出國報告（出國類別：開會）

赴越南參加「極端氣候預報及水資源管理研討會」
(2017 ACTS Workshop on Extreme Weather Forecast and Water Resources Management)

服務機關：經濟部水利署、經濟部水利署第十河川局
姓名職稱：王藝峰副署長、林益生課長
派赴國家：越南
出國期間：106 年 9 月 25 日至 106 年 9 月 28 日
報告日期：106 年 11 月

摘 要

經濟部水利署王藝峰副署長與第十河川局林益生課長於 107 年 9 月 25 日至 28 日奉派至越南河內市，參加台灣颱風洪水研究中心於 106 年 9 月 26 至 27 日與越南資源環境部氣象水文暨氣候變遷研究院(IMHEN)共同舉辦之「2017 ACTS Workshop on Extreme Weather Forecast and Water Resources Management」。

研討會在越南河內華平飯店 (Hoa Binh Hotel)舉辦，以極端天氣預報及水資源管理為主題，兩天會議共有 22 個演講議題，與會人員來自台灣、越南、菲律賓政府單位及學術界，並有聯合國開發計畫署(UNDP)等國際組織成員參加，估計有約 100 位與會。

除參加會議外，另於 9 月 25 日拜會越南氣象水文暨氣候變遷研究院，台灣颱風洪水研究中心與該院並簽署雙方合作備忘錄；9 月 28 日則拜會越南防災總局，交流台越雙方近年防災經驗與作為，除商談未來合作方式外，亦邀請越方人員前來台灣參訪水利署等單位。

此行，台越雙方藉由會議、餐敘、拜會及簽署合作備忘錄等方式，逐步深化及拓寬交流層面，而台灣代表團在水利、水保、防災及氣象等方面經驗及軟實力，將爭取與越南及周邊國家新興市場合作的機會，亦符合政府新南向政策「長期深耕、多元開展，雙向互惠」原則。

出席人員返國後，與越方人員互動密切，並對越方遭受海葵颱風與海雁颱風災害表達關切，雙方均希望台灣在颱風研判分析及防汛社區推動上，後續能有更具體、更積極的合作。

分享台灣防災經驗，提供經驗與技術是加入世舞台應負的責任，水利署將擴大深化相關工作。

目 錄

圖目錄

第一章 目 的

106 年 9 月 26 日至 27 日台灣颱風洪水研究中心(TTFRI)與越南資源環境部氣象水文暨氣候變遷研究院(IMHEN)於越南河內市共同主辦「2017 亞太經濟合作颱風與社會研究中心(ACTS)，極端氣候預報及水資源管理研討會」(2017 ACTS Workshop on Extreme Weather Forecast and Water Resources Management)，包含 1 天半之討論議程以及半天參訪行程，邀請台灣及越南相關氣象、水利、水保及防災等專家學者共同探討劇烈天氣以及水資源管理對社會經濟之衝擊。

大會邀請經濟部水利署派 2 人出席會議，經評估符合政府新南向政策，故派王藝峰副署長及第十河川局林益生課長參加，分別報告「極端氣候下臺灣颱風與暴雨災害管理」及「台北地區的防洪工程及防洪減災策略」，會議共 22 場次演講，台越雙方就氣候變遷、系集預報、天氣研究與預報模式、衛星遙測資訊之應用、水資源及極端氣候下河川水位變化與暴潮之災害管理等相關議題作深入探討及經驗分享，有助於提升台、越水資源交流並促進雙邊防災科技之合作。

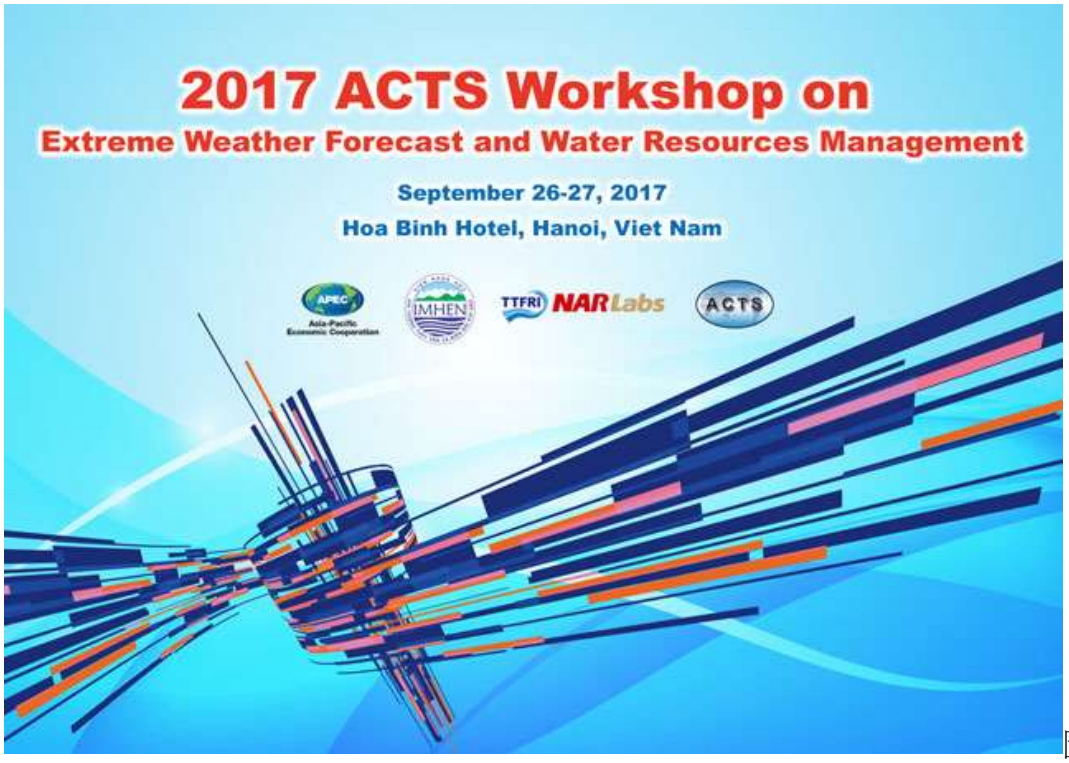

圖 1. 2017 ACTS 極端氣候預報及水資源管理研討會海報

亞太經濟合作颱風與社會研究中心(APEC Research Center for Typhoon and Society ，ACTS)，係為減輕颱風災害，由台灣和菲律賓在亞太經濟合作會議(APEC)聯合提出設立獲得通過，於 99 年在台北成立，該中心成立宗旨如下:

(1)針對亞太地區特有之複雜地形與氣候現象如季風、強降雨等交互作用，提昇在地化颱風科學研究。

(2)啟動颱風對社經影響之在地化研究，以將人民生命財產損失降至最低，並精算公共建設損失，以利完備後續的資源規劃利用。

(3)透過組織間的合作，建立資訊交換平台，以共享科學研究成果及數據。

(4)透過定期舉辦專業人員訓練及相關研討會議，發展能力建構相關計畫。

(5)藉由定期舉辦座談會、科學家訪談及出版刊物，以促進區域性研究之互動與合作。

由於近年越南受到颱風季風影響日深，特大豪雨發生時有所聞，ACTS 也持續數年和越南討論會員體間的合作，包括人員培訓、協助建站、聯合監測等。未來 ACTS 將與中、美、日、韓、澳等國氣象與研究單位合作，從事基礎氣象科技研發，並成立資訊平台交換數據與經驗，提升預測防災能力，讓亞太經濟合作組織(APEC)會員體共享資源與經驗，增進對颱風災害的預測、應變能力。

圖 2. 亞太經濟合作颱風與社會研究中心

第二章 過程

一、行程與成員

本次赴越南河內市時間為 106 年 9 月 25 日至 9 月 28 日，共計 4 日，主要行程如下表:

日期	地區	行程概要及主要拜會人員
9/25(一)	台灣→ 越南河內	上午:搭機 下午:拜會越南資源環境部氣象水文暨氣候變遷研究院(IMHEN)，颱洪中心與 IMHEN 簽署合作備忘錄(副院長 Dr. Mai Van Khiem 及國際合作司 Ms. Tran Thanh Thuy)
9/26(二)	越南河內	上午:2017 ACTS Workshop 開幕(駐越南台北經濟文化代表處石瑞琦大使)及 keynote 演講 下午:2017 ACTS Workshop 演講及晚宴(石瑞琦大使)
9/27(三)	越南河內	上午: 2017 ACTS Workshop 演講及閉幕 下午:參訪河內防洪設施及越式林園
9/28(四)	越南河內 →台灣	上午:拜會越南農業與農村發展部防災總局(副總局長 Vu Xuan Thanh 及國際合作司長 Dr. Doan Thi TUyet Ng) 下午:搭機回程

台灣代表團成員計 18 人包括:

1. 國家實驗研究院台灣颱風洪水研究中心 黃清勇主任(團長)
2. 交通部中央氣象局 葉天降副局長
3. 交通部中央氣象局科技中心 鄭明典主任
4. 經濟部水利署 王藝峰副署長
5. 經濟部水利署十河局 林益生課長
6. 行政院農委會水土保持局土石流防災中心 尹孝元主任

7. 行政院農委會水土保持局 嚴曉嘉工程員
8. 國立台灣大學土木工程學系 林國峰教授
9. 國立台灣大學大氣科學系 周仲島教授
10. 國立海洋大學工學院 李光敦院長
11. 國立台北大學金融與合作經營學系 陳淑玲副教授
12. 國家實驗研究院台灣颱風洪水研究中心 鳳雷副主任
13. 國家實驗研究院台灣颱風洪水研究中心 楊尊華組長
14. 國家實驗研究院台灣颱風洪水研究中心 張龍耀副研究員
15. 國家實驗研究院台灣颱風洪水研究中心 何瑞益副研究員
16. 國家實驗研究院台灣颱風洪水研究中心 蔡金成助理研究員
17. 國家實驗研究院台灣颱風洪水研究中心 許玲瑋副技術師
18. 國家實驗研究院台灣颱風洪水研究中心 朱庭萱佐理研究員

二、行程紀要

(一)拜會越南資源環境部氣象水文暨氣候變遷研究院(IMHEN)與颱洪中心簽署合作備忘錄

106 年 9 月 25 日中午抵達越南河內市，由駐越南台北經濟文化辦事處李通藝科技參事帶領，旋即於下午拜會越南資源環境部氣象水文暨氣候變遷研究院，由副院長梅文謙(Dr. Mai Van Khiem)及國際合作司長 Ms. Tran Thanh Thuy 等接待，雙方先各自互相介紹與會人員，氣象水文暨氣候變遷研究院並簡要說明該院業務，隨後由颱洪中心黃清勇主任及該院副院長 Dr. Mai Van Khiem 簽署合作備忘錄，雙方將進一步建立與強化合作管道。

越南資源環境部氣象水文暨氣候變遷研究院(Vietnam Institute of Meteorology, Hydrology and Climate Change , IMHEN)，最早成立於 1977 年，經改制後目前是自然資源和環境部下的一個政府研究機構，主要從事氣象、氣候、氣候變化、農業

氣象、水文、水資源、海洋水文氣象等科學研究和技術開發。IMHEN 組織架構如圖 6，該院網站為 www.imh.ac.vn。

此外，值得一提的是，9 月 25 日抵達當日，適逢熱帶性低氣壓過境，河內地區下起大雨，道路及周邊地區均有不少淹水狀況，隨車駐越代表處人員表示，越南都市防洪排水設計保護標準較台灣低，故遇午後陣雨即有道路市區淹水災情傳出，颱風豪雨期間更常發生大範圍洪水與土石災害，台灣近年在都市防洪的經驗，不管是工程技術或非工程管制避災措施，在越南均有合作及推廣的機會，而駐越代表處也願意提供雙方連繫溝通的管道。

