



Workshop on Weather Radar Quality Control and Radar Data Exchange

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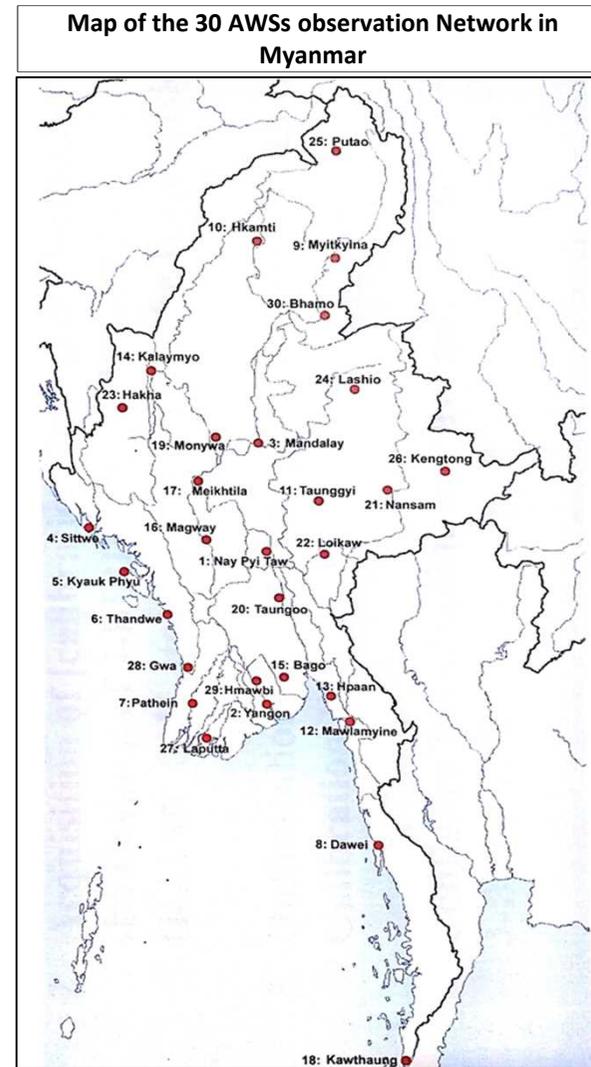
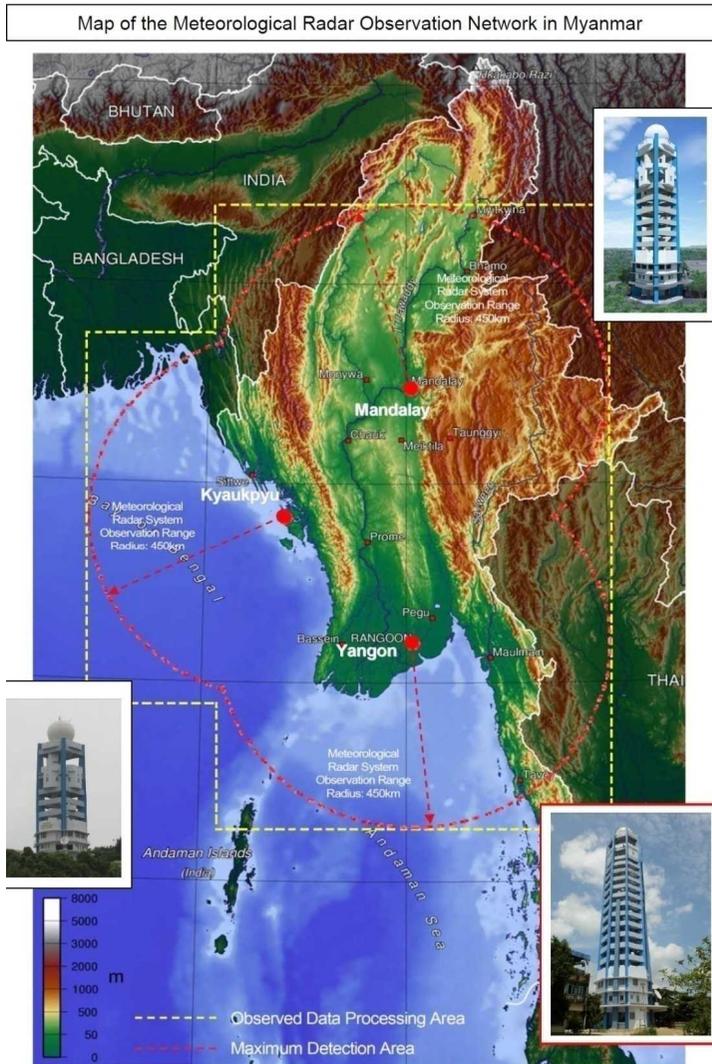
29th January 2024

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- Current Status of Radar Systems in Myanmar
- Some Specifications of Radar
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- Current Problems and Challenges
- Future Development Plans

Current Status of Radar Systems in Myanmar

The three weather RADARs and 30 AWSs are provided by the government of Japan through grant aid under the Project “Establishment of the Disastrous Weather Monitoring System to Myanmar”.



Kyaukpyu Radar station

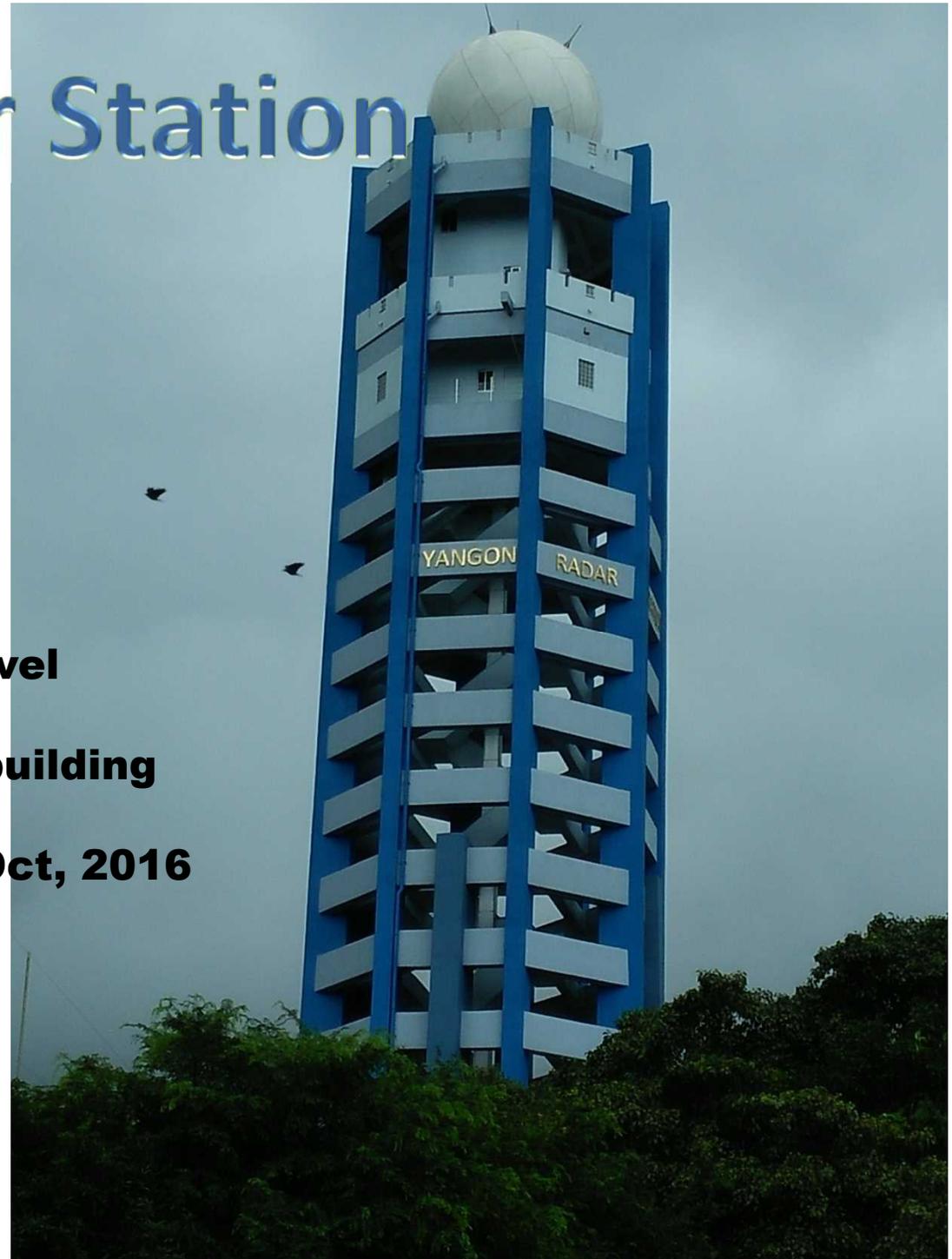


- **45.5m height from ground level**
- **70m above MSL, 9 stories building**
- **Hand over on 9 Oct, 2015**



