

# Years of the Maritime Continent (YMC) – Current & Future

Kunio Yoneyama (JAMSTEC)  
& Chidong Zhang (NOAA/PMEL)  
Co-chairs of YMC Science Steering Committee

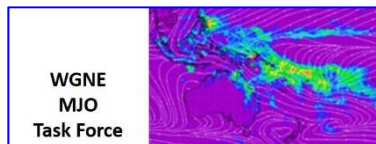
## Outline

- 1) What is the YMC ?
- 2) Field Campaigns – Intensive Observation Periods (IOPs)
- 3) Data Management
- 4) Concluding Remarks

# Endorsements

YMC has been endorsed by the following international organizations.

WMO/WWRP	since Nov. 2015
WMO/WWRP/WGTMR	since Nov. 2015
WCRP+WWRP/S2S	since Apr. 2016
WCRP+CAS/WGNE/MJOTF	since June 2016
WCRP/CLIVAR	since Mar. 2017



Our ref.: 4475-16/WCRP/ARE

Professor Chidong Zhang  
Rosenstiel School of Marine and Atmospheric  
Science (RSMAS)  
University of Miami  
4600 Rickenbacker Causeway  
Miami, FL 33149-1098  
USA

Dr Kunio Yoneyama  
Japan Agency for Marine-Earth Science &  
Technology  
(JAMSTEC)  
2-15, Natsushima, Yokosuka 237-0061  
Japan

GENEVA, 20 June 2016

Subject: Support letter, Years of the Maritime Continent (YMC) international project

Dear Professor Zhang and Dr Yoneyama,

On behalf of co-chairs of the Working Group on Numerical Experimentation (WGNE), Drs Keith Williams and Ayrton Zadra, we eagerly support the Years of the Maritime Continent (YMC) international project, which is expected to contribute significantly to the work of the WGNE Madden-Julian Oscillation Task Force (MJOTF). WGNE is a joint effort from the World Climate Research Programme (WCRP) and the WMO Commission for Atmospheric Sciences (CAS).

The MJOTF was recently renewed in early 2016 for a term of three years, including an explicit reference to advance our understanding of MJO interactions with the Maritime Continent (MC) so as to facilitate improvements in model bias and foster better subseasonal predictions across the MC and the globe. To foster this initiative, the MJOTF has a joint subproject with the Seasonal to Subseasonal (S2S) prediction project related to the MC. Both S2S and the MJOTF deem the interaction of the MC with the MJO a high research priority that has significant bearing on addressing shortcomings and improving operational MJO predictions, and because of the importance of region as a source for the global teleconnections of the MJO, enhanced extra-tropical prediction on sub-seasonal timescales.

While furthering process understanding of MJO-MC interactions that leads to enhanced predictions is one motivating principle of MJOTF activities related to the MC, current practicalities and opportunities have also inspired our recent efforts. In particular, the presence of existing modelling resource to bring to bear on MJO-MC interactions, as well as the impending YMC field project, have provided immediate impetus to this effort. We look forward to working with you and others involved in YMC to help refine the objectives of the field campaign and exploit the significant process study data to address deficiencies in our understanding, and make scientific progress through collaborative observational and modelling activities.

In summary, we envision the YMC project as being an important component of our MJOTF activities related to the Maritime Continent over the next several years, and wholeheartedly support the YMC project and science plan.

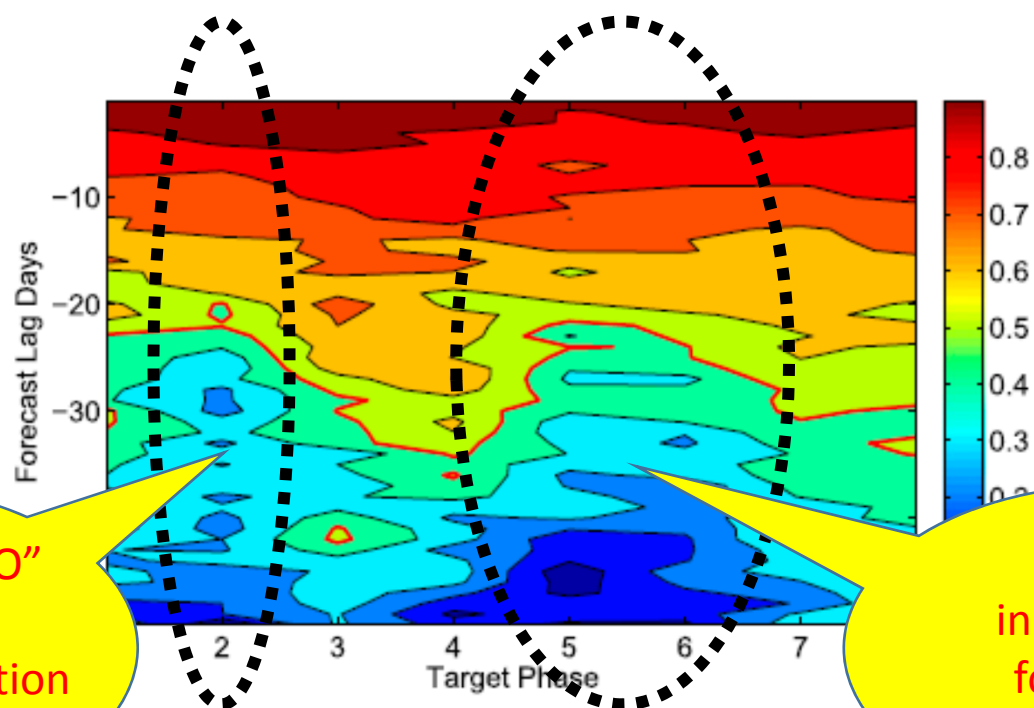
Yours sincerely,

(D. Carlson)  
Director, World Climate Research  
Programme

(D. Terblanche)  
Director, Atmospheric Research and Environment  
Branch

cc: Drs Keith Williams and Ayrton Zadra, Co-Chairs WGNE  
Drs Steve Woolnough and Eric Maloney, Co-Chairs MJOTF

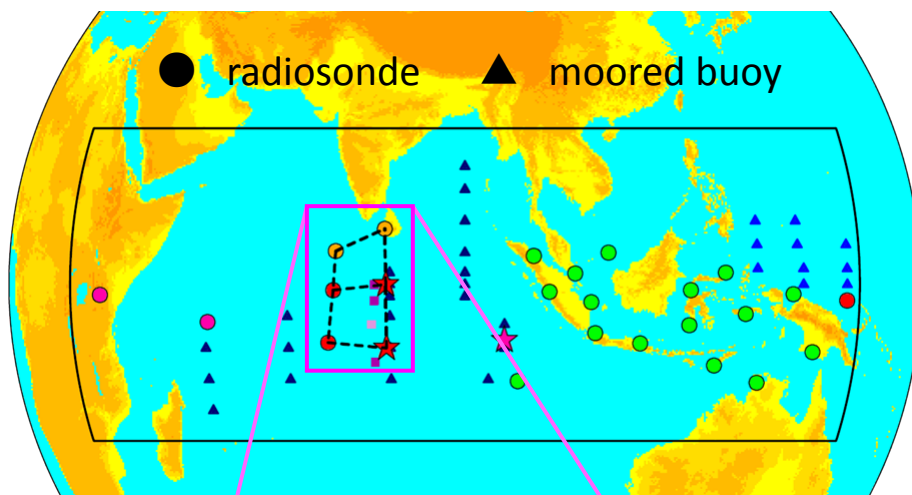
MJO Prediction Skill as a function of RMM Phase



“CINDY/DYNAMO”  
in 2011-2012  
for the MJO initiation  
processes study

“YMC”  
in 2017-2020  
for the MC  
Barrier study

Xiang et al. (2015) for the  
case of GFDL coupled model.



The biggest challenge is how we can conduct observations in the MC

## Purpose:

Collecting in-situ observations

to advance our understanding of the initiation process  
to improve the skill of the MJO simulation & prediction

## Intensive Observing Period:

October 2011 – January 2012

## Participants:

69 institutes/universities from  
Australia, France, India, Indonesia, Japan, Kenya, Korea, Maldives, Papua New Guinea, Seychelles, Singapore, Sri Lanka, Taiwan, UK, and USA

<http://www.jamstec.go.jp/iorgc/cindy/>

[https://www.eol.ucar.edu/field\\_projects/dynamo/](https://www.eol.ucar.edu/field_projects/dynamo/)

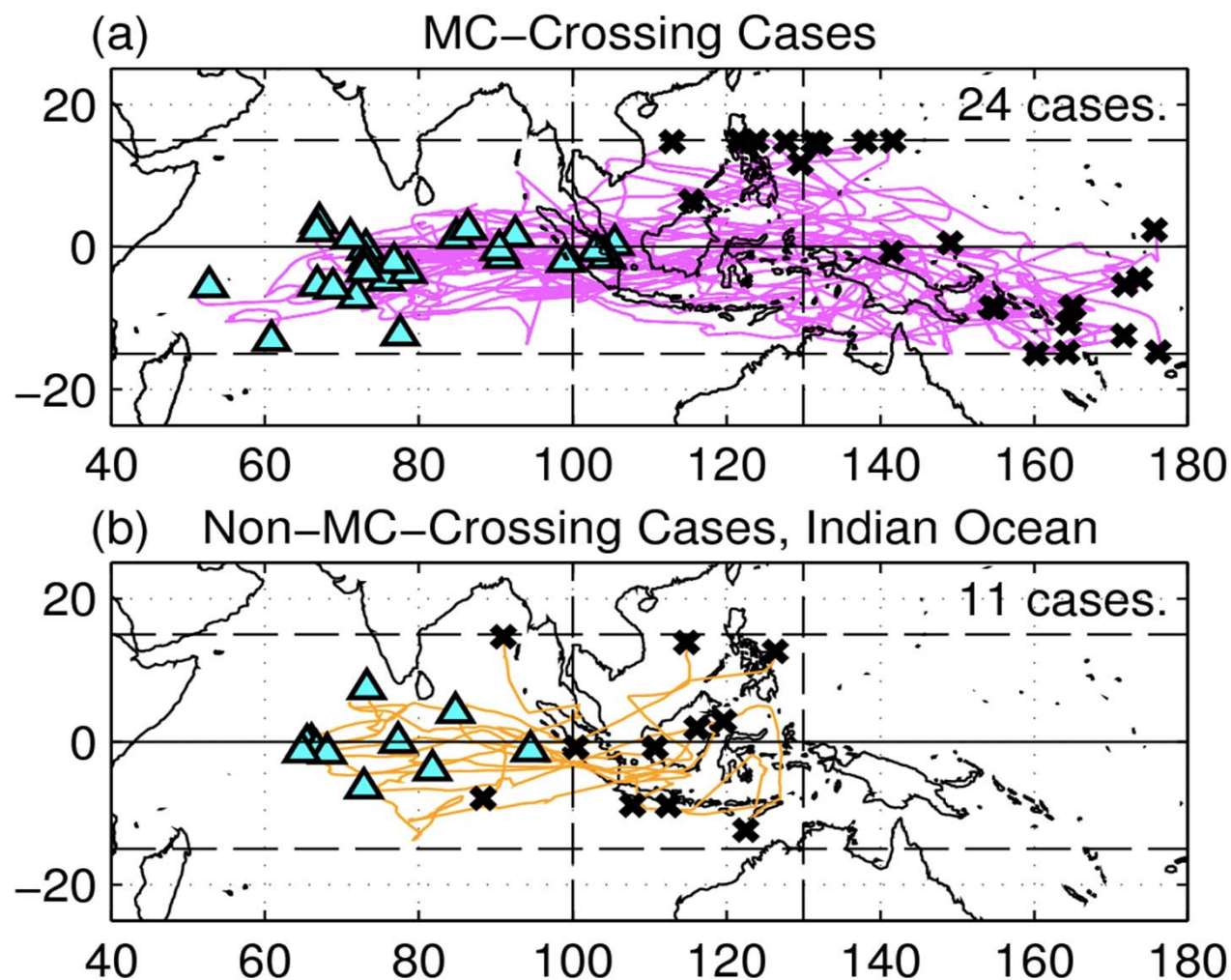
## Special remarks:

- 1) C/D captured many MJO events. In particular, Nov. event is selected as one of benchmarks for modeling project “Vertical structure and physical processes of the MJO” owing to rich and high-quality observations.
- 2) Through the campaign, international community could establish a good relationship with the MC countries.



# MC Barrier Effect onto the MJO

About 30% failed to pass by the MC region.

