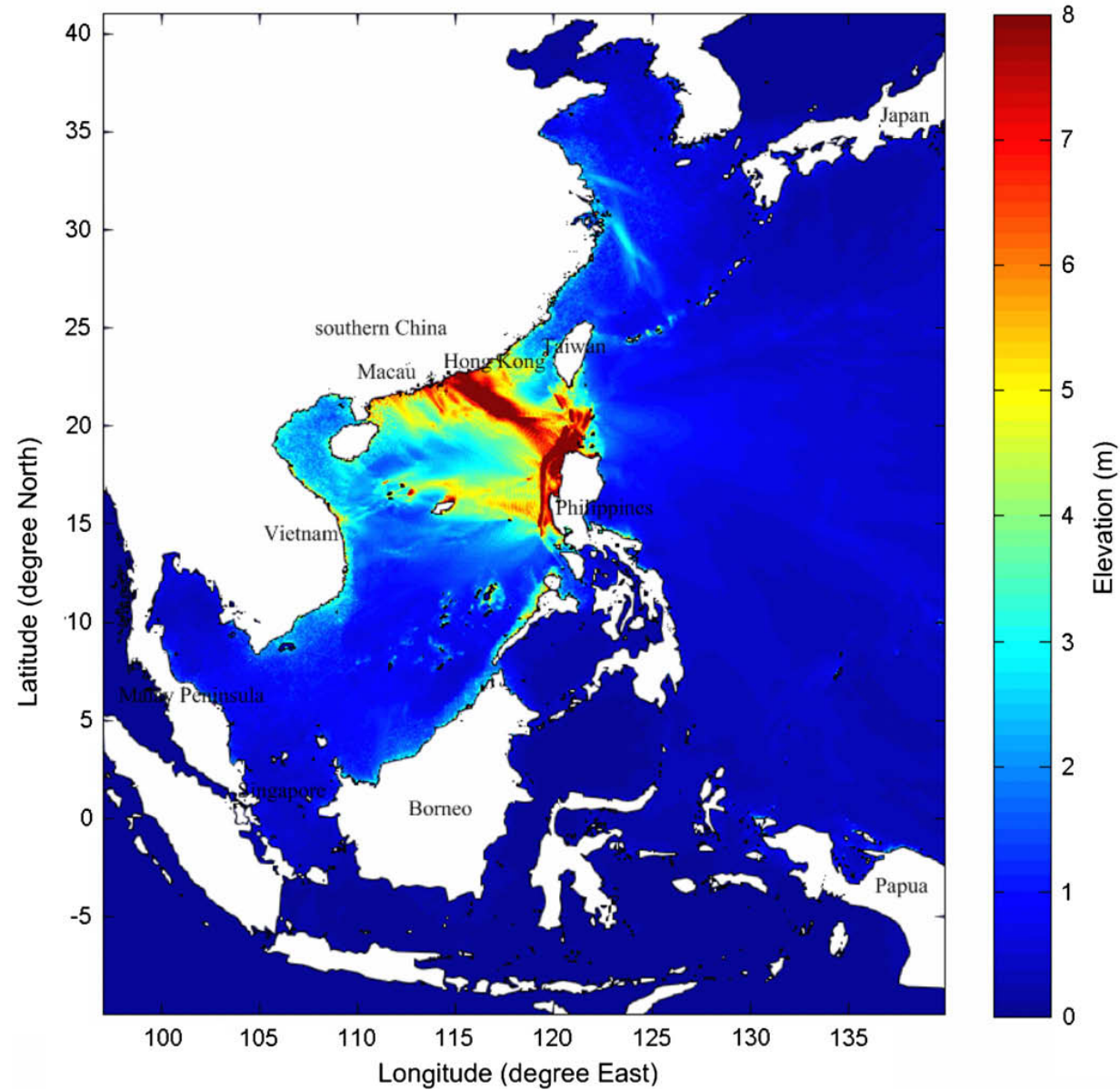


馬尼拉海溝海嘯情境分析：最大波高分布圖

最大波高圖代表海嘯能量傳遞分布



News Report:

South China Morning Post 创立于1903年 繁體中 新浪微博 微信 騰訊微博 Facebook

香港南華早報 星期四 2014年08月 14日 國際

金光大道 度假區

大陸 港澳台 國際 財經 觀點 圖解 南早香港指南

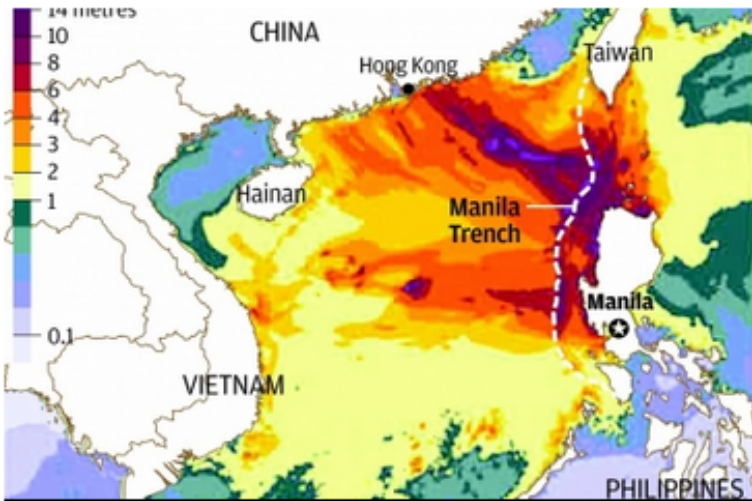
首頁 » 國際 » 馬尼拉海溝地震風險加劇 南海爭端阻預測工作 熱門話題: 中國反腐 “福喜肉”事件

● 國際

馬尼拉海溝地震風險加劇 南海爭端阻預測工作

一旦海嘯發生，包括香港在內的沿海地區可能會有數萬人喪生，導致損失慘重。

陳冰琳 分享到: [f](#) [t](#) [g+](#) [e](#) [+](#) 列印 電郵 2014年08月06日 下午1:05



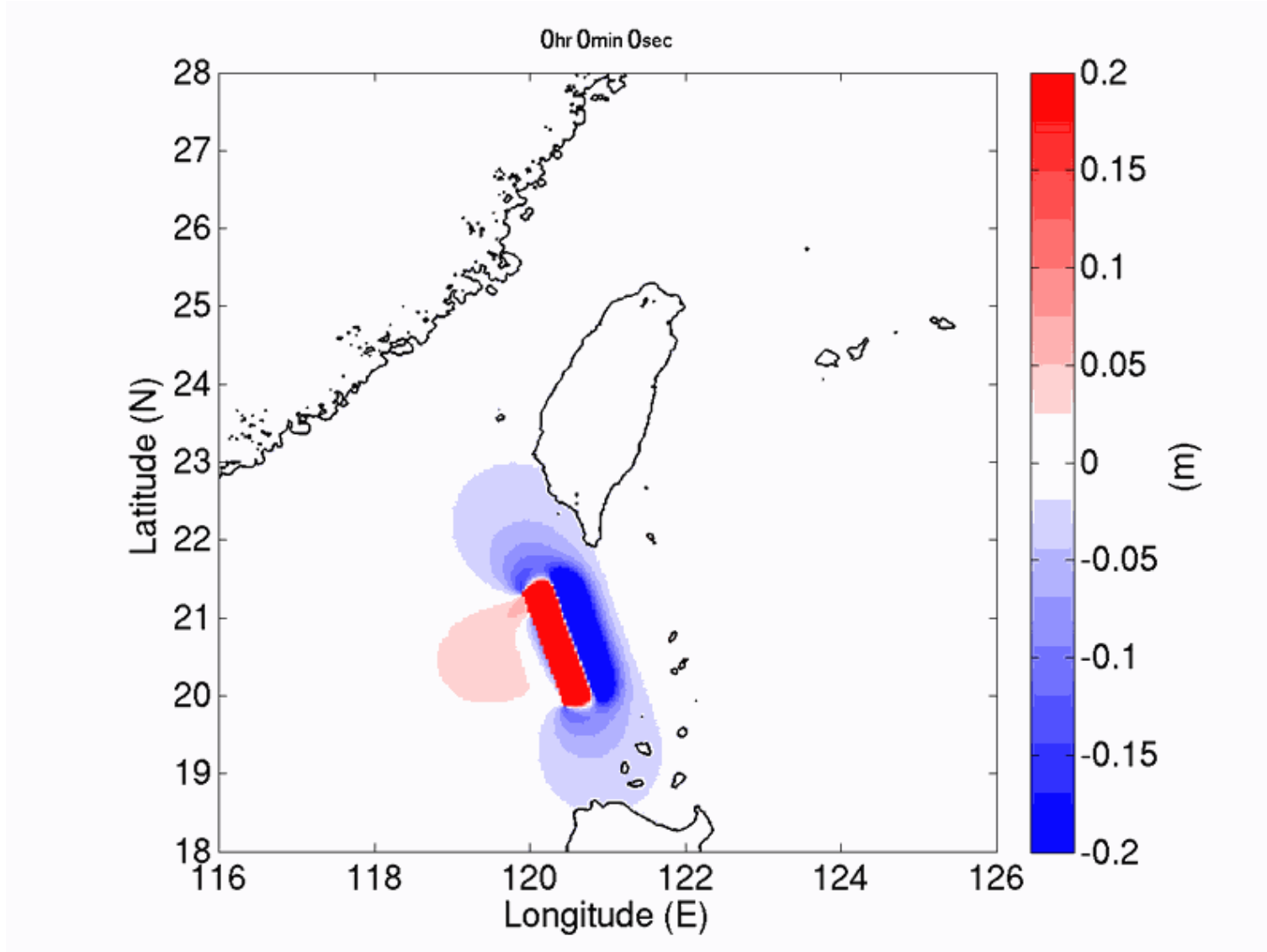
中國大陸、台灣和菲律賓的科學家都認為，南海周邊國家低估了南海海域發生大海嘯的風險。

