



WORLD WEATHER WATCH

Instruments and
Methods of Observation ProgrammeCommission for Instruments and
Methods of Observation***CIMO Newsletter***<http://www.wmo.int/web/www/CIMO/newsletters.html>

JANUARY 2006

The CIMO Newsletter is intended as a complementary means of keeping informed CIMO members and affiliates, and getting them involved in the work of the Commission, by reporting on its activities and other related organizational matters, meetings, publications, etc. Comments from the readers are welcome.

IN ORDER TO KEEP THE LIST OF CIMO MEMBERS IN WMO PUBLICATION No.5 UP-TO-DATE, WE URGE WMO MEMBER COUNTRIES TO INFORM THE SECRETARIAT PROMPTLY OF CHANGES CONCERNING THE DESIGNATION OF THEIR MEMBERS TO THE CIMO. THANK YOU.

New Year Greetings!

The Director of the WWW Department, Mr Dieter Schiessl, and the entire Secretariat Team in support of CIMO-related activities and WWW Programme implementation wish you all a successful Year 2006!

Bonne et heureuse année! ~ Feliz año nuevo! ~ С Новым Годом!

PROGRAMME ACTIVITIES**Intercomparisons****RI Gauges in Laboratory**

The WMO Laboratory Intercomparison of Rainfall Intensity (RI) Gauges was held from September 2004 to September 2005 in the laboratories of the Royal Netherlands Meteorological Institute, Météo-France and the Italian Met Service (Department of Environmental Engineering, University of Genoa).

The main objective of the Intercomparison was to test the performance of catchment type rainfall intensity gauges of different measuring principles under documented conditions. Other objectives were to define a standardized procedure for laboratory calibration of catchment type rain gauges, and to provide information relevant to improving the homogeneity of rainfall time series with special consideration given to high rainfall intensities. Finally, a comment on the need to proceed with a field intercomparison of catchment type of RI gauges was required as well as to identify and recommend the most suitable method and equipment for reference purposes within the field intercomparison of catching and non-catching types of gauges.

The CIMO Project Team consisted of the Chair of the *Expert Team on Surface-based Instrument Intercomparisons and Calibration Methods* (ET-SBII) and of the *International Organizing Committee* (IOC) on Surface-Based Instrument Intercomparisons. The Project Leader and three Site Managers coordinated the work of the laboratories involved. The 19 pairs of instruments proposed by the 18 participating manufacturers were divided into three groups and were tested for 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

concluded by 15 February 2005, the second by 15 May 2005 and the third in September 2005. All expenses related to the lab intercomparisons were borne by both the laboratories and the manufacturers involved.

The majority of participating instruments were tipping-bucket gauges (widely used in operational networks); another type of instruments were weighing gauges; and a third one with only two other instruments used an uncommon measuring principle of water-level based on conductivity measurement.

A 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 being tested 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.

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 is 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.

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. In some cases, problems of water storage in the funnel occurred that could limit the usable range for rain intensity measurement.

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.

The two other gauges using a conductivity measurement method for determining water level showed good performances in terms of uncertainty under controlled laboratory conditions. Siphoning problems with one of these gauges limits its ability to measure a wide range of rainfall intensity. For the other one, a limitation was found related to the emptying mechanism where a 2-minute delay was observed. These two gauges, potentially sensitive to water conductivity had no demonstrated problems during the laboratory tests.

The laboratory tests were performed under controlled conditions and constant flow rates (rainfall intensities) so as to determine the intrinsic counting errors. It must be considered that RI is highly variable in time, thus catching errors may have a strong influence on the overall uncertainty of the measurement. The need to combine the assessment of both counting and catching errors for the instrument analyzed in the laboratory is paramount.

Provided an instrument is properly installed in the field, in accordance with WMO specifications, the question narrows down to *What kind of instrument* (measuring principle, manufacturer, model) *would be most suitable to the specific requirements of a user*. This question cannot indeed be answered based on the laboratory Intercomparison alone, although the results obtained can provide preliminary information to manufacturers and a first-step selection criterion for the user.

Therefore, it is necessary to proceed with the quality assessment procedure initiated in the laboratory by organizing 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. Also other instruments would be included in the field intercomparison, even if not tested in the laboratory phase, with a priority given to non-catching type of instruments.

