Regional radar network and radar data exchange

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HAGIYA Satoshi
RWC Tokyo
Observation Division, Atmosphere and Ocean Department
Japan Meteorological Agency

Contents

- Regional radar network in Southeast Asia
- WMO Early Warnings for All initiatives
- Assumed next step
- Summary

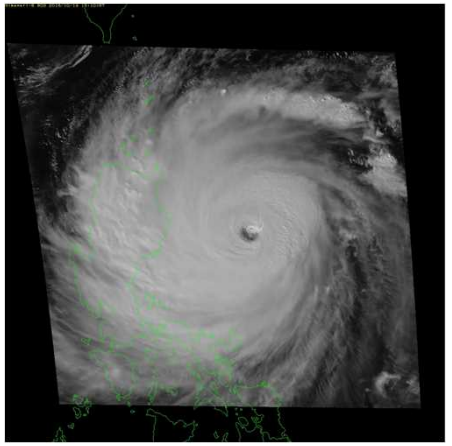
Regional radar network in Southeast Asia

• 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.

Regional radar network in Southeast Asia

- ## 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.

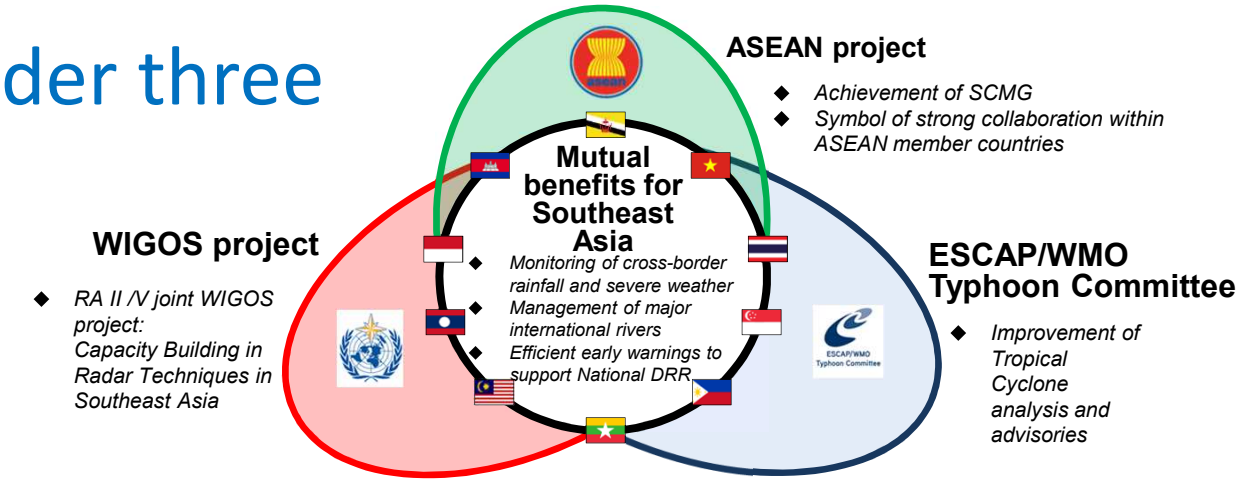


Weather radars in Southeast Asia
(As of Oct. 2023)

- 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.

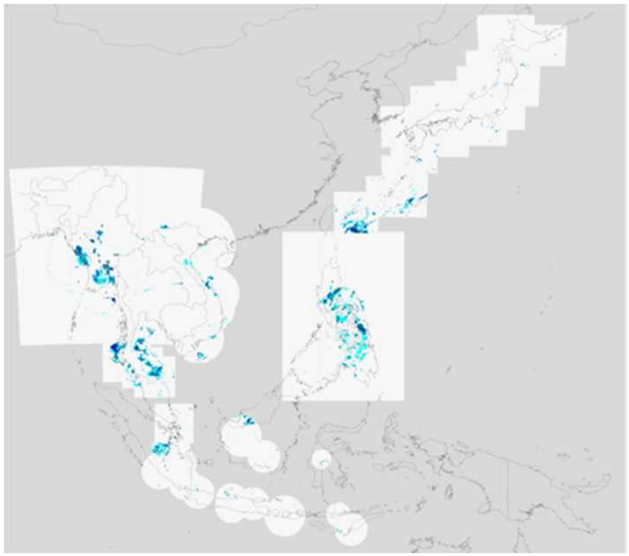
Regional radar network in Southeast Asia

