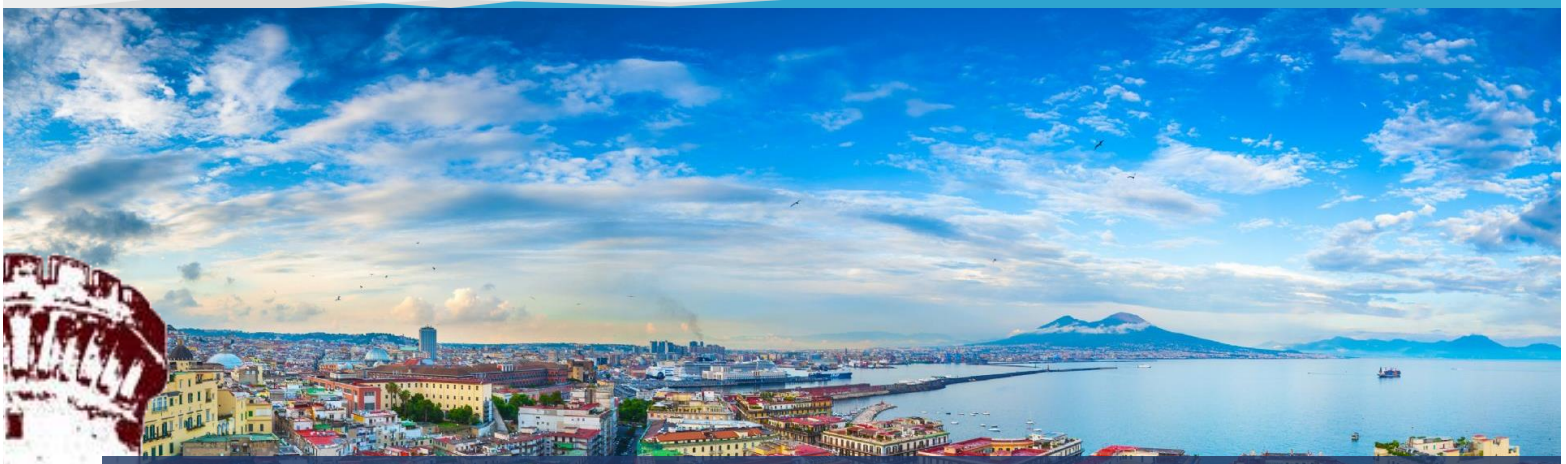
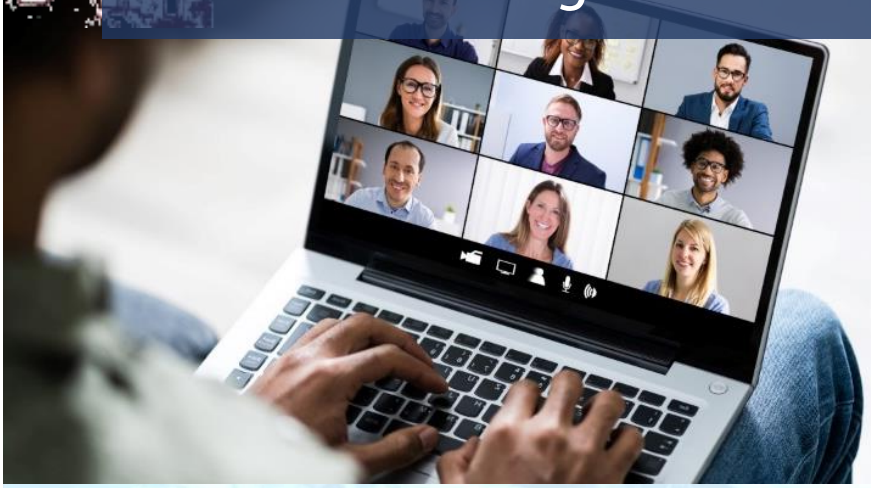


IMEKO TC-19 INTERNATIONAL WORKSHOP ON

METROLOGY FOR THE SEA

Learning to measure sea health parameters



MetroSea #Naples2020

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BOOK OF ABSTRACTS

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MetroSea 2020 - Welcome Message

On behalf of the Organizing Committee, we cordially welcome you to the **2020 IMEKO International Workshop on Metrology for the Sea** (*MetroSea 2020*).

