

**WORLD METEOROLOGICAL ORGANIZATION**

**COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION**

**CIMO EXPERT TEAM ON  
REGIONAL INSTRUMENT CENTERS, QUALITY MANAGEMENT  
SYSTEMS and COMMERCIAL INSTRUMENT INITIATIVES**  
*Reduced Session*

**Geneva, Switzerland**

**4-7 April 2006**

**FINAL REPORT**



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## **EXECUTIVE SUMMARY**

This report provides a summary of the first (reduced) session of the Expert Team (ET) on Regional Centers, Quality Management Systems and Commercial Instrument Initiatives held in Geneva, Switzerland from 4 to 7 April 2006.

The main objective of the ET meeting was to discuss options for improving the functionality of Regional Instrument Centers, review, revise as needed, and approve Terms of Reference, and ultimately preparing a strategy for strengthening the services of Regional Instrument Centers.

The ET also discussed in detail the update of the Guide to Meteorological Instruments and Methods of Observation, WMO-NO. 8, Part III, Chapter 3 "Quality Management" with regard to the international standards.

The ET proposed recommendations for consideration by CIMO-XIV Session, Geneva, December 2006.

## GENERAL SUMMARY

### 1. ORGANIZATION OF THE SESSION

#### 1.1 Opening of the session

1.1.1 The first (reduced) session of the Expert Team on Regional Instrument Centers, Quality Management Systems and Commercial Instrument Initiatives (ET-RICs) was opened by its Chairman, Mr Heng Zhou, at 10:00 am on Tuesday 7 April 2006, at WMO Headquarters, Geneva. He greeted the participants, allowed each to introduce themselves. The list of participants is attached in [Annex 1](#).

1.1.2 Following the opening of the session, Professor Hong Yan, Deputy Secretary-General welcomed the participants to Geneva. In his statement he highlighted the most important topics the meeting was expected to address. He specifically recalled the issues related to the strengthening of the RICs and quality management and quality assurance in the instrument and methods of observation area.

#### 1.2 Adoption of the agenda

1.2.1 The Expert team (ET) adopted the [Agenda](#) for the meeting, which is reproduced at the beginning of this report.

#### 1.3 Working arrangements for the session

1.3.1 The ET agreed on the proposed working arrangements and adopted the work plan for consideration of the various agenda items. The chairman proposed to begin each day at 09h00 and continue until 17h00 with a two-hour break for lunch, except for the opening day. The following change was accepted by the participants to accommodate Mr J. Duvernoy's limited availability due to another commitment. The participants agreed to remain until Mr Duvernoy's presentations and the review of his recommendations regarding the Terms of Reference for Regional Instrument Centers.

### 2. REPORT OF THE CHAIRMAN

2.1 Mr Zhou reported on the mandate received from the CIMO Management Group tasking the ET to evaluate the performance of Regional Instrument Centers (RICs), make recommendations as needed to improve the performance of RICs, and to develop a process by which RIC services are strengthened, especially those RICs established in developing countries.

2.2 He reported that two approaches were to be applied, the first was to evaluate the RICs located in developing countries. These were conducted in 2005 by Mr Duvernoy of Meteo France and the remaining RICs were evaluated by the questionnaire.

2.3 Mr Zhou reported on the Training workshop on Metrology and calibration for the RICs, conducted in Trappes, France in October of 2005. He indicated that this was a first step toward familiarizing each of the participants with the problems and successes of each RIC in establishing RIC capabilities and functionalities.

2.4 Mr Zhou reported on the distribution of the second edition of the World Meteorological Instrument Catalog (WMIC) by the China Meteorological Administration (CMA) in June of 2003. He also indicated the recent posting of the third edition (2005) of the WMIC catalog to the CMA website: <http://www.wmic.cn/>

2.5 Mr Zhou closed his report with a brief statement concerning the escalating cost of new instruments and asked the participants to consider how to minimize the financial impact on developing countries.

### **3. WORK PLAN**

3.1 The ET updated the Work Plan and deliverables of this intersessional period (see [ANNEX II](#)). The ET also discussed issues to be addressed in future by the team and proposed the following areas to be submitted to the CIMO Management Group for consideration:

- (a) The ET discussed the need for developing a list of recommended calibration tools for RIC reference. The ET felt that this should be done in collaboration with HMEI.
- (b) The ET was of the opinion that CIMO should assist in the compilation of procedures used in determining instrument uncertainties.
- (c) The ET discussed the need for preparing an operations guide or Center Operating Procedures template for use by RICs in the development of their annual operating plans.
- (d) The ET was of the opinion that periodic training was needed by RICs. The group expressed the need for developing a template to be used in the development of annual training plans for RICs. Each RIC refer to the template when developing their annual training plan. The plan would include internal and external activities for the calendar year. These plans would be submitted to the Region and CIMO to address those activities requiring logistical support.
- (e) The ET requested the Secretariat investigate on-line training opportunities. The ET would review the results of the Secretariat's investigation and make recommendations as to which training programs would bring the greatest benefit to RICs.
- (f) The ET agreed with Mr Gauert in his assessment concerning the updating of the QMF chapters within the CIMO Guide. He would provide the updated version for chapter 3, but they agreed that the remaining chapters and their integration would require additional time. The ET recommended that this portion of the task required the input from other disciplines and should be carried over into the next work plan.

### **4. STRENGTHENING THE SERVICES OF REGIONAL INSTRUMENT CENTERS**

#### **4.1 Results of the Evaluation of the Regional Instrument Centers**

4.1.1 Mr Duvernoy reported on the evaluations of RICs conducted on behalf of CIMO and the WMO. He reported by region on each individual RIC and described in detail the capabilities of each. Visiting each laboratory he detailed the infrastructure available, traceability of RIC's standards to international standards, uncertainty requirements and which services could be provided to Members. He provided a brief pictorial tour of each laboratory pointing to a wide range of calibration equipment, both old and new. In some instances the identified equipment was not operational thus limiting RIC capabilities and ultimately service to Members. During his presentation it became clear that only a few of the RICs visited had traceability to a recognized international standard and that uncertainty of calibration was not established by many RICs. It was clear that there was a need for the establishment of standard calibration procedures to minimize differences in calibration procedures between RICs. Along with such standard procedures he indicated the need for a list of acceptable (recommended) calibration devices and maintenance/repair centers affiliated with RICs.

