WIGOS DEMONSTRATION PROJECT OF MOROCCO: GOALS, METHODOLOGY AND PROGRESS REPORT

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ABSTRACT:

Demonstration projects conducted by NMHSs are considered as an essential component in WIGOS implementation helping WMO Members to more fully understand WIGOS concept and keeping them current on its practical development. Feedback and lessons learnt from these projects will be extremely beneficial in understanding others' expectations of WIGOS/WIS concept and implementation.

In this regard, the National Meteorological Service of Morocco has studied the description of the demonstration project related to the achievement of standardization and traceability actions according to the outline made by the EC-WG on the WIGOS. The project could be accomplished through: the reinforcement of the capacities of the calibrating laboratory of the Moroccan NMS designated as a new Regional Instrumentation Center (RIC) for AR-I, the improvement of its technical procedures to allow it to accomplish its missions in link to recognized Metrological International chain and the establishment of Metadata catalogues of the whole synoptic, marine, aeronautic and automatic weather stations constituting the Moroccan Meteorological Surface observing Network.

By implementing the Demonstration Project in Morocco, the Moroccan RIC will be able to fulfill its missions and functions as defined by WMO. RIC capacities and staff knowledge in matter of metrology will be improved to the stage that experience and knowledge transfer would be possible with other AR-1 members.

The project is in its final stage and most of the planned action were already achieved. A quality approach was also adopted. The paper will define the vision and the objectives of the project, the implementation plan and the achievement progress.

1. Introduction

The WIGOS demonstration project of Morocco has been designed to achieve a set of actions aiming to improve the standardization and traceability of weather data measurement through:

- The Strengthening of the material capacities and human knowledge of the Moroccan Regional Instrumentation Center (RIC) for AR-I and improving its technical procedures to allow it to accomplish its task of calibration in link to recognized Metrological International chain ,
- The Establishment of Metadata catalogues of the whole synoptic, marine, aeronautic and automatic weather stations constituting the Moroccan Meteorological Surface observing Network.

The first project aims to improve means and capabilities of the NMS of Morocco concerning standardization and traceability, to be able to achieve high quality measurements. This objective will be achieved via the reinforcement of the RIC of Morocco that is the responsible of the quality and the conformity of the instrument's measurement.

The starting point for the achievement of this project is based on the recommendations of WMO convention and those of the CIMO related to the reinforcement of the RICs in standardization and traceability and especially those of developing countries (CIMO, XIV session, Geneva-2006).

In fact, the CIMO recommended, in its report of RIC assessment, to improve the capacities of these organisms concerning data traceability, technical measurement and standardization facilities, quality control by audits and inter-comparisons, and also in terms of accreditation and quality certifications: "*The CIMO underlined the importance and the interest of the RIC reinforcement, being sensible that an aid should be procured them in four big domains*:

a) Setting up of laboratories and purchase of standardization devices;

b) Quality Insurance and control;

c) Training;

d) Assessment of the RIC. "

Furthermore, standardization and meteorological data quality is a concept of WIGOS which concern standardization of instrumentation requirement and measurements.

The second project concern the establishment of Metadata catalogues of the Moroccan Meteorological Surface observing Network. Seeing the rapid expansion of cities, more and more synoptic station had seen their sitting environment modified and in some cases not fulfilling to standards. Moreover, information related to calibration, instruments renewed and sensor exposure is not archived. By this project, it's expected to produce documents describing instrument metadata, as well as, equipment life-cycle:

- Instrument/network sitting,
- Calibration, renewing and maintenance.

2. Progress of the Demonstration Project

To achieve Moroccan RIC reinforcement in the four domains as recommended by CIMO, NMS of Morocco conduct several actions:

2.1 Strengthening RIC material capacities:

Since 2007, the NMS of Morocco conduct a various actions to strengthen the material capabilities of its calibrating laboratory that has been designated as Regional Instrumentation Center with extended capacities in 2007. The following preparatory actions have been achieved in this year:

- Upgrade of existing laboratory equipments (*repairing existing equipments and connecting sensors and standards used with the different equipments to a computer in order to optimize data collection*). This action was accomplished but there is a need to determinate uncertainties due to the introduced system.

- Civil works were conducted to fit laboratory local to standards. This action was achieved but the NMS of Morocco was planning to provide new building for RIC. Special measurements are to be made to prove that atmospheric conditions inside the laboratory are quite stable.

- Calibration of mercury barometers references in Météo-France (RIC for AR-VI).