一旦海嘯發生，包括香港在內的沿海地區可能會有數萬人喪生，導致損失慘重。

中國科學院海洋研究所一位科學家稱，他們亟需最新數據來評估海嘯可能爆發的規模和時間，但由於南海主權糾紛，他們無法前赴該區域獲取數據。

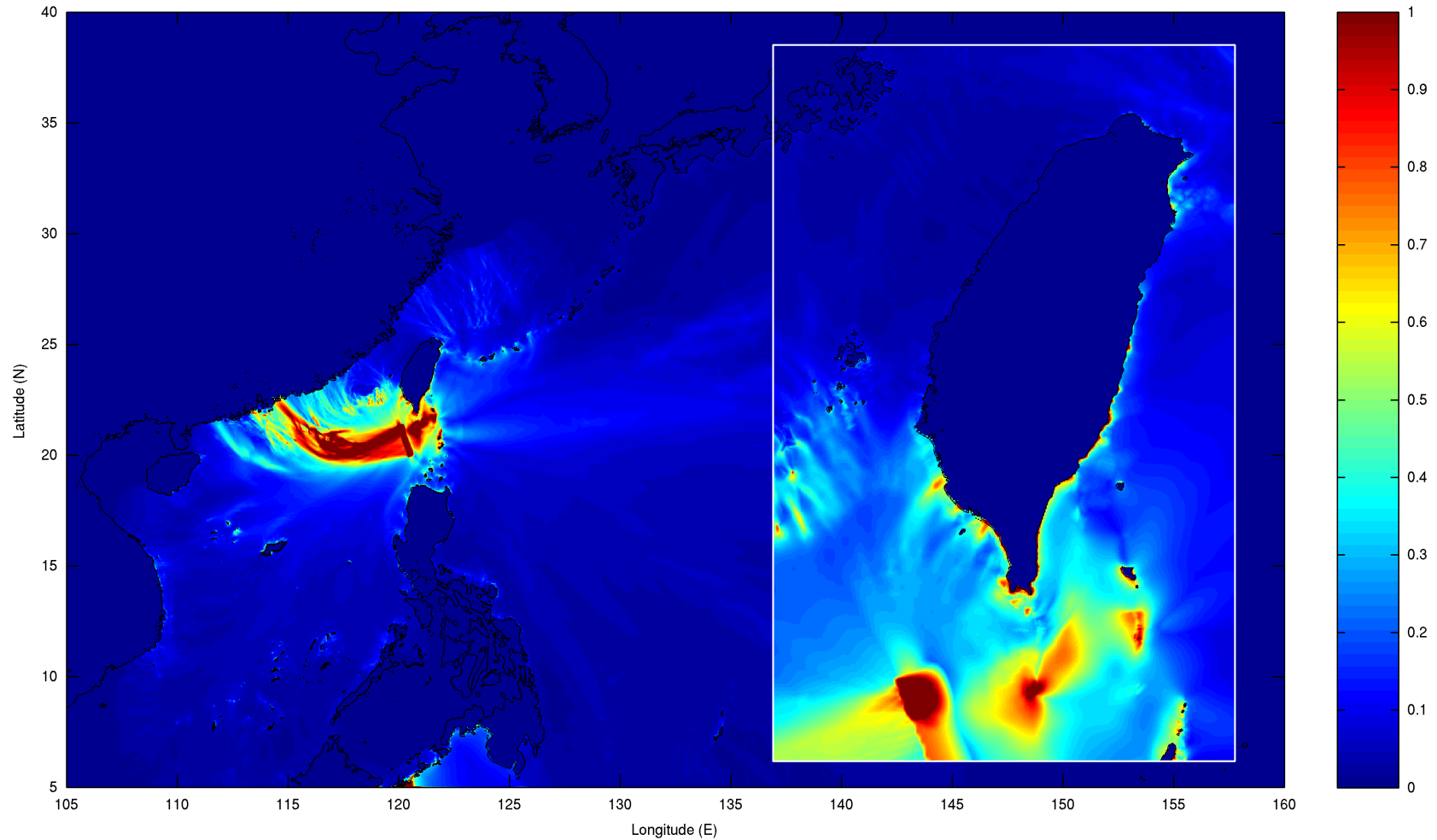
來源：亞洲地球科學期刊

T2 (Manila Trench 1) (Animation)



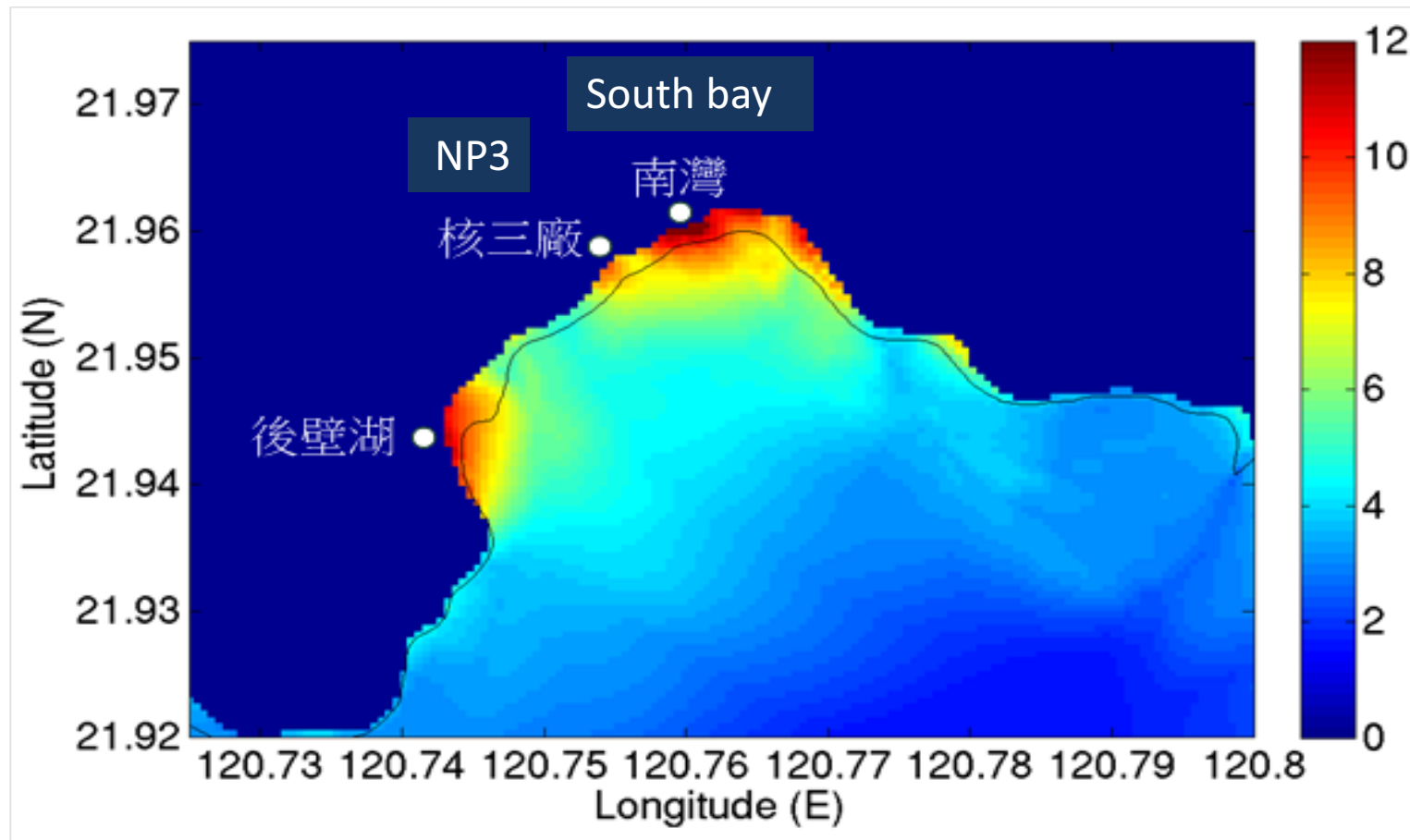
馬尼拉海溝北段，T02(Mw=8.2)海嘯情境之最大波高 分布圖

T02, the Maximum Free-surface Elevation



馬尼拉海溝北段，T02(Mw=8.2)海嘯情境分析結果。
南灣附近之最大波高與溢淹分布圖

T02, Nearshore Inundation and Maximum Runup Height



Runup height: NP3: 10~12m; South Bay: 18m

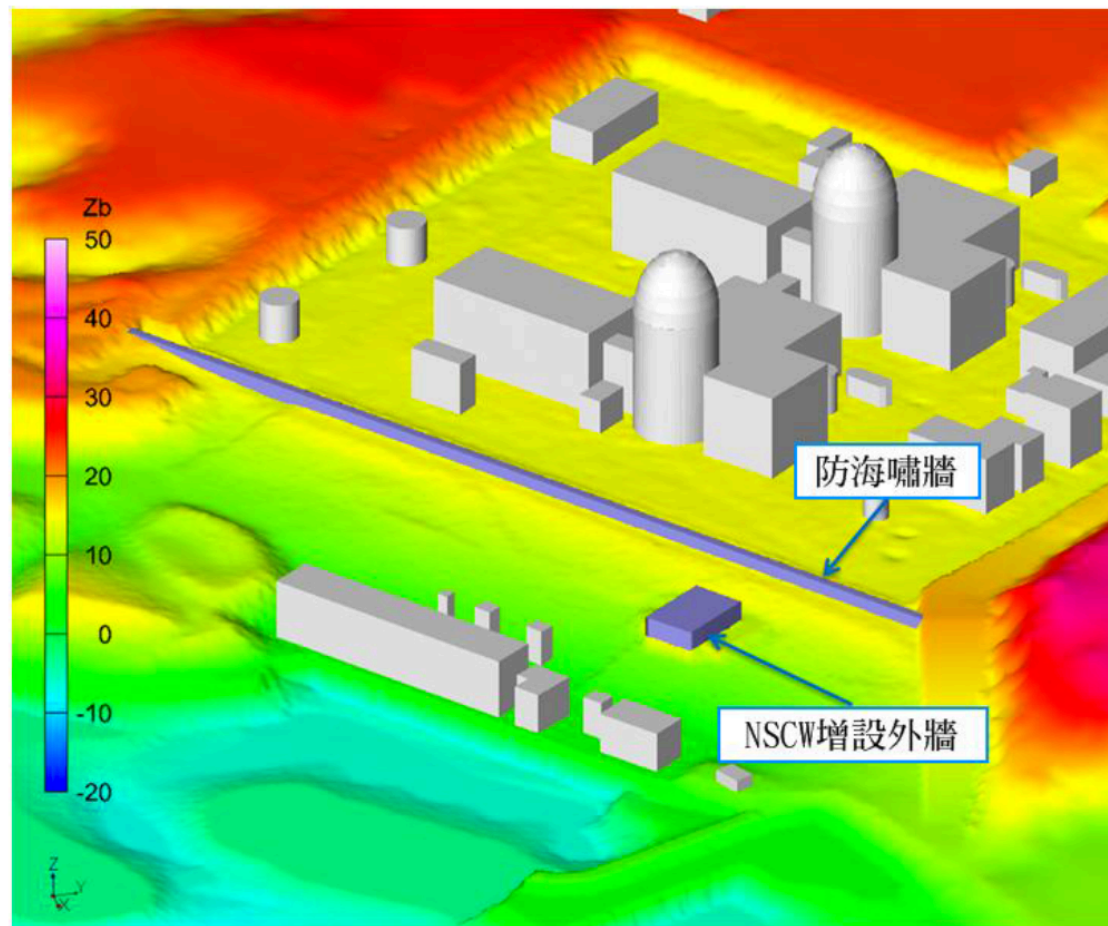
The First National-wide Tsunami Drill in Taiwan in 2014/9/19



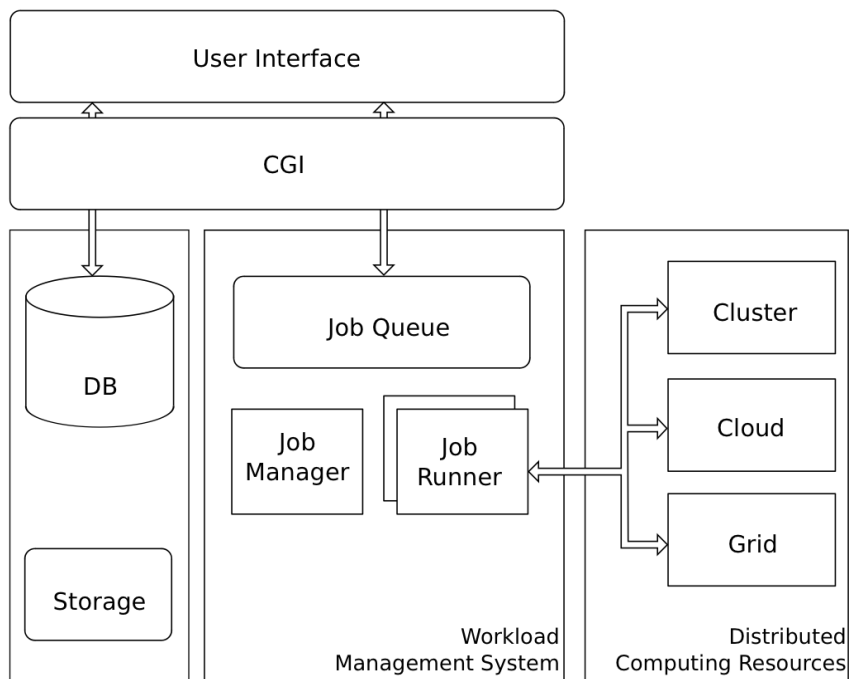


台灣電力公司

核一、二及三廠增設防海嘯牆規劃設計



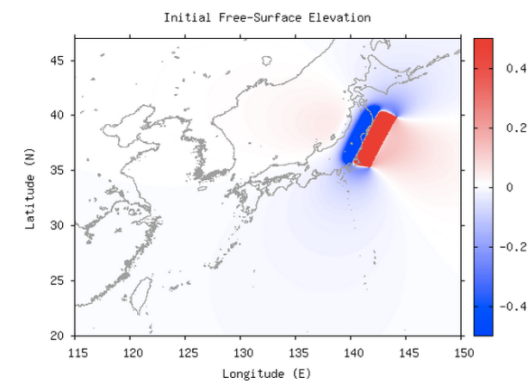
iCOMCOT: 海嘯雲端速算系統 a grid/cloud-based Tsunami system



