

100-112-0211

出國報告（出國類別：出席國際會議）

# 出席 ISOPE-2011 國際海上工程研討會 出國報告

服務機關：交通部運輸研究所

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派赴國家：美國

出國期間：100年06月21日~100年06月26日

報告日期：100年08月30日

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網 址：[www.iot.gov.tw](http://www.iot.gov.tw) (中文版>圖書服務>本所出版品)

電 話：(02)23496789

出版年月：中華民國 100 年 9 月

印 刷 者：

版(刷)次冊數：初版一刷 10 冊

定 價：100 元

## 行政院及所屬各機關出國報告提要

頁數：52 含附件：無

報告名稱：出席 ISOPE-2011 國際海上工程研討會出國報告

主辦機關：交通部運輸研究所

出國計畫主辦機關/聯絡人/電話：

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出國類別：1.考察2.進修3.研究4.實習5.其他

出國期間：100 年 06 月 21 日至 06 月 26 日

出國地區：美國夏威夷州

報告日期：100 年 08 月 30 日

分類號/目：HO／綜合類（交通類）

關 鍵 詞：國際海上工程研討會(Proceedings of the International Offshore and Polar Engineering Conference)、海岸工程(Coastal Engineering)、海洋與極地纜線研究(Offshore and Artic Pipelines, Risers Mooring)、海洋與極地環境工程(Ocean and Artic Environment)

內容摘要：

本報告為參加國際海洋與極地協會 (ISOPE) 於夏威夷主辦之第21屆(2011) 國際海上工程研討會的彙整報告，報告內容主要包含研討會議程與論文發表，及論文研討與參觀等方面。

本研討會議題涵蓋近海工法與技術、海洋與海岸工程、大地環境與工程技術、近海和極地之纜線與平臺技術、自動監測與通信技術、海洋氣象等領域，包含歐美亞洲約有51國家、641篇論文參與發表。藉由參加研討與論文發表機會，可深入及充分瞭解目前國際海岸、海洋工程界之研究方向及現況，並提升與本身業務有關之工程技術和學術交流，除於會議期間參與論文研討外，本文亦就海嘯及海象觀測方面議題相關論文與參訪當地海岸之心得分享。

本文電子檔已上傳至公務出國報告資訊網



## 摘要

由國際海洋與極地協會(The International Society of Offshore and Polar Engineers，簡稱 ISOPE)主辦之國際海上工程研討會(Proceedings of the International Offshore and Polar Engineering Conference)由於研討議題廣泛實際、參加國家與會人數增多，近年來逐漸成為海洋、海岸工程學界的重要國際盛會之一。

本年度ISOPE在美國夏威夷舉辦第21屆研討會議，本次研討會議題主要包含流體力學和計算流體力學、海洋工程、海岸工程、水下載具、船舶技術、環境工程、極地工程、海洋氣象等之數值模擬、現場觀測調查、理論分析與技術研發之相關領域成果發表。同時舉辦特定9場專題研討會，包括海洋礦業、北極科學技術、北極材料、先進能源與技術、材料研討會、再生能源與環境、LNG船航行引致之液體晃動問題應變、納米塗料、高性能材料等有關會議，歐美亞洲約有51 國家、641 篇論文參與發表。除參與論文研討外，本報告亦就海嘯及海象觀測方面議題相關論文與參訪當地海岸之心得分享。

本報告內容計分四章，第一、二章分別為參加本次研討會之目的與過程；第三章則是研討會心得包含與業務有關之論文研討與參與感想概述；第四章提出本次參加研討會建議。



# 出席 ISOPE-2011 國際海上工程研討會出國報告

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# 第一章 目的

國際海上工程研討會(Proceedings of the International Offshore and Polar Engineering Conference) 是由國際海洋與極地協會(The International Society of Offshore and Polar Engineers, 簡稱ISOPE)所主辦的年度性研討會議, 主要探討海洋工程、海底油管、海域環境變遷、極地開發等所涉及工程問題, 並以提升工程技術與學術交流為其成立宗旨, 對外發行學術期刊, 為國際海洋工程界之知名協會, 多年來促進學術與工程技術交流, 提供先進科技對工程界貢獻良多。

此國際海洋與極地協會創始於1989年9月15日, 屬於非營利之國際科學和教育組織, 成立之初共開闢了美國、英國和挪威三個辦公室, 而其參加會員資格開放給對於在海洋工程及極地工程有興趣的人員, 目前主要是以海洋工程和極地工程相關領域之學者專家所組成。最初會員來自30幾個國家成員, 目前則已經有超過50個國家以上是經常性參與其會務和活動。其主辦國際研討會議的主要目的計有下列三項:

1. 促進近海與極地領域相關科學研究及技術的開發, 並促成國際合作和共同參與。
2. 即時的提供近海與極地領域相關科學新知和資訊的交換。
3. 透過協會可以提供從事近海與極地的相關工程, 在施工與維護技術上之支援。

自1991年至2011年, 歷屆國際海上工程研討會議之舉辦國籍及城市則如下表1-1所示。藉由會議期間論文之發表及與其他國家學者專家研討機會, 除可推廣本國研究成果外, 並可獲知與擷取別國於海洋領域研究發展現況, 以作為未來相關研究工作推展之借鏡與參考。職幸獲蒙林所長志明先生核准前往參加研討會, 特此深感致謝。

表1-1 歷屆國際海洋與極地工程研討會舉辦國籍及城市

年度	屆次	國家	城市
1991	1	United Kingdom	Edinburgh
1992	2	USA	San Francisco, California
1993	3	Singapore	Singapore
1994	4	Japan	Osaka
1995	5	Netherlands	Hague
1996	6	USA	Los Angeles, California
1997	7	USA	Honolulu, Hawaii
1998	8	Canada	Montréal
1999	9	France	Brest
2000	10	USA	Seattle, Washington
2001	11	Norway	Stavanger
2002	12	Japan	Kitakyushu
2003	13	USA	Honolulu, Hawaii
2004	14	France	Toulon
2005	15	Korea	Seoul
2006	16	USA	San Francisco, California
2007	17	Australia	Sydney
2008	18	Canada	Vancouver
2009	19	Japan	Osaka
2010	20	China	Beijing
2011	21	USA	Maui, Hawaii

## 第二章 過程

### 2.1 研討會議簡介

本年度ISOPE國際海上工程研討會於美國夏威夷舉辦。會議地點位於夏威夷第二大島茂宜島拉海納鎮君悅飯店(Hyatt Regency Maui Hotel)，由於臺灣並無直飛茂宜島班機，故須先至歐胡島檀香山國際機場(Honolulu International Airport)後，再轉搭乘夏威夷航空過去茂宜島西茂宜卡帕魯亞機場(Kapalua West Maui Airport)，本次會議舉行時間為6月19日至6月24日，研討會議程概要如表2所示。

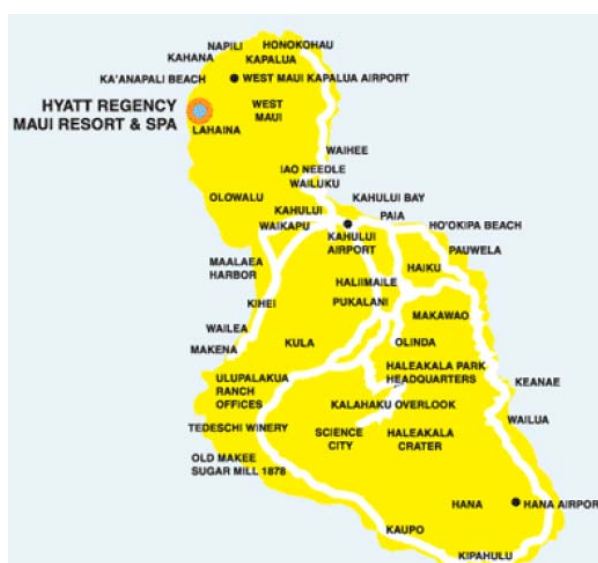


圖2.1 會議地點

表2.1 會議議程概述表

日期	議程概述表
6月19日	報到
6月20日	開幕、研討會
6月21日	研討會
6月22日	研討會、晚宴
6月23日	研討會
6月24日	結束



圖2.2 會議場地及與會同仁照片

## 2.2 會議主題概述

2011 年 ISOPE 國際研討會之論文，本年度包含歐美亞洲約有 51 國家、641 篇論文參與發表，論文涵蓋如：流體力學、計算流體力學、海洋工程、海岸工程、水下載具、船舶技術、環境工程、極地工程、海洋氣象等之數值模擬、現場觀測調查、理論分析與技術研發之相關領域成果發表。同時舉辦特定 9 場專題研討會，包括海洋礦業、北極科學技術、北極材料、先進能源與技術、材料研討會、再生能源與環境、LNG 船航行引致之液體晃動問題應變、納米塗料、高性能材料等有關會議舉辦時現場照片如圖 2.3 所示。

