PROGRESS/ACTIVITY REPORTS PRESENTED AT CIMO-XIV
(unedited)

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C O N T E N T S

AGENDA ITEM 3 – REPORT BY THE PRESIDENT OF THE COMMISSION

CIMO-XIV 06/Rep. 3

REPORT BY THE PRESIDENT OF THE COMMISSION

The New Working Structure

1. The thirteenth session of the Commission for Instruments and Methods of Observation (CIMO-XIII) established a new working structure in accordance with the Thirteenth WMO Congress recommendations and the fifty-third session of the Executive Council. CIMO-XIII also determined that it would assist quicker response to the rapid advances in technologies in instrumentation and the parallel reduction in resources and the number of experts available to undertake in-depth studies for CIMO.

2. The working structure adopted at CIMO-XIII included three Open Programme Area Groups (OPAGs): Surface Observation Technology, Upper-air Observation Technology and Capacity Building. Each of these OPAGs established expert teams to undertake the high priority tasks assigned during CIMO-XIII. The CIMO Management Group (CIMO-MG) was also established on the authority of CIMO-XIII, consisting of the president, the vice-president, and the co-chairpersons of the OPAGs. Expert teams were encouraged to utilize e-mail consultation wherever possible to avoid the need for unnecessary meetings. In addition, members of the CIMO MG were selected to act as focal points to provide rapid input to the newer cross cutting programmes and activities within WMO, such as GEOSS and NDPM, with the terms of reference determined by the president.

3. During the intersessional period the president monitored the new working structure. The president and the CIMO-MG members considered that the new working structure had indeed been very successful, with a large number of tasks being undertaken by a greater number of experts assigned to the expert teams. In future, a new Rapporteur on Climate Observations should be assigned to coordinate the important CIMO input to the climate activities. In addition, a CIMO Coordinator on Quality Management Framework (QMF) would be included in the CIMO-MG in the new intersessional period (along with the GEOSS and NDPM coordinators). The proposed slightly modified structure is detailed in agenda Item 10.

4. The dedication and continuous availability of the CIMO-MG members and instrument experts during the four years since CIMO-XIII allowed a great deal of effective work to be undertaken. This work is extremely valuable for all Members of WMO in the cost effective operation of high quality instruments through their surface and upper-air networks.

Implementation of the Instrument and Methods of Observation Programme

5. The valuable work that had been undertaken by the expert teams (ETs), under the direction of the OPAG co-chairpersons and the dedication and continuous availability of the majority of CIMO-MG members and instrument experts during the four years since CIMO-XIII allowed a great deal of effective work to be undertaken.

6. The major achievements during the intersessional period were:

(a) A major intercomparison of high quality radiosonde technology, in Mauritius, leading to significantly improved upper-air instruments and a wider range of choice for NHMSs leading to higher quality observations and more competitive consumable costs;

(b) Completion of a major three-way laboratory intercomparison for rainfall intensity instruments commonly use by Members with significant results;

(c) Capacity building through two Technical Conferences on Meteorological and Environmental Instruments and Methods of Observation (TECO-2005 and TECO-2006) and the Exhibition of Meteorological Instruments, Related Equipment, and Services (METEOREX-2005);

(d) Capacity building through several training workshops and technology transfer via the strengthening of the Regional Instrument Centres (RICs). An additional two RA VI RICs - Bratislava, Slovakia and Ljubljana, Slovenia - have increased the number to 15;

(e) Publication of the Instrument Catalogue and instrument development reports;

(f) Enhanced collaboration with manufacturers through the Hydro-Meteorological Equipment Industry Association (HMEI);

(g) Establishment and effective implementation of an improved working structure;

(h) More effective intercommission and cross-cutting WMO Programme collaboration;

(i) Completion of the Seventh Edition of the WMO *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) (CIMO Guide) by 42 experts from 17 countries;

(j) Completion of the Tenth International Pyrheliometer Comparison (IPC-X) and the conjoint Regional Pyrheliometer Comparisons (RPCs) with participation of two World Radiation Centres (WRCs), 16 Regional Radiation Centres (RRCs), 23 National Radiation Centres (NRCs) and 11 International Institutions;

(k) Input to the Global Earth Observing System of Systems (GEOSS) work plans;

(l) Collaboration with the Natural Disaster Prevention and Mitigation Programme;

(m) Lead support for the WMO QMF through the Intercommission Task Team;

(n) Publication of 17 Instruments and Observing Methods (IOM) reports, including essential training material;

(o) Promotion of the traceability of measurements to the International System of Units (SI); and

(p) Increased availability of essential instrument, training and other information through a special web portal.

Missions of the president

7. The president participated in all the major meetings and conferences, including the Management Group meetings and TECO and METEOREX conferences, all meetings of the Executive Council and several Meetings of the Presidents of Technical Commissions.

Achievements

Surface Observation Technology

8. An exhaustive WMO Laboratory Intercomparison of Rainfall Intensity (RI) Gauges was undertaken in the recognized laboratories of the Royal Netherlands Meteorological Institute, Météo-France and University of Genova, from 15 September 2004 to 15 September 2005. The generous support for the intercomparison by these laboratories is of great benefit to Member countries. The outcome of the successful intercomparison showed unique and valuable results that Members should be recognizing, for both tipping bucket and weighing rain gauges.

9. The Tenth International Pyrheliometer Comparison (IPC-X) and the conjoint RPCs were held at the WRC, Davos, Switzerland, from 26 September to 14 October 2005. The primary focus of IPC-X was the calibration of standard pyrheliometers of all WMO RRCs, and as such 89 were calibrated during 11 days of favorable weather conditions. National Standard Pyrheliometers were also compared against the World Standard Group (WSG) of radiometers. Experts working at RRCs were trained in a workshop on how to prepare, carry out, and evaluate the results of a RPC.

10. Progress was also made on the establishment of the World Infrared Radiometer Calibration Centre, assessment of its technical/scientific capabilities and provision of guidance for its future operational use. Further development of the WSG of absolute infrared radiometers was examined by the relevant expert team and is reported under agenda item 4.3.

11. The WMO Field Intercomparison of Rainfall Intensity Gauges and the WMO Combined Intercomparison of Thermometer Screens/Shields with Humidity Measuring Instruments are planned for 2007-08.

Upper-air Observation Technology

12. The WMO Intercomparison of High Quality (HQ) Radiosonde Systems, Vacoas, Mauritius, 2-25 February 2005, concentrated on the analysis of results and recommendations towards further improving radiosonde performance. The intercomparison was intended to identify any significant flaws in the new radiosonde designs, so that these could be rectified before their use became widespread in the operational radiosonde networks. Based on the analysis, a proposal was made for the combination of best performing radiosondes as part of working references for radiosonde tests. The final report was published on the CIMO/IMOP Website in January 2006.

13. Members should note the results of the report, in particular the improved accuracy of HQ radiosonde systems, the alternative (to inclusion of a pressure sensor) satisfactory geopotential height derived from GPS radiosondes, and the best combination of HQ radiosondes for reference purposes.

Capacity Building and Regional Instrument Centres

14. After a field evaluation of RICs, options for improving their functionality, recommendations for their Terms of Reference review, and a strategy for strengthening their services through continuous evaluation will be considered in agenda item 6.2. To assist this goal, a WMO Training Workshop on Metrology for the Regional Instrument Centres was successfully held in Trappes, France during 2005 where 20 participants from 13 RICs were trained in basic metrology principles, measurement techniques and calibration of standard instruments.

15. Two successful technical conferences (TECO-2005 and TECO-2006) and an associated METEOREX-2005 exhibition were held in the intersessional period. These conferences accomplished a great deal of technology transfer and capacity building. All papers, including posters, were published on a CD-ROM as well as the CIMO/IMOP Website.

16. Three training workshops on upper-air observations and three training workshops on metrology and calibrations had been a success in the intersessional period. A schedule of training workshops would be proposed to the Commission for the next intersessional period. The aim of the training was to improve the knowledge and skills of operational personnel in producing high quality upper-air and surface observations.

17. The 2005 version of the World Meteorological Instrument Catalogue was produced in collaboration with the China Meteorological Agency with preliminary steps taken to also collaborate with the HMEI in future versions of the catalogue.

18. Significant effort was dedicated to the preparation of technical reports and guidance on instruments and methods of observing practices to Members. Since CIMO-XIII, 18 technical reports have been published under the Instruments and Observing Methods (IOM) report series and are available in CD-ROMs as well as on the CIMO/IMOP Website. Similarly, the update of the CIMO Guide was undertaken by 42 experts from 18 countries, working on the update since 2002. The preliminary release of the Seventh Edition of the CIMO Guide has been made available for comment in an electronic version on the IMOP/CIMO website and on CD ROMs distributed to Members.

Meeting milestones

19. The following major intercomparisons, training workshops, meetings and conferences were held in order to meet task milestones:

3-7 July 2006, Geneva (Switzerland)
CIMO Management Group, Third Session

8-12 May 2006, Buenos Aires (Argentina)
WMO Training Workshop on Upper-air Observations for RA III (South America)

22-26 April 2006, Cairo (Egypt)
WMO Training Workshop on Metrology for RA I (Africa) English-speaking Countries

12-13 April 2006, Bratislava (Slovakia)
WMO Training Workshop on Metrology for RA VI (Central and Eastern Europe)

10-11 April 2006, Ljubljana (Slovenia)
WMO Training Workshop on Metrology for RA VI (South-Eastern Europe)

4-7 April 2006, Geneva (Switzerland)
CIMO Expert Team on Regional Instrument Centres, Quality Management Systems and Commercial Instrument Initiatives (Reduced meeting)

6-10 February 2006, Davos (Switzerland)
CIMO Expert Team on Meteorological Radiation and Atmospheric Composition Measurements, First Session

5-9 December 2005, Geneva (Switzerland)
Joint CIMO Expert Team on Surface-based Instrument Intercomparisons and Calibration Methods, Second Session; and International Organizing Committee (IOC) on Surface-based Intercomparisons, Second Session

28-30 November 2005, Geneva (Switzerland)
Joint CIMO Expert Team on Upper-Air Systems Intercomparisons, Second Session; and International Organizing Committee (IOC) on Upper-Air Systems Intercomparisons, Second Session

26-28 October 2005, Shanghai (China)
The 3rd China International Exhibition on Technology and Equipment of Meteorology Science and Hydrology

26-28 October 2005, Shanghai (China)
The 4th China International Forum and Exhibition on Lightning Protection Technology and Equipment

17-21 October 2005, Trappes (France)
WMO Training Workshop on Metrology for the Regional Instrument Centres

From 26 September 2005 to 14 October 2005, Davos (Switzerland)

The tenth International and Regional Pyrheliometer comparison

13 September 2005 De Bilt (Netherlands)
Extraordinary meeting of the laboratories involved in the WMO Laboratory Intercomparison of Rainfall Intensity Gauges

From 15 September 2004 to 15 September 2005 (France/Italy/Netherlands)
WMO Laboratory Intercomparison of Rainfall Intensity Gauges

2-3 May 2005, Bucharest (Romania)
CIMO Management Group, Second Session

4-7 May 2005, Bucharest (Romania)
TECO-2005

4-6 May 2005, Bucharest (Romania)
METEOREX 2005

14-17 March 2005, Geneva (Switzerland)
Expert Team on Remote Sensing Upper-air Technology and Techniques, First Session

13-16 October 2004, Geneva (Switzerland)
ET on Surface Technology and Measurement Techniques, First Session

17-20 March 2004, Geneva (Switzerland)
Joint CIMO Expert Team on Upper-air Systems Intercomparisons, First Session; and International Organizing Committee (IOC) on Upper-air Systems Intercomparisons, First Session

1-5 December 2003, Casablanca (Morocco)
Training Workshop on Upper-air Observations for RA I (French-speaking countries)

24-28 November 2003, Trappes (France)
Joint CIMO Expert Team on Surface-based Instrument Intercomparisons and Calibration Methods; and International Organizing Committee (IOC) on Surface-based Intercomparisons

3-7 November 2003, Geneva (Switzerland)
CIMO Expert Team on Upgrading the Global Radiosonde Network, First session

7-11 April 2003, Gaborone (Botswana)
Training Workshop on Upper-air Observations for RA I (English-speaking countries)

13-15 February 2003, Los Angeles, CA. (USA)
CIMO Management Group, First Session

20. All the above activities are reported in detail at the WMO IMOP Web site. During the intersessional period the completion of reports was timely for use by Members, and announced in the regular CIMO newsletters.

Acknowledgements

21. There had been a great deal of work by members of the Commission, especially members participating in Expert Teams. The president thanked these members and the vice-president and chairpersons of the OPAGs, ETs and those that provided considerable expertise in undertaking the intercomparison of instruments. He thanked those Members that hosted meetings and experiments. He also thanked the Secretary-General of WMO and in particular the outstanding support of the relatively small Secretariat assigned to CIMO. He advised the session that he was not standing for the role of president for the next intersessional period due to his changed role in his NMHS. However, if the Commission desired, he would take on a Management Group role

(agenda item 10) to support the new president and to assist in the transition of the Management Group leadership.

AGENDA ITEM 4.1 – INSTRUMENTS AND METHODS OF OBSERVATION FOR SURFACE MEASUREMENTS

CIMO-XIV/Rep. 4.1

SURFACE TECHNOLOGY AND MEASUREMENT TECHNIQUES

1. The Expert Team on Surface Technology and Measurement Techniques (ET-ST&MT) dealt with issues related to standardization of automation of visual and subjective observations, systems measuring present weather and algorithms for AWSs, including the possible use of alternative methods for replacing some traditional observations. Other issues included the development of instruments and observing systems for operation in harsh climate conditions, siting criteria and metadata standards, cost implication related to technology changes, and further progress of urban and road meteorological measurement methods and techniques.

2. The chairman of the ET-ST&MT was involved in the EUMETNET PWS-Sci (Present Weather Sensor-Science) Project to study the state of the art of automatic observations of "present weather" (rain, snow, fog, etc.) at ground level and to identify possible solutions for improvement. The final report "Exploratory actions on automatic present weather observations" provides an up-to-date overview of current technologies for reporting present weather observations.

3. The ET-ST&MT took advantage of the above report in addressing the issue of standardization of automation of visual and subjective observations. It was recognized that such standards were dependant on the availability of current and future technologies providing alternative information parameters such as present weather. The team concluded that recommendations for the harmonization of those techniques should be done before the standardization of automation of subjective observation can take place. Such recommendations are of particular interest for present weather reporting as they are based on multi-sensor observations.

4. The ET-ST&MT agreed that defining or selecting standard algorithms would not be feasible due to the variety of observing techniques in use. Also due to the variety of sensors and alternative data sources used in operational practices to produce the same or similar subjective observations, it may not be possible to identify a single standard algorithm. Moreover, fine-tuning of parameters used in algorithms to match sensor input parameters complicates the process of algorithm standardization.

5. The adoption of standard algorithms for individual data output parameters should be treated separately and that priority be given to sky condition (cloud layers: cover/amount, height, type) followed by the state of the present and past weather, icing and the state-of-the-ground.

6. The development of standards for individual input parameters and algorithm processing would need publishing of algorithms by manufacturers. An alternative solution would be tables or matrices that define the relationship between input sensor data elements and output data elements. Such a matrix would include statements on required inputs, sensor data uncertainties required to generate accurate output data parameters. The proposal would aim toward producing a generic table that could be applied to any system producing the same output data parameter.

7. Recommendation of generic standards for input parameters and algorithms might stifle innovation and reduce the diversity in useful and appropriate technologies. Moreover, "implementing standards for sensor output product" would seem impossible to perform. To do so would require the ability to physically generate all weather conditions that a sensor is capable of deriving.

8. The optimization of observing systems, inclusive of applied algorithms is based on subjective evaluation rather then on objective intercomparisons. For such evaluations, a variety of skill score definitions and probability functions are in common use, but there is no international consensus on the recommended use or on required threshold values for accepting any suggested methodology to derive present weather data. Moreover, the lack of well stated uncertainty requirements on subjective observations and the complexity to translate such requirements back through an algorithm into the source variables was well recognized.

9. Due to the difficult nature of defining and implementing standards for automatic sensors performing subjective observations, high priority should be given to identifying and defining data parameters and codes to allow for the measurement and reporting of alternative quantitative data instead of subjective data.

10. The ET-ST&MT developed a table of subjective observations containing a detailed overview of specific observation types and the technologies to automate these measurements. The team was also concerned with the compatibility between operational systems that perform subjective observations.

