Recent Active Forest Fires on Peatland in Indonesia

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International Workshop on
"Inventory, Modeling and Climate Impacts of Greenhouse Gas Emissions (GHG's) and Aerosolos in the Asian Region"
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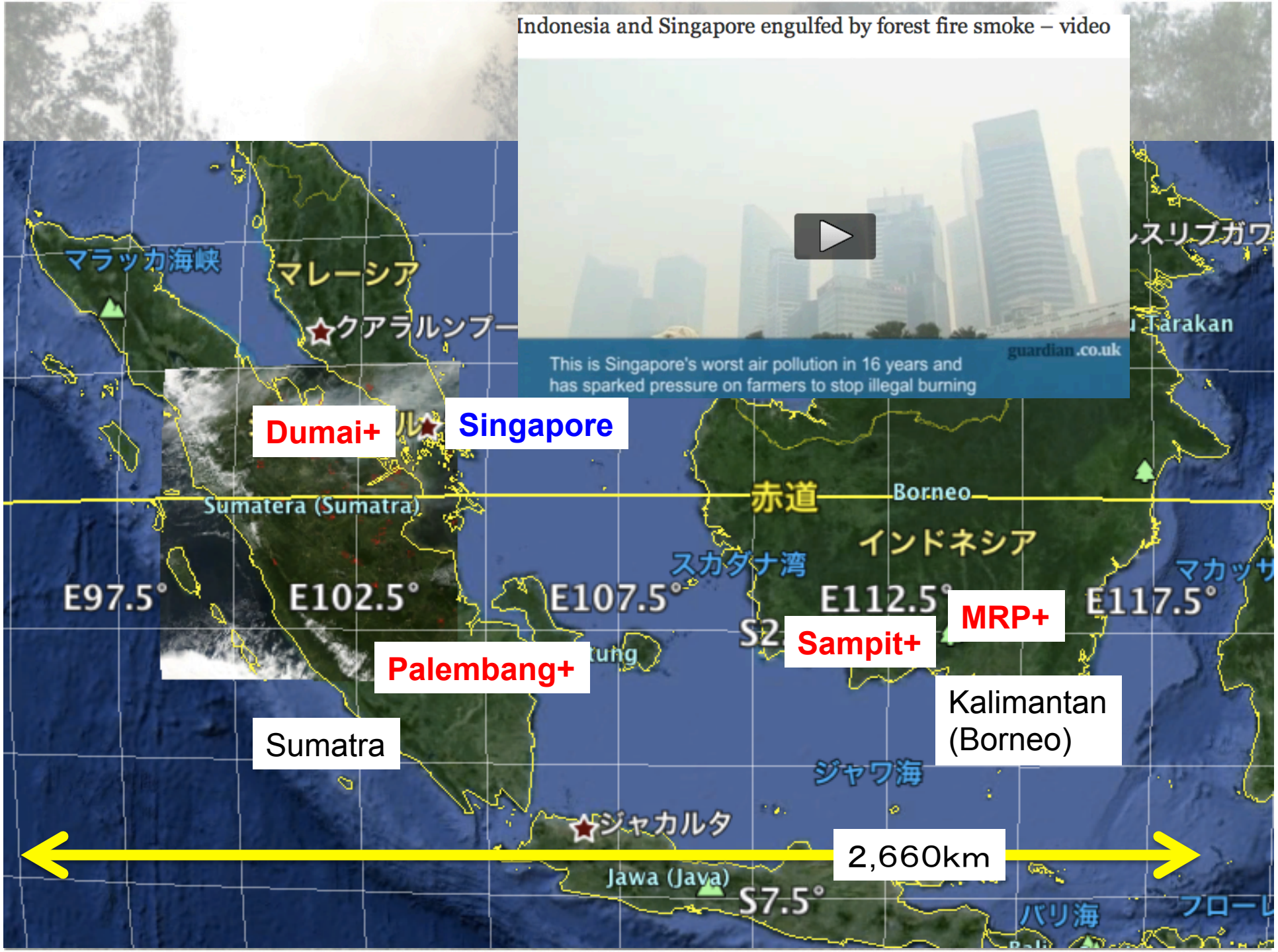
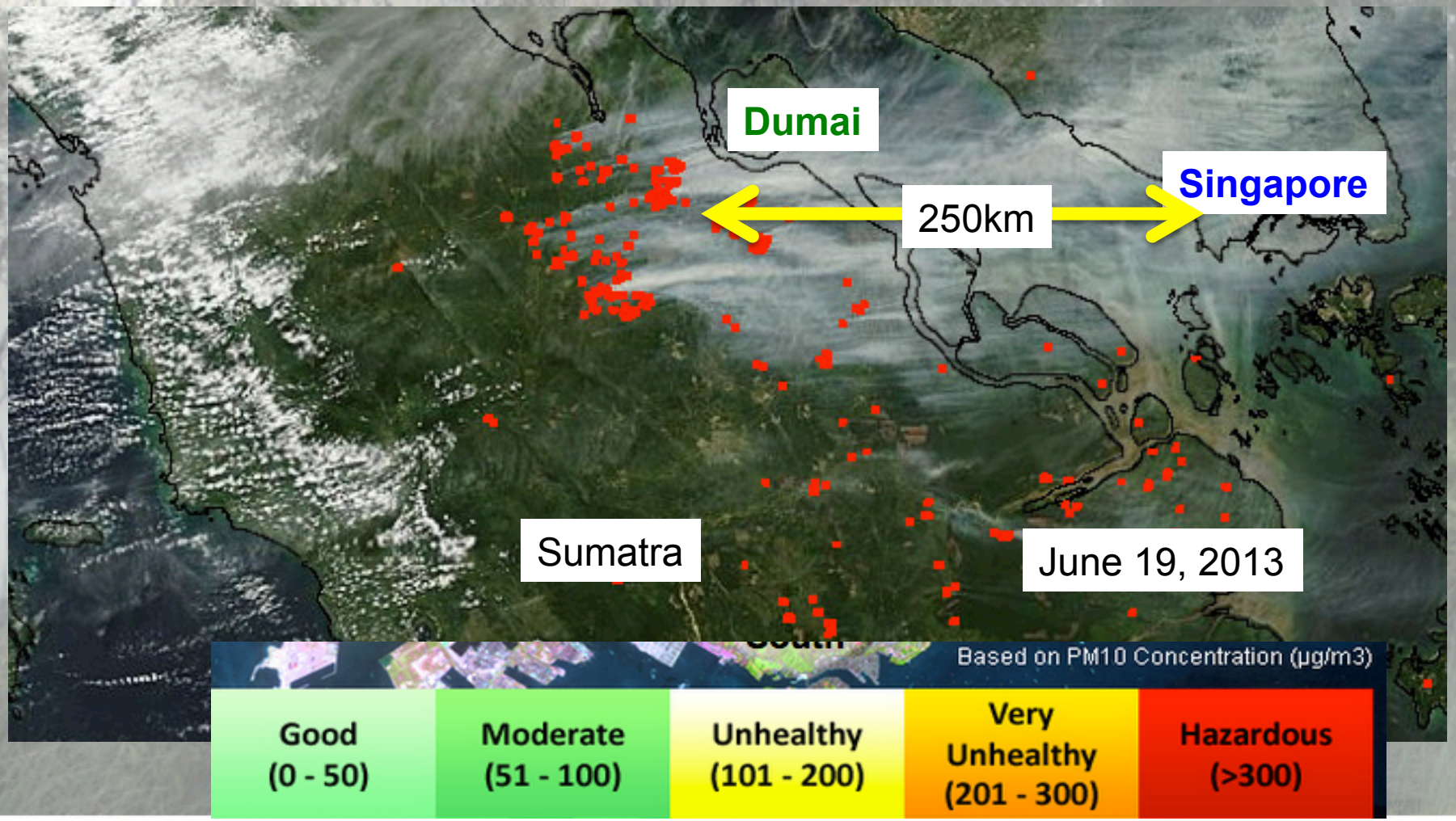

Indonesia and Singapore engulfed by forest fire smoke – video
This is Singapore's worst air pollution in 16 years and has sparked pressure on farmers to stop illegal burning
guardian.co.uk
マラッカ海峡
マレーシア
クアラルンプー
Tarakan
Dumai+
Singapore
Sumatera (Sumatra)
赤道
Borneo
インドネシア
スカダナ湾
E97.5°
E102.5°
E107.5°
E112.5°
E117.5°
MRP+
Sampit+
Palembang+
Kalimantan (Borneo)
Sumatra
ジャワ海
ジャカルタ
2,660km
Jawa (Java)
S7.5°
バリ海

Singapore's worst air pollution in 16 years.

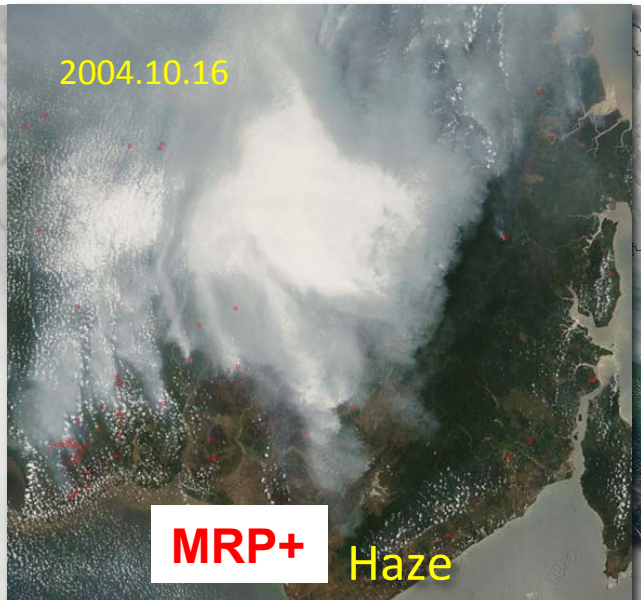
The Pollutant Standards Index (PSI) surged to a record reading of 371.