Existing pressure and humidity test chambers

For the strengthening of RIC capabilities, three stages were defined:

1. Acquisition of standards and calibrating equipments to calibrate instruments measuring atmospheric pressure,
2. Acquisition of standards and calibrating equipments to calibrate instruments measuring temperature and humidity,
3. Acquisition of calibrating equipments for rain gages.

In August 2008, the first phase was accomplished and allows the acquisition of complete automated solution for calibrating analogical and digital barometers in site and at laboratory and also the development of Software with respect to COFRAC standards.

Laboratory automatic pressure generator

Automatic pressure generator for site calibrations

Pressure Standard

In 2009, a first part of the second stage was achieved which consist on the acquirement of liquid bath for temperature sensor calibration, reference temperature sensor SPRT, automatic humidity generator and two laboratory conditions recorders.

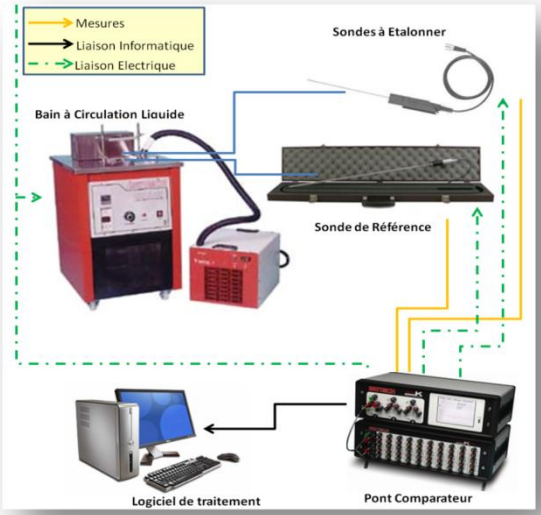
Liquid bath for temperature (WIKA-CTB 9400)

Humidity generator (ROTRONIC- HYGROGEN-2)

Temperature and humidity readout equipment for monitoring atmospheric condition at the calibrating laboratory

By the year 2009, The NMS provide an additional sum to achieve the second part of the stage 2 which consist on the acquisition of the following laboratory equipments:

- ✓ **for temperature:** Acquisition of one key solution including :
  - Liquid bath with two SPRTs (laboratory and work standards),
  - Acquisition unit (high precision thermometer with ADSL bridge) calculating resistances for two values of currents 1.mA and 1.41 mA to avoid self-heating,
  - Specific software to command the liquid bathy and also generate calibrating certificates,
  - Two fixed cells standards (Gallium and Triple points of water) and the associated necessary equipments to maintain these points.



The new solution for calibrating temperature sensors

Fixed cells standards of Gallium and Triple points of water

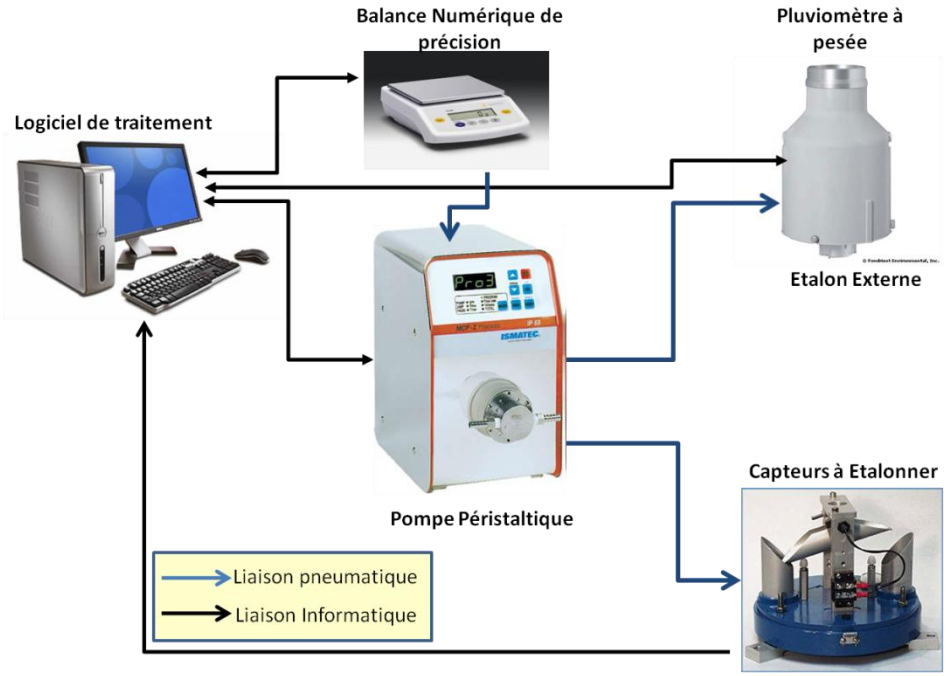
- ✓ **for humidity**:
  - Acquisition of new climatic chamber (ARALAB),
  - Acquisition of a mirror chilled humidity standard (MBW 473),
  - Acquisition of a calibrating set based on salt solution (Vaisala HMK15).

