HARIMAU radar-profiler network over the maritime continent:

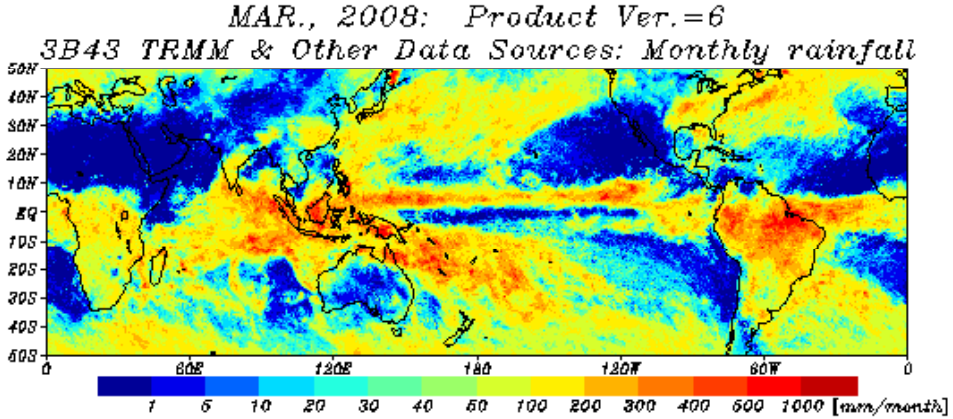
Collaborations with MISMO until now and CINDY in future

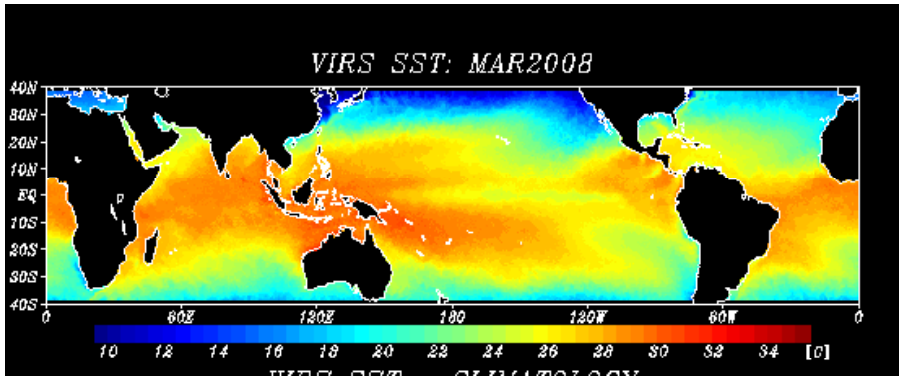
M. D. Yamanaka, S. Mori and H. Hashiguchi

(IORGC/JAMSTEC) (RISH/Kyoto U)

- Significance of Indonesian “maritime continent”
- The HARIMAU project (FY 2005-9)
- Contribution to MAHASRI/CEOP/GEWEX/WCRP and GEOSS
- Past collaboration with MISMO (Oct-Dec 2006)
- Future collaboration with CINDY

“Conditional Instability” paradox





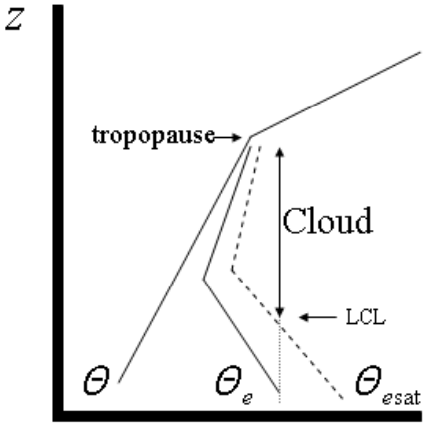
Indonesian maritime continent:
- The most active convective clouds
- The largest rainfall

Why ?

Surrounded by “warm water pool”?

If so, why large rainfall does not appear over ocean but over land ?

Land with smaller specific heat generates convection much easily?

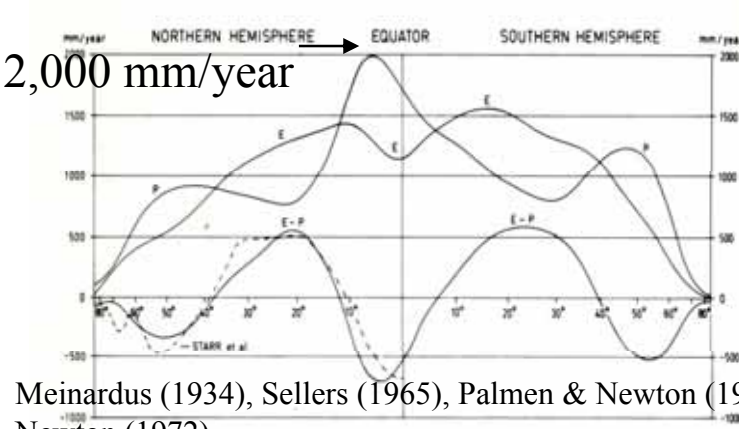


Again, why not Africa nor S. America but maritime continent ?

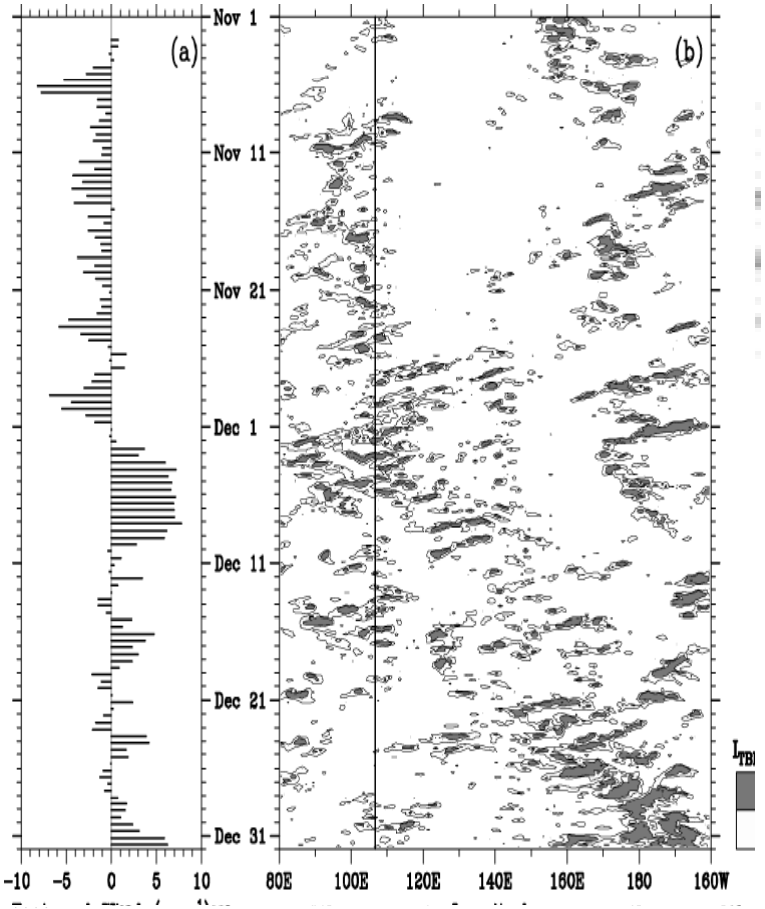
Conditional instability:
- Convection generated spontaneously only when cloud appears.
- Cloud becomes most active when convection is developed.

$\Rightarrow$ *Forced motions (waves, circulations), or CISK*

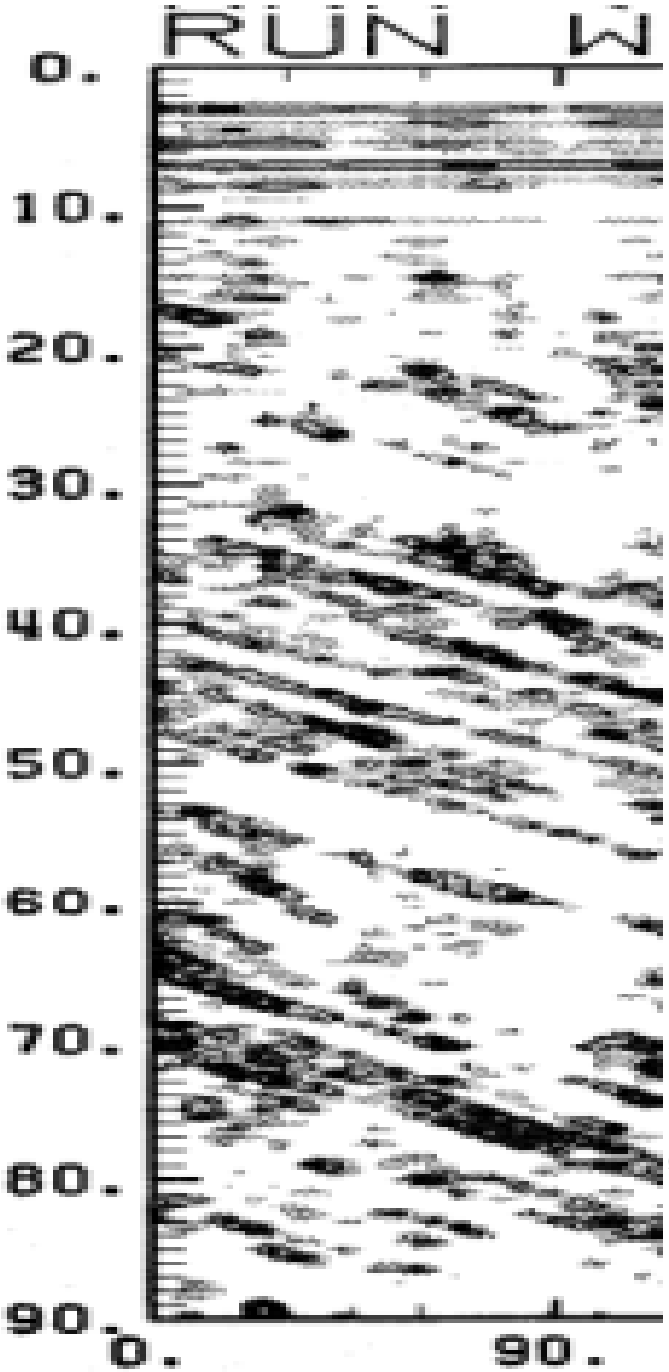
2,000 mm/year



Meinardus (1934), Sellers (1965), Palmen & Newton (19
Newton (1972)

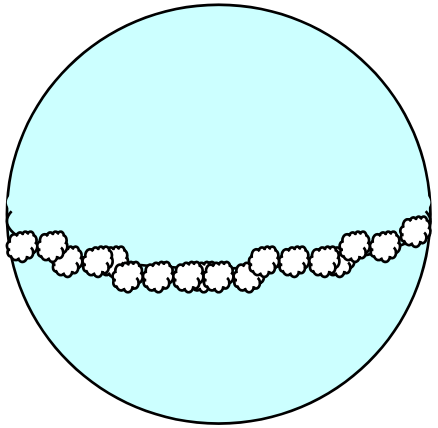


Hashiguchi et al. (1995)

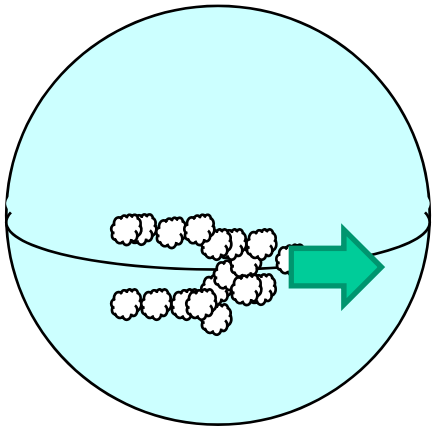


Hayashi & Sumi (1985)

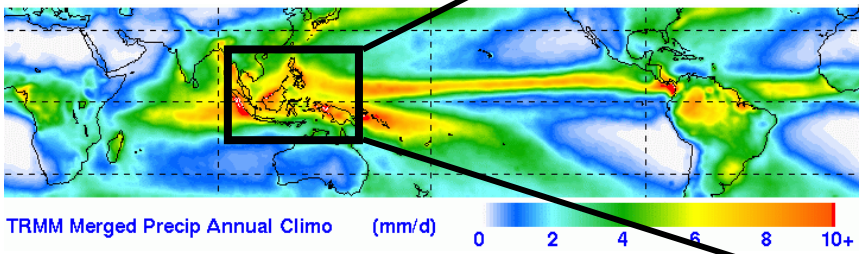
"Aqua Planet"
→ ISVs

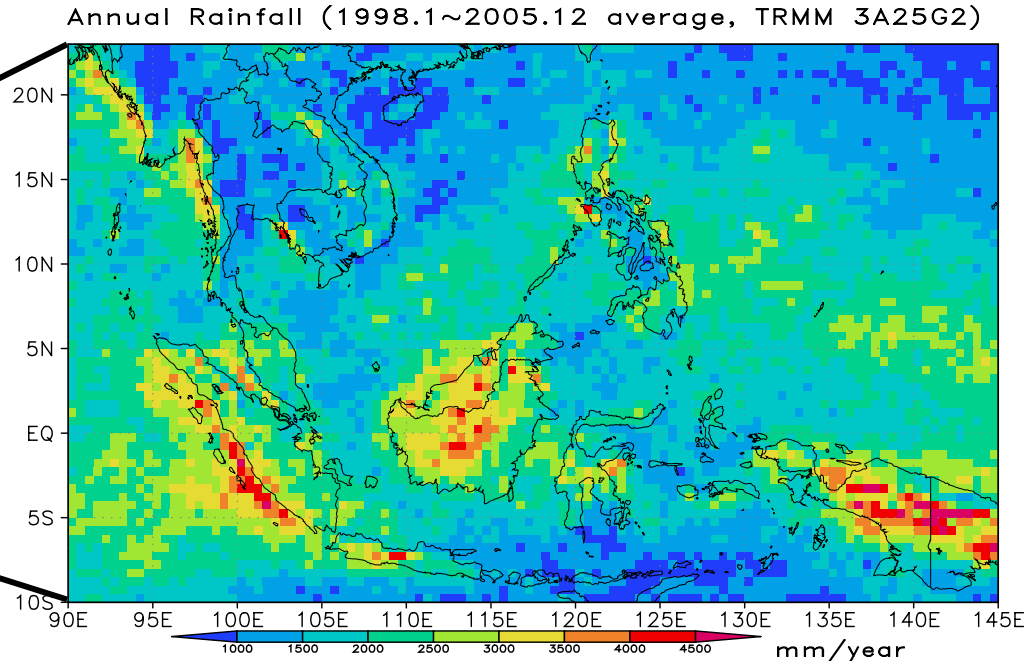


II ?