- Activities under three frameworks



Capacity Building

Exchange of radar composite data

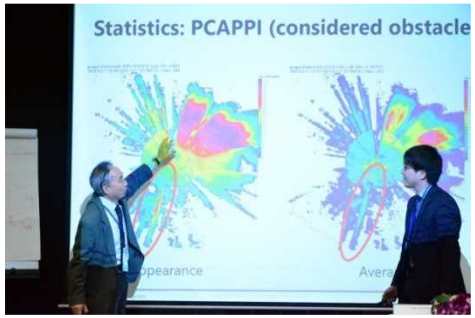


WMO/ASEAN Radar Workshop

(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)

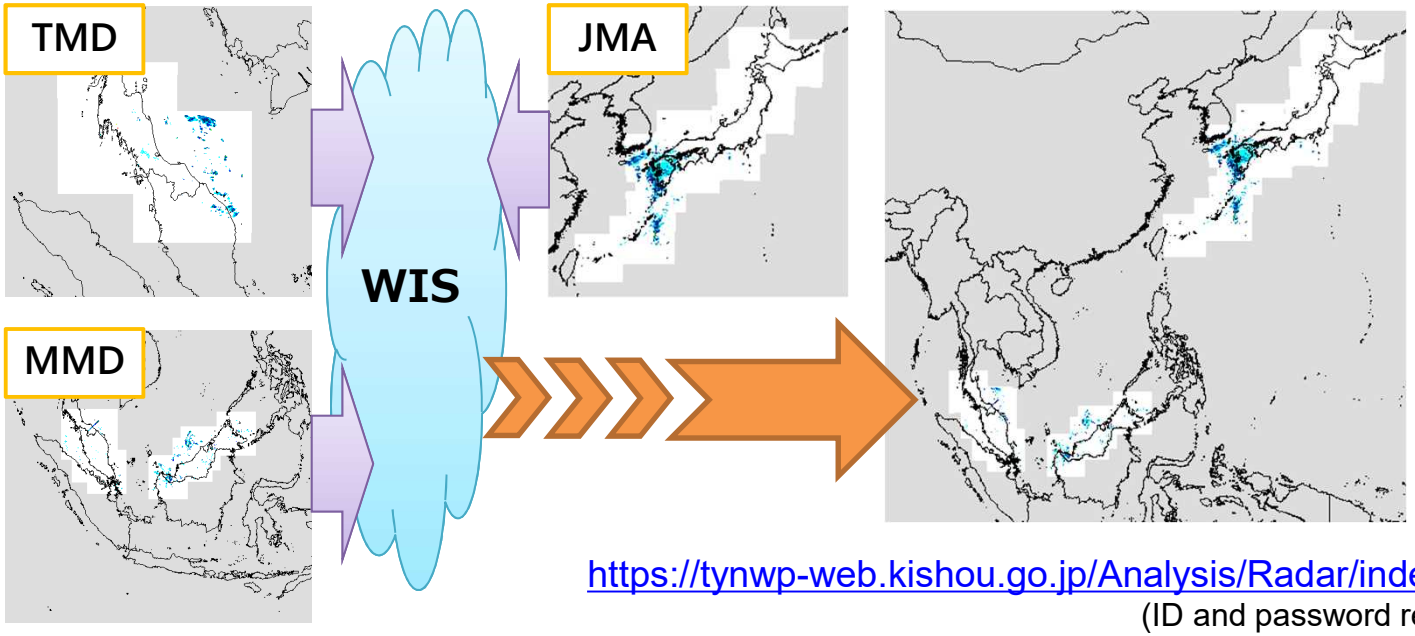
Weather Radar Workshop 2023
(11 - 13 October 2023, Tokyo)

Challenges ; Radar observation in Southeast Asia

- Challenges for operation and maintenance
  - Number and level of well-trained radar technicians and operator for radar maintenance and radar data analysis.
  - Lack of equipment and machinery for inspection and calibration.
  - Replacement of the old radar
  - Spare parts availability
  - Partial Blocking
  - Stability of Network
  - Dual-pol. Calibration
- Challenges for data processing, QC, QPE
  - Frequency interference
  - Estimation of Z-R relationship: No localized setting for drop size distribution, limited rain gauge network
  - Non-precipitation echo
- Challenges related to the preparation of specifications
  - Knowledge of latest radar technology available in market