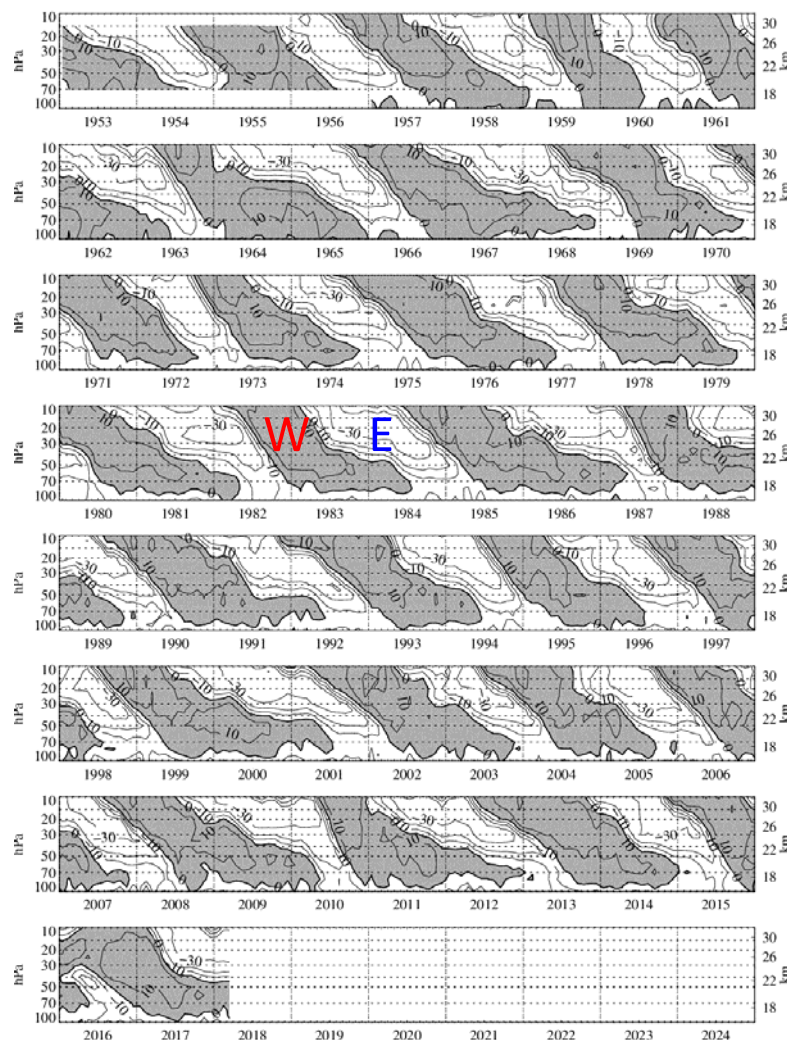


MJO Precipitation Tracking observed in Oct – March, 1998-2015.

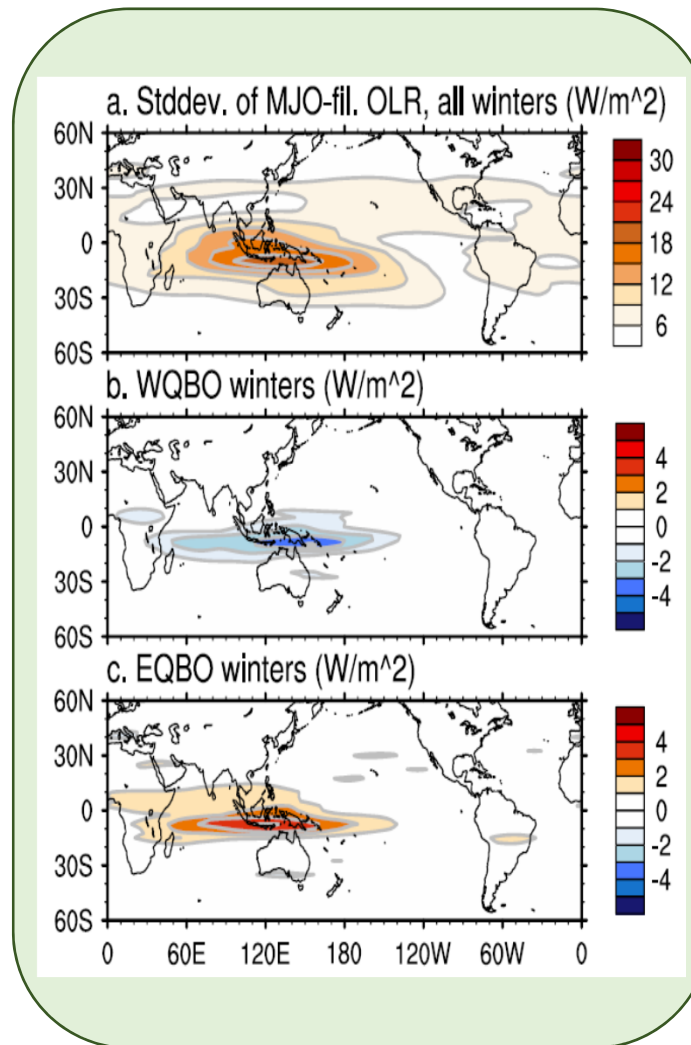
Kerns and Chen (2016)

# MJO vs. Stratosphere - QBO may affect the MJO

MJO activity over the MC in the boreal winter is active in QBO Easterly phase than Westerly.



<http://www.geo.fu-berlin.de/>



Yoo & Son (2016)

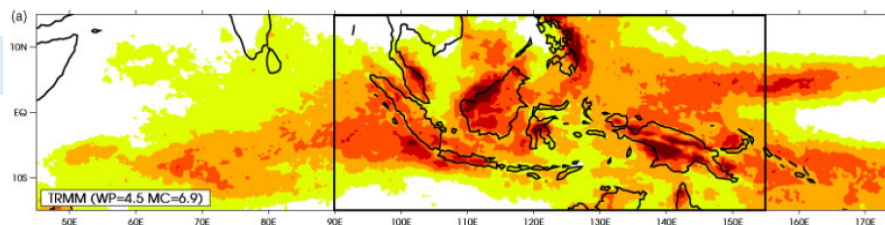
QBO (Quasi-Biennial Oscillation):

Alternate zonal wind pattern in the equatorial stratosphere with 24-30 months cycle.

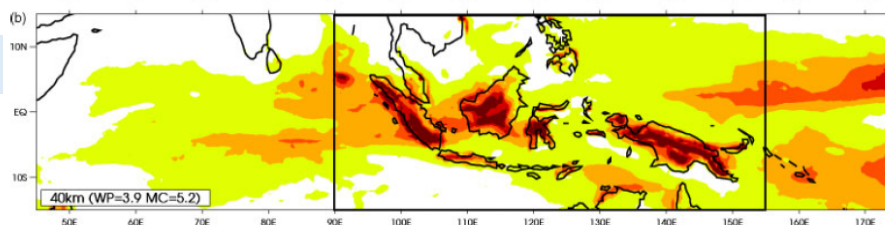
## Purpose

To expedite progress of improving our understanding and prediction skill of local multi-scale variability of the MC weather-climate systems and its global impact.

Observation



Model



State-of-the-art numerical models suffer from systematic errors of rainfall estimation

Comparison of monthly mean rainfall for February.  
Taken from Love et al. (2011)

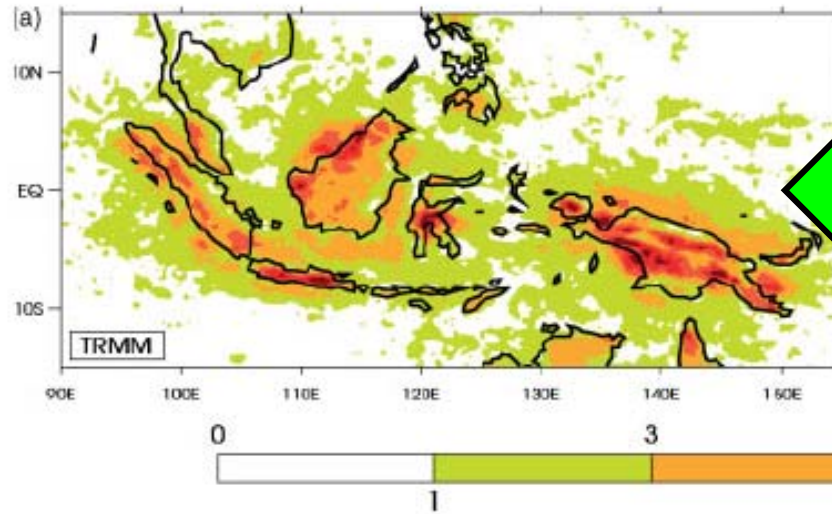
## Main Science Themes

- 1) Atmospheric convection (ex. Diurnal cycle, MJO, monsoon)
- 2) Ocean and air-sea interaction
- 3) Stratosphere-troposphere interaction
- 4) Aerosols
- 5) Prediction

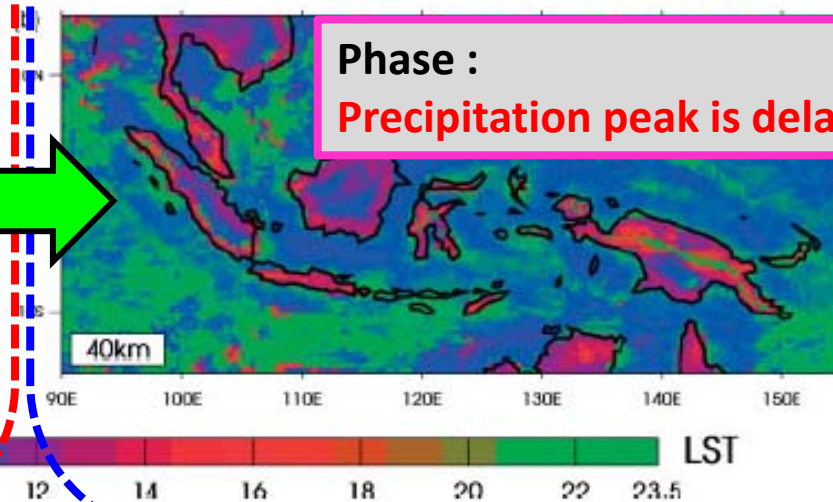
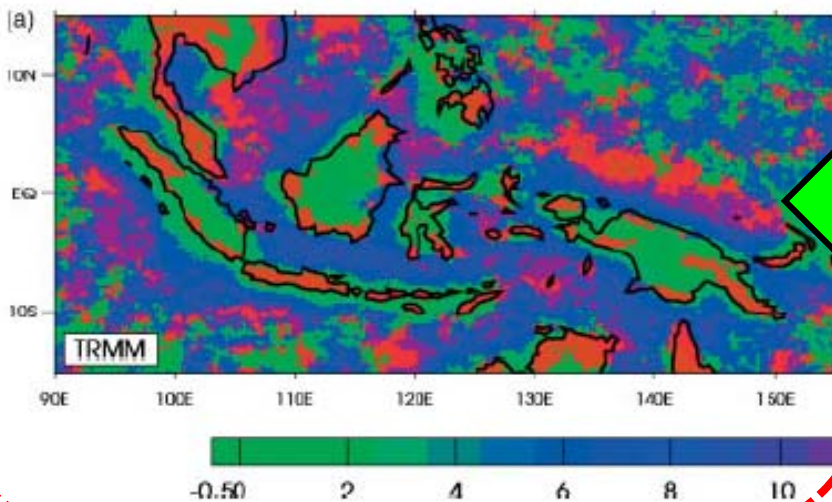
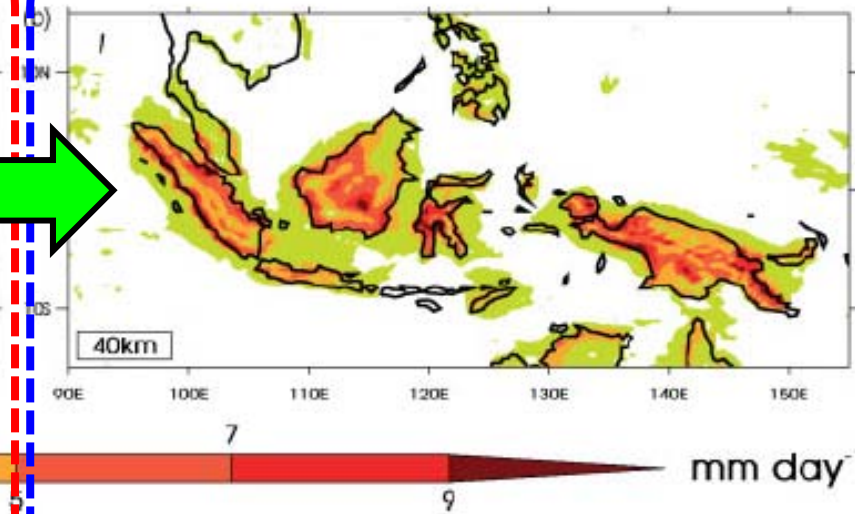


# Diurnal Cycle is still a big challenge

## Observation



## Model



Phase :  
Precipitation peak is delayed

From Love et al. (2011)



## Period

July 2017 – ~~July 2019~~ February 2020

## Participants as of July 2017

Over 70 institutes/universities from

**Australia**, China, France, Germany, **Indonesia**, Italy, Japan, Korea,  
**Malaysia**, Mexico, New Zealand, **Palau**, **Philippines**, Poland,  
**Singapore**, Taiwan, Thailand, UK, US, Vietnam

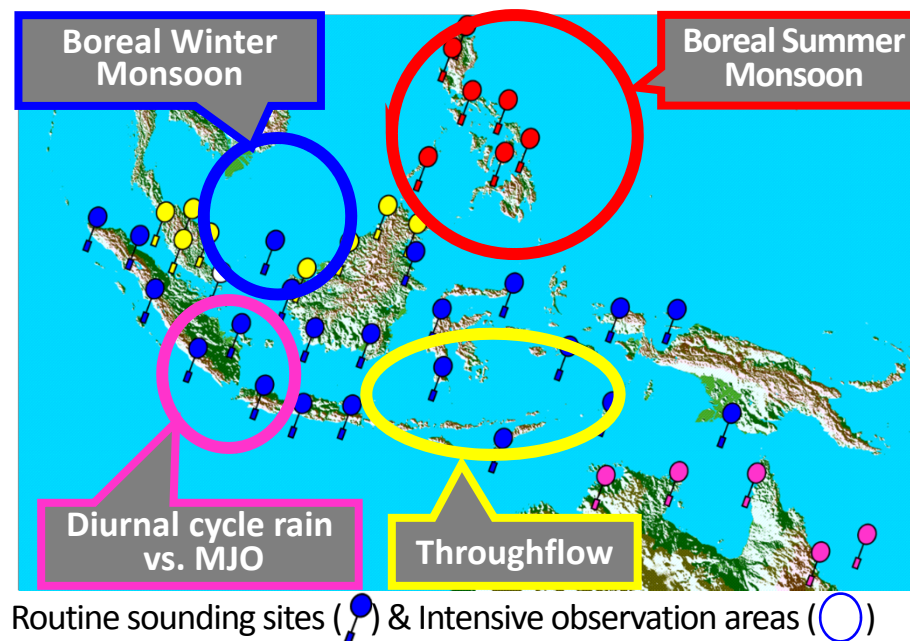
## Web sites

Main <http://www.bmkg.go.id/ymc/>

Ancillary <http://www.jamstec.go.jp/ymc/>

## Main Activities

- 1) Data sharing
- 2) Field campaign
- 3) Modeling
- 4) Prediction and applications
- 5) Outreach and capacity building