## 4.2 Revised Terms of Reference of the Regional Instrument Centers

4.2.1 Mr Duvernoy presented a review of RIC Terms of Reference (TOR) followed by a proposal for revised TOR. He provided the rationale for his suggested changes and each was reviewed and discussed by the participants. Following considerable discussion, the participants began the process for improving the TOR with the goal of strengthening RIC services and improving their performance. The team decided on the following principles to be taken into account in revising the TOR:

- Qualification procedure based on a two level structure of the RICs. The first level establishes the basic capabilities for an RIC, and second, the full capabilities. This would allow the RICs established in developing countries to continuously evolve to a fully functional RIC. The establishment of a new RIC can only be done following the evaluation of the capabilities of the candidate by the respective Regional Association.
- Specialization of the RICs in a Region. This would allow one RIC to be specialized in calibration of e.g., temperature measuring instruments and another in humidity or pressure. This should also allow for better utilization of resources and capabilities within a Region in the best interest of the RICs.
- Traceability of calibration to recognized international standards is a precondition for the traceability of measurements to International System of Units (SI) standards.
- Quality control and quality assurance. These would require the RIC to develop a calibration laboratory guide, thus defining the quality assurance and technical procedure for calibration of meteorological and related environmental instruments using calibration equipment within the respective RIC.
- International standards applied for calibration laboratories. This would require RICs to follow the agreed practices for calibration laboratories, including inter-laboratory comparison.
- Regular assessment to monitor capabilities of the RICs. This would require the respective Regional Association to prepare an implementation plan for non-performing RIC to comply with the TOR and to take corrective measures. A review of the RICs should be done at each Regional Association session.

4.2.2 The revised TORs agreed by the ET are contained in [ANNEX III](#). The revised TORs of the RICs and the concept for their qualification will be proposed to CIMO-XIV for approval.

## 4.3 Proposals for Strengthen the Services of Individual RICs, Especially Developing Countries

4.3.1 Mr Duvernoy presented a number of proposals based on his observations, namely:

- Instrument quality is based on traceability and RICs which have procedures for achieving traceability should share these approaches with other RIC facilities along with the necessary training;
- The quality of RIC services should be validated through periodic review, audits and intercomparisons;
- Some form of certification or accreditation is proof of RIC capabilities.

4.3.2 The ET discussed the possible way to assist the RICs of developing countries to achieve the capabilities as specified in the revised TOR. The ET agreed on the following modalities in assisting the RICs:

## **Building the laboratories and purchase calibration equipment**

4.3.3 Assistance in building laboratories and purchase of calibration equipment could be provided through the WMO Voluntary Cooperation Programme (VCP) and various donors. It was recognized that the RICs play an important role in the Natural Disaster Prevention and Mitigation as well as in maintaining instrument performance within the Global Earth Observing System of Systems, therefore resources should also be sought from major donors in these areas.

4.3.4 CIMO, in collaboration with the HMEI, should develop a recommended set of calibration equipment suited for developing countries, easy to operate in a non-controlled environment. Those should be accompanied by the instruction manuals provided by the manufacturers in the agreed upon language.

## **Quality assurance and Quality control**

4.3.5 CIMO should assist the RICs in establishing the uncertainties of the calibration equipment employed in the respective laboratories.

4.3.6 CIMO should prepare a sample of the operational Guide for calibration laboratories that could constitute a basis for the development of the RICs' Guides, including the proposals for development of the quality assurance procedures.

## **Training**

4.3.7 CIMO should continue providing training courses on metrology and calibration for Members. These should be conducted in the laboratories of well functioning RICs and on the calibration equipment used in the RICs of developing countries (common set of standard calibration equipment). Other possibilities are e-learning modules and technical conferences and exhibitions organized by CIMO.

## **Evaluation of the RICs**

4.3.8 Evaluation of capabilities and functions of an RIC should be performed, at least every five years, by an internationally recognized authority or by experts to be identified by CIMO. A report should be provided to each session of the Regional Association.

## **4.4 Report on the Activities of the RIC Gaborone, Botswana**

4.4.1 Mr Molotsi provided a report on the status of RIC Gaborone listing the activities of the RIC from 2002 through February 2006. In addition to his summary Mr Molotsi provided a list of future activities planned for RIC Gaborone, both at the national and regional levels. He listed problems incurred by RIC Gaborone, which were also common to other RICs in developing countries. Some of the more common problems included issues such as training, lack of collaboration between RICs, the ability to keep calibration systems operational, and a lack of financial support from the Region. In addressing these problem areas he provided a number of suggestions, such as cooperation between RICs, strengthening their services and capacities.

4.4.2 Mr Molotsi made also suggestions for improving the cooperation between RICs. His suggestion called for RICs to hold regularly workshops or Internet fora as a mechanism for the exchange of ideas and information to be used in problem solving.

## **4.5 Improving the GCOS Networks**

4.5.1 Mr R. Thigpen delivered a presentation on the Global Climate Observation System (GCOS) program surface and upper-air networks. In his presentation Mr Thigpen noted that these networks were considered baseline calibration for other data such as satellite and AMDAR. The goal of GCOS is performance and the paying of attention to network performance is of the highest

priority. Based on this focus Mr Thigpen extended an invitation to CIMO and the RICs' representatives to consider future collaboration with GCOS by providing calibration services to Member operated instruments supporting GCOS. He also requested assistance in selection of the new GSN sites and the inspection of the current ones. It was noted that the traceability of the measurements made on many GSN stations to SI is questionable and their value to the climate community is very limited.

4.5.2 Mr Thigpen provided a brief description of Technical Support Projects (TSP) for GSN and GUAN stations being conducted between GCOS in three Regions. In this regard, the collaboration with the RICs is of mutual benefit. As an example, a collaboration between GCOS and the RIC Gaborone, Botswana in TSP for SADC countries. Through these projects more frequent site visits are accomplished which result in better metadata, including photos of the siting and instrument suite as well as improved instrument calibration and training. He supports the concept behind these projects and speaks highly of the excellent results through improved station and network performance.

## **5. OTHER BUSINESS**

### **5.1 Quality Assurance and Management of Observation Systems**

5.1.1 Mr Rolf Gauert conducted, on behalf of the WMO and CIMO, a review of the CIMO Guide, Part III, "Quality Assurance and Management of Meteorological Observing Systems" and especially Chapter 3 "Quality Management". Mr Gauert provided a summary of his evaluation, with recommended changes and supplements to a revised chapter. His presentation was well received by the participants and generated considerable discussion. Mr Gauert's full report is available for review in [ANNEX IV](#).

5.1.2 Following Mr Gauert's presentation, the Secretariat asked if his outline would be sufficient for inclusion in the pending update of the CIMO Guide later this year. He indicated the basic framework of Chapter 3 could be completed in time for publication, but the merger of other chapters within Part III of the Guide would require more time and different expertise. The results of his discussions with the Secretariat and the Chairman are reflected in the future work plan posted to [ANNEX II](#).

5.1.3 Ms Isabelle Rüedi, Program Coordinator for the World Weather Watch made a presentation on the WMO approach toward implementing its Quality Management Framework. She briefly mentioned the Congress Resolution 27 (Cg-XIV) that defines the overall framework in the areas of technical standards, quality control, and certification procedures. She also indicated that the Executive Council felt that the ISO 9001 standard and associated certification was critical for many NMHSs to achieve the desired international visibility and credibility related to commercial competitiveness and in some areas compliance with national and regional regulations.