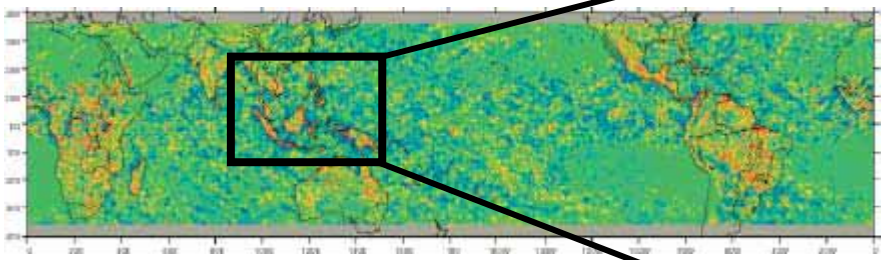


Importance of Maritime Continent

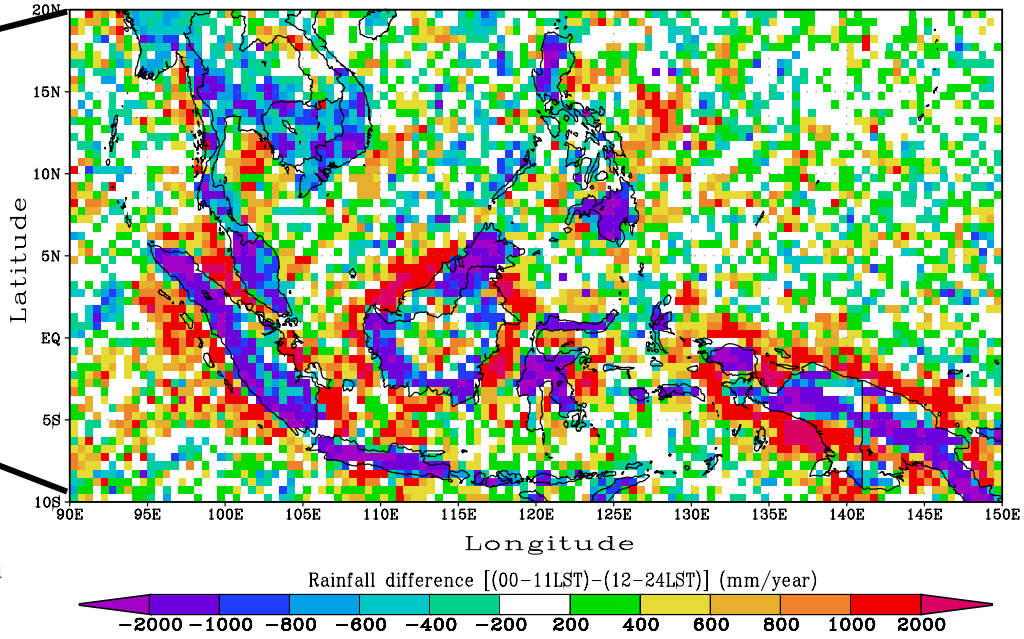




Correlation between **annual rainfall** and **diurnal cycle** dominancy of rainfall



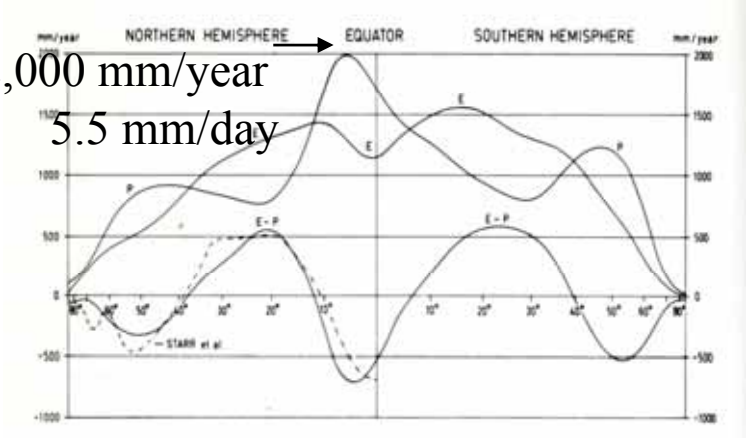
(Hirose & Nakamura, 2004, *J. Appl. Meteor.*)



Morning Rain − **Evening Rain**

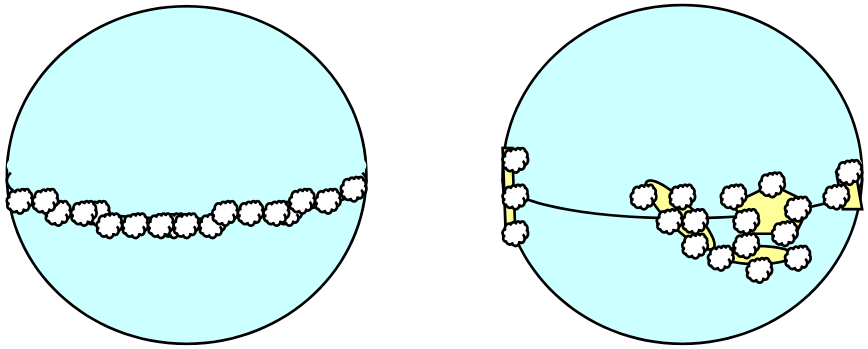
(Mori et al., 2004, Mon. Wea. Rev.)

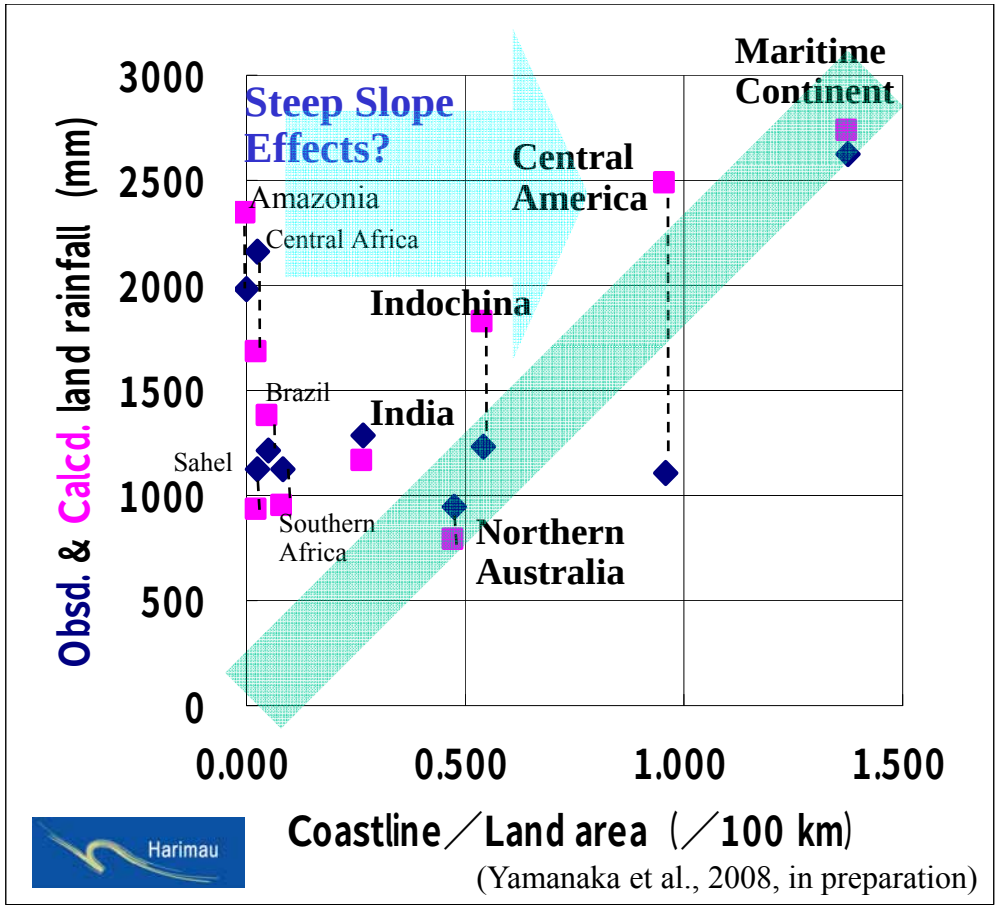
The "Zonal-Mean" Rainfall



2,000 mm/year

5.5 mm/day



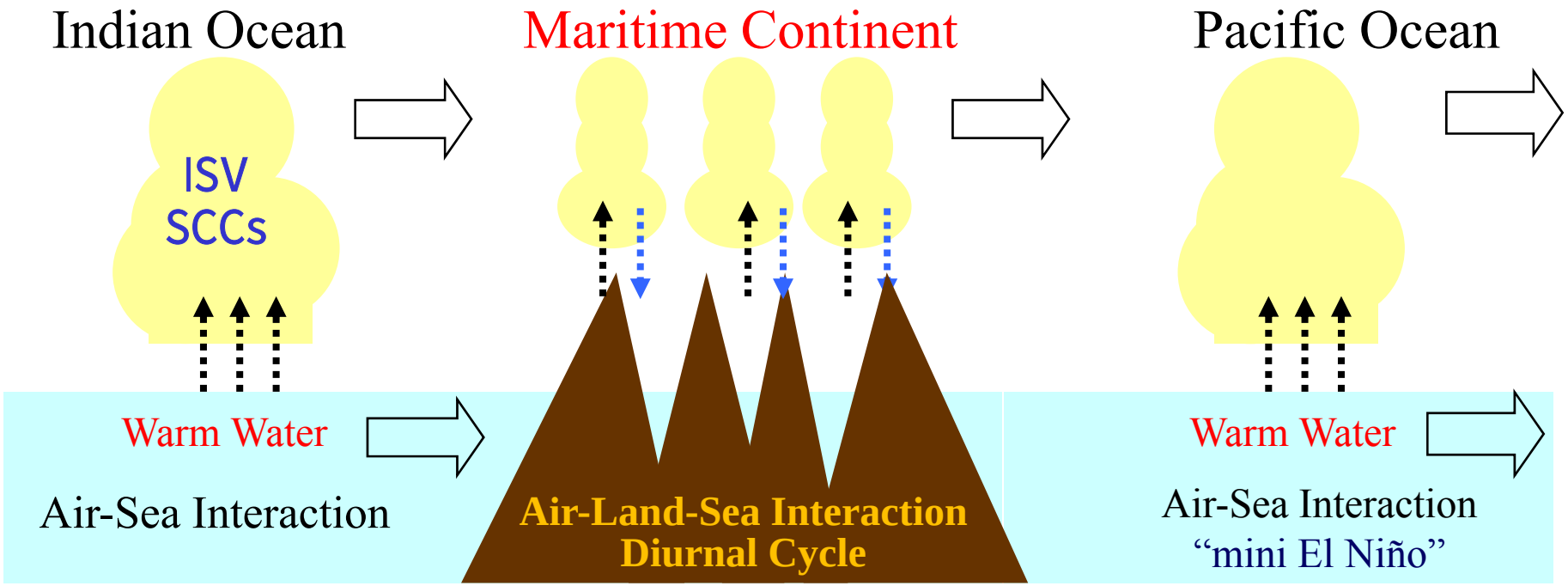


(Yamanaka et al., 2008, in preparation)

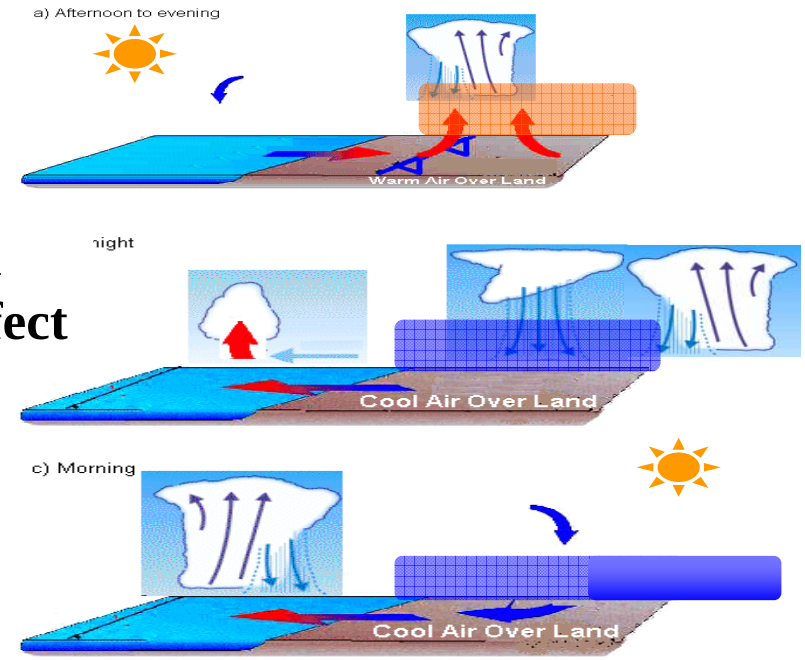
Regional (land) rainfall (mm/year) ＝**2000 (mm/year•10^2 km)** ×[Coastline (10^2 km)/Land area (10^4km^2)

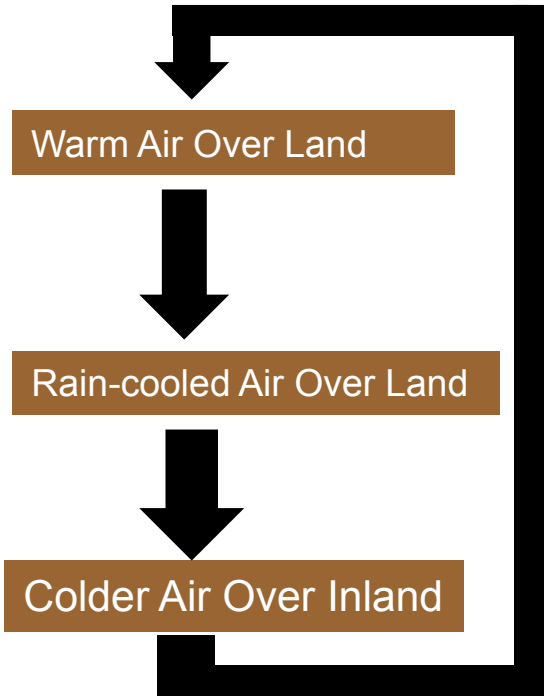
→ Total rain water amount on land (Gt/year) ＝2000 (mm/year•10^2 km) ×Coastline (10^2 km)

- **The maritime continent with the longest coastlines has the largest rainfall.**
- Numerical models must resolve coastlines with 100 km or higher resolution.
- Radar-AMeDAS-like observations must cover all the coastlines/mountain slopes.