圖 3. 拜會越南氣象水文暨氣候變遷研究院

圖 4. 台灣颱洪中心與越南氣象水文暨氣候變遷研究院簽署 MOU

圖 5. 台灣代表團與越南氣象水文暨氣候變遷研究院人員合影

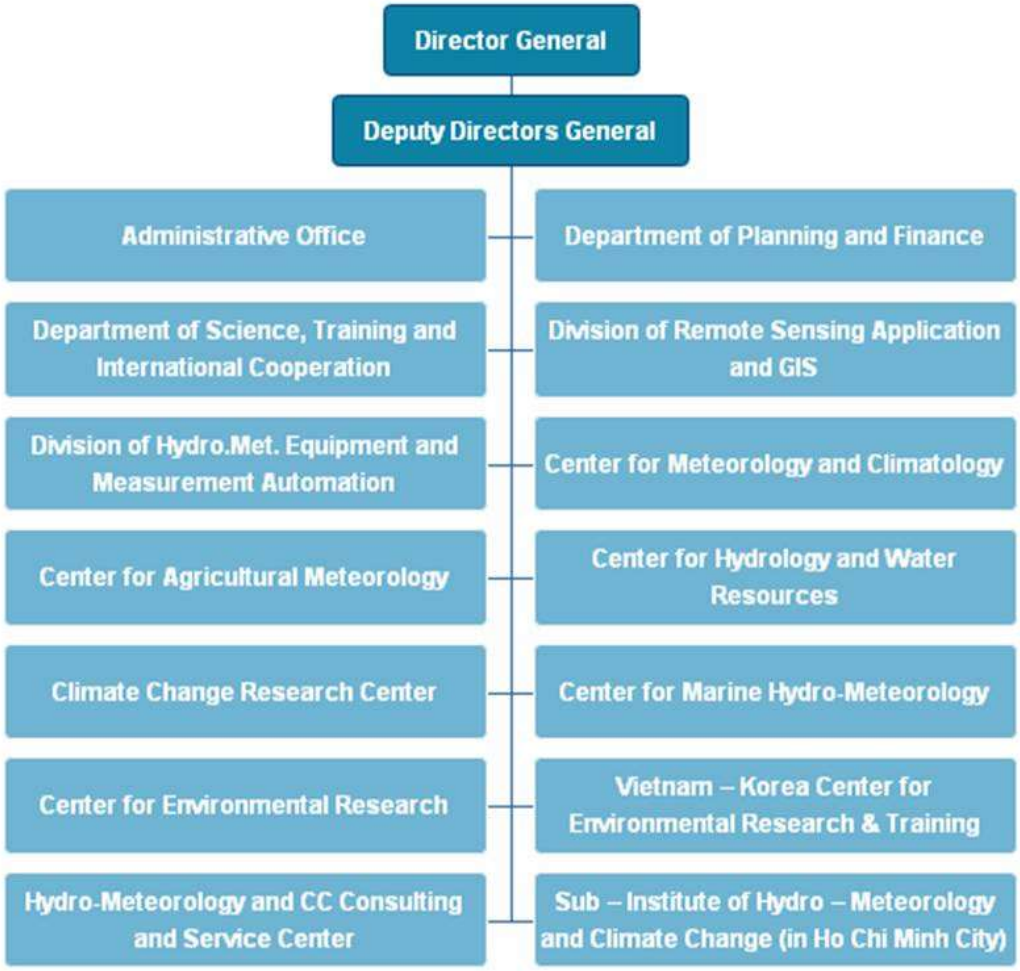

圖 6. 越南氣象水文暨氣候變遷研究組織架構

(二)「2017 亞太經濟合作颱風與社會研究中心(ACTS)，極端氣候預報及水資源管理研討會」開幕及晚宴，台越雙方進行交流

9 月 26 日上午 9 時起在越南河內華平飯店 (Hoa Binh Hotel)舉辦「2017 亞太經濟合作颱風與社會研究中心(ACTS)，極端氣候預報及水資源管理研討會」(2017 ACTS Workshop on Extreme Weather Forecast and Water Resources Management)，會議由越南資源環境部氣象水文暨氣候變遷研究院副院長梅文謙、駐越南台北經濟文化代表處石瑞琦大使及颱洪中心黃清勇主任分別致詞揭開序幕，並邀演講者合影。

本次會議由台灣、越南及菲律賓等國水利和氣象專家學者發表研究成果，計有 22 場次，各場次講者及題目詳如下表，演講簡報可於颱洪中心提供網址下載(http://www.apectyphoon.org/sdt175/img/img/3899/ACTS_Workshop_Agenda.htm)。

Time	26 September (Tue.)
08:30~09:00	**Registration**
09:00~09:20	**Opening Remarks** **Huynh Thi Lan Huong**, Deputy Director General, IMHEN, Viet Nam **H.E. Richard R.C. Shih**, Ambassador, TECO, Chinese Taipei **Ching-Yuang Huang**, CEO, ACTS, Chinese Taipei
09:20~09:30	**Group Photo**
09:30~10:10	Climate Change in Viet Nam: Observation and Projection **Mai Van Khiem**, IMHEN, Viet Nam
10:10~10:30	**Coffee Break**
10:30~11:10	**Keynote Speech 2** Typhoon and Cloudburst Disaster Management under Extreme Climate in Taiwan **Yi-Fung Wang**, WRA, Chinese Taipei
11:10~11:50	**Keynote Speech 3** An Overview of Typhoon WRF Model: Recent Developments **Tien-Chiang Yeh**, CWB, Chinese Taipei
11:50~13:00	**Lunch**

13:00~15:00	**Hydrology Session**
13:00~13:20	Flood Control Project and Flood Mitigation Strategies for Taipei Area **Yi-Sheng Lin**, WRA, Chinese Taipei
13:20~13:40	Runoff Estimation for Typhoon Storms in Ungauged Watersheds **Kwan Tun Lee**, NTOU, Chinese Taipei
13:40~14:00	Water Resources and Management Issues in Vietnam **Le Tuan Nghia**, IMHEN, Viet Nam
14:00~14:20	Dayu Smarter Flood Protection System **Josh Tsun-Hua Yang**, TTFRI, Chinese Taipei
14:20~14:40	Estimated Changes to Ba's River Flows in Southern Central Vietnam under a Changing Climate **Dang Quang Thinh**, IMHEN, Viet Nam
14:40~15:00	Spatio-temporal Assessment of Drought for Poorly Gauged Catchments using Remote Sensing Data: A Case Study of Vu Gia Thu Bon, Vietnam **Duong Du Bui**, NAWAPI, Viet Nam
15:00~15:20	**Coffee Break**
15:20~17:20	**Meteorology Session**
15:20~15:40	Convective Activity in Northern Cascade of Snow Mountain and Flash Floods in Taipei **Ben Jong-Dao Jou**, NTU, Chinese Taipei
15:40~16:00	Generation of Small Scale Features at Outer Regions of a Topical Cyclone Vortex in Numerical Models **Hiep Van Nguyen**, VAST, Viet Nam
16:00~16:20	Evaluation of NCEP CFS and its Downscaling for Seasonal Rainfall Prediction across Vietnam **Phan Van Tan**, HUS, Viet Nam
16:20~16:40	Preliminary Evaluations of Two-Week Tropical Cyclone (TC) Forecasts from the NCEP GEFSv11 Reforecasts by using the CWB TC Tracker **Ming-Dean Cheng**, CWB, Chinese Taipei

16:40~17:00	Simulation and Prediction of Summer Monsoon Climate over the Indochina Peninsula by RFM Model **Nguyen Ngoc Bich Phuong**, IMHEN, Viet Nam
17:00~17:20	A Multi-model Ensemble System for Typhoon Track, Precipitation and Wind Speed Prediction in Taiwan **Chin-Cheng Tsai**, TTFRI, Chinese Taipei
18:00~20:00	**Welcome Banquet (Hosted by the ACTS), Hoa Binh Hotel, Hanoi, Viet Nam**

水利署王藝峰副署長負責第二場 40 分鐘 Keynote Speech，講題為「極端氣候下臺灣颱風與暴雨災害管理」(Typhoon and Cloudburst Disaster Management under Extreme Climate in Taiwan)，主要介紹台灣面臨颱風強降雨的挑戰，已成功地進行災害管理、發展洪災預警系統、洪水災害圖地等技術。未來十年，台灣將會提升城市抗洪能力，結合 ICT / IOT 促進智慧水災管理，以減輕氣候變遷帶來的危害。他特別向與會各國代表強調願意分享上述豐富的經驗，也期望未來與越南合作及開發新技術。

水利署第十河川局林益生課長則於當日下午簡報「台北地區的防洪工程及防洪減災策略」(Flood control project and flood mitigation strategies for Taipei area)，主要說明台灣台北地區防洪作為，除了工程設施外，特別介紹淡水河流域水情中心的即時水情觀測、洪水預警及水情推播等，藉由各種非工程措施達到減災避災的成果。

晚間於河內華平飯店(Hoa Binh Hotel)餐廳舉辦歡迎晚宴，台、越、菲各國人員參加踴躍，駐越南台北經濟文化代表處石瑞琦大使亦全程參與，席間王副署長特別邀請水文暨氣候變遷研究院副院長梅文謙來台訪問進一步交流，梅副院長表示曾來過台灣參加研討會，並拜訪氣象局，他從今日簡報中瞭解台灣在防洪防災上有很多值得越南借鏡之處，將再安排機會來台，參觀水利防災業務，王藝峰副署長除表達竭誠歡迎外，亦允諾屆時將安排參訪水利設施行程。

圖 7. 極端氣候預報及水資源管理研討會開幕合影

圖 8. 駐越南台北經濟文化代表處石瑞琦大使致詞

圖 9. 極端氣候預報及水資源管理研討會場

圖 10. 水利署王藝峰副署長演講

圖 11. 水利署第十河川局林益生課長簡報及問答

圖 12. 歡迎晚宴，王藝峰副署長與石大使、IMHEN 副院長等同桌

(三)「2017 ACTS 極端氣候預報及水資源管理研討會」閉幕及參訪

9 月 27 日上午繼續極端氣候預報及水資源管理研討會，本日會議議程、演講者及講題，詳如下表：

Time	27 September (Wed.)
08:30~08:50	**Registration**
08:50~09:30	**Keynote Speech 4** The Short-term Inundation Forecasting during Typhoons **Gwo-Fong Lin**, NTU, Chinese Taipei
09:30~09:50	**Coffee Break**
09:50~11:50	**Disaster Mitigation Session**
09:50~10:10	Assessment of Saltwater Intrusion Vulnerability in the Coastal Aquifers of Ninh Thuan Province in the Context of Climate Change **Pham Quy Nhan**, HUNRE, Viet Nam
10:10~10:30	Bayesian Inference for Extreme Values: Implication for Extreme Sea-level Studies in the East Sea of Viet Nam **Pham Tien Dat**, IMHEN, Viet Nam
10:30~10:50	Nationwide Decision Support System for Debris Flow Disaster Management in Taiwan **Hsiao-Yuan Yin**, SWCB, Chinese Taipei
10:50~11:10	Development of Physical-based Rainfall-runoff Model and Shallow Landslide Model **Jui-Yi Ho**, ACTS/TTFRI, Chinese Taipei
11:10~11:30	Validation of Landfall Intensity of Typhoon "Ferdie" (Meranti) over Extreme Northern Luzon **Christopher F. Perez**, PAGASA, the Philippines
11:30~11:50	The Engineering and Disaster Prevention Since 1999 Earthquake (Ml=7.3) in Jiufengershan, Central Taiwan **Hsiaochia Yen**, SWCB, Chinese Taipei
11:50~12:00	**Closing Remarks**
12:00~13:30	**Lunch**
14:00~18:00	**Field Study**
18:30~21:00	**Dinner**

本日計有7場次講題，主要為減災議題，講者包含台灣、越南及菲律賓專家學者，持續前一天藉由提問與中場茶敘，與會人員展開交流與討論。

會議至本日中午結束，下午代表團安排越式林園參訪 Viet Phu Thanh Chuong

(Thanh Chuong Viet Palace)，由越南最知名藝術家--阮陳章 Nguyen Thanh Chuong 於 2001 年建立越式林園，越南各地搜集而來的百年、甚至千年的古董，有石頭、陶瓷、佛像、銅器等，遍佈園內四處，展示許多有關越南建築特色、古今藝術、文化傳統等蒐藏，可說是匯聚了整個越南文化傳統精粹。

