



# Radar Network in Southeast Asia

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# I. Introduction

- Challenges in Southeast Asia
- Benefits of regional radar network in Southeast Asia

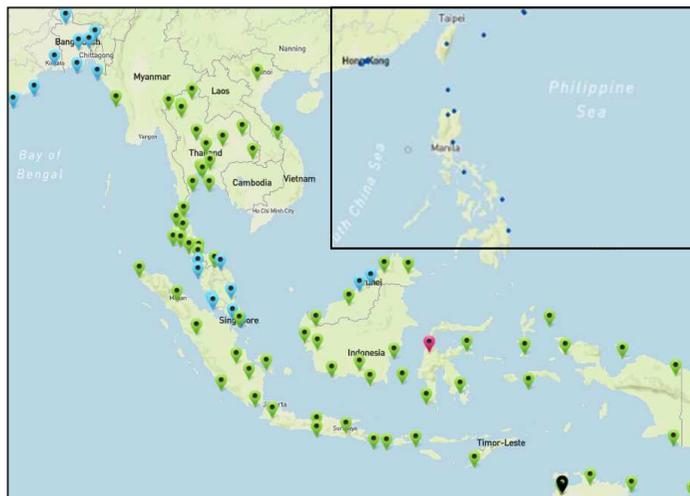
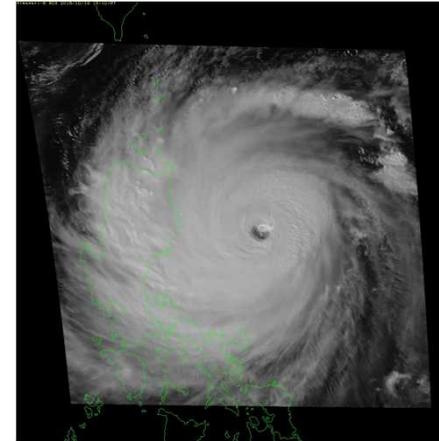
# Challenges in Southeast Asia

- Disaster Risk Reduction (DRR) is a common challenge for NMHSs, especially in Southeast Asia where natural disasters caused by heavy rain highly impact on the society.
- It is essential to monitor the real-time rainfall situation widely and accurately in order to mitigate risks by the disasters.
- To this end, NMHSs in the region have developed weather radar observation for years.



# Challenges in Southeast Asia

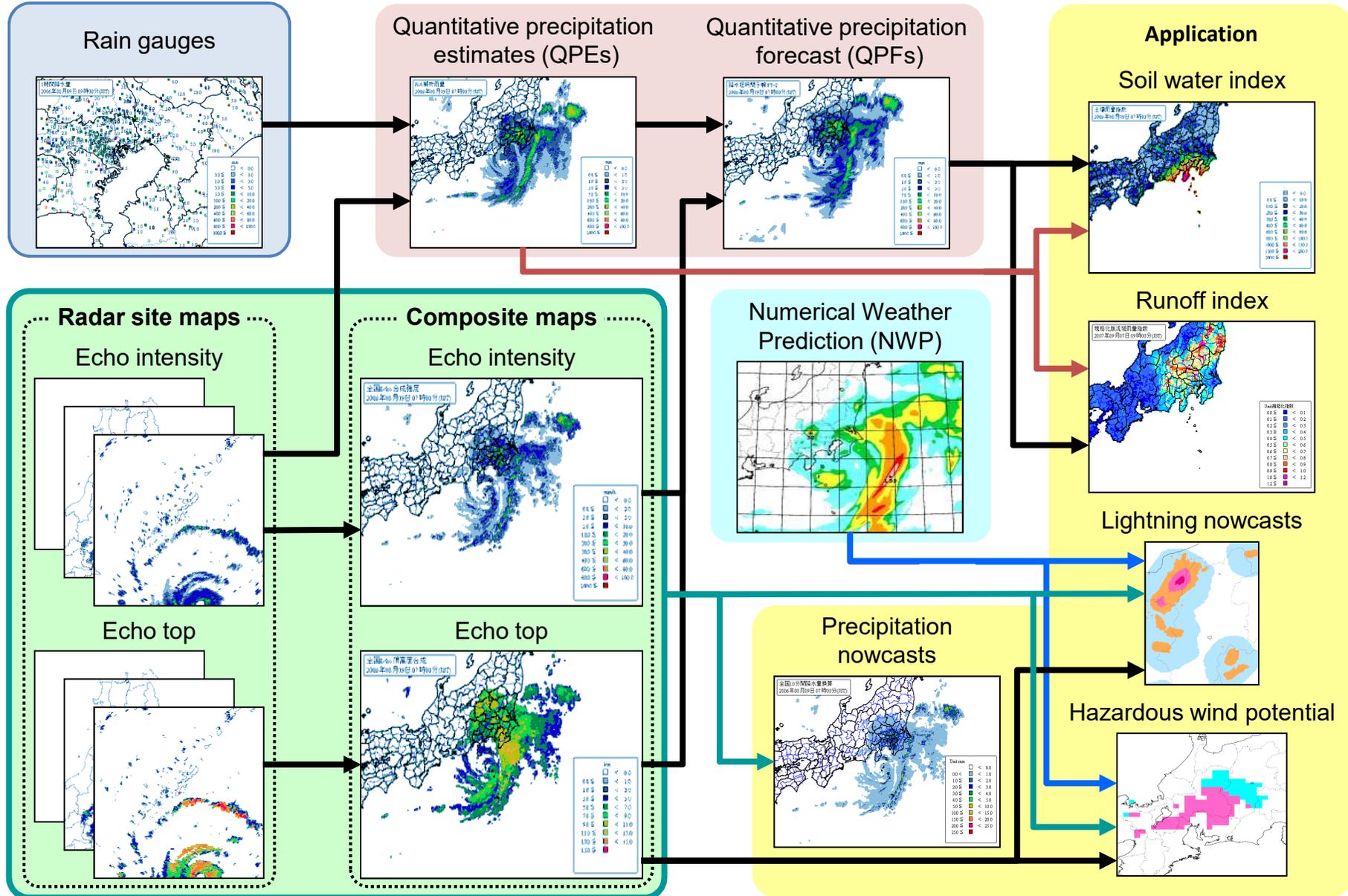
- To enhance ability of NMHSs, it has been desired for long to produce a regional radar network as countries border on others in Southeast Asia.



