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Metrology for ocean salinity and acidity- the European Metrology Research Project ENV05

Petra Spitzer (1), Steffen Seitz (1), Simona Lago (2), Daniela Stoica (3), Michal Mariassy (4), Robert Clough (5), and Maria Filomena Camões (6)

(1) Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany (petra.spitzer@ptb.de, +49(0)5315923015), (2) Istituto Nazionale di Ricerca Metrologica (INRiM), Turin, Italy (s.lago@inrim.it), (3) Laboratoire national de métrologie et d'essais (LNE), Paris, France (Daniela.stoica@lne.fr), (4) Slovenský Metrologický Ústav (SMU), Bratislava, Slovakia (Michal.mariassy@smu.gov.sk), (5) University of Plymouth, Plymouth, UK (rclough@plymouth.ac.uk), (6) Fundação da Faculdade de Ciências da Universidade de Lisboa(FFCUL), Lisbon, Portugal (mfcamoes@fc.ul.pt)

An overview and status report on the EMRP (European Metrology Research Project) "Metrology for ocean salinity and acidity" will be given. The project has been started in September 2011. The consortium consists of partners from ten European metrology institutes and two universities.

Need for the project

The project covers the thermodynamic quantities salinity, conductivity, density, speed of sound, and temperature, and the chemical quantities pH, oxygen content and composition.

It aims to develop methods, standards and tools to improve the databases used for climate models. Measurement standards with well characterized uncertainties will enable calibration of in-situ observing sensor networks and satellite systems traceable to SI units. The results will improve the metrological infrastructure required for a reliable monitoring and modelling of ocean processes. This will allow scientists to measure more accurately small changes in long-term oceanographic data series.

Expected results and potential impact

The basis for data at higher pressure of up to 70 MPa and in a temperature range between 0 ˚C and 40 ˚C for the Equation of State will be improved by measurements of density, salinity and speed of sound.

A novel primary conductivity sensor which can be used at high pressure will be developed, tested and linked to primary improved density measurements at the same high pressure. Improved and robust speed of sound measurement data for both high accuracy laboratory and in situ measurements of seawater, will provided by means of an ultrasonic double-reflector pulse-echo overlap technique. This also includes improved temperature measurements with an uncertainty of 5 mK.

The determination of dissolved oxygen measurement methods will be optimised for the special requirements of seawater. A reduction of the uncertainty by a least a factor of three is anticipated.

Harmonised pH measurement procedures will be provided to underpin the traceability of the pH data of seawater. The development of a primary potentiometric pH procedure at higher ionic strength will allow the characterization of artificial seawater of reference composition which will be suitable as calibration standard for spectrophotometric pH measurements.

A validated method for the quantification of the mass fraction of strontium based on isotope dilution mass spectrometry (ID-ICP-MS) will be developed. Analytical procedures for the quantification of nutrients in seawater will be developed taking into account matrix contributions.

More accurate methodologies for the determination of iron in seawater will be developed. Confidence in quantification will be achieved by rigorous validation (covering sampling and sample treatment), including thorough uncertainty budgeting and the comparison between shipboard methods and ID-ICP-MS.