An overview of

Weather Observation practices over Pakistan

By

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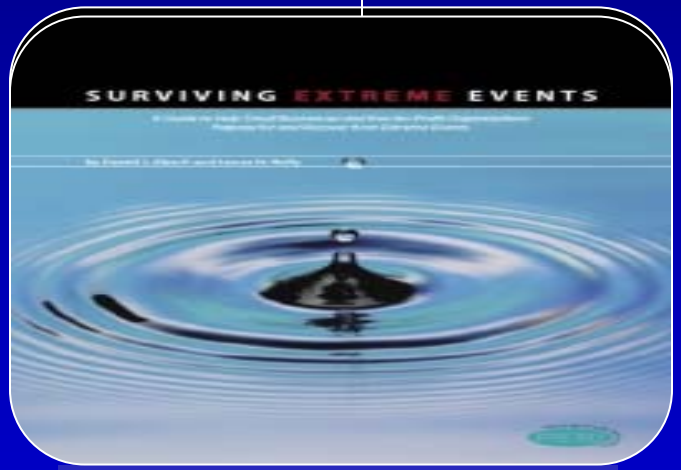
JMA/WMO TRAINING WORKSHOP ON
CALIBRATION AND MAINTENANCE OF METEOROLOGICAL INSTRUMENTS IN RA II (ASIA)
Regional Instruments Centre (RIC)- Tsukuba, Japan (19-22 February 2013)

PMD

Meteorology



Hydrology

Seismology

SERVICES DELIVERED BY PMD

1. AVIATION METEOROLOGICAL SERVICES
2. HYDRO-METEOROLOGICAL SERVICES AND FLOOD FORECASTING
3. AGRO-METEOROLOGICAL SERVICES
4. CLIMATOLOGICAL SERVICES
5. GEOPHYSICAL AND SEISMOLOGICAL SERVICES
6. WEATHER FORECASTING SERVICES TO PUBLIC THROUGH ELECTRONIC & PRINT NEWS MEDIA
7. ASTRONOMICAL INFORMATION SERVICES
8. MET-FORECAST FOR MOUNTAINEERING EXPEDITION / MARINE METEOROLOGICAL SERVICES
9. GLACIER MONITORING AND MOUNTAIN HAZARDS
10. FOG SERVICE

PMD Infrastructure (Contd.)