Weather radars in Southeast Asia  
(As of Oct. 2023)

- At the same time, radar-related techniques of NMHSs need to be improved to maximize potential of the regional radar network as well as each domestic network.

# Inter-product Correspondence



## Benefits of Regional Radar Network in Southeast Asia

- Sharing knowledge of radar observation and operation, and exchanging Radar data and producing regional radar composite map
  - connect to capacity building in radar observation techniques (e.g. data processing, data management, and data application) in each country.
  - Enhancing the capacity to monitor and forecast cross-border rainfall and severe weather.
- Furthermore, by working with hydrological institutions in each country, the capacity leads to;
  - Enhancement of management of major international rivers; and,
  - Efficient early warning to support National DRR.

## II. Three Frameworks underpinning the regional radar network

- Toward the identical goal of developing NMHS's capacity and creating a regional radar network, lots of activities have been conducted under three frameworks.



- ESCAP/WMO Typhoon Committee
  - Annual Operational Plan's radar project



- WMO
  - RA II/V Joint Regional WIGOS Project

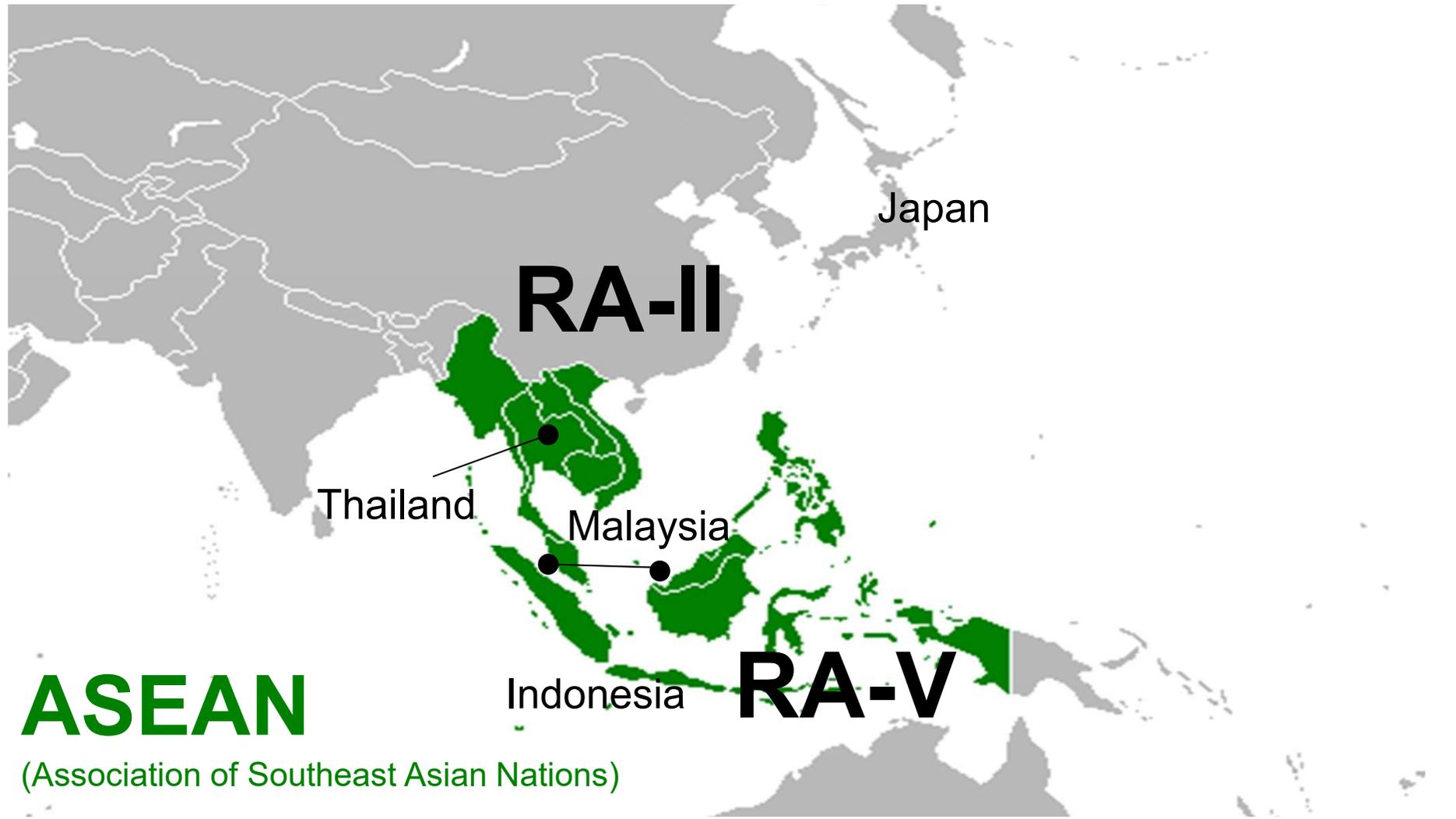


- ASEAN
  - SCMG's radar project

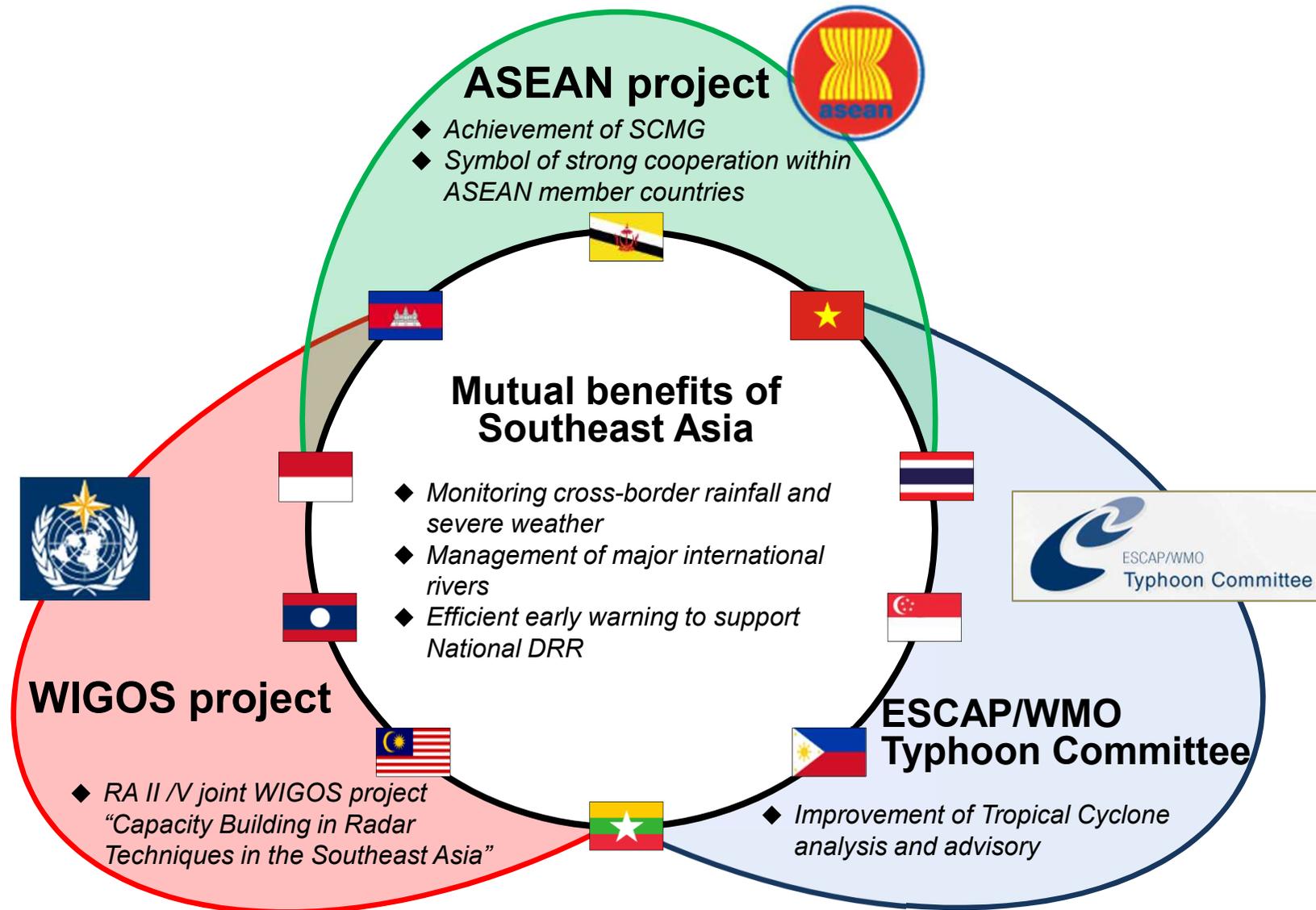
WIGOS: WMO Integrated Global Observing System  
SCMG: Sub-Committee on Meteorology and Geophysics



