

Prof. D.J. Doong's research team is working on the coastal hazard related topics. It includes the hazardous waves (typhoon waves, freak waves, rapid growth waves, swell), storm surges, sea level rise, coastal flooding, rip current and the environmental hazards such as the impact of floating marine debris. The objective of the studies is to increase the understanding on the properties and causes of the hazards in order to develop the warning system to mitigate the loss of life and properties. The approach to achieve the objective is the field data analysis and interpretation based on innovative data analysis techniques. The field data are obtained from latest observation systems.

Hazardous Ocean Waves

Severe sea state may not cause hazards however the rapid change sea is possible to bring shipwreck or people loss because they come without warning.

Typhoon Waves (TW): Extreme wave generated by typhoons.

- predictable.
- Work on the statistical and spectral properties.

Oceanic Freak Wave (OFW): A wave with its height larger than twice of the significant wave height.

- Un-predictable currently.
- One of the causes for shipwrecks.
- Work on the understanding of freak wave in the field, the mechanism of forming a freak wave, the prediction of freak wave by stochastic approaches.

Coastal Freak Wave (CFW): The water splashed to the breakwater or coastal area generated by the interaction of ocean waves and the rock or breakwater.

- Un-predictable currently.
- Dangerous for the fisherman and people at the coastal area.
- Work on the warning system by data mining techniques.

Rapid Growth Waves (RGW): A wave growth up to dangerous form in a short period.

- Not-predictable currently.
- Dangerous for small boat.
- Work on the mechanism and warning method.

Swell: Long period waves usually generated by typhoons.

- Predictable.
- A cause to trigger the freak waves.
- Work on the separation of swell and the mechanism of contributing to the generation of freak waves.

Floating Marine Debris (FMD)

- Naturally occurring marine debris: driftwood, sea grass...
- Human-derived marine debris: debris; plastic bags, buoys, rope, bottles, cans, lost fishing line and nets...
- Impacts to the environment, economy, and human health and safety.
- Work on the classification, source, distribution, transportation and accumulation of the floating marine debris, especially the driftwood.

Innovative Ocean Observation Techniques

Microwave Radar

- 3-dimensional (x,y,t) observational instrument
- Extraction of wave (height, period, direction, spectrum) and current
- Full-day operation

Optical Stereo-imaging System

- Digitalization and re-construction of three-dimensional sea
- Extraction of wave and current
- Nearshore observation capability



