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**JOINT CIMO EXPERT TEAM ON
SURFACE-BASED INSTRUMENT INTERCOMPARISONS
AND CALIBRATION METHODS**

ITEM: 4.1

First Session

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AND

**INTERNATIONAL ORGANIZING COMMITTEE (IOC) ON
SURFACE-BASED INSTRUMENTS INTERCOMPARISONS**

First Session

Trappes, France, 24-28 November 2003

**An invitation from the Italian Meteorological Service (IMS) to host
the WMO Laboratory Intercomparisons of Rainfall Intensity (RI) Gauges**

(Submitted by Mr L. Lanza, University of Genova, Italy)

Summary and purpose of document

This document provides background of the IMS invitation to host the Laboratory Intercomparisons of Rainfall Intensity Gauges.

Action proposed

The meeting is invited to take into account information presented in this document when discussing a place for the Laboratory Intercomparisons of Rainfall Intensity Gauges.

An invitation from the Italian Meteorological Service (IMS) to host the WMO Laboratory Intercomparisons of Rainfall Intensity (RI) Gauges

1. Gen. Roberto Sorani, the Permanent Representative of Italy with for WMO, in his letter reference No. RGPM-RP-43/6755/G8-1/OMM-CIMO/ET, dated 20 October 2003, informed the WMO Secretary-General that the Italian Meteorological Service (IMS), being aware of the importance of a "Precipitation Measurement Intercomparison", is willing to share this work-programme with considerable contribution of the Department of Environmental Engineering of University of Genoa, which is ready to host Laboratory Intercomparison of Rainfall Intensity Gauges.
2. The responsible Institution for the Laboratory Intercomparison of Rainfall Intensity Gauges will be Department of Environmental Engineering of University of Genoa with its hydraulics laboratory (DIAM Laboratory). The profile of the DIAM Laboratory, its Fields of activity, Certifications and Equipment is described in ANNEX I.
3. The Terms of the Invitation including available testing gauges, capacities offered as well as the proposal for the site leader and necessary references are presented in ANNEX II.

DIAM Laboratory



Address:

Department of Environmental Engineering
University of Genova
Viale Cambiaso, 6
6145 Genova
Italy

Tel. 39-010-3532483
Fax: 39-010-3532481

Person responsible: Ing. Luigi Stagi

Website www.diam.unige.it
E-mail luigi@diam.unige.it

Profile

The laboratory lies at the heart of the scientific activity of the Department of Environmental Engineering, aimed not only at pure research experiments but also at the ideation and development of technological solutions as a consultancy activity for private companies and public bodies. The traditional expertise of the former Hydraulic Institute, and its scientific excellence, have merged since 1999 with new competences that contributed to widen its interests on to the innovative aspects of the environmental engineering issues. The equipment of the laboratory allows conducting researches and basic and applied experimental activities in the various fields of hydraulic, fluvial and marine engineering, hydrology and environmental monitoring, as well as the characterization and qualification of instruments and processes that are relevant for environmental protection.

The DIAM laboratory is highly qualified in Italy according to the Decree by Law 297/99.

Fields of activity

Tests on physical and numeric models of hydraulic, fluvial and maritime structures, hydrological processes and environmental monitoring instruments. Scientific and technical consultancy about the fluid-structure interactions. Hydraulic and hydrologic researches related to the management of water resources, the hydraulic infrastructures and the technologies for protection and mitigation against hydro-meteorological hazards. Calibration and certification of rain gauges, both in laboratory and in situ, valves, filters, ultrasonic velocity meters and hydraulic devices in general. Characterization of the pollution of first flush waters from the wash out of impervious surfaces. Tests on physical and mathematical models of transformation processes: electrochemical processes for energy production and waste treatment, treatment processes for water and soil.

Certifications

The Laboratory provide the calibration and certification of hydraulic instruments and devices according to the European regulation EN 30012/ISO 10012-1:1992, e.g. with reference to:



“Area-velocity” flow meters

The determination of the calibration curve and the related certification are obtained based on measurements taken in a rectangular channel with variable slope and controlled flow rates. An automatic acquisition and processing system allows computerizing the certification process.



Tipping-bucket rain gauges

The Qualification Module for Rain Intensity Measurement Instruments developed at the Laboratory is used to generate constant flow rates and to produce the dynamic calibration curve for the instrument analyzed at various controlled rain rates. The process is fully automated and controlled by a dedicated software developed in the LabView environment.

Head losses on various hydraulic devices

The Laboratory is equipped with an hydraulic system for the measurement of the flow rates and the head losses produced by single devices (valves, filters, ejectors, etc.) that are properly monitored.

Equipment

Channels and tanks with wave generators, fixed and mobile bed channels, channels with variable slope, one tank for tidal waves, two components laser velocity meter, Instantaneous velocity vector measurements (Particle Image Velocimetry), laser meter for the acquisition of bed forms, capacity effect bed morphology detector, level sensors for the measurement of free surfaces, ultrasonic level sensors, relative and differential pressure transducers, in field flow rate and velocity measurements, very precise electronic weighting devices. Basic chemical laboratory.

TERMS OF THE INVITATION

The candidate responsible Institution for the intercomparison of RI measurement instruments is the Department of Environmental Engineering of the University of Genoa (Italy), with its hydraulics laboratory hereinafter indicated as the DIAM laboratory.

