# Introduction of RIC Tsukuba (Japan, RAII)

20 March, 2018


***Kouichi NAKASHIMA***
***Scientific Officer***
***Regional Instrument Centre Tsukuba***
***Observing Division, Observing Department***
***Japan Meteorological Agency***

気象庁

# Outline

## 1. Overview of Meteorological Instrument Center

- Organization
- Main services
  - ✓ Quality Assurance of Meteorological Instruments
  - ✓ Research and Development
  - ✓ Responsibilities as WMO/RIC Tsukuba

## 2. Introduction of RIC Tsukuba

- RIC website
- Collaboration between RICs
- Services for Members
- Future plan

,etc.

# Outline

## 1. Overview of Meteorological Instrument Center

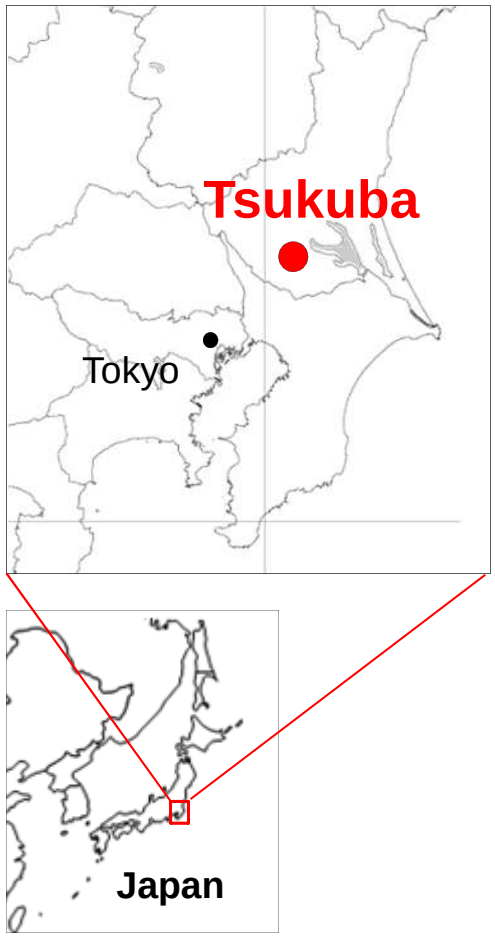
- Organization
- Main services
  - ✓ Quality Assurance of Meteorological Instruments
  - ✓ Research and Development
  - ✓ Responsibilities as WMO/RIC Tsukuba

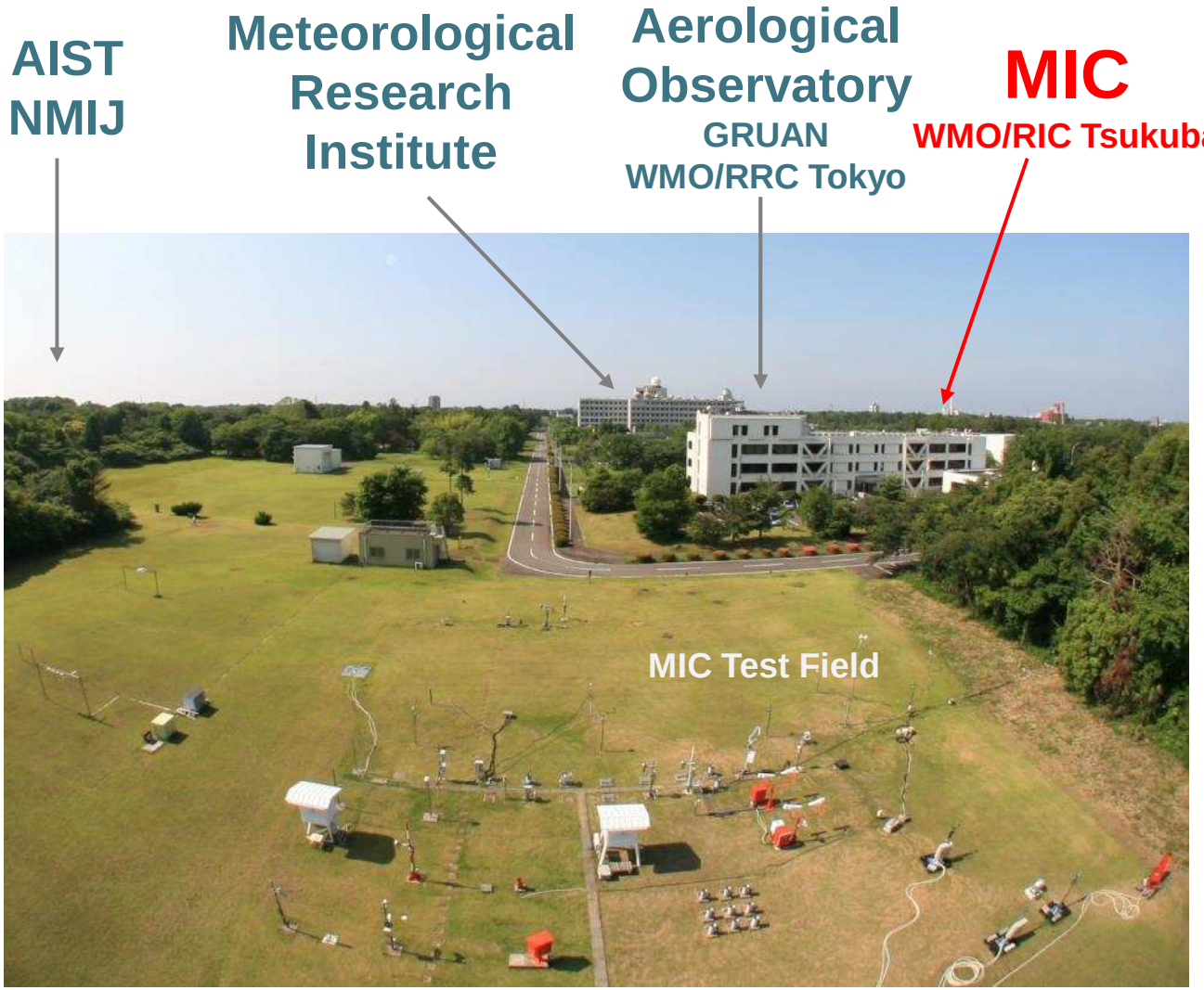
## 2. Introduction of RIC Tsukuba

- RIC website
- Collaboration between RICs
- Services for Members
- Future plan

,etc.

# Location of MIC



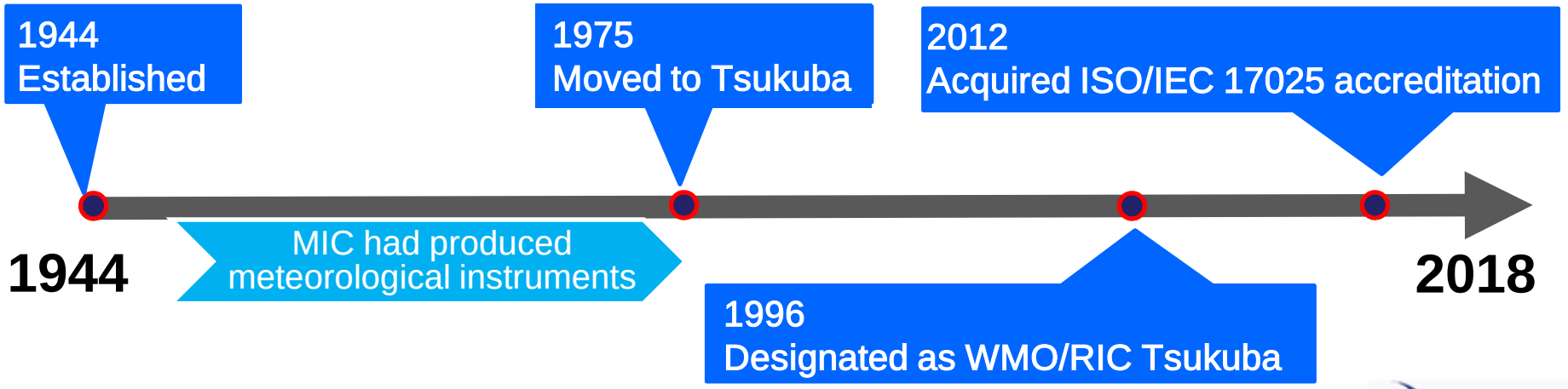



# Development of MIC

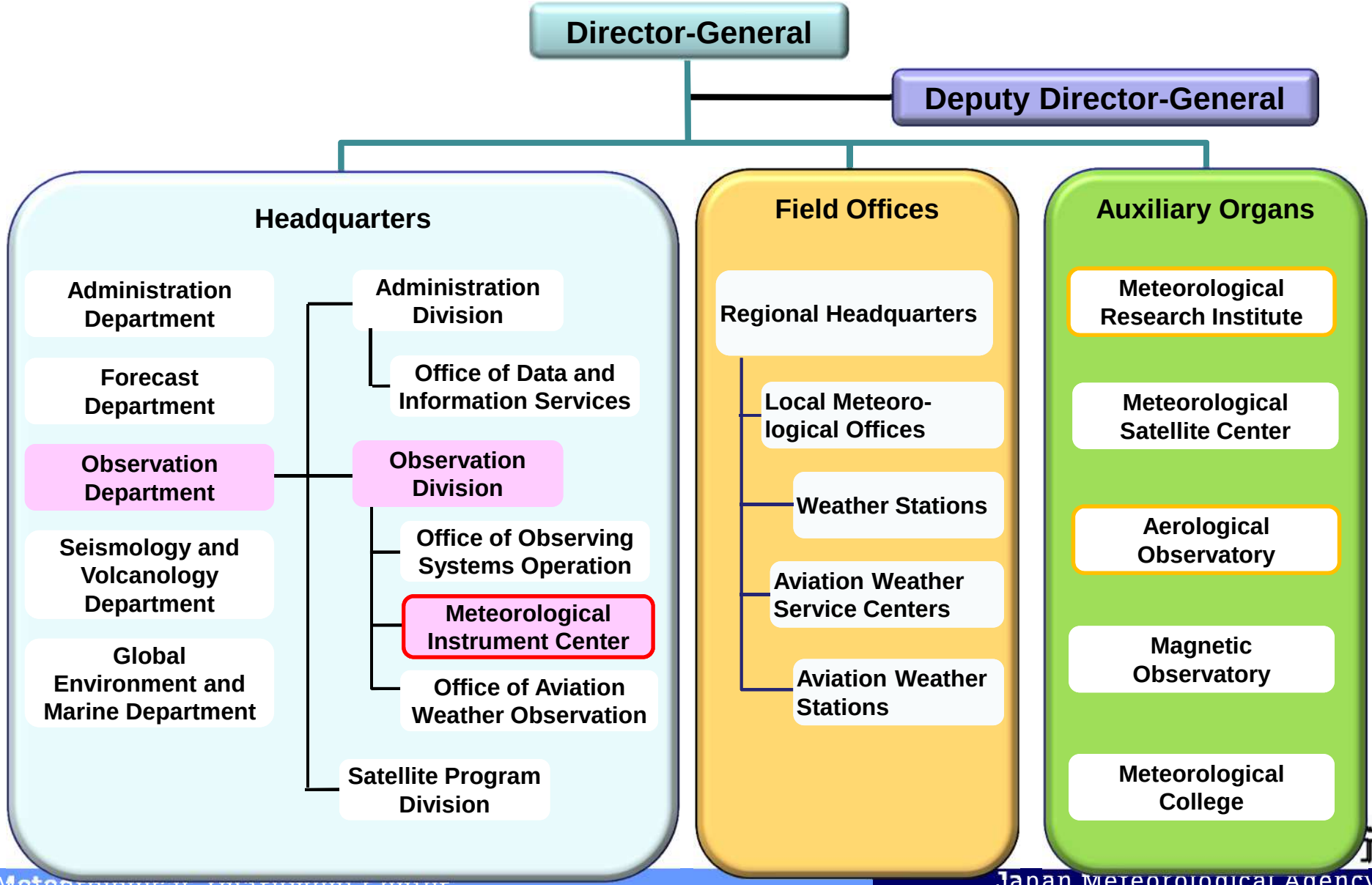
***A unique institution responsible for development of the meteorological instrumentation of JMA***