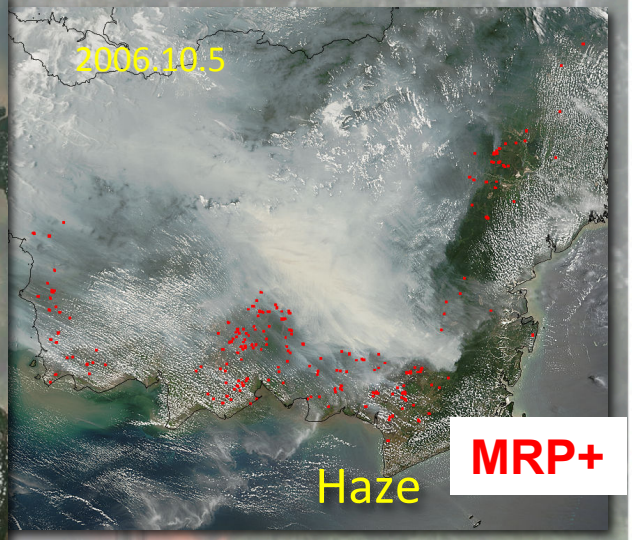


Basic Knowledge

Recent Large Scale Wildland Fires
in Kalimantan, Indonesia

2002 2004 2006 2009





Repeated severe fires every two years

Air Pollution in Palangkaraya

Dangerous condition in highway due to dense smoke (low visibility).

Basic Knowledge

Effective Firebreak–

Ditch & Clear-Cut Saved Dr. Aswin's Camp

MRP+

2009 Severe Surface Fires

Strong surface fire occurred due to Pyrophyte vegetation?

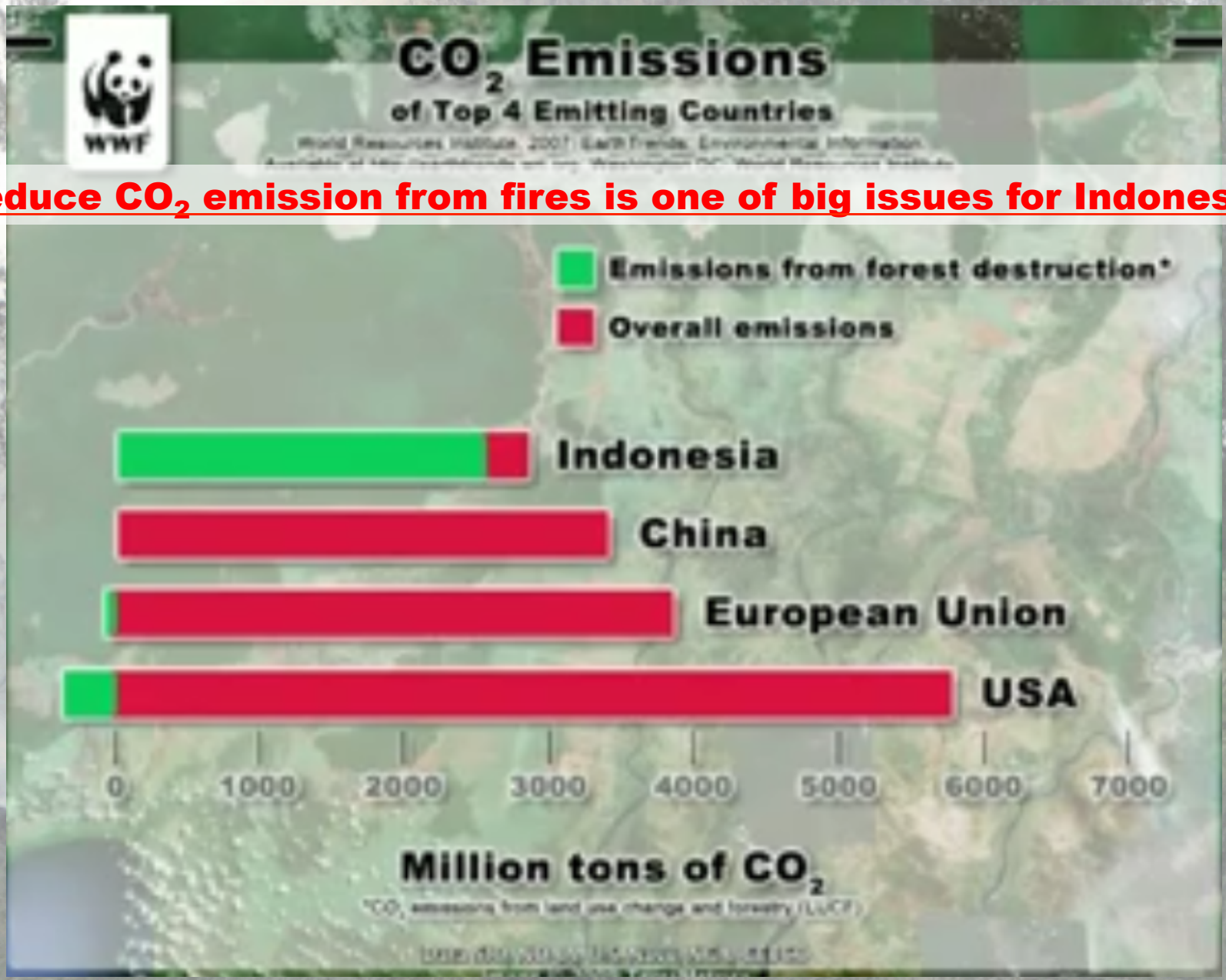
Purun, Hawuk, Karakai, Gakugan, Tsumi, Fern and etc.

Fire line with a deep ditch

Deep and wide!

Deep ditch was proven effective for fire.

Background 1: Contribution of forest and peat fires to entire CO_2 emissions in Indonesia?

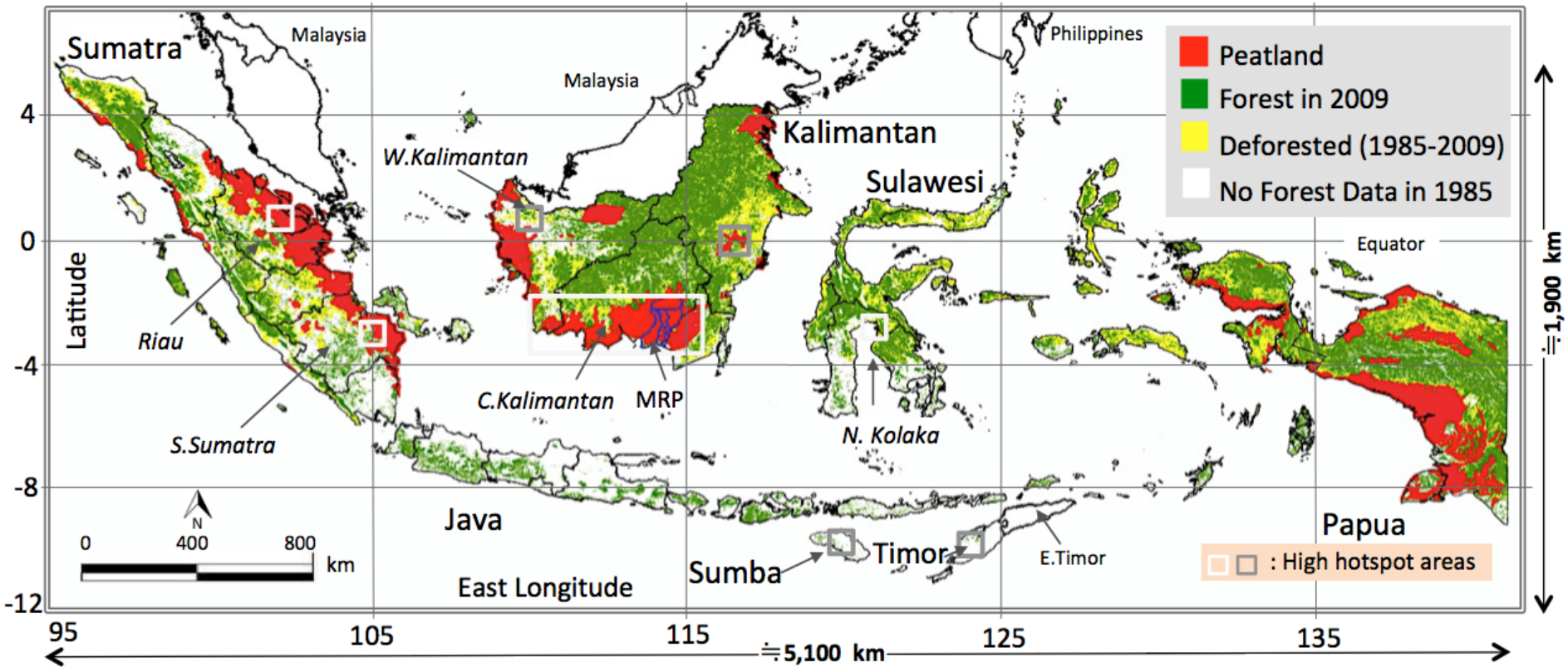


Background 2: There were a few fire reports on peatland for whole Indonesia.

