TESTING RADIOSONDES IN THE EDDIE TUNNEL AT INRIM

Andrea Merlone

METEOMET
Metrology for Meteorology

Istituto Nazionale di Ricerca Metrologica
Torino - Italy

Incorporating metrology techniques to analyse and minimise the bias introduced in temperature series related to the automation of weather stations

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Towards full uncertainty characterisation in the instrument change and transition procedures

Transition from manual to automatic.

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Making the change smooth by introducing uncertainties.

In this case, as a rare case, the uncertainty on the transition is very close to the composition of the two (before and after) calibration uncertainties.

The study must be done keeping the two devices in the same place and the environmental influences are "almost" the same. Repeated calibrations and parallel laboratory analysis are suggested.

“Almost” because different instruments can be influenced in a different way, but this is a relative (let's say second order) effect, since the measurand is the same and the place too.

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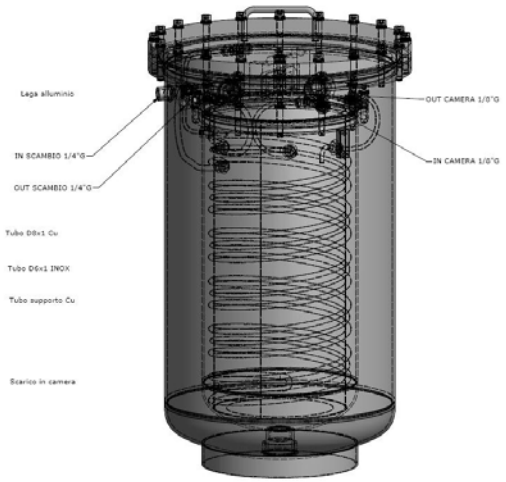
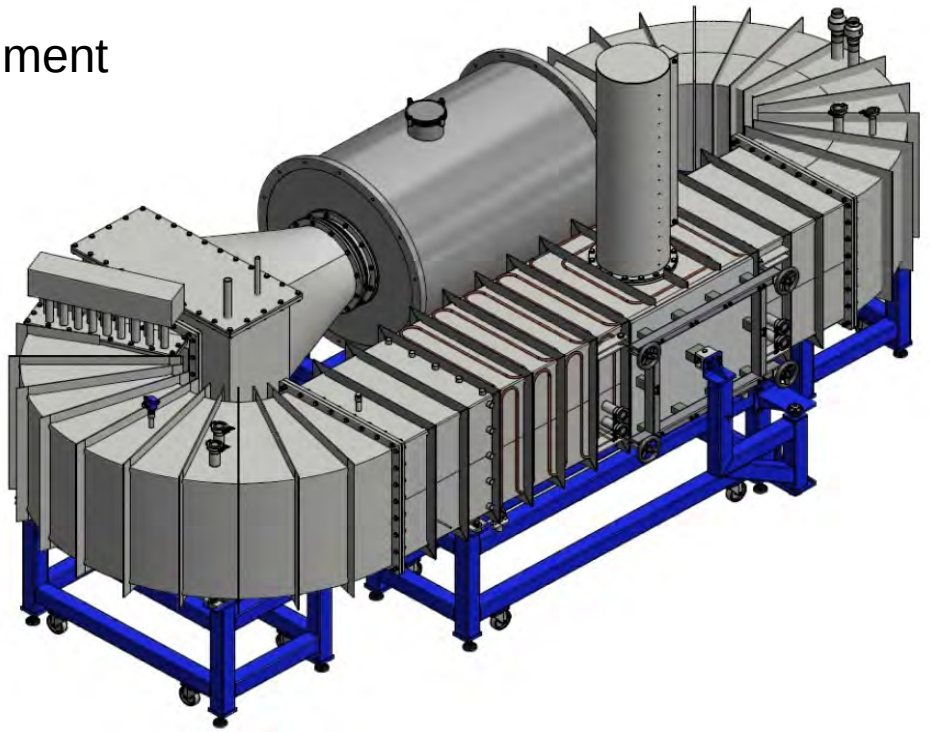
EDIE & EDDIE

Earh Dynamics Investigation Experiment





Earth Dynamics Direct Investigation Experiment

EDIE (Earth Dynamics Investigation Experiment) is a portable climatic chamber.

It simultaneously and independently controls

Temperature (- 30 °C -> +50 °C)
Pressure (1 kPa -> 110 kPa)

Available at INRiM for calibration and testing also in field.

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EDDIE (Earth Dynamics Direct Investigation Experiment) is a climatic chamber with wind generation.

It simultaneously and independently controls

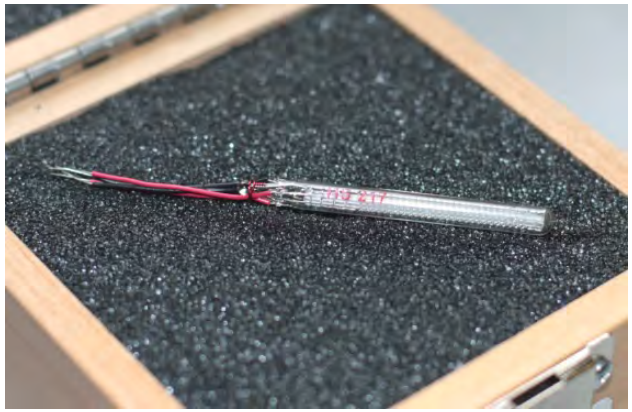
Temperature (- 40 °C -> +50 °C)
Humidity (0% - room)
Pressure (50 kPa -> 110 kPa)
Wind speed (0 -> 30 m/s)

Available at INRiM for calibration and testing.

