Appendix 1. Current status of Members' radar capabilities

For Japan, Thailand, Viet Nam, the Philippines, India

Item	JMA (Japan)	Thailand	Viet Nam	the Philippines	India
(1) Summary of the current situation					
1.Radar observation					
1.1 Basic Radar Information					
Is Metadata managed?(Yes/No)	Yes	Yes	Yes	Yes	Yes
Number of radars (each band)	S (0), C (20), X (0)	S (0), C (27), X (1)	S (2), C (8), X (2)	S (11), C (9), X (10)	S (23), C (11), X (17)
Main band of radar network (S, C, X, those mixed)	C	C band	S,C,X band	S,C,X band	S,C,X band
Transmission method (magnetron, klystron, solid-state power amplifier(SSPA))	SSPA, klystrons	-	SSPA, magnetrons	SSPA, magnetrons	SSPA, klystrons
Single-polarization or dual-polarization (or mixed)	mixed	mixed	mixed	mixed	mixed
Maximum observation range of main radar	400km	~~~~	X band: 80 km, C band: 300 km, S band: 450 km	X band: 80 km, C band: 480-500 km, S band: 480-500 km	500 km (monitoring) 250 km (volume) [S/C]; 150 km (monitoring) 80/100 km (volume) [X].
Scan strategy (lower layerlevel only or three dimensional)	three dimensional	three dimensional	three dimensional	three dimensional	three dimensional
Continuous observation(24/7) or intermittent observation	Continuous observation(24/7)	Continuous observation(24/7)	Continuous observation(24/7)	Continuous observation(24/7)	Continuous observation(24/7)
Observation frequency of precipitation in the lower layer (XX minutes/X hours)	5 min.	15 min.	10 min.	10 or 15 min.	10 min.
Observation frequency of three-dimensional volume scan (XX minutes/X hours/none)	5 minutes (dual-polarization), 10 minutes (single-polarization)	15 min.	10 min.	10 or 15 min.	10 min.
Please fill in the latest future plan for the radar network (installation/update of radars, introduction of dual-pol and SSPA radars, etc.)	All Klystron radars will be replaced with SSPA dual-pol. radars	Continuous improve radar station from single to dual polarization Change some radar site to more appropriate area (as of 2023)	Plan by 2050; 39 weather radar sites (including 10 existing sites and 29 new installed sites) 2021-2025: 8 new sites (Lao Cai, Ha Noi, Nghe An, Khanh Hoa, Binh Thuan, Dak Nong, Ba Ria Vung Tau, Kien Giang) 2026-2030: 5 new sites (Lai Chau, Son La, Ha Giang, Tuyen Quang, Hai Phong) 2031-2050: 16 new sites (Dien Bien, Son La, Hoa Binh, Ha Giang, Bac Can, Thanh Hoa, Nghe An, Ha Tinh, Quang Nam, Da Nang, Kon Tum, Lam Dong, An Giang, Ca Mau) (as of 2023)	All Radars in Dual-Pol for better Rainfall Estimates. Upgrades of Older Radars. Redundant System at site (same brand). More Radar related training, esp. on Radar Hardware. 26 X-Band Radars for Flood Forecasting, Radar and Rain-gauge correlation, specifically for River Basins. (as of 2023)	Maximum Radar in the different frequency bands will be replaced by Solid State Power Amplified(SSPA) and dual polarization functionality
1.2 Radar operation					
Are radars operated by NMHS? Please fill in the name of the operating organization.	Yes(Japan Meteorological Agency)	Thai Meteorological Department	Yes (VNMHA)	Yes, Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA)	Yes(India Meteorological department)
Number of staff for operation and monitoring (at each local office and/or at headquaters)	5 (headquater)	5 (weather forecast division) 5 (observation division)	4 (headquater), 5 each radar (local office)	4 (headquater), 1-2 for each radar (local office)	15 (headquater), 6 each radar (local office)
Number of staff involved in equipment maintenance (at each local office and/or at headquaters)	1 (local office), 8 (headquater)	5 (headquater)	8 (headquater), 1 each radar (local office)	4 (headquater), 1-2 for each radar (local office)	15 (headquater), 6 each radar (local office)
Details of regular inspections (daily)	Remote inspections from the headquaters (JMA staff) : - Confirmation of date and time of each device - Confirmation of operational history of each device - Confirmation of operational status and communication line status	Inspections from the local officer (meteorological officer at radar site) - Confirmation of date and time of each device - Confirmation of operational status.	24/7 monitoring shifts (local), each shift has 1-2 staffs on duty to monitor and operate the system.	as prescribed on the vendor's daily maintenance sheet guide	Remote inspection from the headquarter (IMD Staff)
Details of regular inspections (weekly)	Remote Inspections from the headquaters (JMA staff): - Polarization parameters - Reflectivity, distance and azimuth of fixed targets by terrain echo - Transmission power - Pilot signal level and phase difference - Noise level	Remote Inspections from the headquaters - Polarization parameters - Reflectivity, distance and azimuth of fixed targets by terrain echo - Transmission power - Pilot signal level and phase difference - Noise level	On-site Inspection - Radar site perimeter cleaning - Check power supply - Record receiver and transmitter parameters	as prescribed on the vendor's weekly maintenance sheet guide	None
Details of regular inspections (monthly)	Remote inspections from the local office (JMA staff) : - Dehydrator status - Condition of antenna and radome - Management of station buildings, etc.	Inspections from the local officer (meteorological officer at radar site) ' - Inspection of generator - Management of staion buildings	On-site Inspections - Radar site perimeter cleanup - Checking the power supply - Record receiver and transmitter parameters	as prescribed on the vendor's monthly maintenance sheet guide	Remote inspection from the headquarter (IMD Staff)

