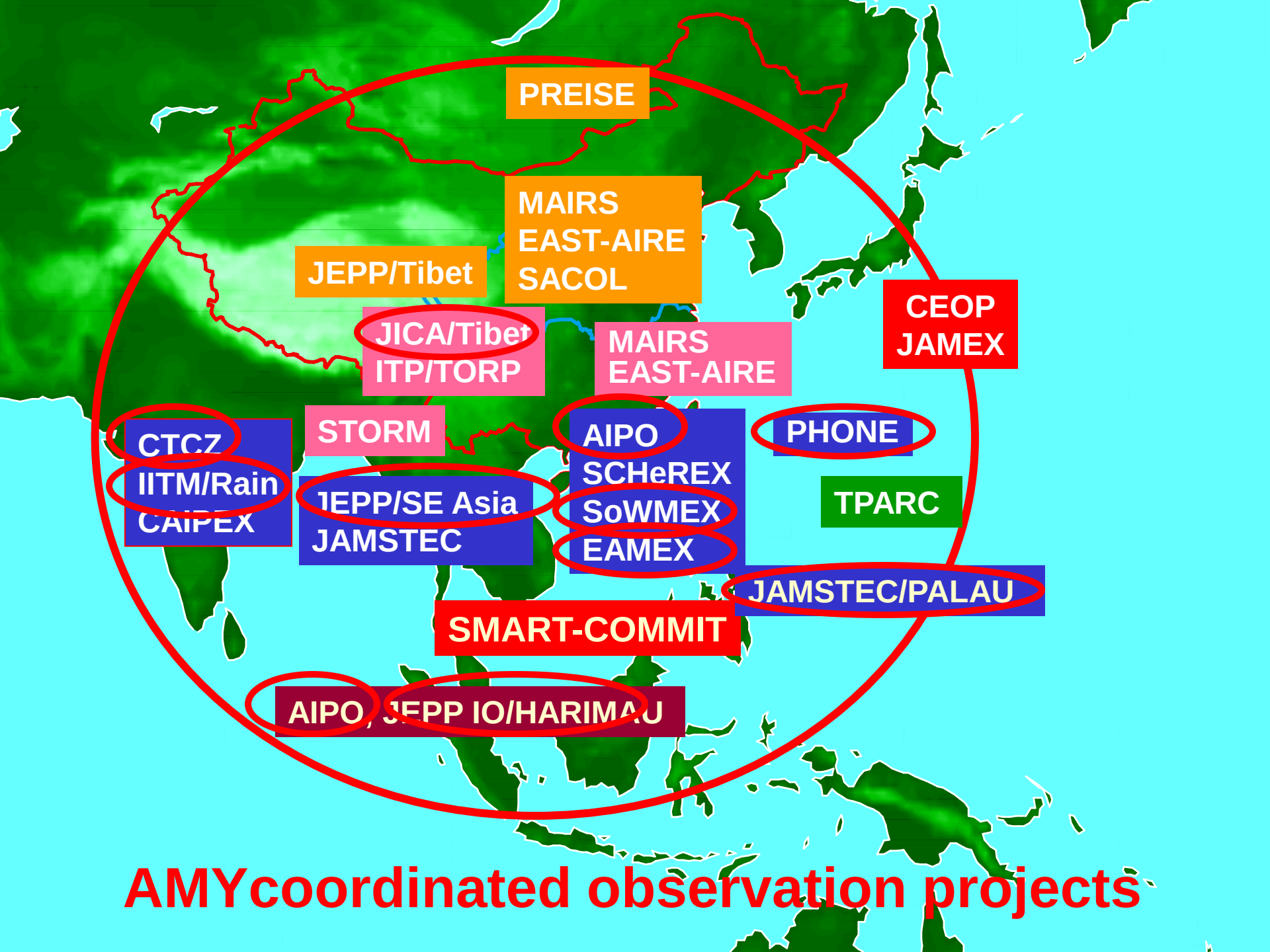
AMY

Overlap, Needs and Contribution

http://www.wcrp-amy.org/

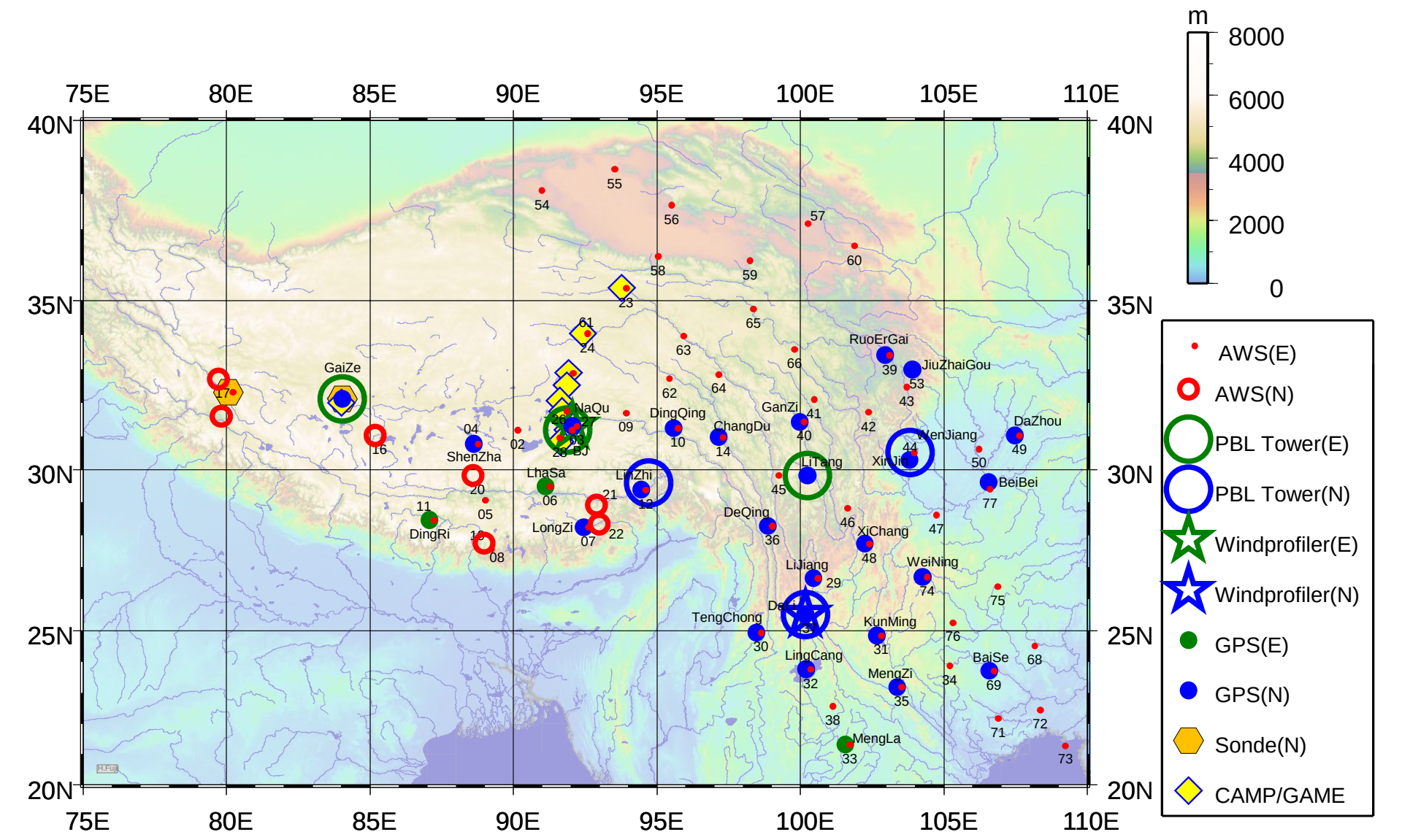
Jun Matsumoto (Tokyo Metropolitan U., JAMSTEC/RIGC)

YOTC IPM at Honolulu, Hi USA, July 13, 2009

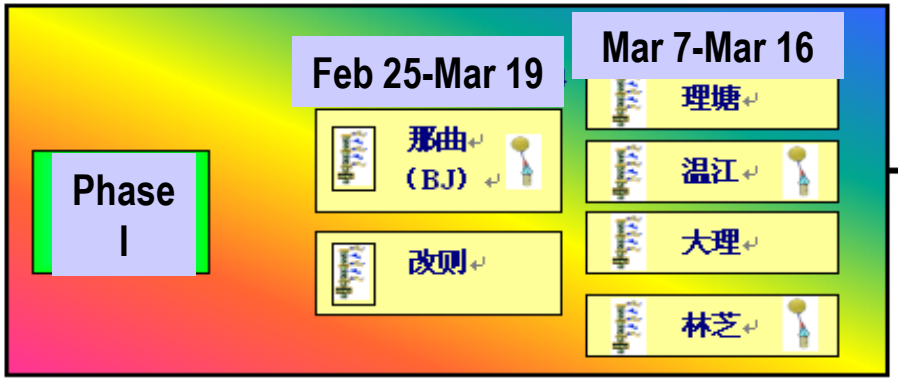


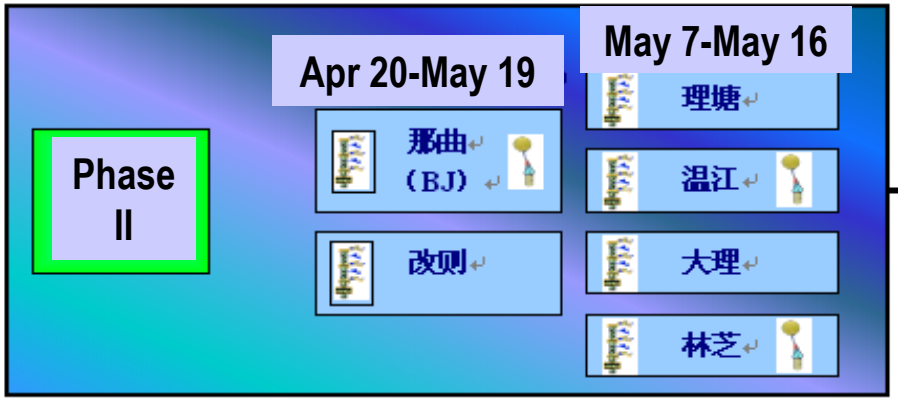
AMYcoordinated observation projects

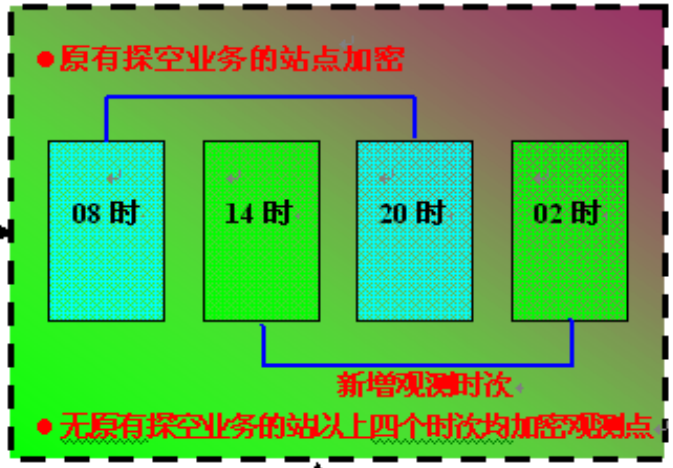
Observation Network of JICA-Tibet Project