圖 13. 提問與討論情形

圖 14. 茶敘及交流情形

圖 15. 參訪越式林園合影

值得一提的是，途中經過越南河內市紅河堤防，堤防高度約 2~4 公尺間，從堤防看去兩側均蓋滿住家及商店，堤外(靠河道高灘地側)甚至有旅社、超市、汽車展示中心等(圖 16.及圖 17.)，從 Google map 航拍圖初步測量距離，堤防至紅河河道主深槽距離約 1500 公尺(兩岸堤防間距離約 3 公里)，其中靠近堤防約 500 公尺寬度內有大量建築物。颱風洪水來襲時堤外地區人員車輛如何撤離河川？政府如何預測洪水到達時間適時通知民眾疏散？撤離執行流程？房屋如何保全？旅社等商家是否為合法建物？洪災損失如何減少？均值得進一步瞭解。

在隔天 9 月 28 日上午拜會越南防災總局時，有特別向該局人員請教上述現象成因與因應方式，防災總局表示堤防外高灘地居住人口估計超過 100 萬人，因 30 年前興建堤防時形成，規劃是希望讓該區住家慢慢搬遷進入市區，以減少洪災損失，但一直未有具體進展。

此外，堤外地區與市區間亦有許多道路直接穿過堤防，該部分並未如台灣常見會設置疏散門(平時開啟供通行，颱風時關閉)，而形成防洪缺口。台灣台北地區淡水河高灘地雖然沒有大量住宅，但有眾多河濱公園與停車場，颱風來襲時已經建立一套標準作業流程，讓堤外人車可以及時撤出河道，相關雨量、水位即時觀測與洪水預警、疏散撤離 SOP 等，應該可以與越南防洪單位交換經驗與推廣。

紅河(越南語：Sông Hồng／瀧紅，Sông Cái)，又名珥河，為跨中國、越南水系，也是越南北部最大河流，呈西北-東南流向，全長 1280 公里，越南境內長 508 公里，流域面積 75700 平方公里；中國境內長 627 公里，流域面積 76276 平方公里。紅河年平均流量為 2,640 立方米/秒（河口），但水流量不均勻，在枯水期，流量降至 700m³/ s 左右，雨季可達 30,000m³/ s。

圖 16. 越南河內市紅河堤防，堤防外河道高灘地有大量房屋

圖 17.河內市紅河堤防兩側均蓋滿住家商店(圖片來源: www.google.com.tw)

圖 18. 越南河內市紅河堤防牆面以馬賽克圖案美化，中間並有植栽槽

(四)拜會越南農業與農村發展部防災總局洽商未來合作方式

9 月 28 日上午前往拜會越南農業與農村發展部防災總局(Vietnam Disaster Management Authority)，由該局副總局長武春成(Vu Xuan Thanh)及國際合作司長 Dr. Doan Thi TUyet Ng 接待，雙方除互相介紹與會人員外，亦簡要說明業務職掌，雙方並初步洽商未來合作方式及邀請該局人員來台訪問與交流。

越南防災總局隸屬於農業和農村發展部（Ministry of Agriculture and Rural Development，MARD），現任局長是 Mr. Trần Quang Hoài 先生(曾任水資源管理局副局長)，該局是近年剛從農業和農村發展部的水資源管理局獨立出來的一個新的部門。主要職掌為農業和農村發展部長提供諮詢、預防和處理各項災害。主要部門如下：1.計畫和財務部。2.科學技術和國際合作司。3.法律部和監察局。4.自然災害管理司。5.災害管理部。6.堤壩管理部。7.總務處。8.自然災害預防和應對部門。9.自然災害防治政策與技術中心。該局網站為：http://phongchongthientai.vn/。

圖 19. 拜會越南農業與農村發展部防災總局(牆上為紅河流域圖)

圖 20. 水利署王藝峰副署長(左)與防災總局武春成副總局長(右)合影

圖 21. 與越南防災總局人員於該局合影

圖 22. 防災總局旁即為越南水資源管理局 Directorate of Water Resources(WRD)

防災總局一旁即為同樣隸屬於越南農業和農村發展部的水資源管理局(Directorate of Water Resources , WRD)，但因為下午即需趕赴機場搭機返台，行程已無餘裕時間可再安排拜會該局，殊為可惜！建議後續可特別針對水資源管理局安排較深入的拜會與交流活動，使台灣與越南水利主管單位建立更密切合作關係。

越南水資源管理局(Directorate of Water Resources , WRD) 主要協助農業和農村發展部部長對越南領土和領海內的雨水、地表水、地下水和海水等水資源進行管理。該局權責簡述如下：

1.制定法律文件、政策，長期、5 年和年度計畫。

2.制定水資源管理的程序、程序、標準、技術經濟規範。

3.向部長提交並取得同意其水資源基礎調查工作任務。

4. 制定水源保護措施，控制和防止水資源惡化和污染。

5.管理基本調查結果，水資源清查和評估；開發國家水資源數據和信息交換。

6.勘察、勘探、開發利用水資源；廢水排放許可證的頒發。

7.水資源領域的國際合作。

8.處理有關水資源的糾紛。

最後，從本次研討會及交流過程中，越方人員提供越南有關水資源的各項統計資料如下：

1.年平均降雨量 1,960mm。

2.全部河流年流量約 8400~8500 億立方公尺。

3.湄公河流域總逕流量佔全國逕流量的 59%，其次是紅河，佔 14.9%。

4.越南超過 10 公里且常年有流量的河流有約 2378 條。

5.有 15 條河川流域面積超過 2500 平方公里，其中 10 個流域面積超過 1 萬平方公里，這些佔越南總面積的 80%。

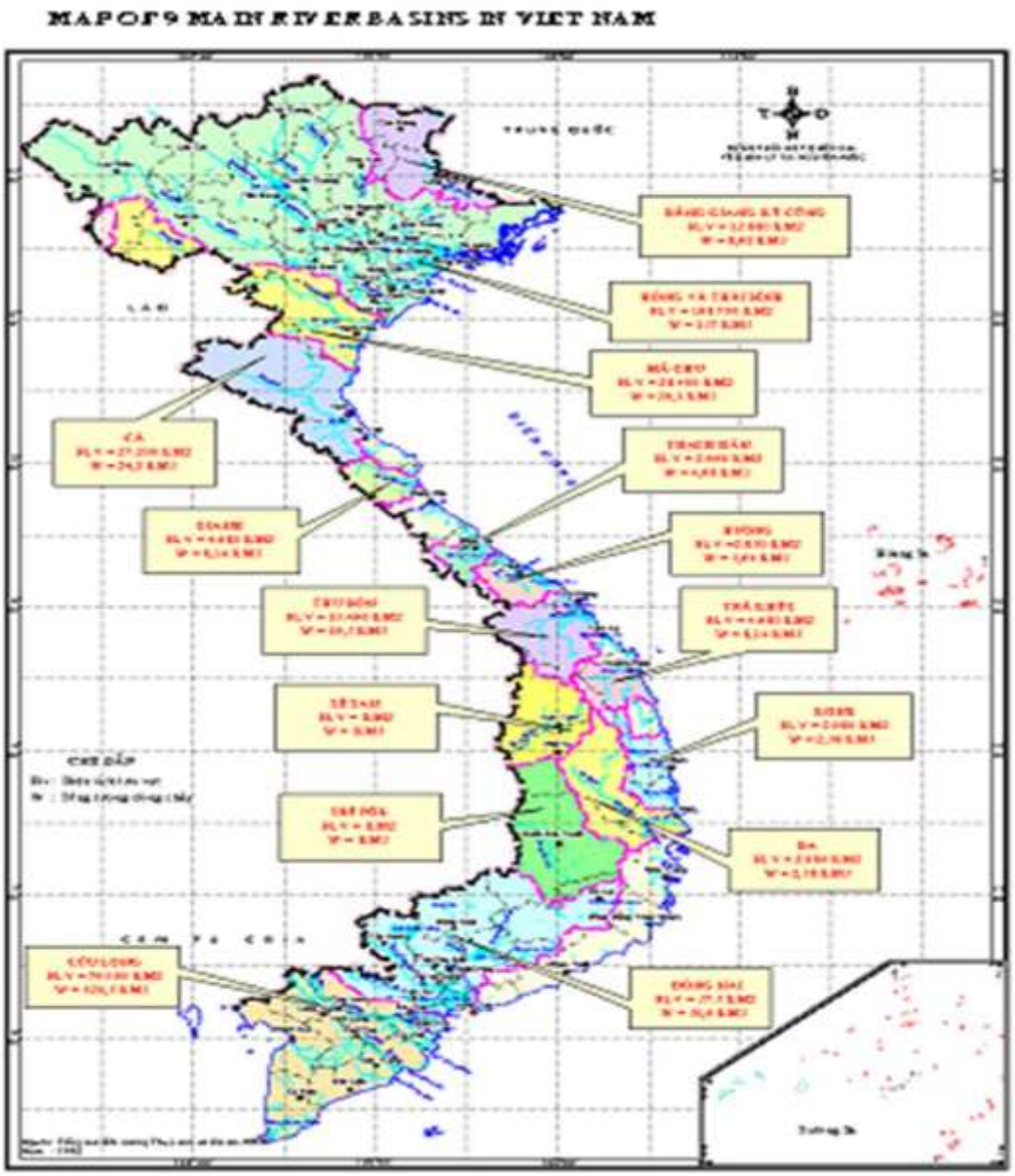

圖 23. 越南主要河川與流域圖

第三章 心得及建議

隨著東協及南亞國家等新興市場國家迅速崛起，而同為亞太地區的臺灣，經濟發展與區域內許多國家具有高度關聯性，故行政院已依據總統「新南向政策」政策綱領，提出「新南向政策推動計畫」，全方位發展與東協、南亞及紐澳等國家的關係，促進區域交流發展與合作，打造臺灣經濟發展的新模式。

本次赴越南河內四天，除參加由台灣颱風洪水研究中心(TTFRI)與越南資源環境部氣象水文暨氣候變遷研究院(IMHEN)共同舉辦的「極端氣候預報及水資源管理研討會」(2017 ACTS Workshop on Extreme Weather Forecast and Water Resources Management)外，亦分別前往拜會越南氣象水文暨氣候變遷研究院(Vietnam Institute of Meteorology, Hydrology and Climate Change , IMHEN)及越南農業與農村發展部防災總局(Vietnam Disaster Management Authority)，交流台越雙方近年防災經驗與作為，台灣代表團包括水利署、氣象局、水保局等政府單位與颱洪中心、學校等代表，透過官方與非官方多元接觸，已達成強化台越雙邊的合作關係，並提高台灣防災實力國際能見度的目標。

臺灣每年都面對颱洪災害，而每次災害都讓臺灣防洪治水等技術邁前一步與累積寶貴經驗。經濟部水利署在水庫排砂、防洪治水及智慧防災技術等經驗，已站上全球水利科技的領先群，目前水利署積極推動分享臺灣經驗，進而拓展水利產業市場，本次交流已跨出關鍵的第一步。

另外，水利署第十河川局經過 20 餘年的發展，在淡水河已發展出即時、穩定的洪水預警系統，可透過自動化水情收集，每 10 分鐘即更新預報未來 6 小時全河段各處的洪水位高度，透過地圖介面清楚展示，幫助防汛人員迅速做出正確的應變作為；而越南不管是湄公河、紅河等許多河流，不似台灣河川洪水到達時間非常短(所以淡水河只預報未來 6 小時)，因此更適合這套洪水預報系統，可以對未來水位做較長時間的預報，像河內市區紅河堤防外大量人車的疏散撤離，更能及早預警應變，發揮更大減災避災功效。

106 年 8 月 4 日越南廣寧省、北寧省與永福省領導參訪團亦曾來台灣，並且至水利署第十河川局淡水河水情中心參觀，對上述水情中心功能與運作方式，均表達合作興趣。

最後，特別感謝台灣颱風洪水研究中心舉辦本次研討會及安排各項行程，也要誠摯感謝駐越南台北經濟文化辦事處李通藝科技參事協助帶領與連繫事宜，讓此次行程順利圓滿，達成預定成果目標。

圖 24. 駐越南台北經濟文化辦事處報導本次會議新聞稿

附 錄 1.