Item	JMA (Japan)	Thailand	Viet Nam	the Philippines	India
Details of regular inspections (every 3 months)	On-site Inspections (JMA staff) : - Inspection of generator - Management of staion buildings	Inspections from the local officer (meteorological officer at radar site) - Management of staion buildings	none	On-site inspection by contractor and headquarters: - General maintenance of the whole radar system. - Replacement of Monthly Consumables	None
Details of regular inspections (every 6 months)	On-site Inspections (JMA staff) : - Check radar equipment (antenna, transmitter, waveguide, receiver, etc.) - Checking of system parameters - Technical guidance to the staff of the local office On-site Inspections (Manufacturer) : - System checking - Spare parts checking - Exchanging expendables (ex; Gear oil, Klystron)	On-site Inspections (staff from headquater) : - Check radar equipment (antenna, transmitter, waveguide, receiver, etc.) - Checking of system parameters	On-site Inspection: - Oil check of antenna system main gear Visual inspection of the radome Antenna control unit to check positional accuracy - Air filter cleaning (antenna control unit, transmitter, receiver cabin) - Check PRF, servo motor, pulse bandwidth, and transmit power.	On-site inspection by contractor and headquarters: - General maintenance of the whole radar system. - Replacement of Monthly Consumables	On-site Inspections : - Check radar equipment (antenna, transmitter, waveguide, receiver, etc.) - Checking of system parameters - Calibration etc
Details of regular inspections (annually)	none	-	On-site Inspection: - Change antenna oil - Check antenna system switches and safety switches On-site inspection by the Military Academy of Science and Technology: - Measure and adjust parameters (beam width, antenna gain, radio energy attenuation factor, transmitter transmit power, receiver sensitivity, etc.) Remote inspection by NCN personnel: - Cleaning of electrical cabinets and radar receivers and transmitters - Measurement of power supply and radio signal reception parameters - Maintenance of mechanical systems - Cleaning and repainting of radome - Recalibration of antenna azimuth and elevation angles - Checking lightning protection systems, etc.	On-site inspection by contractor and headquarters: - Overall maintenance of the whole radar system. - Corrective maintenance of the whole radar system. - Replacement and Replenishment of Yearly Consumables.	On-site Inspections : - Check radar equipment (antenna, transmitter, waveguide, receiver, etc.) - Checking of system parameters - Calibration etc
Details of regular inspections (once every few years)	On-site Inspections: - Replace UPS battery and servo motor every 5 years	-	~~~~	On-site inspection by contractor and headquarters.	~~~~
Is maintenance contract concluded with manufacturer? (Yes/No) If yes, please fill in its details.	Yes: - Inspection and adjustment of radar equipment - Accuracy check of measuring instruments - Operation check of spare parts, etc.	It's depend on budget proposal for each site.	No	Yes, once a year with a foreign engineer. - corrective maintenance of the whole radar system. - they have their own instruments. - no hot spares available at site.	None
Are spare parts controled? (Yes/No)	Yes	Yes	Yes	No, since we can't store spares.	Yes
Redundancy of the main equipment such as the transmitter	Partially redundant (general-purpose computer, dual-polarization radar transmitter module)	Partially redundant (general-purpose computer, dual-polarization radar transmitter module)	Partially redundant	part of future plans. Redundant TX and RX sharing same antenna.	Partially redundant (General purpose Compute etc.)
1.3 Data transmission and storage					
Is the data sent to the center system in (near) real time? (Yes/No)	Yes	Yes	Yes	Yes	Yes
Coordinate system and resolution of the data sent to the center system (e.g., polar coordinates, Cartesian coordinates, lon-lat coordinates)	Polar coordinates (range : 125m, azimuth : 0.7/0.35 degrees)	Polar coordinates (range : 240km, azimuth : 0.6875 degrees)	Polar coordinates (range : 500/1125m, azimuth : 1.7/1 degrees)	Radar Generated Raw Data/Volume	Range : 300m IMD-B, 600m IMD-C, 1Degree Resolution
Data format of files sent to the center system (e.g., GRIB2, NetCDF, Original, png, etc.)	GRIB2	UF , vol	Raw format (Manufacture formats)	Original	IRIS Raw, NetCDF, HDF5,Gif
Variables sent to the center system (e.g., Z, Vr, W, dual-pol parameters, QC data, etc.)	Z, Vr, W, dual-pol parameters, QC data	Z, Vr, W, dual-pol parameters, QC data	Z, Vr, W, dual-pol parameters	All radar products	Z,Vr,W, Dual Pol Parameters
Transmission method to the center system (metal cable, optical fiber cable, mobile, satellite, etc.)	Optical fiber cable, metal cable (Some also have LTE or satellite lines as backup lines)	Optical fiber cable, metal cable	Optical fiber cable	Leased Line(IPVPN), VSAT for remote and unmanned sites	VPN connection or, if it fails, public Internet connection
Communication speed between radar sites and center system (bandwidth guarantee / best effort)	3 Mbps (bandwidth guarantee),sufficient for transmission of dual-pol three-dimensional data	~~~~	4 Mbps, sufficient for transmission of dual-pol three-dimensional data	IPVPN: 5Mbps (min) VSAT: 10-15Mbps (min)	2 Mbps- 20 Mbps
Data storage method at the center system (server (NAS), external HDD, DAT, LTO, etc.)	Server (NAS), LTO	NAS , LTO	Server (NAS), external HDD	Server (NAS), Data Storage Facility	NAS
Retention period of the stored data at the center system	20 years	depend on budget proposal	10 years	~~~~	14 years
Stored data resolution (e.g. Is the data packed into 8-bit or 16-bit integers, or stored as 32-bit or 64-bit floats?)	8-bit integer (Quantized to 252 levels)	8-bit integer	8-bit integer (Quantized to 252 levels)		8-bit
Compression scheme used, if any. (This could be internal compression for some formats (e.g. HDF5) or perhaps simply by compressing the entire file before transport (e.g. gzip))	gzip compression for file transport	gzip , bz2	compressed by private algorithm of manufactures	gzip for storage	tgz for IRIS Raw, zip for NetCDF