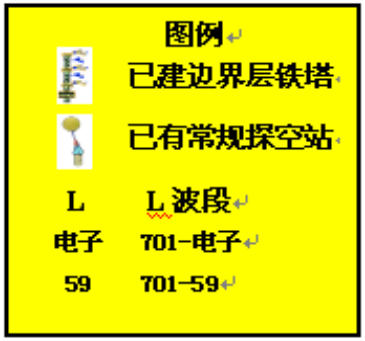


Implementation Scheme for Intensive Observation in 2008

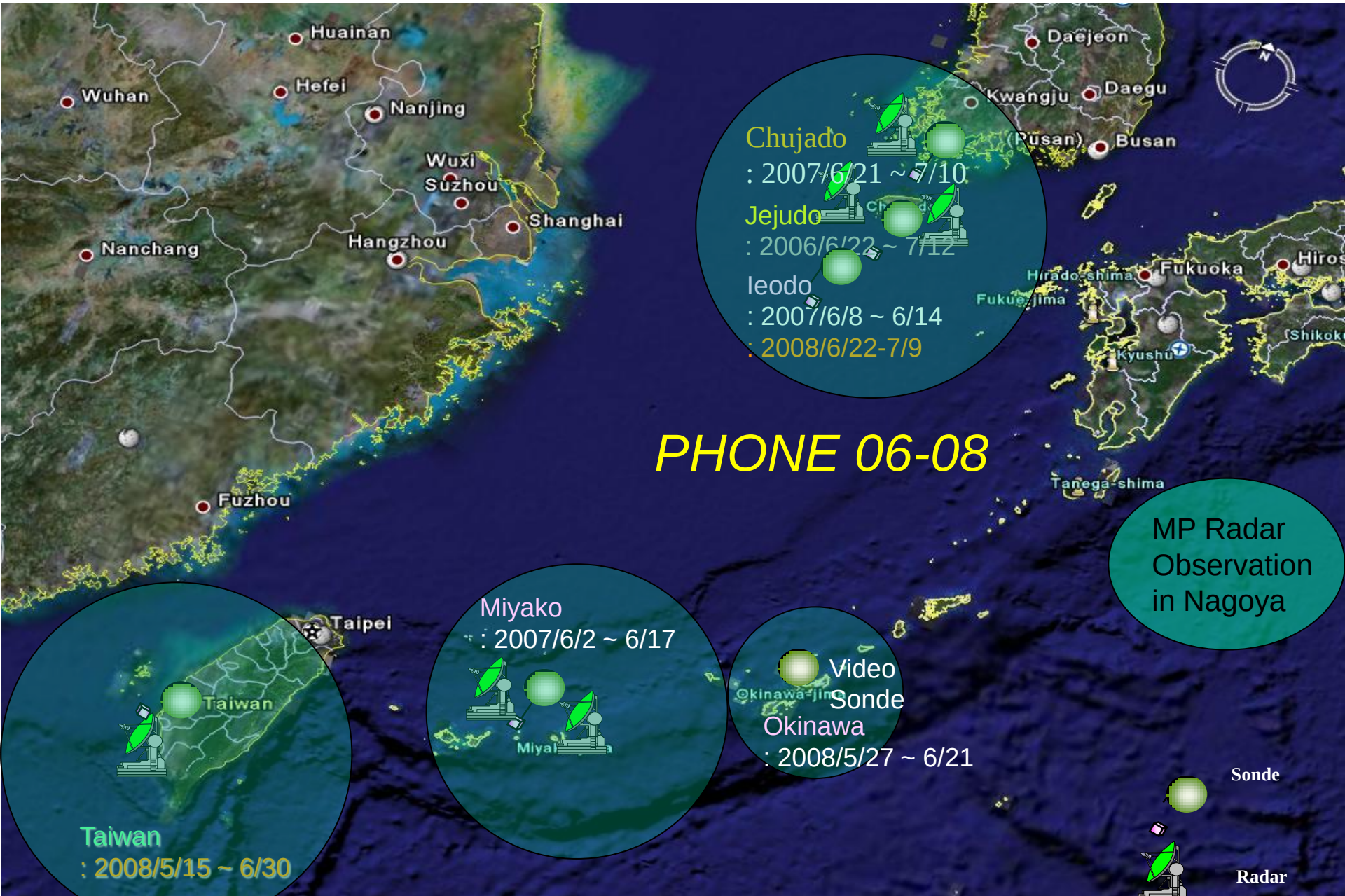


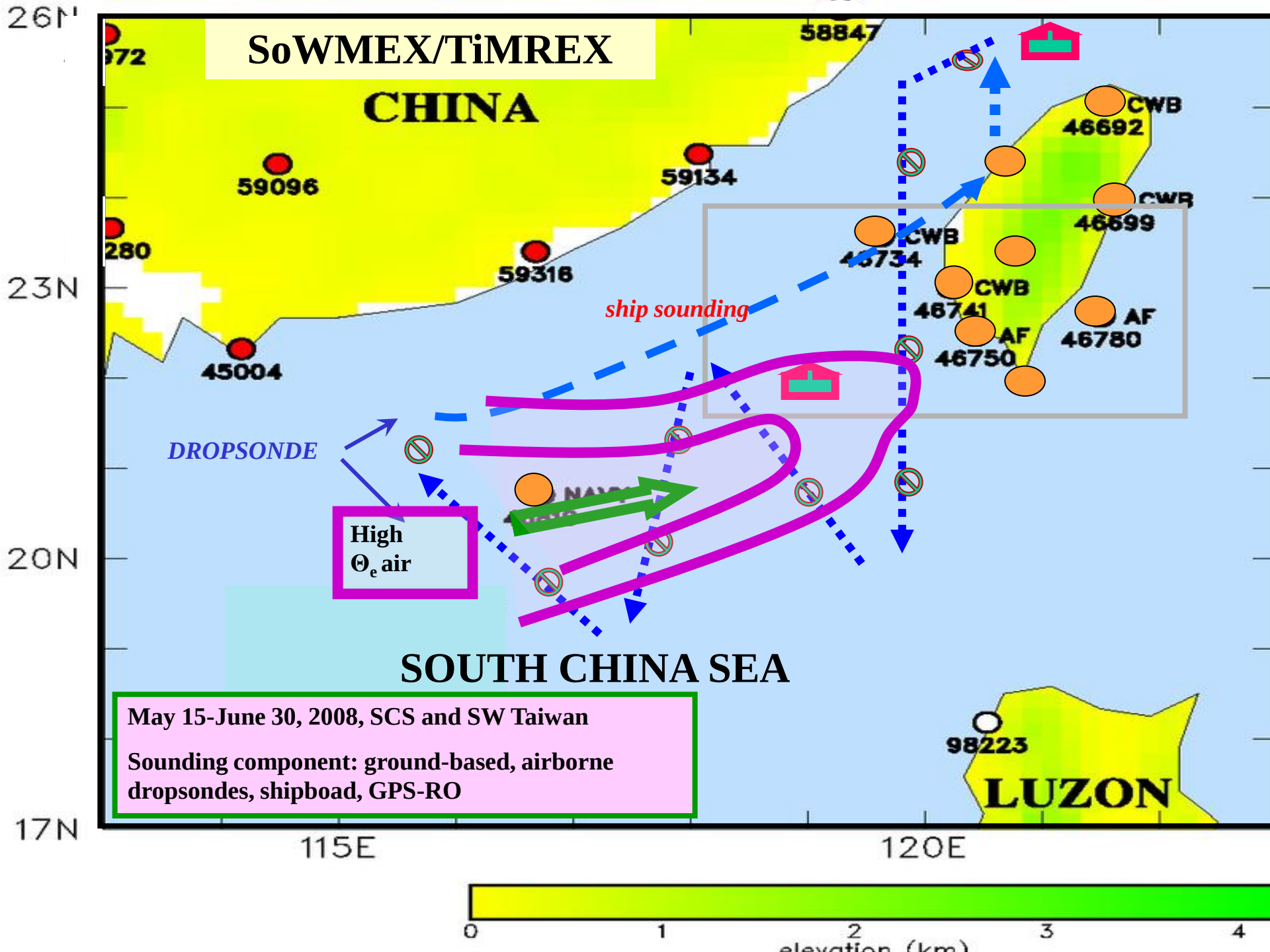






Experiment design (PHONE 06-08)




SoWMEX/TiMREX
CHINA
58847
59096
59134
59316
45004
CWB
46692
CWB
46699
CWB
46734
CWB
46741
AF
46780
AF
46750
ship sounding
DROPSONDE
High
Θe air
SOUTH CHINA SEA
May 15-June 30, 2008, SCS and SW Taiwan
Sounding component: ground-based, airborne dropsondes, shipboad, GPS-RO
98223
LUZON
26N
23N
20N
17N
115E
120E
0
1
2
3
4

IOP#	Date	Scientific objectives	Dropsonde mission/comments
1	06Z May 19 to 00Z May 22	Frontal circulation, Upstream environment for orographic convection, Model verification and data assimilation	mission #1 at 21Z May 20, C, 3:20/12-4. SOP was scheduled to start on 00Z May 15 and was delayed to 00Z May 19
2	06Z May 27 to 21Z May 29	Southwest flow interacting with the terrain, Upstream condition for mountain convection, Lee side vortex/shear zone	mission #2 at 21Z May 28, D, 2:35/13-6
3	21Z May 29 to 12Z May 31	Island effects on SW (LLJ) and the Mei-Yu front Upstream condition for heavy precipitation	mission #3 at 21Z May 29, Cn, 2:43/ 15-10, mission #4 at 21Z May 30, Cn, 2:55/ 13-0, EOP started on 21Z May 29 and scheduled to end on 21Z, June 4
4	21Z June 1 to15Z June 3	Mesoscale convective systems, Shallow surface front, Mesoscale convective vortex	Mission #5 at 09Z June 3, Cn, 2:29/13-0 Astra nose radar malfunction, the flight was delayed (was scheduled on 21Z, June 1)
5	18Z June 3 to 12Z June 4	Mesoscale convective systems, Quasi-stationary front, Mesoscale convective vortex	mission #6, 21Z June 3, C, 3:47/14-2 mission #7, 05Z June 4, E, 2:08/12-0
6	18Z June 4 to 12Z June 6	Mesoscale convective systems; Quasi-stationary front; Mesoscale convective vortex	mission #8, 21Z June 4, C, 3:25/15-1; mission #9, 05Z June 5, E, 2:23/10-0; mission #10, 21Z June 5, D, 2:35/12-1; MCV landed and brought heavy rainfall to Kaohsiung; EOP ended at 18Z June 6 and SOP resumed.
7	00Z June 12 to 12Z June 13	Convection initiation, Orographic convection	UAV mission #1, 04Z and 06Z June 12, Astra engine oil leakage and grounded for a few days
8	00Z June 14 to 12Z June 17	Southwesterly flow interacting with the terrain, Upstream condition for mountain convection, low level jet, Mesoscale convective systems, Mesoscale convective vortex	mission #11, 09Z June 16, E, 2:15/10-1, mission #12, 21Z June 16, E, 2:25/12-0, mission #13, 04Z June 17, E, 2:29/14-1, Astra available after examining by Singapore engineer
9	06Z June 23 to 12Z 26 June	Typhoon Fengseng track uncertainty, Typhoon induced southwesterly flow and related heavy rain systems	Dotstar flight at 08Z June 23, 2:30, A, mission #14 at 09Z June 25, E, 2:30/ 15SOP ends on 12Z June 26
Non-IOP		Afternoon thunderstorm systems and microphysics study	22-26 May; June 7-11; June 18-22

Operation Summary (May 15 to June 25, 2008)

- Daily Planning Meeting 46 times
- Science Meeting 38 times
- Evening update 4 times
- Pre-flight briefing 15 times
- SOP: 42 days
- IOP: 24 days (9 IOPs)
- EOP: 9 days (May 29-June 6)