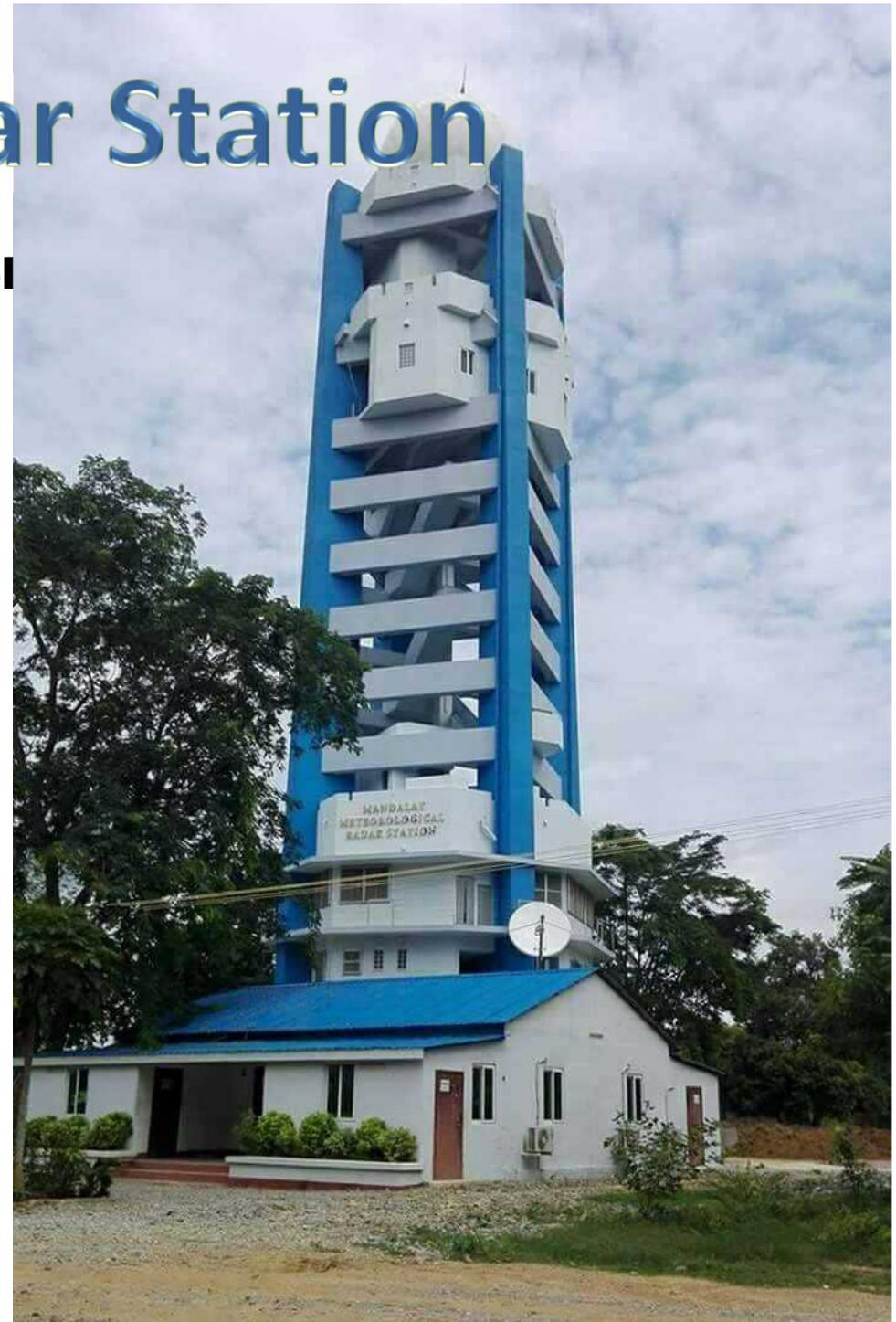
Yangon Radar Station

- **75.5m height from ground level**
- **91m above MSL, 18 stories building**
- **Hand over ceremony on 24 Oct, 2016**



Mandalay Radar Station

- **55.5 m height from ground level**
- **130m above MSL, 12 stories building**
- **Handing over on 8 June, 2018**





**Yangon
International
Airport**



Internet

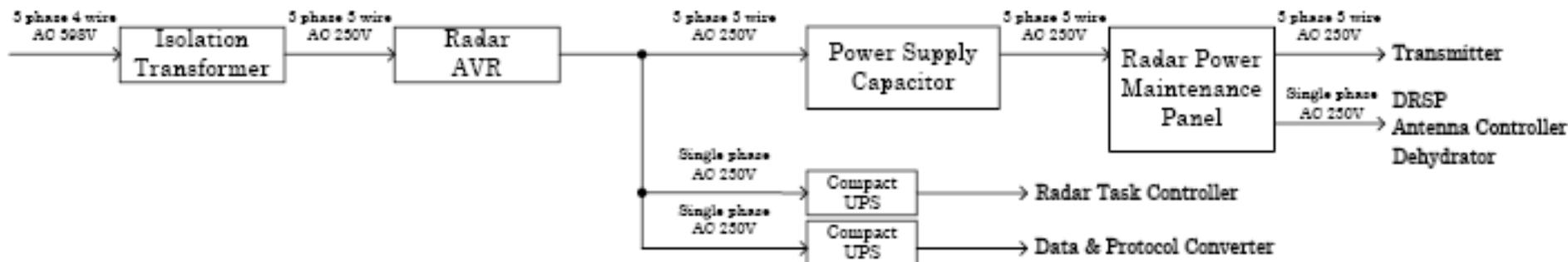
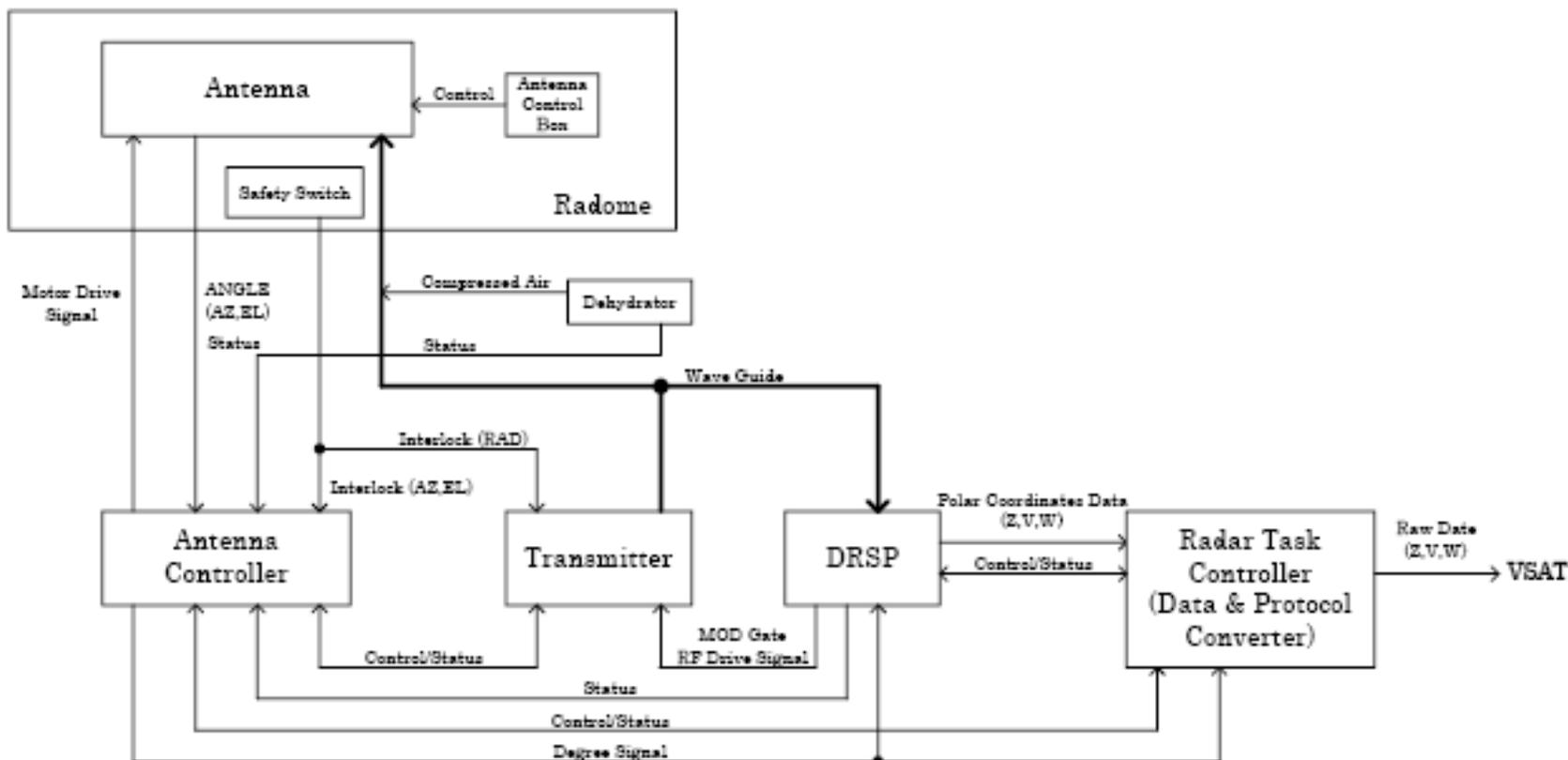
VSAT



Internet



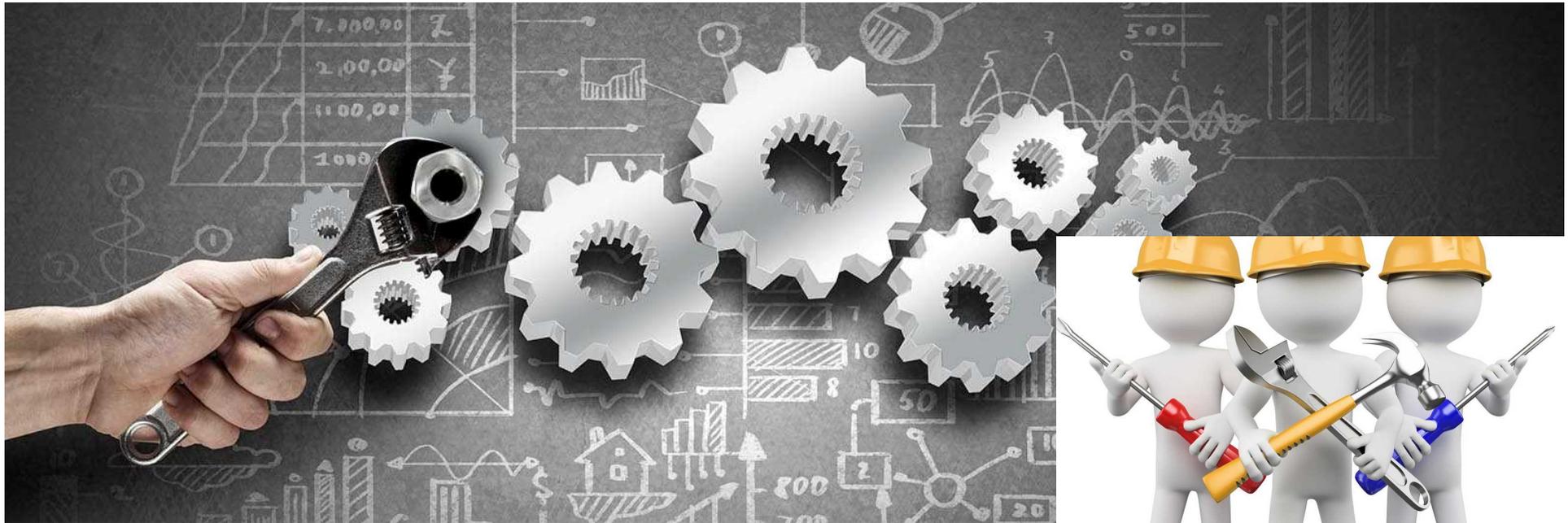
RADAR SYSTEM



Some Specifications of Radar

- Center Frequency : 2796 MHz (+/- 5 MHz)
- Type of Radar: S band Doppler Radar
- Antenna Diameter: approx 5m
- Transmitting Power: 10kW
- Beam angle: 1.56 degree
- Max observation range: (intensity)- 450 km
- Max observation range: (Doppler)- 200 km
- Power Amplifier : Solid State Type
- Antenna Driving Range: - Azimuth 360 degree,
- Elevation -2 to 90 degree
- By using 15kVA power supply capacitor

Equipment and Maintenance



Radome



Item	Specification
Type	Sandwich Type (spherical surface)
Dimension	Approx. 8 m diameter
Color	White
Survival Wind Speed	125 m/s
Suitable frequency	2,796 MHz (+/- 5 MHz)
Transmission loss	0.5dB or less on one way path in dry
Relative humidity	0 to 100%
Lightning rod	Protecting angles of 60 degree
Obstruction light	Waterproof lightning system

Antenna



Item	Specification
Type	Horn feed parabolic antenna
Reflector	Approx. 5m diameter
Suitable frequency	2,796 MHz (+/- 5 MHz)
Beam width	Not wider than 1.7 degree at - 3 dB point
Antenna gain	39 dB or more without radome
Polarization	Linear, Horizontal
Side lobe level	Not more than - 25 dB without radome
Driving range	Azimuth 360 degree, elevation - 2 to + 90 degree
VSWR	Not more than 1.4 without radome
Optical connection box	For converting electric control signal to optical one



Over-view of Radar Equipment

Antenna Controller

The antenna controller drives the servo motors (Azimuth AC servo and Elevation DC servo) and control the elevation angles of the antenna by the control signal and information sent from Radar Task Controller.





