OPERATIONAL FDR IN MALAYSIA AND ASSOCIATION OF SOUTHEAST ASIA NATIONS

AHMAD ZAKI MOHAMAD SAAD
Malaysian Meteorological Department

Contents

- Introduction
- Fire Weather Index System (FWI)
- FDRS Operation
- Output of Malaysian & South East Asia FDRS
- Achievement
- The Analyses on FDRS product

Introduction

- Forest Fire and Haze Episode of 1997/98 has effected:
  - Tourism
  - Health of the people
  - Transport
  - Sport & Education

- National & Regional Responses/ Actions

Kuala Lumpur During Haze Episode in 1997

Haze Condition in 2006

Background

- The Association of Southeast Asian Nations (ASEAN) approved the need for an early warning system in the Regional Haze Action Plan (RHAP) in 1998 to prevent forest fires and the resulting haze through improved management policies and enforcements.
- One of the proposed systems for implementation as part of the RHAP is **Fire Danger Rating System (FDRS).**
- FDRS is the tool that measures risk of fires starting and spreading.

REGIONAL RESPONSE

- One of the regional response is the establishment of SEA FDRS

- Collaboration between Canadian International Development Agency (CIDA) and South East Asian Countries with Canadian forest Service (CFS) as an Executing agency

- This programme was first started in Indonesia

- In Malaysia:

MMD, MACRES, BOMBA, DOE, Forestry Department and UPM etc.

Malaysia Action Plan

Various Departments are mobilized

Malaysian Meteorological Department (MMD) provides:

- Location of forest fires (Hot Spots)
- Prevailing and predicted weather conditions
- Cloud Seeding Operation (if needed)

Department of Environment (DOE) provides information on air quality and haze, bans open burning and enforcement

Malaysian Remote Sensing Department (MACRES) provides relevant remotely sensed data/ information

The Cloud Seeding Operation

PURPOSE

The purpose of FDRS is to protect life and property, serve as a fire danger monitoring, fire behaviour prediction, preparedness planning and as a guide to the policy makers.

FDRS EXPECTATION

- The FDRS output can be used by many related agencies related to forest fire and the environment e.g. Fire Department, DOE, Agricultural Community, MMD, Forestry Department and Logging company to take mitigating and preventive action such as:

  - fire suppression resources planning and allocation,
  - mobilizing their fire-combating machineries and manpower,
  - imposing ban on open burning for high risk areas
  - take remedial action such as carry out cloud seeding operation in fire prone areas.
  - Proper planning for agriculture plot preparation

MMD decided to initiate FDRS because

- There is a need
- It is simple and easy to use
- Weather variables are available
- Climate information/data be used extensively
- GIS (ArcView software) is available

FIRE WEATHER INDEX (FWI) SYSTEM

The two most basic and important modules of the FDRS are Weather Module and FWI system.

- The Weather module is meant to handle weather data access, interpolation and basic SFMS functionality.

- The FWI system:
  - Based on a mass of empirical data collected linking weather, fuel moisture and fire behaviour;
  - Rely on a continuous weather record ;
  - Can also be used with forecasted weather values to yield a forecast of fire danger and this is particularly important in pre suppression planning;
  - Critical tools which can be used for assessing forest/vegetation fire potential.

The FWI System can be explained in two different concept:-

Fuel Moisture Concept, and
Fire Behaviour Concept

Fuel Moisture Concept

FWI system tracks the moisture content of 3 types of forest floor materials or fuels that have different drying rates: Surface litter, loosely compacted duff and deep compact organic layers. This fuels are thought to be most critical to fire behaviour.

Three Codes which represent this concept are:-

- Fine Fuel Moisture Codes (FFMC)-represent relationship of moisture content and ease of ignition
- Duff Moisture Code (DMC) –represent relationship of moisture content and the flammability of the duff layer
- Drought Code (DC) – represent relationship of Moisture content and how its is an indicator of seasonal drought.

Fire Behaviour Concept

The FWI system also reflect current fire potential in relation with fire environment that consist of the surrounding condition, influences and modifying forces of topography, fuels and weather that determine fire behaviour.

Three indices which represent this concept are:-

- Initial Spread Index (ISI) – is a numerical rating of relative fire spread without the effect of slope or fuel consumption.

- Build Up Index (BUI) - provides numerical rating of the amount of fuel available for combustion.

- Fire Weather Index (FWI) – is a numerical rating of fire intensity. It is suitable as a general index of fire danger through out the forested area in the region.

Fire Danger is the ability of a fire to start, spread and do damage.

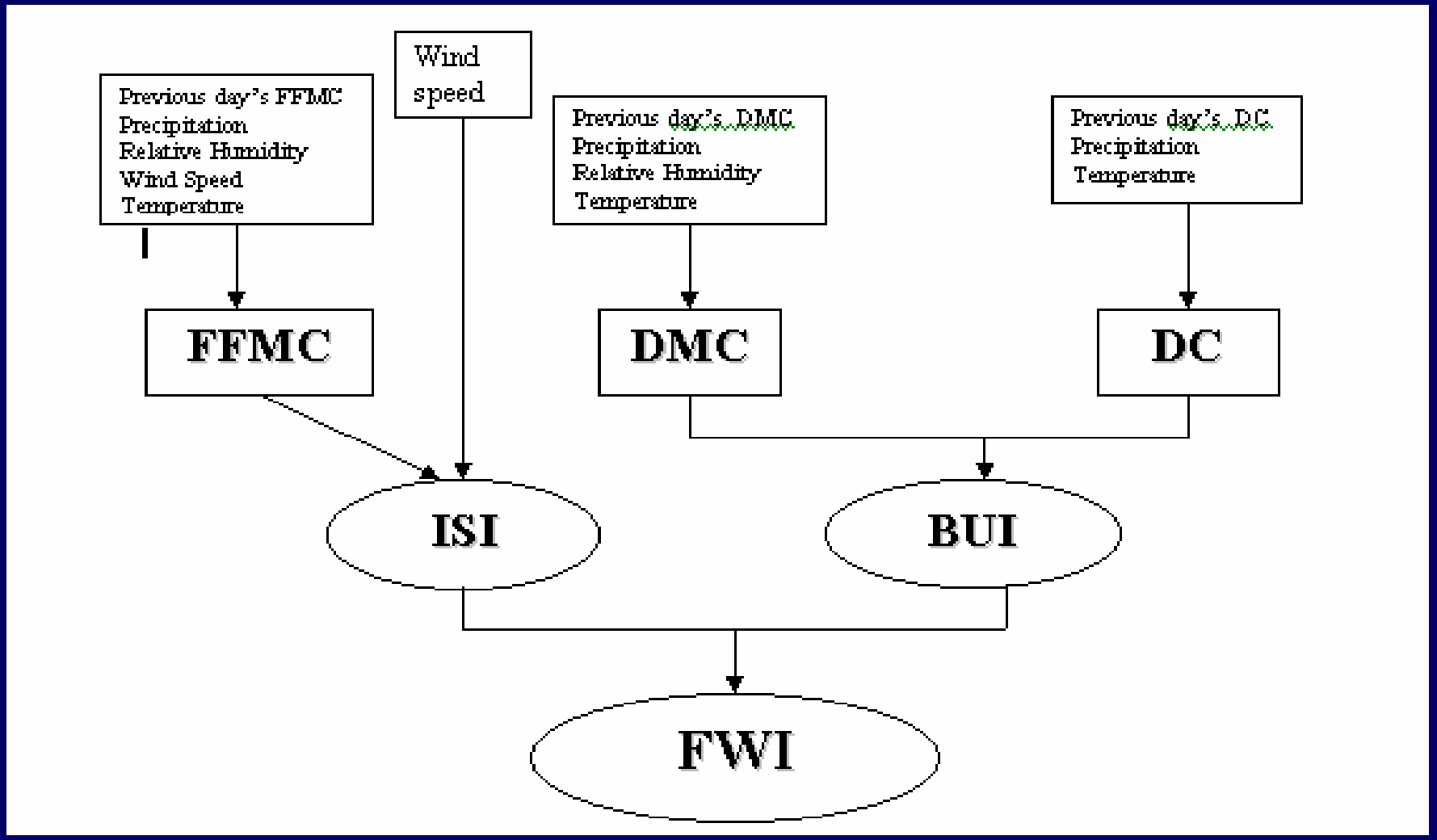
FWI SYSTEM

Fire Weather Observation

Fuel Moisture Codes

Fire Behaviour Indices

Fire Danger



What is Spatial Fire Management System (SFMS)

- Fire Management information and display system.
- A software that integrate fire science model into a geographic information system. (GIS Platform - ArcView)
- A system that consists of a set of interdependent modules.

The Data

- The Weather data for Malaysia FDRS is collected from all MMD main stations from all over the country
- Beginning from October 2003, MMD also generates similar FDRS products for the South East Asian region. They are based on weather data received from meteorological stations in the region that are made available on the GTS.

Daily weather is retrieved along with weather station locations to generate a point shape file. The weather (and possibly Fire Weather Index) grids are then generated using this shape file.

The FDRS Operation

- At present the National Fire Danger Rating System is running operationally in MMD and the output of this system is being displayed on MMD website since February 2003.

- Beside running the National FDRS which is known as Malaysian FDRS, MMD is also running the Regional FDRS known as Southeast Asia Fire Danger Rating System (SEA FDRS).

- Initially, Canada Forestry Service (CFS),which is the executing agency appointed by CIDA to implement this project in SEA region has been running the SEA FDRS from EDMONTON, Canada.

- In September 2003, CFS has asked the MMD to take over the responsibility by running the SEA FDRS operationally from MMD Headquarters.

Malaysian Meteorological Dept.