**Former MIC, 1956**

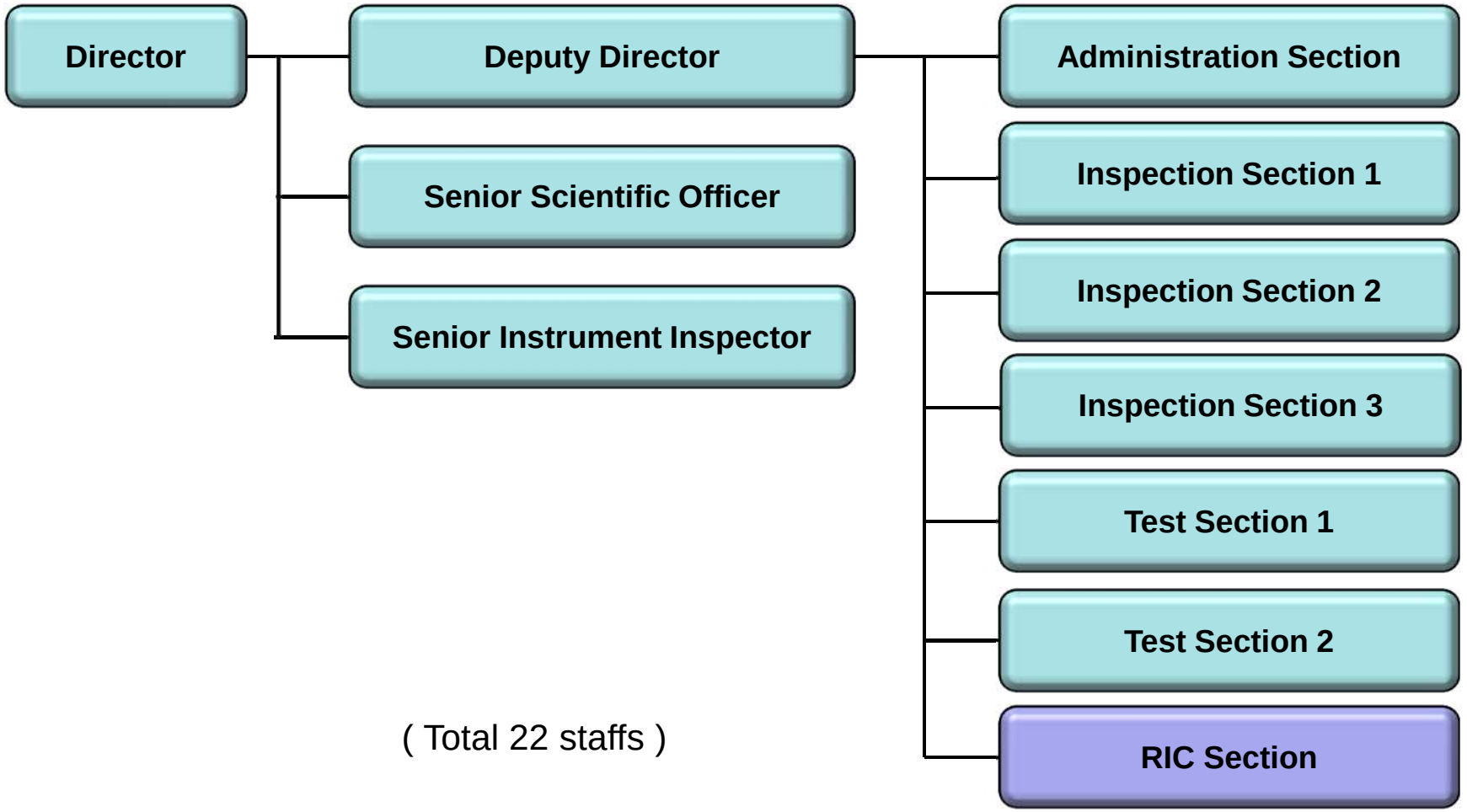
**Present MIC, 2016**



# Organizational structure of JMA



# Organizational structure of MIC




( Total 22 staffs )

# Main Services of MIC

- **Quality Assurance of Meteorological Instruments**

  To inspect meteorological equipment and to maintain standard instruments and their traceability, to ensure high-precision meteorological observations in Japan.

- **Research and Development (R&D)**

  To carry out research and development of instruments and suitable methods and environment for observation.

- **Responsibilities as WMO/RIC Tsukuba**

  To assist Members of RA II (Asia) through calibration and comparison with meteorological instruments, and to conduct training for the Members for fostering specialists in the instrument.

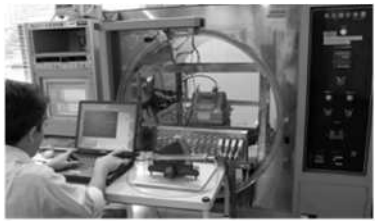
# Main Services of MIC

- **Quality Assurance of Meteorological Instruments**

  To inspect meteorological equipment and to maintain standard instruments and their traceability, to ensure high-precision meteorological observations in Japan.

- **Research and Development (R&D)**

  To carry out research and development of instruments and suitable methods and environment for observation.



- **Responsibilities as WMO/RIC Tsukuba**

  To assist Members of RA II (Asia) through calibration and comparison with meteorological instruments, and to conduct training for the Members for fostering specialists in the instrument.

# Traceability of Meteorological Instruments in Japan

**BIPM**

**International Standard (SI unit)**

**NMIJ**

**National Primary Standard (National Metrology Institute of Japan)**

**National meteorological standard (JMA standard)**

**JMA**

**Working standards (JMA sub-standard)**

**Working instruments (Observation sites)**

(English Translation)

ilac-MRA IAJapan

Certificate of Accreditation

Japan Meteorological Agency

IAJapan hereby accredits the following laboratory as a calibration laboratory based on the Measurement Law as it meets the requirements of relevant international standards. This laboratory also meets the requirements for Mutual Recognition Arrangements (MRA) of ILAC and APLAC.

Accreditation No.
JCSS0295
Name of Laboratory
Meteorological Instruments Center,
Japan Meteorological Agency
Address of Laboratory
Nagamine 1-2, Tsukuba City, Ibaraki, 305-0052, Japan
Accreditation Scope
Temperature, Pressure, Humidity (as attached)
Accreditation Criterion
ISO/IEC 17025:2005

Date of Initial Accreditation : 2012-08-30
Latest Date of Issue : 2013-09-05

Ichiro Fujima
Chief Executive, IAJapan
National Institute of Technology and Evaluation

COPY

**MIC**

MIC is accredited to ISO/IEC17025

- Temperature
- Pressure
- Humidity

In Japan, the Meteorological Service Act requires all meteorological instruments used for public to meet certain technical and performance standards.

# Calibration equipment

## - Standard instruments of JMA -

**Standard thermometer**

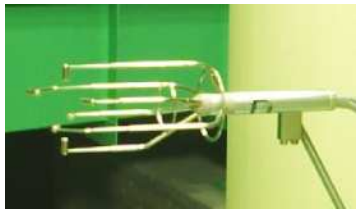
**Platinum resistance thermometer sensor and alternating current bridge**

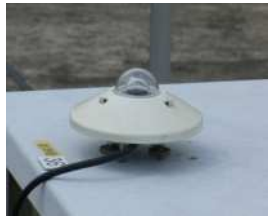
**Standard hygrometer**

**Dew point meter (electronic cooling type) and platinum resistance thermometer**

**Standard barometer**

**Air piston gauge type**





**Other Standard**

**Wind speed, Radiation, Precipitation , etc.**

# Calibration chambers

**Chamber for thermometers**

**Liquid bath type**
**Range: - 85 ~ +50℃**

**Air chamber type**
**Range: -40 ~ +50℃**

**Chamber for hygrometers**

**Wet and dry air mixing type**
**Range: 15 ~ 95%RH**

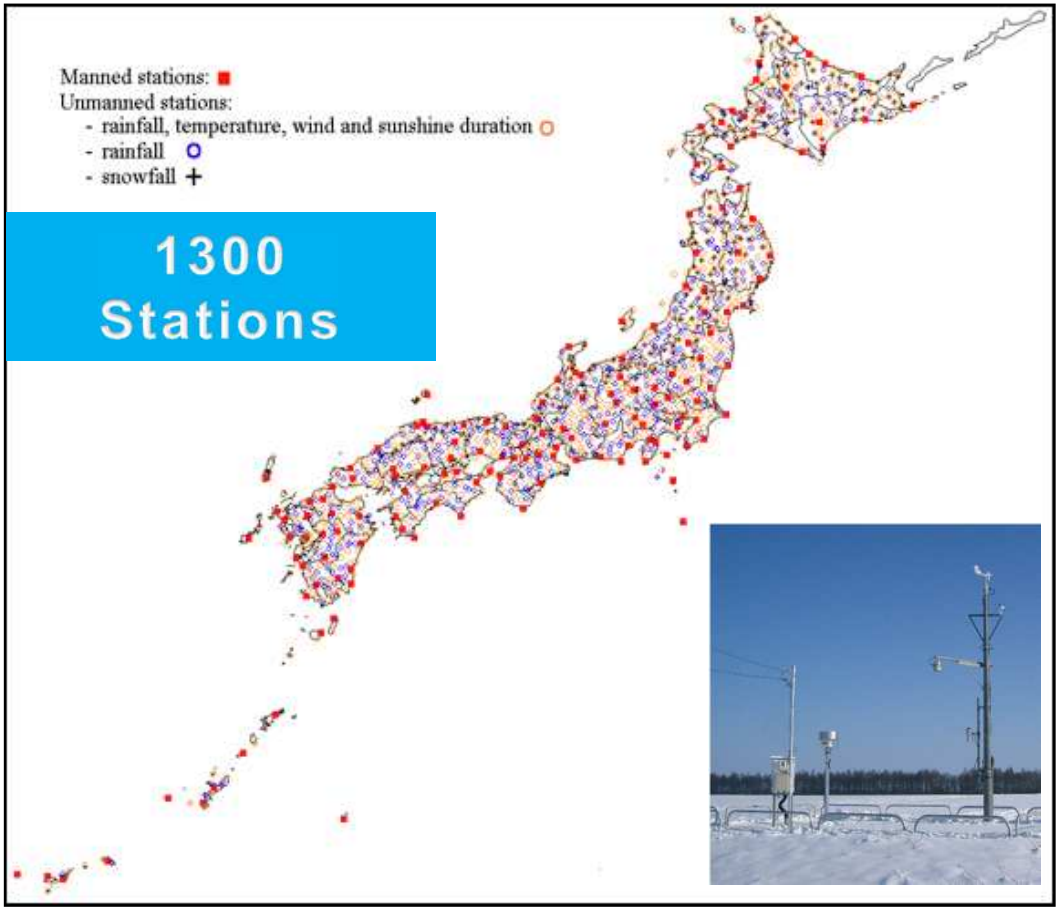
**Wet and dry air mixing type**
**Range: 10 ~ 95%RH, -10 ~ +50℃**

