MAHASRI

Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative

http://mahasri.cr.chiba-u.ac.jp/

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JAMSTEC/ IORGC

The Second CEOP Annual Meeting
at Geneva Switzerland, September 15, 2008

Objective

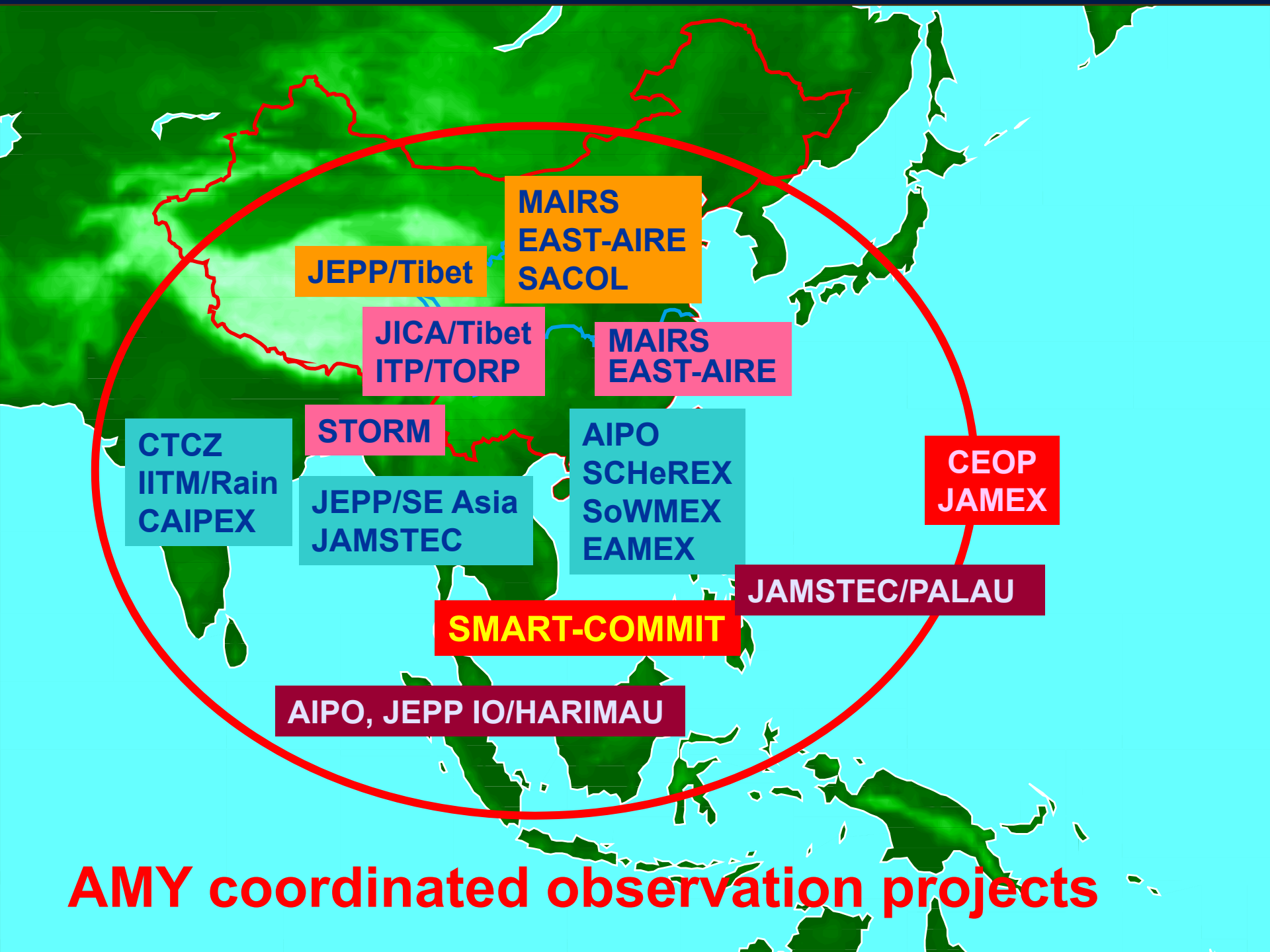
"To establish hydro-meteorological prediction system, particularly up to seasonal time-scale, through better scientific understanding of Asian monsoon variability".

Key Science Issues

- Atmosphere-ocean-land interactions in the Asian monsoon system
- Scale-interactions among diurnal, synoptic, intraseasonal and seasonal variability of Asian monsoon rainfall
- Effect of various-scale orography on monsoon rainfall
- Effect of human influences (i.e., aerosols, land-use change, and greenhouse-gas increase) on hydro-meteorological variations in Asian monsoon regions – Collaboration with MAIRS

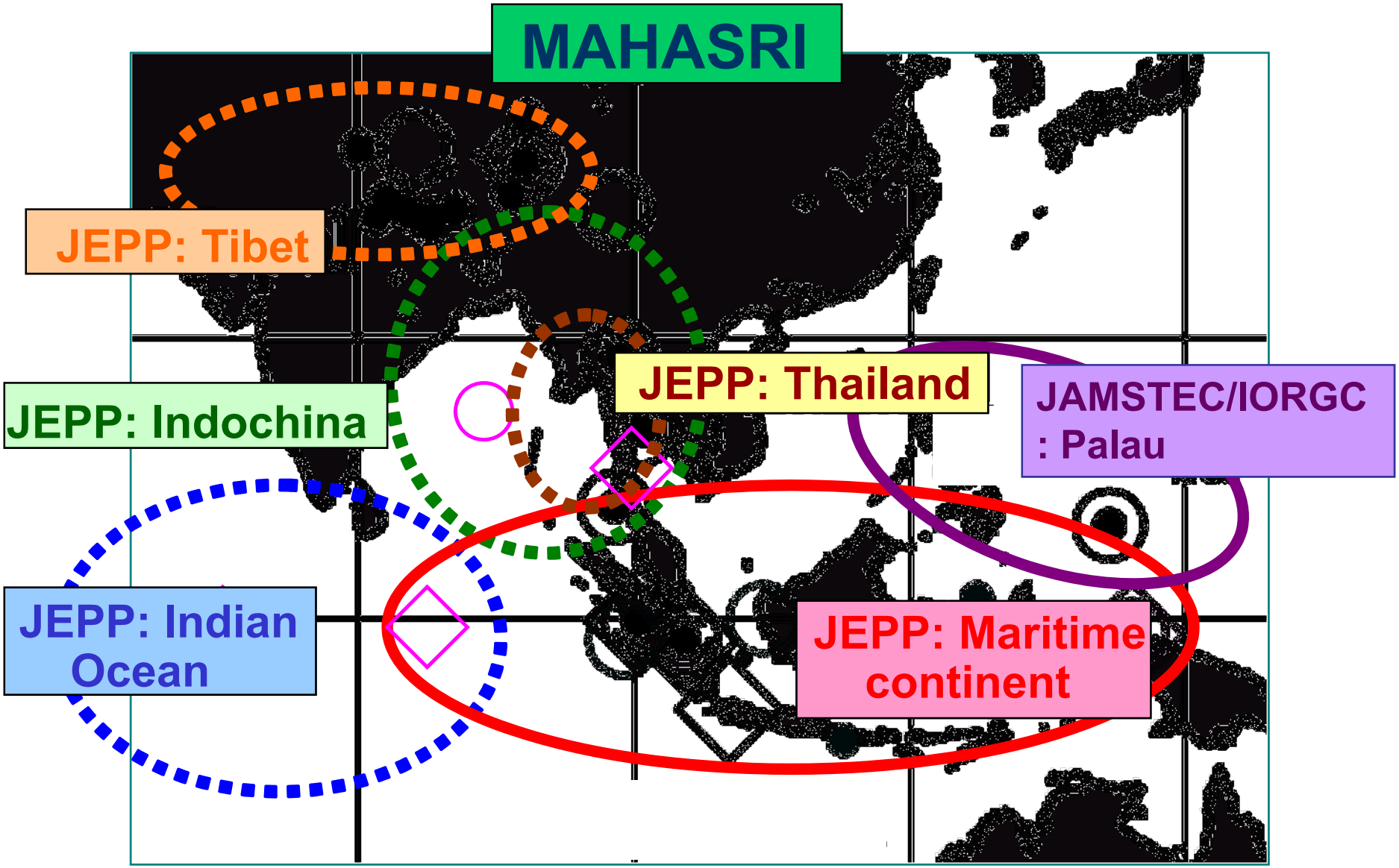
Meetings

- November 19, 2007: International Implementation Workshop of the East Asian Monsoon Field Experiment (EAMEX) at Chung-Li, Taiwan
- December 17-18, 2007:Japan-Taiwan Joint Workshop for the EAMEX and MAHASRI at Hakone, Japan
- December 18, 2007: MAHASRI Domestic Scientific Meeting at Hakone, Japan
- February 27-28, 2008: International Seminar on Climate Variability, Change and Extreme Weather Events at KL, Malaysia
- April 20-25, 2008: MAIRS Anthropogenetic effect on Asian monsoon at Nanjing, China
- May 30, 2008: Japan Geoscience Union (JPGU) Annual Meeting, Special Session on “MAHASRI and its collaboration with related research fields”, Chiba, Japan



AMY coordinated observation projects

MAHASRI and related Japanese Projects (JEPP)



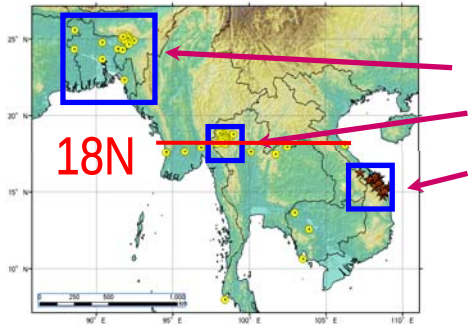
Japan EOS Promotion Program (JEPP) Theme 2-2 by Prof. Matsumoto, U-Tokyo

Development of rainfall observation system in Southeast Asia

Objective: Develop rainfall observation system in order to understand water cycle and its variability by climatic changes in tropical Asian monsoon region over Indochina

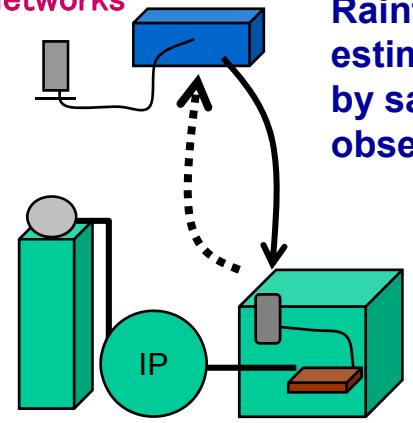
(1) Research on rainfall distribution
Rainfall observation by automatic rain gauges and development of real-time data transmission system

(2) Research on flood prediction
Rainfall estimation using radar and satellite observation and its application to flood prediction