The Sea is the medium that allowed people to travel from one continent to another using vessels and even today despite the use of aircraft. It has been acting also as a great reservoir and source of foods for all living beings. However, for many generations it served as a landfill for depositing conventional and nuclear wastes, especially in its seabed and there is a race to exploit minerals and resources, different from foods, encompassed in it. Its heath is a very challenge for the survival of all humanity since it is one the most important environmental components targeted by the global warming.

"Learning to measure sea health parameters" is a challenge for the whole humanity. This is underlined by the growing interest for the marine sciences. In this field new technologies and analysis techniques have recently improved the combined use of numerical approach and metrology systems to get more detailed marine data. For example, advances in computer science, data acquisition and modelling, new spectrometric techniques, analysis and remote sensing have encouraged interactions among these scientific disciplines based on measurement data and marine data interpretations.

The benefits of a multidisciplinary approach have reduced the level of uncertainty in marine technical studies. The 2020 IMEKO International Workshop on Metrology for the Sea aims to gather people who work in developing instrumentation and measurement methods for the sea. Attention is paid, but not limited to, at new technology for sea environment monitoring, metrology-assisted production in sea industry, ship component measurement, sensors and associated signal conditioning for the sea, and calibration methods for electronic test and measurement for marine applications.

This edition of MetroSea was originally planned to be held in Naples (Italy) hosted by the Università degli Studi di Napoli "Parthenope" as part of the celebrations for the 100th anniversary of its foundation; however, due to the COVID-19 emergency, we were forced to organize this 4th edition as a virtual conference. We do hope that, soon, there will be another chance to host you all in Naples. The virtual Workshop has been planned in order to make an online conference not so different from a live event. It was challenging to set up a web platform to maintain live the presentations and we thank the colleagues of the organizing team, who professionally addressed this issue.

Despite the COVID-19 occurrence, we received 60 extended abstracts from all over the world. Due to the time limits of the workshop, only 45 papers have been selected after a meticulous activity of the program committee and additional reviewers. We like to thank all people who contributed to this process with opinions, comments, and suggestions to choose the best papers and improve their quality.

Authors of all the above contributions are also welcome to submit an extended version to the Special Issues on ACTA IMEKO Journal, MDPI Geosciences, MDPI Sensors and MDPI Journal of Marine Science and Engineering.

The Workshop Technical Program consists of 15 oral sessions scheduled over three days. The technical program encompasses several events and activities. With the wide range of technical sessions covering the many fields of metrology for the sea we are happy to welcome you to the variety of technical presentations that await you this year.

The keynote speeches will be held by experts in the field of metrology for the sea. Cosimo Solidoro and Rajesh Nair, both from National institute for Oceanography and Applied Geophysics OGS, Italy, will speak

about "*Filling a gap: metrology in marine observation and data*". Marcos Portabella, Institut de Ciències del Mar (ICM-CSIC), Spain, will present "*Scatterometer-derived stress-equivalent wind fields: retrievals and applications*". We are honored to have them as plenary speakers and thank them in advance for coming to our conference to share their knowledge and experiences with us.

This edition of the Workshop includes:

- "**Military Metrology for the Sea**", organized by Italian Navy and AFCEA Naples Chapter, October 5, 09:30 CET
- **Tutorials** offering three subjects:
  - "Integrated remote coastal and seabed mapping", S.V.T. Luca Labella, Italian Navy;
  - "Multidimensional marine geophysical data acquisition using Autonomous Surface Vehicles", Dr Luca Gasperini, Institute of Marine Science - National Research Council, Italy
  - "Satellite remote sensing of the ocean: applications in temperate and polar regions", Dr Giuseppe Aulicino, University of Naples "Parthenope", Italy

Several Awards offered by International Institution and Companies will be assigned, in particular to young researchers.

With the aim of providing a common ground for researches to share their findings on the metrology for the sea, the Workshop was improved by adding a significant number of Special Sessions. This allows a spontaneous aggregation providing a forum of discussion close to the single research field. We wish to thank the organizers of these Special Sessions for their cooperation and support to the Workshop organization.