Radar's Network of PMD

10-cm Doppler Radars

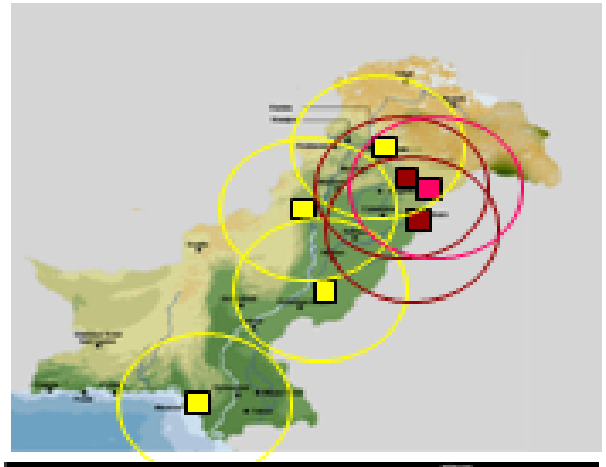
1 – Lahore
2 – Mangla

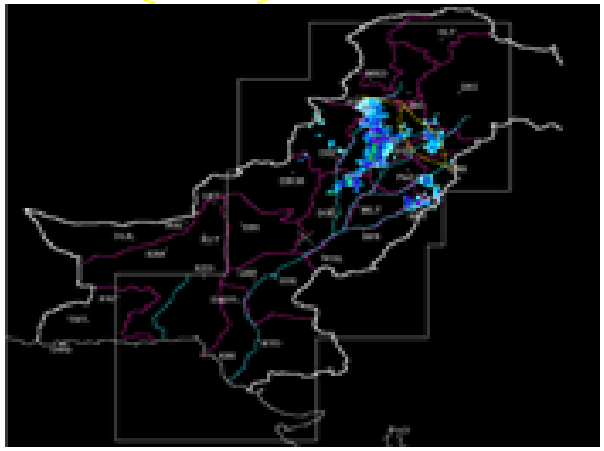
QPM Radar

1 – Sialkot

5-cm Wx. Surveillance Radars

1 – Islamabad
2 – D.I.Khan
3 – Rahim Yar Khan
4 – Karachi



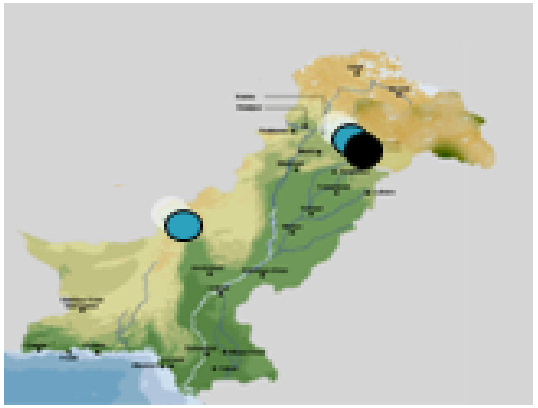


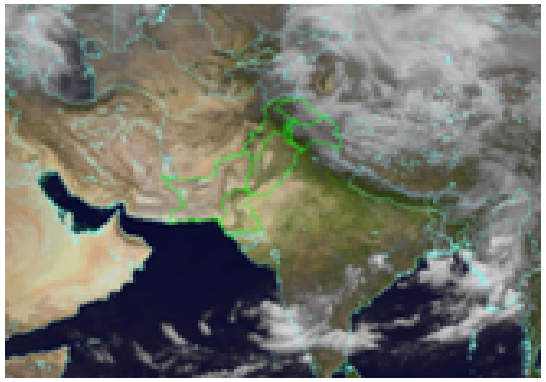
PMD has 7 Radars, which are in operation at different parts of Pakistan. These seven radars are covering almost 80% area of Pakistan.
New 6 Radars are under progress which are expected to complete before Dec 2012.

PMD Infrastructure (Contd.)

Satellite Ground Stations of PMD

- **HRPT**
  - 1 – Islamabad
  - 2 – Quetta
- **FY–2 E/D**
  - 1 – Islamabad

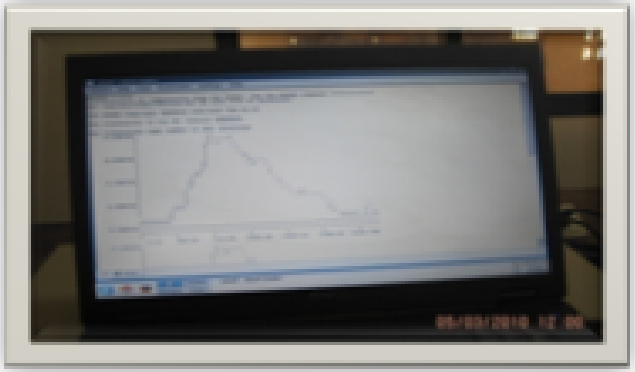




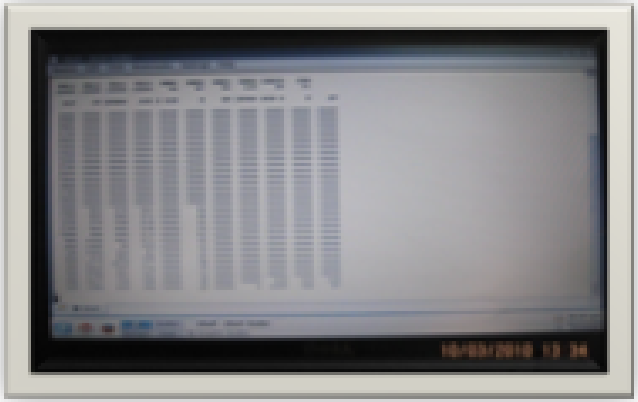
PMD has 3 Satellite grounds;
2 HRPT systems installed at Islamabad and Quetta.
1 is Chinese ground satellite station, working in Islamabad.

PMD Infrastructure (Contd.)