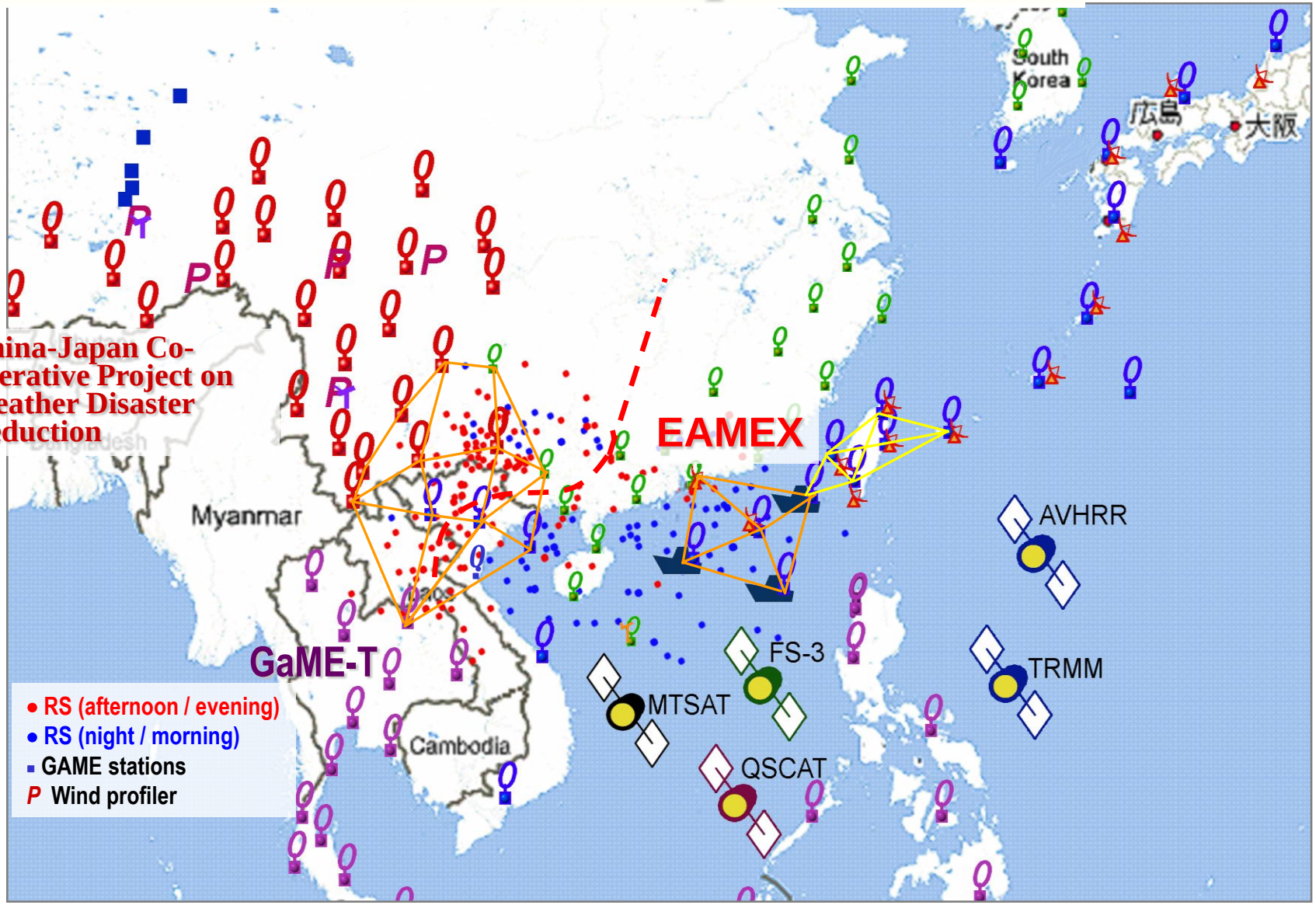
Operation	Man-day
OCC-CWB	900
NPUST-Pingtung	~350
SPOL	520
XPOL (mobile)	337
Super-Site	432
Dropsonde	~100
Sounding System	~2800
Shipboard Sounding	507
Total	~6000

	Banciao 46692	Hualien 46699	Dongsha 46810	Magong 46734	Pingtung 46750	Lyudao 46780	Taichung 99770	Liouguei 99744	Hengchun 99759	SW ship 99810	North ship 99692	Tainan 46741	TOTAL
# of sondes	183	169	146	243	247	218	165	219	193	146	60	64	2032
Re-lay	5	5	3	11	10	11	11	19	15	3	4	4	105
Missing				1	0	8							9
Time of missing				061806		062100-062206							

SoWMEX/TiMREX Project in 2009

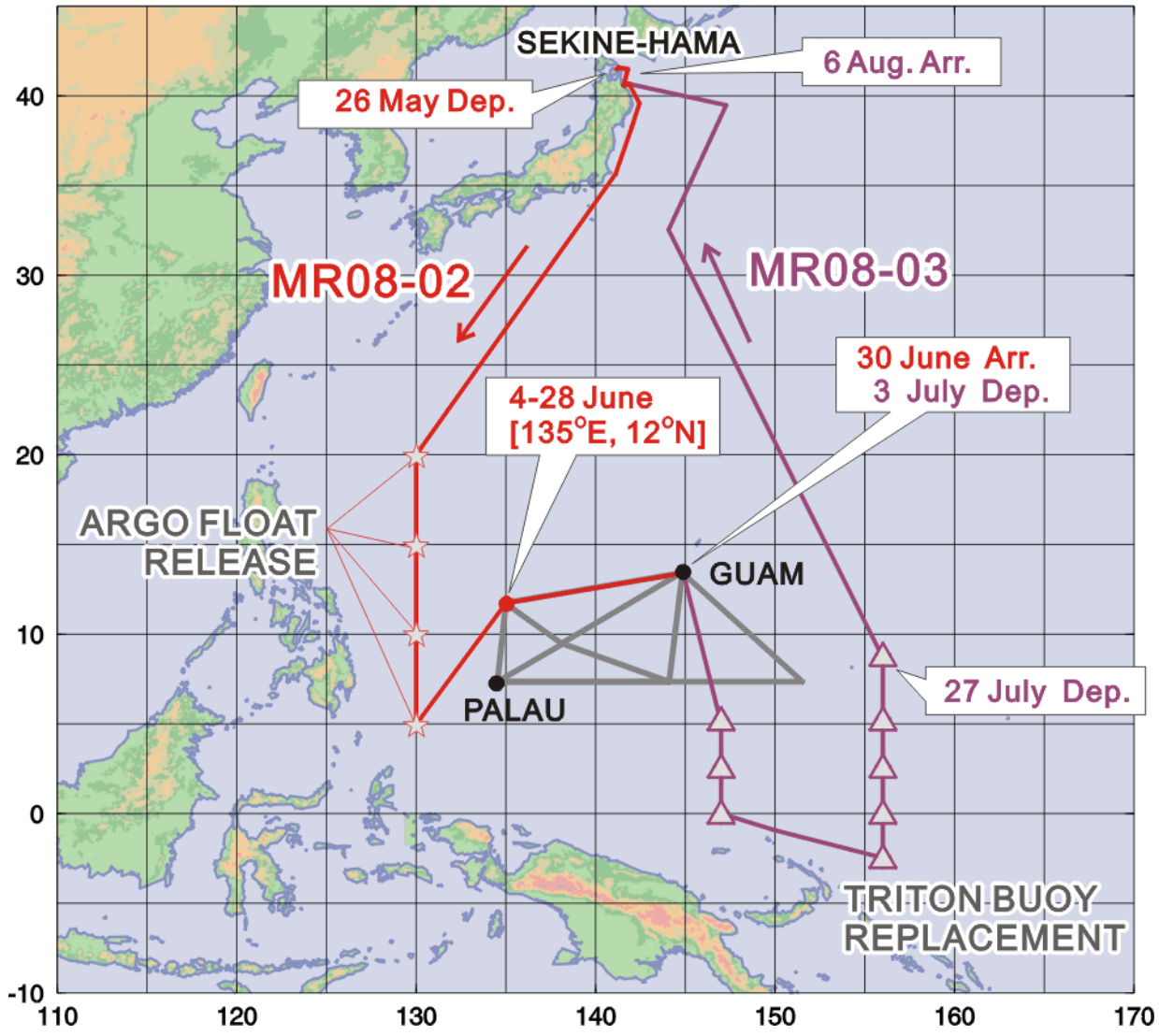
- In 2009, we conducted dropsonde and intensive sounding observations in early June. Two weeks (from June 3 to June16) period is chosen to have intensive sounding observations, i.e., 4 sondes per day. The stations include Banciao, Makung, and Dongsha. Additional site near central part of mountain (Dou-Lieou) is also established to conduct two week sounding launch. China Meteorological Administration agreed to launch 4 sondes per day at Fujian area (cross the Taiwan strait). In the Taiwan strait and central Taiwan, there are two new C-band polarimetric radars (from Gematronics) and also participate the field experiment. There are three major frontal systems passing through the field. Two of them brought heavy rainfall to the coastal and mountain areas in the west side of the island. More details can be found in the website http://sowmex.cwb.gov.tw under sowmex-2009 icon.

Summer Rainstorm Experiment



May-June, 2008

R/V Mirai Cruise for PALAU2008



26 May ~ 30 June

MR08-02

(for PALAU2008)

IOP 4 ~ 28 June

sonde 8 times/day

3 July ~ 6 August

MR08-03

(for buoy replacement)

