



BMG

APEC Climate Center Symposium
Climate Prediction and Application
Busan, Republic of Korea
14 – 16 September 2006

High Resolution Climate Modeling in Indonesia

***Lessons Learned from Regency / District Scale Applications
and Possible Utilization of APCC Data and Information***

Mezak A. Ratag

Centre for Research & Development

Indonesia National Agency for Meteorology & Geophysics(BMG)



BMG

Climate Forecast Applications

Outline

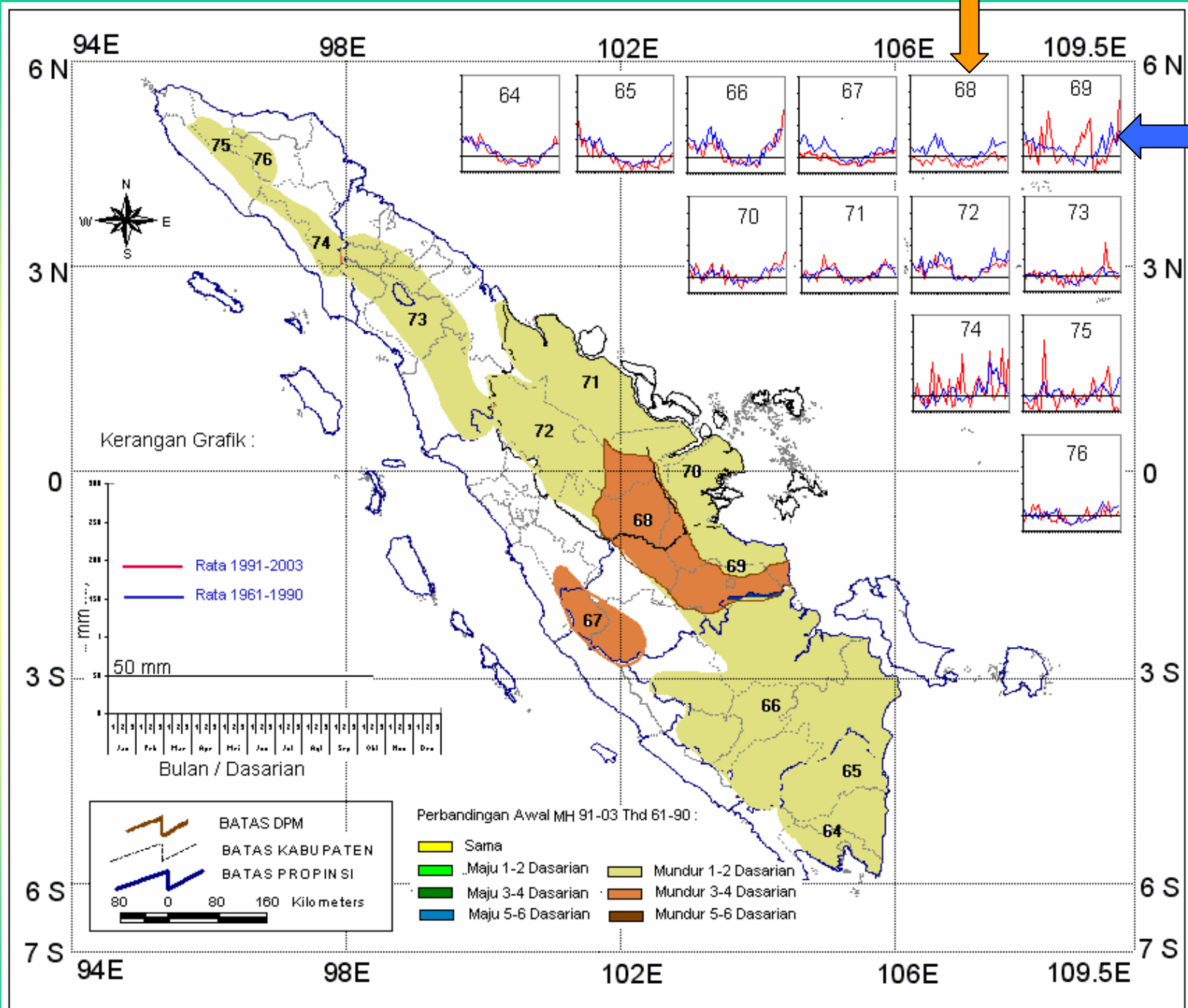




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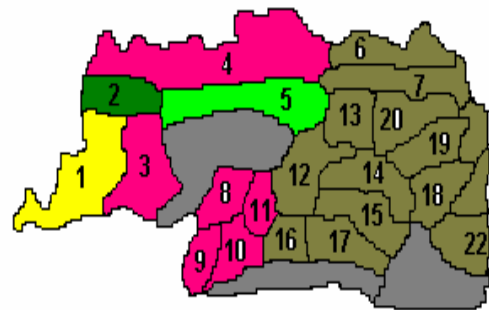
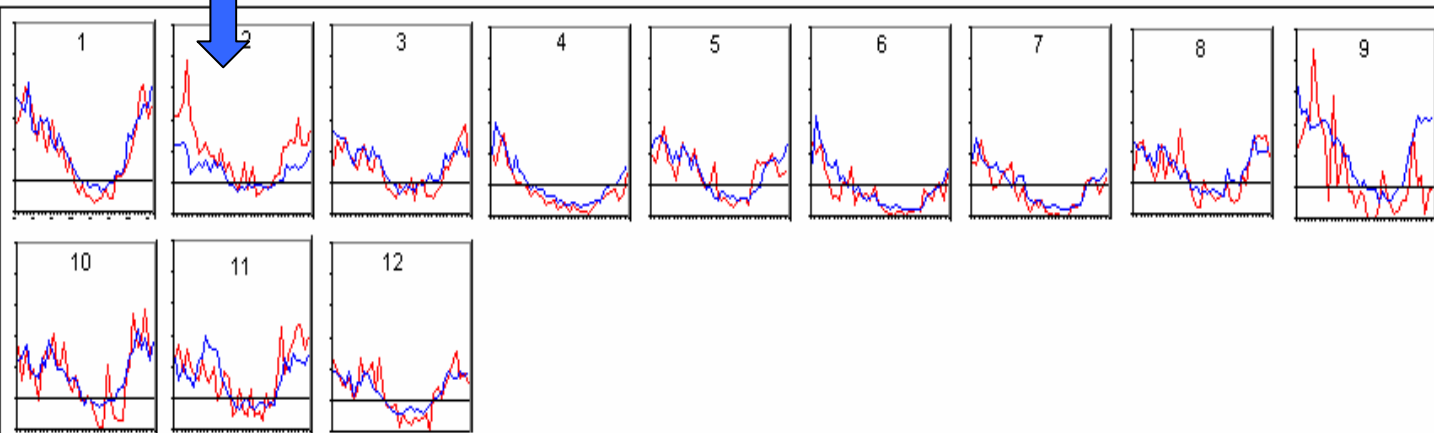
**Rainy
Season
onset
1991-2003
Relative to
1961-1990**

Sumatra



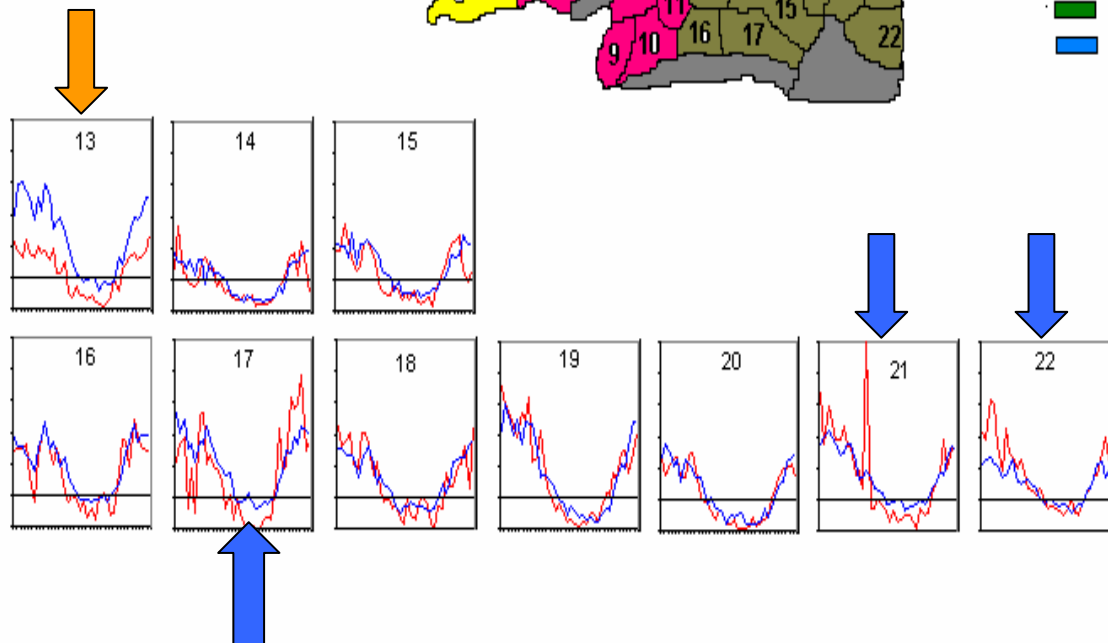


BMG

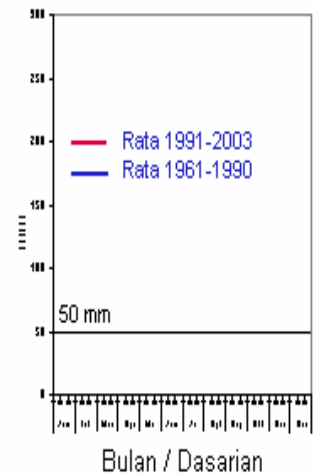


Perbandingan Awal MH 91-03 Thd 61-90 :

- Sama
- Maju 1-2 Dasarian
- Mundur 1-2 Dasarian
- Maju 3-4 Dasarian
- Mundur 3-4 Dasarian
- Maju 5-6 Dasarian
- Mundur 5-6 Dasarian



Keterangan Grafik :

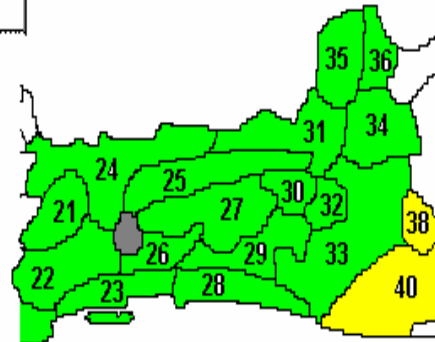
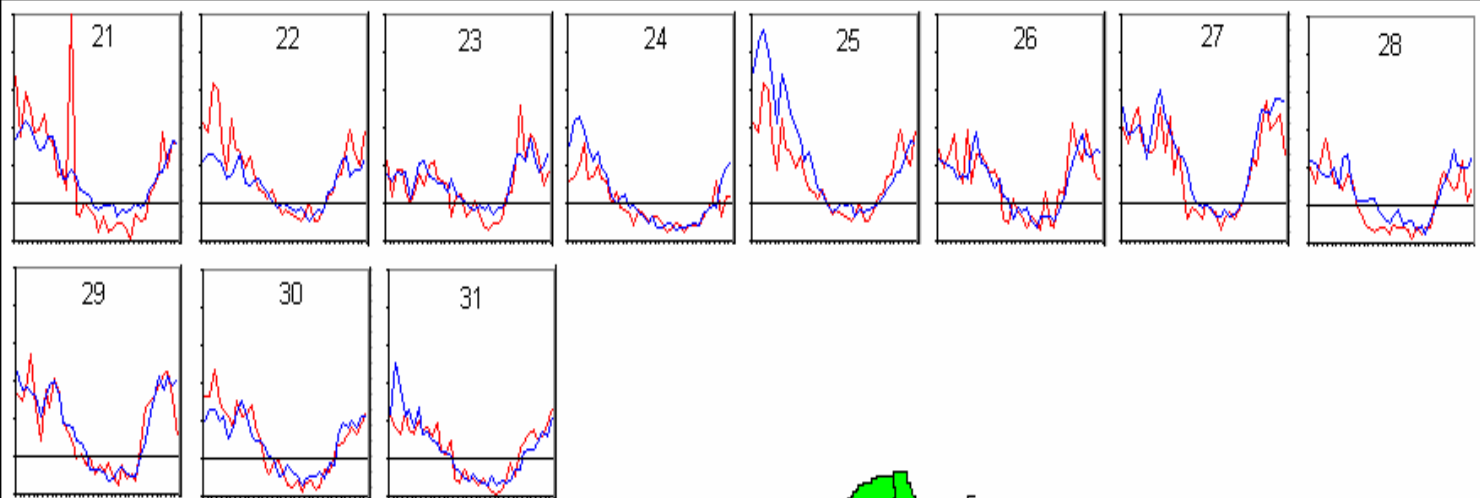


**Rainy
Season
onset
1991-2003
Relative to
1961-1990**

**West
Java**



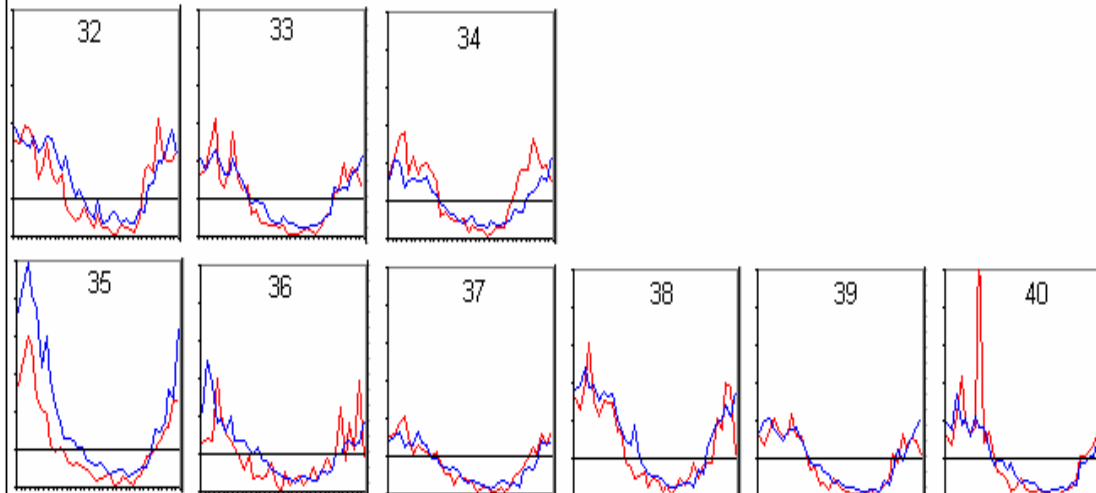
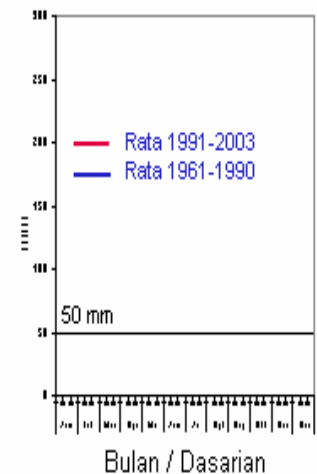
BMG



Perbandingan Awal MH 91-03 Thd 61-90 :

- Sama
- ,Maju 1-2 Dasarian
- Maju 3-4 Dasarian
- Maju 5-6 Dasarian
- Mundur 1-2 Dasarian
- Mundur 3-4 Dasarian
- Mundur 5-6 Dasarian

Keterangan Grafik :