Recent Peat, Forest, & Deforest Areas in Indonesia

Peatland: 225,000km^2
(6%W,83%E.A)(12%LandArea)
Thickness:1~12m-, 2m>42%

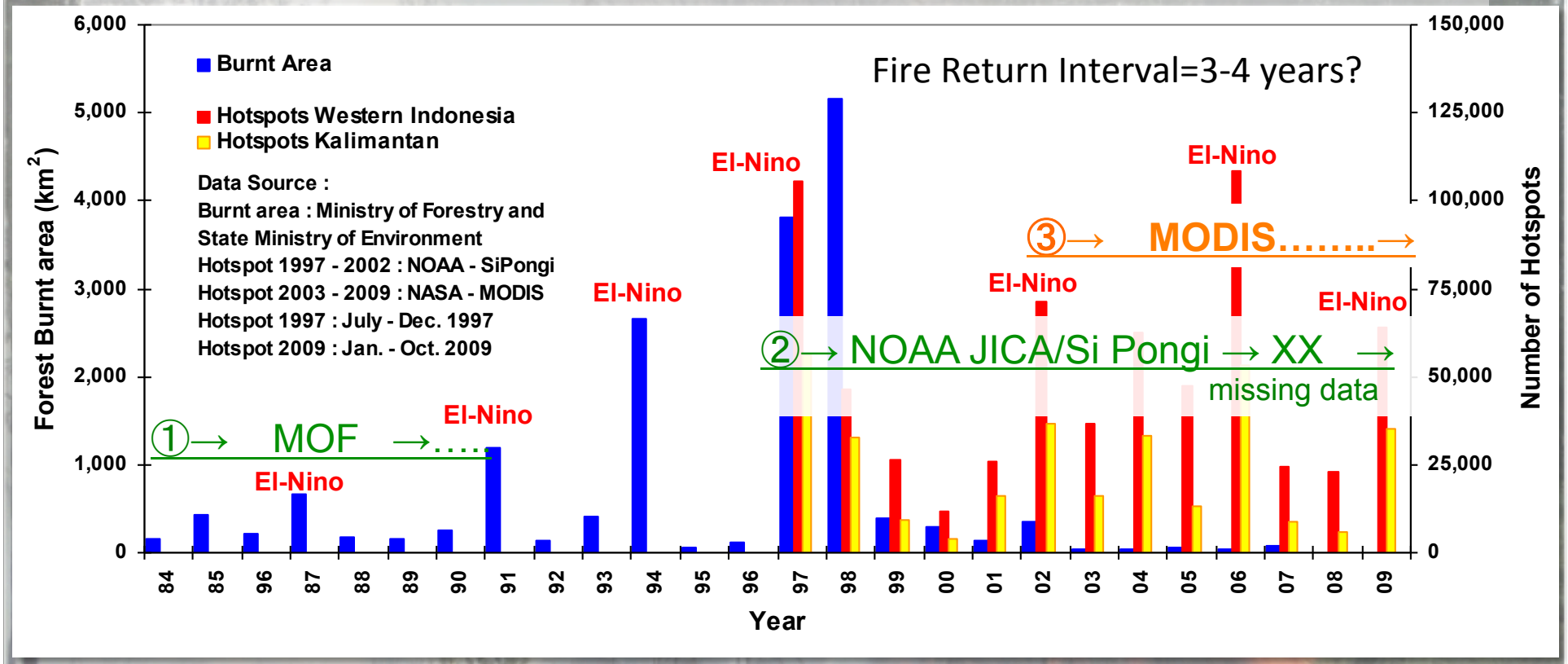
Uncertainty



Background 3: There was no reliable statistical data for whole Indonesia.

Fire History: Fire and El Niño

Forest fires in recent years increased significantly from around 2001 after large fires in 1997 & 1998.



※ Fire data for Indonesia's forest from MOF is simply just for forest.
Total burnt area in all area for forest, plantation and wildland will beestimated more than 10.000 km² area for each El Niño years.

※ Fire detection and observation by satellite started from July 1997 by NOAA and from 2001 by MODIS.

Methodology

MODIS hotspot data from 2002 to 2011 (2012) provided by NASA MODIS rapid response system was analyzed for various purposes.

Several analysis grids using latitude and longitude were used to grasp fire occurrence characteristics in various areas from whole Indonesia to local villages.

Weather (precipitation) data was analyzed to grasp dry season and drought period.

Table: Various Analysis Grid sizes and Their characteristics

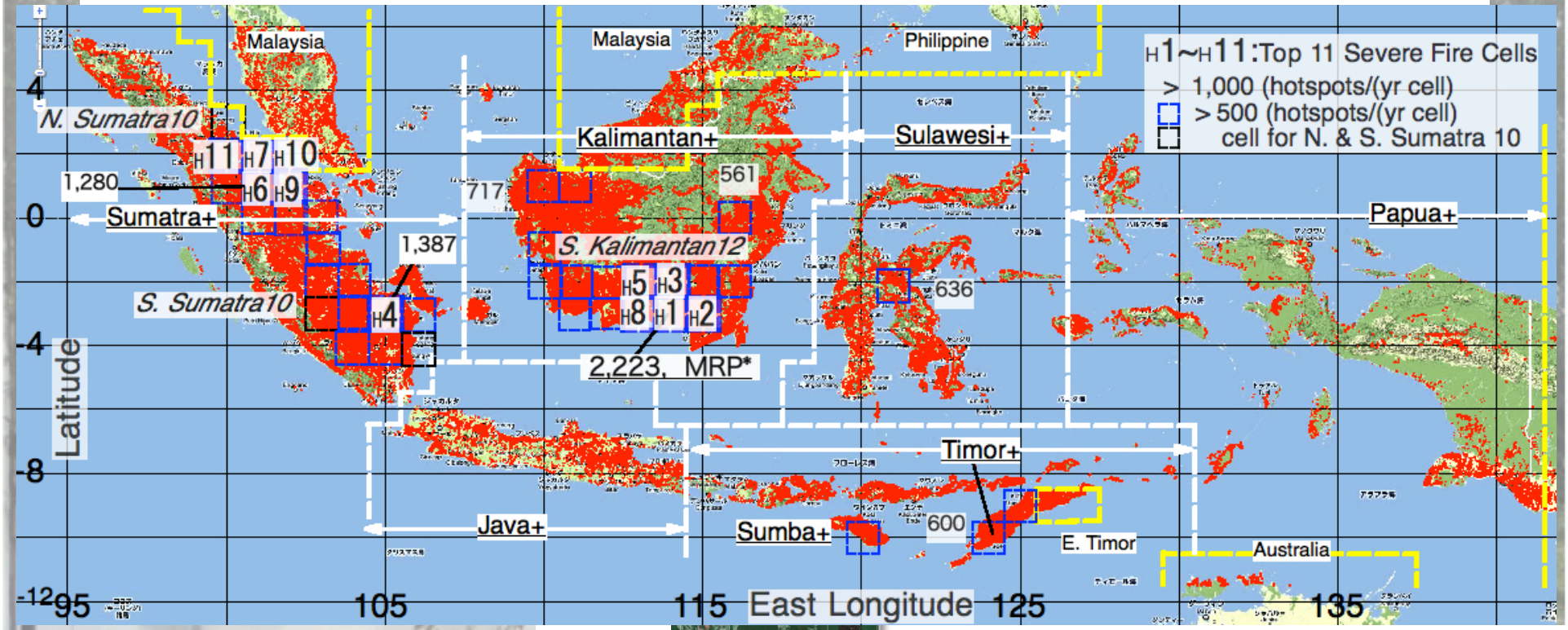
Grid Size (Degree of Lati. & Long.)	Representative Length & Area (One Degree at Equator)		Target	Maximum Number of Grids
	Length (km)	Area (km^2)		
1 x 1*	111.3	12,387.7	Whole Indonesia	846
0.5 x 0.5	55.7	3,096.9	Kalimantan, etc.	3,384
0.1 x 0.1	11.1	123.9	MRP, etc.	84,600
0.05 x 0.05	5.6	31.0	Village, etc.	338,400
0.01 x 0.01	1.1**	1.2	Plantation, etc.	8,460,000

*Preliminary Analysis

**MODIS resolution is 1km

Result : Hotspot Distribution (1 x 1 Deg. Grid)

High Hotspot Areas in Indonesia Recent Ten Years (2002-2011)



