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EDITED AND REVIEWED BY
Marta Marcos,
University of the Balearic Islands, Spain

*CORRESPONDENCE
Davide Bonaldo
davide.bonaldo@cnr.it

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Editorial: Climate change impacts on Mediterranean coastal and transitional areas: assessment, projection, and adaptation

Davide Bonaldo[1]*, Agustin Sanchez-Arcilla[2], Achilleas G. Samaras[3] and Maria Snoussi[4]

[1]Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine (CNR-ISMAR), Venice, Italy, [2]Laboratori d'Enginyeria Maritima, Universitat Politecnica de Catalunya (UPC-BarcelonaTech), Barcelona, Spain, [3]Department of Civil Engineering, Democritus University of Thrace, Xanthi, Greece, [4]Faculty of Sciences, Mohammed V University in Rabat, Rabat, Morocco

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Editorial on the Research Topic
Climate change impacts on Mediterranean coastal and transitional areas: assessment, projection, and adaptation

The combination of the regional intensity of climate change trends and a heavy and increasing anthropic pressure makes the Mediterranean coastal and transitional zones a vulnerability hotspot under both present climate and future scenarios. In such systems, in which diverse land-uses and socio-economic patterns are intertwined with the small scale of coastal processes, the formulation of effective response strategies cannot overlook a thorough assessment of recent trends and future evolution of coastal dynamics and climate change impacts. The key knowledge-related challenges on this front are, thus, typically related with the availability of information with the adequate spatial and temporal coverage for capturing the downscaled climate signal, and with the capability to operationalise this information into a decision-making perspective. The studies collected in this Research Topic undertake the twofold challenge of improving the knowledge base and suggesting new paradigms enabling improved and informed adaptation actions.

Ozer et al. discuss the evidences from a long-term monitoring programme along the coasts of Israel (Eastern Med) to characterise the variability of marine dynamics over different time scales. While confirming a tight coupling between coastal and open-sea near-surface processes, they emphasize a higher responsiveness to atmospheric conditions in coastal areas. Long-term observation programmes can be effectively flanked by data from surveys that may not have been specifically designed for this purpose, but still capture relevant processes for the evolution of the state of the ocean. In this direction, Zodiatis et al. integrate data sets from different monitoring initiatives in the South-Eastern Levantine basin (Eastern Med), identifying the evolution of some of the main circulation features in the region and their relationship with neighbouring dynamical structures. Finally, in the

absence of data with the necessary spatial and temporal resolution and coverage, preliminary information can be drawn from easily available data sources and possibly with a modest investment of resources, while prioritising the knowledge gaps to be filled. This can typically be the case in regions undergoing severe climate and socio-economic pressures, where there is an urgent need to support policy and regulatory development in coastal management and planning. Following this logic, Monioudi et al. show how widely available satellite data can be combined with meteo-marine climate and nearshore numerical modelling to achieve an island-scale assessment of the exposure of Cyprus beaches (Eastern Med) to erosion under different climate change scenarios. The need to optimise the investigation effort by benefiting from large existing datasets is particularly pressing in the projection of future risks associated with intense meteo-marine events on coastal systems, in which the computational cost associated with the need for accuracy in describing small-scale processes and the multi-decadal horizon of climate evolution is practically unsustainable for classical model downscaling approaches. Denamiel et al. exemplify a possible response, proposing a methodology for an affordable prediction of meteotsunami hazards based on the combined use of synoptical indexes from available global climate model (GCM) ensembles and targeted downscaling applications.

Malvarez et al. push the analysis of coastal processes towards a source-to-sink dimension by tackling sediment dynamics on the beaches of Marbella (Western Med) in terms of catchment-scale budget, stimulating a reflection on the timeliness of updating sediment management paradigms and its implications in terms of policy and technological advances. Their study also hints at a dynamical concept of coastal resilience, in which the main functions and processes of coastal systems are overall preserved but are allowed to shift in position. Climate challenges may also lead to rethink criteria and techniques for the very definition of coastal vulnerability. This emerges in the contribution by Sánchez-Artús et al., addressing a regional-scale assessment referred to flooding and erosion based on the use of high-resolution hydrodynamic modelling and on the application of the coastal archetype concept. This approach allows capturing the main elements of coastal complexity for a limited number of representative beaches. New paradigms are also needed for the design of coastal infrastructures, particularly as long as their expected life span is comparable with the time scale of climate change effects: referring to the management of port breakwaters, Stagnitti et al. discuss a methodology for assessing the impact of climate change on the performance of upgraded rubble-mound structures based on a set of application-oriented climate parameters. With the contribution by Agharroud et al., the focus is on climate-related risks for a densely anthropized region along the coast of Morocco (South-Western Med). While providing a valuable view on climate risks in the southern Mediterranean basin and an important support for adaptation and policy-making, this work highlights the importance of risk perception and awareness by the population as a prerequisite for suited responses, pointing out that poor socio-economic conditions and high rates of illiteracy can act as a risk magnifier even in areas characterised by relatively low levels of hazard and exposure.

As coastal ecosystems undergo diverse and potentially severe climate threats, they are at the same time a potential provider for crucial ecosystem services, from carbon sequestration and coastal protection (as in the case of coastal wetlands and seagrass meadows) to biodiversity conservation. A versatile and interdisciplinary methodology for the creation of a solid knowledge ground in support of decision-making in this direction is presented by Vitelletti et al., combining data from publicly available repositories with multi-decadal oceanographic climate projections into a habitat suitability application. The work is based on the modelled prediction of possible coralligenous habitat evolution in the Adriatic Sea (North-Eastern Med).

In summary, the works collected in this Research Topic highlight that the response to climate change in coastal areas can be informed not only by long-term monitoring programmes or large international initiatives, but also (and not less importantly) by relatively small and local datasets. The regional and local subjects typically in charge of these datasets should thus be engaged in a closer interaction with academic research entities, aiming at reducing data fragmentation and enhancing a widespread adoption of FAIR (Findability, Accessibility, Interoperability, Reusability) principles in the creation of a knowledge-base for coastal resilience building.

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