SODAR – the vertical wind profiler



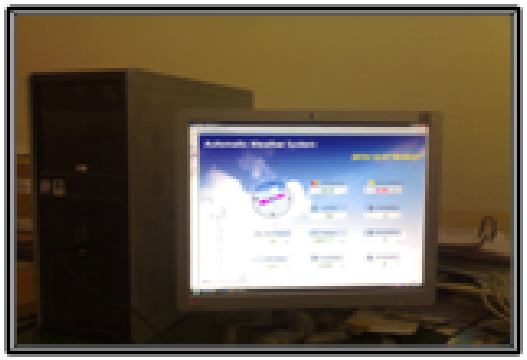
SODAR:
Sonic Detection and Ranging used for vertical wind profile & atmospheric changes over a particular site leading to tropical cyclone tracking. Also helpful in monitoring the instant upper winds up to 5000 ft with RASS- Radio Acoustic Sounding System- measures the virtual temperature .

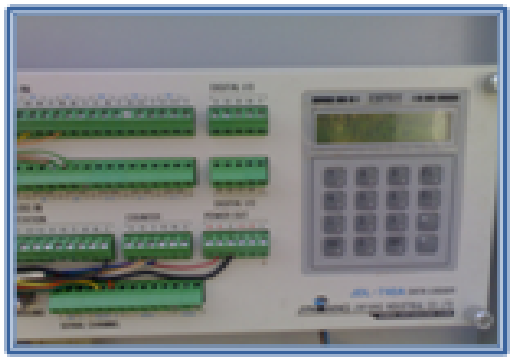


PMD Infrastructure (Contd.)

AWS – automatic weather station

AWS:
Records hourly/half hourly weather elements and transmits the data via GSM modem to TCWC Karachi. This coastal data is extremely vital to monitor the cyclone location and movement.





1. Surface observation station

Generally there are two classes of the Meteorological surface observatories in PMD:

Class-I Observatories: These observatories are provided with:

- Barometer (Mercury Aneroid)/self recording instrument
- Maximum Thermometer
- Minimum Thermometer
- Dry Bulb
- Wet Bulb
- Anemometer
- Wind Vane
- Rain Gauge + Measuring glass
- Observing watch
- Stevenson Screen

Class-I observatories take synoptic observations at least eight times daily at the standard UTC hours i.e. 0000, 0300, 0600, 0900, 1200, 1500, 1800, 2100.

1. Surface observation station

Class-II Observatories:

These observatories are provided with the eye reading equipment only and record daily at least three (3) synoptic observations at standard hours 0000, 0300 & 1200 UTC.

- Barometer (Mercury Aneroid)
- Maximum Thermometer
- Minimum Thermometer
- Dry Bulb
- Wet Bulb
- Anemometer
- Wind Vane
- Rain Gauge + Measuring glass
- Observing watch
- Stevenson Screen