EDIE and **EDDIE** are both equipped with high level standards

Direct traceability to primary standards of the System of Units.

ITS-90 fixed points.



Primary Standard Platinum Thermometers

EDIE was manufactured in three prototypes and two more are in progress**.**

It’s originally intended for in situ calibration.

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EDIE-0

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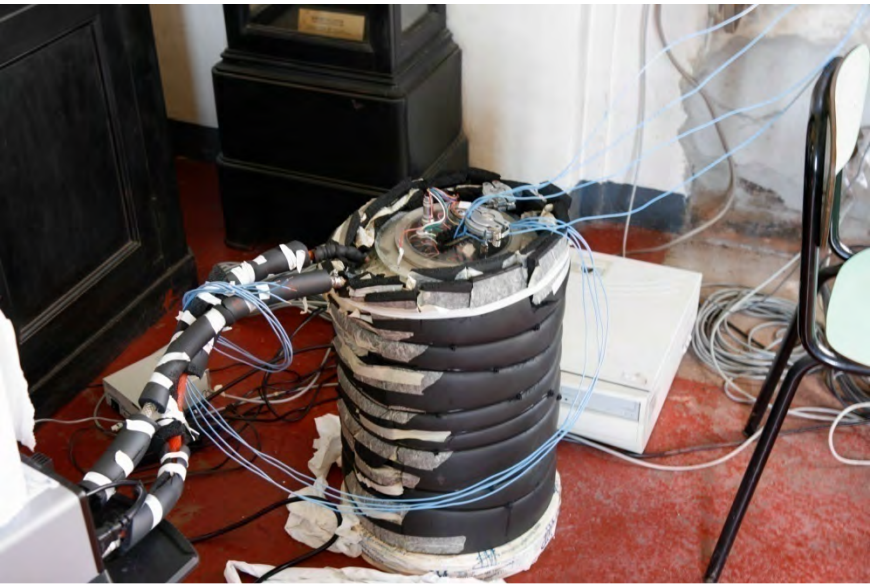

On site calibration of sensors in the centennial station of Moncalieri (see WMO video)

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EDIE-2

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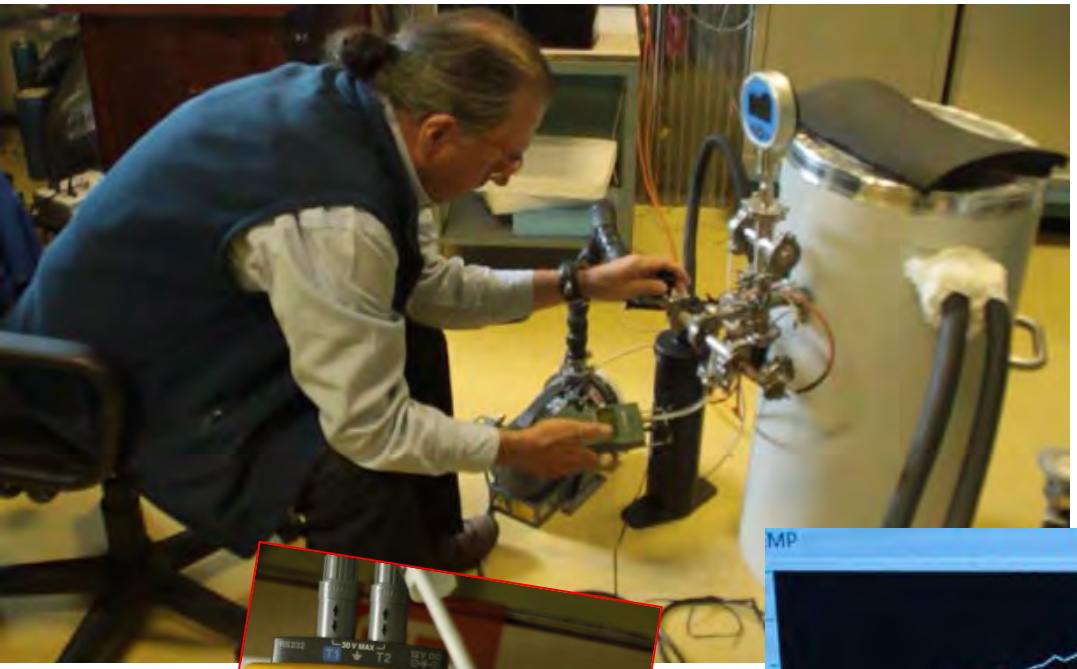