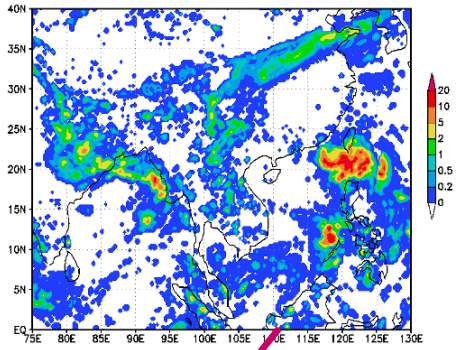


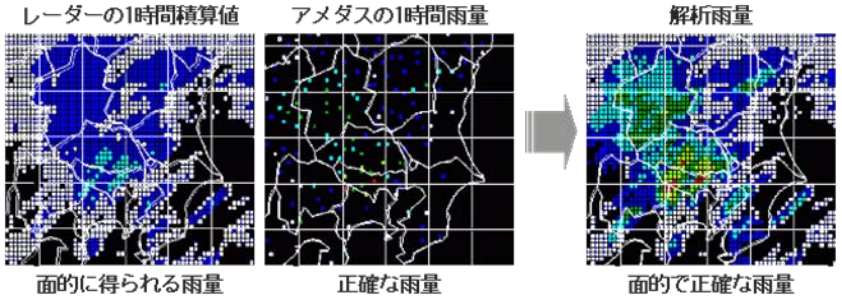
Automatic rain gauge Networks

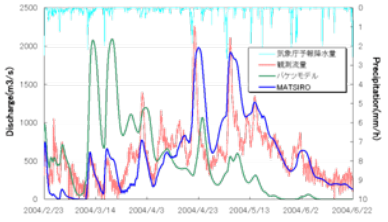
India, Bangladesh	36
Thailand	18
Vietnam	33



Rainfall estimation by satellite observation







Radar data + Raingauge data → Composite rainfall data

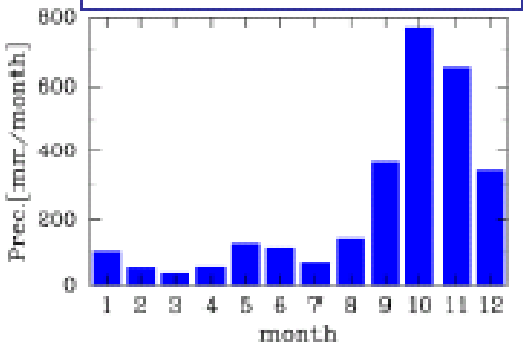
Similar to Radar-AMeDAS system in Japan

Flood prediction

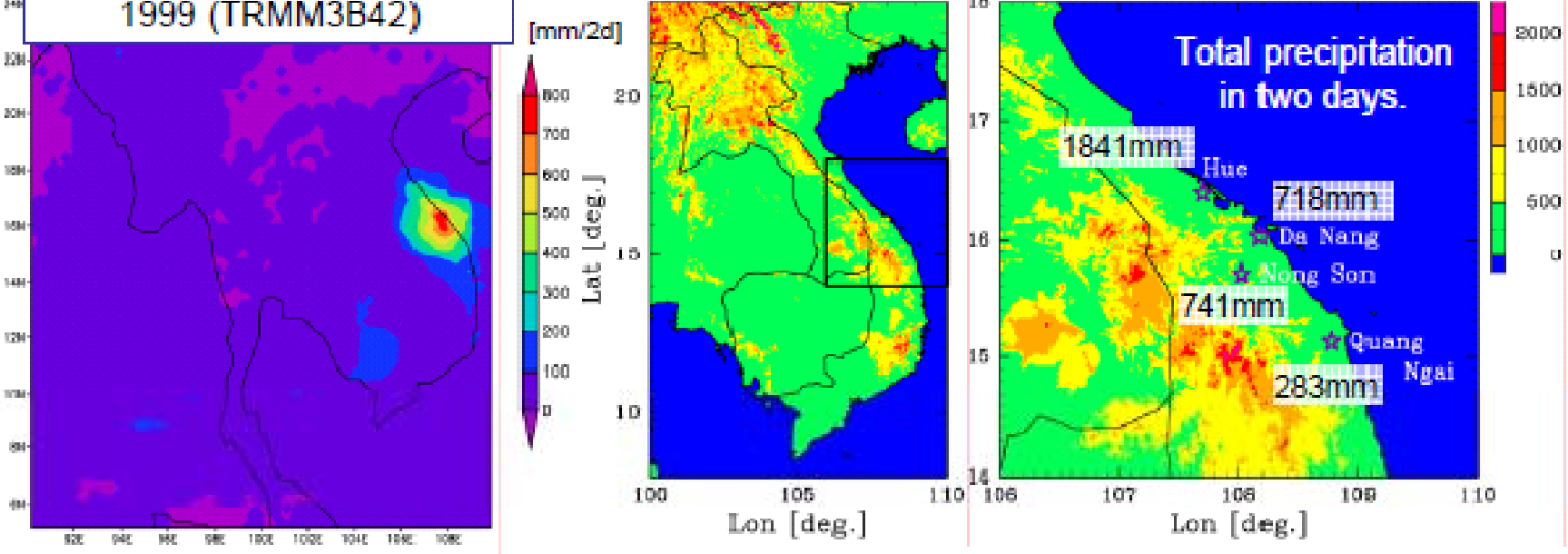
A heavy rainfall event in central Vietnam in November 2-3, 1999

- Precipitation on Nov. 2 and 3, 1999 in Hue (16.4N, 107.7E) is more than 800 mm/day.
  - the maximum precipitation event since 1951.
- Heavy rainfall concentrates in central Vietnam east of the Annam range.

Climatological monthly precipitation at Hue

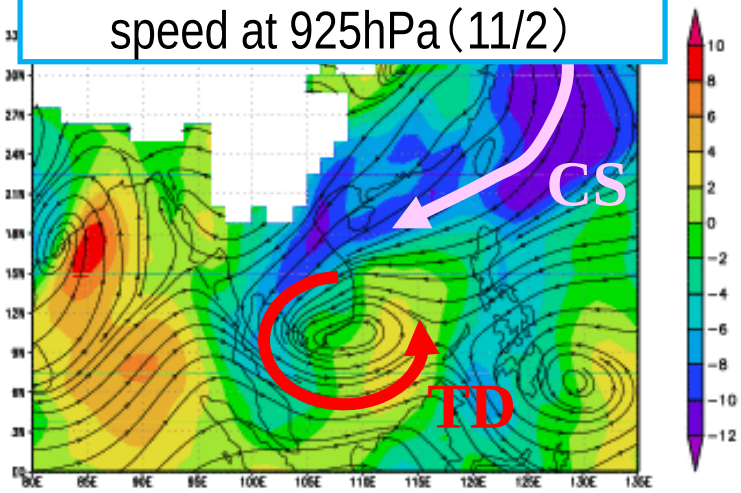


Precipitation in Nov. 2-3, 1999 (TRMM3B42)

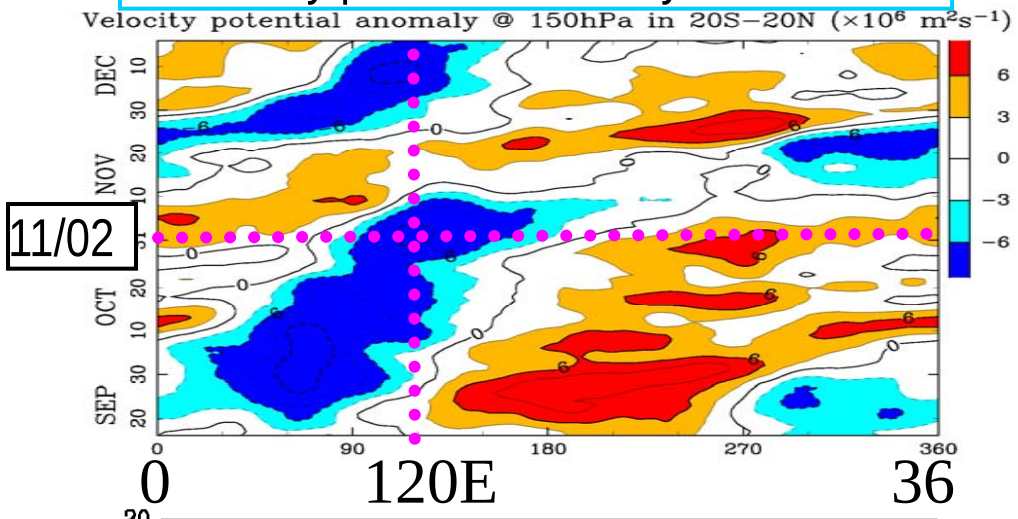


Synoptic-scale processes

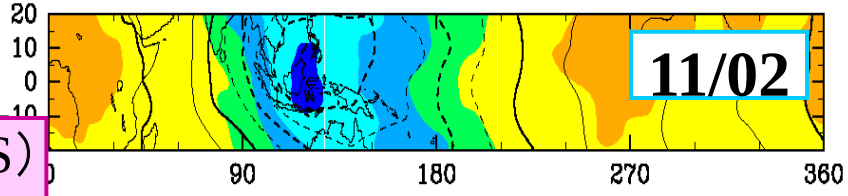
Stream line and meridional wind speed at 925hPa（11/2）