11. The ET-ST&MT analyzed the eighth Inquiry on Instrument Development (IDI-8); however, the results have not yet been published. The team proposed to develop further the CIMO Web Portal on Development, Maintenance and Operation of Instruments, Observing Methods and AWS (http://www.wmo.int/web/www/IMOP/WebPortal-AWS/Index.html) to provide access to all kind of instrument and observing systems. The Portal should facilitate entry and retrieval of up-to-date information on instrument developments other than the IDI, which is updated every four years.

12. The ET-ST&MT emphasized the need to coordinate the roles of the IDI, the World Meteorological Instrument Catalogue (WMIC) and the HMEI Product Catalogue (HMEI-PC). The objective of the WMIC and HMEI-PC is to provide the meteorological community with comparable information on instruments commercially available, whereas the objective of IDI is to inform on planned and on going developments.

13. Some members of the ET-ST&MT participated in the EUMETNET Severe Weather Sensor II project (SWS II) that tested 15 wind sensors, six temperature and humidity measurement systems with different types of shield and 4 solar radiation sensors equipped with heating in the harsh environment in the far North and in mountain regions. Following the results of the experiment, the ET-ST&MT revisited the requirements on instruments suitable for harsh climate conditions. The team emphasized the need to classify stations according to ice induced meteorological conditions and the classification of instruments with respect to their response characteristics during icing conditions.

14. Different approaches are applied to system design and lay out of automatic weather stations (AWS) by different manufacturers. Equipment is sometimes clustered in a way that sensor measurements often influence one another. It is critical that the weather station design comply with recommendations as stated in the CIMO Guide.

15. The representativeness of a station is of utmost relevance for users of observational data, therefore the aspects of location and siting need to be considered. The metadata information on maintenance and calibration are relevant to data interpretation and validation. The location

selection, installation of instruments and performance characteristics must be well documented. The additional effort should be placed on further enhancement of guidance for siting of systems and stations for various applications as well as the administration of collected "metadata". The ET-ST&MT prepared a list of basic metadata elements which should be appended to a next edition of the CIMO Guide.

16. The ET-ST&MT initiated development of a siting classification system, based on a publication on measurement representativeness by Mr M. Leroy (France), presented at the TECO-98. This would enable the user of meteorological observations to select the most appropriate weather stations for the individual data processing needs satisfying the individual application requirements. Such a system would be also useful if alternative weather stations have to be selected in regions where weather stations do not fully comply with WMO Regulations.

17. The ET-ST&MT addressed the issue of cost involved in the continuous development and forced need to replace/upgrade instrument and systems in the GOS. It was recognized that continuous improvements in a quality and availability of data require regular upgrading of observing technologies even before their lifetime is over. There is a need for guidance on how to quantify cost-benefits during technology replacement. This should be developed in collaboration with HMEI.

18. The ET-ST&MT member, Professor Tim Oke (Canada), prepared a new chapter on Urban Meteorological Measurements for the seventh edition of CIMO Guide. The chapter was peer-reviewed and provides excellent guidance to urban meteorology users.

19. The progress in developing standards on site layout and sensor specifications for road meteorological measurements did not progressed as expected due to lack of expertise and reluctance of local road managers to adopt standard practices worldwide. There is also a need to develop guidelines on metadata for road meteorological stations.

AGENDA ITEM 4.2 – SURFACE-BASED INSTRUMENT INTERCOMPARISONS AND CALIBRATION METHODS

CIMO-XIV/Rep. 4.2

SURFACE-BASED INSTRUMENT INTERCOMPARISONS AND CALIBRATION METHODS

1. The Expert Team on Surface-Based Instrument Intercomparisons and Calibration Methods (ET-SBII&CM) focused on activities related to the organization and preparation of a number of surface-based intercomparisons, namely the laboratory and fields intercomparison of rainfall intensity (RI) measuring instruments and the field intercomparison of thermometer screens/shields and humidity measuring instruments.

2. The International Organizing Committee on Surface-Based Instrument Intercomparisons (IOC-SBII) was established. The ET/IOC-SBII defined objectives of the WMO Laboratory and Field Intercomparisons of RI Gauges and the WMO Combined Intercomparison of Thermometer Screens/Shields in Conjunction with the Humidity Measuring Instruments. It established three Project Teams for the three intercomparisons, comprising the ET/IOC-SBII Chairman, Project Manager and site managers. It prepared a strategy for publication of results and agreed on conditions for participation, intercomparison rules and responsibility of host and participants.

3. At the kind invitation from the governments of France, Italy and The Netherlands, the WMO Laboratory Intercomparison of RI Gauges was held in De Bilt (The Netherlands), Genova (Italy) and Trappes (France) from 15 September 2004 to 15 September 2005. Professor Luca Lanza

(Italy), the Project Manager, together with three site managers Mr Luigi Stagi (DIAM Laboratory of the University of Genova, Italy), Mr Christophe Alexandropoulos (Laboratory of Météo-France, France), and Mr Alexander Mazee (retired in 2005) and Mr Wiel Wauben (Laboratory of the KNMI, Netherlands) were responsible for managing the local organization of the intercomparison and preparation of laboratories for testing and comparison of RI gauges.

4. Nineteenth pairs of participating instruments from 18 manufacturers were divided into three groups, with each group being tested for a period of about three to six months in each of the laboratories, in order to obtain a high degree of confidence in the results. The first phase of tests had successfully concluded by 15 February, the second by 15 May 2005 and the third by 15 September 2005. All the cost related to laboratory intercomparisons was born by the laboratories and the manufacturers involved.

5. The general methodology was adopted for the tests, based on the generation of a constant water flow from a suitable hydraulic device within the range of operational use declared by the instrument's manufacturer. The water was conveyed to the funnel of the instrument under test in order to simulate constant rainwater intensity. The flow was measured by weighing the water over a given period of time. The relative difference between the measured and generated rainfall intensity was assumed as the relative error of the instrument for the given reference flow rate. In addition to measurements based on constant flow rates, the step response of each instrument was checked based on the suitable devices developed by each laboratory.

6. Each laboratory developed its own testing device, with some differences in the principle and technology used to generate a constant water flow, as well as in the way the water was weighed in the device. These provided a basis for the development of a standardized procedure for generating consistent and repeatable precipitation flow rates for possible adoption as a laboratory standard for calibration of catchment type RI gauges.

7. The results of the intercomparison showed that the tipping-bucket rain gauges that were equipped with proper correction software provided good quality rainfall intensity measurements. The gauges where no correction was applied had larger errors.

8. According to the results, the uncertainty of the rainfall intensity is generally less for weighing gauges than for the tipping-bucket rain gauges under constant flow rate condition, provided the instrument is properly stabilized. The measurement of rainfall intensity is affected by the response time of the acquisition system. Significant delays were observed in "sensing" time variation of the RI by weighing gauges. The delay is the result of the internal software, which is intended to filter the noise. Only one instrument had a delay that met the WMO 1-minute rainfall intensity requirement.

9. The two gauges using a conductivity measurement for determining water level showed good performances in terms of uncertainty under controlled laboratory conditions. Siphoning problems for one gauge limits its ability to measure a wide range of rainfall intensity. For the other one, a limitation is related to the emptying mechanism, in which case 2-minute delay was observed.

10. The laboratory tests were performed under controlled conditions and constant flow rates (rainfall intensities) so as to determine the intrinsic counting errors. However, the RI is highly variable in time, thus catching errors may have a strong influence on the overall uncertainty of the measurement. Therefore, one of the outcomes of the Laboratory Intercomparison was to proceed with a follow-up intercomparison in the field where the instruments tested in the laboratory should have a priority. This would allow continuity in the performance assessment procedure and result in the estimation of the overall operational error to be expected in the measurement of RI in the field. The field RI intercomparison would also be open to the non-catchment type of instruments.

11. Apart of the performance evaluation of the participating gauges, two important outcomes relate to: (a) The proposal of the standardized procedure for laboratory calibration of catchment type rainfall intensity gauges; and (b) Procedure and reference instruments for field rainfall intensity intercomparisons.

12. The project team also suggested how to avoid the risk of introducing inhomogeneities into rainfall data series through improved uncertainty of RI gauges participating in the intercomparison. An example of the correction of the historical rainfall series was demonstrated using the result of the Laboratory Intercomparison.

13. The Final Report of the WMO Laboratory Intercomparison of RI Gauges had been available from the CIMO/IMOP Website since January 2006, less than four months after the completion of the fieldwork. The report had been peer reviewed by a second meeting of the ET/IOC-SBII, Geneva, December 2005 and is available as IOM Report No. 84, WMO/TD-No. 1304.

14. At the kind invitation of Italy, the WMO Field Intercomparison of Rainfall Intensity Instruments will be held in the Italian Meteorological Service Centre of Meteorological Experimentation (ReSMA), Vigna di Valle, Italy, currently planed from August 2007 to August 2008. Twenty-four instruments of different measuring principles were selected by the ET/IOC-SBII for the intercomparison.

15. At the kind invitation of Algeria, the WMO Combined Intercomparison of Thermometer Screens/Shields, in conjunction with Humidity Measuring Instruments will be held in Ghardaïa, Algeria, situated in a desert region, currently planed from January 2007 to January 2008. Twenty-nine different thermometer screens/shields and sixteen humidity-measuring devices were identified for the intercomparison.

16. The host countries and project teams were working together in preparation of the field sites for those intercomparisons. This included adaptation of the test-beds and data acquisition systems.

17. The ET/IOC-SBII proposed that future WMO Surface-Based Instrument Intercomparisons should be organized in harsh climate conditions, such as:

- Mountainous/Arctic environments (extreme cold);
- Desert and other dusty environments (extremely dry);
- Tropical environment (hot and humid);
- Marine environment (extreme weather, corrosion);
- Urban environment (corrosion, contaminants).

AGENDA ITEM 4.3 – METEOROLOGICAL RADIATION AND ATMOSPHERIC COMPOSITION MEASUREMENTS

CIMO-XIV/Rep. 4.3

Meteorological Radiation and Atmospheric Composition Measurements

1. The Expert Team on Meteorological Radiation and Atmospheric Composition Measurements (ET-MR&ACM) was charged with the organization of the Tenth International Pyrheliometer Comparison (IPC-X) and conjointly organized Regional Pyrheliometer Comparison (RPC). At the kind invitation from the government of Switzerland, the IPC-X was held at the Physikalisches Meteorologisches Observatorium Davos (PMOD)/World Radiation Centre (WRC) from 26 September to 14 October 2005. The Project leader and the Ad-Hoc Group of experts in radiometry were established to manage and oversee the procedures of IPC-X and to guarantee the validity of results of the intercomparison.

2. The favorable weather conditions throughout the intercomparison allowed to take measurements on a total of 11 days, resulting in over 1000 data points for PMO2 instruments compared to the minimum requirement of 150 points. Seventy-two participants from 16 RRCs and 23 NRCs as well as the World Radiation Data Centre and eleven institutions and manufacturers took part in the IPC-X. They operated a total of 89 pyrheliometers. The WRC staff operated six reference instruments of the World Standard Group (WSG).

3. During the IPC-X, the training workshop and the symposium were organized by the staff of the PMOD/WRC, as well as other scientists, to participants of the RRCs and NRCs to promote high quality solar radiation measurements in all national networks. The instructional material is available on request at the PMOD/WRC Website.

4. The World Radiometric Reference (WRR) was defined and calculated as the mean value of the simultaneous measurements of at least three WSG instruments. Each participating instrument was assigned a new WRR factor determined by averaging the ratios of the WRR to the instrument for all data points satisfying data selection criteria.

5. The final report of the IPC-X has been available from the CIMO/IMOP and PMOD/WRC Websites since May 2006, less than five months after the completion of the fieldwork. The report had been peer reviewed during the meeting of the ET-MR&ACM, Davos, Switzerland, February 2006 and is available as IOM Report No. 91, WMO/TD No. 1320. Following the publication of the Final Report, new correction factors for participating pyrheliometers could be applied.

6. In order to guarantee the worldwide traceability of the radiation measurements, the ET-MR&ACM reviewed the Terms of Reference of the World, Regional and National Radiation Centres for the consideration by CIMO-XIV and for the inclusion in the *WMO Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) (CIMO Guide).

7. The ET-MR&ACM noticed that the increasing number of "World Calibration Centres" at PMOD, i.e. WRC, WIRC, WORCC, is potentially confusing to the meteorological community and this nomenclature increases the administrative burden of PMOD. Instead, the team believes that the specialized task areas resident at PMOD should be called sections of the WRC, with these areas being identified by the wavelength range of interest. Presently, there are two tasks designated by the Executive Council and recommended by CIMO, the establishment of the World Radiometric Reference for solar irradiance (Recommendation 3 (CIMO-VII)) and the establishment of a terrestrial infrared irradiance standard (Recommendation 1 (CIMO-XIII)).

Matters related to Baseline Surface Radiation Network (BSRN)

8. The BSRN was founded as a Project of the World Climate Research Programme (WCRP). There are about 40 BSRN sites worldwide and, at present, the BSRN is a part of Global Energy and Water Cycle Experiment of the WCRP (WCRP/GEWEX). Recently, BSRN has also been identified as the radiation network of the Global Climate Observing System.

9. The radiation measurements have a long tradition within CIMO, as well as having the responsibility for international and regional pyrheliometer comparisons and WRR. CIMO's technical responsibility for the WRC, as well as for the RRCs and NRCs, clearly defines its role in radiation measurements. In order to guarantee worldwide data homogeneity, regular calibrations of solar and terrestrial radiation instruments must be performed according to CIMO guidelines as stated in the CIMO Guide. Procedures for calibration and intercomparisons within the CIMO Guide must be reviewed on a scheduled basis.

10. The BSRN community was informed about the activities of the CIMO ET-MR&ACM during the BSRN meeting, Lindenberg, Germany, May 2006 to avoid possible duplication of activities.

11. To remain knowledgeable in the matters and activities of CAS, the ET-MR&ACM must actively collaborate with the three GAW Scientific Advisory Groups (SAGs) for Ozone, UV and Aerosol. The ET-MR&ACM recognized that the CAS SAG Ozone, UV and Aerosol are responsible for the corresponding atmospheric composition measurements and there is a need to avoid any possible duplication of the work done by the several teams. To keep the CIMO Guide up-to-date, the team will monitor the efforts of CAS on operational practices associated with corresponding measurements and will collaborate with CAS on matters related to practices associated with UV radiation and atmospheric composition measurements.

Ozone Measurements

12. Valuable contributions were made by the Regional Ozone Centres in having implemented QA/QC techniques and methodologies in the operation and calibration of instruments used to measure total ozone. It is suggested that more effort be placed in calibration/characterization of filter type instruments used in total ozone measurements. There is also the need for timely archiving of ozone data at the World Ozone and UV Data Centre (WOUDC).

UV Measurements

13. Over the last intersessional period there have been a number of documents published by the CAS SAG UV that would improve CIMO guidelines on observation of UV radiation, specifically on spectral and broadband instruments, the latter being especially useful for Members. Several countries have successfully operated narrow-band filter radiometer networks and are looking forward to the publication by SAG UV of the narrow-band filter radiometer that is being finalized. It is believed that based on their QA/QC and operational documentation, all of which are freely available, the appropriate sections of the CIMO Guide could be updated. This would be a future task of the ET-MR&ACM.

14. The SAG UV has made a valuable contribution in defining QA/QC techniques for UV instruments (GAW Reports 125, 126, 146 and 164). These include technical specifications and techniques for measuring spectrally resolved UV radiation, and technical specifications and methodologies associated with the operation and calibration of broadband UV instruments.

15. The ET-MR&ACM will use the GAW publications as a basis for writing the appropriate sections of the CIMO Guide on UV radiation observations.

Aerosol Optical Depth (AOD) Measurements

16. There are currently ten independent networks with about 90 stations having a continuous record for 4 or more years. More information is available in GAW Report No. 162.

17. The significant contribution of the GAW SAG for Aerosol was made in defining the QC/QA procedures. The SAG also made a plan to produce a QA/QC manual on AOD measurements. The ET-MR&ACM will collaborate with SAG Aerosol on this activity.

18. A primary reference centre for AOD measurements should be established to satisfy the need for traceability of AOD measurements and for conducting international intercomparisons. The ET-MR&ACM proposed that the World Optical Depth Research and Calibration Centre (WORCC) at PMOD/WRC be designated the primary WMO reference centre for OD measurement as part of WRC activities.