茲將本年度年會發表之議題涵蓋範圍與本所港研中心研究相關或未來發展有關研究論文議題簡述如下：

1. 可再生能源：風力發電結構、風能可靠性研究、海洋能源資源和風力發電場、海 浪能源與工程、潮汐和洋流能源。
2. 環境科學與工程：石油污染及水質、環境監測。

3. 晃動動力學與設計：LNG船晃動數值模擬、晃動負荷、物理強度評估。
4. 流體力學：海嘯、海洋氣象、浮體動力學、計算流體力學。
5. 海岸工程：海嘯和風暴潮、波浪和海流、海岸監測和模擬、海底沉積物和漂砂、海岸結構物、潮汐和河口。
6. 風險分析：安全管理、可信度分析。
7. 先進的船舶技術：新的設計和可行性研究，優化設計，衝擊和地震，極限強度，疲勞強度，耐波性，推進性和穴蝕。

本次大會有關詳細論文集以光碟方式提供給報名人員，相關論文摘要可至 <http://www.isope.org/publications/publications.htm> 網址內瀏覽。



圖2.3(1) 會議舉辦現場照片。



圖2.3(2) 會議晚宴舉辦現場照片。

## 2.3 論文發表

本次會中發表，與本所同仁蔡研究員立宏共同發表有關布拉格共振相關研究題目為『Bragg Reflection of Water Waves over Triple Composites of Rectangular Bars』(波浪通過三組複合式矩形潛堤之布拉格反射)，本篇論文主要以一系列研究方式，探討不同的複合式結構，包括間距、數量、入射波條件等，探討其布拉格反射的效應，並探討反射率與透射率相互關係以及與波浪條件和佈置條件之關係，會議進行照片如圖2.4-2.7。

研究結果顯示，延伸的Mile (1981)的理論，可以有效地並方便應用在實際工程中。潛堤間距和組合方式發揮的布拉格共振特性，特性如反射率分布的位置、帶寬和強度。系列潛堤組數增加會增加布拉格共振的帶寬和強度。在某些三組複合潛堤佈置條件下，當布拉格反射發生時會發生特殊的低反射現象。此布拉格共振的低反射乃由於兩組不同間距潛堤互制作用所產生。因此認為關鍵的參數可以選擇合適的控制布拉格共振分佈。我們通過選擇適當的間距三重複合潛堤可以達到可預期的效果，以保護沿岸的海浪衝擊。

本篇論文獲得與會學者專家的熱烈討論，對於複合式系列潛堤應用布拉格反射原理將波浪反射於外海，達到保護海岸之目的表現濃厚的興趣。



圖2.4 論文發表現場照片

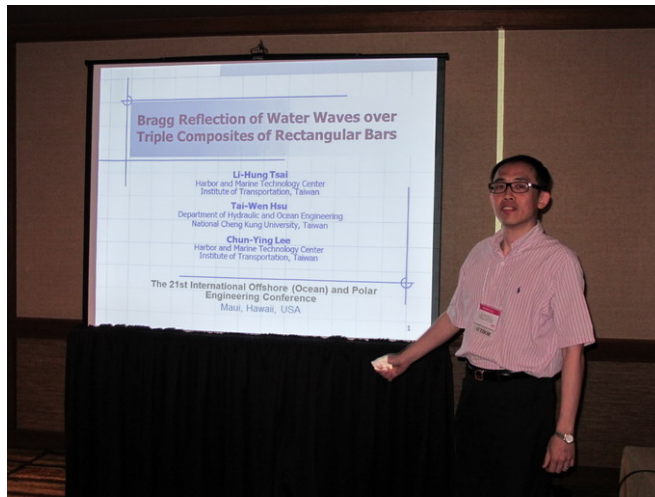


圖2.5 同仁論文發表照片



圖2.6 研討會中討論照片



圖2.7 本節研討會後合照照片

## 2.4 參觀當地港灣及夏威夷大學

在當地6月23日會議結束後，利用在6月24日時間於歐胡島上時間，上午選擇前往珍珠港參觀，下午參觀夏威夷大學，以了解當地港區文化及學校特色。

### 2.4.1 參觀當地港灣

參觀珍珠港的過程主要是參觀亞利桑納號紀念館，首先需排隊領取參觀券，再根據指定時間進入遊客中心，欣賞約20分鐘的紀錄片，影片內容透過當年黑白珍貴照片、音樂和旁白的合成，說明這段珍珠港遭當年日本襲擊慘痛歷史。影片介紹得十分莊嚴肅穆，讓人宛如置身於中並對於珍珠港事件感到悲傷。

隨後便搭乘渡輪前往亞利桑那紀念館(US Arizona Memorial) 如圖2.8所示，這座於1962年落成的白色長方形建築物，長184英尺橫跨在沉沒於海底的亞利桑那號軍艦上，形成象徵性的十字架形狀，從入口進到紀念館後方，有一面紀錄1千多名殉難者的紀念碑。而在紀念館上可以看見亞利桑那號的殘骸如圖2.9所示，目前而且仍可看見原來亞利桑那號滲出的燃油，這些滲出的燃油被稱為「亞利桑那之淚」。在當地參觀過程，周邊景觀維護處處皆可看得出美國政府及美國海軍對於港區歷史及文化重視。

搭乘渡輪期間可小覽港區景觀，該參觀動線區域屬於珍珠港內觀光區域，動線周邊如搭乘渡輪浮動碼頭附近或港區景觀如同圖2.10及圖2.11，都維護的相當好十分美麗，難怪可持續吸引許多國外人士前往，目前國內主要商港由於郵輪增加及國內重視，已部分開始投入港區景觀方面建設，珍珠港雖為軍港但在港區歷史文化及觀光推廣部分，應可作為國內港區景觀發展的借鏡參考。另外在搭乘渡輪同時亦看見港內停靠美國大氣海洋局NOAA海洋勘測船如圖2.12所示，後續查詢該艘船為前美國海軍海測船2002年轉入美國大氣海洋局，排水量為2300噸，船隻大小為68.3 x 13.1 x 4.6 公尺，可同時搭載18位科學家及15位船員。目前主要運作於太平洋中西部地區，主要工作為漁業評估調查，海洋物理和海洋化學，海洋哺乳動物和珊瑚礁的研究。





(上圖爲亞利桑那紀念館模型、下圖爲亞利桑那紀念館)

圖2.8 亞利桑那紀念館照片



圖2.9 亞利桑那號殘骸



圖2.10 搭乘渡輪浮動碼頭



圖2.11 港區景觀



圖2.12 港內停靠NOAA海測船照片

## 2.4.2 參觀夏威夷大學

美國夏威夷州立大學Manoa校區，創立於1907年，是夏威夷州立大學系統內最大的一個分校。學校提供超過100種以上多元化的研究所課程，包括工學、法律、農業以及醫學等專業領域科系。該校在海洋生物學、海洋學、水下機器人技術、天文學、地質學、地球物理學、農業、熱帶醫學、旅遊管理、藝術、水產養殖學、哲學、文化關係等專業領域科系上特別具有學術優勢。

參觀夏威夷大學的過程是與本所同仁及國內學者一同前往，可惜原先預期拜訪學者當日有事不在，於是有請他研究團隊李寧博士後研究帶我們參觀該系相關設備，其中有組作為教學使用簡易型斷面水槽如圖2.16所示，雖非優良實驗設備但用於說明及簡易實驗教學倒是相當不錯。參訪過程中，該校有關海洋科系均在系館有展示相關研究成果內容，以校海洋及資源工程系來說，目前該系教育和研究的重點是放在海岸工程，海洋工程，海洋工程資源。海岸工程涉及沿海和港口的問題，輸沙，近岸環境工程，洪水和沿海風暴潮災害，海嘯。海洋工程是涉及結構和較深層部位的海洋包括大陸棚。它還包括流體力學流體與結構物互制，耐波性和海洋平台，以及浮式結構。海洋工程方面的資源與工程系統開發能源，礦產和生物資源，海洋，利用海洋的廢物處理，以及環境和經濟方面的這些活動等。學術方向與國內相關科系目標差異不大，但該校海洋領域研究在國際上實屬於領先地位，除了學校本身地理位置及提供優良研究設備外，也長期有許多與相關單位如美國大氣海洋局(NOAA)，美國海軍(Office of Naval Research)，美國能源部(US Department of Energy via HNEL)合作案等，並且舉辦相當多海洋方面國際研討會，加上該校約20%學生來自國外，因感受此學校呈現出不同國內一般的國際化的大學。