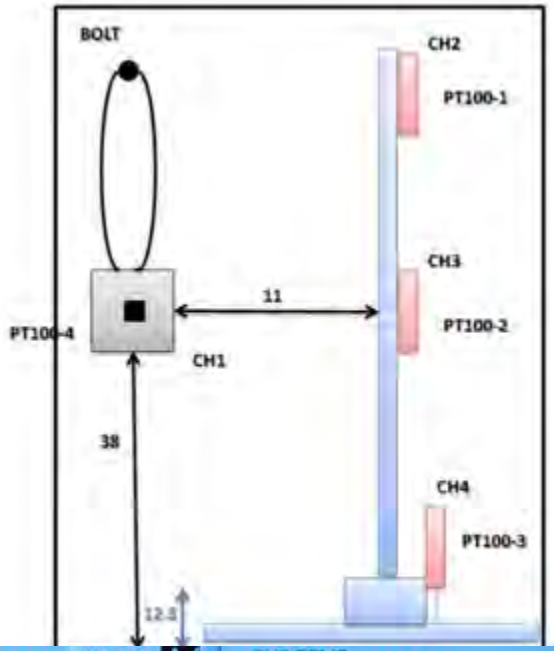

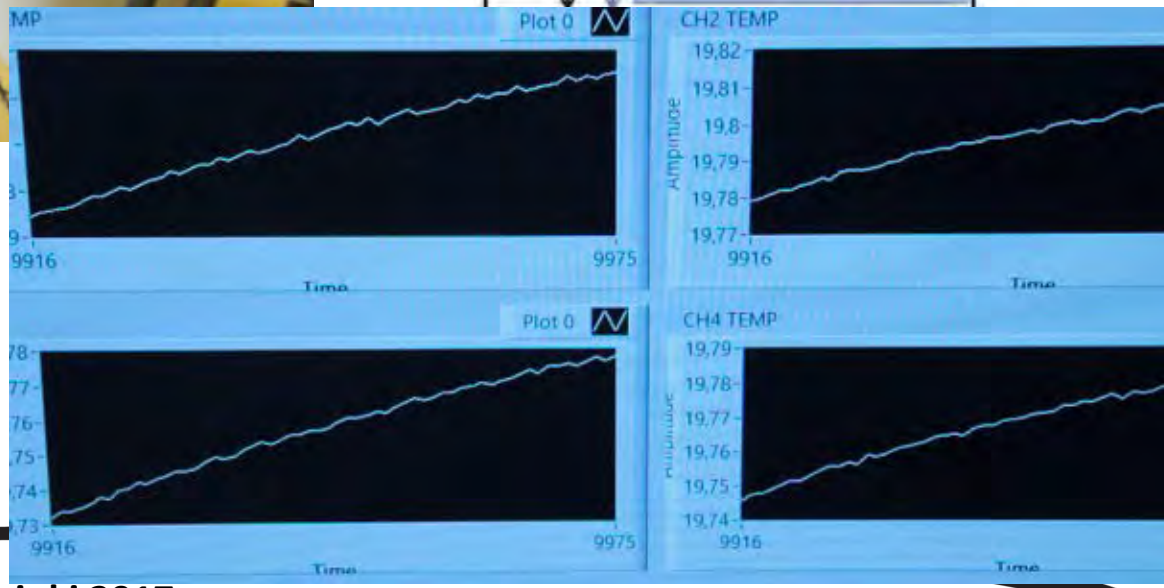

❖ August 2013 EDIE2 goes to Kathmandu first…

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EDIE-2

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Assembling the calibration chamber
and auxiliary equipment in the Everest Pyramid.

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EDIE-2

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The EDIE chamber is originally Designed for field calibrations. It has better temperature stability and pressure control. No wind

Equipped with temperature and pressure standards

EDDIE is a wind tunnel controlled in pressure and temperature

(…or a climatic chamber with wind and pressure control!)

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Earth **D**ynamics **D**irect **I**nvestigation **E**xperiment

EDDIE Chamber

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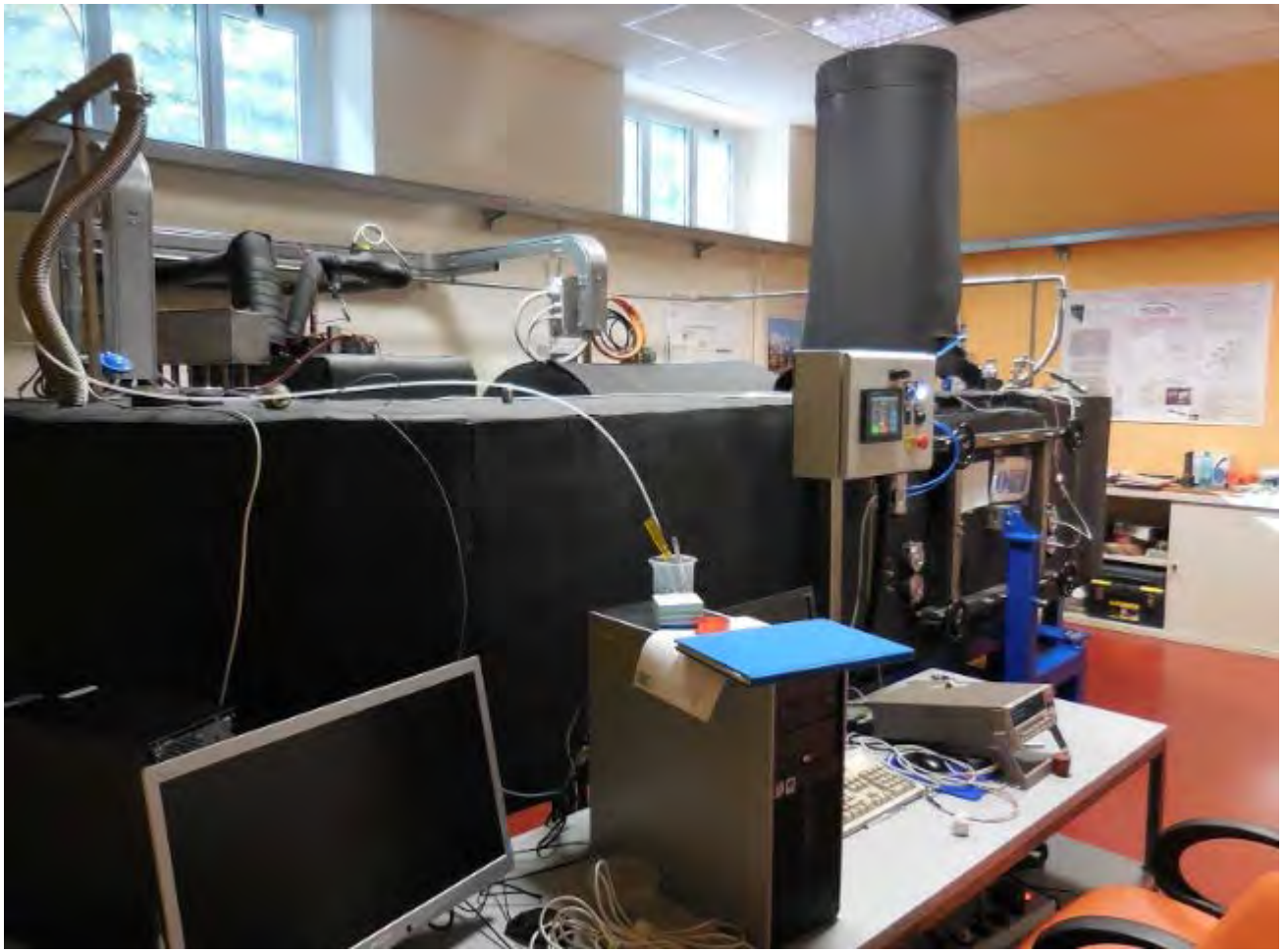

