SUMMARY REPORT

Technical meeting on a regional weather radar network for Southeast Asia

(Tokyo, Japan, 13 – 15 November 2019)

The technical meeting on a regional weather radar network for Southeast Asia was held at the Japan Meteorological Agency (JMA) headquarters, Tokyo, Japan from 13 to 15 November 2019. The meeting was a part of the activities by Annual Operating Plan (AOP) 2019 – item 3 "Development of regional radar network" of the Working Group on Meteorology (WGM) of the ESCAP/WMO Typhoon Committee (TC), which was endorsed by the Fifty-first Session of the ESCAP/WMO Typhoon Committee held in Guangzhou, China from 26 February to 1 March 2019. The meeting was held collaboratively with the regional WMO Integrated Global Observing System (WIGOS) project of WMO Regional Association (RA) II and V on weather radar called "Capacity Building in Radar Techniques in the Southeast Asia", which has the identical goal with the aforementioned activities under TC/WGM.

In line with the aims of the activities under TC/WGM and the regional WIGOS project of RA II/V, the meeting's objective was to review activities so far and to identify necessary activities in 2019 and 2020.

Six staff members of the Viet Nam Meteorological and Hydrological Administration (VNMHA), who were participating in a training course in Japan through a Japan International Cooperation Agency (JICA)'s technical cooperation project, also participated in the meeting as observers on 13 and 14 November.

Mr. MATSUDA Kohei from JMA served as a moderator.

The meeting agenda is provided as Appendix I.

The list of attendees is provided as Appendix II.

1. Opening (13 Nov.)

1.1. The meeting was opened by Mr. DESHIMARU Takuya, Director-General of the Observation Department of JMA, who welcomed all attendees and highlighted weather radars as one of the most powerful tools for monitoring recent extreme weather. He also highlighted the achievement of the activities of networking weather radars in Southeast Asia under the framework of the ESCAP/WMO Typhoon Committee since 2011, and the goal of this activities shared with the WIGOS Project of the WMO RA II/V as well as a project of the ASEAN Sub-Committee on Meteorology and Geophysics. He expected that this meeting would further push forward the activities with many new participants, and that the on-going technical cooperation project in Vietnam would have a synergistic effect.

1.2. All attendees of the meeting made self-introduction.

2. Sharing current status of the project (incl. Progress report of the regional WIGOS project on radar) (13 Nov.)

2.1. Mr. MATSUDA Kohei from JMA gave an introductory presentation on challenges and long-term prospective in Southeast Asia and benefits of regional radar network for Southeast Asia. He explained the three frameworks (WMO/WIGOS, ASEAN and ESCAP/WMO Typhoon Committee) underpinning the network. He reviewed the previous activities under the frameworks and shared the progress with attendees. He urged the attendees to update the members of the coordination group for the RA II/V regional WIGOS project for capacity building in radar techniques in Southeast Asia. He also explained the purpose of this technical meeting.

3. Country report on radar operation (13 Nov.)

3.1. Ms. Asri Susilawati from the Agency for Meteorology, Climatology, and Geophysics of the Republic of Indonesia (BMKG) shared their radar network, products, integration system and future plan including Quality Control (QC) improvement. She also explained their limitations and challenges on maintenance, system, human resources, communication and international data exchange.

3.2. Mr. Ye Htut from the Department of Meteorology and Hydrology of the Republic of the Union of Myanmar (DMH) shared their radar network, hardware specifications, software, maintenance and calibration.

3.3. Mr. Fulgencio A. Austria, Jr. from the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) shared their radar network including on-going projects, data format conversion and challenges for international data exchange.

3.4. Mr. Zheng Kaiyuan from the Meteorological Service Singapore (MSS) shared their radar specifications, operations, QC and products including Quantitative Precipitation Estimation (QPE).

3.5. Mr. Nguyen Vinh Thu from VNMHA shared their radar network, volume scan strategy, products including composite map and QPE and challenges for QC, QPE and Quantitative Precipitation Forecast (QPF).

4. Sharing experience and discussion on radar data composite, QC and calibration (13 Nov.)

4.1. Mr. Mahluddin bin Sahrin from the Malaysian Meteorological Department (MMD) shared their radar network, scanning strategy, maintenance, experience on composite and QC including adjustment of Echo Intensity at the Lowest level (EIL)

table to remove interference and ground clutter, and to obtain better coverage. He also explained their utilization and application of radar data, technical challenge and future plan.

4.2. Mr. Boonlert Archevarahuprok from the Thai Meteorological Department (TMD) shared their radar network, experience on composite and QC including adjustment of EIL table based on statistical analysis using a Python script which was developed by him to convert Pseudo Constant Altitude Plan Position Indicator data of JMA (hereinafter called “PCAPPI”) to NetCDF format (The script was sheared with the attendees). He also introduced their real-time GUI to overlay nationwide radar composite and Himawari-8 satellite data.