Digital Receiver and Signal Processor (DRSP)

- **Generates the RF transmission pulse and sends to the transmitter.**
- **Converts the received signal from the antenna to digital signal and performs signal processing.**
- **Signal Processor provides three basic data; intensity, Doppler velocity and spectrum width**

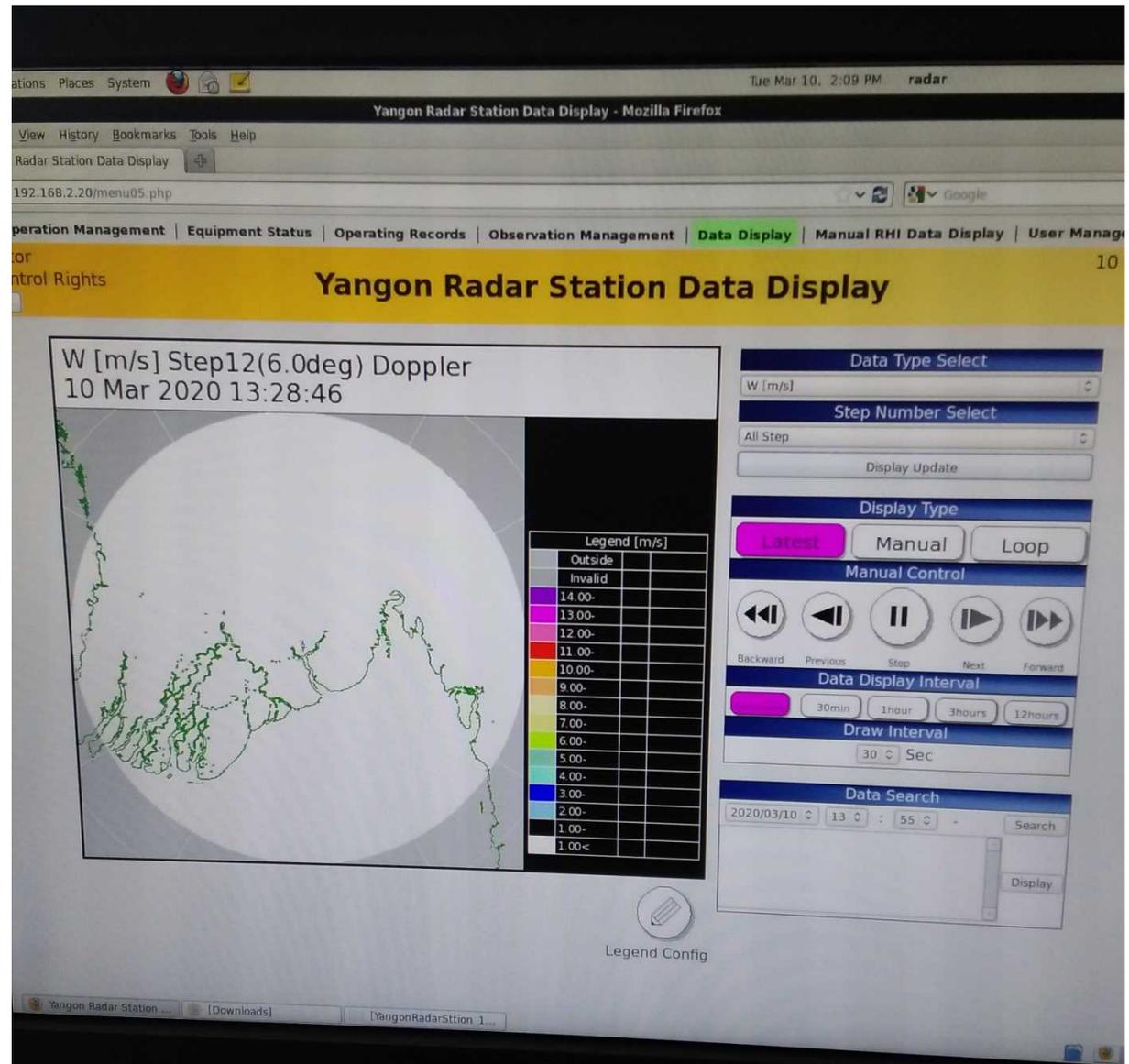
Transmitter

Use RF semiconductor device for power amplifier



RTC (Radar Task Controller)

- handles the operation of radar systems.
- Produces the raw data and sends these data to data and protocol converter.
- Operator can set the meteorological observation mode and schedule. And monitor the radar condition.



Data & protocol converter

Data & Protocol Converter function is to convert the observed data to a format which is compatible with center equipment.

Send raw data to VSAT IDU



Electricity Power Supply room





Two number of 75kVA engine generators are standby for power supply system



Daily Maintenance

Weekly Maintenance

Monthly Maintenance

Semi-annual Maintenance

Annual Maintenance



Daily Maintenance

1.	Voltage and current of AVR (30kVA)	Record the Input voltage on each phase of AVR. Stipulated range : 230VAC +/-20% (184V – 276V)
		Record the Output Voltage on each phase of AVR. Stipulated range : 230VAC +/-5% (218.5V – 241.5V)
		Record the Output Current I on each phase of AVR Stipulated range : 12A +/-20%
2.	Room Temperature	Record the Electricity & Power Supply Room temperature Stipulated range : 20°C - 25°C
		Record the Radar Equipment Room temperature Stipulated range : 20°C - 25°C
		Record the Radar Observation Room temperature Stipulated range : 20°C - 25°C
3.	Voltage and Current on the Radar Power Maintenance Panel (RPMP)	Check the output Voltage on each phase of RPMP is 230VAC +/-5% (218.5V – 241.5V)
		Record the output current on each phase. Stipulated range : 12A +/-20%

4.	Radiation time of the transmitter system	Record the RADIATE hour on the meter of the controller unit in the transmitter.
5.	Amplifier unit channel (A or B) of the transmitter system	Record the Amplifier Unit Channel of the transmitter system.
6.	Count of Dehydrator operation and Wave-guide pressure value	Record the count of Dehydrator operation on the electromagnetic counter.
		Record the pressure value of the wave-guide on the meter of the dehydrator unit.
7.	Status/alarm indicators of the radar task controller	Check the Status/alarm indicators on the radar task controller are colored green.
8.	Data products on the radar task controller	Check that the data is displayed normally.

Weekly Maintenance

1.	Obstruction light on Radome	Check that the obstruction light is energized from outside of the radar tower.
2.	Antenna operating condition	Check the operation condition (Azimuth/Elevation) of the Antenna. (Visually and aurally). **Confirm that there is no unusual sound and vibration coming from the antenna drive section while the antenna is rotating.
3.	Rotation speed of Antenna	Check the antenna rotation speed on the Antenna Controller. ~ 40sec/r +/-10% (36/r – 44/r)
4.	DC voltage of the DRSP	Record the DC voltage on the DC power unit of DRSP. Stipulated range : DC +5V +/- 5% DC +12V +/-5% DC +24V +/-5%

5.	DC voltage of the Transmitter	<p>Record the DC voltage on the Control Panel of the Transmitter.</p> <p>Stipulated range :</p> <p>DC -5V(1) +10% -- -5%</p> <p>DC -5V(2) +10% -- -5% (-5.5V to-4.75)</p> <p>DC +5V(1) +10% -- -5%</p> <p>DC +5V(2) +10% -- -5% (4.75V to 5.5V)</p> <p>DC +15V(1) +10% -- -5%</p> <p>DC +15V(2) +10% -- -5% (14.25V to 16.5V)</p> <p>DC +24V(1) +10% -- -5%</p> <p>DC +24V(2) +10% -- -5% (22.8V to 26.4V)</p>
6.	DC voltage of the fun units of Transmitter	<p>Record the DC voltage on the Fan units of the Transmitter (U1 – U16).</p> <p>Stipulated range : DC +24V +10% -- -5% (22.8V – 26.4V)</p>

Monthly Maintenance

1.	Slip ring and brush of the servomotor in the antenna system	Check and clean the slip ring and the brush of the servomotor in the antenna system
2.	DC voltage of Antenna Controller	<p>Check the DC voltage on the DC power unit of Antenna Controller.</p> <p>DC +5V +/- 5% (4.75V – 5.25V)</p> <p>DC +24V +/- 5% (22.8V – 25.2V)</p>
3.	Transmitting frequency	<p>Measure the Transmitting frequency and confirm that it is 2,793.5MHz (short pulse) / 2,798.5MHz(long pulse) on both mode Intensity and Doppler.</p>
4.	Transmitting Pulse Repetition Frequency (PRF)	<p>Check the PRF on each Transmitting mode.</p> <p>*Intensity mode 300Hz+/-10% (270Hz – 330Hz)</p> <p>*Doppler mode 536/670Hz +/-10%(482-590Hz / 603-737Hz)</p>

5.	Transmitting pulse width	<p>Check the pulse width on each transmitting mode.</p> <p>*Intensity mode $2\mu\text{s} \pm 20\%$ ($1.6\mu\text{s} - 2.4\mu\text{s}$) $100\mu\text{s} \pm 20\%$ ($80\mu\text{s} - 120\mu\text{s}$)</p> <p>*Doppler mode $1\mu\text{s} \pm 20\%$ ($0.8\mu\text{s} - 1.2\mu\text{s}$) $50\mu\text{s} \pm 20\%$ ($40\mu\text{s} - 60\mu\text{s}$)</p>
6.	Transmitting power	<p>Check the Transmitting Power at each mode. Both Intensity and Doppler mode</p> <p>$10\text{kW} \pm 20\%$ ($8\text{kW} - 12\text{kW}$)</p>
7.	Minimum receiving sensitivity (Smin) of the DRSP system	<p>Check that the value is less than 110dBm.</p>
8.	Dynamic range of the DRSP system	<p>Check that the Dynamic range is more than 80dB.</p>
9.	Silica gel in the Dehydrator Unit	<p>Check that the color of silica gels in the dehydrator is blue.</p> <p>If the silica gels' color turned white, down to the red line of the box, replace them with new gels.</p>

