

SPECIAL ISSUE ON AQUATIC SCIENCE AND TECHNOLOGY (i-CoAST) PART 1

PREFACE



The integration of spatial information, autonomous systems, high-precision remote sensing, and advanced numerical modeling is fundamentally restructuring the paradigms through which we perceive, monitor, and manage marine and coastal environments. Expanding upon the discourse established in previous symposia, this special issue spotlights the evolution of aquatic science from static observation into dynamic, intelligent frameworks capable of addressing multifaceted challenges in coastal ecosystem preservation, marine infrastructure resilience, and disaster response. This paradigm shift is propelled by the synergistic convergence of multidisciplinary methodologies, enabling real-time data assimilation and predictive analytics that were previously beyond reach. Commemorating the 10th anniversary of the International Conference on Aquatic Science & Technology (i-CoAST), this special issue comprises ten peer-reviewed contributions that underscore cutting-edge advancements and practical applications within this domain. The articles span a diverse spectrum of topics, ranging from environmental monitoring via satellite and aerial sensing to AI-driven marine spatial data analysis, high-fidelity hydrodynamics, and sustainable coastal development methodologies.

First, the efficacy of remote sensing and spatial analysis in coastal environmental monitoring is demonstrated in several studies. Park *et al.* investigated the paradoxical coastal environmental responses to human behavioral changes during the COVID-19 pandemic using geostationary satellite data and machine learning frameworks. Kim and Lee proposed a robust land–water discrimination framework utilizing single-wavelength airborne bathymetric LiDAR and tree-based machine learning classifiers. Tak *et al.* developed a domain-specific large language model tailored for marine spatial information, demonstrating the feasibility of efficient fine-tuning and RAG integration in a resource-constrained environment. Na *et al.* conducted a comprehensive assessment of S-101 Electronic Navigational Chart accuracy and reliability through rigorous validation protocols to enhance maritime safety.

Moreover, this issue addresses advancements in computational hydrodynamics and physical oceanography. Lee *et al.* evaluated the performance of a novel rotational fender system in mitigating ship-structure collision impacts through dynamic contact analysis using LS-DYNA. Kwon *et al.* conducted 3D numerical investigations on the complex dynamics of gas–liquid two-phase slug flows in underground stormwater tunnels using OpenFOAM. Seo *et al.* provided empirical estimates of scale-dependent horizontal diffusivity in the Northwestern Pacific Ocean by utilizing a custom-designed GPS surface drifter system.

Finally, the application of advanced operational frameworks and cultural sustainability is explored. Lee *et al.* quantitatively evaluated the applicability of an integrated operational framework combining heavy-class ROVs with manned diving systems, based on a case study of the Sewol ferry disaster. Kim *et al.* formulated a comprehensive operational procedure for integrating heavy-class ROVs and manned diving to improve the efficiency and safety of underwater search and rescue in large-scale marine disasters. Sung explored the symbolic capitalization of marine character content intellectual property (MCIP) across South Korean coastal municipalities, highlighting its role in regional identity and sustainable development.

We extend our sincere gratitude to all the authors for their innovative contributions and scholarly dedication. We also offer our deepest appreciation to the reviewers for their constructive critiques, which have significantly elevated the quality of this special issue. Finally, we would like to express our heartfelt thanks to Ms. Momoko Kawamura of MYU K.K. for her unwavering support and meticulous coordination throughout the editorial and publication process.

Jaekang Lee
Department of Civil Engineering, Dong-A University
Republic of Korea