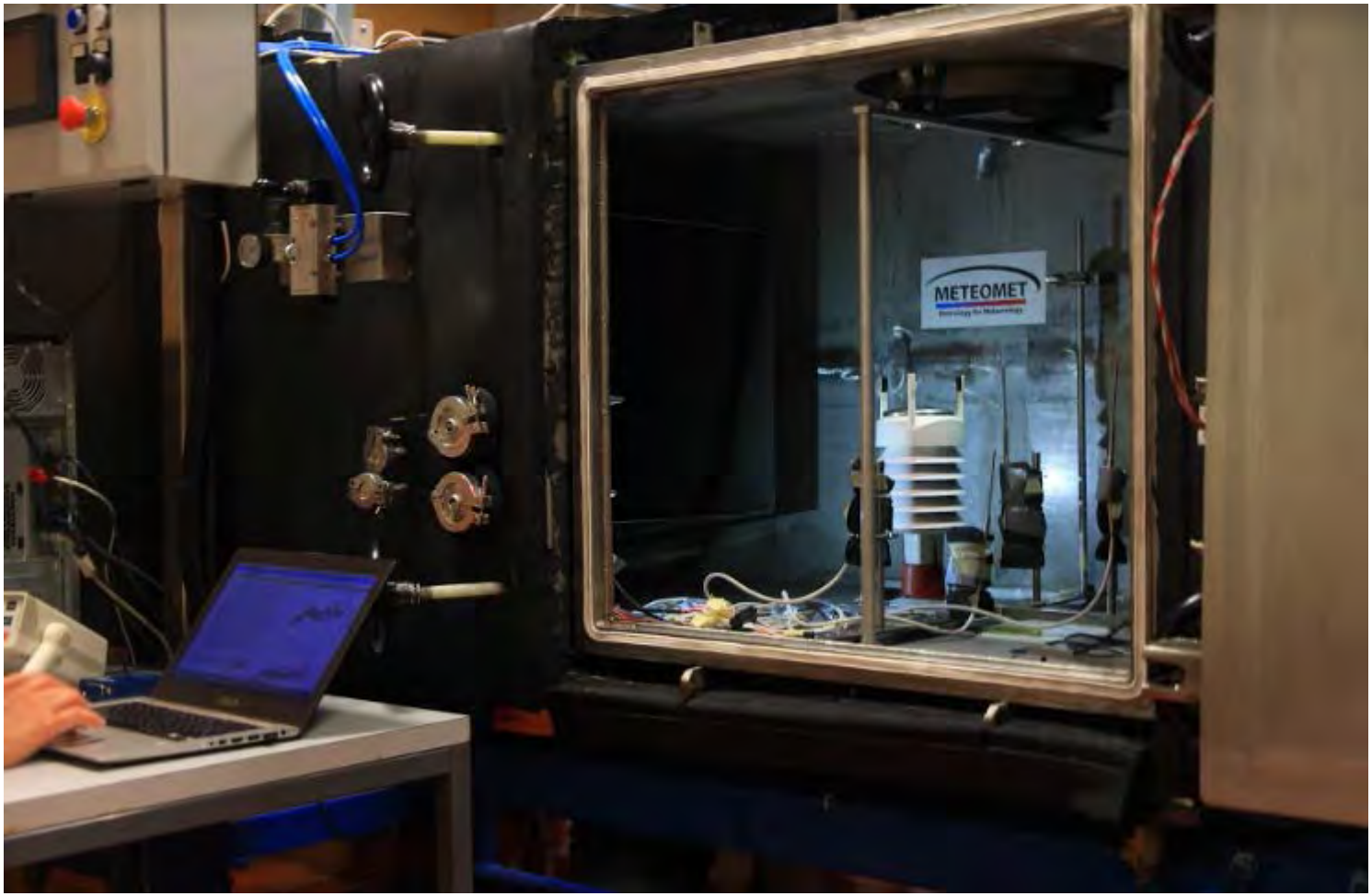
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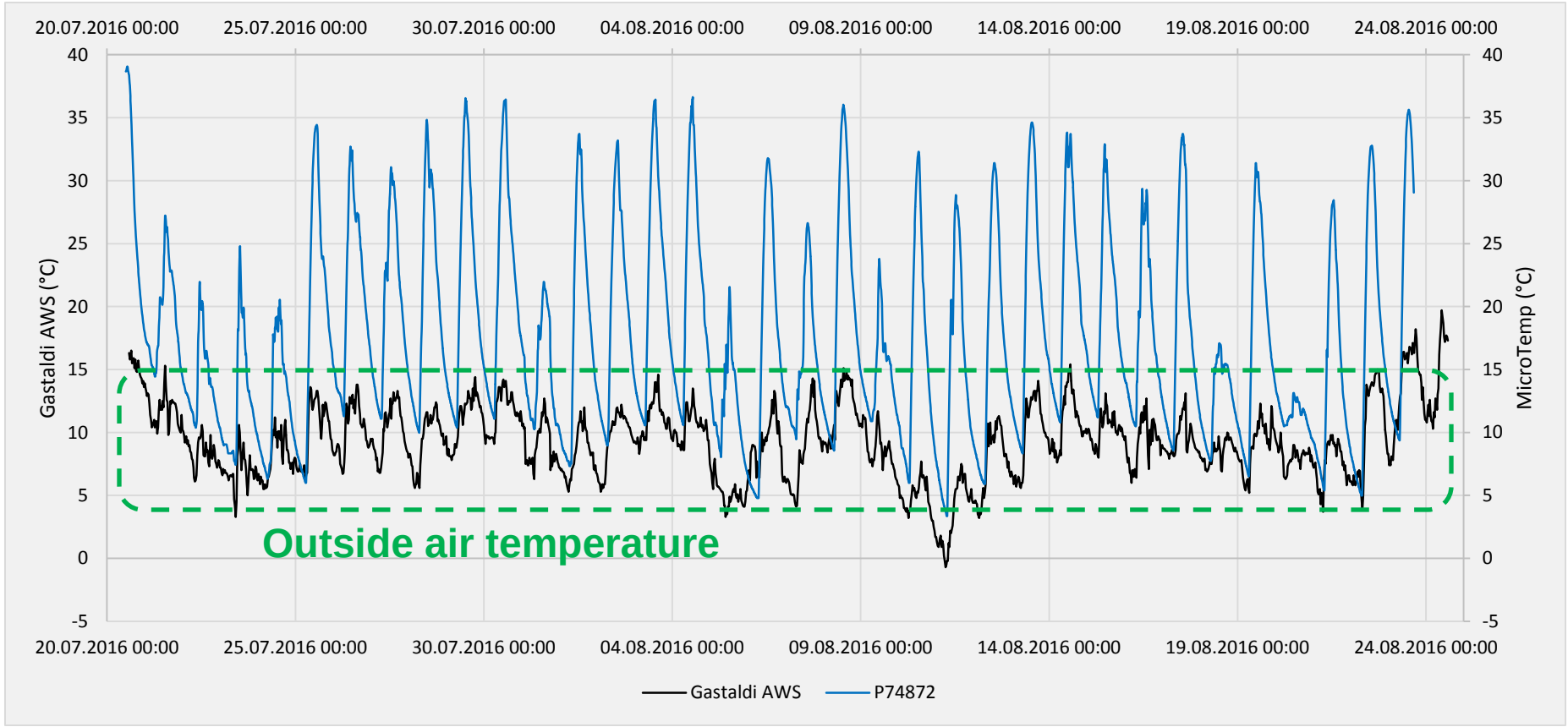
Determination of temperature sensor dynamics :

