CTMO

The Centro di Taratura e Metrologia Oceanografica

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Italy

FixO3 Workshop on training for less experienced users of hardware
Trieste, Italy, September 15 – 17, 2015

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What we're trying to achieve

- **The capacity to calibrate and maintain all our institute's sea-going instrumentation in a way that continuously meets recognized international standards of excellence.**

- **The ability to make and deliver <u>metrologically consistent</u> marine measurements with ascertained, documented characteristics.**

International Relevance

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- **Global ocean observing and marine data management initiatives (GOOS, GMES, JCOMM, CLIVAR, MyOcean, SeaDataNet, etc.)**
- **The European Union's current Integrated Maritime Policy (IMP) and the Europe 2020 strategy: “Blue Growth”, "Marine knowledge 2020“, the Common Information Sharing Environment (CISE), the Marine Strategy Framework Directive (MSFD), etc.**
- **European marine observing initiatives (EuroGOOS, JERICO, JERICO-NEXT, FixO^3, etc.)**
- **The EURAMET European Metrology Research Programme (EMRP).**

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Our methodology

Calibration & Control

Calibration, Performance testing, Inter-comparisons,
Provision of information useful for data quality assurance
Formulation of Best Practice

Testing & Assessment

Evaluation of techniques and instrumentation,
Establishment of testing methods & protocols,
Harmonization of procedures,

Metrological R&D

Investigating/testing reference material, Ensuring traceability,
Evaluating uncertainty

Calibration & Control, an example: pressure

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The Reference System for Pressure

The Pressure Balance (Dead-weight Tester)

Certified weights

A pressure calibration is performed by comparing the pressure readings of the instrument with those of a Reference System.

Calibration & Control, an example: temperature

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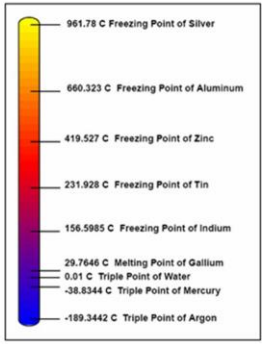
The principal fixed points of the International Temperature Scale of 1990 (ITS-90) used in Oceanography



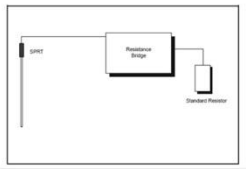
Triple Point of Water (TPW) = 0.01°C

Melting Point of Gallium (MPGa) = 29.7646°C

The Reference System for Temperature

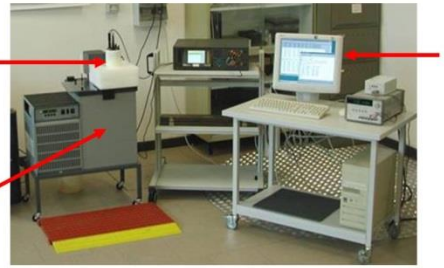
Constituted by a high-precision Digital Thermometer (Resistance Bridge), a Standard Platinum Resistance Thermometer (SPRT) and a Standard Resistor.

Resistance Bridge



Overview of a temperature calibration

A temperature calibration is performed by comparing the temperature readings of the instrument being tested with those of a Reference System in a thermostatic bath.