在中研院網格中心協助下，將COMCOT
模式提昇為雲端系統，以利其他國家之
海嘯災防

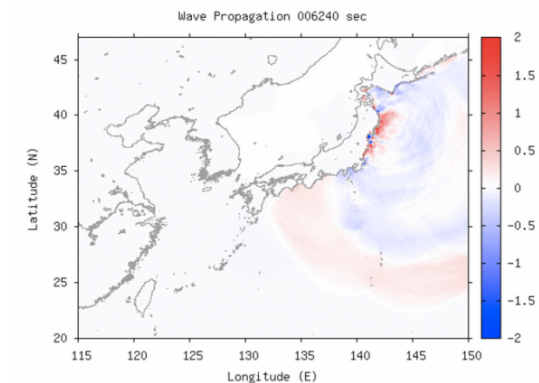
iCOMCOT Home About Simulation - Status Contact Logout scstw6demo

```
INITIAL SURFACE
initial surface
MAXIMUM WAVE HEIGHT
layer01
layer02
TIDE STATIONS
maximum wave height
01_NDBC_21401
02_NDBC_21413
03_NDBC_21418
04_NDBC_21419
WAVE PROPAGATION
layer01 (400x300)
layer01 (640x480)
layer01 (800x600)
BATHYMETRY
layer01
layer02
```



iCOMCOT Home About Simulation - Status Contact Logout scstw6demo

```
INITIAL SURFACE
initial surface
MAXIMUM WAVE HEIGHT
layer01
layer02
TIDE STATIONS
maximum wave height
01_NDBC_21401
02_NDBC_21413
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04_NDBC_21419
WAVE PROPAGATION
layer01 (400x300)
layer01 (640x480)
layer01 (800x600)
BATHYMETRY
layer01
layer02
```



(1) 2012 Invited Speech at UNESCO

(2) Interviewed by isgtw, London, UK

<http://www.isgtw.org/feature/forecasting-wrath-tsunami>

isgtw international science grid this week Advanced Se

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Home

Forecasting the wrath of a tsunami

FEATURE | APRIL 24, 2013 | BY ZARA QADIR

Immediately to the south-west of Taiwan, is the South China Sea and the deep oceanic Manila trench. Roughly every 10 years, the area experiences a moderate earthquake (under 6.9 on the Richter scale). However, there has not been a major earthquake since the 1570s. GPS data and global historical records show that every 700 years an earthquake of magnitude 9.0 is likely to strike the area. The region, therefore, is due one relatively soon (in terms of geological time frames) and if (or when) a mega-sized one does strike, people living in the

22 Tsunami Sources to Taiwan

18 Trench-type tsunami sources (T1-T18) 4 Fault-type tsunami sources (T19-T22)

The spatial distribution of 18 trench-typed tsunami sources (T1-T-18) and 4 fault-typed tsunami sources (T19-T-22). The color bar indicates the seafloor displacement of each tsunami source. Click for large version. Image courtesy Simon Lin, ASGC, from Tso-Ren Wu's paper.

COMCOT ([Cornell Multi-grid Coupled Tsunami Model](#)) is a numerical model that allows both simulation and visualization of the whole lifespan of a tsunami. It shows how a wave will travel on the earth and gives an estimate of its arrival time and the level of run up on to dry land. "The original research model focuses on accuracy and not speed; it took between 12 to 24 hours to generate a result. But for the system to be operational, COMCOT needed to simulate a tsunami as fast as real time propagation, from hours to minutes," says Wu.

Usually an operational system sacrifices some level of accuracy, but COMCOT allows both linear and non-linear equations. "A linear system speeds up the operation and is accurate for the deep ocean, but is not precise enough for the near-shore region. When the wave approaches the shoreline its speed diminishes, and it becomes thinner and taller so the curve can no longer be represented linearly. Most tsunami systems ignore this part of the simulation but it is the most important to impact on human life," explains Wu. COMCOT integrates the [spherical](#) with a [Cartesian](#) coordinate system, which is more accurate for near shore simulations.



台灣海嘯的過去與未來

2016-07-10



20160710

311東日本大震災

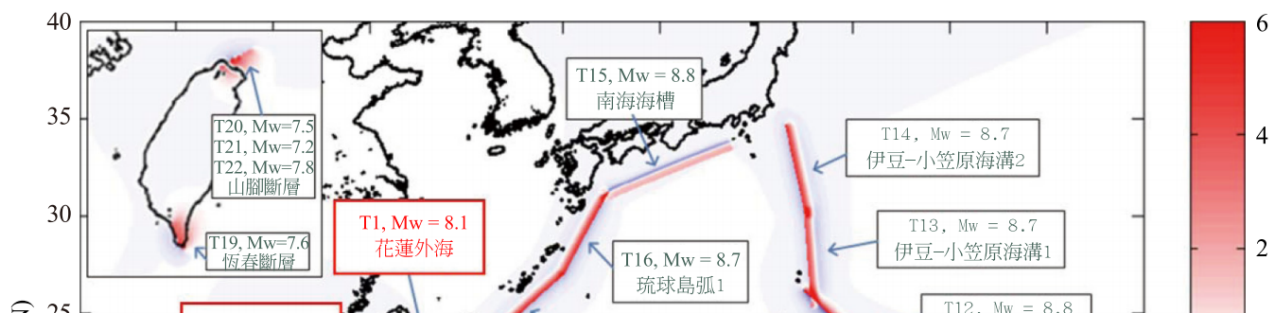
公元2011年3月11日，當地時間下午2時46分，日本東北部海域發生芮氏9.0級地震並引發海嘯。根據2012年4月的日本官方統計，此次地震海嘯共造成15855人死亡，3084人失蹤，6025人受傷。房屋全毀有129483戶，半毀與部分毀壞有952791戶，是日本有觀測紀錄以來規模最大的一次地震，引發的海嘯也是史上最嚴重的。

台灣的海嘯研究與發展

國立中央大學水文與海洋科學研究所 吳祚任

2011年3月11日，日本宮城大地震引發海嘯，災情震撼全球，而後續的核電災變至今仍無法徹底解決。台灣四面環海，天然環境甚至人文環境都與日本類似，透過不斷的災區畫面播送，

讓台灣人產生同情與共鳴。也因如此，台灣自此開始重視海嘯的威脅，也希望透過科學的研究，減少台灣的海嘯災害。



- 1. Longitude
- 2. Latitude
- 3. Focal Depth
- 4. Earthquake Mw

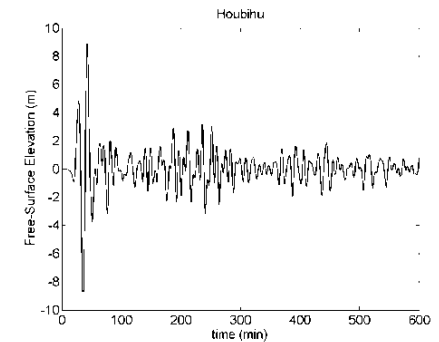
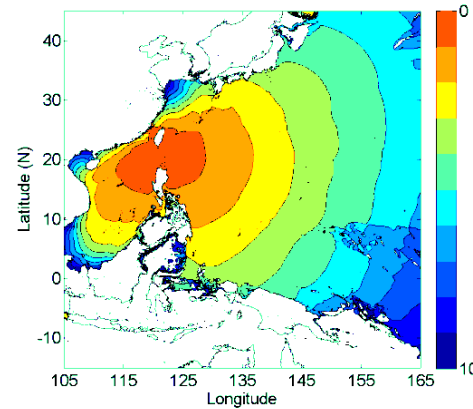
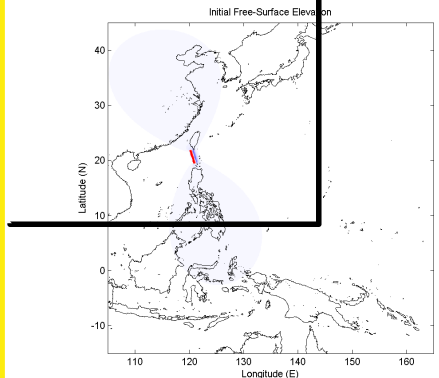
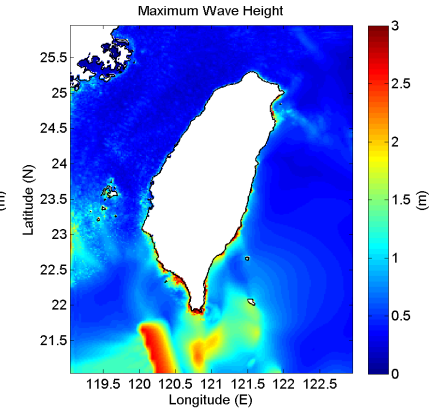
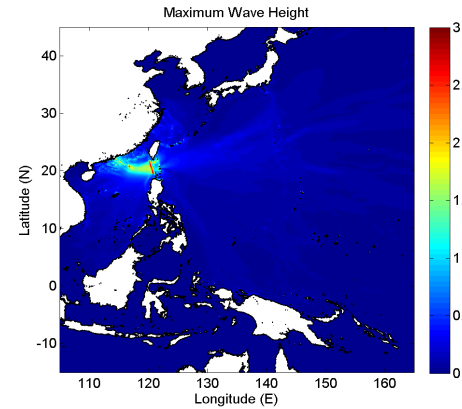
- 1. Longitude
- 2. Latitude
- 3. Focal Depth
- 4. Earthquake Mw
- 5. Strike
- 6. Dip
- 7. Slip

- 1. Longitude
- 2. Latitude
- 3. Focal Depth
- 4. Earthquake Mw
- 5. Strike
- 6. Dip
- 7. Slip
- 8. Rupture L, W
- 9. Dislocation
- 10. Others

Built a Tsunami Fast Calculation System for CWB, Taiwan.

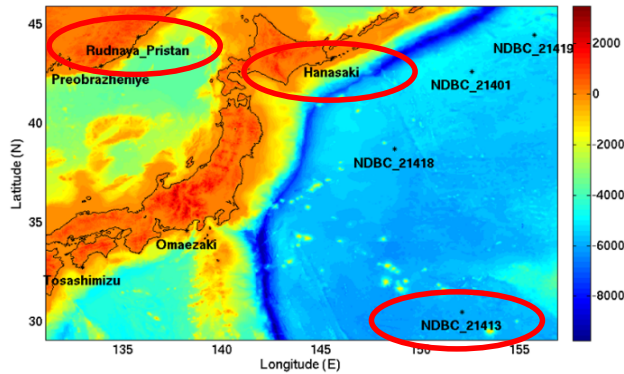
為中央氣象局建置全自動海嘯速算系統

COMCOT
Simulation &
Drawing

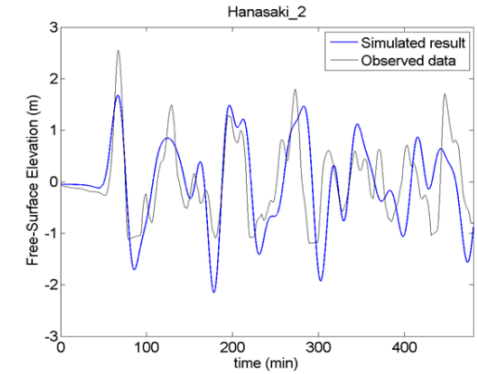
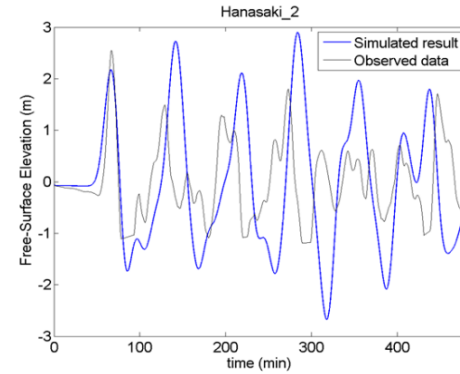


Validation

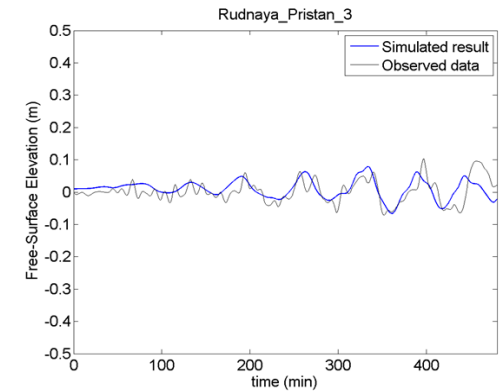
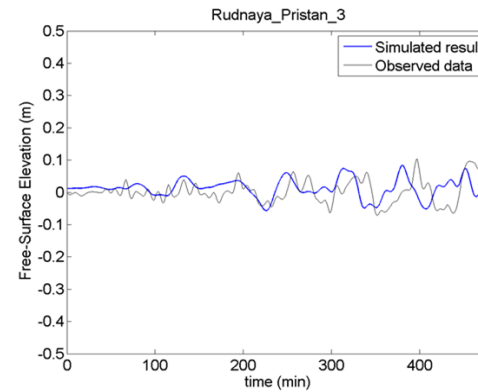
By assuming that only four parameters were known in the early stage.



