Perfiles

Andrea Merlone

COORDINADOR DEL PROYECTO METEOMET

POR FORTUNATO MÁRQUEZ ORTEGA (AEMET, MADRID)

Andrea Merlone PhD, senior researcher, is head of the "Thermal Measurements and Application" program of the Istituto Nazionale di Ricerca Metrologica (INRiM) Torino, Italy and responsible for the projects "Environment and Energy Thermal Metrology" and "Temperature Controls and Traceability". He is coordinator of the EURAMET Joint Research Project "MeteoMet – Metrology for Meteorology", that groups a wide consortium of 18 European institutes of metrology, 7 universities, 12 meteorological institutions, including WMO, manufacturers and research Institutes.

He is also chairman of the working Group 2 of the Consultative Committee for Thermometry of CIPM and member of the CCT Strategy Group. He is member of the Strategy Group and of the Best Practice Task Group of the Technical Committee on Thermometry (TC-T) of EURAMET. He is information officer of the Technical Committee on Thermometry (TC12) of IMEKO, member of the International Surface Temperature Initiative and of the WG of GRUAN - WMO.

Merlone is author or co-author of about 100 papers on international reviews and conferences proceedings. His recent activities ranged from the accurate measurements of phase transitions thermodynamics, to the determinations of the Boltzmann's constant for the new definition of the Kelvin, to a new metrological approach for the traceability of meteorological observations and climate studies. He was awarded the EURAMET impact prize on July 2013 for the outcomes of the MeteoMet Project.

Could you explain briefly the mission or aims of EURAMET´s European Metrology Research Programme (EMRP)?

The European Association of National Metrology Institutes (EURAMET) is a Regional Metrology Organisation of Europe. It coordinates the cooperation of European National Metrology Institutes in fields like research in metrology, traceability of measurements to the SI units, international recognition of national measurement standards and related Calibration and Measurement Capabilities of its members. Through knowledge transfer and cooperation among its members EURAMET facilitates the development of the national metrology infrastructures.

The science of measurement - metrology - is important for scientific research, industry and our everyday lives, as the demand for measurements with high accuracies and low uncertainties continues to increase. The European Metrology Research Programme (EMRP) enables European metrology institutes, industrial organisations and academia to collaborate on joint research projects within specified fields. These collaborative efforts will accelerate innovation in areas where shared resources and decision-making processes are desirable due to economic factors and the distribution of expertise across different countries and sectors.

The EMRP is implemented by EURAMET, organised by 23 National Metrology Institutes, supported by the European Union and has a value of 400 M €. The preceding project iMERA-Plus (implementing Metrology in the European Research Area) had a value of 64.6 M €.

EURAMET is responsible for the elaboration and execution of EMRP. The programme funds joint research projects in specific fields of metrology with over 50 projects selected for funding so far and many more expected over the coming years.

How did the first idea about MeteoMet Project appear?

It was 2005, the international year of physics (IYP), when we decided to show to a wide public how thermal metrology could

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RESUMEN ENTREVISTA

El doctor Andrea Merlone es coordinador del proyecto EURAMET MeteoMet – Metrology for Meteorology que reúne a 18 institutos europeos de metrología, y varias universidades y organizaciones meteorológicas, entre las que se encuentra la OMM. Ha escrito más de 100 artículos científicos, y entre sus actividades más recientes están la medición exacta de las transiciones de fase termodinámicas, la determinación de la constante de Boltzmann para la nueva definición del kelvin y un enfoque metrológico novedoso para la trazabilidad de observaciones meteorológicas y estudios climáticos.

EURAMET coordina la cooperación europea en metrología, trazabilidad de medidas a unidades SI, la homologación internacional de los estándares de medida nacionales y de capacidades de calibración. La metrología es la ciencia de la medida, importante para la investigación científica, industria y nuestras vidas cotidianas. Es responsable de la ejecución de EMRP, el programa de investigación metrológica europeo. Tiene un presupuesto de 400 M €, mucho más que el precedente Imera-Plus (64.6 M €).

La primera idea del proyecto MeteoMet sugió en el año internacional de la Física 2005, en que se decidió hacer un esfuerzo por explicar para el público la metrología térmica. El grupo de Merlone montó una estación para mostrar cómo se pueden medir los parámetros climáticos con precisión, con el objeto de obtener registros climáticos más robustos que permitan una evaluación más precisa de las tendencias climáticas. El lema que sintetiza MeteoMet es: el éxito de cualquier observación meteorológica o investigación climática depende de la disponibilidad de datos robustos. En MeteoMet participan 15 servicios meteorológicos europeos, además de 18 institutos de metrología nacionales y numerosas universidades y empresas, con un presupuesto de unos 5 M €.

Se han identificado dos puntos en que la metrología puede ser útil a la meteorología: uno es la falta de un balance detallado de incertidumbres en la calibración, y otro un concepto deficiente de calibración. Los sensores solo se calibran si el control anterior da resultados negativos. En ocasiones se interpretan las especificaciones del instrumento como la incertidumbre de la medida, un gran error.