**Rainy
Season
onset
1991-2003
Relative to
1961-1990**

**Central
Java**

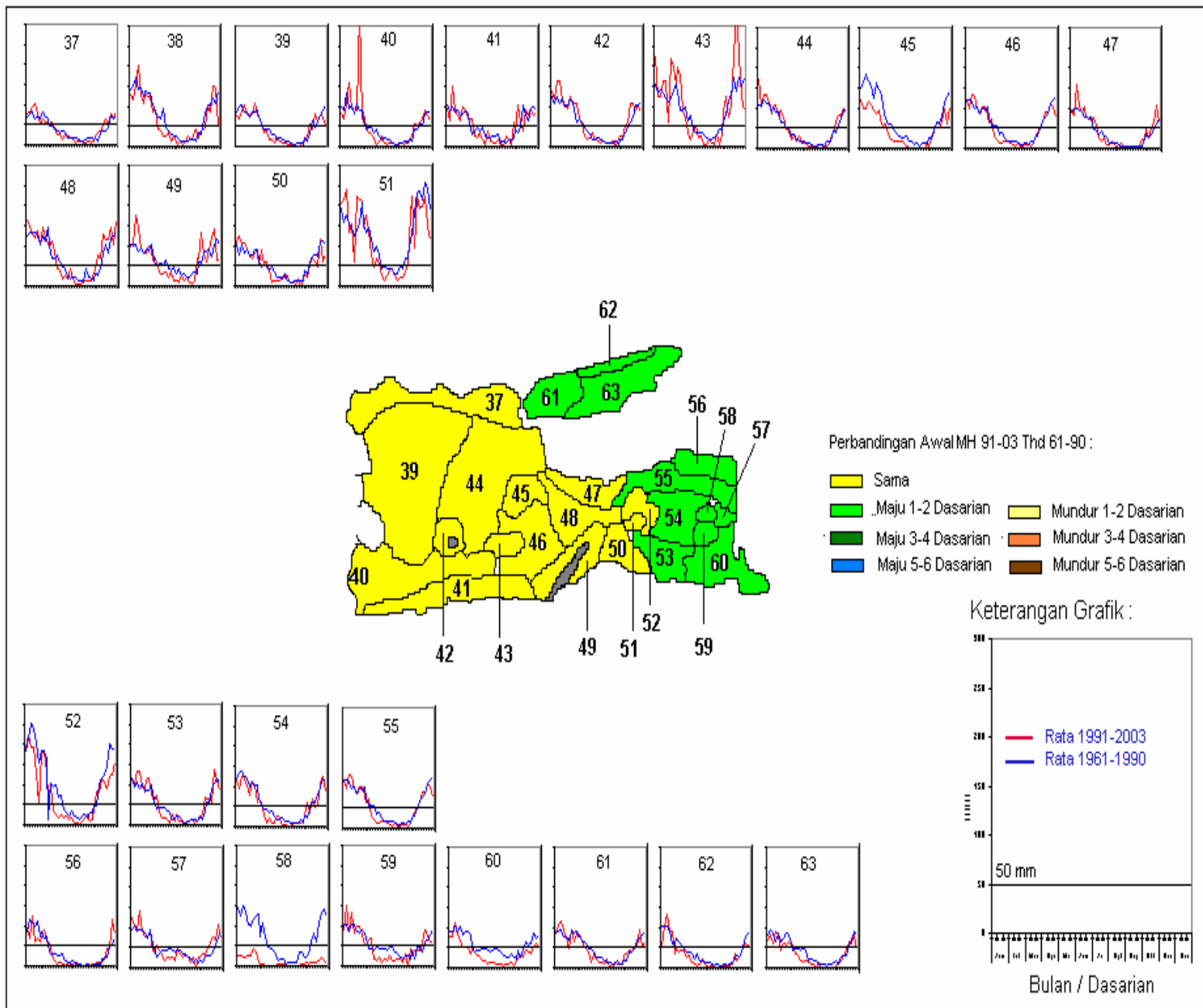


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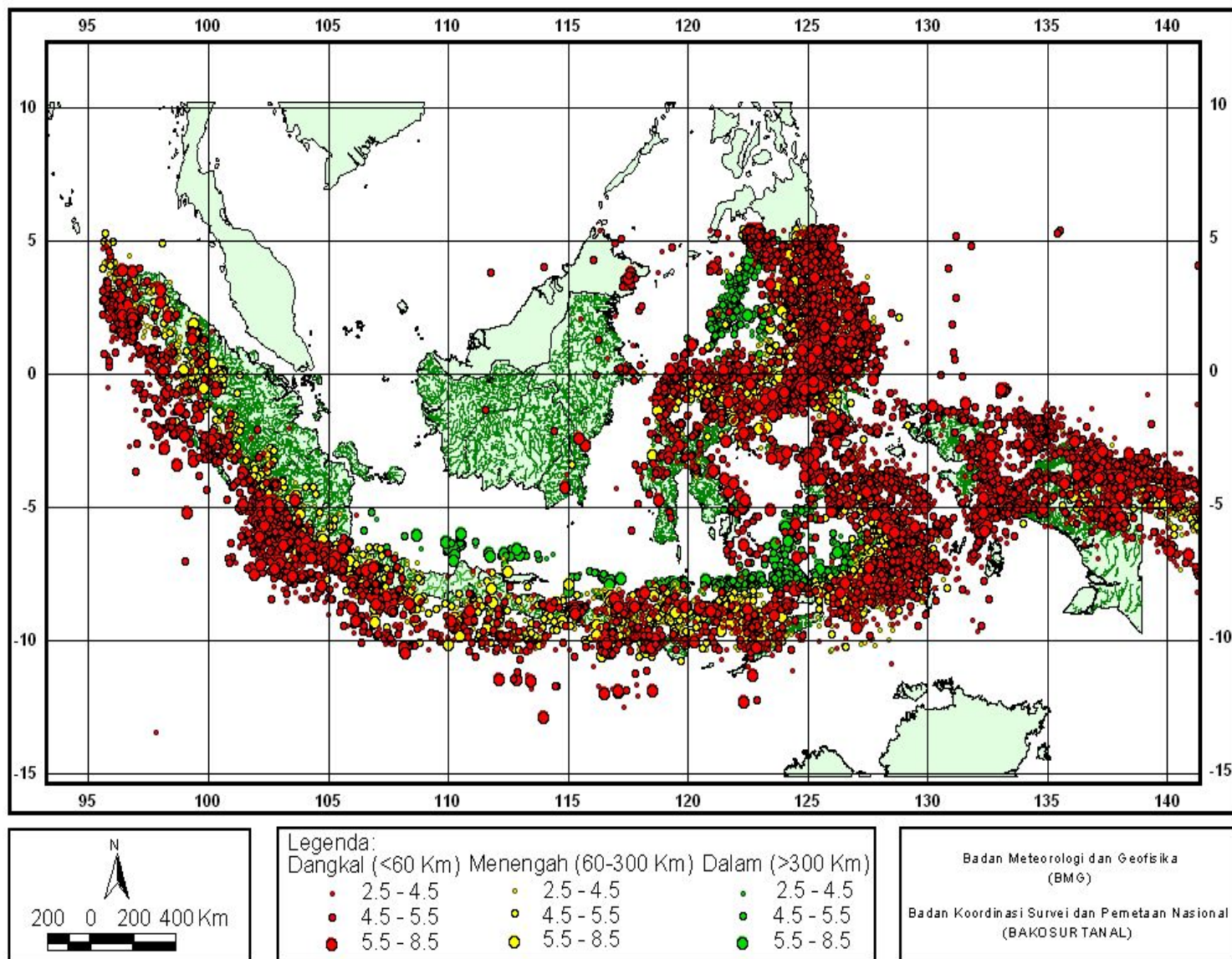
**Rainy
Season
onset**

**1991-2003
Relative to
1961-1990**

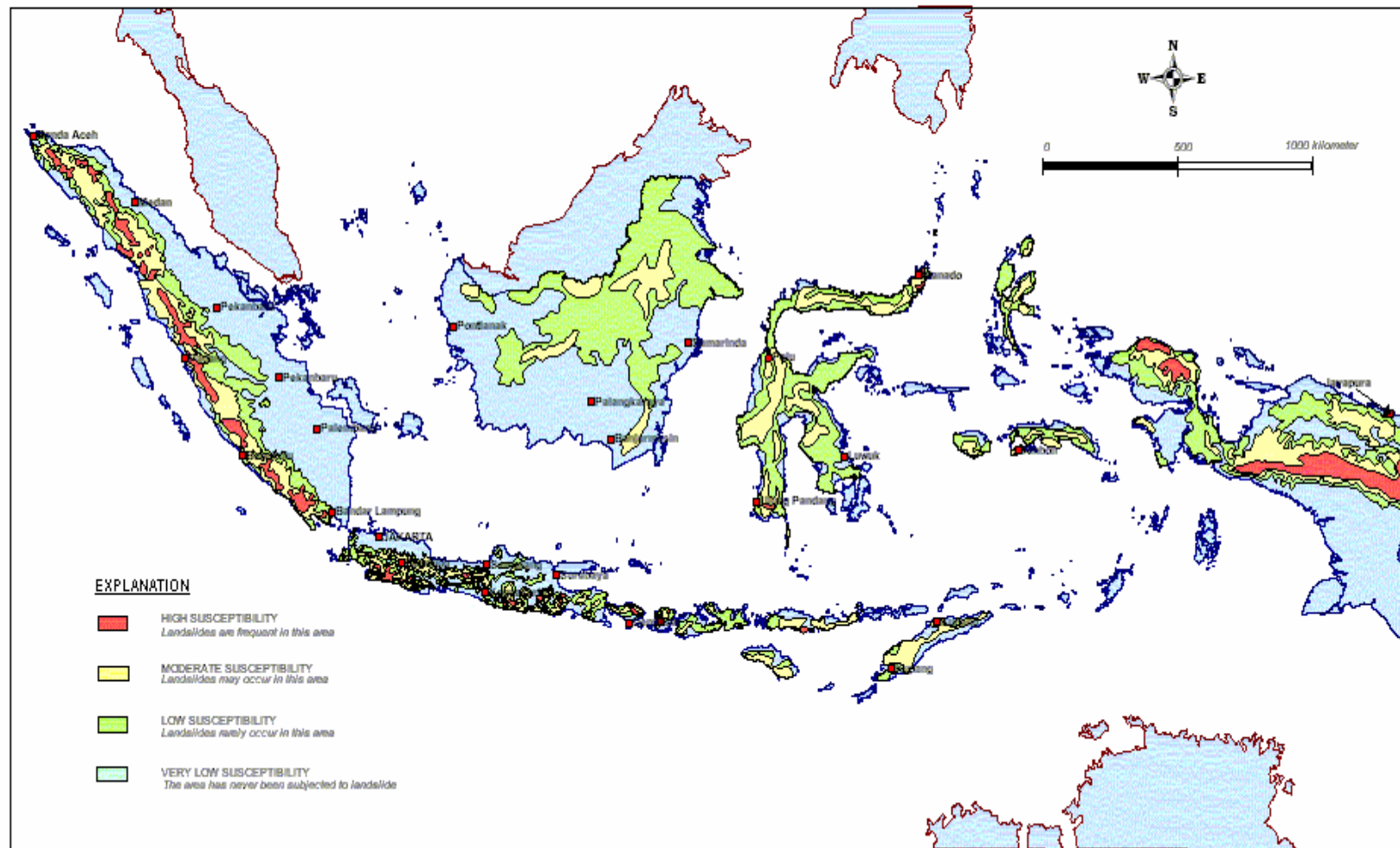
**East
Java**



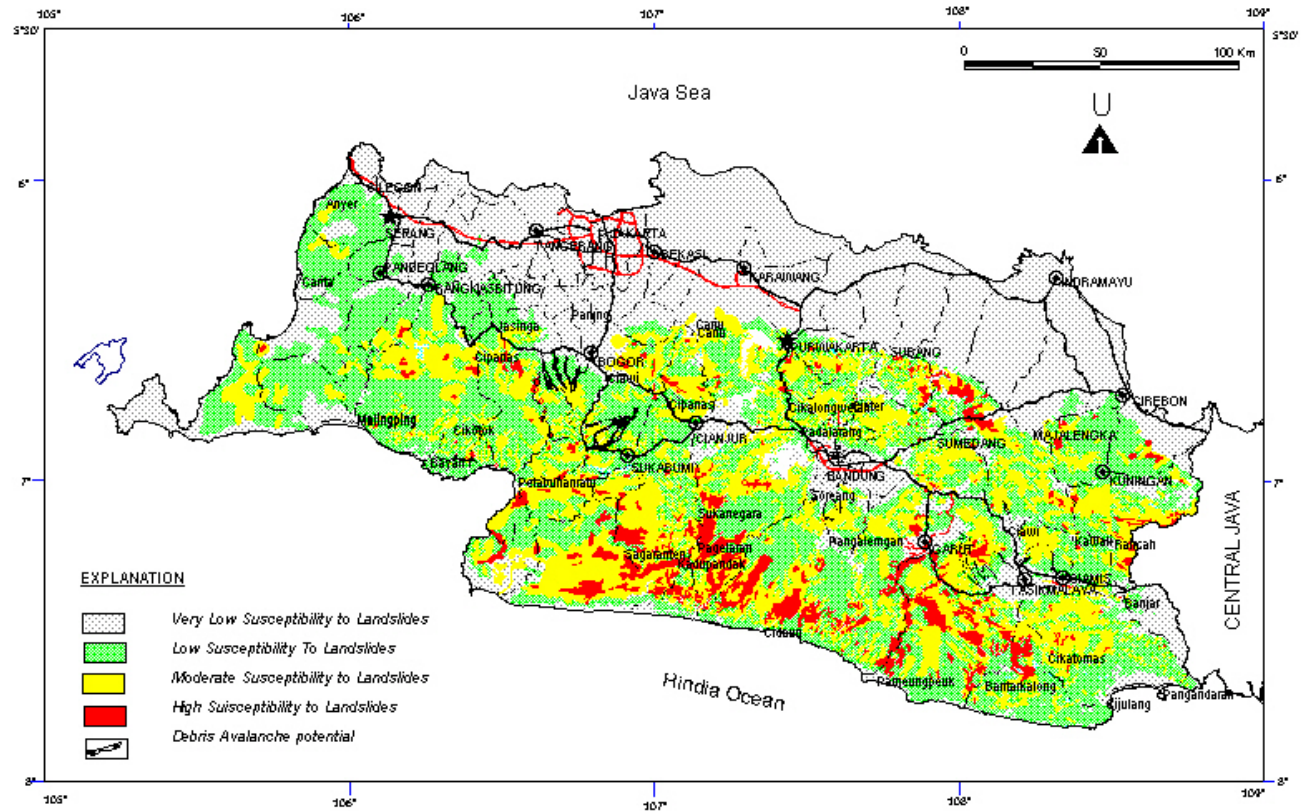
SEISMICITY MAP OF INDONESIA (1973 - 2005)

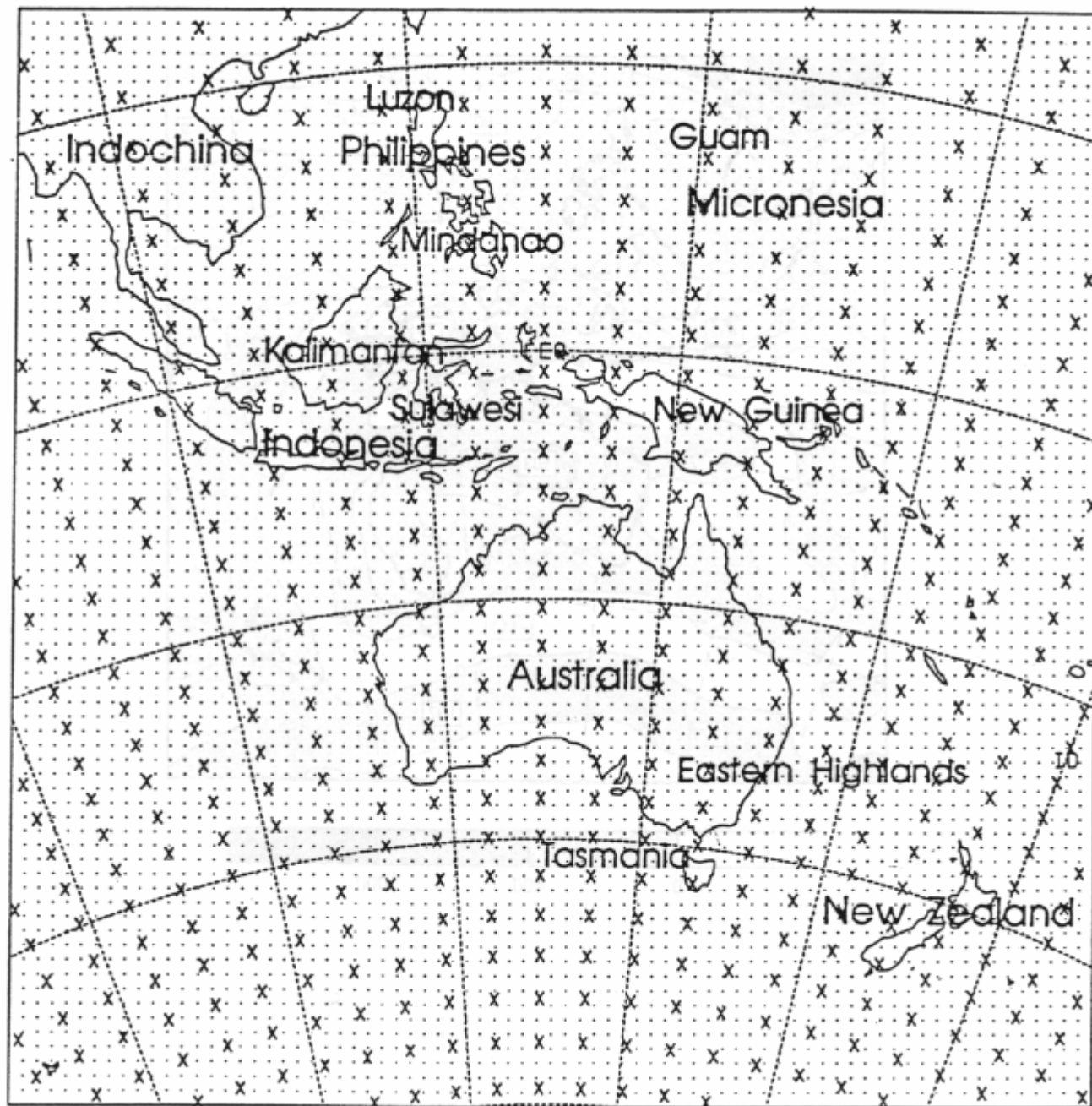


LANDSLIDE SUSCEPTIBILITY MAP OF INDONESIA



LANDSLIDES TO SESCEPTIBILITY MAP OF WEST JAVA, INDONESIA





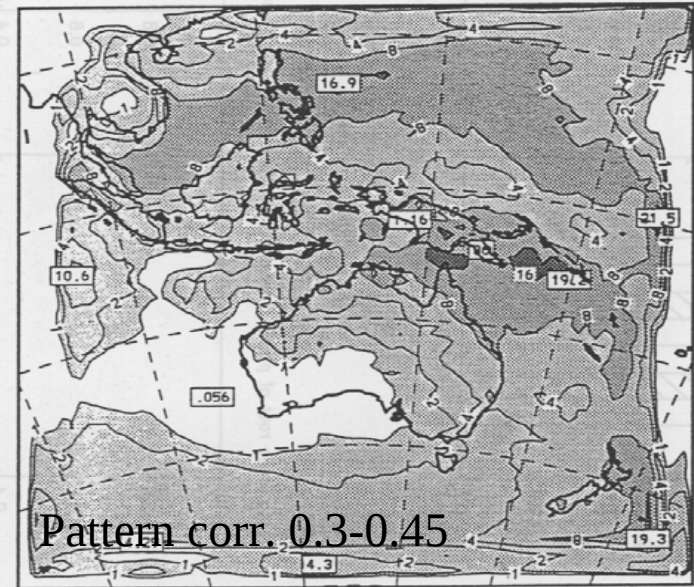
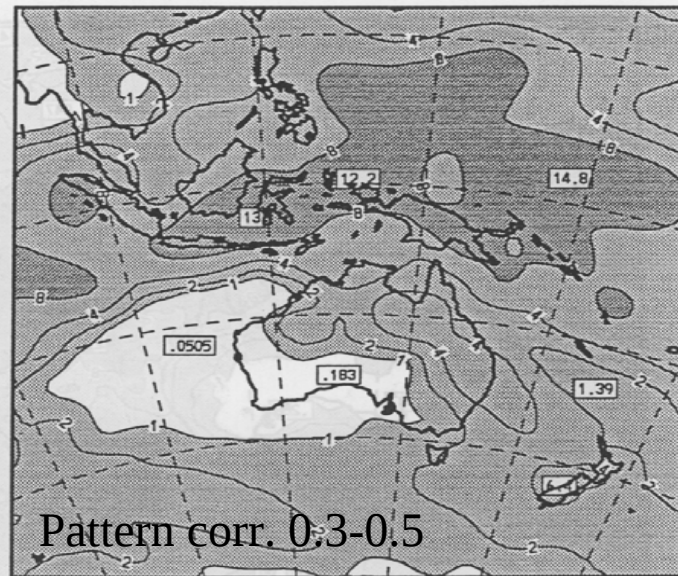
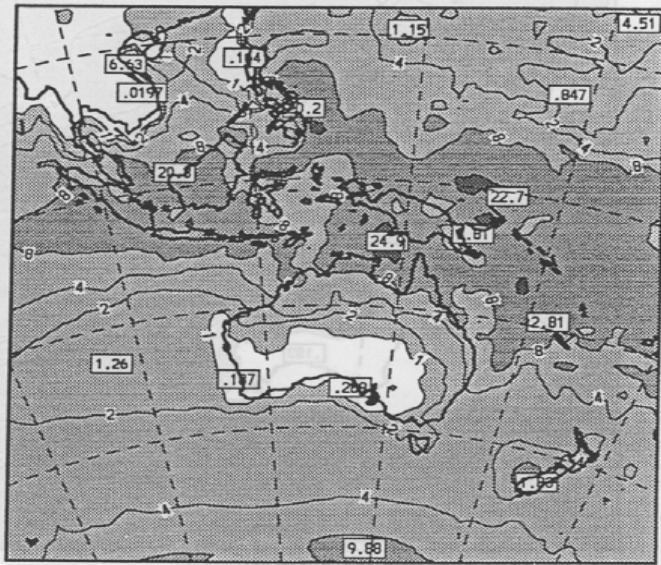
- x **GCM**
CSIRO
Mark 2
- **LAM**
DARLAM