## Basic Strategy

YMC campaign consists of

- 1) Intensive Observations including modeling for specific research topics,
- 2) Provision of routine observation data from the MC Met Agencies

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# Funded / Proposed IOPs

⑪ US-Philippines  
2019.07-08 CAMP<sup>2</sup>Ex (Aerosol)

As of Aug. 2018

③ Taiwan  
2017.12  
2018.08 - 2018.10  
SCSTIMX (Monsoon)

⑤ US-Philippines  
2018.08-10 PISTON, SALICA (BSISO, DC)

② China  
2017.12 - 2018.02  
IIOE-2/EIOURI

⑨ US-Singapore-Malaysia  
2019/2020/2021.01  
MC-CARDIO (DC, MJO)

④ Japan-Philippines-Palau  
2018.07 - 2018.08  
YMC-BSM (BSISO)

⑦ US-UK-Indonesia  
2018.11 - 2019.02  
ELO (CCKW)

⑥ US-Indonesia  
2018.09 - 2019.08  
DIMOP (DC, MJO)

④' Japan-Indonesia-Viet Nam  
2018.07  
YMC-BSM (TTL)

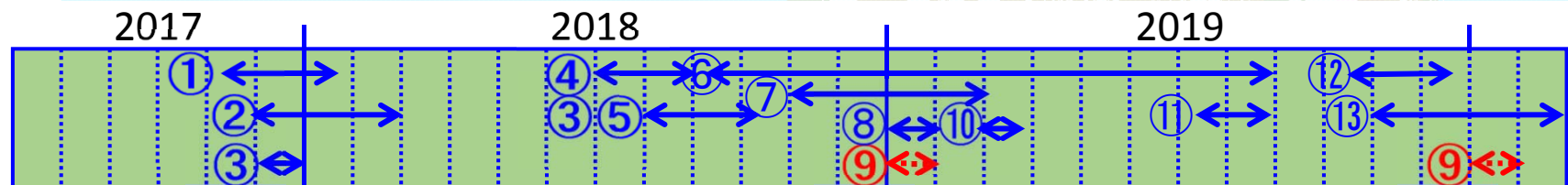
⑩ Japan-Indonesia  
2019.02 - 03  
Ocean Mixing (tidal mixing)

① Japan-Indonesia  
2017.11 - 2018.01  
Sumatra 2017 (DC, MJO)

⑫ Australia-Indonesia  
2019.10 - 2019.12  
Sumatra 2019 (DC, MJO)

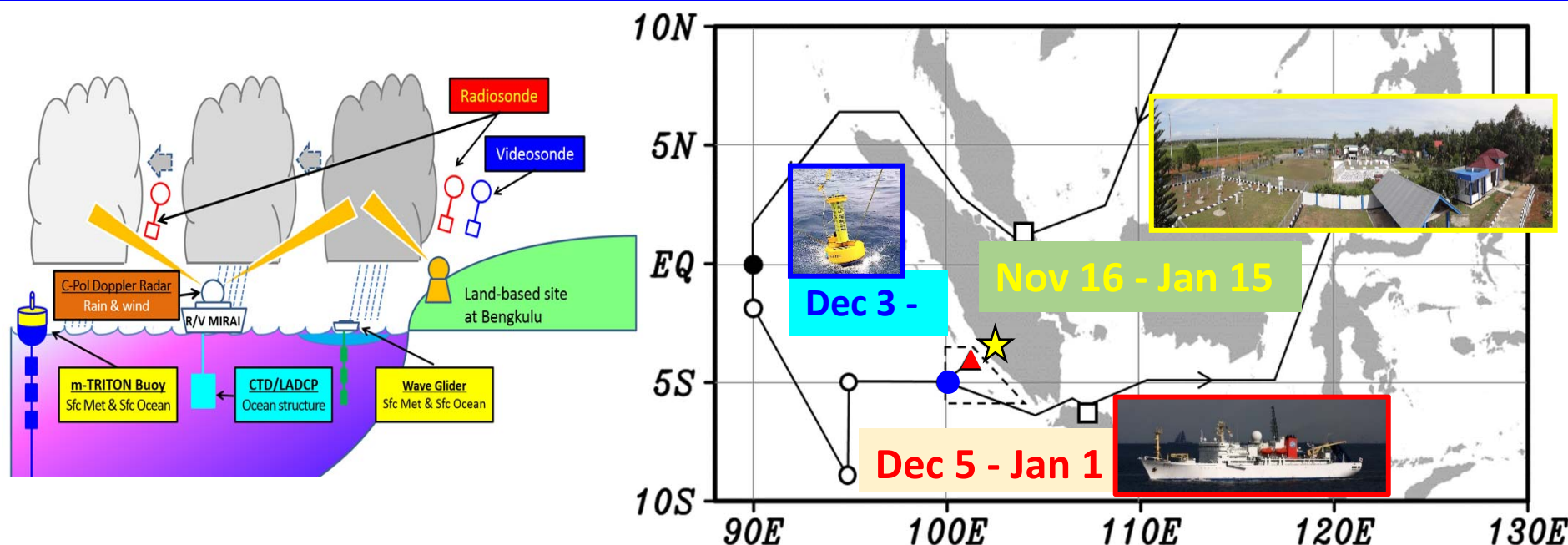
⑬ UK-Australia-Indonesia  
2019.11 - 2020.02  
TerraMaris (DC, MJO)

⑧ US-Indonesia  
2019.01  
YMC-Banda Sea (Air-sea)





# IOP - Example (1) : YMC - Sumatra 2017



Target: MJO vs. Diurnal cycle in rain near the coast line

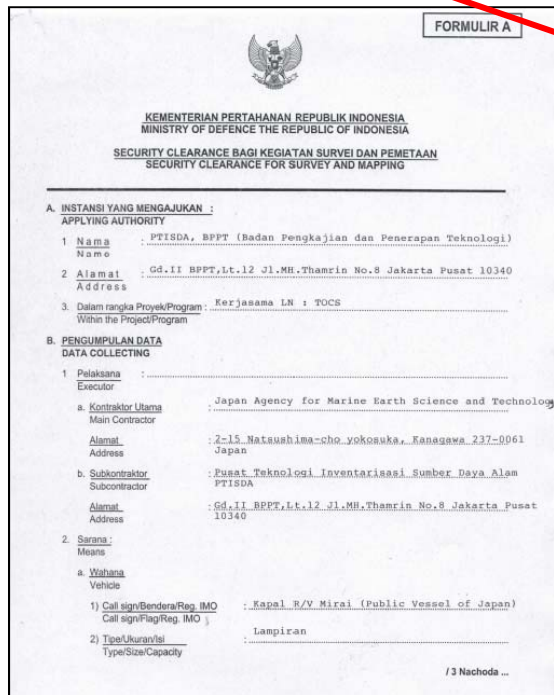
Period: Land-based Nov 16, 2017 – Jan 15, 2018 ( 61 days )  
 Ship-based Dec 5, 2017 – Jan 1, 2018 ( 28 days ) (Jp-Jp; Nov 11, 2017 – Jan 18, 2018)

Obs: Land-based C-band Doppler radar, X-band MPR, Radiosonde, AWS, Special-sonde, etc.  
 Ship-based C-band Polarimetric Doppler Radar, Radiosonde, LIDAR, Surface Met, CTD, ADCP, Sampled water chemical analyses, Buoy, Wave-glider, etc.

Modeling: Forecast using global cloud-system resolving model “NICAM”

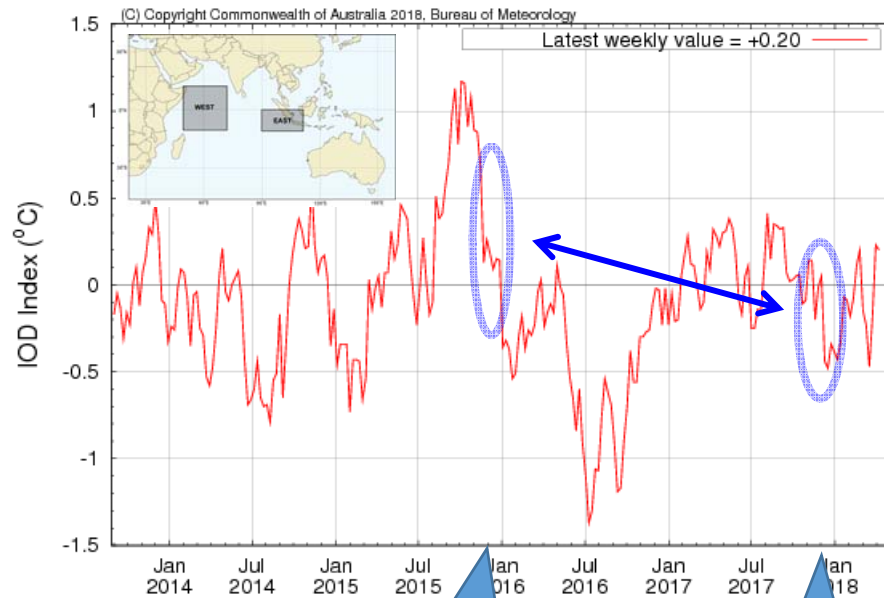
Participants: Japan JAMSTEC, Kyoto U, U Tokyo, U Toyama, NDA, NME, MWJ  
 Indonesia BPPT, BMKG, U Bengkulu  
 US UH/IPRC

Purposes: 1) To obtain data in different large-scale conditions (ENSO, IOD, etc.)  
2) To learn logistics (research permit, collaboration with local staff, etc.)



# IOD & ENSO Phases

## IOD Index

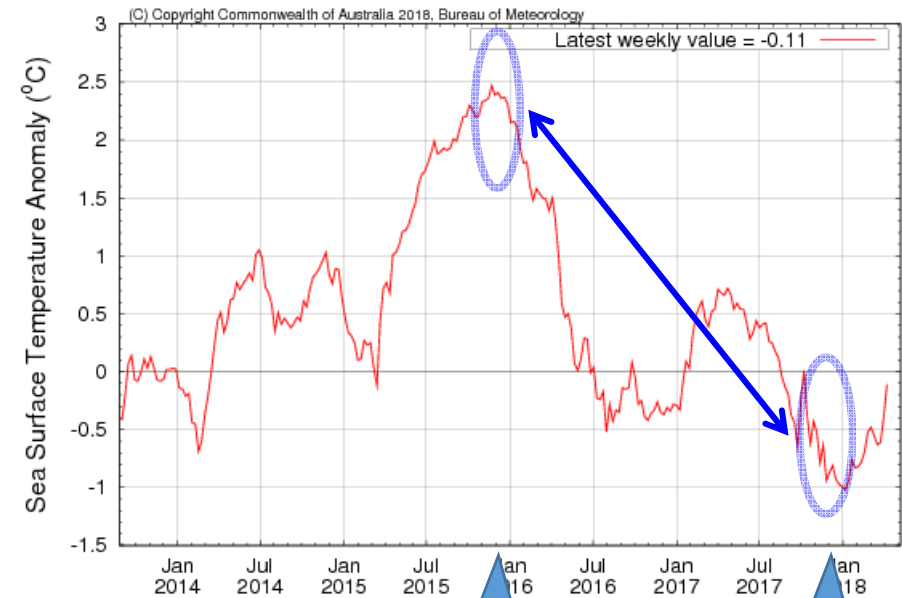


<http://www.bom.gov.au/>

2015. 11-12  
P-IOD to Normal

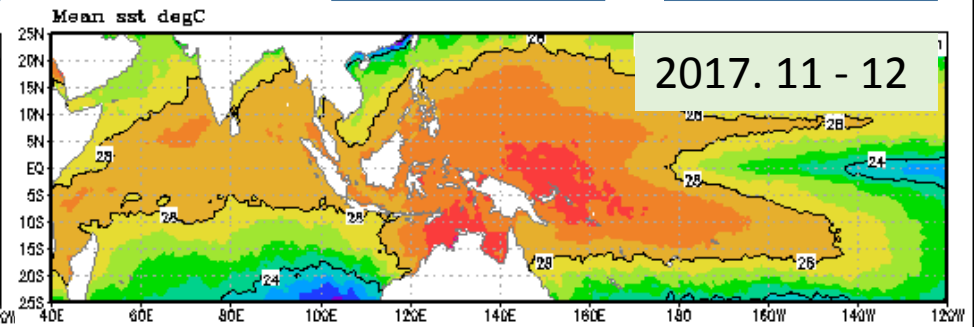
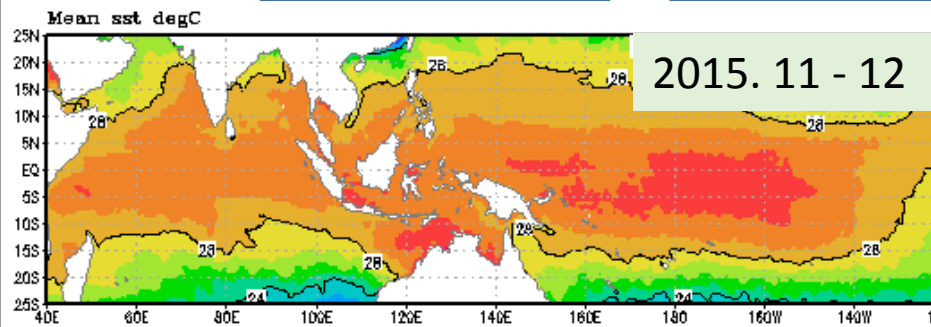
2017. 11-12  
Normal

