SUMMARY REPORT

Technical meeting on a regional weather radar network for Southeast Asia

(Tokyo, Japan, 22 – 26 October 2018)

The technical meeting on a regional weather radar network for Southeast Asia was held at the Japan Meteorological Agency (JMA) Headquarters, Tokyo, Japan from 22 to 26 October 2018. The meeting was a part of the project of ESCAP/WMO Typhoon Committee (TC) Working Group on Meteorology's (WGM) Annual Operating Plan (AOP) 2018 – item 3 "Development of regional radar network", which was endorsed by the 50th Typhoon Committee session held in Hanoi, Vietnam from 26 February to 3 March 2018. 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 "Capacity Building in Radar Techniques in the Southeast Asia", which has the identical goal with the aforementioned project under TC/WGM.

In line with the aims of the project under TC/WGM and the regional WIGOS project of RA II/V, the meeting's objective was to discuss concrete action items to expand this radar project for a draft AOP in 2019.

The meeting was held in parallel and partly in conjunction with the technical meeting on Himawari-8/9 Rapidly Developing Cumulus Areas (RDCA) products, which was a part of the Preliminary Project "Enhancing Utilization of Himawari 8/9 Products" of TC/WGM.

Mr. Kohei Matsuda (JMA) served as a moderator.

The meeting agenda is provided as Appendix I.

The list of attendees is provided as Appendix II.

1. Opening (22 Oct.)

1.1. The two meetings were opened by Naoyuki Hasegawa (Director-General of JMA's Observation Department), who highlighted the achievement of the project of a radar network for Southeast Asia and welcomed the radar experts from not only Southeast Asian countries but also United Arab Emirates (UAE). He also highlighted the usefulness of the satellite data and welcomed the Malaysian satellite experts. He expected that combining the two meetings would eventually lead to more effective products to serve the purposes of all the participating national meteorological services.

1.2. All attendees of the two meetings made self-introduction.

2. Sharing current status of the project (incl. Progress report of the regional WIGOS project on radar) (22 Oct.)

2.1. Mr. Kohei Matsuda (JMA) gave an introductory presentation on challenges and long-term prospective in Southeast Asia and benefits of a 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 explained the purpose of the technical meeting.

3. Country report on radar operation (22 Oct.)

3.1. Mr. Boonlert Archevarahuprok (TMD) shared their radar operation, nationwide radar composite, Quantitative Precipitation Estimated (QPE) and Radar composite data exchange with JMA and MMD. He also explained their radar data policy and Quality Control (QC) method.

3.2. Mr. Mahluddin Sahrin (MMD) shared their radar network, scanning strategy, radar application, challenges for international data exchange and issues on QC.

3.3. Mr. Vanhdy Douangmala (DMH) shared the background of establishment and current status of their Doppler radar at DMH Headquarters.

3.4. Mr. Nguyen Quang Vinh (VNMHA) shared their radar network, radar composition, current situation and future plans on QPE and QC issues.

4. WMO Inter-Programme Expert Team on Operational Weather Radars (IPET-OWR) activities (22 Oct.)

4.1. Mr. Hiroshi Yamauchi (JMA), Vice-Chairperson of the WMO Inter-Programme Expert Team on Operational Weather Radars (IPET-OWR), introduced activities of IPET-OWR, including developing radar data exchange format, the Best Practice Guide to Operational Weather Radar, and the WMO radar database.

5. Introduction of a radar network in West Asia (22 Oct.)

5.1. Mr. Karel de Waal (NCM) introduced a radar network in West Asia. He explained that NCM received the radar data of the Gulf Cooperation Council (GCC) countries as polar volumes and converted to constant altitude plan position indicator (CAPPI) data for radar mosaics on NCM's website.

6. JMA's vision for radar observation (22 Oct.)

6.1. Mr. Hiroki Sekino (JMA) gave a presentation on overview of JMA's radar observation, importance of radar observation and JMA's vision for radar observation. His presentation covered JMA's radar history, automated QC systems, application for disaster risk reduction (DRR), next generation radars and advanced nowcast information.