Precipitation (mm/day)

OBS

GCM

LAM



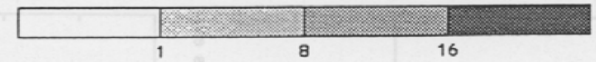
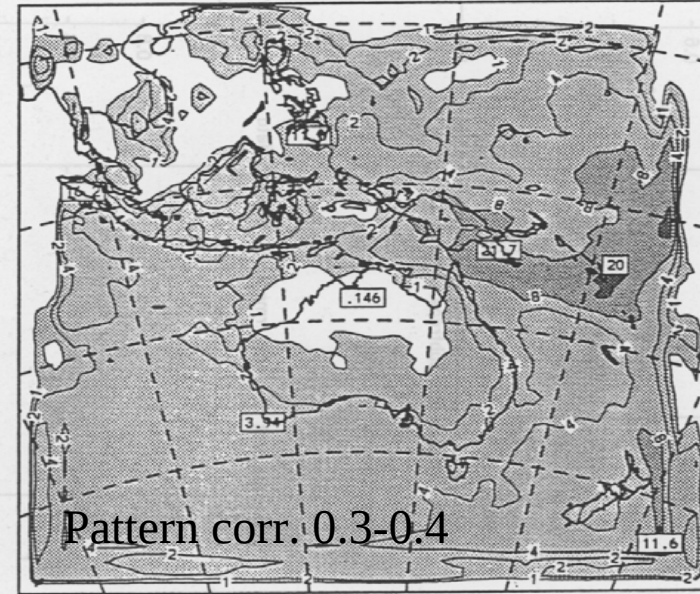
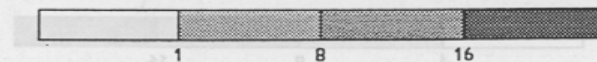
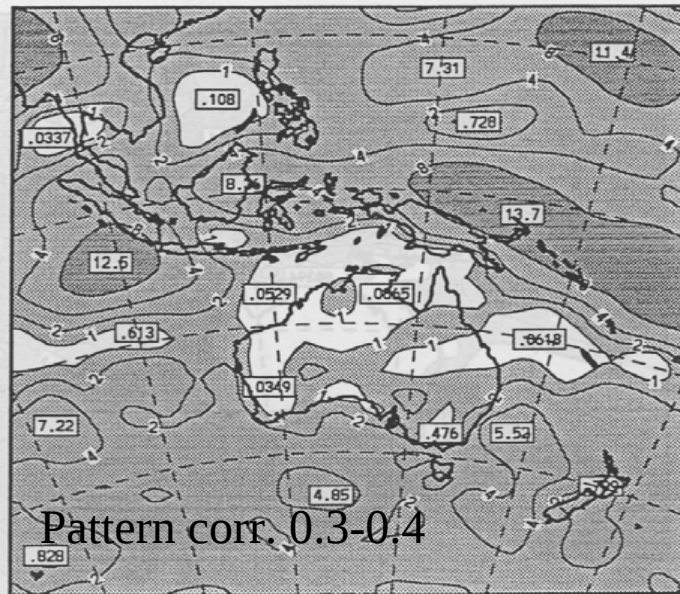
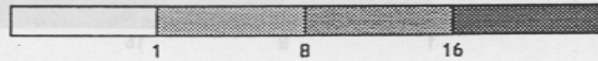
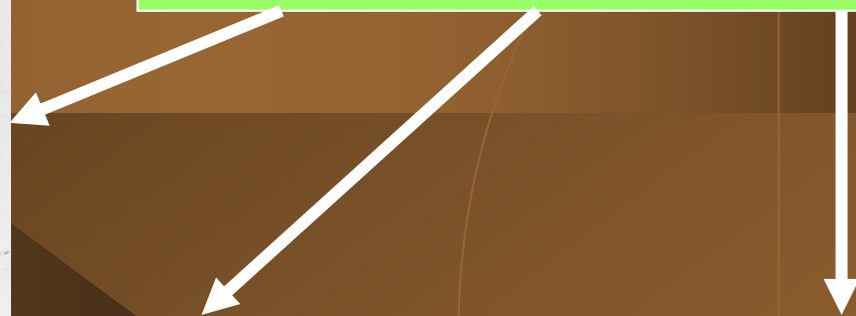
January

Precipitation (mm/day)

OBS

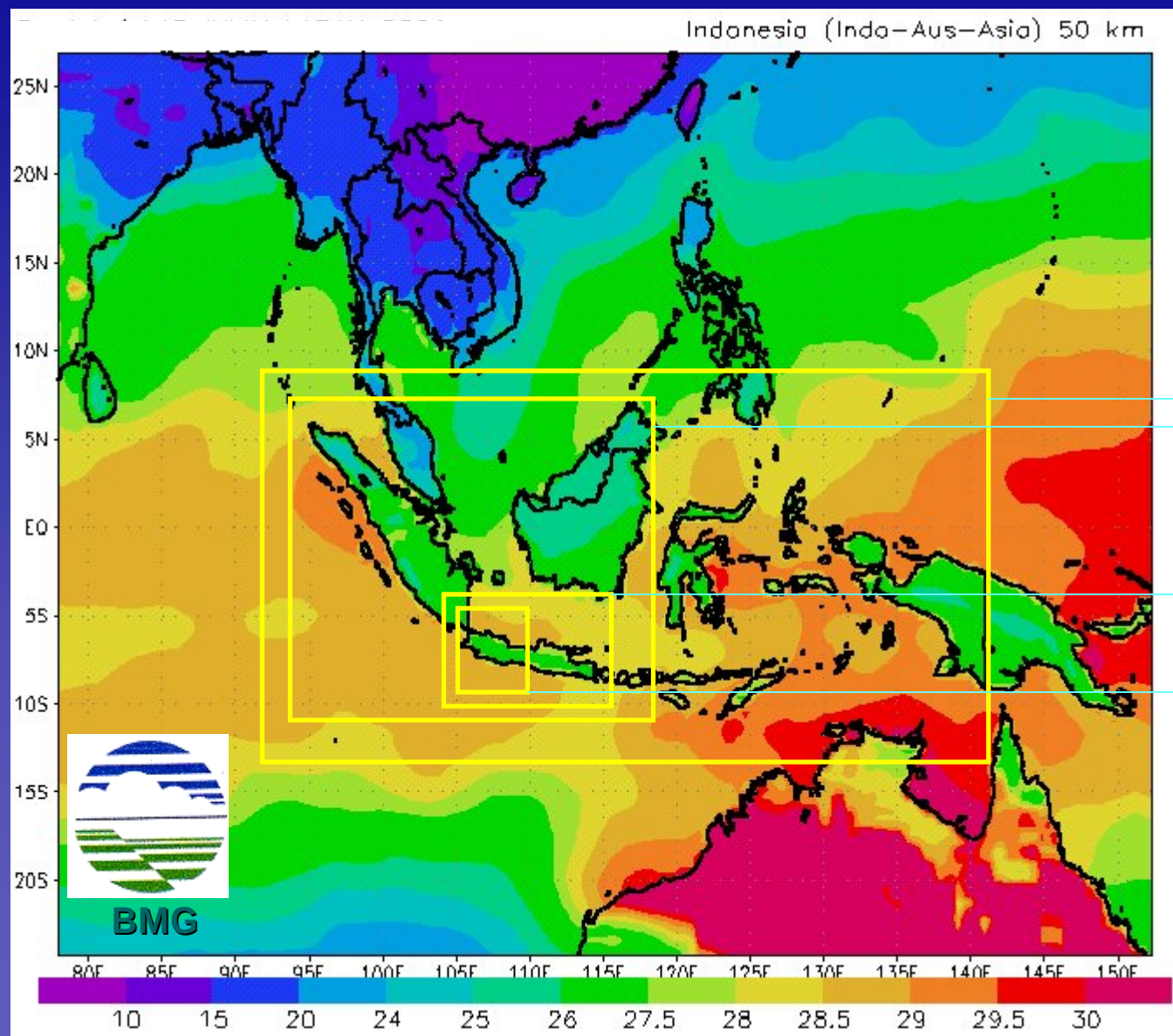
GCM

LAM



July

National, Regional and Local Weather & Climate Models



Horizontal
Resolution

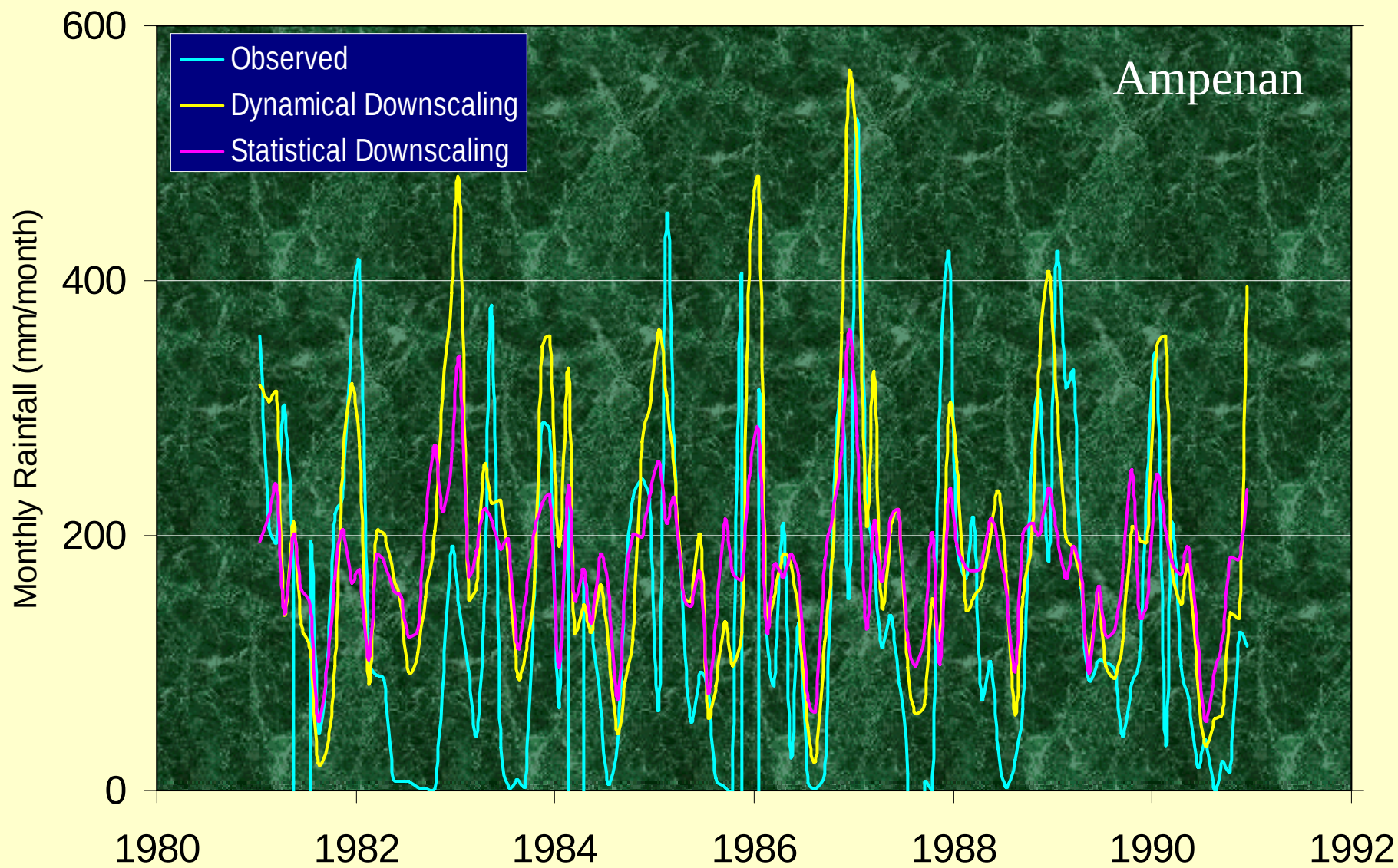
50 km

30 km

5-10 km



Meso/Local
~Kabupaten/
Regency



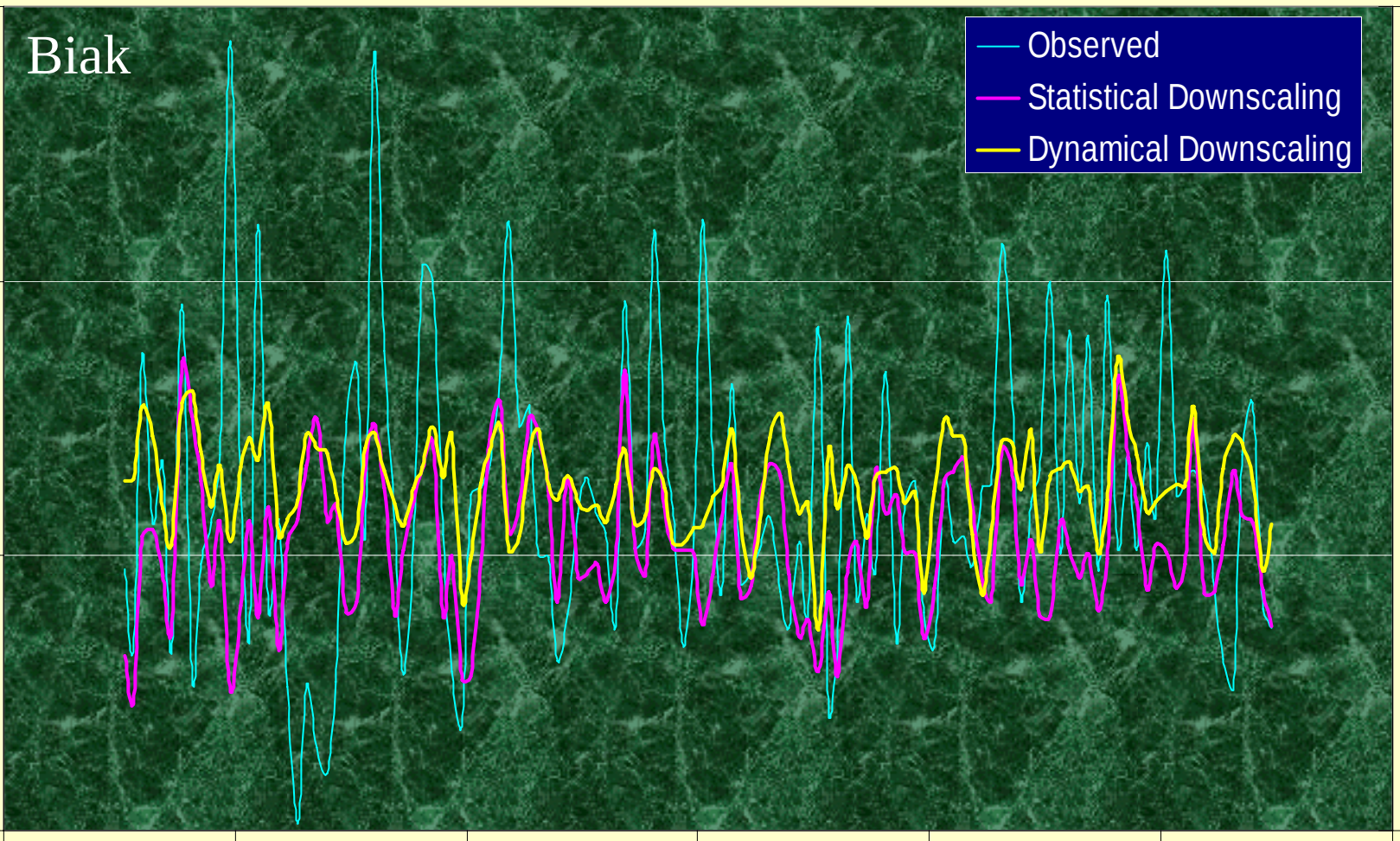
Biak

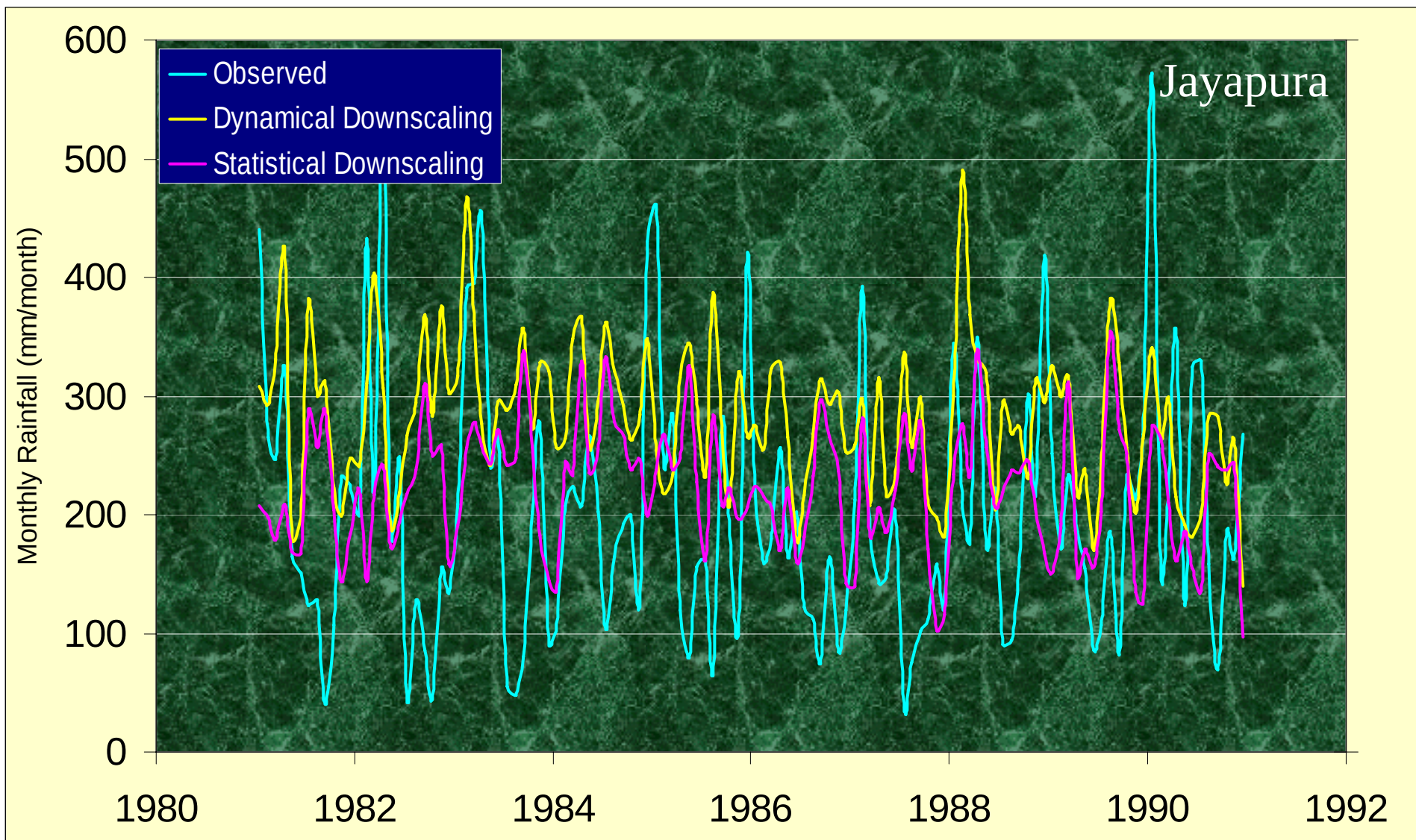
- Observed
- Statistical Downscaling
- Dynamical Downscaling