**Chamber for barometers**

**Range: 4 ~ 1050 hPa**

# Maintenance and Inspection of Instruments in JMA

## AWS Network of JMA (AMeDaS)




### Site maintenance

### Overhaul at MIC (every 5 years)

**MIC inspects about 1,600 units of instrument per year**

# Main Services of MIC

- **Quality Assurance of Meteorological Instruments**

  To inspect meteorological equipment and to maintain standard instruments and their traceability, to ensure high-precision meteorological observations in Japan.

- **Research and Development (R&D)**

  To carry out research and development of instruments and suitable methods and environment for observation.

- **Responsibilities as WMO/RIC Tsukuba**

  To assist Members of RA II (Asia) through calibration and comparison with meteorological instruments, and to conduct training for the Members for fostering specialists in the instrument.

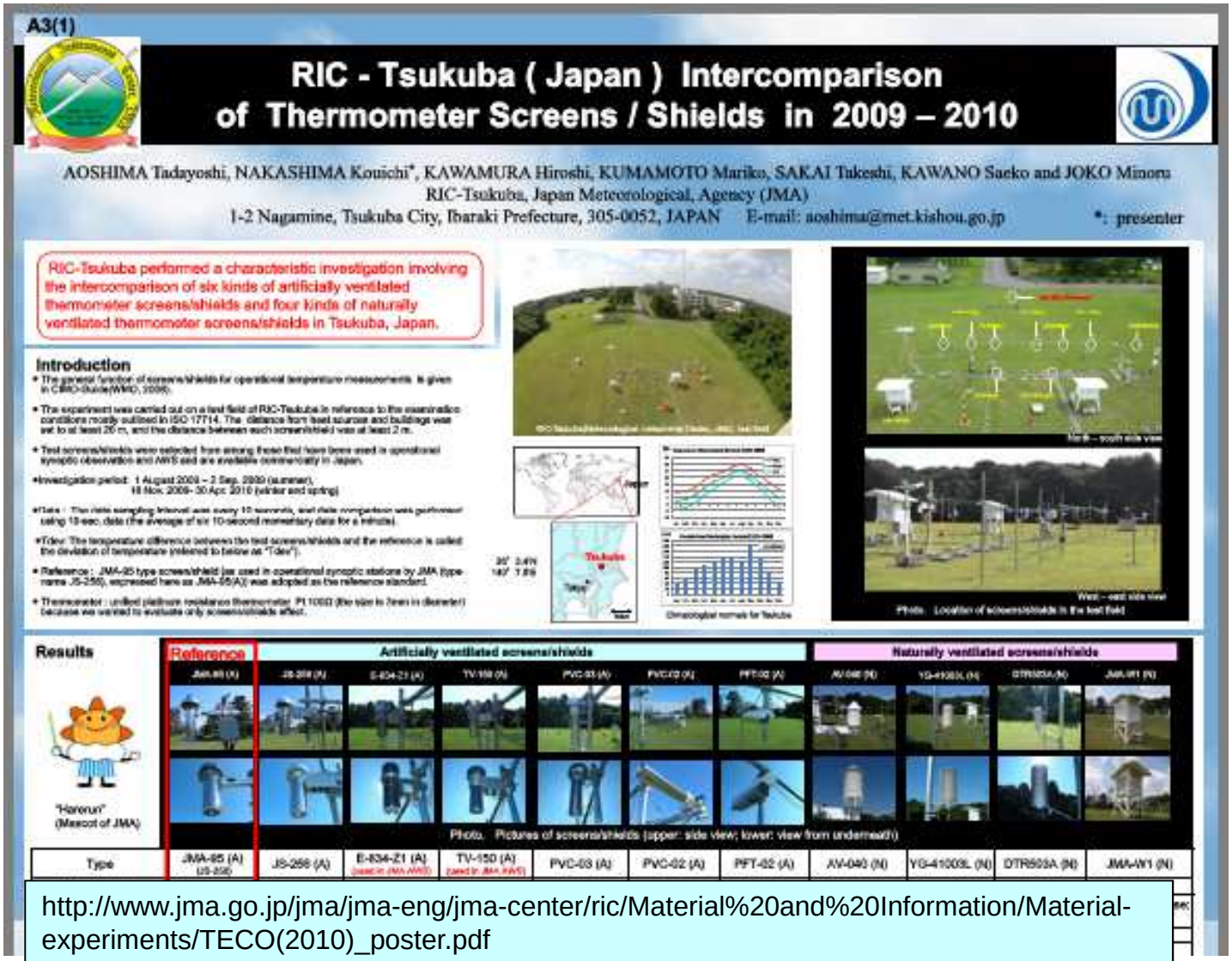
# Investigation and Experimentation on Observation Methods and Instruments

## In order to make more suitable observation

- Study of site environment and methods of observation
- Improvement of meteorological instruments

| Summary of study and improvement in recent years | |
|---|---|
| 2014 | Research on environmental conditions with low hedges around observation fields |
| | Study of substitutes for Assmann aspiration psychrometer |
| 2015 | Research on environmental conditions with low hedges around observation field |
| | Technical study of Assmann aspiration psychrometer |
| | Study of improvement of the lower part of shelters/screens |
| 2016 | Study of substitutes for Assmann aspiration psychrometer |
| | Study of weighing precipitation gauges and disdrometers for Dual- polarization radar |
| | Wind tunnel and field test of some sonic anemometers |
| | Field test of some shelters/screens |

# Intercomparison of Thermometer Screens/Shields in 2009 - 2010




http://www.jma.go.jp/jma/jma-eng/jma-center/ric/Material%20and%20Information/Material-experiments/TECO(2010)_poster.pdf
http://www.jma.go.jp/jma/jma-eng/jma-center/ric/Material%20and%20Information/Material-experiments/TECO(2010)_paper.pdf

# Field Experiment on the Effects of a Nearby Asphalt Road on Temperature Measurement

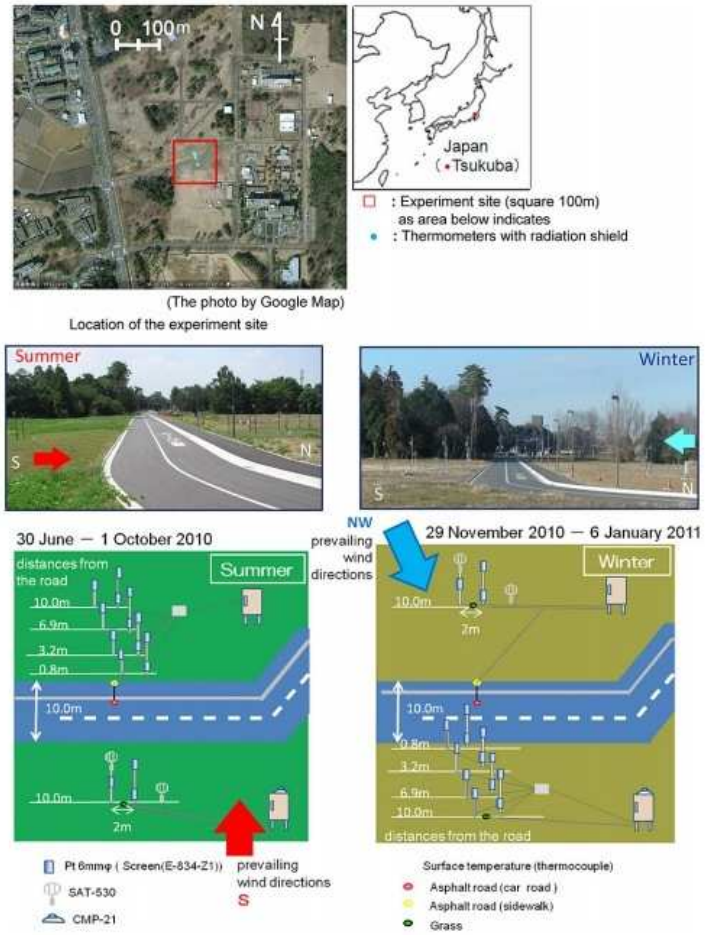
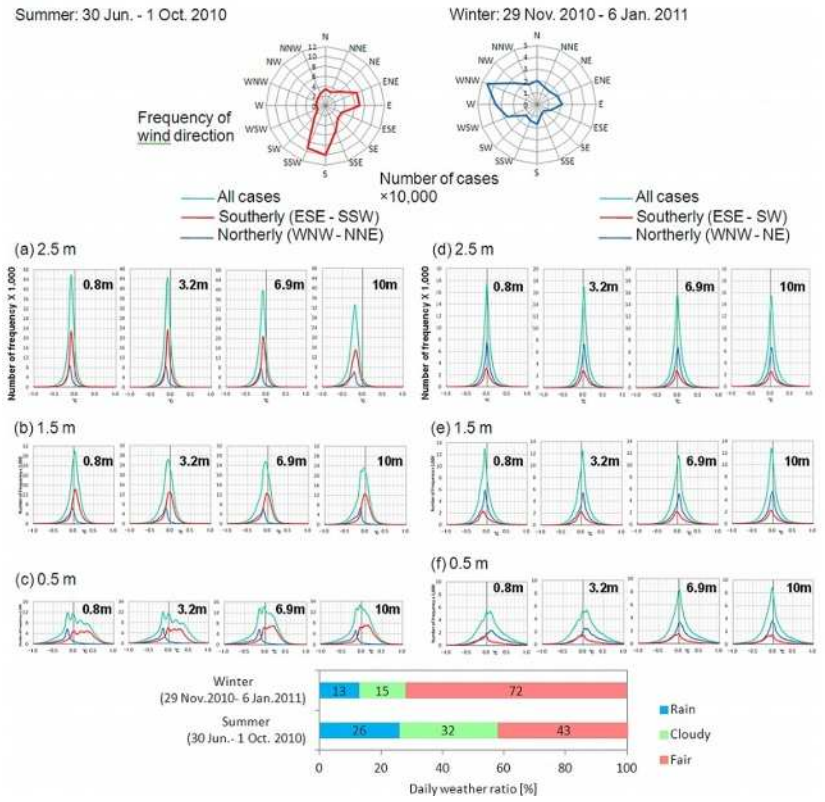



Fig. 1. Location of the experiment site (top), photograph of the site (middle) and layout of instrumentation (bottom).




https://www.jstage.jst.go.jp/article/sola/9/0/9_2013-013/_article

# Field experiments to determine the effect of boundary fences on temperature observation

## P3(70) Field experiments to determine the effect of boundary fences on temperature observation

Kenshi Umehara[1)], Akiko Hosomichi[1)], Saeko Kawano[1)] and Hideaki Mouri[2)]

*1) Meteorological Instrument Center, Japan Meteorological Agency , Tsukuba 305-0052, Japan*

*2) Meteorological Research Institute, Japan Meteorological Agency, Tsukuba 305-0052, Japan*

### 1.Introduction

To protect the temperature observation against warm air arising from a ground heat source, not a few automated weather stations of JMA have boundary fences or hedges around their observation fields. We study the influence of such a fence on the observed temperature by performing a field experiment and a laboratory experiment.