The 2020 IMEKO International Workshop on Metrology for the Sea is about to begin.

Giorgio Budillon, Parthenope University of Naples, Italy
Pasquale Daponte, University of Sannio, Italy
Luigi Sinapi, Italian Navy, Italy

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MetroSea 2020 Plenary Speakers

Tuesday, October 6, 2020 - 09.30 CET

Filling a gap: Metrology in Marine Observation and Data

Cosimo Solidoro, Rajesh Nair

National Institute of Oceanography and Applied Geophysics, Italy

ABSTRACT

The European Union's Marine Strategy Framework Directive (2008) states that "Provision should be made for the adoption of methodological standards for the assessment of the status of the marine environment, monitoring, environmental targets and the adoption of technical formats for the purposes of transmission and processing of data […]". In its 2010 Communication to the European parliament and Council on the Marine Knowledge 2020 initiative within the framework of the European Union's Integrated Maritime Policy, the European Commission highlighted that "Fragmented standards, formats and nomenclature, lack of information on precision and accuracy, the pricing policy of some providers and insufficient temporal or spatial resolution are further barriers [to the exploitation of collected data in developing new products and services]".

The above institutional excerpts are testimony to the pressing need to begin building a strong metrological basis for marine measurements in Europe, making it an integral part of the region's marine observing and data management sectors. The metrological approach represents an established way to assure traceability of measurements to the Système International d'Unités (SI) and achieve true inter-comparability of data at the transnational level. Such traceability is essential to ensure:

- the relation of acquired measurements to recognized standards;
- the conformity of measurement practices amongst laboratories to acknowledged guidelines at both the national and international levels;
- the provision of documentation to handle sensors and data properly.

However, metrology is rarely discussed in marine observing circles and in the marine data management community despite its intimate link to sensor performance, data quality and data usability issues. This disregard arises from ignorance concerning the rigor required of modern measuring activity and the complexity of the underlying metrological system supporting it. It must be said that the situation is also a heritage of the historical evolution of marine observing activity, which developed outside the umbrellas of national metrological institutions (NMIs) and formally recognized international metrological frameworks. Unfortunately, in today's reality, where marine measurements and data are no longer viewed solely as a scientific tool but also as a valuable multiple-use commercial commodity and a resource for social change, this state of affairs is no longer tenable and needs to be addressed.

At the present time, there are very few scientists working formally in the field of metrology applied expressly to marine measurements (perhaps even < 10 persons per country in Europe). But, over the past

few years, these small groups are beginning to work together to try to lay the foundation for a pan-European marine calibration grid in coordination with the system of NMIs and industry. Most of this activity is being, or has been, attempted indirectly, and only in small ways, within the framework of European projects and programmes, most notably, ENV05, JERICO, JERICO-NEXT and JPI-Oceans. There is a strong necessity to inform the marine observing community and the European Commission of the need for specific attention and investments on this topic as it will be fundamental to fulfilling central European policy goals such as the Marine Strategy Framework Directive and Blue Growth.

SPEAKERS BIOGRAPHY

Cosimo Solidoro is research director and currently head of the Oceanography Section of the National institute for Oceanography and Applied Geophysics OGS . Research activities include developments, analysis and use of a variety of numerical methodologies, ecological models and ocean models of different complexity. Recent research activities expand further over the human dimensions and the integration among different components of marine systems. Scientific Coordinator of Sharemd, a EU project on pollution and environmental threats and of ICCC, a PRIN project on pollutants and biogeochemical cycles in a changing climate. President of the International Society of Ecological Modelling - European Chapter, member of the executive board of the european consortium EUROCEANS.

