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Editorial: Advances in multi-use floating islands

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Editorial on the Research Topic
Advances in multi-use floating islands

1 Introduction

The increasing coastal population, limited land space, and growing marine activities demand further exploration and utilization of the ocean's abundant space and energy resources. To address these existing challenges, various artificial island concepts have been proposed to meet the growing demand for affordable deck space at sea, such as the land reclamation technology for creating or extending sandy islands. However, this technology is limited to shallow waters and has increasingly severe environmental impacts. Alternatively, floating concepts are more suitable for deeper waters and can be relocated if necessary. A viable solution to this is the development of very large floating structures (VLFSs). VLFSs are a new and innovative type of offshore structure that offer several advantages over conventional floating bodies. Their unique characteristics include being much larger in size and having low construction costs, high wave resistance, and low environmental impact. VLFSs have potential applications in various fields, including commercial navigation, fisheries, offshore marine energy utilization, and environmental protection. They can also be used for facilities with complicated engineering ethics. However, to maximize their potential, further research and practical applications of related theories, technologies, and security issues must be strengthened to enable their widespread use in the future.

This Research Topic collects research articles that reflect recent advances in VLFSs with a particular focus on the development of the Space@Sea project under the Horizon 2020 initiative, which aims to provide a concept of affordable and flexible floating islands. It consists of one mini review article (Flikkema and Waals), one policy and practice reviews article (Flikkema et al.), one methods article (Tamis et al.), and three original research articles (Souravlias et al.; Drummen and Olbert; Jiang et al.) These research works cover: 1) the Space@Sea project background and approach of the collaborative research (Flikkema and Waals); 2) the governance issues like the assignment of authority on a multi-use floating island and the shift from regulating offshore living for working purposes to living purposes, as well as maritime law and property law (Flikkema et al.); 3) a structured approach for

environmental impact assessments of floating modular islands and their applications (Tamis et al.); 4) a generic methodology to tackle the floating terminal layout design, strategic logistics optimization, and operational process coordination (Souravlias et al.); 5) a heuristic conceptual procedure to design a modular floating multi-purpose island (Drummen and Olbert); 6) a general procedure for determining the sea states and the corresponding values for the limiting criteria of a module floating concept (Jiang et al.).

The initial paper by Flikkema and Waals provides an overview of the Space@Sea project, setting the stage for subsequent papers. It delves into the project's background and research methodology, focusing on four application areas: energy, living, farming, and logistics. The paper concludes by discussing the project's results and anticipated impact.

The second paper by Flikkema et al. examines the governance challenges of multi-use floating islands, including the assignment of authority, maritime law, and property law. Using the Netherlands as a case study, it highlights that current property law prohibits the division of ownership of buildings built on floating objects. This presents a barrier for urban expansion and requires an amendment of current property law to allow future inhabitants to buy property. The paper emphasizes the need for responsible institutions and stakeholders to overcome governance barriers and enable multi-use floating islands.

The methods article by Tamis et al. presents a structured approach for conducting Environmental Impact Assessments (EIAs) of floating modular islands. The authors recommend using a screening approach to identify potential threats to the marine ecosystem and their impacts during the earliest stages of development. They suggest adapting the design, implementation, and operation of the platforms to mitigate any negative impacts and potentially increase benefits to the environment. Site selection is identified as a crucial consideration, and the EIA can provide guidance on this if adequate spatial information is available. If cumulative impacts cannot be excluded, the authors suggest implementing an appropriate monitoring strategy and effective management plan to minimize any long-term negative effects on the environment.

The original research article by Souravlias et al. proposes a modular and floating platform that can serve as an additional terminal for ports to expand their container handling capacity. The authors present a framework that focuses on three key design and decision-making aspects: terminal layout design, strategic logistics optimization, and operational process coordination. They demonstrate their methodology through a case study that examines the use of a modular, floating transport, and logistics hub to accommodate the growth of a port in the Hamburg-Le Havre range.

The original research article by Drummen and Olbert presents a heuristic approach for developers to create a preliminary conceptual design for future floating islands. The approach involves dividing the design space into four main considerations: module size, module shape, module principle, and module connection and mooring. The authors defined evaluation criteria for each consideration to help identify practical and advantageous designs while eliminating impractical ones. They also created two reference installation scenarios, one in the North Sea and one in the Mediterranean Sea, with different focuses of functionality, to serve as a basis for the design.

The original research article by Jiang et al. proposes a two-step strategy to calculate the responses of multiple floating structures in head waves, while taking into account the nonlinearities of the mooring lines and mechanical joints. The first step involves deriving the transfer function to express the wave induced motions and loads in terms of limiting criteria. In the second step, assessments are carried out for various sea conditions against the prescribed values of the criteria to address safety concerns arising from severe platform responses. The proposed methodology is expected to contribute to the safe and reliable design and operation of floating islands in harsh marine environments.

This Research Topic offers a range of approaches to address multi-use floating islands, each tackling different aspects of the problem. As a result, this Research Topic can serve as a valuable reference for those interested in this area of research.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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