

Lecturer Houtani Lab. (Marine Hydrodynamics Lab.)

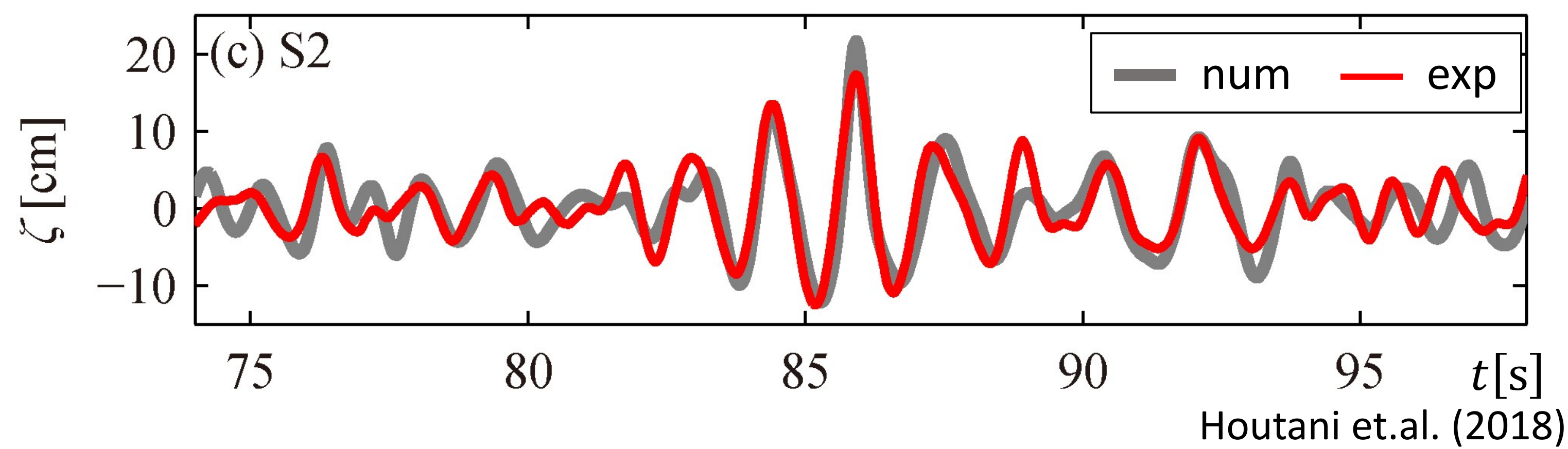
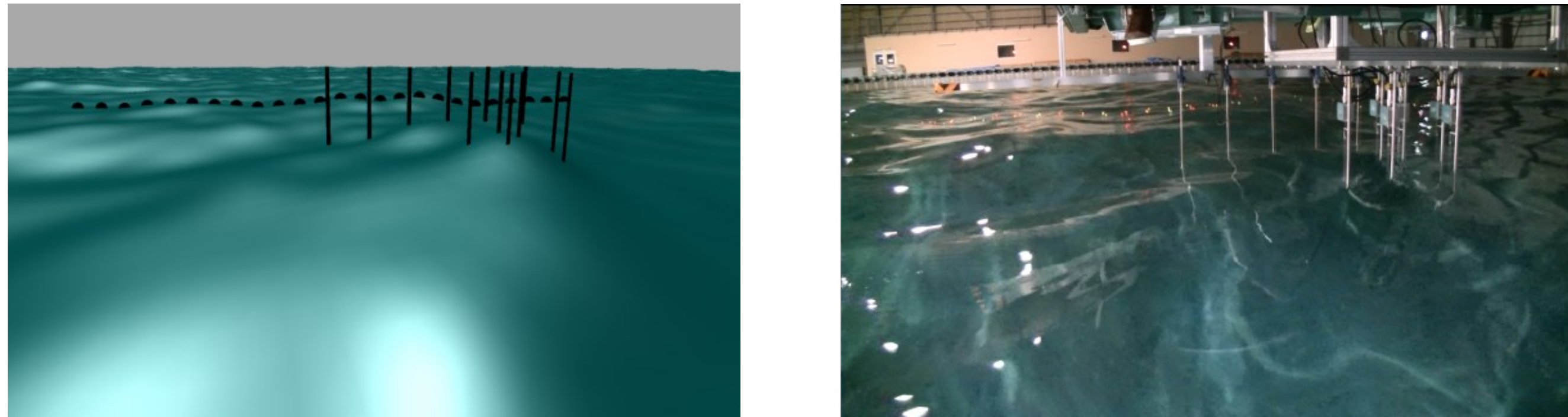
Keywords: Ocean Waves, Nonlinear Waves, Ocean Engineering, Seakeeping Performance, Tank Experiments, Hydroelasticity, Ships and Offshore Structures