圖2.13 與國內學者共同參觀夏威夷大學照片



圖2.14 與李寧博士合照照片



圖2.15 在海洋學院內隨處可見相關研究海報照片

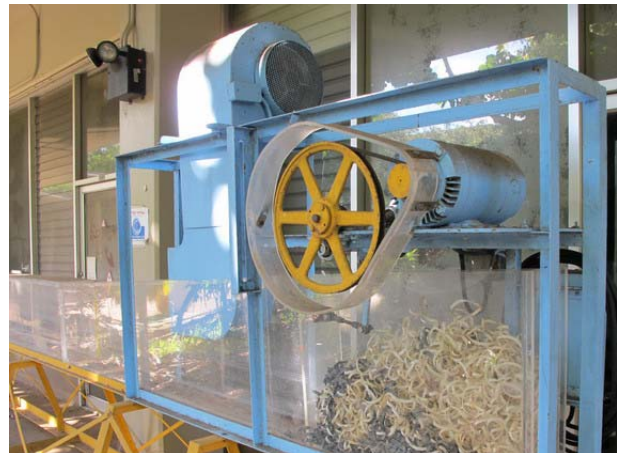


圖2.16 簡易型斷面水槽實驗設備照片

## 第三章 心得

有關本次會議內容包含海洋領域各式主題，由於會議場次眾多，僅就參與部分會議，與本所港研中心業務有關海嘯相關研究及日本目前有關海象觀測技術分享，並參訪期間對於當地海岸保護及海洋環境通識教育作一心得分享。

### 3.1 海嘯相關研究

#### 3.1.1 亞太地區海嘯災害檢討

這部分摘錄有關本次研討會中有關海嘯部分專題演講，日本港灣空港技術研究所海洋水工部高潮津波研究室長福田孝史在演講內容中，分析2006至2010有關亞太地區海嘯災害，主要分析2006年爪哇海嘯、2007年所羅門群島海嘯、2007年南蘇門答臘島海嘯、2009年薩摩亞群島海嘯、2010年智利海嘯等五次海嘯包括規模及當地居民的避難情形，並提供今年度3月11日本海嘯部分現調結果。

提出全球經歷2004年印度洋海嘯大規模悲慘災害(造成約23萬人死亡)，引起全世界對於海嘯災害廣泛注意，因為該次災害遠遠超出了一般區域性的災難規模，於是透過國際合作方式，發展區域性海嘯警報系統。

不過，即使海嘯預警系統近年來已相繼成立，仍有不幸的案件時發生，即使有海嘯警報卻無法有效地發揮其效果。例如，2006年爪哇島地震，地震規模為7.7，海嘯警報並沒有在海嘯抵達時間前告知給沿岸地區的居民，結果造成600人死傷。但在2007年所羅門群島，地震規模為8.1，海嘯造成約55人死亡，雖然最嚴重的區域吉佐島(Ghizo Island)附近的居民並沒有收到海嘯警報，而多數人仍成功疏散，並保住了性命。主要原因為該地感受到較大地震規模後許多社區團體立即跑到山上而且附近有較高的地方可以避難，包括高地板的房子逃離海嘯災害。



圖3.1 2007年所羅門群島海嘯吉佐島情形(圖左)、高地板的房子(圖右)

而在2007年南蘇門答臘島海嘯，地震規模為8.5；2009年薩摩亞群島海嘯，地震規模為8.1，此兩次海嘯前當地居民感受到強大地震，並立即採取了疏散行動，故死亡人數較少。這些資料提醒我們必要加強有關海嘯傳播和疏散演習的警覺性和知識。

而2010年智利海嘯地震，地震規模為8.8，地震發生後在震央附近迪卡托(Dichato)，當地遊客不知道如何撤離而且交通堵塞造成部分汽車及其乘客被洪水沖走。本次較特別留意的是，許多港區貨櫃會受海嘯影響而移動。在塔爾卡瓦諾港(Talcahuano harbor)，受到7米高的海嘯襲擊，約680個貨櫃被海嘯沖走了。有些貨櫃與住宅發生相撞如圖3.2左圖所示。有些甚至遠離海岸的貨櫃碼頭，如圖3.2右圖所示。原因為一個標準空貨櫃大概只要重達3至4噸，只要9.9至13.4公分就可以使之漂浮；即是在裝滿貨物約30.5噸，也只要當海嘯造成水深為1.05公尺以上時，貨櫃就會受其漂浮移動。

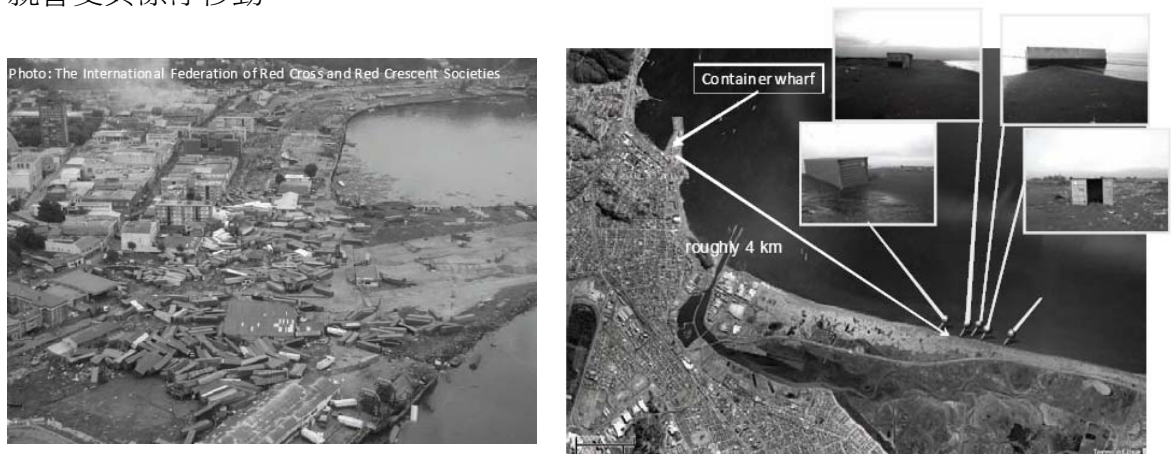


圖3.2 2010年智利海嘯地震塔爾卡瓦諾港(Talcahuano harbor)貨櫃漂移情形

總和結論為在近年的亞太地區海嘯災害，海嘯警報可減少遠域發生海嘯時對於居民的警告，而海嘯知識教育可以讓許多人在危急時自行逃生。若海岸區域設置避

難場所如附近有山坡住宅等，可使民眾迅速撤離降低傷亡。但在缺乏自然的高地上和丘陵時避護所應安排在海嘯淹沒區外，避護所之建築物必須要抵禦海嘯及海嘯造成殘骸碰撞的影響。由於海嘯災害的特性和地區與人類活動區域相關，應制定適合每個地方社區災難應變計劃，要實現這一點，設計海嘯避難地圖是相當實用的方式。而且後續海嘯災害應變作為必須更進一步同時考慮到海嘯後應急搶險救災以及社會和經濟恢復。

另外有關目前日本本年度3月11日發生海嘯，地震規模9.0在太平洋板塊與北美板塊下方（或鄂霍次克板塊）。據日本國家警察廳，於4月2日20時前，確認的死亡人數是1萬1938人及失蹤人數1萬5478人，完全損壞的房屋4萬5761棟和16萬4244人安置於避難所內，受損漁船數量約是1萬8,531艘。

相關後續研究調查有關所遭受海嘯侵襲時當地較為確實的數據可呈現，如圖3.3及圖3.4所示，由圖3.3可很明確得知海嘯傳播並非只是單一波浪，而且時間分布可能高達6小時以上，由圖3.4可知即使同一海嘯來源，受海岸地形折射，以及上岸溯升後地形地物影響，以及大量海水所造成海水溢淹情形，在海嘯發生後會呈現每個區域不同水位高度，故海嘯造成水位高度受區域條件影響相當的大。

即使如日本由於長年受海嘯侵襲，早已經採取許多措施減輕海嘯災害，包含已採取結構性措施，如堤防降低海嘯直接影響；與非結構措施，如廣播傳播系統的即時海嘯警告，規劃海嘯災害圖，指定的建築物緊急疏散，逃生路線規劃，實施疏散演習和民眾海嘯教育推廣，等等。雖然這次海嘯是遠大於原先預期規劃，並造成相當大人員傷亡、財物損耗甚至造成核能危機，但若非有以往規劃及局部措施，本次災害將導致更嚴重的傷亡，故反觀國內對於海嘯災害應該更積極面對該課題。