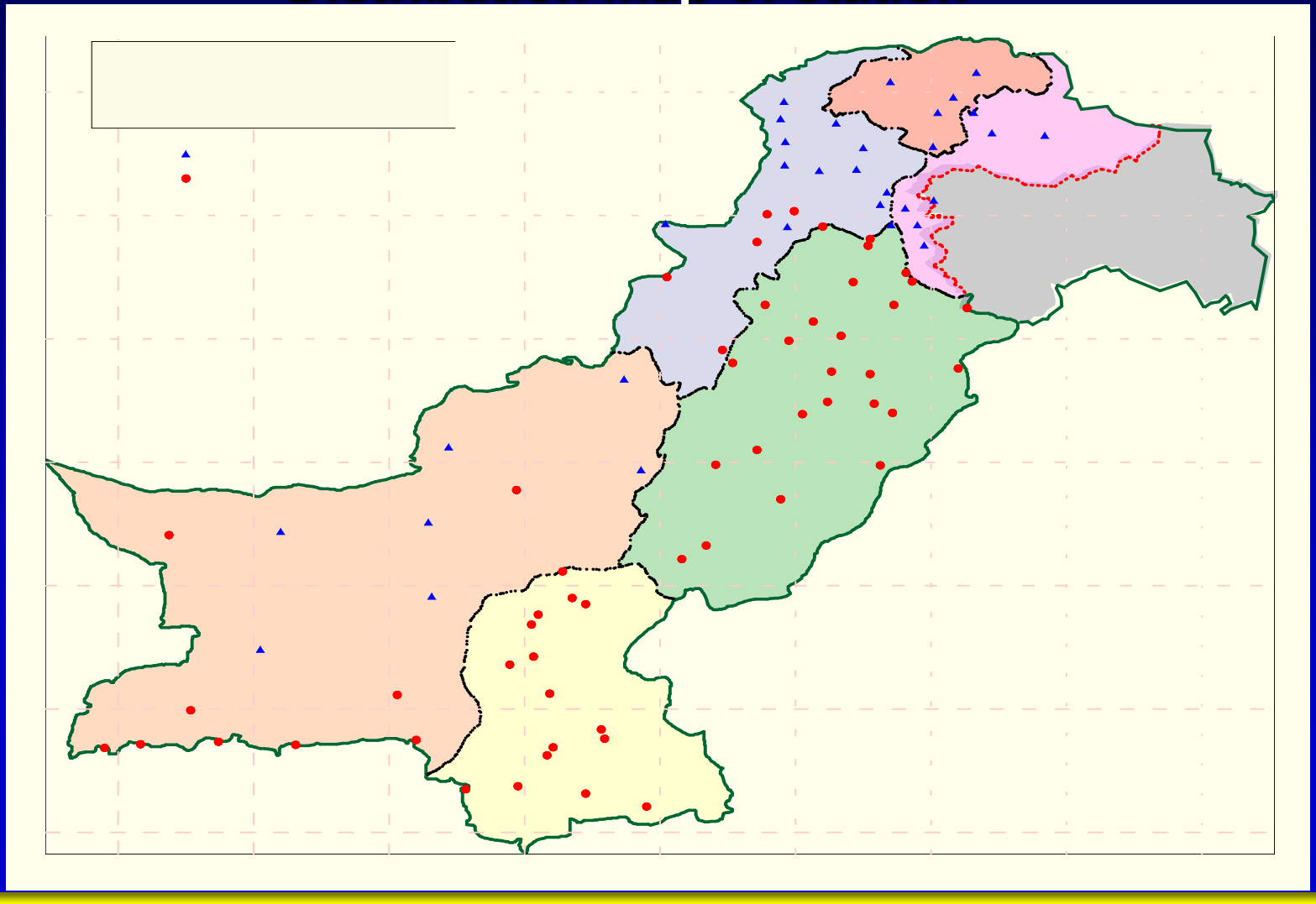
1. Surface observation station

Number of Surface observing stations over Pakistan

• Surface observation stations	88
• Pilot Balloon Observation	35
• Upper air Rawin Sonde Station	02
• Weather Surveillances Radars	07
• Vertical wind profiler (SODAR)	01
• Automatic Weather Station	37

1. Surface observation station

Distribution map of station



1. Surface observation station

Surface Observations-Case Examples

• Surface Observatories are mostly manned and at remote areas automated. Problems generally identified are stated below with their possible solutions.

Instrument	Troubles/Problems	Recovery
Manned Observatories	• Systematic error which appears either due to lack of experience of observer or instrumental error. • Procedural Errors in reporting pressure to sea level or misuse of conversion table	• Training of the concerned professionals and repair of instrument resolve the issues • Reporting observations in supervision of well trained professional for some time
Automated	• Malfunctioning of sensors due to weathering or pollution • Lack of power due to dust deposit on solar panel	Regular maintenance in winter and summer seasons ensures the normal operation of equipment

1. Surface observation station

Surface Observations- Issues and Efforts

Issues

• Most of the observatories are located in far-flung areas and there is no incentive for officials to work in such hostile climates.

• Meteorological service has not been an attractive job despite the challenges of Global Warming and Climate Change.

• Developing countries do not afford replacement of old instruments with new versions; often their spares are not available with manufacturers.

Efforts to maintain Operation

Although all the issues stated above encounter the morale and zeal of meteorological professionals yet the operation is maintained with marginal human resource and maintenance of equipment with indigenous skills.