5.1.4 Ms Rüedi recalled that the EC had asked the technical commissions to carry out a review of their as a priority activity within their regular work program in an attempt to identify areas of overlap and gaps. This review should rectify the issues of deficiencies, duplications, inconsistencies, and errors making those relevant WMO Technical Regulations, guides and manuals viable reference documents for use within a national Quality Management System. It was noted with appreciation that the inconsistencies between CIMO Guide and Manual and Guide on the Global Observing Systems had already been conducted and that the preliminary issue of the Seventh edition of the CIMO Guide incorporating these changes is on the CIMO/IMOP website: <http://www.wmo.int/web/www/IMOP/IMOP-home.html>

5.1.5 Ms Rüedi informed the representatives about a meeting of the Inter-Commission Task Team (ICTT) on Quality management Framework scheduled for 25-27 April 2006 in Geneva. It will be the goal of this team to develop a mechanism for the revision of the WMO technical documentation within the WMO. The ET expressed the wish that the ICTT would develop

recommendations on the role and responsibilities of the technical commission in building the WMO QMF.

5.1.6 Ms Rüedi informed the representatives of the request of EC-LVII to establish a closer working relationship with the International Organization for Standardization (ISO). The Secretariat has plans to meet with representatives of the ISO Secretariat to investigate possibilities for future cooperation with ISO.

5.1.7 Mr Hayes, Director of the WWW, expressed his interest in the application of QMF as used in the instrumentation program and how these applications could be applied to other areas such as forecasting.

## **5.2 Questionnaire on Maintenance and Calibration**

5.2.1 The ET discussed the proposal for the Questionnaire to ascertain the capacity of Members' NMHSs in the areas of calibration and maintenance. The Questionnaire to be sent to Members is in [Annex V](#).

## **5.3 Commercial Instrument Initiatives and Developments**

5.3.1 Mr K. Ristolainen, the representative of the Association of Hydro-Meteorological Equipment Industry (HMEI) provided information to the ET highlighting newly developed commercial instruments from a number of its member manufacturers and the report closed with the mentioning of HMEI active involvement in recent WMO Intercomparisons. Details of these new instruments were presented to the representatives. The ET appreciated that manufacturers use the results of the WMO Intercomparisons to rectify problems identified during the intercomparisons through necessary modifications to their instruments based on the Intercomparison results. It was noted that several manufacturers, following the most recent Intercomparisons, had submitted notices to CIMO of modifications made to their instruments conforming to the performance requirements of Hydro-Meteorological community. He stated that this is an excellent example of how beneficial such joint efforts are to both parties.

5.3.2 The HMEI representative agreed to provide links to manufacturers' website on the new instrument development to be included in the CIMO Web Portal on WMO website: <http://www.wmo.int/web/www/IMOP/IMOP-home.html>. This would provide both, visibility of manufacturers, and easy access of WMO Members to information on the new instrument development.

## **6 DRAFT REPORT OF THE SESSION**

6.1 The ET agreed on the Report of the meeting that would be posted on the CIMO/IMOP website: <http://www.wmo.int/web/www/IMOP/reports.html>.

## **7 CLOSURE OF THE SESSION**

7.1 The session was closed on 7 April 2006 at 13:04 hours.

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**Updated WORK PLAN**  
**Expert Team on RICs, Quality Management Systems and Commercial Instruments Initiatives**  
(2003-2006)

No.	Task description	Person responsible	Action	Deadline	Deliverables	Deadline
<b>1</b>	<b>Boost activities of RICs to maximize their effectiveness in collaboration with RAs:</b>					
1 a)	Strengthen further the services of RICs, particularly those located in developing countries, such as calibration practices and reporting	Heng ZHOU	<ol style="list-style-type: none"> <li>1. Analyze Questionnaire No.4 on RICs</li> <li>2. Conduct survey on RICs by Questionnaire No.5</li> <li>3. Develop Plan of evaluation visits to RICs</li> <li>4. Develop recommendation on required improvements and on the ways to strengthen RICs</li> </ol>	<p>Dec.03</p> <p>Oct.05</p> <p>Mar.04</p> <p>Dec.05</p>	<ul style="list-style-type: none"> <li>• Report on RICs</li> <li>• Analyzed results of survey on RICs</li> <li>• Plan of evaluation visits</li> <li>• Recommendations on the: <ol style="list-style-type: none"> <li>i. Improvements required,</li> <li>ii. Ways to strengthen RICs</li> </ol> </li> </ul>	<p>Feb.04</p> <p>Dec.05</p> <p>Feb.04</p> <p>Apr.06</p>
1 b)	Explore the possibility of strengthening cooperation among RICs by the establishment of a mutual relationship between RICs in the developed and the developing countries	Heng ZHOU	<ol style="list-style-type: none"> <li>1. Explore the possibility of strengthening cooperation among RICs</li> <li>2. Investigate possibilities of establishment of a mutual relationship between RICs in the developed and the developing countries</li> </ol>	<p>Dec.04</p> <p>Feb.05</p>	<ol style="list-style-type: none"> <li>a. Recommendations on cooperation methods, e.g. mentoring, training of trainers, attachments</li> <li>b. Draft proposals for a mutual relationship between RICs</li> </ol>	<p>Jan.05</p> <p>May.05</p>

1 c)	Improve the guidance for RICs, review their terms of reference and develop an appropriate procedure to assist in evaluation of RICs	Kenneth L. RANCOURT	1. Review TOR of RICs 2. Develop criteria for evaluation of RICs 3. Prepare Manual on RICs' activities	Dec.05 Jan.05 -	<ul style="list-style-type: none"> <li>Reviewed TOR</li> <li>Report on developed evaluation criteria</li> <li>IOM Report on Manual on RICs' activities</li> </ul>	Apr.06 Apr.06 -
1 d)	Conduct periodic visits to RICs, by CIMO's representative or regional authority, to provide needed training/briefings and validating the compliance to the stated terms of reference. Evaluate existing RICs	Heng ZHOU & Kenneth L. RANCOURT	1. Conduct visits to RICs 2. Evaluate existing RICs against agreed criteria	Dec.05 Dec.05	<ul style="list-style-type: none"> <li>Visits of RICs completed</li> <li>IOM Report on Results of the evaluation of RICs</li> </ul>	Dec.05 Apr.06
<b>2</b>	<b>Provide advice on <i>Quality Management Systems</i> procedures for instruments and methods of observation (based on the CIMO Guide) and implement links with relevant international organizations active in this area</b>					
2 a)	Develop performance measures to demonstrate continuous improvement in the quality of observations	Bruce FORGAN	1. Develop basic procedures for quality management of observations, instrument maintenance, calibration and operational practices	-	<ul style="list-style-type: none"> <li>IOM Report on Basic procedures for quality management of observations, instrument maintenance, calibration and operational practices</li> </ul>	-
2 b)	Contribute to the review and update of WMO Technical Regulations, Guides and other material related to Quality Management and standardization of observations	Bruce FORGAN	1. Prepare proposal for relevant updates of CIMO Guide 2. Prepare proposals for update of WMO Technical Regulations and Guides	Apr.06 Apr.06	<ul style="list-style-type: none"> <li>CIMO Guide updated</li> <li>Proposals submitted to CIMO-XIV</li> </ul>	Apr.06 May.06