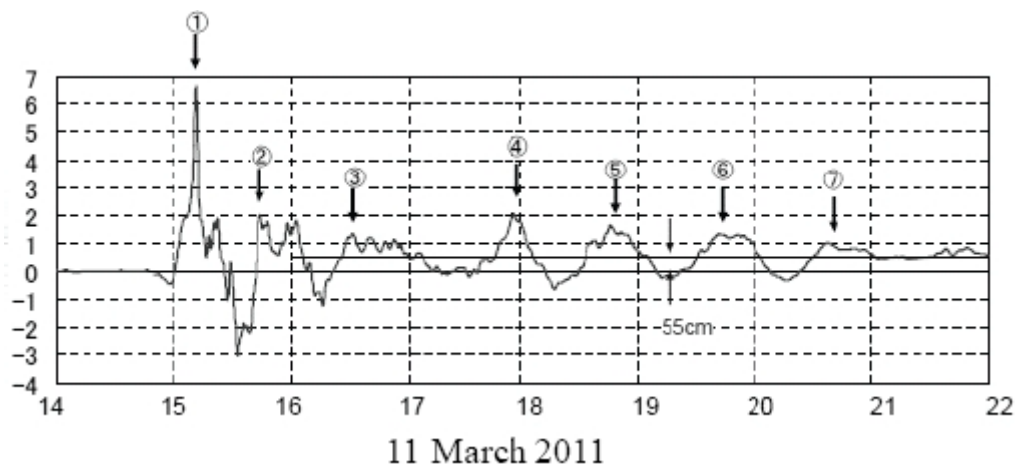
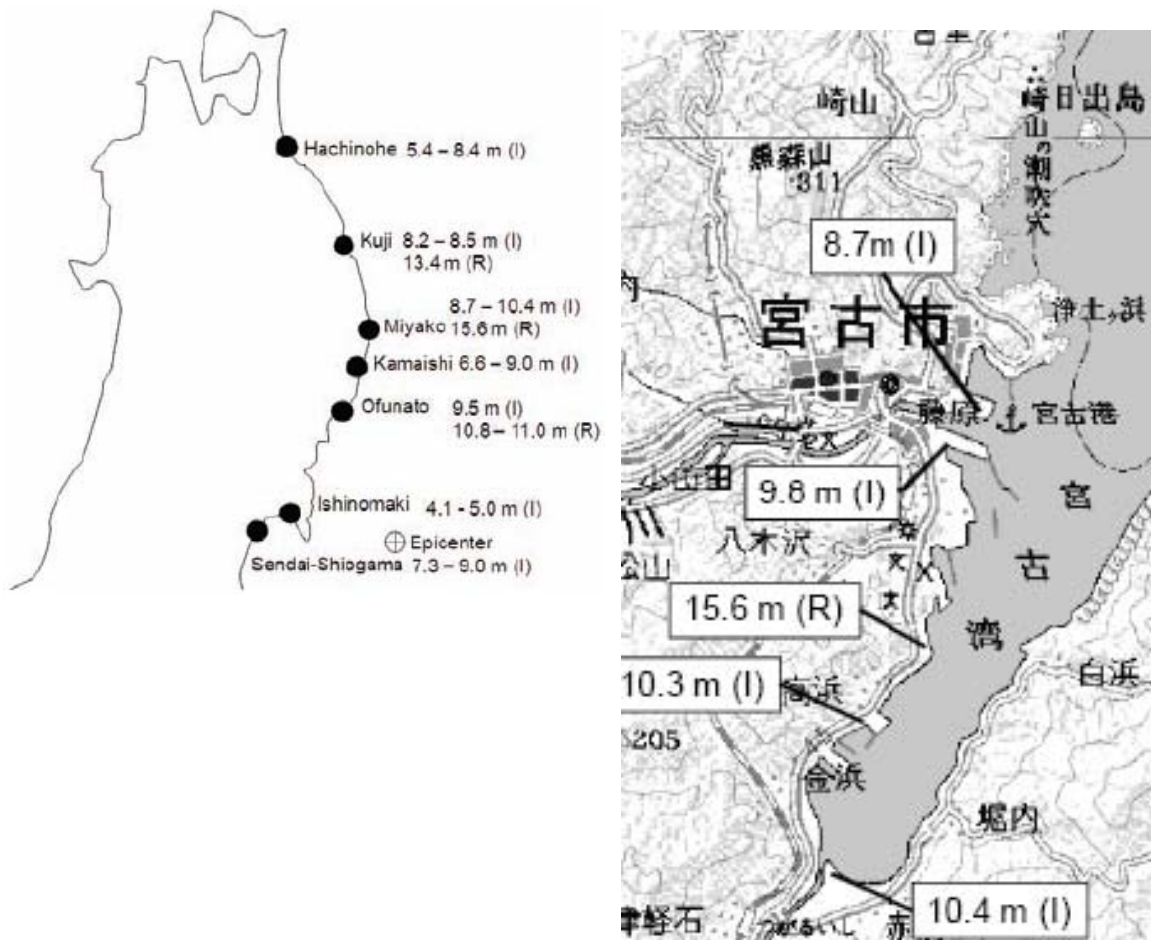


圖3.3 在岩手縣釜石港口(Kamaishi port)外海GPS浮標觀測結果



I 代表淹沒高程、R 代表溯升高程

圖3.4 日本主要港口及宮古灣內海嘯高度

### 3.1.2 海嘯避難路線地圖

這部分摘錄南韓國學者漢陽大學趙永植(Yong-Sik Cho)會議中所發表論文，其分析南韓東海岸Imwon港港口的海嘯避難路線圖，該港口位置如圖3.5所示，歷史上在1983年5月26日，日本東海地震規模7.2所引起的海嘯，造成Imwon港口的淹沒，在這項研究中實際調查當地海嘯溢淹情形，結合當地地形的特性並透過數值方式模擬海嘯數值模擬溢淹高程及範圍如圖3.6所示，並整合人員避難的數值模型與海嘯數值模擬評估逃生區域是否合適如圖3.7所示。最後匯整成一設計海嘯避難路線圖。所開發的避難路線圖可以由當地政府在實際於面對海嘯襲擊時，並作為海嘯教育宣導使用。



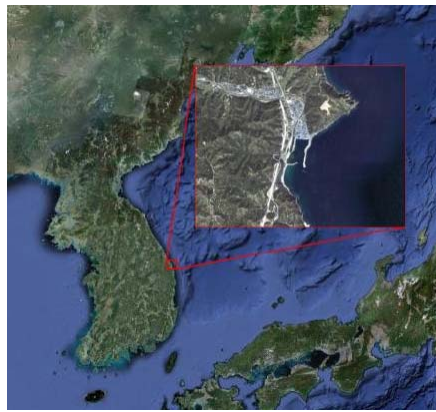


圖3.5 韓國東海岸Imwon港位置

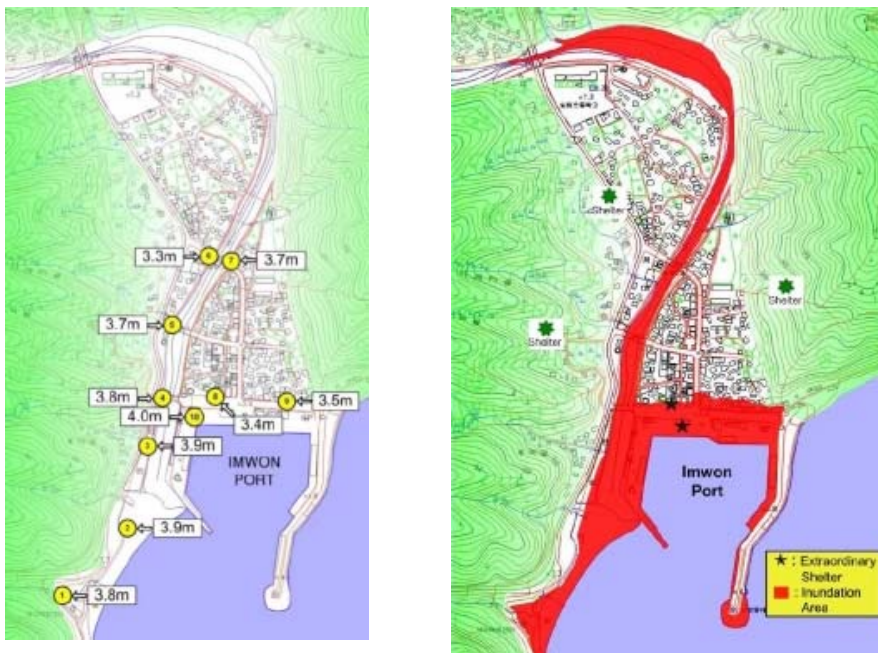
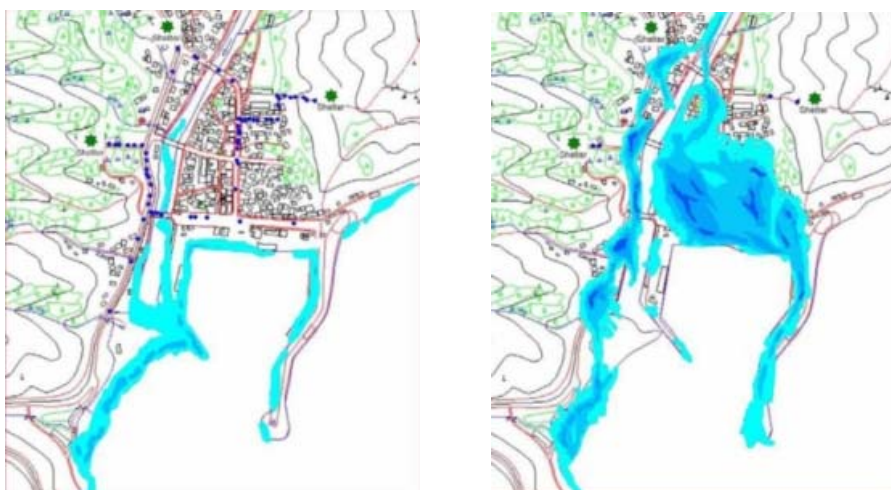