In our quest to ensure the safe use of the ocean, we conduct research focusing on the ocean engineering problem associated with waves, using theoretical, numerical, and experimental approaches. Our goal is to elucidate the nonlinear physical processes underlying the formation of freak/rogue waves and to understand the complex nonlinear behavior of ships and offshore structures in such waves.

Nonlinear Ocean Waves

We are working on elucidating the nonlinear physical processes underlying the formation of freak/rogue waves - exceptionally large waves that suddenly appear in the ocean - and the experimental reproduction of such waves in wave basins.

Numerical simulation of freak waves and their reproduction in a wave basin



Description of nonlinear wave evolution

(Zakharov Equation, Nonlinear Schrödinger Equation)

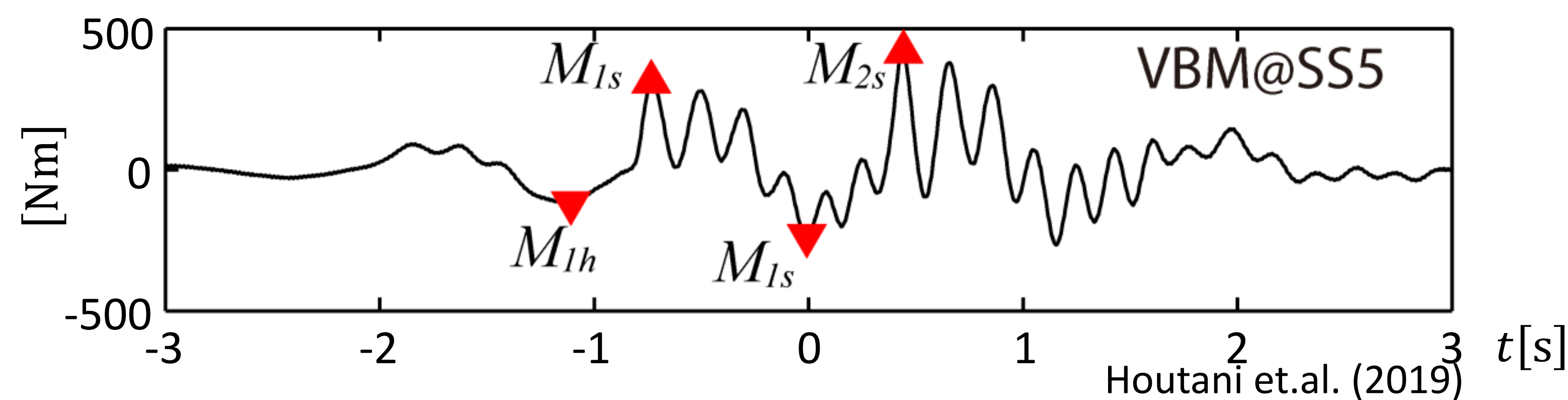
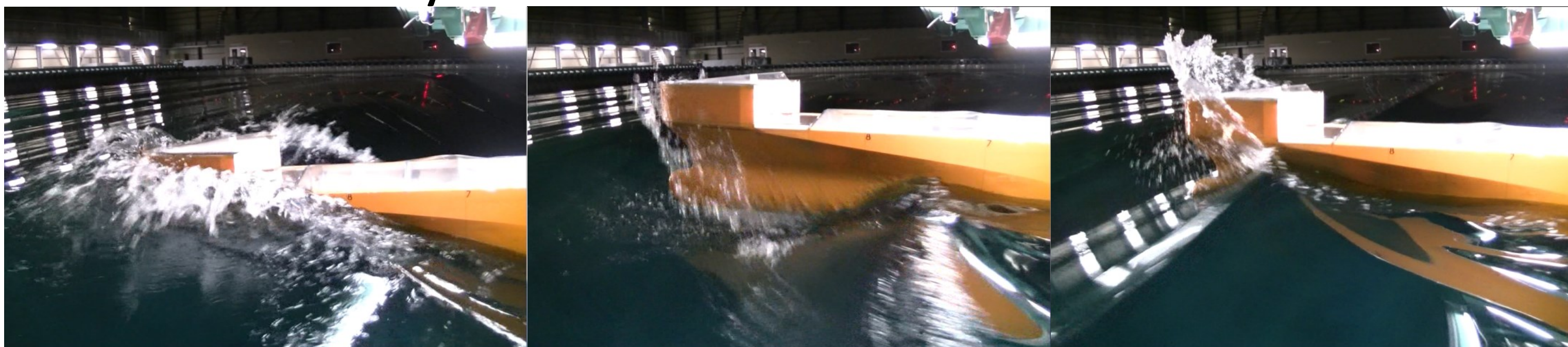
$$i \frac{\partial a_1}{\partial t} = \omega_1 a_1 + \int \tilde{V}_{1,2,3,4}^{(2)} a_2^* a_3 a_4 \delta_{1+2-3-4} dk_{234} + H.O.T.$$