Un campo futuro de colaboración con la OMM sería con CIMO (Comisión para instrumentos y métodos de observación), cuya guía está traduciendo al espa-

be better understood. At that time my group was involved in the new definition of the kelvin through the determination of the Boltzmann's constant. We decided to set-up a demo station where we showed to the public of IYP how climate parameters could be accurately measured, for a robust generation of data records, for a more clear evaluation of climate trends.

Could you sum up MeteoMet´s Project in a sentence?

Yes: this was requested by EURAMET too! The sentence is: the success of any meteorological observation and climate investigation depends upon the availability of reliability data.

How many human or economical resources are involved in MeteoMet project?

MeteoMet has a budget of approx 5 M€. It involves 18 National Metrology Institutes as funded partners, five Research Institutes funded through Research Grants, 9 Universities as Collaborators, 15 Meteo services all over Europe, Manufacturers and other companies as stakeholders. In total more than 50 researchers are involved somehow in MeteoMet over Europe. At INRiM we set a group of thermal metrology for Enviroment of 7 persons, mostly new staff and young people.

One of the aims of this Project consists on gathering information about periodic maintenance and calibration routines carried out by national weather services. According to the information you have received, what do you think about meteorologist attitude towards metrology? Is it this attitude good enough?

Slowly we get in contact with Meteo services. Most of them have a calibration chain or even an internal calibration laboratory. Primary standards, works standards and travelling standards are most of the time used under defined procedures. We noticed two key points where metrology can help. A lack of uniform procedures that do not include complete budget of uncertainties for the calibration and a misleading concept of calibration where most of the time the final instrument is just in-situ checked against a reference. Sensors are calibrated only if the results of the check are negative. Calibration curves are not always applied. Sometime now the specifications of the instrument are taken as measurement uncertainty: a great mistake. One of our future goal will be that to even extend our contribution from calibration uncertainties to measurements uncertainties. .

AEMET is translating the new English CIMO Guide into Spanish. In this guide appear some expressions or definitions that are not using in a correct way, according to the International Metrology Vocabulary. In addition to this, in some measurements, the target uncertainties are not very realistic. Are there going to give any recommendations in order to solve out these problems?

We are in constant contact with WMO – CIMO and GCOS GRUAN (upper air reference network of radiosondes). We worked for the revision of the GRUAN in order to make the procedures and definition in agreement with the GUM. That's been a positive example of contribution from the metrology community. This work was carried on by me and the chair of the JCGM WG1, Dr. Walter Bich, that has in charge the revision of the GUM. I did not needed much work to convince him of the relevance of

such action as an example of starting point! With the CIMO guide we see a very robust internal coherence that can be improved in terms of terminology to make it in sound also with other sciences. That's the advances of the GUM: it can be adopted by any community, helping the interchange of information. Finally a future goal of a strong collaboration between our community and CIMO would be that to achieve a complete uncertainty budget in the measurements. This is claimed to be a clear statement, but it is not that "easy" job it seems. Calibration procedures and sitting definition is not enough. We have to well define sensors related uncertainties, like typologies and dynamics, including a complete knowledge of the quantities of influence on the different sensors. Sitting uncertainties could be improved in terms of uncertainties and sometimes even it is not clear the definition of the measurand itself. When taking a temperature measurement what am I measuring? Thermal equilibrium? Heat transfer? Conduction? Convection? Radiation? How much of the mix of those?

One of the work packages consists on sensors and different upper-air measurements. Has any relation or agreement been established between the GCOS Reference Upper-air Network (GRUAN) and the MeteoMet Project?

I was invited to become effective member of the GRUAN WG. I took part in two of the recent implementation plan. Beside the recalled revision of the GRUAN guide and manual, we are now defining a new work package for "GRUAN – oriented metrology", to be included in a future call for a follow up project. This is an example of real effective collaboration

Other work package devotes on "traceable measurement methods and protocols for ground based meteorological observations". INTA and CEM are involved in this Work Package. Are in situ calibration procedures with their associated uncertainties going to be developed under the MeteoMet project? Is the influence of radiation shield going to be considered in the uncertainty budget of humidity and temperature measurements?

Yes, we are going to make a intercomparison study where we'll try to give advices on possible calibration procedures involving the naked sensors and/or the complete stations, including the evaluation of quantities of influence, like solar radiation and wind speed on temperature, pressure and humidity.

One of the main purposes of this Project is to ensure the metrological traceability of the ground based meteorological observations to national standards. On the other hand, National Weather Services own a large quantity of different instrumentations, data register equipments, in their different observation networks. Do you think if it is possible to ensure metrological traceability to all these devices? Is it a utopia?

I think Europe should start to define a network of reference stations where sensors are calibrated following a unique agreed procedure and siting is well characterised also in terms of uncertainties. Especially those stations and sites that generate data for climate records. Nations should choose some among the thousands stations that will take part in this more robust control. For other stations used to evaluate short terms relative changes, like for weather alarms, the need of a complete defined uncertainty is less heavy and most of the stations can continue to be operated under the running procedures of check. Accuracy and relative uncertainty should be well separated.