圖3.6 海嘯數值模擬溢淹高程範圍及預計避難所位置



(藍色小點為人員疏散情形)

圖3.7 海嘯動態模擬圖右為9分鐘圖左為18分鐘

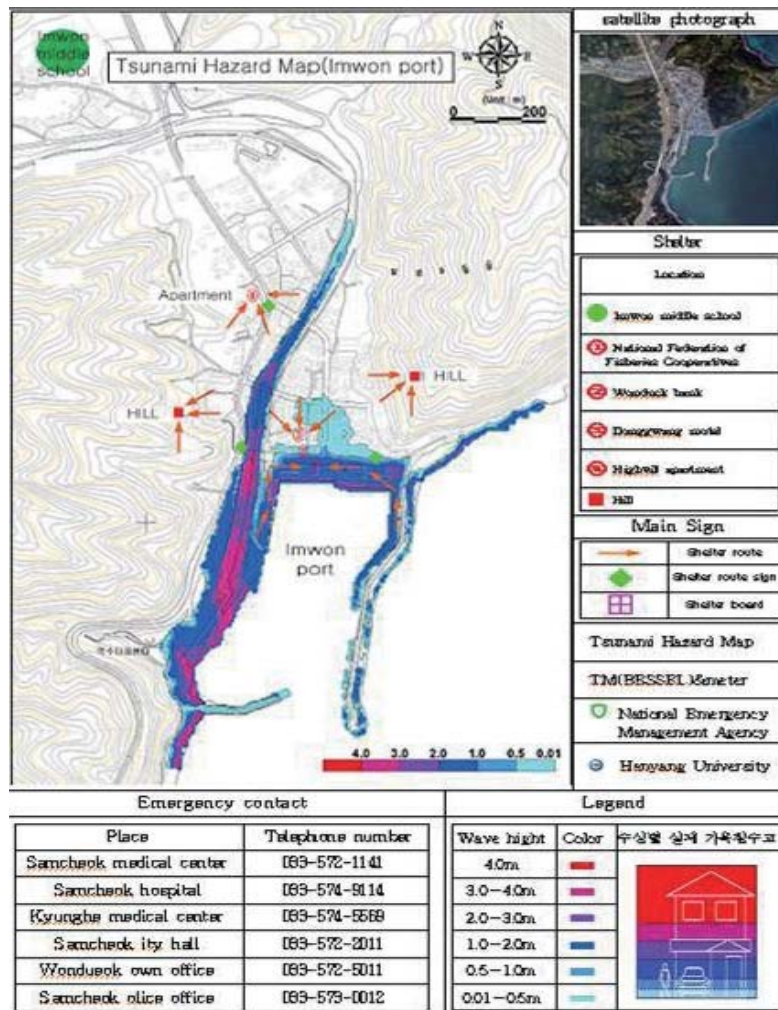


圖 3.8 海嘯避難路線地圖

有關海嘯避難路線圖雖是簡易的地圖，但背後必需整合現地勘查，避難所評估，並整合人員避難模型和海嘯洪水動態數值模型，最後才能完成海嘯避難路線地圖，國內目前農委會水土保持局有做土石流避難路線地圖並於土石流潛勢溪流區之地方政府及該地居民宣導，但尚無海嘯避難路線地圖，本所於海嘯數值發展已累積相關數值經驗，透過本所發展海嘯預警系統，已達到快速計算作業可獲的海嘯預計到達時間及港區外海水位高度，目前該部分計畫主要研究方向為發展相關作業化系統及風險評估，後續本所有關海嘯模擬發展將可嘗試朝此制式化方式製作避難路線圖，提供給各港務局使用。

### 3.2 GPS 綜合海洋監測系統

日本自1997年以來開發浮標技術。所發展的GCOMS綜合海洋監測系統(GPS Comprehensive Oceanographic Monitoring System)技術已經被應用到全國周圍5個地點的海岸GPS波儀表。所謂GCOMS由一個GPS浮標和地面基地。應用即時動態衛星定位(RTK-GPS)方法以維持厘米級的定位精度，作為定位系統為GPS觀測設備，可用於觀測潮汐變化、海嘯、並透過濾波技術獲得風浪資料，但地面基站與浮標必須部署大約20公里。將觀測1Hz的數據通過無線電系統傳輸回地面基地。

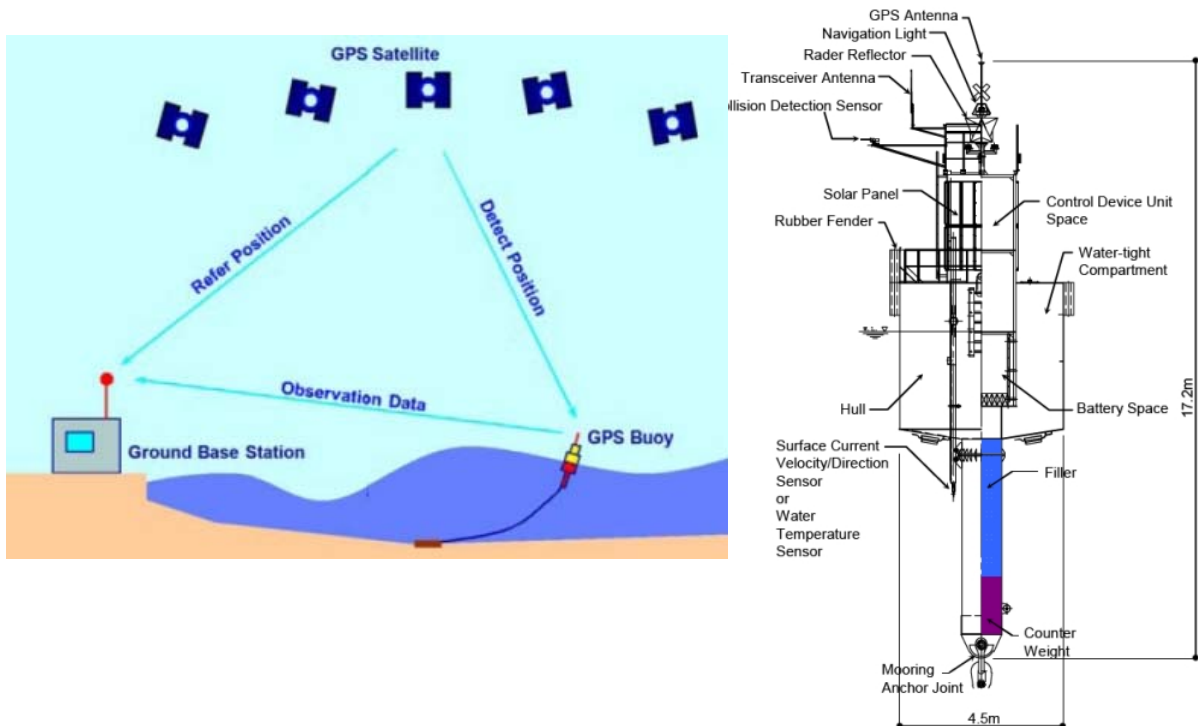


圖 3.9 GPS 綜合海洋監測系統

目前日本GPS綜合海洋監測系統已安裝約20公里近海，這裡的海水深度100米到400米。觀測海象數據資訊發布於日本的全國海浪港灣海洋情報觀測網 <http://www.mlit.go.jp/kowan/nowphas/NOWPHAS> 網站內，此外，日本氣象廳在智利地震對2010年2月27日達成日本各地後，統計共11個GPS浮標成功觀測海嘯傳播數據。