Motivation:

- Important measurement information for sampling rate
- Can affects the maximum and minimum daily records
- Differs with sensor types and construction
- Component of uncertainty budget in temperature measurements

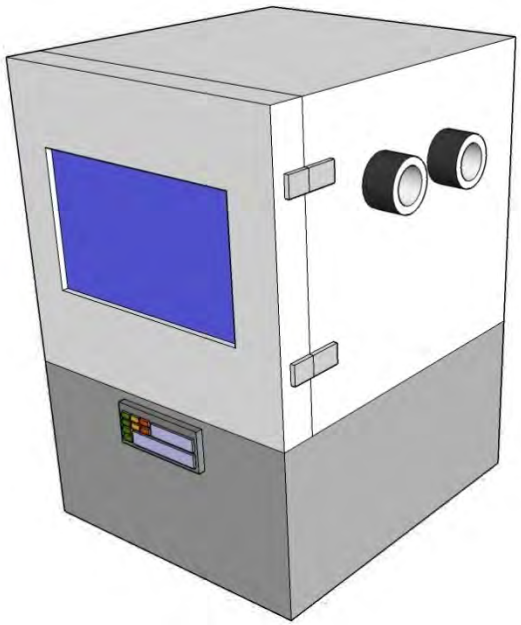
Example of temperature dynamics :

Potential effect on daily measurements:



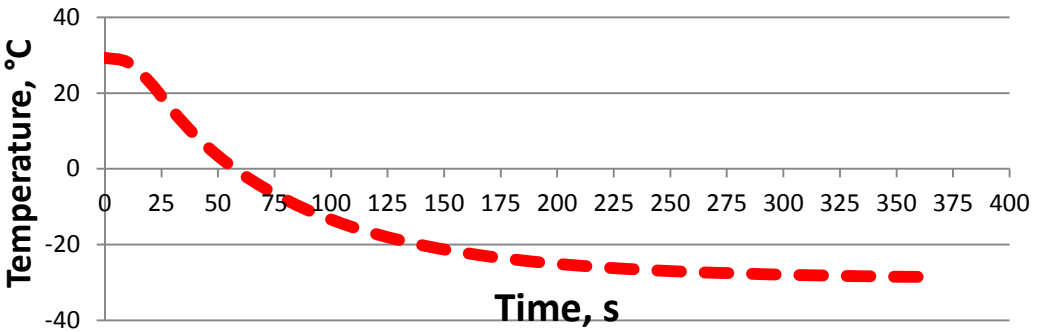
Determination of sensor dynamics :

Experiment procedure and setup:



Climatic chamber

Immediate transfer of sensors from +30°C to -30°C



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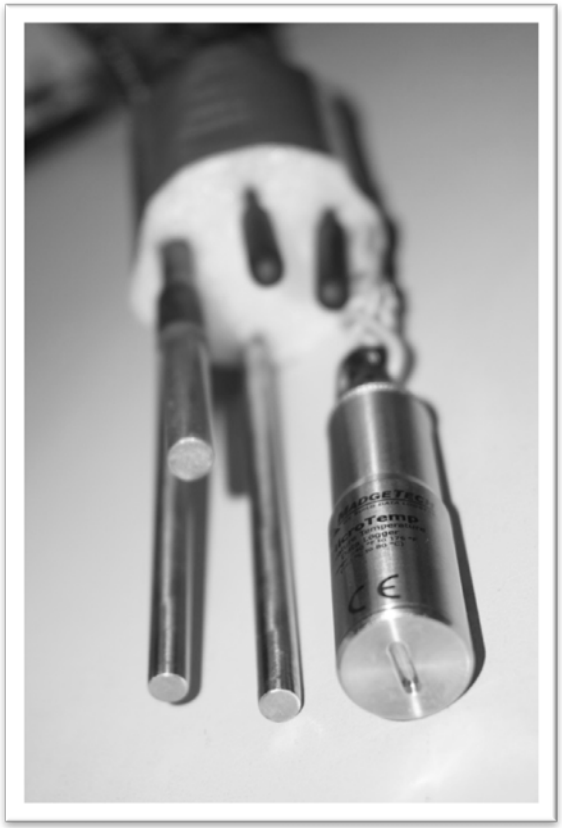
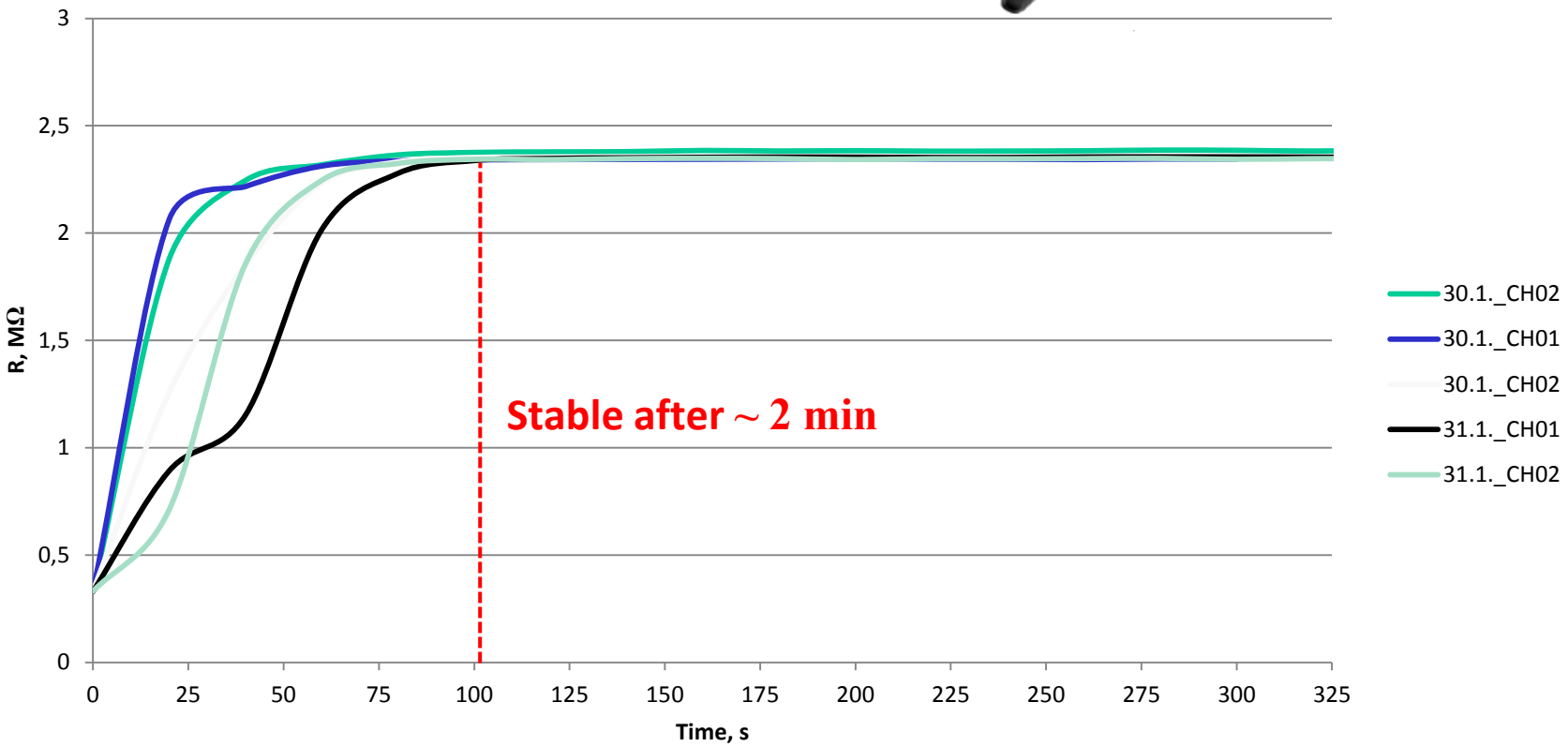
Determination of sensor dynamics :