For the Field Intercomparison a working reference rain gauge(s) should be inserted in a pit according to the EN-13798 standard Reference Raingauge Pit, adopted by ISO, in order to minimize the effect of weather related errors on the measured rainfall intensities. According to the results of the laboratory intercomparison, it is recommended to select the best performing dynamically corrected tipping bucket rain gauge(s) and the weighing gauge(s) showing the shortest step response and the lowest uncertainty as reference gauges. The combined analysis of the reference gauges allows the best possible estimation of the rainfall intensity in the field, given their demonstrated performance in the laboratory. The use of one reference instrument alone is not recommended.

Finally, the improvement of the uncertainty of RI gauges introduces the risk of affecting the homogeneity of rainfall time series. The improvement of the measurement of RI may produce a discontinuity of the historical rainfall intensities records, which could influence especially the studies of extreme events. The bias introduced by non-corrected records propagates through any rainfall-runoff model down to the statistics of flow rates in watercourses, with non-negligible effects on the study of floods and flash floods. An example of the correction of the historical rainfall series was demonstrated using the result of the laboratory intercomparison.

High Quality Radiosonde Systems

The *WMO Intercomparison of High Quality Radiosonde Systems*, held in Vacoas, Mauritius, 2-25 February 2005, was organized because a new generation of radiosondes is being introduced into most of the global upper air network. Six operational radiosonde systems (Vaisala, Sippican, Modem, Meisei, Graw and Meteorlabor) participated in the intercomparison which consisted of 62 successful comparison flights. In addition, three thermistor radiosondes *Sippican MKII* were test-flown to provide a daytime "working reference" for temperature and the Snow-White chilled mirror hygrometer as a "working reference" for dewpoint/relative humidity. 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. The following is a summary of the results.

Measurements of wind by the GPS radiosonde systems were of good availability and quality. Preparing the GPS radiosondes for flight was much easier than in the Intercomparison held in Brazil in 2001. The GPS heights measured by the GPS radiosondes were so accurate that in most situations there is no longer any need to use a pressure sensor on a GPS radiosonde. The Intercomparison in Mauritius demonstrated that most of the errors identified in the *WMO Intercomparison of GPS Radiosondes* held in Brazil have been rectified. Temperature, pressure and relative humidity measurements provided by the six radiosondes agreed closer than in any of the earlier WMO Radiosonde Intercomparisons.

Thus, all radiosondes in this Intercomparison were found to be of better quality than in the previous *WMO Radiosonde Intercomparison* held in Brazil in 2001 and were judged to merit the designation of *High Quality Radiosonde*. Whilst much progress has resulted from major investments by the main manufacturer, the smaller manufacturers have also contributed with significant innovations generating a more competitive environment.

Some problems remain in most systems tested. When rectified these will further improve radiosonde measurement quality (including long term stability of measurement quality). This should produce a stability in radiosonde measurements, absent in earlier generations of radiosondes.

Manufacturers need to consider whether their radiosonde measurements need:

- Hydrophobic coatings on temperature sensors;
- Improved sensor exposure for daytime temperature measurements in the stratosphere;
- Prevention of chemical contamination of relative humidity sensors during storage;
- Procedures to minimize the effects of water contamination on humidity sensors after emerging from cloud;
- Procedures to minimize the effects of ice contamination on humidity sensors after emerging from cloud at all temperatures in the middle and upper troposphere;
- Improved procedures to eliminate low bias in daytime relative humidity caused by the humidity sensor observing at a higher temperature than the reported temperature (software correction or direct measurement of humidity sensor temperature?).

The “*working reference*” systems proved very useful in interpreting results from the Intercomparison, but were not developed to the stage that they could be used as stand-alone references in the type of conditions experienced in Mauritius.

Recommendations on suitable radiosondes for future climate observing networks were presented. Most of the radiosondes tested in Mauritius could be brought up to a standard suitable for this work. Thus, it is suggested that the best traceable upper air measurement record might be obtained by interlinking measurements by two of the best operational radiosonde types at a given observing site. For temperature measurements there is a large range of suitable sensors. For water vapour/relative humidity the range of sensor type is much more limited and further development of new sensors could be beneficial.