在此基礎上在GCOMS技術，延伸新類型的綜合海洋監測方法，主要為新增小型GPS浮標於沿海地區及利用PVD (Point precise Variance Detection) 技術觀測波浪。近岸區域設置小型GPS浮標，其特點是它的成本效益和簡單其圖如3.11所示。遠域區域採用PVD技術浮標，是因為超過20公里後RTK-GPS定位系統會發生問題，而利用技術解決浮標的定位問題，所謂PVD技術為一個單點定位方法不需要參考站，然而此方

法並不適用於長期波動如潮汐或海嘯，但可用於較遠的區域如人工魚礁附近，另外由於PVD浮標距離陸地太遠關係需透過衛星傳送，故須每20分鐘獲得分析資料後才傳輸，以節省資料傳輸費用。PVD浮標設計可以利用連接到現有的海上設施，如浮魚礁，將有利於遠域漁業作業，因為它能夠提供漁民接近實際的波浪資訊，使他們能夠評估的可行性捕魚工作，然後乘船出海作業。這樣可以即時的資訊，也可確保海上作業人員的安全，以及實現有效節省燃料。

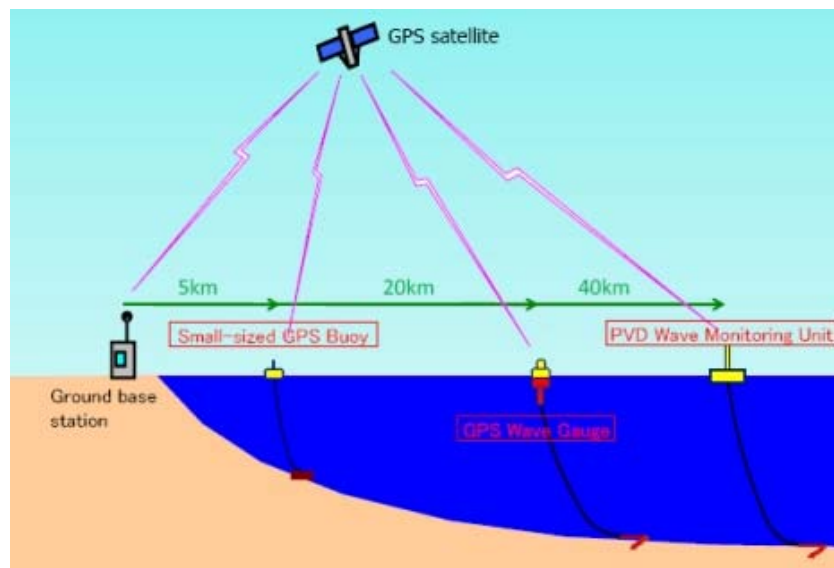


圖 3.10 新型態 GPS 綜合海洋監測系統

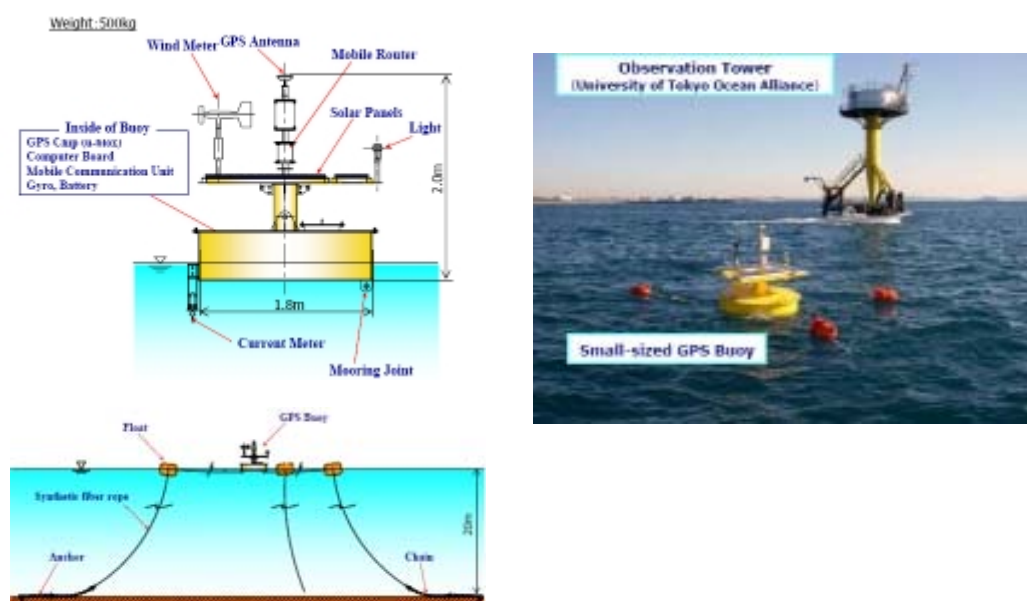


圖 3.11 近岸小型 GPS 浮標

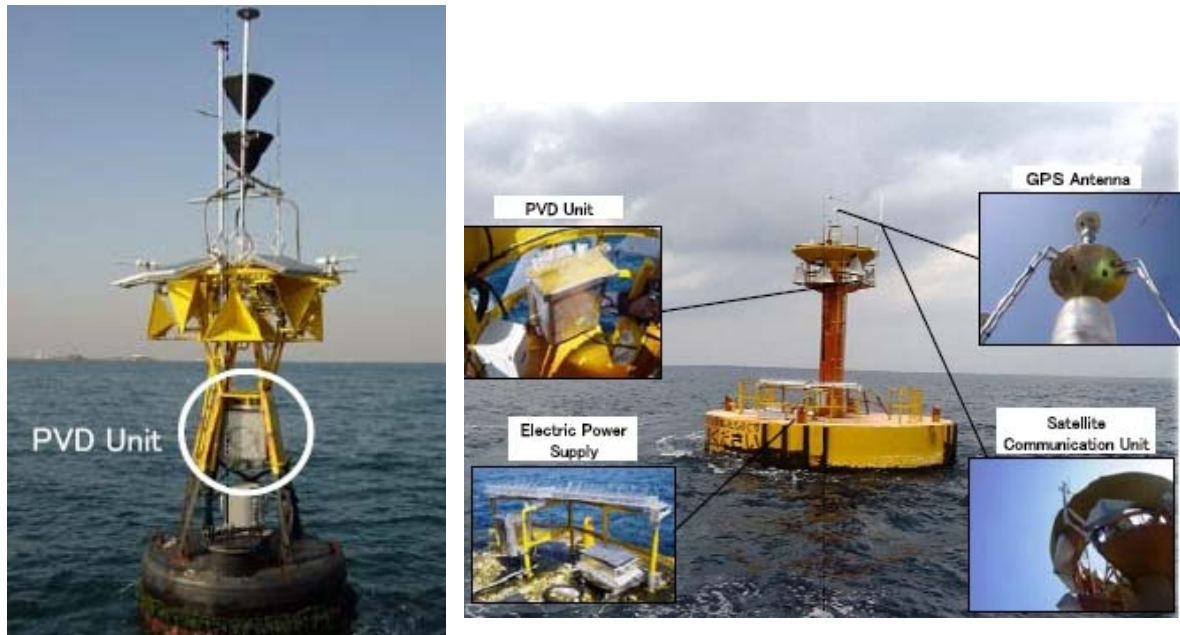


圖 3.12 利用 PVD 技術浮標

這套有關日本新型態的GPS綜合海洋監測系統（GCOMS），包含5公里、20公里及40公里規劃，依照其說明應可成功獲得波浪及海嘯資料，其中在20公里觀測可達1Hz長期觀測數據回國後於，所提供網頁<http://www.tsunamigps.com/> .抓取即時資訊如圖3.13所示包含波浪資料、水位資料及浮標位置都可直接獲得。這套系統包含近、中、遠距離的規劃方式，海象資料時間間距密度較高，以及資料呈現，對於本所港研中心海象觀測應該可做為長期規劃的參考，如果可行未來將可提供更充足的海象資訊確保船行安全使用。