Growing concerns over global warming have necessitated greater accuracy in temperature observation on land and elsewhere (WMO, 2010). Against such a background, quality assurance (QA) for ground observation data is a major objective associated with the WMO Integrated Global Observation System (WIGOS), particularly in light of how meteorological observation has been significantly affected by environmental changes caused by rapid urbanization and other factors in recent years. However, at many weather stations in Japan, boundaries between observation fields and paved roads/parking lots have become indistinct. Winds arising from such heat sources bring warm air that may affect temperature monitoring data.

To minimize the influence of warm air on observations, the Japan Meteorological Agency (JMA) sets boundary fences or hedges with heights in the range of tens of centimeters. Many examples of such structures are now in place (Fig. 1). However, the lifting of warm air by these fences to the height of the thermometer (Oke, 1978) may affect observation temperatures. This applies in particular to maximum temperature values.

**Necessity of Experiments**

No systematic studies on how boundary fences affect temperature observation had previously been conducted. Numerical calculation remains problematic in cases where fences or other types of permeable screen are present. To determine the effects of such structures, field experiments and/or laboratory experiments in a wind tunnel are necessary.

Fig.1 A boundary hedge around the observation field of an automated weather station in Japan

### 2.Field Experiment

The field experiment was conducted from 2014 to 2015 in summer (approximately from July to September) and winter (approximately from December to March). Three observation fields (Fig. 2) were set on a large lawn at the Meteorological Instrument Center, also known as RIC Tsukuba. Each field had an area of 5.5 × 5.5 m, which is typical for JMA automated weather stations. Two thermometers were placed in the areas, one at a height of 1.5 m and one on the ground. An anemometer was also located at a height of 1.5 m. A 1-mm-mesh net was used as the boundary fence.

In 2014, two fields were enclosed with a four-face net at heights of 0.5 and 1.0 m. The other field had no net.

In 2015, one field was enclosed with a four-face net at a height 1.0 m as per the previous year. Another field was enclosed with a three-face net at a height of 1.0 m (Fig. 3) with the open face at the windward or leeward side.

The data recorded from this configuration were one-minute averages of temperature based on momentary values and ten-minute averages of wind speed/direction. Data for use were selected from conditions where the wind was almost perpendicular to the line of the three observation fields and cloud coverage Had been less than 80% over the preceding six hours..

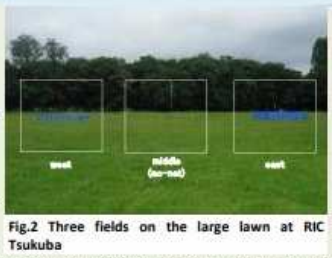



Fig.2 Three fields on the large lawn at RIC Tsukuba

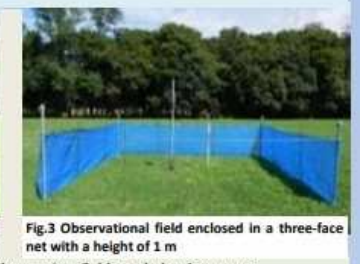
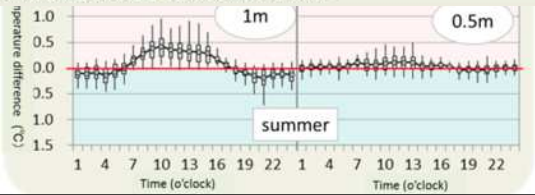
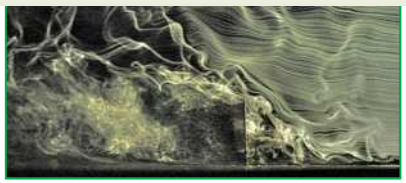


Fig.3 Observational field enclosed in a three-face net with a height of 1 m



http://www.jma.go.jp/jma/jma-eng/jma-center/ric/Material%20and%20Information/Material-experiments/TECO2016%20Field%20Experiment_poster.pdf

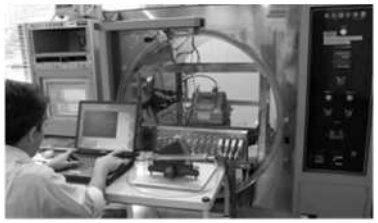
# Main Services of MIC

- **Quality Assurance of Meteorological Instruments**

  To inspect meteorological equipment and to maintain standard instruments and their traceability, to ensure high-precision meteorological observations in Japan.

- **Research and Development (R&D)**

  To carry out research and development of instruments and suitable methods and environment for observation.



- **Responsibilities as WMO/RIC Tsukuba**

  To assist Members of RA II (Asia) through calibration and comparison with meteorological instruments, and to conduct training for the Members for fostering specialists in the instrument.

# Outline

## 1. Overview of Meteorological Instrument Center

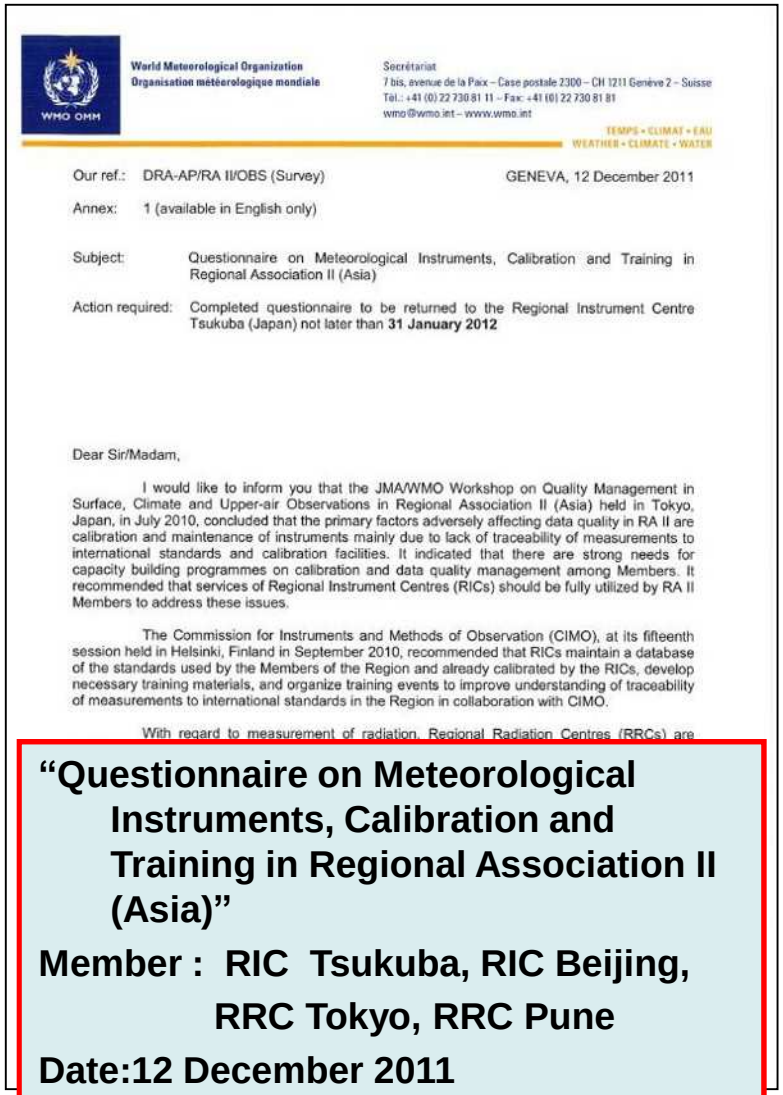
- Organization
- Main services
  - ✓ Quality Assurance of Meteorological Instruments
  - ✓ Research and Development
  - ✓ Responsibilities as WMO/RIC Tsukuba

## 2. Introduction of RIC Tsukuba

- RIC website
- Collaboration between RICs
- Services for Members
- Future plan

,etc.

# WMO Survey of Calibration of Meteorological Instruments in RA II



World Meteorological Organization
Organisation météorologique mondiale

Secrétariat
7 bis, avenue de la Paix – Case postale 2300 – CH 1211 Genève 2 – Suisse
Tel.: +41 (0) 22 730 81 11 – Fax: +41 (0) 22 730 81 81
wmo@wmo.int – www.wmo.int

TEMPS • CLIMAT • EAU
WEATHER • CLIMATE • WATER

Our ref.: DRA-AP/RA II/OBS (Survey) GENEVA, 12 December 2011

Annex: 1 (available in English only)

Subject: Questionnaire on Meteorological Instruments, Calibration and Training in Regional Association II (Asia)

Action required: Completed questionnaire to be returned to the Regional Instrument Centre Tsukuba (Japan) not later than **31 January 2012**

Dear Sir/Madam,

I would like to inform you that the JMA/WMO Workshop on Quality Management in Surface, Climate and Upper-air Observations in Regional Association II (Asia) held in Tokyo, Japan, in July 2010, concluded that the primary factors adversely affecting data quality in RA II are calibration and maintenance of instruments mainly due to lack of traceability of measurements to international standards and calibration facilities. It indicated that there are strong needs for capacity building programmes on calibration and data quality management among Members. It recommended that services of Regional Instrument Centres (RICs) should be fully utilized by RA II Members to address these issues.