Monitoring Stations

- 36 Principal Meteorological Stations
- 154 Climate/Auxiliary/Rainfall Stations
- 22 Air Pollution Monitoring Station
- 10 Radar Station
- 8 Upper Air Station
- 6 Satellite Data Receiving Station
- 165 Agrometeorological Station
- 8 Seismological Station
- 3 Atmospheric Ozone Monitoring Station
- 69 Automatic Weather Station (AWS)

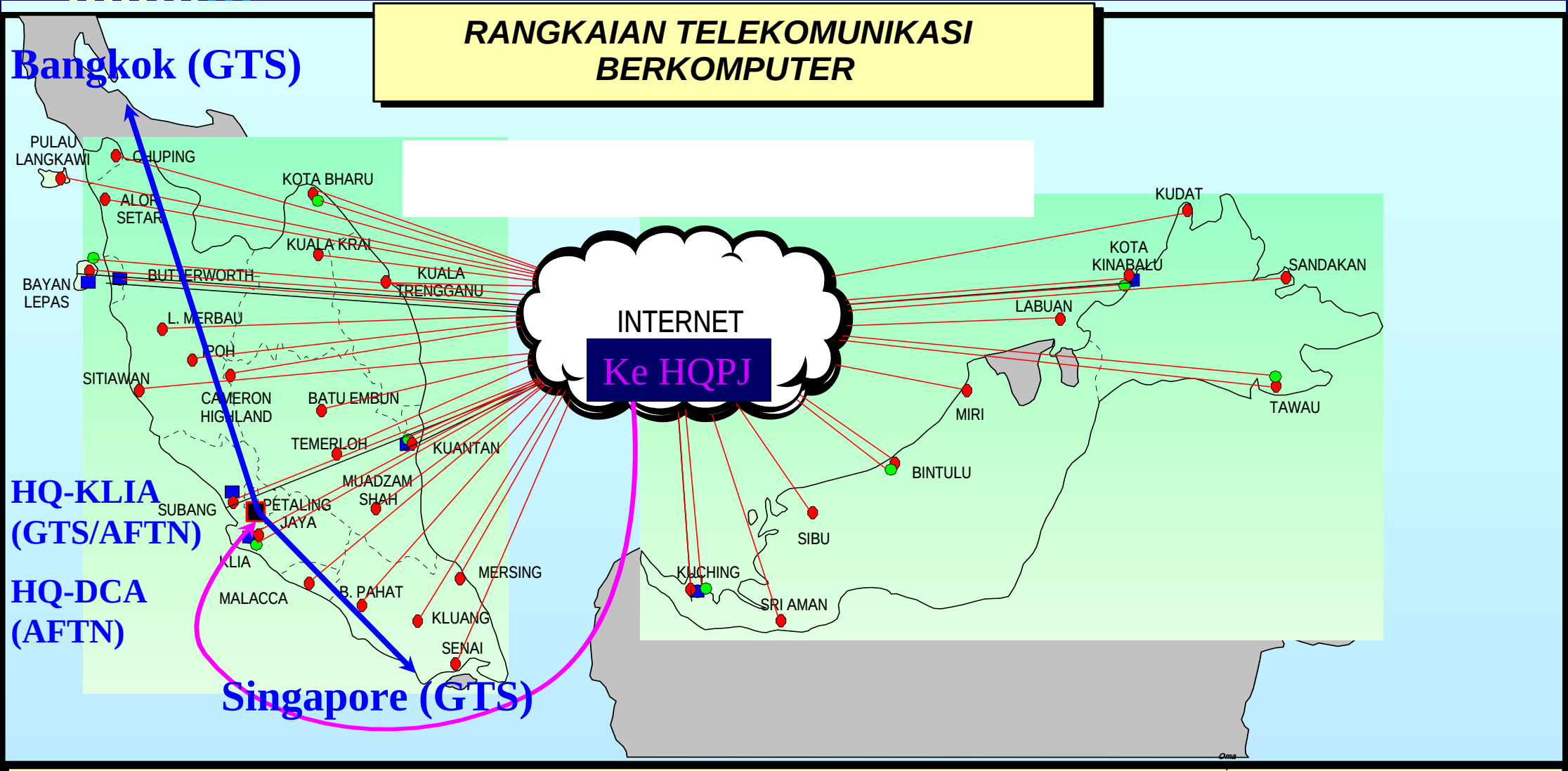
METEOROLOGICAL STATION

UPPER AIR STATION

RADAR STATION

SATELITE STATION

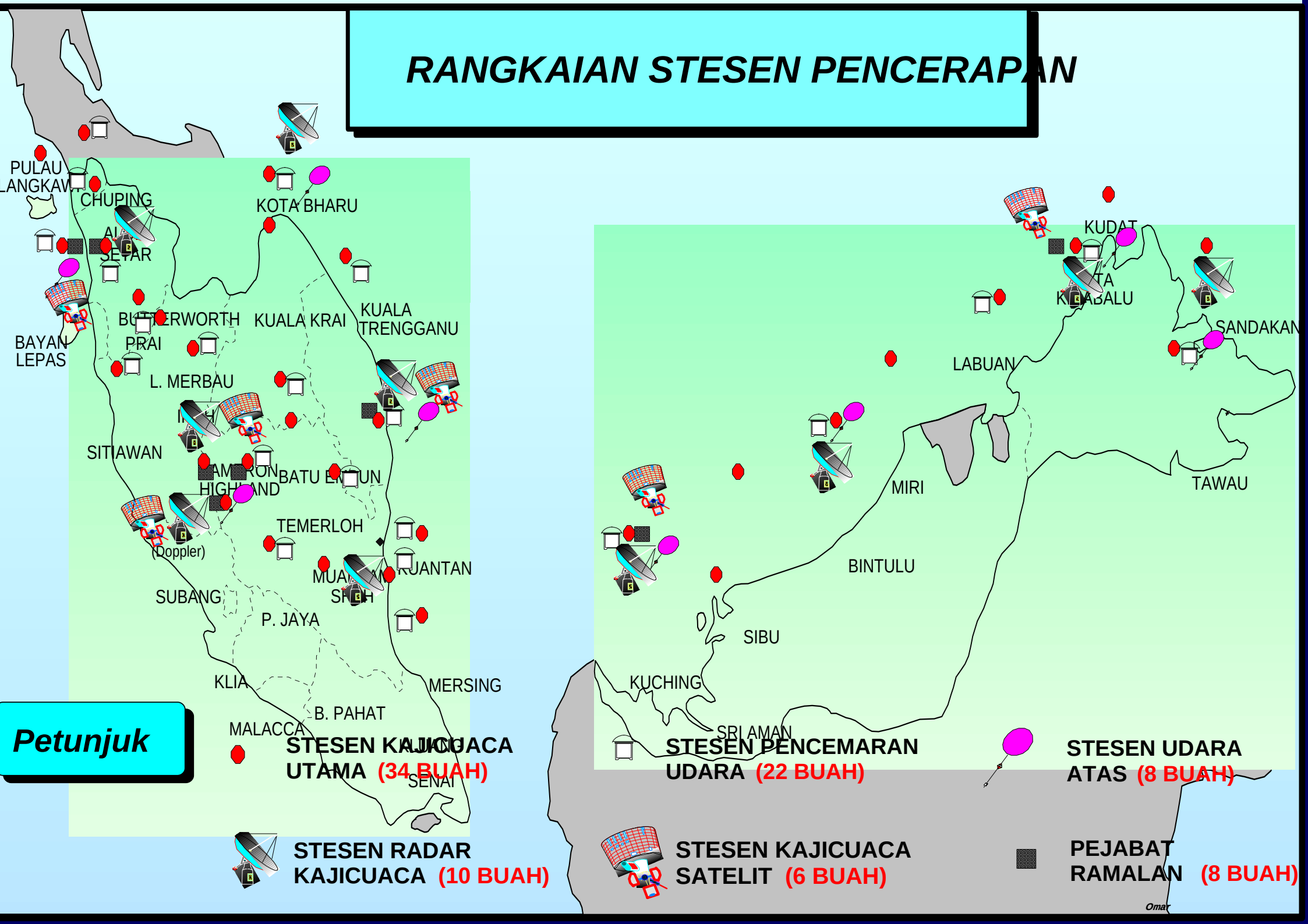
RANGKAIAN TELEKOMUNIKASI BERKOMPUTER



Petunjuk

- PUSAT TELEKOMUNIKASI
- PEJABAT RAMALAN
- STESEN KAJICUACA UTAMA
- STESEN UDARA ATAS

RANGKAIAN STESEN PENCERAPAN



Petunjuk

STESEN KAJICUACA UTAMA (34 BUAH)

STESEN PENCEMARAN UDARA (22 BUAH)

STESEN UDARA ATAS (8 BUAH)

STESEN RADAR KAJICUACA (10 BUAH)

STESEN KAJICUACA SATELIT (6 BUAH)

PEJABAT RAMALAN (8 BUAH)

Omar

Continue…

The FDRS Operation

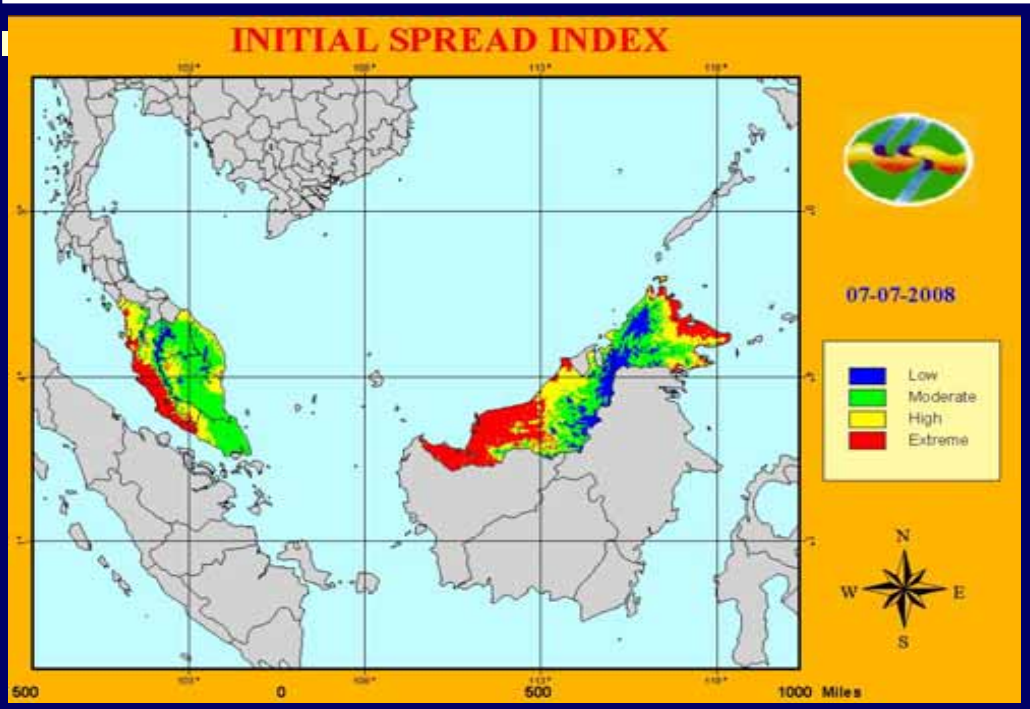
- A team of six people involve in this operation, each person will have to work according to their monthly roster.