sonde 2 or 4 times/day

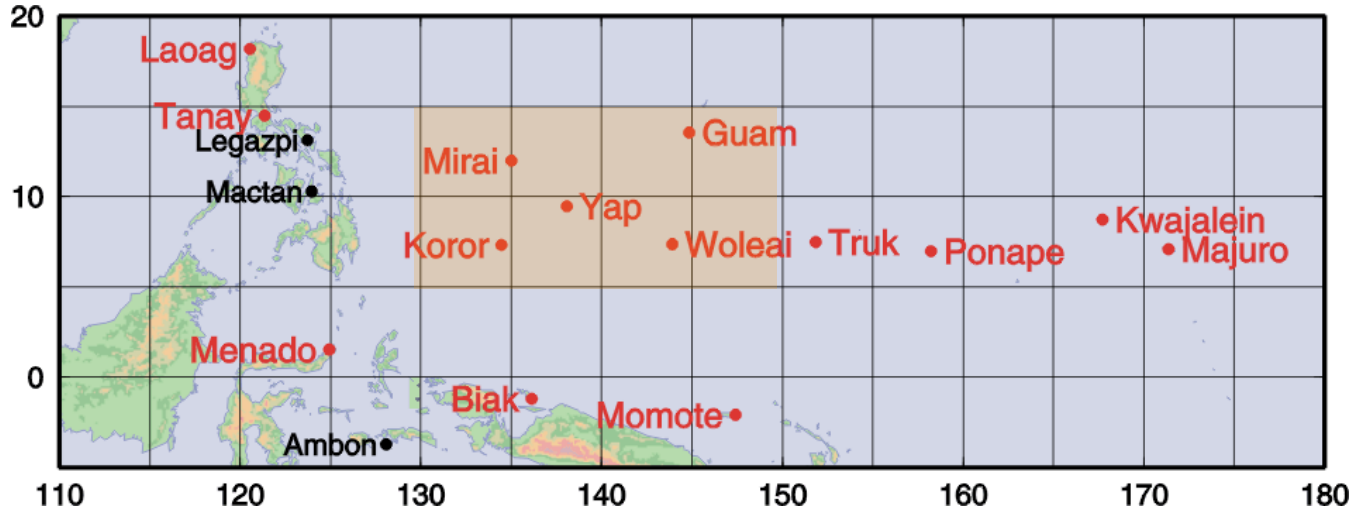
PALAU2008 observation

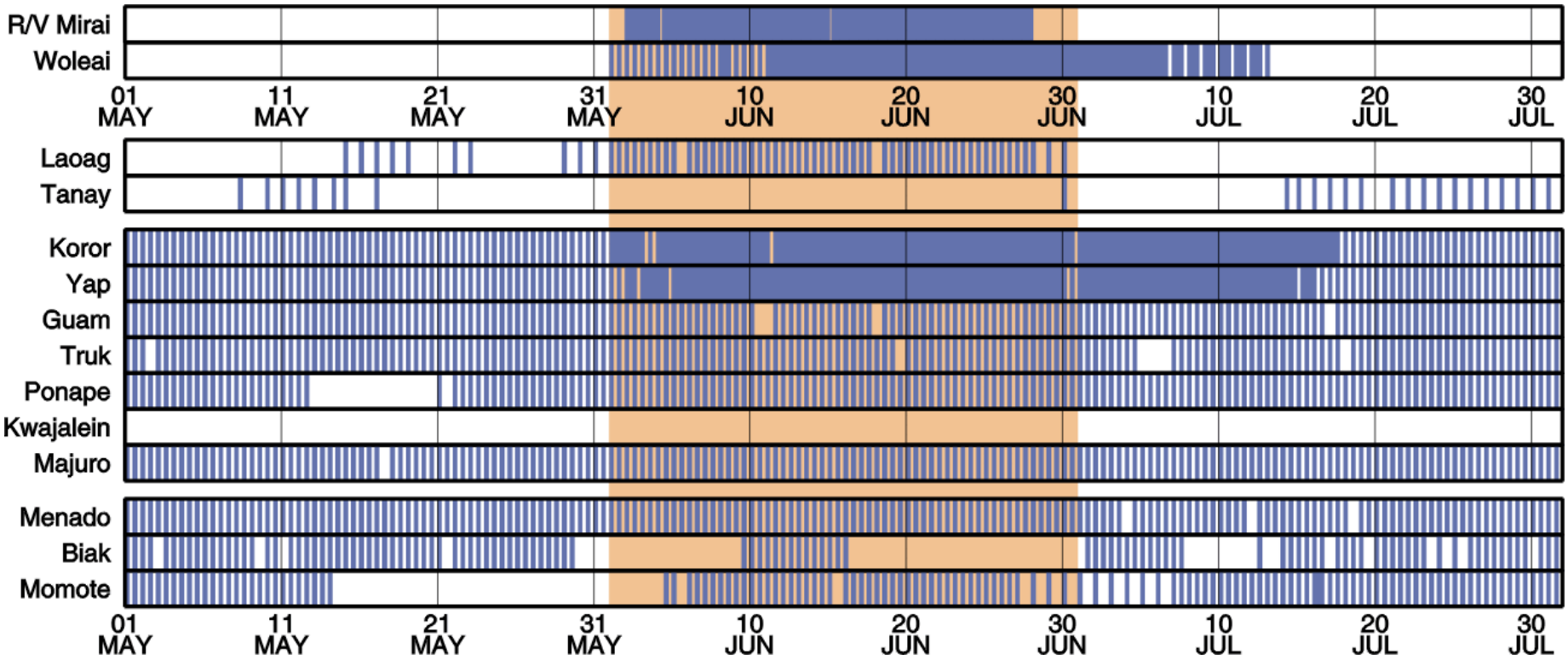
- **Doppler radar**
  Palau (continuous) and R/V Mirai (135°E, 12°N, 4-28 June 2008)
- **Dropsonde**
  G-II (about one week at Palau in late June 2008, 2 ferry and 3 local flights)
- **Radiosonde** <June-early July 2008> (operational / special)

R/V Mirai	[JNSR]	(00, 03, 06, 09, 12, 15, 18, 21 UTC)
Woleai	[no ID]	(00, 06, 12, 18 UTC)
Koror	[91408]	(00, 06, 12, 18 UTC) by Weather service office
Yap	[91413]	(00, 06, 12, 18 UTC) by Weather service office
Guam	[91212]	(00, 12 UTC)

- **Argo float**
  Deploy along 130E (2 Argos and 3 Illigium) from R/V Mirai
- **Forecast experiment**
  MRI-NHM, CReSS
- **Surface weather observations** (ceilometer, disdrometer, AWS etc)
  Palau
- **SST, CTD, and oceanographic observations**
  R/V Mirai (4-28 June 2008)

Upper air soundings during PALAU2008

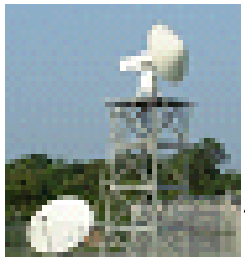




Japan EOS Promotion Program (JEPP) + Indonesian Research/Technology Grant

Hydrometeorological Array for ISV-Monsoon Automonitoring (HARTMAN)

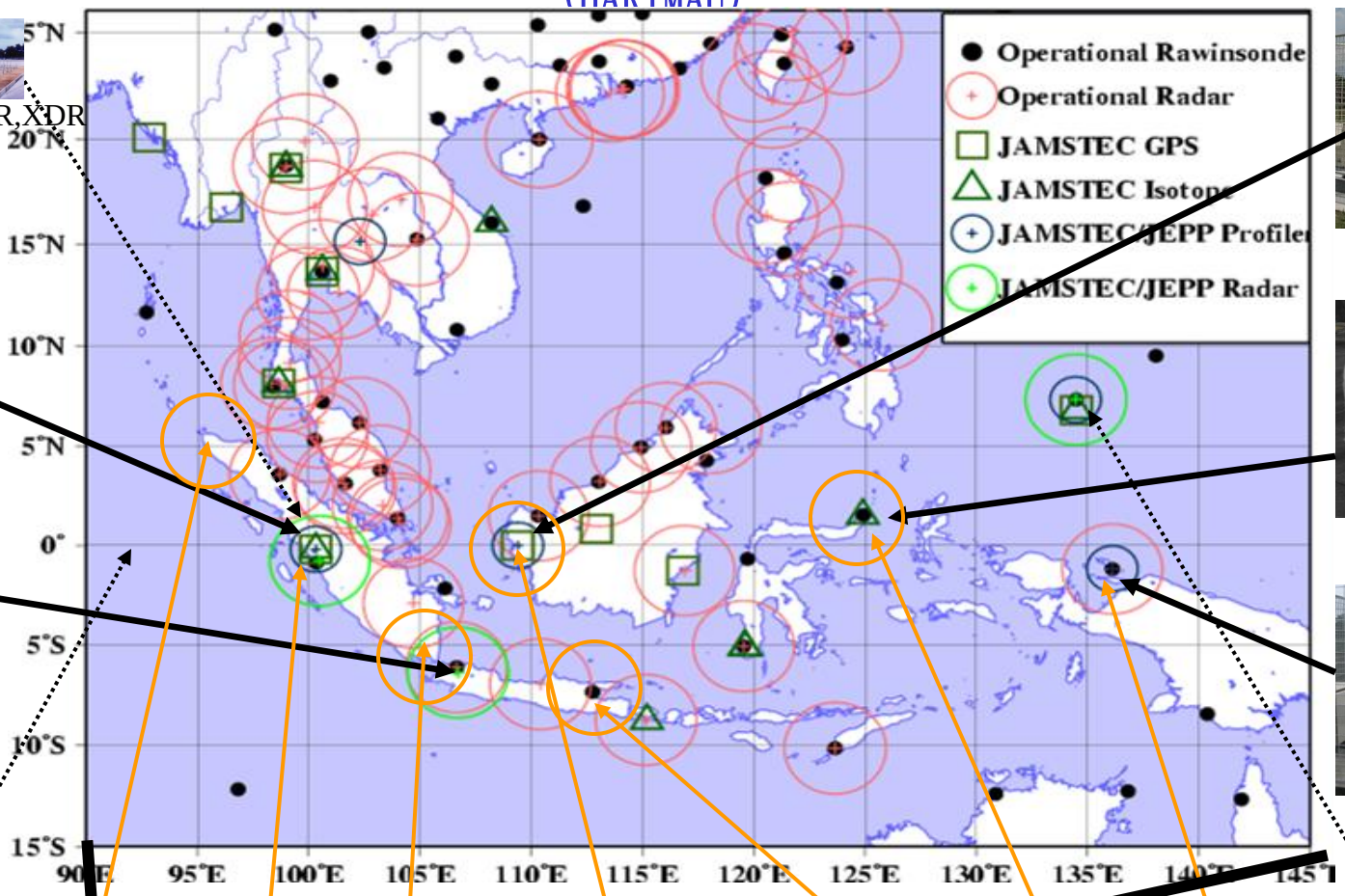
Kototabang EAR,BLR,XDR
KU + LAPAN



MIA XDR

Serpong CDR

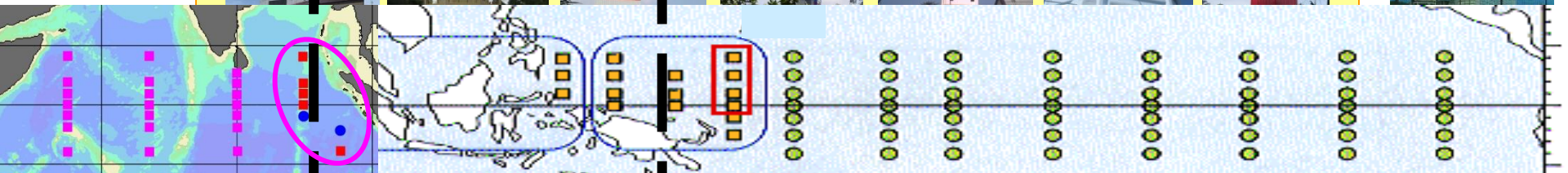
Mirai CDR
JAMSTEC



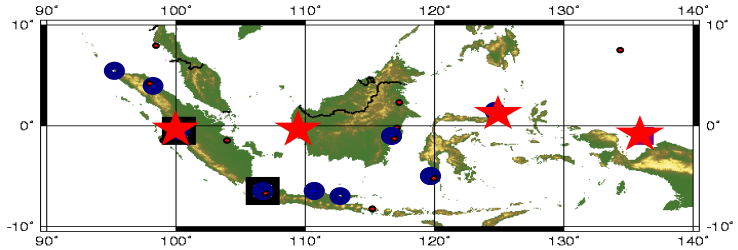
Pontianak WPR

Manado WPR

Biak WPR



ISVs by WPR network



MTSAT TBB Hovmoeller

Average over 2-3 km

Kototabang Pontianak Biak

Dec 1
11
21
Jan 1

Day

-15 0 15

Zonal wind (m/s)

Dec 1
Dec 11
Dec 21
Dec 31

60E 100E 120E 140E 160E

T_{BB}(K)
275
272
269
266
263
260
257
254
251
248
245
242
239
236
233
230

Onset of Monsoon & Rainy Season

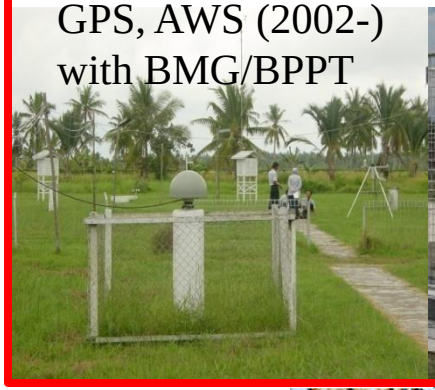
Malay flood

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

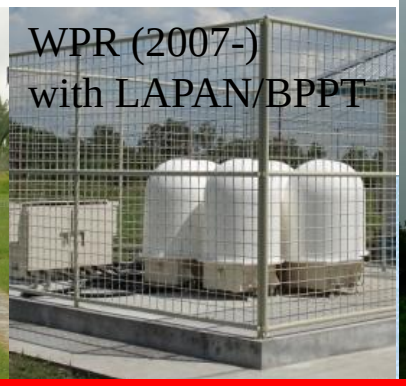
Manado (installed last week!/Sep 2008)