Infrared Measurements

19. The World Infrared Radiometer calibration Centre (IRC) was established at the PMOD/WRC in January 2004 based on Recommendation 1 (CIMO-XIII). The ET-MR&ACM evaluated the IRC during its meeting (Davos, 6-10 February 2006) following the WRC's presentation of the operational aspects of the IRC, including, instruments used, details of the World Infrared Standard Group (WISG), traceability and stability of WISG pyrgeometers, their maintenance and calibration procedures, QA/QC procedures, uncertainties and future plans. The team concluded that a considerable amount of work had been done to ensure Absolute Spectral Radiometer (ASR) as a reference for infrared (3 – 50 µm) measurements. The team believed that the WISG could provide a useful interim reference for pyrgeometer measurements until an absolute reference can be established. To assist in assuring the stability of the WISG the team suggested that carefully selected pyrgeometers outside the WISG are periodically compared to the WISG. The team proposed that CIMO invites the BSRN community in collaboration with the WRC to examine the consistency of characterizing pyrgeometers.

20. Following the evaluation of the IRC including the WISG, the ET-MR&ACM proposed to CIMO-XIV for consideration that:

(a) The World Infrared Radiometer Calibration Centre be renamed to the WRC Infrared Radiometry Section (WRC-IRS);

(b) The IRC establishes the Interim WMO Pyrgeometer Infrared Reference using the procedures and instrumentation that make up the WISG;

(c) The IRC, whenever possible, incorporate new types of instruments into WISG;

(d) The members of CIMO be encouraged to develop instruments and methods to improve traceability of infrared irradiance measurements to SI units;

(e) At least every three years, RRCs supporting networks for measuring far infrared irradiance shall submit a pyrgeometer to the IRC for calibration or verification.

21. In future, the ET-MR&ACM will examine the transfer of WISG to network measurements of infrared irradiance.

22. The ET-MR&ACM updated the CIMO Guide Chapter 7 "Measurement of Radiation" and Chapter 8 "Measurement of Sunshine Duration". However, in view of the recent discussions on IPC, WRR, and RRCs it was felt that additional revision to Chapter 8 is needed. The experts from CAS SAGs updated the Chapter 17 "Measurement of Atmospheric Composition".

AGENDA ITEM 5.1 – INSTRUMENTS AND METHODS OF OBSERVATION FOR UPPER-AIR MEASUREMENTS AND REMOTE SENSING

UPGRADING THE GLOBAL RADIOSONDE NETWORK

CIMO-XIV /Rep. 5.1

Upgrading the global radiosonde network

1. Mr Tim Oakley (UK), the ET-UGRN Rapporteur on Radiosonde Compatibility, maintained the Catalogue of upper-air stations and radiosonde types/systems in use. The Catalogue is placed on the www Website: http://www.wmo.ch/web/www/ois/volume-a/vola-home.htm and it is the only source of information to track the technological changes in the upper-air stations of the GOS. The rapporteur also monitored the "long-term" performance of radiosonde networks and designs using ECMWF "OB-FG" statistics. These compatibility reports are made available to Members on a yearly basis, in a tabular format, on the CIMO/IMOP Website: http://www.wmo.int/web/www/IMOP/monitoring.html and are critical in identifying and resolving deficiencies in the GOS radiosonde network.

2. Mr David Dockendorff (Canada) and Mr Roger Atkinson (Australia) developed a questionnaire on current techniques used to monitor network performance. Once the responses have been received the information will be analysed and results used during the next intersessional period in developing a global plan for implementation of best monitoring practices.

3. Mr Sabry El-Fouly (Egypt) prepared a report on reducing upper-air operational costs. This report presented the results of his survey identifying options for reducing upper-air operational costs. Despite the small sample return his findings confirmed that more assistance to developing countries is needed. Since CIMO-XIII, options for joint purchases by multiple members as well as bulk purchases made by GCOS in support of the GUAN have proven successful and these options should be continued and expanded where possible.

4. In the area of AMDAR measurements, the AMDAR representative in the ET-UGRN prepared a report that provided a thorough update on the progress of AMDAR since CIMO-XIII in the areas of targeted observations, data exchange, monitoring and quality control, training and instrument evaluation as well as a status report on other related sensor systems such as those used in the Tropospheric Airborne Meteorological Data Reporting (TAMDAR) programme.

5. Twenty-one cities in 16 countries in Africa are receiving two or more targeted profiles on most days from aircraft operated by South Africa, E-AMDAR and a small number from Australia. Formal arrangements have now been completed for E-AMDAR to provide targeted data for southern Africa. Australia is currently planning to help develop a regional programme of targeted observations in the southwest Pacific. Further effort is encouraged in closing data gaps through complimentary systems.

6. AMDAR is providing significant support for the International Polar Year 2007-2008 (IPY). This is being undertaken by Canada as it extends operations into arctic Canada and by Germany and Sweden as they extend their operational programmes in high altitudes. The US, Australia and Chile are actively planning to introduce AMDAR operations into Antarctica in time for the IPY.

7. New water vapor sensors "WVSSII "have been installed on 25 B757 freighter aircraft and are currently undergoing operational evaluation. Initial results are encouraging. Additional modification to the sensor still needs to be completed. An intercomparison over the US Great Lakes region against radiosondes and other upper-air systems was conducted in mid-2005. A

second intercomparison will follow. The final report will include the results of the study of the impact of WVSSII water vapor data on NWP forecast quality.

8. The E-AMDAR has commenced a substantial WVSSII evaluation programme. Laboratory testing by the Juelich Research Center in Germany has been completed and following the certification process, operational trials on Lufthansa A320 aircraft and possibly one Mozaic A340 aircraft will commence in 2006. Other international purchase and evaluation collaborative efforts have been organized by the AMDAR Panel with Australia, New Zealand and South Africa who will install a small number of sensors for operational testing.

9. A major step forward in WVSSII deployment had been the interest and involvement of Airbus Industries who, in collaboration with the AMDAR community, are planning to complete certification on the entire A320 family and extend this to all other airbus models. They plan to offer the sensor as an optional component to all airbus customers. A business case is being prepared in collaboration with E-AMDAR and the AMDAR panel. If this process is successful, a similar project will be attempted in the US with Boeing Industries.

10. The two-week field assessment by the Cooperative Institute for Meteorological Satellite Studies (CIMSS) was conducted on 13-24 June 2005 intercomparing WVSSII soundings with co-incident data such as the Vaisala RS-92 radiosonde, GPS Total Perceptible Water (TPW), and Atmospheric Emitted Radiance Interferometer (AERI) sensors. Preliminary results indicated that specific humidity bias results show very small, though generally positive biases (0.1 to 0.2 g/kg) from the surface up to nearly 800 hpa. Above that level, the bias increases to between 0.2 and 0.4 g/kg. The Commission expressed a need in documenting and archiving these and other test results for future analysis and comparison.

11. The future plans for the WVSSII sensor include monitoring of its performance on installed aircraft under real-world conditions to validate sensor availability and performance. The manufacturer, Spectra Sensors will be implementing planned product improvements to the currently deployed 25 sensors. Once the operational deployment reaches 150 aircraft, model sensitivity experiments will be conducted to measure the improvement to the analysis and prediction of atmospheric moisture and related parameters such as quantitative precipitation and icing forecasts.

12. Once the AMDAR Panel determines that the WVSSII water vapor sensor has successfully completed its qualification testing, the ET-UASI is prepared to provide assistance in conducting a field Intercomparison WVSSII and radiosondes as well as other remote sensing instruments deemed ready for evaluation by the ET Remote Sensing Upper-Air Technology and Techniques.

13. Mr Tim Oakley reviewed the current Common Code Table C-2 “Radiosonde/sounding systems used” and identified those radiosonde descriptors that were obsolete. This was to allow new radiosonde designs to be added to the code table. It was expected this code table would be used for BUFR messages and later versions would be more detailed. At the most recent joint meeting of the Coordination Team on Migration to Table Driven Code Forms and the Expert Team on Data Representation, Mr F. Branski reported that HMEI had agreed to BUFR templates for TEMP code.

14. Mr David Franc provided support in developing an International Telecommunications Union-Radio Communication sector (ITU-R) recommendation on sharing the band 1670-1700 MHz between radiosondes and meteorological satellite (METSAT) downlinks. Interference from radiosondes into the METSAT downlinks has been a problem due to uncoordinated use of the band by both users. The recommendation, approved by the ITU, specifies that radiosonde operators should strive to limit their operations to the sub-band 1675-1683 MHz, and meteorological satellite operations should be conducted in 1683-1710 MHz. No new required

actions have been identified to improve coordination with other users of the meteorological spectrum.

15. The International Telecommunication Union has relied on the CBS Steering Group on Radio-Frequency Coordination (SG-RFC) to provide the information necessary for updates to radiosonde system characteristics and operational practices and ITU-R recommendations, however, the ET/UGRN provided valuable input to the SG-RFC, resulting in the updates being completed in late 2005. The next required review and update to the recommendations are scheduled for 2008-2009 timeframe.

16. The efforts are currently underway around the world to develop radiosonde transmitter and receiver standards. To date there has been no attempt to develop a common standard for use by all WMO Members. A workshop was proposed to initiate developing a standard for spectrally efficient radiosondes; taking into account Members resources and requirements. The need for different standards for various parts of the world was also to be considered, but no further action has been taken on holding the workshop. To date, Europe appears to be well ahead of other parts of the world in implementing radiosonde transmitter standards.

17. Mr Franc monitored ITU reports that currently indicate no threat to radiosonde spectrum allocations that would require guidance on addressing the threat. The most important issues to be addressed with members at this time are radiosonde spectral efficiency, and ensuring compatibility between radiosonde and meteorological satellite operations.

18. Members of the ET-UGRN and ET-UASI participated in several meetings with the climate community to discuss radiosonde performance and concerns over perceived shortcomings in the current measurement network. The climate community defined its requirements for upper-air data at the initial meeting conducted in 2005 and has presented them to CIMO and the manufacturers. CIMO participants presented proposals for the use of high quality radiosondes as working references in future networks as well as a mechanism in identifying reference methods and reference instruments. The preliminary results of these meetings were discussed at a meeting between the CIMO Management Group and GCOS Secretariat. The OPAG-UPPER-AIR will continue its coordination with GCOS and provide annual reports to the president on their activities.

AGENDA ITEM 5.2 – UPPER-AIR SYSTEMS INTERCOMPARISONS

CIMO-XIV/Rep. 5.2

Upper-Air Systems Intercomparisons

1. The Expert Team on Upper-Air Systems Intercomparisons (ET-UASI) reviewed reports of recent radiosonde testing worldwide, before recommending that the next WMO Radiosonde Intercomparison be designated for High Quality (HQ) Radiosonde Systems. It recognized that not all radiosonde systems in the world were ready for intercomparison in 2005 and recommended that some requirements for testing upper-air systems suggested by CIMO-XIII be addressed independent of the Intercomparison of HQ Radiosonde Systems.

2. The ET-UASI suggested that a standard for HQ radiosonde was temperature uncertainty less than 0.3 K (all heights), relative humidity uncertainty less than 5 per cent (temperatures down to –60 ºC in the troposphere), and uncertainty in winds less than 0.5 ms-1 (all heights).

3. The International Organizing Committee on Upper-Air Systems Intercomparisons (IOCUASI) was established. The ET/IOC-UASI defined objectives of the WMO Intercomparison of HQ Radiosonde Systems, established a WMO Project Team comprising the ET/IOC-UASI

Chairman, Project Manager, Radiosonde Comparison Expert and Data Manager, supported by the local support staff. It developed a new strategy for publication of results to address the concern of manufacturers with the length of time to achieve publication of results and agreed on conditions for participation, intercomparison rules and responsibility of host and participants.

4. At the kind invitation from the government of Mauritius, the WMO Intercomparison of HQ Radiosonde Systems was held in Vacoas, Mauritius from 2 to 25 February 2005. Dr Beenay Pathack (Mauritius), the Project Manager, was responsible for managing the local organization of the intercomparison, including the import of all the necessary systems and consumables, and in providing the infrastructure needed for participants.

5. The collaboration was established with the Hydro-Meteorological Equipment Industry Association (HMEI) to identify extrabudgetary resources for the intercomparison as well as with the European Cooperation in the filed of Scientific and Technical Research (COST) and its project COST-720 to complement the WMO Intercomparison by providing remote sensing instruments and operating staff. This proved to be beneficial to all parties.

6. Six operational radiosonde systems (Vaisala Oyj, Lockheed-Martin-Sippican, Modem, MEISEI Electric Co., Graw Radiosondes and Meteolabor) participated in the intercomparison, which consisted of 62 successful comparison flights. In addition Sippican MKII, multi-thermistor radiosondes were flown to provide a daytime “working reference” for temperature and the Snowwhite chilled mirror hygrometer as a “working reference” for dewpoint/relative humidity. The division of radiosonde systems into two groups was necessary because of the poor radiofrequency performance of two radiosondes. To optimize resources, radiosondes in future intercomparisons should have stable narrow band transmitters to fly seven or eight radiosondes together in one rig.

7. The Mauritius Meteorological Services (MMS) provided 16 support staff for the intercomparison. These individuals were trained, including training in balloon handling, and supervised by the Project Team. New support staff was introduced each week to allow a wider group to benefit from interaction with the Project Team. MMS’s observation capability benefited both in terms of improved radiosonde operational infrastructure and improved operational procedures. The MMS acknowledged the benefit in terms of capacity building, through the utilizing local staff in conducting the intercomparison.

8. Data acquisition, processing, analysis and archiving were performed using WRSKOMP software that is becoming a standard for the WMO radiosonde intercomparisons. Although data samples were sent to the Data Manger in advance, most manufacturers had modified their databases in Mauritius causing compatibility problems with the intercomparison database. If data processing costs are to be minimized, manufacturers must agree to a standard archive format for intercomparison database.

9. The intercomparison demonstrated that all participating radiosondes merit designation as HQ radiosondes. In particular, the wind measurements from all GPS radiosonde systems were of high quality and good availability with very little missing data. The GPS radiosondes were easier to prepare for use than in the previous WMO intercomparison conducted in Brazil in 2001. The geopotential heights derived from GPS measurements of geometric height were found to be of very good quality. The reproducibility of the GPS height was similar to reproducibility of geopotential height produced by the best pressure sensor in the lower troposphere and better reproducibility than pressure sensor geopotential heights in the stratosphere. This has the consequence that a modern GPS radiosonde does not need to have a pressure sensor. This allows some manufacturers of GPS radiosondes to offer GPS radiosondes that are cheaper than those currently used.

10. The temperature measurements of participating radiosondes agreed more closely than in the previous intercomparison in Brazil. At night, most temperature measurements were on average

within ± 0.2 K of the consensus reference. In daytime, the range of measurements was similar to those found at night in the troposphere, but in the stratosphere the spread of measurements was much larger with measurements falling on average within ± 0.5 K of the consensus reference. The reproducibility of daytime temperatures was much lower than at night. In nearly all cases the manufacturers need to improve the exposure of temperature sensors for daytime measurements to avoid heat contamination from the sensor supports or support framework. There is still room to improve the quality of daytime measurements without major modification to most radiosonde designs.

11. Only one radiosonde temperature sensor flown in Mauritius was painted white (white paint is usually black in the infrared). This particular temperature sensor had very large negative temperature errors at heights around 30 km at night. The relevant manufacturer is now in the process of changing the coating. All manufacturers are urged to avoid the use of white paint on temperature sensors, because of the complexity and magnitude of the associated infrared radiation errors.

12. The Mauritius intercomparison had shown significant progress in the quality of radiosonde Relative Humidity (RH) measurements at night, with the two best radiosonde sensors agreeing to within ± 2 per cent RH from the surface to 14 km [-70°c] over the wide range of RH encountered in the intercomparison. With some radiosonde designs large positive bias occurred at night, suggesting that night time measurements could suffer from water/ice contamination with the particular exposure of some of the sensors.

13. There was clear evidence that most radiosonde RH measurements were not consistent in quality between daytime and night-time conditions, systematic bias as high as -20 per cent RH was present in many radiosonde types. The manufacturers should address the issue of daytime measurement quality seriously, since this had now become the limiting factor in the water vapour measurement quality of most operational radiosondes.

14. The weather conditions in Mauritius were more challenging for radiosonde measurements than in the previous WMO Intercomparison of GPS Radiosondes in Brazil (2001). Rain impacted many more flights; however, the intercomparison data set obtained was larger than in Brazil, with the differences between radiosonde sensors more consistent in the vertical. The balloon burst heights obtained in Mauritius were higher than in Brazil although variable surface winds made launching the comparison rigs difficult.