Experimental radar data exchange

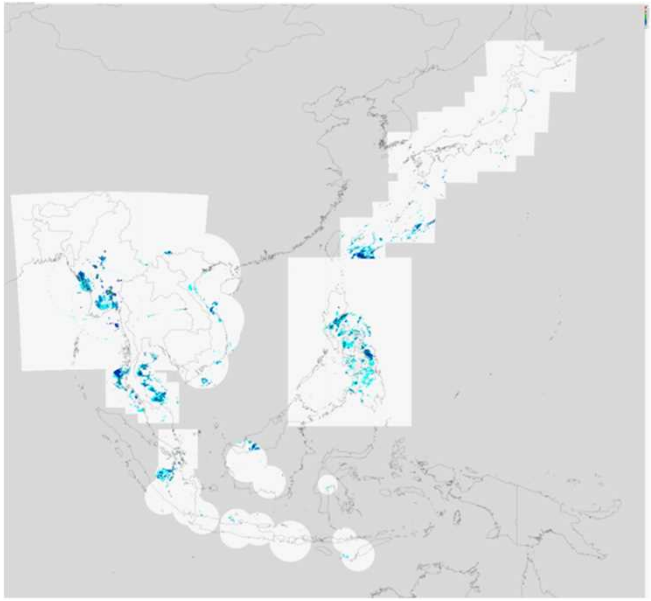
- The experimental exchange of domestic radar composite data among TMD, MMD and JMA started on 10 November 2016.
- Radar composite imageries using the exchanged data has been shared with Typhoon Committee Members since 25 October 2017 on the RSMC Tokyo - Typhoon Center's NTP website.



https://tynwp-web.kishou.go.jp/Analysis/Radar/index.html
(ID and password required)

Guidelines for the experimental radar data exchange

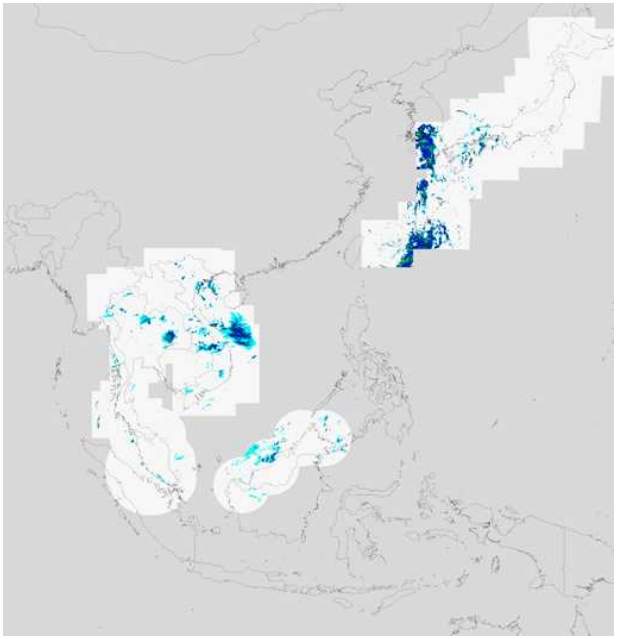
- The *"Guidelines for the Participation in Experimental Regional Radar Composite Data Exchanges in Southeast Asia"* was drafted in 2019 by BMKG, MMD, TMD and JMA.
- JMA has sent official letters with the Guidelines to the participants (BMKG, MMD, TMD, VNMHA and MSS) respectively, and they sent back 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.



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

Benefits of Regional radar network and Radar data exchange

- Development of radar network among multiple countries and international exchange of radar data
  - Enhancing the capacity of monitoring and improving the radar observations for each country
    - By comparing radar observations data
    - By using low-altitude radar data
- Development of regional radar composite map
  - Enhancing the capacity to monitor cross-border phenomena
    - E.g. Typhoon, Tropical Cyclone
  - Flood forecast of the major international rivers
  - Grasping the weather conditions for the international flight
- Improving precipitation forecast in each country through the assimilation of radar data to NWP.

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 EW4All, 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.

Assumed next step

- National level
  - Improvement of radar observation, data application
    - Operation, maintenance and calibration
    - Quality Control
    - Data Composite (National, Sub-national)
    - QPE
    - Utilization of dual-pol Parameters
- Regional level
  - Developing experimental radar data exchange

Summary

- Regional radar network and radar composite data exchange have been developed under regional radar network project.
  - This project supports EW4All initiatives.
- Radar data exchange is effective for enhancing the capacity of radar observation and DRR in each country.
- It is important to improve the radar observation and develop the radar network through the regional radar network project.
  - contribute to improvement of services in each NMHS as well as Disaster Risk Reduction in this region

Thank you!

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