AMY/HARIMAU Winter Monsoon Obs. In Kalimantan, Jan. 20-Feb.7, 2009

GPS, AWS (2002-)
with BMG/BPPT



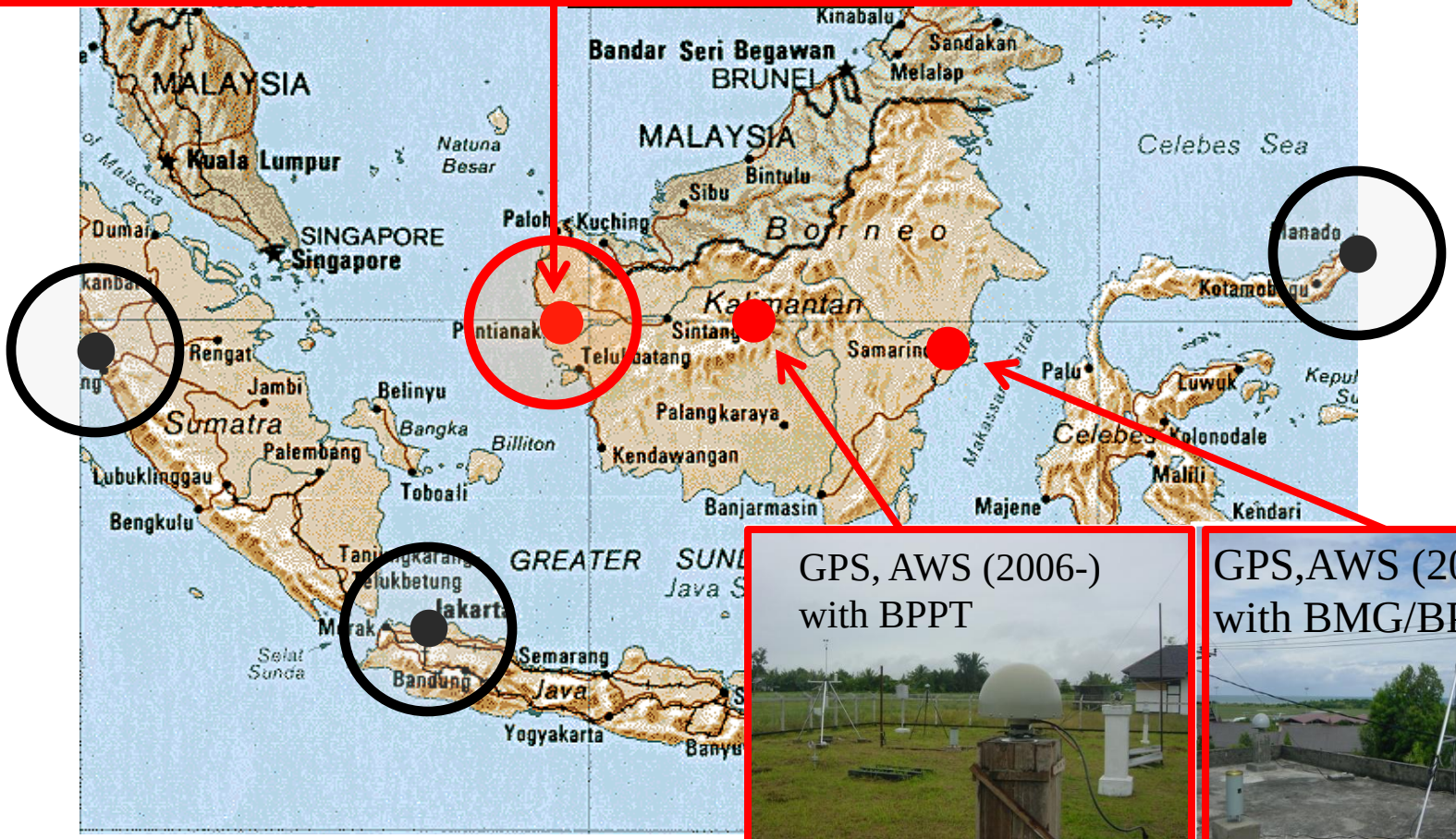
WPR (2007-)
with LAPAN/BPPT



BMG-CDR (2008-)

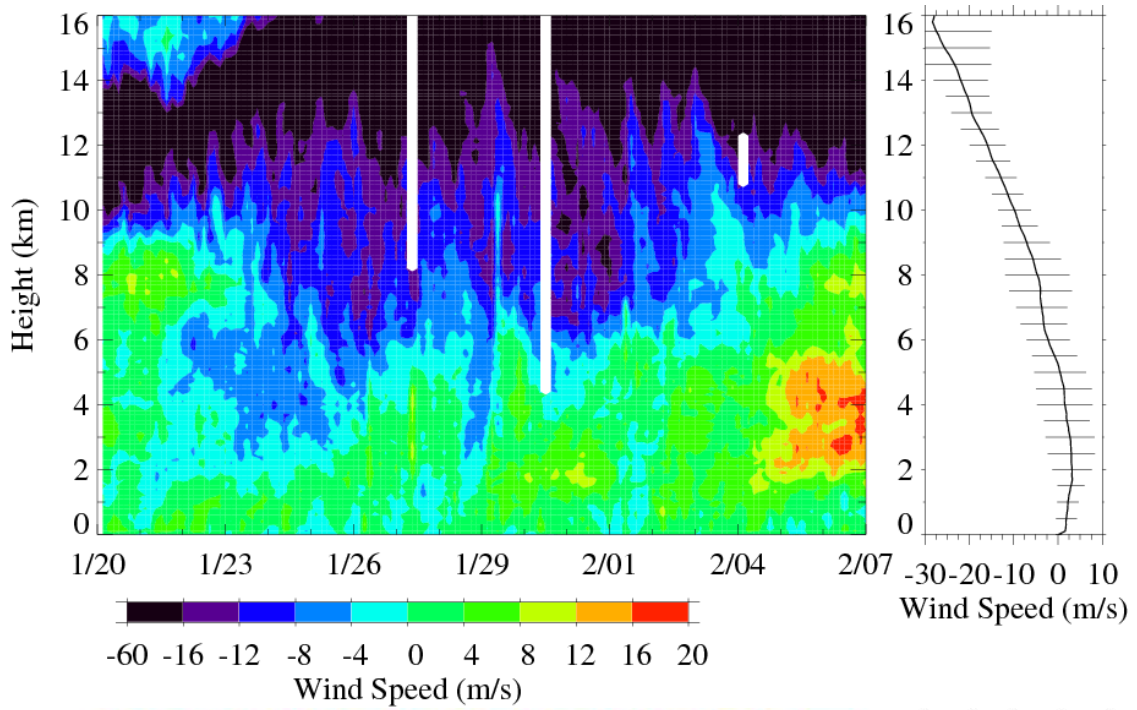
RS (LAPAN/BPPT)

(Jan 13-29)



GPS, AWS (2006-)
with BPPT

GPS,AWS (2003-)
with BMG/BPPT



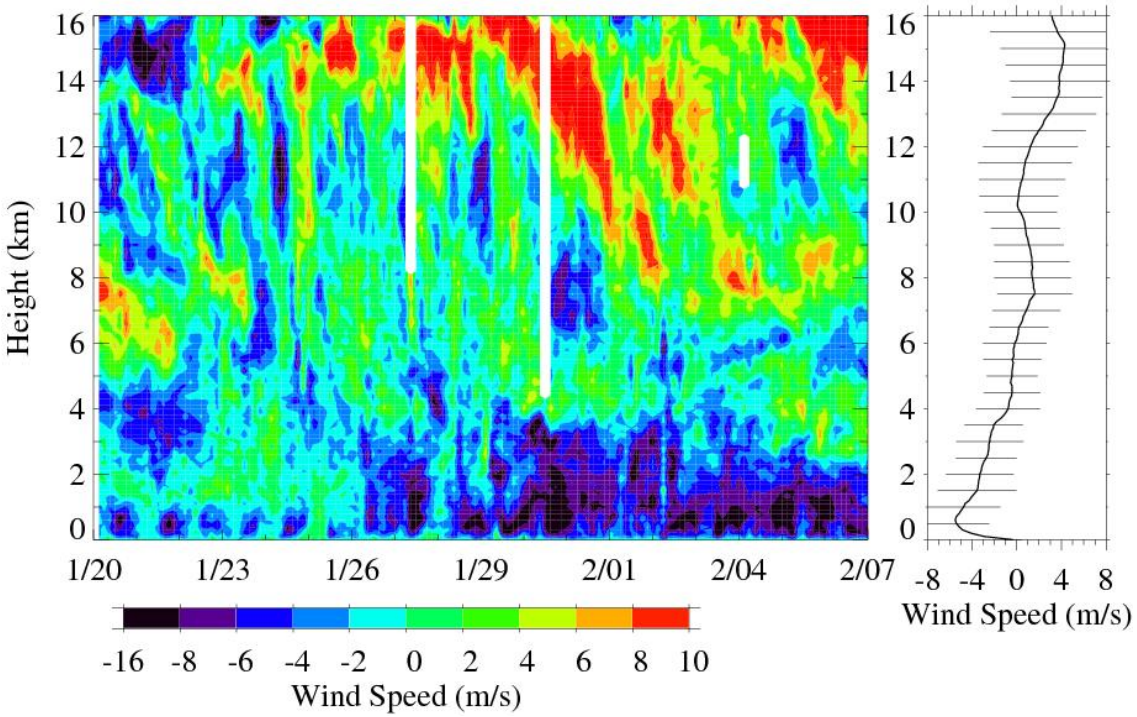


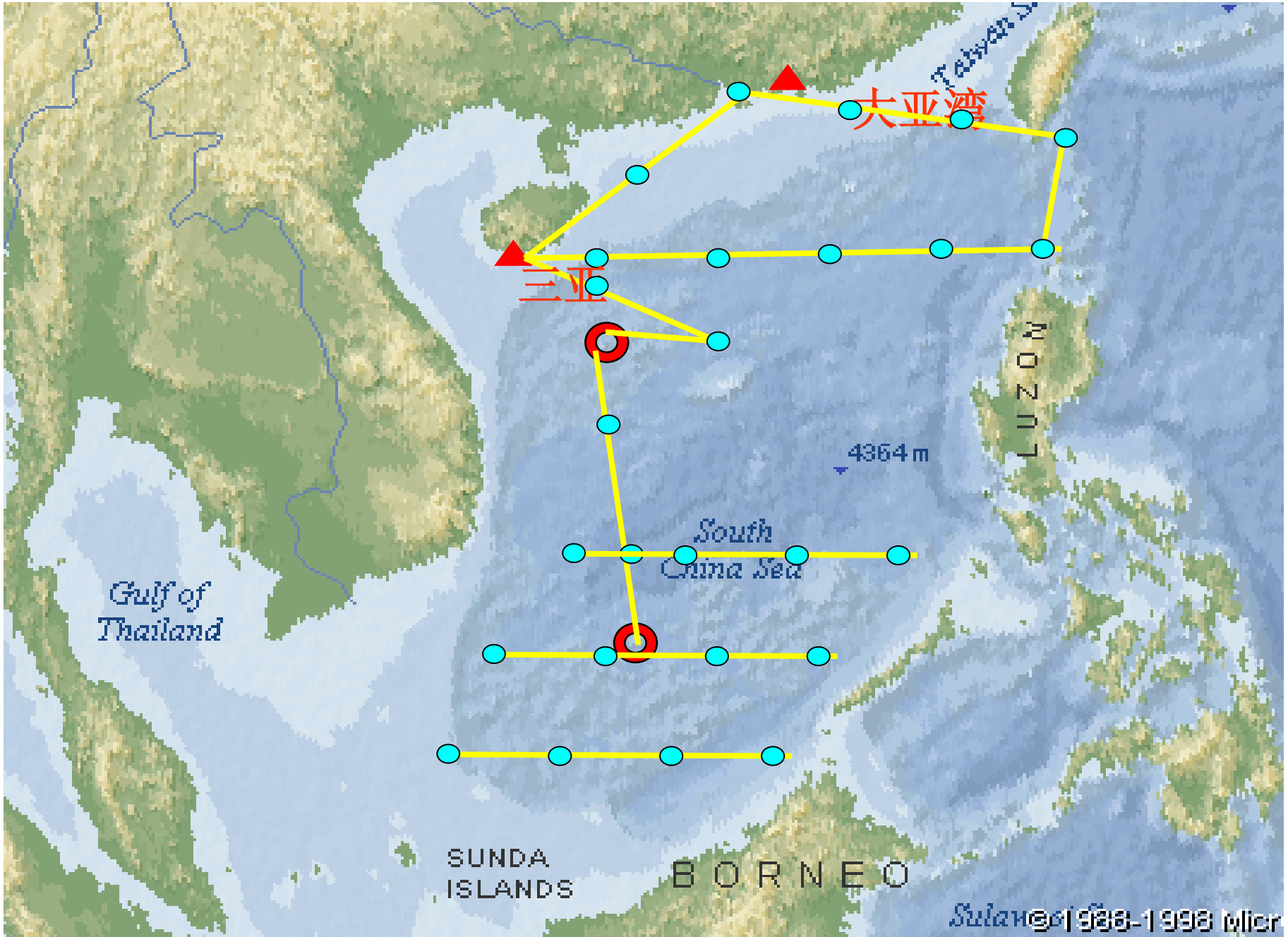
Fig. 1 Time-height cross section of zonal winds (upper panel) and meridional winds (bottom panel) observed at LAPAN office site in Pontianak, western Kalimantan Island during 20 January to 7 February 2009.