Testing & Assessment: an example

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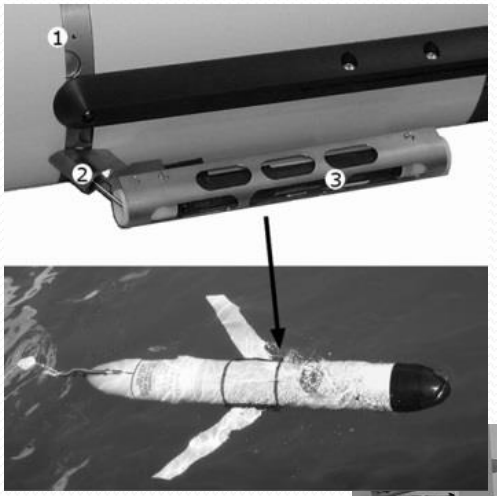
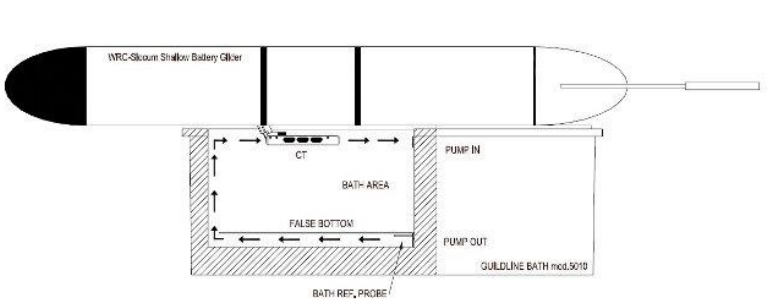
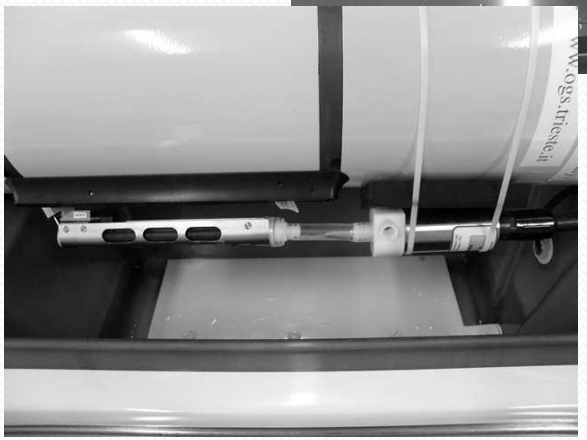
Laboratory Evaluation and Control of Slocum Glider C–T Sensors







Testing & Assessment: an example

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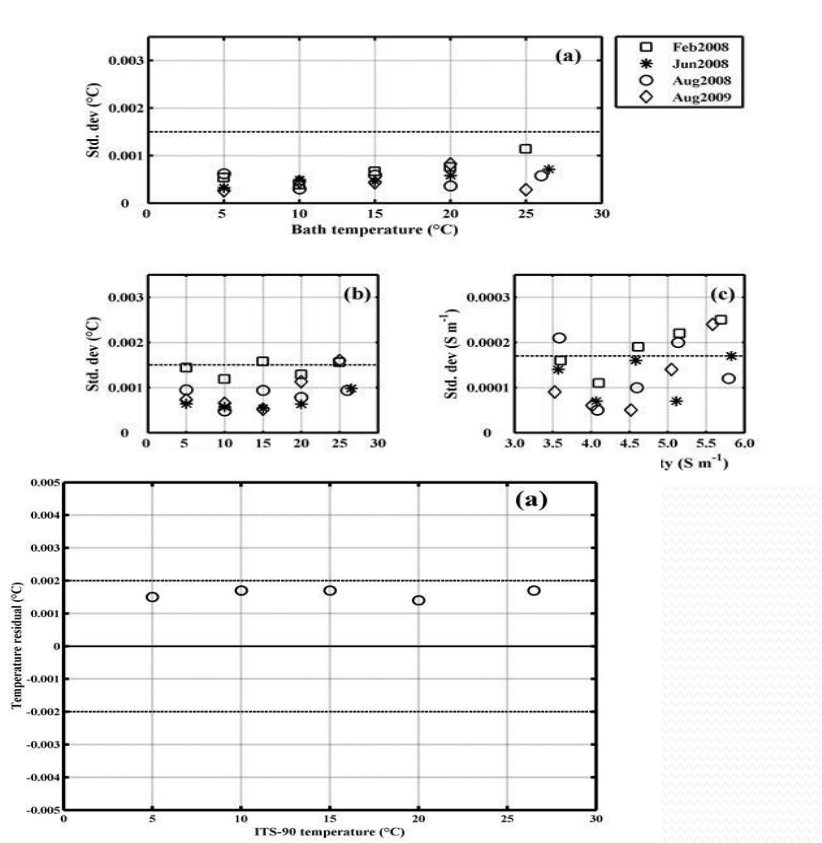
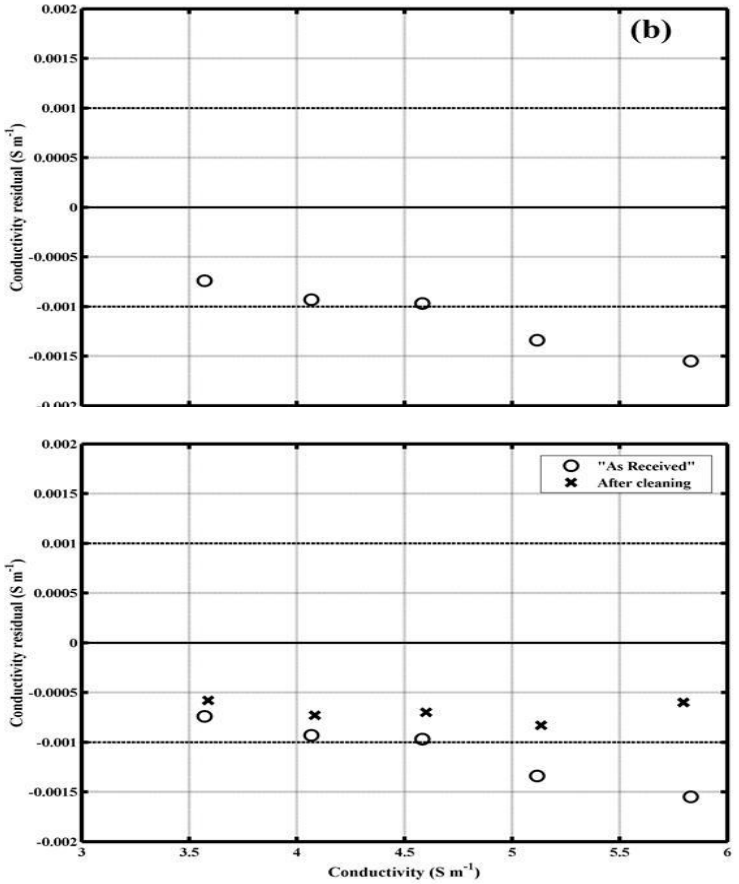
Laboratory Evaluation and Control of Slocum Glider C–T Sensors