# ASEAN and WMO Regions



# Synergies of Radar Projects



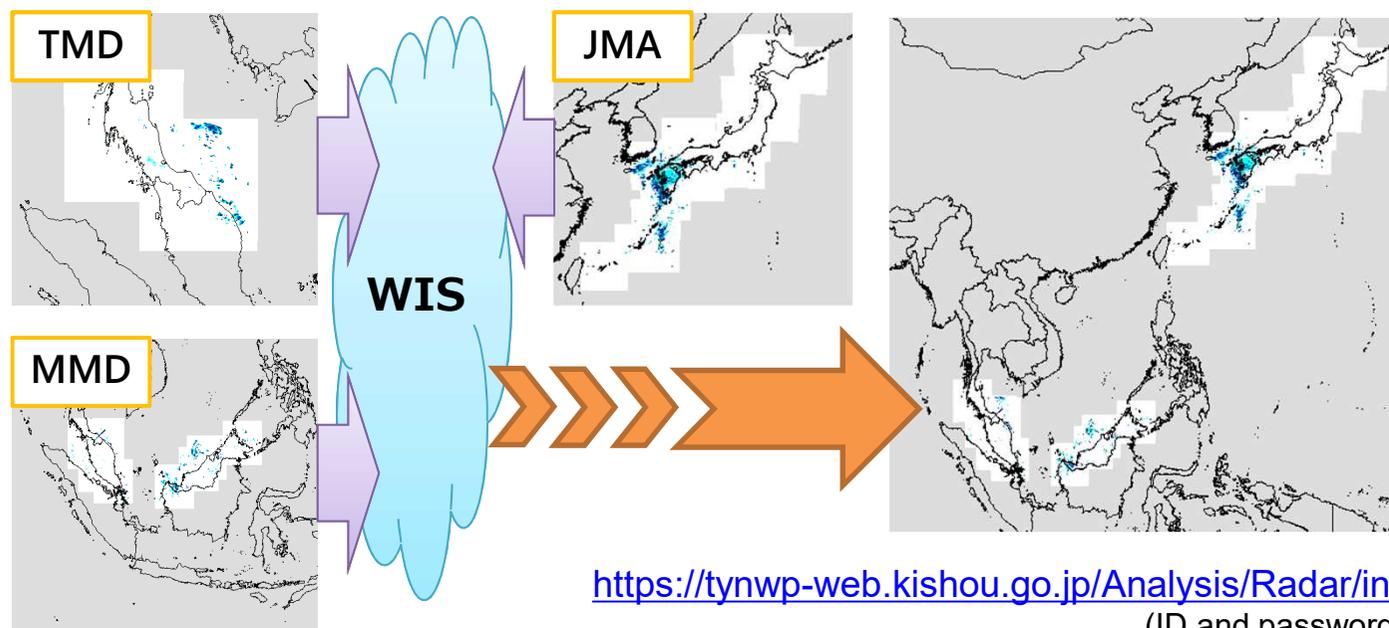


# 1. ESCAP/WMO Typhoon Committee Activity

- The project “Development of regional radar network” has been conducted under the ESCAP/WMO Typhoon Committee as part of its Annual Operating Plans (AOPs) since 2011.
- Participating members have expanded from TMD and JMA to many NMHSs in Southeast Asia.
- Throughout the project, technical cooperation has been conducted and a series of technical meetings have been held annually.

# 1. ESCAP/WMO Typhoon Committee Activity

- The experimental exchange of domestic radar composite data among TMD, MMD and JMA started on 10 November 2016.
- Radar composite imageries using the exchanged data has been shared with Typhoon Committee Members since 25 October 2017 on the RSMC Tokyo - Typhoon Center's NTP website.



## 2. RA II/V Joint Regional WIGOS Project

- The RA II/V Joint Regional WIGOS Project “Capacity Building in Radar Techniques in Southeast Asia” was continuously approved by the RAs.
  - Project term 2013-2016: RA II-15 (Qatar, Dec. 2012)
  - Project term 2017-2020: RA II-16 (UAE, Feb. 2017)  
and RA V-16 (Tonga, Oct. 2018)
  - Project term 2021-2024: RA II-17 (Online, Sep. 2021)

RA: WMO Regional Association

## 2. RA II/V Joint Regional WIGOS Project

- The project's latest approval of was made at the RA II-17 (Online, Sep. 2021).
  
- Project term: 2021-2024
- Deliverables:
  1. Improvement of data quality of existing radars
  2. Development and expansion of national radar networks
  3. Near real-time international exchange of radar data

### 3. ASEAN-SCMG's radar project

- ASEAN Members report their current situation and progress on weather radars at annual SCMG meeting every year.
- Radar workshops approved by SCMG were held in 2014 and 2018.
- This workshop followed the previous radar workshops held in 2014 and 2018.

# ASEAN Radar Workshop

(Bangkok, Thailand, Feb.-Mar. 2014)



- Proposed jointly by MMD and TMD
- Hosted by TMD
- Attended by ASEAN Members
- Led by Japanese experts from JMA, radar manufacturer and University



- The early step toward ASEAN radar network
- Active discussion was conducted and made the workshop successful.