## Nino3 SST Index



2015. 11-12  
El Nino

2017. 11-12  
La Nina



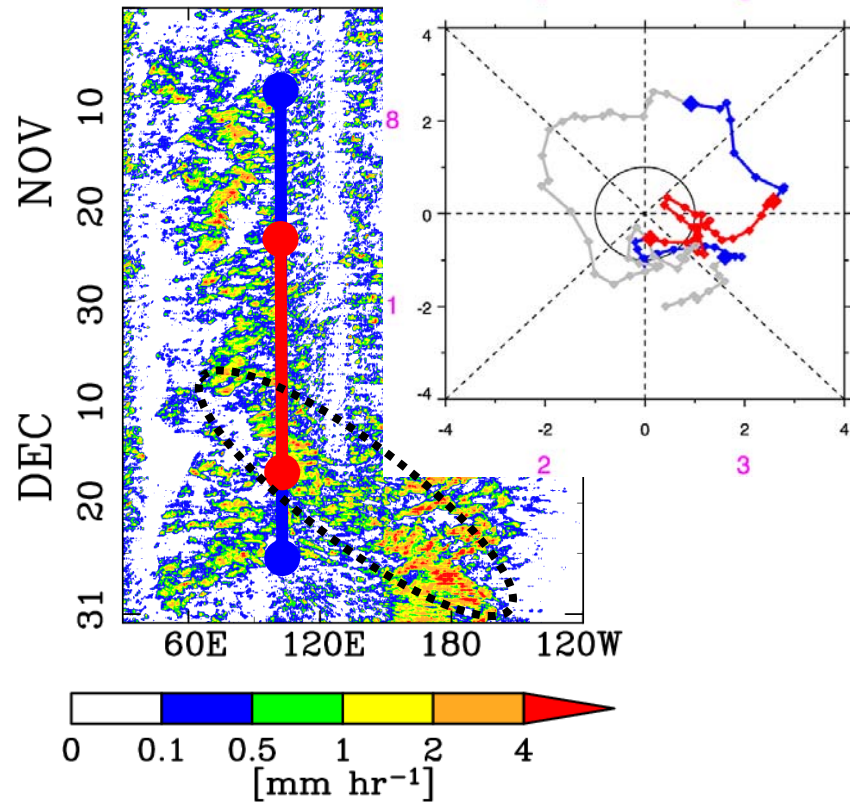
Nov-Dec Mean Sea Surface Temperature (<http://www.esrl.noaa.gov/>)



# MJO Phase

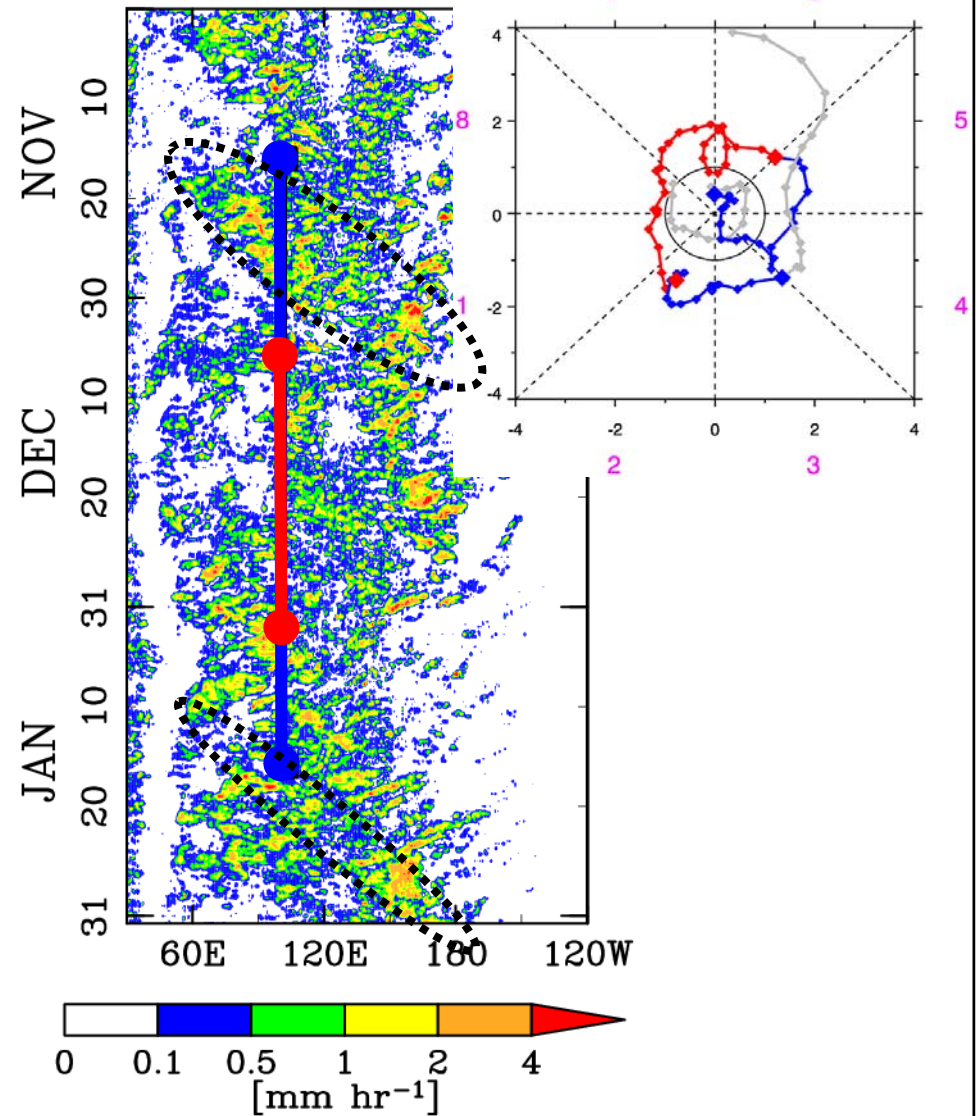
2015

Suppressed → Active



2017

Active → Suppressed

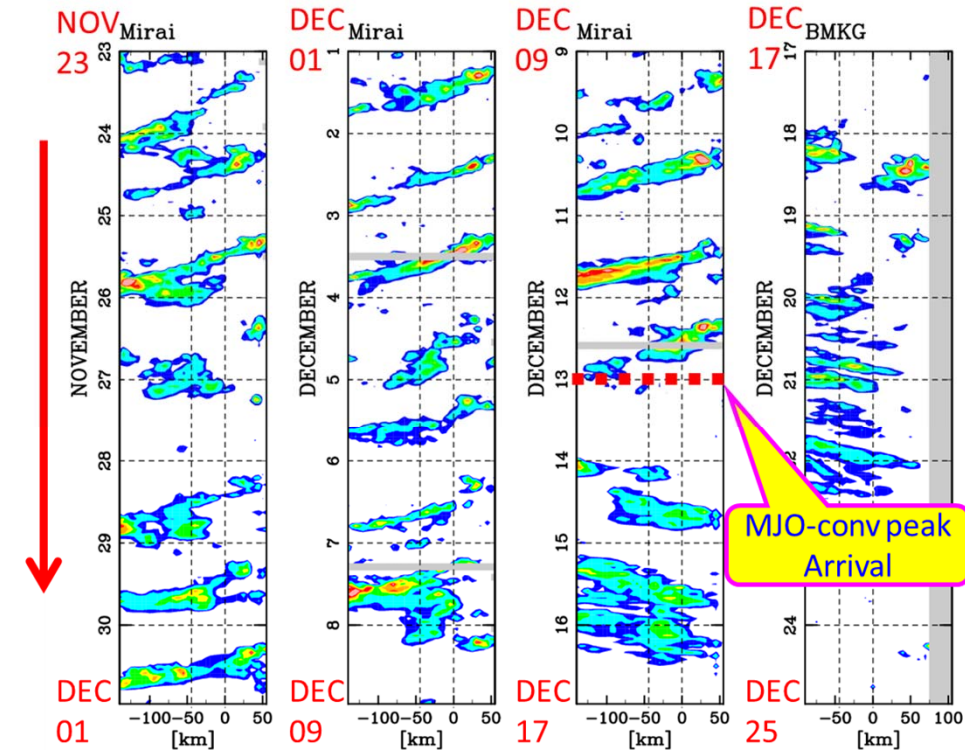


Rain (GSMaP) : <http://sharaku.eorc.jaxa.jp/GSMaP/>  
RMM: <http://www.bom.gov.au/climate/mjo/>

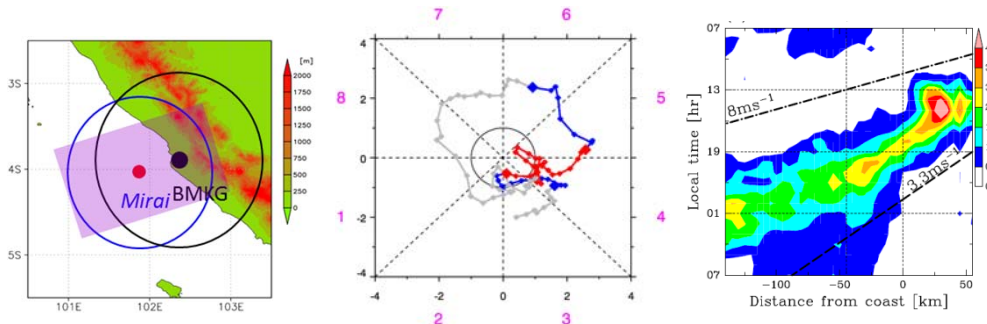


# Radar-derived Rain Rate as a function of time & distance from Coast Line

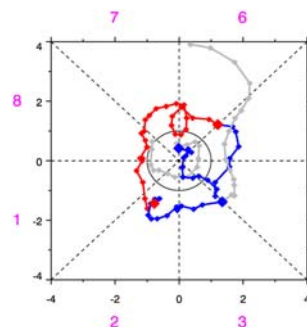
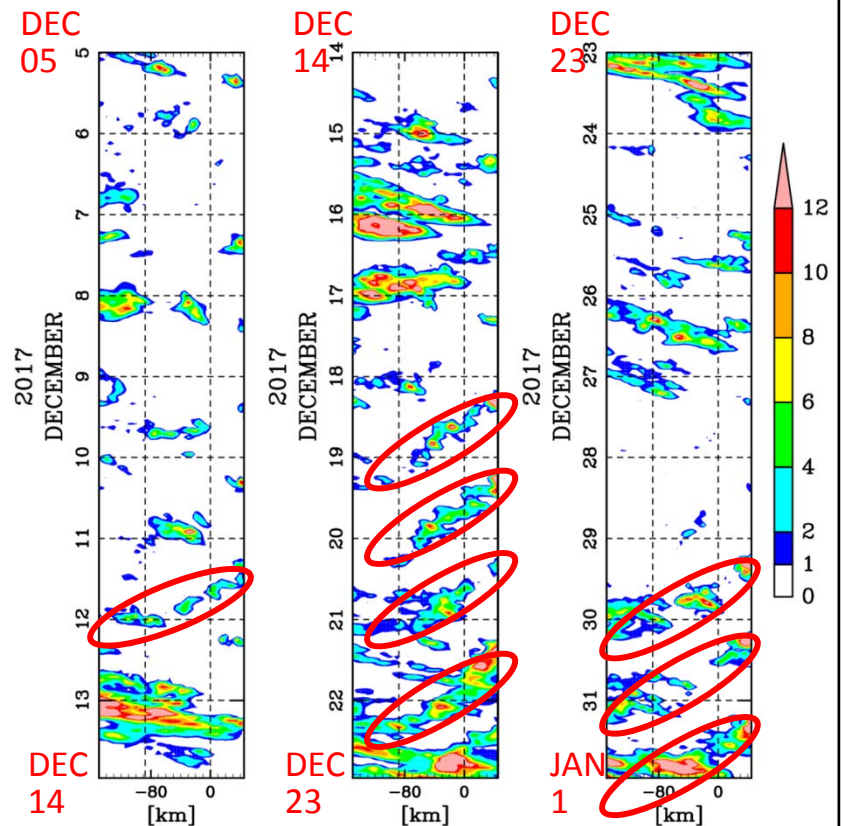
2015