Repeatability



Adjustment



Metrological R & D

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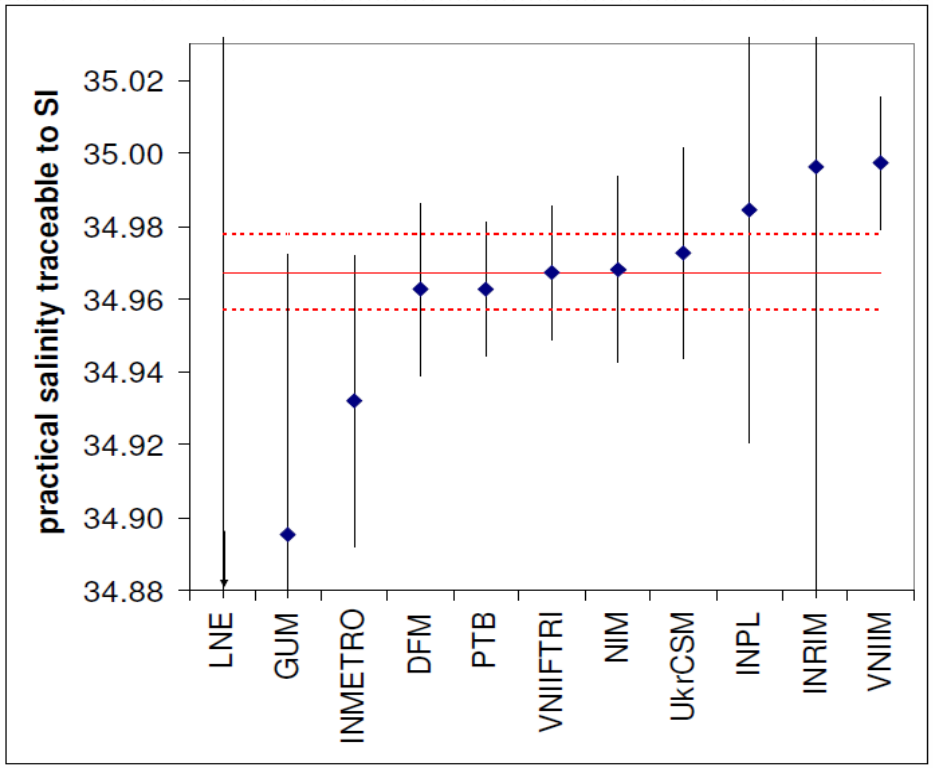
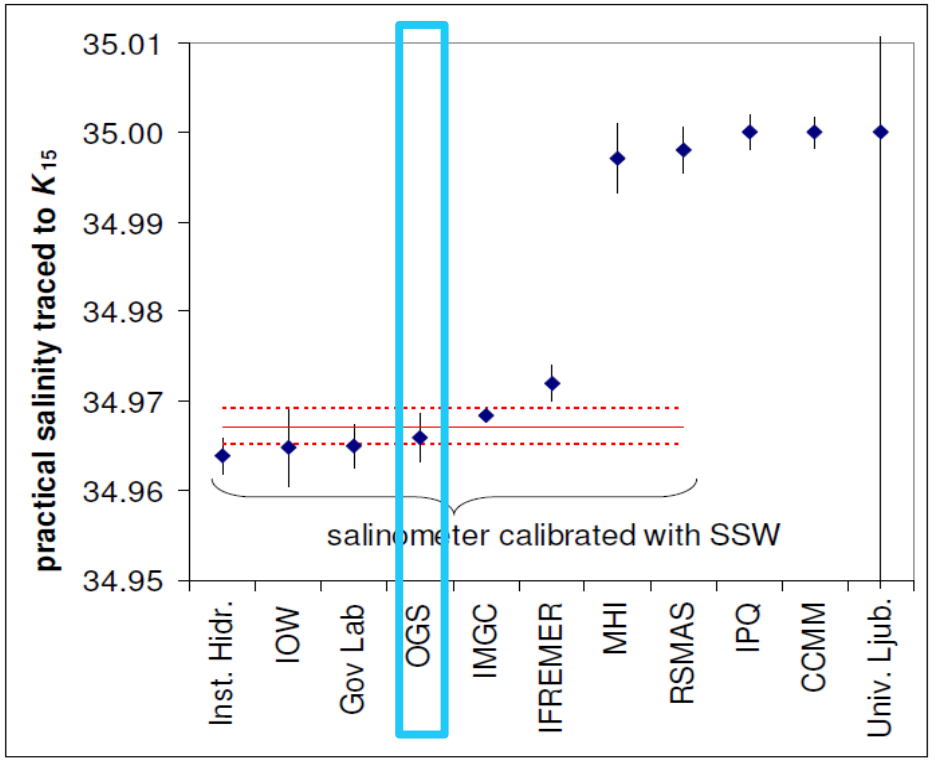