Item	JMA (Japan)	Thailand	Viet Nam	the Philippines	India
1.4 Signal Processing, Quality Control					
Is the ground clutter removed? (Yes/No) If yes, please describe the method. (Doppler filtering such as FIR, IIR, GMAP (Gaussian Model Adaptive Processing), or filtering that uses a combination of various conditions including dual-polarisation information such as selective MTI (JMA), or filtering using a clutter map)	Yes: - selective MTI and clutter map	yes	Yes: - selective MTI and clutter map	Yes: - Quality control based on manufacturers QC techniques and Fuzzy Logic QC for Interference, ground clutter and sea clutter.	Yes: Frequency Domain and Time Domain selective clutter filtering techniques
Are the other clutters removed? (Yes/No) If Yes, please describe the targets. Examples; sea clutter, interference, blight-band, anomalous propagation, sun noise (Please list the types of clutter and the methods used to remove them)	Yes: - Removal of Interference, multiple-trip echo processing, invalid value processing, singularity removal, speckle removal, clear air echo removal	Yes: - Removal of Interference	Yes: - See clutter, interference, bright band, anomalous propagation, sun noise	Yes: - same as above	Yes - Ground Clutter
Is Doppler velocity unfolded? (Yes/No) If yes, please fill in the method. (Dual-PRF, HMP (Hybrid Multi-PRF method), UNRAVEL (Unfold Radar Velocity), etc.)	Yes (HMP)	No	Yes (Dual-PRF)	Yes(to some radars that are capable of velocity unfolding and with right configuration)	Yes
How is comprehensive data quality control carried out? Please describe the method and tools. (ex. QC is carried out by the software developed by our own NMHS / manufacturer,) *Free description is acceptable.	JMA-based We carry out QC based on the method and tool developed by JMA ourselves.	manufacturer,	VNMHA-based, public libraries on the internet We carry out QC based on the method and tool developed by VNMHA ourselves and based on public libraries.	PAGASA - Based QC and QC from the manufacturer.	None
1.5 Data Processing					
Are the radar data processed by the center system? (Yes/No)	Yes	Yes	Yes	No	Yes
Data processing and display software (e.g., Edge, IRIS, J-Birds, self-developed, etc.)	Self-developed (multi-monitor tool)	~~~~	IRIS, J-Birds, self-developed	Manufacturer Dependant / Website	Iris
Is the domestic composite map created? (Yes/No)	Yes	Yes	Yes	Yes	Yes
Coordinate system, resolution and data format of the domestic composite data	lon-lat(0.75 min(lon), 0.5 min(lat)), GRIB2	?	lon-lat(1kmx1km), binary, netcdf	lat-long image mosaic, PNG, jpg	~~~~
Is the CAPPI data created? (Yes/No) If yes, please fill in the altitude plane of CAPPI.	Yes: - 1-15 km, 15 layers per km	Yes: - ~~~~	Yes: - 1-15 km, 15 layers per km	2 km CAPPI (for some radar in NETCDF format)	No
Is the P-CAPPI data created? (Yes/No) If yes, please fill in the altitude plane of P-CAPPI.	Yes: - 2 km altitude plane	Yes: - ~~~~	Yes: - 2 km altitude plane	Yes: 2 km for some radar	No
1.6 Technology and R&D					
Is there a department for development of radar operation softwares? (Yes/No) If yes, please fill in its main development items. (e.g. QPE, QPF, HC (Hydrometeor Classification) etc.)	Yes (QPE, QPF, HC)	Yes (QPE)	Yes (QPE, QPF)	No: No other software. Yes, for radar operations, But under development for QC- QPE, QPN and QPF	No
Is there a R&D department for radar? (Yes/No) If yes, please fill in its main research activities.	Yes: Research and development on signal processing, data assimilation, etc. at the Meteorological Research Institute	likely , almost R&D in the post processing like QPE , QPF and data analysis.	No	NO: - R&D for radar is just being organized and initialized by Numerical Modelling Section of RDTD. Focusing on data integration of Radar and WRF.	No
Which development and analysis tools are used? Please also provide the name of the software. E.g. OSS(Open Source Software), commercial, or self-developed.	Self-development(Draft), OSS (PyART, etc.)	Self-develoment , (PyArt , wradlib)	OSS (PyART, wradlib, etc.)	OSS - Python - PyArt, Wradlib	~~~~

Item	Japan	Thailand	Viet Nam	the Philippines	India
2. Use of radar data and products in forecasting operations					
2.1 Major radar data and products used in forecasting	Domestic composite of precipitation intensity, QPE, QPF, and precipitation nowcasts as well as lightning and tornado nowcasts are available.	Domestic composite of precipitation intensity, QPE and analysis nowcasting by tmd staff	QPE, QPF, Doppler Velocity, HC, other products (CAPPI, ETOPS,…)	All Radar products, SP and DP Products, together with Data Interpretation and Interpolation from Radar Display Software. QPE Product.	QPE, QPF
2.2 Is the use of radar data in forecast to qualitative or quantitative?	Used both qualitatively and quantitatively	Used both qualitatively and quantitatively	Used both qualitatively and quantitatively	quantitatively	Used both qualitatively and quantitatively
2.3 Is radar data used for precipitation monitoring or for precipitation forecasting?	Used for both precipitation monitoring and forecasting	Used for precipitation monitoring	Used for both precipitation monitoring and forecasting	Used for precipitation monitoring and forecasting	Used for both precipitation monitoring and forecasting
2.4 Is radar data being utilized for meteorological warnings announcements?	Yes	Yes	Yes	Yes	Yes
2.5 Is the QPE being implemented?	Yes	Yes	Yes	Yes, being published already on PAGASA Website.	Yes
If you answered yes to the question 2.5 (above), please fill in the outline of QPE method. (e.g. based on JMA/JICA method, By software created by manufacturer, etc.) *Free description is acceptable.	Quality control is performed on JMA and MLIT (Ministry of Land, Infrastructure, Transport and Tourism) radar data, and rain gauge data from JMA and other departments (MLIT and prefectures) are used to perform a two-step correction (overall correction and local correction) and synthesized nationwide.	JMA/JICA based	JMA/JICA based	The development of Radar Quantitative Precipitation Estimation (QPE) allows for the identification and measurement of rainfall levels during a radar observation. Interference (Lin et al. 2021), sea clutter, and ground clutter were removed from the radar using a fuzzy logic quality control approach. This product was developed through collaborative efforts between DOST - PAGASA and the Central Weather Administration via the MECO/TECO VOTE I and II projects. JICA/JMA/JMBSC provided a Radar Data QPE System suitable for the utilization of UF files. (under development)	~~~~
If you answered yes to the question 2.5 (above), please fill in the overview of QPE accuracy.	Compared to rain gauge data not used for QPE, it has a correlation coefficient of 0.975.	in 2023 , CC ~0.7 - 0.8	Compared to rain gauge data not used for QPE, it has a correlation coefficient of 0.85.	under development (by phase)	~~~~
2.6 Is the QPF being implemented?	Yes	No: - Under development	Yes	No	Yes
If you answered yes to the question 2.6 (above), please fill in the overview of QPF method.	A weighted average of the Extrapolated Forecast (EX6) based on QPE and the Meso-Scale Model (MSM) forecast precipitation, according to the precipitation forecast accuracy of the two models, is used to provide a short-time forecast of precipitation up to 6 hours ahead. From 7 to 15 hours ahead, the precipitation is forecast by combining the results of statistical processing of the MSM and the Local Forecast Model (LFM). Precipitation nowcasts are also provided up to 1 hour ahead, which are more immediate and spatially and temporally detailed. This is done by extrapolation methods only, not by numerical forecasting.	-	Based on optical flow algorithm, is used to provide a nowcasting of precipitation up to 3 hours ahead.	-	~~~~
2.7 Are quantitative indices for floods, landslide disasters, and inundation damage created based on radar data?	Radar data is used to create Soil Water Index, Surface Water Index, and Runoff Index. These indexes are used to create Risk Map for floods, landslide disasters, and inundation hazards.	From the QPE data, a risk map is created by color-coding by accumulated precipitation (Yellow: 35-90 mm, Red: >=90 mm).	The system displays the risk of flooding and landslides based on the accumulated precipitation over a six-hour period or three days, and issues warnings.	~~~~	~~~~
2.8 Usage of Doppler velocity	Velocity data is used for monitoring, developing the products such as Tornado Nowcast, assimilating into the NWP model.	for WRF-DA	Assimilate into the WRF model.	Velocity data are being used to trace the location of the center and eye of the storm where the Eye is not distinct.	~~~~
2.9 Usage of polarization data	Porarization data is used for quality control and to improve the accuracy of precipitation intensity estimation.	No: - Under development for quality control and to improve the accuracy of precipitation intensity estimation.	Porarization data is used for quality control and classify the severe phenomena (Hail, heavy rain, …)	Polarization data are being used to provide QPE for rainfall derived products and is also being used to detect hail observation during Intense convective Thunderstorm events.	~~~~
2.10 Data assimilation into a NWP model	Doppler velocity and reflectivity (which estimates humidity) are used for the MSM and the LFM. QPE is also used for the MSM.	Doppler velocity and reflectivity (which estimates humidity) are used for the WRF-DA in thailand.	Assimilate into the WRF model.	Currently reflectivity only, under research development (assimilation to WRF models)	~~~~
2.11 Are there any aooperation and collaboration with the hydrological department? **If yes, please fill in the activity (such as in radar operation, radar data exchange, data processing and analyze) .**	Radar data observed by the River Bureau is shared with JMA, and incorporated into JMA's radar products including QPE. JMA's radar products data and related products are shared with the River Bureau.	SEAFFGS	Providing radar data as input for flash flood, landslide (FFGS) or urban flood warning systems (flood4cast)	On-going collaboration with the HMD. (under development)	~~~~