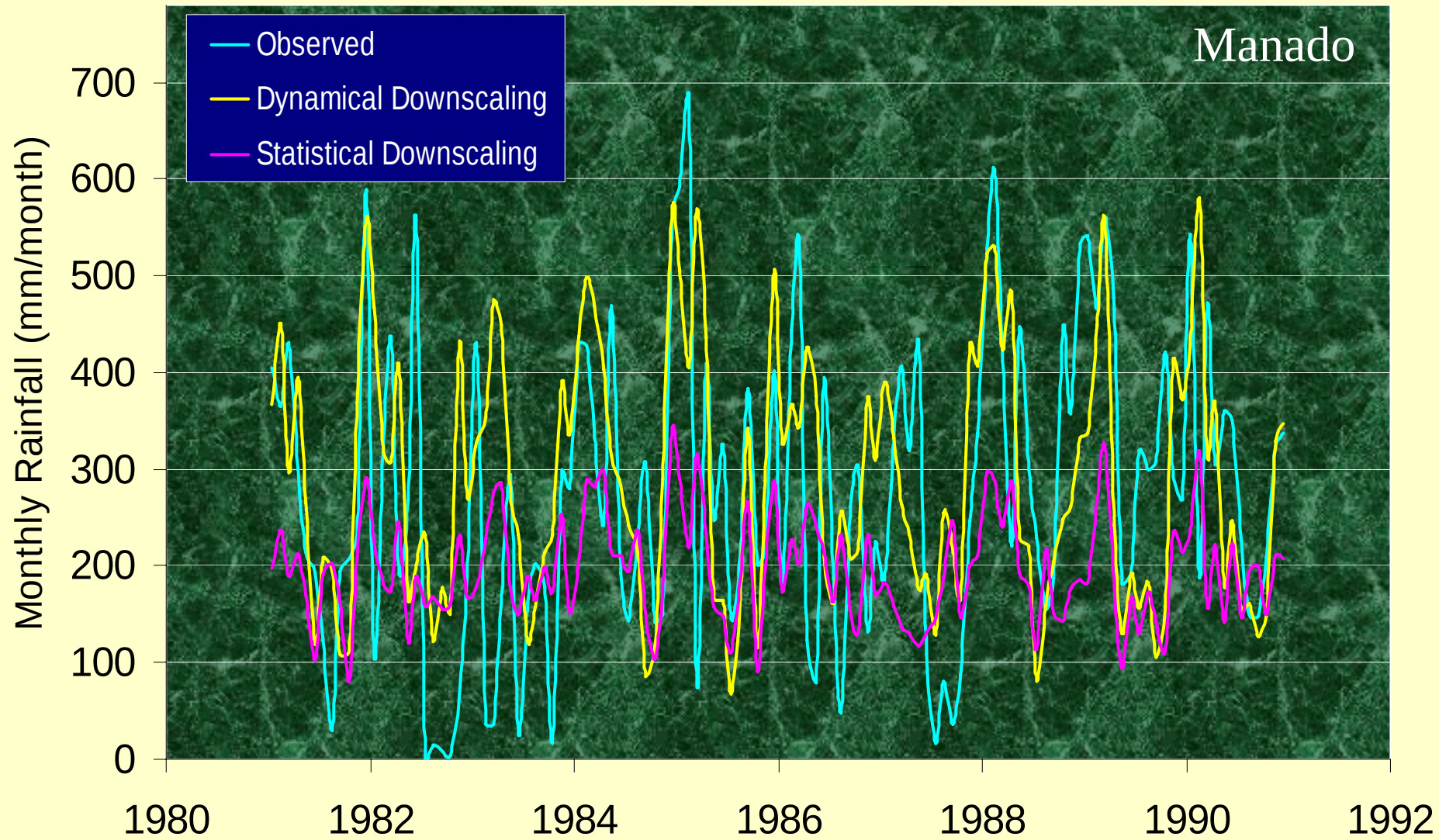
Monthly Rainfall (mm/month)

600
400
200
0

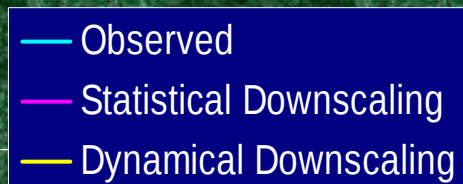
1980 1982 1984 1986 1988 1990 1992



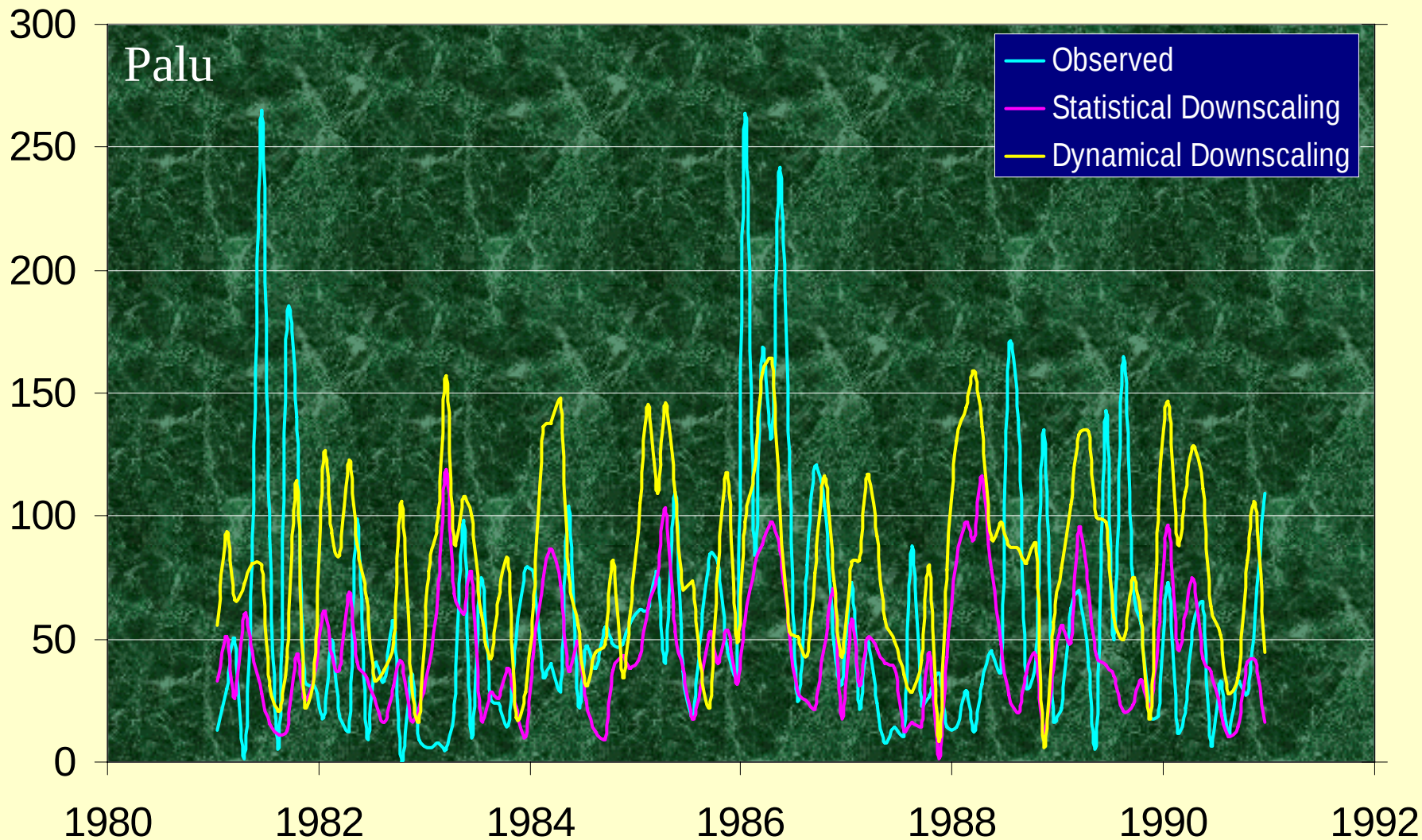


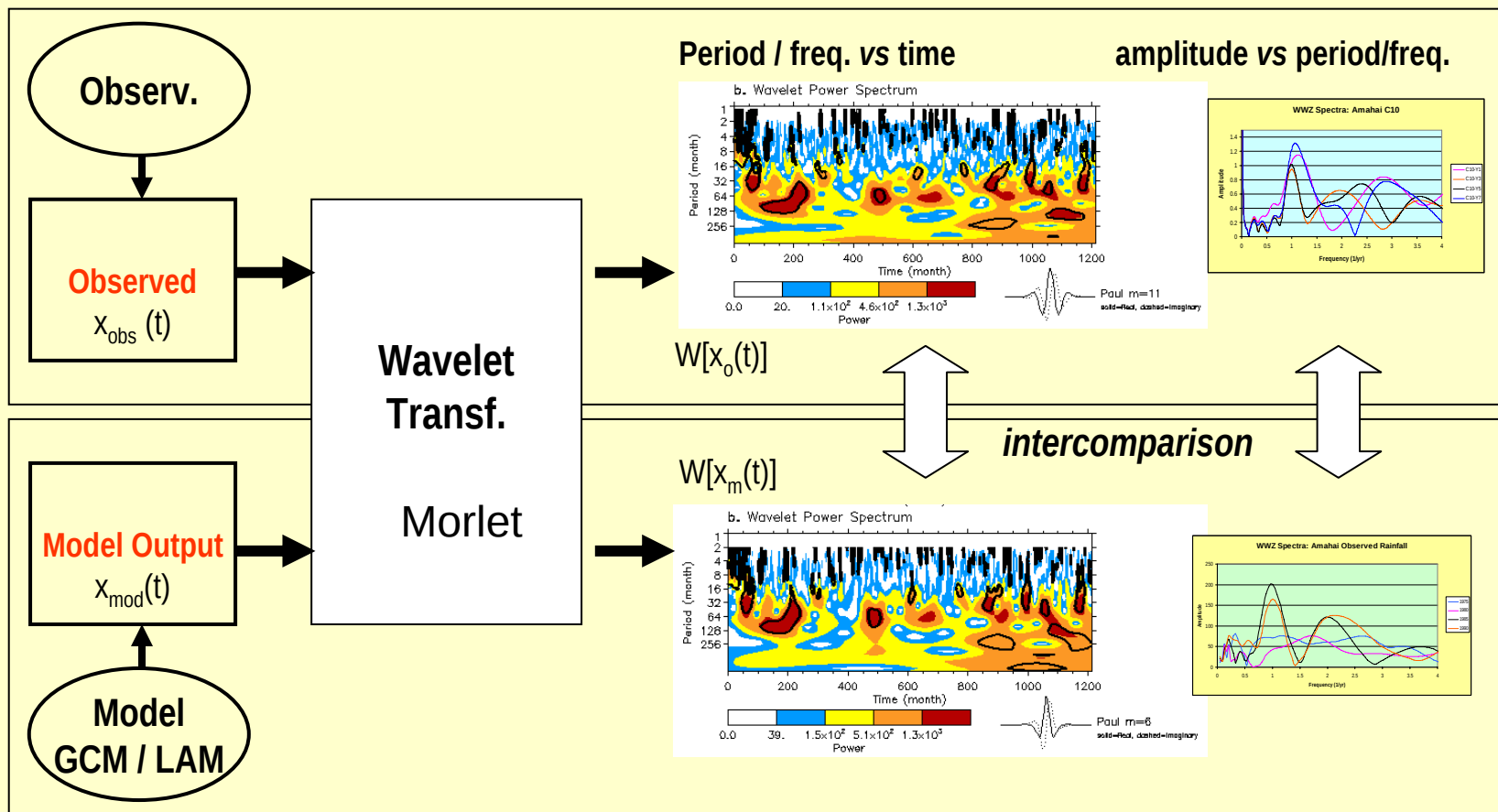


Palu



Monthly Rainfall (mm/month)





Identification & analysis of processes
and periodic phenomena
($W[x_o(t)]$ and $W[x_m(t)]$)

Validation & Verification of RCM / LAM Using Wavelet Time-Frequency Analysis

Mezak A. Ratag (BMG)



BMG

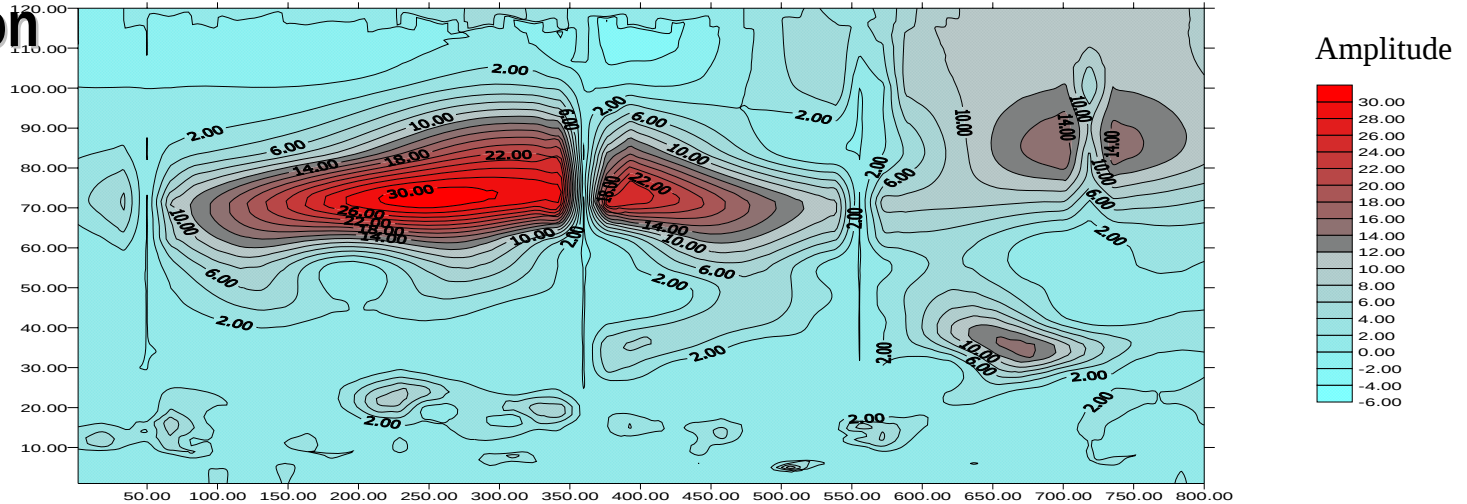
Bandung (West Java)

Observation

AO

Period
(Pentad)

SAO

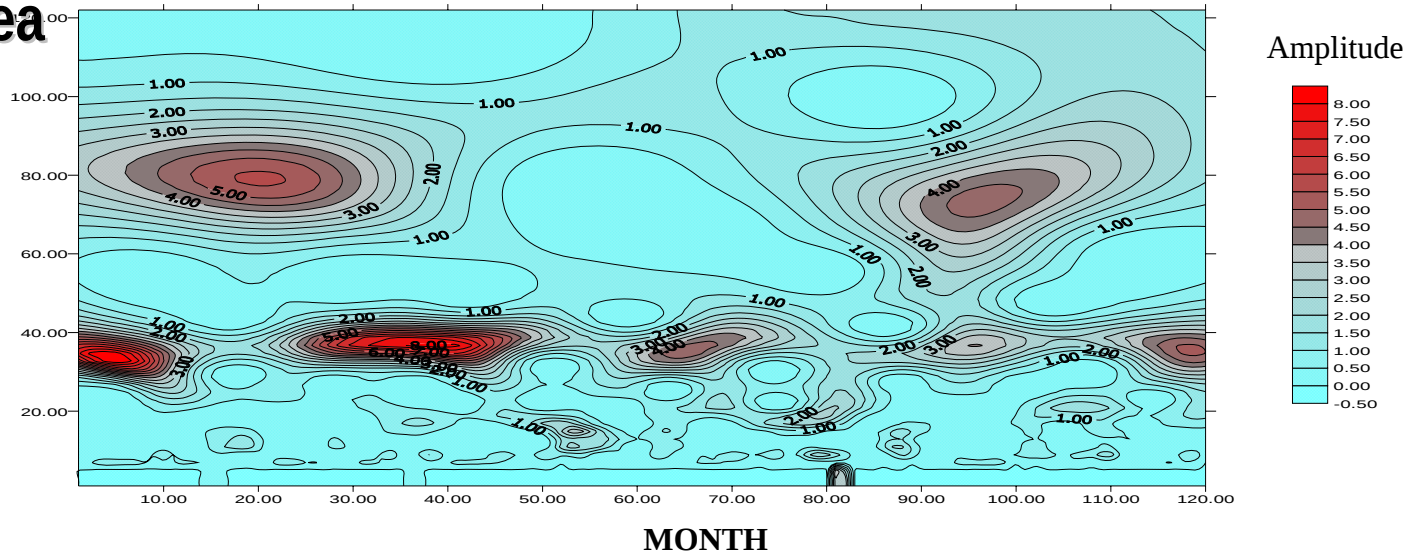


Limited Area Model

AO

Period
(Pentad)