The new climatic chamber

mirror chilled humidity standard and calibrating set based on fixed point solution

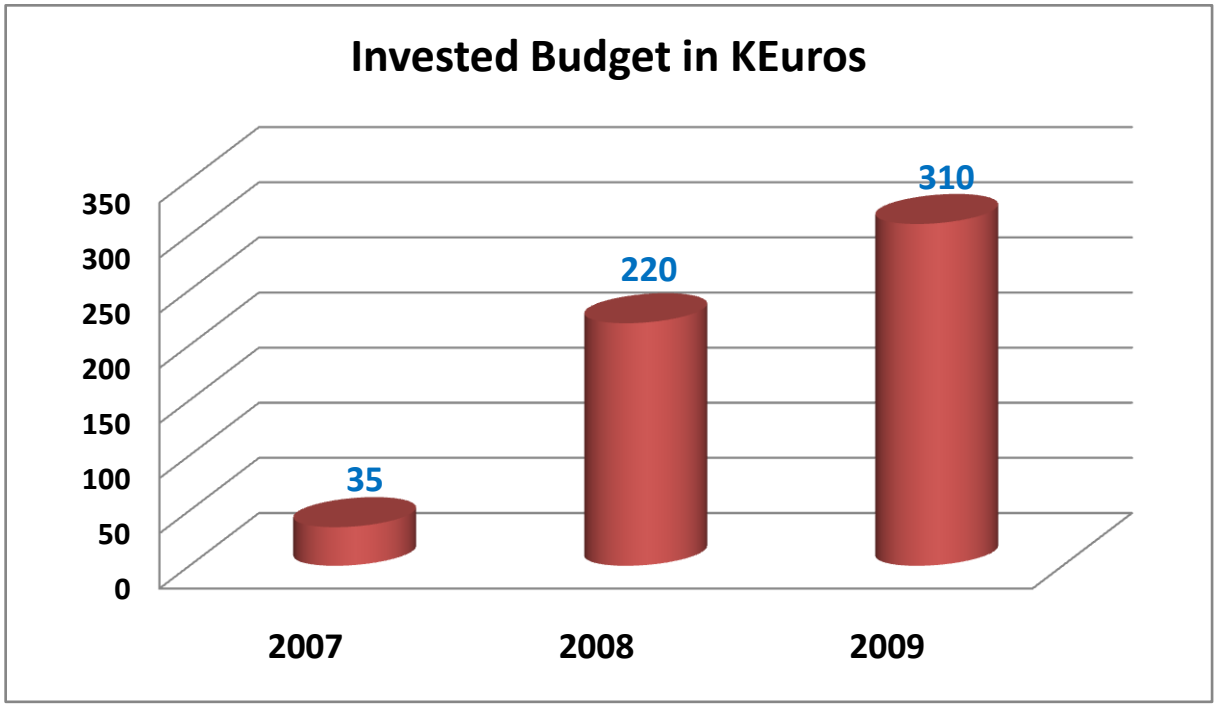
✓ **for precipitation**:
The equipments acquired consist on a solution to compare tipping bucket rain gage measurements to the water pumped for various intensities:

- Acquisition of a peristaltic pump,
- Acquisition of two digital scales with high precision,
- Acquisition of a weighing rain gage



Functional scheme of the solution acquired for precipitation

Furthermore, the NMS decide to hold RIC in the main building of the Direction. For this purpose, civil works were conducted to prepare the new RIC locals. The new local is now available and also equipped. Participant and CIMO ET on RICS visit the new laboratory during its meeting in Casablanca, December 2009.



Evolution of the annual cost for the acquisition process of the new laboratory equipment

2.2 Training:

- RIC Staff received training on metrology of pressure and on installing and handling the new pressure calibrating system,
- NMS of Morocco hold, in December 2009, the French session of the WMO course on metrology for the AR-I French speaking countries (30 November to 03 December 2009),
- The technical staff of the calibrating laboratory follows the training in matter of metrology organized by the African Commission of Metrology (CAFMET) held in Casablanca in May 2010.