6 regions:
Sumatra+, Kalimantan+
Java+, Sumba+ & Timor+
Sulawesi+, Papua+

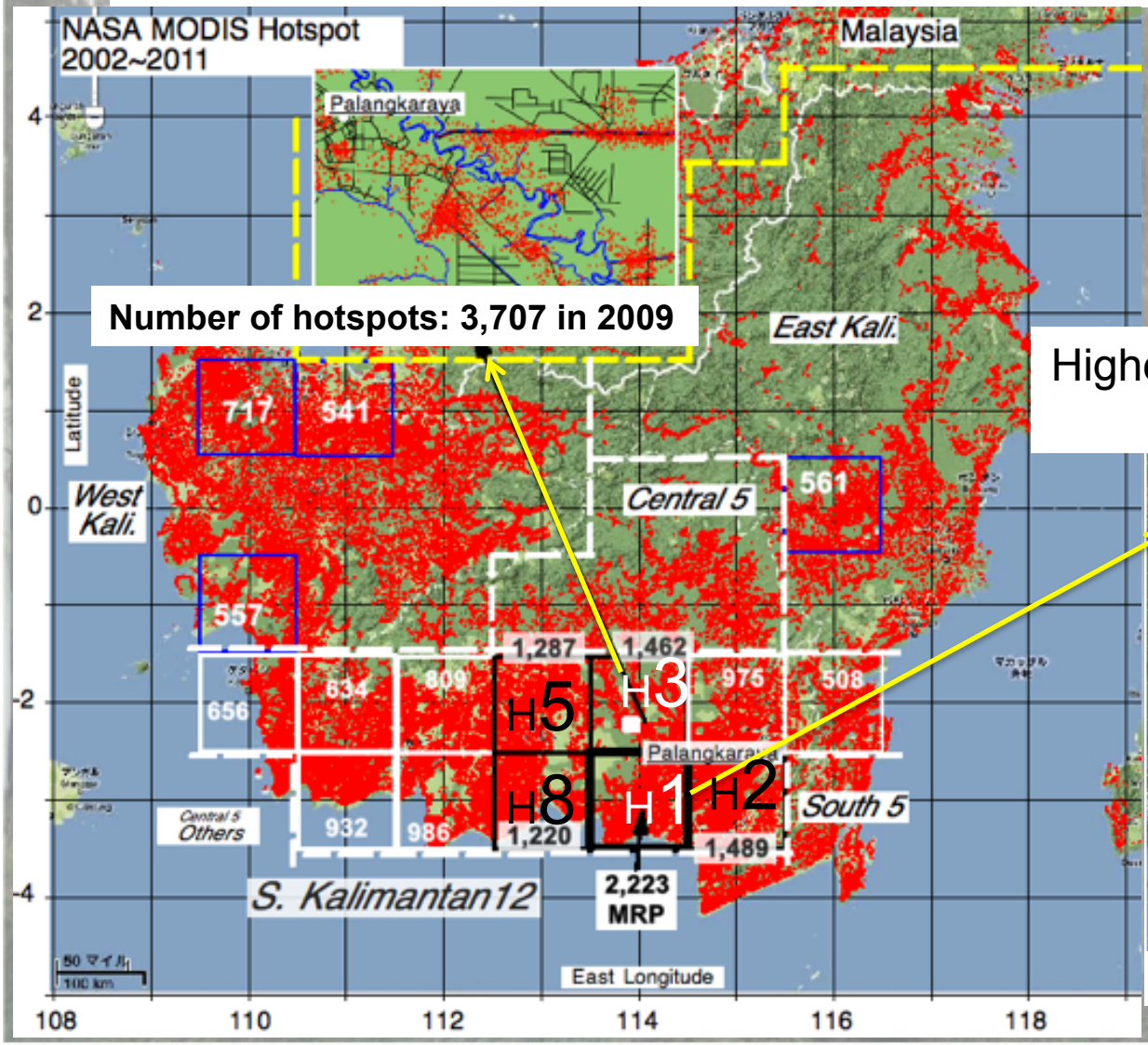
MRP*

Highest number of hotspots: 2,223/yr.
Hotspot density:0.182 fires/(km^2・yr.)
Grid center: S -3, E 114

J/J Pro. Haya110917

Result : Hotspot Distribution in Kalimantan (1 x 1 Deg. Grid)

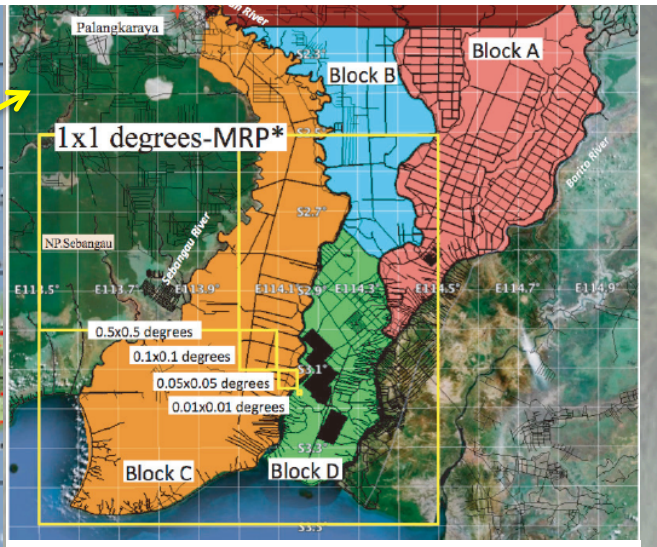
Hotspot Distribution and 5 Highest Hotspot Areas in Kalimantan



Number of hotspots: 3,707 in 2009

5 regions:
S. Kalimantan12
West & East Kali.
Central 5
South 5

Highest number of hotspots: 5,382 in 2006



H1: Highest Hotspot Density Area

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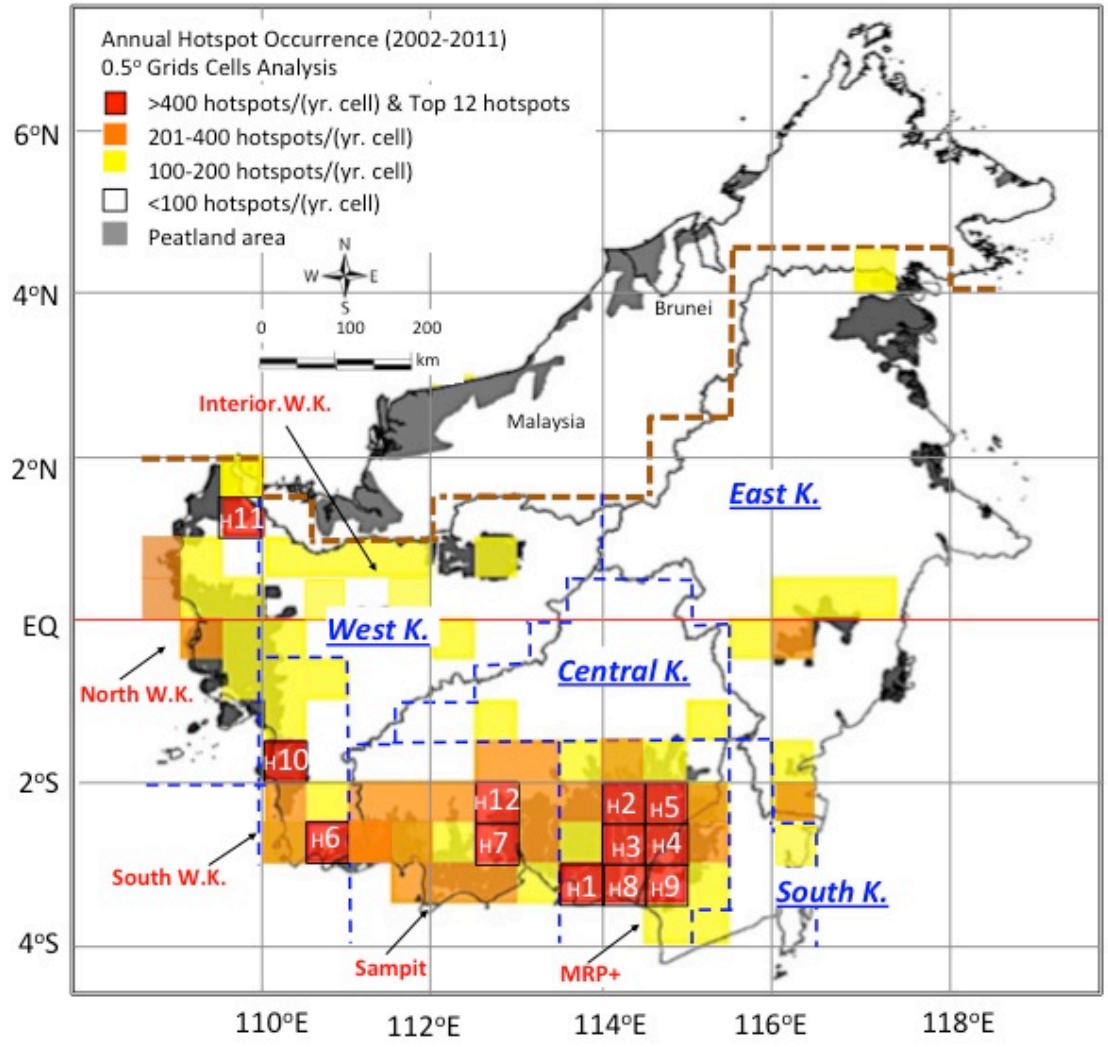
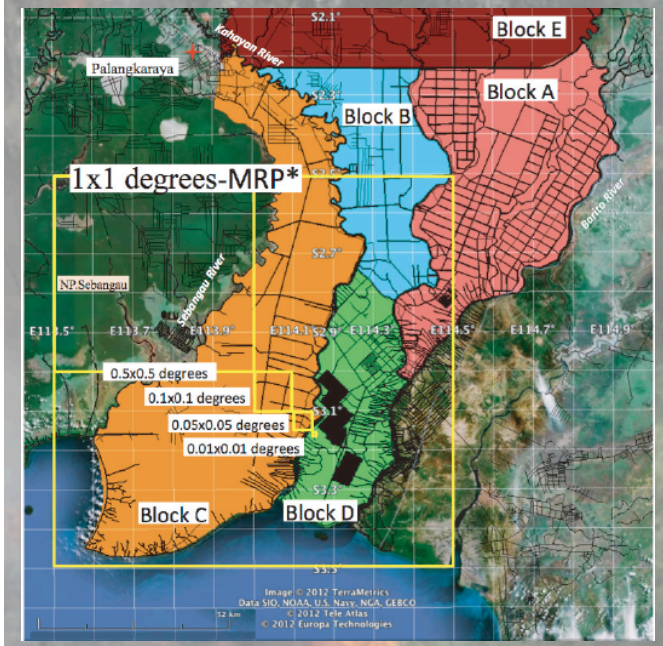
*Preliminary Analysis