Semi-Annual Maintenance

1.	Visual inspection of Radome	Check the Radome visually. <ul style="list-style-type: none">- internal view- panel caulking- Base caulking
2.	Oil condition of the antenna system	Check the oil level of the gear and the gear reducer visually. <ul style="list-style-type: none">- Azimuth- Elevation Check if there are oil leakage on the main gear and gear reducer visually. <ul style="list-style-type: none">- Azimuth- Elevation Check the oil color if the main gear and gear reducer visually. <ul style="list-style-type: none">- Azimuth- Elevation
3.	Belt of the antenna system	Check the belt visually. <ul style="list-style-type: none">- Azimuth- Elevation

4.	Replenishing of grease on the antenna system	Replenish the grease to the azimuth roller bearing.
5.	Position accuracy of the antenna controller system	Check that the azimuth/elevation position accuracy is less than 0.1 degree.
6.	Cleaning of the air filters in the antenna controller system	Clean the air filters in the antenna controller system.
7.	Cleaning of the air filters in the transmitter system	Clean the air filters in the transmitter system.
8.	Cleaning of the air filters in the DRSP system	Clean the air filters in the DRSP system.
9.	Cleaning of the air filters in the AVR	Clean the air filters in the AVR.
10.	Cleaning of the air filters in the Power Supply Capacitor	Clean the air filters in the Power Supply Capacitor.

Annual Maintenance

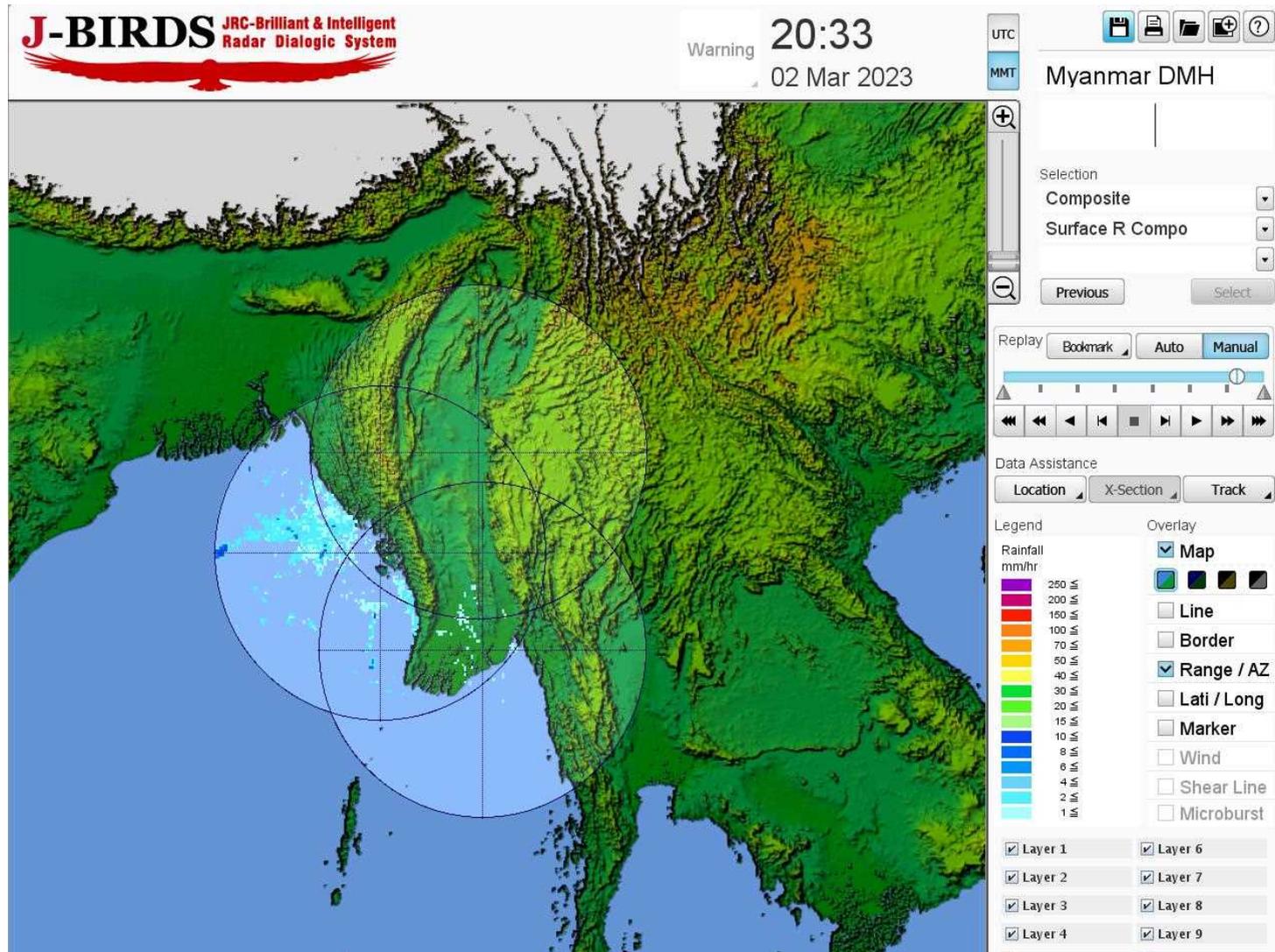
1.	Oil Replacement	Azimuth section (Main gear & gear reducer) Elevation section(Main gear & gear reducer)
2.	Switch Operation	S3 : lower first limit at -4 degrees S4 : lower second limit at -6 degrees S2 : Upper first limit at +92 degrees S1 : Upper second limit at +94 degrees Safety switch

Application of Radar Products for Severe Weather Forecasting

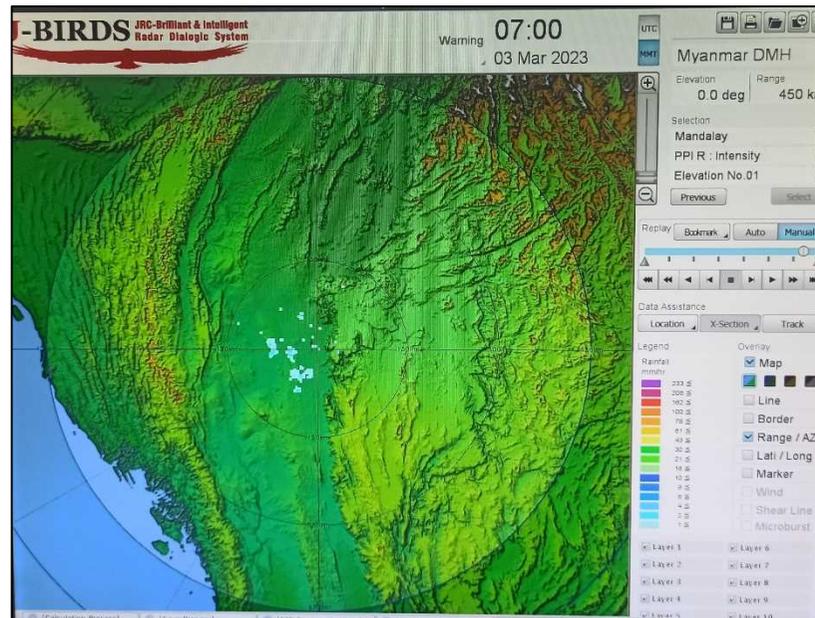
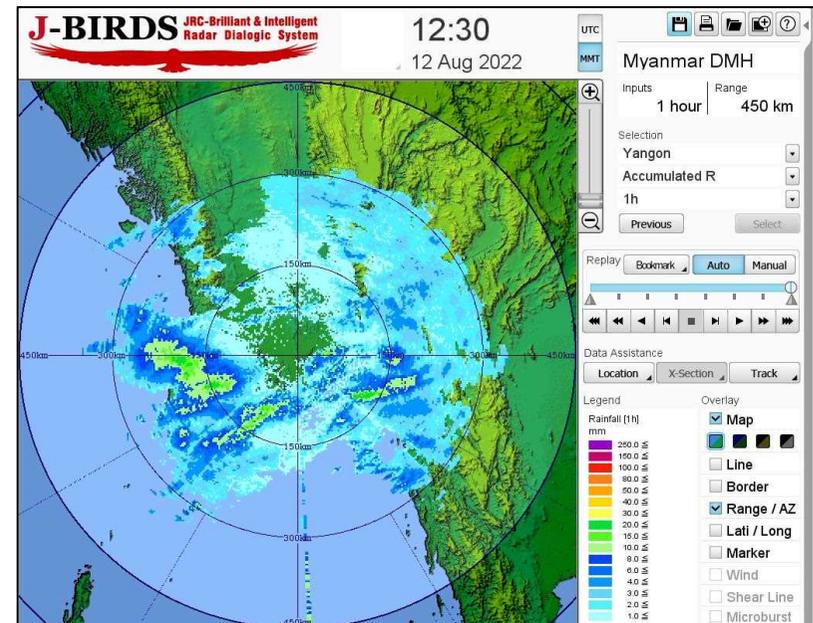
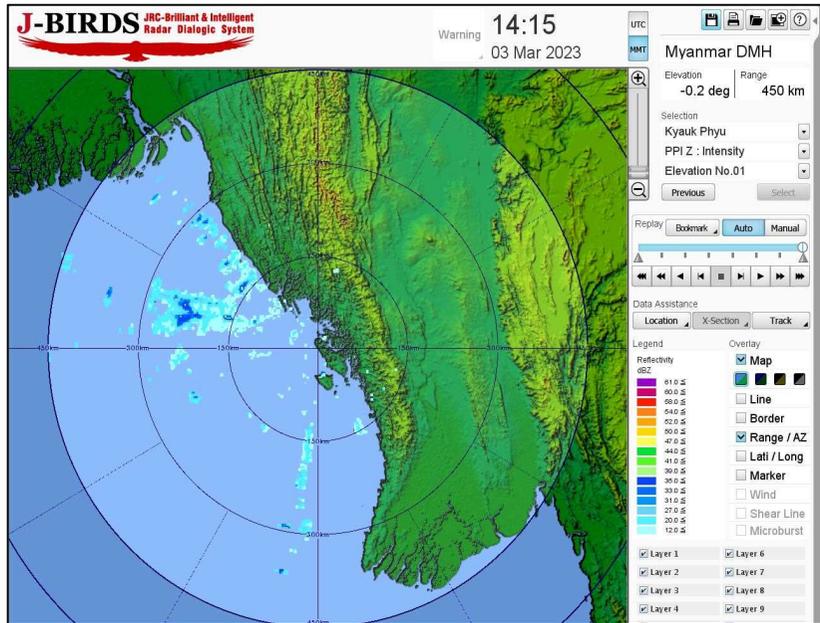
- Plain Position Indicator (PPI)
- Doppler Velocity
- Range-Height Indicator (RHI)
- Range Time Indicator (RTI)
- Constant Altitude PPI (CAPPI)
- Constant Altitude PPI (CAPPI) 3D
- Horizontal Wind Distribution (Wind Speed and Direction)
- Time-Height Indicator (THI)
- Echo Top and Echo Bottom
- Surface Rainfall Intensity (Surface R)
- Vertically Integrated Liquid (VIL)
- Velocity Assumed Display (VAD)
- Arbitrary Cross Section
- Warning Products

Radar Composition

Data from 3 Meteorological Radar stations can be used at one time of composite. Including the timing of every 15 minutes.