研討會手冊(含講者簡歷及講題摘要)

2017 ACTS Workshop on
Extreme Weather Forecast and Water Resources Management

September 26-27, 2017
Hoa Binh Hotel, Hanoi, Viet Nam

Handbook

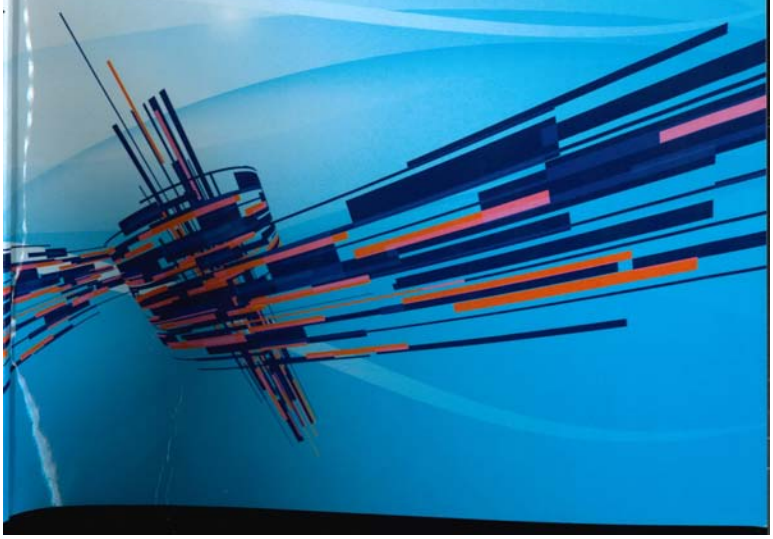

Table of Content

Keynote Speakers

Mai Van Khiem

Deputy Director General
Vietnam Institute of Meteorology, Hydrology and Climate Change
Vietnam

Yi-Fung Wang

Deputy Director General
Water Resources Agency
Ministry of Economic Affairs
Chinese Taipei

Tien-Chiang Yeh
Deputy Director General
Central Weather Bureau
Ministry of Transportation and Communications
Chinese Taipei

Gwo-Fong Lin

Distinguished Professor
Department of Civil Engineering
National Taiwan University
Chinese Taipei

Speakers

Yi-Sheng Lin

Chief of Construction Session
10th River Management Office
Water Resources Agency
Ministry of Economic Affairs
Chinese Taipei

Kwan Tun Lee

Distinguished Professor
Department of River and Harbor Engineering
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Le Tuan Nghia

Researcher
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Josh Tsun-Hua Yang

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Taiwan Typhoon and Flood Research Institute
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Dang Quang Thinh

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Climate Change Research Center
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National Center for Water Resources Planning and Investigation at Ministry of Natural Resources and Environment
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Center for Marine HydroMet Research
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Philippine Atmospheric Geophysical and Astronomical Services Administration
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Hsiaochia Yen

Engineer
Research and Technology Development Team
Soil and Water Conservation Bureau
Council of Agriculture
Chinese Taipei

2017 ACTS Workshop on Extreme Weather Forecast and Water Resources Management

26-27 September, 2017
Hoa Binh Hotel, Hanoi, Viet Nam

Time	26 September (Tue.)
08:30~09:00	**Registration**
09:00~09:20	**Opening Remarks** **Huynh Thi Lan Huong**, Deputy Director General, IMHEN, Viet Nam **H.E. Richard R.C. Shih**, Ambassador, TECO, Chinese Taipei **Ching-Yuang Huang**, CEO, ACTS, Chinese Taipei
09:20~09:30	**Group Photo**
09:30~10:10	**Keynote Speech 1** Climate Change in Viet Nam: Observation and Projection **Mai Van Khiem**, IMHEN, Viet Nam
10:10~10:30	**Coffee Break**
10:30~11:10	**Keynote Speech 2** Typhoon and Cloudburst Disaster Management under Extreme Climate in Taiwan **Yi-Fung Wang**, WRA, Chinese Taipei
11:10~11:50	**Keynote Speech 3** An Overview of Typhoon WRF Model: Recent Developments **Tien-Chiang Yeh**, CWB, Chinese Taipei
11:50~13:00	**Lunch**
13:00~15:00	**Hydrology Session**
13:00~13:20	Flood Control Project and Flood Mitigation Strategies for Taipei Area **Yi-Sheng Lin**, WRA, Chinese Taipei
13:20~13:40	Runoff Estimation for Typhoon Storms in Ungauged Watersheds **Kwan Tun Lee**, NTOU, Chinese Taipei

13:40~14:00	Water Resources and Management Issues in Vietnam **Le Tuan Nghia**, IMHEN, Viet Nam
14:00~14:20	Dayu Smarter Flood Protection System **Josh Tsun-Hua Yang**, TTFRI, Chinese Taipei
14:20~14:40	Estimated Changes to Ba's River Flows in Southern Central Vietnam under a Changing Climate **Dang Quang Thinh**, IMHEN, Viet Nam
14:40~15:00	Spatio-temporal Assessment of Drought for Poorly Gauged Catchments using Remote Sensing Data: A Case Study of Vu Gia Thu Bon, Vietnam **Duong Du Bui**, NAWAPI, Viet Nam
15:00~15:20	**Coffee Break**
15:20~17:20	**Meteorology Session**
15:20~15:40	Convective Activity in Northern Cascade of Snow Mountain and Flash Floods in Taipei **Ben Jong-Dao Jou**, NTU, Chinese Taipei
15:40~16:00	Generation of Small Scale Features at Outer Regions of a Topical Cyclone Vortex in Numerical Models **Hiep Van Nguyen**, VAST, Viet Nam
16:00~16:20	Evaluation of NCEP CFS and its Downscaling for Seasonal Rainfall Prediction across Vietnam **Phan Van Tan**, HUS, Viet Nam
16:20~16:40	Preliminary Evaluations of Two-Week Tropical Cyclone (TC) Forecasts from the NCEP GEFSv11 Reforecasts by using the CWB TC Tracker **Ming-Dean Cheng**, CWB, Chinese Taipei
16:40~17:00	Simulation and Prediction of Summer Monsoon Climate over the Indochina Peninsula by RFM Model **Nguyen Ngoc Bich Phuong**, IMHEN, Viet Nam
17:00~17:20	A Multi-model Ensemble System for Typhoon Track, Precipitation and Wind Speed Prediction in Taiwan **Chin-Cheng Tsai**, TTFRI, Chinese Taipei
18:00~20:00	**Welcome Banquet (Hosted by the ACTS), Hoa Binh Hotel, Hanoi, Viet Nam**

Time	27 September (Wed.)
08:30~08:50	**Registration**
08:50~09:30	**Keynote Speech 4** The Short-term Inundation Forecasting during Typhoons **Gwo-Fong Lin**, NTU, Chinese Taipei
09:30~09:50	**Coffee Break**
09:50~11:50	**Disaster Mitigation Session**
09:50~10:10	Assessment of Saltwater Intrusion Vulnerability in the Coastal Aquifers of Ninh Thuan Province in the Context of Climate Change **Pham Quy Nhan**, HUNRE, Viet Nam
10:10~10:30	Bayesian Inference for Extreme Values: Implication for Extreme Sea-level Studies in the East Sea of Viet Nam **Pham Tien Dat**, IMHEN, Viet Nam
10:30~10:50	Nationwide Decision Support System for Debris Flow Disaster Management in Taiwan **Hsiao-Yuan Yin**, SWCB, Chinese Taipei
10:50~11:10	Development of Physical-based Rainfall-runoff Model and Shallow Landslide Model **Jui-Yi Ho**, ACTS/TTFRI, Chinese Taipei
11:10~11:30	Validation of Landfall Intensity of Typhoon "Ferdie" (Meranti) over Extreme Northern Luzon **Christopher F. Perez**, PAGASA, the Philippines
11:30~11:50	The Engineering and Disaster Prevention Since 1999 Earthquake (Ml=7.3) in Jiufengershan, Central Taiwan **Hsiaochia Yen**, SWCB, Chinese Taipei
11:50~12:00	**Closing Remarks**
12:00~13:30	**Lunch**
14:00~18:00	**Field Study**
18:30~21:00	**Dinner**

Dr.		Deputy Director General
Mai Van Khiem		**Viet Nam Institute of Meteorology, Hydrology and Climate Change (IMHEN)**
		Email: maikhiem77@gmail.com

Biography

Dr. Mai Van Khiem has a Ph.D. degree in Environmental Engineering from the University of Tokyo, Japan (2010). He is presently researcher at Vietnam Institute of Meteorology Hydrology and Climate Change. His research is focus on climate change and variability, natural hazards assessment, tropical cyclones, weather and climate prediction.

Education

- 2010 PhD (Environmental engineering), The University of Tokyo, Tokyo
- 2003 M.Sc. (Meteorology and climatology), Hanoi University of Science
- 2001 B.Sc. (Meteorology and climatology), Hanoi University of Science

Work Experience (most recent)

- 10/2010 – present: Viet Nam Institute of Meteorology, Hydrology and Climate Change, Hanoi
- 5-7/2012: Met Office, United Kingdom, Climate change modeling and analysis, Visiting scientist
- 4- 9/2010: Institute of Industrial Science, the University of Tokyo (IIS), Tokyo, urban climate modeling
- 2001 – 2006: The Meteorology and Climatology Research Center , IMHEN, Hanoi Climate Scientist

Research Interests

- Climate change and variability
- Natural hazards assessment
- Tropical cyclones, weather and climate prediction

Climate Change in Viet Nam: Observation and Projection

Tran Thuc, Nguyen Van Thang, Huynh Thi Lan Huong, Mai Van Khiem, Nguyen Xuan Hien, Vu Van Thang

Vietnam Institute of Meteorology Hydrology and Climate Change

Abstract

In 2016, climate change and sea level rise scenarios for Viet Nam were updated. Dynamical downscaling method based on five high-resolution regional climate models is used, including: AGCM / MRI, PRECIS, CCAM, RegCM, and clWRF. Each RCM is driven by GCMs from IPCC AR5 (IPCC, 2013). The employment of several downscaling members would help on decreasing in uncertainty of model projection. Sea level rise scenarios for coastal area of Viet Nam is built on the basis of the IPCC method (AR5) and the findings of Church et al (2013) and Slagen et al (2014).

According to these scenarios, mean annual surface air temperature will likely increase over all regions in Vietnam when compared with the baseline 1986-2005, based on two scenarios RCP4.5 and RCP8.5. The increased trend in the North will be faster than in the South. According to the RCP4.5 scenario (middle), surface air temperature will likely increase in a range of 1.3 to 1.7°C at the mid-21st century (2046-2065) and in a range of 1.7 to 2.4°C at the end of the 21st century. For the highest scenario RCP8.5, surface air temperature will likely increase in a range of 1.8 to 2.3°C at the mid-21st century and in a range of 3.0 to 4.0°C at the end of the 21st century. Averaged minimum and maximum surface air temperatures will likely increase markedly in both scenarios.

Annual rainfall will likely increase over the whole country for both scenarios. Under RCP4.5 scenario, rainfall will likely increase between 5 and 15% at the mid-21st century and the end of the 21st century. For the highest scenario RCP8.5, the increased trend of rainfall will likely be in the same level of the RCP4.5 scenario. Noticeably, rainfall will likely increase of above 20% in most of the North, Central Central Vietnam, apart of the South Vietnam and Central Highlands. Averaged maximum 1-day and 5-day rainfall will likely increase from 20 to 60% over the whole country.

Future projection show that the number of extreme cold days in the North will likely decrease for both scenarios, the number of maximum temperatures ($Tx \geq 35°C$) will likely increase over most of the country, especially in North Central Coast Vietnam. Drought can be severer in the spring and summer of South Central Vietnam, in the spring of South Vietnam and in the summer of North Vietnam.

Regarding sea levels, Vietnam's sea levels are likely to rise 22 cm (14 cm ÷ 32 cm) by the middle of the 21st century and 53 cm (32 cm ÷ 76 cm) by the end of the 21st century as compared with the period of 1986-2005, this would cause severe flooding and salt intrusion in coastal areas and deltas of Viet Nam, resulting in millions of people having to move their housings and agricultural/aquaculture production being seriously reduced.

For use of climate change scenarios information, it is note that climate change scenarios remain uncertainties which depend on the emission scenarios, understanding of global and regional climate systems, ice melting, construction of climate change scenarios and mathematical models. Climate models have been developing to enhance certainty of climate change scenario. The scenarios will be updated continuously following scheduler of IPCC. Thus, assessment of impacts and vulnerability should be reviewed and up-to-date when updated scenarios are published.