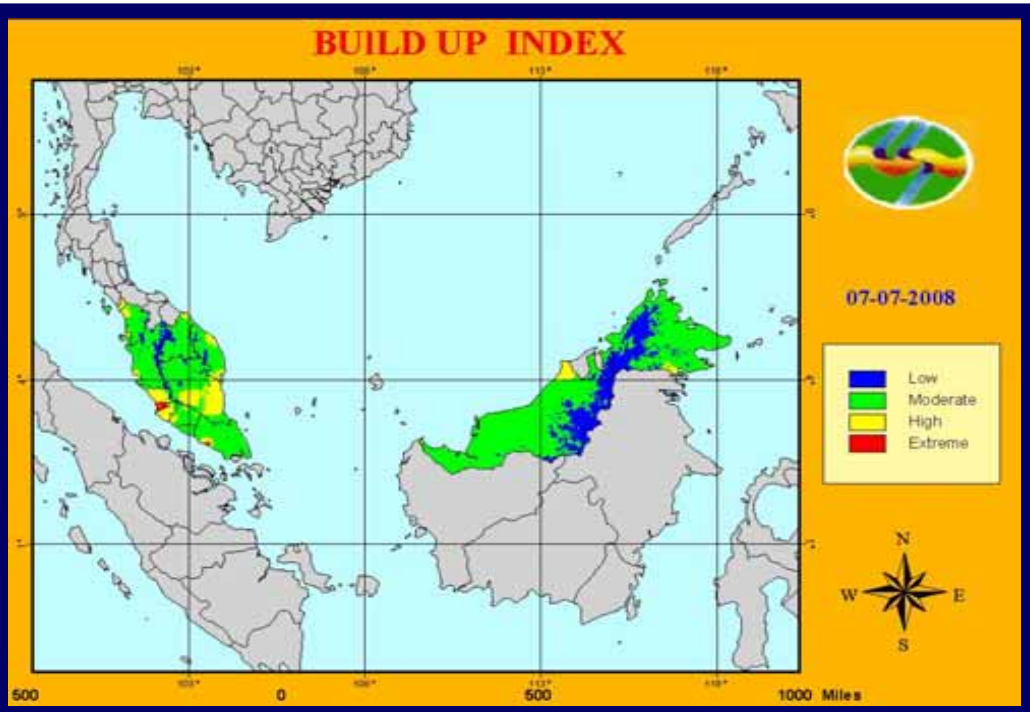
- We will run SEA FDRS at 0030 UTC when all the weather data of SEA region has been collected. Just before 0300 UTC, the products will be displayed on the MMD website.

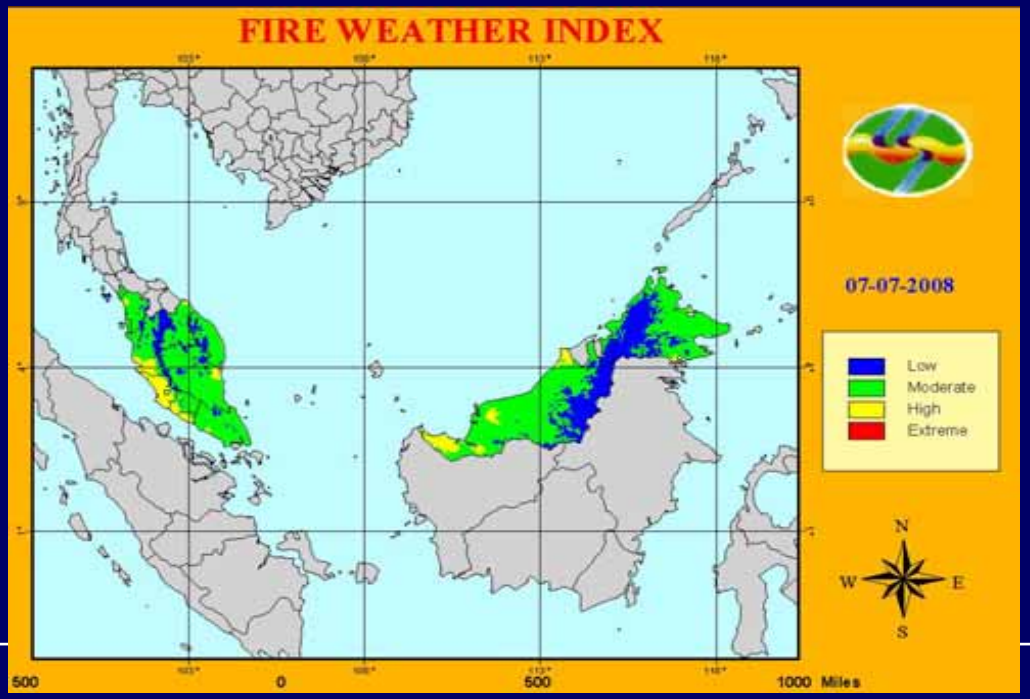
- At 0630 UTC, when all the Malaysian data goes into the MMD database, Malaysian FDRS will be generated and before 0830 UTC, the product will be displayed on the web.

- So far the system has been running smoothly and has produced useful products.

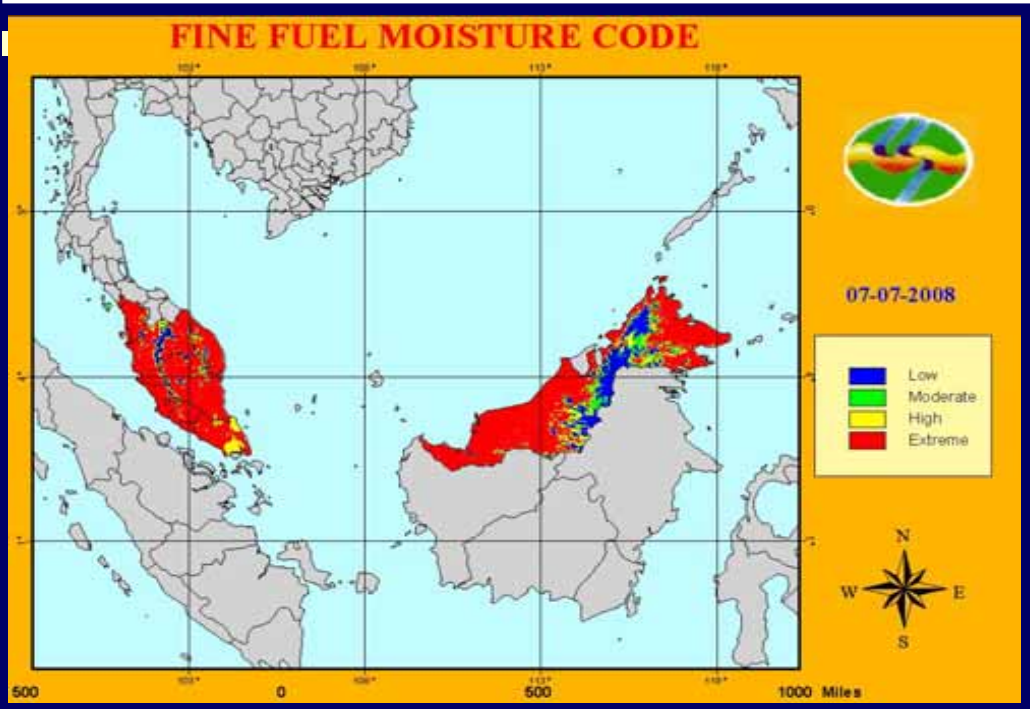
The Product of Malaysian and Southeast Asia FDRS

