Quality Assurance and Quality Control of Surface Observations in JMA

Japan Meteorological Agency

Hakaru MIZUNO

"Guide to Meteorological Instruments and Methods of Observation", WMO-No.8, 7th ed., 2008.

"Guide to the Global Observing System", WMO-No. 488, 3rd ed., 2007

"Manual on the Global Observing System", WMO-No. 544, 2003

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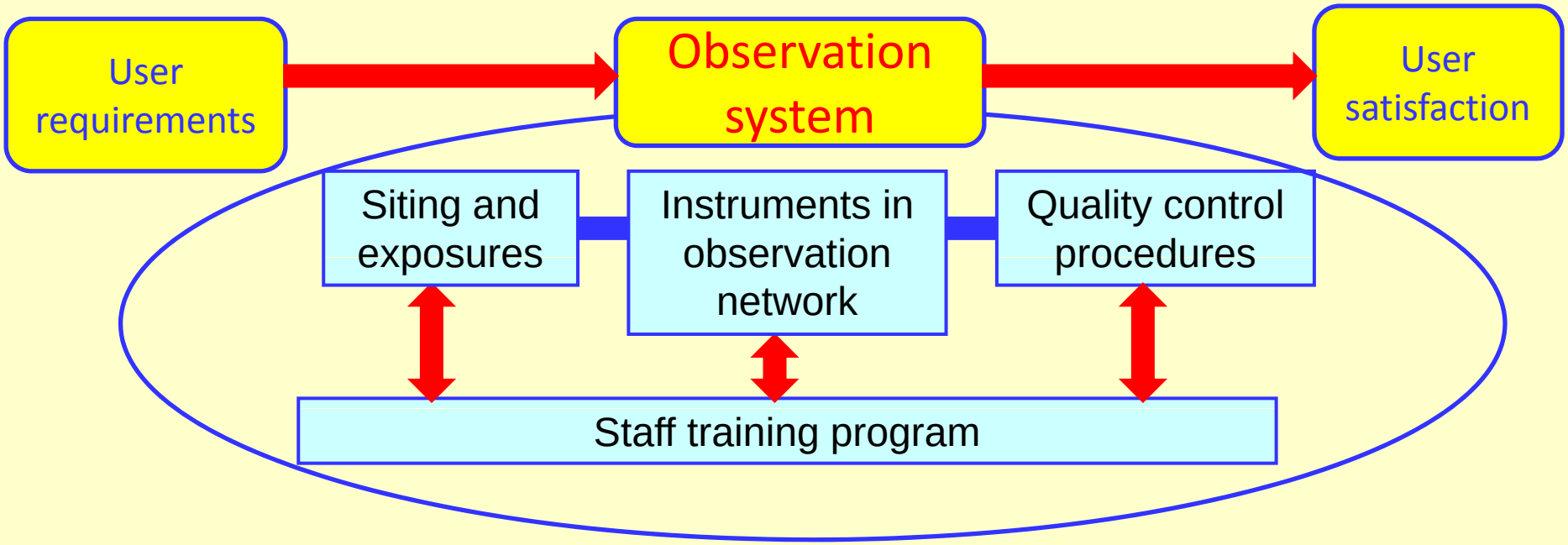


Definitions (WMO-No. 488, 2007)

Quality: Degree to which a set of inherent characteristics fulfils requirements.

Quality assurance: Part of quality management focused on providing confidence that quality requirements will be fulfilled; includes all the planned and systematic activities implemented in a quality system so that quality requirements for a product or service will be fulfilled.

Quality control: Part of quality management focused on fulfilling quality requirements; includes all the operational techniques and activities used to fulfil quality requirements.

Quality management: Coordinated activities to direct and control an organization with regard to quality.