5. Introduction of JMA's Radar Observation and Processing System (ROPS) (incl. technical tour to the observation operation room) (14 Nov.)

5.1. Mr. YAMAUCHI Hiroshi from JMA introduced their operational radar center system: ROPS (Radar Observation and Processing System). He noted that since the system is significantly important for JMA, the system was implemented by a manufacturer although the algorithms used for its data processing were developed by JMA. He explained that its functions such as operation status monitoring, data acquisition monitoring, data processing, product delivery, data archive, data display, typhoon center position determination and event logging. He also explained the functions in more detail while showing the actual screens in the Observation Operation Room of JMA headquarters. Technical documents on ROPS were distributed to the attendees for their reference.

6. Progress report on “Guidelines for the Participation in Experimental Regional Radar Composite Data Exchanges in Southeast Asia” (14 Nov.)

6.1. Mr. ENDO Hiroya from JMA reviewed the history and the participants' awareness of the need of "Data Exchange Guidelines" to invite potential participants to the network. He clarified the benefit of the radar network and introduced required rules including what they call Guidelines for data exchange, which can assure the benefit. Then, he explained the ongoing preparation, that is, the Guidelines were drafted among BMKG, MMD, TMD and JMA, and JMA sent letters with the Guidelines to the three separately, and they were sending back their acceptance letters. He also explained the outline of the Guidelines.

6.2. The attendees confirmed that any applicants can join the radar network anytime by exchanging the letters upon agreeing with the Guidelines. They also confirmed that

technical condition such as data format, data transmission interval and method were not stipulated in the Guidelines, and should be provided as technical information described in the Annex I and II to the Guidelines after coordination among the applicant and other participating Members.

7. Introduction of radar data composite and QPE technology (14 Nov.)

7.1. Mr. MATSUDA Kohei from JMA introduced outline of JMA's radar data QC and composite method. The presentation covered the cause of quality loss, overview of JMA's QC method, QC on the PCAPPI process including adjustment of EIL tables, and GRIB2 format on the radar composite of JMA and on the current regional data exchange.

7.2. Mr. KASAHARA Shingo from JMA introduced the key role of QPE and how to create QPE. He explained that JMS's QPE called Radar/rain-gauge Analyzed Precipitation (R/A) is created from radar and rain-gauge data taking advantage of both strengths. He also explained the process of creating R/A consisting of QC and 1-hour accumulation, first precipitation estimation, second precipitation estimation and composition of all radar precipitation estimation.

7.3. Mr. Mahluddin bin Sahrin from MMD, Mr. Boonlert Archevarahuprok from TMD and Mr. IZUMI Toshiharu, Ms. IGARASHI Yohko and Ms. KOMATSU Naoko from JMA had detailed discussion on the structure and contents of a user's guide, which was drafted by JMA. Based on the discussion, JMA will update the user's guide and share with MMD and TMD in this fiscal year.

8. Introduction of an information sharing tool (14 Nov.)

8.1. Mr. MATSUDA Kohei from JMA introduced an information sharing tool called "Redmine", which is a free and open source, web based project management and issue tracking tool, and is already used for a pilot Regional WIGOS Centre (RWC) established in JMA in 2019. He explained why, for what and how it can be utilized, and that the materials of this meeting was shared at first. He also shared the email contact of JMA for related activities (jma-radar-project@met.kishou.go.jp).

9. Discussion on the way forward (15 Nov.)

9.1. Attendees reviewed progress of AOP in 2019. The progress so far is shown as follows:

- JICA training for VNMHA on radar QC & QPE (JMA headquarters, Tokyo, Japan, 8-9 May 2019)

- Field survey at a failed radar site in Lao PDR was conducted by WMO and JMA.
- The Guidelines for the Participation in Experimental Regional Radar Composite Data Exchanges in Southeast Asia was drafted among BMKG, JMA, MMD and TMD.
- Technical meeting on weather radar network for Southeast Asia was held at JMA headquarters, Tokyo, Japan from 13 to 15 November 2019 to review activities so far and to identify necessary activities in 2019 and 2020.

9.2. Attendees shared AOP in 2020 submitted to the Working Group on Meteorology (WGM) at the 14th Integrated Workshop (IWS) from 4 to 7 November 2019 in Guam, USA. The AOP is shown as follows:

a. To further refine quality control techniques applied to the participants' radar networks, including dual pol. radars, to improve their quality of radar composites.
b. To implement and refine MMD and TMD's QPE calibration using rain-gauge with technical assistance of JMA.
c. To support applicants to join the experimental radar data exchange in the near future, and to share the progress with the RA II/V WIGOS radar project in Southeast Asia.
d. To compose a user's guide among JMA, MMD and TMD.
e. Submission of progress reports by participants. Upon the receipt of the reports, holding follow-up technical meeting(s) to identify a way forward.

