

# COASTAL ENVIRONMENTAL ENGINEERING: POLLUTION, ENERGY PRODUCTION, MONITORING AND ECONOMIC ENVIRONMENTAL ASSESSMENT, REGULATORY CONTEXT

The coastal environment represents a complex natural context characterized by the interaction of many different factors, often heterogeneous. In this particular context a wide variety of disciplines and research activities are involved in order to study different phenomena and give solutions. Engineering science contributes in a wide field such as pollution, energy production, monitoring and economic environmental assessment, regulatory context. For each mentioned field different approaches, design, monitoring activities, assessment criteria and economic evaluations can be then proposed and implemented. It is important to underline that, from the engineering point of view, particular attention must to be done to national and international reference regulatory framework. This session, with title *Coastal Environmental Engineering*, aims to study these aspects and includes topics as: plants and techniques for purification and desalination of water; systems and techniques for coastal and marine energy production; systems, sensors and instruments for measuring environmental parameters; techniques and procedures for coastal monitoring; evaluation of the reliability and performance of measurement systems; information acquisition systems and data for the coastal environment; economic assessments in the construction and management of plants; impact analysis of new production plants energy on local economic systems and climate change gas emission; analysis of the reference regulatory framework.

This is the main reason considered by the Organizing Committee to propose this technical Session that saw a large participation as a whole, with works presented by qualified Research Units variously distributed nationally and internationally, demonstrating a shared and widespread interest on the above mentioned topics.

In practice, many interesting contributions has been proposed by Authors. As below, some of them focus on measurement system and instrumentation, other take into account pollution. Important considerations are made considering the regulatory framework in particular context. The contributions received in this regard are manifold and of considerable scientific interest, also due to the transversal nature that the topics covered in some of them cover in the broad theme of the Symposium.

- The paper *Renewable power sources in coastal areas a viability assessment in the scope of needs and regulations* proposed by A. Bono, University of Genova, and M. Marini from University of Sassari deals with renewable energy projects in the context of the evolution of the deregulated energy market. A fundamental aspect taken into account by Authors in this paper concerns renewables and the actual situation in Italy from the standards and regulations point of view, in terms of promotion and incentives granted to renewable power plants for a wider development of them. Details concerning economic aspects are also proposed.

- M. De Vincenzi and G.Fasano from CNR Institute of BioEconomy in Florence present the paper *Monitoring coastal areas: a brief history of measuring instruments for solar radiation*. As said by Authors, the first references to the concept of solar radiation are due to Aristotle. Nowadays, the measurement of Solar radiation is a fundamental topic and sophisticated instruments and measurement process are implemented during the years. Among the last developments, a wide range of sophisticated electronic radiometers are designed and produced with interesting measurement performance in terms of resolution, accuracy and precision. At the same time, complex monitoring system need to realize in order to control climatic phenomena in real time. Authors conclude the presentation speaking about the recent developments of radiometric measurements for research in marine and coastal environments and for studies on the effects of the various components of solar radiation on human health.
- The continuous increase in maritime traffic of goods and people over the years, both by ferries and cruises, highlights the problem of environmental pollution in port areas, especially when the port is located in proximity of urban areas. D.Colarossi and P.Principi from the Università Politecnica delle Marche underline these aspects in *Feasibility study of a cold ironing system and district heating in port area*. Cold ironing strategy is considered in order to satisfy the electrical power demand of ships while they are at berth replacing on board diesel generators. In particular, a detailed analysis of the electrical loads required by the ships while they're at berth is presented, as well as a correlated economical evaluation that prove the feasibility of the proposed system.
- Yet referred to economical and environmental evaluation of pollution regarding an important coastal site in Molise is the paper *The economic-environmental impact analysis in the choice of the management of the dredging materials of a port basin in relation to their classification and quality: the experience of the port of Termoli (2018)*. A.Cioffi, F.Cuculo, L.Di Nucci and G.Orlando shows the comparison of the economic and environmental impact analysis in a study case: "Dredging work on the seabed of the port of Termoli 2018", taking into account the Ministerial Decree 173/2016 regarding *ecotoxicological characterization of the sediments of the dredging area and of the diving area led*. The study aims to evaluate the pollution level of dredging materials in Termoli port for the consequence location, of such materials, in open sea. From the result of this study, on the basis of the national regulation, Authors conclude that, according to the monitoring studies (led by Arpa Molise) and the into force regulations of November 2015, the totality of materials coming from the Termoli's harbor dredging could be immersed in a compatible area chosen in open sea.
- The paper "*Flex 2018*" *Cruise: an opportunity to assess phytoplankton chlorophyll fluorescence retrieval at different observative scales*, proposed by A. Di Cicco et AL., speak about the oceanographic cruise "FLEX 2018", organized by CNR with the aim to contribute to calibration/validation activities for existing and future space mission developments. The main topic concerns in situ measurements of Solar Induced Fluorescence (SIF) and the use of different instruments. In particular, as said by Authors, active and passive fluorescence were investigated at different scales in aquatic