Item	Japan	Thailand	Viet Nam	the Philippines	India
3. Provision and exchange of radar data products					
3.1 Publication on the website					
Are radar products publicly available on your website? If yes, please fill in the product name.	Yes: - National composite of precipitation intensity, QPE, Precipitation Nowcast, QPF	Yes: - Nationwide radarcomposite	Yes: - National composite of reflectivity, QPE, QPF, accumulated rainfall up to 72h, Flash flood and landslide products	Yes - hybrid mosaic, - no blockage, lowest available reflectivities with no blockage.	Yes: - ~~~~
Frequency of products updates on the website	National Composite Precipitation Intensity: every 5 minutes QPE: every 10 minutes Precipitation Nowcast: every 5 minutes QPF: every 10 minutes for the next 6 hours, every hour for the next 7-15 hours	Nationwidel Composite Precipitation Intensity: every 15 minutes QPE: every 1 hours	National Composite reflectivity: every 10 minutes QPE, QPF, accumulated rainfall up to 72h, Flash flood and landslide: every 01 hours	RADAR Mosaic QPE - Every 15 mins	~~~~
3.2 Provision of radar data					
Is data provided to relevant ministries and agencies? If yes, please fill in about data format, real-time/non-real-time, and data policy.	Yes(GRIB2, real-time, free and unrestricted)	Yes (ASCII, real time)	Yes(NetCDF, binary, images, real-time)	No. but we can have a MOA with other departments and agencies for the data sharing and other policies.	Yes, Gif, PNG, NetCDF, HDF5, BUFR, IRIS Raw, Real Time, Non Real Time, NDC Data Policy(IMD).
Is data provided to the private sector? If yes, please fill in about data format, real-time/non-real-time, and data policy.	Yes, via the designated entity (GRIB2, real-time and non real-time, free and unrestricted (charged at delivery cost)	Yes (ASCII, real time)	Yes(NetCDF, binary, images, real-time)	Yes, access is provided depending on the specific request (e.g., radar images). However, historical data is restricted, and the private sector must request such data through the Climate Data Section of PAGASA.	Yes, Gif, NetCDF, PNG, HDF5, BUFR, IRIS Raw, Real Time, NDC Data Policy(IMD), Non Real Time, charged per Mb
Is data provided to the general public? If yes, please fill in about data format, real-time/non-real-time, and data policy.	Yes, via the designated entity (GRIB2, real-time and non real-time, free and unrestricted (charged at delivery cost)	Yes (ASCII, real time)	Yes(NetCDF, binary, images, real-time)	Yes, access is provided through designated sections (radar images, volume data, non-real-time data) and is subject to restrictions (upon requests, image files mostly). However, for research purposes, data are provided to students free of charge. (UF Files)	Yes, Gif, PNG, NetCDF, HDF5, BUFR, IRIS Raw, Real Time, Non Real Time, NDC Data Policy(IMD), charged per Mb
3.3 Exchange radar data with other countries					
Is radar data exchanged bi-/multi-lateral internationally? If yes, please fill in the data format and communication speed.	Yes (GRIB2 (composite)	Yes (GRIB2 (composite)	Yes (GRIB2 (composite)	Yes - GRIB2 (Composite)	Historical Data (NC) in zip
Coordinate system and resolution of internationally exchanged radar data	Lon-lat (0.75 min.(lon), 0.5 min.(lat))	Lon-lat (0.01 min.(lon), 0.01 min.(lat))	Lon-lat (1km x 1km)	Not available	~~~~
Variables of internationally exchanged radar data (e.g., precipitation intensity R, reflectivity Z, vertical integrated rainfall VIL, Doppler velocity, etc.)	Precipitation intensity	Precipitation intensity	Precipitation intensity	Reflectivity and QPE	~~~~
Vertical layer(s) of internationally exchanged radar data (e.g., PCAPPI (2 km altitude plane), CAPPI (10 layers, every 1 km))	PCAPPI (2 km altitude)	PCAPPI (2 km altitude)	PCAPPI (2 km altitude)	PCAPPI (2km altitude)	~~~~
Stored data resolution (for international exchange) (e.g. Is the data packed into 8-bit or 16-bit integers, or stored as 32-bit or 64-bit floats?)	8-bit integer (Quantized to 252 levels)	8-bit integer (Quantized to 252 levels)	8-bit integer (Quantized to 252 levels)	Not available	
Compression scheme used (for international exchange), if any. (This could be internal compression for some formats (e.g. HDF5) or perhaps simply by compressing the entire file before transport (e.g. gzip))	Run length packing (GRIB2)	Run length packing (GRIB2)	Run length packing (GRIB2)	Not available	
Do you create composite data from domestic and internationally exchanged data? (Yes/No)	Yes	Yes	Yes	Domestic Data only	