# Joint RA II/V Workshop on WIGOS for DRR

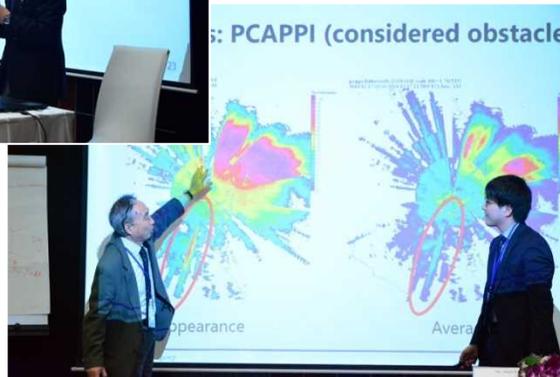
(Jakarta, Indonesia, 12-14 October 2015)

- The workshop hosted by BMKG concluded the Jakarta Declaration which refers to the importance of improvement of radar quality and development of regional radar network in Southeast Asia.



# WMO/ASEAN Radar Workshop

(Bangkok, Thailand, 5-13 February 2018)



- Proposed and hosted by TMD
- Attended by nine NMHSs from ASEAN Members and Bangladesh
- Led by experts from JMA, WMO's radar expert team (IPET-OWR) and radar manufacturers

- Participants learned the importance of improvement of radar data quality and discussed the way to expand the regional radar network in Southeast Asia



- **Technical meetings and workshops (2021-)**

- Under a Regional WIGOS project and the ESCAP/WMO Typhoon Committee's project

- [Technical meeting on regional weather radar network for Southeast Asia 2021](#) (11-12 November 2021, online)

- [Weather Radar Workshop](#) (31 January - 2 February 2023, Tokyo)

- [Weather Radar Workshop 2023](#) (11 - 13 October 2023, Tokyo)

- Workshops with specific themes toward a comprehensive approach to challenges regarding radar observation in Asia
  - Network design, planning, procurement, installation, and implementation
  - Operation, maintenance and application

- ✓ Highlighted and discussed the current situations and challenges of attendee countries in weather radar
- ✓ Underlined the significance of data exchange within the regional radar network and engagement in technical collaboration
- ✓ Reviewed current directions and plans for data exchange under the Southeast Asian radar project
  - Agreed to proceed with data exchange support for NMHSs.



Technical meeting on regional weather radar network for Southeast Asia 2021 (11-12 November 2021)



Weather Radar Workshop (31 January - 2 February 2023, Tokyo)



Weather Radar Workshop 2023 (11 - 13 October 2023, Tokyo)



### III. Status and future plan of radar data exchange in Southeast Asia

- Experimental exchange of radar composite data
- Future challenge

# Guidelines for the experimental radar data exchange

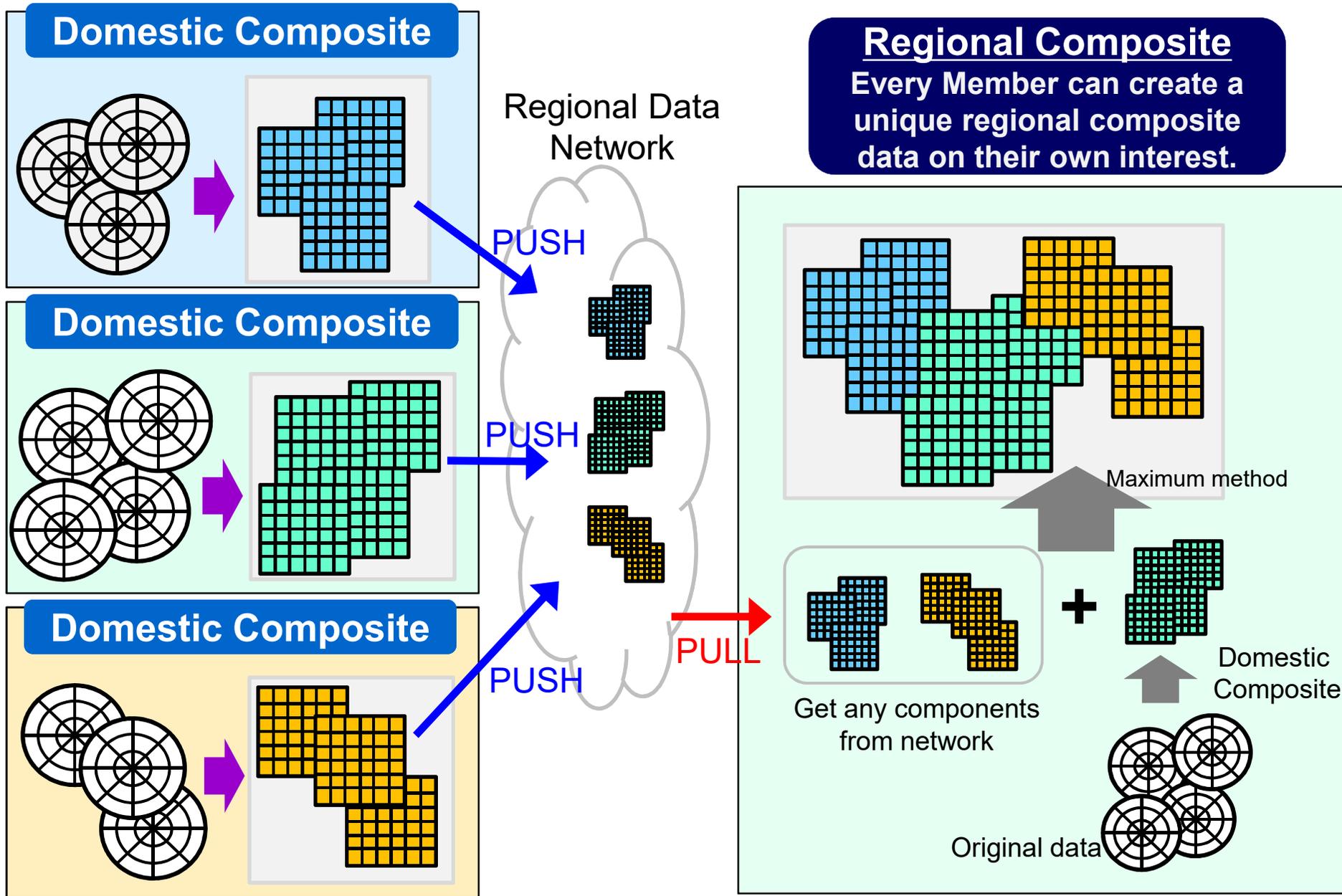
- The “*Guidelines for the Participation in Experimental Regional Radar Composite Data Exchanges in Southeast Asia*” was drafted in 2019 by BMKG, MMD, TMD and JMA.
- JMA has sent official letters with the Guidelines to the participants (BMKG, MMD, TMD, VNMHA and MSS) respectively, and they sent back letters with their acceptance.
  - VNMHA participated in May 2022
  - MSS newly participated in April 2023.
- Any applicants can join the experimental data exchanges upon agreeing with the Guidelines.
- The Guidelines can be updated anytime with consensus of all participants at that time.