**Secondary Analysis

**MODIS resolution is 1km

12 Highest Hotspot Areas in Kalimantan



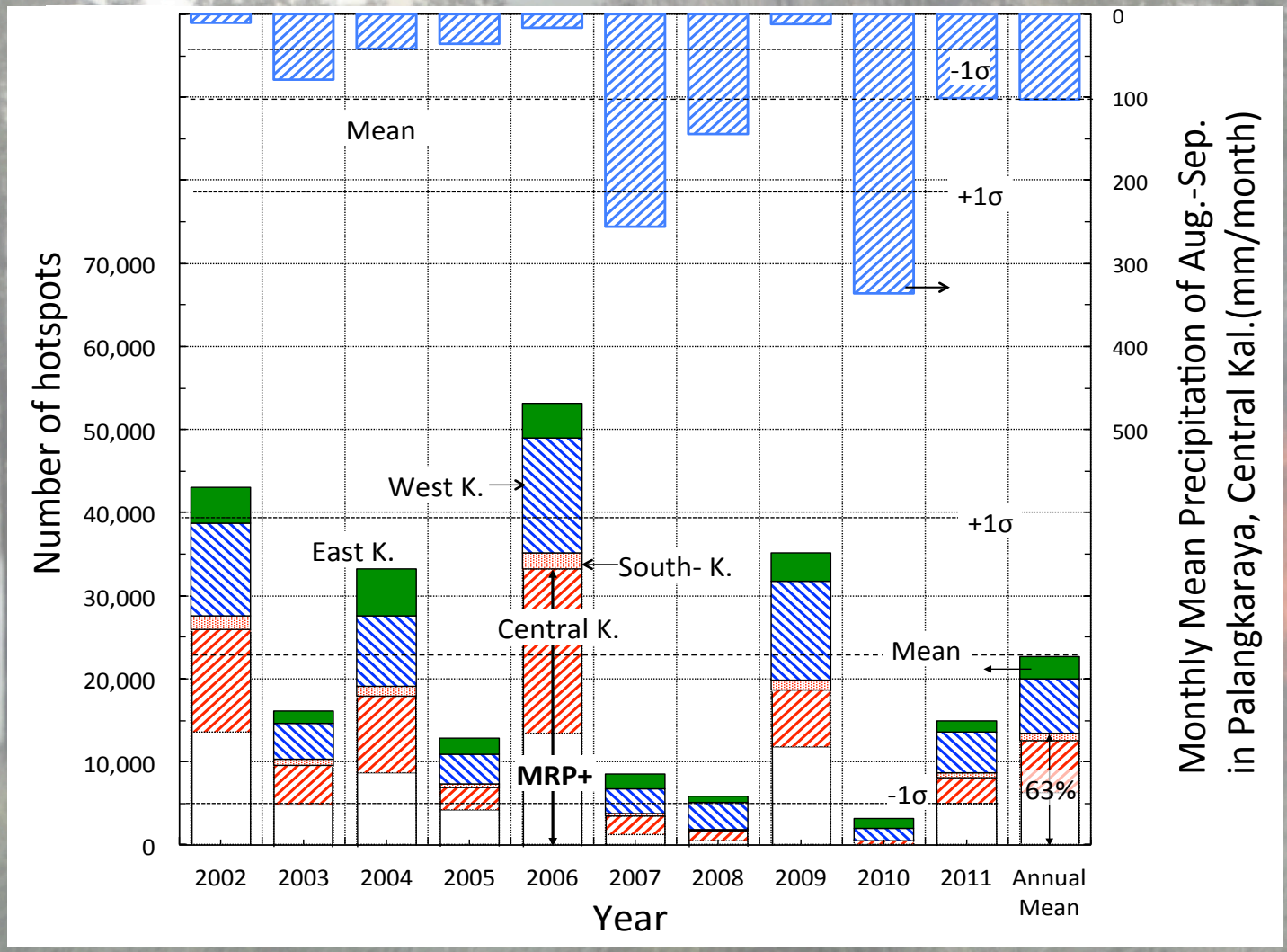


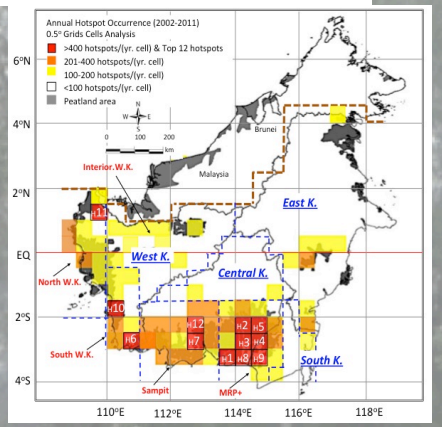
5 high hotspot regions:
MRP+, Sampit, South W.K., North W.K., Interior W.K.

H1: Highest Hotspot Density Area Located South of Block C in MRP+

Recent Fire Year for Kalimantan

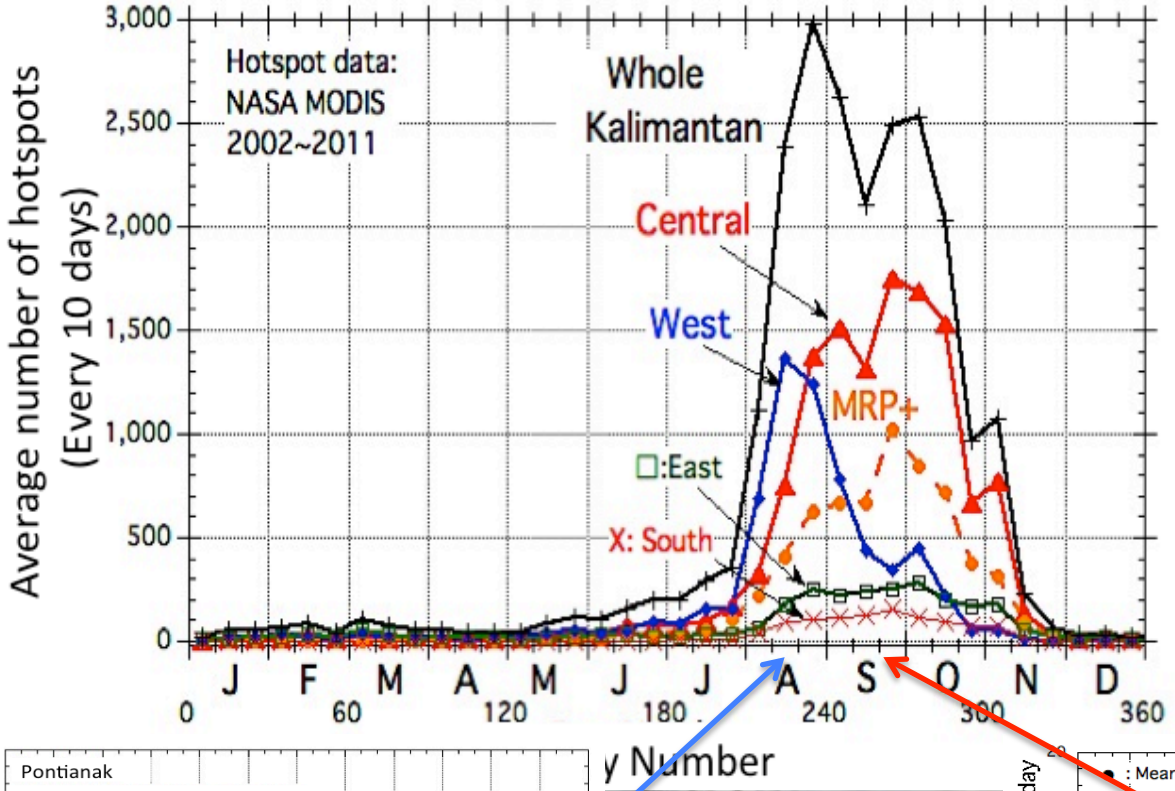
2002, 2004, 2006, and 2009

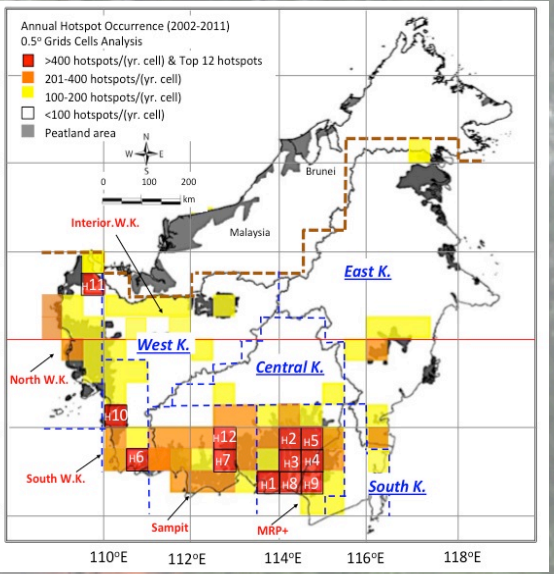


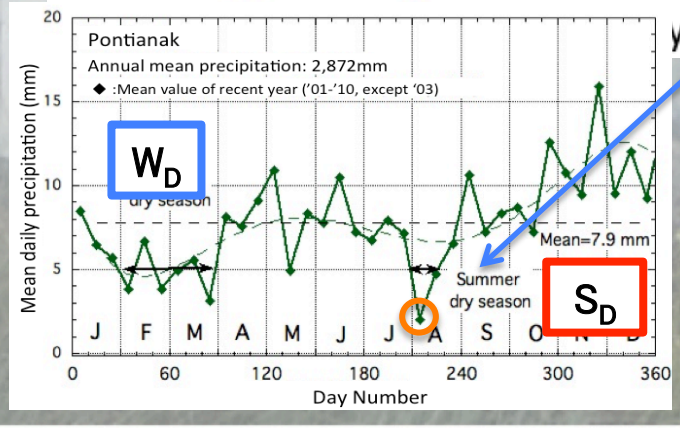


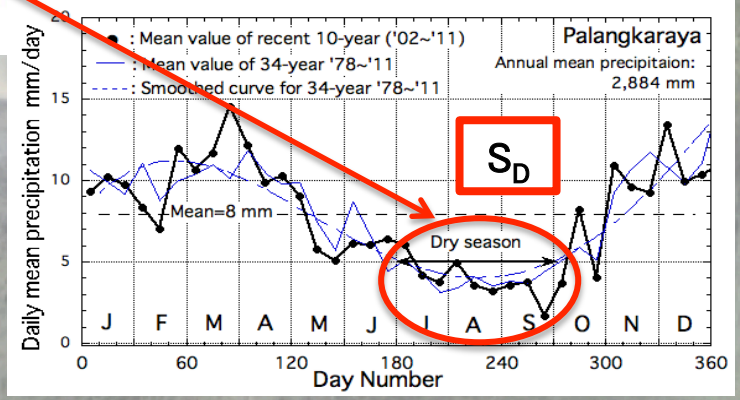
Result : Fire Season in Kalimantan (0.5 x 0.5 Deg. Grid, 10-day Analysis)