"Guide to the Global Observing System", WMO-No. 488, 3rd ed., 2007

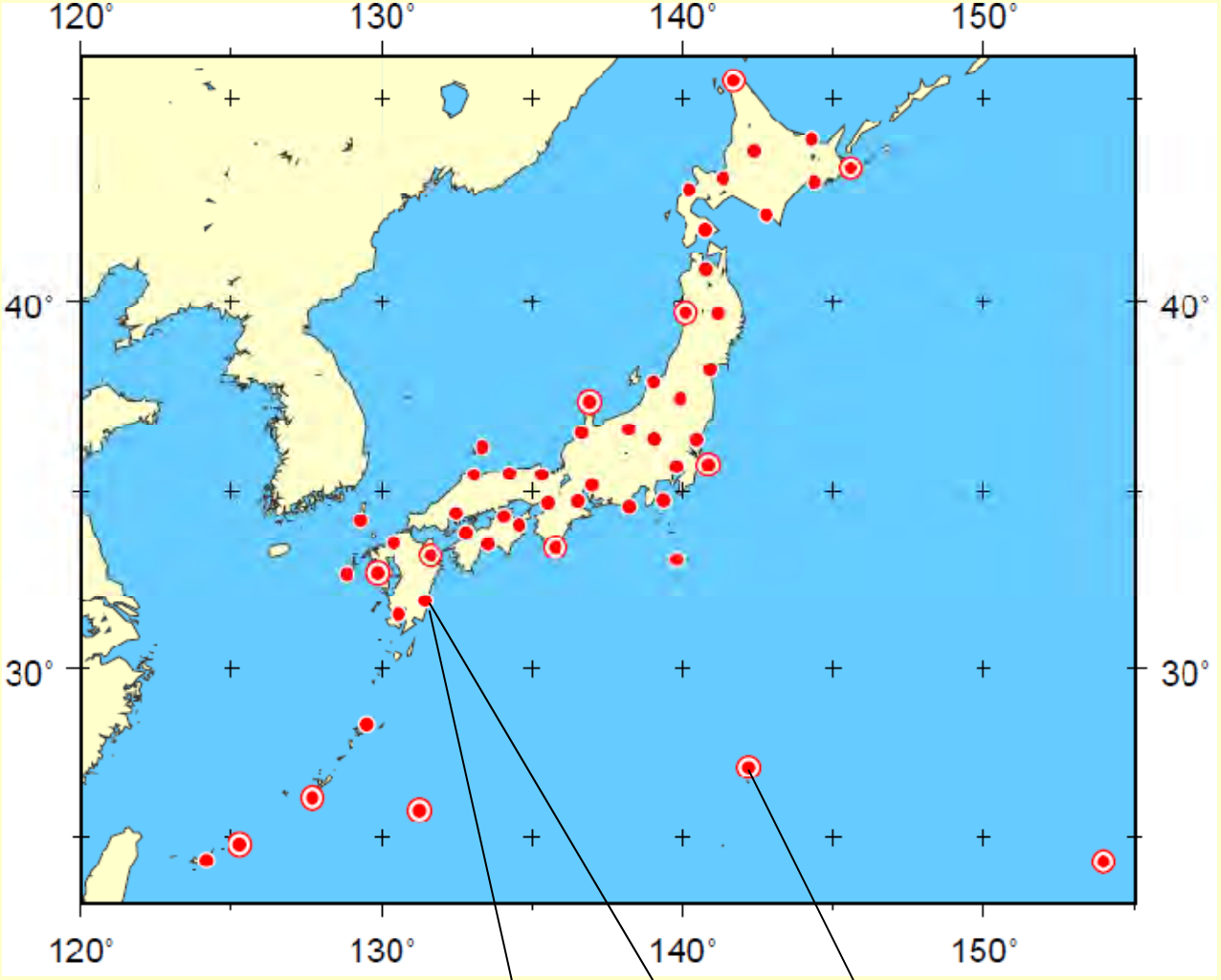
Need for quality control of observational data

- Meteorological observational data are exchanged between countries on a worldwide basis.
- Users need that the observations are made according to agreed standards set by WMO.

- Observational data must be quality controlled at different levels of data pre-processing and processing and transfer in real time and non-real time, using various procedures.

"Guide to the Global Observing System"(WMO No.488, 2007)

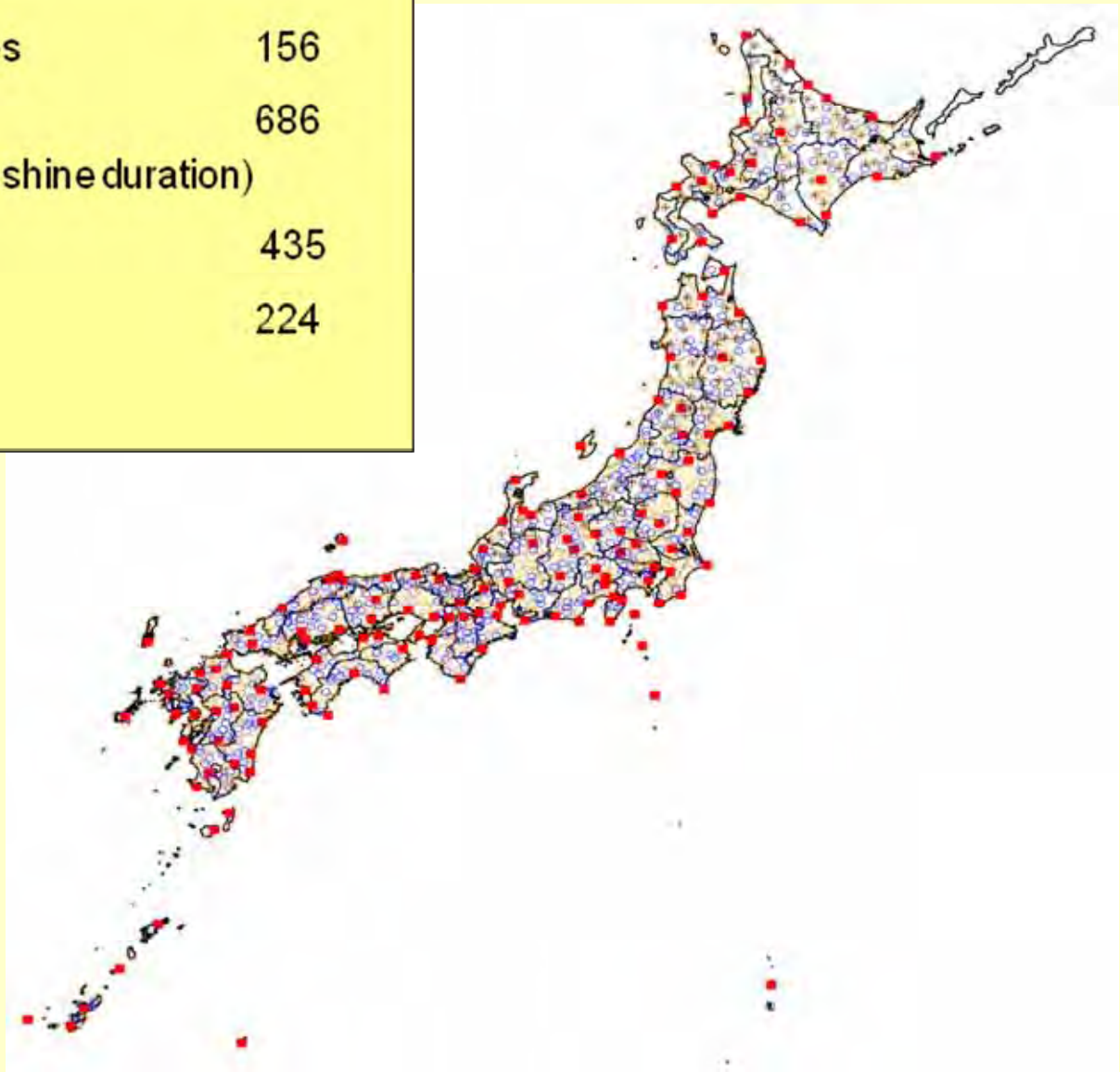
2. Overview of JMA's Surface Observation Network