$$\left(\frac{\partial A}{\partial t} + c_{gc} \frac{\partial A}{\partial x} \right) + i \frac{\omega_c}{8k_c^2} \frac{\partial^2 A}{\partial x^2} + i \frac{\omega_c k_c^2}{2} |A|^2 A = 0$$

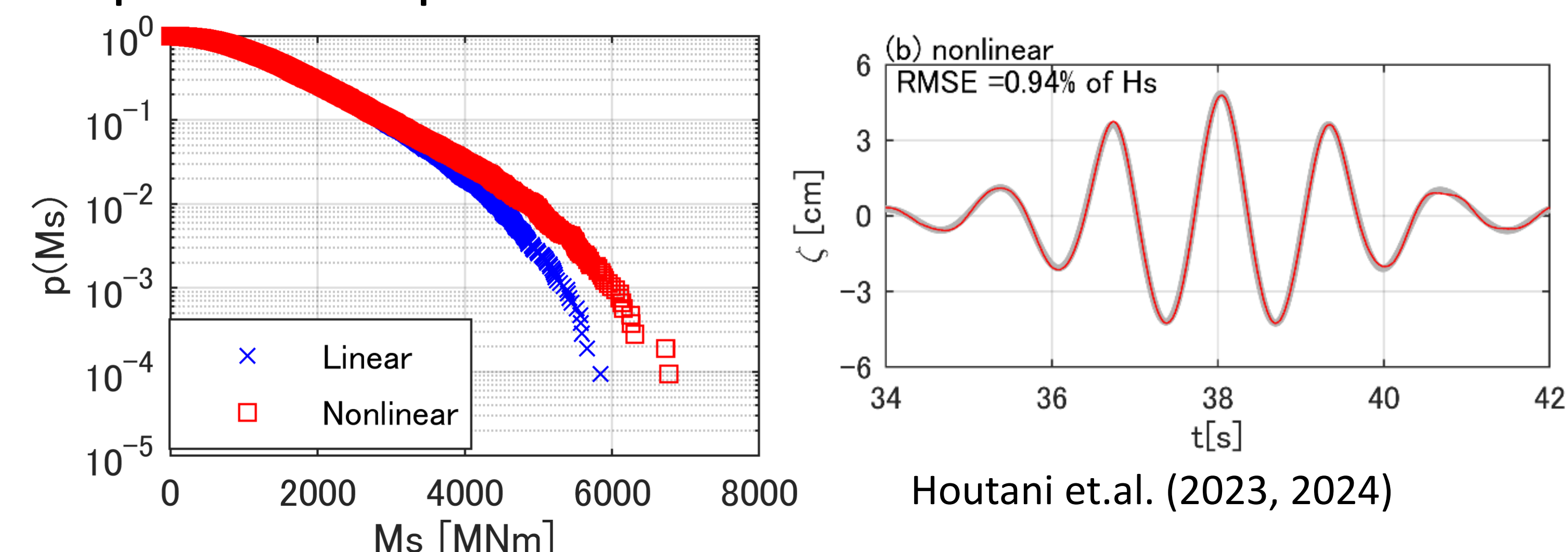
Ship Responses in Extreme Waves

We conduct research on unraveling highly nonlinear phenomena of ships and offshore structures against extreme waves, such as impact loads from slamming and the resulting elastic vibrations of structures.