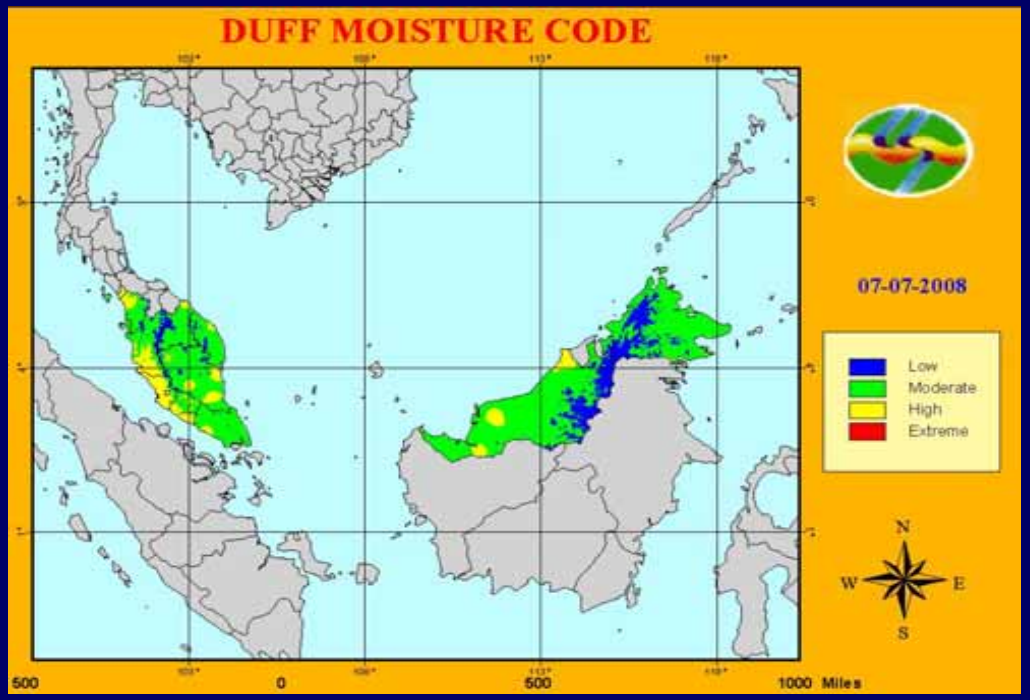


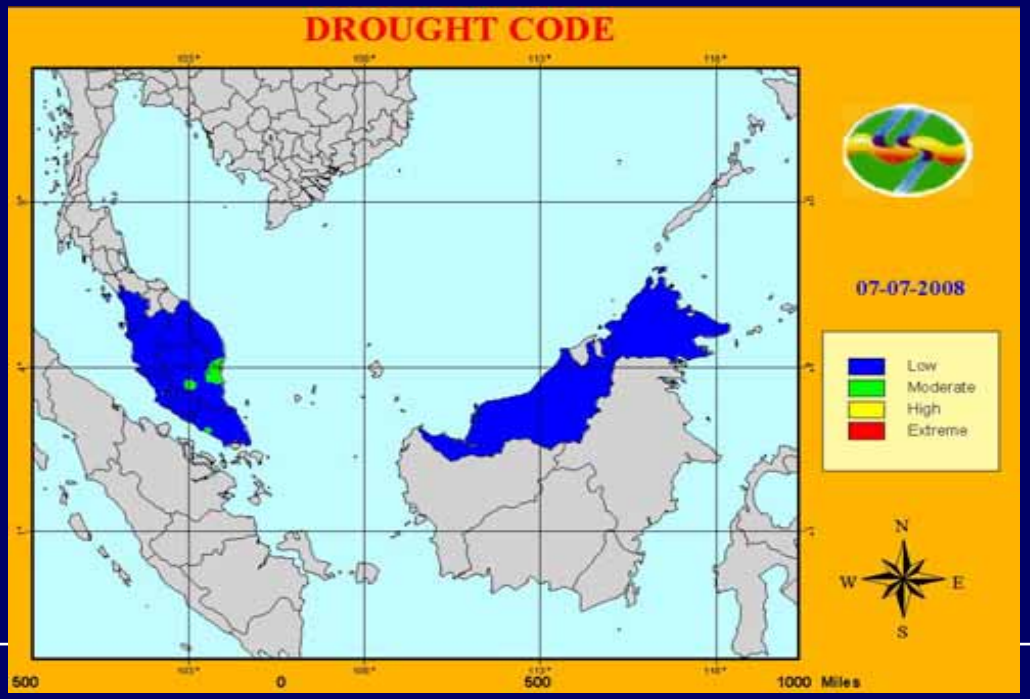




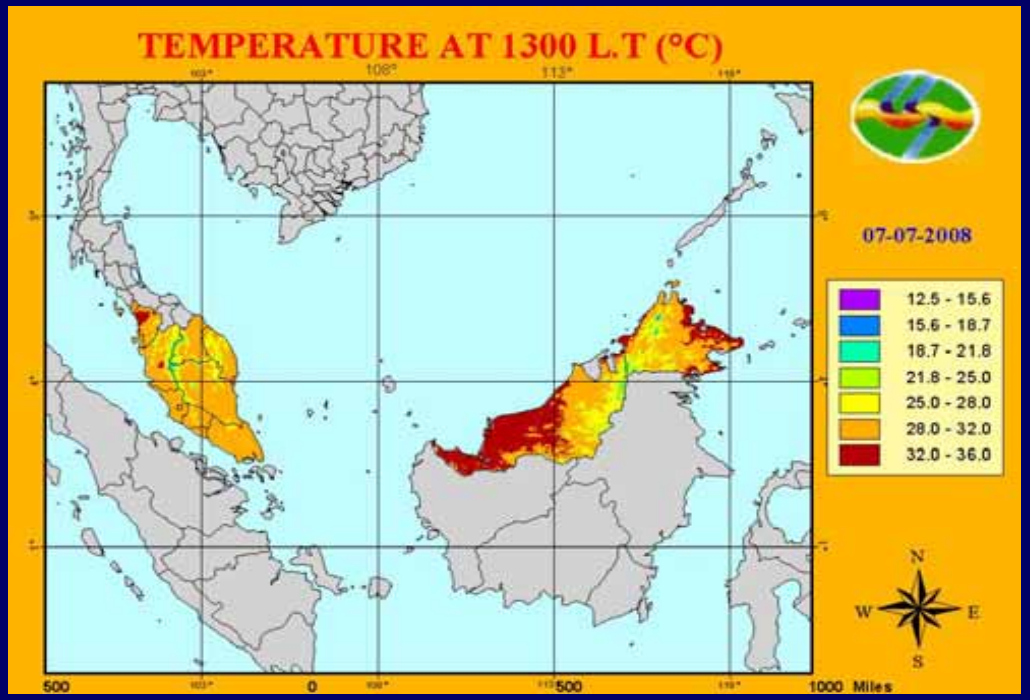
Malaysian BUI, ISI and FWI

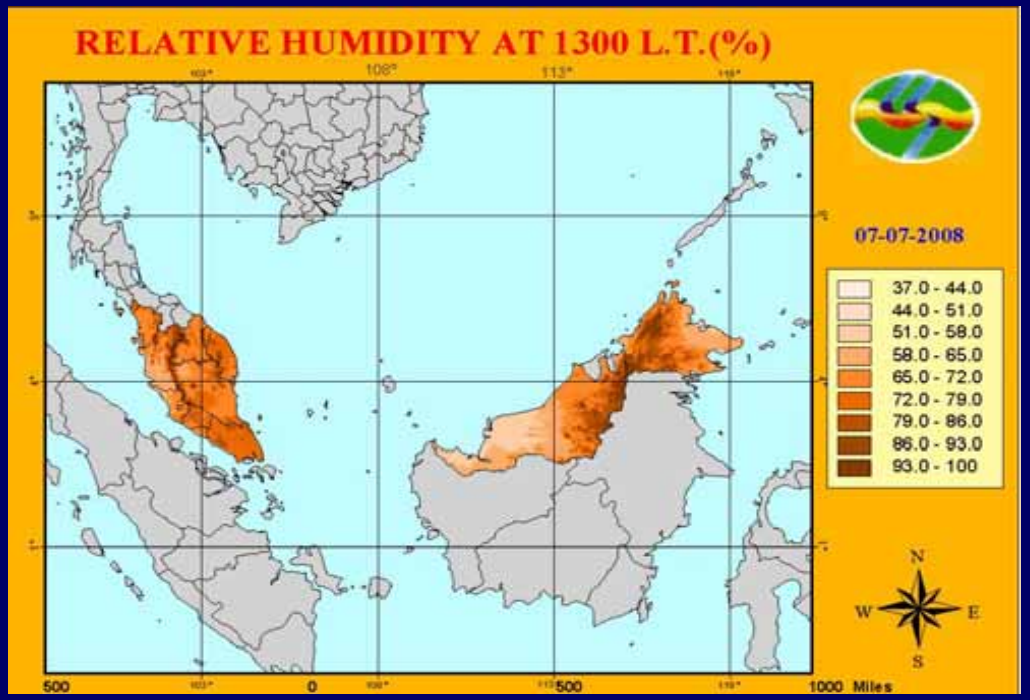




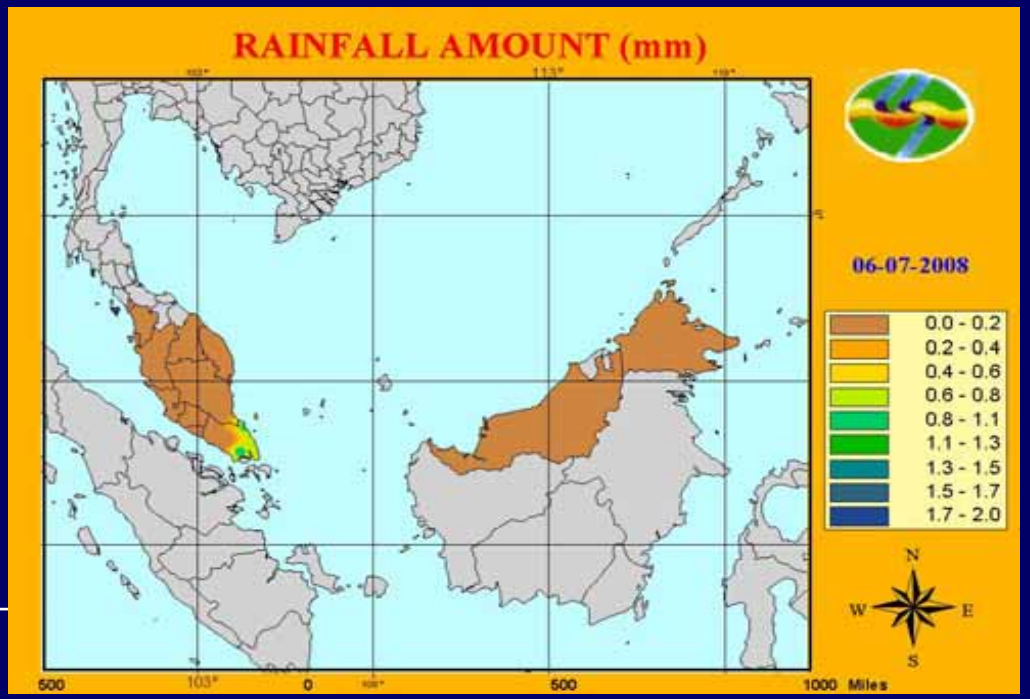


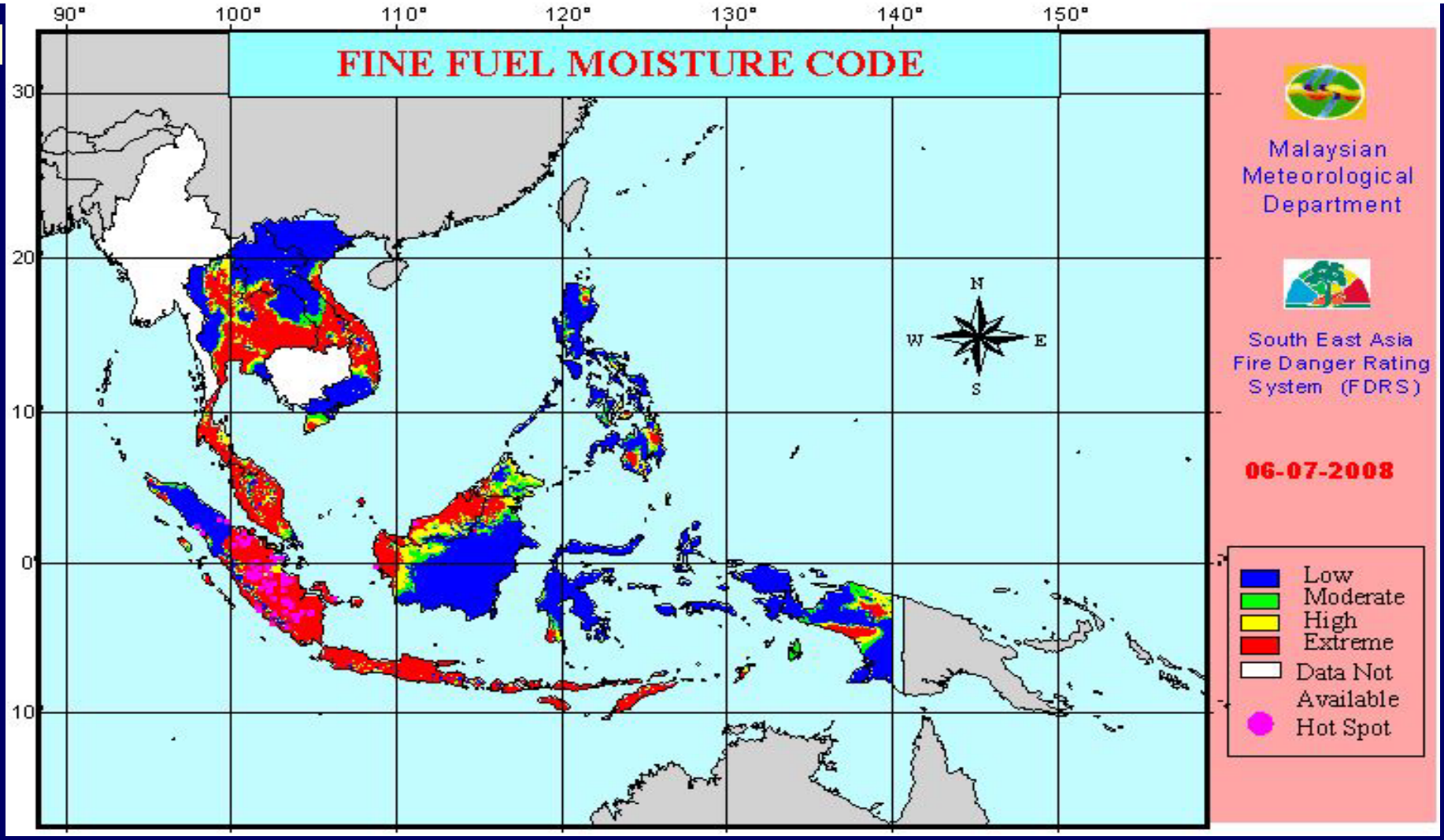
Malaysian FFMC, DMC and DC



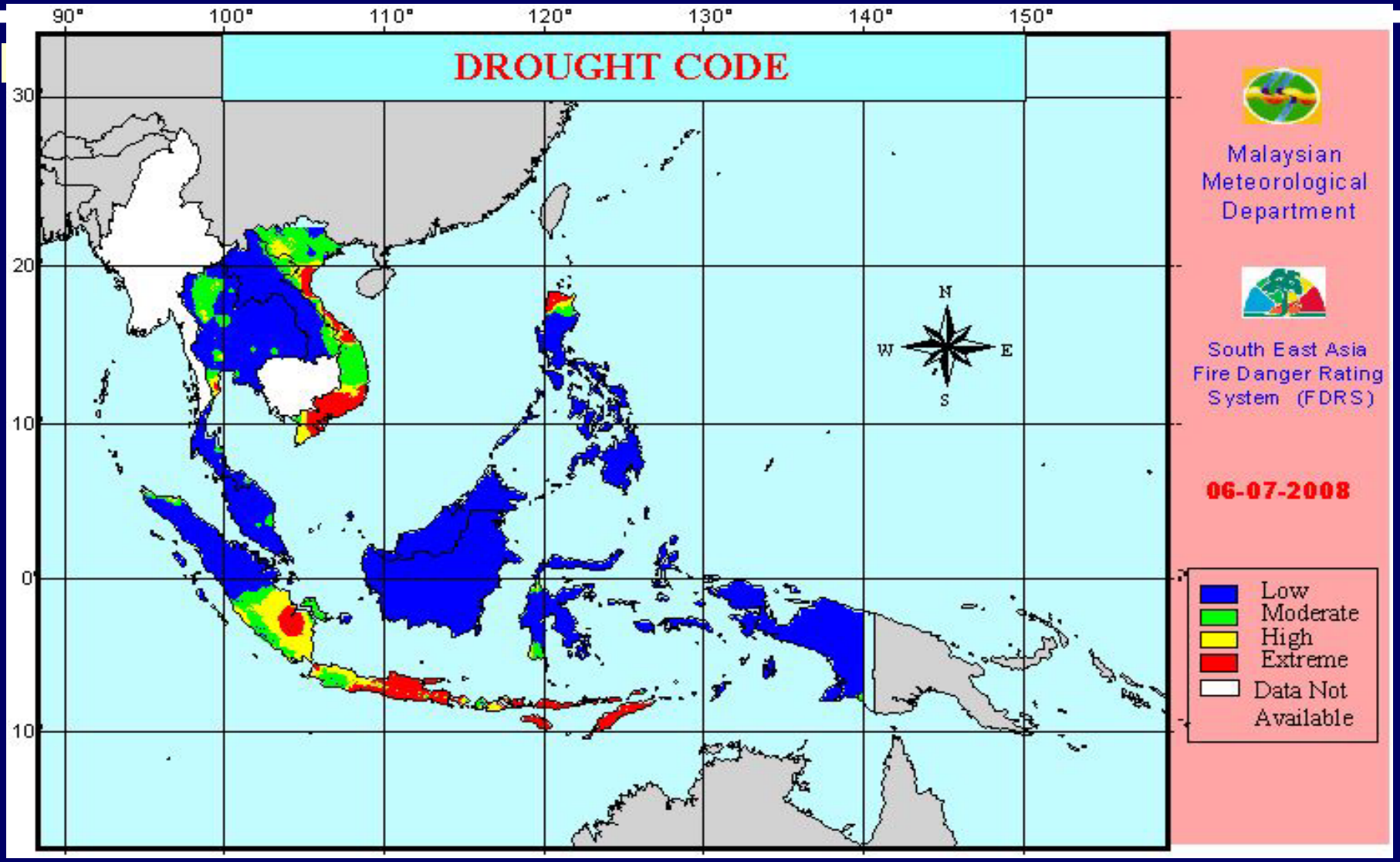


Malaysian Temp., RH And Rainfall Map

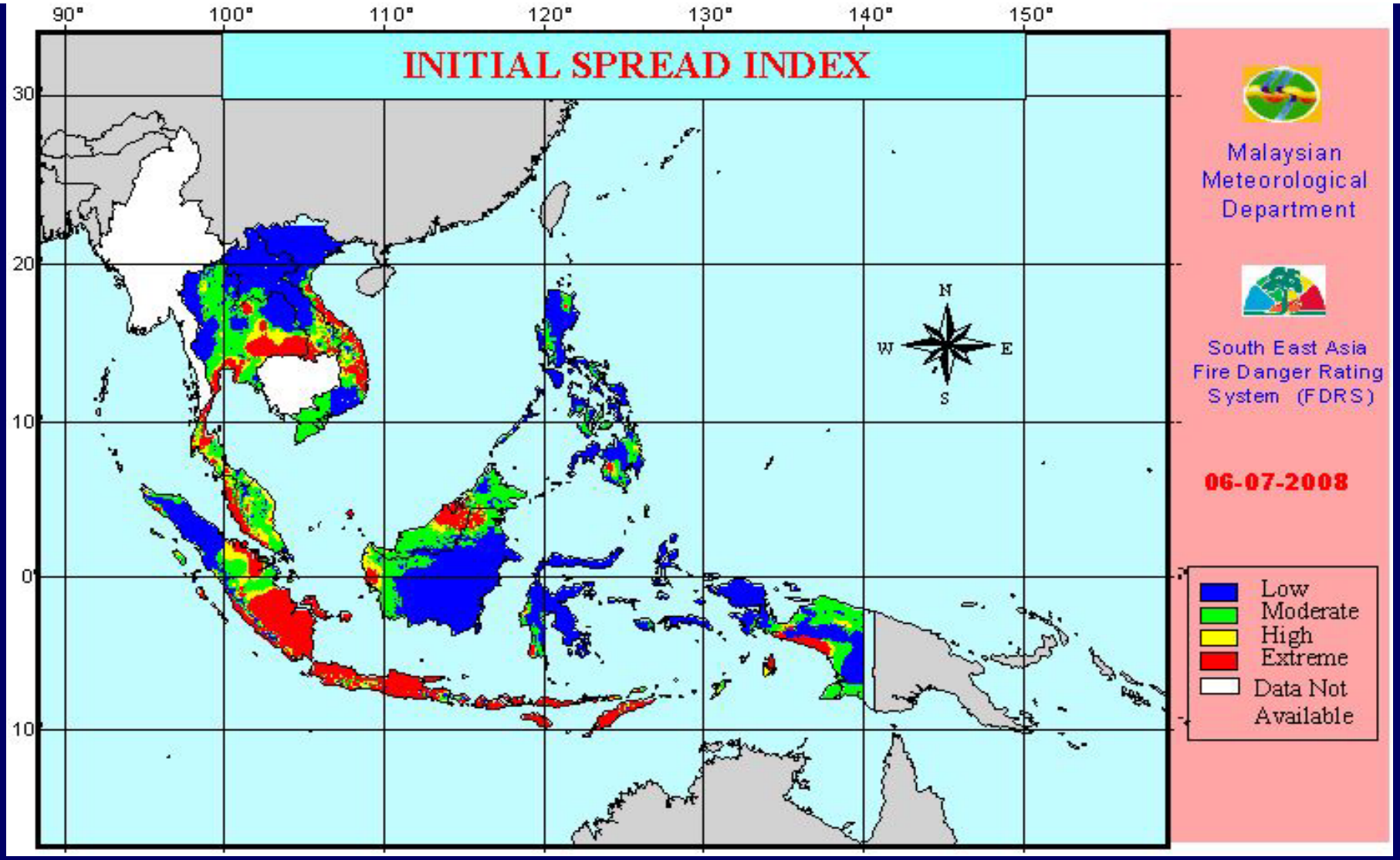




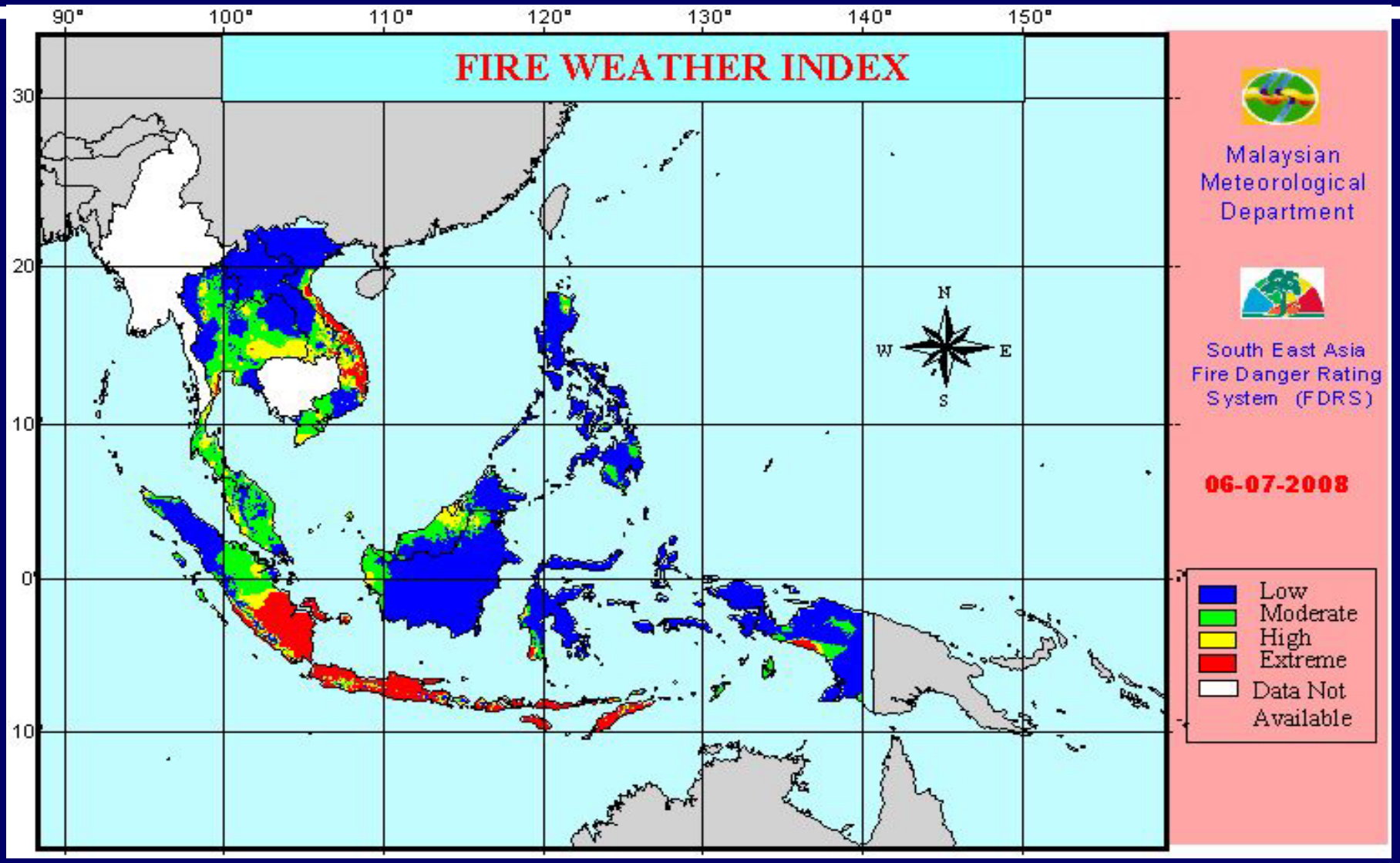
- **Low** - Fine fuel not inflammable.
- **Moderate** - Fine fuel is moderately inflammable. Ignition may occur in grassland and slash fuel groups.
- **High** - Fine fuel will easily ignite, potentially resulting in many fires.
- **Extreme** - Fine fuel including open forest will ignite extremely easily, potentially resulting in many fires.