15. The objectives of the intercomparison in Mauritius were achieved. Nevertheless, there are some lessons learned and the resource planning for future radiosonde intercomparison needs to be improved and guidance material for conducting radiosonde intercomparisons be modified to emphasize improved resource planning. Those are as follows:

i. It was recognized that the composition of the Project Team was inadequate for the workload experienced during the first week of the test and that additional trained personnel would be necessary for future intercomparisons. During the first week of the intercomparison most senior engineers from the radiosonde companies were present at the intercomparison site. The ET/IOC-UASI chairman was required to provide consultations each day with the engineers, as well as to direct the intercomparison. Two additional Radiosonde Comparison Experts were needed to manage the intercomparisons and they arrived at the start of the second week, supported by the COST-720;

ii. More than one HMEI member found difficulties in financing the operation of their radiosonde throughout the entire intercomparison period. In future, the cost of the intercomparisons to manufacturers should be minimized, possibly by using local staff to operate all radiosonde systems for a part of the intercomparison;

iii. Intercomparisons require sufficient and regular supply of filling gas. The new hydrogen generator donated by GCOS and installed in Vacoas a few weeks before the intercomparison solved the outstanding logistics problem;

iv. Real time quality checking of intercomparison measurements identified limitations in most radiosonde types, which required resubmission or reprocessing of data to eliminate identified errors. All reprocessing of data required the approval of the ET/IOC-UASI chairman. Faults included errors in conversion of GPS heights to geopotential heights and incorrect radiation corrections for temperature measurements, many due to incorrect local time within the ground system. The rectification of these faults in the system software should ensure correct performance in subsequent operational use of the radiosonde system worldwide. All multi-thermistor radiosonde measurements were reprocessed at least once because of errors in software originally supplied for processing by the manufacturer. Resolving these problems more than doubled the workload of the Project Team, both during the intercomparison and in the followed analysis;

v. The achieving of a consensus between manufacturers and the ET/IOC-UASI on the final report of the intercomparison was not a simple process. In practice, two preliminary reports summarizing the results from the intercomparison were prepared. The first preliminary report was presented at TECO-2005, Bucharest, Romania, in May 2005, and the presentation of results was discussed individually with each of the manufacturers. The second report was presented at the AMS Instrument and Methods of Observation Symposium, Savannah, Georgia, in June 2005. These preliminary reports led to rapid initiation of development efforts to eliminate or identify the origin of outstanding measurement problems identified during the intercomparison. Although beneficial, this required a substantial effort by the Project Team to inform and advise participants. The ET/IOC-UASI had not anticipated this level of effort.

16. The final report of the WMO Intercomparison of HQ Radiosonde Systems, Mauritius, had been available from the WMO Website since February 2006, less than a year after the completion of the fieldwork. The report had been peer reviewed by a second meeting of the ET/IOC-UASI, Geneva, November 2005 and is available as IOM Report No. 83, WMO/TD-No. 1303. Information from the Intercomparison was used to update the Seventh edition of the CIMO Guide.

17. The GCOS had requested advice from CIMO on a suitable method of providing reference quality temperature measurements. The ET/IOC-UASI has recommended that suitable quality could be obtained by flying two different high quality operational radiosondes from a given reference site. The two most suitable radiosonde types from the intercomparison in Mauritius were the Vaisala RS92-SGP and Sippican IMS-5. However, it was also recognized that several of the other radiosonde types tested in Mauritius would soon be modified to produce measurements of similar quality to Vaisala and Sippican. Another option for consideration is to use a multi-thermistor radiosonde such as the Sippican multi-thermistor radiosonde used in Mauritius or the NASA ATM.
The two types of radiosondes from different manufacturers could be flown together to establish systematic differences between radiosonde types, but also could be launched individually within an hour, thus giving a more representative sample of the atmospheric temperature profile near the launch site. This would provide a suitable reference option for future upper-air climate reference network.

18. The ET-UASI developed and applied performance measures to demonstrate the improvement in the quality of upper-air observations as WMO radiosonde intercomparisons have progressed.

19. The ET-UASI took responsibility for investigating the feasibility and usefulness of interoperable upper-air systems. It supervised the demonstration test of the 1680 MHz interoperable upper-air system “IMS-1600 - Integrated Upper-air System” from Inter Met (USA), Dar Es Salaam, Tanzania, 18-30 October 2004. An extensive training on operation of upper-air systems was also provided to Tanzania NMS. The results (available at the CIMO/IMOP Website) were encouraging and two more systems were subsequently installed in Africa. Members of HMEI were requested to provide a report on the usefulness of interoperable systems. A formal report on the interoperability was produced by the HMEI representing a majority view, but also a minority view. Details are presented to CIMO -XIV in the information document CIMO -XIV/INF. 4. This was a complex issue and individual members would need to consider very carefully the advantages and disadvantages for their own situation.

AGENDA ITEM 5.3 – REMOTE SENSING UPPER-AIR TECHNOLOGY AND TECHNIQUES

CIMO-XIV/Rep. 5.3

Remote Sensing Upper-Air Technology and Techniques

1. The Expert Team on Remote Sensing Upper-Air Technology and Techniques (ET-RSUT&T) reviewed progress in developing networks of ground-based GPS water vapour measurements, practices applied and techniques used in validating their performance. Several ET-RSUT&T members participated in the European cooperation in the field of science and technological research (COST) Project 716 “Exploitation of ground-based GPS for operational numerical weather prediction and climate applications”. The COST-716 demonstration experiment showed that although data were of varying quality, there had been continuous improvement in meeting the operational requirements and more than 400 sites were delivering data to the central collection site. The project also developed reasonable representation format in a BUFR, approved by WMO. COST-716 stimulated development of the follow-up projects, such as the EUMETNET GPS water vapour programme (E-GVAP) that is aimed at providing its EUMETNET partners with European GPS delay and water vapour measurements for operational meteorology. A key goal of E-GVAP is to improve the quality, homogeneity and stability of the ground based GPS near-real time (NRT) delay data to meet the user requirements and to transfer COST-716 water vapour network from research funding to operational service.

2. Some non-European Members use GPS derived Integrated Water Vapor (GPS-IWV) in NRT and their applications vary from being used to compliment operational radiosondes to using measurements as a proxy for moisture soundings in Numerical Weather Prediction (NWP). Networks operated and maintained by commercial companies, government agencies or universities, deliver a large portion of the measurements used by Members. Some of these networks have been established or expanded in cooperation with National Meteorological Services. These measurements have found application in operational weather forecasting, climate monitoring, atmospheric research, as well as satellite calibration and validation.

3. GPS-IWV data have proven to provide high temporal resolution when compared with conventional measurements. However, IWV from GPS MET only provides an integrated value of the profile. The vertical information of water vapor can be retrieved from GPS-derived slant water vapor (SWV) and tomography techniques. GPS-IWV has a potential to provide a cost-effective approach to measuring atmospheric water vapor.

4. Mr Siebren de Haan (The Netherlands) conducted a survey of 14 countries using GPS technology and prepared a report on national and regional operational procedures for GPS water vapour networks and agreed upon international procedures. The results are being published in an IOM Report No. 92 WMO/TD-No. 1340.

5. The ET-RSUT&T reviewed the status of remotely sensed upper wind measurements with a view to make suggestions on improving their quality and availability. This was done through the reports under the IOM series reports, namely Operational Aspects of Wind Profiler Radars by J Dibbern (Germany) et al., IOM report No. 79, WMO/TD-No. 1196, and Operational Aspects of Different Ground-Based Remote Sensing Observing Techniques for Vertical Profiling of Temperature, Wind, Humidity and Cloud Structure, by E.N. Kadygrov (Russian Federation), IOM Report No. 89, WMO/TD-No. 1309.

6. There are around 200 wind profiler radars (WPR) operated worldwide by NHMSs, universities, research institutes and other agencies. Different operational networks exist around the world. In Europe, the EUMETNET WINPROF Programme (developing further the COST-76 Project) is aimed at maintaining the CWINDE (Coordinated wind profiler network in Europe) network and at developing it further towards operations. There are 22 WPRs networked to CWINDE. Some European countries are continuing to install further WPRs as part of their operational upper-air network. CWINDE has been receiving wind profile data also from other systems, like conventional Doppler weather radars using the VAD/VVP technique (about 80 sites) and sodars (2 sites). These data are evaluated as well, using the existing WINPROF infrastructure. The WPR data are mainly used by major NWP centres in Europe in their operational data assimilation.

7. In the USA, the NOAA Profiler Network (NPN) has some 35 systems operating at 404 MHz and 449 MHz. NOAA-FSL (Forecast Systems Laboratory) in a project with other agencies owning profilers acquire boundary layer profiler wind and temperature data from about 65 profilers collected by the Profiler Control Centre and processed into hourly, quality-controlled products.

8. In Japan the Japan Meteorological Agency (JMA) has an operational network of more than 30 systems operated at 1.357 GHz. The WPRs were installed throughout the Japanese islands with a control center at Tokyo, where after quality control of the data, the Doppler velocities obtained every 10 minutes at each site were translated into wind vectors. The JMA was also planning further improvement of the spatial resolution of the profiler network.

9. Special emphasis is being placed by operators of WPRs on improving the standard signal processing with the aim of improving the system performance characteristics such as data accuracy and availability under all meteorological conditions. At present many of WPR networks show a technical reliability of about 98 percent and provide data up to 12 km in height, depending on frequency, with data availability greater than 70 percent. Depending on profiler type, frequency used, pulse length, vertical resolution, etc., the maximum measuring height may be as high as 16 km, however, with the data availability progressively reduced. The JMA is experiencing variations in height coverage due to seasonal variation. For example, in the summer the JMA network provides height coverage between 6 and 7 km and during the winter season only between 3 and 4 km. This seasonal variation was determined to be the result in the seasonal difference in water vapor in the lower troposphere.

10. The numerous regional experiments were conducted with various tropospheric WPRs to determine their operational suitability. These experiments have shown that WPR direction and speed detected by these systems compare favorably with radiosonde profiles. These results have led to high space- and time-resolution wind measurements suitable for weather warnings, watches, and NWP and have produced improvements in forecast and warning accuracy as well as statistical improvements in NWP model output. Some NMHSs assimilate these data into the NWP model, use these data in weather nowcasting, use data in an integrated fashion to complement their radiosonde network providing improvements to atmospheric profiling, and used in support of airport safety. In future, the ET-RSUT&T would concentrate on guidelines for the operation, calibration and maintenance of WPRs to be incorporated into the CIMO Guide.

11. In a large number of countries various types of radar or radar networks are in operational use. They are used for severe weather and precipitation measurement and in some regions measurements are being prepared for assimilation into regional numerical weather prediction models. Members reported that they have either completed the upgrading of their radar network or will be upgrading their radar network with Doppler radar systems. Many of the members made reference to the extensive use of the Doppler radars for nowcasting and the use of velocity azimuth display (VAD) wind profiles as one element in identifying severe weather environments.

12. The advances in Doppler radar technology and improvements in algorithms have proven the value of the system not only in localized severe weather situations, but also in examining larger scale systems such as tropical cyclones and their application to the investigation of the lower atmosphere for lower and middle level wind shear. For this reason alone some national agencies have positioned Doppler radars at or near airports. Independent investigations of Doppler radars have documented the accuracy of wind speed measurements to be accurate within 1m/s, and wind direction accuracy to 10 degrees. Doppler radars are used for wind calibration but also calibration of rainfall mapping as well as complementary technology to surface rain gauge networks and satellite rainfall estimates. Considerable processing is required to produce rainfall mapping and this is still evolving. Such techniques allow the forecaster to provide accurate precipitation nowcasts up to an hour and short-term precipitation forecasts up to 6 hours in combination with Numerical Weather Prediction.

13. The Doppler radar systems have proven their potential as an additional tool for nowcast purposes. The technical and operational advances make this system suitable for deployment in national or regional networks. NWP data assimilation systems emphasize the need for estimates of uncertainty of the radar data that are consistent within and across national boundaries. The ET-RSUAT&T members are collecting information in order to develop a Practioner's Guide to Radar Systems containing guidelines for the operation, calibration, and maintenance of radar systems. This would be included in the future work programme of the team.

14. In a few countries advanced dual polarization radars are in the process of moving from the development stage towards operational use. Dual polarization offers more accurate rainfall estimates, since the polarization measurements remove some of the uncertainty in the relationship between radar signal and precipitation rate. It also offers improved quality control by discriminating some sources of spurious signals.

15. The ET reviewed national and regional lightning detection projects and networks and addressed the issue of the compatibility of lightning detection systems (LDS) and conventional in-situ observation. From review of LDS systems used in Asia, Europe, North and South America, it became clear that networks were using various techniques, sensor types and the quality of network measurements varied between networks. Despite the number of regional networks much of Asia, Africa, India and South America are still poorly covered. Lightning detection networks would be easily extended to other national or regional areas. For example, the UK indicated that a few additional sensors in the southern hemisphere would extend their coverage to Africa and India.

16. The performance of LDS may vary from 70 to 90 percent at an accuracy of around 2 km depending on range, location and season, during the winter, 30 to 60 percent, and summer, 80 to 90 percent. Technical difficulties for many of these systems have been resolved, but the effects of propagation and topography still remain an issue for many regions.

17. Most of the existing networks are heterogeneous, either LF, VLF, or both. Few manufacturers have combined LF/VHF networks to detect both cloud-to-cloud and cloud-to-ground lightning within one network. The technology to identify both cloud-to-cloud and cloud-to-ground lightning currently exists, but the majority of systems measure cloud-to-ground lightning only.

18. The ET-RSUT&T is of the opinion that LDS network performance needs to be verified at several levels; these include detection efficiency, peak current estimates and location accuracy. Methods including independent measurements should be applied as much as possible as well as conducting inter-system comparisons should be encouraged at both national and regional levels. Any of the following methods independently or in combination could be used to verify performance. The different methods include instrumented towers, rocket triggered lightning, video camera studies and network intercomparisons.

19. There is a potential for integrating remote-sensing systems to improve vertical resolution, vertical coverage and/or data quality thereby improving measurement of meteorological parameters such as wind, temperature, humidity or cloud parameter. The ET-RSUT&T had compiled a list of recent and ongoing projects examining integration of ground-based observing techniques available for members to review. This list can be found in the final report of the ET-RSUT&T, Geneva, 14-17 March 2006.

20. The members of the ET-RSUT&T participated in the COST-720 "Integrated Ground-Based Remote-Sensing Stations for Atmospheric Profiling". Its main objective was the development of integrated ground-based remote-sensing stations for atmospheric profiling and the assessment of their use for meteorological analysis and forecast as well as climate research and climate monitoring. During the project extensive experiments were made, such as TUC (Temperature humidity and cloud profiling experiment, Payerne, Switzerland, 2003-2004) and LAUNCH (International Lindenberg campaign for assessment of humidity and cloud profiling systems and its impact on high-resolution modelling, Germany, 2005). Their objectives were to assess the new remote-sensing techniques and/or algorithms for remote sensing of basic parameters (in particular temperature, humidity and winds), to improve their quality and resolution and to supply a dataset for the NWP experimentation and a study of remote-sensing systems integration.

21. Weather forecasting and the prediction of climate change rely to a large extent on the results of numerical simulations. The development of new parameterization schemes and the operational validation of process representation in NWP and climate models require high-quality surface and upper-air measurements at the same time and location. For various reasons, the satellite data are insufficient to perform this task. However, continuous measurement of relevant parameters can be accomplished from multiple coordinated ground-based atmospheric observatories. Such measurements are currently performed at a number of advanced atmospheric observatories. As a follow-up of COST-720 project, preparations started to integrate existing European atmospheric observatories into one coordinated network of advanced ground-based observational facilities equipped with remote-sensing and in-situ instruments needed to characterize the state of the atmosphere, the vertical profile of clouds and radiative properties and interaction with the land surface, for supply of operational and reference data for NWP evaluation and for the development of improved parameterizations of these processes.

22. The ET-RSUT&T investigated radiofrequency demand and found that due to the increasing demand on the radiofrequency portion of the spectrum in which meteorological instruments operate the pressure is more or less constant on these frequency bands. They are particularly attractive to other users such as satellite operators because they are almost always allocated on a worldwide basis and not regionally. The ET-RSU&T would continue to monitor the problems related to frequency allocation for wind profilers and weather radars; as adopted by WRC-2003, and also related to national radio-frequency administration policy and procedures. The ET-RSUT&T through its collaboration with ET-UGRN will prepare information for input to the ITU-R in coordination with the CBS SG-RFC. However, there continues to be a threat to other surfaced remote sensing systems. The ET-RSUT&T would continue to gather more information on active radiofrequency system licensing. For a number of years, WMO has kept a database of satellite-based passive systems; at present there is no inventory of surface-based radiometers, making it difficult to argue for protecting certain bands for passive observations.