SLB circulation with cloud "sprinkler" effect





(Wu, Yamanaka & Matsumoto., 2008)

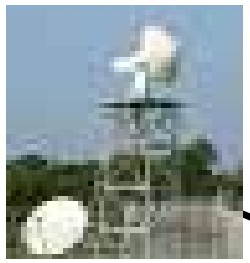
Harimau

Japan EOS Promotion Program (JEPP) **+ Indonesian Research/Technology Grant**

Hydrometeorological Array for ISV-Monsoon Automonitoring (HARIMAU)

Kototabang EAR,BLR,XDR

KU + LAPAN

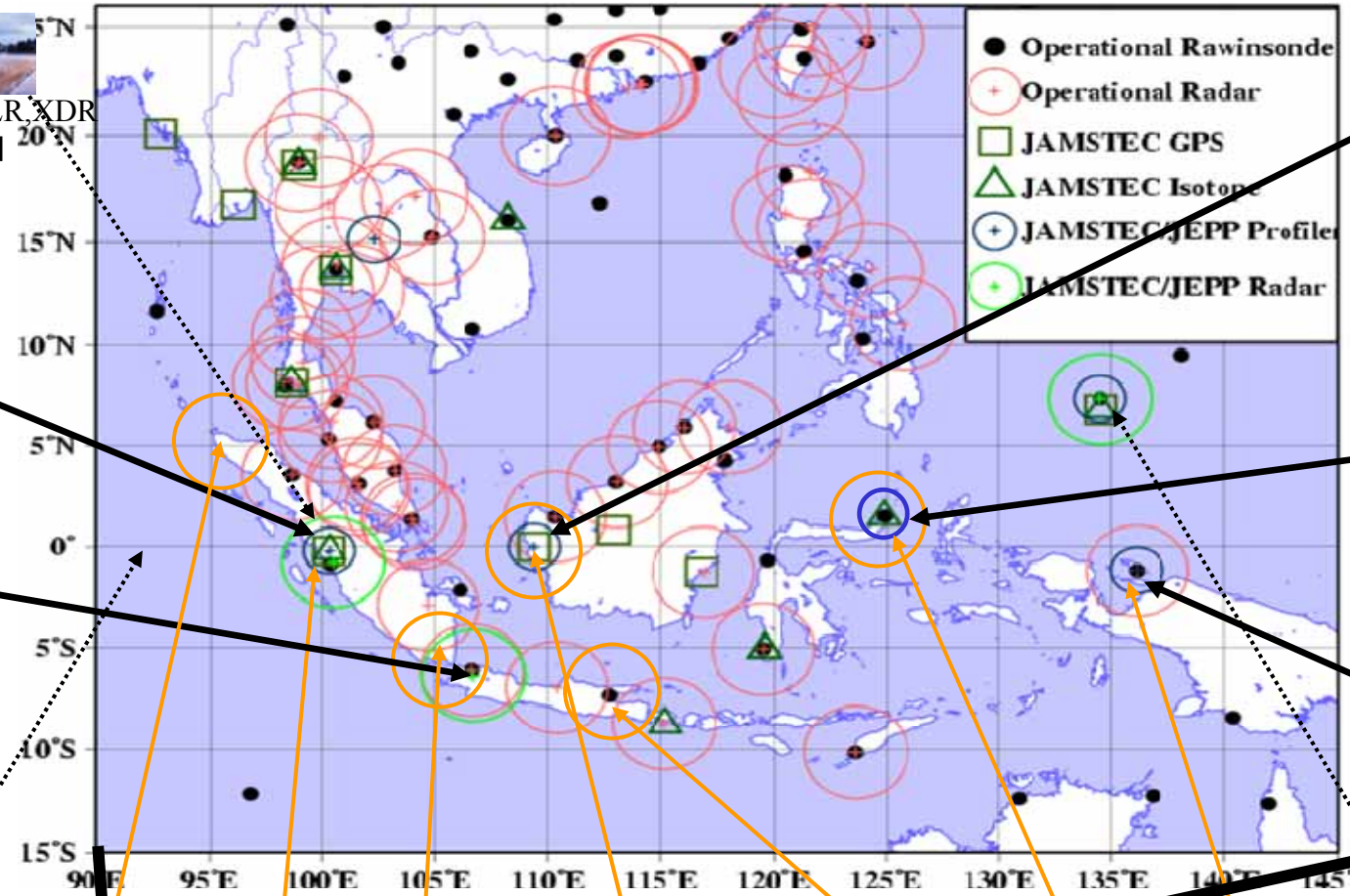


MIA XDR

Serpong CDR

Mirai CDR

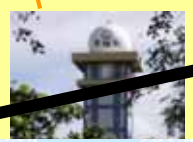
JAMSTEC

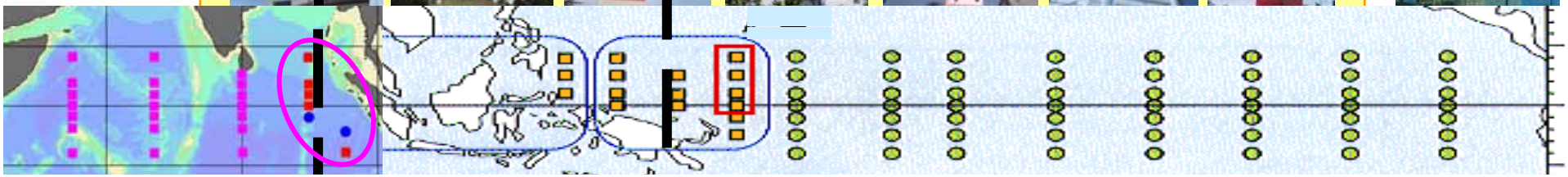


Pontianak WPR

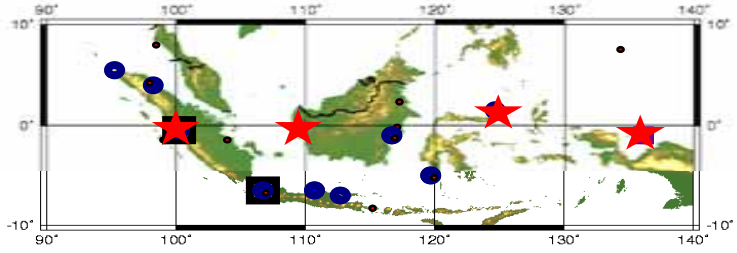
Manado WPR

Biak WPR

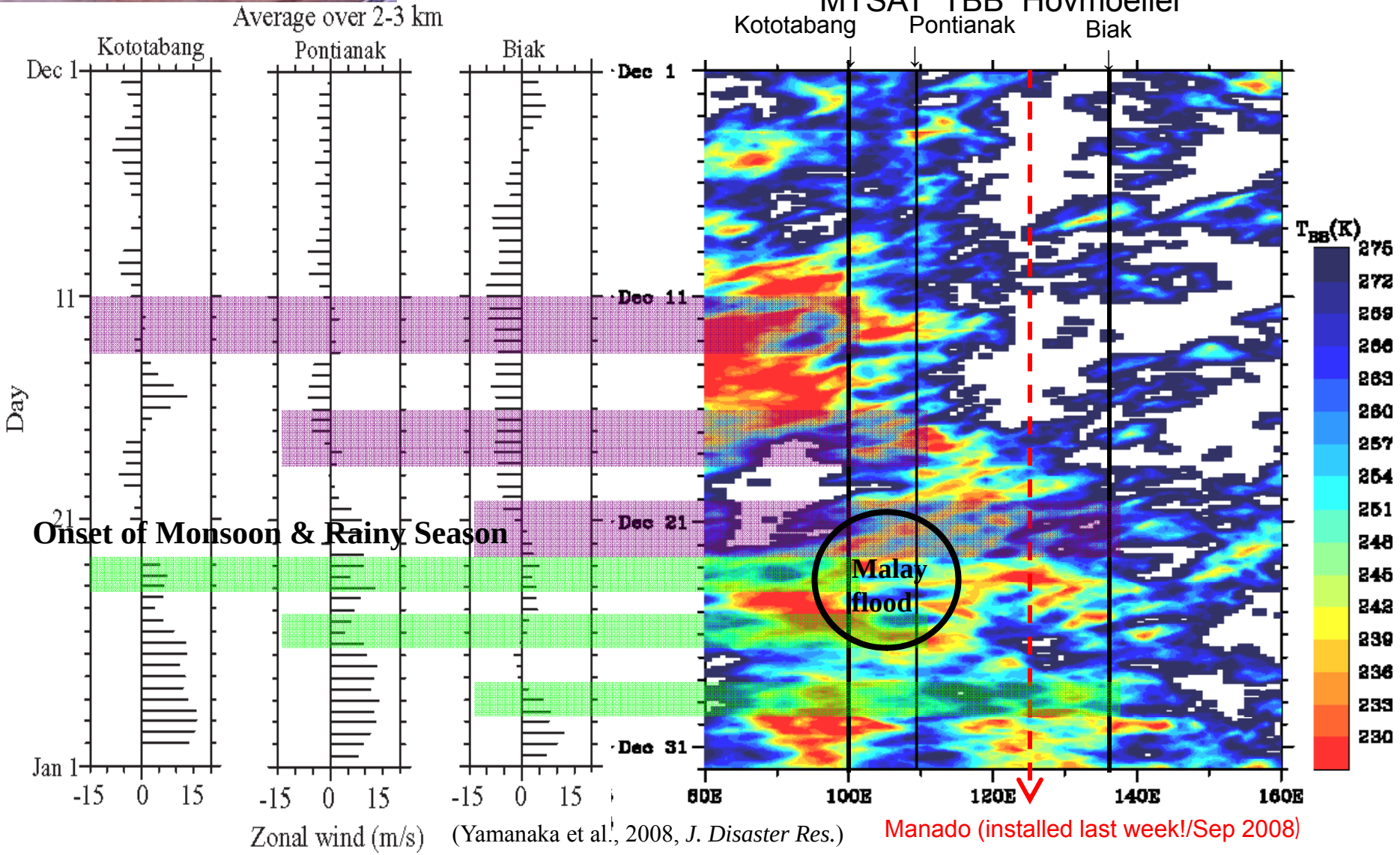




ISVs by WPR network



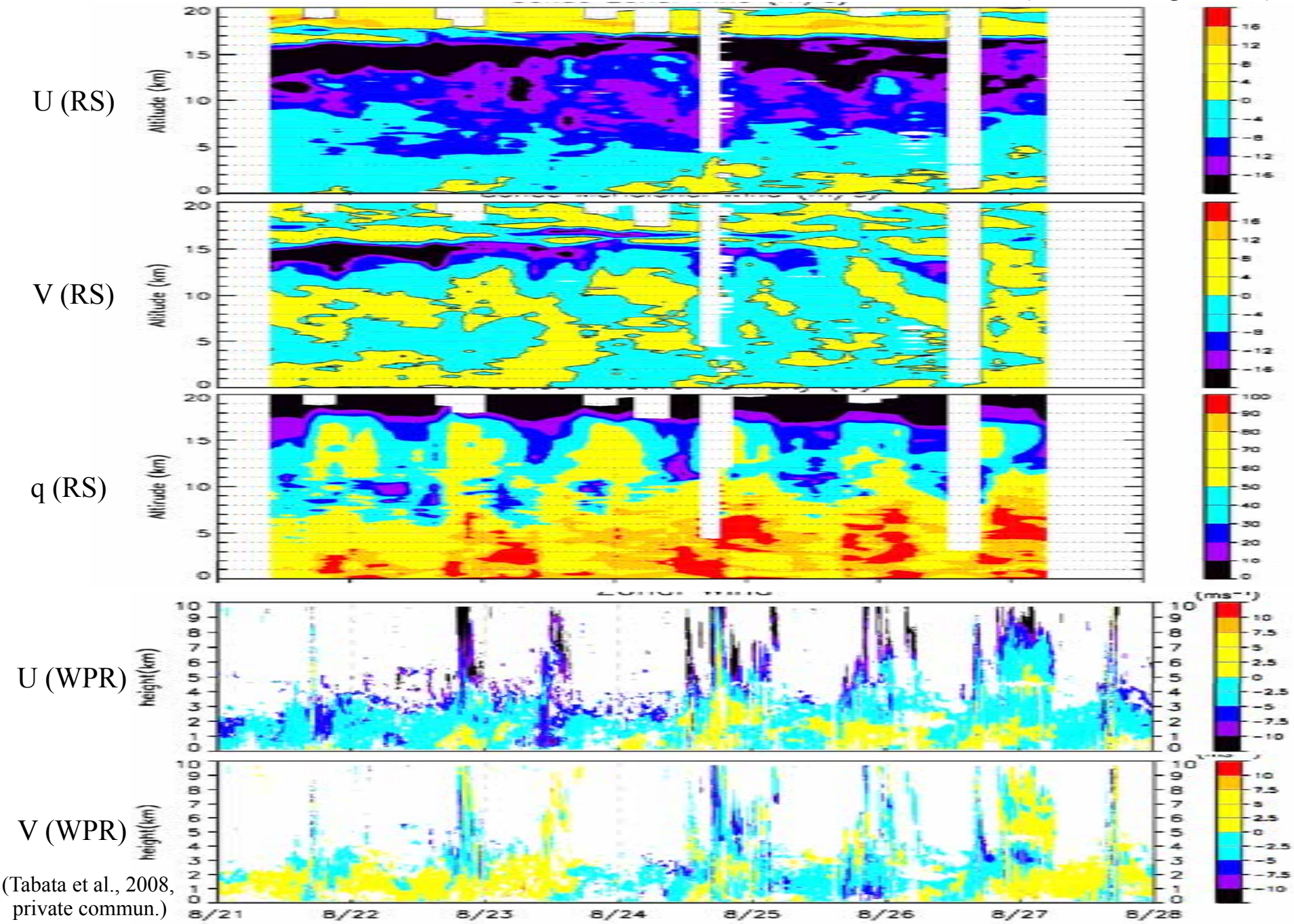
MTSAT TBB Hovmoeller



(Yamanaka et al., 2008, *J. Disaster Res.*)