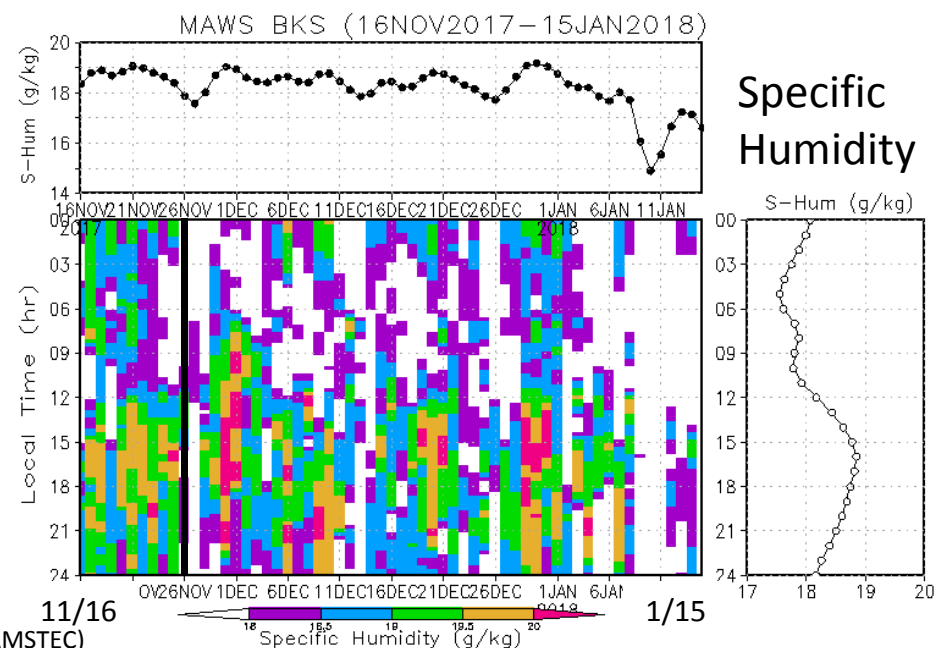
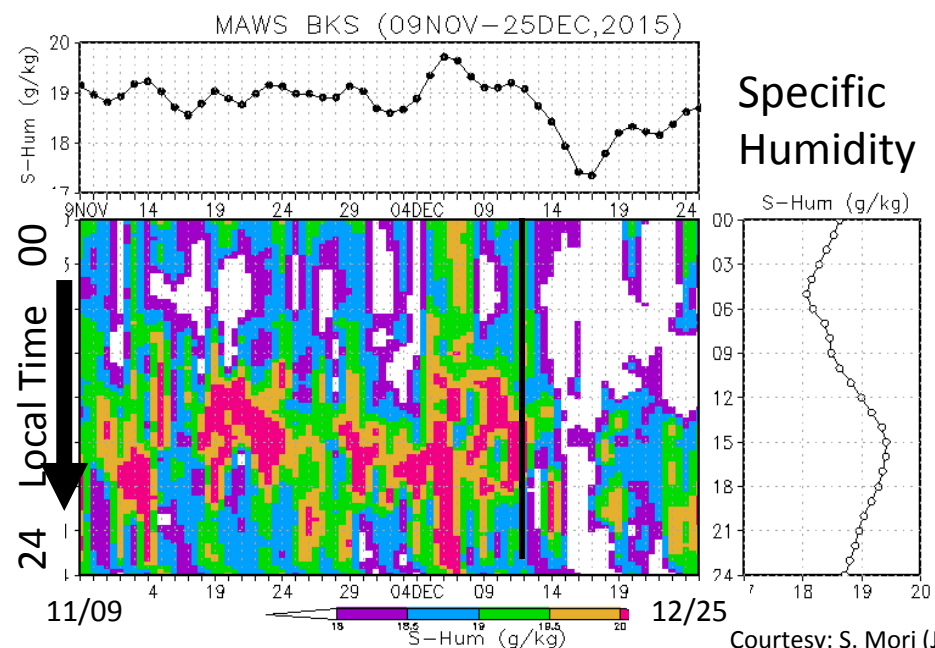
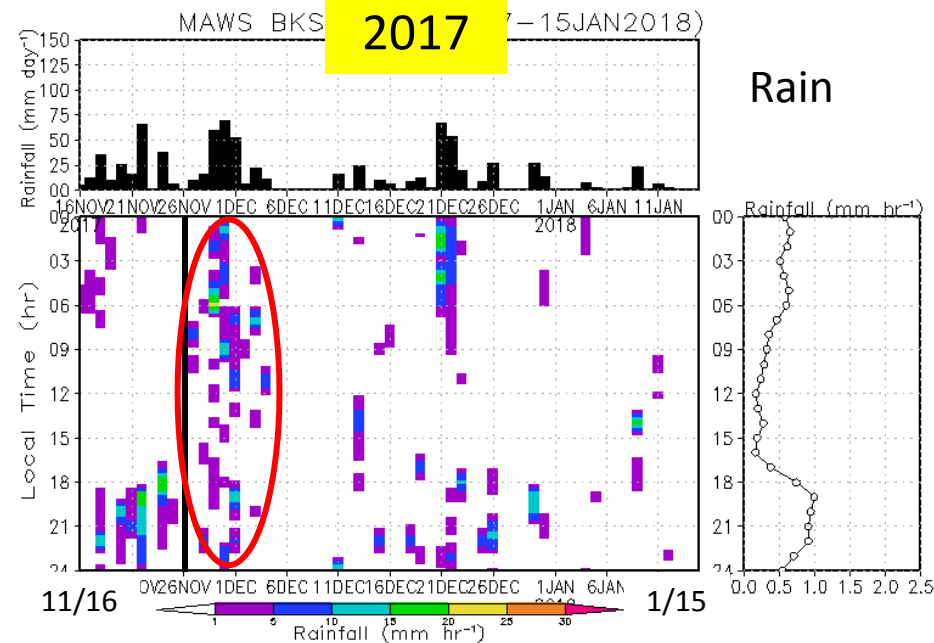
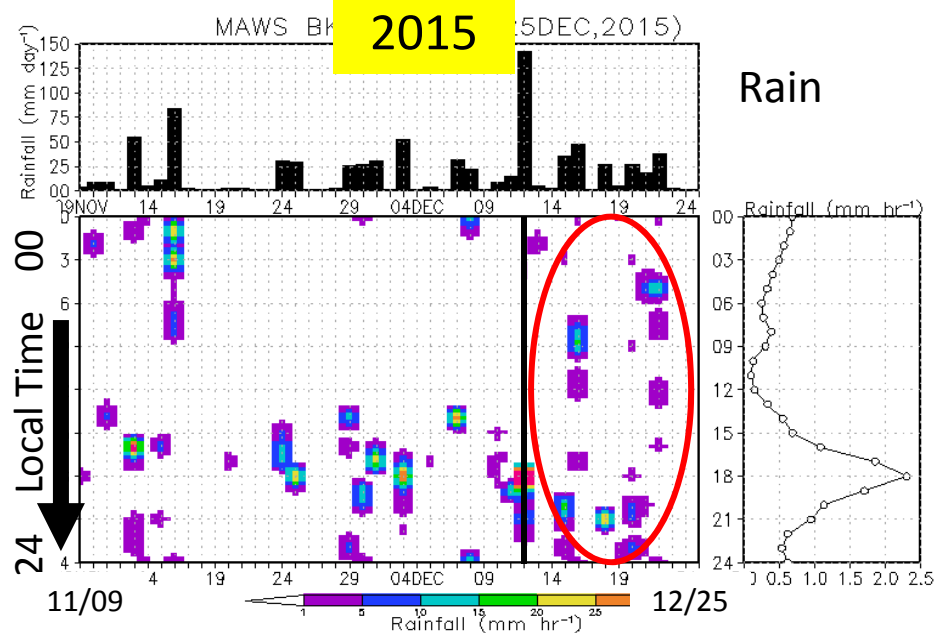
Offshore Land



2017



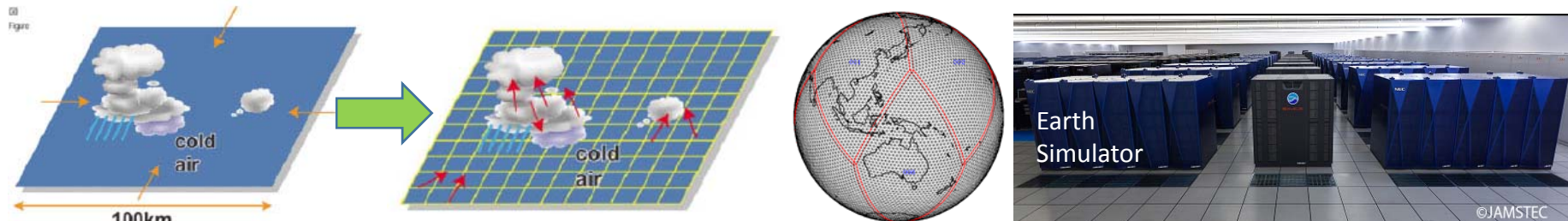
# Diurnal Cycle of Rain & Humidity - 2015 vs 2017 -



Courtesy: S. Mori (JAMSTEC)

# Near-Real time Forecasting using NICAM

Non-hydrostatic Icosahedral Atmospheric Model (NICAM) ... Global cloud-system resolving model



<http://nicamfcst.jamstec.go.jp/>



## Settings:

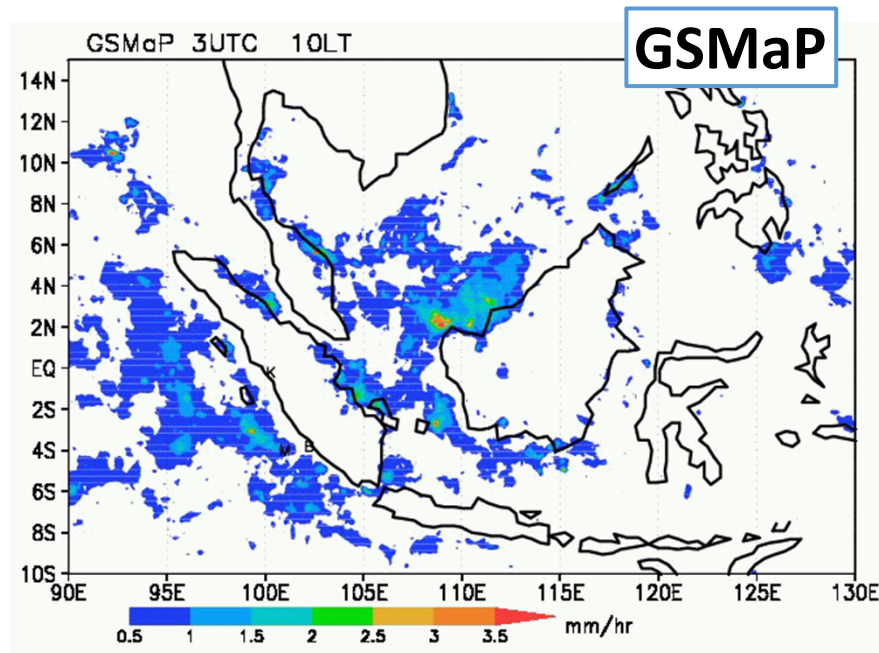
- cloud microphysics : NSW6 (Tomita 2008)
  - convective parameterization: off
  - turbulence : MYNN level 2
- (Nakanishi and Niino 2004; Noda et al. 2010)
- radiation : MSTRN X (Sekiguchi and Nakajima 2008)
  - land surface : MATSIRO
  - initial data : interpolated from NCEP final analysis (1.0x1.0)
  - SST: prescribed (daily climatology + initial anomaly)

Global 7-km mesh, 14-day forecast, daily update

Global 14-km mesh, 30-day forecast, weekly update



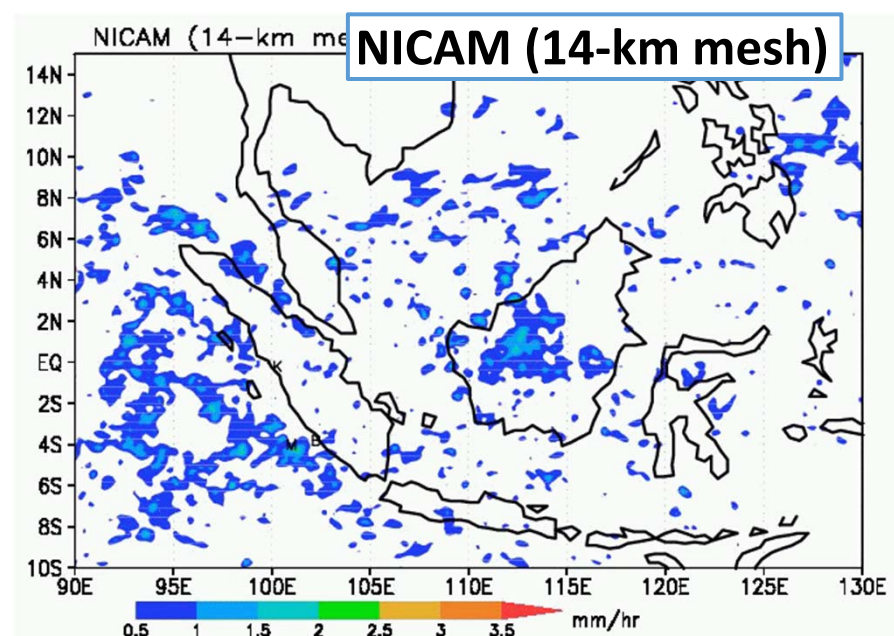
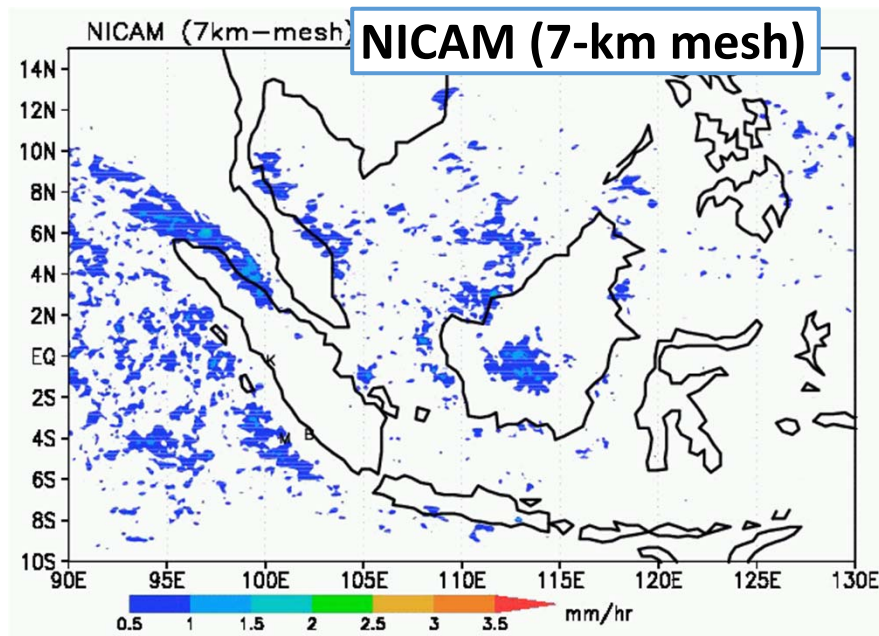
# Simulation - Diurnal Cycle of Rain during November 2015



NICAM Simulation shows:

- Weak coastal peak
- Phase delay by several hours  
→ better with high resolution
- Sharper peak along mountain

Courtesy of Dr. T. Nasuno (JAMSTEC)





## R/V Investigator Cruise

Purpose: Diurnal cycle vs. MJO, ITF, etc.