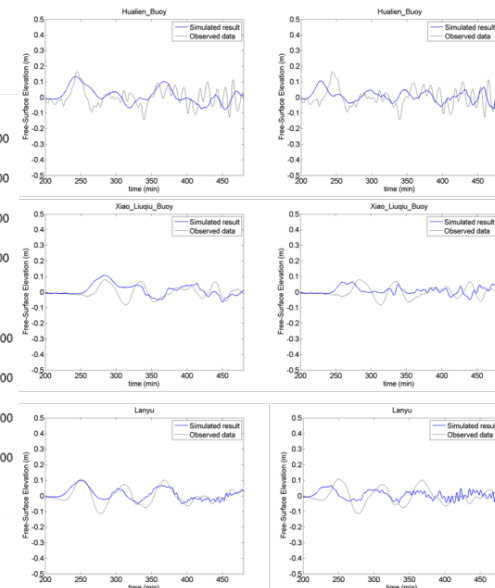
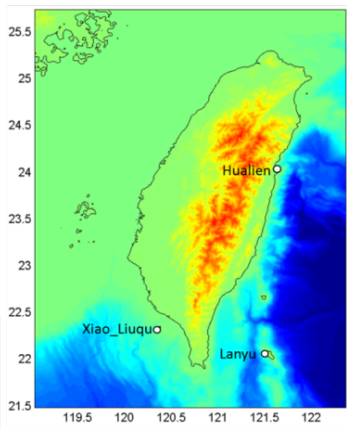
Japan 日本



Russia 俄羅斯

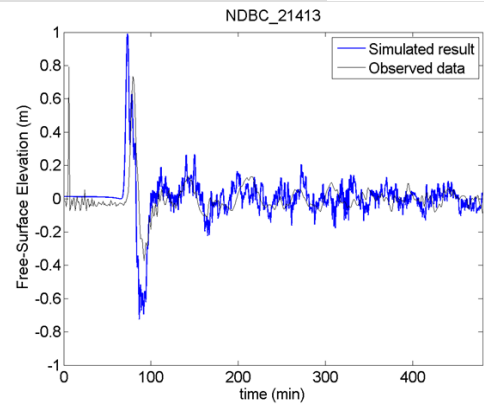
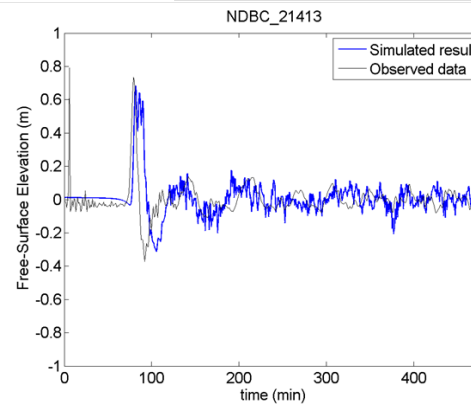


Taiwan 台灣



初步參數(present) 較詳細參數(GCMT)

USA 美國



初步參數(present)

較詳細參數(GCMT)

COMCOT風暴潮溢淹預報模式之介紹

(Cornell Multi-grid Coupled Tsunami Model – Storm Surge)

Nonlinear Shallow Water Equations on the Spherical Coordinate

$$\frac{\partial \eta}{\partial t} + \frac{1}{R \cos \varphi} \left\{ \frac{\partial P}{\partial \psi} + \frac{\partial}{\partial \varphi} (\cos \varphi \cdot Q) \right\} = 0$$

$$\frac{\partial P}{\partial t} + \frac{1}{R \cos \varphi} \frac{\partial}{\partial \psi} \left(\frac{P^2}{H} \right) + \frac{1}{R} \frac{\partial}{\partial \varphi} \left(\frac{PQ}{H} \right) + \frac{gH}{R \cos \varphi} \frac{\partial \eta}{\partial \psi} - fQ + F_{\psi}^b = - \frac{H}{\rho_w R \cos \varphi} \frac{\partial P_a}{\partial \psi} + \frac{F_{\psi}^s}{\rho_w}$$

$$\frac{\partial Q}{\partial t} + \frac{1}{R \cos \varphi} \frac{\partial}{\partial \psi} \left(\frac{PQ}{H} \right) + \frac{1}{R} \frac{\partial}{\partial \varphi} \left(\frac{Q^2}{H} \right) + \frac{gH}{R} \frac{\partial \eta}{\partial \varphi} + fP + F_{\varphi}^b = - \frac{H}{\rho_w R} \frac{\partial P_a}{\partial \psi} + \frac{F_{\varphi}^s}{\rho_w}$$

- Solve shallow water equations on **both spherical and Cartesian coordinate systems**
- **Explicit leapfrog Finite Difference Method** for stable and high speed calculation
- **Multi/Nested-grid system** for multiple shallow water wave scales
- **Moving Boundary Scheme** for inundation
- **High-speed efficiency**

• Moving Boundary Scheme

Moving boundary scheme was also introduced in COMCOT to model the run-up and run-down. The instant "shoreline" is defined as the interface between a dry grid and wet grid and volume flux normal to the interface is assigned to zero.

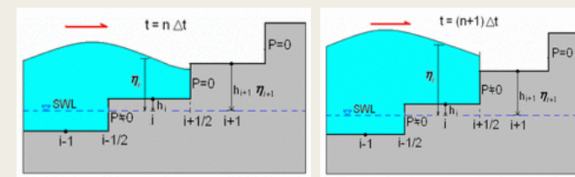
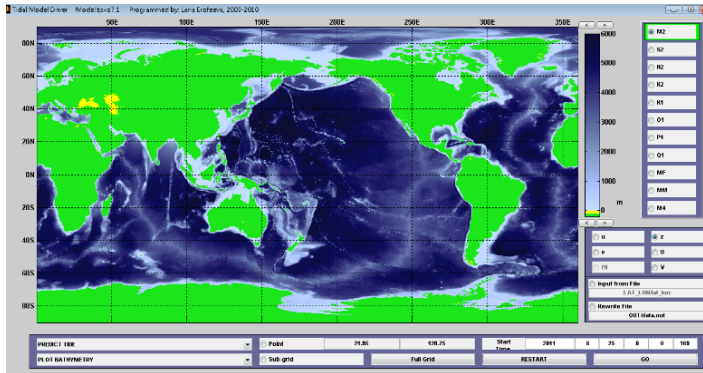
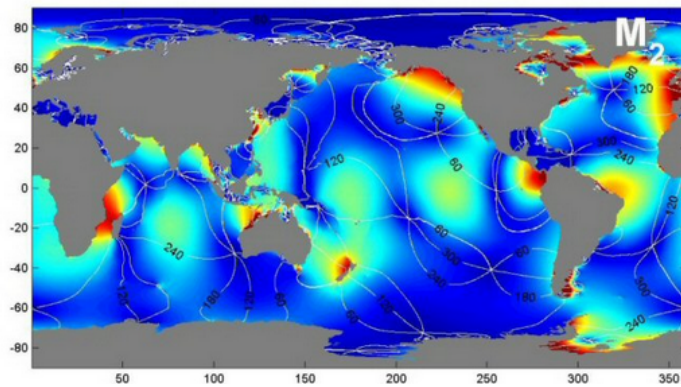


Fig.02 Moving Boundary Scheme

已完成與全球知名天文潮TPXO模式之即時耦合



TPXO操作介
工



提供各種不同分潮資訊，以M2分潮為例



The tides are provided as complex amplitudes of earth-relative sea-surface elevation for eight primary (M2, S2, N2, K2, K1, O1, P1, Q1), two long period (Mf, Mm) and 3 non-linear (M4, MS4, MN4) harmonic constituents, on a 1440x721, 1/4 degree resolution full global grid (for versions 6.* and later).

A TOPEX/POSEIDON global tidal model (TPXO.2) and barotropic tidal currents determined from long-range acoustic transmissions

BRIAN D. DUSHAW¹, GARY D. EGBERT², PETER F. WORCESTER³, BRUCE D. CORNUELLE³,
BRUCE M. HOWE¹ and KURT MEITZGER⁴

¹Applied Physics Laboratory, College of Ocean and Fishery Sciences,
University of Washington, Seattle, WA, U.S.A.

²College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR, U.S.A.

³Scripps Institution of Oceanography, La Jolla, CA, U.S.A.

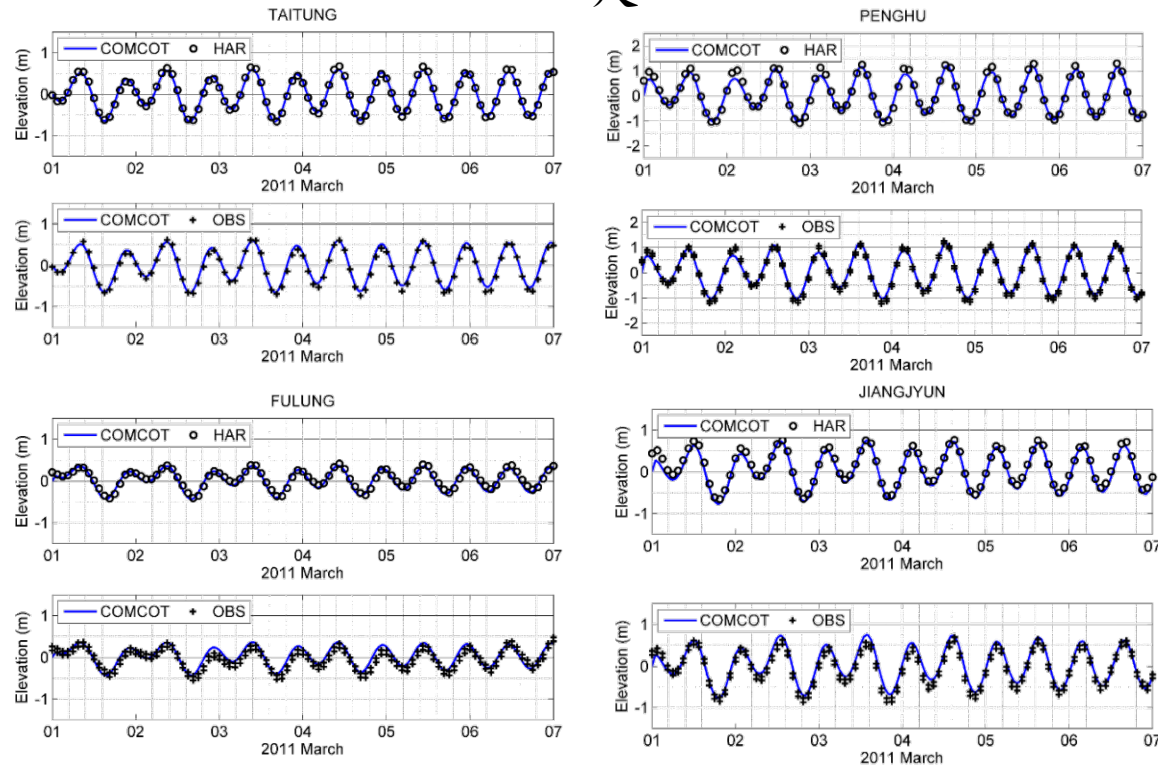
⁴Department of Electrical Engineering and Computer Science, University of Michigan,
Ann Arbor, MI, U.S.A.