Rajesh Nair (male) has nearly 30 years of experience in Oceanography and the Marine Sciences, with a strong experimental background, extensive field skills and "hands-on" knowledge of a wide variety of marine instrumentation. As part of the permanent staff of the Centro di Taratura e Metrologia Oceanografica (CTMO), the oceanographic calibration facility of the INOGS which he helped set up in 2002, his present activities and interests focus on marine observing technologies, including calibration, control and testing of instrumentation, and the application of metrological principles to measurement quality assurance both in the laboratory and in the field. Mr. Nair is actively involved in marine research at both the national and EU levels, and internationally. He co-led Work Package 2 ("Harmonization of technologies and methodologies - technical strategy) of the EU H2020 project, JERICO-NEXT (Joint European Research Infrastructure network for Coastal Observatory - Novel European eXpertise for coastal observaTories; 2015 - 2019), and was the leader of Work Package 5 ("Data management and distribution") of the EU FP7 project, JERICO (Towards a Joint European Research Infrastructure network for Coastal Observatories, 2011 - 2015). Mr. Nair currently co-chairs the Technology Panel Working Group (TPWG) of the European Global Ocean Observing System (EuroGOOS), the European component of the Global Ocean Observing System (GOOS), and is also a National Representative in the EU's JPI Oceans (Joint Programming Initiative - Healthy and Productive Seas and Oceans) European Marine Sensor Calibration Network Joint Action.

Wednesday, October 7, 2020 - 09:30 CET

Scatterometer-derived stress-equivalent wind fields: retrievals and applications

Marcos Portabella

Institut de Ciències del Mar (ICM-CSIC), Spain

ABSTRACT

Spaceborne scatterometers (real-aperture radars) are known for their near-surface wind sensing capabilities over the ocean. Their derived stress-equivalent wind field observations are increasingly used in a wide variety of atmospheric, oceanographic and climate applications. An introduction to the physical principles of scatterometry, followed by an overview of the wind retrieval processing chain will be presented and discussed. The radar antenna geometry, the measurement noise, as well as non-linearities in the relationship between the measurements and the wind vector complicate the wind retrieval process. In addition, scatterometers are sensitive to geophysical phenomena other than wind, such as confused sea state, rain, and land/ice contamination of the radar footprint. These phenomena can distort the wind signal, leading to poor quality retrieved winds. As such, elimination of poor quality data is a prerequisite for the successful use of the retrieved winds. The differences between sea-surface C-band and Ku-band radar signatures will also be discussed in the context of sensor inter-calibration efforts.

The main applications of the scatterometer-derived stress-equivalent winds will also be presented. Besides the obvious atmospheric applications, such as nowcasting and global and regional Numerical Weather Prediction (NWP) data assimilation, scatterometer winds can provide very useful information on NWP model errors. They are also used to well characterize the extreme wind stress divergence and vorticity (missed by NWP models) associated to extreme rain events in the tropics. In addition, these observations are also required to drive ocean circulation, wave and surge models, and are used to compute sea surface currents and air-sea fluxes. Recent developments show that a modified NWP output using scatterometer-based corrections can introduce true smaller scale signal into the model output, which corresponds to the physical processes absent or misrepresented by the model, e.g., strong current effects (such as WBCS, highly stationary), wind effects associated with the ocean mesoscales (SST), coastal effects (land see breezes, katabatic winds), parameterization errors, and large-scale circulation effects, e.g., at the ITCZ. Finally, recent efforts to consolidate an in situ high and extreme wind reference for improving current and future scatterometer extreme wind calibration and validation will be discussed in the context of improved monitoring and prediction of extreme wind events, such as tropical and extra-tropical cyclones, and polar lows.

SPEAKER BIOGRAPHY

Marcos Portabella was born in Barcelona, Spain, in 1970. He received the B.Sc. degree in physics from the University of Barcelona, Barcelona, Spain, in 1994, the M.Sc. degree in remote sensing from the Institute of Space Studies of Catalonia, Barcelona, in 1995, and the Ph.D. degree in physics from the University of Barcelona. He is currently with the Institut de Ciències del Mar (ICM-CSIC), Barcelona, where he leads the Satellite Winds Group. He is involved in satellite remote sensing, and in particular, scatterometry and L-band radiometry.

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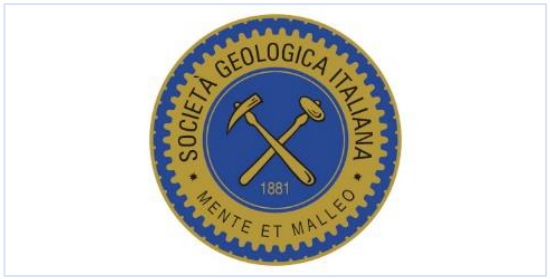
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