Period: Oct 19 - Dec 18, 2019

Courtesy: Dr. M. Wheeler (BoM)



RV Investigator – Australia's Marine National Facility



## TerraMaris

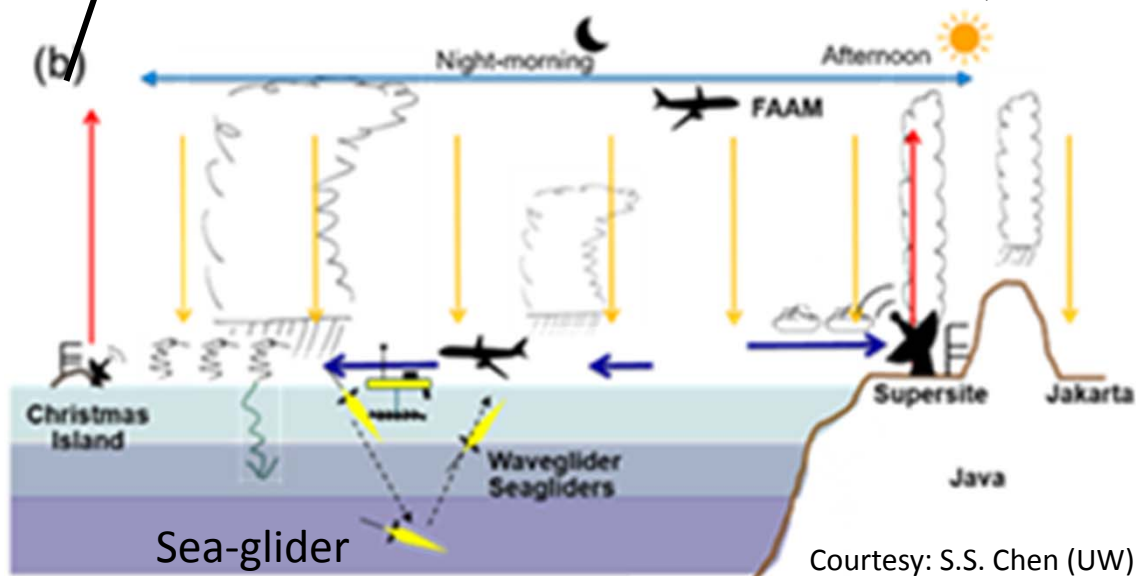
Purpose: Diurnal cycle vs. MJO

Period: Nov 2019 - Feb 2020



FAAM BAe-146

Courtesy : Dr. A. Matthews (UEA)  
Mr. P. Barrett (UKMet)



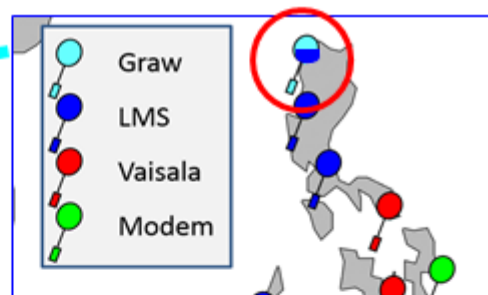
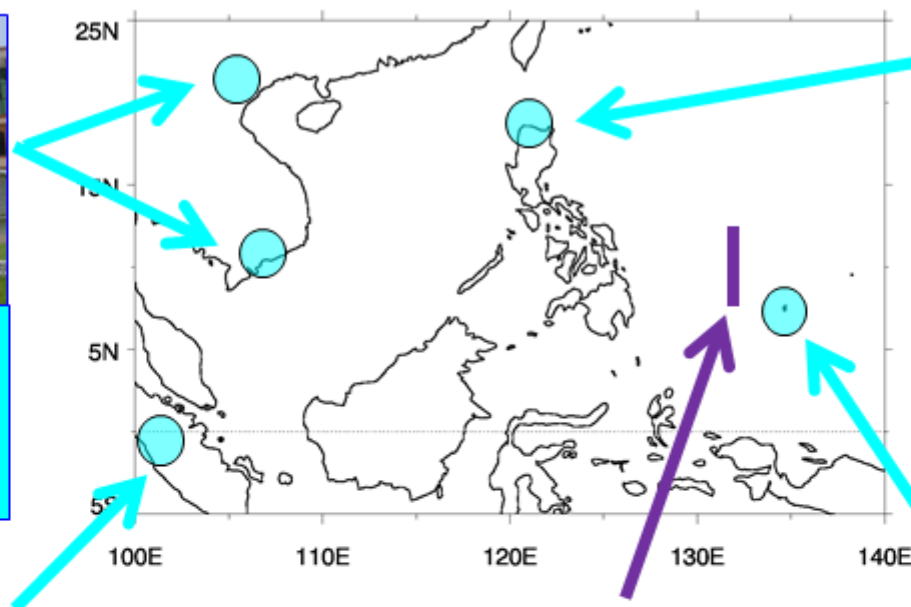
Courtesy: S.S. Chen (UW)

# IOP - Example (3) : YMC - BSM 2018

Main targets : Boreal Summer Monsoon focusing on Northward Propagating ISV  
 Period: July 1 – August 31, 2018  
 Participants: Japan (JAMSTEC, Kyoto Univ, NME), Philippines (PAGASA, UP),  
 Indonesia (LAPAN, BMKG), Viet Nam (NHMS), Palau (KWS)



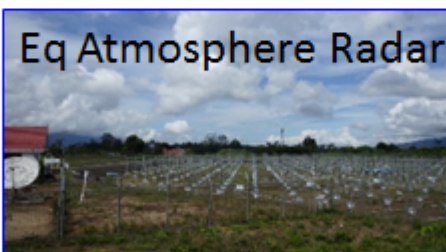
Ozone-sonde  
 (15 times) both at  
**Hanoi,**  
**Ho Chi Minh**



Radiosonde (4/day),  
 X-band MP Radar,  
 GNSS & AWS at **Laoag**



CFH



Eeq Atmosphere Radar

CFH/ECC/CPS-sonde (10 times)  
 & EAR operation at **Kototabang**



Wave-glider along 132E  
 at 8/10/12N



Radiosonde (4/day),  
 Lidar & AWS at **Palau.**

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Co-chairs of YMC Science Steering Committee

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- 1) What is the YMC ?
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- 3) **Data Management**
- 4) Concluding Remarks



# Data Policy & Management

YMC adopts “timely release & free/open sharing data policy”.

All QCed data will be opened from YMC data archive centers (web sites). Basically researchers are requested to provide QCed data within 1 year after the campaign.

We should keep in mind about  
“Availability” & “Accuracy”.

## Data Archive Centers

BMKG, Indonesia

<http://www.bmkg.go.id/ymc/>

JAMSTEC, Japan

<http://www.jamstec.go.jp/ymc/>



# “Availability” : Data Collection

## Main Activities

### 1) Data sharing

Through collecting, archiving, and sharing data from observing networks in the MC region, satellites, and NWP products, build a two-year comprehensive database for detailed documentation of multi-scale variability and interaction of the MC weather-climate system.

### 2) Field campaign

### 3) Modeling

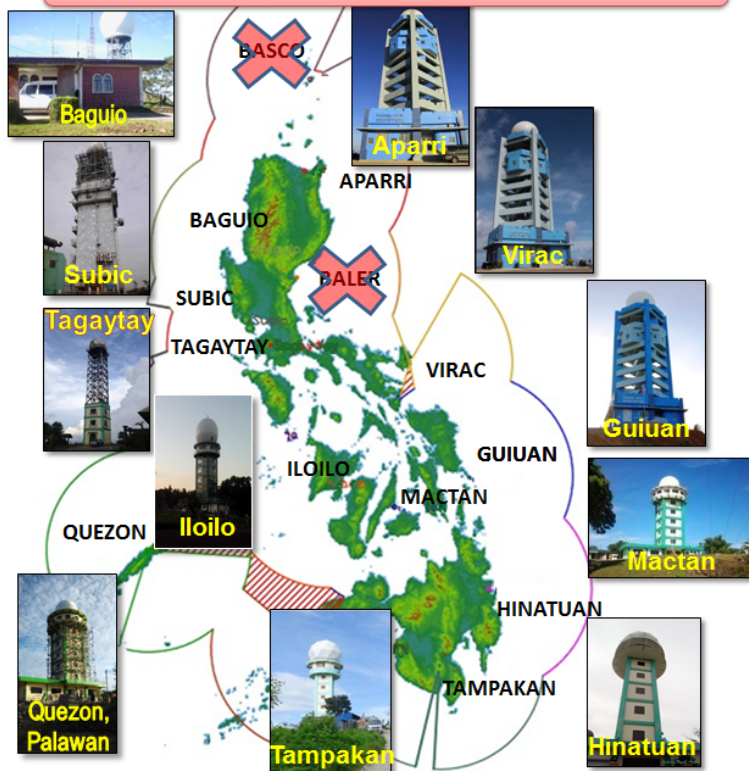
### 4) Prediction and applications

### 5) Outreaching and capacity building

# “Availability” : Data Collection

**Example.** Radar data collection from PAGASA Stations in the Philippines

## PAGASA RADAR NETWORK



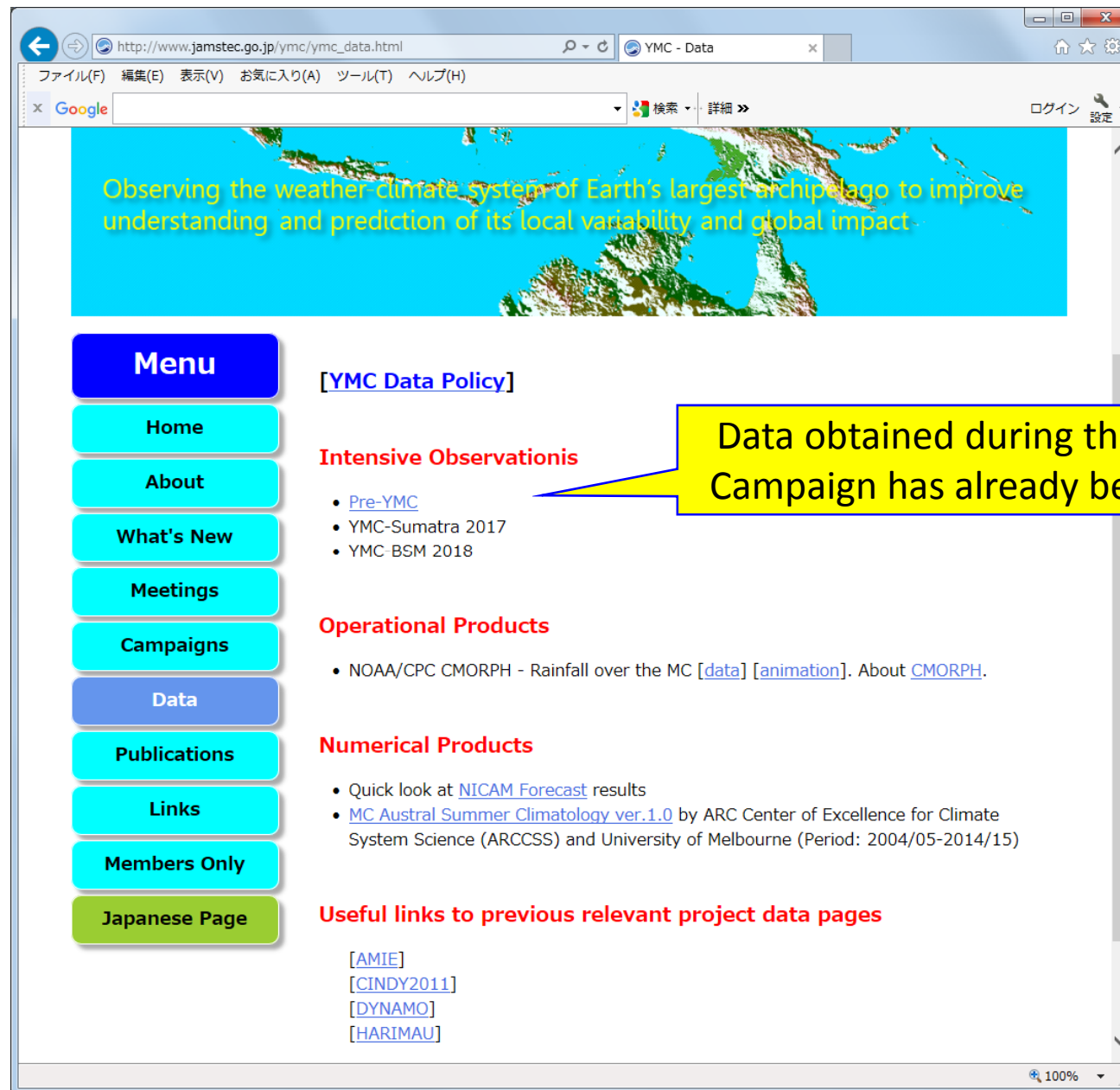
	2017								2018					
	7	8	9	10	11	12	1	2	3	4	5	6	7	
Appari	0	0	0	0	0	0	0	0	0	0	0	0	0	
Baguio	x	x	x	x	x	x	x	x	x	x	x	0	0	
Cebu	0	0	0	0	0	0	0	0	0	0	0	0	x	
Guiuan	x	x	x	x	x	x	x	x	x	x	x	x	x	
Hinatuan	0	0	0	0	0	0	0	0	0	0	0	0	0	
Iloilo	x	x	x	x	0	x	0	0	0	0	0	0	0	
Mactan	x	x	x	x	x	x	x	x	x	x	x	0	0	
Palawan	x	x	x	x	x	x	x	x	x	x	x	x	x	
Subic	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tagaytay	0	x	0	0	x	x	0	0	0	0	0	0	0	
Tampakan	x	x	x	x	x	x	x	x	0	0	0	0	x	

Courtesy of





# “Availability” : Data Release from YMC Web site



The screenshot shows a web browser window with the URL [http://www.jamstec.go.jp/ymc/ymc\\_data.html](http://www.jamstec.go.jp/ymc/ymc_data.html). The page features a header with a map of the Indonesian archipelago and the text: "Observing the weather-climate system of Earth's largest archipelago to improve understanding and prediction of its local variability and global impact".