# The Outline of the Guidelines

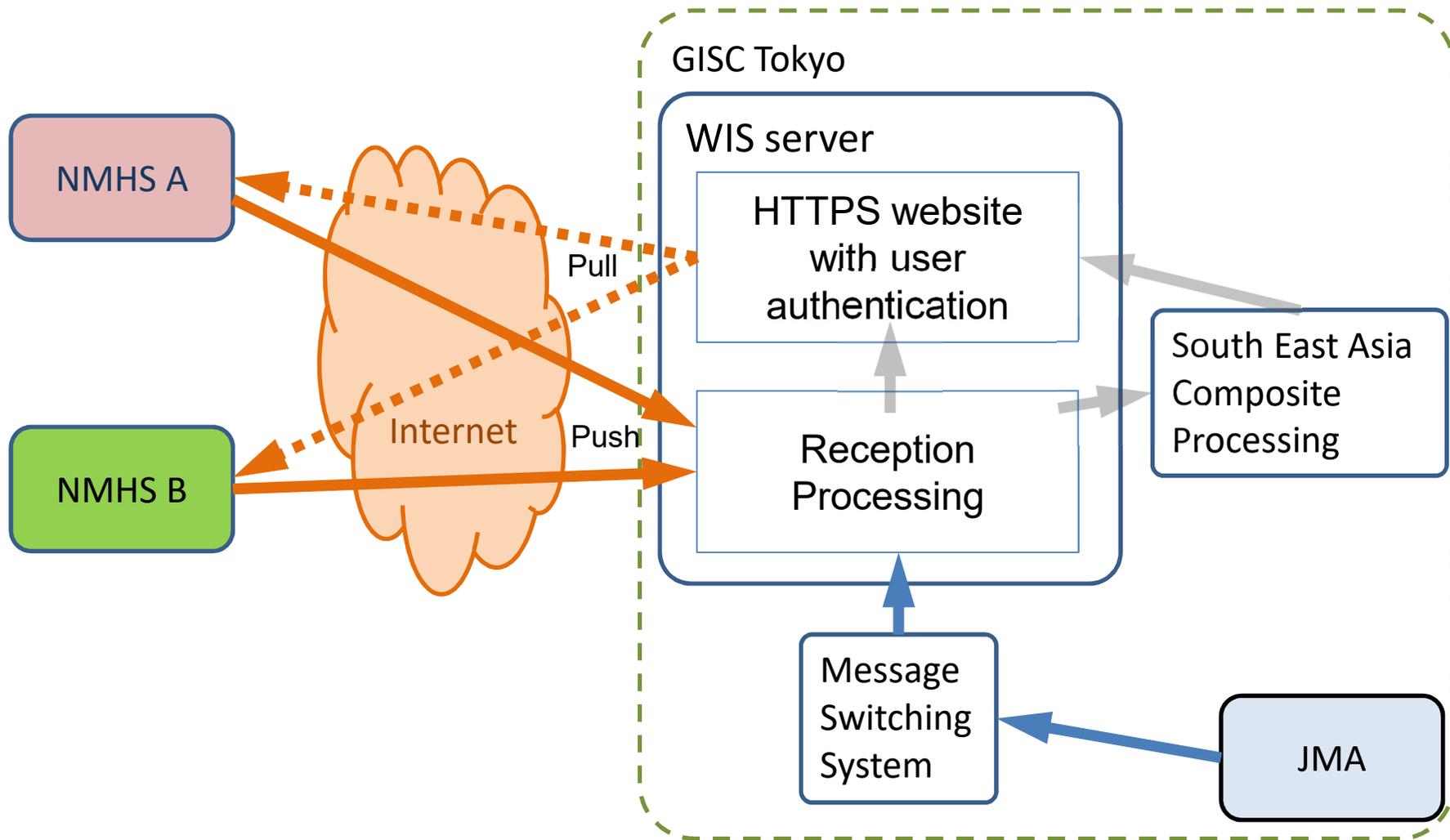
## *- Guidelines for the Participation in Experimental Regional Composite Data Exchanges in Southeast Asia -*