Dr.		Deputy Director General
Yi-Fung Wang		Water Resources Agency
		Email: fluidwang@gmail.com

Biography

Working for Water Resources Agency (WRA) more than 20 years, Water policy planning, source water conservation and typhoon-cloudburst disaster management are my major responsibilities. I established complete disaster management framework for WRA, innovated a new inundation early warning system, promoted flood routing technology and draw Taiwan flood hazard maps (risk map) when being the Chief of Water Disaster Mitigation Center. Experienced in international exchanges and is passionate about sharing Taiwan's disaster prevention, water conservation and catchment conservancy experiences.

Education

- 1989-1994, Ph.D. Department of Civil Engineering, National Taiwan University
- 1987-1989, M.S. Department of Civil Engineering, National Taiwan University
- 1983-1987, Bachelor, Department of Hydraulic Engineering, National Cheng-Kung University

Work Experience (most recent)

- 2015.7-2016.11, Chief Secretary, Water Resources Agency.
- 2011.2-2015.6, Chief of Water Conservation Division, Water Resources Agency.
- 2008.3-2011.1, Chief of Water Disaster Mitigation Center, Water Resources Agency
- 1994.7-1995.6, Post-Doctor Researcher, Department of Civil Engineering, National Taiwan University.

Research Interests

- Water policy planning
- Disaster mitigation and risk management
- Source water and catchment conservation
- Computational fluid dynamics

Typhoon and Cloudburst Disaster Management under Extreme Climate in Taiwan

Yi-Fung Wang
Water Resources Agency

Abstract

Taiwan and Southeast Asia Nations all belong to Monsoon Asia. We have Typhoon in summer and monsoon during winter to spring. Averagely, there are 3 to 4 typhoons make landfall in Taiwan every year and result seriously damages. Under extreme climate, Researches show that the number of rainy days (less than 130mm/day) would decrease 14% but that of heavy-rain days (more than 130mm/day) would increase 15% by the end of 21st century. Typhoon and Cloudburst disaster management must be improved to adopt such challenges.

After Typhoon Morakot 2009, Taiwan already established a successful disaster management framework, innovated many early warning system for flood and inundation. We also developed accurate flood routing and flood hazard maps (risk map) technologies. In the next decade, Taiwan will promote urban flood resilience and develop smart water disaster management projects by combing ICT/IOT to mitigate hazard from climate change.

We are willing to share the rich experience of typhoon and cloudburst disaster management with Vietnam. Taiwan also expects to cooperate with Vietnam for developing new technology in the future.

Dr.		Deputy Director-General
Tien-Chiang Yeh		Central Weather Bureau
		Email: yeh@cwb.gov.tw

Biography

Dr. Tien-Chang Yeh is the Deputy Director-General of the Central Weather Bureau (CWB). He has been working for the CWB for over 30 years. Before being the Deputy Director-General, he took positions as Section Chief, Technical Specialist, Deputy Director, Director, and Chief Secretary. He was the Director of the CWB Planning Division and the Director of the Weather Forecast Center before promoted to Deputy Director-General in 2010.
Dr. Yeh graduated from the Department of Meteorology at the Naval Postgraduate School in Monterey, California, USA. During his graduate studies, he gained a great deal of expertise in numerical analysis and modeling on tropical cyclones. Dr. Yeh has written numerous technical reports and research papers. Many of his works are published in renowned journals. He has been involved in domestic and international large-scale field projects in related area over the last decade.

Education

- M.S., Graduate Institute of Geophysics, National Central University, Taiwan.
- Ph. D., Department of Meteorology, Naval Postgraduate School, Monterey CA, USA.

Work Experience (most recent)

- Deputy Director, Meteorological Information Center, Central Weather Bureau.
- Director, Weather Forecast Center, Central Weather Bureau.
- Director, Planning Division, Central Weather Bureau.
- Chief Secretary, Central Weather Bureau

Research Interests

- Typhoon
- Numerical weather prediction

An Overview of Typhoon WRF Model: Recent Developments

Tien-Chiang Yeh[1], Der-Song Chen[1], Jing-Shan Hong[1]
Ling-Feng Hsiao[2], Chun-Teng Cheng[1], I-Han Chen[1], Esperanza O. Cayana[3]

[1]Central Weather Bureau, Taipei, Taiwan
[2] Taiwan Typhoon and Flood Research Institute, Taipei, Taiwan
[3] Philippine Atmospheric Geophysical and Astronomical Services Administration, Manila, Philippines

Abstract

Numerical weather prediction models have been applied in most of the weather forecast centers to improve the weather forecast. However, high mountains and complex terrain distribution degrade the accuracy of the model forecasts in lower model resolution. For providing guidance in tropical cyclone track and rainfall forecasts, Taiwan's Central Weather Bureau has developed and implemented a version of the Advanced Research Weather Research and Forecasting Model, named Typhoon WRF (TWRF) for operational usage. Recently the model horizontal resolutions has been improved from grid intervals 45/15/5 km to 15/3 km, and the vertical resolutions also has been increased from 45 levels to 52 levels.

In this report, overview of TWRF, TWRF track forecast error statistics, and the major milestones of the TWRF developments in the past few years will be introduced. Results of applying the TWRF in the forecast of 2 tropical cyclones rainfall events in Philippines area will also be introduced. The two events are Typhoon Koppu (2015) over Central Luzon and Typhoon Melor (2015) over Central Philippines. The results show the TWRF model is able to simulate the scenarios of both Typhoon Koppu and Typhoon Melor invaded Philippines. The timing and the amount of the heavy and long lasting rainfall in Western Luzon (774 mm in 24 hours at Baquio) during Koppu invasion was simulated reasonable well by TWRF. The heavy rains occurred over the islands of Central Philippines when Melor was passing from the east, and the heavy rains over the Eastern Luzon after Melor weakened in west of Philippines were all well simulated by TWRF.

The prediction of the extreme rainfalls is of most important and challenge. The key to further improve the model, particularly to improve the short-duration extreme rainfall events, depends on a better data assimilation system to assimilate the radar observation. In this report, brief introduction of some radar data assimilation experiments performed at the Central Weather Bureau will be given.

Prof.		Distinguished Professor
Gwo-Fong Lin		**Department of Civil Engineering, National Taiwan University**
		Email: gflin@ntu.edu.tw

Biography

Prof. Lin is currently a Distinguished Professor in the Department of Civil Engineering at the National Taiwan University, and serves as senior adviser at the Taiwan Typhoon and Flood Research Institute. He is also a Fellow of the Chinese Institute of Civil and Hydraulic Engineering. He received his B.Sc. degree from National Taiwan University, M.Sc. degree from Asian Institute of Technology, and Ph.D. degree from University of Pittsburgh. He was the Chairman of the Civil Engineering Department and Director of the Hydrotech Research Institute at National Taiwan University, and was elected as Hydrological Sciences Section President of the AOGS for 2011-2014. He has received various honors and awards. He has been invited to serve in various international expert committees, scientific journal editors (AOGS Geoscience Letters, IAHR-IWA-IAHS Journal of Hydroinformatics, etc.) as well as to deliver keynote lectures at many scientific conferences. Prof. Lin has made outstanding scientific and professional contributions over more than 35 years in the areas of Hydrological Science and Engineering.

Education

- Ph.D., Civil Engineering, University of Pittsburgh, PA, USA.
- M.Sc., Water Resources Engineering, Asian Institute of Technology, Thailand.
- B.Sc., National Taiwan University

Work Experience (most recent)

- Distinguished Professor, Department of Civil Engineering, National Taiwan University
- President, Hydrological Science Section, Asia Oceania Geosciences Society
- Senior adviser, Taiwan Typhoon and Flood Research Institute

Research Interests

- Stochastic Hydrology
- Inundation Forecasting
- Rainfall forecasting
- Application of AI Techniques
- Hydroinformatics
- Computational Hydraulics

The Short-term Inundation Forecasting during Typhoons

Gwo-Fong Lin

Department of Civil Engineering, National Taiwan University

Abstract

Typhoons are among the most devastating of natural disasters. The inundation resulting from typhoons frequently leads to serious disasters such as loss of life and property, and economic impacts. During typhoons, accurate forecasts of hourly inundation depths are essential for inundation warning and mitigation. The issue of short-term real-time typhoon flood inundation forecasting is addressed herein. Sufficient data are not available for developing inundation forecasting models because of the lack of observed data of inundation maps. The inundation depths, which are simulated and validated by a physically based two-dimensional model, are used as a database for inundation forecasting. A two-stage inundation forecasting model is proposed to yield 1- to 6-h lead-time inundation maps during typhoons. Actual application is conducted to demonstrate the superiority of the proposed model. The proposed model provides reasonable spatial inundation forecasts, and is able to deal with the nonlinear relationships between inputs and desired output. In conclusion, the proposed model is suitable and useful for inundation forecasting.

Mr.		Chief
Yi-Sheng Lin		**Construction Section, 10th River Management Office, Water Resources Agency, Ministry of Economic Affairs**
		Email: wra10075@wra10.gov.tw

Biography

I am 46 years old, and have had 19-year experience at the 10th River Management Office since 1998. From 1998 to 2005, I was primarily responsible for the Keelung River Improvement Project and Yuanshanzi Flood Diversion tunnel. Then from 2005 to 2014, I was responsible for survey and design of flood control facilities, administrate and supervising construction affairs, water resources and conservancy affairs, planning of basic hydrological measurements and surveys, analysis and management of hydrologic data.

Education

- 1993 B.A., Department of Soil and Water Conservation, National Chung Hsing University.
- 1995 M.A., Department of Civil Engineering, National Taiwan University

Work Experience (most recent)

- 2017- Present, Chief of Construction Section
- 2014-2017, Chief of Planning Section
- 1998-2017, The 10th River Management Office

Research Interests

- Leakage Singularities of Axisymmetric Flow Produced in a Closed Cylindrical Container by a Rotating Disk, 1995.

Flood Control Project and Flood Mitigation Strategies for Taipei Area

Yi-Sheng Lin

The 10th River Management Office, Water Resources Agency, Ministry of Economic Affairs

Abstract

Tamsui River in northern Taiwan is the third longest river in Taiwan. The river basin is the political and economic center of Taiwan, with over 6.5 million people. During the typhoon season, the intense rain and high peak flow make it difficult for water to flow out in time, so the drainage area of Tamsui River often suffered from flooding before the governance project was implemented.

The 10th River Management Office is a government agency in charge of the governance and management of Tamsui River System. Tamsui River Flood Control Project was proposed and implemented since 1973.The project uses the 200-year-flood frequency as protection criteria for its planning, and builds 60 miles of dike alongside the banks of Tamsui River and its branches. The project invested a total of 115.8 billion NTD (3.86 billion USD).

In addition to the measures mentioned earlier, we also established the water information center for disaster preparation and early warning operation. We also established a model for early warning of flooding, so the public can receive early warning for early evacuation. The flood forecasting model for Tamshui River was developed by the 10th River Management Office in 2004. It could give a forecasting computation automatically, and the customized user interface developed for real demand while flood periods. The model has two systems: The first one operates automatically every day and the forecast frequency is set at every 10 minutes. The forecast allows us to predict the hydrologic situation in the next six hours. Another system is a expert policy-making system that needs to be operated manually. It allows us to carry out simulation using various hydrologic conditions to understand the potential changes of flood at different reaches under different hydrologic conditions, so flood prevention personnel can use the simulation to make informed decisions and better policies.

Dr.		Distinguished Professor
Kwan Tun Lee		**Dept. of River & Harbor Engrg.** **National Taiwan Ocean University**
		Email: ktlee@ntou.edu.tw

Biography

Prof. Kwan Tun Lee joined National Taiwan Ocean University (NTOU) as an associate professor in 1992 and has been a professor since 1998. Currently, he is the dean of the engineering college and also serves as the director of Geographic Information System Research Center in NTOU. He is an adjunct senior research fellow at Taiwan Typhoon & Flood Research Institute, Taiwan. His research focuses on surface water hydrology, river hydraulics, and Geographic information system.

Education

- 1977-1981, B.S. in Agricultural Engineering, National Taiwan University, Taiwan.
- 1983-1985, M.S. in Agricultural Engineering, National Taiwan University, Taiwan.
- 1987-1991, Ph.D. in Civil Engineering, National Taiwan University, Taiwan.
- 1991-1992, Post-Doctoral Associate Research Fellow, Hydraulic Research Laboratory, National Taiwan University, Taiwan.
- 1993-1994, Post-Doctoral Research Fellow, Department of Civil Engineering, University of Illinois at Urbana-Champaign, U.S.A.