Towing experiment of a flexible container ship model in freak waves and measurement of the hydroelastic vibration of the model



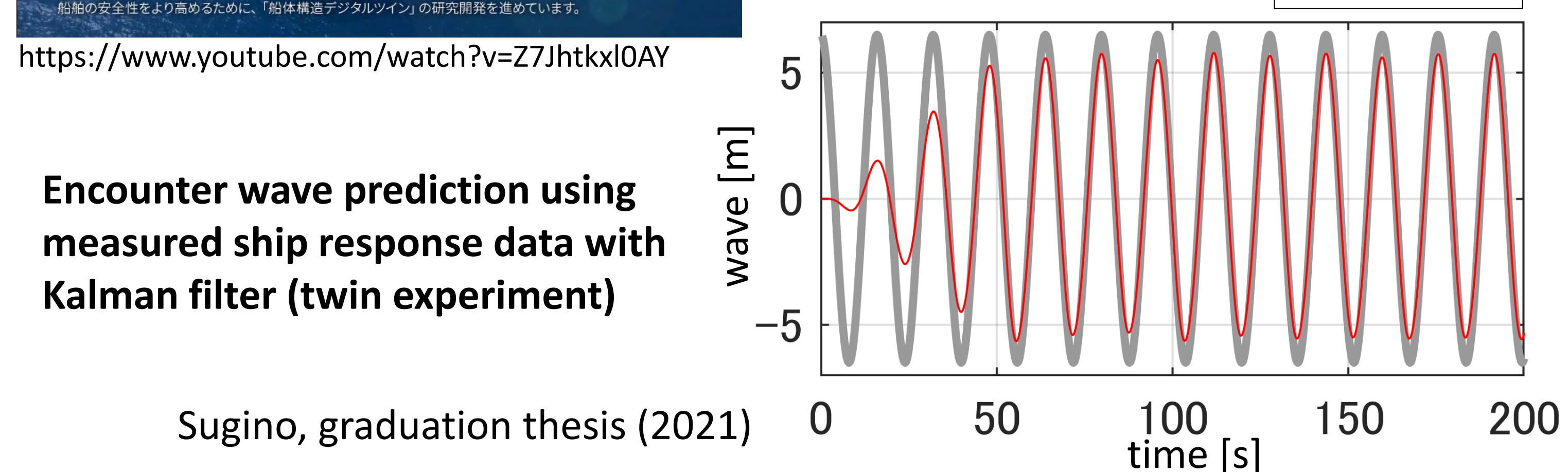
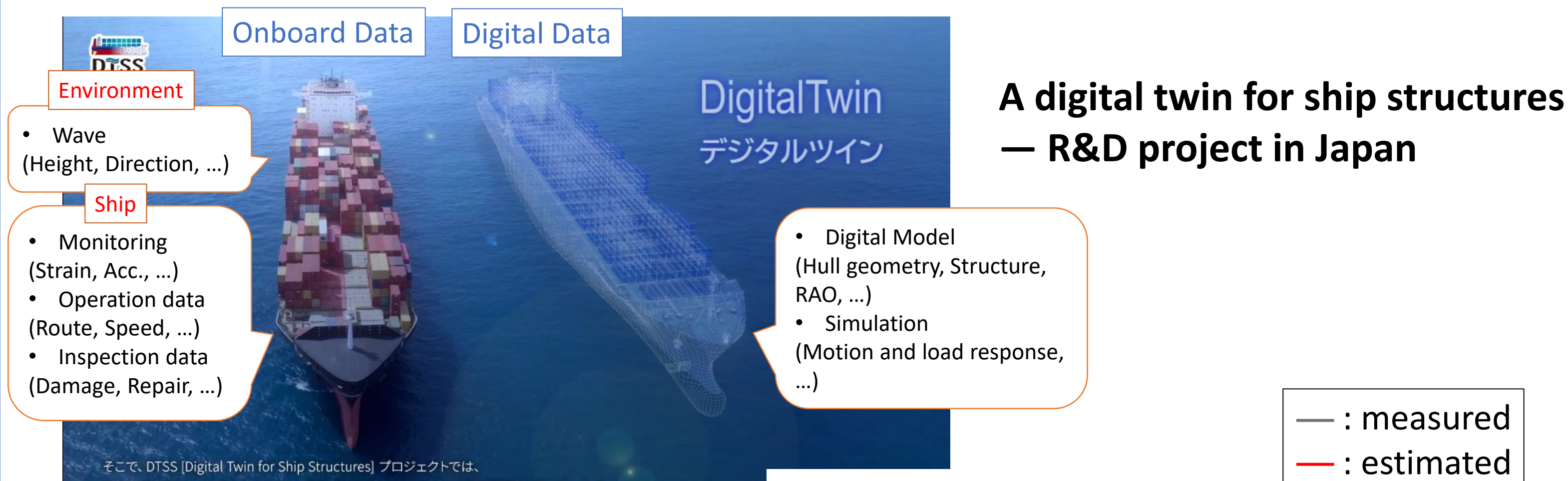
Stochastic prediction of wave loads on ships in nonlinear waves and corresponding most probable wave episode