- Guiding Principle
- Radar Composite Data Exchanges
  - To exchange nationwide composite data on a real-time basis
  - To provide technical information to other members
  - To use the exchanged data for members' internal use in principle
  - To be implemented on a reasonable effort basis
- Technical Cooperation
  - To provide other members with technical assistance
- Focal Points

# How regional radar data exchange work

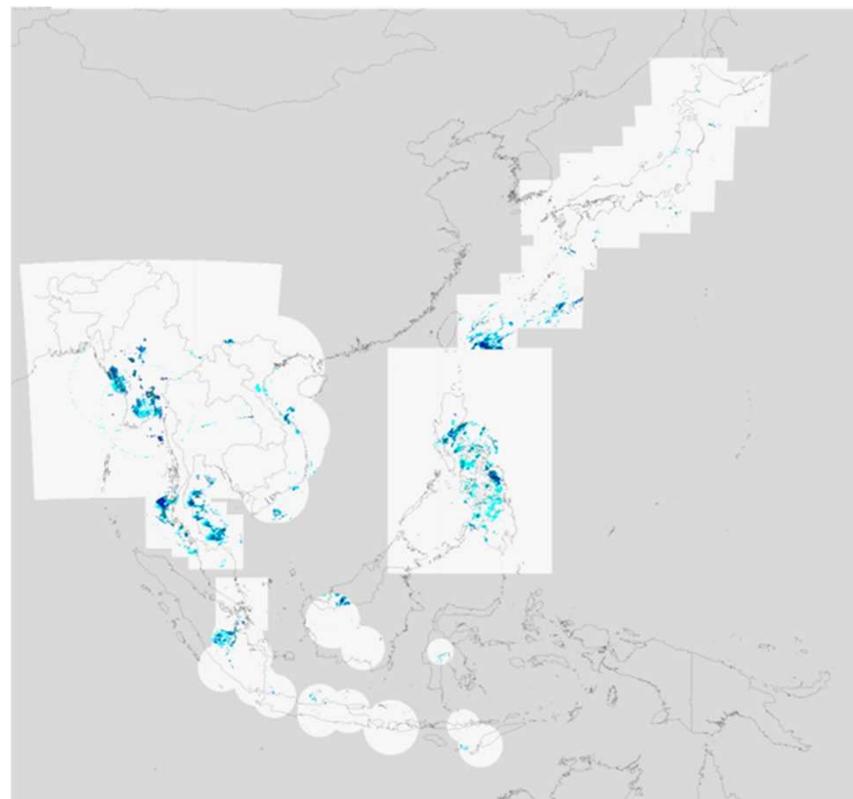


# Data flow



# Demonstration of the regional network

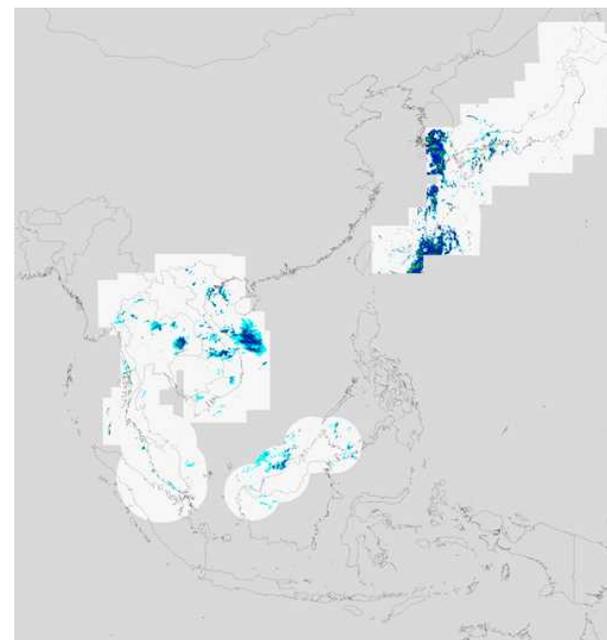
- In order to demonstrate the effectiveness of the regional radar data exchanges, a sample regional map was created by offline basis.
- The map is a result of the last Typhoon Committee project's technical meeting in 2019.
- Participating members sent their data to JMA in 2020.
- JMA produced the regional composite map and shared it with them in February 2021.