Work Experience (most recent)

- Director, Computer Center, National Taiwan Ocean University, Taiwan (2003-2005).
- Adjunct Senior Research Fellow, Taiwan Typhoon & Flood Research Institute, National Applied Research Laboratories, Taiwan, R.O.C. (2009/01 -)
- Visiting Professor, Disaster Prevention Research Institute, Kyoto University, Kyoto, Japan (2011/08-2011/10)
- Dean, Engineering College, National Taiwan Ocean University, Taiwan, R.O.C. (2012/11-)

Research Interests

- Surface water hydrology
- River hydraulics
- Geographic information system

Runoff Estimation for Typhoon Storms in Ungauged Watersheds

Kwan Tun Lee

Adjunct Senior Research Fellow, Taiwan Typhoon and Flood Research Institute
National Applied Research Laboratories, Taipei, Taiwan.
Dean of Engineering College, National Taiwan Ocean University, Keelung, Taiwan

Abstract

More frequent and severe typhoon storms were noticed in recent years. The impact resulted from climate variability has increased the extent of flood disaster. To develop a hydrological model for runoff estimation in ungauged watersheds is an important task for hydrologists. This study focuses the application of the kinematic-wave-based geomorphologic instantaneous unit hydrograph model (KW-GIUH). The model can be applied to gauged and ungauged watersheds for runoff estimation only based on watershed geomorphologic information. Instead of using grid-based routing models, the IUH operating provides an efficient way for rainfall-runoff simulation, and the runoff nonlinearity can also be considered in this model. In considering the complexity of performing a digital elevation model (DEM) for geomorphologic factors extraction, the geomorphologic and hydrological analyses have been integrated on a geographic information system (GIS) platform and further included channel-flow routing processes. The windows-based platform can provide both geomorphologic and hydrological information for hydrologists to perform engineering design work or real-time forecasting at any desired location in the watershed.

Mr.		Researcher
Le Tuan Nghia		**Centre for Hydrology and Water Resource, Vietnam Institute of Meteorology, Hydrology and Climate Change**
		Email: Le.nghia84@gmail.com

Biography

Mr. Le Tuan Nghia is researcher working for Centre for Hydrology and Water resource, Vietnam Institute of Meteorology, Hydrology and Climate Change for 10 years. He participated in projects relate to water resources management, flood risk management, flash flood warning development and climate change. He has experiences in hydrology-hydraulic modelling, assessment of water resources and impacts of climate change on water resources. Currently, he is especially interested in development of flash flood warning system for Vietnam.

Education

- 2013 – 2016, Master of Science. Water Resources Management, Cologne University of Applied Sciences corporate with Vietnam Academy for Water Resources. Hanoi, Vietnam
- 2002 – 2007, Bachelor of Science. Hydrology and Environment, Thuy Loi University. Hanoi, Vietnam

Work Experience (most recent)

- 1/2013 – present, Researcher, Centre for Hydrology and Water resource, Vietnam Institute of Meteorology, Hydrology and Climate Change
- 03/2012–12/2012, Junior Riparian Professional Officer, Mekong River Commission. Office of the Secretariat in Phnom Penh (OSP)
- 09/2007 – 03/2012, Researcher, Centre for Hydrology and Water resource, Vietnam Institute of Meteorology, Hydrology and Climate Change

Research Interests

- Water resources assessment;
- Hydrology-hydraulic modelling;
- Climate change;
- Flood - Flash flood forecast and warning

Water Resources and Management Issues in Vietnam

Le Tuan Nghia

Institute of Meteorology, Hydrology and Climate change

Abstract

Vietnam has abundant water resources, the annual average rainfall of about 1960 mm, and the total flow of the river about 835 km^3. However, more than 60% of the river water is generated from the neighboring countries. In other words, therefore water resources of Vietnam is subject to exploitation in the upstream countries. Due to the influence of topography and geographical location, rain water resources are not evenly distributed in the territory and changes strongly over time in years with most of water is regenerated in flood season (account for 70-80% total annual flow). In addition, annual population grow rapidly with unreasonable structure system in water use and savings which leading to Vietnam has become a water shortage country. Many challenges for the water resources management such as over exploitation, hydropower development without management, lack of comprehensive water resources plan taking to account multi-sectors, water pollutant… It requires a mechanism and a reasonable policy for sustainable development of water resources of Vietnam. Solutions for solving controversial problems in terms of integrated planning of water resources in Vietnam could be focused include: strengthening laws and policies, establishing water resources management at basin scale, developing water resources assessment and protection plan, strengthening and development of science, technology to water monitoring and management.

Dr.		Division Director
Josh Tsun-Hua Yang		**Taiwan Typhoon and Flood Research Institute (TTFRI), National Applied Research Laboratories (NARLabs)**
		Email: tshyang@narlabs.org.tw

Biography

Tsun-Hua Yang is a Research Fellow and the Division Director of the Taiwan Typhoon and Flood Research Institute (TTFRI) at the National Applied Research Laboratories, where he has been since 2012. He also holds a joint appointment as Professor of Civil and Disaster Prevention Engineering at Nation United University in Taiwan. He received his PhD in Civil Engineering from the University of UC Davis in 2008. From 2008 to 2012 he worked at MWH Global, Inc. in Sacramento, CA, as a registered professional engineer. His research interests are in hydro-meteorological modeling, with a focus on flood forecasting. He also serves as project leader for multiple projects. For example, Dr. Yang joins the global Horizon 2020 project which is related to large scale disaster prevention and manages one of five demonstration for this project. In addition, he is working on a project to develop a next generation smart flood information system for an industrial park. Dr. Yang has given a few invited domestic & international talks and tutorials on flood-related modeling works.

Education

- 2008 PhD, Department of Civil and Environmental Engineering, UC Davis, USA

Work Experience (most recent)

- 2017-Present Joint Appointment Professor, National United University, Taiwan
- 2016-Present Division Director, TTFRI, Taiwan
- 2015-Present Research Fellow, TTFRI, Taiwan

Research Interests

- Hydro-meteorological modeling
- Application of artificial intelligence in engineering
- Disaster Internet of Things

Dayu Smarter Flood Protection System

Josh Tsun Hua Yang[1,2]

[1]Taiwan Typhoon and Flood Research Institute, National Applied Research Laboratories, Taipei, Taiwan

[2]Department of Civil and Disaster Prevention Engineering, National United University, Miaoli, Taiwan

Abstract

Taiwan is located in the Northwestern Pacific Ocean and suffers from typhoons 3 to 4 times a year. A combination of different disasters such as typhoon, flood, and earthquake may occur at the same time and cause catastrophic loss of life and property. The historical events such as Typhoon Morakot in 2009, the Thailand flood of 2011, and Fukushima Daiichi nuclear disaster in 2011 were all within the category of compound disasters. For example, the Thailand flood in 2011 resulted in over hundreds of deaths and millions of people affected. The economic damage is estimated at over US$40 billion according to The World Bank's survey. Non-structure measures such as early warning systems can help first responders take necessary actions to reduce damage and losses. However, most of the early warning systems only provide passive information, for instance flood forecasts or real-time observations. TTFRI has developed a flood protection system, named Dayu, to integrate on-site monitoring sensors and advanced modeling tools to provide better flood forecasts. In addition, the system further analyzes all the collected information and forecasts to trigger active actions, for example automatic start/stop control of water pumps and adjustment of floodgates. TTFRI works with a security company to offer innovative disaster relief services. The system has been implemented in Taiwan. It has shown the potential to respond to a wide range of threats from floods in a more effective manner.

Dr.		Researcher
Dang Quang Thinh		**Climate Change Research Center, Vietnam Institute of Meteorology Hydrology and Climate change**
		Email: thinhdangq@gmail.com

Biography

Dang Quang Thinh has finished his Ph.D. study at Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research (KIT/IMK-IFU), Germany. He holds a Master degree in Hydrology and Water Resources at Institute for Water Education, UNESCO-IHE (IHE-Delft), the Netherlands. His research fields focus on catchment hydrology and water resources as well as impact of climate change on water balance and agricultural sector. He holds expertise in hydrological-hydraulic modelling and hydrological extreme analysis. Another focus of his work is the optimization modelling. He is also interested in climate change impact assessment and adaptation measures.

Education

- 2013-2017, Ph.D. Institute of Meteorology and Climate Research (KIT/IMK-IFU), Karlsruhe Institute of Technology, Germany
- 2008-2010, MSc. Institute for Water Education IHE-Delft, the Netherlands
- 1996-2001, BS. Water Resources University, Vietnam

Work Experience (most recent)

- 2017-present, Researcher, Climate Change Research Centre, Institute of Meteorology, Hydrology and Climate Change
- 2011-2012, Researcher, Climate Change Research Centre, Institute of Meteorology, Hydrology and Climate Change
- 2010-2011, Researcher, Centre for Hydrology and Water Resources, Institute of Meteorology, Hydrology and Environment

Research Interests

- Water resources management
- Catchment hydrology, hydraulic modelling
- Hydrological impact
- Climate change analysis
- Sedimentation transport

Estimated Changes to Ba's River Flows in Southern Central Vietnam under a Changing Climate

Huynh Thi Lan Huong, Nguyen Van Dai, Dang Quang Thinh

Vietnam Institute of Meteorology Hydrology and Climate Change

Abstract

This study aims at estimating changes of flows in the Ba river basin, Southern Central Vietnam due to climate change using a modeling chain approach. The Mike 11 model was applied to simulate river flows for the Ba basin. The future climate was studied using the MAGICC/SCENGEN software and a statistical downscaling method over current 1980-1999 and future climates (2020-2039, 2040-2059, 2060-2079, 2080-2099). There emission scenarios: high emission (A2), medium emission (B2) and low emission (B1) were considered. An overall increasing trend for peak flows and a decreasing trend for low flows are revealed. The Southern Central Vietnam is likely to suffer more from floods and drought. However, care should be taken when designing water-related works due to highly uncertainty of results.

Dr.		Director
Duong Du Bui		**National Center for Water Resources Planning & Investigation (NAWAPI) at Ministry of Natural Resources and Environment (MONRE) of Vietnam**
		Email: duongdubui@gmail.com

Biography

A scientist, educator policy planer and media writer with focus on water security for sustainable development of Asia and Vietnam.

Education

- 9/2011, Doctorate of Philosophy of Engineering, Tokyo Metropolitan University, Japan
- 5/2005, Bachelor of Science, The Water Resources University, Vietnam

Other trainings: Having attended various training courses such as:

- ASEAN-US S&T Fellowship training on "Communication skills for Science" 2nd -3th Nov. 2015, Vientiane, Laos
- Understanding State Administration and Public policy of Vietnam, May-July 2015, Hanoi
- Training Course on Hydrological modeling, February, 2012 at Deltares, the Netherlands
- Asia-Pacific Initiative training course on Disaster Management and Humanitarian Assistance, Sept-Nov, 2010, UNU, Tokyo
- DAAD Summer School on "GIS-Theories and Application", Sept, 2007- taught by Rostock University, Germany.
- Training Course "Groundwater Development and Management", Aug, 2007- taught by Asia Institute of Technology, Thailand.