This JRP is focused on the traceability and reliability of measurements involved in Climate Change, as temperature. There are some magnitudes that exert an influence on the temperature measurement (for example the wind speed) in which the type, shape or size of the shield make the obtained data change. Those factors can be a major source of influence even more than the corrections and uncertainties related to the instruments that have been used. In your opinion (the Project has not finished yet), ¿how can we resolve this? Do you seem that we do not need the Stevenson screens?

My personal opinion is that, except for some special cases, the Stevenson screens will not be used in the future. AWS will take the leading role. We'll have to concentrate on such new systems and evaluate a complete characterisation in terms of ageing, reflectivity, uncertainties, mutual influences, resolutions, time constants etc.

The task 3.2.1 is the design of a reference housing for ground climate sensors, perhaps will this artifact be suggested to CIMO as standard or reference screen for meteorological observations?

The new screen has been studied and manufactured. It is now under test. We'll see how tests results will be and we'll publish the results on a reviewed journal. We'll present this to WMO. But there our work ends: our role is that to give advice on metrological issues. There are commercial and regulatory issues we do not want to be involved into.

The 2012 meeting of the Comité Consultatif de Thermométrie (CCT); Andrea Merlone, second from the right, was then elected Chair person of the working group 2 on secondary thermometry, that includs monitoring and activities on environmental issues. The picture was taken in front of one of the BIPM pavilions.

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ñol la AEMET. En este sentido un objetivo futuro sería el logro un balance de incertidumbres completo en la medidas.

Otro campo dentro de MeteoMet es un estudio de intercomparación para precisar la influencia de la radiación solar, la velocidad del viento o la presión en la medida in situ de humedad y temperatura. En este contexto A. Merlone está a favor de que se defina una red europea de estaciones de referencia, con sensores calibrados según un procedimiento único y la ubicación escogida para una mayor representatividad de incertidumbres, en especial las que producen datos climáticos.

Sobre la cuestión de la medición precisa de la temperatura en el marco del cambio climático y la influencia del tipo de garita, A. Merlone piensa que que la garita Stevenson no se usará en el futuro, el mayor papel corresponderá a las automáticas. Es necesario caracterizar de forma completa a estas en términos de envejecimiento, reflectividad, e incertidumbres entre otros. También se está diseñando una nueva garita que se ofrecerá a la OMM.

Finaliza A. Merlone señalando que el objetivo es establecer una colaboración permanente entre la metrología y la meteorología. Esta supone una oportunidad excelente para sacar a la metrología del laboratorio para beneficio de la generación futura de climatólogos.

Close to the end of the project or at the end of the project, is it going to celebrate any international meeting between the Partners and the collaborators (stakeholders)? It would be very interesting to discuss about the results of the Project, mainly, for the national weather services.

We are planning a joint workshop in September 2014 in Slovenia, where we will present the main outcomes of MeteoMet to a large audience. The event is endorsed by WMO-CIMO, GCOS-GRUAN, EURAMET, IMEKO and other Institutions both from the metrology and climate communities. It is called MMC2014 – Metrology for Meteorology and Climate.

At the end of this Project, several calibration facilities will have been developed. Is training courses going to be celebrated for the staff of national weather calibration services? How could the national weather services get these facilities?

We already had training course and we plan to have at least two dates each year where we'll present the new studies and facilities. By now we are testing the effective use of the calibration facilities together with meteo services and research institutes. One of those chamber will be transported at the Everest pyramid in September. We'll go there and setup all the necessary equipment to make the atmospheric measurement recorded in such an unique environment, directly traceable to SI standards. "Bringing traceability to the top of the world"! In 2014 we'll do the same for a GRUAN station in the Swalberd islands.

Have you thought in some medium, where Metrologist could have input of Meteorologist in order to get a better communication between both communities?

We are now working to prepare the follow up proposal. We will try to slowly move from calibration to measurements uncertainty, trying to focus on one contribution at a time. We'll keep working and enforcing our collaborations with GRUAN, ISTI, CIMO and other Institutions, We'll extend our activities to deep sea temperature measurements, to upper air, to ground based systems. We'll include attention to the soil with metrological approaches in the calibration and measurements uncertainties for soil moisture and permafrost measurements. This last one will be a focus for my personal activity since it's a challenging example on how we can try to define complete measurements uncertainties in a relevant field of climatology and "paleo-climatology". Moreover, we trained young metrologists in this new activities: it is worth to make those effort lasting for the benefit of other disciplines. Yes our goal is to establish a permanent collaboration between metrology and meteorology. Quality of data is a fundamental aspect for such studies. My personal opinion is that this is a key contribution that the metrology community can bring "outside" the laboratory for the benefit of the future generation of climatologists.

On behalf on our readers, thank you very much Mr Merlone for your kindness and for the interesting explanation of your activities provided.