Coastal Engineering Laboratory

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Research topic 1: The formation and development of oceanic wind waves

Wind blowing on the sea's surface generates wind waves. Along with the great damage wind waves cause to coastal areas when they reach great heights, they cause the ocean layers near the surface to mix when they break. These kinds of ocean surface layer conditions become an issue because they affect the movement of atmospheric carbon dioxide between the atmosphere and the ocean.

Using 3D stereoscopic PIV visualization in wind tunnel water tank experiments, our lab has been carrying out research that correlates wave surfaces and wind speeds to the characteristics of air current turbulence of wave surfaces and of breaker turbulence below the ocean's surface.

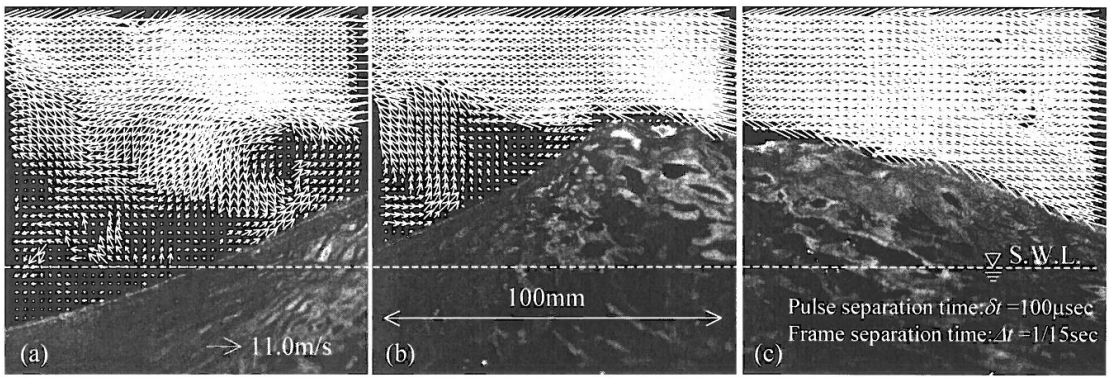
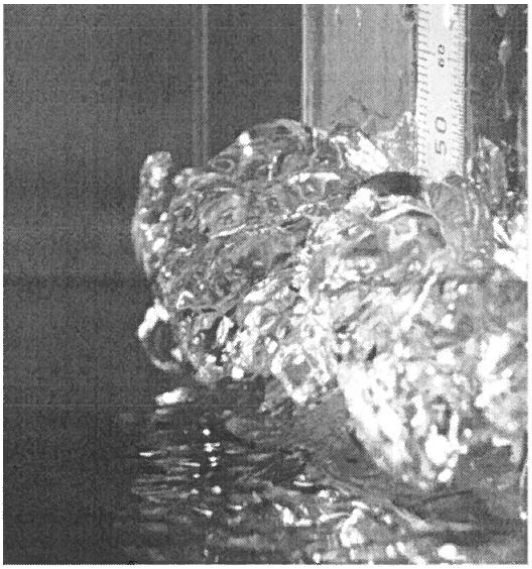


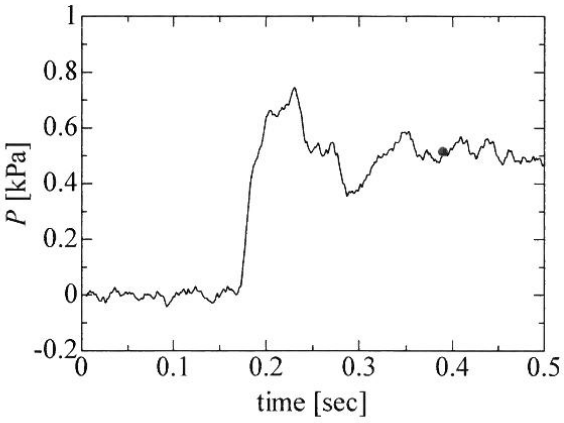
Fig.1 air flow separation from wind wave crest with inverse flow (breaking point)

Research topic 2: The effect that wave power of tsunamis that come ashore has on buildings

Japan suffered tremendous damage from the Great East Japan Earthquake in 2011. Estimates are that over 90 percent of the victims were killed by the tsunami the quake generated. We have been conducting research regarding the ways that tidal tsunamis damage buildings to find ways to mitigate the damage from tsunamis after a Nankai Trough earthquake—which reportedly will occur in the near future—as much as possible.

Our laboratory has been conducting research into fluid phenomena and mechanisms that generate wave pressure, employing wave tanks to observe the effects of tsunamis on models of buildings.





Research topic 3: Oscillating water column wave power generation

The use of renewable energy is currently spreading around the world. One form is marine wave energy, but relatively little progress has been made on practical applications on this compared to wind or solar energy, and research is ongoing.

Our lab has been investigating oscillating water column (OWC) wave power generation, using numerical calculations and experimental tanks. While OWC wave power generation improves efficiency during generator resonance periods, it also lowers the length of operation, which is an issue. We have been using various approaches to carry out research related to such issues.

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N. Mizutani, M. Kaji and M. Miyajima: Air Pressure Distribution above Wind Waves computed from PIV Measurement Data, *Journal of Japan Society of Civil Engineers, Series B2 (Coastal Engineering), Vol. 69, No. 2* (pp. I 1401–1405). 2013.

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