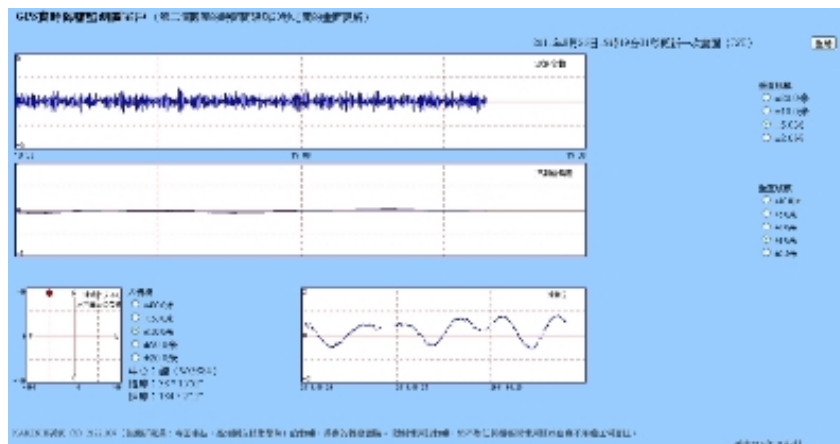


圖 3.13 網頁即時觀測資料 <http://www.tsunamigps.com/>

### 3.3 當地海岸及海洋環境通識教育

#### 3.3.1 當地海岸

由於夏威夷為火山群島位於太平洋中間，雖有颶風侵襲，但長期亦受遠域傳來湧浪保護沙灘，而在夏威夷海灘就是其重要的觀光資源之一，所以藉由此次參訪期間於海岸觀察，在沙灘上常見有關海岸結構物，可見當地政府對於海岸沙灘的保護比我之前想像中更加積極，如圖3.14所示為人工突堤照片，此照片地點為歐胡島有名觀光景點Wakiki海岸，有相當多人於該處衝浪，一旁有小型救生站如圖3.15所示。回國後為了解區域附近全貌，於網路擷取google空拍圖如圖3.16，可見得Wakiki海岸施作相當多人工結構物保護，足以說明夏威夷聞名全球美麗的海灘其實也需要透過適當的海岸工程設施的方式來才能永續保護沙灘作為當地觀光產業基石。



圖 3.14 歐胡島 Wakiki 海岸沙灘上人工突堤照片



圖 3.15 歐胡島 Wakiki 海岸沙灘上救生站

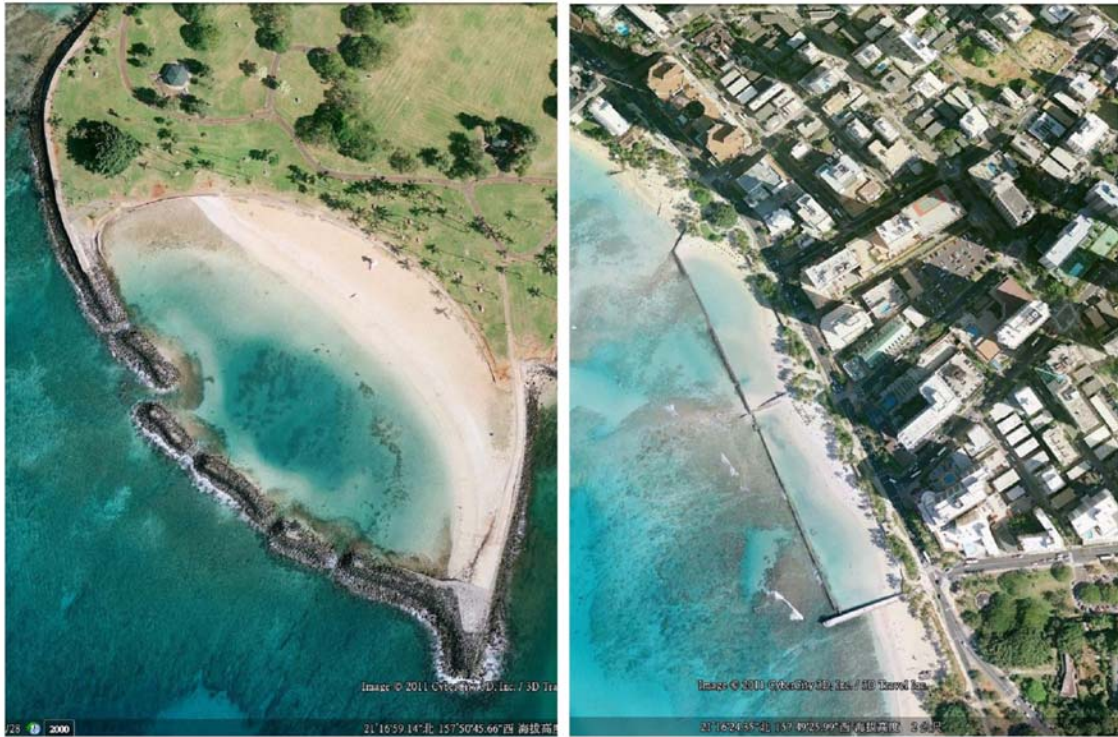
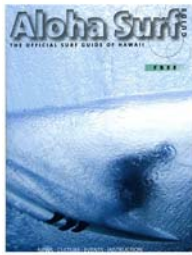


圖 3.16 夏威夷海岸衛星圖 (摘錄自 google map)

### 3.3.2 當地海洋環境通識教育

在參訪期間令我印象深刻是夏威夷對於海洋通識教育可說是深入各式資料中，如圖3.16所示，是在飯店內免費取得小本雜誌，雜誌內容主要是介紹夏威夷的衝浪訊息，但就可以看見夏季潮汐表、海灘邊的流況警告、甚至於說明有關波浪的成因及波浪基本說明。另外在每日報紙如圖3.17所示內，除了與國內一樣有氣象資訊外，另可見有大篇幅的海象資訊提供，包含島上分區預測波高，三日內詳細的潮位資料，所以在夏威夷上海象資訊已不再是針對船隻，而是已經是成為十分普遍化資訊提供出來使用，成為協助觀光產業發展及保護民眾安全的利器。雖然本所業務並非如中央氣象局需針對於一般民眾，但如何讓本所港灣資訊明確清楚提供給各港務局及相關單位，以及推廣有關海洋知識普及應是我們長期目標。



NOAA Tide Predictions - Honolulu, HI, 2011  
Times and Heights of High and Low Waters  
Standard Time Only

Month	Day	Time	Height	Month	Day	Time	Height
April	1	06:58	1.2	May	1	06:58	1.2
	2	07:00	1.2		2	07:00	1.2
	3	07:02	1.2		3	07:02	1.2
	4	07:04	1.2		4	07:04	1.2
	5	07:06	1.2		5	07:06	1.2
	6	07:08	1.2		6	07:08	1.2
	7	07:10	1.2		7	07:10	1.2
	8	07:12	1.2		8	07:12	1.2
	9	07:14	1.2		9	07:14	1.2
	10	07:16	1.2		10	07:16	1.2
	11	07:18	1.2		11	07:18	1.2
	12	07:20	1.2		12	07:20	1.2
	13	07:22	1.2		13	07:22	1.2
	14	07:24	1.2		14	07:24	1.2
	15	07:26	1.2		15	07:26	1.2
	16	07:28	1.2		16	07:28	1.2
	17	07:30	1.2		17	07:30	1.2
	18	07:32	1.2		18	07:32	1.2
	19	07:34	1.2		19	07:34	1.2
	20	07:36	1.2		20	07:36	1.2
	21	07:38	1.2		21	07:38	1.2
	22	07:40	1.2		22	07:40	1.2
	23	07:42	1.2		23	07:42	1.2
	24	07:44	1.2		24	07:44	1.2
	25	07:46	1.2		25	07:46	1.2
	26	07:48	1.2		26	07:48	1.2
	27	07:50	1.2		27	07:50	1.2
	28	07:52	1.2		28	07:52	1.2
	29	07:54	1.2		29	07:54	1.2
	30	07:56	1.2		30	07:56	1.2
	31	07:58	1.2		31	07:58	1.2

### North Shore Surf Safety For ALL surfers and beachgoers!

**Beware these DANGEROUS RIP CURRENTS:**

▶ The waves in a big swell come in "sets" of four to six waves followed by a "lull" - a deceptively calm, flat period that can last up to 20 minutes. People will often walk out onto the rocks, or stand at the water's edge during a lull and then have to run for their lives when the set rolls in. Keep your family safe - stay on dry sand.

**BIG SURF SAFETY TIPS**

- Swim only at lifeguarded beaches.
- Check with lifeguard for conditions.
- Read and obey the posted signs.
- Watch your children carefully. Hold on to young ones and stay off wet sand areas.
- DO NOT turn your back to the ocean.
- DO NOT try to swim at the water's edge during big surf!
- DO NOT surf or body-surf unless you're an expert.
- DO NOT rely on your surf-board or leech as a substitute for your swimming ability.
- DO NOT DRINK ALCOHOL and swim!
- DO NOT LEAVE VALUABLES IN PARKED CARS!

www.waterlifeguards.com

### What Causes Waves?

Waves around Hawaii shorelines are caused by storms thousands of miles away - at least the waves that surfers want. Local storm-driven surf is usually too windy and choppy. Far away storms such as hurricanes, cyclones and polar lows create winds that result in waves that travel very long distances. Three factors of the wind hitting the ocean water during these storms affect the swell - fetch, velocity and duration. When winds (velocity) blow for a period of time (duration), over an area (fetch), a ripple effect is started. This ripple effect is similar to throwing a rock into water. The ripple is a transfer of energy that when unobstructed can travel thousands of miles. When the water's energy hits shallow rock or coral, a sandbar or a river mouth, the energy is transformed into a breaking wave.