Abstract – Tidal currents derived from the TPXO.2 global tidal model of Egbert, Bennett, and Foreman are compared with those determined from long-range reciprocal acoustic transmissions. Amplitudes and phases of tidal constituents in the western North Atlantic are derived from acoustic data obtained in 1991–1992 using a pentagonal array of transceivers. Small, spatially coherent differences between the measured and modeled tidal harmonic constants mostly result from smoothing assumptions made in the model and errors caused in the model currents by complicated topography to the southwest of the acoustical array. Acoustically measured harmonic constants (amplitude, phase) of M₂ tidal vorticity ($3-8 \times 10^{-9} \text{ s}^{-1}$, 210–310°) agree with those derived from the TPXO.2 model ($2-5 \times 10^{-9} \text{ s}^{-1}$, 250–300°), whereas harmonic constants of about ($1-2 \times 10^{-9} \text{ s}^{-1}$, 350–360°) are theoretically expected from the equations of motion. Harmonic constants in the North Pacific Ocean are determined using acoustic data from a triangular transceiver array deployed in 1987. These constants are consistent with those given by the TPXO.2 tidal model within the uncertainties. Tidal current harmonic constants determined from current meters do not generally provide a critical test of tidal models. The tidal currents have been estimated to high accuracy using long-range reciprocal acoustic transmissions; these estimates will be useful constraints on future global tidal models. © 1998 Elsevier Science Ltd. All rights reserved

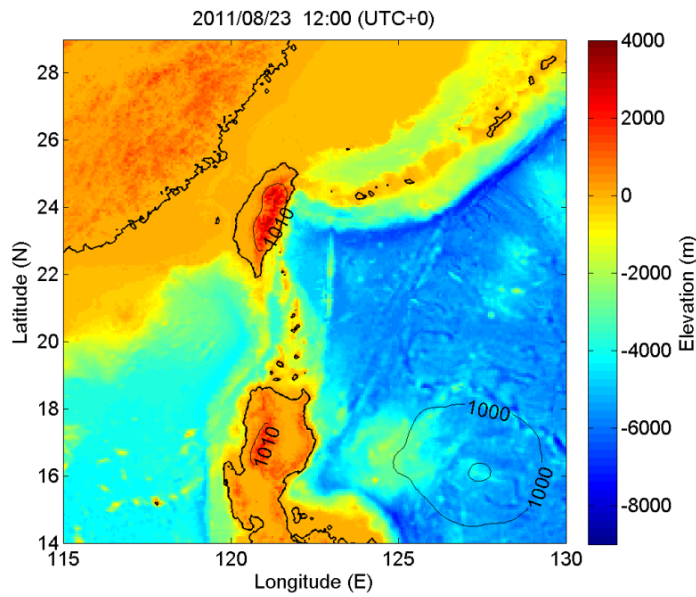
(Dushaw et al.,
1997)

高準確度潮汐校驗之結果

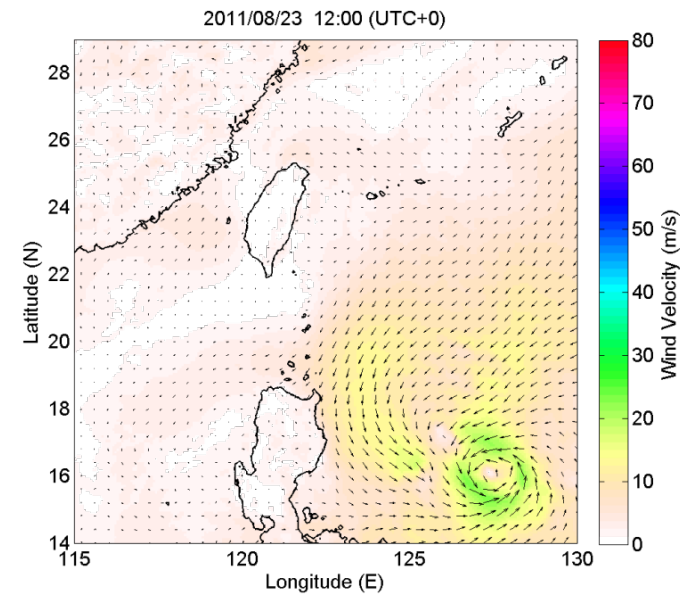
偏差量(Bias)小於0.1公尺且方均根誤差(RMS)小於0.6公尺



已完成TWRF大氣模式之耦合



Pressure Field



Wind Field

The case shows the non-symmetric typhoon fields of 2011 Typhoon Nanmadol.

可將颱風受地形影響之非對稱氣象場，導入風暴潮模擬中。

超強颱風「尼伯特」登陸台灣

2016-07-08

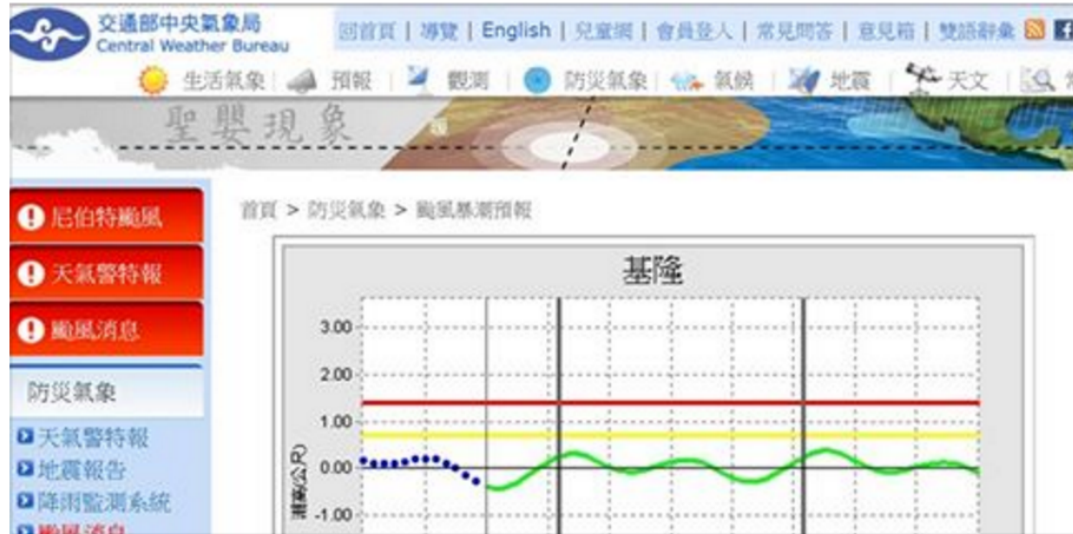


尼伯特來襲，台東、綠島、蘭嶼多處停電、鐵皮屋、路樹、招牌全被吹得四散，好像被原子彈轟炸過。

After 5-year hard work, our storm surge model is finally online now.
It performed really well in the current event.

花五年開發的風暴潮新模式，預報得非常準！
育霖，Excellent job!!