Sample regional radar composite map  
(4 November 2019, 20UTC with some exception)

## Recent progress

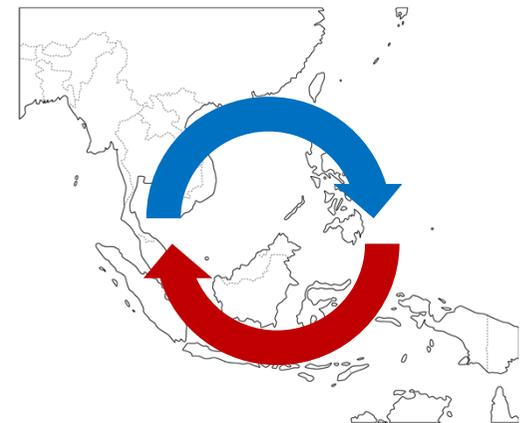
- MSS; newly participated in the experimental data exchanges in April 2023
  - Shared sample radar data
- VNMHA; participated in May 2022
  - Shared sample data of nationwide radar composite data
- MMD
  - Shared image of nationwide radar composite data tentatively
- BMKG
  - Under technical coordination for sharing data
- PAGASA
  - Guidelines have shared with JMA



Sample regional radar composite map including Malaysia and Viet Nam

# Future challenge

- Radar data exchange format FM301/ CfRadial2 was endorsed by the seventy-sixth session of the Executive Council (EC-76) in February 2023.
  - Polar coordinate radar/lidar data format.
- The options for the exchange of operational weather radar data will be explored (raw format / grid products).
- Radar data exchange in this region will be a future challenge.
  - Which radar data are required for data exchange in this region?



# Early Warnings for all

- [Early Warnings for All](#) is a groundbreaking initiative to ensure that everyone on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027.
- The United Nations Secretary-General, António Guterres, in 2022 called for a global effort to ensure that early warning systems protect everyone on Earth by 2027.
- Consisting of the 4 essential pillars;
  1. Disaster risk knowledge
  2. Detection, observation, monitoring, analysis, and forecasting
  3. Warning dissemination and communication
  4. Preparedness and response capabilities
- ✓ Pillar 2 is led by WMO



# Early Warnings for all

- Early Warning Systems are underpinned by a global upward reporting of surface and space-based observation data, exchanged freely between all countries, and ingested into several highly advanced supercomputing modelling centres.
- These centres run numerical models which replicate the physical interactions of the full Earth System (weather, hydrology, ocean, cryosphere and more) to create predictions
  - which are then cascaded back down from global to regional and national levels
  - NHMSs can provide forecast services to their citizens

- [WIGOS](#)  
(WMO Integrated Global Observing System)
- [GBON](#)  
(Global Basic Observing Network)
- [RBON](#)  
(Regional Basic Observing Network)



# Linkage between Southeast Asian Radar project and RBON

- [RBON](#): Regional Basic Observing Network
  - consist of surface stations and upper-air stations designated by the regional associations.
- Each Regional associations design their RBON networks to address key regional challenges.
- Key regional weather, climate, water and other environmental challenges to be considered when designing the RAII RBON network (RA II MG-18)
  - Heavy rainfall(thunderstorms, lightning), pluvial, flash floods, landslide,
  - Tropical cyclones/typhoons/tropical depressions
  - Drought
  - Extreme temperature events (heat and heatwaves, cold waves)
  - Sand and dust (suspension, deposition, and sedimentation, storms)
- Weather radar data is one of the data expected to be exchanged in RBON in the future.
- This project will demonstrate the effectiveness of the regional radar network in RBON, and support [Early Warnings for All initiatives](#).



## IV. Purpose of the Workshop

- Aims of each country in the region are;

*(in the short term)*

- 1) Capacity building in radar observation techniques;
- 2) Composite of national radar data;

*(in the mid-long term)*

- 3) Development of radar network in Southeast Asia;
- 4) Disaster Risk Reduction caused by heavy rain.

## IV. Purpose of the Workshop

- Capacity building and exchange of radar composite data have been developed in the region
  - Through bilateral cooperation between TMD, MMD, and JMA, and multilateral framework (e.g. Typhoon Committee)
- Dual-polarization radars are being developed operationally in some countries.
- Sharing and expanding the knowledge gained through the above activities are necessary.

## IV. Purpose of the Workshop

- From the aspect of capacity building in techniques, In this workshop, lectures and hands-on training will be provided focused on following objects:
  - 1) Quality Control
  - 2) Operation, Maintenance and Calibration
  - 3) Radar data applications
    - Rainfall estimation, Doppler velocity
    - Training on processing and visualization of weather radar
  
- Development of regional radar network in Southeast Asia
  - Radar data exchange
  - Problems and future challenges in radar observation and usage in each country will be shared among participants



## V. Summary

- Improvement of weather radar observations and development of a national radar network make radar observation data effectively be utilized in DRR in each country.
- Development of radar network among multiple countries and international exchange of radar data help each NMHS predict impacts of the disaster (caused by flood of international rivers and tropical cyclones) in advance.

## V. Summary

- Activities on capacity building in radar techniques and development of regional radar network has been conducted under the frameworks of WMO/WIGOS, ASEAN and ESCAP/WMO Typhoon Committee.
- This workshop is a good chance to facilitate capacity building in radar techniques and development of regional radar network in each country in this region.



**Thank you.**  
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