AGENDA ITEM 6.1 – EDUCATION AND TRAINING, CAPACITY BUILDING

TRAINING ACTIVITIES AND TRAINING MATERIALS

CIMO-XIV/Rep. 6.1

1. The Expert Team on Training Activities and Training Material (ET-TA&TM) coordinated the implementation of CIMO training and capacity building activities. In doing so it collaborated with the relevant CIMO expert teams and Members from whom expertise was needed to prepare training materials for the various training events.

2. The CIMO Management Group (MG) had identified two significant gaps in the operational practice of NMHSs in the area of: (a) upper-air observations; and (b) metrology and calibration. It requested the chairperson of the ET-TA&TM to initiate preparation of two training modules with the objective to strengthen the operational practices of Members through implementation of those modules in all WMO Regions. The CIMO MG also requested to include, as far as possible, Regional Instrument Centres (RICs) in the preparation, hosting and conducting of the training activities.

Training Workshops on Upper-air Observations

3. Three Training Workshops on Upper-air Observations were held during the intersessional period. The workshop for RA I (Africa) English-speaking countries was hosted by the Botswana Meteorological Service in Gaborone, 7-11 April 2003, the Workshop for RA I (Africa) French-speaking countries was hosted by the Morocco Meteorological Service in Casablanca, 1-5 December 2003, and the Workshop for RA III (South America) was hosted by the National Meteorological Service of Argentina in Buenos Aires, 8-12 May 2006.

4. Thirty-four trainees from 20 countries participated in the Botswana Workshop, 21 participants from 19 countries in the Morocco Workshop and 13 participants from 10 countries in the Argentina Workshop.

5. The training workshops were aimed at improving the knowledge and skills of senior operational personnel in charge of the national upper-air networks. They had both theoretical and practical lessons. The theory was conducted in the training premises and the practical lessons at the local upper-air stations.

6. The theory covered topics, such as basic introduction to radiosonde soundings and all preparatory activities prior to the launching of radiosondes. The practical work dealt with all activities during and after the radiosonde launch. A number of individual or twin radiosondes flights were launched during the demonstrations. Review of the presently used technology was complemented by information on possible future systems, such as wind profilers, RASS, GPS total water vapour, and radiometers.

7. The workshops also addressed the operational problems experienced in RA I and RA III through country reports presented by the participants. Representatives of the Hydro-Meteorological Industry Association (HMEI) made suggestions on how to solve pertinent problems and on how to best optimize the equipment performance under the particular conditions of the countries concerned.

8. The host countries provided the necessary infrastructure for the successful outcome of the workshops complemented by additional ground upper-air systems, radiosondes and other consumables for the practical training from the Inter Met System (USA), Modem (France) and Vaisala Oyj (Finland).

9. Experts from the UK Met Office prepared master training lecture notes for the workshops. They were further complemented by individual lectures from the USA NWS Training Centre, Météo-France, MétéoSuisse, the Meteorological Service of Canada (MSC), Botswana Meteorological Service, Morocco Meteorological Service, the National Meteorological Service of Argentina and by the representatives of the HMEI.

10. The UK Met Office provided three lecturers for Botswana and three for the Argentina workshop; USA NWS provided one lecture for Botswana and one for the Argentina workshop; and Météo-France, MétéoSuisse and MSC each provided one lecturer for the Morocco training. Lecturers from host countries complemented the WMO lecturing teams, especially in practical training.

11. The fruitful dialog set-up between lecturers and participants led to a better understanding of the needs and requirements in terms of operation, maintenance and procurement of instruments as well as training relevant to upper-air observations under the particular conditions of countries in RA I and RA III.

12. A set of the guidance and training material was provided to participants on a CD to assist them in the follow-up training at national level and is available in the WMO Secretariat on request.

Training Workshops on Metrology

13. The Training Workshop on Metrology for the RICs was held in Trappes, France from 17 to 21 October 2005. Twenty participants from 12 RICs participated at the workshop. The focus of training was to improve the knowledge base of the RIC operational staff in the area of basic metrology principles, measurement techniques and calibration of basic instruments and instrument comparisons. The workshop consisted of both theory, which was conducted in the classroom, and practical lessons, which were carried out in the laboratories of the RIC Trappes. In addition, every participant gave a presentation detailing the last five years of RIC operation. At the end of the training, the trainees were expected to extend their newly acquired knowledge to their respective RIC staff. Météo-France not only hosted the workshop but its experts developed master training lecture notes and provided two lecturers for the training event. Training material for Metrology and calibration is published as the Instruments and Observing Methods (IOM) Report No. 86, WMO/TD-No. 1306.

14. The Training Workshop on Metrology for RA I English-speaking countries was carried out in Cairo, Egypt from 22 to 26 April 2006. Twenty-two participants from 21 countries that participated at the workshop showed a great deal of dedication, enthusiasm and will to learn and to know more about the basic metrology principles, calibration practices and traceability of measurements to the International System of units for the benefit of their own country, the Region and the whole meteorological community. Classroom theoretical lessons were followed with practical lessons; conducted in the laboratories of the RIC Egypt. Météo-France, the Australian Bureau of Meteorology and the Environmental Agency of Slovenia each provided one lecturer for the workshop complemented by the trainers from the RIC and Regional Meteorological Training Centre (RMTC) Cairo.

15. The Training Workshop on Metrology for RA VI South Eastern part of Europe was conducted in Ljubljana, Slovenia, 10-11 April 2006 and the Training Workshop on Metrology for RA VI Central and Eastern part of Europe in Bratislava, Slovakia, 12-13 April 2006. Twenty-two participants from 18 countries participated at the two workshops. The aim of the workshops was the same as previous workshops, to provide operational field staff instrument maintenance and calibration training. The training also covered basic metrology principles and explored current client services. Participants presented papers and participated in open dialogue on issues enhancing the exchange of information and promoting the traceability of measurements to SI standards. Météo-France, the Environmental Agency of Slovenia and the Slovak

Hydrometeorological Institute provided lecturers for the workshop complemented by trainers from the National Metrology Institutes of Slovakia and Slovenia.

Other Training Activities

16. The Training Workshop and the Symposium on Meteorological Radiometry and Atmospheric Radiation for the Regional Radiation Centres (RRCs) and National Radiation Centres (NRC) participating in the Tenth International Pyrheliometer Comparison and conjointly held Regional Pyrheliometer Comparison (RPC) was hosted by the World Radiation Centre (WRC) Davos, Switzerland, 26 September-14 October 2005. Seventy-two participants from 16 RRCs and 23 NRCs as well as the World Radiation Data Center and eleven institutions and manufacturers took part in the workshop and the symposium. The WRC and RRCs of developed countries provided lecturers for the workshop and seminar. Their aim was to promote high quality solar radiation measurements in all national networks and to increase knowledge on conducting pyrheliometer comparisons. The training material is available on request at the PMOD/WRC Website.

17. The Turkish State Meteorological Service and its RMTC Alanya, in coordination with ET-TA&TM, conducted Training on Automated Weather Observing Systems (AWOS), Alanya, Turkey, 6-10 June 2005. The objective of training was to provide instruction to trainees on basic features of AWOSs, how it operates and how to maintain an AWOS or an AWOS network. The RMTC Alanya provided four lecturers. The training was attended by participants from twelve countries. Course contents included understanding an AWOS system, the basic principles for data acquisition, communication, data processing, maintenance and trouble-shooting. Quality management of AWOS networks was also discussed during training. Participants were given practical training and provided textbooks. Training material on AWOSs is published as the IOM Report No. 87, WMO/TD No.-1307.

18. The Turkish State Meteorological Service and its RMTC Alanya, in coordination with ET-TA&TM, conducted Training on Weather Radars, Alanya, Turkey, 12-16 September 2005. The objective of the training was to provide basic information on meteorological radars including operation, and basic maintenance. The course had nine participants from eight countries. Course content included basics of weather radar, radar types, systems and radar networks, radar receivers and transmitters, antenna radar control processor and signal processor, radar products, scanning strategies, radar product application, calibration techniques, measurements and transmitter measurements on receiver, antenna and radome, maintenance software and radar site selection. In addition to lecturers from RMTC Alanya, the radar manufacturers supported the training; Barron Services (USA), Gematronik (Germany), Metstar (People's Republic of China), Mitsubishi (Japan), Esdas (Turkey), and Vaisala (Finland). Training material on Weather Radar Systems is published as the IOM Report No. 88, WMO/TD-No. 1308.

Other Capacity Building Activities

TECO and METEOREX

19. The WMO Technical Conference on Meteorological and Environmental Instruments and Methods of Observation (TECO-2005) and the Exhibition on Meteorological Instruments, Related Equipment and Services (METEOREX-2005) were hosted by the National Meteorological Administration (NMA) in Bucharest, Romania, from 4 to 7 May 2005. Two hundred and fifty-four experts from 71 countries participated and discussed 146 papers and posters on the subject theme of *"The Role of Instruments in the Earth Observation Systems"*. TECO-2005 papers and posters were published as IOM Report No. 82, WMO/TD-No. 1265. At METEOREX-2005, 64 manufacturers presented their products and new technical solutions for measurements and observing systems. It offered a unique opportunity for the exchange of experience and knowledge

to experts of Meteorological Services and representatives of the private instrument sector. METEOREX-2005 also provided a welcome opportunity to enhance the collaboration between instrument manufacturers, HMEI and WMO.

Instruments and Observing Methods (IOM) Reports

20. Significant assistance to Members in strengthening their capacity building and operational capabilities was provided through IOM Reports and the WMO *Guide to Meteorological Instruments and Methods of Observation*, WMO-No. 8. An extraordinary effort was made in the preparation of a new edition of the Guide *(see CIMO-XIV/Doc. 6.3)*. Similarly, significant effort was made in producing IOM Reports covering various aspects of the instruments and methods of observation. Seventeen IOM Reports were published since the CIMO-XIII, marking a progress never made before.

Web Portal on Development, Maintenance and Operation of Instruments, Observing Methods and

Automatic Weather Stations

21. The Web Portal on Development, Maintenance and Operation of Instruments, Observing Methods and Automatic Weather Stations was developed in 2004 and is accessible through the CIMO/IMOP Website: http://www.wmo.int/web/www/IMOP/WebPortal-AWS/Index.html. It provides links to relevant information on instruments and methods of observation worldwide in several categories: Operational Guides and Guidelines, Siting and Exposure, Maintenance and Repair, Methods of observation, Algorithms and Procedures, QC/QA, Instrument Intercomparisons, New Sensor Developments, Papers and Presentations, Training Material, IOM Reports and other interesting links. CIMO community is invited to supply new entries to develop further the Web Portal.

22. The ET-TA&TM discussed the possibilities of preparing training materials in classical form or in computer aided learning. It found that many meteorological services are not in a position to assist in the development of training material, as they no longer provide specialized instrument training to their own staff. It was suggested that CIMO Web Portal be used more to link different sites for available training material including those of manufacturers. HMEI representatives were asked to provide such links.

Instrument Catalogue

23. The China Meteorological Administration (CMA), under the auspices of CIMO, produced the new versions of the World Meteorological Instrument Catalogue (versions 2002 and 2005). Version 2002 was distributed to Members in June 2003. Following the request of EC-LVII, the CMA developed version 2005 that is accessible from the CMA Website since April 2006: http://www.wmic.cn/en/index.asp?id=5. Underlining the importance of the Catalogue for Members, it is important to keep the Catalogue up-to-date.

Future Considerations

24. The ET-TA&TM in discussing a strategy for better addressing training needs, concluded that:

(a) Meteorological Instruments are continuously changing due to improvements in technology. Therefore, training of trainers or operational managers would enhance the knowledge and skills of the technical personnel to ensure effective operation and maintenance of the equipment as well as the quality of the observations;

(b) Simple manuals and maintenance procedures would assist the operational personnel to maintain equipment in good working condition;

(c) Manuals provided by manufacturers as well as documents like the CIMO Guide could assist the operational and technical personnel to improve their knowledge and skills in equipment maintenance. Therefor, the CIMO Guide should be regularly updated;

(d) Workshops would further enhance the confidence of the technical personnel through practical training;

(e) The WMO Compendium on meteorological instruments should be significantly updated or rewritten. Members are requested to identify potential resource persons for this task;

(f) Contract for procurement of new equipment should include technical training in order to ensure effective operational use and maintenance of the equipment,

(g) Outsourcing for instrument maintenance is one of the options used in some of the NMHSs in order to provide equipment maintenance.

25. The ET-TA&TM recommends that future training activities concentrate on completing the two training modules already developed by CIMO in all WMO Regions.

AGENDA ITEM 6.2 – REGIONAL INSTRUMENT CENTRES, QUALITY MANAGEMENT SYSTEMS AND COMMERCIAL INSTRUMENTS INITIATIVES

CIMO-XIV/Rep. 6.2

REGIONAL INSTRUMENT CENTERS, QUALITY MANAGEMENT SYSTEMS AND COMMERCIAL INSTRUMENTS INITIATIVES

1. The Expert Team on Regional Instrument Centres, Quality Management Systems and Commercial Instruments Initiatives (ET-RICs) paid particular attention to issues related to strengthening the Regional Instrument Centres (RICs), especially those located in developing countries. The preliminary evaluation of the functions and capabilities of the RICs began with analysis of the Questionnaire 4 on RICs and by identifying steps for their in-depth evaluation. These steps included developing evaluation criteria, selection of appropriate expert and plans for evaluation missions to RICs.

2. Mr J. Duvernoy (France), the recognized expert from the RIC Trappes, prepared evaluation criteria and conducted the evaluation missions in the RICs in Alger (Algeria), Cairo (Egypt), Nairobi (Kenya), Gaborone (Botswana), Buenos Aires (Argentina), Bridgetown (Barbados), San José (Costa Rica) and Manila (Phillippines). The evaluation of the RICs in Beijing (China), Tsukuba (Japan), Mount Washington (USA), Melbourne (Australia) and Trappes (France) was done through a Questionnaire developped for this purpose. The report described in detail the capabilities of each individual RIC, covering the infrastructure available, traceability of RIC’s standards to international standards, uncertainty requirements, which services could be provided to Members and proposals for further strengthening of the RICs. From the report it became clear that only a few of the RICs had traceability to recognized international standards and that uncertainty of calibration was not established by many RICs. There was a need for the establishment of standard calibration procedures to minimize differences in calibration procedures between RICs.

3. The results of the evaluation and proposals for further strengthening of the RICs were discusssed by the ET-RICs at the meeting in Geneva, 4-7 April 2006. The meeting agreed that the terms of reference (TOR) of the RICs should be updated as a first step for their further

strenghtening to reflect the current need for quality measurements and variety of their capabilities. The team decided on the following principles to be taken into account in revising the TOR:

(a) Qualification procedure based on a two level structure of the RICs. The first level establishes the basic capabilities for a 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;

(b) 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 of humidity or pressure. This should also allow for better utilization of resources and capabilities within the Region in the best interest of the Region;

(c) Traceability of calibration to recognized international standards is a precondition for the traceability of measurements to International System of Units (SI) standards;

(d) Quality Control and Quality Assurance. These would require a 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;

(e) International standards applied for calibration laboratories. This would require RICs to follow the agreed practices for calibration laboratories, including inter-laboratory comparison;

(f) 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. The ET-RICs developed the revised TOR of the RICs based on the above principles for consideration by the CIMO-XIV and for implementation by the Regional Associations.

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

(a) 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;

(b) 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;

(c) CIMO should assist the RICs in establishing the uncertainties of the calibration equipment employed in the respective laboratories;

(d) 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;

(e) 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, technical conferences and exhibitions organized by CIMO;

(f) Evaluation of capabilities and functions of a 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.

6. The ET-RICs considered the need to revise the WMO *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) (CIMO Guide), Part III, "Quality Assurance and Management of Meteorological Observing Systems" and especially Chapter 3 "Quality management". The first draft revision was done by Mr R. Gauert (Germany) as a response to Resolution 27 (Cg-XIV) defining the overall framework in areas of technical standards, quality control, and certification procedures as well as following advice of EC-LVI and EC-LVII. Mr Gauert's recommendations are under technical review by other experts and will be consider for inclusion to the next CIMO Guide update.

7. The ET-RICs developed a Questionnaire on Calibration and Maintenance to ascertain the capacity of Members' NMHSs in the areas of calibration and maintenance. The analysis of the survey confirmed that the traceability of measurements has become a critical issue in metrology of NMHSs worldwide. The team proposed that CIMO should address this issue with the highest priority.