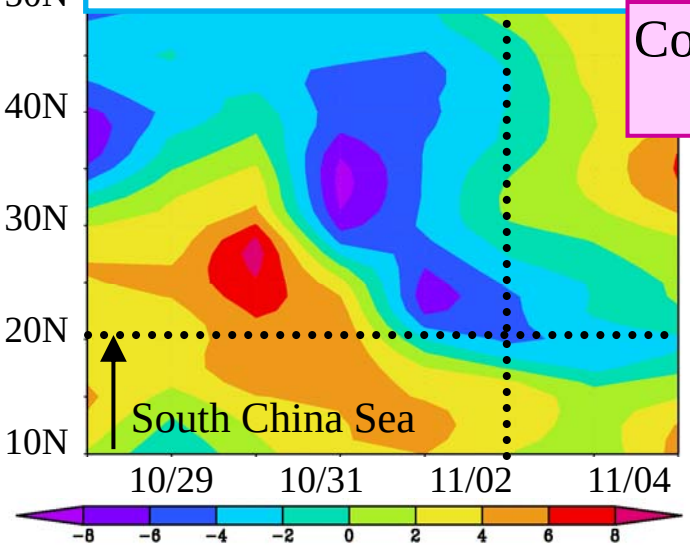
Velocity potential anomaly at150hPa



0 120E 36



Time- lat. Section of v-wind in 110-120 E



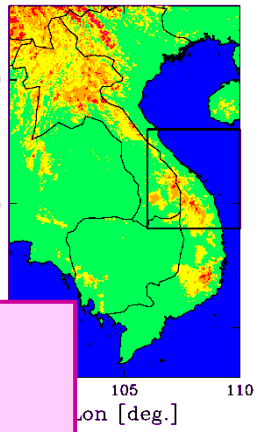
Cold surge（CS）

TD in SCS

Active MJO

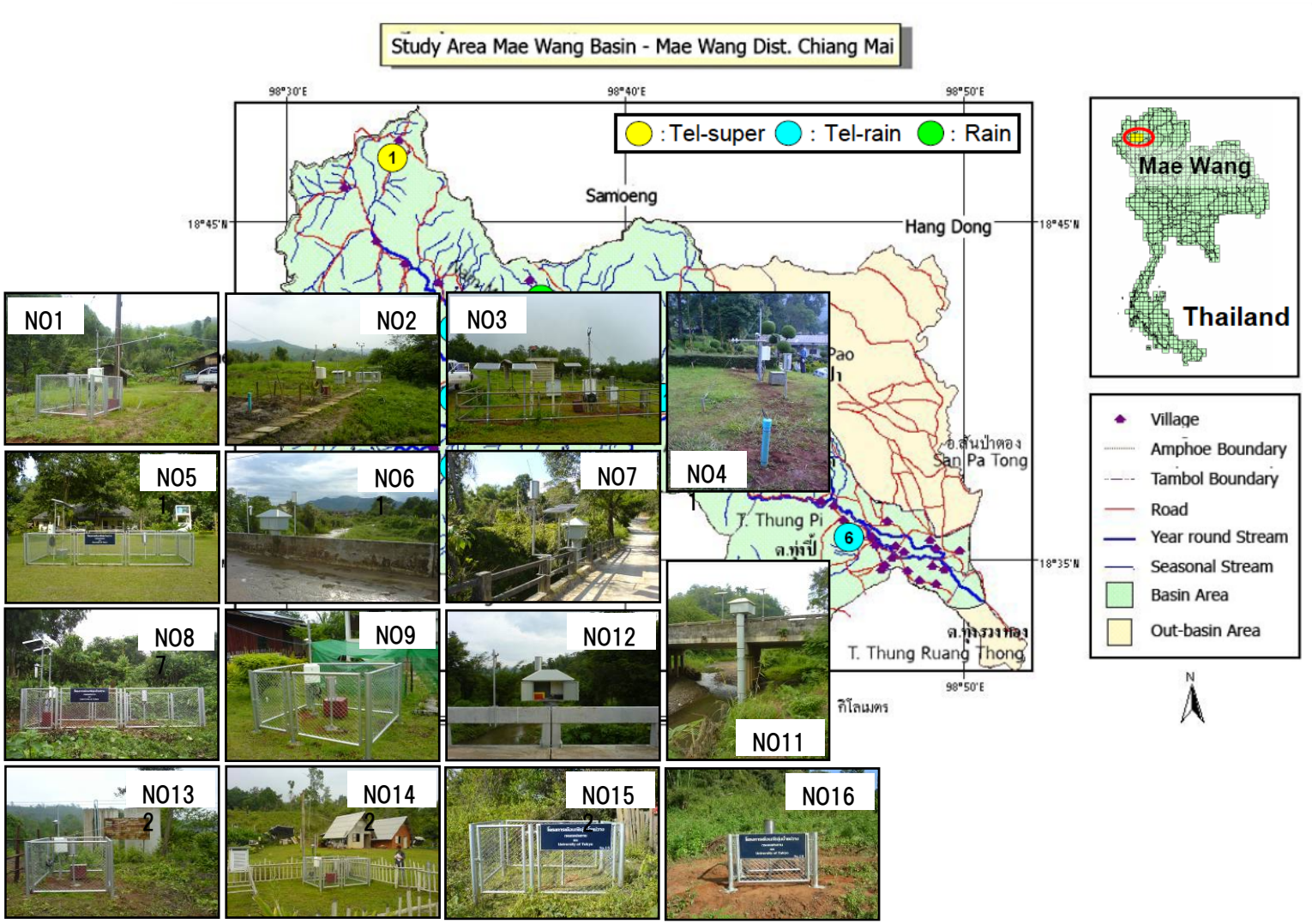
- Orography
- Low level convergence

Persistent orographically enhanced rainfall



Site description

Mae Wang basin in Chiang Mai (basin area : 600 km^2)

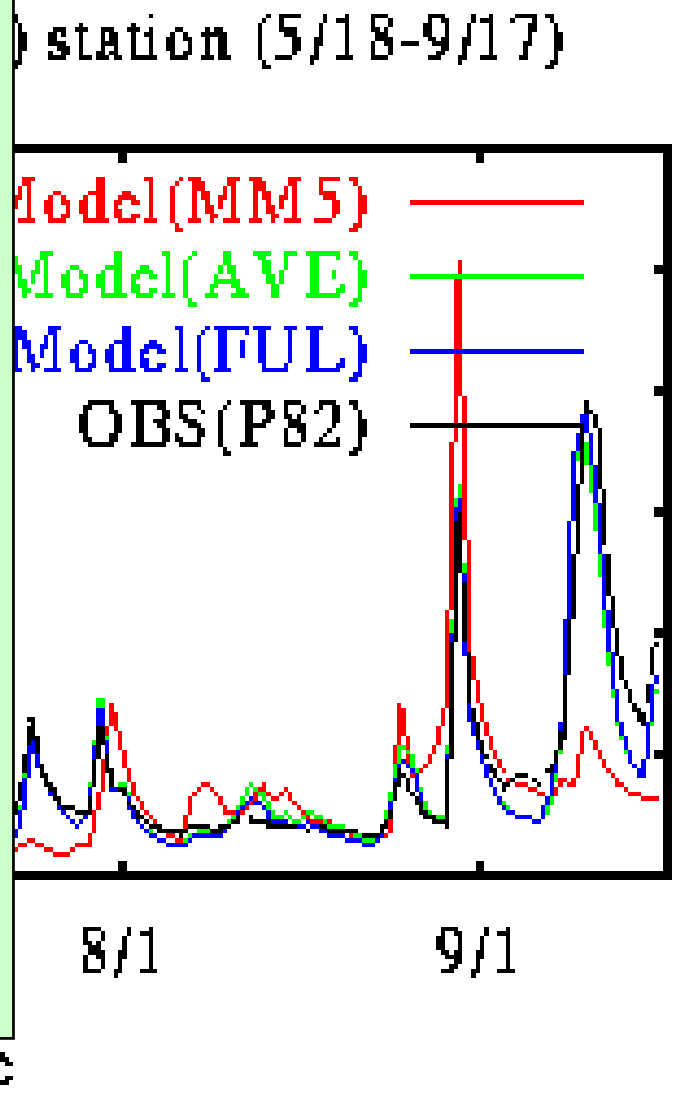


Results ~Daily Discharge~

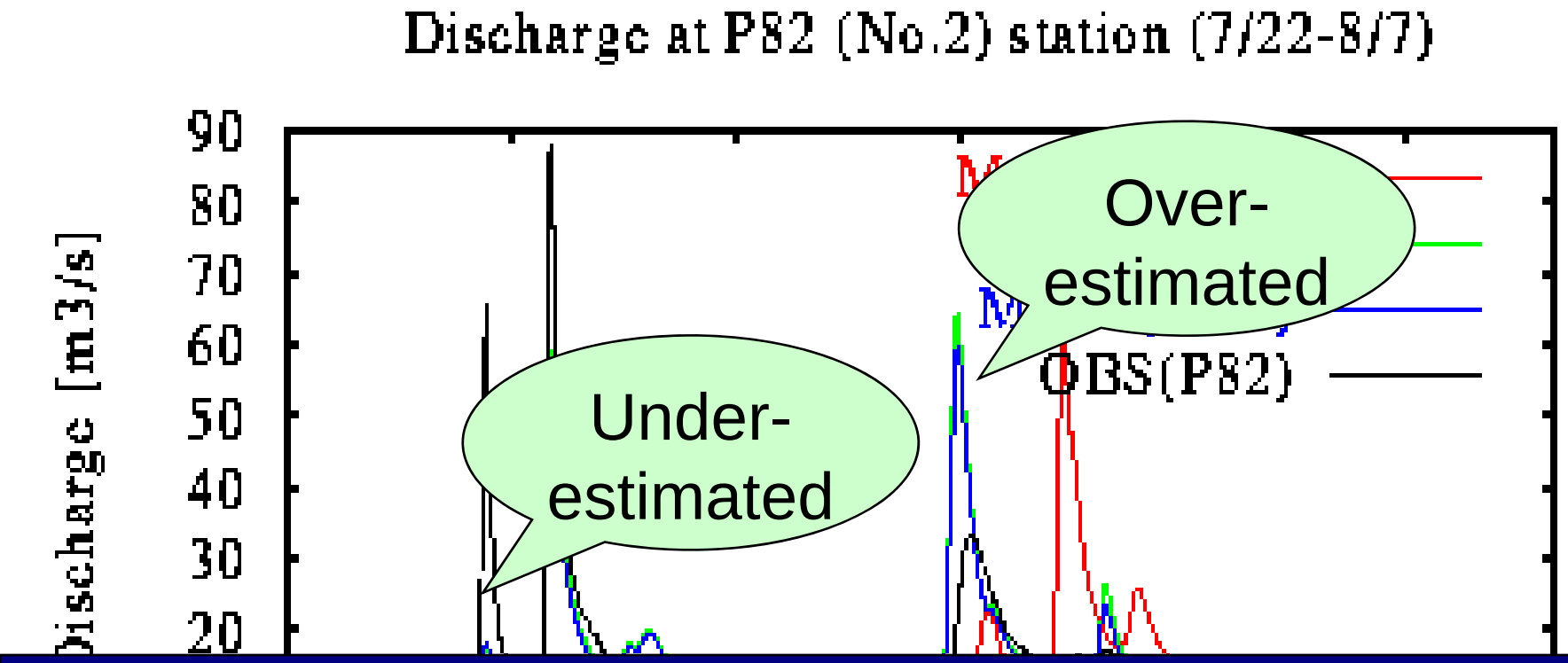
- MM5 can represent some flood events, but others not.
- FUL hydrograph is very close to AVE (Correlation Coefficient is over 0.99)!!

→ Basin average precipitation data has large effects on runoff discharge!!