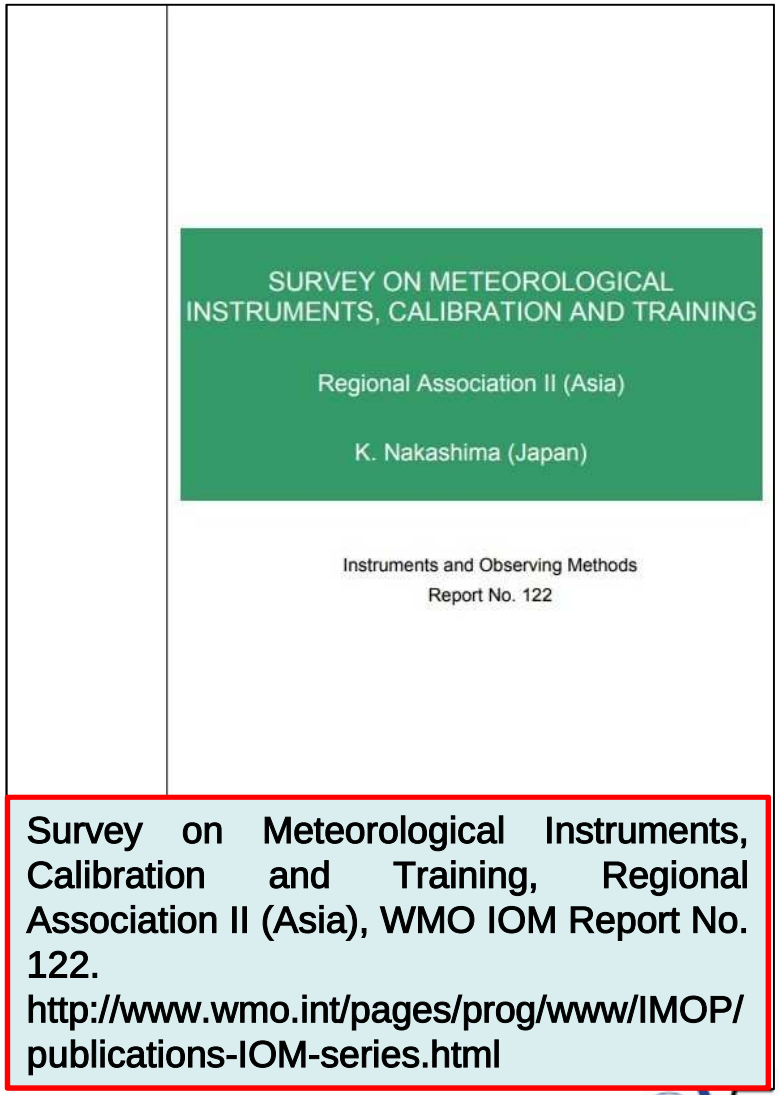
The Commission for Instruments and Methods of Observation (CIMO), at its fifteenth session held in Helsinki, Finland in September 2010, recommended that RICs maintain a database of the standards used by the Members of the Region and already calibrated by the RICs, develop necessary training materials, and organize training events to improve understanding of traceability of measurements to international standards in the Region in collaboration with CIMO.

With regard to measurement of radiation, Regional Radiation Centres (RRCs) are

**"Questionnaire on Meteorological Instruments, Calibration and Training in Regional Association II (Asia)"**

**Member : RIC Tsukuba, RIC Beijing, RRC Tokyo, RRC Pune**

**Date:12 December 2011**



SURVEY ON METEOROLOGICAL INSTRUMENTS, CALIBRATION AND TRAINING

Regional Association II (Asia)

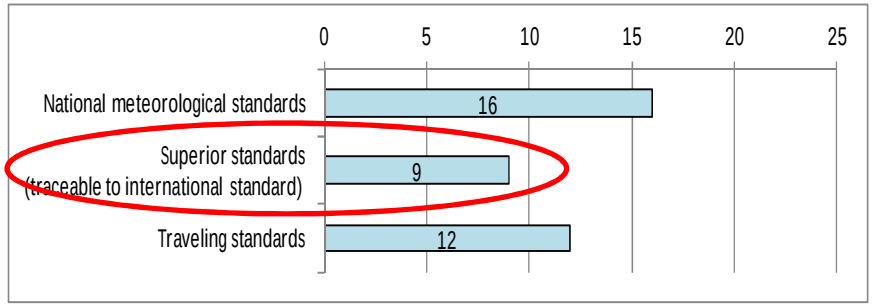
K. Nakashima (Japan)

Instruments and Observing Methods
Report No. 122

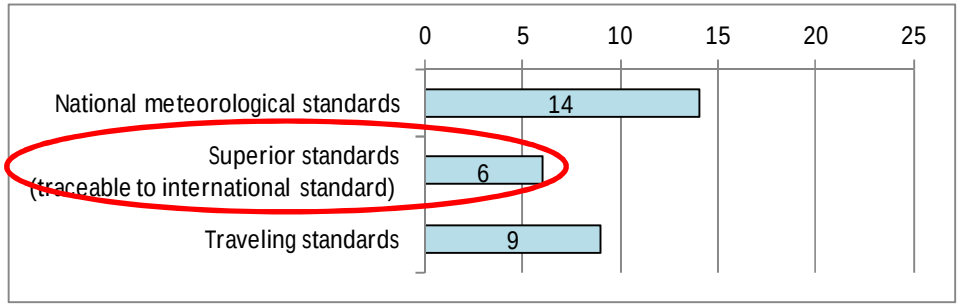
Survey on Meteorological Instruments, Calibration and Training, Regional Association II (Asia), WMO IOM Report No. 122.
http://www.wmo.int/pages/prog/www/IMOP/publications-IOM-series.html