Implementation of AMY-associated South China Sea observation in 2008

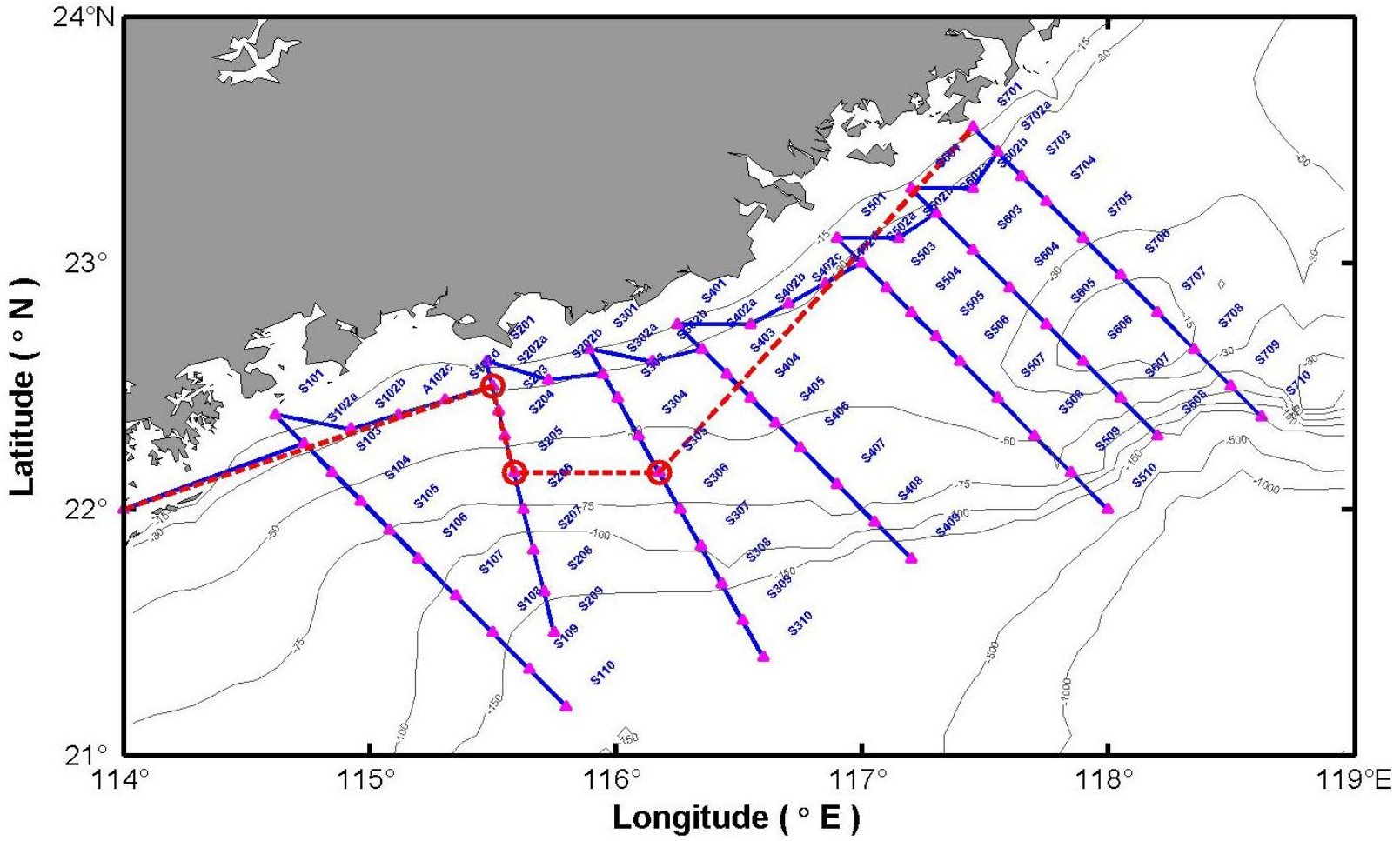
Dongxiao Wang

South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou 510301, China

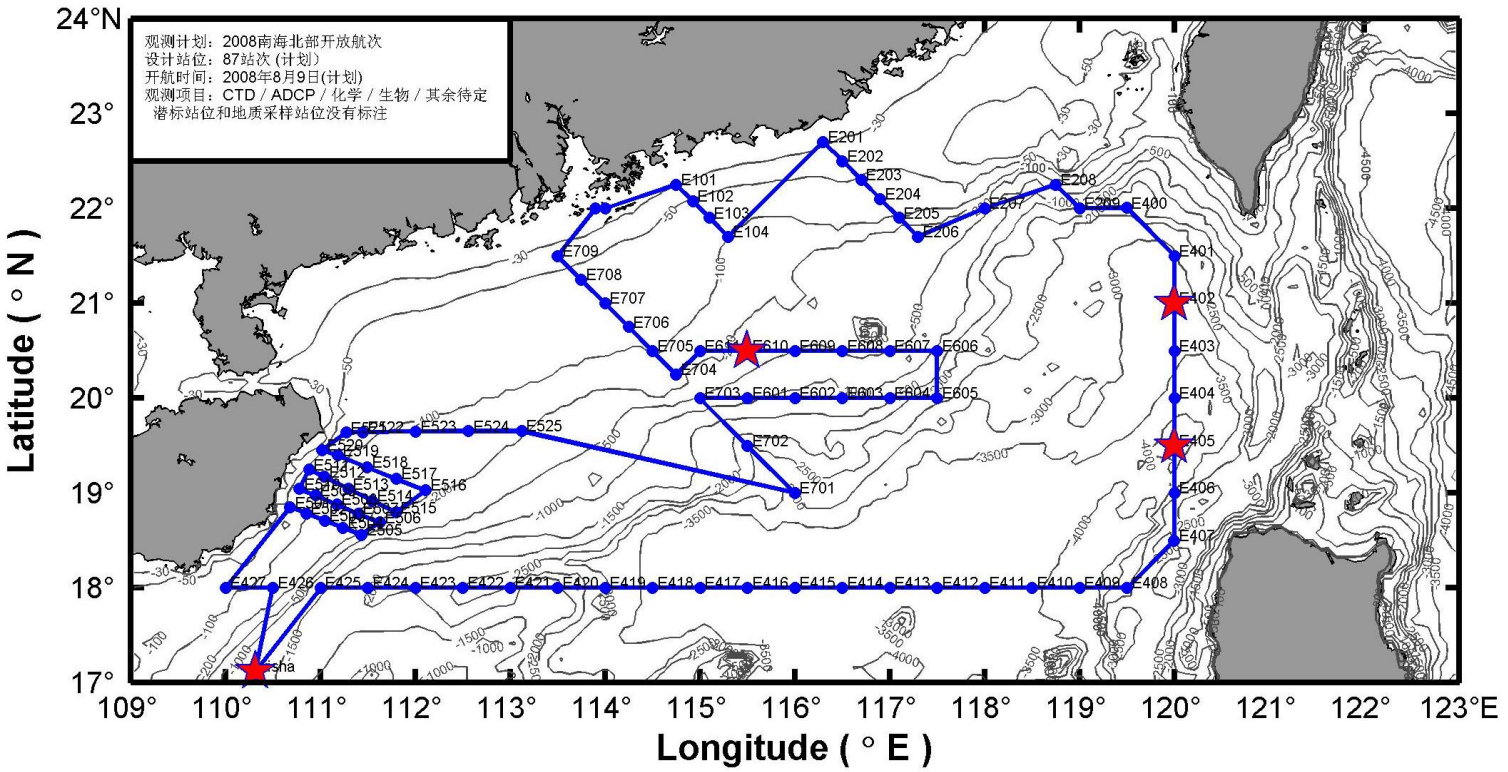
The observation network in the South China Sea



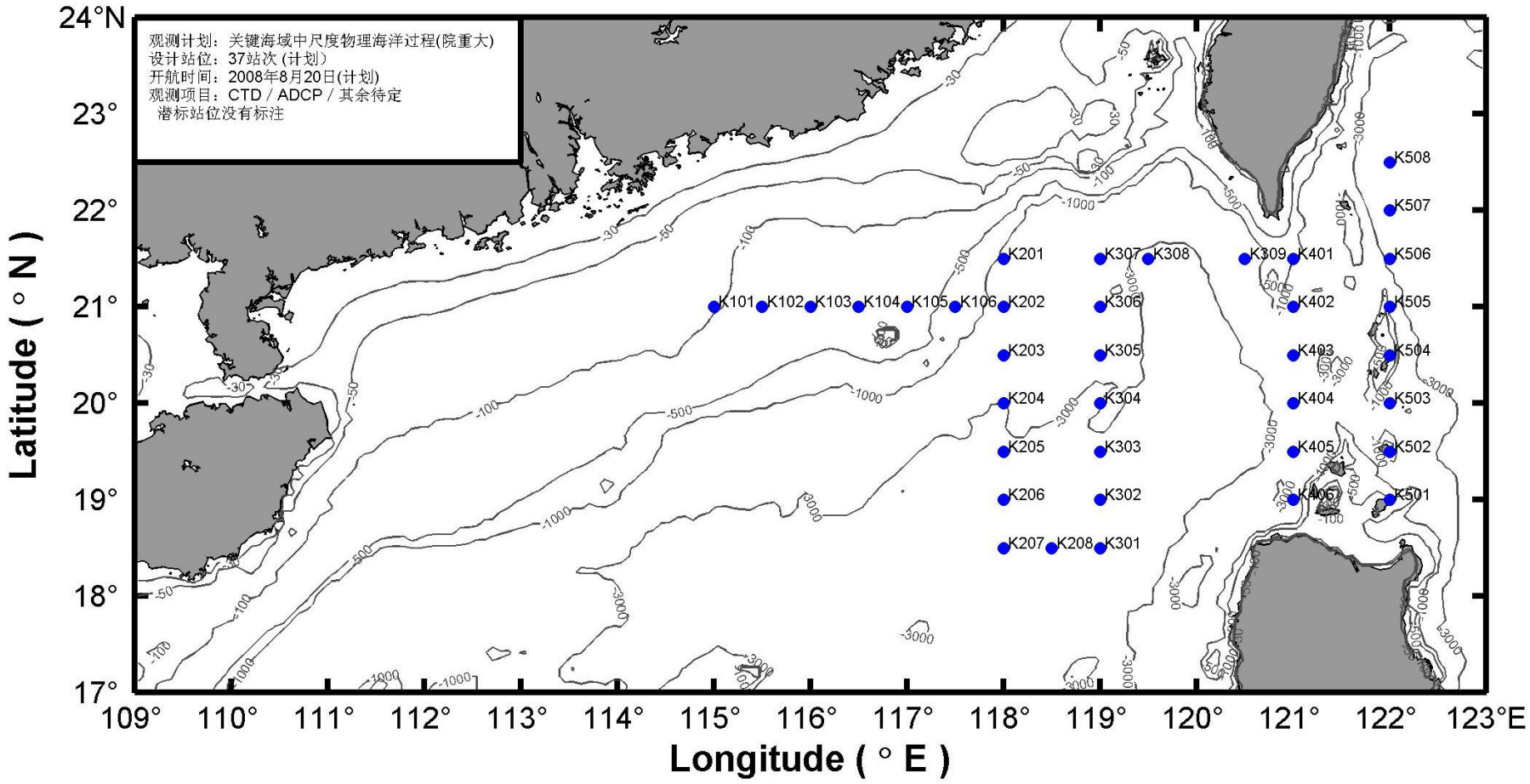
The coastal cruise in June-July, 2008



The open cruise in August, 2008

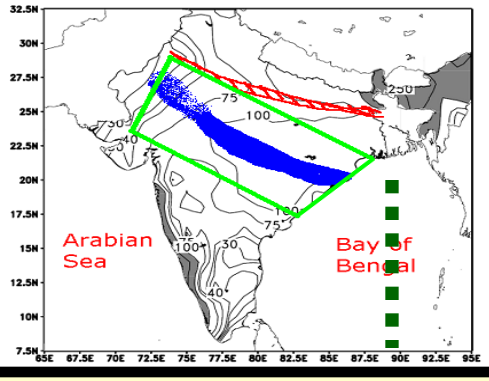


The third cruise in September, 2008



Continental Tropical Convergence Zone (CTCZ) Programme under the Indian Climate Research Programme (ICRP)

- IOP from July 1 to August 31, 2009
- The observational campaigns include airborne measurements for aerosol-cloud interactions over the Indo-Gangetic plain region, ship (two ships) based measurements for ocean-atmosphere interactions in the Bay of Bengal, boundary layer and land surface processes at selected watersheds.