- FUL and AVE accurately represents the flood events, but…

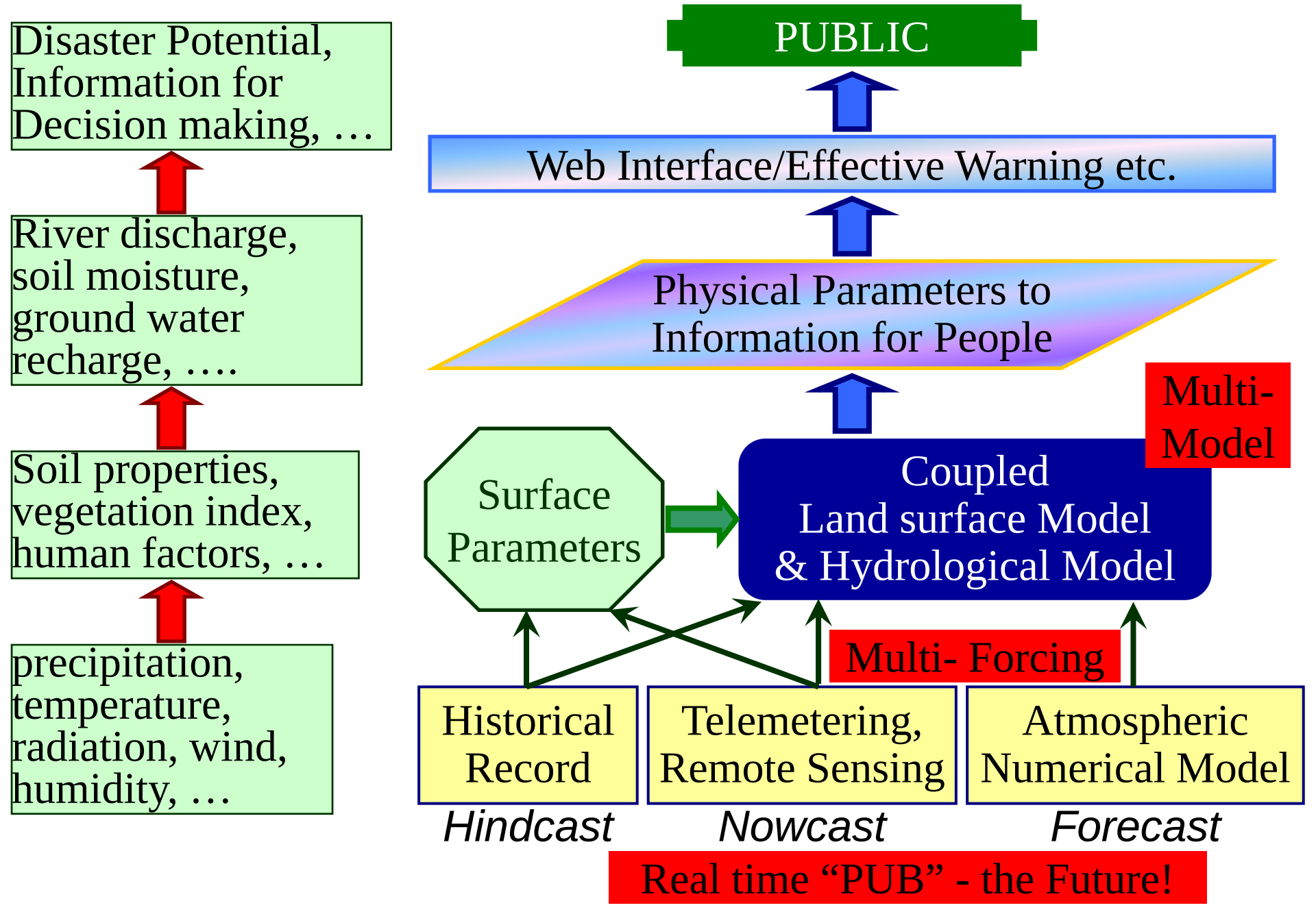


Results ~Hourly Discharge~

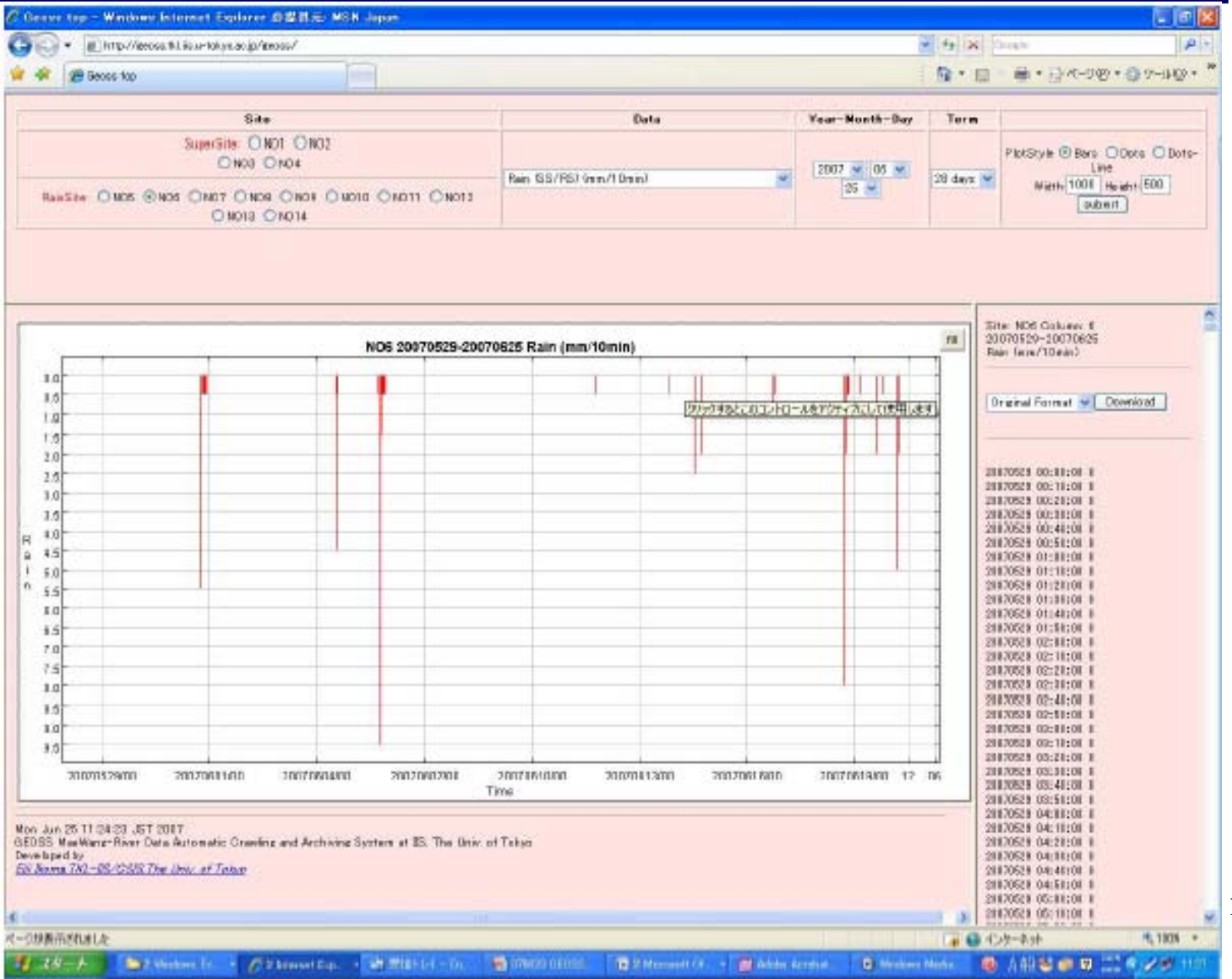


What makes this?

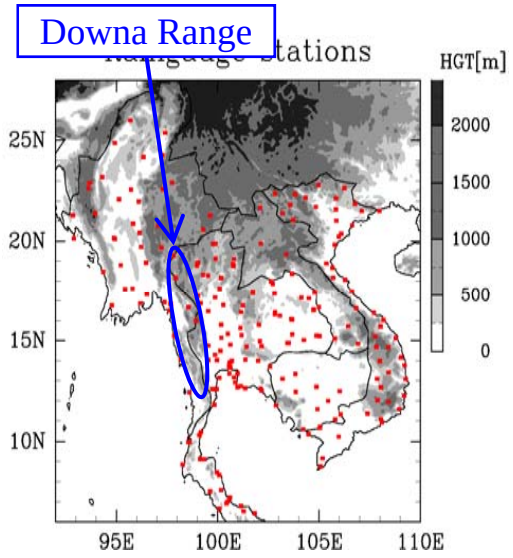
1. Interpolation methods should be improved??
2. GEOSS observation system is not dense enough??


Disaster Potential, Information for Decision making, …
River discharge, soil moisture, ground water recharge, ….
Soil properties, vegetation index, human factors, …
precipitation, temperature, radiation, wind, humidity, …
PUBLIC
Web Interface/Effective Warning etc.
Physical Parameters to Information for People
Multi-Model
Surface Parameters
Coupled Land surface Model & Hydrological Model
Multi- Forcing
Historical Record
Telemetering, Remote Sensing
Atmospheric Numerical Model
Hindcast
Nowcast
Forecast
Real time "PUB" - the Future!

JEPP/GEOSS Data Archive

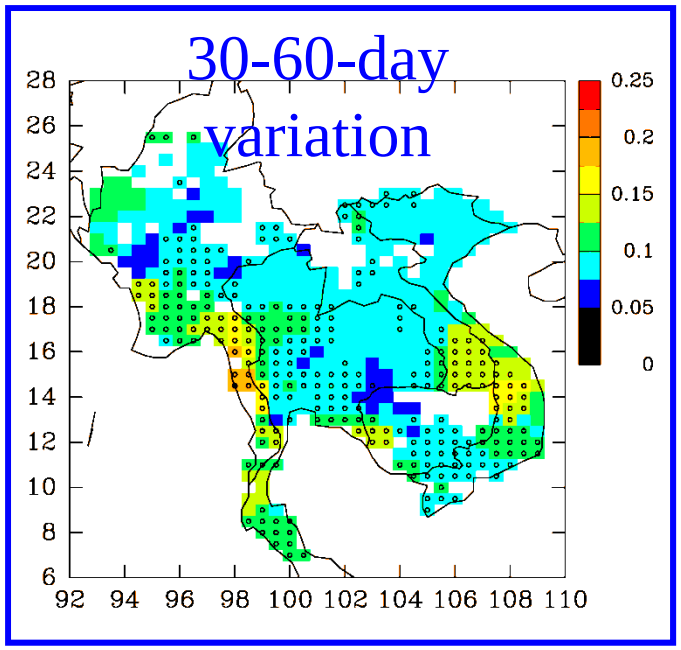


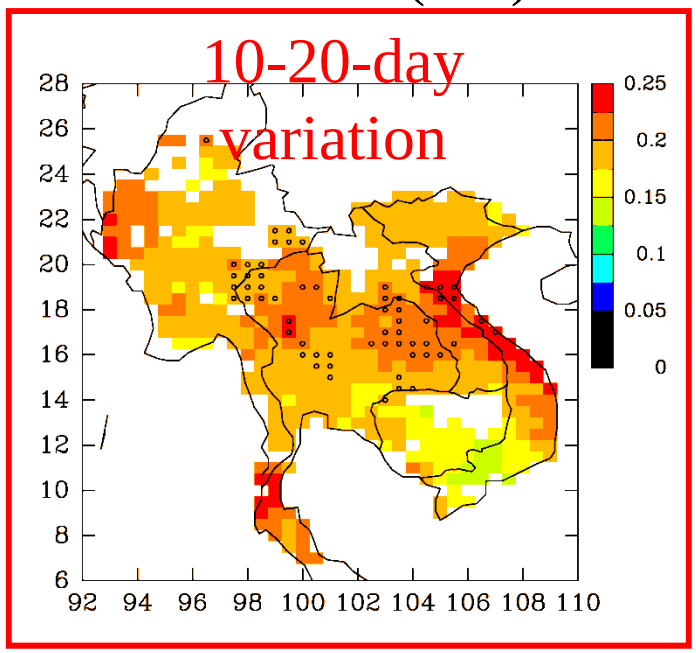
ISV variance of precipitation over Indochina Peninsula



- 210 raingauge sites
- rainy season
- 1978-2003

Percent variance of intra-seasonal variation (ISV)