http://www.cwb.gov.tw/V7/prevent/typhoon_surge/



讚 留言 分享

NEPARTAK 尼伯特颱風
時，準確預報風暴潮及
潮汐水位

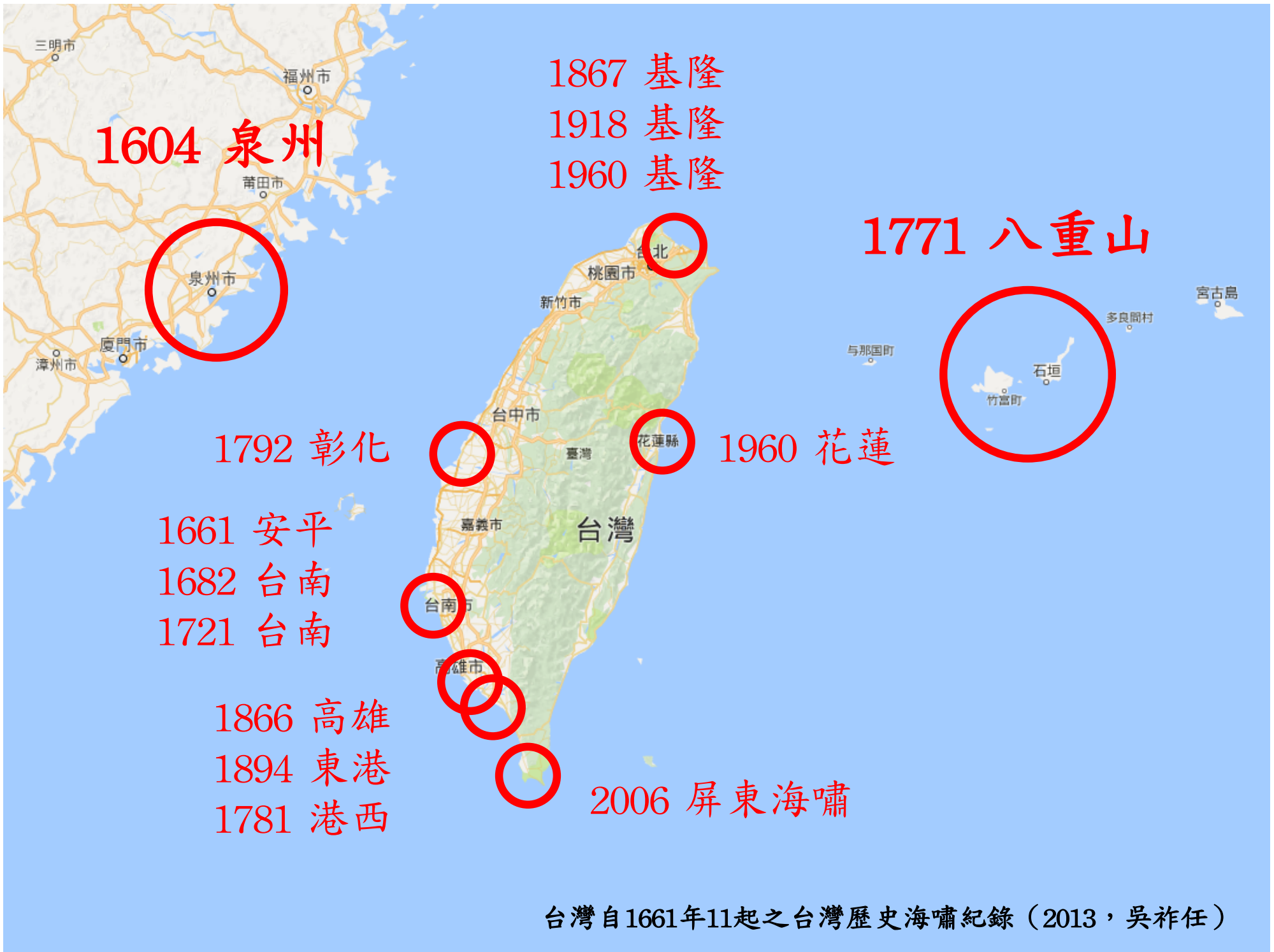
目前本模式已成
為中央氣象局之
標準風暴潮預報
模式

COMCOT Storm
Surge Model is the
official operational
SS model in Taiwan

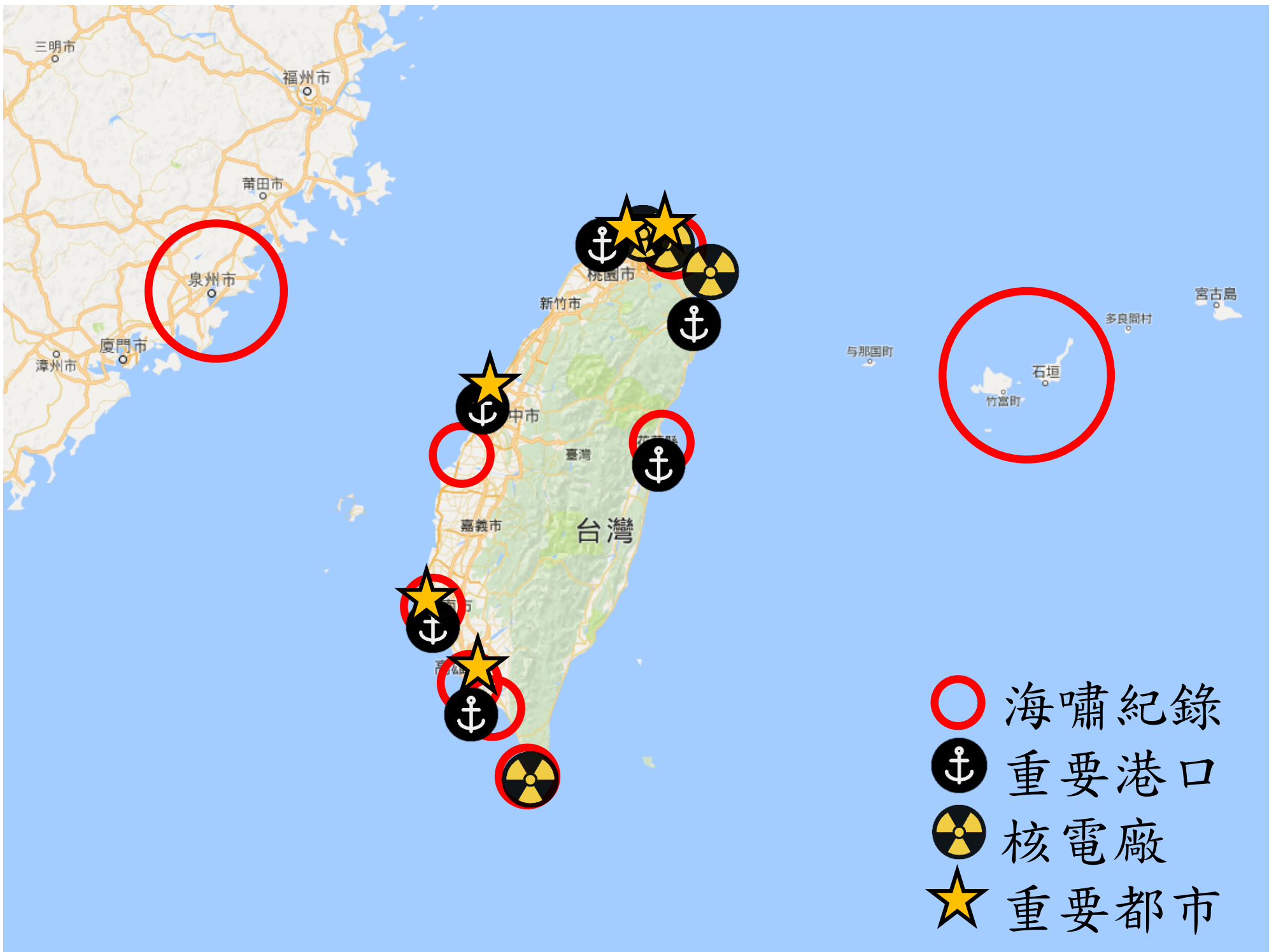
台灣歷史海嘯紀錄

台灣自1661年11起之台灣歷史海嘯紀錄（2013，吳祚任）

時間	地點	出處	描述
1661年1月	安平	德人海卜脫（Herport）著旅行記	1661年1月某日晨6時開始地震，有3船入港，在水中亦激烈震動
1721年1月5日	台南縣	重修台灣縣志「雜誌。祥異」及明清史料戊編	明清史料戊編載朱一貴供詞有云：「因地震，海水冷漲，眾百姓合夥謝神唱戲。」。
1781年4、5月間	屏東港西里	台灣采訪冊「祥異。地震」	海水暴吼如雷，巨湧排空，水漲數十丈，近村人居被淹，不數刻，水暴退。
1682年	台南	Soloviev and Go, 1974	台南發生強烈地震並造成嚴重災情，海嘯隨之而來，並以東西向方式攻擊海岸地區。40,000多居民喪生。
1792年8月9日	彰化	「台灣采訪冊」（頁39-40）「祥異，地震」	嘉城地大震，忽無風，水湧起數丈，舟人曰：『地震甚。』
1866年12月16日晨8時20分	高雄	阿瓦力茲（Alvarez）著「福爾摩薩（Formosa）」	發生地震，約歷一分鐘，樹林、房舍及港中船隻，無不震動；河水陡落3尺，忽又上升。
1867年12月18日	基隆	淡水廳志、Alvarez, Formosa等	雞籠頭、金包里沿海，山傾地裂，海水暴漲，屋宇傾壞，溺數百人。
1894年	屏東東港	記載於東隆宮、鎮海宮、嘉蓮宮、南隆宮之廟誌及碑文上	崙仔頂(鎮海宮)、汕仔寮、太監府(東隆宮)三個村落在1894年遭海嘯襲擊，盡沉海底
1918年5月1日	基隆	楊春生等（1983）	台灣東北部海底地震引起海嘯，基隆海嘯溯上約3.7公尺
1960年5月24日	基隆、花蓮	聯合報等	基隆測候所的記錄，24日上午6時30分，基隆港內海潮高出海平面1.9公尺
2006年12月26日	屏東後壁湖漁港	吳祚任，中央氣象局	屏東外海所發生之規模7.0及6.9之雙地震，於後壁湖港區產生40cm之海嘯。

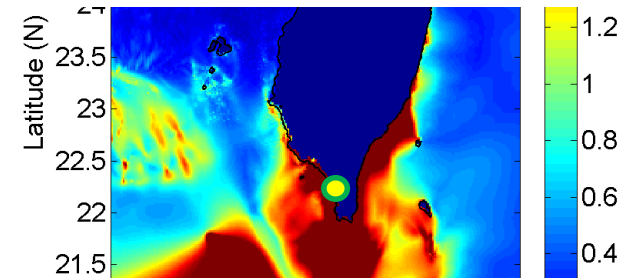


台灣自1661年11起之台灣歷史海嘯紀錄 (2013, 吳祚任)



- 海嘯紀錄
- ⚓ 重要港口
- ☢ 核電廠
- ★ 重要都市

1781年（清乾隆46年）5月間 （4月24日-6月21日）屏東港西里海嘯



- 「台灣采訪冊」「祥異，地震」：「乾隆四十六年四、五月間，時甚晴霽，忽海水暴吼如雷，巨浪排空，水漲數十丈，近村人居被淹，皆攀援而上至尾，自分必死，不數刻，水暴退，人在竹上搖曳呼救，有強力者一躍至地，兼救他人，互相引援而下。間有牧地甚廣及附近田園勾壑，悉是魚蝦，撥刺跳躍，十里內村民提籃契筒，往爭取焉。聞只淹斃一婦，婦素悍，事姑不孝，餘皆得全活。嗣聞是日有漁人獲兩物，將歸，霎時間波濤暴起，二物竟趣，漁者乘筏從竹上過，遠望其家已成巨浸，至水汐時，茅屋數椽，已無有矣。」。
- 文中描述到第二海嘯波，幾乎可以肯定為海嘯事件。
- 第一波波高約3公尺。第二波約4~5公尺。淹溢範圍約1km。
- “In 1781 around the 4th to 5th month, 46th Qianlong year, the weather was fine. Suddenly the sea roared like thunder. Giant wave appeared. Water rose for tens of zhang high. Villagers nearby were submerged. They climbed upwards, expecting to die. After a few quarters, it ebbed. People were swinging on top of bamboos, crying for help. One strong man jumped to ground, and helped others getting down. Gazing lands, farmlands and gullies were full of leaping fishes. Villagers nearby rushed to collect by baskets. It was heard that one woman was drowned. The woman was fierce, and was not filial to her parents in law. Except for the woman, everybody was survived. After collecting the fishes and heading home, suddenly the sea roared again. Fishermen lost their fishes. They sailed on top of bamboos on raft, watching their homes submerged from far.”

About 230 years ago

About 4~5m

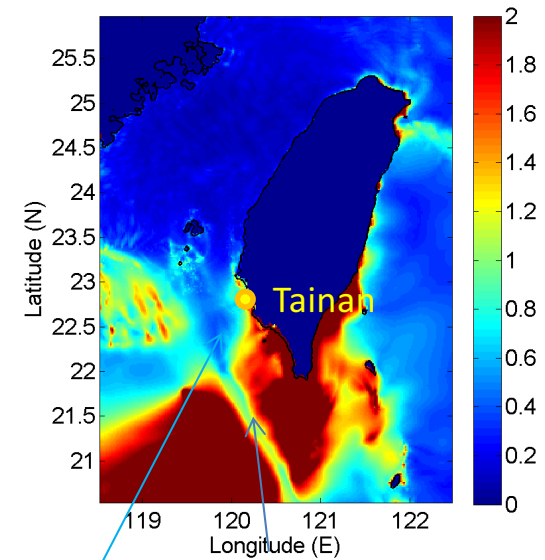
Second tsunami coming in

About 1km far

About 3m

(感謝許明光、李昭興、吳季莊提供資料)

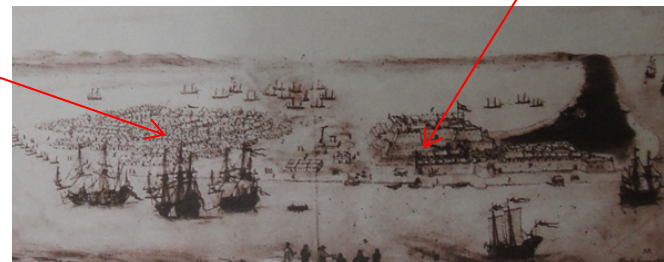
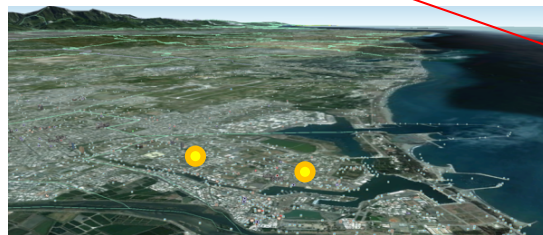
- 「1782年5月22日 (1682年12月?) 台灣 (台南) 發生強烈地震並造成嚴重災情，海嘯隨之而來，並以東西向方式攻擊海岸地區。『幾乎全島』超過120公里被海嘯所淹沒。地震和海嘯歷時8小時。該島的三大都市和二十多個村莊先是被地震破壞，隨後又為海嘯浸吞。海水退去後，原本是建築物的地方，只剩下一堆瓦礫。幾乎無人生還。40,000多居民喪生。無數船沉沒或被毀。一些原本伸向大海的海角，已被沖刷，形成新的峭壁和海灣，並造成淹水。安平堡 (即熱蘭遮) 以及赤崁城堡 (台南市赤崁樓舊址) 連同其坐落的山包均被沖跑了」



(Epicenter was not far away from Tainan)