Observations include

- **Over land**

  AWSs (~200), Flux towers (~10),

  DW Radar network (IMD+IAF)~5-10

  Aerosol measurements (~10)

  High resolution GPS radiosondes (5-10)

  CCN & Cloud Microphysics

- **hydrology** **2 Water sheds (Eastern India, Himalayan foothill)**
- **Ocean** **- 2 ships**

  buoy network (~90E line, 10S to 20N)

STORM Programe

Severe Thunderstorms – Observations & Regional Modeling

March – May (Pre-monsoon)

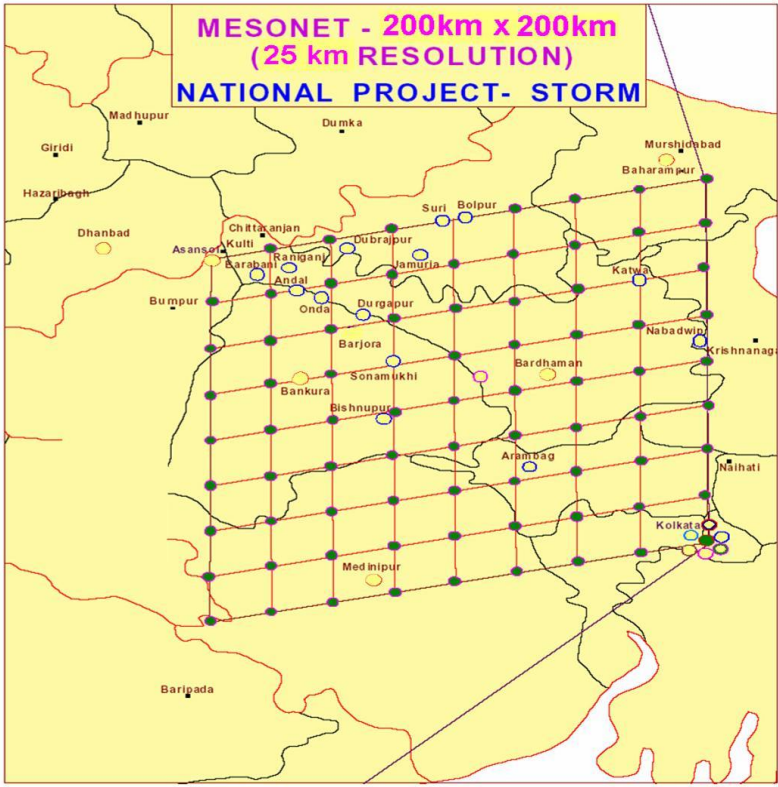
Severe Thunderstorms & Tornadoes

NW-SE traveling systems

India: STORM - Field Experiment

Proposed Instrumentation BY 2008:

- AWS - meso-network of 100 AWS
- RS/RW (Additional) - 4 stations
- Dropsondes (instrumented IAF aircraft) - 1
- Wind Profilers - 3
- Mobile Doppler Radar - 1
- Research Ship at the Head Bay - 1
- Micro-towers - 4; with 6 levels of instruments
- Disdrometers - 3
- Atmospheric Electric Sensor - 1
- Aerosol Sampler - 1
- Aerosol particle sensors - 2
- Electric Mill - 3



RAJO-MEGHA (Sanskrit: Dust-Cloud):

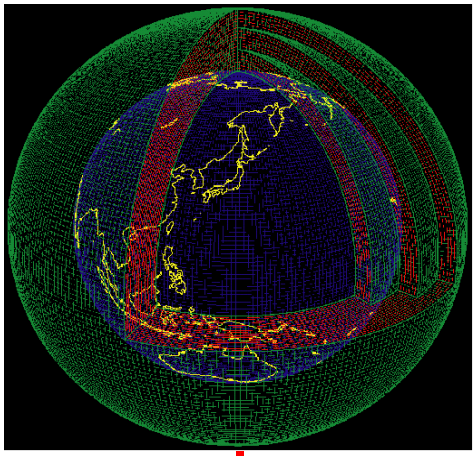
Radiation, Aerosol Joint Observations - Monsoon Experiment in Gangetic-Himalayan Area

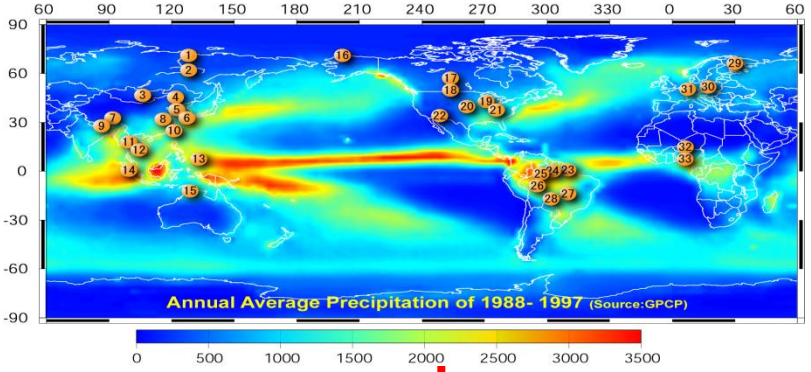
- More than *600 million* people (~10% global population) from Lahore, Pakistan to Calcutta, India depend critically on 2-3 months' *monsoon rain water*;
- *Melt-water* from the Himalayas sustain the regional agriculture throughout the *dry season*;
- *Glaciers* are rapidly shrinking, jeopardizing the long-term *water supply* over the region;
- *Aerosol loading* is extremely high throughout the year and is increasing with the growth of the Indian economy (~8%/year); and
- The impact of *aerosols* on human health, agricultural productivity and the monsoon is poorly understood.

Coordinated Enhanced Observing Period
Three Unique Capabilities

Interoperability Arrangement

A well organized collecting, processing, storing, and disseminating shared data, metadata and products





In-Situ Data Archiving Center at NCAR (National Center for Atmospheric Research) of USA

Model Output Data Archiving Center at the World Data Center for Climate, Max-Planck Institute for Meteorology of Germany

Data Integrating/Archiving Center at University of Tokyo and JAXA of Japan

CEOP SFC Data Status and Quality

The colors represent the CEOP Data Quality Flags (see definitions) as follows: green=G, yellow=D, red=B, black=I, gray=U. Note that the time period covered varies from station to station. If a station does not measure any FLX parameters it is not included in this table.

For the Soil Temperature and Moisture Data Status and Quality summary click here.
For the Meteorological Tower Data Status and Quality summary click here.
For the Flux Data Status and Quality summary click here.

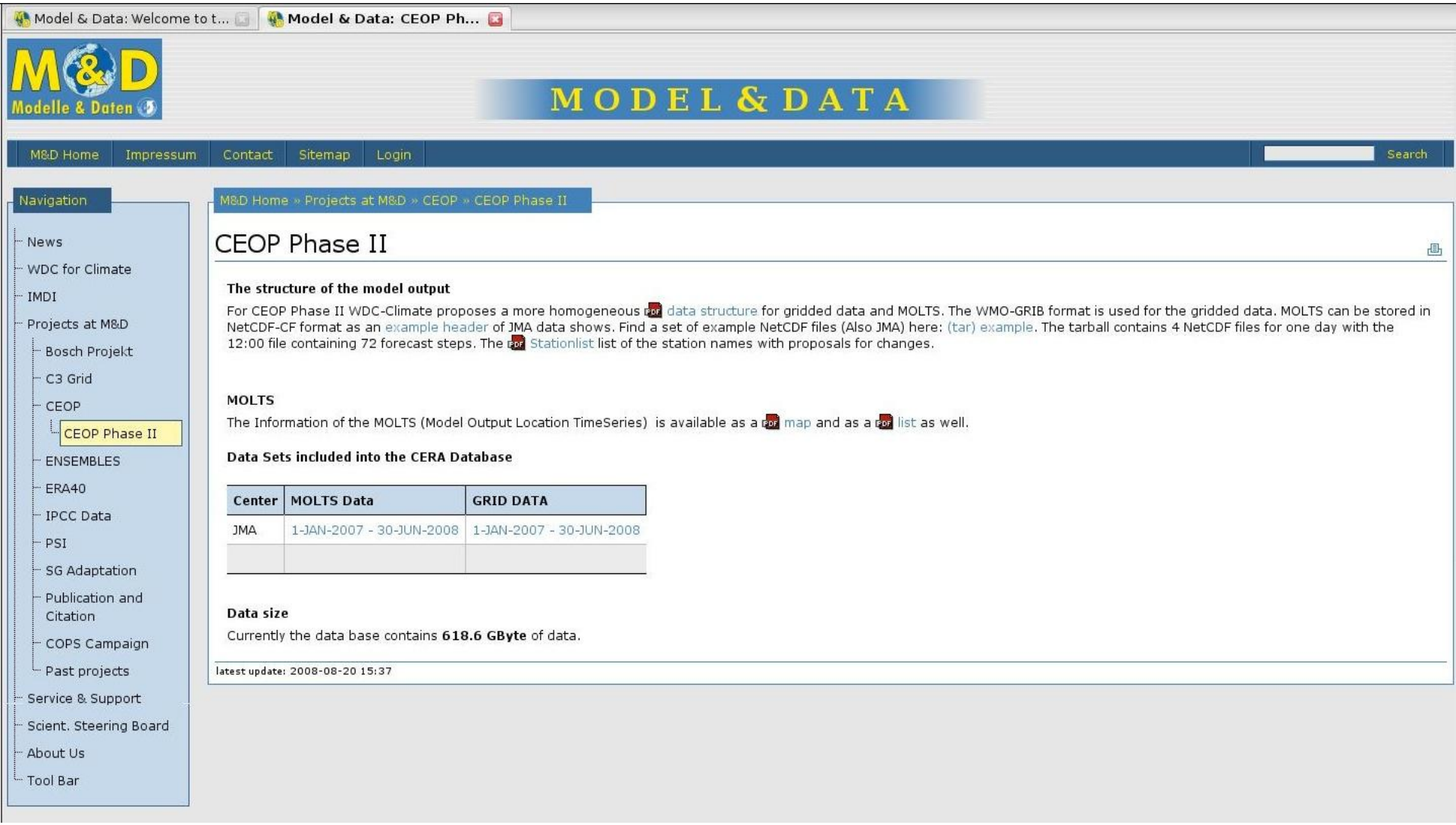
RHP	Reference Site	Station	Station Pressure	Air Temp	Dew Point	Relative Humidity	Specific Humidity	Wind Speed	Wind Dir	U Wind	V Wind	Precip	Snow Depth	In Short	Out Short	In Long	Out Long	Net Rad	Skin Temp	In PAR	Out PAR
BALTEX	Cabauw	Cabauw											None							None	None
BALTEX	Lindenberg	Falkenberg																			
BALTEX	Lindenberg	Forest						None	None	None	None		None							None	None
BALTEX	Norunda	Norunda										None	None						None		
BALTEX	Sodankyla	Oberseratory Site A														None	None	None	None	None	None

RHP	Reference Site	Station	Station Pressure	Air Temp	Dew Point	Relative Humidity	Specific Humidity	Wind Speed	Wind Dir	U Wind	V Wind	Precip	Snow Depth	In Short	Out Short	In Long	Out Long	Net Rad	Skin Temp	In PAR	Out PAR
CliC (MAGS)	BERMS		No data available yet.																		