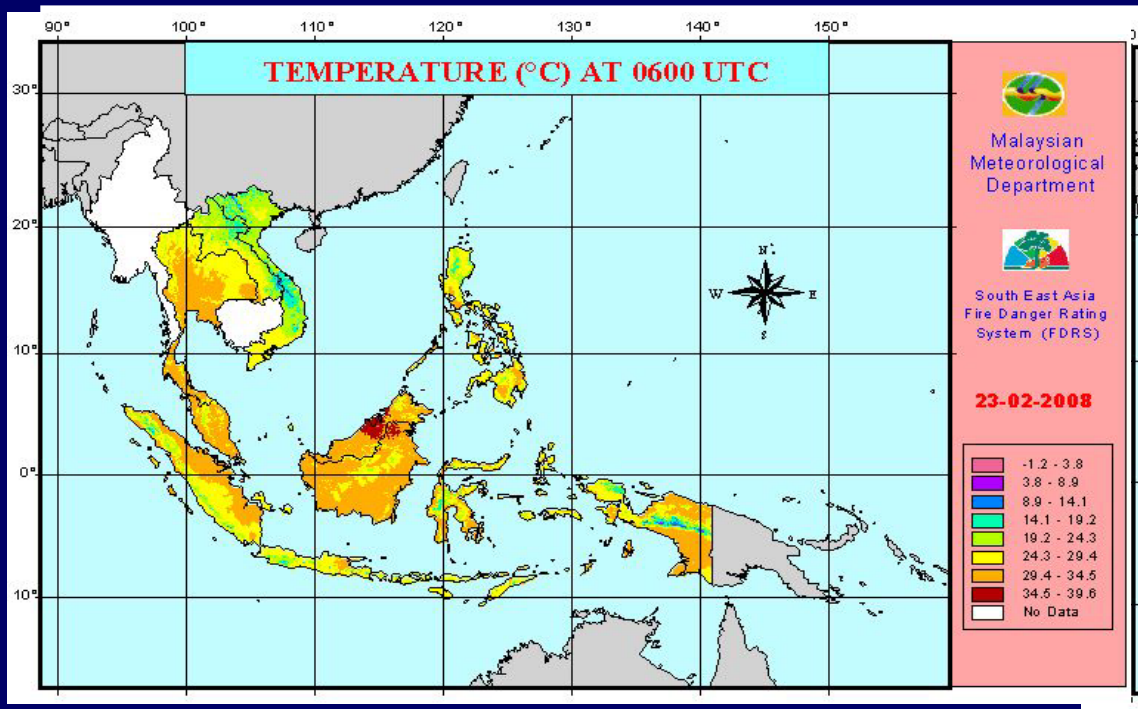
- **Low** - Ground fires in peat soils are unlikely
- **Moderate** - Persistent smouldering in peat soils is possible
- **High** - Persistent smouldering could occur in peat soils.
- **Extreme** - Deep and long-burning fires. High probability of severe haze occurring within about two weeks. Burning should not be permitted when the numerical rating value is above 400.

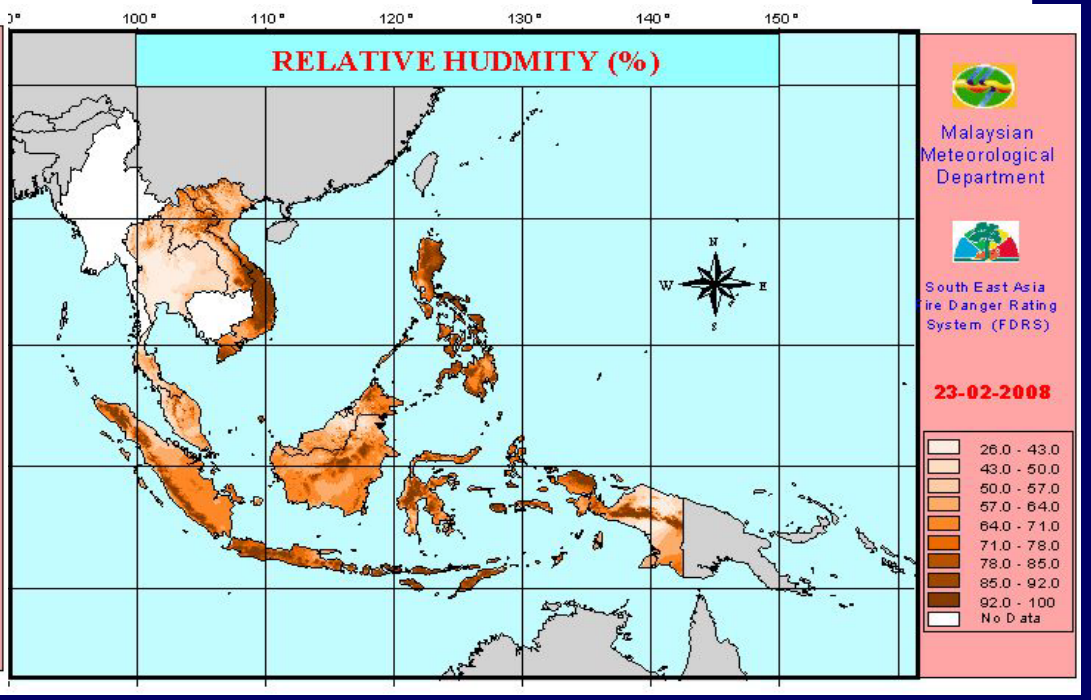


- **Low** - No fire spread/ slow fire spread shortly after ignition.
- **Moderate** - A moderate rate of fire spread shortly after ignition.
- **High** - High rate of fire spread shortly after ignition.
- **Extreme** - Fire rate of spread is extremely rapid shortly after ignition.