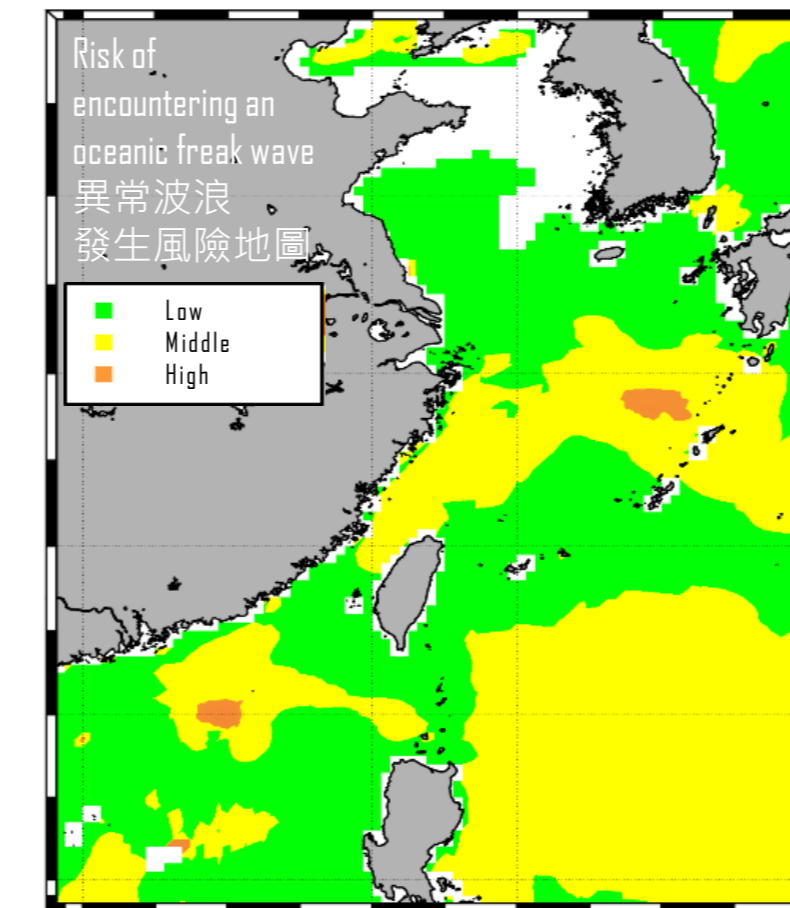
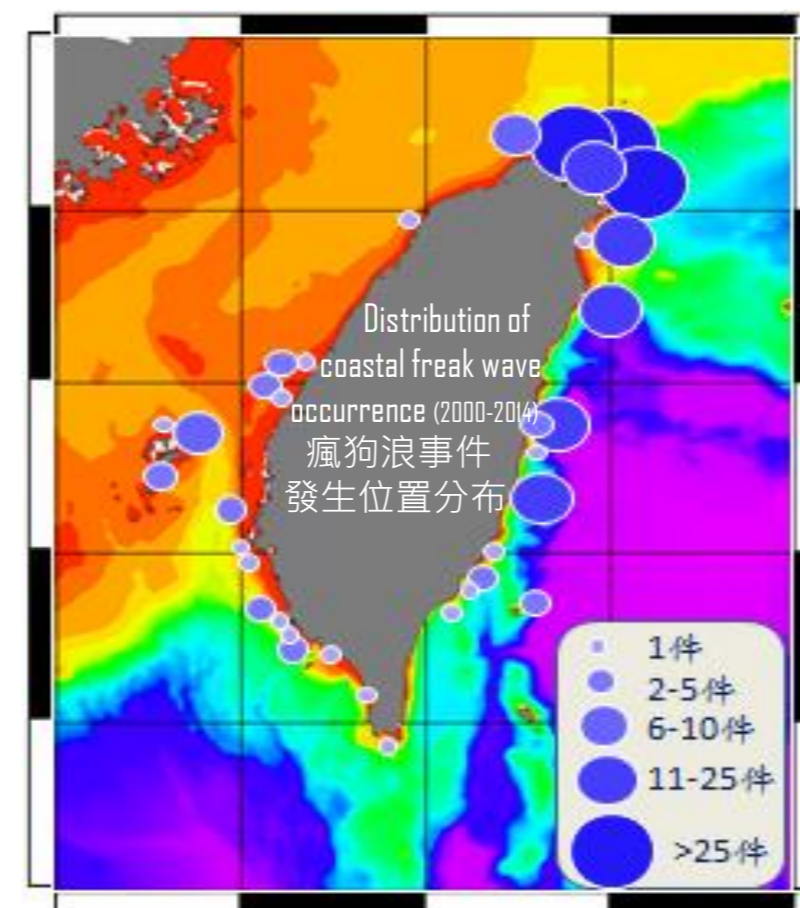
Ferry Ocean-lala hit by a oceanic freak wave (2010/8/8 Taiwan Strait) 海洋拉拉號遭遇異常波浪事件，2010/8/8，台灣海峽