8. The ET-RICs addressed the commercial instruments initiatives and developments through reports provided by the Hydro-Meteorological Equipment Industry Association (HMEI) mainly on new instrument developments. The HMEI agreed to provide relevant manufacturers' links on new or improved instruments to the IMOP Web Portal on Development, Maintenance and Operation of Instruments, Observing Methods and Automatic Weather Stations. The HMEI representative acknowledged the importance of the manufacturers participating in Intercomparisons. Through these intercomparisons the manufacturers learn on instrument weaknesses and can correct identified problems.

AGENDA ITEM 6.3 – GUIDE TO METEOROLOGICAL INSTRUMENTS AND METHODS OF OBSERVATION AND INFORMATION DISSEMINATION

CIMO-XIV/Rep. 6.3

THE GUIDE TO METEOROLOGICAL INSTRUMENTS AND METHODS OF OBSERVATION AND INFORMATION DISSEMINATION

1. The main task of the Expert Team on the CIMO Guide and Information Dissemination (ET-Guide) was to coordinate the revision of the WMO *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) (CIMO Guide) and the publication of its seventh edition.

2. Work on updating the CIMO Guide began in January 2002 and finished in December 2005. Forty-two experts from 17 countries prepared proposals for updating segments of 32 chapters and drafted two new chapters, providing guidelines on Urban and Road Observations. All changes and proposals were reviewed and approved by the pre-editor, Mr Ralph Pannet, then reviewed and approved by technical editors selected by the CIMO Management Group (CIMO MG) and submitted to the WMO language service for final publication. The role of the paid pre-editor, in

particular, was critical in progressing through to completion each new or updated chapter. The master version of this and previous editions are kept by the Secretariat.

3. The preliminary release of the seventh edition of the CIMO Guide was posted to the CIMO/IMOP Website in March 2006 as well as distributed to all Permanent Representatives of Member countries with WMO in May 2006 for comments. Two types of comments were received from Members: (a) minor, mostly to reflect the changes since first proposals for updates were made; and (b) significant, mostly to update those segments of the Guide that had not been reviewed. The minor changes were taken into account and preliminary release of the seventh edition of the CIMO Guide was corrected and the final version prepared for CIMO-XIV for consideration and approval. The significant comments (new proposals) will be a subject to a new evaluation by technical editors and a next update of the Guide.

4. All changes and proposals were edited electronically and submitted to the WMO language service. Difficulty was encountered due to the inability to track changes to the master copy of the sixth edition of the CIMO Guide. This was due to the editorial section working with a version of desktop publishing software, QuarkXpress, which is incompatible with the MS WORD used by CIMO editors, but still allows the versatility needed to produce WMO publications.

5. The CIMO MG at its third session, Geneva, 3-7 July 2006, reviewed the procedures for updating of the CIMO Guide and agreed that the new procedures should be based on the following assumptions:

(a) A Rapporteur on the CIMO Guide would better serve in keeping the CIMO Guide up-to-date;

(b) Updates/revisions of the Guide are initiated as soon as a sound proposal is submitted;

(c) Responsibility for updates/revisions resides with the Rapporteur on the CIMO Guide;

(d) The Rapporteur on the CIMO Guide coordinates activities with the Secretariat when addressing substantial updates/revisions, especially when a paid pre-editor is required or when a task to update/revise a particular part of the Guide is needed to be addressed by an expert requiring payment;

(e) Technical editors are selected by the relevant OPAG co-chairpersons and approved by the president of CIMO;

(f) The Rapporteur on the CIMO Guide submits updates/revisions to the Secretariat in a form of tracked text (both hard copy and electronic) of the current version. The Secretariat assures, in this way, the traceability to older versions;

(g) The CIMO president approves preliminary issue of updates/revisions on behalf of the CIMO-MG;

(h) The Permanent Representatives are requested to provide their comments to the preliminary issue. Comments are reviewed and consolidated by the technical editors in collaboration with the Rapporteur on the CIMO Guide and submitted to the CIMO president for approval;

(i) The CIMO president approves updates/revisions for publication on behalf of the Commission;

(j) The Secretariat publishes the relevant parts (pages) of the Guide as supplements;

(k) A report is provided to regular sessions of CIMO for information.

6. The current process of updating the CIMO Guide remains slow as evidenced in the time required between publishing the sixth edition in 1996 and the seventh edition in 2006. User requirements call for changes to be implemented as soon as they are needed, therefore CIMO needs to address those requirements in a timely manner and initiate the standardization process by implementing them into the CIMO Guide.

7. The ET-Guide recognized that it could not assist in the technical review of the CIMO Guide due to lack of expertise among the members of the team and had to rely on the experts identified by the CIMO MG. It therefore proposed to CIMO-XIV to consider within the future CIMO working structure a Rapporteur on the CIMO Guide, rather than an expert team, having the responsibility for future updates/revisions of the Guide.

AGENDA ITEM 7.1 – ADDITIONAL MATTERS RELATED TO THE INSTRUMENTS AND METHODS OF OBSERVATION PROGRAMME

CIMO-XIV/Rep. 7.1

Global Earth Observing System of Systems

1. Following the advice from the CIMO Management Group, the acting president of CIMO established, within the CIMO-MG structure, the GEOSS Coordinator as of 15 September 2006. Mr Rainer Dombrowsky (USA) agreed to serve as CIMO Coordinator for GEOSS.

2. CIMO-MG agreed on the following Terms of Reference of CIMO Coordinator for GEOSS:

(a) To coordinate Commission activities, across its relevant Open Programme Area Groups, related to implementation aspects of the GEOSS 10-Year Implementation Plan and advise Commission members on activities that will contribute fully to the development and implementation of GEOSS including enhanced operation of the IMOP relevant to GEOSS;

(b) To coordinate with other regional and technical commission GEOSS rapporteurs and liaise with the WMO Secretariat on relevant GEOSS activities;

(c) To coordinate with GEO through its GEO Secretariat located with the WMO Secretariat on matters relevant to the Commission and GEO;

(d) To provide the CIMO Management Group with appropriate information and recommendations on the Commission's GEOSS related activities.

3. Since making contact with GEO leadership the CIMO Coordinator for GEOSS has been added to the GEO information distribution list. Subsequently he provided CIMO input to the draft 2006 GEO implementation plan. Under the final GEO Task Document activities under the CIMO IMOP are being supported and tasked under the plan. CIMO is providing quarterly activity status reports to GEO for activities planned for 2006.

4. In 2006, the first year of GEOSS Implementation, the GEO community has engaged in impressive mobilization of activity: around 97 tasks of the 2006 Work Plan, agreed as a living document by GEO-II Plenary in December 2005. Although some concern were raised at the Plenary about the ambitious scale of the plan, it was recognized that the plan had to reflect the ambition of the 247 targets of the GEOSS 10-Year Implementation Plan reference document, and of the GEOSS enterprise itself, namely to build a system of systems drawing from the entire

community of Earth observation providers and users, encompassing all disciplines of Earth science, to serve society.

5. To date CIMO/IMOP contributions to the 2006 GEO work plan comprises relevant Instrument intercomparisons and Training and capacity building activities.

6. Instrument Intercomparisons activities refer to the WMO Field Intercomparison of RI Instruments, Vigna di Valle, Italy, mid-2007–mid-2008, and the WMO Field Intercomparison of Thermometer Screen/Shields and Humidity Measuring Instruments, Ghardaïa, Algeria, beginning 2007–beginning 2008.

7. The training and capacity building activities refer to the WMO Training Workshop on Metrology for the RA VI (South-East Europe), Ljubljana, Slovenia, 10-11 April 2006. the WMO Training Workshop on Metrology for the RA VI (Central and East Europe), Bratislava, Slovakia, 12-13 April 2006, the WMO Training Workshop on Metrology for the RA I (Africa) English-speaking countries, Cairo, Egypt, 22-26 April 2006, and to the WMO Training Workshop on Upper-Air Observations for RA III (South America), Buenos Aires, Argentina, 8-12 May 2006.

8. The CIMO Management Group participated in the first review of the 2007-2009 GEO Work Plan and is currently in the process of participating in the review of version 2 of the draft, "2007-2009 Work Plan: TOWARD CONVERGENCE". As part of the first review a list of CIMO contributing tasks for the next three years was provided to GEO Secretariat. These were derived from the TORs of the future CIMO Expert Teams proposed at CIMO MG-3.

9. New items for 2007-2009 Work Plan have been proposed by CIMO to accomplish two objectives:

- Ensure completion of the two-year targets, as well as initiation of activities to meet the six and ten-year targets, identified in the GEOSS 10-Year Implementation Plan;

- Provide opportunity for new ideas to complement and refine the existing tasks and for new groups and communities to join GEO and contribute to GEOSS implementation.

10. WMO provides important contributions to the GEOSS: the space- and ground-based components of the observing system of systems and the WWW components are among the core contributors to GEOSS. Observing and accurately predicting environment is critical for health, safety and prosperity of all nations. As the responsibilities of WMO Members increase in monitoring and forecasting for the environment, many of the subsystems that contribute to GEOSS, not part of the WWW will become more important for WMO Members.

11. The core components of GEOSS are based in, or cross-cut in some way, each of the nine societal benefit areas:

- Improving weather information, forecasting and warning;

- Reducing loss of life and property from natural and human-induced disasters;

- Improving water-resource management through better understanding of the water cycle;

- Understanding, assessing, predicting, mitigating and adapting to climate variability and change;

- Improving management and protection of terrestrial, coastal and marine ecosystems;

- Understanding environmental factors affecting human health and well-being;

- Improving management of energy resources;
- Supporting sustainable agriculture and combating desertification;
- Understanding, monitoring and conserving biodiversity.

AGENDA ITEM 7.2 – NATURAL DISASTER PREVENTION AND MITIGATION (DPM) PROGRAMME

CIMO-XIV/Rep. 7.2

1. Progress has been made with respect to the development of a new crosscutting WMO DPM Programme:

(a) Fourteenth Congress (Geneva, May 2003) through Resolution 29 decided to initiate a major crosscutting programme on Natural Disaster Prevention and Mitigation (DPM);

(b) EC-LVI (Geneva, June 2004) established the Executive Council Advisory Group on Disaster Prevention and Mitigation (EC AG DPM) providing a mechanism for review and advise on development of WMO DPM;

(c) EC-LVII (Geneva, June 2005) endorsed the recommendations of the First Meeting of the EC AG DPM (Geneva, March 2005) and adopted the Revised Implementation Plan of DPM Programme;

(d) EC-LVIII (Geneva, June 2006) established a clear crosscutting framework involving the WMO Scientific and Technical Programmes, Technical Commissions (TCs), Regional Associations (RAs) and strategic partners.

2. The DPM-related coordination structure within WMO has progressed as follows:

(a) In the Secretariat, the Steering Committee for Disaster Reduction (SCDR) has been established; involving Directors to provide guidance on crosscutting DPM related activities of their Programmes;

(b) DPM Programme Department is responsible for coordination and facilitation of the process to identify strategic priorities and related crosscutting projects and activities that are implemented through Scientific and Technical WMO Programmes, Technical Commissions, Regional Associations and partners;

(c) All WMO Scientific and Technical Departments have established DPM focal points;

(d) As of July 2006, WMO Permanent Representatives have nominated 141 National DPM focal points;

(e) As of July 2006, RAs II, IV, V and VI have established regional DPM Working Groups;

(f) As of July 2006, CBS, CAeM, and CIMO have formally designated their DPM focal points or coordinators within their Management Group. CAgM, CCl, JCOMM, and CHy have designated interim DPM focal points until a focal point is formally established through the Commission.

3. Following the recommendation of the CIMO Management Group, the acting president of CIMO established within the CIMO-MG structure, the DPM Coordinator as of 15 September 2005. Mr Rainer Dombrowsky (USA) agreed to serve as CIMO Coordinator for DPM implementation activities. The following are the Terms of Reference that were prepared by the CIMO Management Group for the Coordinator for DPM:

(a) To coordinate Commission activities, across its relevant Open Programme Area Groups, related to Natural Disaster Prevention and Mitigation (DPM) and advise Commission members on activities that will contribute fully to the DPM Programme including relevant enhanced operation of the World Weather Watch;

(b) To provide the CIMO Management Group with appropriate information and recommendations on the Commission's DPM related activities.

4. During the Second World Conference on Disaster Reduction (Hyogo, Kobe, Japan, 18-22 January 2005), 168 countries adopted the Hyogo Framework for Action 2005-2015 (HFA), providing a framework for development of disaster risk management capacities at national, regional and international levels. In HFA five main action areas have been identified for implementation, including:

(a) Ensure that disaster risk reduction (DRR) is a national and a local priority with a strong institutional basis for implementation;

(b) Identify, assess and monitor disaster risks and enhance early warnings;

(c) Use knowledge, innovation and education to build a culture of safety and resilience at all levels;

(d) Reduce the underlying risk factors;

(e) Strengthen disaster preparedness for effective response at all levels.

The fifty-seventh session of the Executive Council (June 2005) stressed that WMO and NMHSs were in an excellent position to take a leadership role at international national levels for the implementation of HFA, respectively, particularly in the second action area, while also contributing to the other four areas.

5. The implementation of HFA and a number of major disasters over the last two years have captured significant attention at the ministerial level of the need for disaster risk reduction plans at the national level. A number of developing countries have been developing national disaster risk reduction plans, built upon the existing organizational structures (e.g. NMHS), legislation, and legal framework to support the implementation. As an example, following the development of the Sri Lanka Road Map for Disaster Risk Management in which the roles and responsibilities of the National Met Service had been clearly identified, at the request of Sri Lankan government WMO organized a visit by an expert from the USA to assist the Meteorological Service to developing a modernization plan that would be aligned with the mandate of the Met Service as defined in the Sri Lanka Road Map. The Government of Sri Lanka has since appropriated some funds toward the purchase of observing instruments for the Met Service. In Pakistan similar support was provided after the tragic earthquake in 2005.

AGENDA ITEM 7.3 – WMO QUALITY MANAGEMENT FRAMEWORK

CIMO-XIV/Rep. 7.3

WMO QUALITY MANAGEMENT FRAMEWORK

1. A review of the *WMO Guide to Meteorological Instruments and Methods of Observation*, WMO-No. 8 (CIMO Guide), Part III, "Quality Assurance and Management of Meteorological Observing Systems" and especially Chapter 3 "Quality Management" is presently under revision and the outline of this chapter was discussed at the meeting of the CIMO Expert Team on Regional Instrument Centres, Quality Management Systems and Commercial Instrument Initiatives (ET-RICs), Geneva, 4-7 April 2006 *(see agenda item 6.2, CIMO-XIV/Rep. 6.2).*

2. The Executive Council (Council) asked the technical commissions (TCs) to carry out a review of their documentation as a priority activity within their regular work programmes in an attempt to identify areas of overlap and gaps. This review should rectify issues of deficiency, duplication, inconsistency, and errors; making the relevant WMO Technical Regulations, Guides and Manuals viable reference documents for use within national quality management systems (QMS). It should be noted that up to now, no concrete mechanism has been established to carry out this review; however several initiatives have been undertaken by individual Commissions, such as CIMO and CBS, which conducted a review for inconsistencies between the CIMO Guide and the *Manual* and *Guide on Global Observing Systems*.

3. Surveys on status and plans related to QMS within NMSs were carried out and revealed that many Members were implementing QMS for part or all of their activities, that a number of them had been certified according to ISO standards and that quality management (QM) was of growing relevance to Members. The surveys also showed that the overall costs for achieving ISO 9001 certification had decreased, mainly resulting from a wider availability of know-how and experience in that area, and that the pure certification (audit) costs were reported as being much lower than what was expected earlier.

4. In order to address the need of many Members for basic information on QM, WMO developed guidance material that was distributed to all Members and a Website was created with most of the available guidance material. A list of ISO certified NMSs willing to receive visitors for training was also made available and training seminars were organized in various regions.

5. EC-LVI established the Inter-Commission Task Team on Quality Management Framework (ICTT-QMF). The first meeting of the ICTT-QMF was held in Geneva, 25-27 April 2006. CIMO was represented at this meeting by Mr Guido Halbig (Germany). The meeting made several recommendations related to the further development of the WMO-QMF, which were subsequently reviewed by EC-LVIII. The ICTT-QMF was re-established by EC-LVIII with revised TOR.