7. Sharing experience on radar data exchange and national composite (23 Oct.)

7.1. Mr. Kohei Matsuda (JMA) explained the purpose of the topic and the subsequent discussion.

7.2. Mr. Hiroaki Minematsu (JMA) confirmed the necessity of rules to expand the radar 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 for deciding the rules and draft of the Guidelines, and got agreement on those from attendees.

7.3. Mr. Takumu Egawa (JMA) explained the protocols and commands for radar data collection and the file naming conventions used in the experimental radar data exchange.

7.4. Mr. Takashi Unuma (JMA) introduced cooperation tools for making Pseudo CAPPI of JMA (hereinafter called "PCAPPI") and national composite data in GRIB2 format, and explained radar data types, file formats and coordinates used in the experimental radar data exchange.

7.5. Mr. Boonlert Archevarahuprok (TMD) shared TMD's experiences on how to make radar composite including making elevation angle composite tables for PCAPPI.

7.6. Mr. Mahluddin Sahrin (MMD) shared MMD's experiences on radar composite. He explained their experience on using IRIS application for making composite map from BUFR format, and using JMA's software for making PCAPPI and composite GRIB2.

7.7. Mr. Karel de Waal (NCM) shared NCM's data exchange challenges on data policy, data formats, servers and storage as well as reverse sharing.

8. Practical discussion about the way to join radar data exchange and conduct national composite (23 Oct.)

8.1. Based on the country reports, all attendees shared new participants' problems and current technical situation and discussed key components of the radar network and what participants should do by 2020 to invite new participants to the radar network early. The discussion is summarized as follows:

- Data policy is made by decision makers in some countries in Southeast Asia and different in each country; on the other hand, in West Asia, that policy was decided by the GCC Meteorological Counsel meeting for the GCC radar data exchange.

- Nationwide radar composite data should be exchanged in common format(s) shared with all contributors. Whereas, in the case of the radar network in West Asia, they exchange polar data and data QC including synchronization of data retrieving is performed by each data owner.
- Servers with a good network and internet connection including archiving and disaster recovering system are required for participants.
- Toward 2020, participating countries should continue to improve data QC including utilization of dual-polarization data, and applicant countries should prepare contact points, data policy, sample raw data, telecommunication systems and proper radar scan setting, and learn the Guidelines for data exchange.
- In the future, following the success of the regional radar exchange in Southeast Asia, the exchange of the volume scan data in CfRadial 2.0 will be considered.

9. Sharing experience on radar data QC (24 Oct.)

9.1. Mr. Kohei Matsuda (JMA) explained the purpose of the topic and the subsequent discussion.

9.2. Mr. Boonlert Archevarahuprok (TMD) shared TMD's experiences on radar data QC by radial moment summation, statistical base QC and adjusting elevation angle composite tables, clutter maps and noise cut parameters.

9.3. Mr. Mahluddin Sahrin (MMD) shared MMD's experiences on radar data QC by adjusting elevation angle composite tables and clutter maps based on data accumulation and compering to rain gauge data.

9.4. Mr. Karel de Waal (NCM) shared NCM's data quality challenges on anomalous propagation clutter, radio LAN interference and military chaff. He mentioned QC with dual-polarization parameters to address the challenges.

9.5. Mr. Yuki Saeki (JMA) gave a presentation on JMA's QC method. The presentation covered the cause of quality loss, overview of JMA's QC, QC on the PCAPPI process including adjustment of elevation angle composite tables.

9.6. Mr. Akihito Umehara (JMA) gave a presentation on QC and QPE with dual-polarization parameters. He explained basic scheme of polarimetric radars, definitions and interpretation of dual-polarization parameters such as differential reflectivity, correlation coefficient, specific differential phase and textures (standard deviation of parameters), and benefits of using the parameters.

10. Practical discussion about radar data QC (24 Oct.)

10.1. Based on the country reports, all attendees shared new participants' problems and current technical situation and discussed what participants should do to solve new participants' problems on radar data QC. The discussion is summarized as follows:

- Adjustment of QC parameters and elevation angle composite tables for PCAPPI based on statistics is very powerful but it needs continuous evaluation. QC based on dual-polarization parameters is also beneficial but it can be still applicable for limited radars.
- Sustainable mechanism for continuous QC is needed. JMA will establish a pilot phase of Regional WIGOS Centre in 2019, which will support the WIGOS project with TMD and MMD.