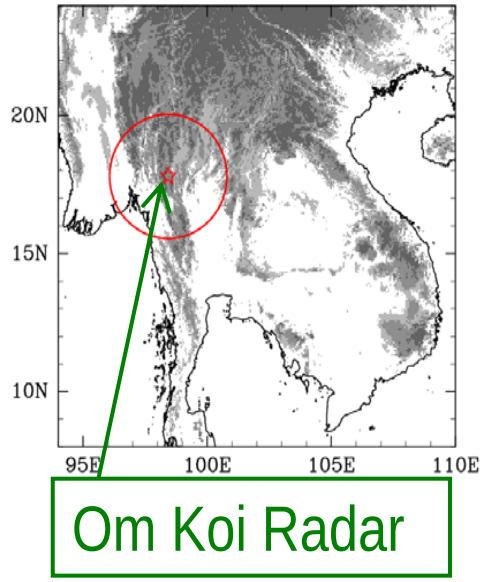
o: statistically significant variance

- High variance area:
  - 30-60-day variation: WEST (windward side) of major mountain ranges (coastal area of Myanmar, southern Laos & central Vietnam)
  - 10-20-day variation: coastal area of Vietnam & inland areas
- Sharp contrast across the Downa Range (especially, for the 30-60-day variation)

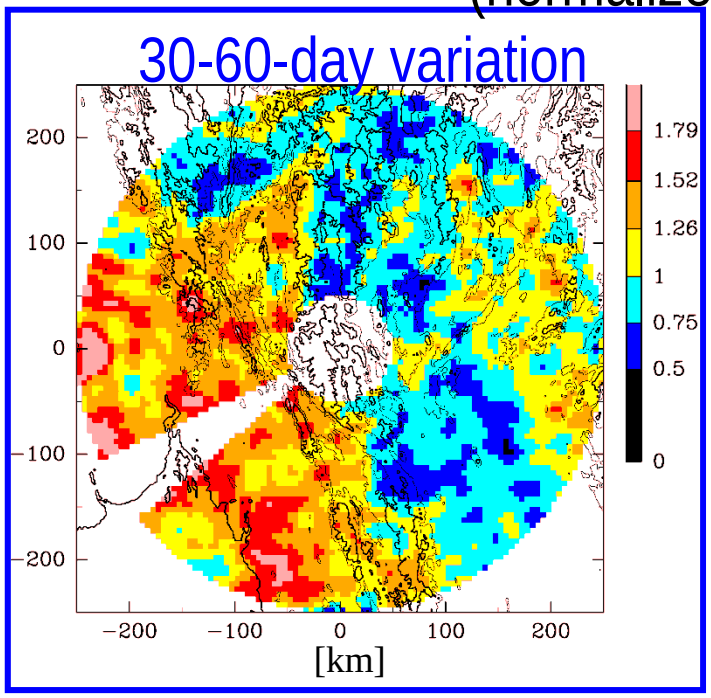
Yokoi, Satomura & Matsumoto, 2007: Climatological characteristics of the intraseasonal variation of precipitation over the Indochina Peninsula. *J. Climate*, **20**, 5301-5315.

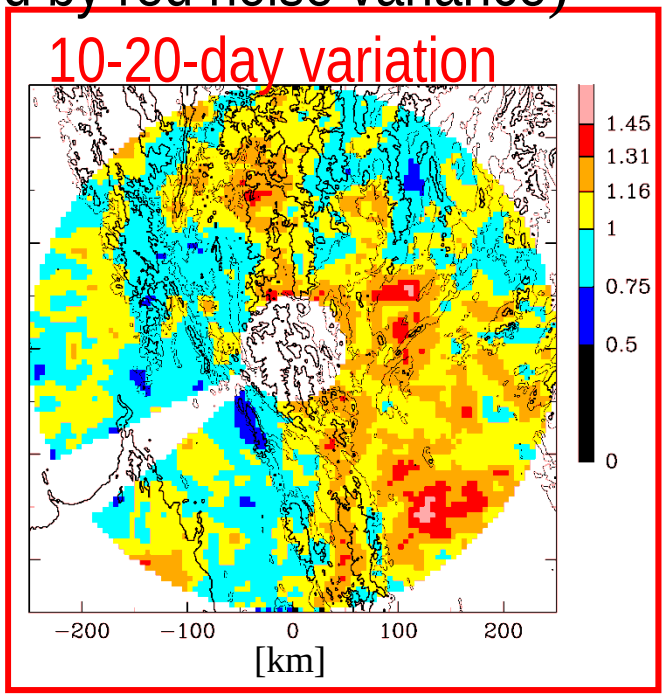
ISV variance of radar reflectivity over western ICP

(normalized by red noise variance)



- 3km CAPPI
- May-Sep, 1998-2000





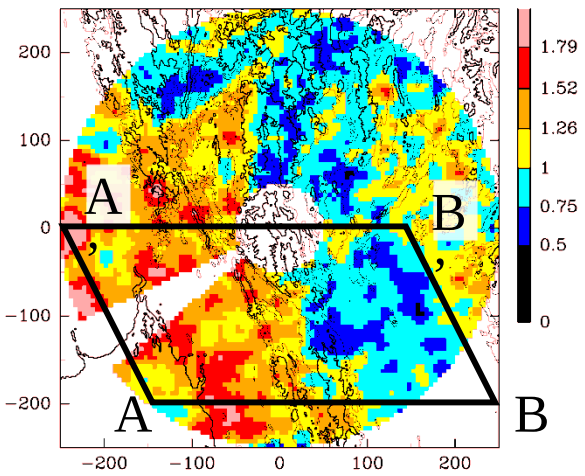
Red & **pink** shadings indicate statistically significant variance at **95%** & **99%** confidence levels, respectively.

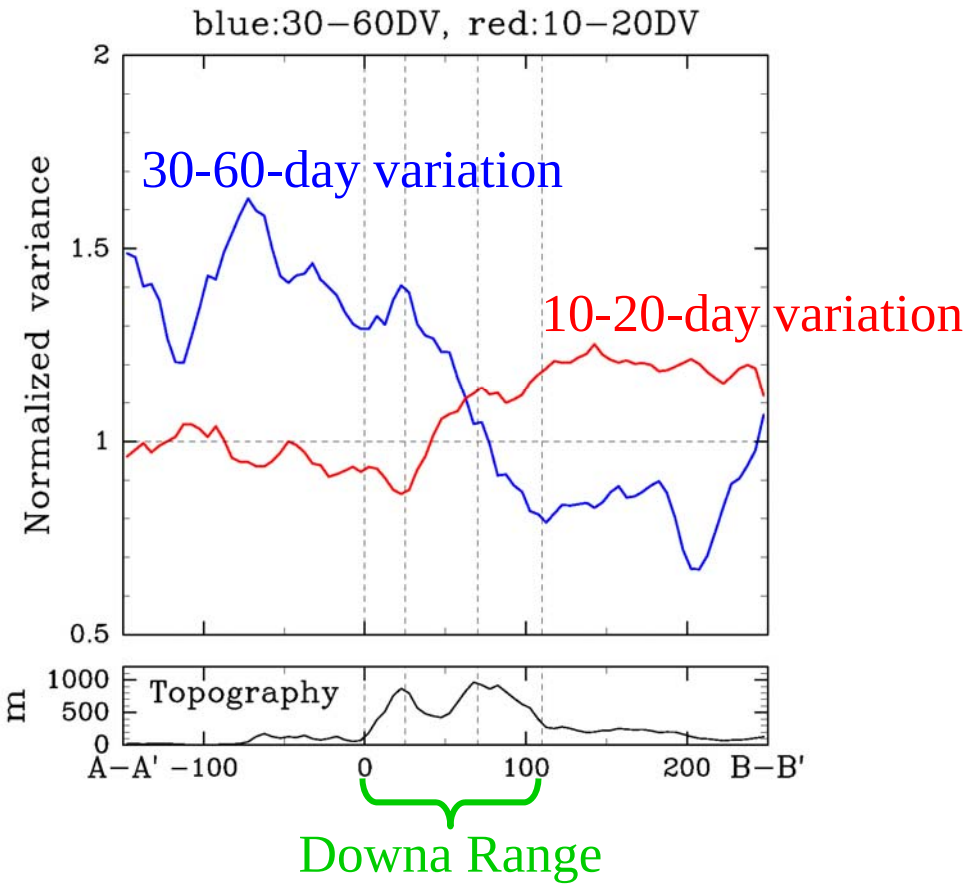
+ High variance area:

- 30-60-day variation: coastal areas WEST of the Downa Range.
- 10-20-day variation: inland areas EAST of the Downa Range.

Yokoi & Satomura, 2008: Geographical distribution of variance of intraseasonal variations in western Indochina as revealed from radar reflectivity data. *J. Climate, in press.*

Relationship with topography





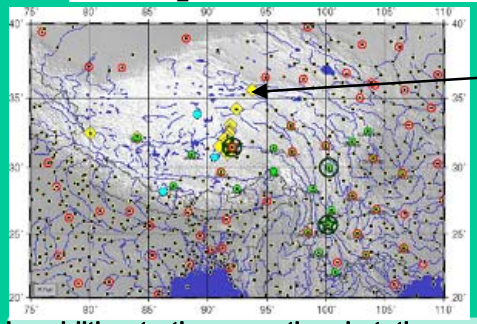
- Both variance varies sharply over the Downa Range.

Yokoi & Satomura, 2008: Geographical distribution of variance of intraseasonal variations in western Indochina as revealed from radar reflectivity data. *J. Climate*, *in press*.

Japan Earth observation Promotion Plan (Theme 2-2)

Promotion of Integrated Observation Study of Energy/Water Circulation over the Tibetan Plateau

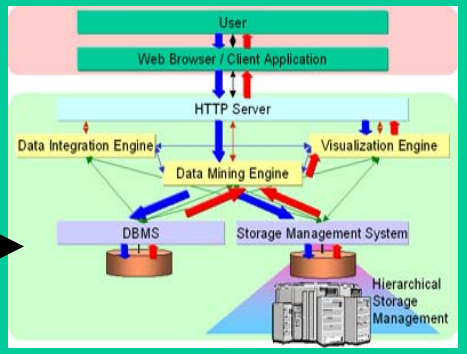
Establishment of land base stations in data sparse area



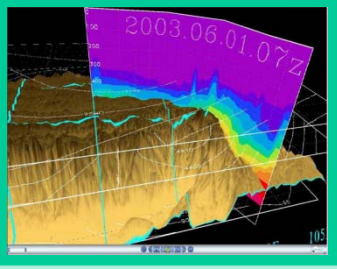
A new site near D66 (Aug. 28, 2006)

In addition to the operational stations, research stations in GAME/ Tibet and Camp/Tibet are updated for the longer and continuous observation. Twenty four GPS stations for precipitable water, three PBL tower and a profiler are now being constructed.

Integrated Database System



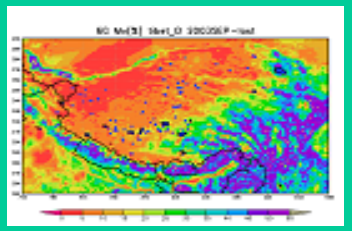
3-D Visualization



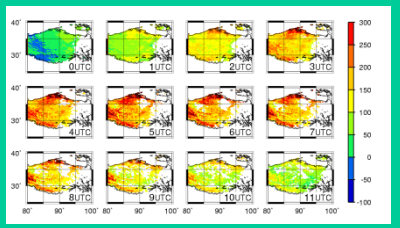
State of arts information technology is applied to implement a sophisticated database system to store and to use land-based and satellite data interactively.

