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

*CORRESPONDENCE
Geórgenes H. Cavalcante
georgenes.cavalcante@icat.ufal.br

†PRESENT ADDRESS
Filipe Vieira,
Applied Technology and Management, Inc. (ATM) –A Geo Company, Dubai,
United Arab Emirates

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Editorial: Marine and coastal environments under extreme stress

Geórgenes H. Cavalcante[1]*, Edmo Campos[2], Radouhane Ben-Hamadou[3], Filipe Vieira[4†] and Björn Kjerfve[5]

[1]Institute of Atmospheric Science, Federal University of Alagoas, Maceió, Brazil, [2]Oceanographic Institute of the University of São Paulo, São Paulo, Brazil, [3]Environmental Science Program, Department of Biological and Environmental Sciences, College of Arts and Science, Qatar University, Doha, Qatar, [4]Interdisciplinary Centre of Marine and Environmental Research of the University of Porto, Matosinhos, Portugal, [5]School of the Earth, Ocean, and Environment, University of South Carolina, Columbia, SC, United States

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Editorial on the Research Topic
Marine and coastal environments under extreme stress

Marine and coastal ecosystems occupy the dynamic interface where land, water, and atmosphere interact and constantly are modified by natural events and human actions, causing the most immediate effects of environmental changes, habitat destruction, and biodiversity loss. They are rich in biodiversity and of great economic importance by providing multiple uses and resources for over half of the population currently living in coastal areas. Also, coastal wetlands (mangrove forests, salt marshes, and seagrass meadows) constitute the blue carbon ecosystems and are among the most efficiently sequesters of carbon). The pressure that marine and coastal ecosystems across the coasts of the world now face is not new and highly varied, resulting in far-reaching implications for the ocean and adjacent areas. Nevertheless, apart from the known responses of marine environments to climate changes on their functioning and structure, significant knowledge gaps on the potential effects of catastrophic natural events and intense anthropogenic stress and destruction on ecosystem dynamics are still needed, requiring new approaches to solve this problem. This Research Topic aimed to contribute to the potential responses of marine and coastal ecosystems, when subject to extreme chronic stressors or catastrophic events, either by natural or anthropogenic actions, providing a broad overview of assessment and monitoring tools from case studies from different continents.

In Louisiana and South Florida coasts in the northern Gulf of Mexico, microclimate regimes are modified by the temperature differences across interfaces among vegetation canopy, water, and soil (Zhao et al.). A study over three years on the temperature differences at those three interfaces in mangrove-saltmarsh ecotones showed that temperature offsets variability below-canopy resulted from vegetation regulating near-ground energy fluxes. Extreme weather events weaken canopy buffering, resulting in long-term changes in the canopy or soil temperature offsets (Zhao et al.). These results highlighted the importance of simultaneously measuring the interaction between ecological and climatic processes in macro- and microclimates in coastal areas. On the west coast of Canada, a particular challenge is the extreme precipitation events triggered by frequent atmospheric rivers, which

are generally characterized by probable maximum precipitation (PMP) that can affect the resilience of the coastal communities vulnerable to hydrological risks (Liang and Yong). In this study, the regional climate model used to physically estimate the PMP in Vancouver revealed that the increase of precipitation for the estimated PMP relative to the extreme historical precipitation was closely associated with the increased atmospheric moisture transport and the changes in the atmospheric dynamic factors (Liang and Yong).

Extreme weather events can also strongly impact driving modifications in coastal hydrology and hydrodynamics. A case study on the Bay of Brest (French Atlantic coast) showed that several extreme weather events triggered severe low salinity conditions. It also revealed a doubling of the occurrence and duration of extremely low salinity in western France (Poppeschi et al.). Another case of an extreme event was Hurricane Harvey in 2017, which caused a large amount of inorganic and organic nutrients to be transported towards the estuaries and coastal areas of the Houston/Galveston region (Texas, United States). As a result, hurricane-induced negative surge events affect net nutrient budgets in estuarine and coastal seas (Douglas et al.).

Climate change and the high frequency of episodes with extremely high temperatures have also increased the incidence of severe coral bleaching events in different regions, such as the Arabian/Persian Gulf (Burt et al., 2020). Shallow reefs on the Qatar coast were found to have low species richness and abundance relative to deeper reefs. The primary cause suggested was the impacts of recurrent bleaching events and development pressures over recent decades (Bouwmeester et al.). Another example is the coral reefs in Singapore, which are heavily degraded and suffered further impact due to the moderate to severe coral bleaching across reefs induced by the elevated sea surface temperature in 2016 (Bauman et al.). It was predicted that such changes might compromise the long-term stability of reef biodiversity and productivity. Assessing extreme heat episodes through a novel application of NOAA Coral Reef Watch products revealed invaluable information to monitor global coral bleaching events across the three tropical ocean basins (Little et al.).

A growing human population has also increased the reliance on the sea and coastal lagoons for food. Despite soaring demand, the management of pollution released by cities located in coastal areas is still deficient, resulting in concerns about human consumption of seafood, mainly in developing countries. From the tropical region, Guanabara Bay, located in Rio de Janeiro, Brazil, serve as a nursery habitat for many crustaceans and fish species, contributing to maintaining an important local feed resource (Rodrigues et al.). Although its environmental and economic importance, Guanabara Bay exhibits high levels of contamination by mercury (Hg) which brought a need to assess the health risk associated with consumption of swimming crabs, shrimp and squid. In the study, a particular challenge was the potential risk to the health of children eating swimming crabs and squid and young women eating swimming crabs, even when seafood contained Hg concentrations below established limits (Rodrigues et al.).

The study of the impact of extreme events on the functioning and dynamics of coastal ecosystems is undoubtedly a hot topic nowadays. More often, multi-disciplinary approaches are used to take advantage of recent technological innovations. Climate change, temperature anomalies, climate models, anthropogenic pressures, coral bleaching, ecosystem monitoring, and nutrient budget are among the hot topics highlighted in the present work collection. Merging the knowledge from these key research areas has proved to be a perfect combination to advance the understanding of the implication of extreme weather events on the overall stability of coastal ecosystems.

Author contributions

GC wrote the first draft of the manuscript. EC, RB-H, FV and BK revised the first draft of the manuscript. All authors contributed to the manuscript revision, read, and approved the submitted version.

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Conflict of interest

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