**Menu**

- Home
- About
- What's New
- Meetings
- Campaigns
- Data**
- Publications
- Links
- Members Only
- Japanese Page

**[YMC Data Policy]**

**Intensive Observationis**

- [Pre-YMC](#)
- YMC-Sumatra 2017
- YMC-BSM 2018

**Operational Products**

- NOAA/CPC CMORPH - Rainfall over the MC [[data](#)] [[animation](#)]. About [CMORPH](#).

**Numerical Products**

- Quick look at [NICAM Forecast](#) results
- [MC Austral Summer Climatology ver.1.0](#) by ARC Center of Excellence for Climate System Science (ARCCSS) and University of Melbourne (Period: 2004/05-2014/15)

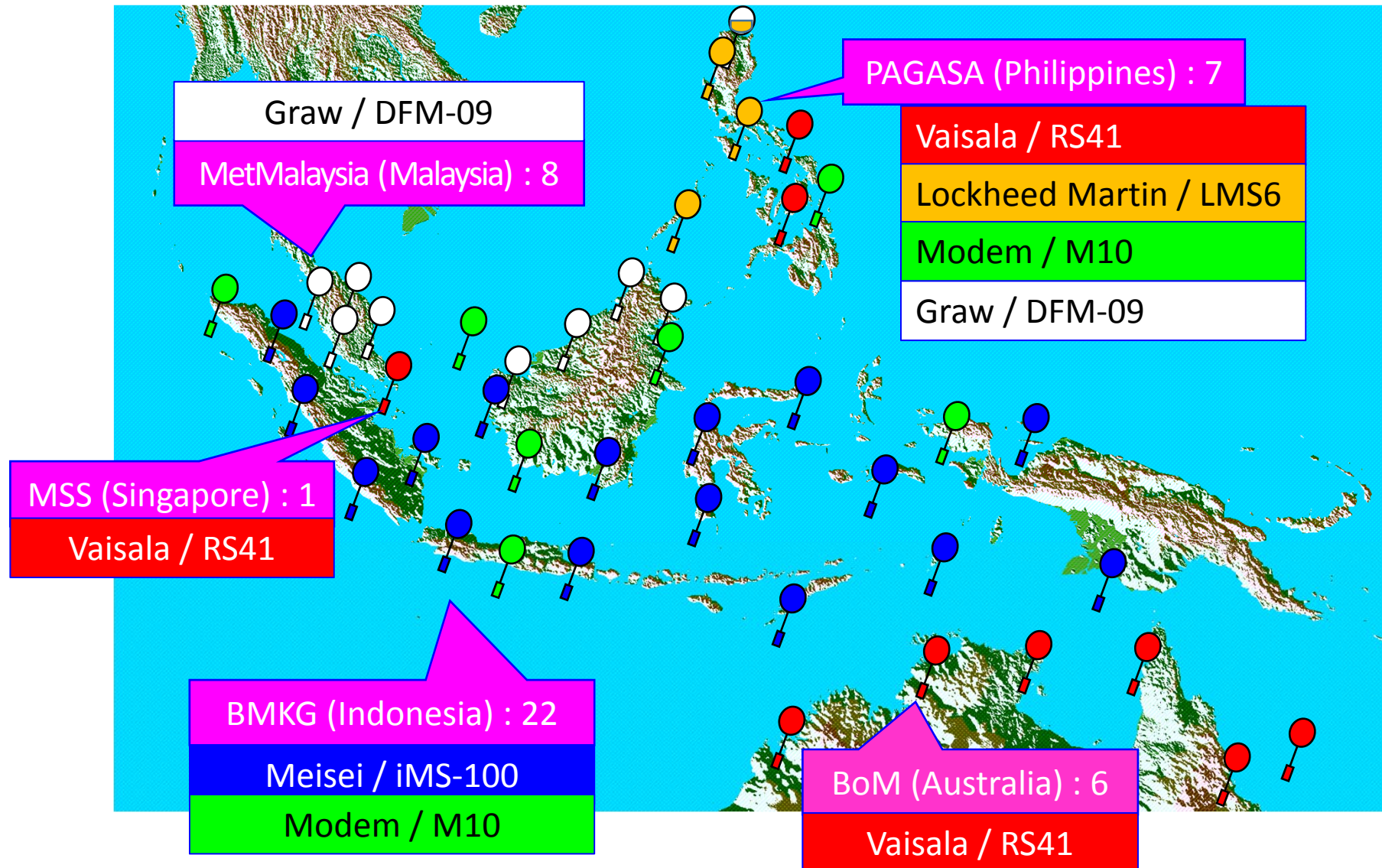
**Useful links to previous relevant project data pages**

- [\[AMIE\]](#)
- [\[CINDY2011\]](#)
- [\[DYNAMO\]](#)
- [\[HARIMAU\]](#)

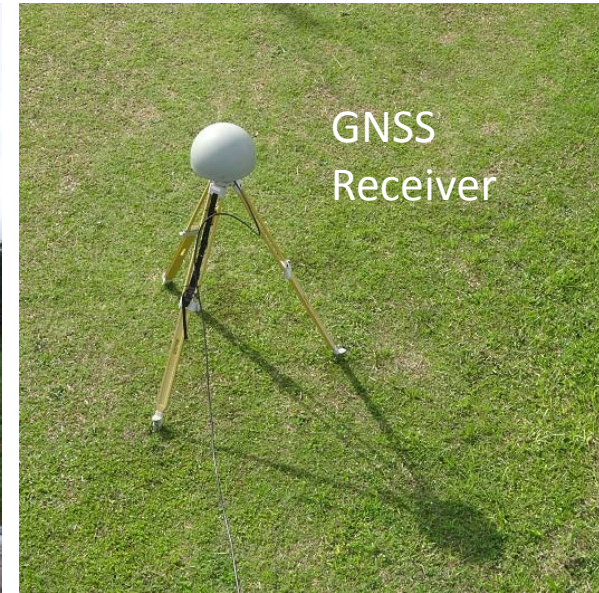
A yellow callout box points to the "Intensive Observationis" section with the text: "Data obtained during the Pilot Study Campaign has already been released."

# "Accuracy" : Data Correction

Operational Radiosonde Observations by the MC Meteorological Agencies



# Intercomparison during YMC-Sumatra 2017



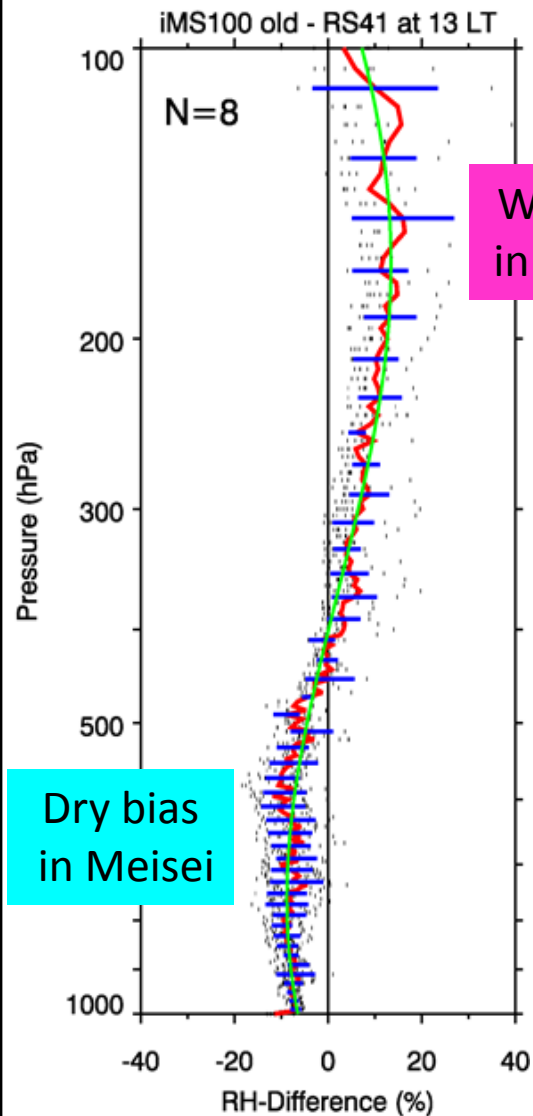
Inter-comparison: 18 times (10 daytime, 5 dawn/dusk, 3 nights)

- 1) Meisei (iMS-100) ... BMKG Routine observations + IOP
- 2) Vaisala (RS41-SGDP) ... onboard the R/V MIRAI
- 3) CFH (Cryogenic Frost-point Hygrometer) ... 7 times
- 4) GNSS-derived Water Vapor



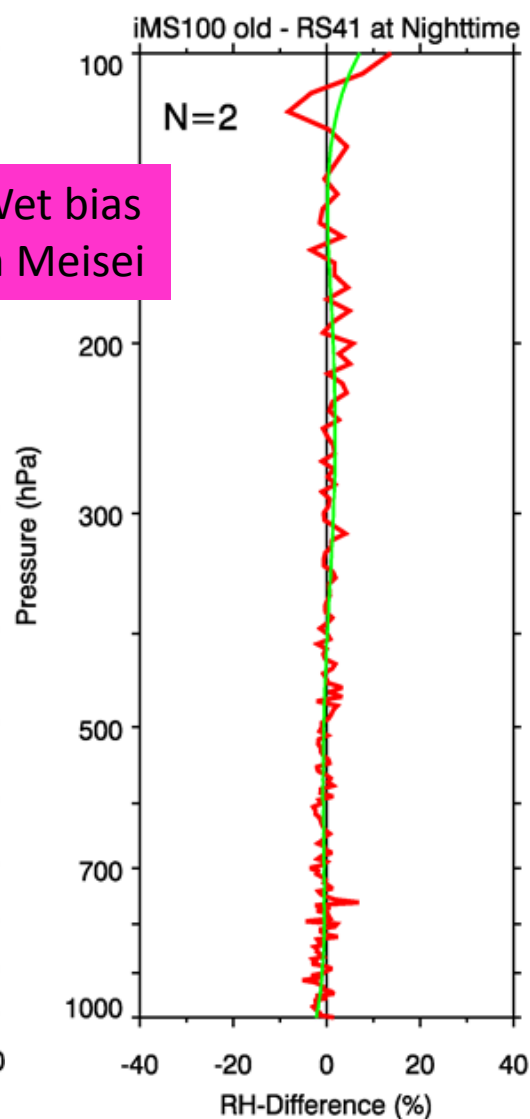
# Intercomparison during YMC-Sumatra 2017