	RBSN	RBCN	GSN
Number	52	52	13

Surface Observations

■	Meteorological Observatories	156
○	AMeDAS	686
	(rainfall, temperature, wind, sunshine duration)	
○	AMeDAS (rainfall)	435
+	AMeDAS (snow depth)	224
	(1 July 2010)	

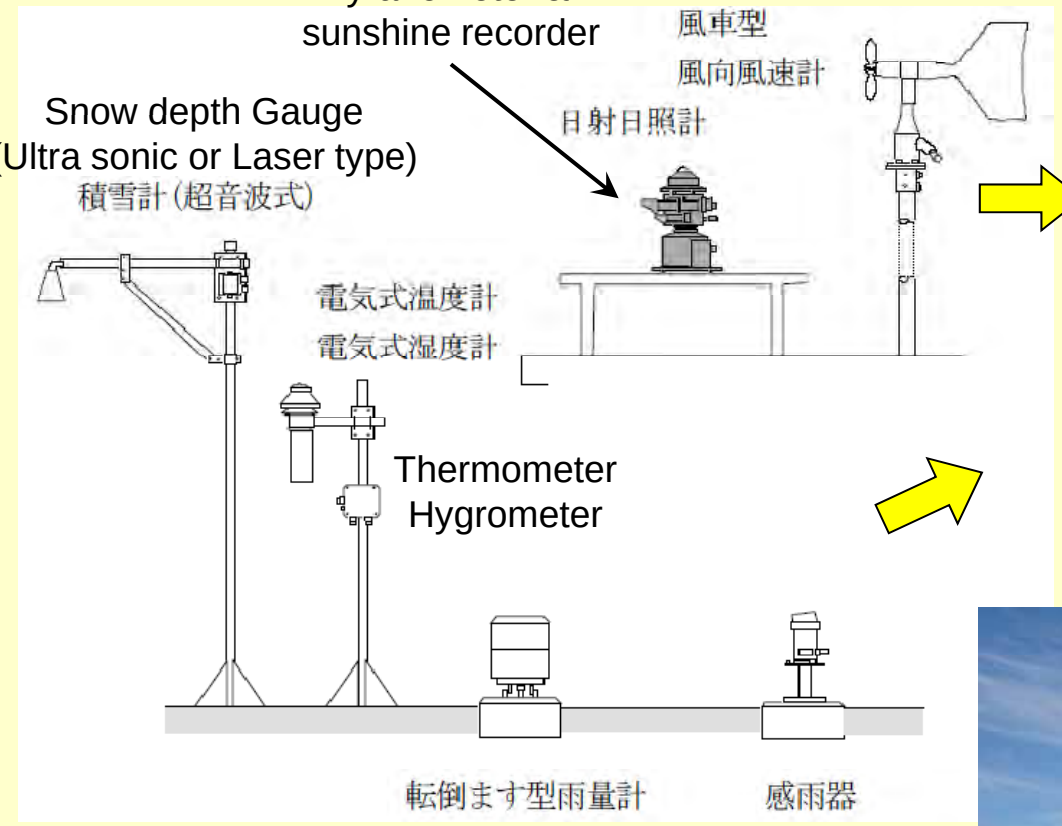


Meteorological Instruments at Meteorological Observatories

The measurement accuracy meets or exceeds the WMO/CIMO recommendations.

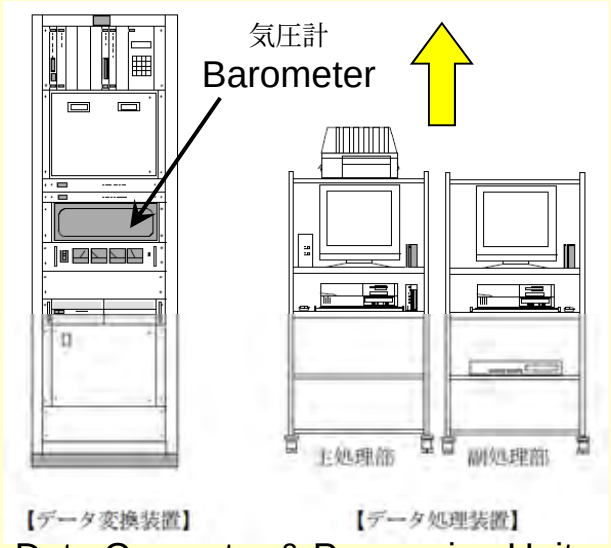
ADESS
(JMA DATA network)