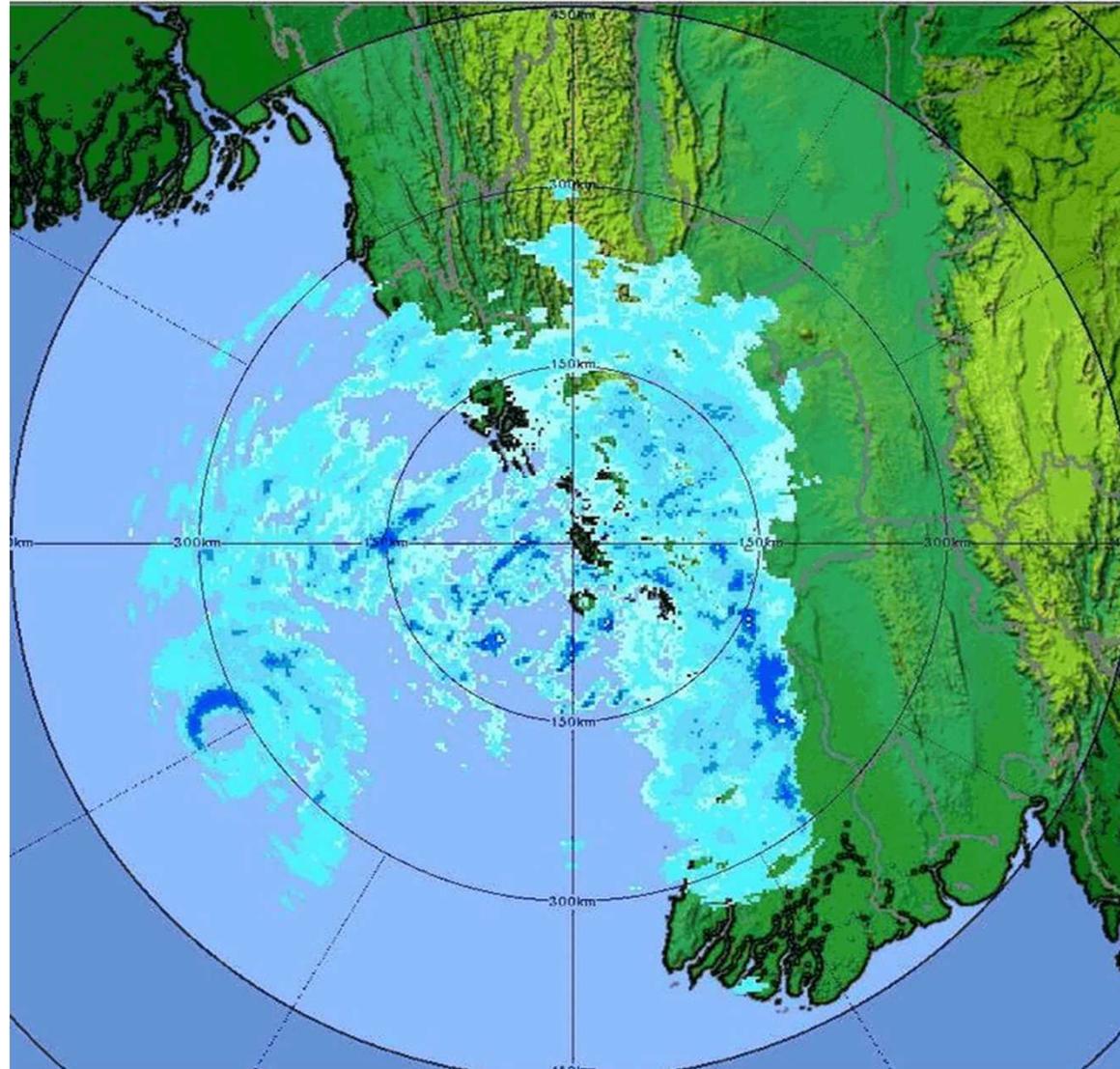
Radar Images of Kyaukpyu, Yangon and Mandalay



Extremely Severe Cyclonic Storm "Mocha"