SAO



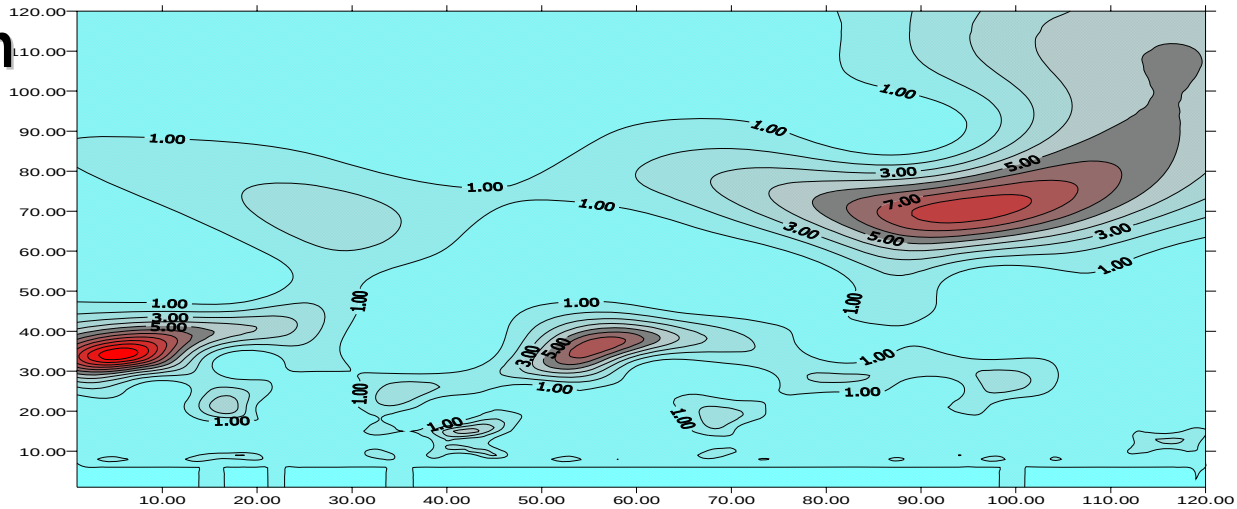
Medan (North Sumatra)

Observation

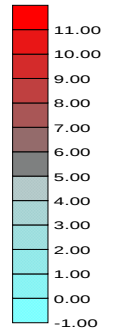
AO

Period
(Pentad)

SAO



Amplitude

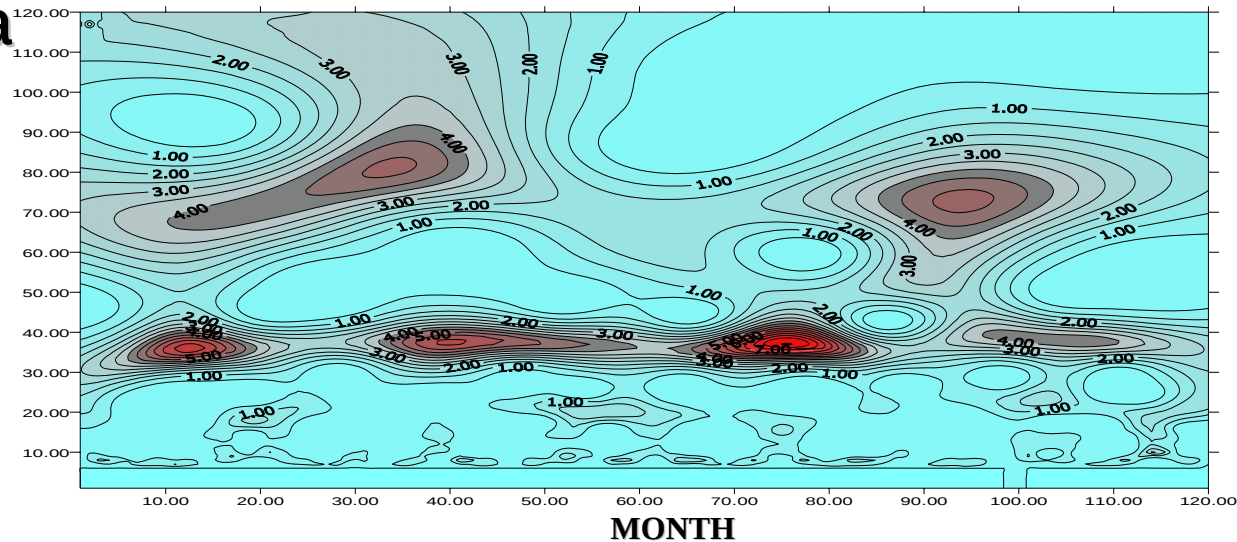


Limited Area
Model

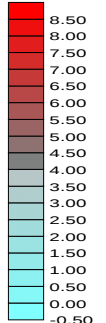
AO

Period
(Pentad)

SAO



Amplitude



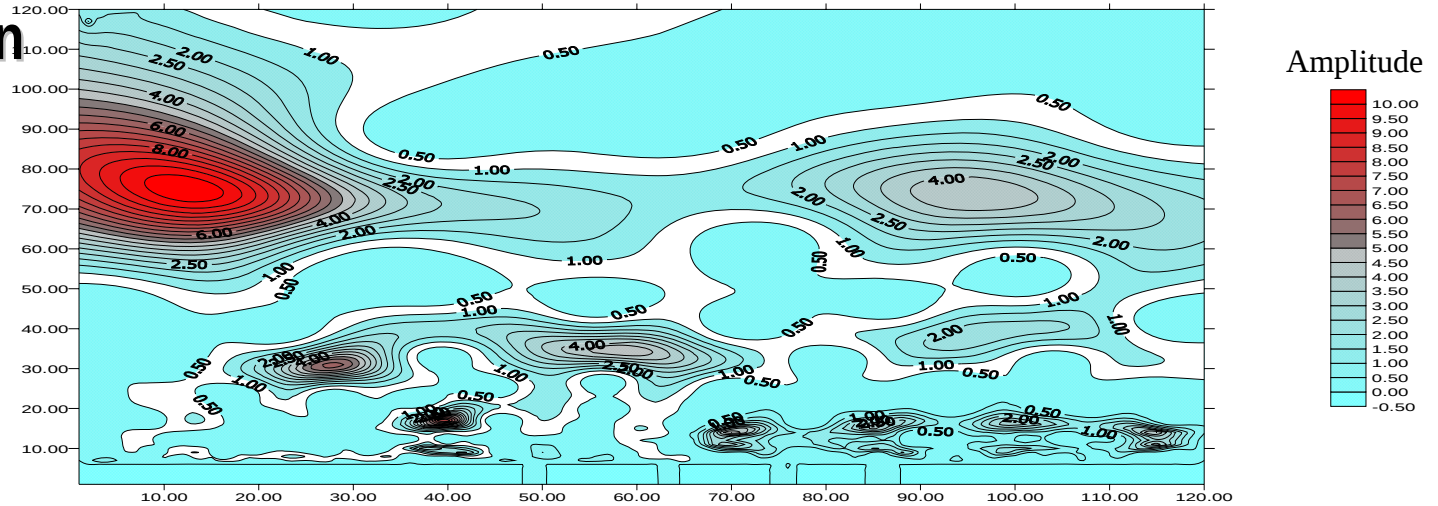
Manado (North Sulawesi)

Observation

AO

Period
(Pentad)

SAO

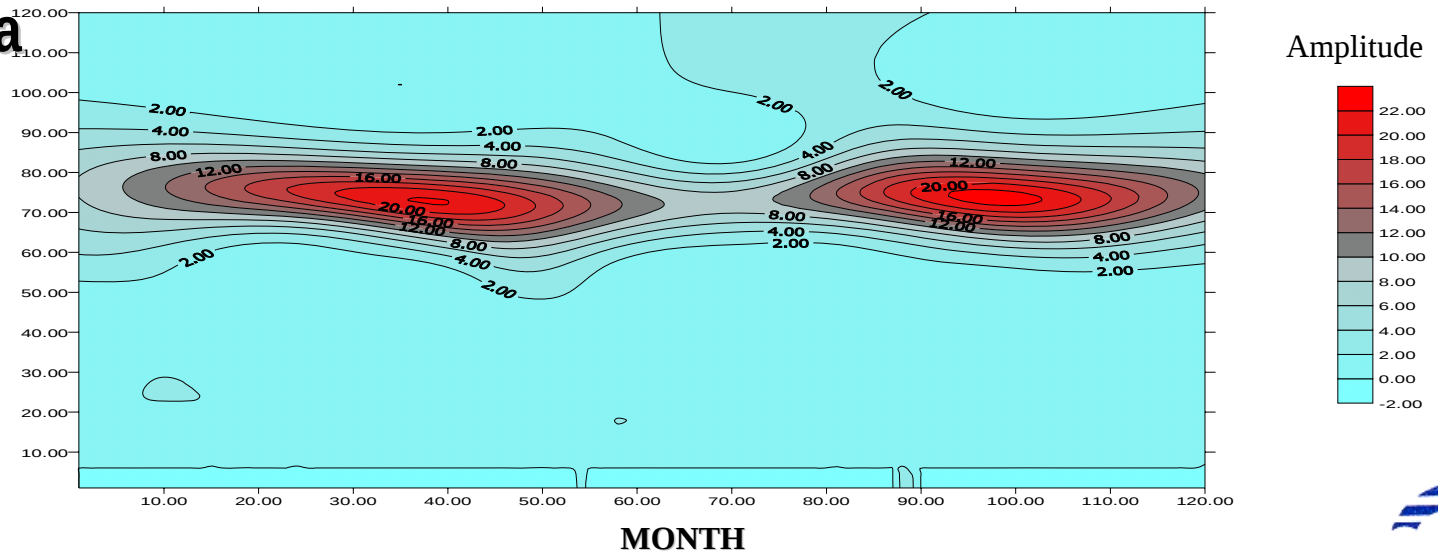


Limited Area Model

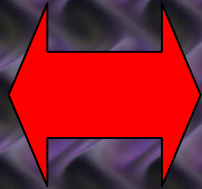
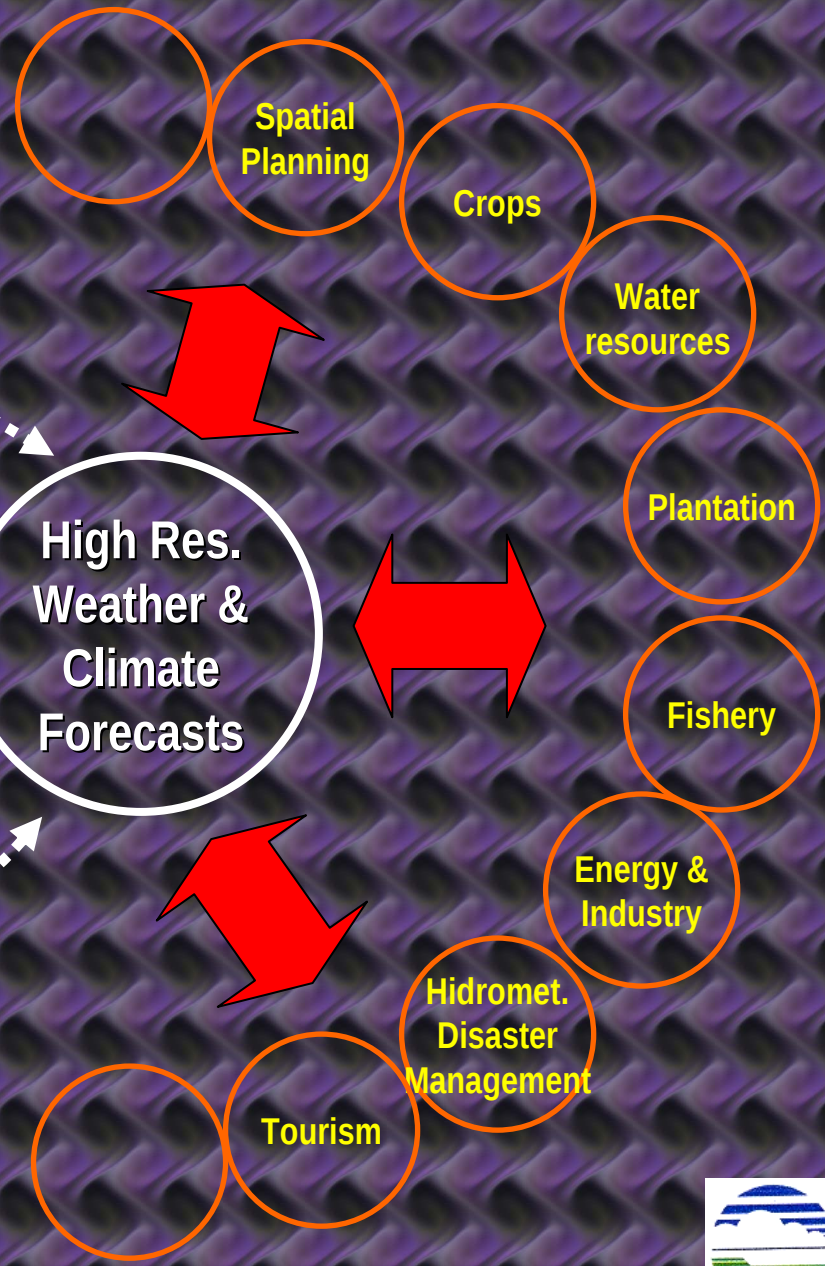
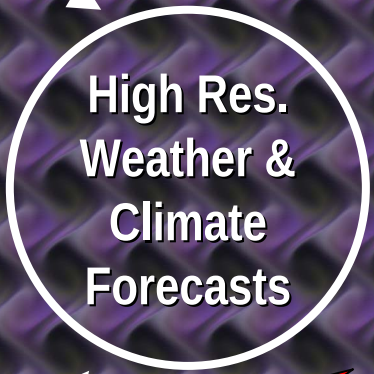
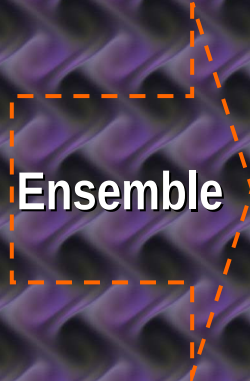
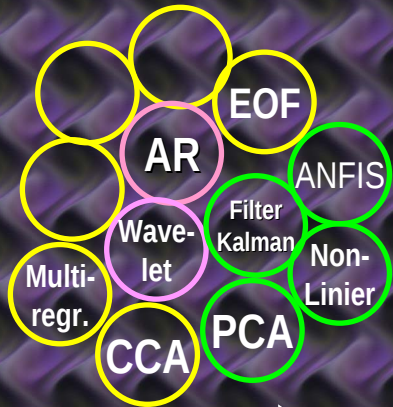
AO

Period
(Pentad)