Satellite Data Archive and Use

Soil water content (SSMI)

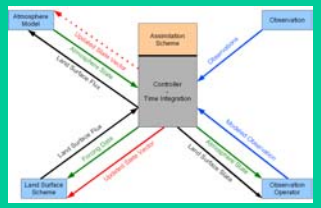


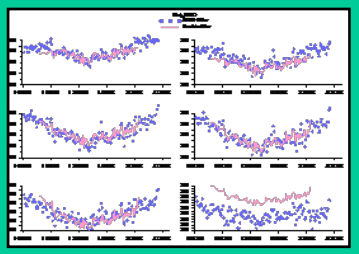
Surface heat flux (FY2C)

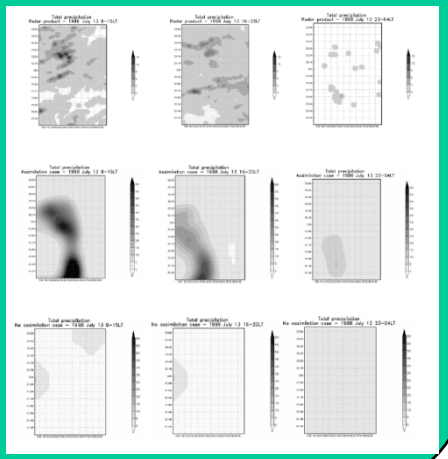


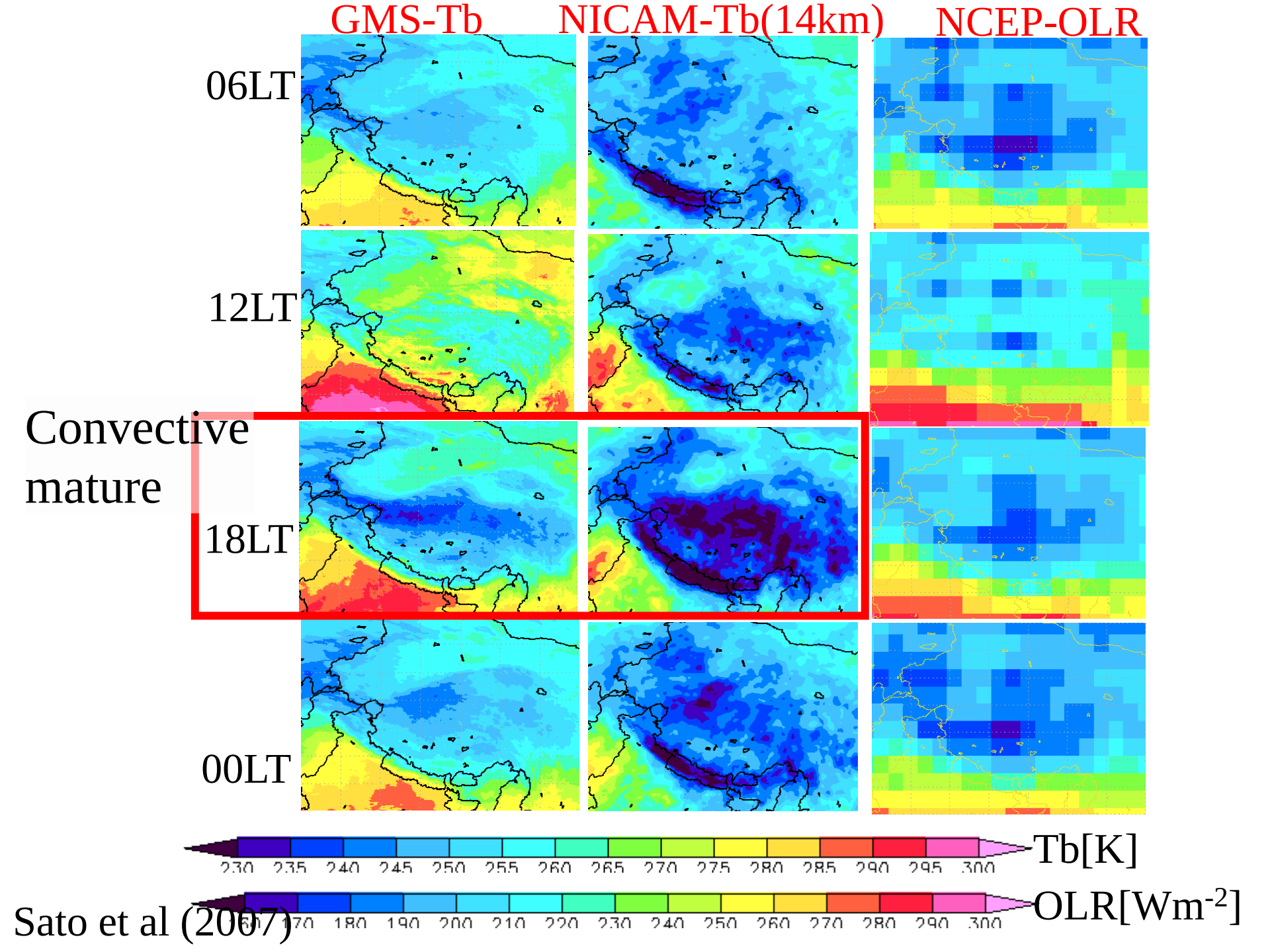
The satellite data are collected from various polar orbit satellites. In addition the data from the Chinese geostationary satellite, FY2C, are received and archived, which are used to produce surface temperature and various land surface fluxes.

Mitigation of Meteorological Hazards through 4 Dimensional Data Assimulation







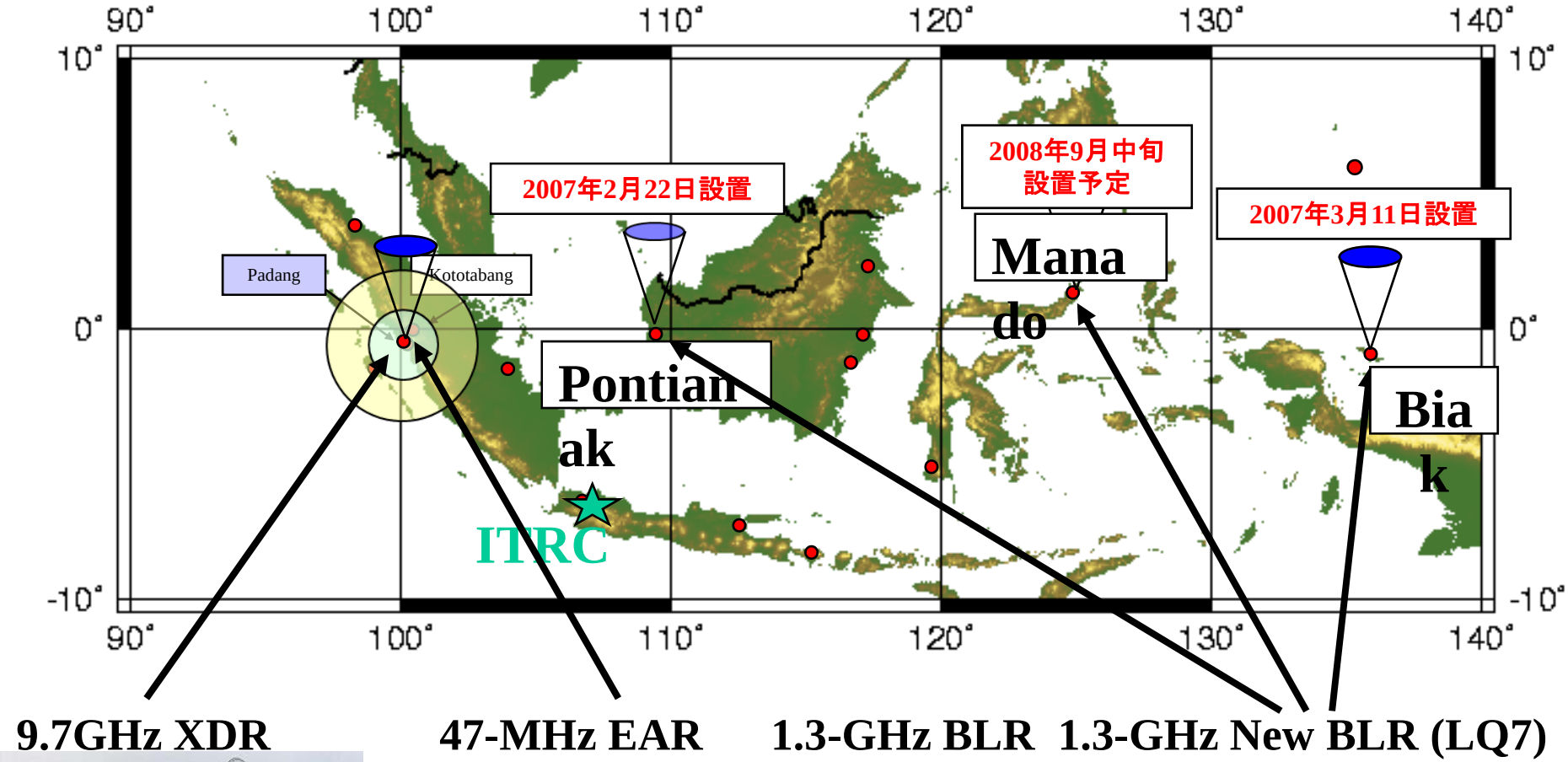


Sato et al (2007)

HARIMAU (Hydrometeorological ARray for ISV-Monsoon AUtomonitoring)

Japanese EOS Promoting Program (JEPP)