3	<b>Review and suggest methods to develop the IMOP capacities of developing countries, in collaboration with HMEI</b>					
3 a)	Encourage development, fabrication of instruments and operation of low-cost, good quality meteorological and hydrological observing systems	Heng ZHOU	<p>a. Review the requirements for observation equipment in developing countries</p> <p>b. Explore the possibilities of enhancing equipment development in developing countries</p> <p>c. Study the possibilities for joint procurement mechanisms for consumables and equipment to assist in achieving a reduction in the cost of instrument operation</p>	<p>May.05</p> <p>Dec.05</p> <p>-</p>	<ul style="list-style-type: none"> <li>• IOM Report on Requirements for observation equipment in developing countries</li> <li>• Proposals for enhancing equipment development in developing countries</li> <li>• Proposals for joint procurement mechanisms for consumables and equipment</li> </ul>	<p>May.06</p> <p>Mar.06</p> <p>-</p>
3 b)	Consider possible means to minimize the impact on the cost of the continuous improvements of instruments	Bruce FORGAN	<p>a. Study the impacts</p> <p>b. Suggest means to minimize impacts</p>	<p>Mar.05</p> <p>Dec.05</p>	<ul style="list-style-type: none"> <li>• IOM Report on Means to minimize the impact on the cost of the continuous improvements of instruments</li> </ul>	<p>May.06</p>

**Draft Resolution – REGIONAL INSTRUMENT CENTRE** (with full capabilities)

**NOTING RECOMMENDATION 19 (CIMO-IX) – Establishment of Regional Instrument Centres,**

**CONSIDERING:**

- (1) The results of the evaluation of the RICs and the need for the sustainability of their services to Members;
- (2) The need for regular calibration and maintenance of meteorological and related environmental instruments to meet increasing needs for high quality meteorological and hydrological data;
- (3) The need for building the hierarchy of the traceability of measurements to International System of Units (SI) standards;
- (4) The requirements of Members in the Region for standardization of meteorological and related environmental instruments;
- (5) The need for international instrument comparisons and evaluations in support of world-wide data compatibility and homogeneity;
- (6) The role RICs play in the Global Earth Observing System of Systems, Natural Disaster Prevention and Mitigation and other WMO crosscutting programmes;

**NOTING** with appreciation the offer by .... *(name of the country)* ..... to provide/commit the facilities of its .... *(name of the NMS)* ..... to perform the functions of a Regional Instrument Centre;

**DESIGNATES** the .... *(name of the NMS)* ....., as a Regional Instrument Centre for RA **xx** with the following:

**Capabilities:**

- (a) An RIC must have necessary facilities and laboratory equipment to perform the functions necessary for the calibration of meteorological and related environmental instruments;
- (b) An RIC must maintain a set of meteorological standard instruments and establish traceability of its own measurement standards and measuring instruments to the SI;
- (c) An RIC must have qualified managerial and technical staff with necessary experience in fulfilling its functions;
- (d) An RIC must develop their individual technical procedures for calibration of meteorological and related environmental instruments using calibration equipment employed by the RIC;
- (e) An RIC must develop their individual quality assurance procedures;
- (f) An RIC must participate in, or organize inter-laboratory comparisons of standard calibration instruments and methods;
- (g) An RIC must, when appropriate, utilize the resources and capabilities of a region to the best interest of the RIC;
- (h) An RIC must, as far as possible, apply international standards applicable for calibration

laboratories, such as ISO 17025;

- (i) An RIC must be assessed by a recognized authority, at least every five years, to verify their capabilities and performance;

**Functions:**

- (j) An RIC must assist members of the Region in calibrating their national standard meteorological and related environmental instruments;
- (k) An RIC must participate in, or organize WMO and/or regional instrument intercomparisons, following WMO recommendations;
- (l) An RIC must contribute positively to Members regarding quality of measurements according to WMO recommendations;
- (m) An RIC must advise Members on inquiries regarding instrument performance, maintenance and the availability of relevant guidance materials;
- (n) An RIC must actively participate and assist the WMO in organizing regional workshops on meteorological and related environmental instruments;
- (o) The RIC must co-operate with other Regional Instrument Centres in standardization of meteorological and related environmental instruments;
- (p) An RIC must report<sup>1</sup>, on an annual basis, to president of the Regional Association and to the WMO Secretariat on services offered to Members and activities done;

INVITES .... (*name of the NMS*) .....to implement these functions and capabilities as soon as possible.

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<sup>1</sup> Web based approach is recommended

**Draft Resolution – REGIONAL INSTRUMENT CENTRE** (with basic capabilities and functions)

**NOTING RECOMMENDATION 19 (CIMO-IX) – Establishment of Regional Instrument Centres,**

**CONSIDERING:**

- (7) The results of the evaluation of the RICs and the need for the sustainability of their services to Members;
- (8) The need for regular calibration and maintenance of meteorological and related environmental instruments to meet increasing needs for high quality meteorological and hydrological data;
- (9) The need for building the hierarchy of the traceability of measurements to International System of Units (SI) standards;
- (10) The requirements of Members in the Region for standardization of meteorological and related environmental instruments;
- (11) The need for international instrument comparisons and evaluations in support of world-wide data compatibility and homogeneity;
- (12) The role RICs play in the Global Earth Observing System of Systems, Natural Disaster Prevention and Mitigation and other WMO crosscutting programmes;

**NOTING** with appreciation the offer by .... (*name of the country*) ..... to provide/commit the facilities of its .... (*name of the NMS*) ..... to perform the functions of a Regional Instrument Centre;

**DESIGNATES** the .... (*name of the NMS*) ....., as a Regional Instrument Centre for RA **xx** with the following:

**Capabilities:**

- (a) An RIC must have the necessary facilities and laboratory equipment to perform the functions necessary for the calibration of meteorological and related environmental instruments;
- (b) An RIC must maintain a set of meteorological standard instruments<sup>2</sup> and establish traceability of its own measurement standards and measuring instruments to the SI;
- (c) An RIC must have qualified managerial and technical staff with necessary experience in fulfilling its functions;
- (d) An RIC must develop their individual technical procedures for calibration of meteorological and related environmental instruments using calibration equipment employed by the RIC;
- (e) An RIC must develop their individual quality assurance procedures;
- (f) An RIC must participate in, or organize inter-laboratory comparisons of standard calibration instruments and methods;