BIRDS JRC-Brilliant & Intelligent
Radar Dialogic System

Warning 00:03
14 May 2023



UTC
MMT Myanmar DMH

Range 450 km

Selection
Kyauk Phyu
Surface R

Previous Select

Replay Auto Manual

Data Assistance
Location X-Section Track

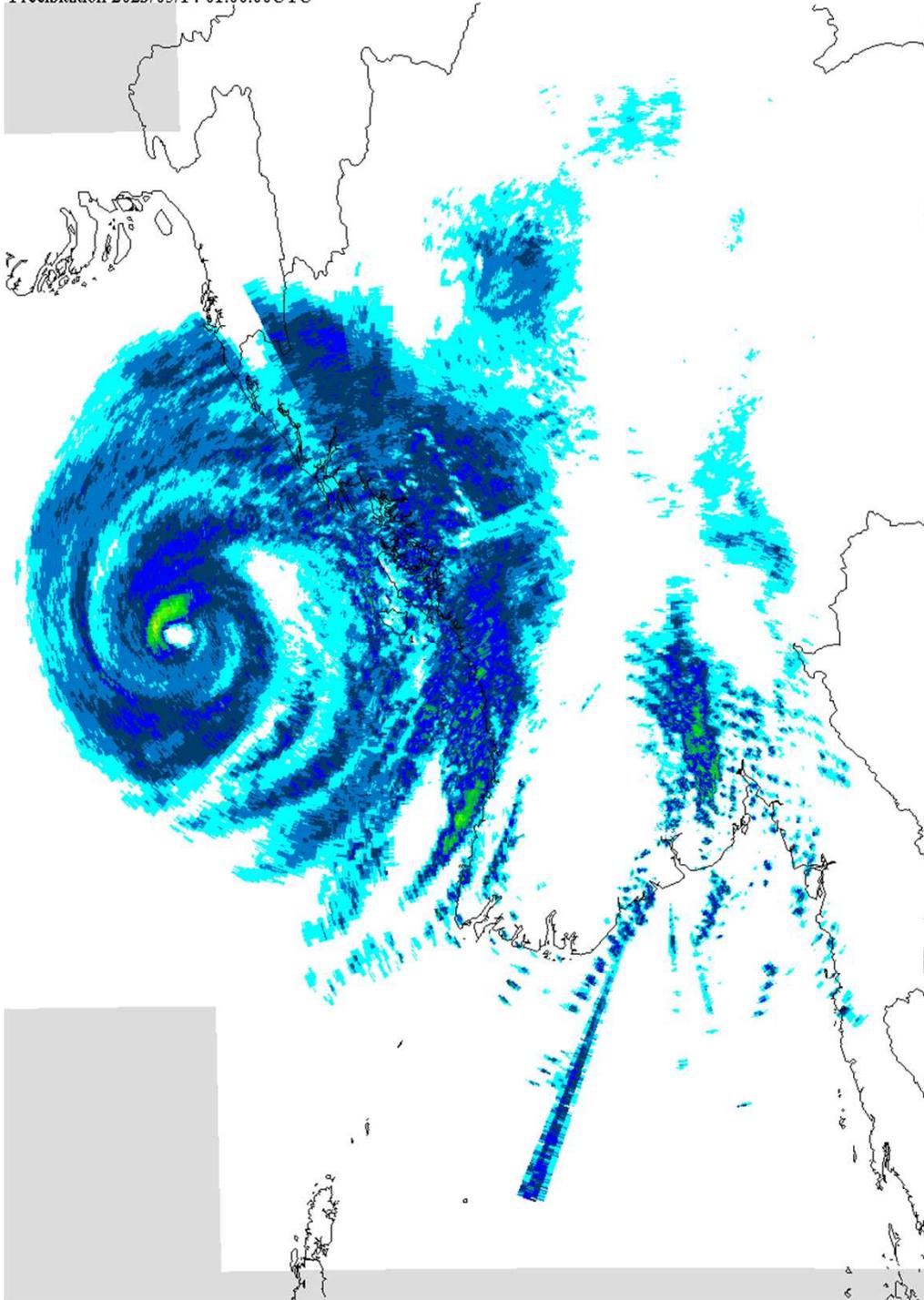
Legend
Rainfall mm/hr

233	IA
208	IA
182	IA
100	IA
78	IA
61	IA
43	IA
30	IA
21	IA
16	IA
10	IA
8	IA
6	IA
4	IA
2	IA
1	IA

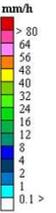
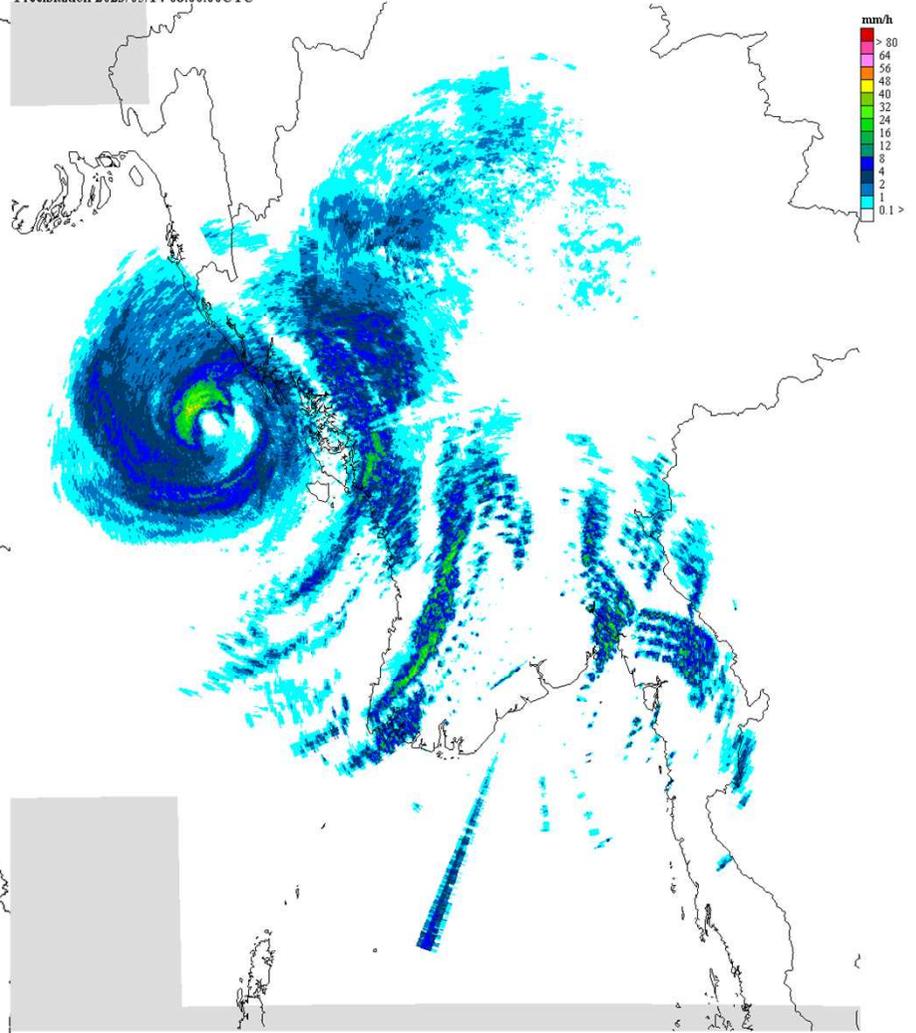
Overlay

- Map
- Line
- Border
- Range / AZ
- Lati / Long
- Marker
- Wind
- Shear Line
- Microburst

Precipitation 2023/05/14 01:00:00UTC



Precipitation 2023/05/14 06:00:00UTC

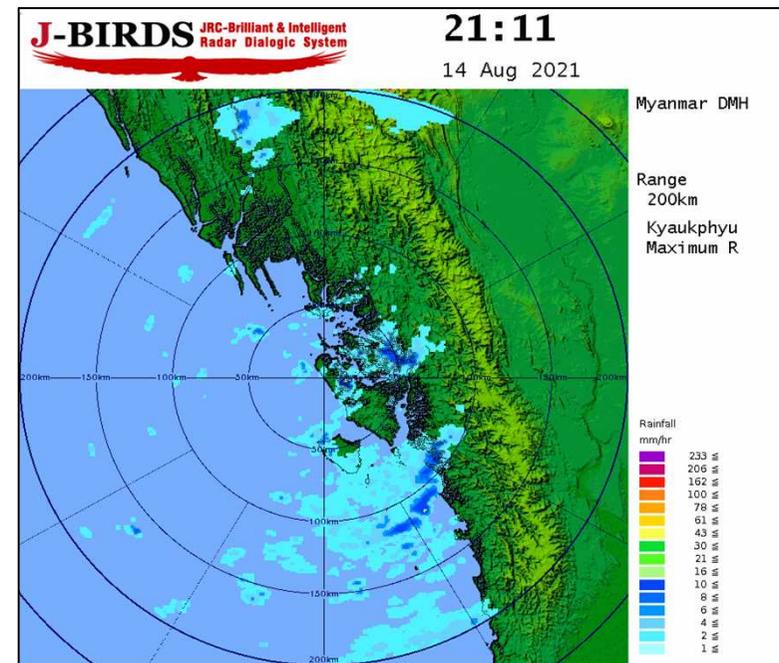
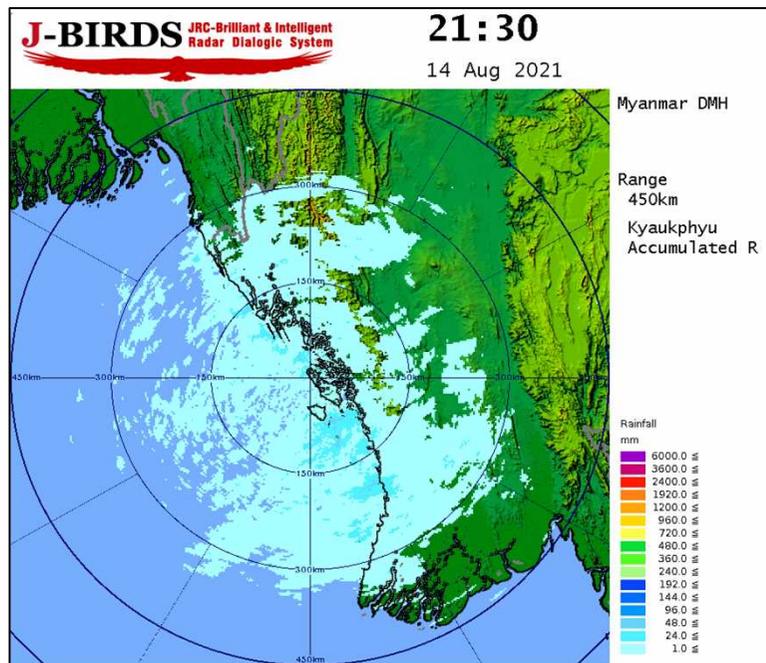
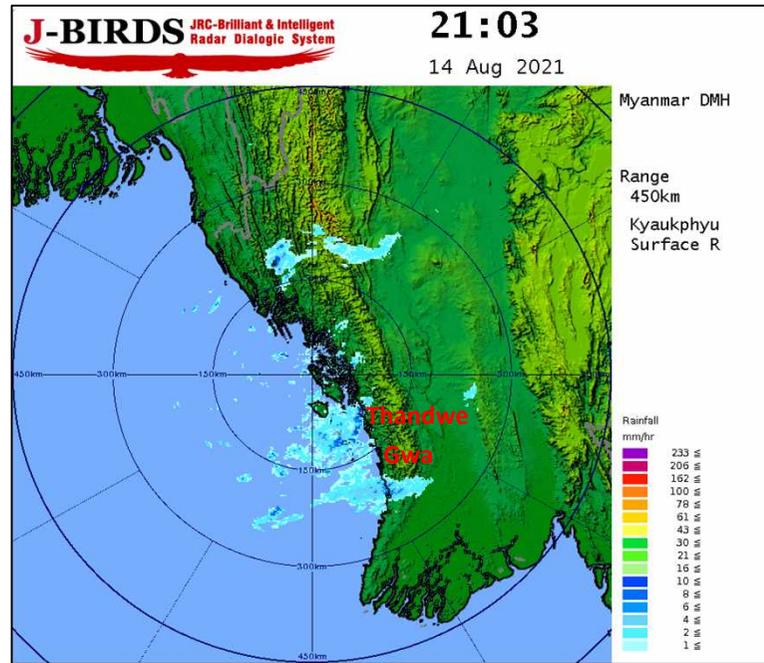


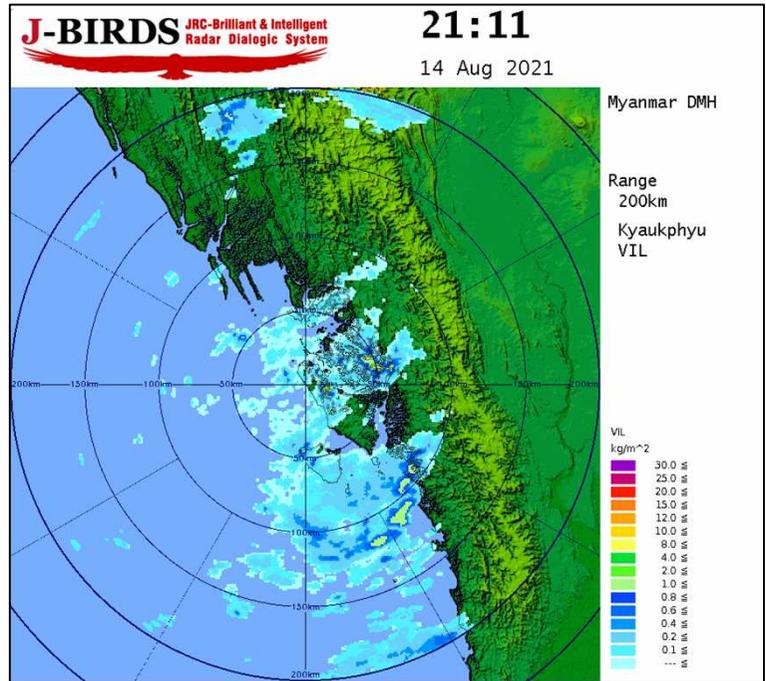
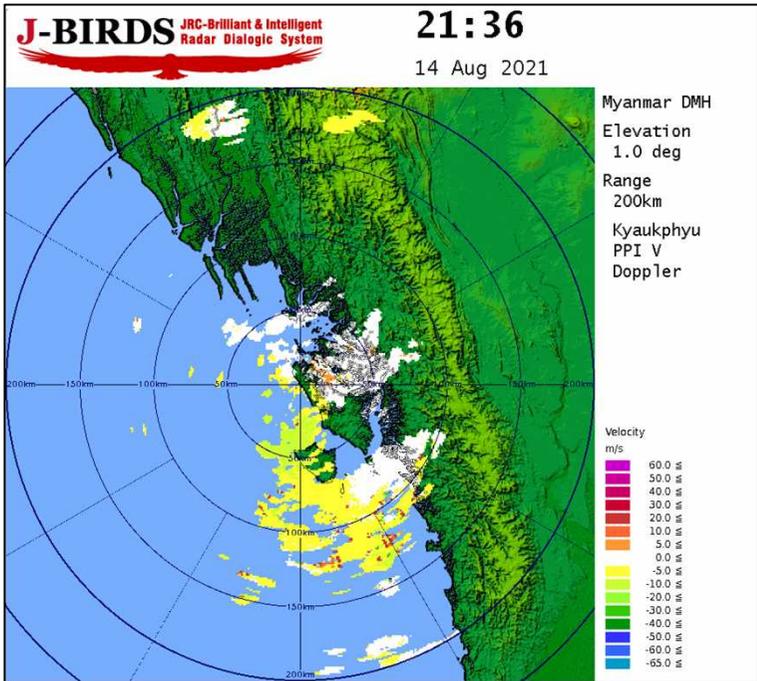
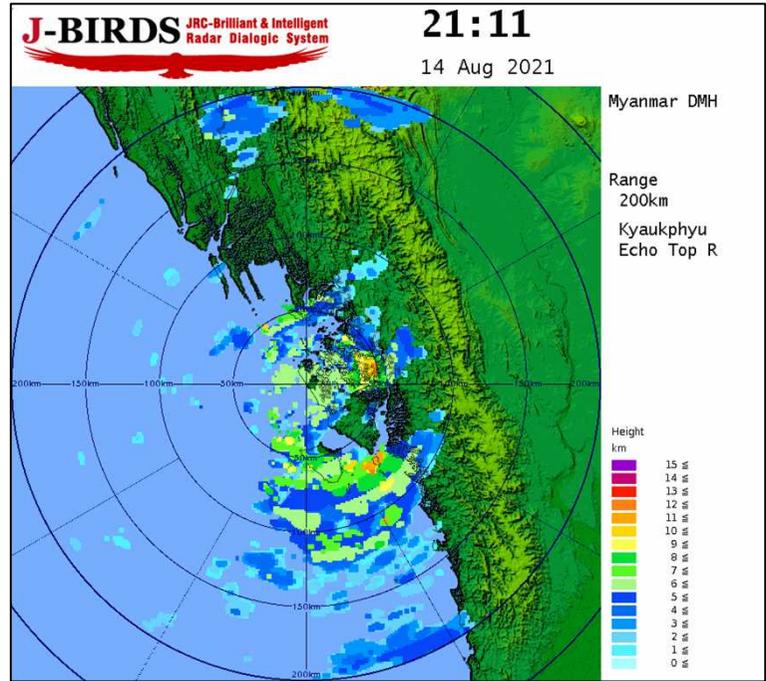
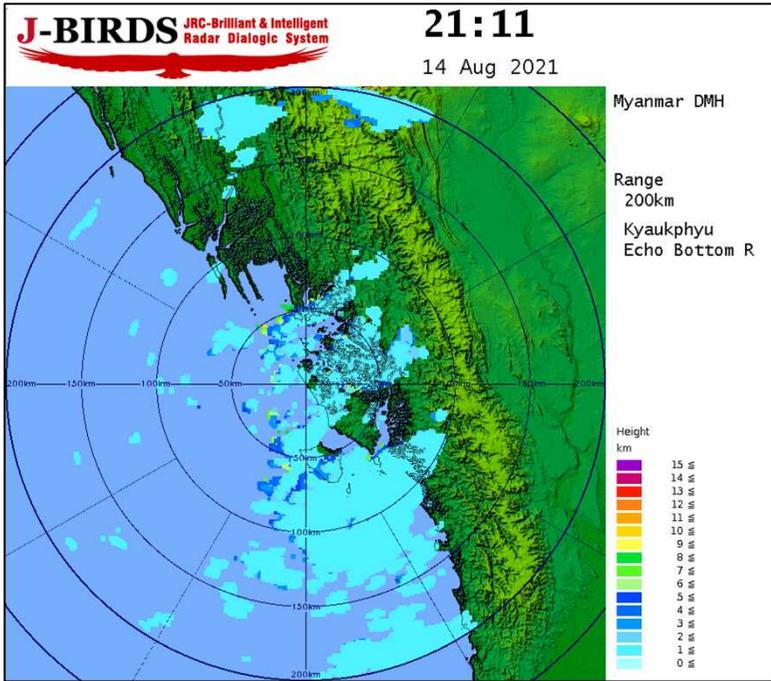
QPE

