Pontianak-West Kalimantan

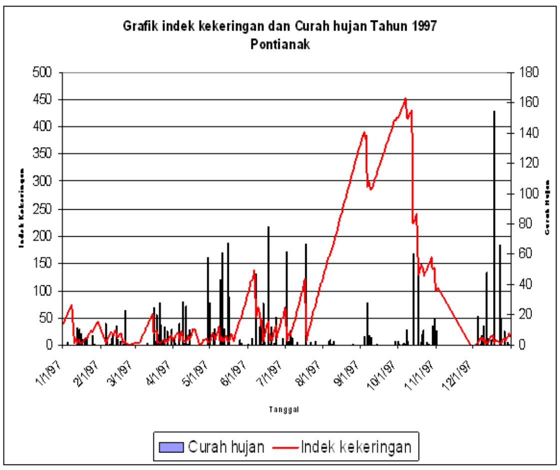


Figure 8. Graph of dangerous condition in Pontianak-West Kalimantan, Redline is DC and blackchart is rainfall.

4. RESULT

4.1. Applications in Fire Management

Since April 2000 with the development of a central FDRS, to focus on the fire prone areas of Kalimantan and Sumatra. The FDRS is being designed to support Indonesian central agencies in monitoring fire conditions and in developing national level actions to support prevention, monitoring and mitigation activities at a provincial level. During the Initiative will involve continued adaptation activities, with a focus on characterizing several fuel types in the Southeast portion of Sumatra, which have been determined to generally represent the main fuels found throughout the fire prone areas in the region. In late 2001, the central-level FDRS adapted and operated electronically and manual lly in two province in Indonesia.

The ongoing development since 1999 of Fire Suppression and Mobilization Plans (FSMP) in Riau Province in Sumatra and in West Kalimantan Province provide an opportunity to introduce FDRS at local levels within an established framework of fire policy, institutions and programs. The FSMP activities are supported by numerous agencies locally (provincial and district forestry, BAPEDALDA, agriculture and civil defence), nationally (forestry and BAPEDAL), and internationally (ASEAN HTTF & RFA, USFS, AUSAID, CIDA, EU, GTZ, etc.). Such widespread support provides the best opportunity for FDRS to be used on a sustained basis following the completion of the FDRS programs.

Earlier 2002 (10th February) begin handover and BMG operate daily Fire Danger Rating System for whole Southeast Asian region (Include Indonesian region) based on daily weather observation. Operations and application of FDRS outputs in Indonesia will also be important activities in year two. For Indonesia, the Meteorology and Geophysical Agency (BMG) is responsible to collect, record and disseminate daily weather information at national and local levels. For this reason, BMG is the preferred agency to operate the FDRS.

Several other FDR system that have linkages to the Indonesia Initiative. Notably, FDRS already adapted and operated with partner agencies in Sabah and Sarawak States of East Malaysia. Activities are also planned with the ASEAN Secretariat to integrate FDRS in the Coordinating and Support Unit (CSU), which monitors and reports progress on the Regional Haze Action Plan (RHAP).

4.2. Collaborators

This a part discusses the involvement of the various Indonesian agencies that could contribute to the FDRS activities. It identifies where the potential for collaboration exists with and between the agencies in national level (Indonesia). The roles and relationships in this scenario are described. Finally, a review is provided of current land and forest protection activities, especially those with a danger rating or early warning component.

The Indonesian Meteorological and Geophysical Agency (BMG) will be requested to supply meteorological data. When the project is able to expand with further commitments, meteorological data from other agencies will be requested for ASEAN level. Agencies with vegetation inventory data within Indonesia are the Ministry of Forestry (MOF), BAKOSURTANAL, LAPAN, and Ministry of Agriculture. Fuels data is more complex as no one agency is tasked with collection of comprehensive vegetation inventory that could be used for identification of fuel types. Instead fuel maps have to be derived from the most suitable available sources. These sources include forest inventory, collected and maintained by agencies responsible for forest management and land use maps that classify agricultural crops and cleared land. Land use maps may be available from such diverse agencies as those responsible for land management, agriculture and the environment. Remote sensing agencies also have been commissioned by these agencies to prepare comprehensive land inventories from satellite imagery.