# WMO Survey on meteorological instruments, calibration and training in RA II

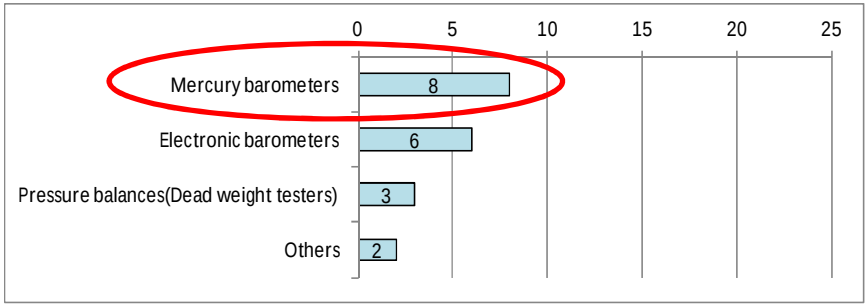
**Pressure**

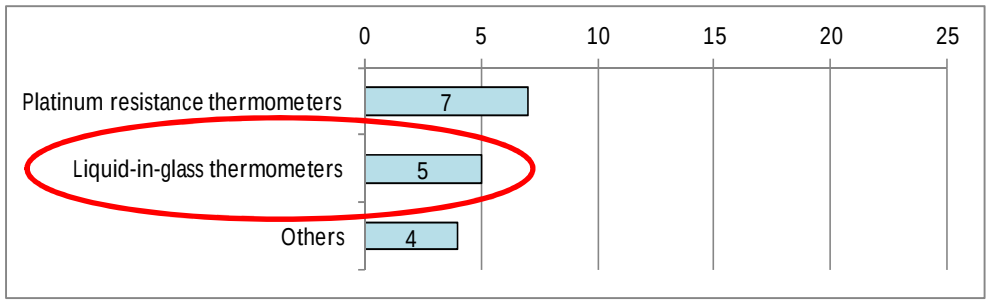



**Temperature**




***Maintenance of standards and traceability to an international standard*** **(N = 21)**

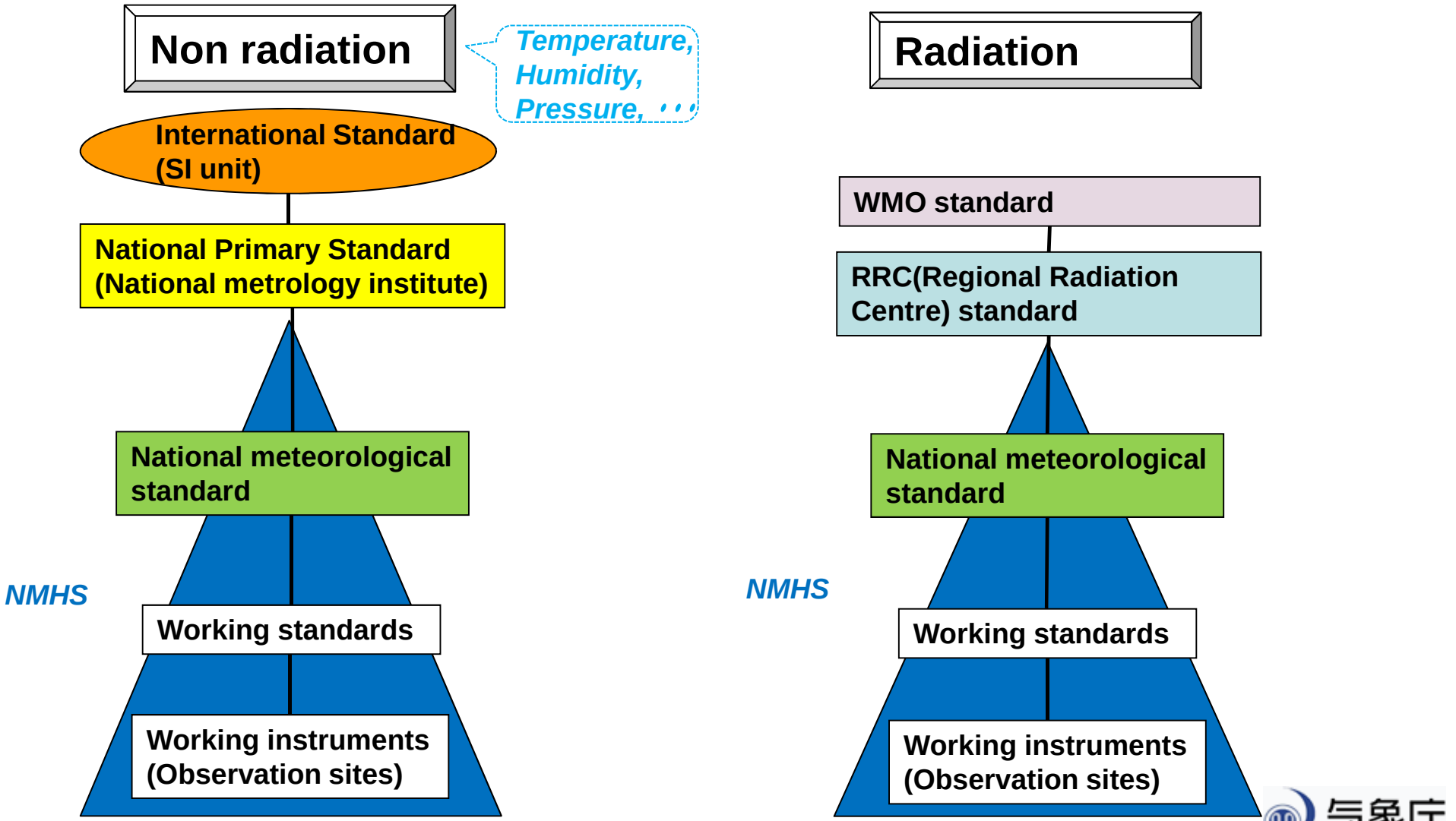


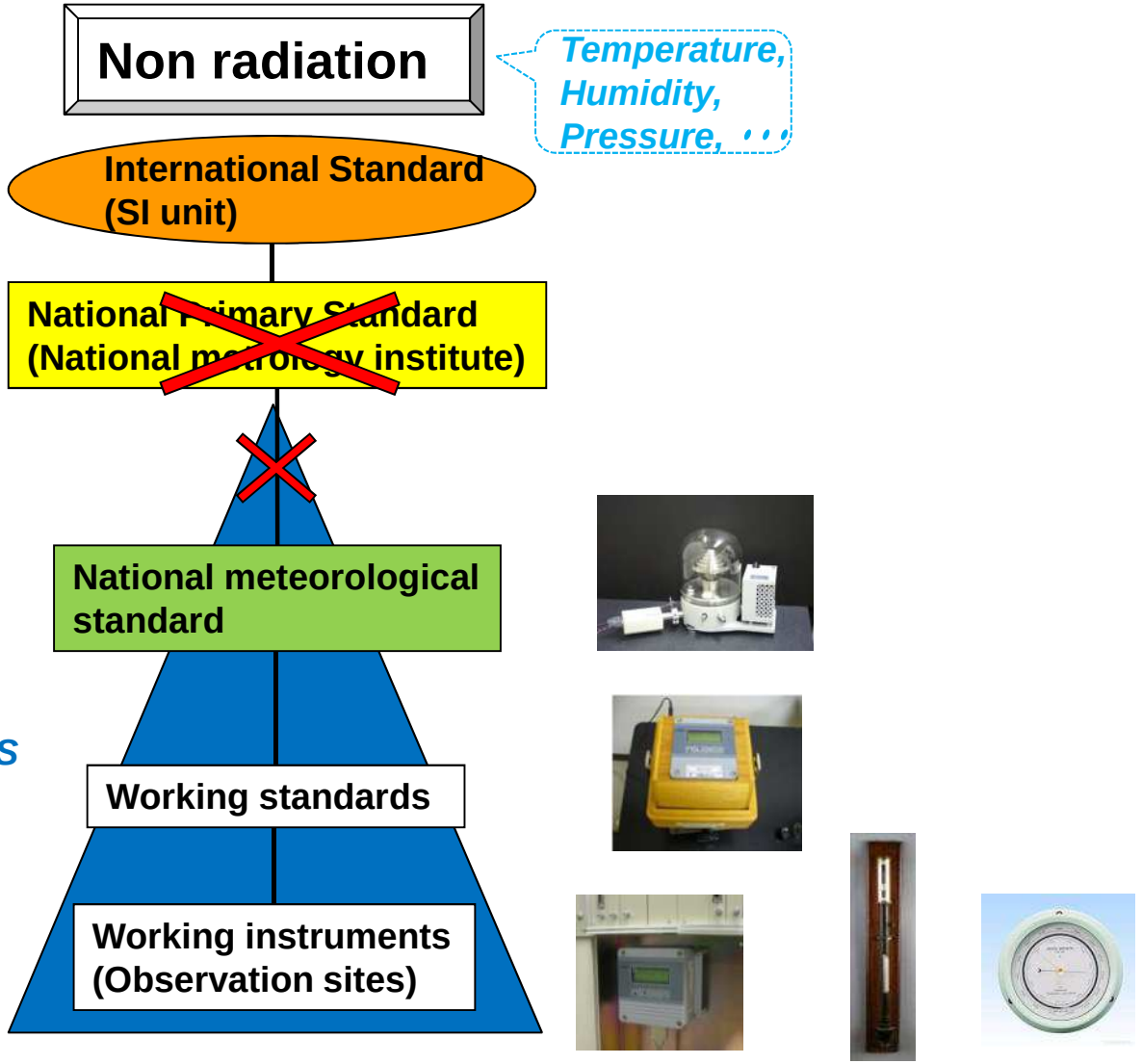

***Instrument type/method used for national meteorological standards*** **(N = 21)**

- Meteorological instrument calibration was not conducted properly in many cases; fewer than half of the Members responding to the questionnaire had national meteorological standards that were traceable to international standards.
- Conventional instruments such as mercury barometers and liquid-in-glass thermometers were still used rather than electrical instruments for most meteorological parameters in operational use.

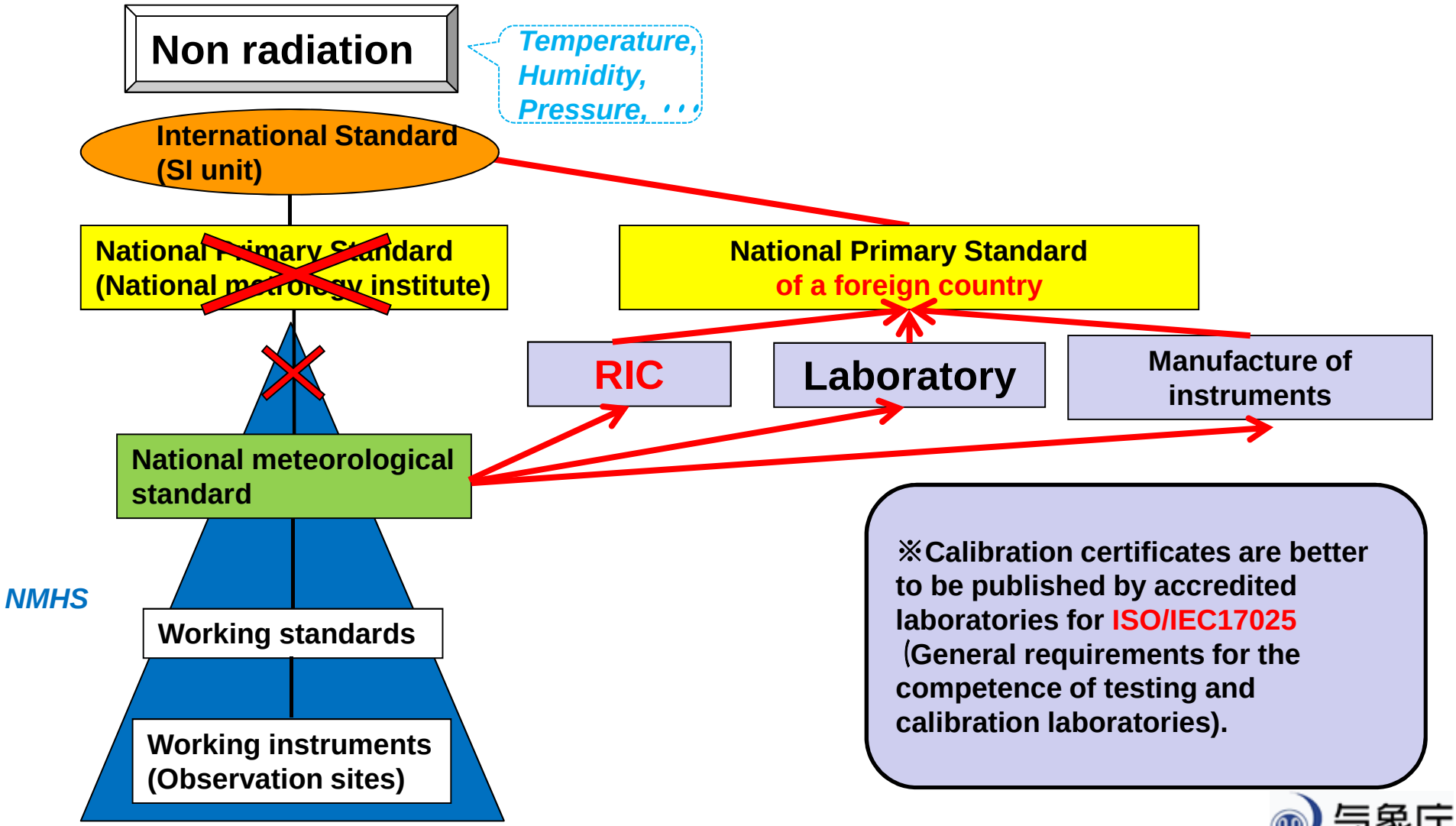
# Traceability in meteorological instruments