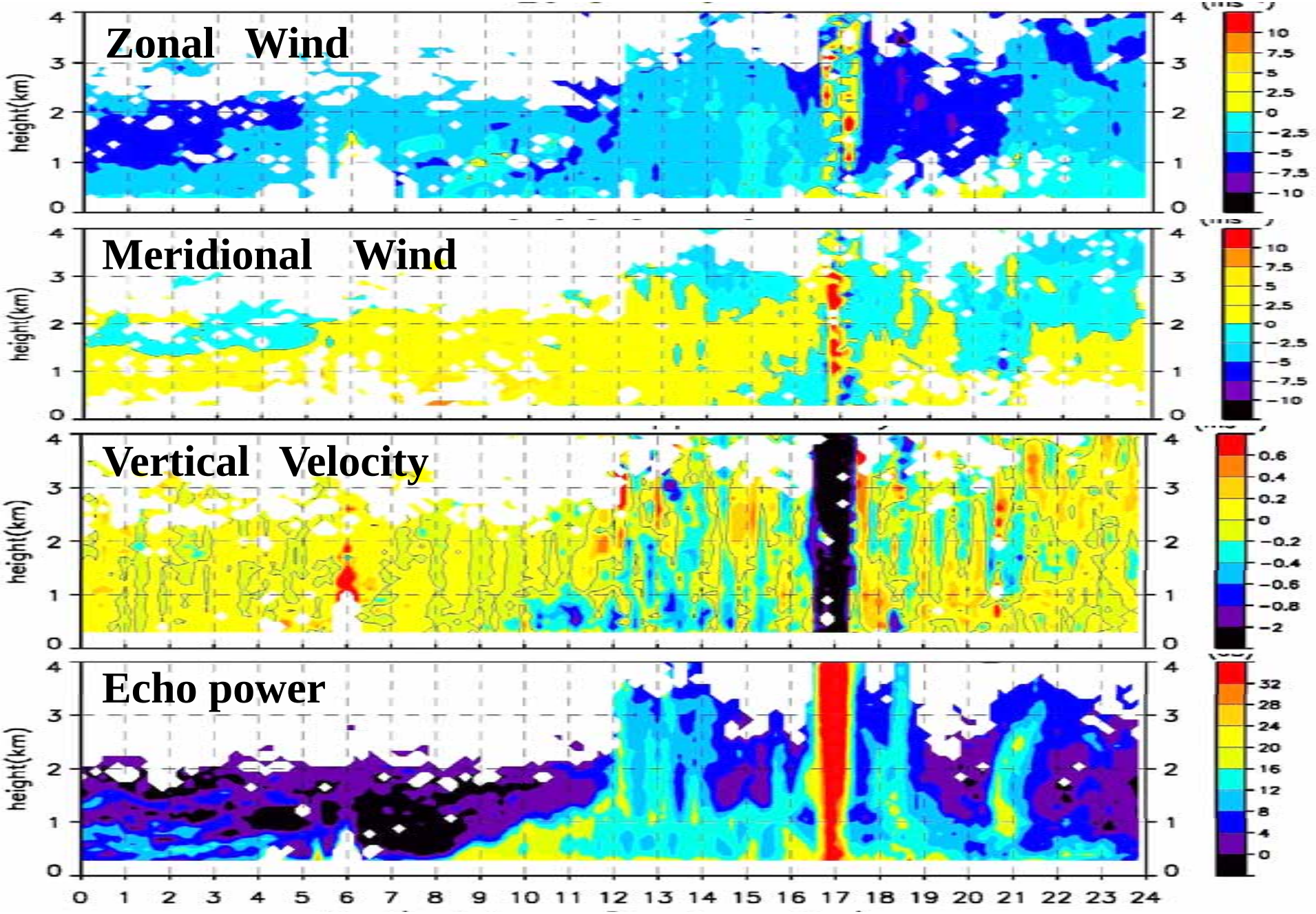
Manado (installed last week!/Sep 2008)

“Summer monsoon” observation Pontianak, Kalimantan (21-28 Aug 2008)



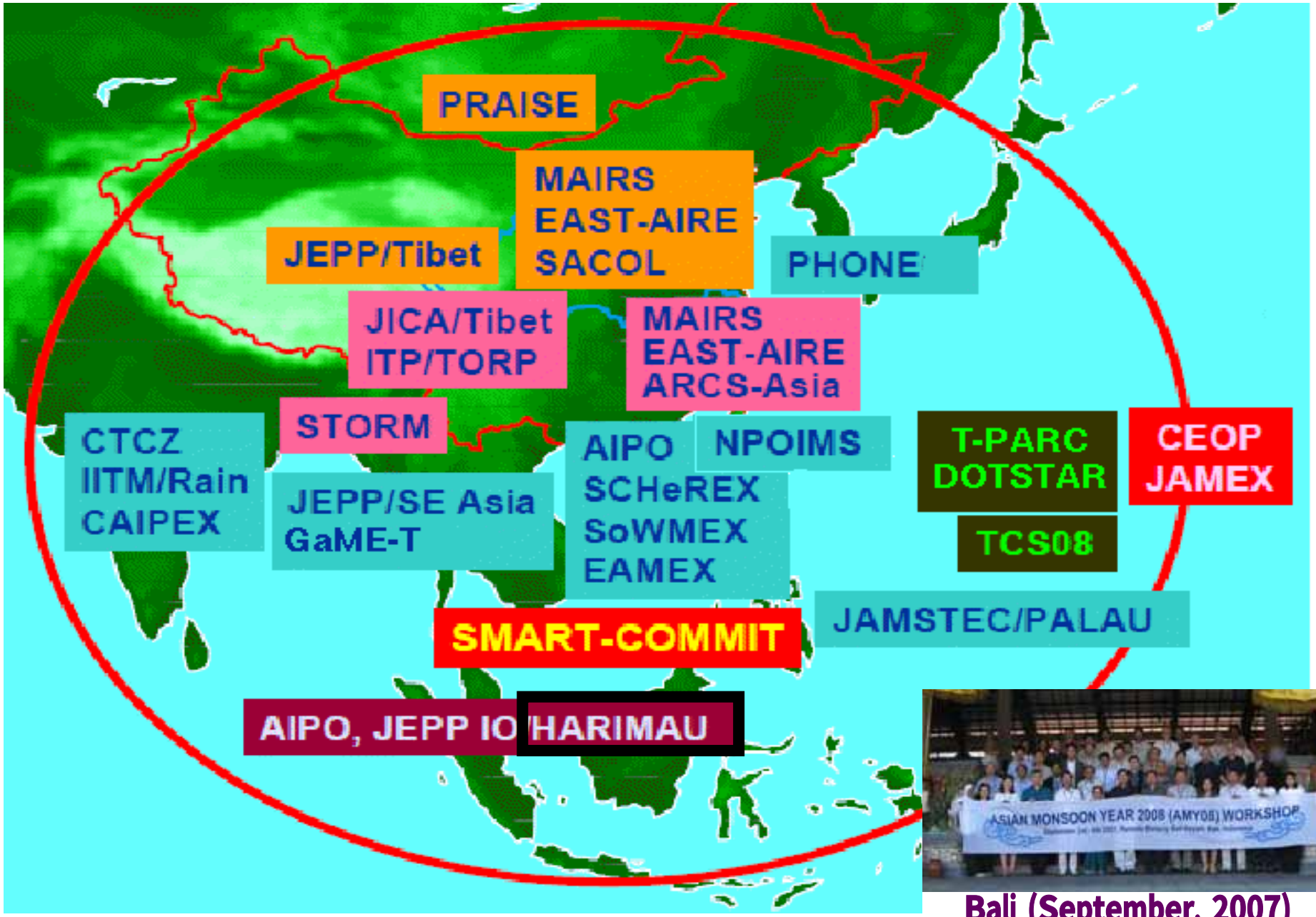
(Tabata et al., 2008, private commun.)

Example of 1-day obs. by WPR at Pontianak/Kalimantan (21 Aug 2008)



(Tabata et al., 2008, private commun.)

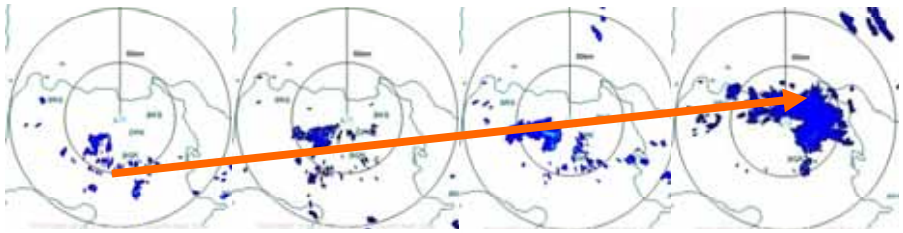
WCRP/MAHASRI & Asia Monsoon Years (2007-12)

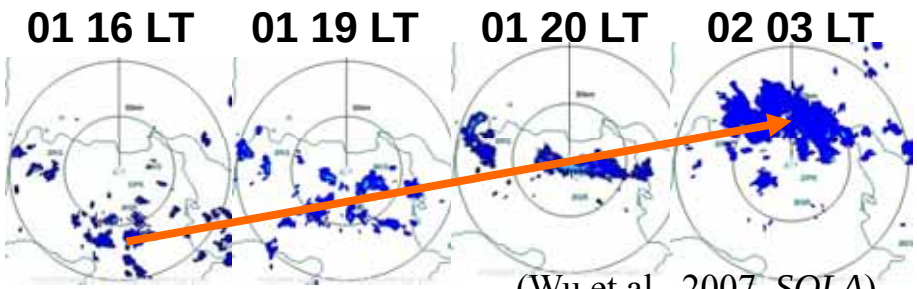


Bali (September, 2007)

Contribution to GEOSS

Jakarta Flood (Jan-Feb 2007)





(Wu et al., 2007, *SOLA*)

16	Hydrometeorological ARray for ISV-Monsoon AUtomonitoring HARIMAU It is an observation system made of Rain Radars and wind-profilers installed in the Indonesian maritime continent (IMC), to observe IMC-excited global climate variations such as El Nino, with a large potential to prevent hydro meteorological / climatological disasters such as flood not only in IMC but also all over the world Data are openly available on the internet in real time. Collaborating countries are: Japan, Indonesia, Thailand, Vietnam, Myanmar	Three major stations installed and data available.

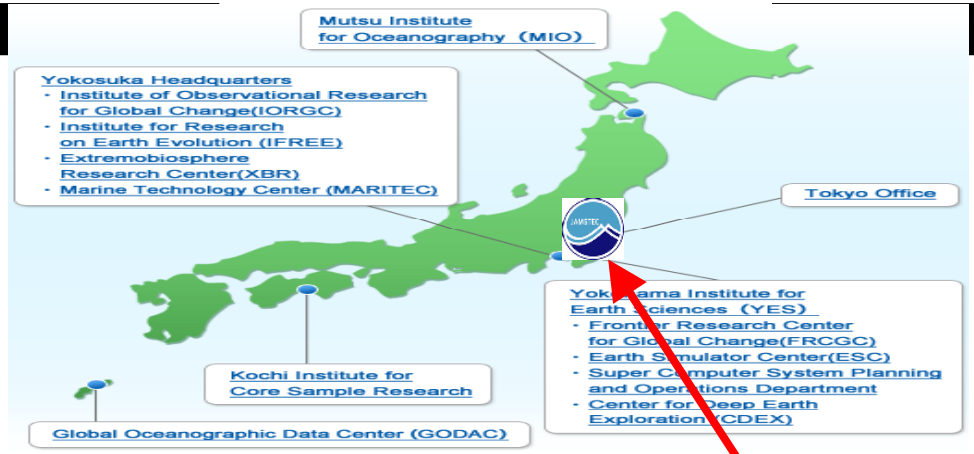
STATE MINISTER FOR RESEARCH AND TECHNOLOGY
REPUBLIC OF INDONESIA

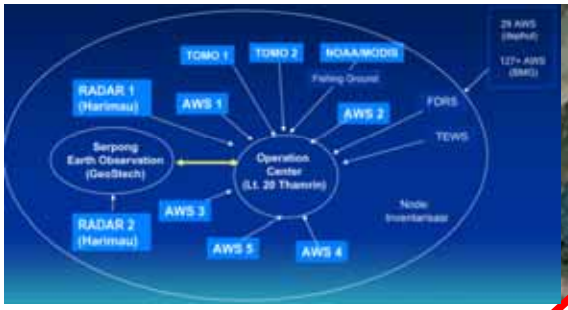
Maritime Continent COE

Proposed for JICA

＜Science promotion＞
(科学的成果)