Houtani Lab. is a new lab established in 2024. Some studies have been conducted in collaboration with Hideyuki Suzuki Lab. Don't hesitate to contact us if you are interested in our lab. We welcome you to visit our lab.

Predicting Wave and Floating Body Response

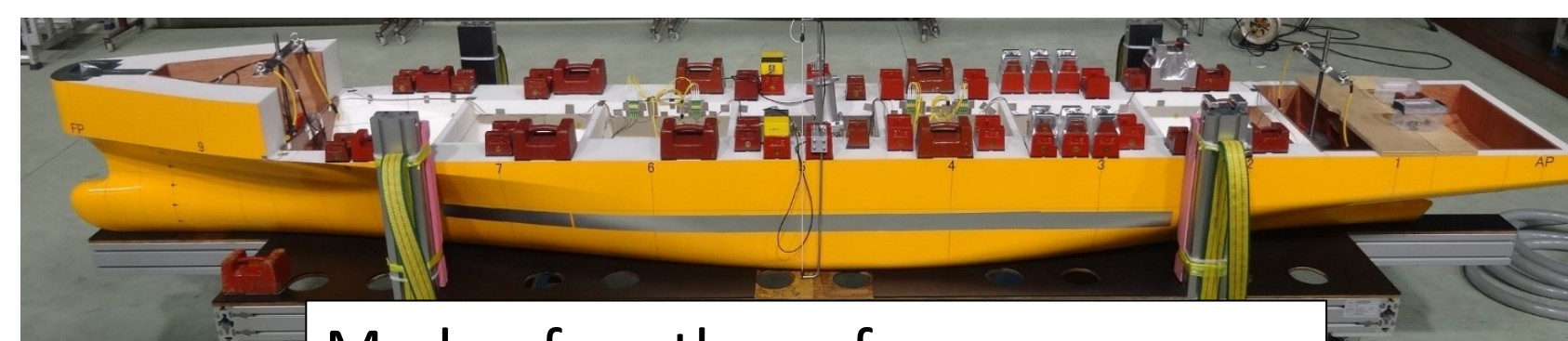
We are developing methods to predict unmeasured waves and ship responses using measured ship responses with data assimilation schemes.



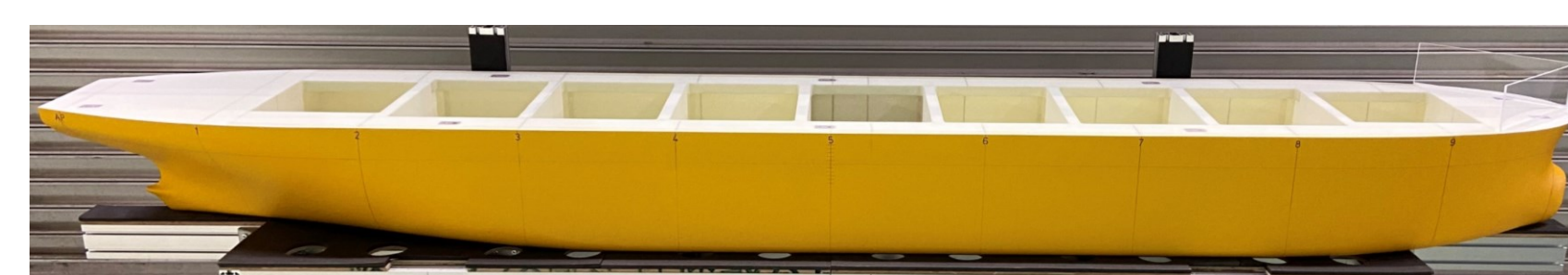
Novel Tank Experiment Techniques

We have developed novel experimental techniques, such as new concept flexible ship model designs, wave generation methods in wave tanks, etc.