# Traceability in meteorological instruments

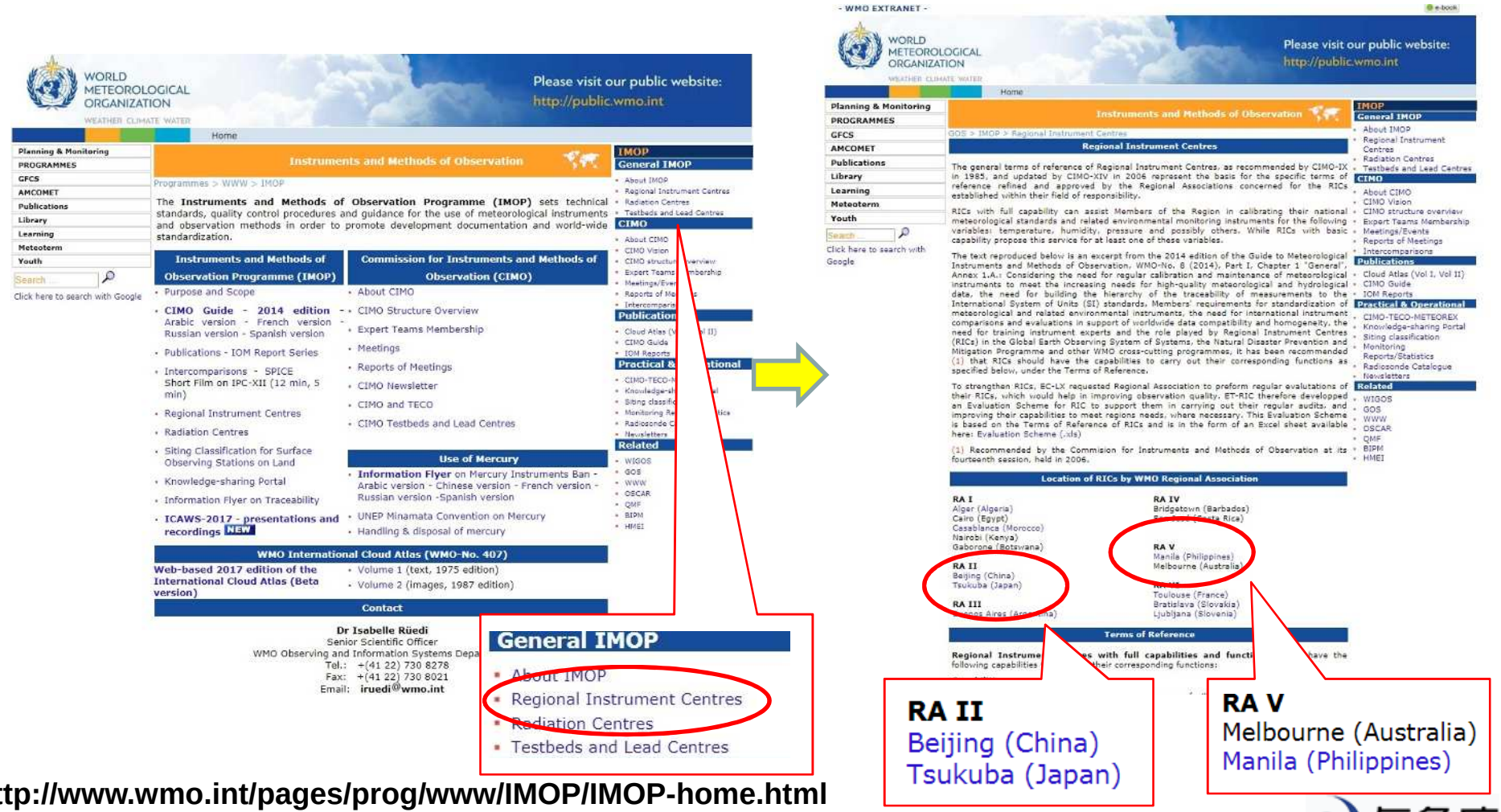


# Traceability in meteorological instruments



# How to get information of RICs?

->RIC Website




**http://www.wmo.int/pages/prog/www/IMOP/IMOP-home.html**

# How to get information of RICs?

->RIC Website

- WMO EXTRANET -

WORLD METEOROLOGICAL ORGANIZATION

WEATHER CLIMATE WATER

Please visit our public website: http://public.wmo.int

Home

WWW > IMOP > Regional Instrument Centres

## RIC at Tsukuba, Japan (Region II)

(Information on this webpage is based on the Report from the RIC received in May 2017, and the updates received in September 2017. Please refer to the RIC's website for the latest information.)

### General Information

**Address:** 1-2 Nagamine Tsukuba Ibaraki 305-0052, Japan

**Website:** http://www.jma.go.jp/jma/jma-eng/jma-center/ric/RIC_HP.html

**Contact person:** Kouichi NAKASHIMA

**Email:** kouichi.nakashima@met.kishou.go.jp; ric-tsukuba@met.kishou.go.jp

**Tel:** +81 298 51 4123

**Fax:** +81 298 51 1670

**Calibration capabilities:** Temperature, Relative Humidity, Atmospheric Pressure, Wind

### Specific Information on instrument calibration capabilities

**Temperature**

| Instrument Undergoing Calibration | Calibration Range | Reference standard, Equipment | Calibration and Measurement Capability (CMC)* | Traceability of Reference equipment | |
|---|---|---|---|---|---|
| | | | | Last standard calibration date | Calibration body |
| Contact Type Thermometer | -40 to 50 °C | Platinum resistance thermometer NSR-160 (Netsushin) | -40 °C to < 0 °C: 45 mK, at 0 °C: 13 mK, 0 °C < to 50 °C: 36 mK | 17 August 2017 | Tanaka Kikinzoku Kogyo K.K. Isehara Works Thermometer Calibration Laboratory |
| | | Triple point of water cell 5901C-G (Hart Scientific, Inc.) | | 7 August 2017 | Tanaka Kikinzoku Kogyo K.K. Isehara Works Thermometer Calibration Laboratory |

Status of accreditation (date of the latest accreditation): 29 August 2017

Link to the accreditation certificate

Accreditation body: National Institute of Technology and Evaluation (Japan)

| | | | | | |
|---|---|---|---|---|---|
| Anemometer | 0.5 to 90 m/s | From 20 to 90 m/s: Pitot tube F-202 (Rika seiki, Japan) Differential pressure gauge MT210 (2 sets) (Yokogawa, Japan) | N/A | 7 December 2015 | National Metrology Institute of Japan |

Status of accreditation:

Link to the accreditation certificate

Accreditation body:

* A **CMC (calibration and measurement capability)** is the smallest uncertainty of measurement that can be expected to be achieved by the RIC during a calibration. This CMC is evaluated by the RIC itself and described in the scope of accreditation of the RIC, if available.

Further Information

Report of the RIC (May 2017)

▲ Top

**Further Information**

Report of the RIC (May 2017)

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale
Organización Meteorológica Mundial
Всемирная метеорологическая организация
المنظمة العالمية للأرصاد الجوية
世界气象组织

Secrétariat
7 bis, avenue de la Paix – Case postale 2300
CH 1211 Genève 2 – Suisse
Tél.: +41 (0) 22 730 81 11
Fax: +41 (0) 22 730 81 81
wmo@wmo.int – www.wmo.int

## Form for Regular Reporting of Regional Instrument Centres

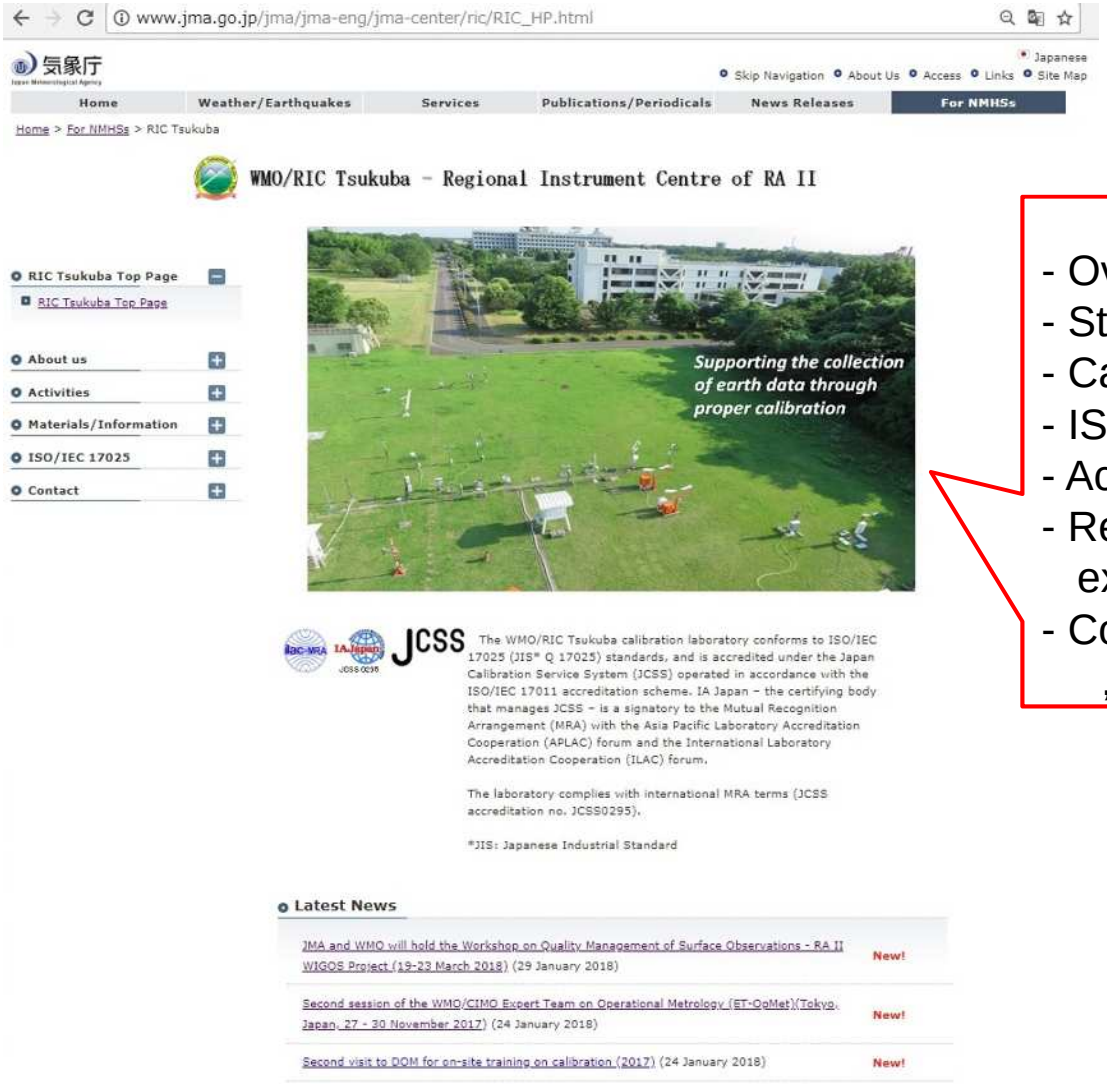
(please expand the cells as required to properly reflect your activities)

Terms of Reference for Regional Instrument Centres (RICs) are available under: https://www.wmo.int/pages/prog/www/IMOP/instrument-reg-centres.html

| Regional instrument Centre - General Information | |
|---|---|
| Name of RIC | RIC Tsukuba |
| RIC's website | http://www.jma.go.jp/jma/jma-eng/jma-center/ric/RIC_HP.html |
| Institute hosting RIC | Japan Meteorological Agency |
| City | Tsukuba |
| Country | Japan |
| Regional Association | Region II |

| Contact Person for the Regional Instrument Centre | | |
|---|---|---|
| Courtesy Title | Mr | |
| First name | Kouichi | |
| Family name | NAKASHIMA | |
| Street and number | 1-2 Nagamine | |
| Postal code | 305-0052 | |
| City | Tsukuba | |
| State/Province | Ibaraki | |
| Country | Japan | |
| Tel. number(s) | +81 298 51 4123 | |
| Fax number(s) | +81 298 51 1670 | |
| Email(s) | kouichi.nakashima@met.kishou.go.jp<br>ric-tsukuba@met.kishou.go.jp | |
| Has contact person changed since 2013? | ☒ Yes | ☐ No |

# RIC Tsukuba's own website




- Overview of RIC Tsukuba
- Standard instruments
- Calibration facilities
- ISO/IEC 17025
- Activities
- Reports on instrument experiments
- Contact information ,etc.