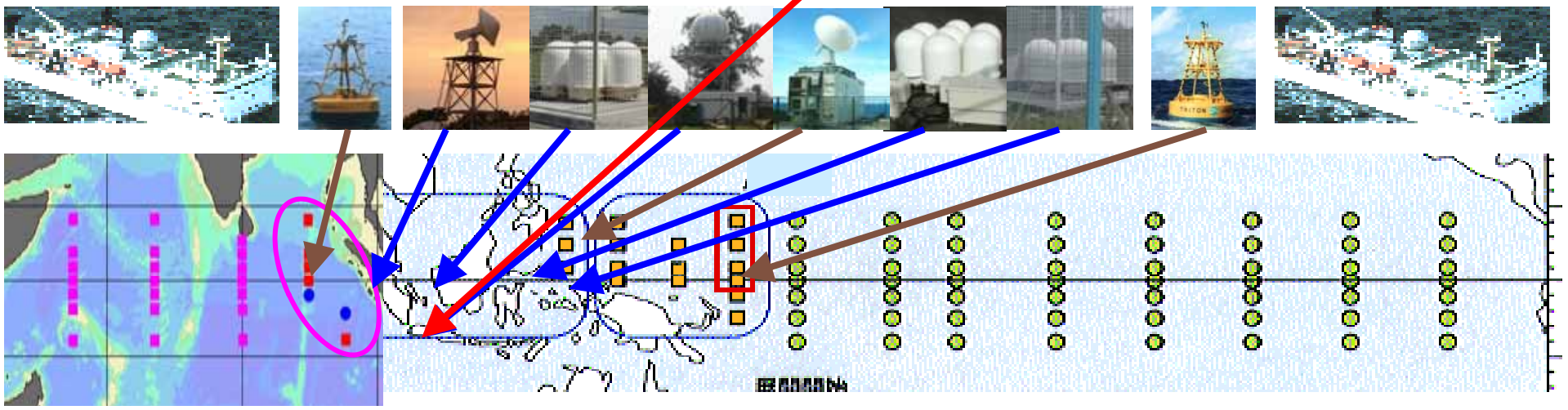
- **Land-Ocean-Atmosphere science (陸面海洋大気系科学)**
- **Physical climatology (気候変動物理学)**
- **Synergy between S&T and diplomacy (地球環境科学と国際社会科学の結合)**

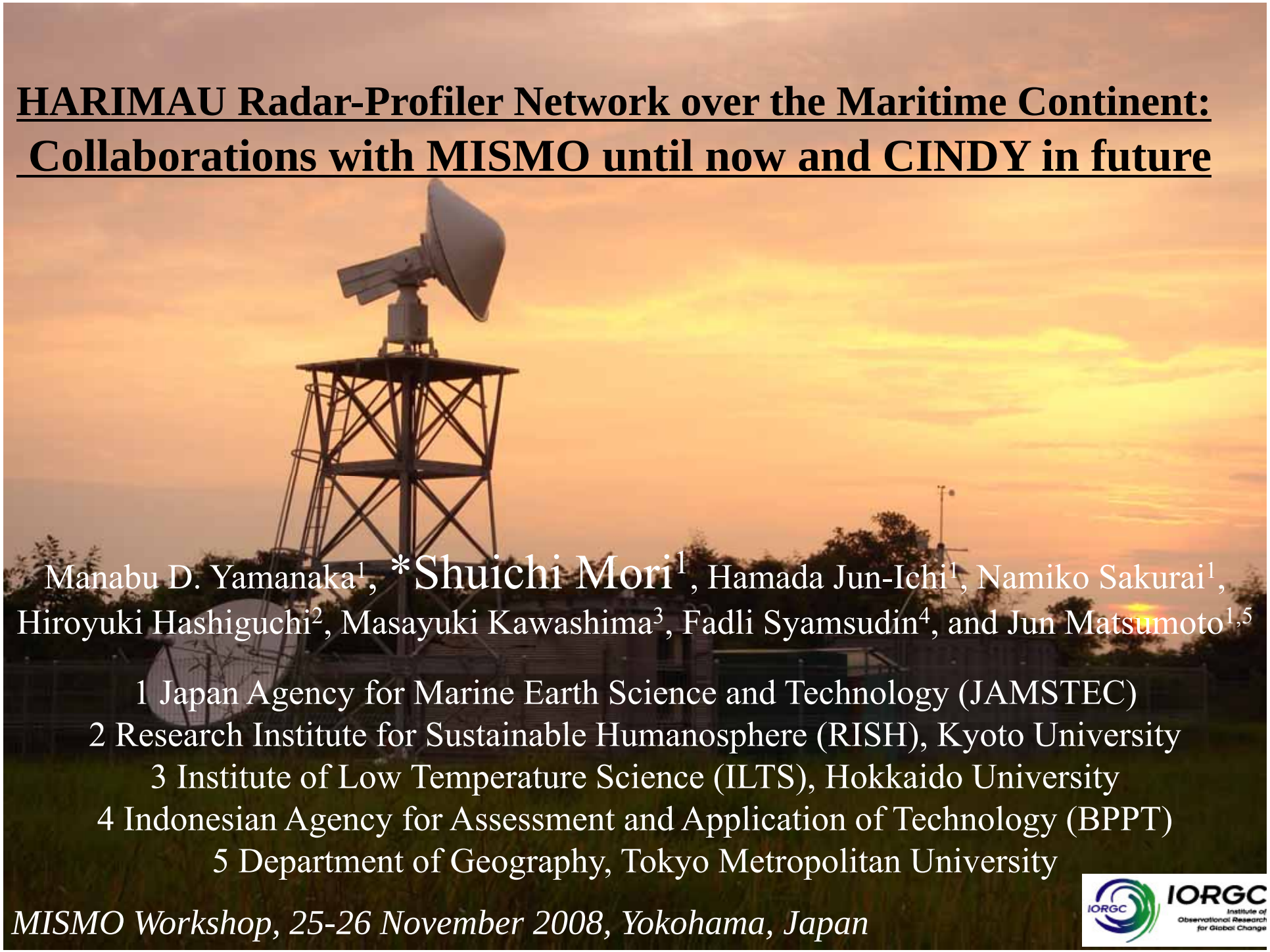




＜Social benefits＞
(社会貢献)

- **Capacity development (地球環境科学の基礎科学技術者育成)**
- **Disaster prevention (気候変動の緩和･適応, 自然災害の減災).**
- **Security for Japanese (海外在住日本人への防災情報提供)**





HARIMAU Radar-Profiler Network over the Maritime Continent: Collaborations with MISMO until now and CINDY in future

Manabu D. Yamanaka[1], *Shuichi Mori[1], Hamada Jun-Ichi[1], Namiko Sakurai[1], Hiroyuki Hashiguchi[2], Masayuki Kawashima[3], Fadli Syamsudin[4], and Jun Matsumoto[1,5]

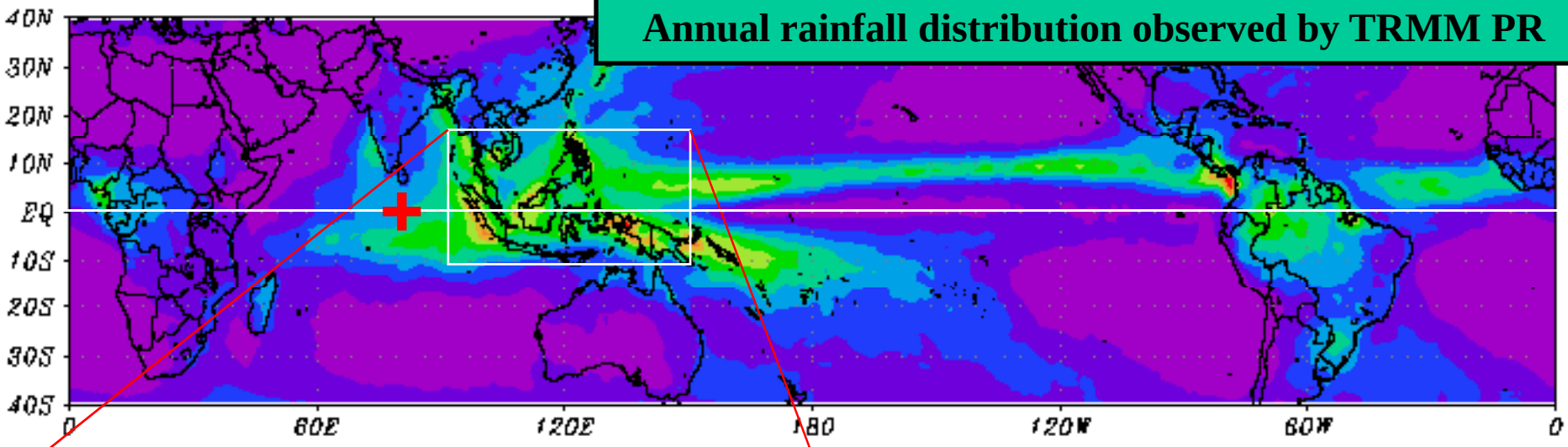
1 Japan Agency for Marine Earth Science and Technology (JAMSTEC)
2 Research Institute for Sustainable Humanosphere (RISH), Kyoto University
3 Institute of Low Temperature Science (ILTS), Hokkaido University
4 Indonesian Agency for Assessment and Application of Technology (BPPT)
5 Department of Geography, Tokyo Metropolitan University

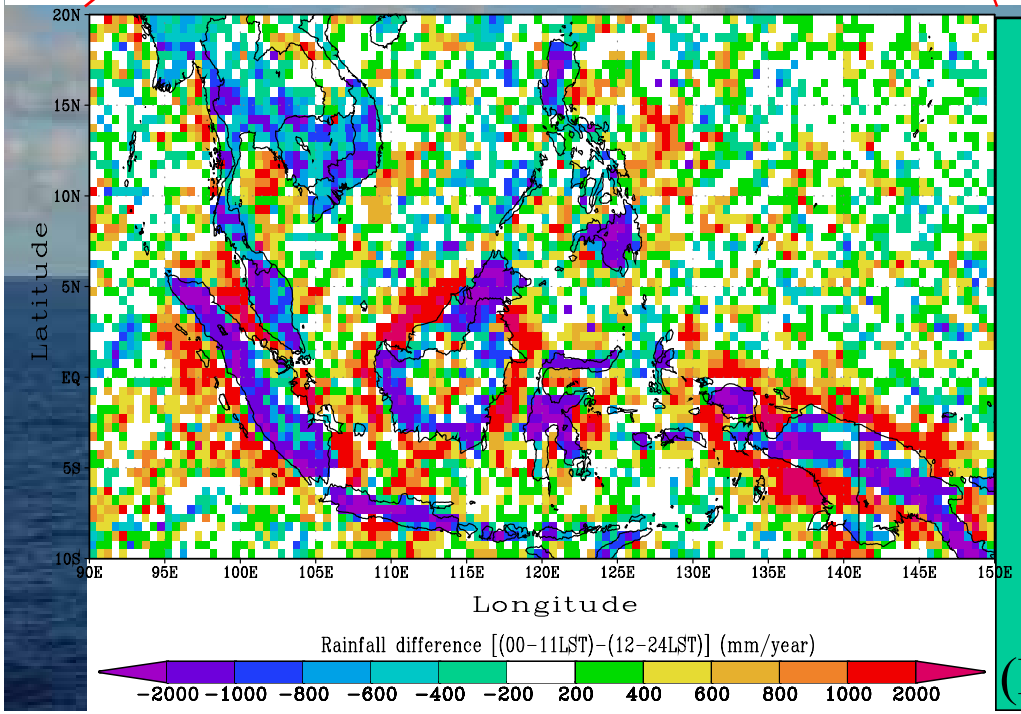
MISMO Workshop, 25-26 November 2008, Yokohama, Japan

IORGC
Institute of Observational Research for Global Change

Background of our study Importance of "Land (Island)" for Abundant Rainfall over the Equator and its Diurnal variation

Annual rainfall distribution observed by TRMM PR





Clear contrast

between

Morning rain (00-11LST)

over the *Coastal sea region*

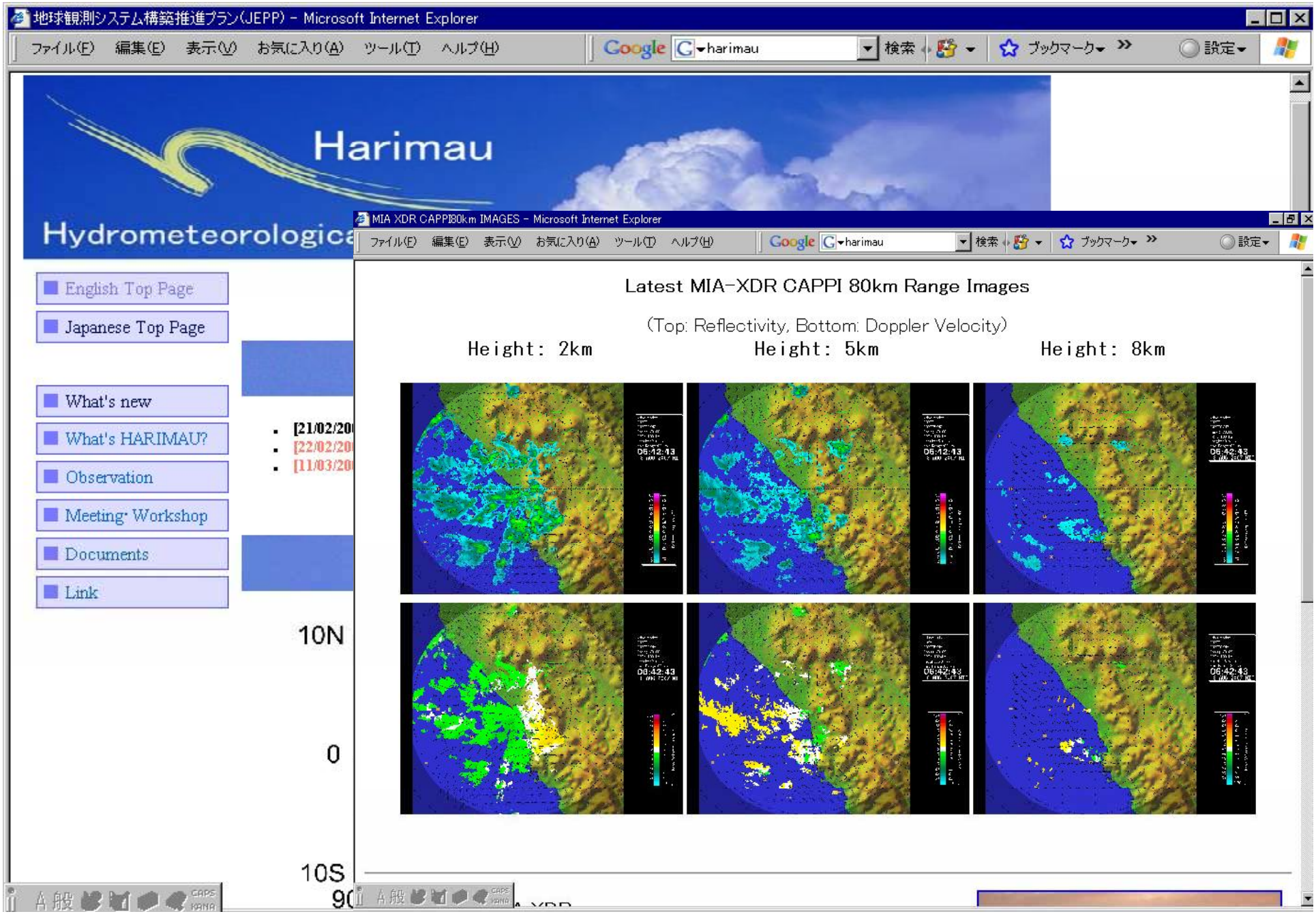
and

Evening rain (12-23 LST)