11. Public Weather Service (25 Oct.)

11.1. Attendees listened to the lecture on Public Weather Service including QPE of the ESCAP/WMO Typhoon Committee Attachment Training 2018 at the RSMC Tokyo as reference for the application of radar to DRR.

12. Sharing summary of projects on a weather radar network and Himawari-8/9 RDCA products (25 Oct.)

12.1. Attendees of the technical meeting on a regional weather radar network for Southeast Asia and the technical meeting on Himawari-8/9 Rapidly Developing Cumulus Areas (RDCA) products shared summary of their projects on the weather radar network and Himawari-8/9 RDCA products and exchange viewpoints each other.

12.2. Mr. Kohei Matsuda (JMA) shared current status of the radar project. Mr. Boonlert Archevarahuprok (TMD) shared the summary of the discussion about the way to join radar data exchange and conduct national composite. Mr. Mahluddin Sahrin (MMD) shared the summary of the discussion about radar data QC.

12.3. Attendees listened to the summary of the project on Himawari-8/9 RDCA products including the result of verification with radar data. Attendees recognized the benefits of combining weather radar and satellite observation.

13. RSMC for Nowcasting (25 Oct.)

13.1. Mr. Seiichiro Kigawa (JMA) gave a presentation on RSMC for Nowcasting, covering the mission, products, development plan and collaboration with NMHSs in the region and the Japan Aerospace Exploration Agency (JAXA) on

satellite-related matters. He explained that key components on RSMC for nowcasting are RDCA, Global Satellite Mapping of Precipitation (GSMaP) by JAXA, the Southeast Asian radar network and Tokyo Action Plan 2018 (TAP2018) regarding surface observation instruments.

13.2. Dr. Takuji Kubota, an invited expert from the Japan Aerospace Exploration Agency (JAXA), presented a multi-satellite rainfall product known as Global Satellite Mapping of Precipitation (GSMaP). He explained about satellite microwave remote sensing, GSMaP and its real-time version named GSMaP_NOW. He mentioned that the domain of GSMaP_NOW would be extended to GEO-satellite Meteosat domain soon.

14. Discussion on the way forward (26 Oct.)

14.1. Attendees discussed a draft Annual Operating Plan (AOP) of this project in 2019 to be submitted to the Working Group on Meteorology at the 13th Integrated Workshop (IWS) from 05 to 09 November 2018 in Chiangmai, Thailand. The draft AOP is shown as follows:

Organizer: TMD, MMD, JMA

Participants: Lao PDR, Vietnam, Philippines

Action:

a. To further refine quality control techniques applied to MMD and TMD 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 refine quality control techniques in VNMHA with technical assistance of JMA.
d. 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.
e. Submission of progress reports by TMD, MMD and VNMHA. Upon the receipt of the reports, holding follow-up technical meeting(s) to identify a way forward.
f. To compose a user’s guide among JMA, MMD and TMD.

14.2. Attendees agreed that the project needs to pursue both expansion of the network and technical development among its participants, and to this end, the current experimental radar data exchange should be joined by applicants at an early date while existing participants provide technical advance to the new ones.

15. Closure (26 Oct.)

15.1. Mr. Kohei Matsuda (JMA) provided closing remarks.

Appendix I

AGENDA

Monday, 22 October

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. WMO Inter-Programme Expert Team on Operational Weather Radars (IPET-OWR) activities
5. Introduction of a radar network in West Asia
6. JMA's vision for radar observation

Tuesday, 23 October

7. Sharing experience on radar data exchange and national composite
8. Practical discussion about the way to join radar data exchange and conduct national composite

Wednesday, 24 October

9. Sharing experience on radar data QC
10. Practical discussion about radar data QC

Thursday, 25 October

Joint items with the technical meeting on Himawari-8/9 Rapidly Developing Cumulus Areas (RDCA) products

11. Public Weather Service
12. Sharing summary of projects on a weather radar network and Himawari-8/9 RDCA products
13. RSMC for Nowcasting