Surface Meteorological Observation System (JMA-95 type)



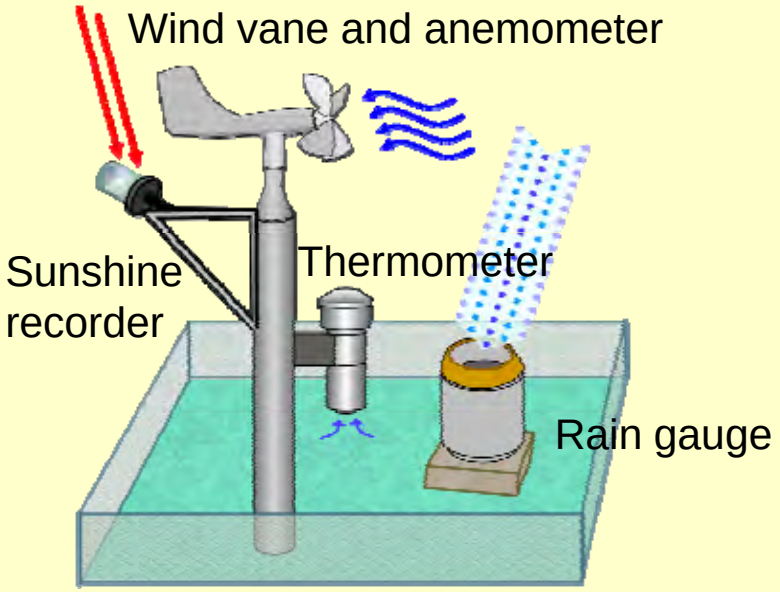
Rain Gauge
(Tipping bucket)

Rain Detector



Data Converter & Processing Unit

Meteorological Instruments at AMeDAS (AWS)



Station

Wind vane and anemometer

to indicate wind direction,
and
to measure the wind speed.

Rain gauge

to collect and measure the accumulated depth of rainwater that has fallen on a unit area and a specified time interval at a given point.

Thermometer

to measure temperature by incorporating a thermal sensor that utilizes the variation of the physical properties of substances.

Sunshine recorder

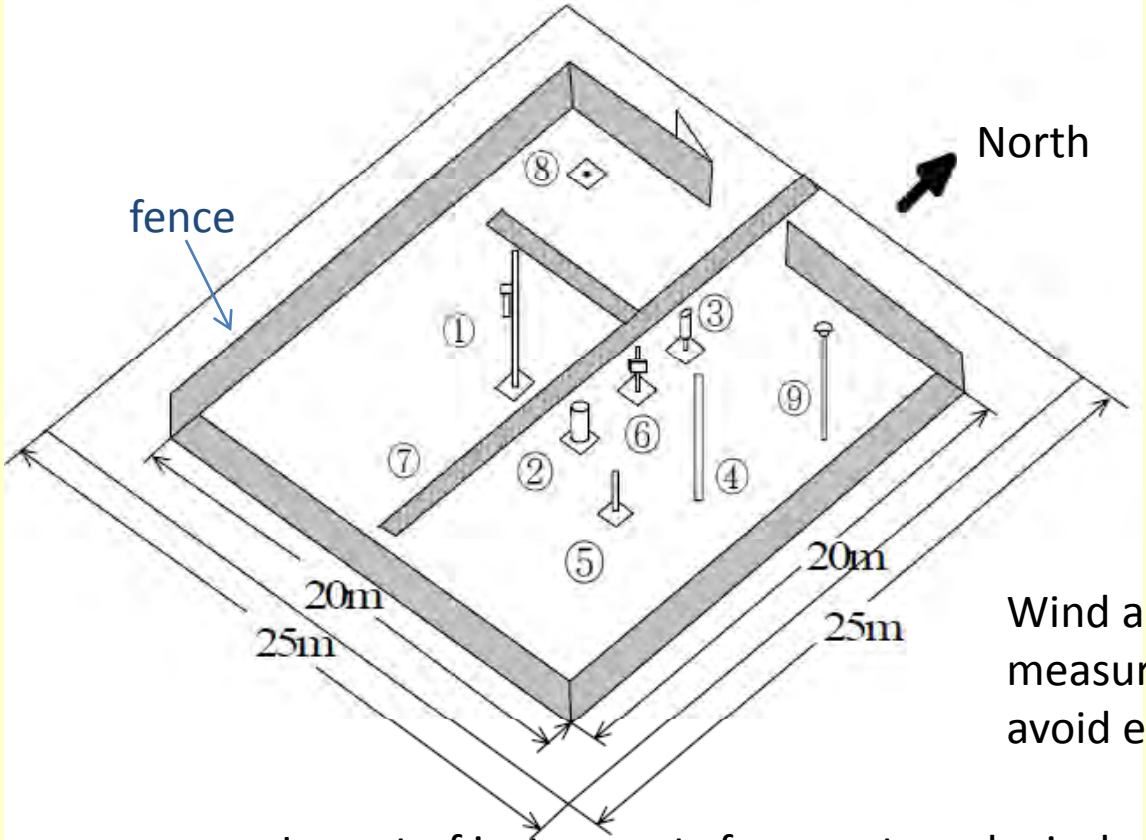
to record the duration of bright sunshine without regard to intensity at a given location.

snow cover meter

to record the snow depth.
They were set up in the snowy area in Japan.