6. Matters, which were discussed by EC-LVII and EC-LVIII and that are relevant to CIMO are summarized below.

7. The Council noted that QM constitutes for WMO one of the most important issues and comprises two distinct aspects: (1) an overall strategy for WMO, which would cover all WMO technical programme activities that relate to the delivery of products, data and services; and (2) the implementation of QMS by its Members.

QM for WMO as a whole

8. The Council agreed that, though quality had been at the heart of WMO's activities for years, an overall Framework for QM needed to be developed for WMO as a whole, which would

cover all WMO technical programme activities that relate to the delivery of products, data and services. This Framework would need to be launched by issuing a quality policy and specifying the role of each of the constituent bodies in the WMO QMF. This is in accordance with the previous Council decision that, in the future, QMF aspects should become an integral part of the work of the TCs. The Council supported the recommendation of the ICTT-QMF to include “quality management” at the highest level of the Technical Regulations in an independent Volume IV (Quality Management Framework) encompassing the overall WMO policy related to quality and including a chapter for each of the Commissions. A draft resolution will be prepared for next Congress on that matter.

QM for NMHSs

9. The Council felt that the implementation of QMS was critical for many NMSs to achieve the desired international visibility and credibility related to commercial competitiveness and to comply with the increasing user requests. A resolution will be prepared for the next Congress addressing the implementation of QMS by NMHSs and should: encourage NMHSs to implement a QMS following appropriate internationally recognized standards; encourage NMHSs to develop a QMS covering most of their activities; allow them to choose whether they wanted to pursue certification or not; and, in case they opted for certification, allow them to certify part, or all, of the activities covered by their QMS, as appropriate;

Relations to ISO

10. The Council decided to establish closer cooperation with the International Organization for Standardization with a view to develop a formal working agreement aimed at developing joint ISO-WMO technical standards based on WMO Technical Regulations, Manuals and Guides, which would widen the recognition of WMO standards. The objective of this agreement is not aimed at developing management standards, but technical standards. WMO would retain primary control over the development and updating of the standards, could propose its technical documentation for becoming joint-standards as appropriate, but could also retain WMO specific standards and would propose its standards at a very advanced stage of the ISO standard development process.

QM terminology

11. The Council agreed that a harmonization of the terminology related to quality and to the nomenclature of the technical guidance documents was necessary and adhered to the definitions provided in the ISO 9000:2005 standard for quality related terms. The Council furthermore requested the TCs to follow those terms in the review of their documentation.

Review of QM documentation

12. The Council requested the TCs to review their technical documentation so that Members have easy access to all the relevant valid documentation and, if appropriate, include the content of some technical documents in their guides/manuals and/or develop necessary QA/QC procedures. In that context the ICTT-QMF developed a preliminary list of the commissions’ valid technical guidance documents to be used by Members. EC recommended that this list be updated yearly by the TCs.

WMO publication policy

13. The Council supported a review of the WMO publication policy taking into account the development of the electronic technologies and agreed that it would be beneficial for Members if a CD be published on a yearly basis and distributed to all Members with the latest versions of the WMO technical documents, manuals and guides to use as reference documentation and that issuing supplements of documents in printed form should be reduced;

Capacity building activities

14. The Council endorsed the recommendation that capacity building activities addressing the implementation of QMS be best addressed through the VCP Programme, by including "Implementation of Quality Management System" as one high priority area and by promoting partnerships and cooperation rather than through a demonstration project, which could delay the availability of the information to other NMHSs, while also recognizing that the result of such a project may not be easily transferable to other NMHSs.

Certification scheme

15. As far as a WMO-own certification scheme was concerned, the conclusions from experts was that such a scheme would most likely be more expensive than ISO 9001 certification because of costs for WMO permanent staff, interpretation and travel and the requirements for neutrality and geographic balance within a WMO-own certification team.

AGENDA ITEM 7.5 – INTERNATIONAL POLAR YEAR 2007-2008 (IPY)

CIMO-XIV/Rep. 7.5

INTERNATIONAL POLAR YEAR 2007-2008

1. IPY 2007-2008 initiated by WMO and ICSU will be an intensive and internationally coordinated campaign of high quality research activities and observations in Polar Regions. Following Resolution 34 (Cg-XIV), Resolution 11 (EC-LVI) and Resolution of 28th ICSU Assembly, WMO and ICSU as lead agencies for the IPY preparation and implementation had established in November 2004 a Joint Committee (JC) for IPY. Membership of the JC includes 14 prominent scientists and representatives of IASC, ICSU, IOC, SCAR and WMO. Membership of the JC, Terms of Reference of the JC and other relevant material are available on: www.ipy.org. The JC had established three Sub-Committees: on Observations, on Data Policy and Management, and on Education, Outreach and Communications.

2. The main role of the JC is to facilitate projects and activities within IPY that are consistent with the six themes and observational initiatives outlined in the Framework for the International Polar Year 2007-2008. The official observing period of the IPY is from 1 March 2007 to 1 March 2009. The main geographic focus will be the Earth's high latitudes, but studies in any region relevant to the understanding of polar processes or phenomena will be encouraged.

3. In order to collect the information on IPY projects planned by the nations, WMO and ICSU, in November 2004, issued a call to WMO Permanent Representatives, ICSU Scientific Unions and National Committees on IPY to provide the JC with Expressions of Intent (EOI). About 1000 EOI were collected by mid-January 2005 at the International Programme Office on IPY (IPO) established by WMO and ICSU in Cambridge, UK. They have been evaluated by the JC and, as a result, all EOI proponents received a response from the JC, indicating the category of EOI and requesting to develop full proposals based on EOI by 31 January 2006.

4. In order to coordinate IPY activities within WMO, in particular among technical commissions and NMHS, EC-LVI established an Intercommission Task Group (ITG) on the IPY, chaired by Prof Qin (China). ITG membership includes representatives of CAS, CAeM, CBS, CCl, CHy, CIMO, JCOMM, and WCRP. The ITG at its first session (Geneva, 4-6 April 2005) had considered the role of technical commissions in the process of the preparation of IPY full proposals and developed a number of recommendations approved by EC-LVII to JC and technical commissions regarding ways and means for the better coordination of the IPY preparation among

NMHS, international agencies and multinational programmes. The JC at its second session (Geneva, November 2005) expressed the appreciation to the ITG for its active role in the process of preparation of full project proposals for IPY and very much welcomed the involvement of technical commissions in the development and implementation of IPY activities addressing observational data and products, data management and information services as well as education, outreach and communication.

5. In April 2006 the JC had completed an evaluation of 452 full project proposals received from nations up to 31 January 2006 for scientific or educational significance, for consistency with the IPY themes, for evidence of international collaboration, and for evidence that activities proposed would contribute to an IPY legacy. Out of these 452 project proposals the JC endorsed 218 (166 scientific proposals and 52 for education and outreach) in which 60 countries participate. A large number of NMHS had played an active role in preparation of more than half of IPY project proposals that are related to the studies of atmosphere, ocean, cryosphere and climate and planned to participate in their implementation. Considering the role of NMHS and technical commissions in IPY, EC-LVIII (June, 2006) concluded that they would play an important role during the IPY implementation when the existing elements of global observing systems which are at present within their areas of responsibility would be in use, as well as beyond IPY, when the major role of NMHS and technical commissions should be to ensure the legacy of observing systems improved or established during the IPY.

6. The CIMO Management Group at its third session (Geneva, July, 2006) has been informed on the status of IPY preparation. It provided the ITG with useful guidance, in particular with respect to:

(a) Requirements for standardization and calibration of observational data obtained by the IPY project observing facilities;

(b) Instrument traceability providing quality data sets derived from standard and hardened instruments developed to operate in harsh climates; and

(c) Improvement of the observational networks in the Arctic and Antarctica as result of IPY.

AGENDA ITEM 8 – WMO STRATEGIC PLANNING RELEVANT TO THE COMMISSION

CIMO-XIV/Rep. 8

WMO STRATEGIC PLANNING RELEVANT TO THE COMMISSION

a.

Monitoring and evaluation of the implementation of the Sixth WMO Long-term Plan (6LTP)

1. EC-LVIII noted that the evaluation of the 6LTP should be against the current nine WMO strategies described in terms of three separate perspectives: Regional Associations, Technical Commissions and Secretariat activities. The Council recognized that monitoring and evaluation of the 6LTP should be a continuous process.

Preparation of the WMO Strategic Plan 2008-2011

2. The fifty-eighth session of the Executive Council (EC-LVIII) recognized the need to focus WMO long-term planning on strategies to achieve the desired outcomes of the Organization. It agreed that hereafter the Seventh Long-term Plan should be referred to as the WMO Strategic Plan 2008-2011, which would be a statement of strategic intent for the Organization for the period 2008-2011, corresponding with the fifteenth financial period. The Plan would provide a longer-term

perspective in terms of the planning framework and strategic analysis. Its scope would reflect what meteorology and hydrology could contribute to, rather than what they are about.

3. By focusing on strategy, a simpler, comprehensible, concise and more focused document would be developed. The EC-LVIII agreed on the conceptual framework as shown in the Annex to this paragraph. A mechanism will be developed for ensuring that this framework is put into operation consistently across Regions, Technical Commissions and Programmes.

4. The Strategic Plan should be linked to the performance of the Organization through a set of Key Performance Targets (KPTs) and Key Performance Indicators (KPIs). These would be used to measure the progress towards the 11 Expected Results. The KPTs must be realistic, achievable, unambiguous and be of an optimum number. Performance targets should also be included in the operating plans, although these would more probably relate to activities rather than outcomes. The EC-LVIII recognized that KPTs require further development, testing and revision of the targets prior to implementation of the Strategic Plan in 2008.

5. In the future, performance would also be aligned more directly to the following activity areas: capacity building; research and development; data and observation; service delivery; partnership, advocacy and outreach; and support services. Reporting on the performance of the Strategic Plan 2008-2011 would be the responsibility of the Secretary-General. The EC Working Group on Long-term Planning (WG/LTP), in consultation with Regional Associations and Technical Commissions, should look into aligning the WMO Programmes with the Strategic Plan. The Strategic Plan should be easily understood and useable by decision-makers and by external groups.

6. The common alignment of the WMO Programmes with the WMO Strategic Plan 2008-2011 should commence soon after the Fifteenth Congress.

7. The Strategic Plan is a work in progress. The WG/LTP should develop as soon as possible a timeline for the finalization of the draft Plan. The alignment of the WMO programme structure as well as the programme and budget with the Strategic Plan is important. Such alignment would allow the Strategic Plan to more effectively guide the development of the WMO programme and budget under consideration by Cg-XV.

Operating Plans

8. The EC-LVIII agreed that an Operating Plan for the WMO Programmes and Major Activities should be prepared. There should be a clear link between the Strategic Plan and the Operating Plan. The Operating Plan will be high-level guidance for the whole of WMO, aimed at bringing all components of the Organization to the level of change being proposed in the Strategic Plan.

9. The EC-LVIII requested the Secretary-General, using the existing WMO Programmes as building blocks and in close coordination with the Chairman of the WG/LTP, to develop a WMO Operating Plan in accordance with the existing Strategic Plan.

Desired Outcomes

10. Desired outcomes are the results and/or impacts of what WMO wishes to achieve, and for which WMO can play a significant role. There are five desired outcomes for people throughout the world, and for the benefit of all nations:

(a) Improved protection of life and property;
(b) Increased safety on land, at sea and in the air;
(c) Enhanced quality of life;
(d) Sustainable economic growth; and

(e) Protection of the environment.

Top Level Objectives (TLOs)

11. In order to contribute to the desired outcomes, WMO and its Members have redefined the three leading strategies of the 6LTP as TLOs. The first and second of these cover the direct delivery of services and information to the public and users, in terms of the vision “to contribute to the safety and wellbeing of people throughout the world and to the economic benefit of all nations”, while the third emphasizes the contribution of WMO as the United Nations authority, and National Meteorological and Hydrological Services as the national authority for weather, climate, water and related natural environmental information:

(a) To deliver increasingly accurate and reliable warnings of severe events related to weather, climate, water and the related natural environment throughout the world, and ensure that they are able to reach their target audience (individuals, emergency services, decision makers) in a timely and useful manner;

(b) To enable the provision of increasingly beneficial weather, climate, water and related environmental services to the public, governments and other users/customers throughout the world;

(c) To inform society through WMO, which is the United Nations system’s authoritative voice, and through the National Meteorological and Hydrological Services, which are the national authorities, on the state and behaviour of the Earth’s atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of water resources; and to ensure that WMO and NMHSs support relevant international conventions, protocols, and other legal instruments, and that these agreements are scientifically based.

Strategies

12. The TLOs are achieved through six strategies (formally strategies 4 to 9 in the 6LTP). Strategies 1-3 are concerned with improving the utility and delivery of weather, climate, water and related environmental information, while Strategies 4-6 are concerned with improving the capability of WMO and its Members to achieve the TLOs. These six strategies are identified with six key areas of activities to which they are primarily (though not exclusively) associated:

Strategy 1:	Capacity Building	To inform and educate the public, governments and other interested parties about the socio-economic benefits of understanding the weather, climate, water and related environment.
Strategy 2:	Research and Development	To improve understanding and prediction of the processes which affect the current and future state of the atmosphere, the weather, water resources, the physical state of the oceans, climate change and related environmental states such as air quality and pollution levels
Strategy 3:	Data and Observations	To observe, record and report on the weather, water resources, climate and the related natural environment, to use these data for the preparation of operational forecast and warning services and related information, and to maintain and enhance systems to exchange these data, products and information.

Strategy 4:	Service Delivery	To enhance the capabilities of NMHSs to deliver services, and improve cooperation and collaboration between them.
Strategy 5:	Partnership, advocacy and Outreach	To work more effectively with service users, international partners, other relevant organizations, academia, the media and the private sector.
Strategy 6:	Supporting Services	To improve the effectiveness, efficiency and flexibility of the structure and working mechanisms and practices of WMO, to enable it to respond more rapidly to the changing needs of society and to the new opportunities provided by technological advances.

Expected Results (ERs), Key Performance Indicators (KPIs) and Key Performance Targets (KPTs)

13. Implementation of the WMO Strategic Plan is achieved by WMO through its major Programmes, its Regional Associations (RAs) and Technical Commissions (TCs), and by its Members primarily through their National Meteorological and Hydrological Services. The main basis for realizing the strategy is the programme and budget document, which proposes activities needed to achieve the TLOs.

14. The monitoring and evaluation of the WMO's performance in implementing the WMO Strategic Plan will be carried out in terms of agreed ERs, KPIs and KPTs. These are associated to one of the six strategies (associated to a primary key activity area) and link the WMO operating plans with the Strategic Plan. The ERs are what WMO expects to achieve during the performance period through the implementation of a particular strategy and measured by a set of performance indicators with specific targets. The KPIs indicate what should be measured, while the KPTs set quantifiable targets that the Organization is expected to achieve during the performance period. In turn, these KPIs and KPTs are tied to the activities of the Regional Associations and Technical Commissions.

15. The RAs and TCs will develop their own strategic/action plans in which they identify their own KPTs in support of the overall WMO KPTs identified for each expected result. Mapping the KPIs and KPTs to these individual activities is part of the development of the operational plans of the WMO Programmes, which implement the work of the RAs and TCs.