When the ocean energy encounters a shallow land mass and local conditions, the wave shows its true form. Local conditions include winds, tide, currents, storms, ocean floor topography and shoreline configuration. Local high winds will ruin most good swells. And local storms usually result in a lot of land run-off diluting the water.

### Wave Sizes

Wave heights are generally measured two ways, face scale and Hawaiian scale. In scientific terms and most used by the surfing community around the world, the wave height is measured vertically from the trough to the crest and is known by surfers as face scale. In Hawaii, local surfers use the back of the wave to measure wave height and is called Hawaiian scale or local scale. The history of Hawaiian scale and the conversion itself are widely discussed and debated. The conversion from face to Hawaiian is roughly 1/2 to 2/3 the size measured from trough to crest. There are many factors that distort this conversion and social distortion and perception are probably the biggest. For example, some surfers tend to brag up the size of the wave like exaggerating fishermen. Some hardcore surfers purposefully understate size. The reason for this is uncertain as some say it's a reverse odd factor of making big wave surfing seem easy. Many people have no idea what size the waves are and they just throw a number out there. Other factors that affect the conversion of face and local wave sizes at the size of the swell, which surf break, the measurement and local winds, currents and tides. A simple solution used by many surfers to communicate wave height is to relate the wave size to the human body. Flat, knee high, waist high, shoulder high head high, overhead, double overhead, triple overhead are used rather than numeric sizes. But you still can't please everyone because some will argue it depends on the height of the surfer.

圖 3.17 夏威夷海岸衝浪指南摘錄(摘錄自 Aloha Surf guide summer 2011)

**THE PACIFIC**  
Map showing the Pacific Ocean region with Hawaii highlighted.

**NEIGHBOR ISLAND FORECAST**  
Forecast for Maui, Lanai, Molokai, and Kahoolawe.

**OHAI 3-DAY FORECAST**  
Today: Sunny showers, 80-71. Partly sunny showers, Wind ENE at 10-20 mph. Partly cloudy tonight.

**THE ALMANAC**  
Sunrise: 6:58 AM, Sunset: 6:02 PM, Moon: Waxing Crescent.

**ACCUWEATHER.COM UV INDEX™**  
9.20+  
MODERATE, HIGH, VERY HIGH, EXTREME  
Today's forecast: The higher the UV index number, the greater the need for eye and skin protection. Shown is the highest value of the day.

**TIDES ACROSS THE STATE**  
Today, Friday, Saturday  
Honolulu, Haleiwa, Kaneohe, Nawiliwili, Hanalei, Kahului, Lahaina

**GUY HAGI'S SURF REPORT**  
Southernly energy continues with breezy tradewinds.  
NORTH: 0-1 feet. Time to fix dings or go fishing.  
WEST: 3-5 feet. Head-high sets with offshore winds.  
SOUTH: 4-6 feet. Slightly overhead sets with side/off-shore winds.  
EAST: 2-3 feet. Semi-bumpy with chest-high sets.

圖 3.18 夏威夷當地報紙



## 第四章 建議

有關第21屆國際海洋與極地研討會為職第一次參加國際研討會，本次研討會與近幾年有關資訊情形相同，各國學者專家均相當踴躍參加而且不遠千里而來，並就有興趣之議題與論文內容交換意見。與國內相關海洋研討會比較，國際性的研討會涵蓋面即具有多樣性，有關研究議題更為相關領域較領先課題，經由本次參與研討，就大致可瞭解國外近來與本身職務有關研究方向與發展。因此，參加本次國際性之研討會對職個人業務、視野或資訊取得有極正面之幫助與提升。綜合以上心得說明，茲建議以下數點

1. 為瞭解國外近來之研究方向與發展，以及幫助與提升對業務、視野或資訊之取得，因多鼓勵同仁參加相關性質之國際性研討會。
2. 未來有關海嘯災害之防治與減災策略之研擬，可設計制式海嘯避難路線地圖。
3. 可參酌日本GPS綜合海洋監測系統包含近、中、遠距離的規劃方式，作為對於本所港研中心海象觀測長期規劃的參考。



## 附錄 研討會主題、論文題目及作者

### 1. 研討會主題

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##### (一) DEEPWATER HIGH ARCTIC DEVELOPMENT

##### (二) JACKUP RIGS IN CHINA

##### (三) FRONTIER ENERGY RESOURCES TECHNOLOGY

1、 Clean Energy

2、 Clean Coal

##### (四) DEEPWATER INSTALLATION, OFFSHORE MECHANICS AND HYDRODYNAMICS

1、 Deepwater Systems & Installation

2、 Floating Structures

3、 FPSO

4、 SPAR and TLP

5、 Jacket and Jackup

##### (五) RENEWABLE ENERGY

1、 Wind Loads and Structures

2、 Floating Structures for Wind Energy

3、 Wind Energy and Reliability

4、 Offshore Energy Resources and Wind Farm

5、 Ocean Wave Energy and Engineering

6、 Tidal and Ocean Current Energy

##### (六) ENVIRONMENT SCIENCE AND ENGINEERING

1、 Triple I Program

2、 Oil Pollution and Water Quality

3、 Environment Monitoring

4、 Environment Modeling and Restoration

5、 Sediment and Debris

##### (七) ARCTIC SCIENCE AND TECHNOLOGY

1、 Ice Observation and Modeling

2、 Ice and Ocean Environments

3、 Ice-Structure Interactions and Performance

4、 Navigation and Ice Management

5、 Exploration and New Instrumentation

6、 Ship Design and Navigation

## 二、 VOLUME II

### (一) OFFSHORE AND ARCTIC PIPELINES, RISERS AND MOORING

- 1、 Steel Catenary Risers (SCR)
- 2、 Riser Analysis and Design
- 3、 Riser Integrity
- 4、 Pipe-Soil Interactions
- 5、 Flows in Pipeline
- 6、 Pipeline Integrity
- 7、 Pipeline Design
- 8、 Mooring Dynamics

### (二) AQUAMECHANICS, ROV, AUV AND COMMUNICATION

- 1、 Aquabiomechanics
- 2、 AUV and Robotics
- 3、 Communication and Navigation

### (三) GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING

- 1、 Subsea and Installation
- 2、 Mechanics of Soils
- 3、 Soil Properties and Test
- 4、 Soil Dynamics and Liquefaction
- 5、 Foundations and Anchors
- 6、 Piles and Anchors
- 7、 Soil Improvement
- 8、 Modeling and Simulation
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- 2、 Sloshing Loads
- 3、 Sloskel, Physics
- 4、 Strength Assessment

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- 1、 Tsunami
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- 3、 Springing/Whipping

- 4 、 Roll and Stability
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- 6 、 Floating Body Dynamics CFD
- 7 、 CFD and NWT Waves
- 8 、 CFD Impact
- 9 、 CFD Cylinders & Flows

**(四) COASTAL ENGINEERING**

- 1 、 Tsunami and Storm Surge
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- 4 、 Composites
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- 6 、 Non-destructive Testing
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**(二) ARCTIC MATERIALS**

**(三) FRICTION STIR WELDING**

- 1 、 Process Application
- 2 、 Microstructure and Properties: Ferrous
- 3 、 FSW of Stainless & Dissimilar Metals
- 4 、 FSW Stainless and Non-Ferrous Alloys

**(四) STRAIN-BASED DESIGN**

- 1 、 Materials for SBD
- 2 、 Modeling in SBD
- 3 、 Full Scale Testing in SBD
- 4 、 Fracture Mechanics in SBD

**(五) NANOMATERIALS**

**(六) RISK, SAFETY & RELIABILITY**

- 1 、 Safety Management

- 2、 Reliability Methods
- 3、 Impact and Damage
- 4、 Water Impact and Ship Impacts

(七) **ADVANCED SHIP TECHNOLOGY**

- 1、 New Design and Feasibility
- 2、 Optimum Design, Impact and Earthquake
- 3、 Ultimate Strength and Buckling
- 4、 Fatigue Strength, Seakeeping
- 5、 Propulsion and Cavitation

## 2. 論文題目及作者

本部分僅彙整摘錄本次研討會，有關第三部分論文頁碼、題目及作者，其餘部分請參考 <http://www.isopec.org/publications/publications.htm> 網址。

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