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<sup>2</sup> For calibrating one or more of the following variables: temperature, humidity, pressure or other specified by the Region

- (g) An RIC must, when appropriate, utilize the resources and capabilities of a region to the best interest of the RIC;
- (h) An RIC must, as far as possible, apply international standards applicable for calibration laboratories, such as ISO 17025;
- (i) An RIC must be assessed by a recognized authority, at least every five years, to verify their capabilities and performance;

**Corresponding functions:**

- (j) An RIC must assist members of the Region in calibrating their national standard meteorological and related environmental instruments;
- (k) An RIC must contribute positively to Members regarding quality of measurements according to WMO recommendations;
- (l) An RIC must advise Members on inquiries regarding instrument performance, maintenance and the availability of relevant guidance materials;
- (m) The RIC must co-operate with other Regional Instrument Centres in standardization of meteorological and related environmental instruments;
- (n) An RIC must report<sup>3</sup>, on an annual basis, to the president of the Regional Association and to the WMO Secretariat on services offered to Members and activities performed;

INVITES .... (*name of the NMS*) .....to implement these functions and capabilities as soon as possible.

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<sup>3</sup> Web based approach is recommended

**Revision of the Guide to meteorological Instruments and Methods of Observation  
Part III, Quality Assurance and Management of Meteorological Observing Systems  
Chapter 3 Quality Management**

Imbedded link to the PDF presentation of Mr R. Gauert:



**QUESTIONNAIRE ON MAINTENANCE AND CALIBRATION**  
of basic meteorological instrumentation

**Instruction to fill in the Questionnaire**

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Please note, this questionnaire has been prepared in a format to facilitate the electronic compilation of data. Whenever possible, kindly use the e-copy available on the WWW website at:

<http://www.wmo.int/web/www/documents.html>

and provide us with a copy of the completed questionnaire via e-mail attachment to the address:

[mondras@wmo.int](mailto:mondras@wmo.int)

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***How to complete the questionnaire:***

For questions requiring a Yes/No reply, just click on the boxes to see the markings appear (clicking again makes a marking disappear). For all other questions, the grey shaded areas will expand as much as the text of your reply may require.

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**1. Country:**

**A. Number and density of surface-based stations<sup>4</sup>**

2. Manned land stations:
3. Automatic land stations:
4. Fixed sea stations:
5. Mobile sea stations:
6. Automatic sea stations:
7. Aeronautical stations:
8. Climatological stations:
9. Agricultural stations:
10. Density of surface-based stations:                      per km<sup>2</sup> of area

**B. Preventive maintenance of instruments used in surface-based stations**

11. Preventive maintenance done solely by NMHS:                      Yes                       No
12. Preventive maintenance done in collaboration with a subcontractor: Yes                       No
13. Ratio of Preventive maintenance performed by NMHS/subcontractor:
14. Preventive maintenance done solely by a subcontractor:                      Yes                       No
15. Number of NMHS' staff employed in a maintenance unit (other than in 20):

**C. Repair of instruments used in surface-based stations**

16. Repair done solely by NMHS:                      Yes                       No
17. Repair done in collaboration with a subcontractor:                      Yes                       No
18. Ratio of repair performed by NMHS/subcontractor:
19. Repair done solely by a subcontractor:                      Yes                       No

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<sup>4</sup> See Manual on the Global Observing system, WMO-No. 544

20. Number of NMHS' staff employed in a repair unit (other than in 15):

*D. Frequency of preventive maintenance of basic instruments used in surface-based stations*

Preventive maintenance done:

- |   |                              |                             |
|---|------------------------------|-----------------------------|
| 21. Daily:                                  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 22. Weekly:                                 | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 23. Monthly:                                | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 24. Half-yearly:                            | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 25. Yearly:                                 | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 26. Other frequency (specify):              |                              |                             |
| 27. No preventive maintenance is performed: | <input type="checkbox"/>     |                             |

**Calibration of instruments used in surface-based stations**

**E. Instruments measuring pressure:**

- |  |                                     |                                    |
|--|-------------------------------------|------------------------------------|
| <b>28. Mercury barometers in operational use:</b>                        | <b>Yes</b> <input type="checkbox"/> | <b>No</b> <input type="checkbox"/> |
| 29. Calibration done by NMHS:  | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 30. Calibration done by subcontractor:                                   | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 31. Calibration done:  | every                               | months                             |
| 32. No calibration performed:  | <input type="checkbox"/>            |                                    |
| 33. Calibration traceable to an international standard:                  | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| <b>34. Aneroid barometers in operational use:</b>                        | <b>Yes</b> <input type="checkbox"/> | <b>No</b> <input type="checkbox"/> |
| 35. Calibration done by NMHS:  | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 36. Calibration done by subcontractor:                                   | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 37. Calibration done:  | every                               | months                             |
| 38. No calibration performed:  | <input type="checkbox"/>            |                                    |
| 39. Calibration traceable to an international standard:                  | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| <b>40. Barographs in operational use:</b>                                | <b>Yes</b> <input type="checkbox"/> | <b>No</b> <input type="checkbox"/> |
| 41. Calibration done by NMHS:  | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 42. Calibration done by subcontractor:                                   | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 43. Calibration done:  | every                               | months                             |
| 44. No calibration performed:  | <input type="checkbox"/>            |                                    |
| 45. Calibration traceable to an international standard:                  | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| <b>46. Pressure sensors/digital transmitters (1) in operational use:</b> | <b>Yes</b> <input type="checkbox"/> | <b>No</b> <input type="checkbox"/> |
| 47. Type (specify):  |                                     |                                    |
| 48. Calibration done by NMHS:  | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 49. Calibration done by subcontractor:                                   | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 50. Sensor calibration done:   | every                               | months                             |
| 51. System calibration done:   | every                               | months                             |
| 52. No calibration performed:  | <input type="checkbox"/>            |                                    |
| 53. Calibration traceable to an international standard:                  | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |

- 54. Pressure sensors/digital transmitters (2) in operational use:** Yes  No
55. Type (specify):
56. Calibration done by NMHS: Yes  No
57. Calibration done by subcontractor: Yes  No
58. Sensor calibration done: every months
59. System calibration done: every months
60. No calibration performed:
61. Calibration is traceable to an international standard: Yes  No
- 62. Others in operational use (specify):**
63. Calibration done by NMHS: Yes  No
64. Calibration done by subcontractor: Yes  No
65. Calibration done: every months
66. No calibration performed:
67. Calibration traceable to an international standard: Yes  No
- F. Instruments measuring temperature:**
- 68. Liquid-in-glass thermometers in operational use:** Yes  No
69. Calibration done by NMHS: Yes  No
70. Calibration done by subcontractor: Yes  No
71. Calibration done: every months
72. No calibration performed:
73. Calibration traceable to an international standard: Yes  No
- 74. Thermographs in operational use:** Yes  No
75. Calibration done by NMHS: Yes  No
76. Calibration done by subcontractor: Yes  No
77. Calibration done: every months
78. No calibration performed:
79. Calibration traceable to an international standard: Yes  No
- 80. Temperature sensors/digital transmitters (1) in operational use:** Yes  No
81. Type (specify):
82. Calibration done by NMHS: Yes  No
83. Calibration done by subcontractor: Yes  No
84. Sensor calibration done: every months
85. System calibration done: every months
86. No calibration performed:
87. Calibration traceable to an international standard: Yes  No
- 88. Temperature sensors/digital transmitters (2) in operational use:** Yes  No
89. Type (specify):
90. Calibration done by NMHS: Yes  No