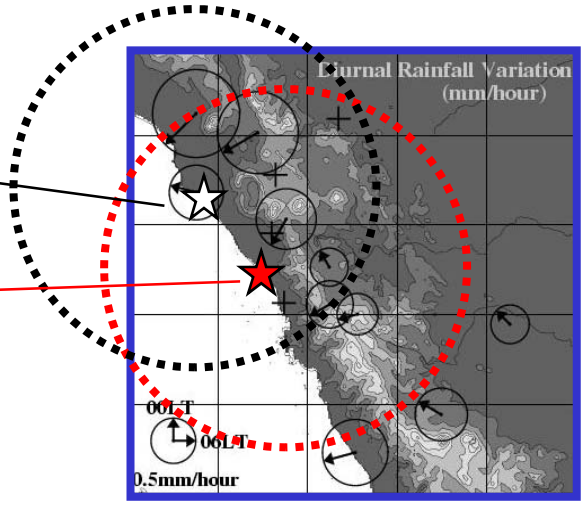
Poster No. 9

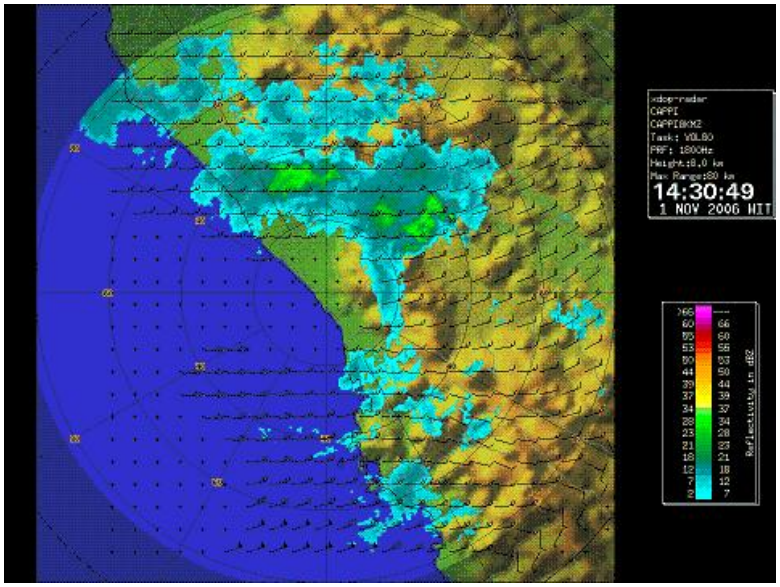


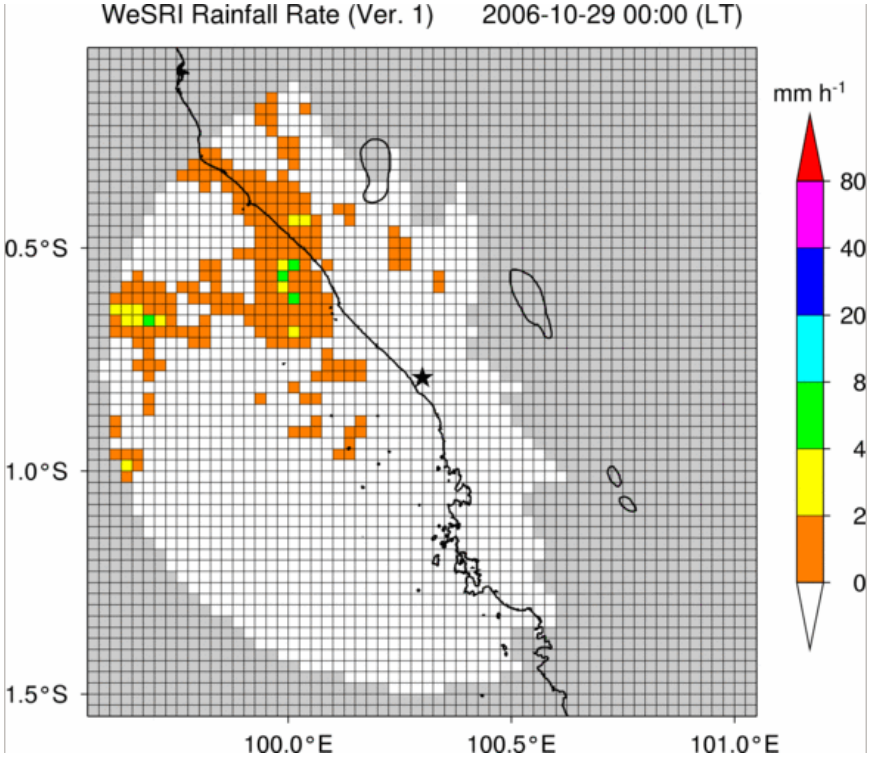
9.7GHz XDR **47-MHz EAR** **1.3-GHz BLR** **1.3-GHz New BLR (LQ7)**

Sumatra MIA・Tiku(Hokkaido U.)X-band radars

(2006.10.23 -);
(Tiku -07.8.30)







Real-time data

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

Data (10-minute averaged value after QC)

http://www.rish.kyoto-u.ac.jp/radar-group/blr/pontianak/data/
http://www.rish.kyoto-u.ac.jp/radar-group/blr/biak/data/

Biak-WPR Data

Wind Profiler Ra
Observation

(Version 02.02

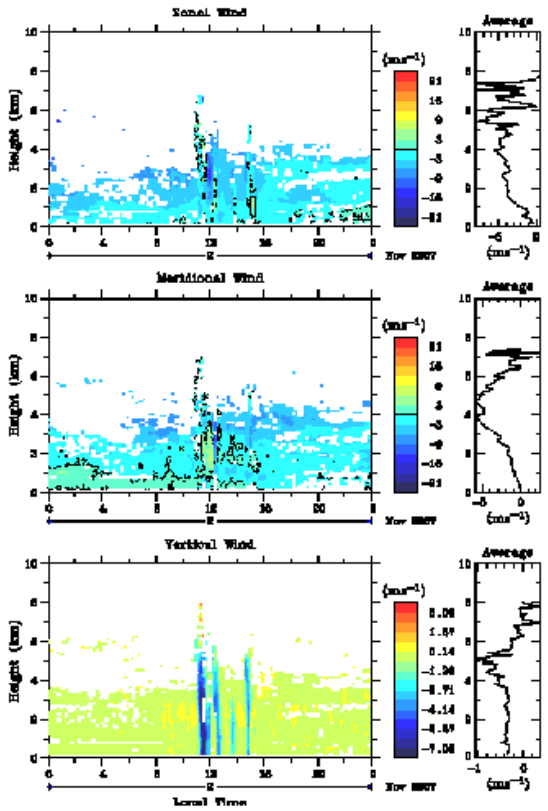
Please note: If you acquire Biak-WPR data,
acknowledge us in your use of the data. Thi
text such as Biak-WPR data provided by R
Sustainable Humanosphere of Kyoto Univer
appreciate receiving a copy of the relevant

Archive parameters:
CSV (Comma Separated Values) formatted
File names of CSV data are composed of d
abbreviations: (year)(month)(day).(variable).

Variables	File	Units	
Zonal wind	uwnd	m/s	We
Meridional wind	vwnd	m/s	So
Vertical wind	wwnd	m/s	Up
Echo intensity for Beam 1	pwr1	dB	Ar
Echo intensity for Beam 2	pwr2	dB	Ar
Echo intensity for Beam 3	pwr3	dB	Ar
Echo intensity for Beam 4	pwr4	dB	Ar

Biak-WPR Data

November 01, 2007
Winds (Zonal , Meridional , Vertical) GIF
Echo intensity (Beam No.: 1 , 2 , 3 , 4 , 5
Spectral width (Beam No.: 1 , 2 , 3 , 4 , 5
November 02, 2007
Winds (Zonal , Meridional , Vertical) GIF
Echo intensity (Beam No.: 1 , 2 , 3 , 4 , 5
Spectral width (Beam No.: 1 , 2 , 3 , 4 , 5
November 03, 2007
Winds (Zonal , Meridional , Vertical) GIF
Echo intensity (Beam No.: 1 , 2 , 3 , 4 , 5
Spectral width (Beam No.: 1 , 2 , 3 , 4 , 5
November 04, 2007
Winds (Zonal , Meridional , Vertical) GIF
Echo intensity (Beam No.: 1 , 2 , 3 , 4 , 5
Spectral width (Beam No.: 1 , 2 , 3 , 4 , 5
November 05, 2007
Winds (Zonal , Meridional , Vertical) GIF
Echo intensity (Beam No.: 1 , 2 , 3 , 4 , 5
Spectral width (Beam No.: 1 , 2 , 3 , 4 , 5
November 06, 2007
Winds (Zonal , Meridional , Vertical) GIF
Echo intensity (Beam No.: 1 , 2 , 3 , 4 , 5
Spectral width (Beam No.: 1 , 2 , 3 , 4 , 5



The Feb 2007 Jakarta flood

Duration	:	2 February–12 February 2007
Damages	:	$400 million
Fatalities	:	54
Areas affected	:	Jakarta, West Java, Banten

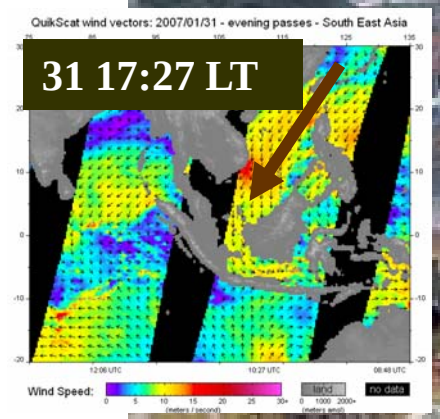
(Wikipedia)

News pictures

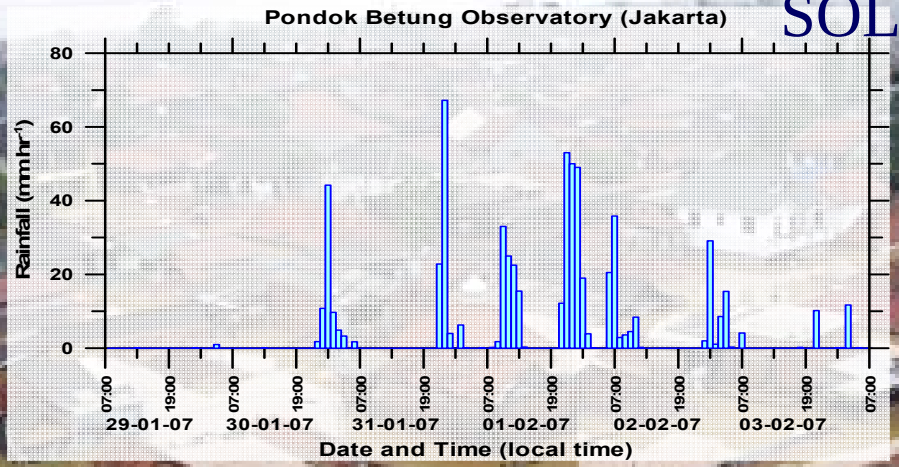
Diurnal cycle enhanced by monsoon beyond equator

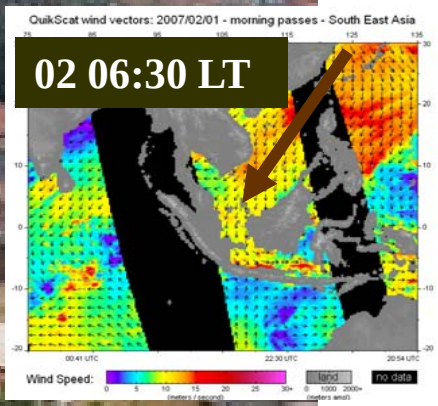
(Jan-Feb 07 Jakarta flood)

(Wu et al., 2008, SOLA)