The two radiosonde systems currently closest to the standards required for climate measurements at the highest levels in the tropics (pressures as low as 5 hPa) were *Vaisala RS92-SGP* and *Sippican LMS-5*. However, it is expected that several of the other systems will become closer to this standard shortly, and could possibly offer cost effective alternatives in the long term.

The use of GPS radiosondes without a pressure sensor, tested in 2001 for MODEM and Sippican in the WMO GPS Radiosonde Comparison in Brazil, and also used by Meisei in Mauritius, was found to offer a reliable method of reducing consumable costs.

The system developed by Graw demonstrates how GPS radiosonde systems can be developed to make setting up and operations extremely easy for unskilled staff.

The SRS digital radiosonde system proved a very reliable method of flying the Snow-White chilled mirror hygrometer, with much less operational trouble than was experienced with the Sippican/Snow-White combination in the Brazil intercomparison.

This Intercomparison was performed in Mauritius under the management of a small WMO CIMO Project Team (Chaired by Dr John Nash, UK Met Office). The team was responsible for the conduct of the test and for training of local staff from the Mauritius Meteorological Service. The Intercomparison demonstrated that local staff were experienced enough and could be trained quickly in more advanced test procedures. This resulted in an improved morale and knowledge within the Mauritius Meteorological Services.

The deployment of a WMO CIMO Project Team to supervise the test was successful, however, for future tests it should be recognized that the supervisory work involves a lot of real time consultation with the participants and is much more than purely managing the test procedures. Also, this consultation period actually extended for several months beyond the completion of the test and was not just limited to the time during the intercomparison.

Tenth IPC

The Tenth International Pyrheliometer Comparison (IPC-X) and conjoint Regional Pyrheliometer Comparisons (RPC) were held from 26 September to 14 October 2005 in the World Radiation Centre (WRC), Davos, Switzerland. 72 participants took part in the Intercomparison, representing 17 Regional Radiation Centres, 24 National Radiation Centres and 5 other institutions. 101 pyrheliometers (including the World Standard Group instruments) were calibrated.

In accordance with Resolution 1 of CIMO-XI, an Ad-hoc Group, chaired by Dr Bruce Forgan (Australia) was established to assess the preliminary results and to recommend the updating of calibration factors of the participating instruments.

The favorable weather conditions yielded a record number of calibration points for most of the participating instruments. Cloudy and overcast days were used for technical preparations and training of participants as well as for the IPC-X Symposium.

The Final Report is under the preparation and will be discussed during the meeting of the CIMO Expert Team on Meteorological Radiation and Atmospheric Composition Measurements (ET-MR&ACM), scheduled to be held in Davos, Switzerland, 6-10 February 2006.

OPEN PROGRAMME AREA GROUPS

OPAG-Surface

Co-chairs:

Jitze VAN DER MEULEN (A1) jitze.van.der.meulen@knmi.nl

Michel LEROY (A2) michel.leroy@meteo.fr

Klaus BEHRENS (A3) klaus.behrens@dwd.de

ET-SBII&CM and IOC-SBII

The second session of the Joint Expert Team on Surface-Based Instrument Intercomparisons and Calibration Methods (ET on SBII&CM) and the International Organizing Committee on Surface-based Instrument Intercomparisons (IOC-SBII) was held in Geneva from 5 to 9 December 2005.

The ET/IOC discussed and agreed on the Final Report of the WMO Laboratory Intercomparison of Rainfall Intensity (RI) Gauges held in Trappes (France), Genoa (Italy) and De Bilt (The Netherlands) from September 2004 to September 2005.

The ET/IOC evaluated the proposal of Italy to host the WMO Field Intercomparison of RI Gauges in Vigna di Valle, Italy. In doing so, it considered the results of the evaluation of the testing site done by CIMO experts as well as the local climatology of the site and concluded that the Vigna di Valle test site fulfils all of the required characteristics and it is therefore suitable for the planned field RI intercomparison. Subsequently, the ET/IOC agreed to organize the intercomparison in Vigna di Valle in the time frame as proposed by the representative of Italy (mid 2007-mid 2008). The meeting also reviewed the operational aspects related to the intercomparison, such as conditions for participation, type of instruments, intercomparison rules, responsibility of host(s) and participants, data acquisition, processing analysis methodology and publication results.