91. Calibration done by subcontractor: Yes  No
92. Sensor calibration done: every months
93. System calibration done: every months
94. No calibration performed:
95. Calibration is traceable to an international standard: Yes  No
- 96. Others in operational use (specify):**
97. Calibration done by NMHS: Yes  No
98. Calibration done by subcontractor: Yes  No
99. Calibration done: every months
100. No calibration performed:
101. Calibration traceable to an international standard: Yes  No

**G. Instruments measuring humidity:**

- 102. Psychrometers in operational use:** Yes  No
103. Calibration done by NMHS: Yes  No
104. Calibration done by subcontractor: Yes  No
105. Calibration done: every months
106. No calibration performed:
107. Calibration traceable to an international standard: Yes  No
- 108. Hygrometers in operational use:** Yes  No
109. Calibration done by NMHS: Yes  No
110. Calibration done by subcontractor: Yes  No
111. Calibration done: every months
112. No calibration performed:
113. Calibration traceable to an international standard: Yes  No
- 114. Hygrographs in operational use:** Yes  No
115. Calibration done by NMHS: Yes  No
116. Calibration done by subcontractor: Yes  No
117. Calibration done: every months
118. No calibration performed:
119. Calibration traceable to an international standard: Yes  No
- 120. Humidity sensors/digital transmitters (1) in operational use:** Yes  No
121. Type (specify):
122. Calibration done by NMHS: Yes  No
123. Calibration done by subcontractor: Yes  No
124. Sensor calibration done: every months
125. System calibration done: every months
126. No calibration performed:
127. Calibration traceable to an international standard: Yes  No

**128. Humidity sensors/digital transmitters (2) in operational use:** Yes  No

129. Type (specify):

130. Calibration done by NMHS: Yes  No

131. Calibration done by subcontractor: Yes  No

132. Sensor calibration done: every months

133. System calibration done: every months

134. No calibration performed:

135. Calibration traceable to an international standard: Yes  No

**136. Others in operational use (specify):**

137. Calibration done by NMHS: Yes  No

138. Calibration done by subcontractor: Yes  No

139. Calibration done: every months

140. No calibration performed:

141. Calibration traceable to an international standard: Yes  No

**H. Instruments measuring wind:**

**142. Mechanical anemometers in operational use:** Yes  No

143. Calibration done by NMHS: Yes  No

144. Calibration done by subcontractor: Yes  No

145. Calibration done: every months

146. No calibration performed:

147. Calibration traceable to an international standard: Yes  No

**148. Anemographs in operational use:** Yes  No

149. Calibration done by NMHS: Yes  No

150. Calibration done by subcontractor: Yes  No

151. Calibration done: every months

152. No calibration performed:

153. Calibration traceable to an international standard: Yes  No

**154. Wind sensors/digital transmitters (1) in operational use:** Yes  No

155. Type (specify):

156. Calibration done by NMHS: Yes  No

157. Calibration done by subcontractor: Yes  No

158. Sensor calibration done: every months

159. System calibration done: every months

160. No calibration performed:

161. Calibration traceable to an international standard: Yes  No

**162. Wind sensors/digital transmitters (2) in operational use:** Yes  No

163. Type (specify):

164. Calibration done by NMHS: Yes  No

165. Calibration done by subcontractor: Yes  No
166. Sensor calibration done: every months
167. System calibration done: every months
168. No calibration performed:
169. Calibration traceable to an international standard: Yes  No
- 170. Others in operational use (specify):**
171. Calibration done by NMHS: Yes  No
172. Calibration done by subcontractor: Yes  No
173. Calibration done: every months
174. No calibration performed:
175. Calibration traceable to an international standard: Yes  No

**I. Instruments measuring rainfall:**

- 176. Ordinary raingauge in operational use:** Yes  No
177. Calibration done by NMHS: Yes  No
178. Calibration done by subcontractor: Yes  No
179. Calibration done: every months
180. No calibration performed:
181. Calibration traceable to an international standard: Yes  No
- 182. Ombrographs in operational use:** Yes  No
183. Calibration done by NMHS: Yes  No
184. Calibration done by subcontractor: Yes  No
185. Calibration done: every months
186. No calibration performed:
187. Calibration traceable to an international standard: Yes  No
- 188. Tipping bucket raingauges in operational use:** Yes  No
189. Calibration done by NMHS: Yes  No
190. Calibration done by subcontractor: Yes  No
191. Sensor calibration done: every months
192. System calibration done: every months
193. No calibration performed:
194. Calibration traceable to an international standard: Yes  No
- 195. Weighing raingauges in operational use:** Yes  No
196. Calibration done by NMHS: Yes  No
197. Calibration done by subcontractor: Yes  No
198. Sensor calibration done: every months
199. System calibration done: every months
200. No calibration performed:
201. Calibration traceable to an international standard: Yes  No

**202. Other raingauges (1) in operational use (specify):**

203. Calibration done by NMHS: Yes  No
204. Calibration done by subcontractor: Yes  No
205. Sensor calibration done: every months
206. System calibration done: every months
207. No calibration performed:
208. Calibration traceable to an international standard: Yes  No

**209. Other raingauges (2) in operational use (specify):**

210. Calibration done by NMHS: Yes  No
211. Calibration done by subcontractor: Yes  No
212. Sensor calibration done: every months
213. System calibration done: every months
214. No calibration performed:
215. Calibration traceable to an international standard: Yes  No

**J. Instruments measuring solar radiation:**

**216. Pyrheliometers in operational use:**

- Yes  No
217. Calibration done by NMHS: Yes  No
218. Calibration done by subcontractor: Yes  No
219. Calibration done: every months
220. No calibration performed:
221. Calibration traceable to an international standard: Yes  No

**222. Pyranometers in operational use:**

- Yes  No
223. Calibration done by NMHS: Yes  No
224. Calibration done by subcontractor: Yes  No
225. Calibration done: every months
226. No calibration performed:
227. Calibration traceable to an international standard: Yes  No

**228. Pyrgeometers in operational use:**

- Yes  No
229. Calibration done by NMHS: Yes  No
230. Calibration done by subcontractor: Yes  No
231. Calibration done: every months
232. No calibration performed:
233. Calibration traceable to an international standard: Yes  No