Novel flexible ship models

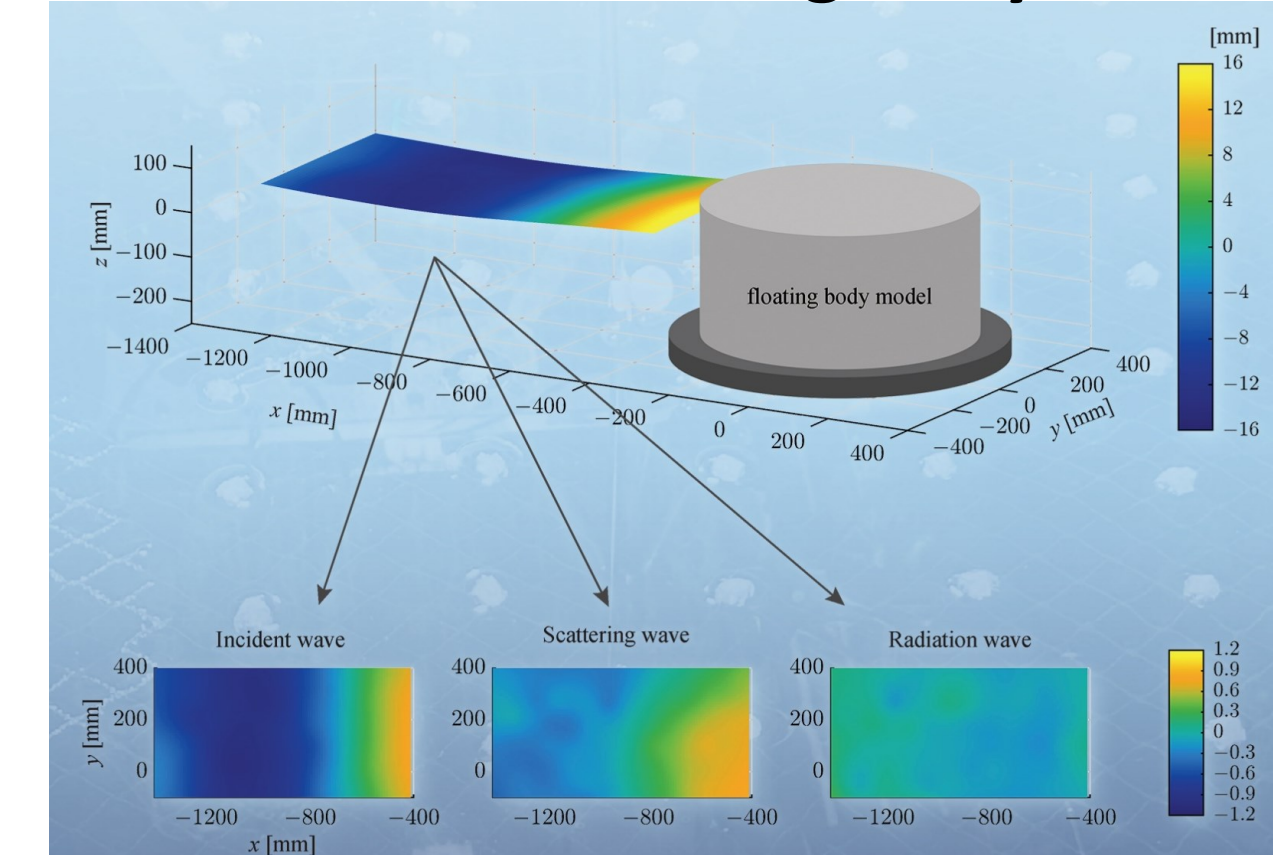


Made of urethane foam: to measure torsional vibration



Made of GFRP sandwich panels: to measure ship hull response and local deformation of the bottom hull