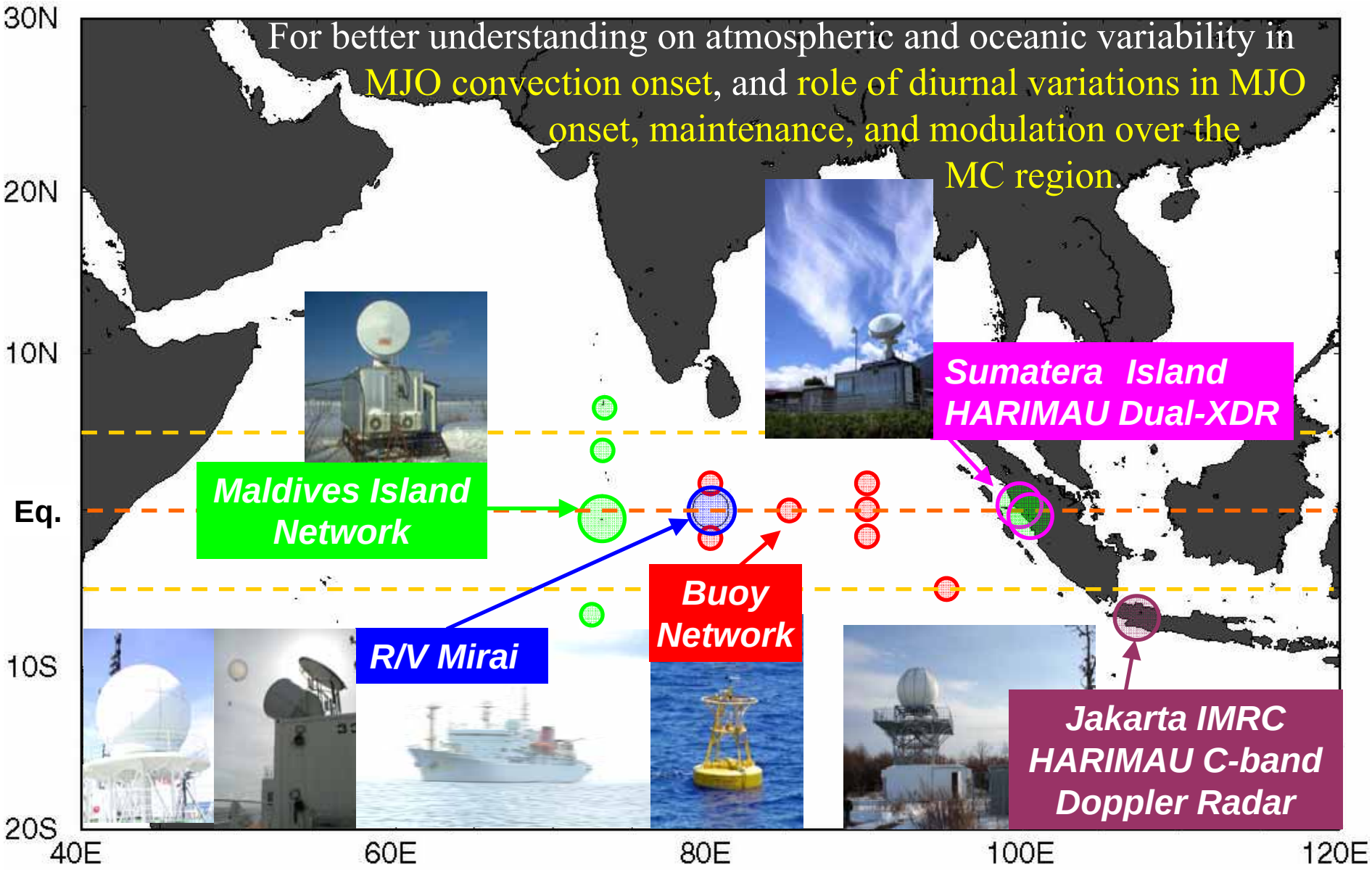
over the *Land region*

(Mori et al., 2004, MWR)

http://www.jamstec.go.jp/iorgc/harimau/HARIMAU.html



HARIMAU2006 in collaboration with MISMO during October 28 – November 27, 2006



HARIMAU2006 Intensive Observation

- **Background and Objective**

  To better understand structures and dynamics of diurnally generated convective systems over the southwestern coastal region of Sumaetra Island, and their interactions with intraseasonal variation (MJO).

- **Observation Sites**

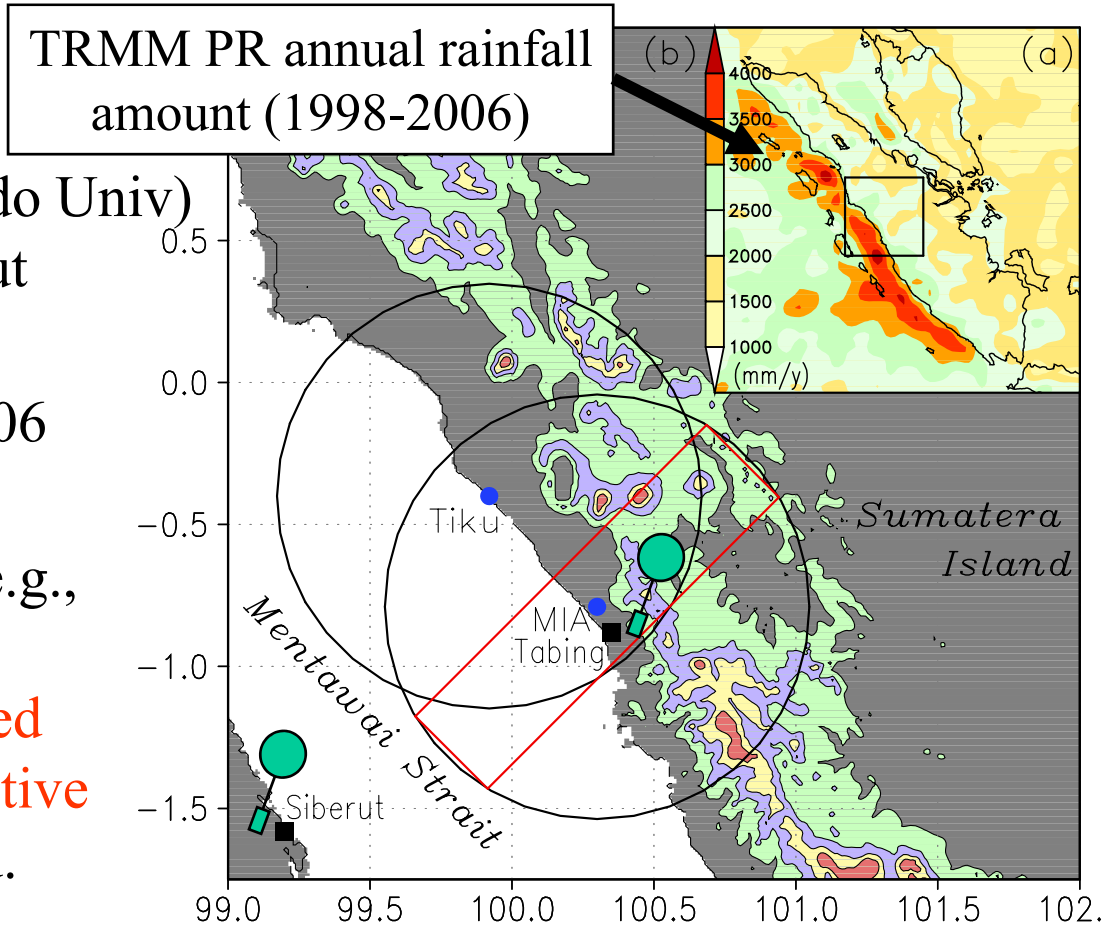
  X-band Doppler radars at MIA (JEPP) and Tiku (Hokkaido Univ)
  Soundings at Tabing and Siberut

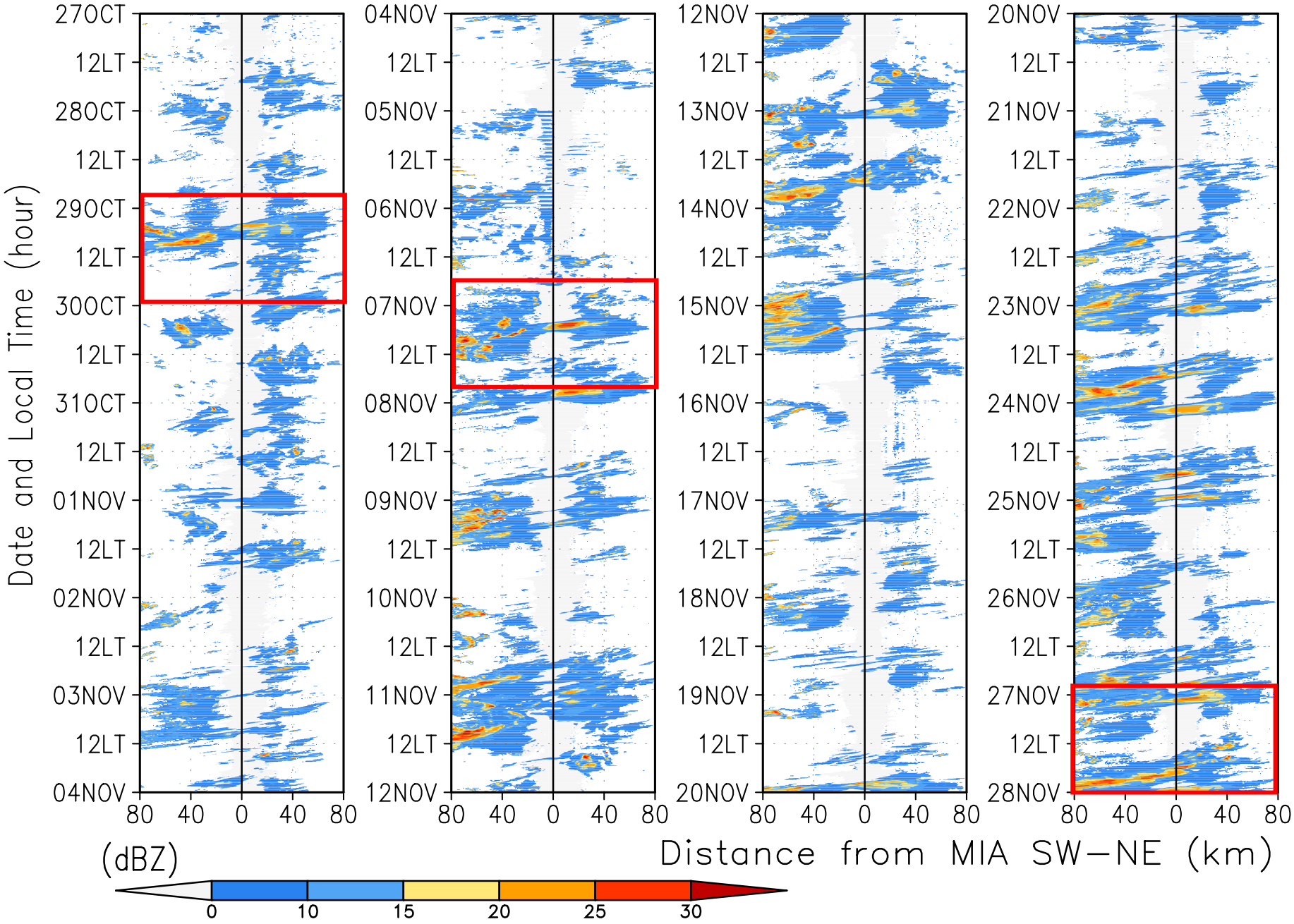
- **Observation Period**

  October 28 – November 27, 2006

- **Status**

  Various kinds of convections (e.g., isolated, organized, hazardous) embedded in diurnally developed cloud systems during MJO inactive phase were frequently observed.