SAO



Statistical Models



*Statistical
Downscaling*



*Dynamical
Downscaling*



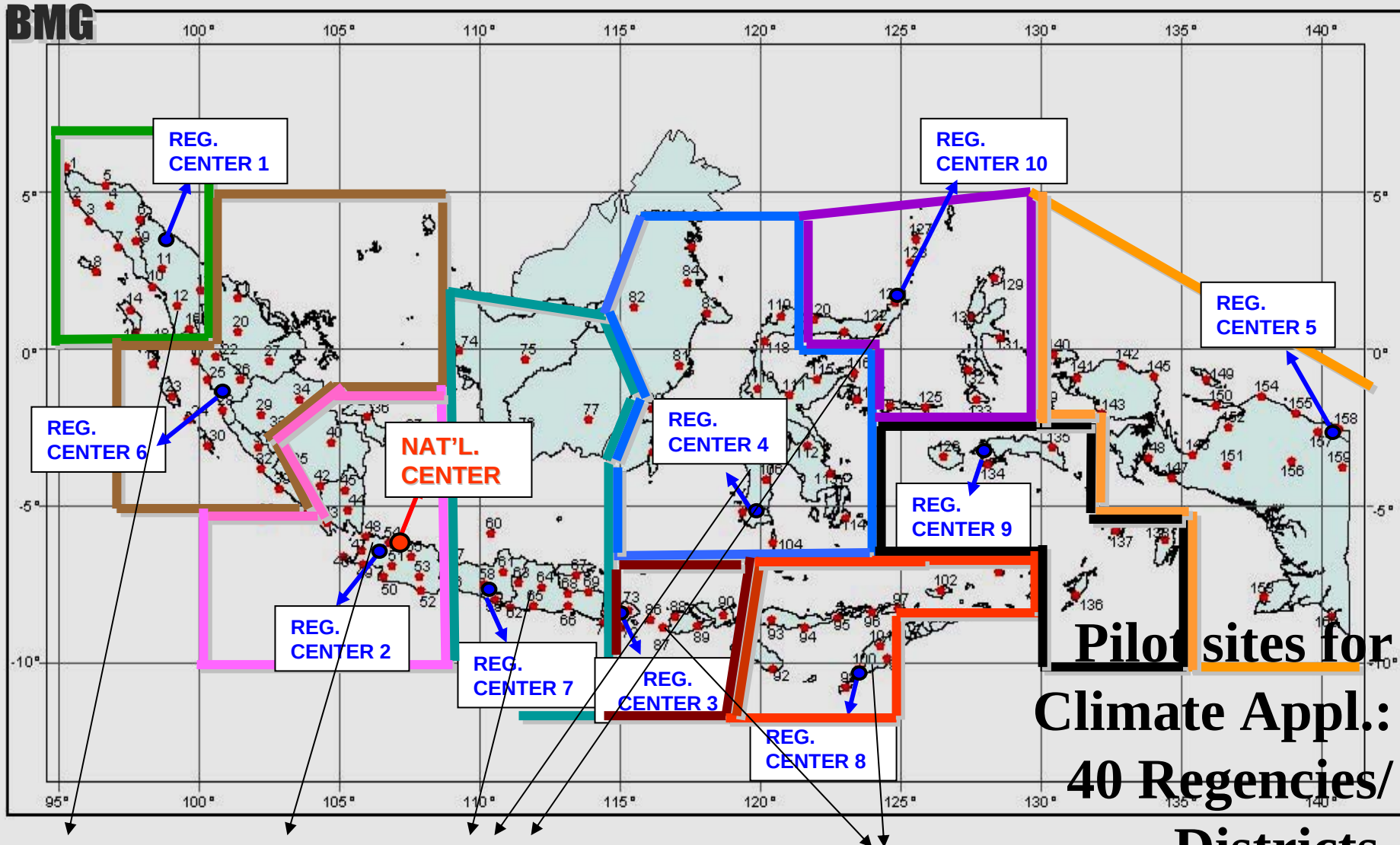
Numerical/Dynamical Models



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10 REGIONAL CENTERS MULTI-HAZARDS WARNING SYSTEM



Horticulture
Pest Management

Rice Production
Flood
Landslide

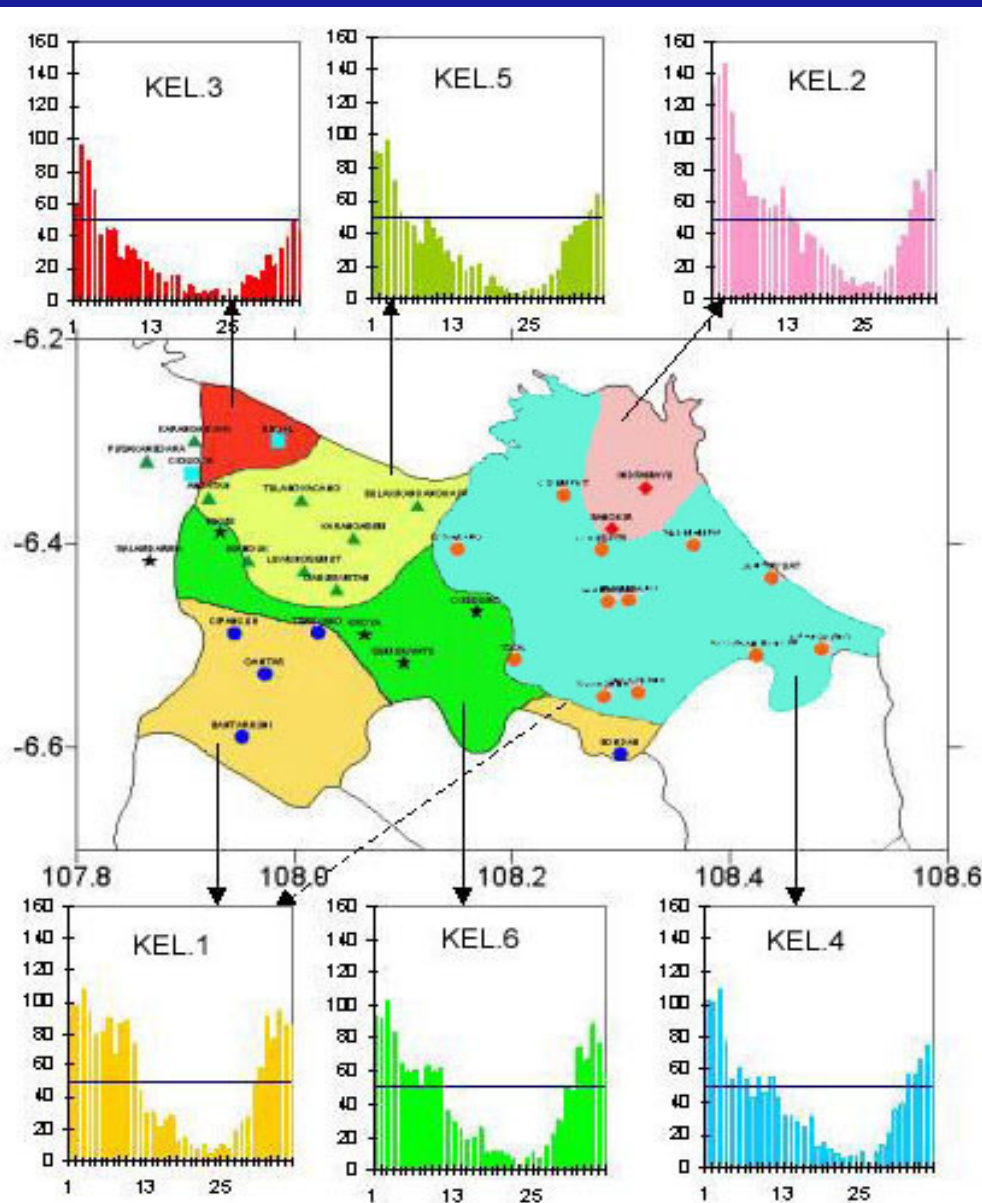
Rice Production
Plantation
Flood

Salt Mining

Water Management

**Pilot sites for
Climate Appl.:
40 Regencies/
Districts
(~10%)**

Rainfall Type Zonation KAB. INDRAMAYU



Kel-1 : bag sel Haurgelis/ Gabuswetan/
Bangodua

Kel-2 : bag.utara Indramayu

Kel-3 : bag.utara Anjatan/Sukra

Kel-4 : Krangkeng /Karangampel

Juntinyuat/ Sliyeg/Kertasemaya/

Jatibarang/Widasari/Sindang/

Lohbener/ bag.Utara Bangodua

Kel-5 : Kandanghaur/Bongas/bag.utara

Gabuswetan/bag.timur

Anjatan/Lohsarang

Kel-6 : Cikedung /bag.sel.Gabuswetan

/bag.utara Haurgelis/ Lelea

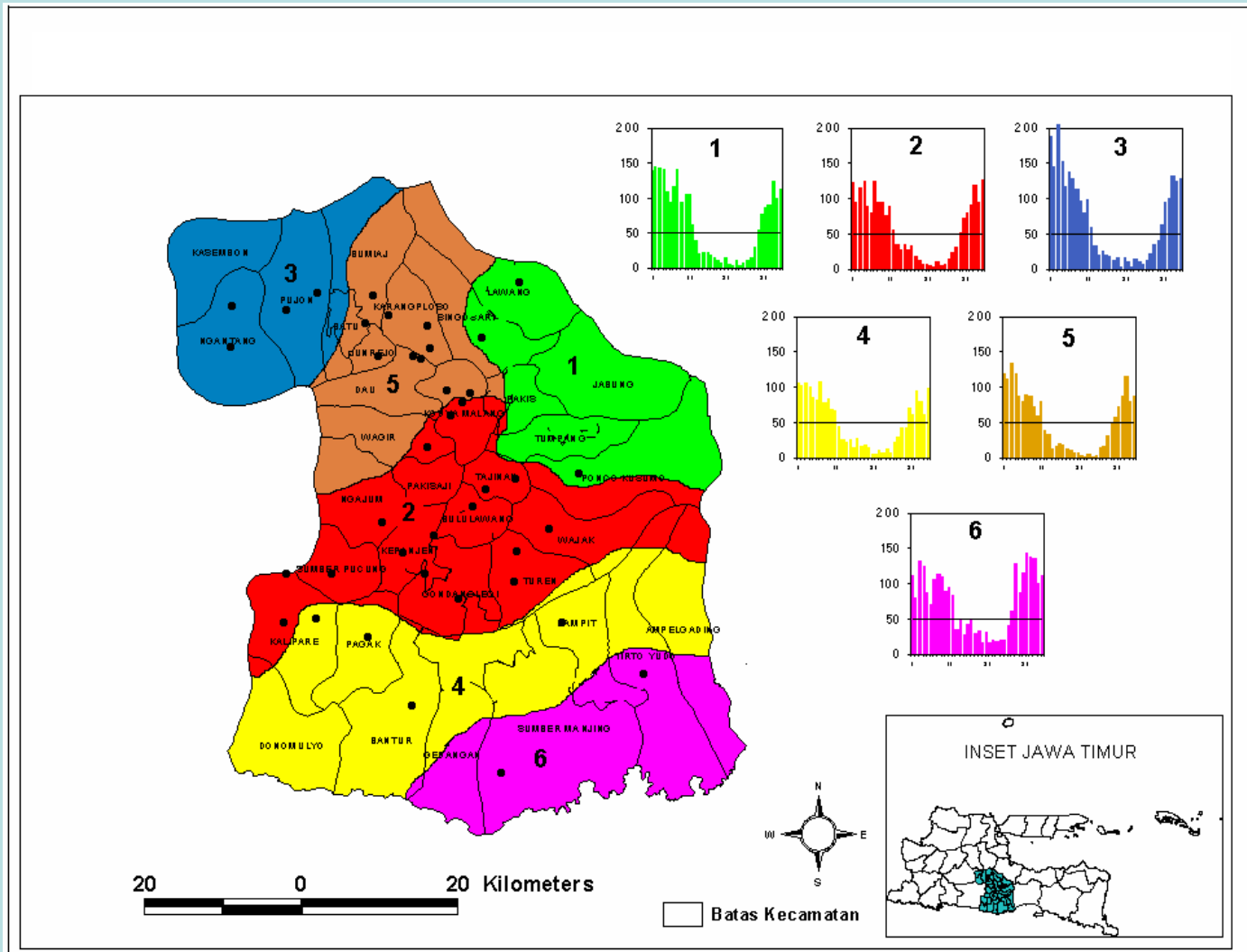


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Malang, East Java



Climate risk management: Demonstration sites in SE Asia

Diversity of climate hazards + socio-economic systems

Multi-scale partnerships



Can Tho

Indramayu

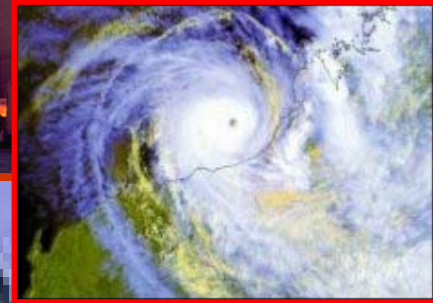
Bali

Nusa Tenggara
Timur

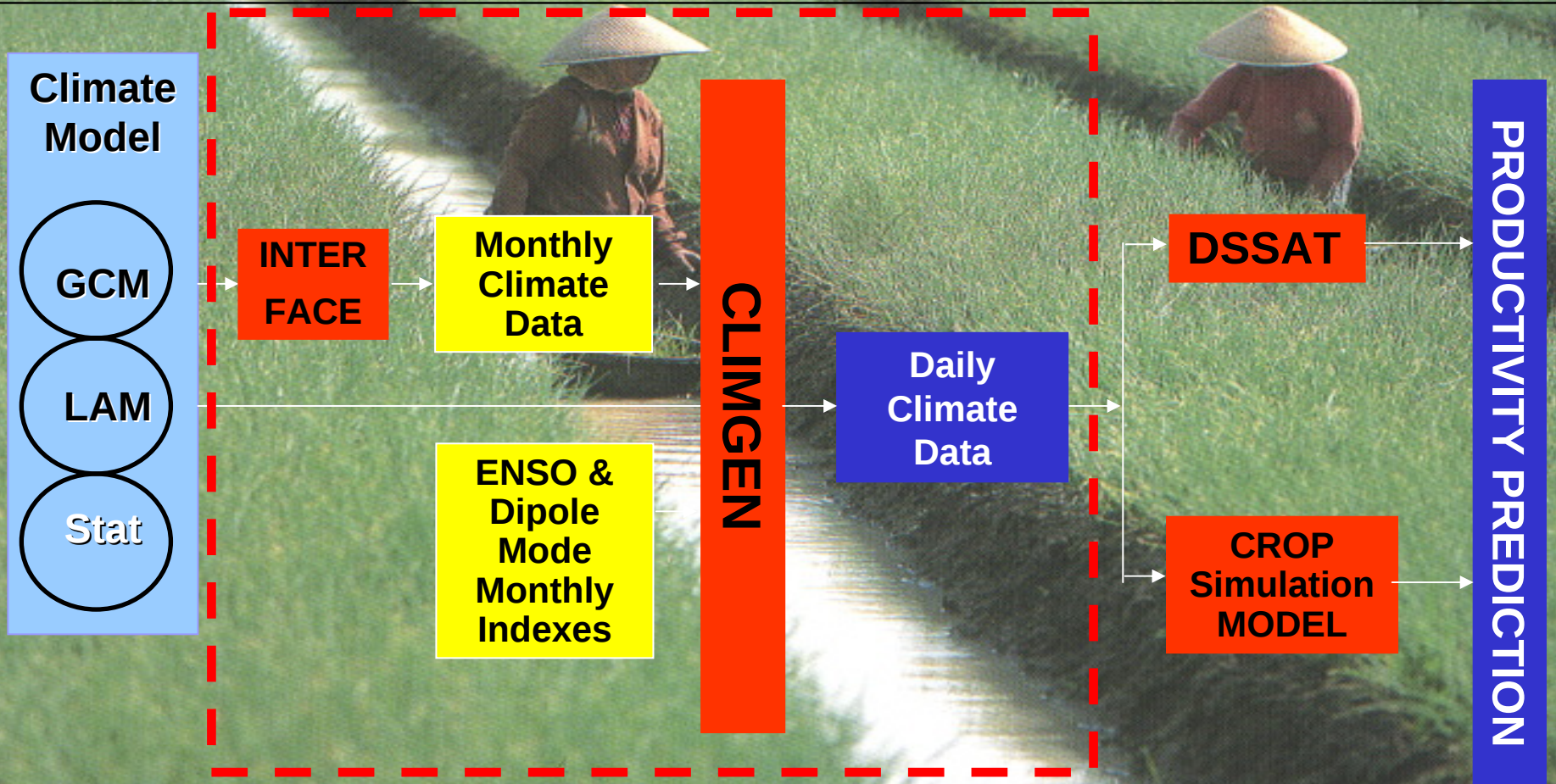
Timur



Sectors



Integrated Climate-Crop Model



GCM : General Circulation Model

LAM : Limited Area Model

DSSAT : Decision Support System for Agrotechnology Transfer



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Universities,
Research Institutes

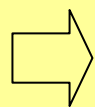


Climate & Weather
Observation Data

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Basic Map
Landslide & Flood
Susceptibility Maps

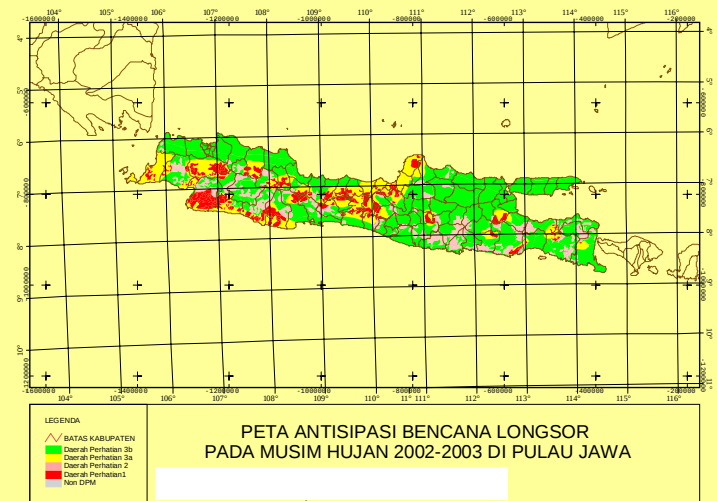
Bakosurtanal
Ditjen. Geologi & SDM
Dep. Kimpraswil



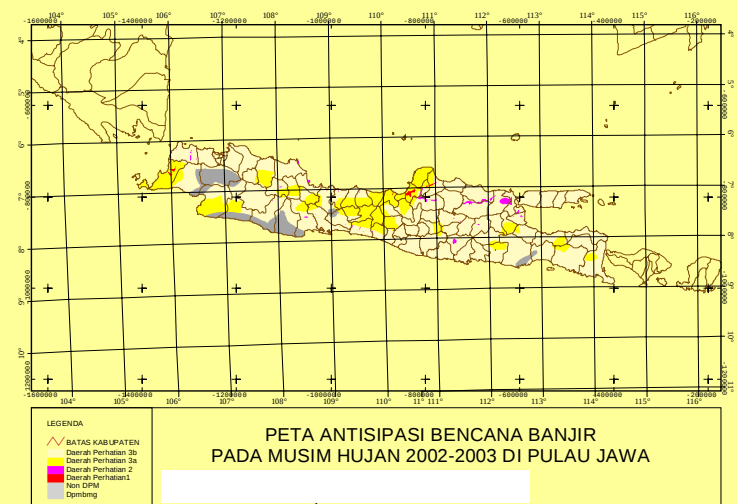
Rainfall
Forecast

BMG

GIS Gridding
&
Susceptibility
Classification



Hazard Atlas & Prediction Map
For Landslides & Floods



Land & Forest Fires



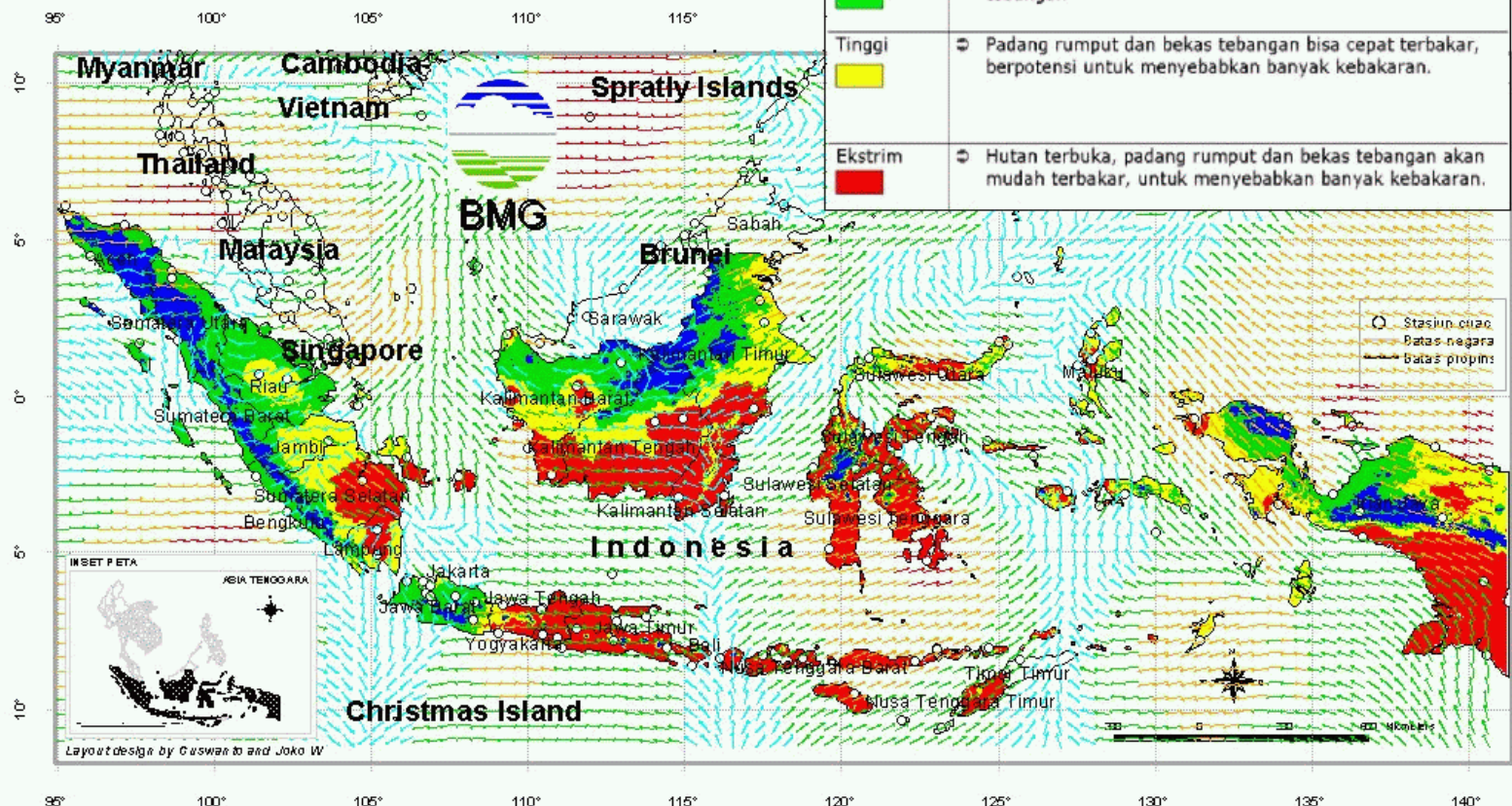
Central Kalimantan
LANDSAT-5 TM

Fire Danger Rating System

INDONESIA, 21 OKTOBER 2003

**POTENSI TINGKAT KEMUDAHAN PENYULUTAN API
MENJADI KEBAKARAN HUTAN DAN LAHAN**

(INDEK KELEMBABAN BAHAN BAKAR HALUS)