**234. Others (1) in operational use (specify):**

235. Calibration done by NMHS: Yes  No
236. Calibration done by subcontractor: Yes  No
237. Calibration done: every months
238. No calibration performed:

239. Calibration traceable to an international standard: Yes  No
- 240. Others (2) in operational use (specify):**
241. Calibration done by NMHS: Yes  No
242. Calibration done by subcontractor: Yes  No
243. Calibration done: every  months
244. No calibration performed:
245. Calibration traceable to an international standard: Yes  No

**K. Standards used in calibration of instruments measuring pressure (for definition of standards see ANNEX)**

246. **Primary standard:** Yes  No
247. Name of the instrument
248. Manufacturer of the instrument
249. Principle of function
250. Date of last calibration
251. **Secondary standard:** Yes  No
252. Name of the instrument
253. Manufacturer of the instrument
254. Principle of function
255. Date of last calibration
256. **International standard:** Yes  No
257. Name of the instrument
258. Manufacturer of the instrument
259. Principle of function
260. Date of last calibration
261. **National standard:** Yes  No
262. Name of the instrument
263. Manufacturer of the instrument
264. Principle of function
265. Date of last calibration
266. **Reference standard:** Yes  No
267. Name of the instrument
268. Manufacturer of the instrument
269. Principle of function
270. Date of last calibration
271. **Working standard:** Yes  No
272. Name of the instrument
273. Manufacturer of the instrument
274. Principle of function

275. Date of last calibration

**276. Traveling standard:**

Yes

No

277. Name of the instrument

278. Manufacturer of the instrument

279. Principle of function

280. Date of last calibration

**L. Standards used in calibration of instruments measuring temperature (for definition of standards see ANNEX)**

281. **Primary standard:**

Yes

No

282. Name of the instrument

283. Manufacturer of the instrument

284. Principle of function

285. Date of last calibration

286. **Secondary standard:**

Yes

No

287. Name of the instrument

288. Manufacturer of the instrument

289. Principle of function

290. Date of last calibration

291. **International standard:**

Yes

No

292. Name of the instrument

293. Manufacturer of the instrument

294. Principle of function

295. Date of last calibration

296. **National standard:**

Yes

No

297. Name of the instrument

298. Manufacturer of the instrument

299. Principle of function

300. Date of last calibration

301. **Reference standard:**

Yes

No

302. Name of the instrument

303. Manufacturer of the instrument

304. Principle of function

305. Date of last calibration

306. **Working standard:**

Yes

No

307. Name of the instrument

308. Manufacturer of the instrument

309. Principle of function

310. Date of last calibration

- 311. Traveling standard:** Yes  No
312. Name of the instrument
313. Manufacturer of the instrument
314. Principle of function
315. Date of last calibration

**M. Standards used in calibration of instruments measuring humidity (for definition of standards see ANNEX)**

316. **Primary standard:** Yes  No
317. Name of the instrument
318. Manufacturer of the instrument
319. Principle of function
320. Date of last calibration
321. **Secondary standard:** Yes  No
322. Name of the instrument
323. Manufacturer of the instrument
324. Principle of function
325. Date of last calibration
326. **International standard:** Yes  No
327. Name of the instrument
328. Manufacturer of the instrument
329. Principle of function
330. Date of last calibration
331. **National standard:** Yes  No
332. Name of the instrument
333. Manufacturer of the instrument
334. Principle of function
335. Date of last calibration
336. **Reference standard:** Yes  No
337. Name of the instrument
338. Manufacturer of the instrument
339. Principle of function
340. Date of last calibration
341. **Working standard:** Yes  No
342. Name of the instrument
343. Manufacturer of the instrument
344. Principle of function
345. Date of last calibration
346. **Traveling standard:** Yes  No

- 347. Name of the instrument
- 348. Manufacturer of the instrument
- 349. Principle of function

**N. Standards used in calibration of instruments measuring wind (for definition of standards see ANNEX)**

- |                                     |                              |                             |
|-------------------------------------|------------------------------|-----------------------------|
| <b>350. Primary standard:</b>       | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 351. Name of the instrument         |                              |                             |
| 352. Manufacturer of the instrument |                              |                             |
| 353. Principle of function          |                              |                             |
| 354. Date of last calibration       |                              |                             |
| <b>355. Secondary standard:</b>     | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 356. Name of the instrument         |                              |                             |
| 357. Manufacturer of the instrument |                              |                             |
| 358. Principle of function          |                              |                             |
| 359. Date of last calibration       |                              |                             |
| <b>360. International standard:</b> | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 361. Name of the instrument         |                              |                             |
| 362. Manufacturer of the instrument |                              |                             |
| 363. Principle of function          |                              |                             |
| 364. Date of last calibration       |                              |                             |
| <b>365. National standard:</b>      | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 366. Name of the instrument         |                              |                             |
| 367. Manufacturer of the instrument |                              |                             |
| 368. Principle of function          |                              |                             |
| 369. Date of last calibration       |                              |                             |
| <b>370. Reference standard:</b>     | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 371. Name of the instrument         |                              |                             |
| 372. Manufacturer of the instrument |                              |                             |
| 373. Principle of function          |                              |                             |
| 374. Date of last calibration       |                              |                             |
| <b>375. Working standard:</b>       | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 376. Name of the instrument         |                              |                             |
| 377. Manufacturer of the instrument |                              |                             |
| 378. Principle of function          |                              |                             |
| 379. Date of last calibration       |                              |                             |
| <b>380. Traveling standard:</b>     | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 381. Name of the instrument         |                              |                             |
| 382. Manufacturer of the instrument |                              |                             |

383. Principle of function

**O. Standards used in calibration of instruments measuring rainfall (for definition of standards see ANNEX)**

384. **Primary standard:** Yes  No

385. Name of the instrument

386. Manufacturer of the instrument

387. Principle of function

388. Date of last calibration

389. **Secondary standard:** Yes  No

390. Name of the instrument

391. Manufacturer of the instrument

392. Principle of function

393. Date of last calibration

394. **International standard:** Yes  No

395. Name of the instrument

396. Manufacturer of the instrument

397. Principle of function

398. Date of last calibration

**399. National standard:** Yes  No

400. Name of the instrument

401. Manufacturer of the instrument

402. Principle of function

403. Date of last calibration

**404. Reference standard:** Yes  No

405. Name of the instrument

406. Manufacturer of the instrument

407. Principle of function

408. Date of last calibration

**409. Working standard:** Yes  No

410. Name of the instrument

411. Manufacturer of the instrument

412. Principle of function

413. Date of last calibration

**414. Traveling standard:** Yes  No

415. Name of the instrument

416. Manufacturer of the instrument

417. Principle of function

**P. Standards used in calibration of instruments measuring radiation (for definition of standards see ANNEX)**

418. **Primary standard:** Yes  No

419. Name of the instrument

420. Manufacturer of the instrument

421. Principle of function

422. Date of last calibration

423. **Secondary standard:** Yes  No

424. Name of the instrument

425. Manufacturer of the instrument

426. Principle of function

427. Date of last calibration

428. **International standard:** Yes  No

429. Name of the instrument

430. Manufacturer of the instrument

431. Principle of function

432. Date of last calibration

433. **National standard:** Yes  No

434. Name of the instrument

435. Manufacturer of the instrument

436. Principle of function

437. Date of last calibration

438. **Reference standard:** Yes  No

439. Name of the instrument

440. Manufacturer of the instrument

441. Principle of function

442. Date of last calibration

443. **Working standard:** Yes  No

444. Name of the instrument

445. Manufacturer of the instrument

446. Principle of function

447. Date of last calibration

448. **Traveling standard:** Yes  No

449. Name of the instrument

450. Manufacturer of the instrument

451. Principle of function

**Q. Standards used in calibration of instruments measuring other parameter (1) (for definition of standards see ANNEX)**