RHP	Reference Site	Station	Station Pressure	Air Temp	Dew Point	Relative Humidity	Specific Humidity	Wind Speed	Wind Dir	U Wind	V Wind	Precip	Snow Depth	In Short	Out Short	In Long	Out Long	Net Rad	Skin Temp	In PAR	Out PAR
CPPA (GAPP)	Bondville	Bondville											None								
CPPA (GAPP)	Ft. Peck	Ft. Peck											None								
CPPA (GAPP)	Mt. Bigelow	Mt. Bigelow	No data available yet.																		
CPPA (GAPP)	Oak Ridge	Oak Ridge											None								

RHP	Reference Site	Station	Station Pressure	Air Temp	Dew Point	Relative Humidity	Specific Humidity	Wind Speed	Wind Dir	U Wind	V Wind	Precip	Snow Depth	In Short	Out Short	In Long	Out Long	Net Rad	Skin Temp	In PAR	Out PAR
CPPA (GAPP)	SGP (ARM)	C1 Lamont	None	None	None	None	None	None	None	None	None	None	None							None	None
CPPA (GAPP)	SGP (ARM)	E1 Lamed											None						None	None	None
CPPA (GAPP)	SGP (ARM)	E2 Hillsboro	None	None	None	None	None	None	None	None	None	None	None						None	None	None
CPPA (GAPP)	SGP (ARM)	E3 Le Roy											None						None	None	None
CPPA (GAPP)	SGP (ARM)	E4 Plevna											None						None	None	None
CPPA (GAPP)	SGP (ARM)	E5 Halstead											None						None	None	None
CPPA (GAPP)	SGP (ARM)	E6 Towanda											None						None	None	None
CPPA (GAPP)	SGP (ARM)	E7 Elk Falls											None						None	None	None

CEOP Phase II at ceop.wdc-climate.de



- **Modeling:**
  - Global re-analysis (by MRI/JMA)
  - Regional re-analysis (TBD)
  - NICAM and other high resolution models for case study (TBD)
  - Coordinated intra-seasonal hindcast to access predictability & prediction skill for MISO

MJO/MISO Hindcast Experiment Plan

A joint effort by

CLIVAR/AAMP, APCC, YOTC and AMY

Hindcast Experiment for Intraseasonal Prediction

1. Motivation

The Madden-Julian Oscillation (MJO)

interacts with, and influences, a wide range of weather and climate phenomena (e.g., monsoons, ENSO, tropical storms, mid-latitude weather), and represents an important, and as yet unexploited, source of predictability at the subseasonal time scale.

The Monsoon Intraseasonal Oscillation (MISO)

is one of the dominant short-term climate variability in global monsoon system

The wet and dry spells of the MISV strongly influence extreme hydro-meteorological events, which composed of about 80% of natural disaster, thus the socio-economic activities in the World's most populous monsoon region.

2. Need for a Coordinated Multi-Model ISO Hindcast Experiment

There are still **great uncertainties regarding the level of predictability that can be ascribed to the MJO, other subseasonal phenomena and the weather/climate components that they interact with and influence.** The development and analysis of a multi-model hindcast experiment is needed to address the above questions and challenges.

The development of an MME is **the intrinsic need for lead-dependent model climatologies (i.e. multi-decade hindcast datasets) to properly quantify and combine the independent skill of each model as a function of lead-time and season.**

Hindcast Experiment for Intraseasonal Prediction

3. Objectives

◆ Better understanding of the physical basis for intraseasonal prediction. Determine potential and practical predictability of ISO in a multi-model frame work.

◆ Developing optimal strategies for multi-model ensemble (MME) ISO prediction system, including effective initialization schemes and quantification of the MME's ISO prediction skills with forecast metrics under operational conditions.

◆Revealing new physical mechanisms associated with intraseasonal variability that cannot be obtained from analyses of a single model.

◆Identifying model deficiencies in predicting ISO and finding ways to improve models' convective and other physical parameterizations relevant to the ISO through development of model process diagnostics.

◆Help to determine ISO's modulation of extreme hydrological events (e.g., midlatitude weather, monsoon depressions, and tropical cyclones) and its contribution to seasonal and interannual climate variation.

Hindcast Experiment for Intraseasonal Prediction

4. Experimental Design

EXP1: Control Simulation

A long simulation allows us to better understand the dependence of the prediction on initial conditions and better define metrics that measure the "drift" of the model toward their intrinsic MJO/MISV modes

Free coupled runs with AOGCMs or AGCM simulation with specified boundary forcing (e.g., observed SST and Sea ice distribution) are requested for at least 20 years. The period for the forced AGCM run should be consistent with the hindcast period

EXP2: ISO Hindcast

Retrospective Forecast Period	20 years from Jan 1989 to Decembr 2008 MJJAS 2009 (optional)
Initial Date	Every 10 days on 1st, 11th, and 21st of each calendar month
The Length of Integration	At least 45 days
Ensemble Member	At least 6 members
Initial condition	Initial conditions may use one day or 12 hours lag

Hindcast Experiment for Intraseasonal Prediction

5. Current Status

Institution	Participants	Current Status
ABOM	Harry Hendon	26-year integration initiated the first day of every month with 10 ensemble simulations (1980-2006)
COLA and GMU	E. Jin, J. Kinter, J. Shukla	
ECMWF	F. Molteni, Frederic Vitart	1991-2007 integration initiated the 15th of every month with 15 ensemble simulation
GFDL	W. Stern	26-year integration initiated the first day of every month with 10 ensemble simulations
IAP/LASG	T. Zhou, B. Wang	
JAMSTEC/APL	T. Yamagata, J.-J. Luo	
NASA/GMAO	S. Schubert, P. Pegion	20-year integration initiated every day, AGCM only
NCEP/CPC	A. Kumar, J. E. Schemm	26-year integration initiated every month with initial condition of 9, 10, 11, 12, 13, 19, 20, 21, 22, 23, 29, 30, 1, 2, 3
SNU	I.-S. Kang	21-year integration initiated every five days during NDJFM season
UH/IPRC	X. Fu, J.-Y. Lee	20-year integration initiated every 5 day during MJJAS
UM	B. Kirtman	
INGV	Annalisa Cherichi	
MRD/EC	Gilbert Brunet, Hai Lin	20-year integration initiated every 10 days (almost finished), AGCM only
CWB	Mong-Ming Lu	20-year integration initiated every 15 days, working on the case with 21st initial condition
BCC/CMA	Zhang Peiqun, Chen Lijuan	

JRA-55 & AMY reanalysis by MRI/JMA

Dr. Kiyotoshi Takahashi
Japan Meteorological Agency
Tokyo, Japan
Dr. Hirotaka Kamahori
Climate Research Divivion
Meteorological Research Institute
Tsukuba, Japan

Outline of JRA-55

- JMA has just started the new reanalysis project, JRA-55.
- Computation will start in 2010.
- The production of the global analysis will be completed in the end of 2012JPFY.
- AMY Reanalysis will be conducted at the first stage of JRA-55.

	JRA-25	JRA-55
Target Period	1979-2004 (26 years)	1958-2012 (55 years)
Model	T106L40 (~110km)	TL319L60 (~60km)
Assimilation scheme	3D-var	4D-Var
Continuation	JCDAS 2005 ~	Under planning

AMY Re-analysis

- **Input data**
  Surface (Ps, T, RH, U, V)
  Upper level (Z, T, RH, U, V)
  Ship (Ps/Z, T, RH, U, V)
  Airplane (Z, T, RH, U, V)
  Satellite(Direct assimilation, Retrieve quantity assimilation)

- **Products**
  Model surface analysis (640x320 : 0.5625deg) ∽ 60Km
  Pressure level analysis (288x145 : 1.25deg) ∽ 140Km
  Physical monitor

Global Data Assimilation System

- ✓ **Prediction model**

  Resolution: T319L60 (model top:0.1 hPa) ∽60km

  Cumulus parameterization: Arakawa-Schubert

  SST：COBE

  Boundary layer：Y-M level-2

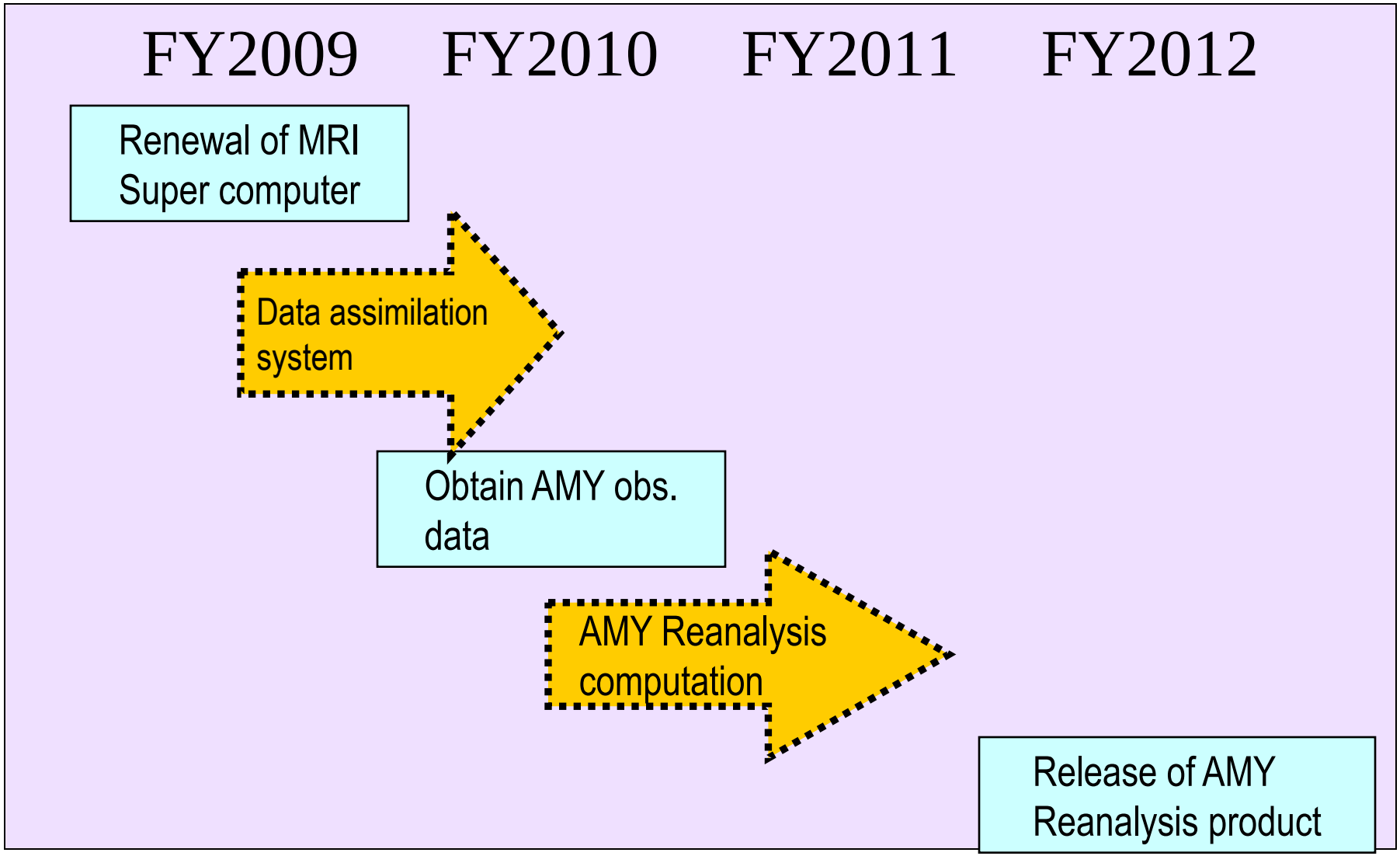
- ✓ **Assimilation scheme**

  Algorism: 4D-VAR

  Resolution: T159L60 Increment method ∽80km

  Land surface: Snow cover analysis (Surface obs. and satellite estimation)

Time Table (Tentative)



Summary

- Intensive observation data during the AMY-IOP (2008-2009) will contribute to YOTC.
- The relationship between heavy rainfall in monsoon region and MJO activity, the MJO modification processes in the maritime continent, are some of the examples of scientific targets.
- CEOP data-set will also contribute to YOTC.
- AMY modeling also target MJO and MISO so can strongly collaborate with YOTC.
- AMY-reanalysis will also contribute to YOTC. Data input from AMY and other projects are needed.