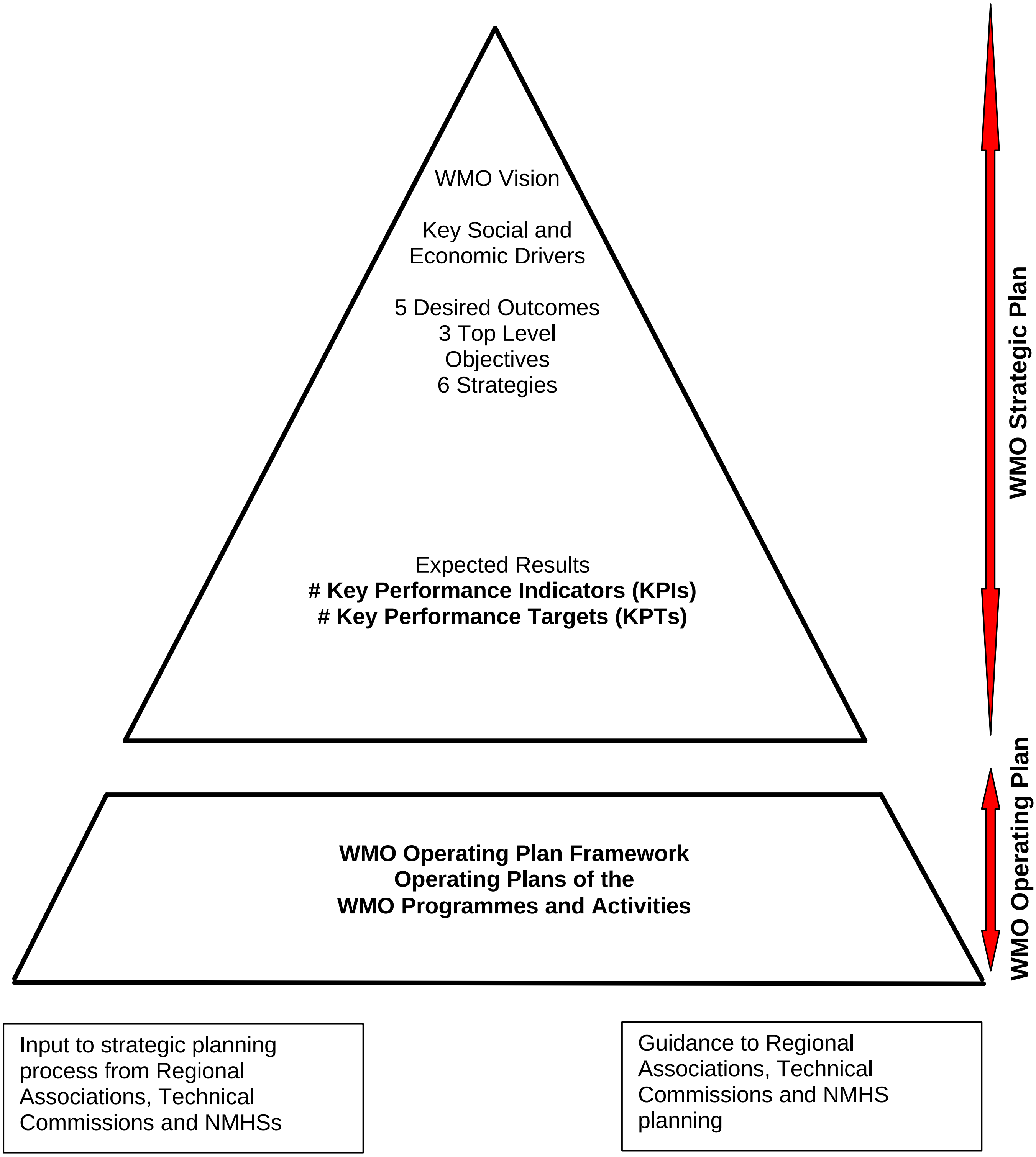
Basis for WMO Operating Plans for Strategy 3 "Data and Observations"

Expected Results	Strategy[1]	Key Performance Indicators	Key Performance Targets[2]
Expected Result 4 Improved technologies, sustainability, inter-operability and cost-effectiveness of the WMO Integrated Global Observing System (WIGOS).	**3 Data & Observations**	Level of satisfaction with system inter-operability and network sustainability.	**Target 8**: 80% of NMHSs satisfied with system in first year of operation increasing to 98% in year two and thereafter sustained at 98% level of satisfaction **b) Requires -** 60% of NMHSs using the system in year 1, rising to 100% thereafter; 5% per annum reduction in the cost of the system relative to 6LTP baseline; 99% reliability achieved within second year of full operation of the system

1 The strategy shows the primary strategy that will deliver the expected results. In general more than one strategy will contribute to a particular result.
2 Draft Key Performance Targets, which will be tested and revised prior to the implementation of the strategy in 2008.

Annex to paragraph 3

WMO Strategic Planning Framework



AGENDA ITEM 9 – COLLABORATION WITH RELEVANT INTERNATIONAL ORGANIZATIONS

CIMO-XIV/Rep. 9

International Organization for Standardization (ISO)

1. The ISO – a non-governmental organization – is a federation of the national standards bodies of 157 countries. The ISO members propose the new standards, participate in their development and provide support in collaboration with ISO Central Secretariat for the 3000 technical groups that actually develop the standards.

2. The fifty-eighth session of the Executive Council agreed that it would be beneficial to develop a formal working agreement with the ISO, the proposed objective being to develop joint ISO-WMO technical standards based on WMO Technical Regulations, Manuals and Guides, which would widen the recognition of WMO standards. The agreement should be presented to Congress for approval.

3. The ISO Technical Committee TC-146 "Air Quality" and its Sub-committee SC-5 "Meteorology" is responsible for standardizations relevant to instruments and methods of observation. The Working Group 1 (WG) dealt with the standardization of Wind vanes and rotating anemometers, WG 2 with Sonic anemometers/thermometers, WG 3 with Test methods for comparing the performance of radiation shields and definitions of important characteristics and WG 5 with Remote atmospheric boundary layer profiling - Test methods for ground based equipment.

4. The WMO kept liaison with the TC-146, however, the development of standards was done through WMO Members. A meeting was held with the aim of further exploring the relationship between ISO-146/SC-5, the CIMO Management Group and the Hydro-Meteorological Equipment Industry Association (Bucharest, 3 May 2005) in the development of standards relevant to instruments and methods of observation. The meeting also discussed the potential new work items of the SC-5

International Committee for Weights and Measures (CIPM)

5. The working arrangements with the CIPM were approved on behalf of the WMO by the Executive Council at its fifty-fourth session. These working arrangements were notified and confirmed by an exchange of letters between the Secretary-General of WMO (letter of 28 June 2002) and the Director of the International Bureau of Weights and Measures (BIPM) on behalf of the CIPM (letter of 7 April 2003).

6. The collaboration with the BIPM was mainly in the areas of radiation measurements and strengthening of the Regional Instrument Centres. Three experts were representing BIPM in the relevant CIMO Expert Teams (ET). The BIPM experts also participated in the review of the scientific results of the Tenth International Pyrheliometer Comparison, Davos, Switzerland, 2005.

7 The BIPM Secretariat proposed WMO to become a signatory of the CIPM Agreement of the Mutual Recognition of national measurement standards and of calibration and measurement certificates issued by National Metrology Institutes that could give the possibility to NMHSs to take part in the CIPM key comparisons, which in return would give technical confidence in the day-to-day measurements. The parties agreed that the direct participation of the NMHSs in the CIPM key comparisons is unlikely in the foreseeable future because of the cost involved and because of the traceability of NMHSs' standard instruments is normally done through the National Metrology Institutes. In case of the interest from NMHSs or the existing WMO World and Regional Centres this issue could be reconsidered by CIPM and WMO. During the follow-up meeting, actual and future collaboration with the BIPM were discussed, including the traceability of measurements to

International System of Units.

Collaboration with manufacturers of hydro-meteorological equipment

8. Following the approval of the consultative status for the Association of Hydro-Meteorological Equipment Industry (HMEI) by the Executive Council at its fifty-fourth session, the HMEI became a primary point of contact with the manufacturers of hydro-meteorological equipment. To date 90 manufacturers are members of the HMEI.

9. CIMO, at the request of WMO Members, has encouraged an active information exchange between WMO Members and manufacturers to ensure commercial providers understand WMO Member needs and to ensure WMO Members understand instrument capabilities, and operations and maintenance procedures. This information exchange was done mainly through the participation of the HMEI representatives at the various CIMO ETs, technical conferences, exhibitions, training workshops and instrument intercomparisons.

10. HMEI nominated 31 instrument experts that participated in various CIMO ET meetings; eleven experts of three manufacturers participated in the training workshops on upper-air observations. Ten scientific/technical papers were presented during the technical conference TECO-2005 in Bucharest, Romania. At the conjoint exhibition METEOREX-2005, 64 manufacturers presented their products and interfaced with the Members. Collaboration with the HMEI was essential for the successful outcome of the three intercomparisons held during the intersessional period and for the preparation of the two intercomparisons planned for 2007.

11. The HMEI reported 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. Following the most recent intercomparisons, several manufacturers had submitted notices to CIMO of modifications made to their instruments conforming to the performance requirements of the Hydro-Meteorological community. Intercomparisons are an excellent example of how beneficial such joint efforts are to both parties.

12. WMO was invited to the General Assemblies of the HMEI that emphasized the importance of the cooperation between HMEI and WMO. The CIMO Management Group, at its third meeting, appreciated the close collaboration with the HMEI and its support to CIMO activities and suggested that further improvement could be done through high-level coordination meetings, such as participation of the president of CIMO in the General Assembly of the HMEI.

13. As regards the Professor Dr Vilho Väisälä Award, the fifty-sixth session of the Executive Council (EC-LVI) recalled that over the years almost all award winners were from developed countries, as the criteria for granting the Professor Dr Vilho Väisälä Award practically confined a successful competition to leading-edge researchers. In that connection the Secretary-General raised that issue with Vaisala Oyj which resulted in the pledge by the firm for an additional award that is focused on, and encourages instrument work in developing countries and countries in economies in transition; and in a modification to the Guidelines for Granting the Awards. Vaisala Oyj provided an additional 100,000 Euros into a trust fund for the establishment of the second award. The EC-LVI welcomed this offer and decided to establish a second Professor Dr Vilho Väisälä Award and expressed its sincere gratitude to Vaisala Oyj for its continuing support to the IMOP Programme and WMO. The Council also adopted new Guidelines for Granting the Professor Dr Vilho Väisälä Awards. The nineteenth Dr Vilho Väisälä Award (2004) was the last according the original Guidelines. The selection of winners according to the new Guidelines was done at the EC-LVIII (June 2006). Both awards are granted on a biennial basis, normally in connection with the WMO TECO/METEOREX, with a cash prize of US$ 10,000 each.

The Network of European Meteorological Services (EUMETNET)

14. EUMETNET is a network grouping 21 European National Meteorological Services. EUMETNET provides a framework to organize cooperative programmes between the Members in the various fields of basic meteorological activities such as observing systems, research and development, and training.

15. The collaboration with the EUMETNET was strengthened through the participation of the EUMETNET experts in three CIMO ETs and the participation of various CIMO ETs' members in the EUMETNET programmes. This allowed for coordination of activities and avoiding of possible duplication of the work of experts.

European Union Cooperation on Science and Technology (COST)

16. COST is an intergovernmental framework for European Cooperation in the field of Scientific and Technical Research, allowing the coordination of nationally funded research on a European level, with increasing participation from outside Europe. The European Science Foundation (ESF), by a contract with the European Commission, took overall responsibilities for COST as of 1 January 2004.

17. The COST Technical Committee (TC) of Meteorology was responsible for the implementation of the COST Actions related to Meteorology until 2005. WMO took part in the TC Meteorology meetings as a permanent observer. The COST restructured the scientific and technical Domains of COST in November 2005 and created nine Domain Committees (instead of former 12 Technical Committees). Meteorology is now a part of a new domain “Earth System Science & Environmental Management (ESSEM)”.

18. Following the request of the CIMO-XIII, the Secretary-General ensured WMO representation in the COST actions to facilitate the rapid transfer of results and knowledge to all interested parties and to avoid a possible duplication of the work. Focal points were established to 17 COST Actions, some of them related to instruments and methods of observation.

19. The COST Office nominated its representative to three CIMO ETs under the OPAG-UPPER-AIR. Through these representatives collaboration with the COST-720 was established within the framework of the WMO Intercomparison of High Quality Radiosonde Systems, Mauritius, 2005.

20. More details on the cooperation with ISO, CIPM, HMEI, EUMETNET and COST are in Reports under agenda items 4, 5, 6 and 7.

AGENDA ITEM 10 – FUTURE WORK AND WORKING STRUCTURE OF THE COMMISSION

CIMO-XIV/Rep. 10(2)

EXECUTIVE SUMMARY OF THE SECOND WMO CONFERENCE ON WOMEN IN METEOROLOGY AND HYDROLOGY[3]

The Second WMO Conference on Women in Meteorology and Hydrology was held at the Headquarters of the WMO Secretariat in Geneva from 24 to 27 March 2003. The main objectives of the Conference were: to review the current situation as regards the participation of women in meteorology and hydrology; to review progress since the WMO Bangkok Meeting on the Participation of Women in Meteorology and Hydrology in 1997; to develop benchmarks to measure future progress; and to develop strategies to increase the participation of women in the activities of WMO and in the work of National Meteorological and Hydrological Services (NMHSs). The Conference also considered the gender sensitive aspects of the activities of NMHSs such as the application of climate information by rural women and the special roles women play in water management and disaster response.

The Conference reviewed and reaffirmed the recommendations of the 1997 Bangkok meeting and stressed the need for their implementation and for accountability. To advance that objective, and to further promote the participation of women in meteorology and hydrology and in WMO activities, the Conference agreed that the following actions should be taken by women professionals, and in particular, participants to the Conference:

- Women professionals to promote and participate in the process of career development through formal and informal mentoring, guiding and counseling activities;
- Participants to brief the Permanent Representatives of their countries prior to Congress on the recommendations and outcomes of the conference;
- Participants to work continuously to promote awareness of results of the conference within their own institutions/organizations/countries;
- Participants to form regional/sub-regional networks to exchange ideas, experiences and policies. These networks could also be used to allow participants to share information with other countries within their region not present at the conference.

The Conference urged NMHSs, Technical Commission and Regional Associations and the Permanent Representatives to take the following actions:

- NMHSs to establish and support gender focal points on meteorology and hydrology in each country;
- Regional Associations and Technical Commissions to appoint and support gender focal points from among women with appropriate expertise;
- Regional Associations and Technical Commissions to report regularly on progress on gender issues to Congress/EC;
- Permanent Representatives to make regular reports on gender issues at Regional Association meetings;
- Permanent Representatives to ensure that information related to career opportunities and development is made available in particular to their female staff;

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3 The conference proceedings are available in English, French and Spanish from:
http://www.wmo.int/web/wmoh/womendocs/FinalReport-ConfMarch2003-EN.pdf
http://www.wmo.int/web/wmoh/womendocs/FinalReport-ConfMarch2003-FR.pdf
http://www.wmo.int/web/wmoh/womendocs/FinalReport-ConfMarch2003-SP.pdf

- NMHSs to take special actions to retain young female professionals, for example, by offering exchanges, secondments, and special assignments;
- NMHSs to consider establishing national associations of women in meteorology and hydrology with a view towards the eventual formation of an International Association of Women in Meteorology and Hydrology.

AGENDA ITEM 11 – REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND OF RELEVANT RESOLUTIONS OF THE EXECUTIVE COUNCIL

CIMO-XIV/Rep. 11

SUGGESTED ACTION ON THE RESOLUTIONS AND RECOMMENDATIONS ADOPTED BY THE COMMISSION PRIOR TO ITS THIRTEENTH SESSION STILL IN FORCE

I. RESOLUTIONS ADOPTED BY CIMO-XIII

Res. Number	Title	Suggested action
1.	Working Structure of the Commission	To be kept in force
2.	CIMO Management Group	Not to be kept in force
3.	Open Programme Area Groups of the Commission	Not to be kept in force
4.	Revision of the resolutions and recommendations of the Commission	Not to be kept in force

II. RECOMMENDATIONS ADOPTED BY CIMO-XIII

Rec. Number	Title	Suggested action
1	Establishment of a World Infrared Radiometer Calibration Centre	Not to be kept in force
2	Review of the previous resolutions of the Executive Council related to the Commission	Not to be kept in force

III. RECOMMENDATIONS ADOPTED PRIOR CIMO-XIII AND STILL IN FORCE

Rec. Number	Title	Suggested action
1 (CIMO-XII)	Possible conflicts with external standardization organizations	Not to be kept in force
3 (CIMO-XII)	Introduction of new meteorological instruments	To be kept in force
4 (CIMO-XI)	Calibration of meteorological and related geophysical instruments	To be kept in force
6 (CIMO-XI)	Improvement of instrumentation used in observing systems of developing countries	To be kept in force
8 (CIMO-XI)	Correction of upper-air measurements	To be kept in force
11 (CIMO-XI)	Organization of WMO Technical Conferences on Instruments and Methods of Observation	Not to be kept in force
12 (CIMO-XI)	Education and training for capacity building	To be kept in force
13 (CIMO-XI)	Intercomparisons of instruments	To be kept in force

SUGGESTED ACTION FOR REVIEW OF RESOLUTIONS OF THE EXECUTIVE COUNCIL RELATED TO THE COMMISSION AND STILL IN FORCE

Resolution	Title	Remarks and suggested actions
13 (EC-XXXIV)	Development and comparison of radiometers	To be kept in force
7 (EC-LV)	Report of the thirteenth session of the Commission for Instruments and Methods of Observation	Not to be kept in force as it will be replaced by a new resolution to be adopted by EC-LIX.