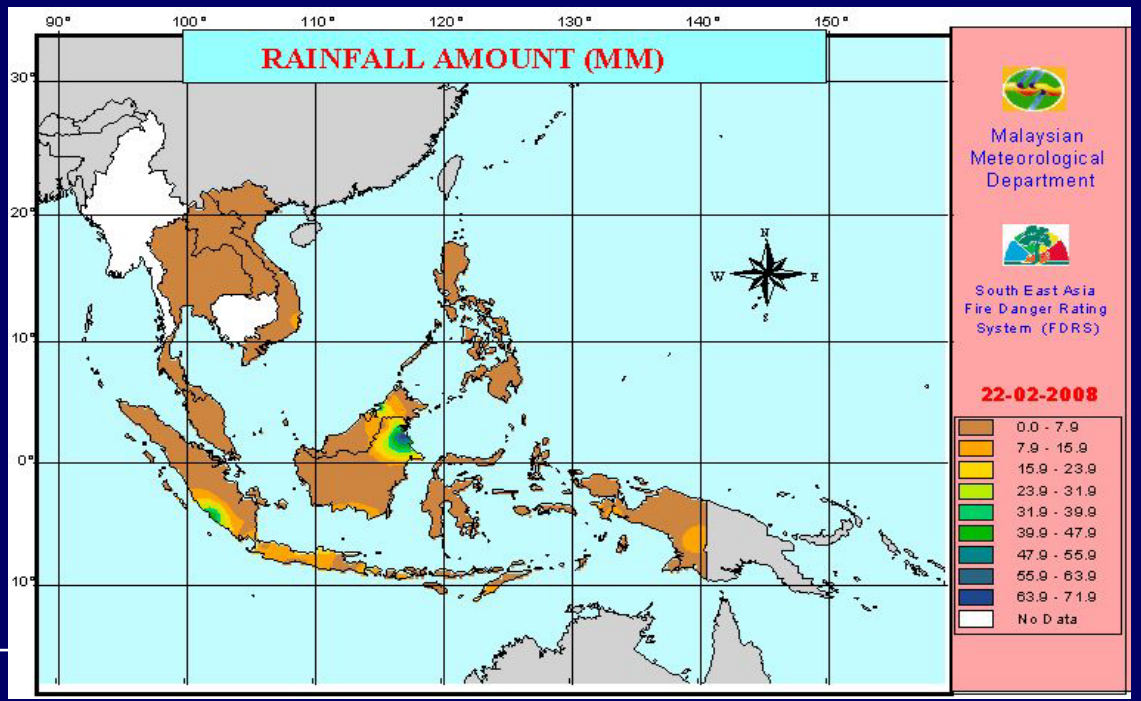


- **Low** - Low level fire intensity and they are usually isolated, short duration and do not spread much beyond their point of origin.
- **Moderate -** Potentially moderate level of fire intensity. Fires may be more common, and periods of burning can be longer in duration and fire may cover a greater spatial extent. Control of these fires is easy.
- **High** - Potentially high level of fire intensity. Periods of burning are potentially longer in duration and area of burning cover a greater spatial extent. Both moderate and high intensity fires can occur. Control of fires could be difficult.
- **Extreme** - Potentially extreme level of fire intensity. Severe drought conditions and dangerous burning condition exist. High intensity fires can occur.