Item	Japan	Thailand	Viet Nam	the Philippines	India
4. Regulations and capacity development related to radar observation operations					
4.1 Radar Observation Regulations					
Are documents defining the internal rules of radar operation prepared?	Yes	Yes	Yes	Yes	~~~~
Are manuals describing radar operation, maintenance, and troubleshooting prepared?	Yes	Yes	Yes	Yes, in headquarters and on-site	~~~~
Are reports on radar operation and troubleshooting regularly compiled and retained?	Yes	Yes	Yes	Yes	~~~~
Are reports on regular radar operation and troubleshooting-issued regularly?	Yes	Yes	Yes	Yes	~~~~
4.2 Human resource development					
Are in-house training programs related to radar conducted? If yes, please describe the outline.	Yes JMA contracts with a manufacturer to provide on-site training to JMA staff once a year. JMA headquarters staff provide on-the-job training to the local staff. A comprehensive training course for remote sensing is conducted at JMA headquarters via a live connection to the local offices once a year.	Yes, - after installation have a traning course for TMD staff - another way like a knowledge management (KM) in TMD.	Yes.	Yes. In terms of Radar Data Applications, PAGASA conducts refresher courses on radar data observation and interpretation for all employees who utilize radar information in their daily operations. Additionally, Radar Meteorology is integrated as a core subject in the Meteorologist Training Course (MTC), ensuring comprehensive training for aspiring meteorologists. No, for technical aspects. All (4) Radar Engineers/Technicians at headquarters doesn't have a proper, concrete, and precise technical training related on Radar Operation, Troubleshooting and Maintenance. All relevant trainings are coming from FAT, SAT, on-site training, and Maintenance Activities from Contractor. The rest are self-taught.	Yes: - In-house lectures on parts removal and how to use measuring instruments (spearmanas and power meters)
Are research collaborated with universities and/or research institutes related to the radar conducted? If yes, please describe the outline.	Joint research to improve the prediction accuracy of Stationary linear mesoscale convective systems with Universities and National Research Institutes including technical development for advanced application of radar data is conducted.	Yes, - radar quality control with University.	Yes. Cooperation through projects that use radar to estimate rainfall and warn of dangerous weather phenomena such as hail	There is an ongoing collaborative effort with the Central Weather Bureau of Taiwan through the MECO-TECO I and II projects to develop RADAR QPE for the Philippines. Additionally, graduate research at the University of the Philippines Diliman and Ateneo de Manila University focuses on the aspect of radar data utilization. And, research studies have been conducted with UP Department of Computer Science, where there are development of AI for Rainfall Warning Services	~~~~
Are study abroad program related to the radar conducted? If yes, please describe the outline.	JMA staff can apply for the Administrative Officer Long-Term Overseas Research Program to study abroad for research using radar and other observation data.	Yes. - technical tour and radar site visit	VNMHA nominates staff to participate in short-term courses invited by WMO member countries (JMA, KMA,...)	Various international government organizations, such as the Japan Meteorological Agency (JMA), Korea Meteorological Administration (KMA), and China Meteorological Administration (CMA), regularly invite PAGASA to participate in their capacity-building initiatives focused on radar observation, forecasting, and other observational data applications. For capacity-building regarding in Radar Operations and Maintenance, we hope that JMA and other NMHSs collaborate with this to ensure that all radar maintenance personnel are fully equipped with relevant knowledge and skills needed on this task.	~~~~

