Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05568, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05568
EGU General Assembly 2008

A portable device for dynamic calibration of catching type rain gauges in the field

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The WMO Field Intercomparison of RI gauges was started in September 2007 in Vigna di Valle, Rome (Italy). A total number of 39 instruments have been accepted in this Field Intercomparison, including catching and non-catching types of instruments. Installation of the instruments in the field was preceded by the laboratory calibration of all submitted catching type rain gauges at the University of Genoa, and periodic testing of these gauges by means of dynamic calibration is now performed throughout the measurement campaign, using a portable calibration device.

The portable device was developed at the University of Genoa with the aim of providing the on-site capability of performing the same kind of tests that were preliminarily used for calibration of all submitted catching type rain gauges under controlled conditions in the laboratory. The same methodology is indeed adopted, 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 is conveyed to the funnel of the instrument under test in order to simulate a constant rainfall intensity. The relative difference between the actual flow of water conveyed through the instrument and the "rain intensity" measured by the instrument itself is assumed as the relative error of the instrument for the given reference flow rate.

The principle exploited by this portable device is that of preserving a constant hydraulic head over a given orifice area by ensuring the automatic and continuous pressure adaptation of the air/water contained inside a closed container. The transit time of the water level between two fixed limits is the only variable to be measured to

complete the test at any reference rainfall intensity. In order to reduce the sampling error, with reference to e.g. a tipping-bucket rain gauge having a resolution of 0,2 mm (bucket volume of 20 g) and a collector's area of 0,1 m^2, the container should be filled in with at least 2 litres of water, so that at least 100 tips of the buckets will occur.

The developed portable device allows to perform:

- high precision tests for rain intensity measurement uncertainties rather than for the sole rain accumulation over a given time period;
- dynamic calibration tests rather than just volumetric or single intensity tests;
- the generation of rigorously constant water flows for the entire duration of each test;
- the entire calibration procedure recommended by WMO for rain intensity measurement instruments, with one single apparatus and on-site;
- non invasive tests that do not require modifications of the instrument and changes from its current operational conditions;
- tests with results being immediately available, since no special post-processing of the data measured during the tests is required.

From the operational viewpoint the portable device has the advantages to avoid taking down the rain gauge for delivery to the laboratory, to perform the tests rapidly – with durations that are comparable to the usual time spent for ordinary maintenance interventions, and to exploit not specially trained personnel to perform the tests – due to the very simple operations required. Also, the portable device is well suited for use in less industrialised countries, where simple and readily understandable technologies are required, with no need for any sophisticated component and just a limited volume of water required to perform the tests.

Finally, the proposed portable device is an ideal and cost effective solution for metrological qualification of rain intensity instruments within the framework of the quality assurance procedures that are now widely adopted by the organisations in charge of managing meteorological measurement networks at the regional, national and international levels.