Experiment procedure and setup:



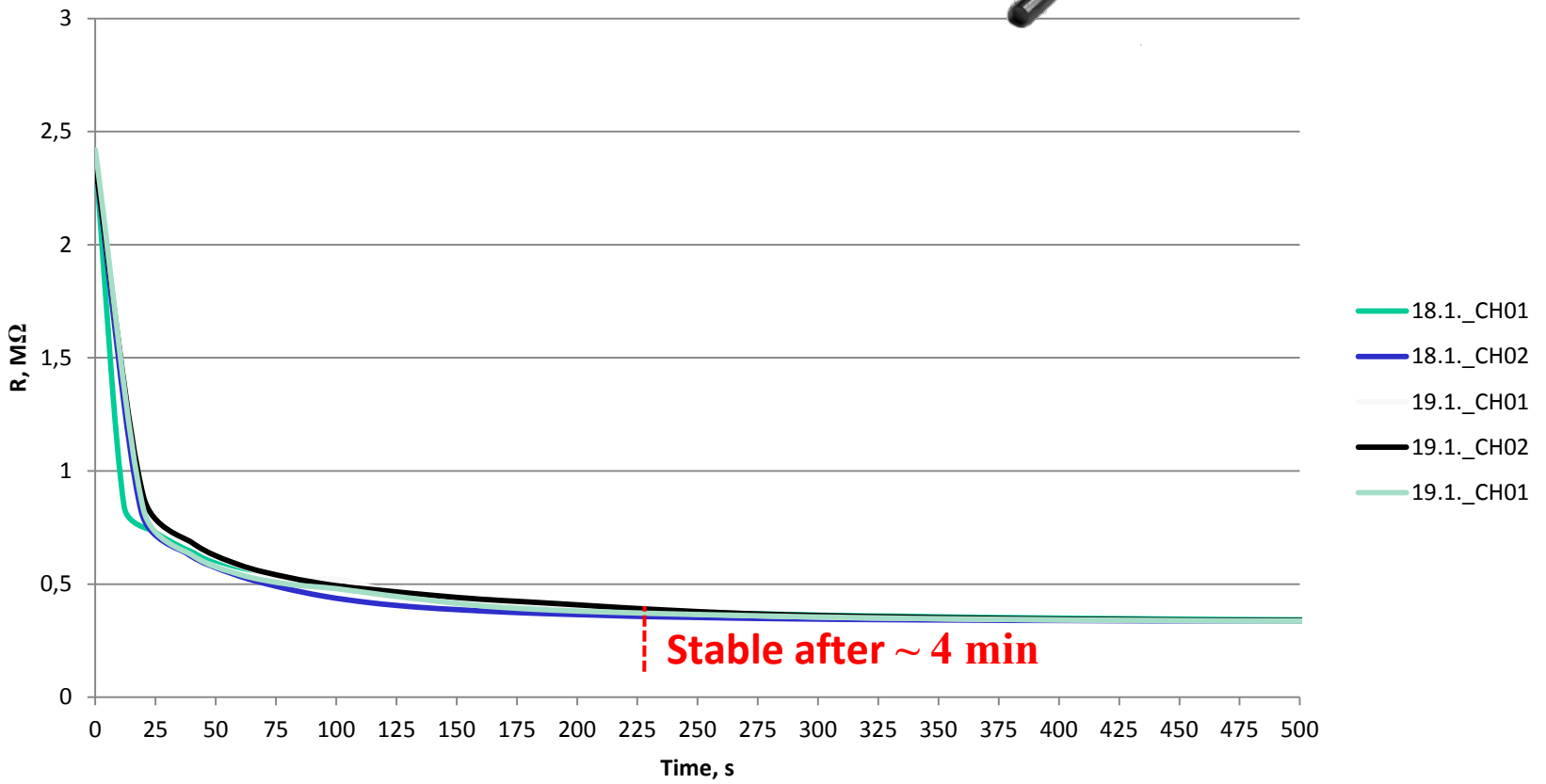
Determination of sensor dynamics :

Results: Termistor probes - Cooling



Determination of sensor dynamics :

Results: Termistor probes - Heating



Determination of sensor dynamics :

Measurement dynamics uncertainty:

Termistor probe

SOURCE		Value	Unit	Distribution	
Clima chamber homogeneity		0,021	°C	Rectangular	0,012
Clima chamber stability		0,29	°C	Rectangular	0,16
Alcohol bath homogeneity		0,12	°C	Rectangular	0,066
Alcohol bath chamber stability		0,04	°C	Rectangular	0,023
Sensor relosution	Termistor Probe	0,0052	°C	Rectangular	0,0030
Sensor noise	Termistor Probe	0	°C	Normal	0
Fit equation		N/A	N/A	N/A	N/A
Reproduceability	Termistor Probe	0,39	°C	Rectangular	0,23