Appendix 1. Current status of Members' radar capabilities

For Pakistan, Bangladesh, Singapore, the United Arab Emirates, Sri Lanka

Item	Pakistan	Bangladesh	Singapore	the United Arab Emirates	Sri Lanka
(1) Summary of the current situation					
1.Radar observation					
1.1 Basic Radar Information					
Is Metadata managed?(Yes/No)	Yes	Yes	Yes	Yes	-
Number of radars (each band)	S (2), C (1), X (1)	S (5), C (0), X (0)	S (1), C (1), X (0)	S (0), C (7), X (0)	
Main band of radar network (S, C, X, those mixed)	C,S,X band	C Band	S,C band	C-band	
Transmission method (magnetron, klystron, solid-state power amplifier(SSPA))	SSPA,magnetron	Klystron for old radar SSPA for new radar	klystron, magnetron	magnetron	
Single-polarization or dual-polarization (or mixed)	Single-polarization	Single-polarization	dual-polarization	dual-polarization	
Maximum observation range of main radar	480km (Monitoring),200 km(Doppler Quantitative)	450 Km	500km	250km (Operational Range)	
Scan strategy (lower layerlevel only or three dimensional)	Three Dinentional	Three Dimention	three dimensional	three dimensional - Top Down	-
Continuous observation(24/7) or intermittent observation	Intermittent	continuous 24/7	Continuous observation(24/7)	Continuous observation(24/7)	-
Observation frequency of precipitation in the lower layer (XX minutes/X hours)	10 min	10 Min	5 min.	6 min.	-
Observation frequency of three-dimensional volume scan (XX minutes/X hours/none)	10 min	8.4 minutes	5 min.	6 min.	-
Please fill in the latest future plan for the radar network (installation/update of radars, introduction of dual-pol and SSPA radars, etc.)	Expension of radar notwork as follow 1. 4 Sband(Dual Plorization) 2. 2 C band(Dual Plorization) 3. 2 X band(Dual Plorization) and Upgradation of 01 Cband radar.	All klystron radar will be replaced by SSPA radar	Replacement of S-band Radar Tender is called, expected completion by end 2026. • Automate system monitoring to reduce response time to system fault • Improve data quality of radar products • Design radar that is relatively easy to maintain • data processing in a cloud environment Collaboration with other Agencies Ongoing collaboration with • using PUB's X-band data to improve overall quality of radar data across Singapore; • Integrated CAAS wind lidar into MSS radar visualization system.	Replace the first three Dual-pol radars - 2025-27 (Mix between S and C-band)	Bid awarded and civil construction started for C-band SSPA dual-pol. Radar under the grant by JICA. Observation range is 400km
1.2 Radar operation					
Are radars operated by NMHS? Please fill in the name of the operating organization.	PMD(Pakistan Meteorological Department)	Yes (BMD persennel)	Yes. Meteorological Service Singapore	Yes (National Center of Meteorology - UAE)	-
Number of staff for operation and monitoring (at each local office and/or at headquaters)	15 (headquater), 6 each radar (local office)	10 each radar (local office)	2 each radar (local office)	4 (headquarter)	-
Number of staff involved in equipment maintenance (at each local office and/or at headquaters)	15 (headquater), 6 each radar (local office)	10 each radar local office and Headquarter personel if needed	2 each radar (local office)	4 (headquarter)	-
Details of regular inspections (daily)	On-site Inspection: - Check power supply, room temperature, and radar power maintenance panel. - Check transmitter, dryer, radar task control, antenna task control.	On-site Inspection - Check room temperature, equipment room, backup room, power supply, transmitter, dehydrator	none	Remote inspection from the headquarter: - Check data, alerts, network status between systems, quality, and filtering status - checking radars raw data	-
Details of regular inspections (weekly)	On-site Inspection: - Check radome light indication, antenna, DRSP (DC power supply unit voltage), transmitter (DC power supply unit voltage, fan unit voltage)	On-site Inspection: - Check radome, antenna controller (DC voltage, rotation speed), and meter readings Check DC voltage, antenna tuning unit (ATU) of transmitter, both Doppler mode and intensity mode	On-site inspection by contractor - Hardware and Software	Remote Inspections that include checking: - TX power, forward & reversed power, VSWR - Reflectivity, distance and azimuth of fixed targets by terrain echo - Dehydrator duty cycle - Noise level - Polarization parameters	-

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Details of regular inspections (monthly)	On-site Inspection: - Check antenna controller DC power, transmitter (frequencies including short and long pulses), CH-I and CH-II intensity mode and Doppler mode PRF, pulse width, transmit power, duty (dB), DRSP (dynamic range), dehydrator (silica gel color)	On-site Inspection: - Check both intensity and Doppler modes, frequency, pulse repetition frequency, pulse width, zero adjustment, signal level, and silica gel color.	On-site Inspection by contractor: - Hardware and Software	On-site Inspections that include checking: - Antenna & Radome condition - Radar shelter condition -Radome and shelter air conditioning units - Waveguides & cables between shelter & Radome - Diesel Generator	
Details of regular inspections (every 3 months)	On-site Inspection: - Radome (interior view, checking of panels and base) - Antenna (oil level, oil leaks, oil color, EL and AZ section belts, grease replenishment) - Antenna controller (position accuracy, clean air filter) - Air filter cleaning (transmitter, DRSP, AVR, power capacitors)	Daily, Weekly, Monthly etc	none	~~~~	-
Details of regular inspections (every 6 months)	On-site Inspection: - Radome (interior view, checking of panels and base) - Antenna (oil level, oil leaks, oil color, EL and AZ section belts, grease replenishment) - Antenna controller (position accuracy, clean air filter) - Air filter cleaning (transmitter, DRSP, AVR, power capacitors)	On-site Inspection: - Check antenna controller, azimuth and elevation angle	none	On-site Inspections that include: - Checking pedestal levelling - Checking/Performing sun calibration - Cleaning Radome area and pedestal - Checking/Setting transmitter power - Checking/Setting transmitter frequency - Checking/Performing receiver calibration - Cleaning filters and system - Checking for noisy fans - Checking the cabinet cooler - Checking internal cables	-
Details of regular inspections (annually)	On-site Inspection: - Includes all tasks performed during daily, weekly, monthly, and six-monthly maintenance, additional tasks include: oil change/change, antenna switch operation, first limit operation, second limit operation, safety switch operation	On-Site Inspection: - UPS, oil change if necessary Check switch operation	On-site Inspection by contractor: - ~~~~	Annual maintenance with the manufacturer (Vaisala) for all NCM-Vaisala radars that includes a full inspection and calibration of each radar by Vaisala field service engineer	-
Details of regular inspections (once every few years)	~~~~	New so no need	~~~~	~~	-
Is maintenance contract concluded with manufacturer? (Yes/No) If yes, please fill in its details.	No	No	Yes: - Weekly, monthly and annual maintenance contracts with the goal of achieving a 99.5% service level. Includes hardware and software maintenance. Contractor submits maintenance plan in advance for approval.	Yes, an annual maintenance service contract with the manufacturer (Vaisala) for all NCM-Vaisala radars that includes a yearly full inspection and calibration of each radar by Vaisala field service engineer	
Are spare parts controled? (Yes/No)	No	Yes	No: - Instead, contractors are required to submit a spare parts management plan, which must be approved by the MSS, and to manage spare parts to meet radar uptime requirements. They are also required to update the spare parts list annually and to notify the MSS if parts are not readily available. In addition, the availability of spare parts is regularly audited to prevent downtime due to parts shortages.	Yes	
Redundancy of the main equipment such as the transmitter	Partially redundant (computer,radar transmitter module)	As Spare Parts	~~~~	Partial redundancy with new radars, (Standby Computers)	-
1.3 Data transmission and storage					
Is the data sent to the center system in (near) real time? (Yes/No)	Yes	Yes	Yes	Yes	-
Coordinate system and resolution of the data sent to the center system (e.g., polar coordinates, Cartesian coordinates, lon-lat coordinates)	Polar coordinates (range : 500m Doppler)	Lon-Lat Coordination	~~~~	Polar coordinates (range : 300m, azimuth : 0.9degrees)	
Data format of files sent to the center system (e.g., GRIB2, NetCDF, Original, png, etc.)	Original	Original	~~~~	Sigmet and NetCDF	-
Variables sent to the center system (e.g., Z, Vr, W, dual-pol parameters, QC data, etc.)	Z,V,W	Yes	~~~~	Z-TOT, Z, Vr, W, dual-pol parameters	-
Transmission method to the center system (metal cable, optical fiber cable, mobile, satellite, etc.)	Optical Fiber	Mobile and satellite lines	Optical fiber cable	Optical fibber cable and mobile 4/5G	-
Communication speed between radar sites and center system (bandwidth guarantee / best effort)	100 Mbps	C-band	~~~~	8 Mb fibber and mobile best effort. Sufficient for transmission of dual-pol three-dimensional data	
Data storage method at the center system (server (NAS), external HDD, DAT, LTO, etc.)	External HDD	External HDD	~~~~	Server (NAS) and at DR site, LTO	-
Retention period of the stored data at the center system	06 Year	1 Year	~~~~	For ever.	-
Stored data resolution (e.g. Is the data packed into 8-bit or 16-bit integers, or stored as 32-bit or 64-bit floats?)	16 Bit	8 bit		32 bit float, migrating to 64 bit float	
Compression scheme used, if any. (This could be internal compression for some formats (e.g. HDF5) or perhaps simply by compressing the entire file before transport (e.g. gzip))	No	zip		Internal and gzip.	