Average Seasonal (Every-10 day) Fire Occurrence in Kalimantan

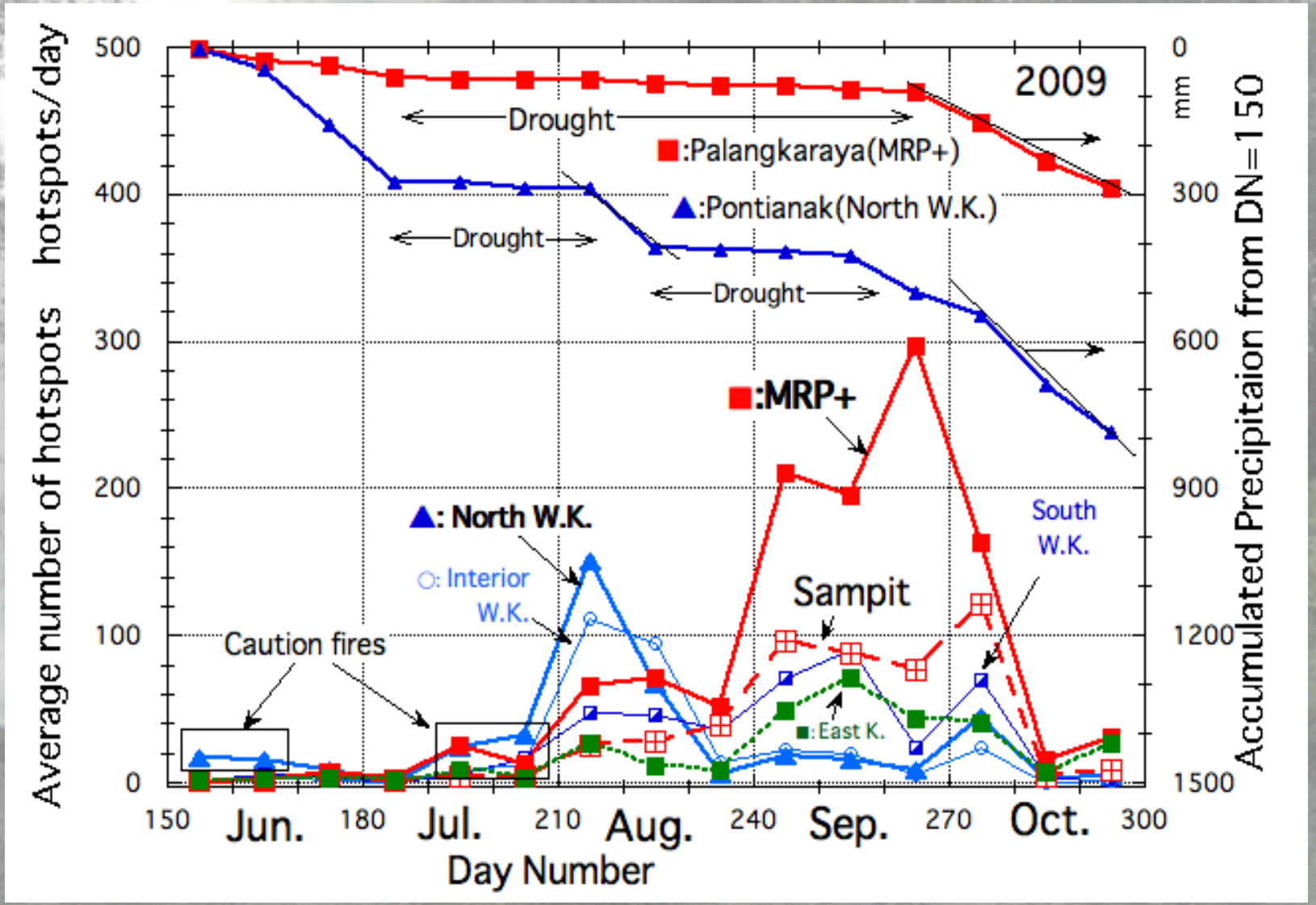








2009 Seasonal (Every-10 day) Fire Occurrence in Kalimantan



Result : Hotspot Distribution in Kalimantan (1 x 1 Deg. Grid)

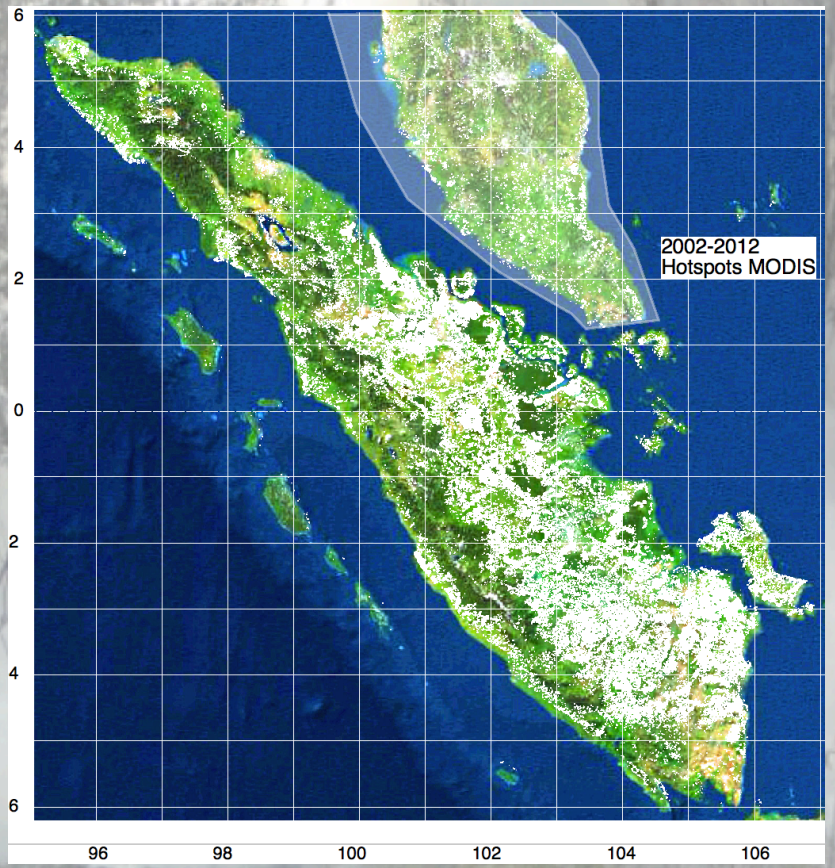
Fire Occurrence and El Nino in Kalimantan

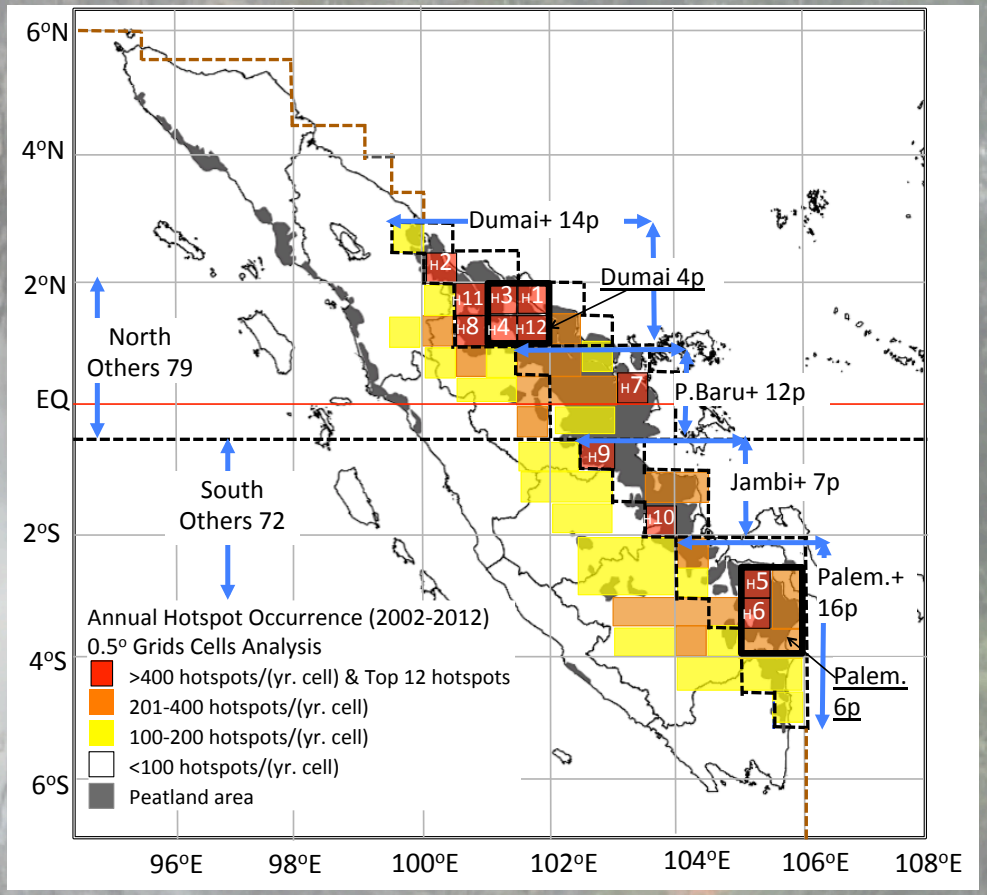
Rank by hot-spot	Year	Fire		Weather condition					Remarks
		Sum of num.hotspots in Kalimantan Σ Jun.-Oct. (DN=150 to 299)	Fire situation	ENSO		Daily mean precipitation (150 days:Jun.-Oct.) mm			
				El Niño La Niña	Running 3-month mean ONI values in NDJ**	Average ((A)+(B))/2	(A) Palangka raya	(B) Pontianak	
1	2006	43,383	Severe fire year	Weak El*	1.0	2.4	2.0	2.8	Sever fires in Sampit & MRP (Fig.8)
2	2002	41,730		Mod El*	1.3	2.9	2.1	3.7	Sever fires started from late August
3	2009	34,078		Mod El*	1.6	3.6	2.0	5.2	Severest fire year for MRP (Figs.7,11)
4	2004	30,801		Weak El*	0.7	4.7	3.0	6.3	Rainfall in July
5	2003	15,492	Average fire year		0.3	–	3.6	–	Rainfall in late Aug. & Sep. in Palangkaraya
6	2011	14,146		Weak La*	−1.0	–	4.5	–	Rainfall from late August in Palangkaraya
7	2005	11,699		Weak La*	−0.8	6.6	2.2	11.0	Rainfall in August in Palangkaraya
8	2007	7,478	Weak fire year	Mod La*	−1.4	10.1	11.5	8.6	Heavey raifall
9	2008	4,722			−0.7	7.6	4.8	10.3	Heavey raifall
10	2010	2,136		Strong La*	−1.5	12.7	13.8	11.6	Heavey raifall
Average		20,567		–	−0.1	6.3	5.0	7.5	