Observed Heavy Rainfall (15th August 2021)

Thandwe = 161 mm

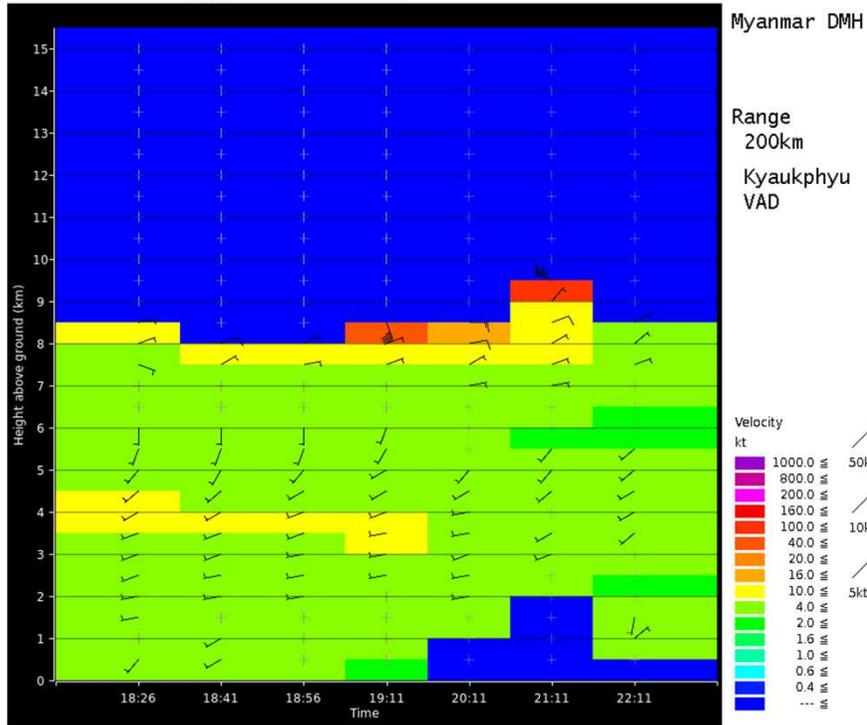
Gwa = 103 mm





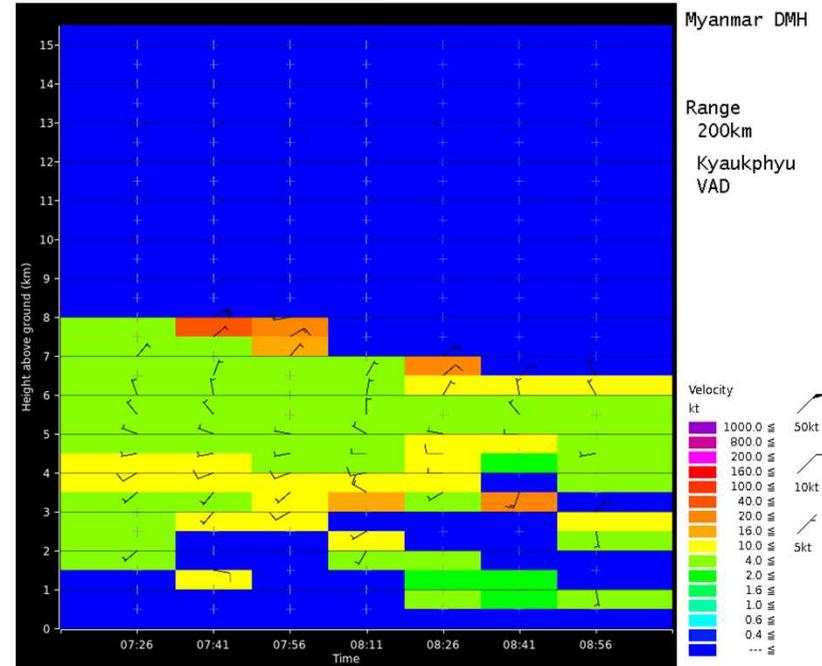
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14 Aug 2021

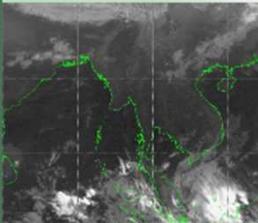


00:11

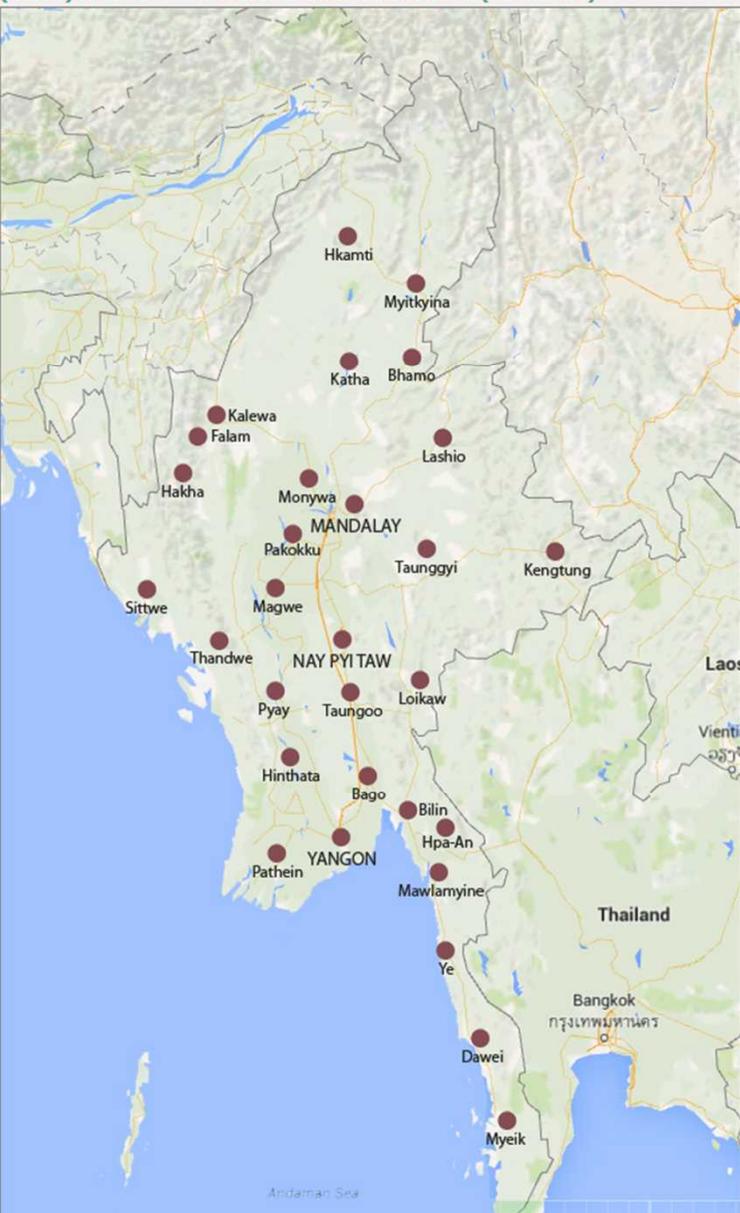
15 Aug 2021



himawari-8

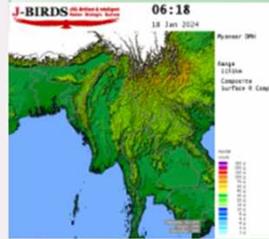


Welcome to Department of Meteorology and Hydrology (12:30) M.S.T Current Weather Condition of Cities(18.1.2024)