Item	Pakistan	Bangladesh	Singapore	the United Arab Emirates	Sri Lanka
1.4 Signal Processing, Quality Control					
Is the ground clutter removed? (Yes/No) If yes, please describe the method. (Doppler filtering such as FIR, IIR, GMAP (Gaussian Model Adaptive Processing), or filtering that uses a combination of various conditions including dual-polarisation information such as selective MTI (JMA), or filtering using a clutter map)	Yes ,Selective MTI	Yes , Filtering	Yes:	Yes: -filtering using mostly combination with dual-polarisation information. "NCAR - LROSE"	-
Are the other clutters removed? (Yes/No) If Yes, please describe the targets. Examples; sea clutter, interference, blight-band, anomalous propagation, sun noise (Please list the types of clutter and the methods used to remove them)	Yes(Partially)	Yes: - See clutter, interference	Yes: - See clutter, multiple-trip echoes, interference, removal of data bins with very large velocity widths, dual-polarization attenuation correction	Yes: - land and sea clutter, anomalous propagation, blight-band, sun noise, second trip, RF interference and chaff.	-
Is Doppler velocity unfolded? (Yes/No) If yes, please fill in the method. (Dual-PRF, HMP (Hybrid Multi-PRF method), UNRAVEL (Unfold Radar Velocity), etc.)	Yes (HMP)	By Manufacturer	~~~~	Yes: - Dual-PRF	-
How is comprehensive data quality control carried out? Please describe the method and tools. (ex. QC is carried out by the software developed by our own NMHS / manufacturer,) *Free description is acceptable.	No Machanism	By Manufacturer	~~~~	QC is carried out by using LROSE software developed by NCAR, UCAR. (RadxRate and RadxQC) *Free description is acceptable. - NCM also uses Vaisala filtered products.	-
1.5 Data Processing					
Are the radar data processed by the center system? (Yes/No)	Yes	Yes	Yes	Yes	-
Data processing and display software (e.g., Edge, IRIS, J-Birds, self-developed, etc.)	J-Birds	IRIS, J-BIRDS	Rainbow	LROSE (Rview and CIDD), IRIS Focus.	-
Is the domestic composite map created? (Yes/No)	No	Yes	Yes	Yes	-
Coordinate system, resolution and data format of the domestic composite data	~~~~	lat(24Degree 0 minute) long (90 degrree 25 minute)	GRIB2, geotiff	NCM Generate the following 3D Mosaic data: - UAE mosaic X,Y,Z: 0.5km x 0.5km x 0.5km (40) - UAE mosaic Lat/Lon X,Y,Z: 0.0051 x 0.0051deg x 0.5km (40) - GCC mosaic X,Y,Z: 1.0 x 1.0 x 1.0km (18) - GCC mosaic Lat/Lon X,Y,Z: 0.016 x 0.016deg x 1.0km (18) Formats: NCAR MDV, NetCDF and GRIP2	-
Is the CAPPI data created? (Yes/No) If yes, please fill in the altitude plane of CAPPI.	Yes: 1- 12 km Altitude plane	Yes	No	Yes: - as noted above with Z, 0.5 (40) and 1.0km (18).	-
Is the P-CAPPI data created? (Yes/No) If yes, please fill in the altitude plane of P-CAPPI.	Yes	Yes	Yes. 2km	Yes: - use 1 km to 2 km altitude planes.	-
1.6 Technology and R&D					
Is there a department for development of radar operation softwares? (Yes/No) If yes, please fill in its main development items. (e.g. QPE, QPF, HC (Hydrometeor Classification) etc.)	No	No	~~~~	Yes (QPE, QPF, HC)	
Is there a R&D department for radar? (Yes/No) If yes, please fill in its main research activities.	General Meteorological R&D is inplace	No	~~~~	Yes: Research and development: Latest Project completed: - Hail probability forecasting. @ NCM-UAE	-
Which development and analysis tools are used? Please also provide the name of the software. E.g. OSS(Open Source Software), commercial, or self-developed.	OSS	Jbirds, RedHat linux.	~~~~	OSS (LROSE, PyART)	-