The ET/IOC also evaluated the proposal of Algeria to host the WMO Combined Intercomparison of Thermometer Screens/Shields, in Conjunction with Humidity Measuring Instruments in Ghardaïa, Algeria. On behalf of the Algeria, the chairman of ET/IOC presented the Algerian project for hosting the intercomparison in Ghardaïa. Subsequently, the meeting agreed to hold the intercomparison in Ghardaïa, Algeria, approved the operational aspects related to the intercomparison including a draft time frame of the related activities.

ET-MR&ACM

The first session of the Expert Team on Meteorological Radiation and Atmospheric Composition Measurements will be held in Davos, Switzerland from 6 to 10 February 2006.

The meeting will review the Final report of the IPC-X, operational practice associated with total ozone, UV and aerosol optical depth measurements. It will discuss the further development of a World Standard Group of absolute long-wave radiometers and will review and audit the Infrared Radiometer Calibration Center (IRC) established at World Radiation Center (WRC) in Davos in 2004.

OPAG-Upper-air

Co-chairs:

Rainer DOMBROWSKY (B1) rainer.dombrowsky@noaa.gov

John NASH (B2) john.nash@metoffice.com

Alexei IVANOV (B3) ivanov.cao@mail.ru

ET-UASI and IOC-UASI

The second session of the Joint Expert Team on Upper-Air Systems Intercomparisons (ET-UASI) and the International Organizing Committee on Upper-Air Instrument Intercomparisons (IOC-UASI) was held in Geneva from 28 to 30 November 2005.

The ET/IOC discussed and agreed on the Final Report of the WMO Intercomparison of High Quality radiosonde Systems held in Vacoas, Mauritius in February 2005. The Final Report provides factual information as well as scientific discourse of the intercomparison results thus becoming a valuable source of information for the whole range of readers, from staff employed in the operation of the upper-air

networks, through managers to scientific personnel and private manufacturing industry. It is expected that the intercomparison will significantly contribute to further improvements in radiosonde performance.

The ET/IOC agreed that the follow-up WMO Regional Intercomparisons of Radiosonde Systems should be organized within next 2-4 years to link the High Quality radiosondes with other radiosondes used predominantly in certain regions. A preliminary plan was made to hold the regional intercomparison in China in 2007.

The joint meeting discussed the status and possible future development of the Interoperable Upper-Air Systems. It agreed that International Met Systems, on behalf of the HMEI, would prepare a discussion document/guidance for the Fourteenth session of the Commission for Instruments and Methods of Observation.

The progress in the development of the performance measures to demonstrate continuous improvement in the quality of UA observation was presented to the ET/IOC. The study demonstrates that a significant improvement in the quality, over last two decades, of temperature and geopotential height biases at 10 hPa from, typically from more than 3 degree C of discrepancy down to better than 0.5 degree C for temperature, and respectively from more than one thousand meters down to less than 20 m for geopotential heights.

The ET/IOC was informed on the results of intercomparison between the NASA ATM radiosonde, Modem, InterMet and Sippican radiosondes and on the partial results in satellite-derived temperature and humidity profiles based on GPS occultation measurements by the CHAMP satellite.

OPAG-Capacity Building

Co-chairs:

Eliphaz BAZIRA (C1) bazirae@yahoo.com

Heng ZHOU (C2) cmanet@sina.com

Russell STRINGER (C3) r.stringer@bom.gov.au

ET-RICs

The reduced session of the Expert Team on Regional Instrument Centres, Quality Management systems and Commercial Instrument Initiatives will be held in Davos, Switzerland from 4 to 7 April 2006. The meeting will review the results of the evaluation of the RICs, their revised Terms of Reference and proposals to strengthen further services of individual RICs, especially from developing countries. It will also discuss the issues related to Quality Management of Observing Systems and WMO QMF.

RA VI Metrology Workshop

At the kind invitation of the Permanent Representatives of Slovenia and Slovakia with WMO, the *WMO Training Workshop on Metrology for RA VI Central and Eastern Europe* is tentatively planned to be held in Ljubljana, Slovenia, 10-11 April 2006 and in Bratislava, Slovakia, 12-13 April 2006. The aim of the workshop is to train the operational staff, working in the field of the instrument maintenance and calibration, in basic metrology principles and present the services available at the two new RICs (Ljubljana, Bratislava) to Members.