Collaborating agencies will be expected to provide personnel to participate in the technical design and implementation of the FDRS. These personnel and others will also be trained in operation of the system. A wider group of users of the FDRS outputs will be trained in how to access and interpret these outputs. As this group will experience annual staff turnover we also plan to train a core group who will be able to deliver training on a continuing basis after completion of the initial work.

FDRS has been identified as an important component in the Sumatra forest fire authorities. A Fire Surveillance Pilot Project in Riau Province, Sumatra was aimed to establish a real-time early detection system of fires, monitor fire distribution and spread, install new communications equipment, provide quick and accurate fire information to agencies, and use early detection to suppress high-risk fires. Recommendations of this activity include the use of FDRS with AVHRR hot spot data from Ministry of Forestry to determine aerial detection schedules and routing. The FDRS would incorporate real-time climate and fuel information to determine areas of fire risk. The FDRS would reduce the costs of the aerial surveillance operations. Cooperation between the FDRS programs and the Sumatra RFA will help in achieving a common objective while sharing in the resources.

During developing forest fire early warning system, there some donor countries help Indonesia with different system. GTZ and JICA projects have concentrated on using easily accessible and current remote sensing methods, based on NOAA AVHRR data, to identify fire locations based on surface temperature. The European Union Forest Fire Prevention and Control project is also located in Sumatra, at Palembang. This project has focused on use of forest related information as the basis for improved forest management. CIDA project concentrate FDR calculation base on weather data, Fire Management Advisors, Fire surveillance project in Riau Province and Regional fire fighting inventory & analysis. All projects in Indonesia are working with the MoF. Other agencies especially BAPEDAL, BMG, BPPT and LAPAN which are involved with collection, analysis and dissemination of fire information.

4.3. Future Developments (eg. Data needs, planned improvements, etc.)

To increase capacity building and reduce the forest fire and their impact, we try to socialize and continuos disseminate the FDR information. We should translate FDR information from the tehnical language into local and practical languages. We hope they will understand and care to the fire and their impacts. Fire manager, peoples, goverment and private company should be work together, same understanding about fires and has a periodically disscuss forum. Base on local knowledge difficult to stop the forest fire because economical reason, but we can minimize the fire and impact.

The important thing in forest fire are smoke and fuel condition, because the fire weather index information already in place. We hope there is one integration system about the forest fires, since 1990 there so many project and activities related to the forest fires. We need the complete system about FDR, start from the database system, processing unit, regulation, human resources, FDR distribution system, high technology and fire stakeholder.

5. CONCLUSIONS

The Indonesian Fire Danger Rating Systems develope to support the most important and relevant types of decisions that managers face when addressing fires in the national and regional. The types of decisions are anticipated to include: land use activity and regulation; fire prevention activities; fire suppression resources planning and allocation; daily incident response and mitigate of fire.

The FDR system began in Indonesia with a central system, which focuses on the fire prone areas of Kalimantan and Sumatra. The FDRS support Indonesian central agencies in monitoring fire conditions and in developing national level actions to support prevention, monitoring and mitigation activities at a provincial level. The FDRS also adapted and operated in two provinces in Indonesia, Sumatra (Riau) and in Kalimantan (West Kalimantan).

Indonesia has increased public-awareness activities, and stepped up detection activities as preventative actions taken to decrease occurrence of wildfires in Indonesia. Situation notification is relayed to relevant agencies and companies. Monitoring actions include providing daily indicators of fire hazards, critical for planning aerial surveillance and pre-suppression activities and enforcement. Mitigation efforts are effective, thanks to positioning resources where more fires are expected, determination of resource requirements based on potential severity of fire, and coordination of resources of relevant agencies and companies.

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