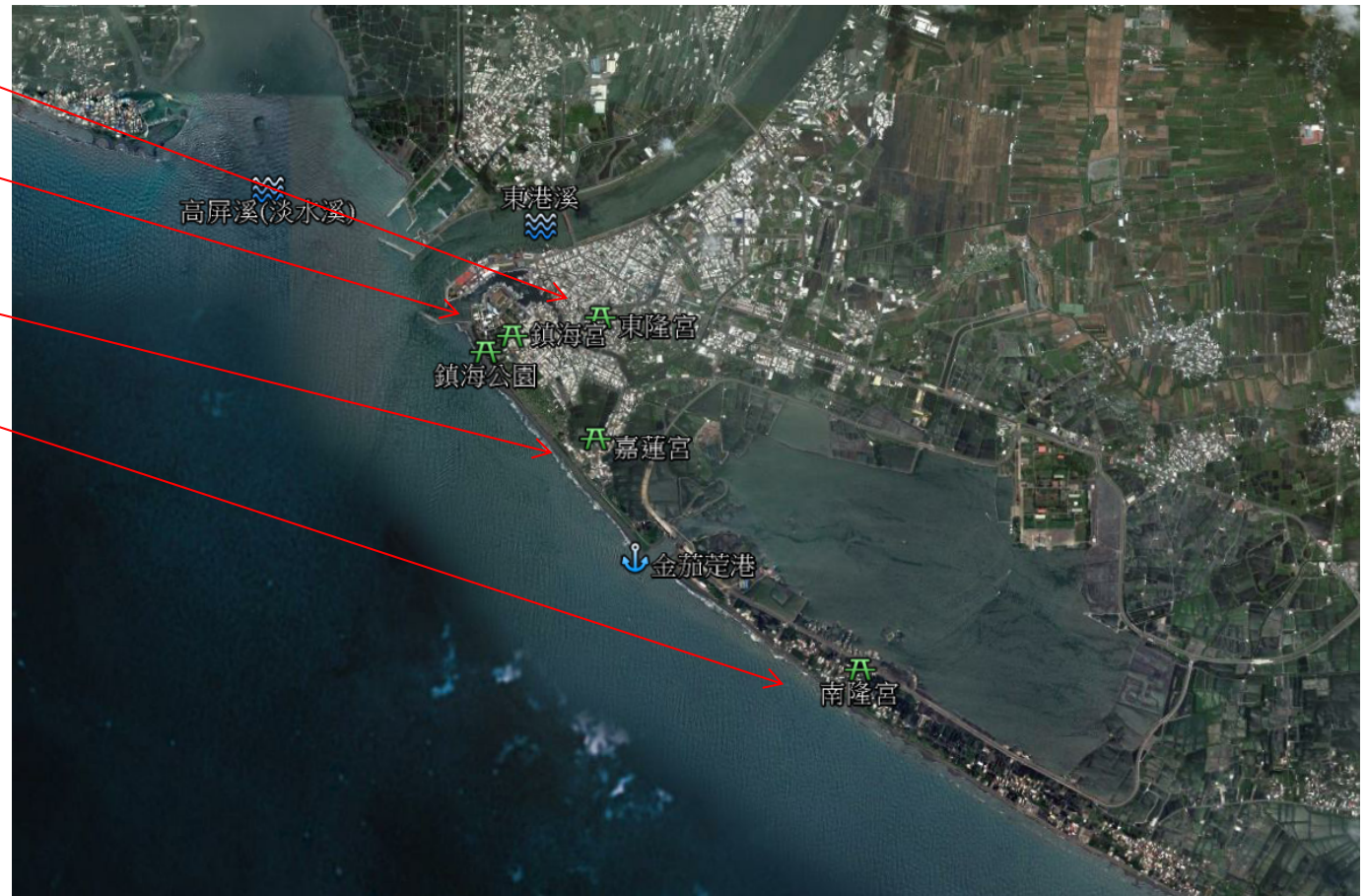
In 1782 May 22 (or 1682 December ?), strong earthquake shook the Taiwan (Tanian) and vyzvuzshee (??) and caused severe damage, followed by tsunami waves, attacking the coastal area in the East-West direction. "Almost the whole island" was flooded **by tsunami for over 120 km**. Earthquake shaking and **tsunami waves lasted for 8 hours**. Three big cities and 20 villages of the island were destroyed by an earthquake at first, and then by the tsunami. After ebbing, the locations where the buildings stood remained only the debris. "There were nobody left alive". **More than 40,000 inhabitants were killed**. Lots of ships were destroyed or sunk. In the places where some capes were swashed away, fresh slopes and coves appeared, and filled with water. Forts Zealand (Anpin) and Pigchingi were washed away along with the hills on which they are located. (Perrey, 1862c; Mallet, 1854; lida et al, 1967; Cox, 1970)

Translated by Prof. NGUYEN NOHG PHUONG (2011/11/16, Hanoi, Vietnam)



1894年東港海嘯 相關地點調查結果

- 東隆宮
- 鎮海宮
- 嘉蓮宮
- 南隆宮



(蔡育霖、李俊叡、柯利鴻提供，中大水海所海嘯科學研究室)

東隆宮



沿革誌摘要：

- 光緒二十年(西元1894年)，某天發生海嘯，浪濤翻天，淹沒了當時的太監府，.....
- 當時之太監府已沉入海底，距離現在鎮海里大約一公里之海中，.....



(蔡育霖、李俊叡、柯利鴻提供，中大水海所海嘯科學研究室)

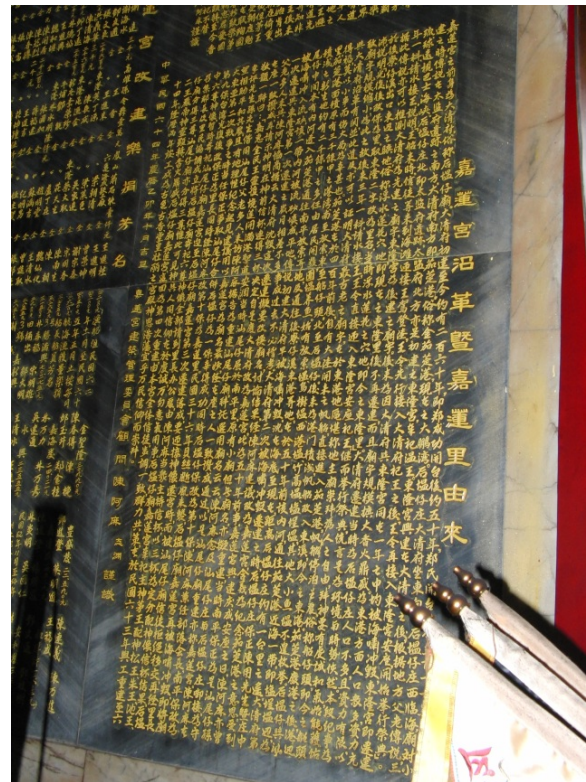
嘉蓮宮

碑文摘要：

- 俗稱大清府，初建之時傳說在太監府遺跡之南方，即茄荳港(現大鵬灣一帶)。
- 曾於與東隆宮同時遭海嘯摧毀。
- 茄荳港一帶泥沙淤積嚴重，然後廢港，帆船改入東溪(今之東港)。
- 約西元1925年左右，原大鵬灣有一內河通往茄荳港近海一帶，因海嘯衝入流砂，該一帶內河被流砂填成平地。

◎碑文上雖無描述時間，但有描述東隆宮遷建後之地點，與之比對，確定為西元1894年之海嘯。

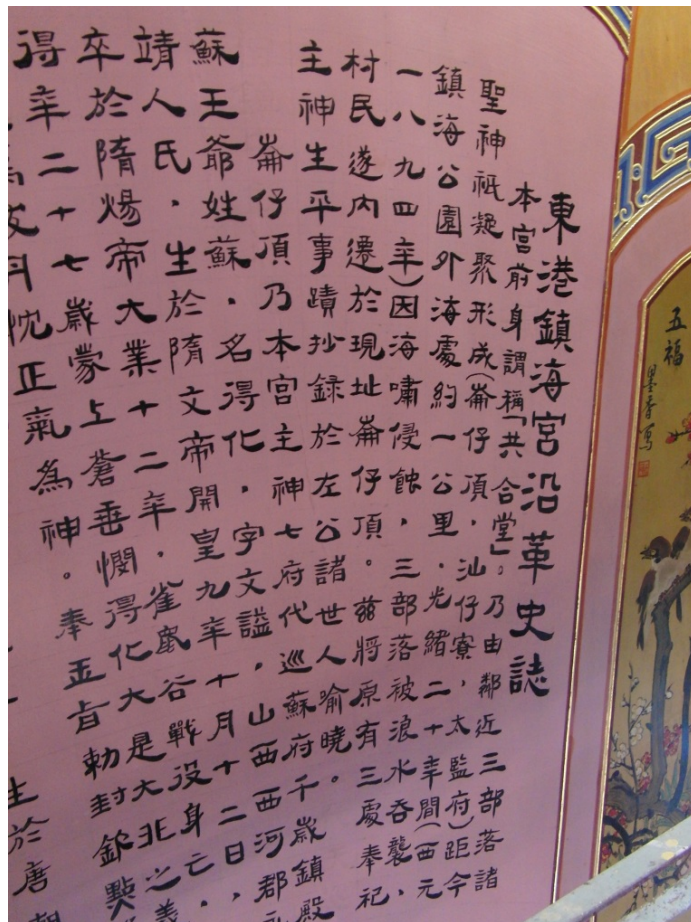
(蔡育霖、李俊叡、柯利鴻提供，中大水海所海嘯科學研究室)



鎮海宮

碑文摘要：

- 崙仔頂(鎮海宮)、汕仔寮、太監府(東隆宮)三個村落在1894年遭海嘯襲擊，盡沉海底。



(蔡育霖、李俊叡、柯利鴻提供，
中大水海所海嘯科學研究室)

南隆宮

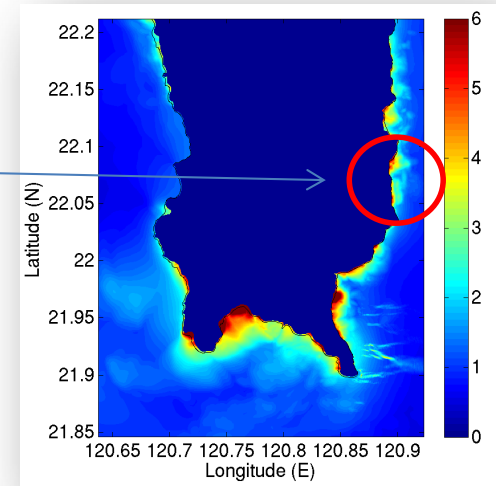
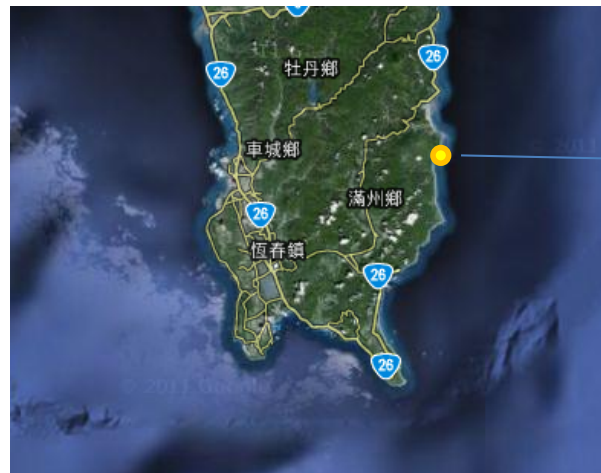
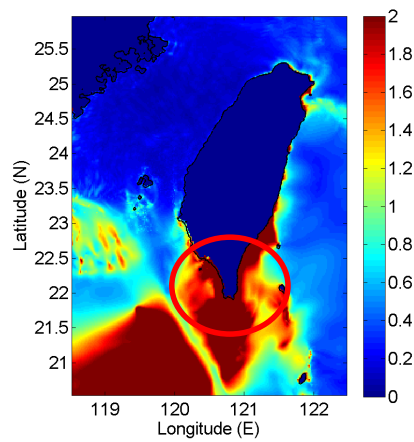
碑文摘要：