31 17:27 LT





02 06:30 LT

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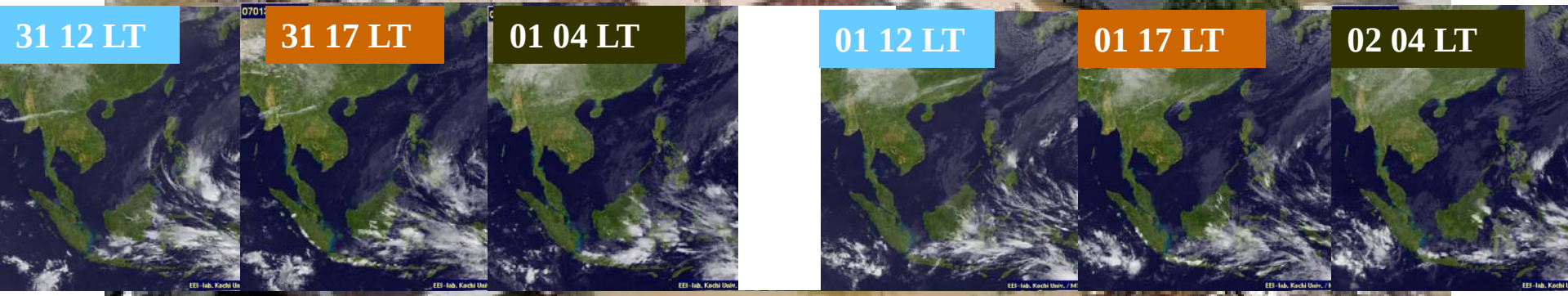
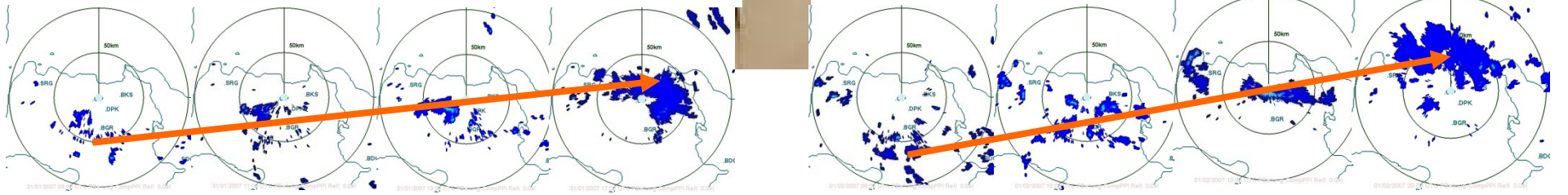
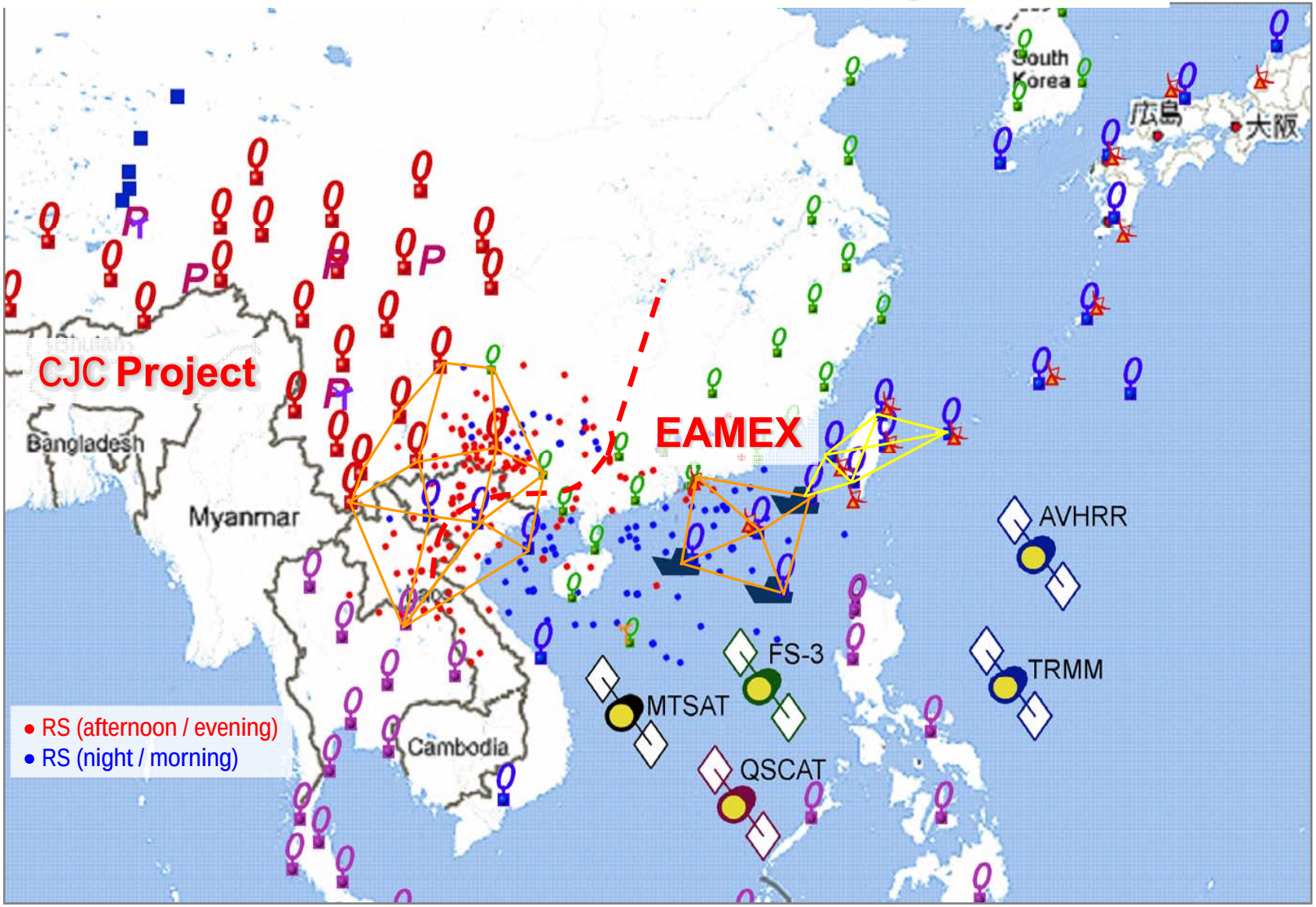


31 16 LT | 31 18 LT | 31 20 LT | 01 00 LT | 01 16 LT | 01 19 LT | 01 20 LT | 02 03 LT



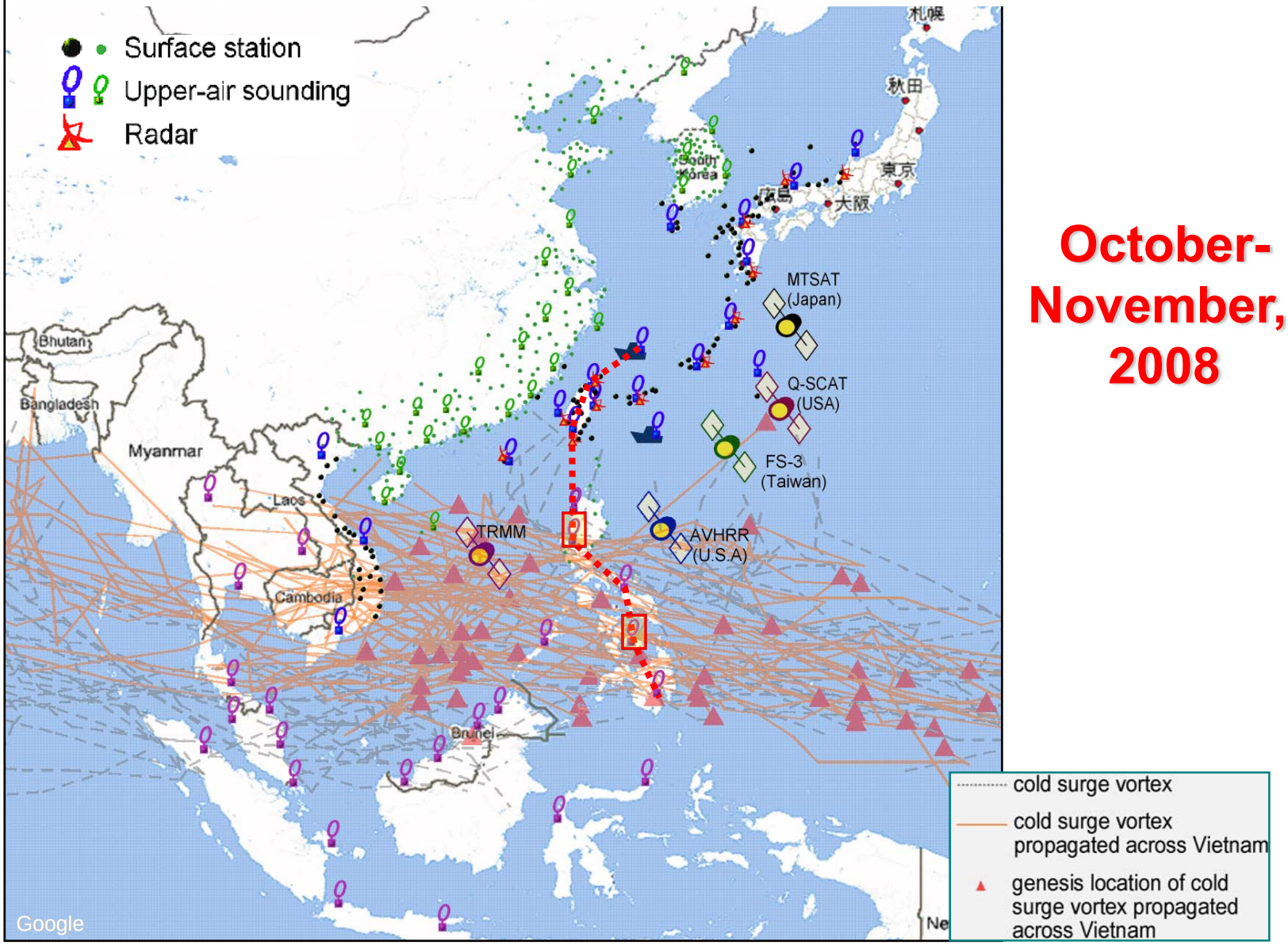
Summer Monsoon Rainstorm Experiment



May-June, 2008

Winter Rainfall Experiment

Cold Surge Vortex / Heavy Rainfall Events in Late Fall



October-November, 2008

Contributions to the CEOP objectives:

- Provision of reference site data
- Contribution to monsoon cross-cut study
- Contribution to high elevation cross-cut study, in particular, over Tibet
- Contribution to semi-arid cross-cut study, in particular, over Mongolia
- Contribution to extreme cross-cut study in Asian monsoon rainfalls

Contributions to GEWEX Roadmap:

- Produce high resolution gridded rainfall data set in Asia
- Produce AMY IOP data set
- Improve model predictions by land-surface assimilation in Asian monsoon
- Understanding of atmosphere-ocean-land interacting feedback system in Asian monsoon variability

Future: Next 1 – 3 yeas foreseen activities:

- Researches related with WCRP Pan-Monsoon activity will be performed by utilizing AMY IOP data and coordinated modelling activities, for example, multiple-scale interactions between diurnal cycle and intra-seasonal variations, role of Asian monsoon on global climate variations.
- Data management of the AMY IOP data
- Data rescue activity for, in particular, pre-1950 daily rainfall data
- Collaboration with modelling community, in particular, using cloud resolving models, such as NICAM and/or regional models.

New directions (longer term vision):

- Coordination with WCRP Pan-Monsoon Activity
- Collaboration with IGBP/iLEAPS
- Collaboration with ESSP/MAIRS
- Social applications under the JICA and other international aiding projects

Meeting Schedule in 2008 / 2009

- June 16-20, 2008: AOGS at Busan, Korea
  - Session AS(16) “AMY: A New Coordinated Asian Monsoon Experiment”
  - June 18 evening-19 morning
  - 5th AMY Workshop, June 19
- September 22-24, 2008: EAMEX/MAHASRI WS, Taiwan
- October 20-25, 2008: IMW-IV at Beijing, China, including CLIVAR/AMMP, Pan-WCRP Monsoon Workshop, 5th AMY Workshop
- November 19-21, 2008: Meteorological Society of Japan Fall Annual Meeting at Sendai
  - Special Session “From GAME to MAHASRI”
- March 2-4, 2009: The 2nd Vietnam-Japan MAHASRI Workshop, at Danang (?), Vietnam

Photo: Geneva Gare Cornavin, September 15, 2008