9.3. Attendees discussed a specific plan to expand the experimental radar data exchange according to the AOP in 2020. The agreed plan is shown as follows:

- Before April 2020
  1. BMKG, MMD, DMH, PAGASA, MSS, TMD, VNMHA will send sample data of domestic composite product to JMA, subject to approval of their management. JMA will inform date and time for the sample data to be sent to JMA.
  2. JMA will make a possible sample regional composite image using the data of MMD, TMD and other members and provide it to all members.
  3. New participating members will check the Guidelines.
  4. If possible, TMD will make a video for the Fifty-second Session of the ESCAP/WMO Typhoon Committee.
- After April 2020

1. JMA and new participating members will coordinate letter exchange for acceptance of the Guidelines.
2. JMA and new participating members will exchange technical information for radar data exchange.
3. JMA will make a sample composite map using new participating members' data.

10. Closure (15 Nov.)

10.1. Mr. MATSUDA Kohei from JMA made closing remarks.

Appendix I

AGENDA

Wednesday, 13 November

1. Opening
2. Sharing current status of the project (incl. Progress report of the regional WIGOS project on radar)
3. Country report on radar operation
4. Sharing experience and discussion on radar data composite, QC and calibration

Thursday, 14 November

5. Introduction of JMA's Radar Observation and Processing System (ROPS) (incl. technical tour to the observation operation room)
6. Progress report on "Guidelines for the Participation in Experimental Regional Radar Composite Data Exchanges in Southeast Asia"
7. Introduction of radar data composite and QPE technology
8. Introduction of an information sharing tool

Friday, 15 November

9. Discussion on the way forward
10. Closure

Appendix II

LIST OF ATTENDEES

Indonesia	
Ms. Asri Susilawati	Head of Sub Division for Weather Radar Imagery Management The Agency for Meteorology, Climatology, and Geophysics of the Republic of Indonesia
Malaysia	
Mr. Mahluddin bin Sahrin	Meteorological Officer of Radar & Satellite Meteorological Division Malaysian Meteorological Department
Myanmar	
Mr. Ye Htut	Deputy Chief Engineer Department of Meteorology and Hydrology
The Philippines	
Mr. Fulgencio A. Austria, Jr.	Weather Facilities Specialist II Philippine Atmospheric, Geophysical and Astronomical Services Administration
Singapore	
Mr. Zheng Kaiyuan	Executive Meteorologist, Central Forecast Office Meteorological Service Singapore
Thailand	
Mr. Boonlert Archevarahuprok	Expert on Research and Development for Meteorology Thai Meteorological Department
Viet Nam	
Mr. Nguyen Vinh Thu	Director, Aero-Meteorological Observatory Viet Nam Meteorological and Hydrological Administration

Japan	
Mr. MATSUDA Kohei	International Strategy Officer for Meteorological Observation, Administration Division, Observation Department Japan Meteorological Agency
Mr. NOMURA Yukihiro	Scientific Officer, Administration Division, Observation Department Japan Meteorological Agency
Mr. TABATA Tasuku	Assistant Scientific Officer, Administration Division, Observation Department Japan Meteorological Agency
Mr. YAMAUCHI Hiroshi	Deputy Director, Observation Division, Observation Department Japan Meteorological Agency
Mr. HOTTA Junji	Assistant Scientific Officer, Observation Division, Observation Department Japan Meteorological Agency
Mr. UNUMA Takashi	Assistant Scientific Officer, Office of Observation Systems Operation, Observation Division, Observation Department Japan Meteorological Agency
Mr. SAITO Riku	Assistant Scientific Officer, Office of Observation Systems Operation, Observation Division, Observation Department Japan Meteorological Agency
Mr. KASAHARA Shingo	Senior Forecaster, RSMC Tokyo - Typhoon Center, Forecast Division, Forecast Department Japan Meteorological Agency
Ms. IGARASHI Yohko	Senior Scientific Officer, RSMC Tokyo - Typhoon Center, Forecast Division, Forecast Department Japan Meteorological Agency
Mr. IZUMI Toshiharu	Scientific Officer, RSMC Tokyo - Typhoon Center, Forecast Division, Forecast Department Japan Meteorological Agency
Ms. KOMATSU Naoko	Senior Scientific Officer, Office of International Affairs, Planning Division, Administration Department Japan Meteorological Agency
Mr. ENDO Hiroya	Scientific Officer, Office of International Affairs, Planning Division, Administration Department Japan Meteorological Agency