*Defined by NOAA ** ONI=Ocean Niño index, NDJ=November, December, and January

Result: Hotspot Distribution in Sumatra (0.5 x 0.5 Deg. Grid)

12 Highest Hotspot Areas in Sumatra





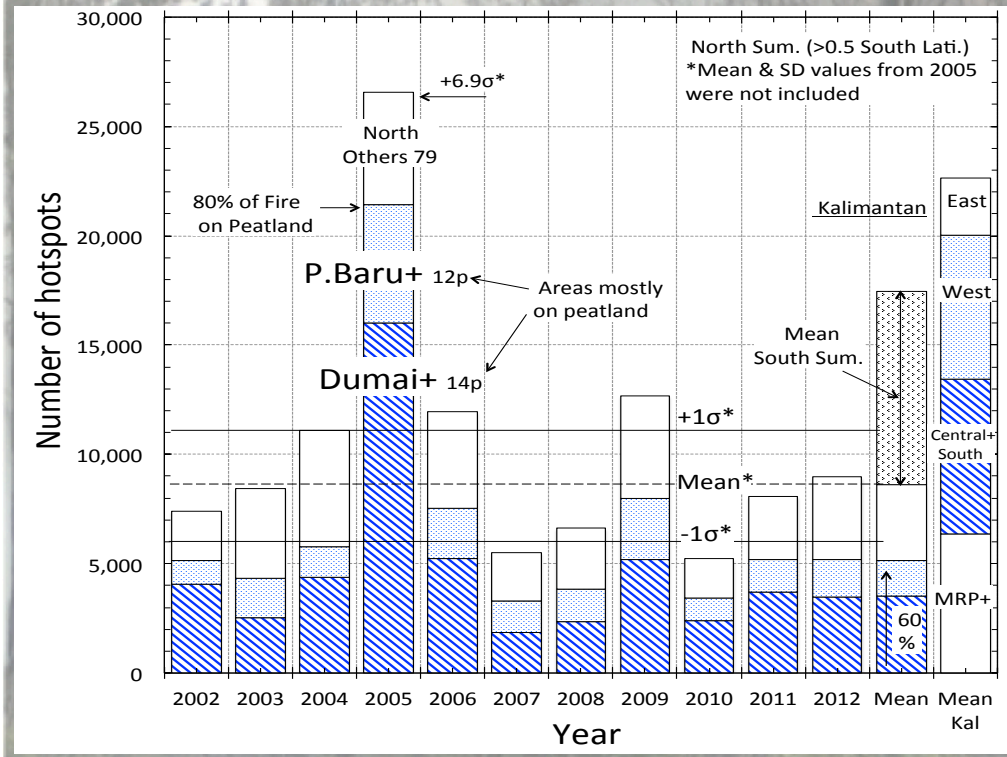
4 high hotspot regions:
Dumai+14, P. Baru+12, Jambi +7, Palembang+16

H1: Highest Hotspot Density Area in Dumai

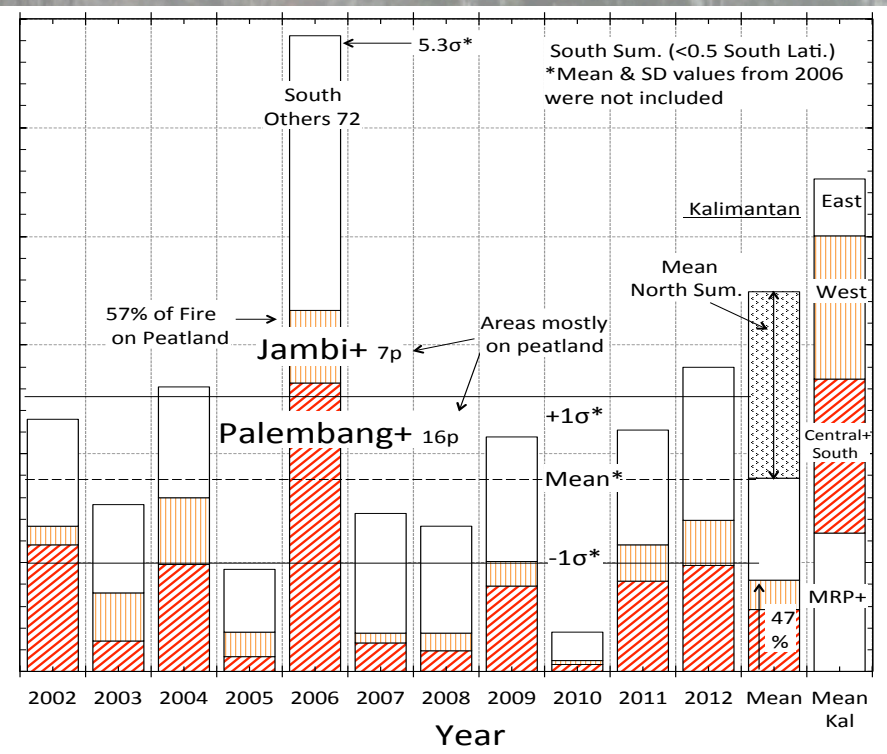
Result : Severe fire occurrence in Sumatra (0.5 x 0.5 Deg. Grid)