Issued : Tgl. 21 OKTOBER 2003, 16.00 LST
 Valid : Tgl. 22 OKTOBER 2003, 16.00 LST

Medan angin 10 M DPL

0-2 km/jam 6-9 km/jam
 3-5 km/jam 10-12 km/jam

Data source : Badan Meteorologi dan Geofisika
 Product : GIS-BMG Work Group

Air Quality & Air Pollution Dispersion Model

Air Quality Modelling



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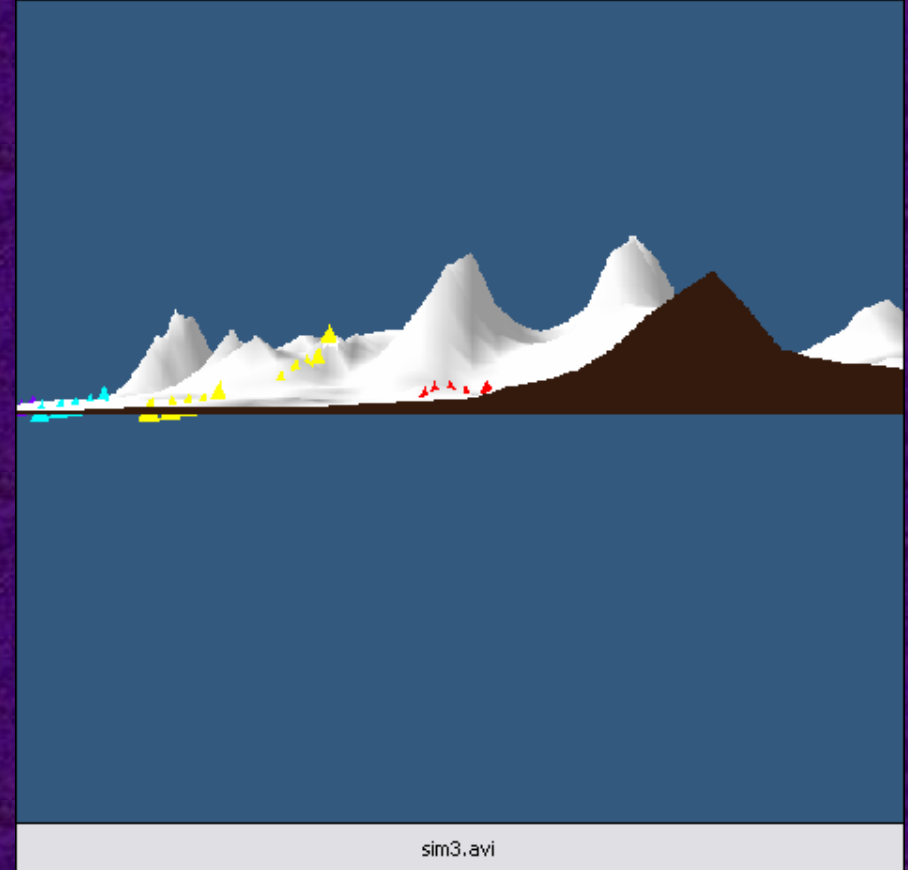
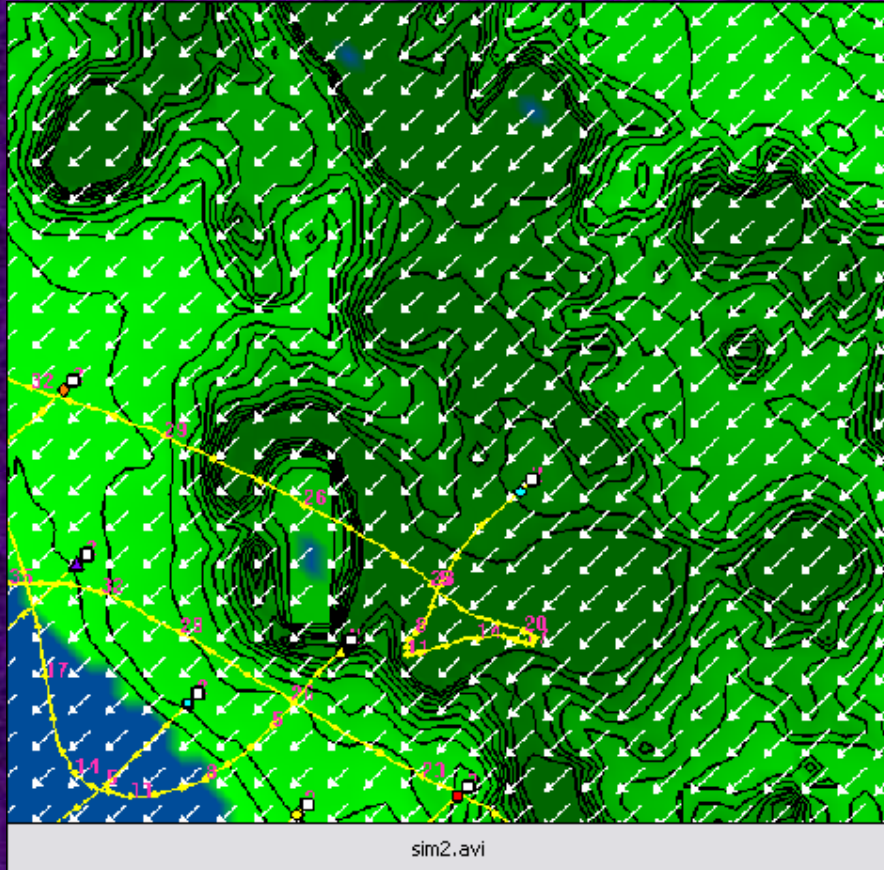
Particle Trajectory

Wind Field

'washing'
by rainfall

Day 2 20:00





Air Pollution Dispersion Model

Case Study: West Sumatra

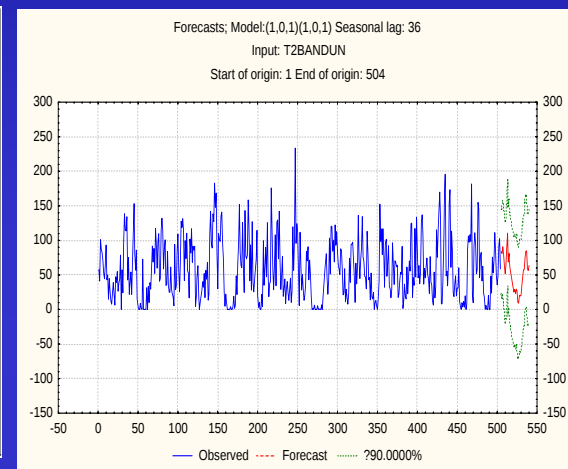
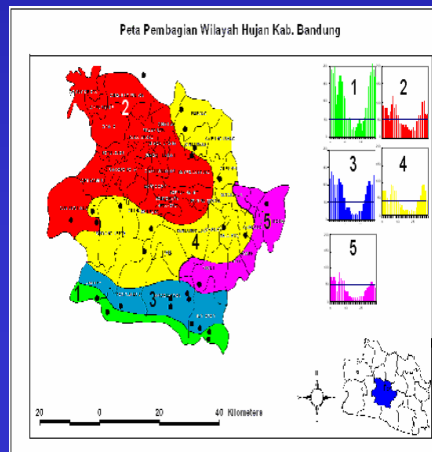
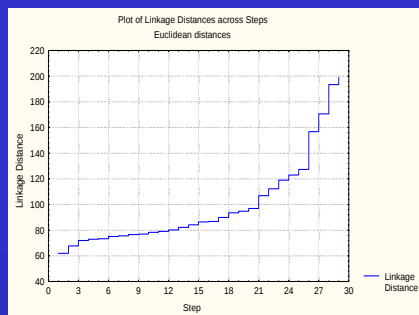
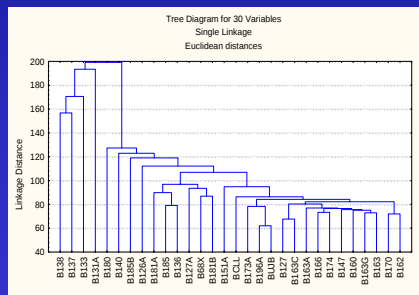
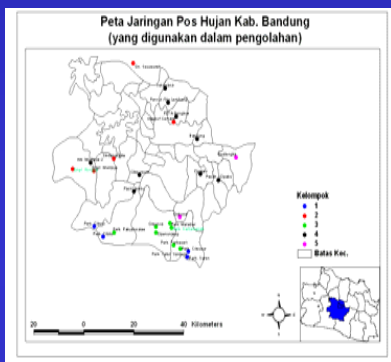


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in collaboration with Dept of Agriculture, IPB, IRI, ADPC



Positioning &
Data
Collecting

Clustering

Zoning

Multi-Model
Develop-
ment

Forecasting

Validation

Challenges for Provider to Meet End Users Needs

The need:

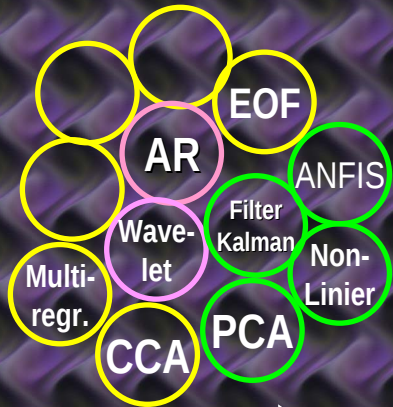
Weather & Climate forecast information that:

- is localized
- timely
- in easily understandable language

Challenges for Provider:

- Capacity to generate the localized information
- Experience in communicating probabilistic scientific information for practical use by end users

Statistical Models



*Statistical
Downscaling*

AO-
GCM

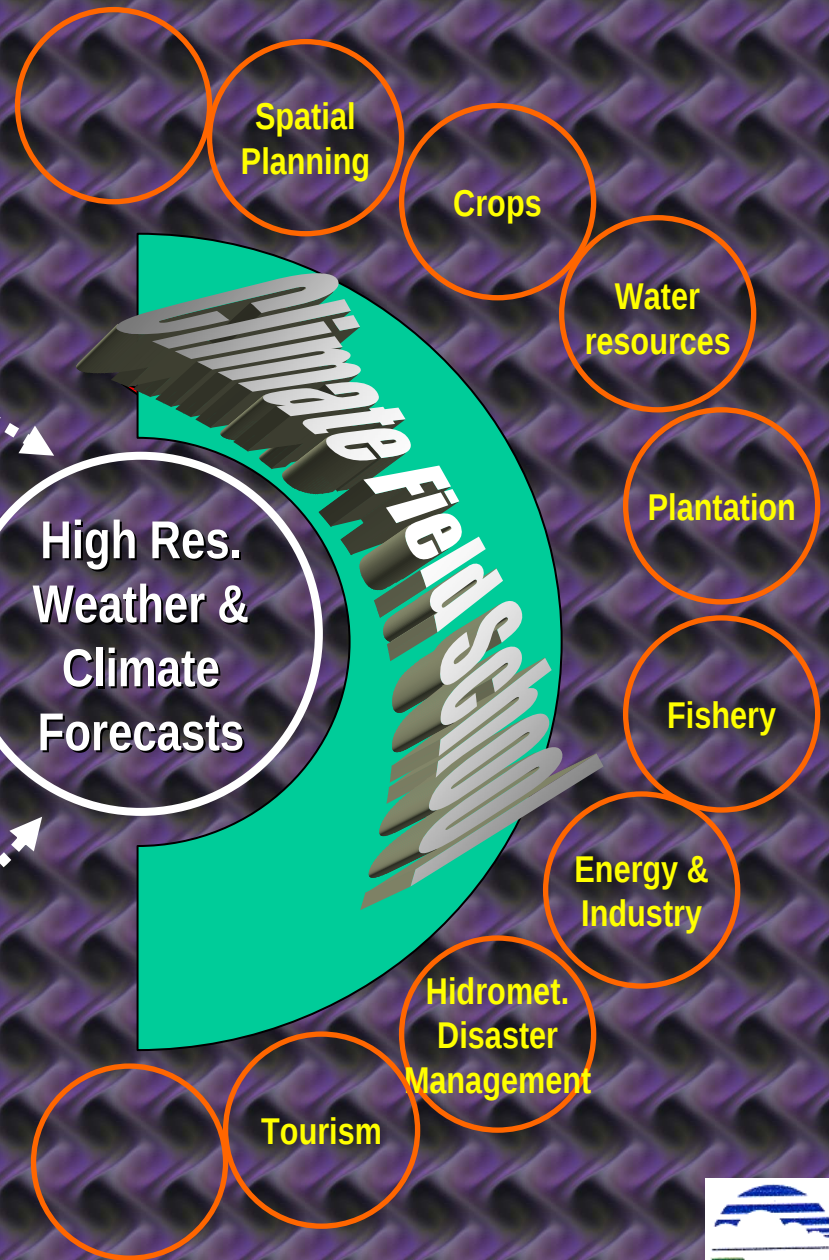
*Dynamical
Downscaling*

RCM

Ensemble

High Res.
Weather &
Climate
Forecasts

Numerical/Dynamical Models



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Climate Forecast Dissemination Activities

Science Forum



CREDIBLE

Science-Policy Forum



LEGITIMATE

SALIENT



Activity Schedule for Planting Season. Irrigated Paddy, Nusa Tenggara Timur (Kupang Dist.)

Activity	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Prayer ceremony post-harvest	■					■						
Water Users Asso. exec. Meeting	■	■				■						
Water Users Asso. members meeting	■	■	■	■	■	■	■	■	■	■	■	
Canal and road maintenance	■	■	■	■	■	■	■	■	■	■	■	■
Securing land from open grazing	■				■	■						
Land preparation	W/C					W/C						
Nursery		■	■				■	■				
Seedling transplant			W/C				W/C	■				
Fertilizing		■	■	■			■	■	■			
Weeding			■	■			■	■	■			
Pest and disease management		■	■	W/C	■	■	■	W/C	■	■	■	
Draining field water & canal rehab					■					■		
Harvesting						W	■				W	■
Collecting fee from farmer members						■	■	■			■	■
Evaluation & planning for next season						C						



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adpc

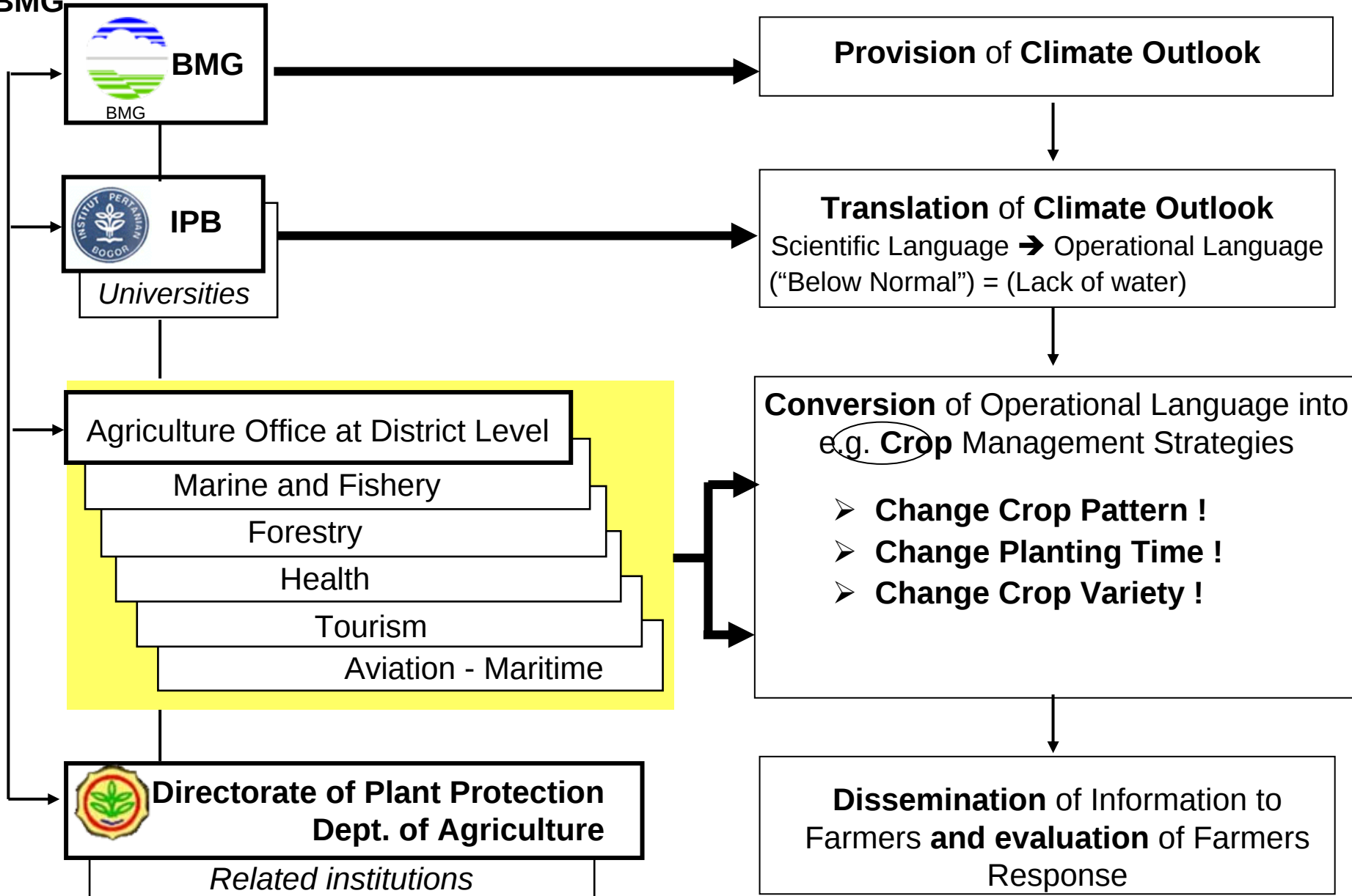
Asian Disaster Preparedness Center

	OKT			NOV			DES			JAN			FEB			MAR			APR			MAI		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
73/74																								
74/75																								
75/76																								
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Planting Area (%)	3			2			4			24			33			19			1			1		