National Metrological Institutes



Marine Research Institutes

Traceable determination of practical salinity and mass fraction of major seawater components

BIPM-CCQM study (P111) in cooperation with

SCOR/IAPSO WG 127 on Thermodynamics and Equation of State of Seawater

Metrological R & D

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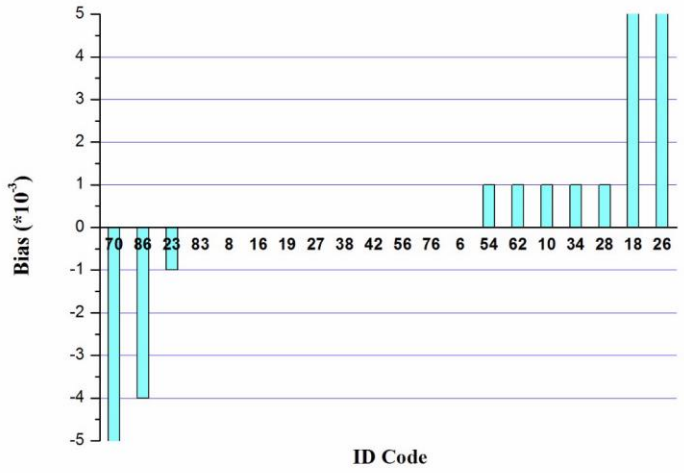
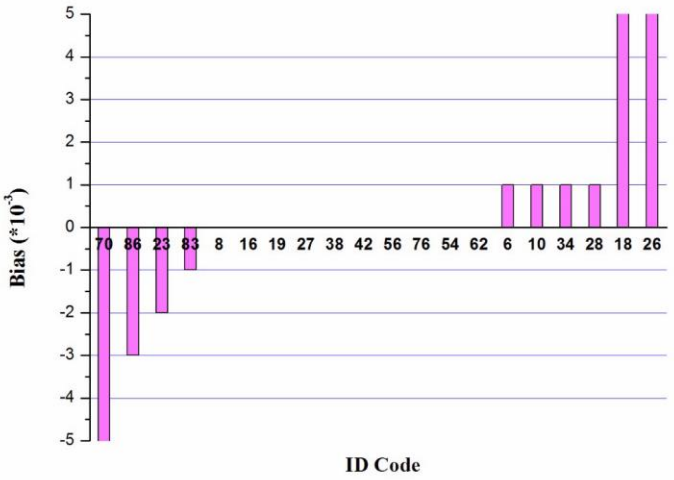
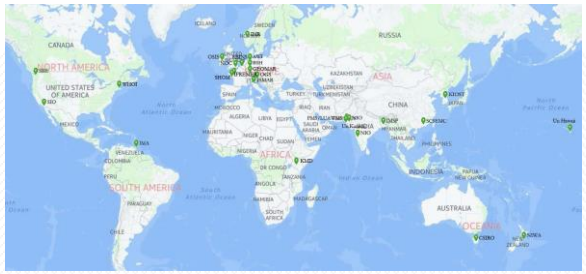