Friday, 26 October

14. Discussion on the way forward
15. Closure

Appendix II

LIST OF ATTENDEES

Lao People's Democratic Republic

Mr. Vanhdy Douangmala
Head of Aeronautical Meteorology Division
Department of Meteorology and Hydrology (DMH)

Malaysia

Mr. Asmadi Abdul Wahab
Principal Assistant Director of Radar and Satellite Meteorology Division
Malaysian Meteorological Department (MMD)

Mr. Mahluddin Sahrin
Principal Assistant Director of Radar and Satellite Meteorology Division
Malaysian Meteorological Department (MMD)

Thailand

Mr. Boonlert Archevarahuprok
Expert on Research and Development for Meteorology
Thai Meteorological Department (TMD)

Vietnam

Mr. Nguyen Quang Vinh
Aero-Meteorological Observatory (AMO)
Viet Nam Meteorological Hydrological Administration (VNMHA)

Mr. Kenji Akaeda
Expert
Japan International Cooperation Agency (JICA)

United Arab Emirates

Mr. Khalid Mohammad Al Zeraihi
Head of Networks & Telecommunications Section
National Center of Meteorology (NCM)

Mr. Karel de Waal
Radar Networking Specialist
National Center of Meteorology (NCM)

Japan

Mr. Hiroshi Yamauchi
Senior Scientific Officer
Administration Division, Observation Department
Japan Meteorological Agency (JMA)

Mr. Kohei Matsuda
International Strategy Officer for Meteorological Observation
Administration Division, Observation Department
Japan Meteorological Agency (JMA)

Mr. Toshihiro Hayashi
Scientific Officer
Administration Division, Observation Department
Japan Meteorological Agency (JMA)

Ms. Keiko Makiyama
Assistant Scientific Officer
Administration Division, Observation Department
Japan Meteorological Agency (JMA)

Mr. Seiichiro Kigawa
Senior Coordinator for Development Collaboration
Office of Meteorological Analysis and Application Development,
Administration Division, Observation Department
Japan Meteorological Agency (JMA)

Mr. Kentaro Yamamoto
Scientific Officer
Office of Meteorological Analysis and Application Development,
Administration Division, Observation Department

Japan Meteorological Agency (JMA)

Mr. Akihito Umehara
Assistant Scientific Officer
Office of Meteorological Analysis and Application Development,
Administration Division, Observation Department
Japan Meteorological Agency (JMA)

Mr. Hiroki Sekino
Senior Scientific Officer
Observation Division, Observation Department
Japan Meteorological Agency (JMA)

Mr. Yuki Saeki
Assistant Scientific Officer
Observation Division, Observation Department
Japan Meteorological Agency (JMA)

Mr. Kazunori Irie
Scientific Officer
Office of Observation Systems Operation,
Observation Division, Observation Department
Japan Meteorological Agency (JMA)

Mr. Junji Hotta
Assistant Scientific Officer
Office of Observation Systems Operation,
Observation Division, Observation Department
Japan Meteorological Agency (JMA)

Mr. Takashi Unuma
Assistant Scientific Officer
Office of Observation Systems Operation,
Observation Division, Observation Department
Japan Meteorological Agency (JMA)

Mr. Koichiro Kakihara
Senior Forecaster
RSMC Tokyo - Typhoon Center, Forecast Division, Forecast Department
Japan Meteorological Agency (JMA)

Ms. Yohko Igarashi
Senior Scientific Officer
RSMC Tokyo - Typhoon Center, Forecast Division, Forecast Department
Japan Meteorological Agency (JMA)

Mr. Yoritsugi Ohno
Scientific Officer
Information and Communications Technology Division, Forecast Department
Japan Meteorological Agency (JMA)

Mr. Takumu Egawa
Scientific Officer
Information and Communications Technology Division, Forecast Department
Japan Meteorological Agency (JMA)

Mr. Hiroaki Minematsu
Scientific Officer
Office of International Affairs, Planning Division, Administration Department
Japan Meteorological Agency (JMA)

Dr. Takuji Kubota
Earth Observation Research Center (EORC)
Japan Aerospace Exploration Agency (JAXA)