Radar Image

J-BIRDS 06:18
18 Jan 2024



31.0 °C NayPyiTaw

REPORTS



Daily Weather Forecast



10-Day/Farmer Weather Forecast



Monthly Met/Hydro Forecast

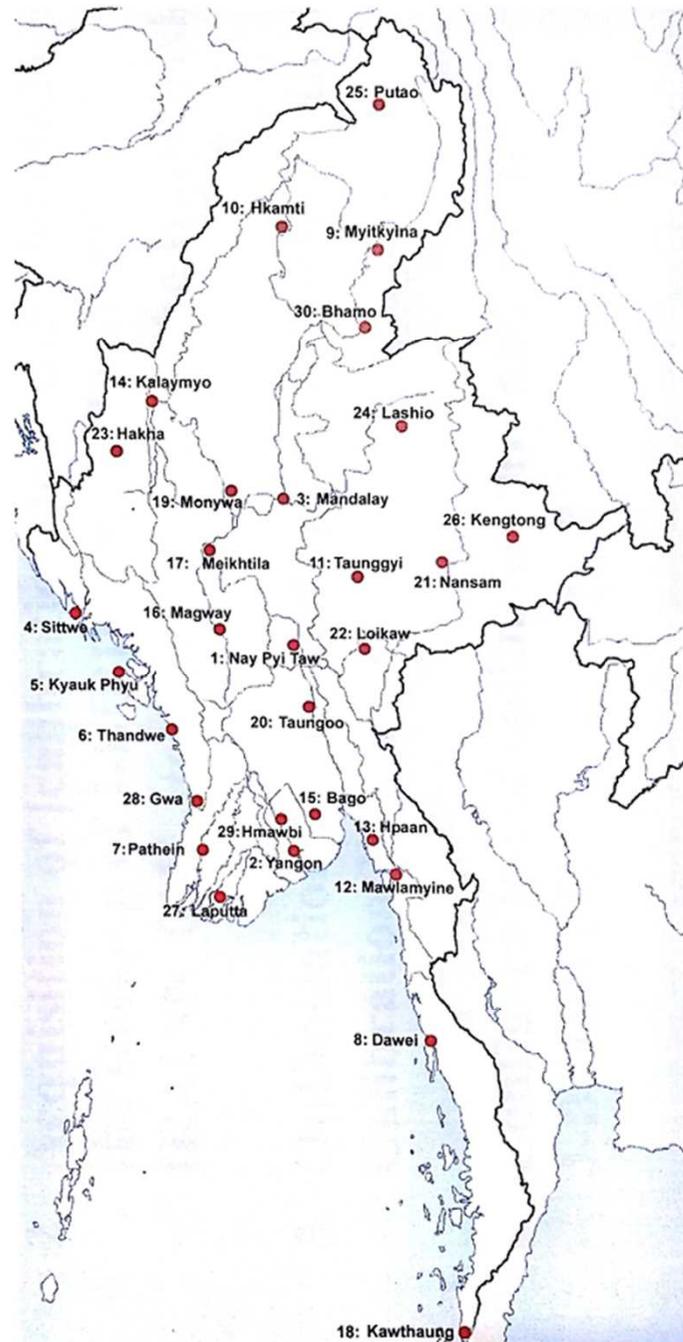


- NMHSS
- Regional City Weather
- Glossary
- Flash Flood Guidance Bulletin

Calibration with radar data and AWS data

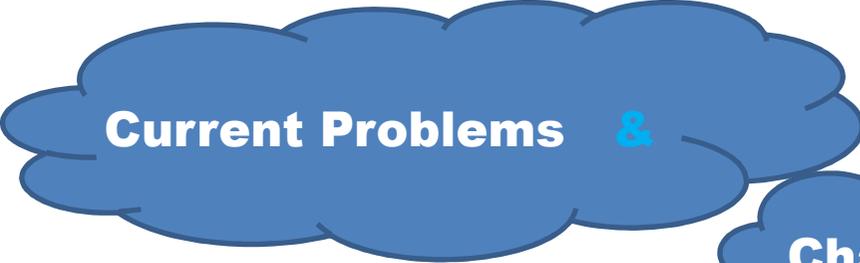
Current Setting is ...		Optimized 'B' and 'β'	
B	49	B	49
β	1.7	β	1.7
Site	Yangon		

Date	AWS Site	BAGOO, Bagc	HPAAN, Hpæ	LAPUT, Laput	MAWLA, Mav	PATHE, Pathè	TAUNG
2022012031 23:59:00		0	0	0	0	0	0
2022012031 23:00:00		0	0	0	0	0	0
2022012031 22:00:00		0	0	0	0	0	0
2022012031 21:00:00		0	0	0	0	0	0
2022012031 20:00:00		0	0	0	0	0	0
2022012031 19:00:00		0	0	0	0	0	0
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2022012031 02:00:00		0	0	0	0	0	0
2022012031 01:00:00		0	0	0	0	0	0
2022012031 00:00:00		0	0	0	0	0	0
2022012030 23:00:00		0	0	0	0	0	0
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2022012030 20:00:00		0	0	0	0	0	0



Data format for composite

Name	Date modified	Type	Size
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202305121303_R_composite.bin.xy	5/12/2023 1:04 PM	XY File	127 KB
202305121318_R_composite.bin.xy	5/12/2023 1:19 PM	XY File	127 KB
202305121333_R_composite.bin.xy	5/12/2023 1:34 PM	XY File	127 KB
202305121348_R_composite.bin.xy	5/12/2023 1:49 PM	XY File	127 KB
202305121403_R_composite.bin.xy	5/12/2023 2:04 PM	XY File	127 KB
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202305121833_R_composite.bin.xy	5/12/2023 6:34 PM	XY File	127 KB
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202305121933_R_composite.bin.xy	5/12/2023 7:34 PM	XY File	127 KB



Current Problems &

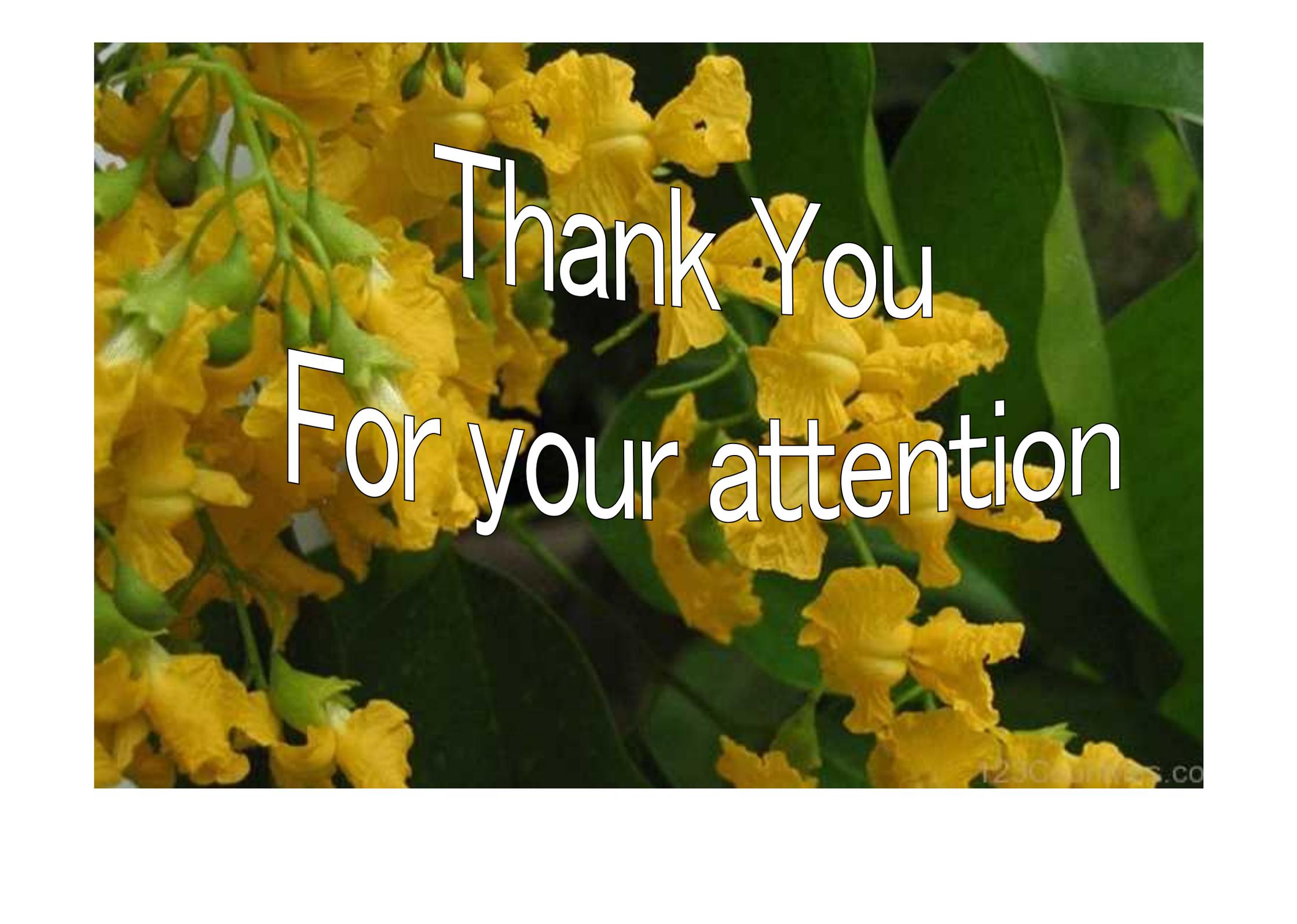


Challenges!

- Spare Parts.
- Human resources both radar engineer and radar products application.
- IT technology for data exchange.
- QC of radar data.
- Interpretation of radial velocity images to identify convergence and divergence for nowcasting and severe weather forecasts.
- Velocity spectrum width application for wind shear and turbulence area.

Future Development Plans

- Radar data exchange with WMO/ASEAN.
- Improve QC of radar data (need the technical supporting).
- Radar data application in now casting.
- Predict heavy rainfall based on the radar data analysis and echo movement and in tracking pre-existing rain system by using SWIRLS (Short-range Warning of Intense Rainstorms in Localized Systems) software (need the technical supporting).
- Estimate hail by using reflectivity, VIL value and Echo-Top (Hail Index based on the Radar).
- Analysis of tropical cyclones using radar, satellite and station data.
- Overlaying images on radar and satellite (need the technical supporting).



Thank You
For your attention