**http://www.jma.go.jp/jma/jma-eng/jma-center/ric/RIC_HP.html**

# JMA/WMO Training Workshop on Calibration and Maintenance of Meteorological Instruments in RA II (ASIA)

(19-22 February 2013 Tokyo, Tsukuba, Japan)


http://www.jma.go.jp/jma/en/Activities/RIC_Workshop_2013/RIC_Workshop_2013.html

# Collaboration between RICs


RIC-Tsukuba and RIC-Beijing conducted reciprocal visits of their experts (2010)

Cooperation between RIC-Tsukuba and RIC-Manila (2016)

# Calibration list at RIC Tsukuba

| Month/year | Country/region | Standard instruments calibrated |
|---|---|---|
| Mar. 2000 | Thailand | Barometer, thermometer |
| Oct. 2001 | Republic of Korea | Anemometer |
| Aug. 2006 | Philippines | Pyranometer |
| Apr. 2007 | Thailand | Barometer, thermometer |
| Dec. 2007 | Hong Kong, China | Barometer |
| Jun. 2010 | Thailand | Barometer, thermometer, anemometer |
| Feb. 2012 | Sultanate of Oman | Barometer, thermometer, hygrometer |
| Nov. 2012 | Indonesia | Barometer, *thermometer,* hygrometer |
| Oct. 2013 | Bangladesh | *Barometer,* thermometer, hygrometer |
| Jan. 2015 | Hong Kong, China | Anemometer |
| May 2015 | Indonesia | Pyranometer |
| Jun. 2015 | Fiji | *Barometer, thermometer, hygrometer* |
| Nov. 2015 | Philippines | *Barometer* |
| Jan. 2016 | Mozambique | *Barometer, thermometer* |
| Jan. 2016 | Sri Lanka | *Barometer* |
| Jun. 2016 | Fiji | *Barometer, thermometer, hygrometer* |
| Jan. 2017 | Philippines | Anemometer |

Note: Red characters show the ISO/IEC 17025 (General requirements for the competence of testing and calibration laboratories) calibration.

# Calibration of pyranometer of Indonesia (RIC Tsukuba, July, 2015)

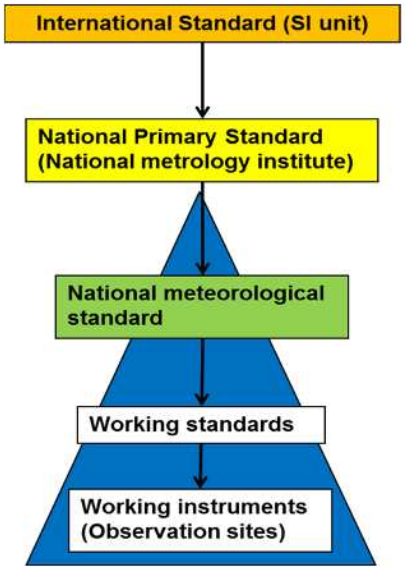
# Technical Cooperation and Capacity Development to Establish International Traceability

**For improving the quality of meteorological data**

Training for Bangladesh staff (Bangladesh, Nov,. 2013)

Training for 10 Pacific Island Countries staff (Fiji, Nov., 2015)

**BIPM**




**NMHSs**

Training for Mozambique staff (RIC Tsukuba, Feb., 2016)

Training for Sri Lanka staff (RIC Tsukuba, Feb., 2016)

# Flow of RIC Tsukuba Package

JMA

Calibration Technology

JICA

Bilateral Assistance

Survey

- Preliminary survey of calibration capacity

Provision

- Provision of standard instruments and/or inspection equipment

Training

- Training sessions

Follow-up

- Follow up activities

**Improvement of technical capacity of NMHS**

- To ensure traceability of meteorological instruments.
- To improve quality of surface observation.

# RIC Tsukuba Package for Bangladesh in 2013

## RIC Tsukuba Package Improves Quality of Surface Observation

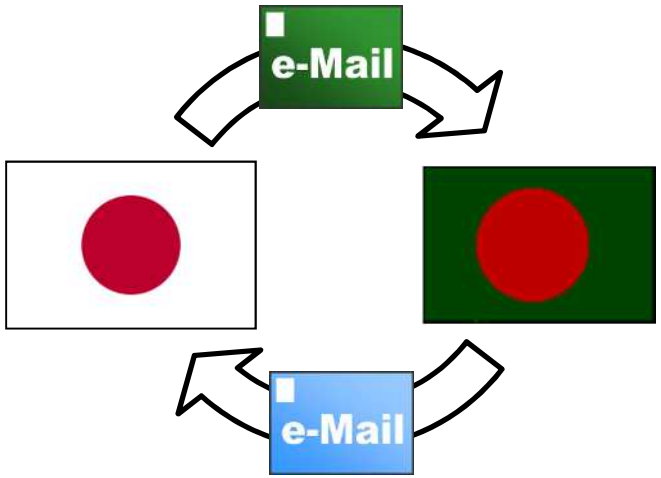
**Survey**

**Provision**

**Training**

**(in Japan and Bangladesh)**

**Follow-up**

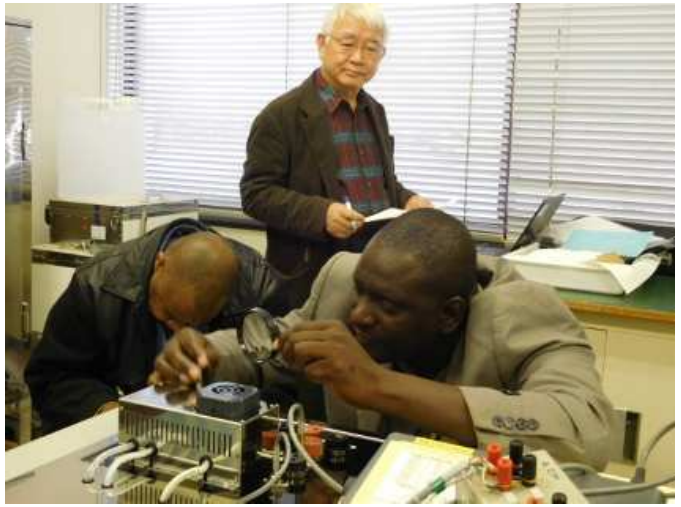


# Training for Pacific Island Countries (Fiji, Oct.- Nov., 2015)

# Training for Fiji
# (RIC Tsukuba, July, 2016)

# Training for Fiji
# (FMS, Nov.- Dec., 2016)

# Training for Mozambique
# (RIC Tsukuba, Dec., 2015)



# Training for Mozambique (Mozambique, Aug., 2016)

# Training for Sri Lanka staff (RIC Tsukuba, Feb., 2016)

# Training for Sri Lanka
# (Sri Lanka, June, 2017)

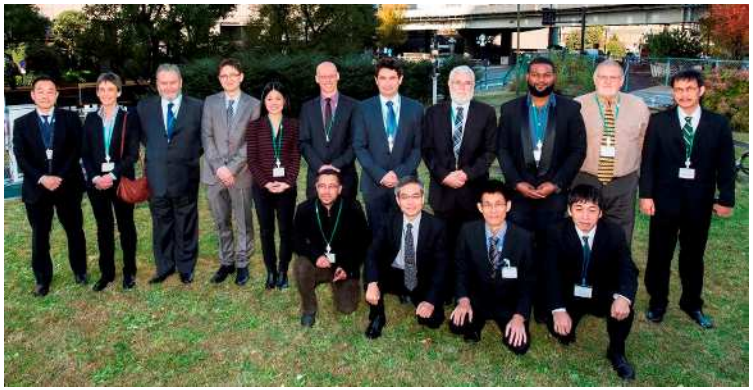
気象庁

# WMO/CIMO Expert Team


Meeting of the CIMO Expert Team on Regional Instrument Centres, Calibration and Traceability (First Session)
23-26 Sep.2013, Nairobi (Kenya)

Meeting of the CIMO Expert Team on Operational Metrology, First Session
1-4 Dec. 2015, Ljubljana (Slovenia)

# WMO/CIMO Expert Team





Second session of the CIMO Expert Team on Operational Metrology
(Tokyo, Japan, 27 - 30 November 2017)

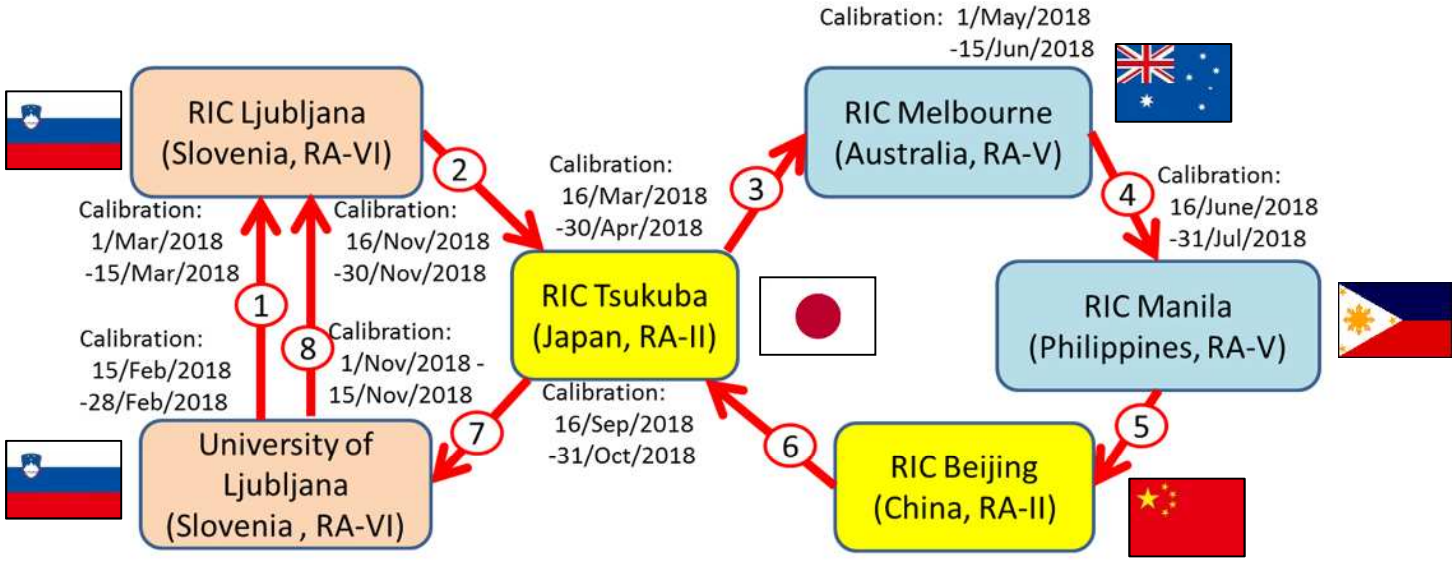
http://www.jma.go.jp/jma/en/photogallery/session_of_ET-OpMet_2017.html

# Future plan

Interlaboratory comparison among RAII, RA V and RA VI in 2018

RICs' Terms of Reference (TOR) / Capabilities:

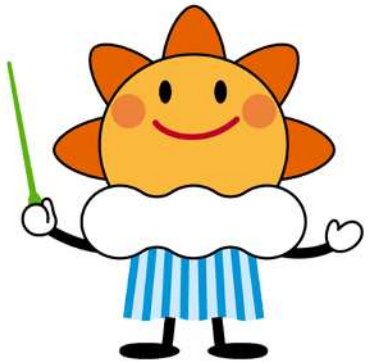
(f) A RIC must participate in, or organize, inter-laboratory comparisons of standard calibration instruments and methods;




# Summary

- **Traceability and Calibration of instruments are essential for quality assurance of observation data.**
- **RICs can assist and advise Members in these areas.**
- **Feel free to contact RICs if you have any questions.**

***Thank you for your attention !***



**Mascot of JMA ”Harerun”**