S = 32.530



S = 24.698

Locations of participating laboratories

Final Report, JCOMM Pilot Intercomparison Project For Seawater Salinity Measurements

JCOMM Technical Report No. 84 (WMO, 2015)

Data Quality Assurance: an example

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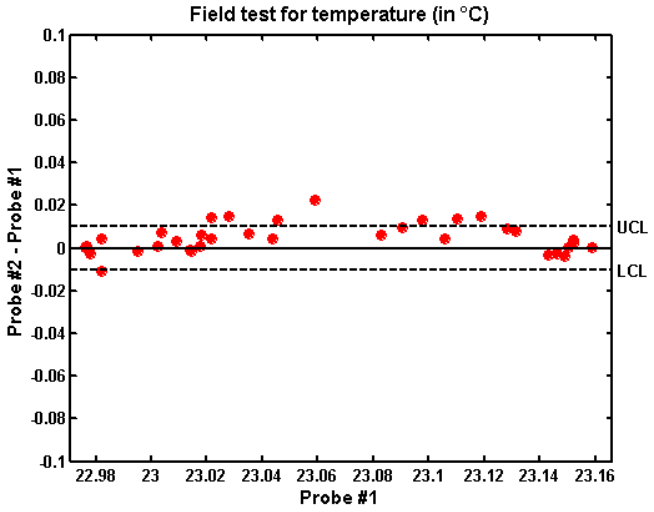
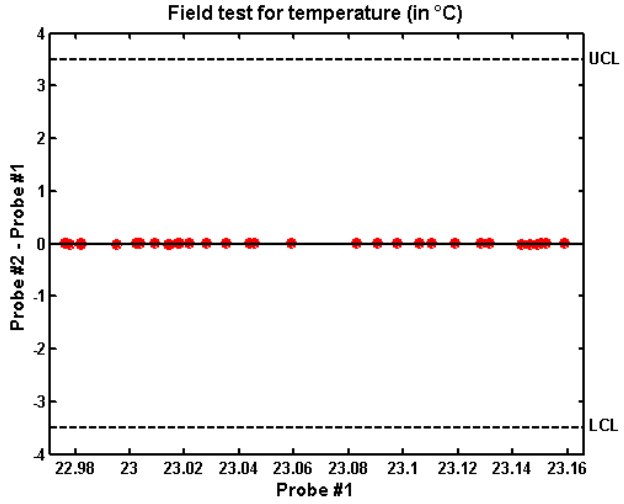


Residual plot showing the deviations of temperature measurements made by the probe on a data buoy in the Gulf of Trieste (Probe #2) with respect to the temperatures measured by a reference probe (Probe #1) during a field calibration check; UCL (the Upper Control Limit in °C) and LCL (the Lower Control Limit in °C) indicate the bounds of the tolerance interval established on the basis of calibration information and evaluations of sampling uncertainty.



Same as above, except that UCL (the Upper Control Limit in °C) and LCL (the Lower Control Limit in °C) are established on the basis of the analysis of historical temperature data relating to the area comprising the mooring site.