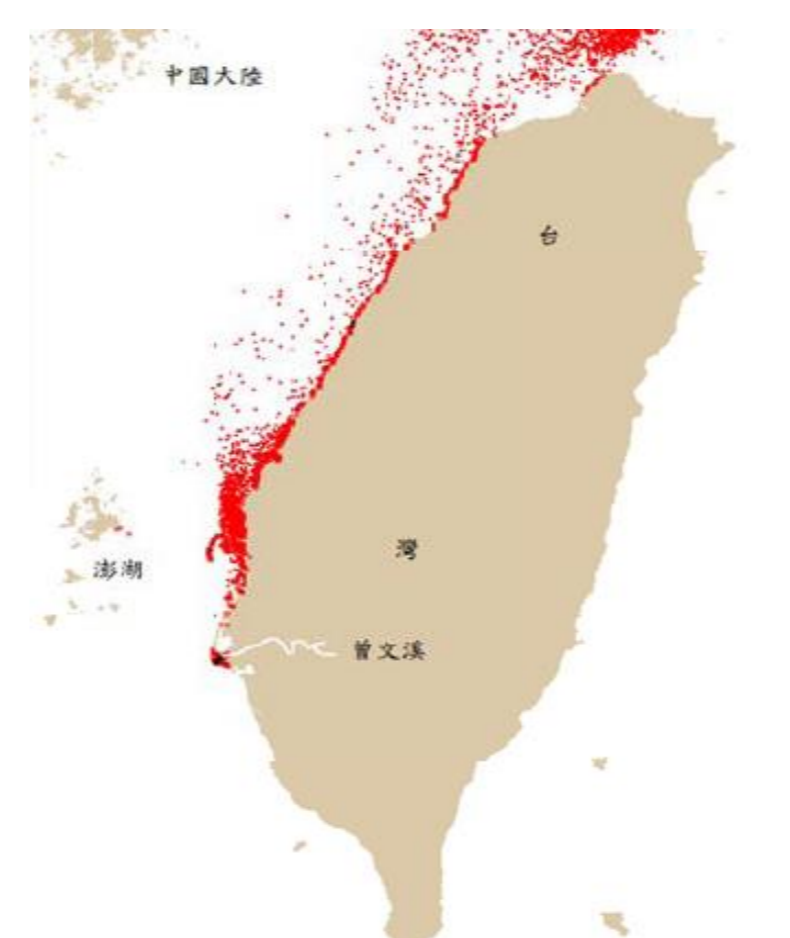
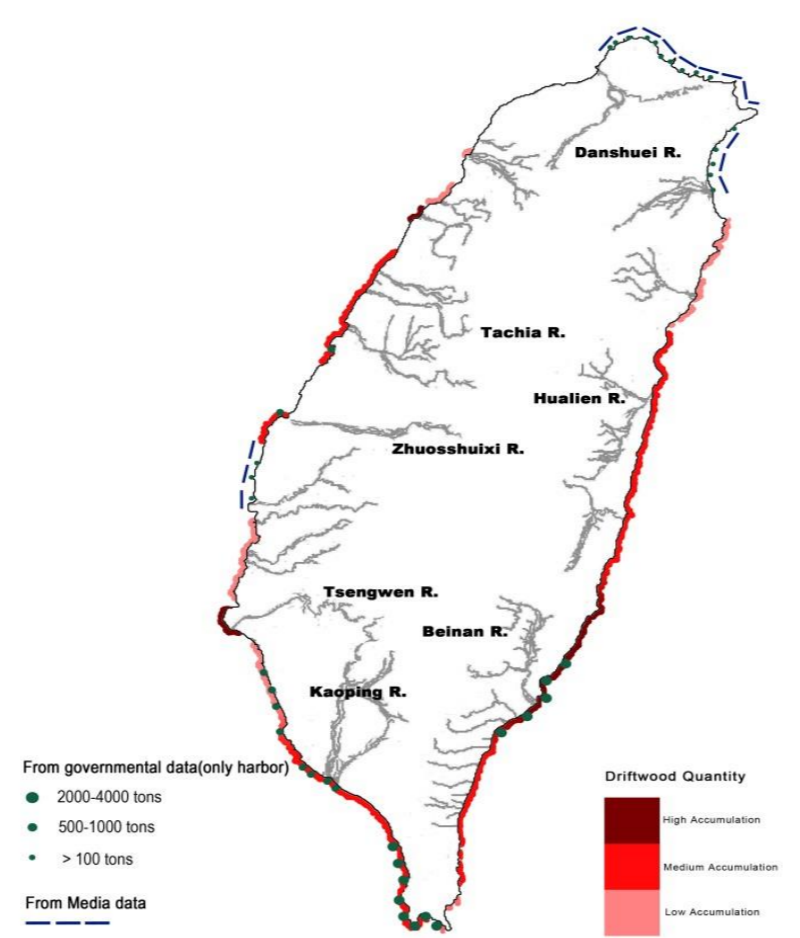
Coastal freak wave occurred at Genggang Harbor (2012/10/14) 瘋狗浪吞人吃車事件，2012/10/14，新北市梗枋漁港