3. Siting and exposure requirements
(Meteorological observatories)

Outdoor instruments should be installed on a level area of ground covered with short grass, preferably more than 20 m in width or length, and approximately 600 m^2 in area.



① Thermometer screen
② Tipping-bucket raingauge
③ Rain intensity sensor
④ Snow depth meter
⑤ Snow plate
⑥ Connection box
⑦ Cable pit
⑧ Benchmark stone
⑨ Mercury lamp

Wind and Sunshine are usually measured on the top of buildings to avoid effects of nearby obstacles

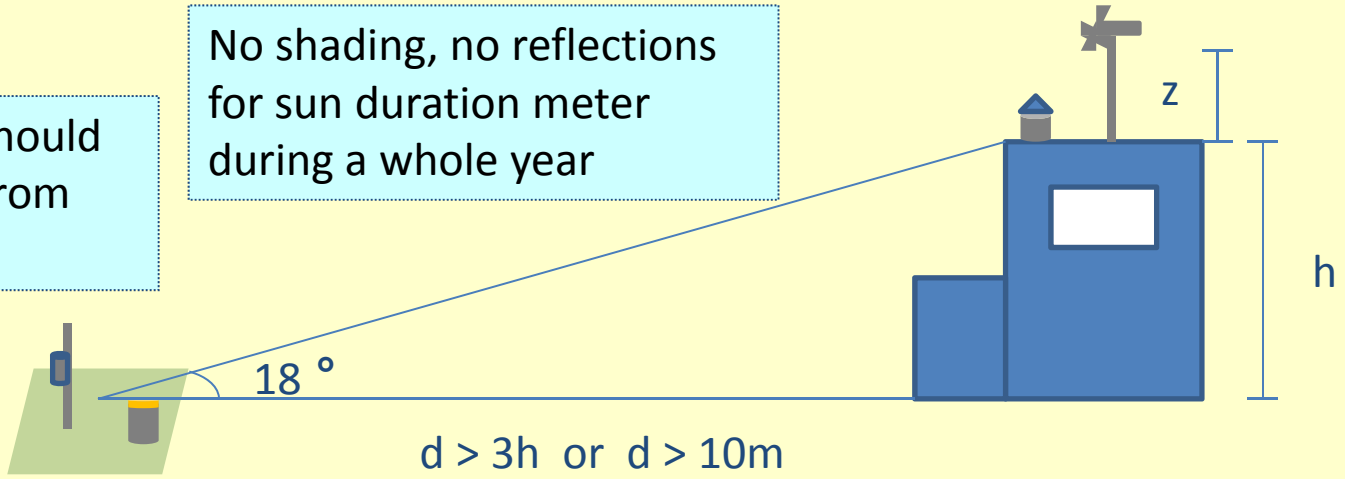
Layout of instruments for a meteorological observatory

Siting and exposure requirements (Meteorological observatories)

- The site should be well away from buildings, more three times of the height of the buildings or ten meters away.
- Angular heights of nearby buildings seen at the center of the site should be equal to or less than eighteen degrees.

Heat sources should be kept away from the site.

No shading, no reflections for sun duration meter during a whole year



Wind instruments should be raised at such a height (z) that its indications should not be too much affected by local obstructions.

$U / U_0 \leqq \pm 10\%$ - $U_0(U)$: Average wind speed without (with) local obstructions

$\sigma_U / \sigma_{U0} \leqq 1.2$ - $\sigma U_0(\sigma U)$: Standard deviation of gust during average wind of $U_0(U)$

Siting and exposure requirements
(local observing stations)

- The area of a site should be more than 30 m^2
- Temperature
  - The sensor should be mounted at the height of 1.5 m above the ground
  - Heat sources should be kept at least 10 m away from the sensor
  - No shading around the sensor
- Wind
  - The sensor should be mounted on the mast whose height is around 6 ~ 10 m above the ground.
  - No nearby buildings or trees whose height are more than 10 m

Siting and exposure requirements
(local observing stations)

- Precipitation
  - The sensor should be placed on the ground or the top of a rack
  - No obstacles above the gauge
  - The distance between the gauge and obstacles should be far enough to avoid wind disturbance