Transnational Access: an example

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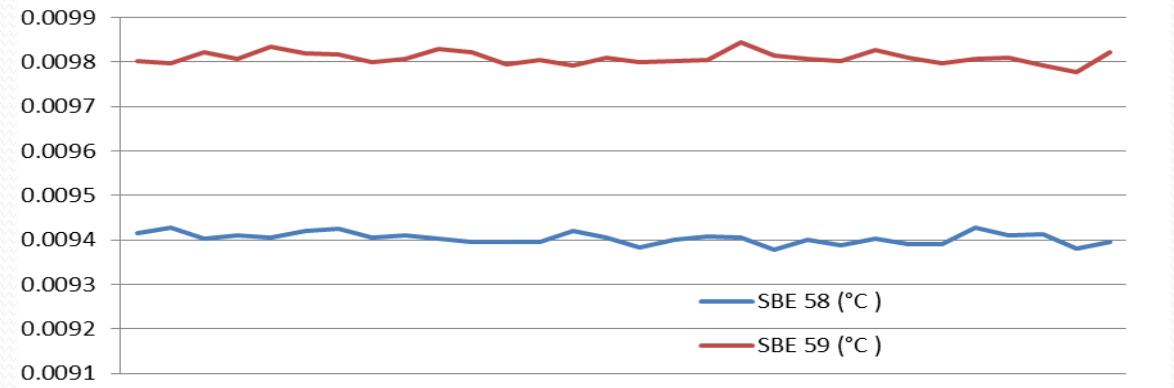
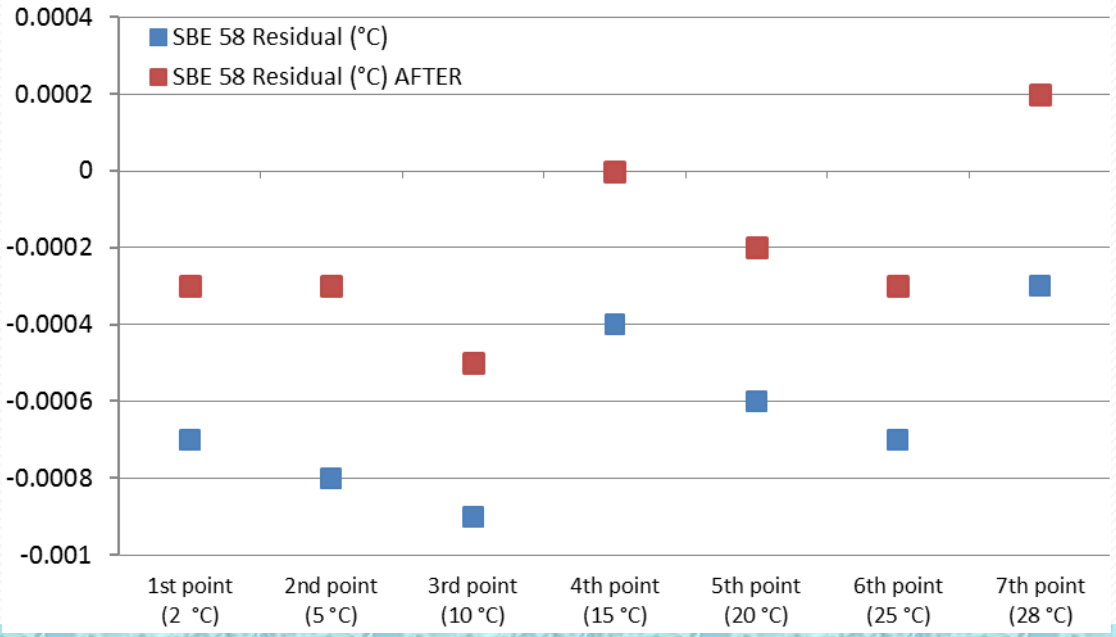
Calibration of reference temperature probes for the Hellenic Center for Marine Research (HCMR), Heraklion, Crete, Greece.





Temperature residuals of the SBE 35, serial number 058, before and after the Slope and Offset adjustments.

Ongoing/future work

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- **JERICO-NEXT ("Joint European Research Infrastructure network for Coastal Observatory - Novel European eXpertise for coastal observaTories") : a 4-year EU H2020 project starting on 01 September, 2015.**

- **A proposal for setting up a European metrological network for marine measurements: under preparation for submission as a COST (European Cooperation in Science and Technology) Action.**

- **RITMARE ("Ricerca ITaliana per il MARE"): running National Research Programme, funded by the Italian Ministry of University and Research.**

- **Consultation and collaborations within the context of other relevant national/international projects and in-house research activities.**

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Thank you for listening!

Questions?