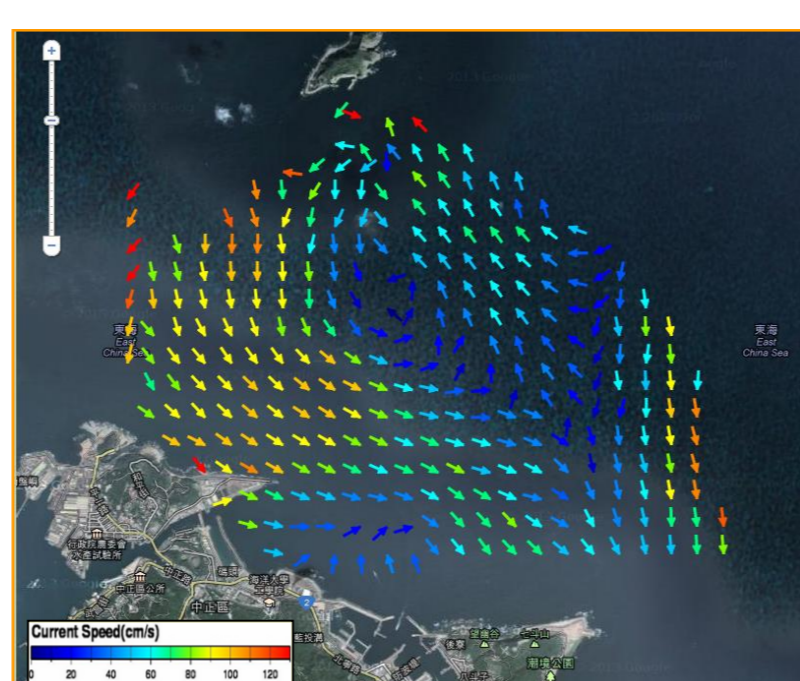
Coastal freak wave occurred at NTU breakwater (2014/10/12) 瘋狗浪衝擊摩托車入海事件，2014/10/12，基市海大防波堤



Driftwood accumulation in the Fugang Bay, Taitung, Taiwan 2009 莫拉克颱風過後台東富岡海灣堆積漂流木



Distribution of coastal driftwood along the coasts (left) and its transportation in the sea after typhoon Morakot in 2009 莫拉克颱風過後漂流木在全台海岸堆積情形(左圖)及在海洋中運移軌跡(右圖)



Surface current measured by microwave radar 微波雷達觀測表面海流結果之一例



The stereo-imaging observation system 光學立體海象監測系統

本研究室從事海岸災害與防護、預警相關研究，研究之海岸災害內容包含海象引致災害，譬如颶風波浪、瘋狗浪、湧浪、暴潮、海平面上升、海岸淹水、裂流等，以及海洋與海岸環境問題，譬如海洋垃圾。研究室主要透過現場觀測蒐集實測資料，應用最新資料分析技術來從事前述課題研究。

危害性波浪

極端波浪常引致災害，但易防範。瞬變海象(包含外洋異常波浪、近岸瘋狗浪、急速成長波浪)帶來危害常令人措手不及，數值模擬也難以預測，這些災害性波浪的特性與成因，以及其可能的防範預警方法值得深入研討。

異常波浪 – 突然的高浪，發生於海上，可令船隻翻覆，也稱外洋瘋狗浪，難以預防。

瘋狗浪 – 波浪傳遞至海岸，與礁岩、防波堤交互作用激起巨大水花將人車沖刷入海。

急速成長波浪 – 特定氣象條件下，短時間內快速成長變大的波浪，小船隻應變不及，易致危害。

湧浪 – 颶風引起提早抵達岸邊波浪，波面圓順、週期長、移動速度快、衝擊力大，是造成瘋狗浪原因之一。

海洋與海岸垃圾

海洋垃圾包含人造垃圾如塑膠袋、寶特瓶等，天然垃圾包含漂流木、水草等，它們的出現衝擊海洋與海岸環境，其來源、種類、在海洋上的運移軌跡、堆積地點，以及攔截方法為本研究室研究重點課題。

海洋觀測技術研發

現場資料是從事海岸保護、評估海洋能源開發、海事工程施工重要依據，本研究室發展海洋觀測技術，包含微波雷達與光學遙測海象觀測技術，藉以收集時間與空間資料，提供瘋狗浪、潮流發電、黑潮發電等研究分析。