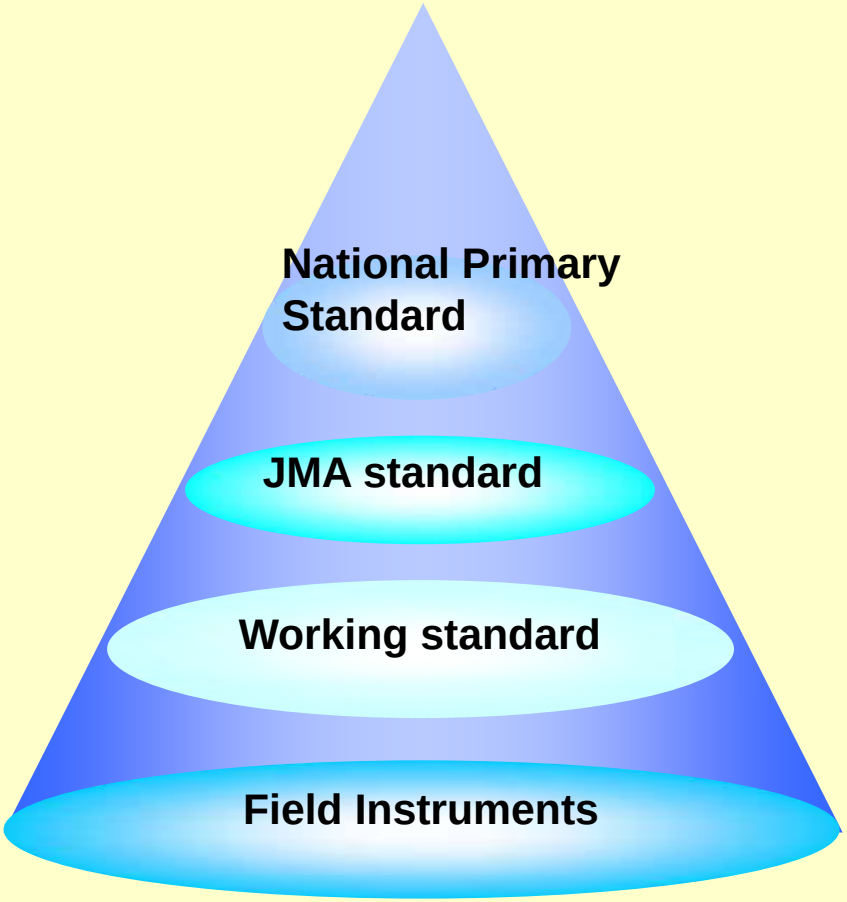
    (between 2 to 4 times the height)

- Sunshine duration
  - The sensor should be mounted on the mast whose height is around 6 - 10 m above the ground
  - No shading of surroundings

4. Maintenance and Inspection of Instruments

Maintenance of standard instruments

- JMA uses meteorological standard instruments with the traceability.



Traceability chart of JMA

JMA pressure standard

JMA temperature standard

Regular maintenance

Interval	Check Items for manned station / AWS: annual)
Daily	data quality checks inspecting the condition of observation fields and instruments
Weekly	hardware clocks cleaning the glass shields of pyranometers
Monthly	UPS, checking silica gel of pyranometers
Three months	cleaning sensors and the cover of instruments checking DC power supplies
Six Months	changing the filters of humidity sensors, checks for snow depth meter, inverter batteries
Annual	calibration for barometers and visibility/weather sensors, changing the sensors of rain gauges and wind vanes/anemometers, checks for cables and anti-icing equipment
Two years	changing inverter checker boards
Five years	changing inverter boards (RS-232C switch boards, CPU boards, CONV boards, modem boards)

Maintenance and Inspection of Instruments

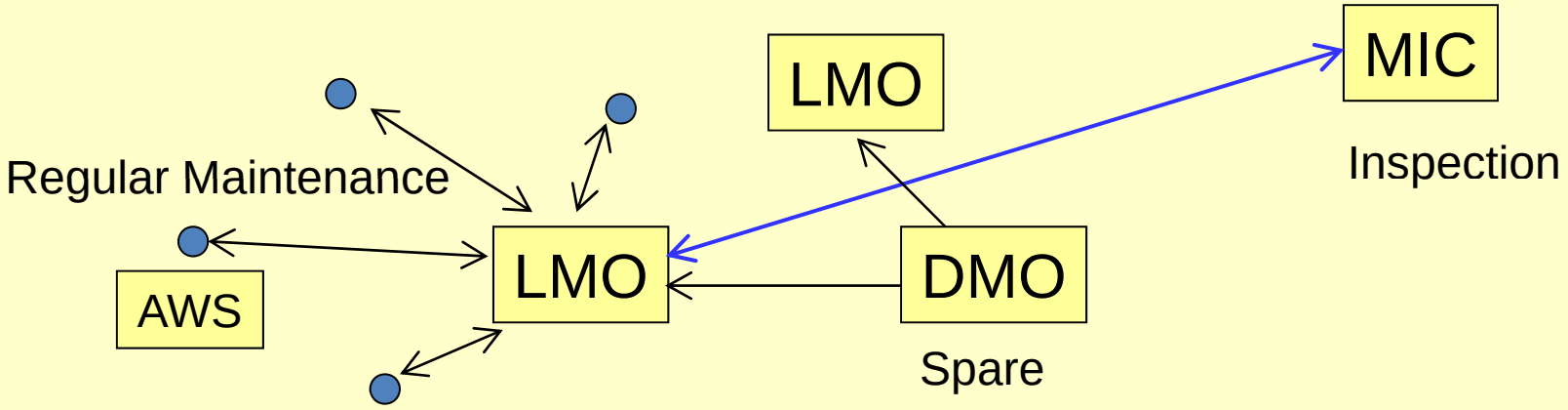
Regular Maintenance at Stations

by Local Meteorological Observatories (LMO)

Daily~5yr interval for manned station, Annual for AWS

Maintenance and Inspection of Instruments at Meteorological Instruments Center (MIC)

5yr interval



Maintenance and Inspection of Instruments

•In order to obtain accurate data in meteorological observations which JMA itself performs, Meteorological Instruments Center(MIC) maintains the almost JMA's instruments.

•MIC overhauls and inspects instruments in general every five years and repairs broken instruments.