Item	Pakistan	Bangladesh	Singapore	the United Arab Emirates	Sri Lanka
2. Use of radar data and products in forecasting operations					
2.1 Major radar data and products used in forecasting	QPF	Nowcasting, Norwester, tornado and Cyclone warning	Precipitation intensity of Singapore surrounding 480km range, storm tracking	DBZ, Composite QPE, storm tracking, Hail probability tracking.	-
2.2 Is the use of radar data in forecast to qualitative or quantitative?	Used both qualitatively and quantitatively	Used both qualitatively and quantitatively	Used both qualitatively and quantitatively	Used both qualitatively and quantitatively	-
2.3 Is radar data used for precipitation monitoring or for precipitation forecasting?	Used for both precipitation monitoring and forecasting	Used for both precipitation monitoring and forecasting	Used for both precipitation monitoring and forecasting	Used for both precipitation monitoring and forecasting	-
2.4 Is radar data being utilized for meteorological warnings announcements?	Yes	Yes	Yes	Yes	-
2.5 Is the QPE being implemented?	No	No,	No: - Under development	Yes	-
If you answered yes to the question 2.5 (above), please fill in the outline of QPE method. (e.g. based on JMA/JICA method, By software created by manufacturer, etc.) *Free description is acceptable.		~~~~	~~~~	Quality Control applied to radar data using LROSE particle identification detection filtering. Rain gauge network sparse and quality control not applied.	-
If you answered yes to the question 2.5 (above), please fill in the overview of QPE accuracy.	~~~~	~~~~	~~~~	Compared to rain gauge data not used for QPE, it has a correlation coefficient of +/- 0.85.	-
2.6 Is the QPF being implemented?	Yes	No,	No	No	-
If you answered yes to the question 2.6 (above), please fill in the overview of QPF method.	~~~~	~~~~	~~~~	~~~~	-
2.7 Are quantitative indices for floods, landslide disasters, and inundation damage created based on radar data?	~~~~	No	~~~~	Dubai and Al Ain municipalities are exploring the use of meteorological data which includes radar data for flood flash guidance and planning.	
2.8 Usage of Doppler velocity	For Monitoring of Cyclone ,Gust and thunderstrom	Used for tornado, norwester and cyclone warning	~~~~	Velocity data is monitored at airports for flight operations. Use of VEL and DBZ in NWP 3DVAR data assimilation.	
2.9 Usage of polarization data	~~~~	Single polarized	Yes	Polarization data is used for quality control and to improve the accuracy of precipitation intensity estimation.	
2.10 Data assimilation into a NWP model	~~~~	Yes	Yes,	We provide 6-minute hybri-rate data per radar for Cosmo/ICON Model, 3DVAR (dBZ and VEL) for WRF (data assimilation) hourly and 6-minute QPE mosaic for WRF (Hydro), with GCC merge Max dBZ composite data every 10-minutes for WRF (Met Plus).	-
2.11 Are there any aooperation and collabaration with the hydrological department? **If yes, please fill in the activity (such as in radar operation, radar data exchange, data processing and analyze) .**	~~~~	Yes	Yes, exchange of radar rainfall data with national hydrological agency, PUB.	Yes: - data exchange.	-

Item	Pakistan	Bangladesh	Singapore	the United Arab Emirates	Sri Lanka
3. Provision and exchange of radar data products					
3.1 Publication on the website					
Are radar products publicly available on your website? If yes, please fill in the product name.	Yes: Surface R,Cappi R,Accumulated R	Yes	Yes: - Current Rain Areas	Yes: - National composite of dBZ data. - 3D dBZ radar mosaic. - Storm forecast - 1hr	-
Frequency of products updates on the website	10 min	Every 10 minutes	5min, 15min, 30min	UAE mosaic (6 minutes) GCC mosaic (10 minutes)	-
3.2 Provision of radar data					
Is data provided to relevant ministries and agencies? If yes, please fill in about data format, real-time/non-real-time, and data policy.	Yes (real time)	Data not provided but forcasting nowcasting warning message provided when necessary.	Yes: GRIB2, NetCDF, GeoTIFF, PNG at 5 min intervals	Yes: Mainly web based. Also share products in MDV and NetCDF format, real-time, limited to approved users/agencies.	-
Is data provided to the private sector? If yes, please fill in about data format, real-time/non-real-time, and data policy.	No	No	Yes: GRIB2, NetCDF, GeoTIFF, PNG at 5 min intervals	Mostly QPE or Rain rate data on request provided in NetCDF. (Cost recovery charge)	-
Is data provided to the general public? If yes, please fill in about data format, real-time/non-real-time, and data policy.	Yes (real time via website)	forecasting, nowcasting and warning are Dissiminated by our website and different type of print or electronic media	Yes: Raster via website (PNG) at 5 to 30min intervals.	Yes, on request with cost recovery.	-
3.3 Exchange radar data with other countries					
Is radar data exchanged bi-/multi-lateral internationally? If yes, please fill in the data format and communication speed.	No	No	Yes: GRIB2 (composite)	Yes: - Mosaic and individual radars. - NetCDF, LROSE-MDV and Rainbow	-
Coordinate system and resolution of internationally exchanged radar data	~~~~		Cartesian coordinates, equal distance projection (1km)	Polar data and Cartesian data as per	-
Variables of internationally exchanged radar data (e.g., precipitation intensity R, reflectivity Z, vertical integrated rainfall VIL, Doppler velocity, etc.)	~~~~		Reflectivity Z	Reflectivity Z	
Vertical layer(s) of internationally exchanged radar data (e.g., PCAPPI (2 km altitude plane), CAPPI (10 layers, every 1 km))	~~~~	~~~~	PCAPPI; 2 km altitude plane	CAPPI - 18 x 1 km levels (MDV and NetCDF) Dual-Pol data (Rainbow) for UAE radars.	-
Stored data resolution (for international exchange) (e.g. Is the data packed into 8-bit or 16-bit integers, or stored as 32-bit or 64-bit floats?)			8-bit integer, 32 bit float	32 and bit float data	
Compression scheme used (for international exchange), if any. (This could be internal compression for some formats (e.g. HDF5) or perhaps simply by compressing the entire file before transport (e.g. gzip))			No	Internal compression NetCDF and MDV, Gzip for transfer.	
Do you create composite data from domestic and internationally exchanged data? (Yes/No)	~~~~	No	Yes(Domestic)	Yes	-

Item	Pakistan	Bangladesh	Singapore	the United Arab Emirates	Sri Lanka
4. Regulations and capacity development related to radar observation operations					
4.1 Radar Observation Regulations					
Are documents defining the internal rules of radar operation prepared?	~~~~	Yes	Yes	Yes	-
Are manuals describing radar operation, maintenance, and troubleshooting prepared?	Yes	Yes	Yes	Yes	-
Are reports on radar operation and troubleshooting regularly compiled and retained?	Yes	Yes	Yes	Yes	-
Are reports on regular radar operation and troubleshooting-issued regularly?	No	Yes	Yes	Yes	-
4.2 Human resource development					
Are in-house training programs related to radar conducted? If yes, please describe the outline.	No - ~~~~	Yes	Yes. Yearly radar refresher course to MSS forecasters	Yes: - NCM-UAE provide a radar course for forecaster students in collaboration with a local University. - NCM-UAE provide basic radar knowledge to any interested group. - NCM-UAE will also provide a radar course for the region under WMO.	-
Are research collaborated with universities and/or research institutes related to the radar conducted? If yes, please describe the outline.	~~~~	No		Yes: - UAE funded UAEREP program for rainfall enhancement projects.	-
Are study abroad program related to the radar conducted? If yes, please describe the outline.	No - ~~~~	Yes (our radar related personel regularly participate in different abroad program)	No	No: not at the moment.	-