2.3 Conducting calibrating operations:

RIC of Morocco already conducted calibrating operations in 2007 and 2008:

- Calibrating 15 digital barometers installed in the principal airports (*achieved with the support of Meteo-France calibrating laboratory*)
- Calibrating 24 mercury barometers installed in the synoptic stations.

The conclusion of the operation made is that almost 40% of mercury barometers calibrated has uncertainties near or superior of WMO tolerances.

A new calibrating campaign will take place by the end of the year 2010.

2.4 Laboratory standards Intercomparison

The RIC of Morocco conducted, in July 2010, a laboratory standards intercomparison with the Météo-France Calibrating Laboratory (RIC for AR VI). This intercomparison will constitute a continuity of the laboratory standards intercomparison achieved two years ago between RICs of Météo-France, Australia, Slovakia and Slovenia.

2.5 Quality approach:

In matter of Quality insurance, NMS of Morocco has engaged a quality approach since 2007. The fundamental processes such as observation, general forecast, marine meteorology and meteorological assistance to aeronautic navigation are in the final stages. Quality manuals are prepared.

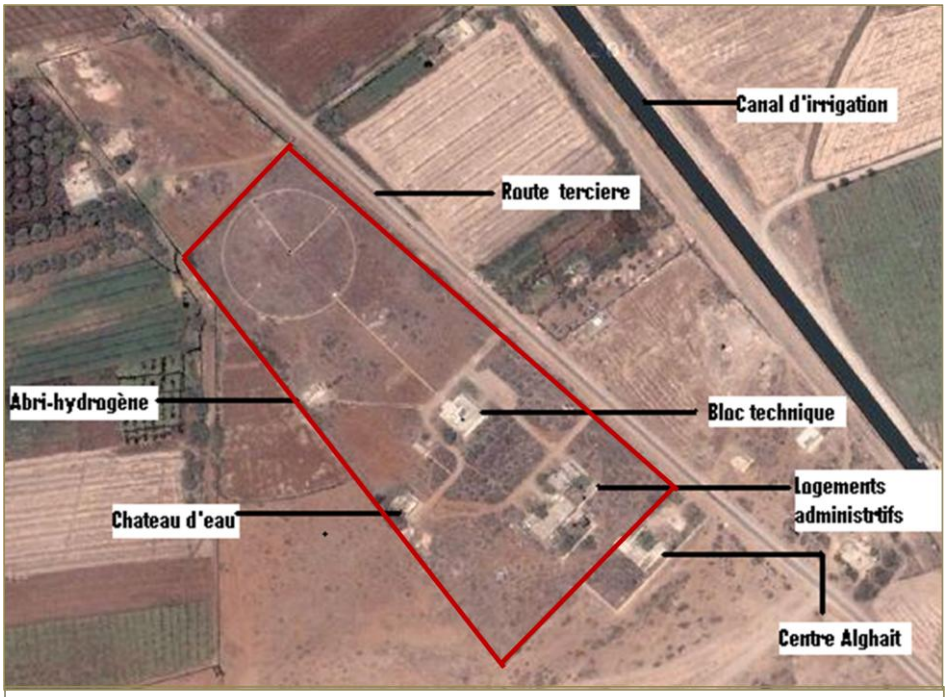
During 2008, NMS of Morocco start quality circles for support processes like maintenance and calibration. Furthermore, a contractor was contacted to provide quality circles and training for RIC staff in matter of 17025 requirements.

Standards Intercomparison at Meteo-France calibrating Laboratory (RIC for AR VI) was also achieved in July 2010,

During the meeting of the CIMO ET on RICs held in Casablanca, the participants have engaged an assessment test of the RIC of Morocco with regards to the ISO 17025 requirements and RIC TOR using the new template evaluating Scheme developed by the ET.

The scores obtained during this evaluation were very encouraging and could be improved by writing laboratory technical procedures and a real involvement of the RIC in the certification process.

For the second project, official letter was send to different synoptic station to help in collecting METADATA and the catalogue is under preparation.