Exchange and Inspection

in every 5 years

(1)To Make plan of inspection

(2)To send alternative instrument from MIC to observatory

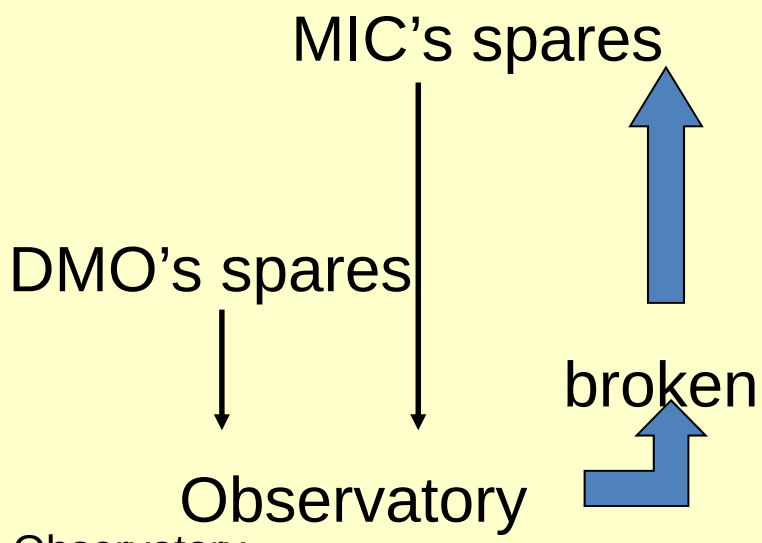
(3)To exchange instruments at observatory

(4)To receive instruments after exchange

(5)Overhaul

(6) Inspection

Solution to broken instruments



DMO:District Meteorological Observatory

5. Quality control procedures

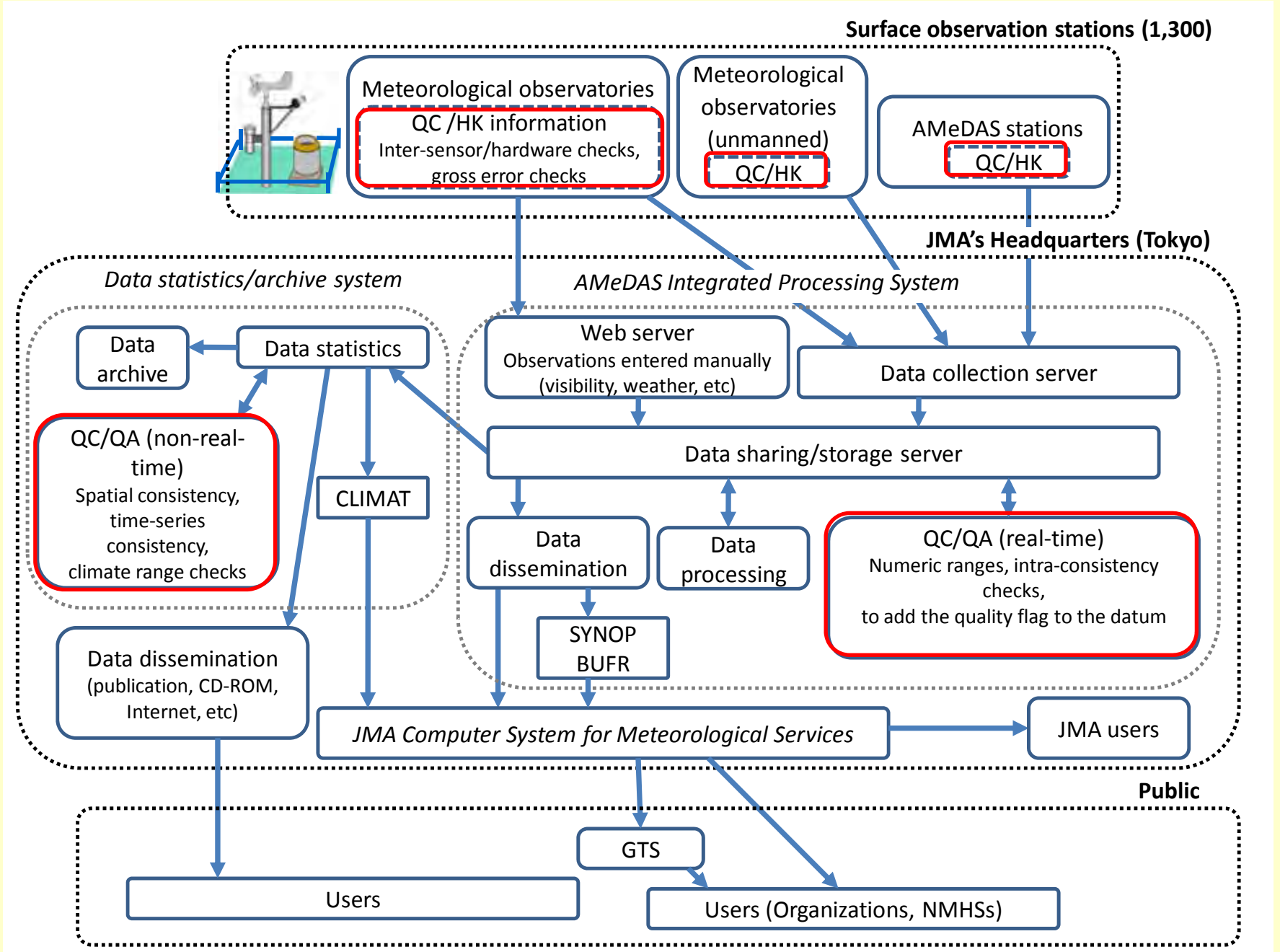
1. Real time

- Instrumental AQC
  - self-check and automatic quality check
- AQC in the processing systems
  - gross-error check and logical check for 10-s, 1-min and 10-min values

