Taking the Temperature of the Earth, 25 - 27 June 2012, Edinburgh

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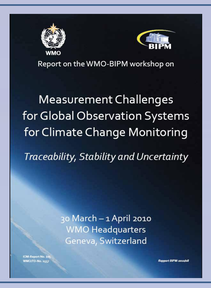
Metrological approach to Earth Temperature measurements: The MeteoMet project



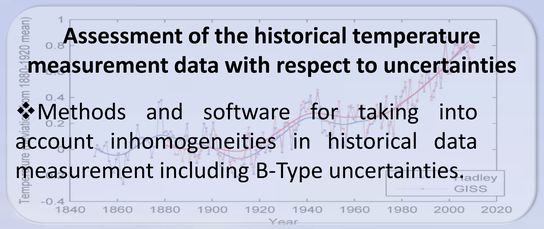
Needs

The success of any meteorological observation and climate investigation depends upon the availability of reliable data.

Project Structure

Upper air measurements

❖ Realization of traceable tunable diode laser hygrometers and the study of absorption lines of water molecule
❖ Implementation of new microwave hygrometers, innovative multisensors for free-space non-contact atmospheric measurements, ultrasonic anemometers, novel methods for GPS and Galileo-based measurements. Traceability of radiosonde-based measurements.
❖ Intercomparison of airbone field humidity sensors (Aquavit 2 campaign).
❖improvement in the water vapour formulae



Assessment of the historical temperature measurement data with respect to uncertainties

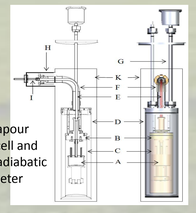
❖Methods and software for taking into account inhomogeneities in historical data measurement including B-Type uncertainties.

Ground based measurements

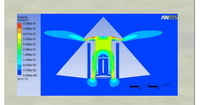
❖ Proposition of calibration protocols for automatic weather stations (AWS), evaluation of the effect of solar radiance, traceability in wind speed measurements. Evaluation of calibration uncertainties for air temperature sensors.
❖ Development of facilities for laboratory and in situ simultaneous calibration of T, P, RH sensors also working in extreme conditions.
❖ First metrological intercomparison of AWS.
❖ Software validation of (AWS).

Activities in the first 6 months:

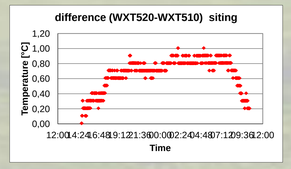
• Model for the seeding deposition effect on the ultrasonic anemometer.
• Questionnaire on AWS
• Collection of historical series

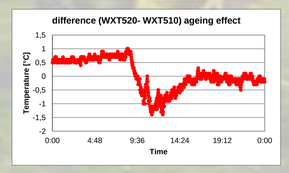


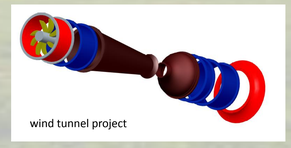
Water vapour pressure cell and associated adiabatic calorimeter



AWS reference housing







wind tunnel project

METEOMET

Metrology for Meteorology

"Metrology for pressure, temperature, humidity and airspeed in the atmosphere"

www.meteomet.org

EMRP2010 Call Industry and Environment

Start date: October 2011 – Duration: 3 years

Project Aim

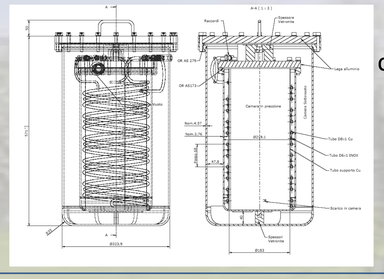
Ensuring a defined traceability to the national standards for meteorological observations: surface and upper air measurements of temperature, pressure, humidity, wind speed and direction, solar irradiance and reciprocal influences analysis.

❖ achievement robust data with uncertainty budget
❖ accurate interpretation of historical temperature data series

Validation of Earth Temperature measurements

Robustness of temperature data

• Metrological validate calibrations procedures
• Traceability through unbroken chains of calibrations
• Measurement uncertainty budget
• Mutual influence analysis between parameters
• T, P, RH, solar radiation, wind speed calibration



transportable calibration facility

laboratory calibration facility

Objectives

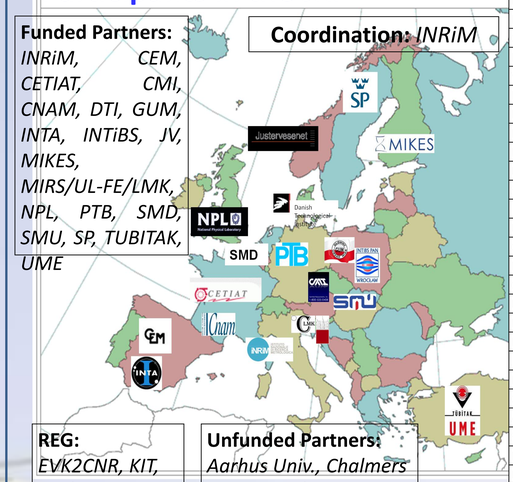
• **Traceability** to national standards for cliamte parmeters
• Definition of **measurement protocols** in line with WMO
• **Uncertainty** evaluation for climate measurements
•**Calibration** of weather stations and reference radiosondes
• Development of novel instruments for ground based observations
• Assessment of historical temperature data series and data homogenization (type B uncertainty inclusion)
• Improve **communication and co-operation** between Meteo Institute and Metrological and climate studies Institutes

Metrological support to climate monitoring

Participants in the JRP

Funded Partners: *INRiM, CEM, CETIAT, CMI, CNAM, DTI, GUM, INTA, INTiBS, JV, MIKES, MIRS/UL-FE/LMK, NPL, PTB, SMD, SMU, SP, TUBITAK, UME*

Coordination: *INRiM*



REG: *EVK2CNR, KIT, Aarhus Univ*

Unfunded Partners: *Aarhus Univ., Chalmers Univ, Wroclaw Univ.*

An agreement at European level on validated climate indicators

Collaboratores:
Meteorological Institute of Belgium
Bulgarian Insitute of Meteorology
Czech Hydrometeorological Institute
Danish Meteorological Institute
Vaisala Oyj
Finnish Meteorological Institute
MétéoFrance
METEOMODEM
ISAC CNR
Università di Milano
Società Meteorologica Italiana
CAE
Università degli studi di Cassino
Galileo ambiente
Meteo Duomo
Climate Consulting
Università di Torino
Michell Italia S.r.l.
National Metrology Institute
Japan Meteorological Agency
Environmental Agency of Slovenia
C3-Universidad Rovira i Virgili, Tarragona
Agencia Estatal de Meteorologia
Swedish Meteorological
Met. Office Research Unit
University of Reading
University of Edinburgh
Rotronic
NOAA
Turkish State Meteorological Service
ISTI
GCOS-GRUAN
WMO-CIMO

A possible follow up project for 2014-2017

• **Water contact thermometry**
(high mountains lakes temperature, water surface contact thermometry, deep ocean water temperature measurement, reference for satellites)
• **Network of reference ground based stations**
(classification of weather station)
• Airport reference station
• **Indirect** climate change **indicators**
(phenology, biosystems adaptation)
• **Agricoltural Meteorology**
(electronic leaf mist control metrological assessment, models validation)
• Results dissemination

International Surface Temperature Initiative

GRUAN