ecosystems, to support preparatory activities of the FLuorescence EXplorer (FLEX) satellite mission to be launched in 2022.

- J.Droit from CEREMA, France, presents the paper *Careening areas in marinas, anchorages, and private shipyards. Status of implementation of the MSFD measure*. The paper considers the impact, from the pollution point of view, of the stripping process of ship careening and the use of antifouling paint. In particular, the presence of waste, in the form of dust or flakes, which can contaminate the marine environment by runoff or by air is taken into account. This process, necessary for the maintenance of the careen, can be polluting for the presence of chemical contaminants (biocides, hydrocarbons, microplastics, solvents ...) that can have an impact on the environment and human health. The goal was to carry out a national study identifying the level of equipment in fairing areas of marinas, anchorages and private shipyards to assess their respect for the environment. To this aim a survey was implemented in order to check the impact of the process.
- The presence of some elements such as nitrogen, phosphate and silicon have an impact in the planktonic primary production. Consequently, it is fundamental to check such elements in the sea, above all in particular morphological conditions. F.Figueroedo et Al. considers this topic in the paper *Electrochemical phosphate detection in oligotrophic seawater with a stand-alone plastic electrode*. The study was implemented in the northern Adriatic Sea, that is particular water system in which the levels of nutrients are commonly low or unbalanced with an abundance of nitrogen. As alternative to classical approaches that are present in literature for detecting nutrients, Authors propose a new method based on the application of a plastic conductive electrode containing a molybdenum reagent embedded. Authors demonstrate good performance in terms sensitivity for phosphate detection using the proposed measurement system.
- The study presented by N.Ghirardi et Al. is focused on the use of satellite remote sensing to map coastal erosion vulnerability in two Italian sites: Pianosa Island (Tuscany) and Piscinas (Sardinia). In the paper *Mapping of the risk of coastal erosion for two case studies: Pianosa island (Tuscany) and Piscinas (Sardinia)*, Authors focuses the attention on the land/water transitional ecosystem, with the aim of identifying potential coastal erosion phenomena. In this research the remote sensing data was used, as acquired by the Multispectral Imager (MSI) on-board of Sentinel-2A (S2). The research theme concerning the beach and dunes volume changes has been integrated by COSMO-SkyMed SAR data acquired over repeated orbits. As conclusion, Authors affirm that the use of multi-source remote sensing satellite data allowed to contribute to the assessment of the phenomenon of coastal erosion phenomenon, offering a new perspective and allowing to overcome some limitations associated with field surveys. In addition, as concluded by Authors, the dedicated processing and the use of physically based algorithms provided reliable results, although further activity seems necessary to validate the satellite-inferred maps.
- In the contribution proposed by P.Ventura and M.Palmarocchi the synergy between the coastal protection and energy production with vertical turbine is presented. The paper

*New coastal protection and sea energy production* takes in consideration the benefit of Turbine barrier location as a system able to transform the energy of the vertical pulsating waves (offshore) into horizontal sea currents (inshore). The advantages of such system can be reach in a soft defense of the coast in alternative to the traditional rigid defense obtained with rockfill, piers, etc. At the same time, in addition to a reduction of erosion, the electricity production by turbine is possible.

As conclusion, after this brief presentation of the papers, we can say that the wide and varied works proposed by the researchers for this Session is a valid demonstration on the high interest for the Coastal Environment. Many open points are present, many further developments are proposed by Authors, demonstrating the fact that the environmental engineering and physics need to research activities able to study complex phenomena.

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