The laboratory lies at the heart of the scientific activity of the Department of Environmental Engineering, aimed not only at pure research experiments but also at the ideation and development of technological solutions as a consultancy activity for private companies and public bodies. The traditional expertise of the former Hydraulic Institute, and its scientific excellence, have merged since 1999 with new competences that contributed to widen its interests on to the innovative aspects of the environmental engineering issues. The equipment of the laboratory allows conducting researches and basic and applied experimental activities in the various fields of hydraulic, fluvial and marine engineering, hydrology and environmental monitoring, as well as the characterization and qualification of instruments and processes that are relevant for environmental protection.

The DIAM laboratory is highly qualified in Italy according to the Decree by Law 297/99. This national regulation replaces the ISO certification for public owned institutions in Italy. A short description of the laboratory and its relevant facilities is annexed to the present document.



As for the specific equipment required for the Intercomparison, the laboratory has developed a Qualification Module for Rain Intensity Measurement Instruments that is available both as an automatic (see Fig.1) and manually operated device (presented in Lanza and Stagi, 2002).

The automatic version of the apparatus is associated with a data acquisition system connected with a dedicated PC Pentium IV, running the LabView software, and with the appropriate National Instruments data acquisition modules.

A new rainfall generator is being realized in order to be able to investigate also non-catching types of rain gauges (optical gauges, disdrometers, ecc.).

Fig. 1: The developed Qualification Module for Rain Intensity Measurement Instruments

The chief of the DIAM laboratory, Dr. Luigi Stagi, will be available to act as a site leader for the intercomparison. Two other technicians will execute the tests, in collaboration with one responsible engineer who will take care of the acquisition system (software and hardware) and the processing of the results.

All the persons involved have a large experience in rain gauge calibration tests, since they have been operating on the developed qualification module for many years, producing calibration data and official certification for hundreds of tipping bucket rain gauge instruments, provided by the local hydrographic service and manufacturing companies.

No specific external capacity is therefore required for running the tests.

Tipping bucket and weighting type rain gauges can be easily tested at present. The equipment for testing non-catching types of gauges is under development and its availability for the intercomparison can be confirmed at a later stage.

The tests on TBRs and weighting type gauges can be initiated on February 2004 as from the draft timetable already circulated by Dr. Leroy, or in any other period in case different agreements are made during the next meeting in Trappes.

The duration of the tests obviously depends on the number and types of gauges to be tested.

There is no direct funding availability from the laboratory, although the proposed work load can be quantified as follows in monetary terms. The cost of each single test with a tipping-bucket rain gauge costs 100 Euros. Overhead costs may be estimated at usual rates.

External financial support is not required, unless the terms and modalities of the intercomparison as agreed in the next IOC meeting in Trappes should involve further costs and equipment.

The proposed site leader is Dr. Luigi Stagi, chief of the laboratory. Dr. Stagi has a wide experience on the subject, that is demonstrated by the following selected list of publications on related subjects:

- Lombardo, F. and L. Stagi (1998). Verifica e taratura dinamica della strumentazione pluviometrica finalizzata alla valutazione degli errori per intensità di pioggia elevata (in Italian). XXVI Nat. Conf. on Hydraulics and Hydraulic Structures, Catania, 9-12 September 1998, Vol. II, p. 85-96.
- La Barbera, P., Lanza, L.G. and L. Stagi (2000). Influence of calibration errors of tipping-bucket rain gauges on the statistics of rainfall extremes. XXVII Nat. Conf. on Hydraulics and Hydraulic Structures, Genova, 12-15 September 2000, Vol. II, p. 363-370.
- Molini, A., La Barbera, P., Lanza, L.G. and L. Stagi (2001). Rainfall intermittency and the sampling error of tipping-bucket rain gauges. Phys. Chem. Earth, **26**(10-12), 737-742.
- La Barbera, P., L.G. Lanza and L. Stagi (2002). Influence of systematic mechanical errors of tipping-bucket rain gauges on the statistics of rainfall extremes. Water Sci. Techn., **45**(2), 1-9.
- Molini, A., La Barbera, P., Lanza, L.G. and L. Stagi (2002). L'errore sistematico meccanico dei pluviometri a vaschette basculanti: ricostruzione e correzione delle serie storiche (in Italian). XXVIII Nat. Conf. on Hydraulics and Hydraulic Structures, Potenza, 16-19 September 2002. Vol. 1, pp. 139-148.
- Cerisola, D., Vallebona, A., La Barbera, P., Lanza, L.G., Molini, A. and L. Stagi (2002). An automatic device for dynamic calibration of tipping-bucket rain gauges. TIES 2002, Annual Conf. of the International Environmetrics Society. Genova, Italy, June 18 - 22, 2002.
- Lanza, L.G. and Stagi, L. (2002). Quality standards for rain intensity measurements. WMO Techn. Conf. On Meteorological and Environmental Instruments and Methods of Observation (TECO-2002), Bratislava, Slovakia, 23-25 September 2002.
- Lanza, L.G. e L. Stagi (2002). Sulla misura dell'intensità di pioggia con pluviometri a vaschette basculanti: errori sistematici e statistiche dei valori estremi (in Italian). Rivista di Meteorologia Aeronautica, Anno 63, No 1, pp. 13-21.
- Casu, G., Foti, F., Venanzi, G., Lanza, L.G. e L. Stagi (2003). Rainfall intensity measurements at Re.S.M.A. station in Vigna di Valle: calibration and data correction issues. Sixth European Conf. On Applications of Meteorology, Roma, 15-19 September 2003, Proceedings published on CD-ROM.

The laboratory is located in the urban area of the city of Genova, therefore allowing a set of accommodation facilities over a wide range of prices. Easy connection with public transportation is ensured both from the airport to the laboratory and with the various hotels.