SEA Temp., RH And Rainfall Map



Key Assumption and Limitation of the FWI System

- Based on an empirical data
- Only account for weather influences on fire potential
- Assume level terrain
- Uses a single point observation,
- Based on single daily observation time. The daily standard FWI system values represent the mid afternoon peak of fire danger.
- The numerical value are relative and are no units.
- About 20% minimum changes in value is required to see a recognizable different in fire behaviour.

Daily Variation

One basic assumption in the system:-

The component weather elements follow a more or less average diurnal pattern. If the weather suddenly change (e.g: wind picks up, wind calms, precipitation starts after the readings are taken) The values generated from the 1200h LST reading may no longer reflect the current fire potential.

In these cases, new weather observation may be taken and new codes and indices calculated to better reflect the current fire potential.

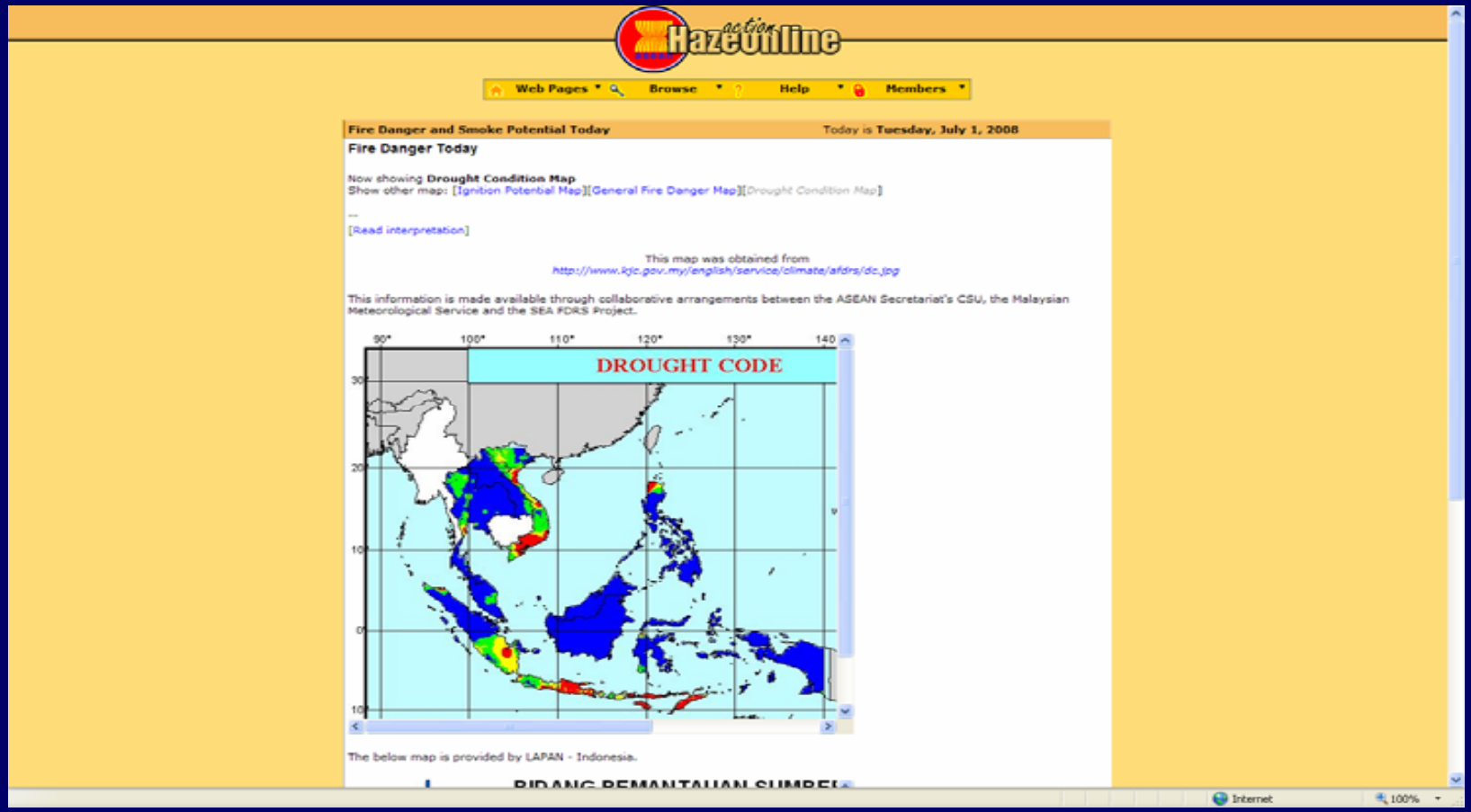
Achievement

- The Malaysian FDRS has been running operationally since January 2003 and SEA FDRS since October 2003 and the products of the system are made available on MMD website at http://www.met.gov.my .

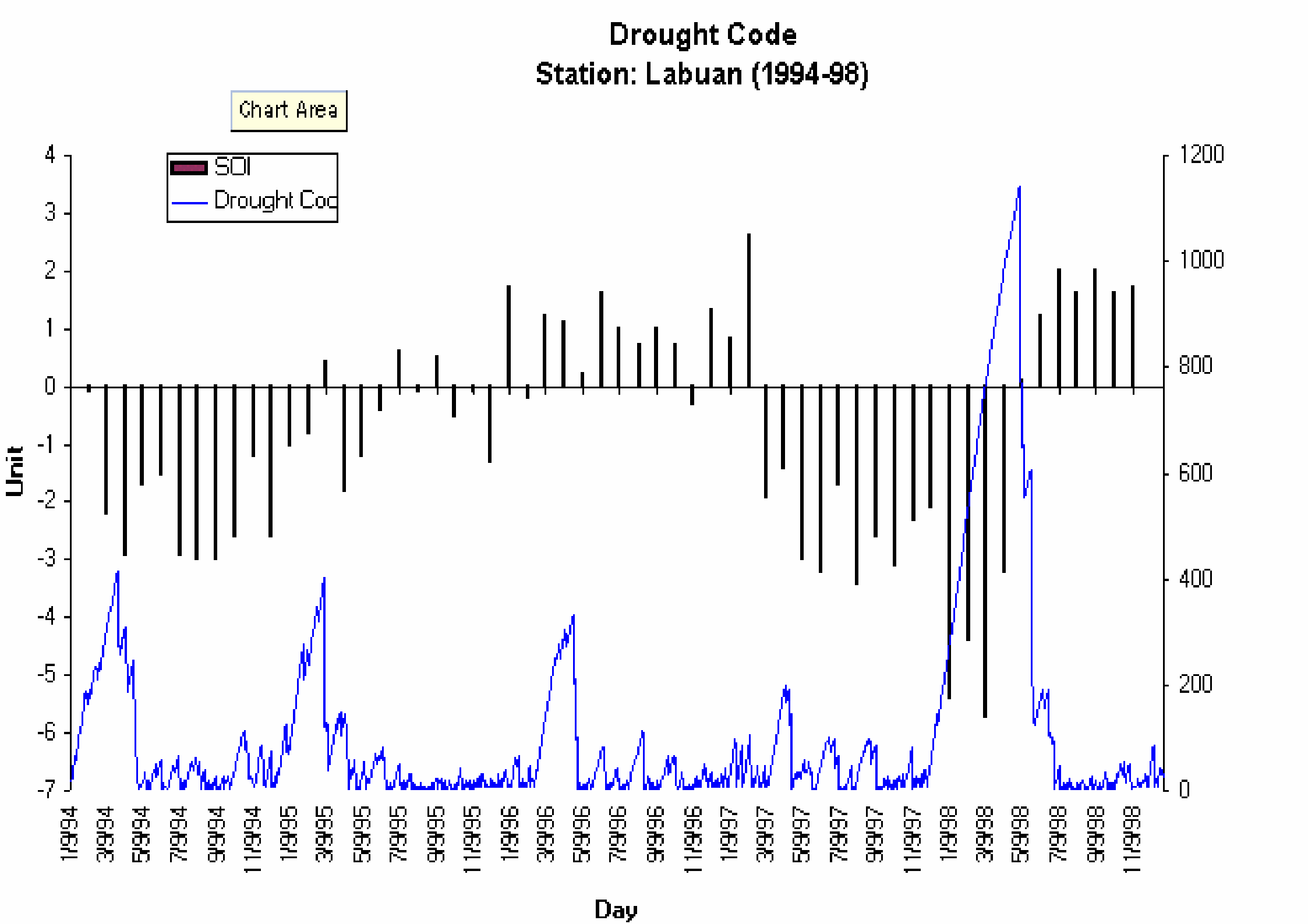
- The products are based on the hourly/daily weather data collected from MMD Principle Stations and other meteorological stations in the region.