Work Experience (most recent)

- 5/2014 – present, Deputy Director of Department, National Center of Water Resources Planning and Investigation (NAWAPI) of Vietnam
- 5/2013 - 5/2014, Head of Department of Integrated Water Res. Management, Hanoi University of Natural Resources and Environment (HUNRE)
- 11/2011 - 4/2013, Research Fellow, Singapore-Delft Water Alliance/NUSDeltares - National University of Singapore
- 6/2011 - 11/2011, Researcher, The United Nations University Institute for Sustainability and Peace
- 10/2008 - 6/2011, Ph.D. Research Fellow, Tokyo Metropolitan University

Research Interests

- Water resources management, climate change, disaster risk reduction

Spatio-temporal Assessment of Drought for Poorly Gauged Catchments Using Remote Sensing Data: A case Study of Vu Gia Thu Bon, Vietnam

Minh Duc Nguyen[1], Tien Le Thuy Du[2,4], Duong Du Bui[3,*], Hyongki Lee[4], Trung Anh Nguyen[3]

[1]Dynamic Solutions International, USA

[2]Danang Institute for Social and Economic Development, Danang, Vietnam

[3]National Centre for Water Resources Planning and Investigation, Ministry of Natural Resources and Environment, Hanoi, Vietnam

[4]Department of Civil and Environmental Engineering, University of Houston, Houston, Texas, USA

Abstract

Agriculture is often the first sector to be affected by drought, causing significant loss to crop production, livestock and threatening food security. Assessment of agricultural drought is crucial to evaluate probability of drought occurrence, its severity and build impact mitigation plan. This study assessed spatio-temporal drought using the monthly moderate-resolution imaging spectroradiometer (MODIS) normalized difference vegetation index (NDVI) and land surface temperature (LST) data within a poorly gauged river basin with humid climate - Vu Gia Thu Bon (VGTB) - in the Central Vietnam. The data were processed for the 2010-2016 dry season using vegetation health index (VHI) method, which is computed using NDVI and LST data. Findings show a statistically significant negative relationship between NDVI and LST, reflecting that water is the primary factor limiting vegetation growth. The spatial distribution of agricultural drought was found in 2010, 2014 and 2016 with the heaviest drought in 2014 and the most affected area was the cropfield area. Results from the study were consistent with drought observations reported by the government and media. The study provides useful information for agricultural drought monitoring and early warning systems in humid region like VGTB river basin.

Dr.		Professor
Ben Jong-Dao Jou		**Department of Atmospheric Sciences, National Taiwan University**
		Email: jouben@ntu.edu.tw

Biography

Being an outstanding atmospheric scientist, Professor Ben Jong-Dao Jou was the founder and the first CEO of the APEC Research Center for Typhoon and Society (ACTS). Professor Jou was selected and appointed by Steering Committee members as the Chief Executive Officer of ACTS in November 2010. During his term at ACTS, he had arranged symposiums, workshops, and training programs related to meteorology, hydrology, preparedness, and disaster mitigation to open up dialogues between academia and government officials, as well as APEC member economies. Prof. Jou had successfully established a unique and good foundation for ACTS to promote scientific understanding and to research on the socio-economic impacts of typhoons.

Education

- PhD, Atmospheric Sciences, University of Washington (1978-1984)
- MSc, Meteorological Sciences, University of Oklahoma (1976-1978)
- BSc, Atmospheric Sciences, National Taiwan University (1972-1976)

Work Experience (most recent)

- Chair, Department of Atmospheric Sciences, National Taiwan University (1999-2002)
- Chief scientist, Taiwan Weather Research Program (2000-2012)
- Advisor of Meteorological Division, National Center for Disaster Reduction (NCDR) (2016-)
- CEO, APEC Research Center for Typhoon and Society (2010- 2014)
- President and Fellow, Meteorological Society of ROC (Taiwan) (2009–2013)
- President, Chinese Geoscience Union (CGU) (2017-)

Research Interests

- Mesoscale meteorology
- Radar meteorology
- Atmospheric dynamics

Convective Activity in Northern Cascade of Snow Mountain and Flash Floods in Taipei

Ben Jong-Dao Jou

Department of Atmospheric Science, National Taiwan University, Taipei, Taiwan

Abstract

Convective activity over northern Taiwan is greatly affected by the northern cascade of Snow Mountain (here we call Snow Mountain Cascade: SMC), especially during the warm season with weak synoptic conditions. SMC is a mountain range located at northern Taiwan, east of Taipei city, with a width of ~25 km, a length of ~ 100 km, a height of ~ 500-1000 m, and an orientation of northeast-southwest. During the warm season, the prevailing southwesterlies flow around the island accompanying with local circulations produce local convergence zones in northern Taiwan. Pronounced convective activity is frequently observed around the mountain range and causes severe flash floods in the metropolitan of Taipei.

In this study, common features of the convective activity around SMC in the warm season are described using Taiwan radar network. A recent flash flood case over Taipei was chosen for detail analysis. Mesoscale surface network and dual-polarized radar data are utilized to reveal the kinematic flow structure at low-levels and the dynamic and microphysical characteristics of the storm. The major findings suggest the storm is characterized with short duration extreme rainfall intensity and is closely related to the merge of convective cells. The merge of convective cells produces enlarged precipitation area and extends strong echo to a much higher altitude. Enhanced horizontal convergence produced by the sea breeze and downslope flow from earlier weak convections over sloping area of Snow Mountain is favorable for the cell merge.

Significant variations of the structure and distribution of polarimetric variables before and after cell merge are identified. Large areas with existence of mixed-phase hydrometeors, hail with rain and graupel with rain, are the major differences. Rain drop size distributions associated with the storm reveal characteristics similar to continental storms as suggested by earlier studies.

Dr.		Director/Senior Researcher
Hiep Van Nguyen		**Applied Geophysics Center (AGPC), Institute of Geophysics (IGP), Vietnam Academy of Science and Technology (VAST)**
		Email: hiepwork@gmail.com

Biography

Dr. Hiep Van Nguyen got his PhD degree in Meteorology at the University of Hawaii at Manoa, Hawaii, USA in 2011. He is currently a senior researcher, the director Applied Geophysics Center (AGPC) under the Institute of Geophysics (IGP), Vietnam Academy of Science and Technology (VAST). His research interests include terrain effects on weather and climate over complex terrain areas, high-wind and heavy-rainfall events, regional climate, typhoon track and intensity, and tropical cyclone initialization for hurricane models.

Education

- 2011, PhD., Department of Atmospheric Sciences, University of Hawaii at Manoa, Hawaii, USA
- 2006, MSc in Meteorology, Department of Atmospheric Sciences, University of Hawaii at Manoa, Hawaii, USA
- 2001, Bachelor of Science in Meteorology, Department of Hydro-Meteorology and Oceanography, Hanoi National University, College of Science, Hanoi, Vietnam

Work Experience (most recent)

- 2017-now, Senior Researcher, Director, Applied Geophysics Center (AGPC), Institute of Geophysics (IGP), Vietnam Academy of Science and Technology (VAST)
- 2014-2016, Researcher, Head of Tropical Meteorology and Typhoon Division, Deputy Director, Center for Meteorology and Climatology, Vietnam Institute of Meteorology, Hydrology and Climate Change (IMHEN), Hanoi, Vietnam
- 10/2012-10/2014, Researcher, Head of Climate Division, Center for Meteorology and Climatology, Vietnam Institute of Meteorology, Hydrology and Climate Change (IMHEN), Hanoi, Vietnam
- 8/2011-6/2012 , Postdoctoral Researcher, Department of Meteorology, Uni. of Hawaii at Manoa, Hawaii, USA

Research Interests

- Terrain effects on weather and climate over complex terrain areas, high-wind and heavy-rainfall events
- Regional climate, climate and climate change, air quality modelling
- Hurricane dynamics, hurricane track and intensity forecasts, TC initialization
- High resolution numerical model forecast and verification

Generation of Small Scale Features at Outer Regions of a Tropical Cyclone Vortex in Numerical Models

*[1]Hiep Van Nguyen, [1]Anh Xuan Nguyen, [1]Nhu Hong Dang
[1]Nam Duc Nguyen, [1]Nam Gia Hoang, [2]Yi-Leng Chen
[1]Institute of Geophysics (IGP), Vietnam Academy of Science and Technology (VAST), 18 Hoang Quoc Viet, Cau Giay, Hanoi, Vietnam
[2]Department of Atmospheric Sciences, University of Hawaii at Manoa, Honolulu, Hawaii

Abstract

Tropical cyclones (TC) form and spend most of their lifetime over ocean where the data are sparse. Except some cases of enhanced data by flight observation, limited observed data in the TC region results in relatively poor representation of TC vortex structure in the initial conditions of a regional model. A bogus scheme is usually used to improve TC intensity and structure in the near TC center region. Nguyen and Chen (2011; 2014) (NC2014) had developed a vortex dynamical initialization technique based on model cycle runs with wave filter and adjustment of TC intensity and structure toward observed intensity and analyzed large-scale environments. The technique has gained some promised results in improvements of typhoon track and intensity forecasts. One limitation of the NC2014 technique comes from its assumption that the TC structure is not significantly changed within the short period of a cycle run (an hour). The assumption is to allow the adjustment of the initial condition by the 1-hour spin-up vortex. Because the assumption only works well at small radii from TC center, the NC2014 is not be able to spin up small-scale features at outer regions at radii of larger than 600 km from the TC center. In this paper a technique was developed to generate small-scale features at outer regions of a tropical cyclone vortex. The technique is applied for the advanced research version of the Weather Research and Forecasting (WRF-ARW) model. The small-scale features at large radii is then smoothly merged with the vortex generated by NC2014 scheme to use as initial conditions for the numerical model. Initial results from the combining technique suggested that while the original NC2014 scheme can reproduce TC structure, the advance technique can generate features associated with observed deep convective cloud locations at large distances from TC center. Some possible future applications are also discussed in the paper.

Prof.		Professor
Phan Van Tan		**Faculty of Hydrology, Meteorology and Oceanology, Vietnam National University - Hanoi University of Science**
		Email: phanvantan@hus.edu.vn

Biography

Dr. Phan Van Tan is a Professor in Earth Science, Leader of Regional Climate Modelling and Climate Change (REMOCLIC) team, under the VNU Hanoi University of Science (HUS), and Chairman of the Council of Earth Sciences and Environment, National Foundation for Science and Technology Development (NAFOSTED). He has more than 25 years of experiences in weather and climate research, focusing mainly on climate change, tropical cyclone prediction, regional climate modelling, and statistical data analysis. In recent years he has been working on projects related to climate change and seasonal prediction. He was a leader of National and International projects of Climate Change Impacts on Extreme Climate Events in Vietnam, High Resolution Climate Projection for Vietnam, Seasonal Prediction by Dynamical Downscaling, and Climate Change-Induced Water Disaster.

Education

- 1988-1994, Ph.D. Department of Meteorology, Vietnam National University, Hanoi
- 1976-1981, BSc. Department of Meteorology, Vietnam National University, Hanoi

Work Experience (most recent)

- 2010-Now, Professor, VNU Hanoi University of Science (HUS)
- 2002-2010, Associate Professor, VNU Hanoi University of Science (HUS)
- 2000-2015, Head of Department of Meteorology, HUS

Research Interests

- Regional Climate Modeling and Climate Change Projection
- Dynamical Seasonal Rainfall and Tropical Cyclone Prediction
- Droughts

Evaluation of NCEP CFS and its Downscaling for Seasonal Rainfall Prediction across Vietnam

Tan Phan-Van[1], Thanh Nguyen-Xuan[1], Hiep Van Nguyen[2], Patrick Laux[3], Ha Pham-Thanh[1] and Thanh Ngo-Duc[4]
[1] Department of Meteorology and Climate Change, VNU University of Science (HUS), Hanoi, Vietnam
[2] Applied Geophysics Center (AGPC), Institute of Geophysics (IGP), Vietnam Academy of Science and Technology (VAST), Hanoi, Vietnam
[3] Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research, Atmospheric, Environmental Research (KIT/IMK-IFU), Garmisch-Partenkirchen, Germany
[4] Laboratory for Remote Sensing and Modeling of Surface and Atmosphere (REMOSAT) University of Science and Technology of Hanoi (USTH), Vietnam Academy of Science and Technology (VAST), Hanoi, Vietnam

Abstract

In this study the ability of applying the National Centers for Environmental Prediction (NCEP) Climate Forecast System (CFS) products and its downscaling using the Regional Climate Model Version 4.2 (RegCM4.2) on seasonal rainfall forecasts over Vietnam has been investigated. Firstly, the CFS reforecasts (CFS_Rfc) from 1982 to 2009 are used to assess the ability of the CFS to predict the overall circulation and precipitation patterns at forecast lead times of up to 6 months. Secondly, the operational CFS forecasts (CFS_Ope) and its RegCM4.2 downscaling (RegCM_CFS) for the period 2012-2014 are used to derive seasonal rainfall forecasts over Vietnam. CFS_Rfc and CFS_Ope are validated against the CFS reanalysis, the Global Precipitation Climatology Centre (GPCC) analyzed rainfall, and observations from 150 meteorological stations over Vietnam. The results show that the CFS_Rfc can capture the seasonal variability of the Asian monsoon circulation and rainfall distribution. The higher resolution RegCM_CFS product is advantageous over the raw CFS in specific climatic sub-regions during the transitional, dry and rainy season, particularly in the Northern part in January, and in the Central Highlands of Vietnam in July.