Date and Local Time (hour)
27OCT
12LT
28OCT
12LT
29OCT
12LT
30OCT
12LT
31OCT
12LT
01NOV
12LT
02NOV
12LT
03NOV
12LT
04NOV
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23NOV
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25NOV
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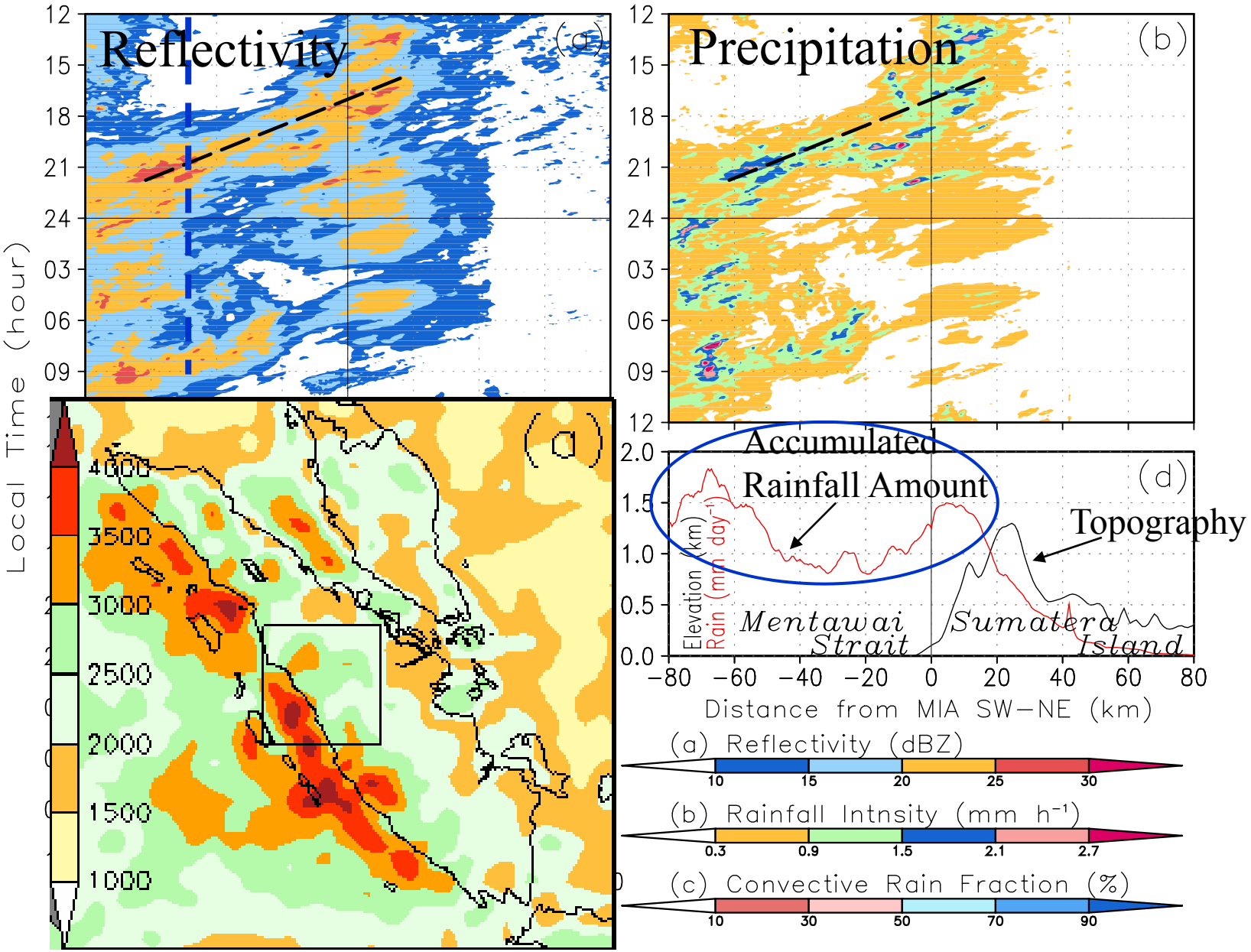
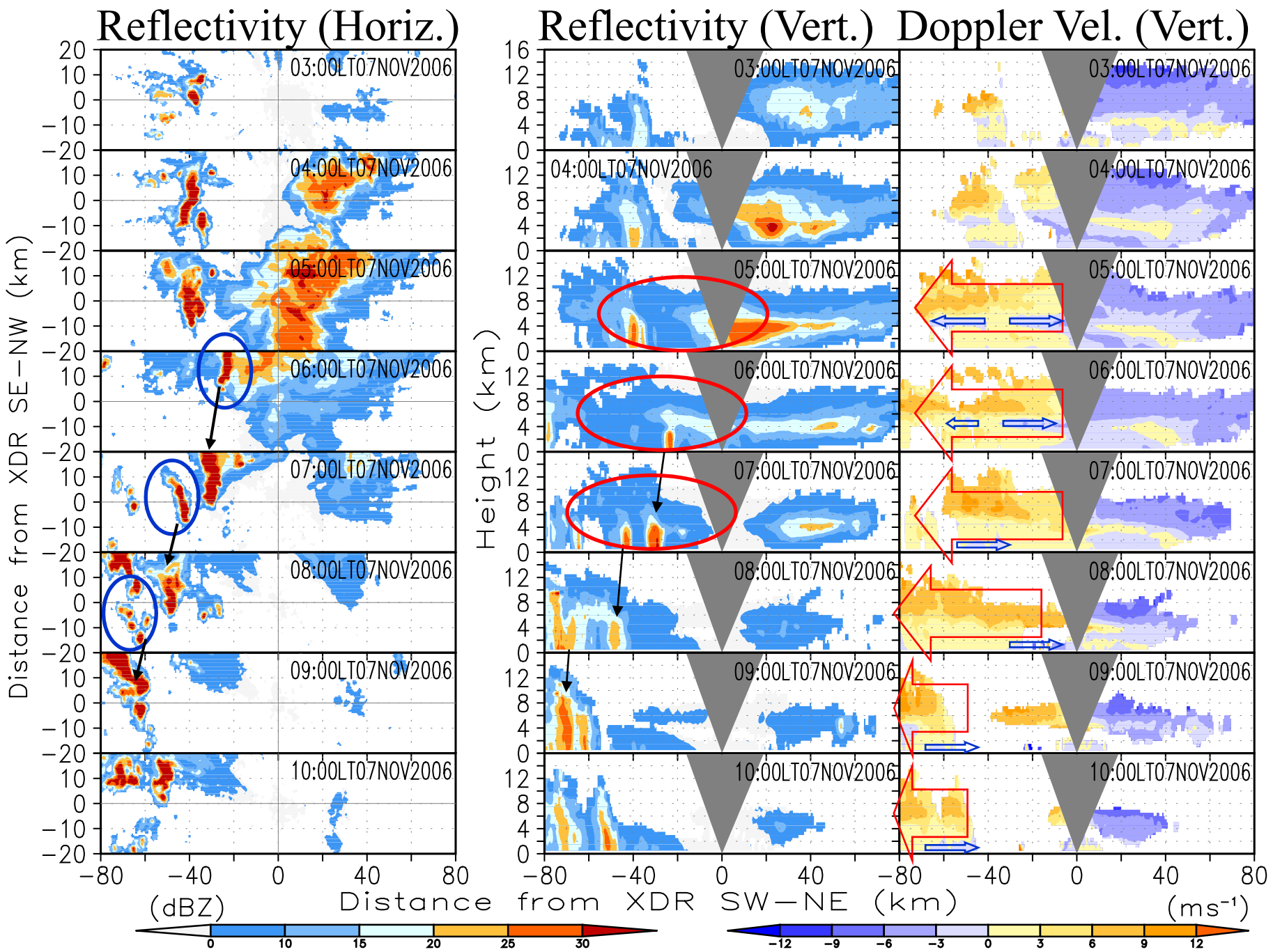
26NOV
12LT
27NOV
12LT
28NOV
80 40 0 40 80
Distance from MIA SW–NE (km)
(dBZ)
0
10
15
20
25
30

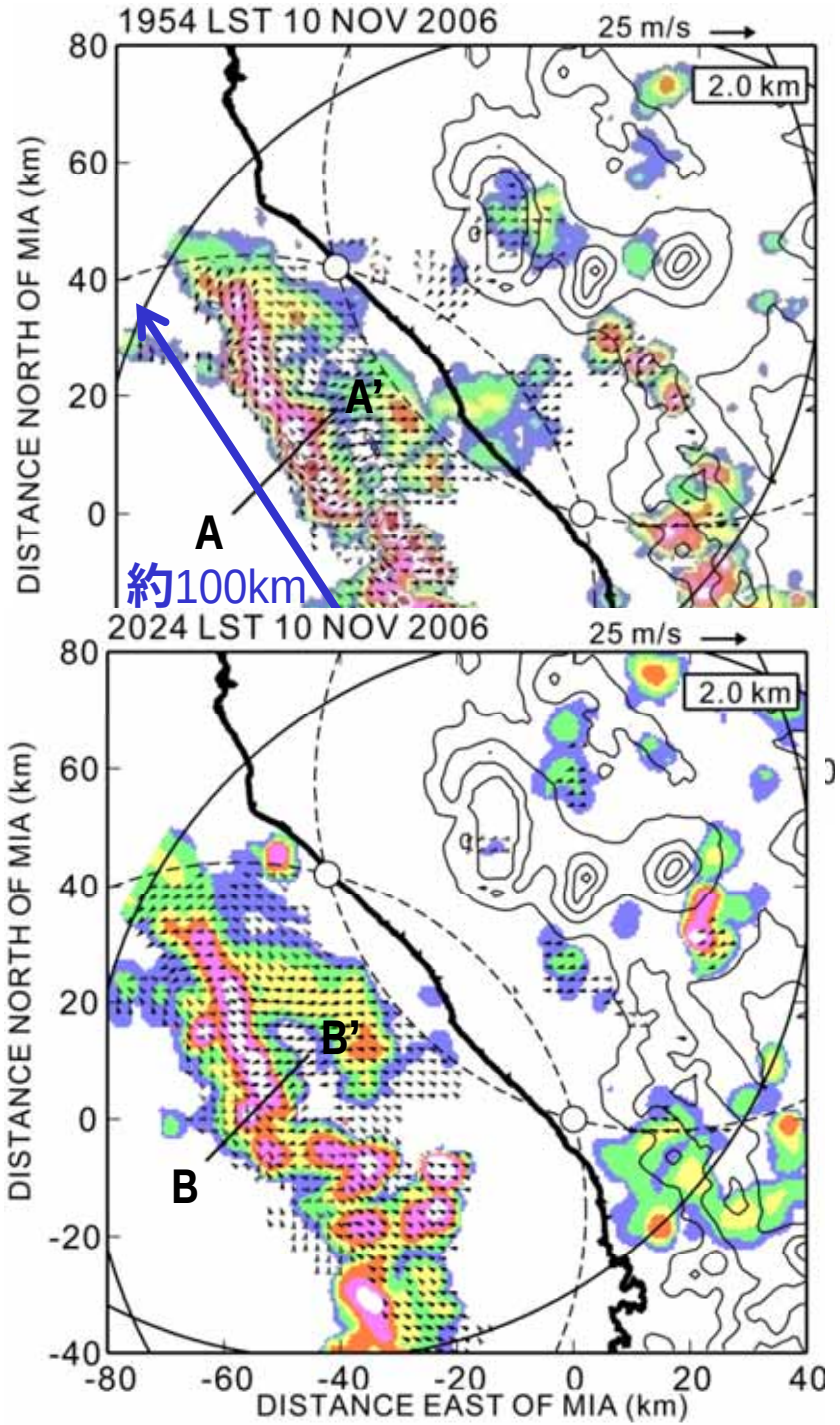
Nocturnal re-development of coastal precipitation

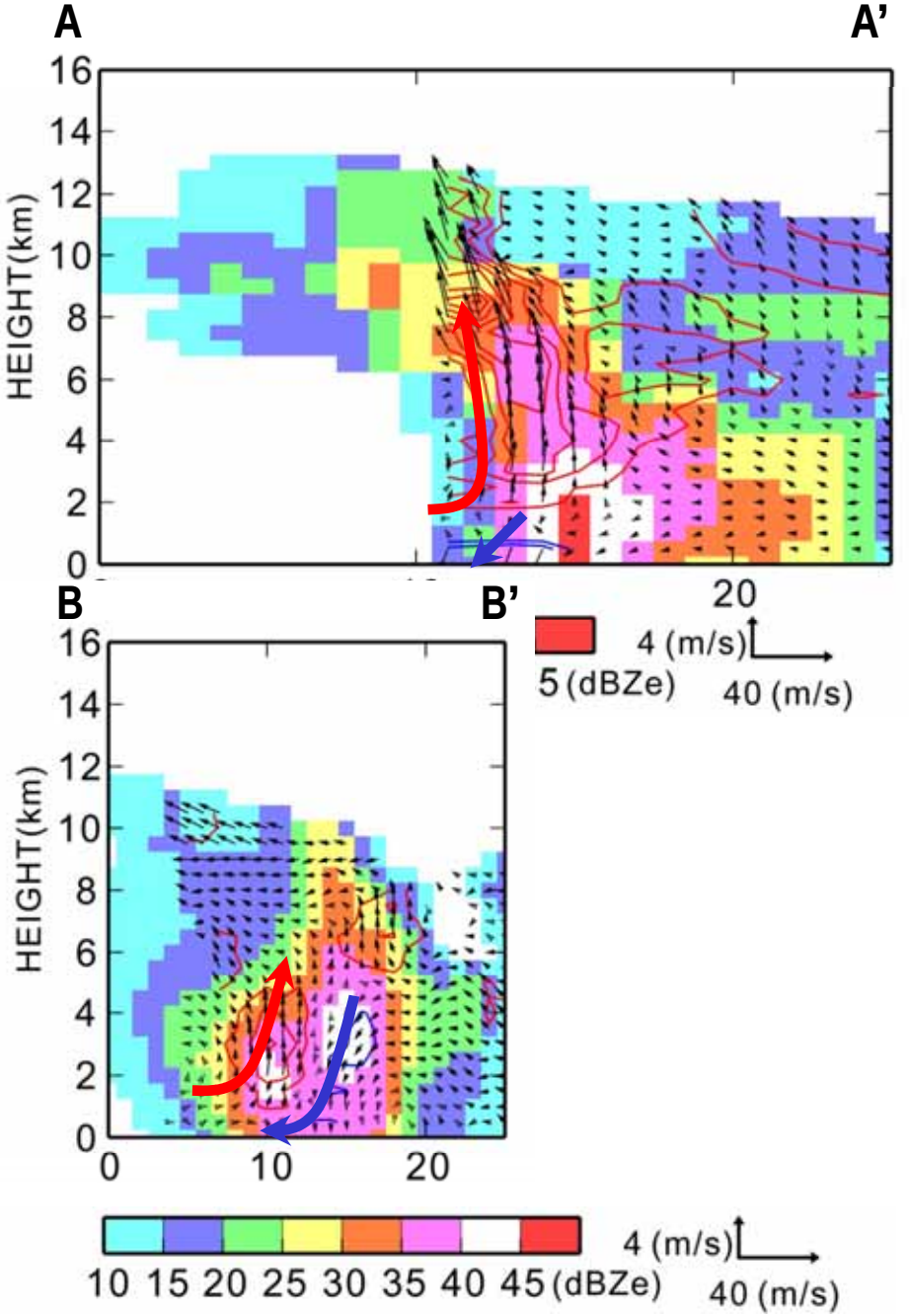




2nd Case for 0300LT-1000LT 07 November 2006

Sakurai et al. 2008 (in preparation)





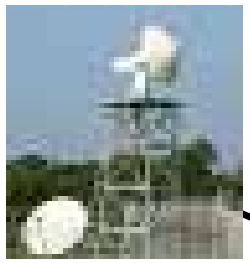
Future plan .....