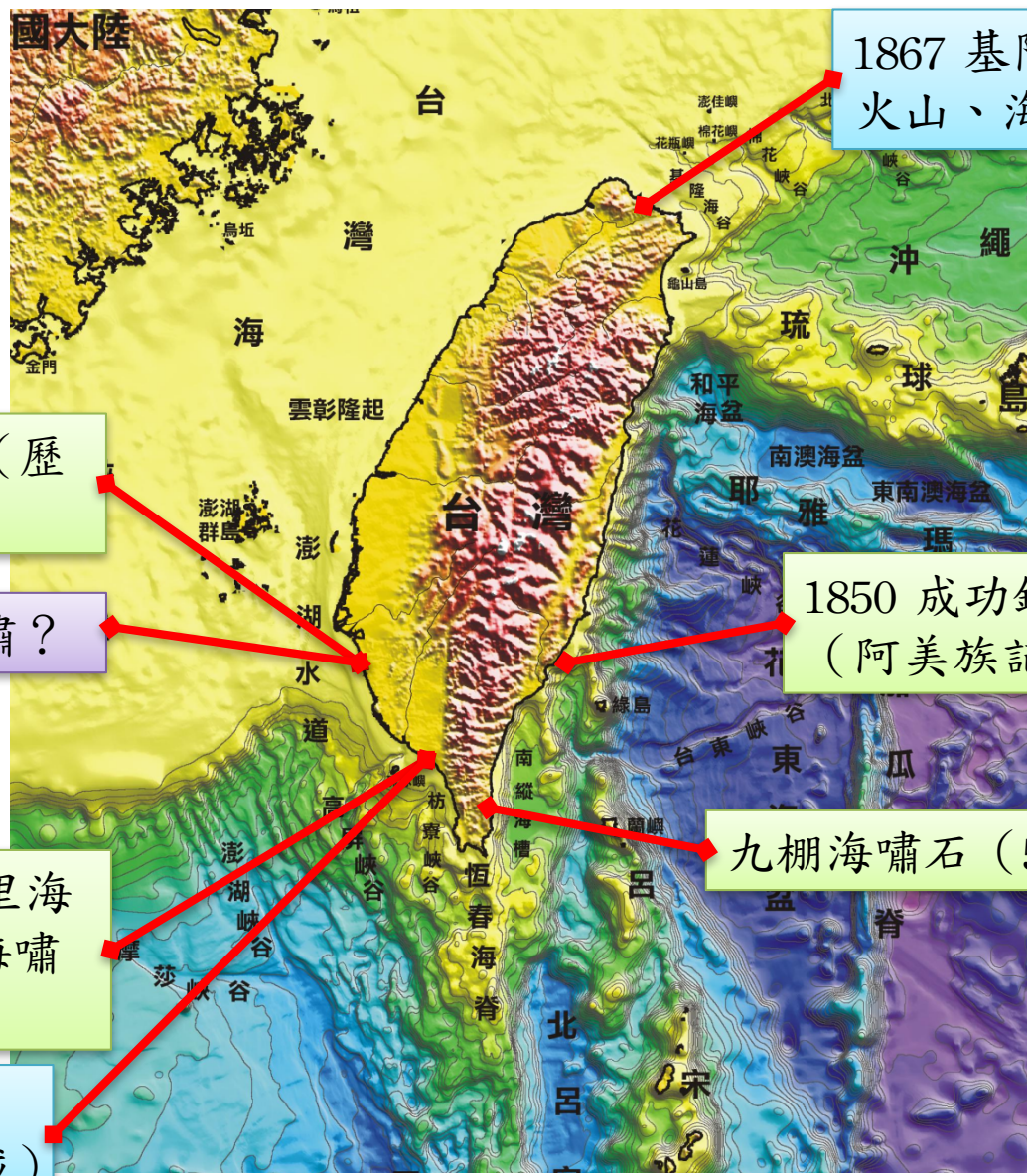
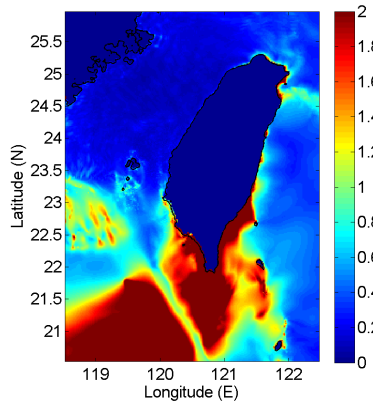
- 緣南平里昔日位處金茄荳港，.....
- ...大鵬灣港口之中心位置，西面有一顆大松樹，.....，其後有紅毛番(荷蘭人)路過，好奇而將古松樹之大樹鬚(根)砍斷，不過三年，**連遭天然災變，本庄竟被怒濤吞沒，地勢變動**，住民逐漸遷移至現在里址定居，.....

(蔡育霖、李俊叡、柯利鴻提供，中大水海所海嘯科學研究室)



Tsunami Boulders were found in Taiwan





1867 基隆海嘯 (地震、火山、海底山崩)

1782 台南海嘯 (歷時與地點精確)

1661 鄭成功海嘯?

1850 成功鎮海嘯 (阿美族記載)

1781 屏東港西里海嘯 (記載兩次海嘯波)

九棚海嘯石 (5000年內)

1894 東港海嘯 (四座宮廟記載)

台灣歷史暨古海嘯事件 (吳祚任整理, 中大水海所海嘯科學研究室)

Recent Breakthrough on the tsunami early warning

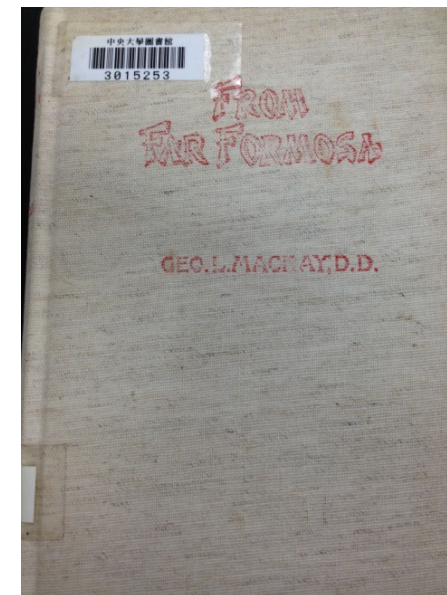
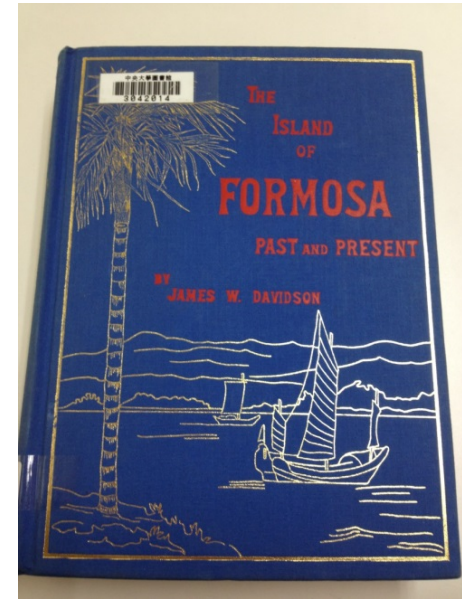
- Before the event, can I know where is dangerous location for the tsunami source?
(能否預先知道哪地方發生的海嘯對我會有重大影響?)
- Is it possible that knowing the tsunami height without using a computer? (能不能不要靠電腦，不要靠網路，光是茶圖表就可以知道這個海底地震對我是否有影響?)

Brand New Method for Tsunami Hazard Mitigation (全新的海嘯災防概念)

- IIA : Impact Intensity Analysis
 - 海嘯衝擊強度分析法
- STR : Seismic-Tsunami Relationship
 - 地震-海嘯關係圖

1867 基隆海嘯

- 字林西報」(North China Dairy News)
 - 「棕櫚島和基隆島之間的海面上有湮霧。海港內的水湧向海外，致使遠至閩王岩的地方有幾秒鐘成為無水地帶，所有的東西都被退去的海水捲走了，然後海水又形成兩個大浪湧回，將舢板和上面的人淹沒，並把帆船擱淺在基隆對岸。海水也不像往常那樣清澈，而是變得又黃又渾。大量的魚被沖到岸上。海水退出港口時，有一個男人從一條帆船上下來，但是在他到達岸上之前，就被回湧的海水淹沒了。無數的煤船傾覆沈沒。一條深埋在沙中多年的舊帆船沖上了岸」。
- 「淡水廳志」
 - 「(同治六年)冬十一月，地大震。…二十三日，雞籠頭、金包里沿海，山傾地裂，海水暴漲，屋宇傾壞，溺數百人」(祥異考)。
- Reports on Trade at the Treaty Ports for the Year, 1864~1881
 - 「1867年地震發生在12月18日，海水從基隆港傾瀉而出，留下了一個乾涸的泊位，但不幾秒鐘，帶著兩個浪頭的海水又洶湧而回，淹沒了舢板和人口。基隆、金包里及巴其那等城鎮部份泡為廢墟。淡水遭到嚴重破壞，好幾百人死亡」。
- 「臺灣遙寄」(From Far Formosa)
 - 「地大震，雞籠頭、金包里沿海，山傾地裂、海水暴漲、屋宇傾壞、溺數百人。北部地震更烈，災害亦更大：基隆城全被破壞。港水似已退落淨盡，船隻被擱于沙灘上。不久，水又復回。來勢猛烈，船被衝出，魚亦隨之而去，砂灘上一切被沖走」。
- 「同治年間於金包里附近的地變」
 - 「地震發生在清同治六年(慶應三年)十一月二十三日上午十點，震前並無徵兆，初時，南邊的硫磺山發出如雷的聲響，聲音由南向北傳遞，繼而地面開始左右劇烈搖晃，約五分鐘後，海面開始暴退，三十分鐘後，海底約裸露四、五町之多，一個鐘頭後，海水暴漲，發生海嘯。磺港、水尾港附近皆受波及，海水暴升兩丈高，金包里街、八斗子均被海水淹沒……。」



李俊叡整理 (中大水海所海嘯科學研究室)

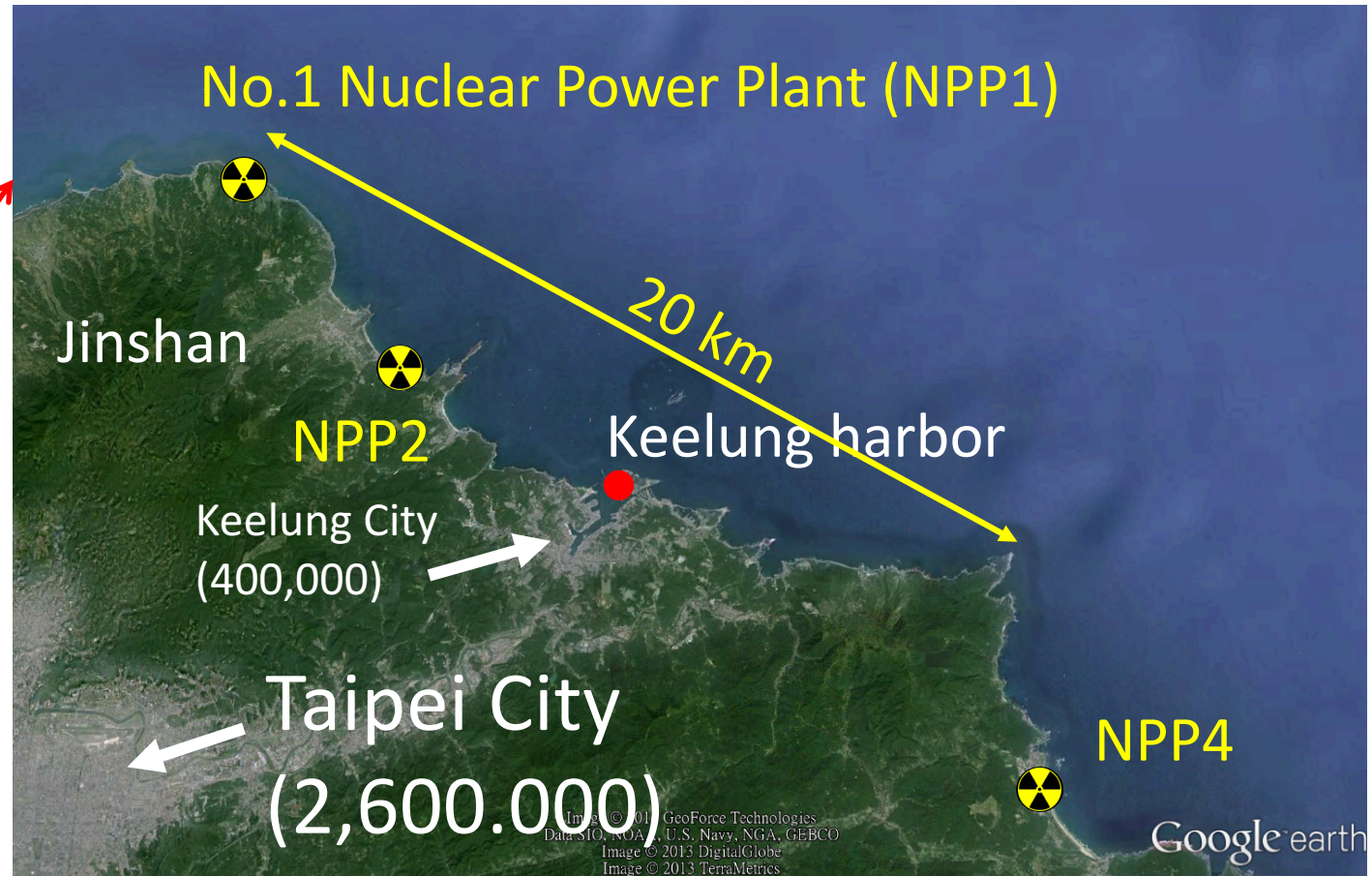
Reconstructing the 1867 Keelung Tsunami Event (1867年基隆海嘯事件之還原)



Tsunami deposit were found on the Hoping Island, Keelung,
Taiwan (Liberty Times, 2012)

基隆和平島海嘯沉積物考察 (自由時報, 2012)

Why the 1867 Keelung tsunami is important?



It is the only tsunami event officially recognized by Taiwan government, so far.