EMRP Call 2013 – Energy, Environment

Selected Research Topic number: **SRT-v03**
Version: 1.0

Title: Metrology for Essential Climate Variables

Abstract

Climate change and its consequences require immediate actions in order to safeguard the environment and economy in Europe and in the rest of the world. Reliable assessment of climate change crucially depends on the robustness of climate data and methodology and also on the associated measurement uncertainties. Essential Climate Variables (ECVs) as defined by the Global Climate Observing System (GCOS) include key variables such as pressure, temperature and humidity.

As stated by GCOS, international exchange is required for both current and historical ECV observations. A metrological approach for ECVs would develop common procedures, providing traceability and quality assessment of environmental measurements. As a result, improved reliability of weather phenomena decisions (e.g. avalanche and flood risk) and correct calculation of risks linked to weather phenomena may avoid consequences such as increased flood and drought, biodiversity reduction and financial loss for sectors such as energy, transport, forestry, agriculture, and tourism.

Conformity with the Work Programme

This Call for JRPs conforms to the EMRP Outline 2008, section on “Grand Challenges” related to Energy and Environment on page 24.

Keywords

Metrology for meteorology, meteorological observation, climate change monitoring, weather measurements traceability, sensors-network calibration, automatic weather station, reference surface observing stations, measurement uncertainty, siting uncertainty, Weather phenomena decision making, Surface and upper air weather measurement instruments, Metrology for earth atmosphere, GRUAN, sea temperature, lakes temperature, high mountain meteorology, metrology for permafrost, metrology for soil moisture.

Background to the Metrological Challenges

The European meteorological organisations and community networks have identified a need to develop traceable climate measurements. In close collaboration with the GCOS/WMO and the stakeholder community, critical research for such networks is the calibration of instruments, development of measurement methods and standards, traceability of measurements and assessment of measurement uncertainty of ECVs.

Reference series play a key role in improving climate historical series although traceable climate specific data or uncertainties often do not exist. A reference site for ECVs along with a sound metrological approach could allow improvement in monitoring and characterisation of surface climate changes within Europe. In fact, GCOS explicitly requests traceability to the SI for all measurements.

Dynamic measurement analysis is proposed in order to achieve accurate calibration of atmospheric sensors. Dynamic measurement uncertainty will be evaluated as one of the contributions in measurement uncertainty budget.

Environmental measurements of rapidly varying or transient measurands test the dynamic characteristics of sensors and investigation of sensor responses to transient and periodic reference signals needs to be performed. As documented in ISO recommendations 17714:2007 and according to the Guide to the expression of Uncertainty in Measurement (GUM) and GUM Supplements 1 and 2, there is currently a lack of uncertainty assessment and knowledge on dynamic characteristics of sensors. The resulting challenge will be the move from traditional determination of calibration uncertainty (sensor response to a calibration artefact under controlled conditions) to traceable determination of measurement uncertainty. This would

ideally be extended to the complete range of atmospheric conditions (such as permafrost, deep sea and soil moisture measurement).

For upper air measurements, the GCOS Reference Upper Air Network (GRUAN) is an international reference observing network and covers measurements of a range of key climate variables including humidity and temperature. GRUAN requires traceable measurements and uncertainty estimation within specified limits [GCOS-112, 2007]. Procedures and protocols are required to support the definition and implementation of these measurements.

Scientific and Technological Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the JRP-Protocol.

The JRP shall focus on the traceable measurement and characterisation to provide traceability for Essential Climate Variables (ECVs).

A crucial element in developing proposals will be close collaboration with WMO, GCOS and the wider stakeholder community to determine the priorities of the ECVs to be addressed, starting from those related to temperature, pressure and humidity.

The specific objectives are:

1. To develop methods and procedures to ensure that networks of climate monitoring stations can report data traceable to the SI and are therefore comparable.
2. To characterise sensors used in these measurements so that they can demonstrate traceability and uncertainties can be evaluated, especially for those sensors used to monitor fast changing parameters or those used in extreme environments.
3. Activities engaging stakeholders to strengthen cooperation and to promote sustainable engagement between the European metrology and meteorology communities to establish an infrastructure for traceability of climate variables.

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. To enhance the impact of the R&D work, the involvement of the user community such as industry, and standardisation and regulatory bodies, as appropriate, is strongly recommended.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this and EMRP JRP ENV07 (MeteoMet) ‘Metrology for pressure, temperature, humidity and airspeed in the atmosphere‘.

EURAMET expects the average size of JRPs in this call to be between 3.0 to 3.5 M€, and has defined an upper limit of 5 M€ for any project. Any proposal received for this SRT is expected to be significantly above 3.5 M€. The available budget for integral Research Excellence Grants is 30 months of effort.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community. This may be through the inclusion of unfunded JRP-Partners or collaborators, or by including links to industrial/policy advisory committees, standards committees or other bodies. Evidence of support from the “end user” community (eg letters of support) is encouraged.

You should detail how your JRP results are going to:

- feed into the development of urgent documentary standards through appropriate standards bodies
- transfer knowledge to the wider environmental sector.
- strongly link with the needs of the meteorological community following ECV guidelines but also reach beyond the direct impact in that community,

You should detail other impacts of your proposed JRP as detailed in the document “Guide 4: Writing a Joint Research Project”

You should also detail how your approach to realising the objectives will further the aim of the EMRP to develop a coherent approach at the European level in the field of metrology and includes the best available contributions from across the metrology community. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of Member States and countries associated with the Seventh Framework Programme whose metrology programmes are at an early stage of development to be increased
- outside researchers & research organisations other than NMIs and DIs to be involved in the work

Time-scale

The project should be of up to 3 years duration.