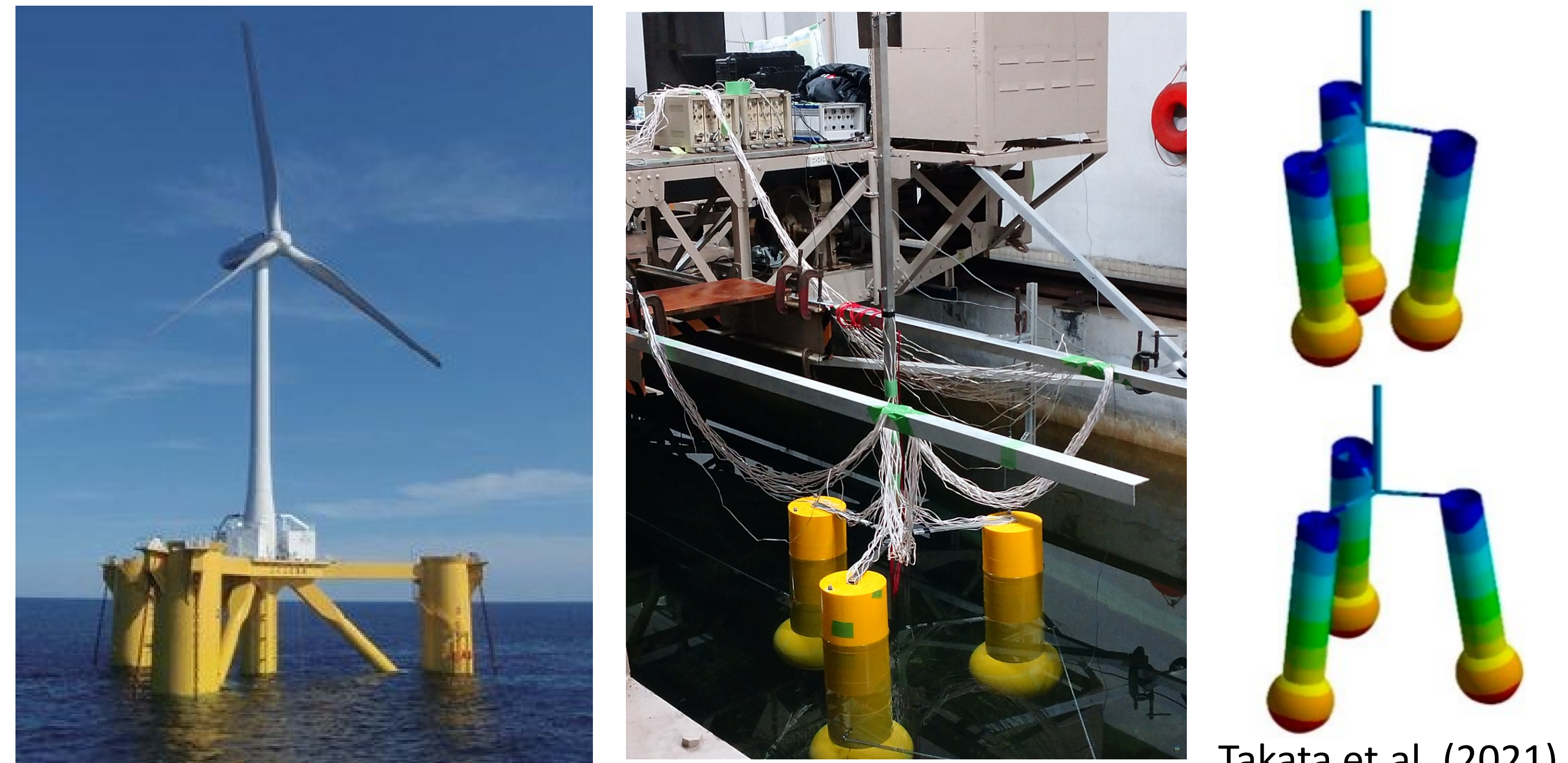
Stereo reconstruction of 3D wave fields around a floating body model



Floating Offshore Wind Turbine

We are working on the analysis of the dynamic response of floating offshore wind turbines (FOWT) and the development of very lightweight FOWT designs. (with Prof. Hideyuki SUZUKI.)

Research on the motion and elastic deformation of multi-column FOWT



Lecturer
Hidetaka HOUTANI

Website: <https://www.mhl.t.u-tokyo.ac.jp/>
Office/Lab.: Room 349, Eng. Bldg. No. 3, Hongo Campus
Email: houtani@sys.t.u-tokyo.ac.jp