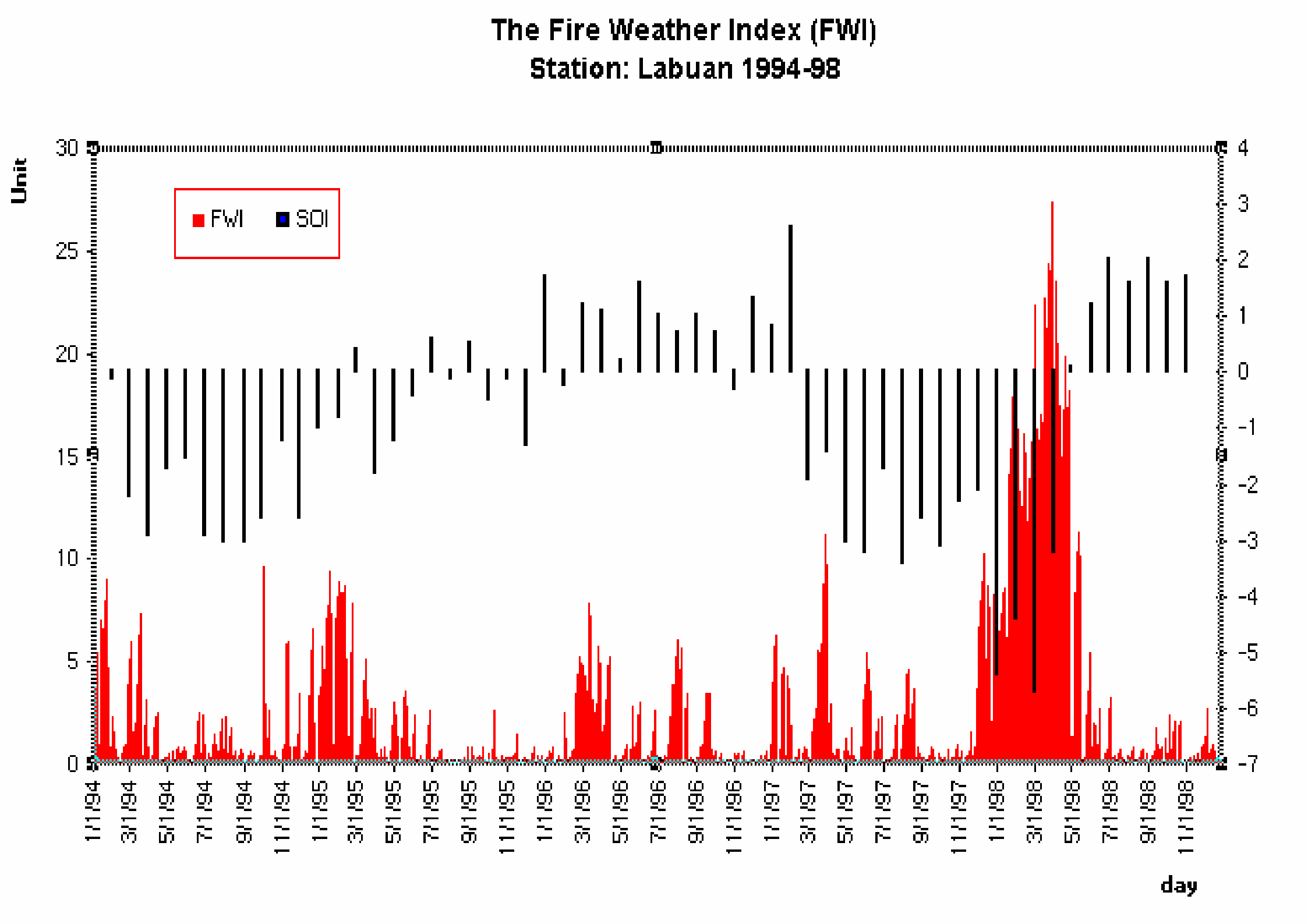
- Further development depend on cooperation with other related agencies including MACRES, BOMBA, DOE, UPM and Forestry Department.

ASEAN Secretariat Haze-on-Line: http://www.haze-online.or.id/

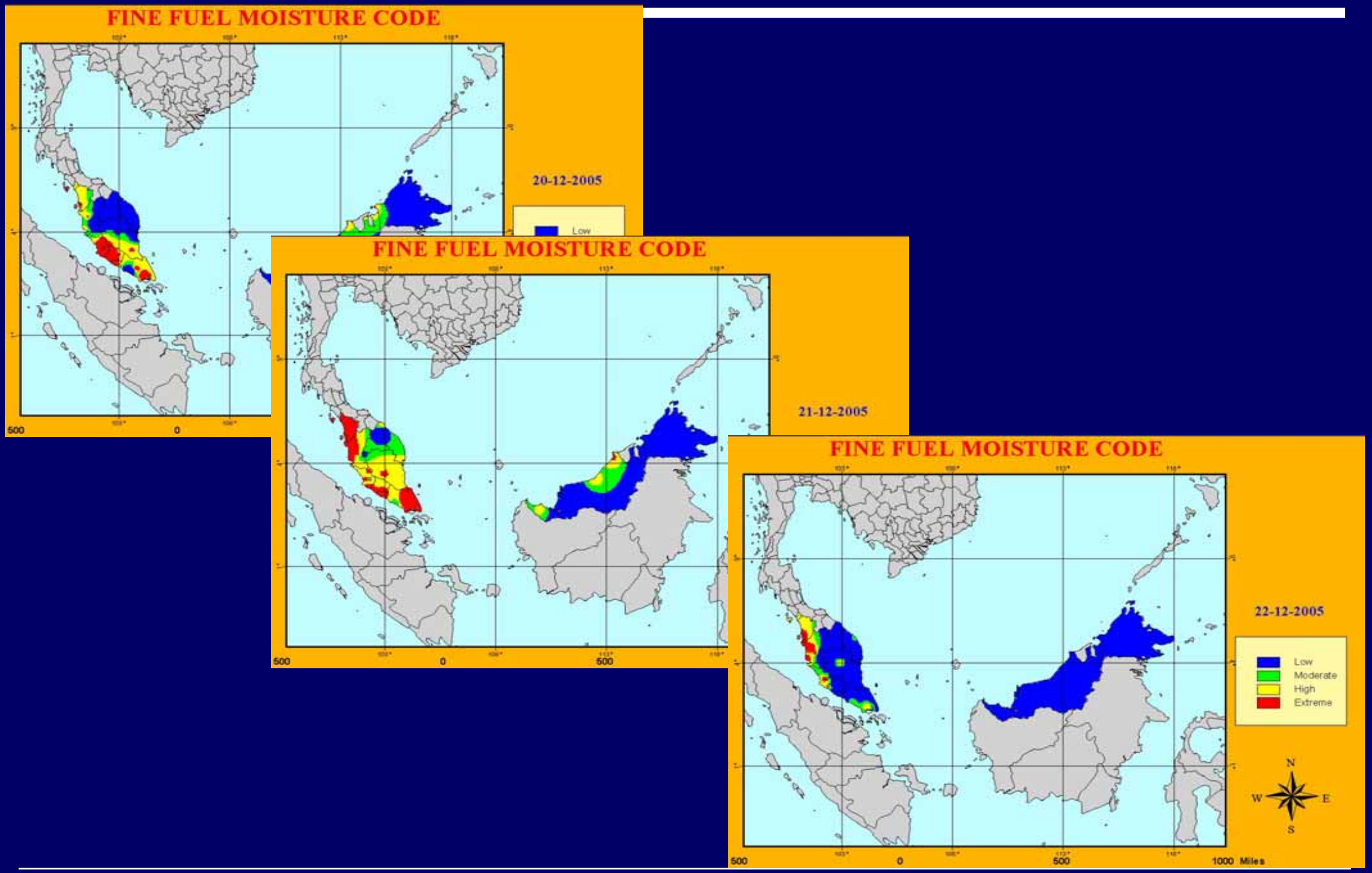


The Analyses done on some of the FDRS products


Drought Code
Station: Labuan (1994-98)
Chart Area
SOI
Drought Coc
Unit
Day
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
1200
1000
800
600
400
200
0
1/1/94
3/3/94
5/5/94
7/7/94
9/9/94
11/11/94
1/1/95
3/3/95
5/5/95
7/7/95
9/9/95
11/11/95
1/1/96
3/3/96
5/5/96
7/7/96
9/9/96
11/11/96
1/1/97
3/3/97
5/5/97
7/7/97
9/9/97
11/11/97
1/1/98
3/3/98
5/5/98
7/7/98
9/9/98
11/11/98


The Fire Weather Index (FWI)
Station: Labuan 1994-98
Unit
FWI
SOI
30
25
20
15
10
5
0
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
1/1/94
3/1/94
5/1/94
7/1/94
9/1/94
11/1/94
1/1/95
3/1/95
5/1/95
7/1/95
9/1/95
11/1/95
1/1/96
3/1/96
5/1/96
7/1/96
9/1/96
11/1/96
1/1/97
3/1/97
5/1/97
7/1/97
9/1/97
11/1/97
1/1/98
3/1/98
5/1/98
7/1/98
9/1/98
11/1/98
day

Flood over northern Peninsular Malaysia 18 – 27 Dec. 2006

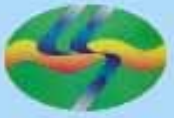

FINE FUEL MOISTURE CODE
20-12-2005
Low
500
0
FINE FUEL MOISTURE CODE
21-12-2005
500
0
500
FINE FUEL MOISTURE CODE
22-12-2005
Low
Moderate
High
Extreme
N
W
E
S
500
0
500
1000 Miles

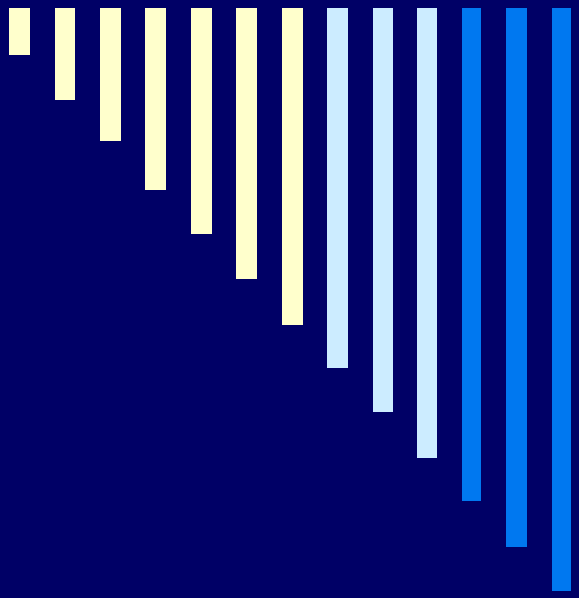
For more information, please visit our website at

http://www.met.gov.my

Kementerian Sains,
Teknologi & Inovasi (MOSTI)

Jabatan Meteorologi
Malaysia (JMM)





Terima Kasih

THANK YOU