2. Instruments in operational use

Manufacturer & model, current status & interval of maintenance & calibration

SN	Element	Instrument	Make & Model	Current Status	Maintenance Interval & Calibration *
1	Pressure	Mercury-filled Barometer	F. Darton & Co. London 1955	Functional	Biannually (M) & Annually (C)
2	Temperature	Mercury-filled Thermometer	G. H. Zeal/ RW Munro London 1970	Functional	Biannually (M) & Annually (C)
3	Humidity	Hair hygrograph	Casella/ Fairmount London, 1980	Functional	Biannually (M) & Annually (C)
4	Wind	Electrical Anemometer	PMD, 2010	Functional	Biannually (M) & Annually (C)
5	Precipitation	Rain gauge (Manual +Automated)	PMD, 2010	Functional	Biannually (M) & Annually (C)
6	Sunshine duration	Sunshine recorder	German, 2005	Functional	Biannually (M) & Annually (C)

*M- maintenance, C- calibration

2. Instruments in operational use

Instruments in Operational Use-Case Examples

• Surface Observatories are mainly equipped with manually operated instruments such as thermometers, anemometers, raingauges etc.

Instrument	Troubles/Problems	Recovery
Anemometer	• Dust mixed with Lubricant james/retards the operation • Plastic belt expands/ contracts due to extreme temperatures slows meter reading	• Cleaning of mechanical assembly in kerosene oil/petrol • Change of belt before the onset of summer and winter where necessary in harsh climatic zones
Thermometer	• Creation of air bubble • break in column	Both the problems are inter-related and they are recovered by boiling and freezing treatment
Raingauges	• Ordinary raingauges collector develop some leakage outlet at aged welded points • Self-recording raingauges get clock slow down problems	• Collectors are replaced with a continuous steel sheet container and no joint is left • Clock repairs recover the normal operation

2. Instruments in operational use

Instruments in Operational Use-Case Examples

Surface Meteorological Network of Pakistan includes Automatic Weather Stations (AWS) at low elevation from SIAP Italy and high elevation plains from SIBA Germany (Glacier Area of Himalayas-Karakoram and Hindukush)

Instrument	Troubles/Problems	Recovery
Low Elevation AWS	• Dust and birds excreta on solar panel reduces the power support (common problem) • Dust choks sensors in frequent dust storm zones	• Regular cleaning of solar panel to ensure optimum power supply •Sensors are cleaned frequently in dust storm season with a dust cleaning sheet
High Elevation AWS	• Snow Pillows unevenness records less or more snow • Failure of Pluvio's heating system stops recording snow	• Cemented surface or wood sheet is used to maintain level • Battery and solar panel to provided to work alternatively

3. Standards and equipments for calibration

National meteorological standards, Working standards, Traveling standards:

S N	Instrument	Manufacturer	Current status	Interval of calibration
1	National Standard Barometer	Negretti & Zambra M/2728	Functional	Two years
2	Working Standard Barometer	F Dalton & Co., England PMS-8919	Functional	Two years
3	Travelling Standard Barometer	F Dalton & Co., England P-314	Functional	Two years
4	Working Standard Barometer with calibration chamber	Negretti & Zambra	Functional	Two years
5	Working Standard Wind Blower,	Vickers Metropolitan, England, 13955	Functional	Two years
6	Three cup anemometer	MWS, PMD, Pakistan	Functional	Two years
7	Humidity Chamber	F Dalton & Co., England 59/101	Functional	Two years
8	Working Standard Thermometer	G H Zeal, England 7833	Functional	Two years
9	Travelling Standard Thermometer	Casella, London KSF-58239	Functional	Two years

2. Instruments in operational use

Instruments in Operational Use-Issues and Efforts in Maintenance and Calibration

Issues

• Calibration with Regional Standard is a top issue which require transportation of instruments bearing heavy costs of boarding and lodging.

• Very old models of equipment do not find a compatible standard instrument for calibration

• Spares of various models are not available with companies as they have moved to improved versions.

Efforts in Maintenance and Calibration

• **CMA** helped PMD for calibration of met instruments bearing all the costs of logistic, boarding and lodging.

• Local engineering staff struggles to modify the faulty components to fit in for sustainable operation up to some extent.

Thank You