Daytime



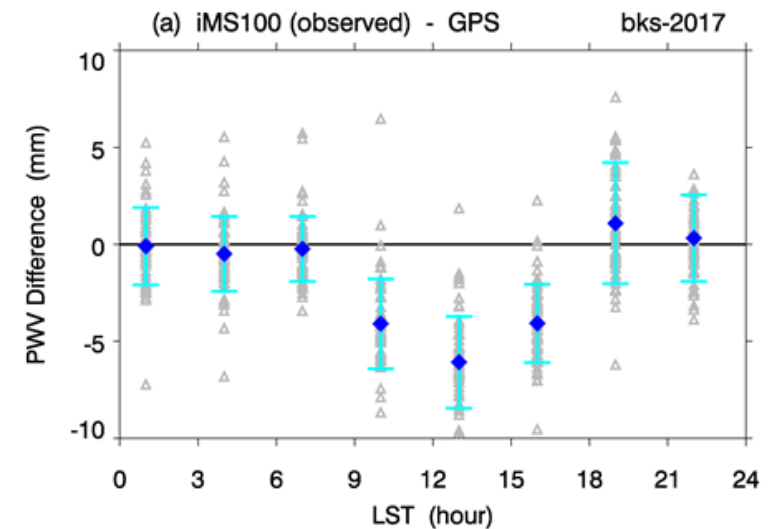
Dry bias  
in Meisei

Nighttime

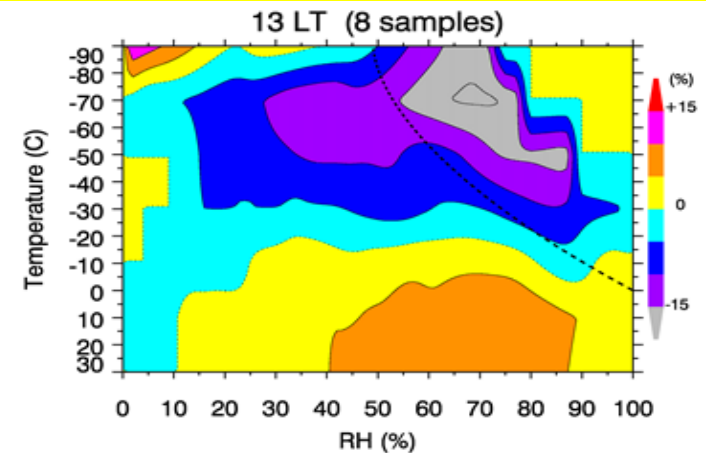


Wet bias  
in Meisei

Precipitable Water Vapor  
Sonde (Meisei) - GNSS

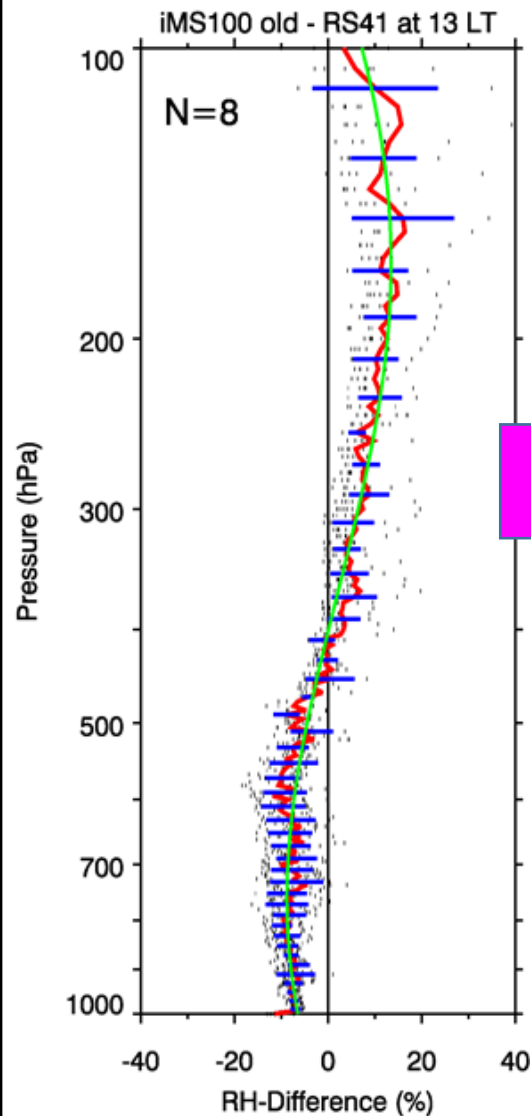


Correction based on intercomparison

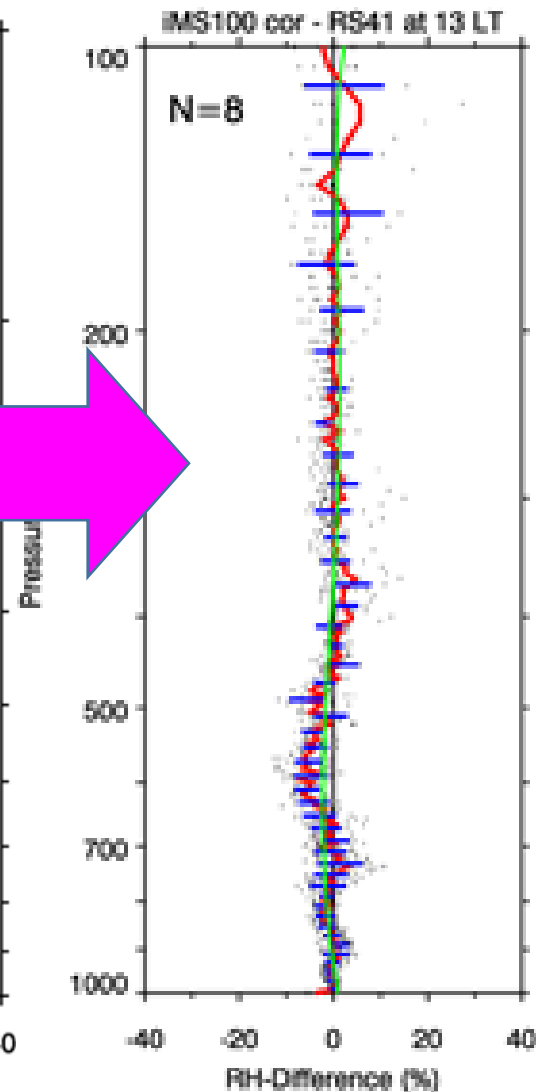


# Intercomparison during YMC-Sumatra 2017

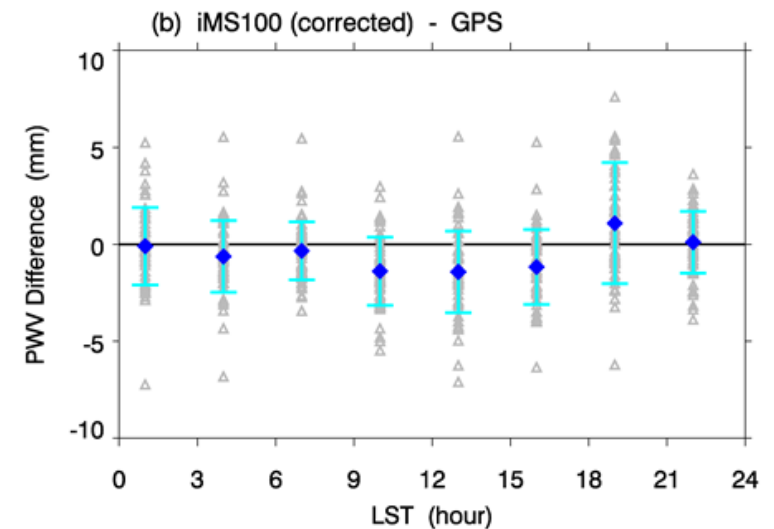
Before



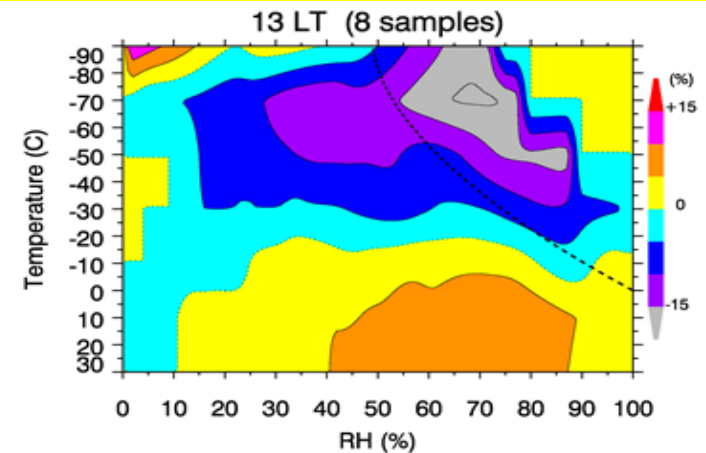
After



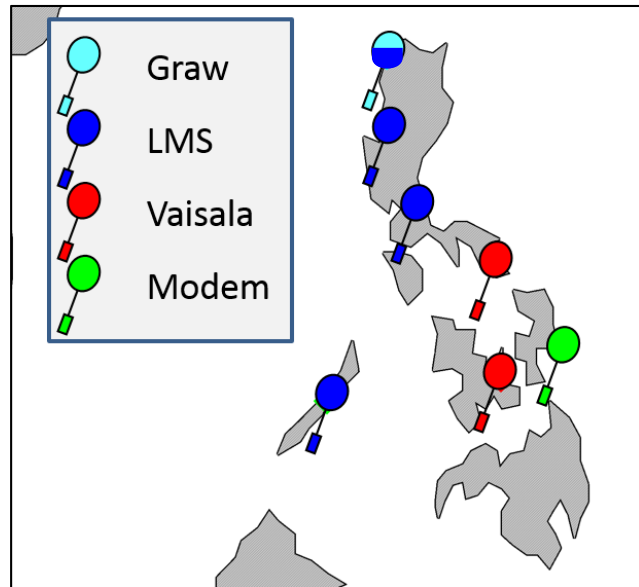
Precipitable Water Vapor  
Sonde (Meisei) - GNSS



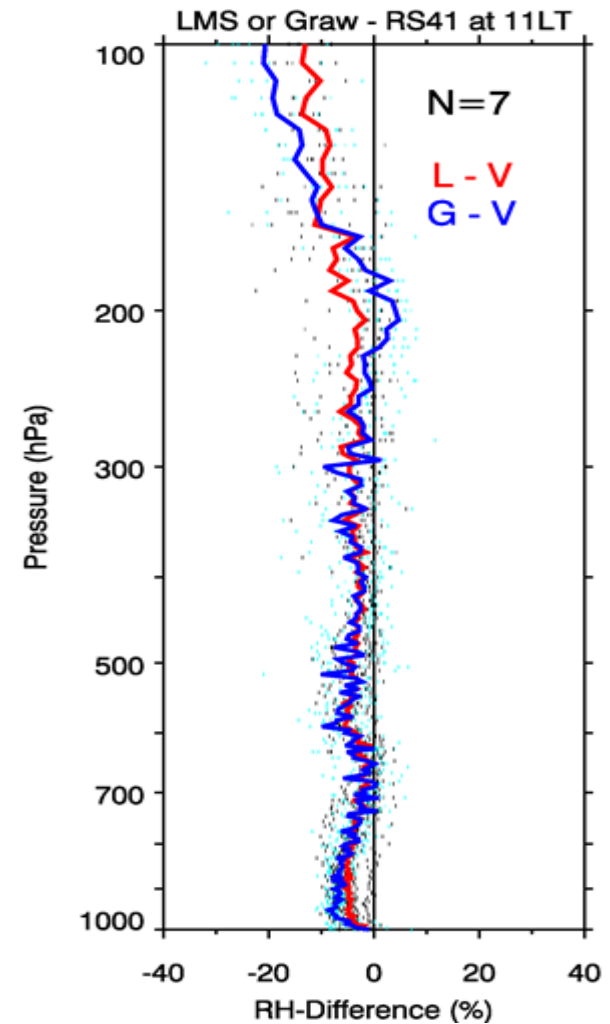
Correction based on intercomparison



# Intercomparison during YMC-BSM 2018 at Laoag



Intercomparison among different types of radiosonde (Graw, LMS, and Vaisala) has been done at PAGASA Laoag station during July 27 – Aug. 2, 2018.





# Years of the Maritime Continent (YMC) – Current & Future

Kunio Yoneyama (JAMSTEC)  
& Chidong Zhang (NOAA/PMEL)  
Co-chairs of YMC Science Steering Committee

## Outline

- 1) What is the YMC ?
- 2) Field Campaigns – Intensive Observation Periods (IOPs)
- 3) Data Management
- 4) Concluding Remarks

## Concluding Remarks

- 1) YMC field campaign has started since July 2017, and its first IOP has been conducted west coast of Sumatra during Nov 2017 – Jan 2018. Currently, several IOPs focusing on the boreal summer monsoon & ISO have been conducted around the Philippine Sea.
- 2) So far, 12 IOPs have been funded, and one proposed project is under review.
- 3) While quality control for observations have been made, many preliminary results have been brought out by the IOP participants. YMC sessions have been arranged at various scientific meetings including AGU, AMOS, AOGS, etc. QCed data will be available through YMC Archive Centers in a timely manner.
- 4) Currently, YMC is scheduled to continue until early 2020, when the last IOP campaign is expected to take place. However, another discussion has been initiated to extend it as Phase-2. It will not be the same as the current one, but it will mainly focus on interaction among MC-local and international scientists to verify the improvement of numerical prediction skill.

## Purpose

To expedite progress of improving our understanding and prediction skill of local multi-scale variability of the MC weather-climate systems and its global impact.

## Participants

Over 70 institutes/universities from  
Australia, China, France, Germany, Indonesia, Italy,  
Japan, Korea, Malaysia, Mexico, NZ, Palau, Philippines,  
Poland, Singapore, Taiwan, Thailand, UK, US, Vietnam  
(as of July 2017)

## Period

July 2017 – early 2020

## Main Science Themes

- 1) Atmospheric convection (ex. Diurnal cycle, MJO, monsoon)
- 2) Ocean and air-sea interaction
- 3) Stratosphere-troposphere interaction
- 4) Aerosols
- 5) Prediction

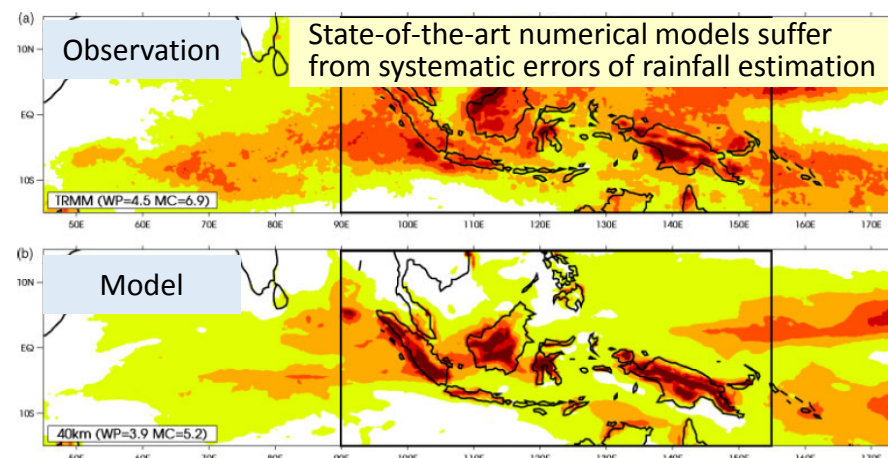
## Main Activities

- 1) Data sharing
- 2) Field campaign
- 3) Modeling
- 4) Prediction and applications
- 5) Outreach and capacity building

## Remarks

YMC has been endorsed by many international bodies including WMO/WWRP, WCRP/CLIVAR, etc.

<http://www.bmkg.go.id/ymc/>  
<http://www.jamstec.go.jp/ymc/>



Comparison of monthly mean rainfall for February.  
Taken from Love et al. (2011)

**Key:**  
YMC campaign consists of;  
1) Intensive Obs + Modeling, &  
2) Long-term routine obs.