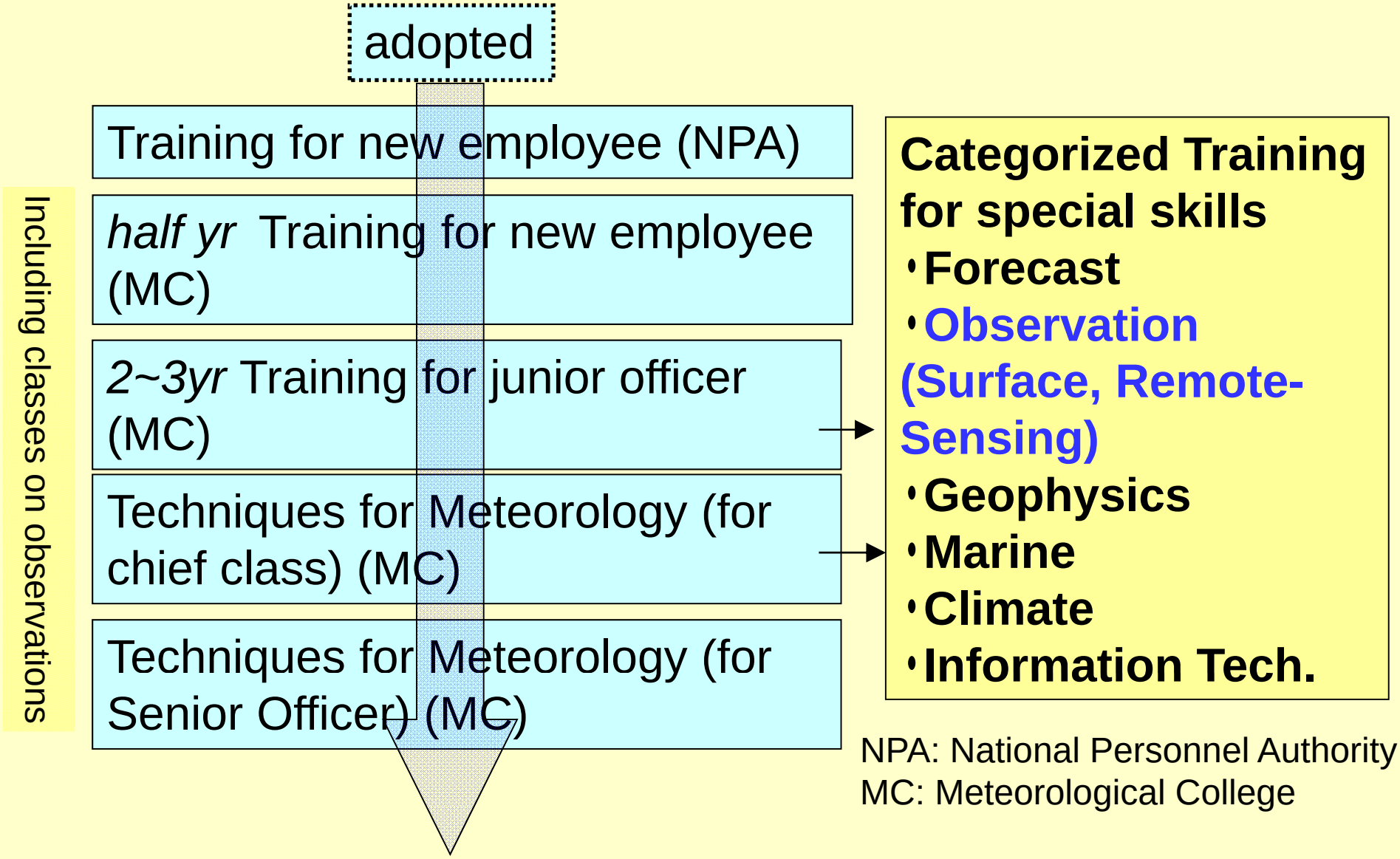
2. Non-real time

- AQC in the processing systems
  - Spatial check, Sequential check, Extreme value check

Data flow of surface observational data



6. Training Program



NPA: National Personnel Authority
MC: Meteorological College

The period of every course at MC is about 2 ~ 7 weeks.

Training Program

- Special programs on surface observation instruments (12 trainees, 22 days at Meteorological College)
  - Improving high skills and knowledge of local maintenance staff at observatories
  - Fostering leadership in maintenance practices among staff
- Training on surface observation instruments (58 trainees, 2 days, at District Meteorological Observatories)
  - Learning generally needed knowledge and skills for local staff to maintain instruments and procedures in case of any mechanical troubles or accidents

Summary

• JMA operates surface observation networks carried out at about 1,300 stations

• Data transmitted to JMA headquarters
  - every ten seconds at meteorological observatories, and
  - ten minutes at other AWSs.

• Quality controlled
  - in the instruments in real time,
  - in the data-processing centre in real time,
  - in processing systems in non-real time AQC:
    -Spatial check, sequential check and extreme value check.

• The officer in the observatory corrects observation value, according to the AQC result.

Thank you for your attention.