452. Specify the type of the parameter

453. **Primary standard:** Yes  No
454. Name of the instrument
455. Manufacturer of the instrument
456. Principle of function
457. Date of last calibration
458. **Secondary standard:** Yes  No
459. Name of the instrument
460. Manufacturer of the instrument
461. Principle of function
462. Date of last calibration
463. **International standard:** Yes  No
464. Name of the instrument
465. Manufacturer of the instrument
466. Principle of function
467. Date of last calibration
468. **National standard:** Yes  No
469. Name of the instrument
470. Manufacturer of the instrument
471. Principle of function
472. Date of last calibration
473. **Reference standard:** Yes  No
474. Name of the instrument
475. Manufacturer of the instrument
476. Principle of function
477. Date of last calibration
478. **Working standard:** Yes  No
479. Name of the instrument
480. Manufacturer of the instrument
481. Principle of function
482. Date of last calibration
483. **Traveling standard:** Yes  No
484. Name of the instrument
485. Manufacturer of the instrument
486. Principle of function

**R. Standards used in calibration of instruments measuring other parameter (2) (for definition of standards see ANNEX)**

487. Specify the type of the parameter
488. **Primary standard:** Yes  No

489. Name of the instrument
490. Manufacturer of the instrument
491. Principle of function
492. Date of last calibration
493. **Secondary standard:** Yes  No
494. Name of the instrument
495. Manufacturer of the instrument
496. Principle of function
497. Date of last calibration
498. **International standard:** Yes  No
499. Name of the instrument
500. Manufacturer of the instrument
501. Principle of function
502. Date of last calibration
503. **National standard:** Yes  No
504. Name of the instrument
505. Manufacturer of the instrument
506. Principle of function
507. Date of last calibration
508. **Reference standard:** Yes  No
509. Name of the instrument
510. Manufacturer of the instrument
511. Principle of function
512. Date of last calibration
513. **Working standard:** Yes  No
514. Name of the instrument
515. Manufacturer of the instrument
516. Principle of function
517. Date of last calibration
518. **Traveling standard:** Yes  No
519. Name of the instrument
520. Manufacturer of the instrument
521. Principle of function

**S. Further need for calibration of instruments**

522. **If calibration of some or all instruments is not performed for any reasons at a country level, is there an interest to calibrate them at the Regional Instrument Centres (RICs)?** Yes  No
- If yes, which instruments do you wish to calibrate?
523. Instrument measuring pressure: Yes  No

- |   |                              |                             |
|---|------------------------------|-----------------------------|
| 524. Instrument measuring temperature:                | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 525. Instrument measuring humidity:                   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 526. Instrument measuring wind:                       | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 527. Instrument measuring rainfall:                   | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 528. Instrument measuring radiation:                  | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 529. Instrument measuring other parameters (specify): | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

**T. Further need for calibration of standards**

- |  |                                     |                                    |
|--|-------------------------------------|------------------------------------|
| <b>530. Do you wish to calibrate your standards at the RICs</b>        | <b>Yes <input type="checkbox"/></b> | <b>No <input type="checkbox"/></b> |
| 531. If yes, which standards do you wish to calibrate or intercompare? |                                     |                                    |
| 532. For pressure:   | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 533. For temperature:  | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 534. For humidity:   | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 535. For wind:   | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 536. For rainfall:   | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 537. For radiation:  | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |
| 538. For other parameters (specify):                                   | Yes <input type="checkbox"/>        | No <input type="checkbox"/>        |

**U. Calibration Laboratories**

- |  |                              |                             |
|--|------------------------------|-----------------------------|
| 539. The laboratories recognized in the organizational structure of the NMHS:    | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 540. The laboratories are independent from maintenance unit:                     | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 541. Are some laboratories accredited with ISO 17025?                            | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
| 542. The laboratories are certified with other international standard (specify): |                              |                             |
| 543. If not certified, do you intend to certify them in the future?              | Yes <input type="checkbox"/> | No <input type="checkbox"/> |

**V. Name and position of the person responsible for filling out this Questionnaire:**

544. First name:  
 545. Family name:  
 546. Position:  
 547. E-mail:

**W. Approved by the Permanent Representative of the WMO Member:**

548. First name:  
 549. Family name:  
 550. Date:

Please return the completed questionnaire, as soon as possible,  
but not later than **xxxxx 2006**  
to the WMO Secretariat, to the attention of:

Dr M. Ondráš

Senior Scientific Officer,  
Observing System Division

World Weather Watch Department

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ANNEX to Questionnaire

### **Standards**

Calibration of instruments or measurement systems is customarily carried out by comparing them against one or more measurement standards. These standards are classified according to their metrological quality. Their definitions (ISO, 1993) are given in The Guide to Instruments and Methods of Observation, WMO-No. 8, Chapter 1, Part I, and may be summarized as follows:

1. *Primary standard*: A standard which has the highest metrological qualities and whose value is accepted without reference to other standards.
2. *Secondary standard*: A standard whose value is assigned by comparison with a primary standard.
3. *International standard*: A standard recognized by an international agreement to serve internationally as the basis for assigning values to other standards of the quantity concerned.
4. *National standard*: A standard recognized by a national decision to serve, in a country, as the basis for assigning values to other standards.
5. *Reference standard*: A standard, generally of the highest meteorological quality available at a given location or in a given organization from which measurements made there are derived.
6. *Working standard*: A standard that is used routinely to calibrate or check measuring instruments.
7. *Transfer standard*: A standard used as an intermediary to compare standards.
8. *Traveling standard*: A standard, sometimes of special construction, intended for transport between different locations.

Primary standards reside within major international or national institutions. Secondary standards often reside in major calibration laboratories and are usually not suitable for field use. Working standards are usually laboratory instruments that have been calibrated against a secondary standard. Working standards that may be used in the field are known as transfer standards. Transfer standard instruments may also be used to compare instruments in a laboratory or in the field.