Resulting Uncertainty	0,29

REPRODUCIBILITY AFTER THERMAL SHOCK

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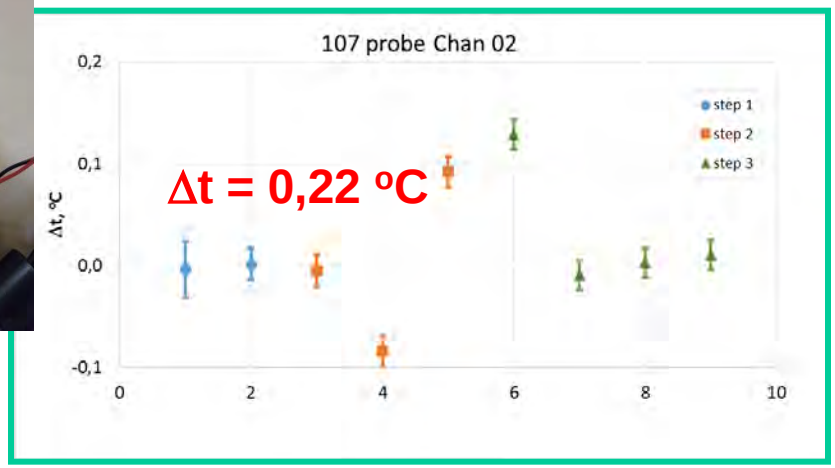
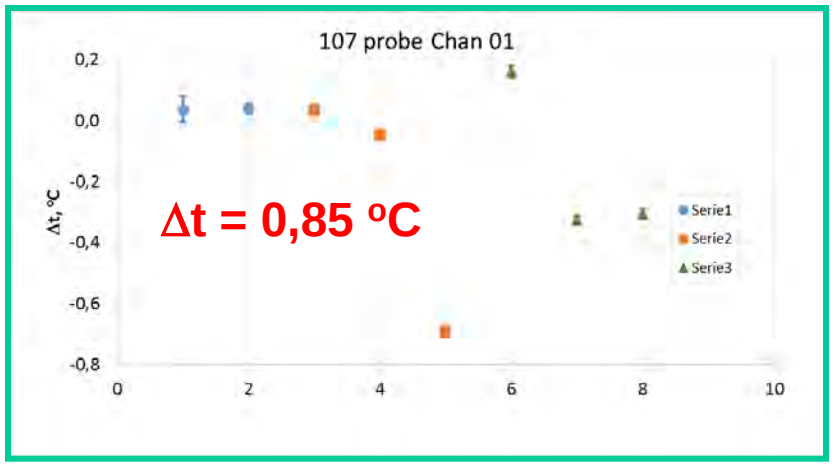
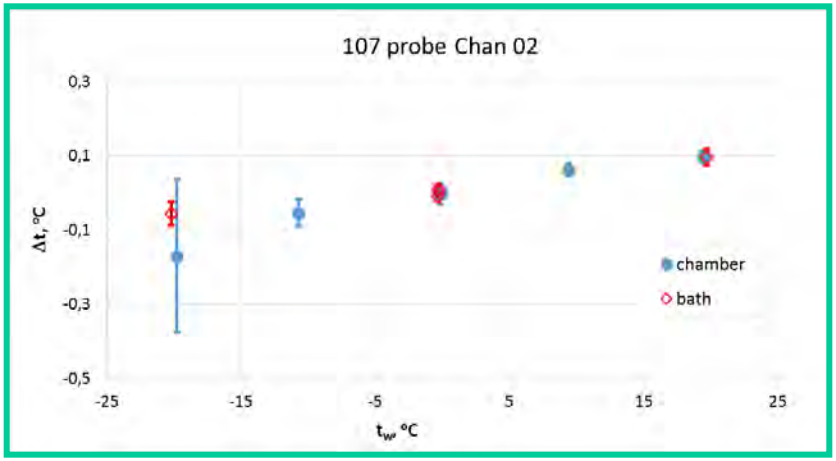
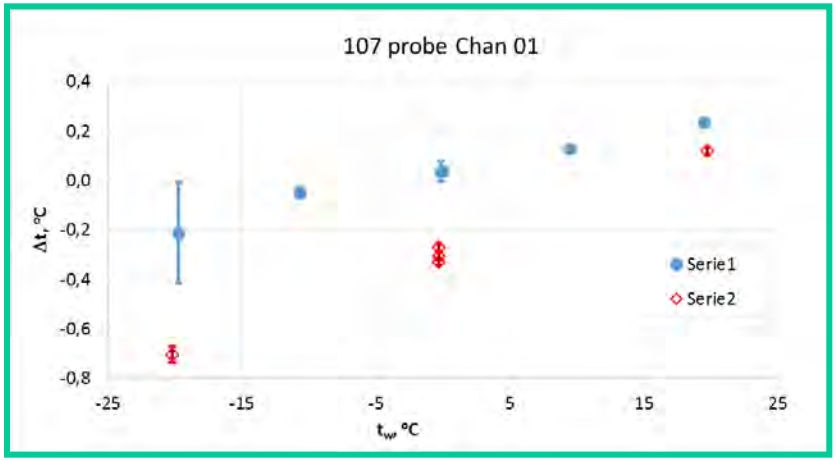
107 Thermistor sensors









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EDIE is now busy in Ny-Ålesuns (an EDIE 3 is being manufactured)

EDDIE is busy with MeteoMet activities

Parallel radiosondes tests can be done in early 2018.

To see EDIE & EDDIE youtube GRUAN or MeteoMet videos.