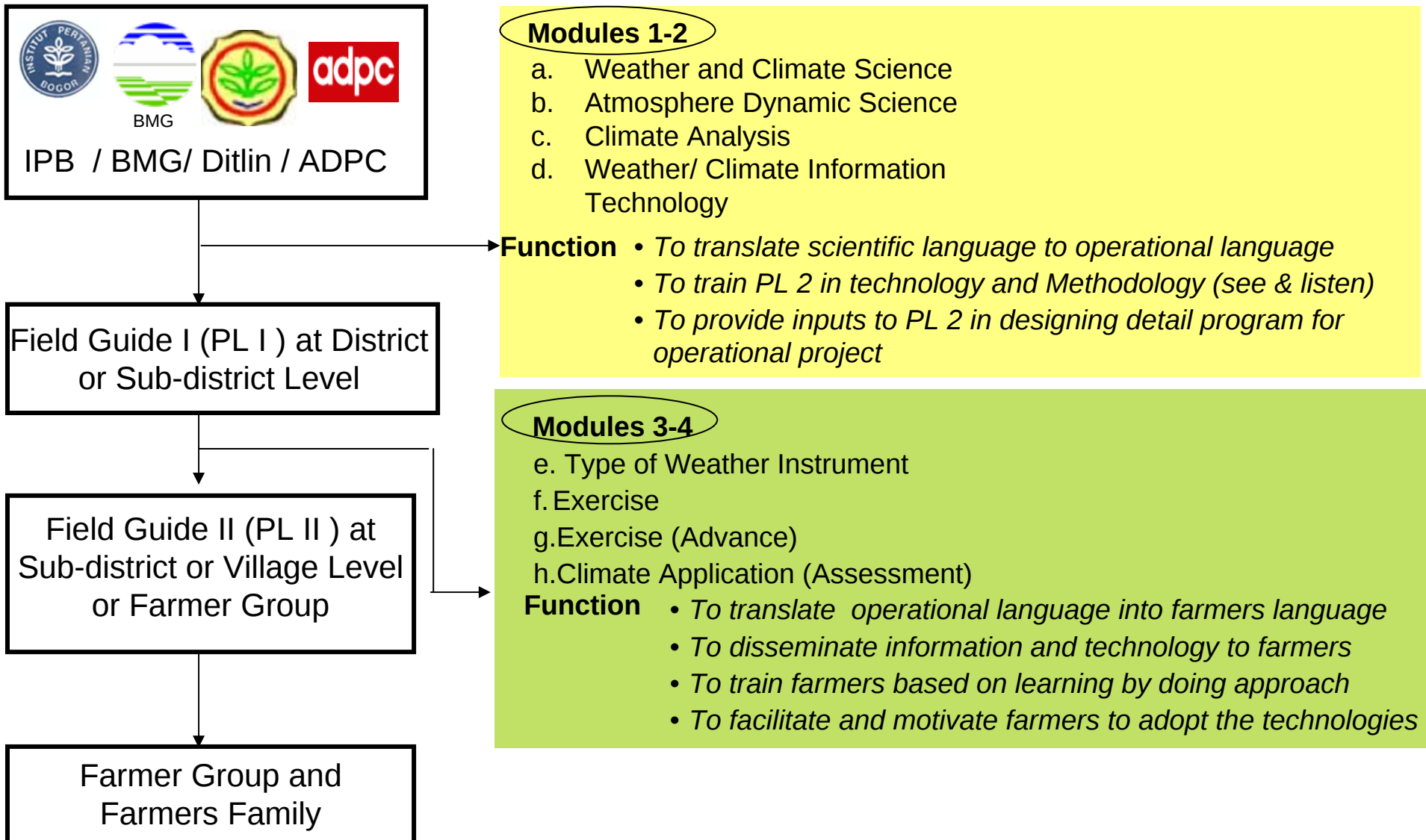
BMG

Institutional Framework for Climate Forecast Application





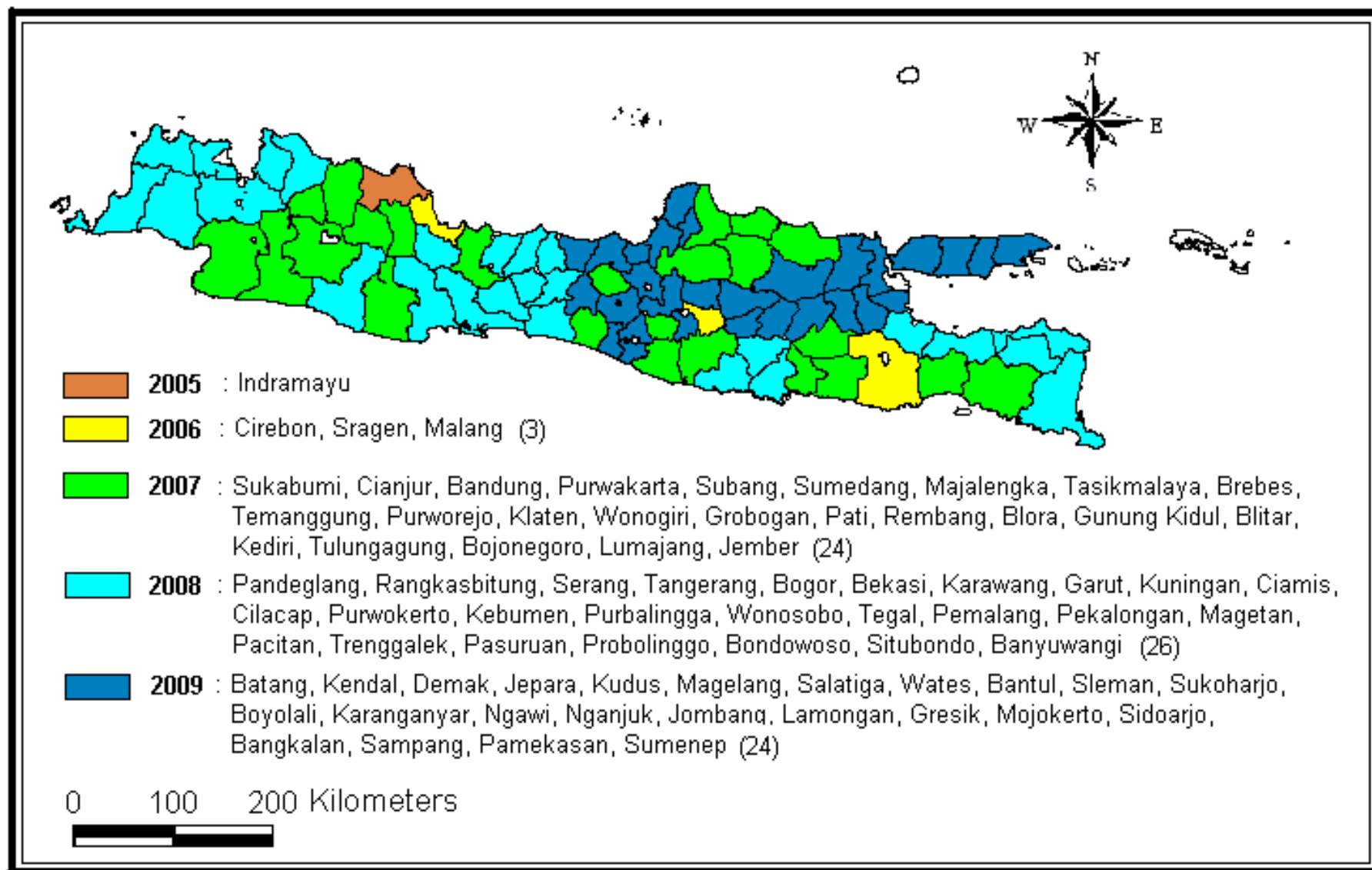
Schematic Diagram of Climate Field School Activities



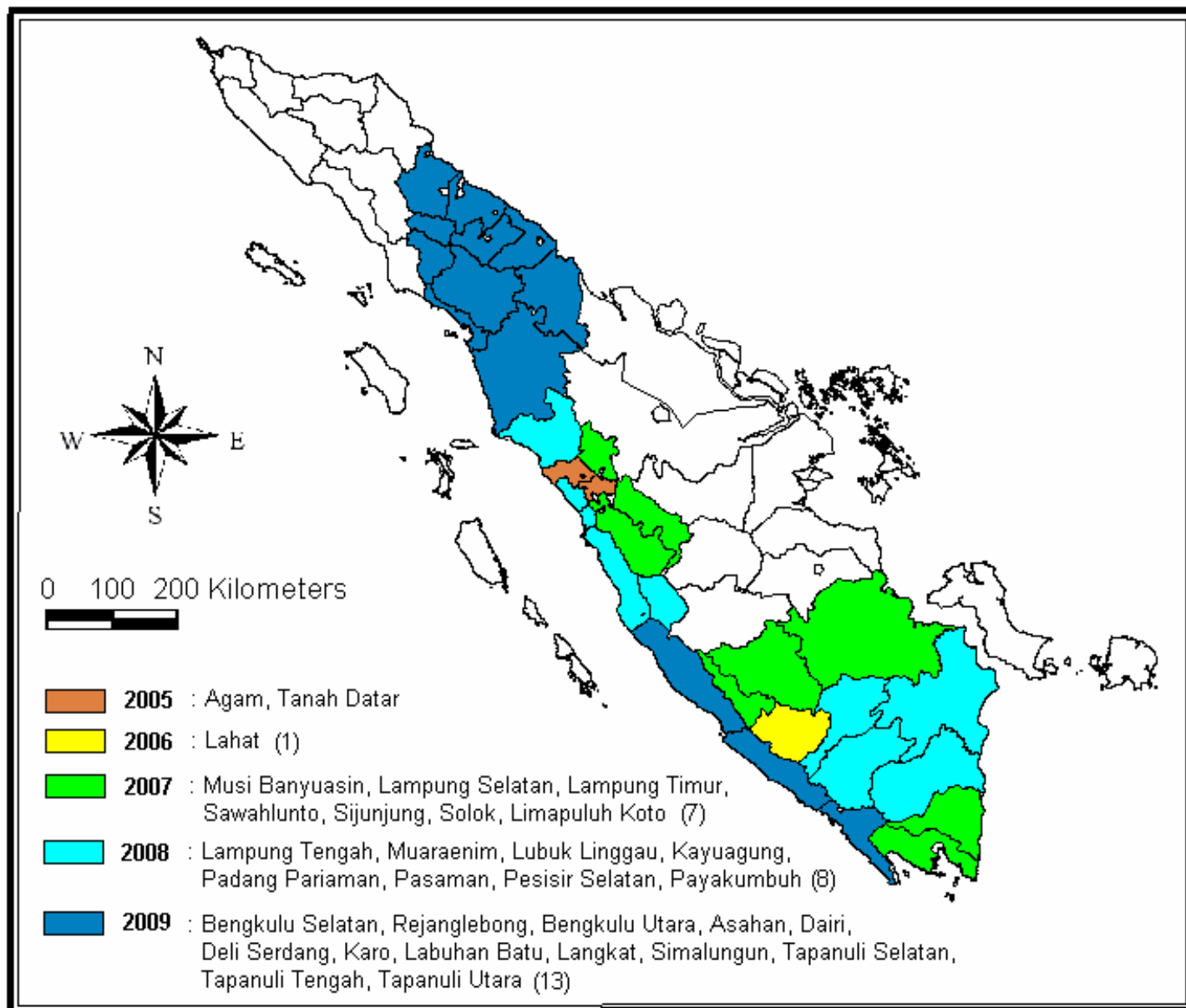


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Priority Areas of Climate Field School (Java)



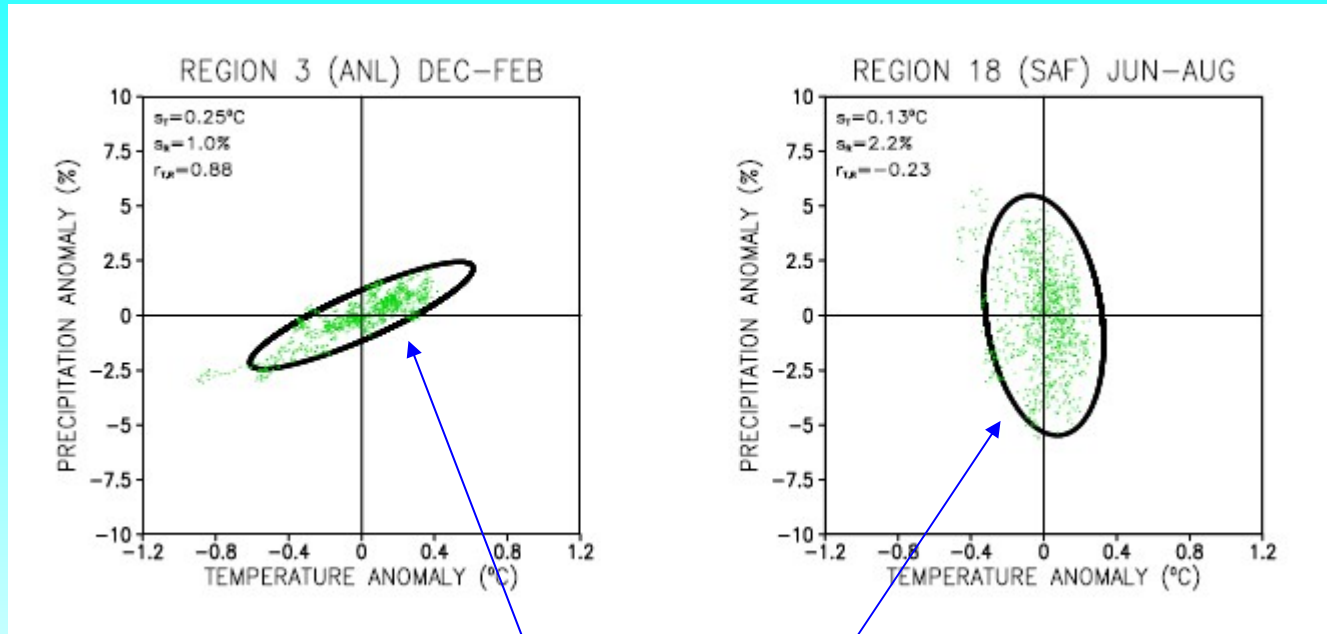
Priority Areas of Climate Field School (Sumatra)





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Remarks from preliminary results of climate change studies



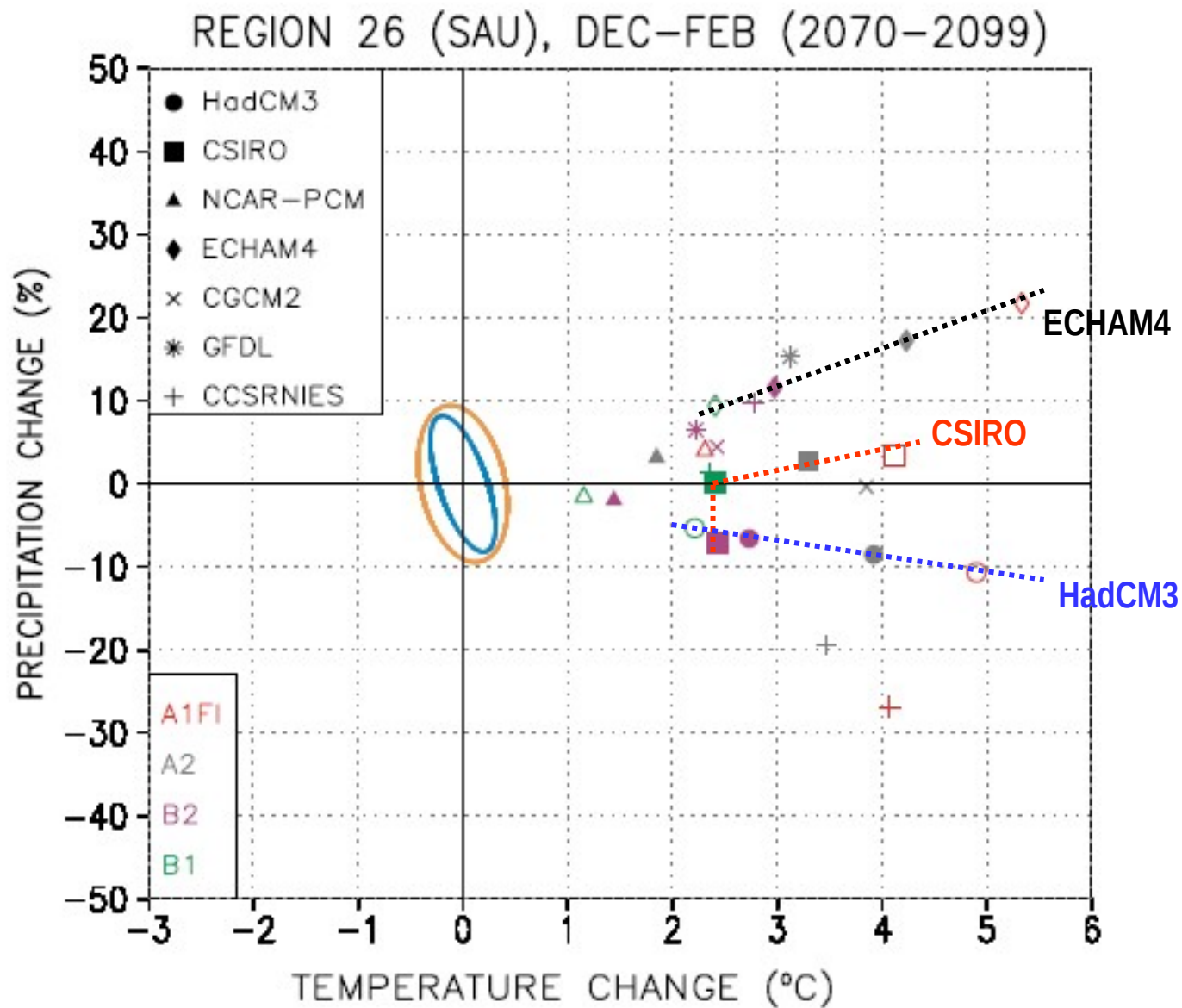
$$\frac{1}{1-\rho^2} \left\{ \frac{T'^2}{\sigma_T^2} - 2\rho \frac{T'}{\sigma_T} \frac{R'}{\sigma_R} \frac{R'^2}{\sigma_R^2} \right\} = \chi^2(df=2, p=0.95) = 5.99$$

95% contour ellipse of the two-dimensional normal distribution adjusted to the anomaly data.

Source : Ruosteenoja et al. (2004)



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Source : Ruosteenoja et al. (2004)



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Concluding Remarks

We have described the procedures of high resolution climate forecasting applied in Indonesia based on dynamical and statistical downscaling in combination with some advanced statistical techniques

Lessons learned from the implementation of the techniques in producing high resolution climate forecasts at regency/district scale in Indonesia indicate some advantages of this multi-model approach:

- computationally inexpensive**
- provide local information in the form of probability density function $\leftrightarrow$ risk management**

Crucial impedances in the dissemination of climate information: diversity in “language”, socio-economic behaviours, institutional framework/arrangements

Thank You



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Tuban, Bali

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