1. JEPP/HARIMAU program comes to end in March 2010, however, we're applying another funding (JICA-JST) to develop our activity with Indian Ocean moored buoy research/develop group directed by Dr. Mizuno.
2. Furthermore, the IORGC is going to be reorganized in 2009, and our "large-scale hydrological research group", MJO study groups directed by Dr. Yoshizaki, and buoy study/develop group are merged in one research program.
3. Therefore, we'll have closer collaboration with CINDY 2011 by using HARIMAU radar-profiler network which can obtain comprehensive structure of MJOs passing over MC and study "effect of land/island" on MJO modulation.
4. Detailed strategy of CINDY collaborated activity in the MC is under discussion in our group and Indonesian researchers.

Buoy array and Atmospheric radars in Tropics for Application of climate Variability study trough Indonesia-Japan scientific Alliance (BATAVIA)

Kototabang EAR,BLR,XDR

KU + LAPAN

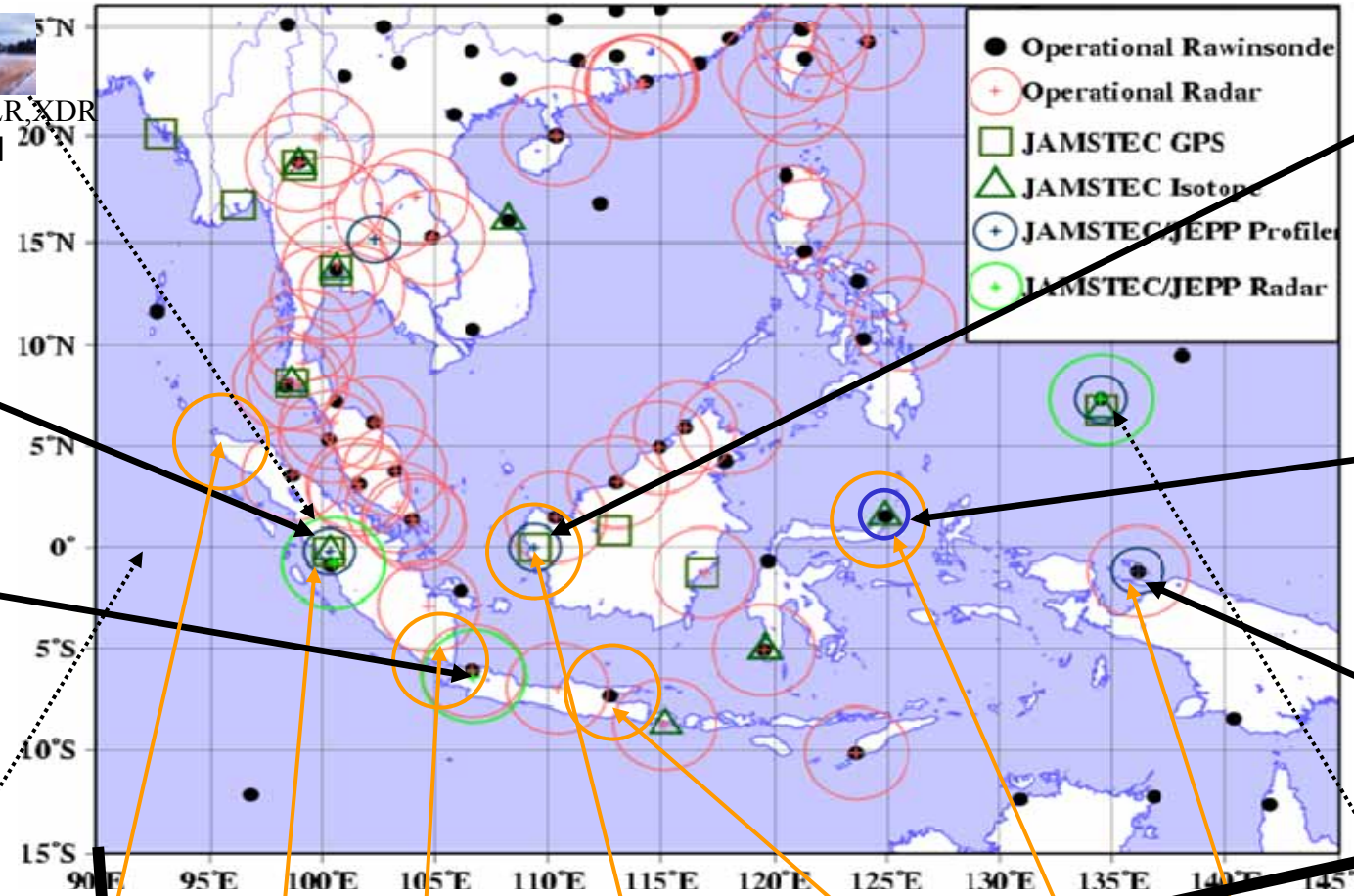


MIA XDR

Serpong CDR

Mirai CDR

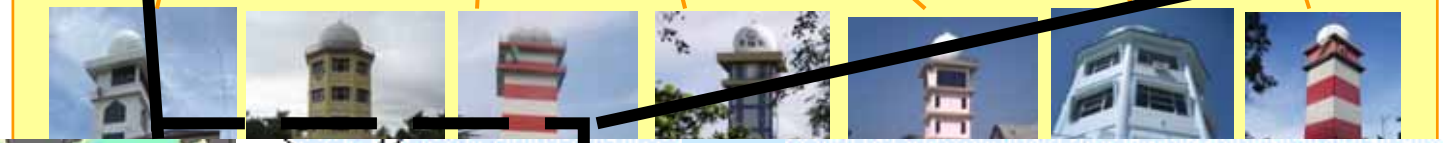
JAMSTEC

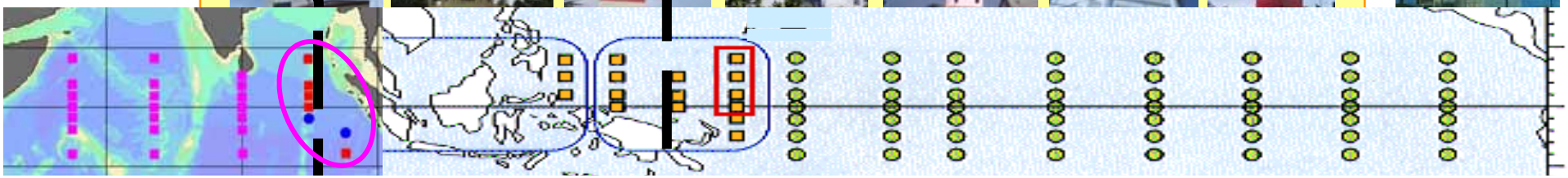


Pontianak WPR

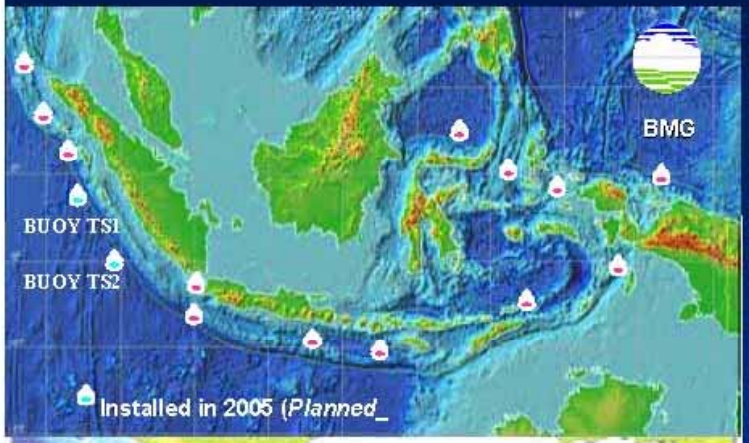
Manado WPR

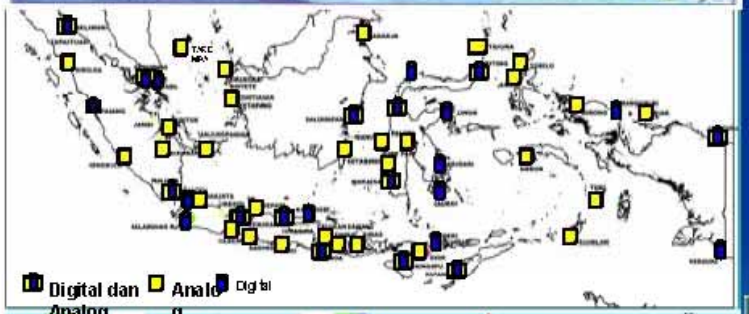
Biak WPR

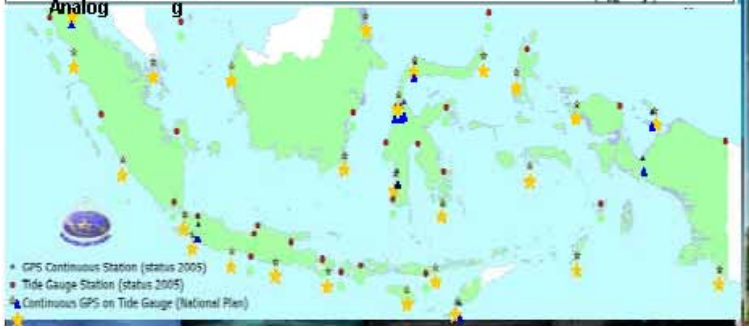




MARINE RESEARCH FACILITIES







1. BRKP - DKP
2. BAKOSURTANAL
3. LAPAN
4. BMG
5. DISHIDROS
6. BPPT
7. LIPI
8. MGI - DESDM

Wahana K/R BPPT & LIPI

RADAR BARU

(7 LOKASI)

BMG

ACEH

PADANG

MANADO

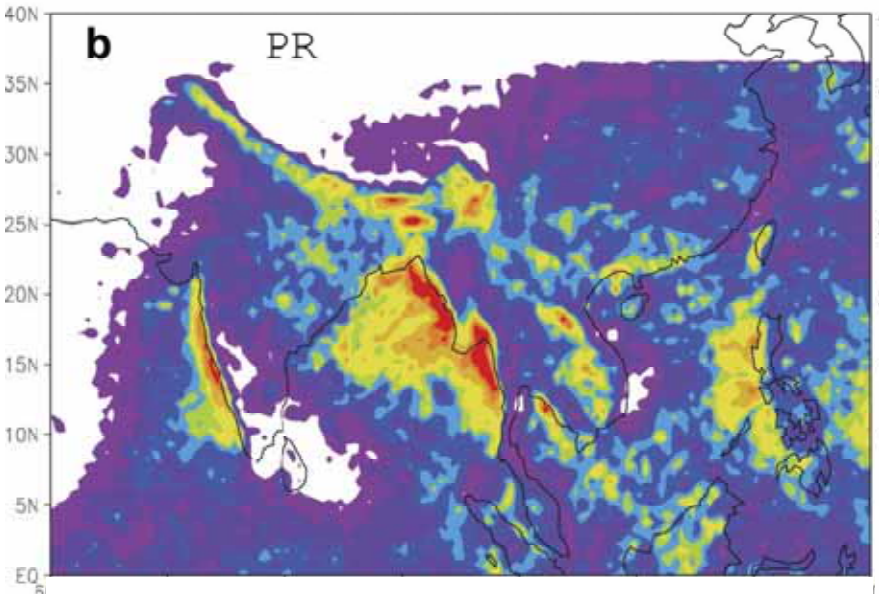
LAMPUNG

PONTIANAK

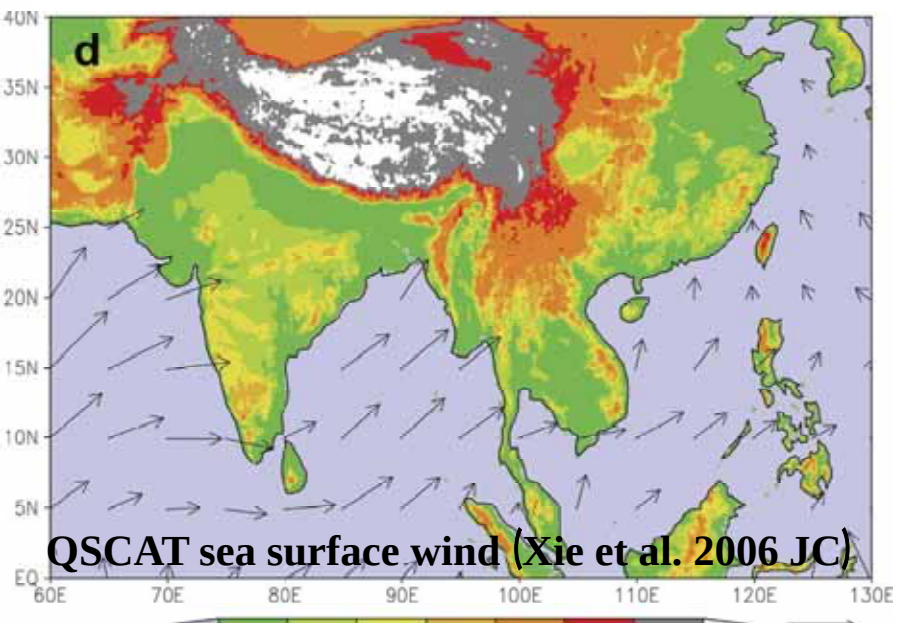
SURABAYA

BIAK

Coastal Rain Bands in South-Southeastern Asian Monsoon Region



Rainfall distribution (JJA) observed with TRMM PR and related coastal mountain ranges in Asian region (Xie et al. 2006 JC)



QSCAT sea surface wind (Xie et al. 2006 JC)