Data, Observation & Modelling

Fri. Nov 13, 2026 2:00 PM - 3:30 PM JST | Fri. Nov 13, 2026 5:00 AM - 6:30 AM UTC | Room B (Kujaku) (2F)

Oral B5 Coastal and Marine Ecosystems, Blue Carbon and Regional Ocean

Chair: Konobu Kimura, Fadli Syamsudin

2:15 PM - 2:30 PM JST | 5:15 AM - 5:30 AM UTC

[TPZePaqP-02] Marine Excess and Stressor Occurrences: A Digital Twin Perspective for Ocean Health, Biodiversity and Coastal Stewardship

*Katja Breitenfelder[1] (1. Fraunhofer Institute for Building Physics IBP (Germany))

Coastal and marine environments are increasingly shaped by substance-based occurrences linked to climatic change, extreme events and human activity. Episodic sediment surpluses, extensive macroalgal accumulations, polymers and mixed biogenic fractions alter ecosystem functioning, reduce biodiversity and intensify pressure on coastal communities and infrastructure. These developments expose a critical scientific need to determine when such occurrences act as ecological stressors, when they represent temporary excess, and when they may be suitable for safe removal or circular utilisation. At present, no unified methodology exists to define, classify or evaluate such occurrences across their physical, ecological and governance dimensions.

Digital Twins of the Ocean (DTOs) provide the computational environment in which these elements can be integrated. Their capacity to combine multi-source observations with dynamic ocean modelling provides a foundation for multi-criteria assessment logic that reflects regional ecosystem characteristics. This contribution presents a conceptual framework that maps the required data integration, modelling pathways and decision criteria needed to embed excess and stressor occurrences within digital-twin architectures.

The framework synthesises existing European and international indicator catalogues, parameters and ecological typologies to structure the analytical workflow: from initial observation data and hydrodynamic transport modelling to assessing ecological carrying capacities and delivering transparent information for decision-makers and downstream material pathways. To enable multi-criteria decision support, it specifies how monitoring pipelines, predictive transport models and impact functions must be interlinked.

This work establishes the analytical foundations required for developing region-specific criteria, modelling components and governance protocols within evolving ocean-twin infrastructures, supporting a gradual shift towards science-based evaluation, informed decision-making and strengthened coastal stewardship.

© 2026 DITTO Summit Local Organising Committee. All rights reserved.