Severe Fire Year for Sumatra 2005 and 2006

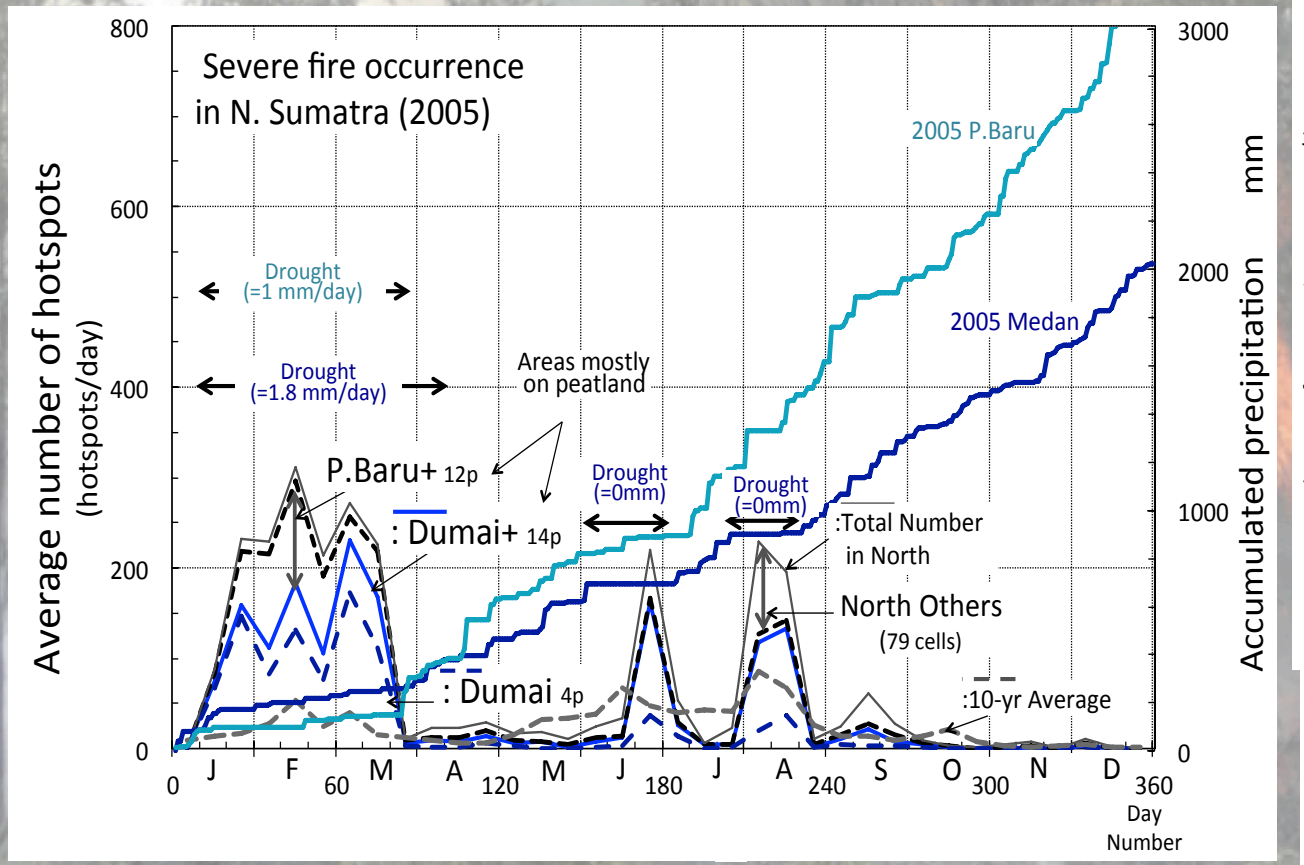
↓ 2005 for N. Sumatra

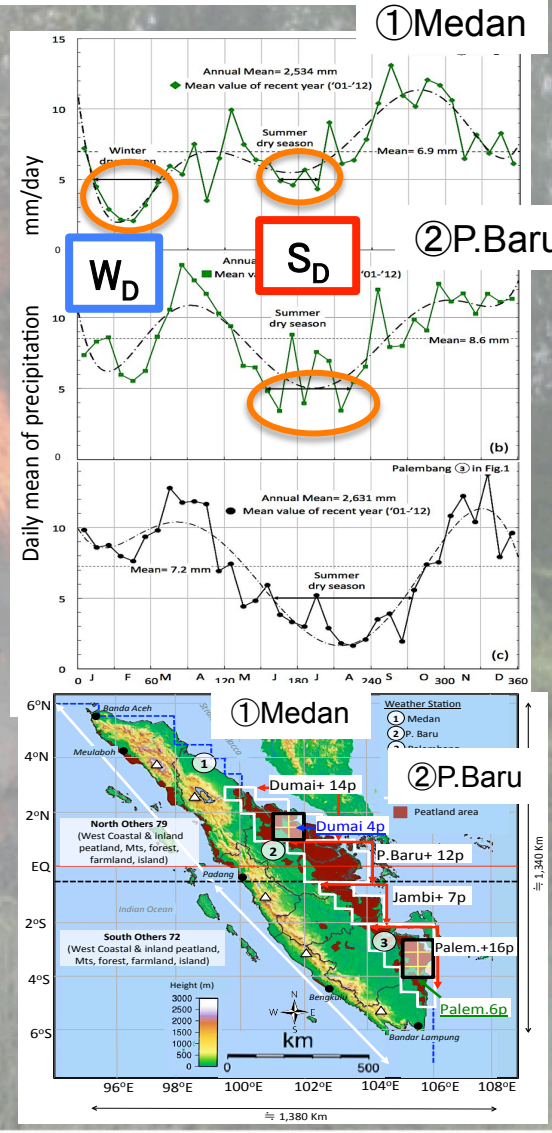


↓ 2006 for S. Sumatra

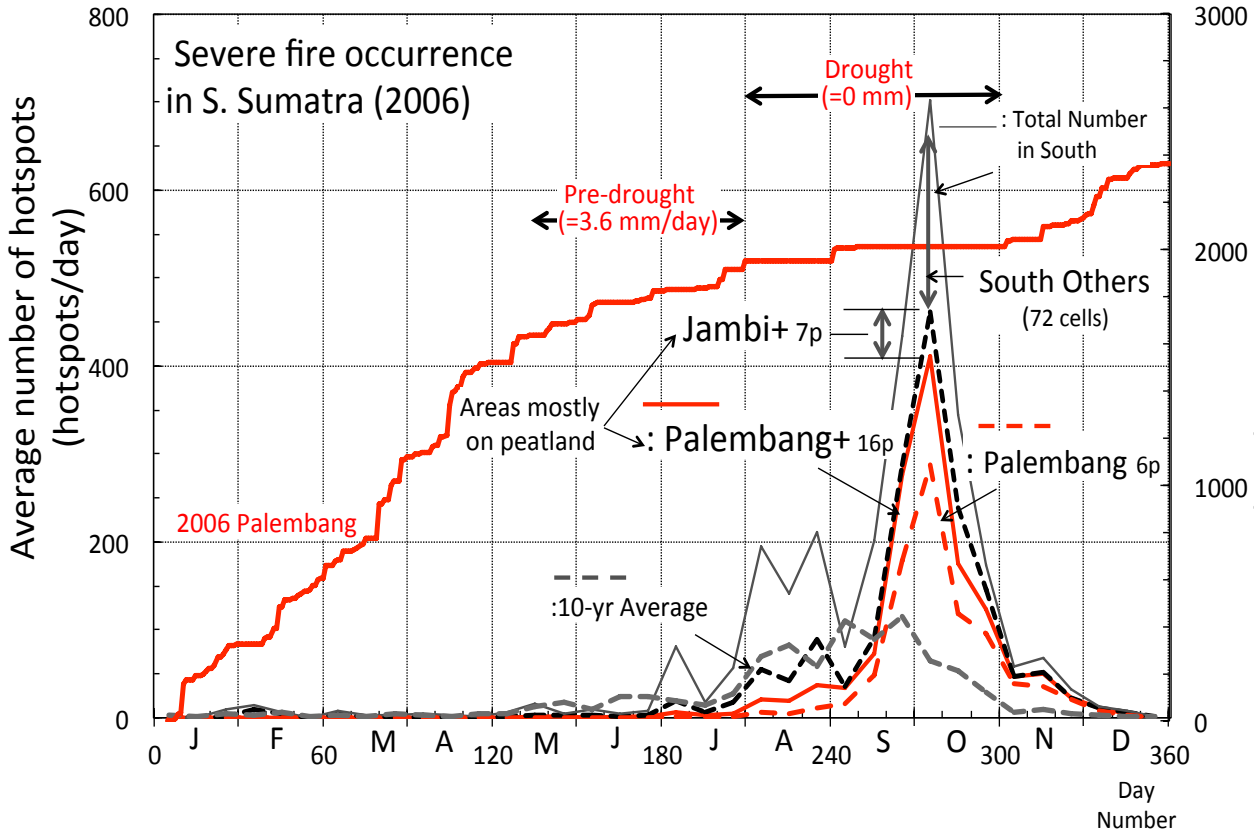


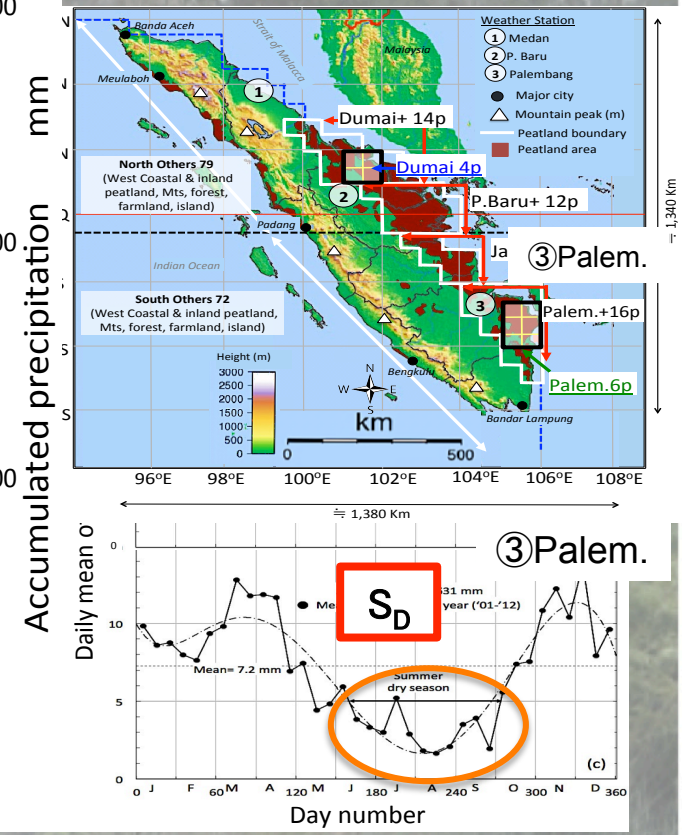
2005 Severe Fire Occurrence in N. Sumatra





2006 Severe Fire Occurrence in S. Sumatra





Four Fire Prone Areas in Indonesia

Island	Area	Dry Season Peroid (Month)		Hotspot (fire)		
		Winter	Summer	Ave. Hotspot	SD	F. MAX.
Kalimantan	MRP+visinty (13)	x	3	5,635	4,792	1.41
	Sampit+ (20)	x	1+1/3	5,077	5,651	2.23
	(East Kalimanta (Int.))	1/3	3	1,279	918	1.91
Sumatra	Dumai+(14)	1～2	1～2	4,652	3,934	2.88
	Palembang+(16)	x	3+1/3	3,784	3,722	2.55

Island	Area	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Kalimantan	MRP+visi	12,400	4,244	7,674	3,714	12,238	936	381	10,604	98	4,057		56,346
	Sampit+ (	11,494	3,619	7,103	1,528	17,681	1,022	544	5,220	118	2,438		50,767
	(East Kal	2,474	598	3,033	650	1,860	651	556	1,682	616	670		12,790
Sumatra	Dumai+(1	4,058	2,547	4,370	16,002	5,217	1,874	2,331	5,204	2,399	3,688	3,486	51,176
	Palembar	5,820	1,387	4,929	661	13,281	1,333	939	3,914	330	4,138	4,895	41,627

Four Fire Prone Areas in Indonesia

Conclusions

MODIS hotspot data of recent years (2002-2012) revealed recent most fire prone areas in Indonesia.

1. Two areas in both Kalimantan and Sumatra.

2. They were: MRP and Sampit area in Central Kalimantan, Dumai area in N. Sumatra, and Palembang area in S. Sumatra

3. Worst place was MRP area due to dried peat made during its longer summer dry season (S_{D3}).