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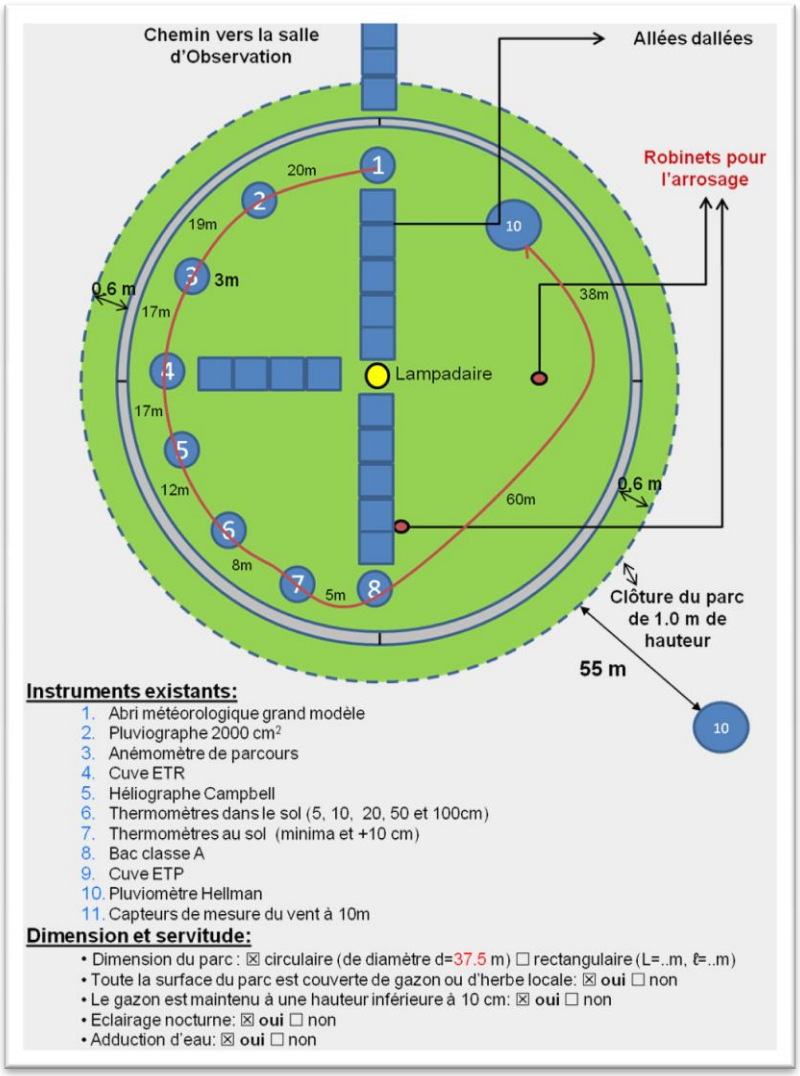

Example of Metadata of the Synoptic station of Beni Mellal

3. Experiences gained, problems encountered, implementation constraints

The NMS of Morocco and especially its calibrating laboratory considers that experiences have been acquired in the following areas:

- Making benefit from WIGOS values and taking part, while being satisfied, to its implementation,
- Definition of needs and establishment of technical specifications of each materiel to be acquired,
- Management of the acquisition process (budget, acquisition project achievement…),
- Acquiring knowledge in matter of standards and processes related to the calibration of meteorological instruments,
- Implementing quality control process.

Several difficulties were encountered during the execution of the Demonstration Project. Following examples of some problems encountered and lessons learned:

- A real difficulty was encountered during the development of calibrating software. In fact, there was a need of help of technical expert for providing the way to calculate and determine metrological parameters (uncertainty, hysteresis, repeatability…). To overcome this problem, a technical assistance was provided RIC of AR VI.
  In this context, WIGOS should encourage cooperation between RICs of developing and developed countries. This cooperation should lead to a real knowledge transfer.

- Difficulties were also encountered when bringing barometers from station to laboratory (need of replacement). RIC acquired, to resolve this problem, necessary digital barometers with LCD screen to replace mercury barometers not fulfilling WMO standards. (18 digital barometers were acquired in 2009; total cost of this action is 60.000 Euros). The WIGOS should emphasize the practical application of its terms of reference. Indeed, the implementation of the concept of WIGOS at different levels (observation, coding and transmission, modeling, dissemination ...) will generate some friction that may be exceeded by the definition of clear and comprehensible procedures and deliverables.

As a conclusion, the progress of the project is consistent with the timetable presented at TECO-WIGOS. NMS of Morocco took into charge the actions mentioned above and expressed need of additional support in matter of:

- Staff training in matter of metrology and quality insurance,
- Organizing visits to other RICs as an approach for knowledge transfer and experience exchange,
- Assisting in the preparation and writing of working procedures for laboratory and site calibrating operations. These procedures will also serve in the preparation of quality manuals.