RA I Metrology Workshop (English)

At the kind invitation of the Permanent Representative of Egypt with WMO, the *WMO Training Workshop on Metrology for RA I English speaking countries* will be held in Cairo, Egypt, from 22 to 26 April 2006.

The aim of the workshop is to train the operational staff, working in the field of the instrument maintenance and calibration, in basic metrology principles, measurements techniques and calibration of basic instruments and on how to conduct tests and comparisons. The workshop will have both theoretical and practical lessons. The theory will be conducted in a classroom and the practical part will be performed at the laboratories of the Egyptian Meteorological Authority.

WMO will arrange for lecturers and training materials for the workshop according to the Preliminary Programme. In addition, every participant is invited to prepare country presentations on calibration and maintenance of their instruments. After completion of the workshop, the participants are expected to perform training at country levels and report on the outcome to the WMO Secretariat.

RA III Upper-Air Workshop

At the kind invitation of the Permanent Representative of Argentina with WMO, a *Training Workshop on Upper-Air Observations for RA III (South America)* is tentatively planned in Buenos Aires, Argentina, from 8 to 12 May 2006. The Workshop is aimed at improving the knowledge and skills of senior operational personnel in charge of the national upper-air networks. Simultaneous interpretation will be provided into English and Spanish.

CIMO-TECO-METEOREX

CIMO-XIV is tentatively scheduled to take place in Geneva, 7-13 December 2006, preceded by a Technical Conference, also tentatively scheduled to be held from 4 to 6 December.

The Announcement and Call-for-papers for TECO-2006 will be placed on the web, in due course, under the address: <http://www.wmo.int/web/www/CIMO/cimo-teco-meteorex.html>

A METEOREX event is not planned on this occasion, as a similar event will be held in conjunction with Cg-XV in May 2007.

Meetings and Reports on the Web

For upcoming meetings: <http://www.wmo.int/web/www/IMOP/meetings.html>
For the final reports: <http://www.wmo.int/web/www/IMOP/reports.html>
CIMO/IMOP website: <http://www.wmo.int/web/www/IMOP/IMOP-home.html>

Schedule of Meetings

DATES IN 2006	PLACE	EVENT
6-10 Feb	Davos	CIMO Expert Team on Meteorological Radiation and Atmospheric Composition Measurements , First session
4-7 April	Geneva	CIMO Expert Team on Regional instrument Centres, Quality Management Systems and Commercial Instrument Initiatives (Reduced meeting)
10-11 April <i>and</i> 12-13 April <i>tentatively</i>	- Ljubljana - Bratislava	WMO Training Workshop on Metrology for RA VI (Central and Eastern Europe)
22-26 April	Cairo	WMO Training Workshop on Metrology for RA I (Africa), English speaking countries
8-12 May	Buenos Aires	WMO Training Workshop on Upper-air Observations for RA III (South America)
3-7 July	Geneva	CIMO Management Group , Third session
4-6 Dec <i>tentatively</i>	Geneva	TECO-2006
7-13 Dec <i>tentatively</i>	Geneva	CIMO-XIV

Newsletter Note

The CIMO Newsletter is issued at least twice a year and is distributed by e-mail to CIMO members and affiliates, including the Hydro-Meteorological Equipment Industry Association (HMEI) and the International Bureau of Weights and Measures (BIPM), provided that the e-mail addresses are known to the Secretariat.

The contents of this Newsletter may be forwarded to other persons interested in contributing to the work of CIMO, or interested in receiving information on its activities.

Information on the implementation of the Instruments and Methods of Observation Programme as well as on the work of the Commission for Instruments and Methods of Observation, is regularly posted on the WWW website, under the heading CIMO home, at:

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

Contact us

Contact at WMO Secretariat on CIMO/IMOP related matters

Dr Miroslav Ondráš, WWW/GOS/Senior Scientific Officer MOndras@wmo.int

Ms Imelda de Chavez, WWW/GOS Senior Secretary IdeChavez@wmo.int

Ms Sary Vargas, WWW Web Editor SVargas@wmo.int

Tel.: +(41 22) 730 8409 / -8091 / -8517 - Fax: +(41 22) 730 8021