Dr.		Director
Ming-Dean Cheng		**Research and Development Center, Central Weather Bureau**
		Email: mdc@cwb.gov.tw

Biography

Dr. Cheng received his undergraduate education at the National Taiwan University. He attended the graduate school at UCLA in 1982 and later obtained his Ph.D. degree on Atmospheric Sciences on the fall of 1987 under the supervision of Professor Yanai. He became the Director of the Research and Development (R&D) Center of CWB since October 1, 1993 except from November 2, 2009 until February 18, 2017 during which he served as the Director of the Weather Forecast Center (WFC) of CWB. The WFC is responsible for the daily operational weather forecasts in Taiwan, while the R&D Center conducted a couple of research projects focusing on typhoon-track prediction and heavy rainfall weather systems. The R&D Center also offers the administrative supports of CWB for all aspects of its research projects, annual conference, Journal publication, and on-job training programs, etc. Dr. Cheng himself is convening a Numerical Weather Prediction (NWP) research group for the maintenance and further improvements of CWB's operational NWP system. Recently, he is promoting climate application researches between CWB and related Agencies of the government.

Education

- 1987, Ph.D., Atmospheric Sciences, UCLA
- 1980, B.A., Atmospheric Sciences, NTU

Work Experience (most recent)

- Feb. 2017 – present, Director, Research and Development Center, CWB
- Nov. 2009 –Feb. 2017, Director, Weather Forecast Center, CWB
- Oct. 1–Nov. 2009, Director, Research and Development Center, CWB

Research Interests

- Numerical weather prediction

Preliminary Evaluations of Two-Week Tropical Cyclone (TC) Forecasts from the NCEP GEFSv11 Reforecasts by using the CWB TC Tracker

Ming-Dean Cheng
Central Weather Bureau, Chinese Taipei

Abstract

To evaluate the predictability of the two-week tropical cyclone (TC) forecasts in the western North Pacific and Taiwan area, the CWB TC Tracker (Tsai et al. 2011; Wea. Forecasting) is utilized to objectively detect TCs in the 16-day NCEP Global Ensemble Forecast System version II (GEFSvII) reforecasts during 2006-2015. The detected activities of TC are studied by examining ROC curve (Relative Operating Characteristic curve) and reliability diagram.

For the entire Western North Pacific, the AUC (Area Under Curve) of ROC for Week-1 and Week-2 are 0.76 and 0.68 respectively, and false alarm can be found especially when the forecast probabilities are higher. For Taiwan area, the AUC of ROC is 0.88 for week-1 and 0.75 for week-2, and the forecast reliability is depicted reasonably well.

Currently, we are Investigating the relationships between the TC forecast skill and the large-scale environment, e.g., ENSO and MJO. The conclusion from this study can be applied to calibrate TC predictions.

This study was a joint work done by Tzu-Ting Lo and Meng-Shih Chen from CWB as well as by Hsiao-Chung Tsai and Pang-Cheng Chen from Tamkang University.

Ms.		Deputy Head
Nguyen Ngoc Bich Phuong		**Climate Research Center, Vietnam Institute of Meteorology, Hydrology and Climate Change**
		Email: nn.bichphuong@gmail.com

Biography

MSc. Nguyen Ngoc Bich Phuong is a researcher and a deputy head of Climate Research Center at Vietnam Institute of Meteorology, Hydrology and Climate Change (IMHEN). She holds Master and Diploma degree in climatology from the Hanoi University of Science (HUS). Her research centres on climate variability, climate prediction and climate change. She holds expertise in regional climate modelling based on dynamical as well as statistical downscaling approaches for Vietnam and South East Asia regions. She was a climate scientist in the LUCCi project in Germany. Now she is a secretary of the project "Development of seasonal climate forecasting system by dynamic models for Vietnam".

Education

- 2012 -2017 Ph.D. student. Faculty of Applied Computer Science, University of Augsburg
- 2006 -2009, Master degree. Faculty of Hydrology, Meteorology and Oceanography. Hanoi University of Science, Vietnam
- 2002 -2006, Graduated degree. Faculty of Hydrology, Meteorology and Oceanography. Hanoi University of Science, Vietnam

Work Experience (most recent)

- 2016-2019, The secretary of the project "Development of seasonal climate forecasting system by dynamic models for Vietnam", Vietnam
- 2016-2017, A member of the project "Capacity strengthening in adaptation to climate change in Tuyen Quang", Vietnam
- 2012-2016, A member of the project "Interaction of Land use change and Climate change-LUCCi", Germany

Research Interests

- Seasonal climate forecasting
- Monsoon
- Climate extreme
- Climate change
- Land use/ land cover change

Simulation and Prediction of Summer Monsoon Climate over the Indochina Peninsula by RSM Model

Nguyen Ngoc Bich Phuong
Vietnam Institute of Meteorology, Hydrology and Climate Change

Abstract

Monsoon is a major component of global climate system, affecting floods, droughts and other climate extremes. In this study, we examine the performance of RSM model in predicting summer monsoon over the Indochina Peninsula (ICP). The NCEP - Climate Forecast System Reforecast (CFS-reforecast) was used to provide large-scale forcings for the RSM configured with an approximately 20-km grid over the ICP. The empirical orthogonal function (EOFs) and basically statistical methods were used to evaluate the simulated summer monsoon of the RSM model. The simulations of RSM are satisfactory in terms of the simulated large-scale features for the different years. Of which, the model result RSM simulates well the interaction between Southwest and Southeast airflow, which is the main characteristics of the study area. The result also demonstrates that the large-scale features over the ICP link to El Niño–Southern Oscillation (ENSO) on interannual scales. The onset of summer monsoon is later in summer of El Niño year. For precipitation, the RSM reproduces lower than the actual in values; however, the distribution of precipitation is compatible with the observation data

Mr.		Assistant Researcher
Chin-Cheng Tsai		**Atmospheric Modeling Division, Taiwan Typhoon and Flood Research Institute, National Applied Research Laboratories**
		Email:tsai.chincheng@narlabs.org.tw

Biography

My father is a fishman and the weather really affects the operational procedure of my father's job. When I was a senior high school student, I had been interested in the weather phenomenon, especially typhoon, since we can have a day off as typhoon invading Taiwan. When I got the master degree, I applied the Research and Development Substitute Services in Taiwan Typhoon and Flood Research Institute (TTFRI). After finished the Substitute Services, I keep going to work at TTFRI and have a wish to be a weatherman some day in the future.

Education

- 2007-2009, M.S., Atmospheric Physics, National Central University, Taiwan
- 2003-2007, B.S., Atmospheric Science, National Central University, Taiwan

Work Experience (most recent)

- 2009-present：Assistant Researcher, Atmospheric Modeling Division, Taiwan Typhoon and Flood Research Institute

Research Interests

- Mesoscale Modeling
- Mesoscale Ensemble prediction
- Air-sea interaction

A Multi-model Ensemble System for Typhoon Track, Precipitation and Wind Speed Prediction in Taiwan

Chin-Cheng Tsai, Ling-Feng Hsiao, Delia Yen-Chu Chen, Loung-Yao Chang, Chieh-Ju Wang, Chou-Chun Chiang, Jia-Chyi Liou, Ming-En Hsieh, Lei Feng, Ching-Yuang Hunag

Taiwan Typhoon and Flood Research Institute

Abstract

A multi-model ensemble system, named Taiwan cooperative precipitation ensemble forecast experiment (TAPEX), was consisted of Advanced Research Weather Research and Forecasting Model (ARW-WRF), Fifth-Generation NCAR / Penn State Mesoscale Model (MM5) and Hurricane WRF model (HWRF). This ensemble NWP system was initialized at 2010 and was the first attempt to design a high-resolution numerical ensemble system in Taiwan. For the high computing resource and hardware demand, the ensemble system was semi-operational from 2011 to 2016 during the typhoon season in the western North Pacific Ocean. The presentation will demonstrate the performance of typhoon track and precipitation of TAPEX in the past 6 years. Results shows that the ensemble mean track forecast better than single member and the mean precipitation forecast can predict the rainfall pattern but might underestimate the maximum value. Therefore, few technics to improve the ensemble mean forecast for typhoon track and rainfall forecast will be demonstrated.

Furthermore, the wind speed prediction data of TAPEX was preliminarily applied to forecast wind gust. Two approaches to predict the wind gust for each stations around Taiwan were designed and evaluated.

Dr.Assoc.Prof.		Vice President
Pham Quy Nhan		**Hanoi University of Natural Resources and Environment**
		Email: pqnhan@hunre.edu.vn

Biography

He has almost 30 year experiences on ground water resources in Vietnam. Teaching and research are most favorable in his life. He has completely supervised 4 PhD and more than 30 MSc and on-going with 4 PhD students. His publications are 4 text books in Vietnamese and about 20 international peer review papers and more than 100 national papers. He has been doing as manager about 10 joint research and national projects.

Education

Engineer:	Graduated in Hanoi Univ. of Mining and Geology. Major in Hydrogeology and Engineering Geology (1977-1982).
PhD	Studied Ph.D. on Hydrogeology in Hanoi Univ. of Mining and Geology (1994-1999).
Fellowship awards:	in Austria (1991), Sweden (1996, 2001), Russia (2010), Australia (2015, 2017), Brunei (2016).

Work Experience (most recent)

- Associate Professor at Hanoi University of Mining and Geology (HUMG): 2000-2009
- Adjunction Professor at Vietnam National University (VNU): 2005-present
- Vice Director general. Center for Water Resources Planning and Investigation, MONRE:2009-2013
- Associate Professor at Hanoi University of Natural Resources and Environment (HUNRE): 2013-present
- Vice President, Hanoi University of Natural Resources and Environment (HUNRE): 2013-present
- Vice President, Vietnam Hydrogeologist Association: 2014-present
- Coordinator, Red river delta wing, Delta Alliance

Research Interests

- Groundwater hydraulics
- Groundwater modeling
- Groundwater salt intrusion and solute transport

Assessment of Saltwater Intrusion Vulnerability in the Coastal Aquifers of Ninh Thuan Province in the Context of Climate Change

T.T.Thoang[1], P.Q.Nhan[1], N.B.Hoang[2]

[1]Hanoi University of Natural Resources and Environment

[2]Center for water resources quality and protection (WARAPO)

Abstract

Ninh Thuan province is the most arid region of Vietnam where the dry season lasts for 9 months per year with the average annual rainfall of 300-400mm. As the reduction of the surface water source under climate change condition, groundwater became the most important source of water supply for the province. Due to groundwater extraction and sea level rise, groundwater in coastal aquifers of Ninh Thuan is now facing with seawater intrusion with more than 60% of the salinity zone out of the aquifer distribution. As seawater intrusion became the biggest concern for the groundwater resources of the province, it is necessary to evaluate the saltwater intrusion vulnerability in aquifers for planning and sustainable exploitation of groundwater in this province. In this study, an overview of groundwater intrusion was carried out to understand on the situation or status of the salinity of groundwater. Besides, GALDIT method was used for an assessment of saltwater intrusion in the coastal aquifers of the study area with six factors incorporated are groundwater occurrence, aquifer hydraulic conductivity, depth to groundwater level, distance from shore, impact of existing seawater intrusion, and aquifer thickness allowing us to rank and map the vulnerability of the coastal aquifers from low to very high. Within this study, each of GALDIT factor will be evaluated based on the data collected from various sources includes hydrogeological mapping projects, groundwater investigation reports, and groundwater chemistry analyses. However, the weight of each GALDIT index was used the same as applied in other regions in the world, but considered for the condition of Ninh Thuan province that is limitation of this study and will be improved in further study.

Dr.		Researcher
Pham Tien Dat		**Researcher, Center for Marine HydroMet Research, Vietnam Institute of Meteorology, Hydrology and Climate Change**
		Email: datptocean@gmail.com

Biography

Pham Tien Dat is a researcher at Center for Marine HydroMet Research - Vietnam Institute of Meteorology, Hydrology and Climate Change. He received his Bachelor's and Master's degrees in Oceanography from Vietnam National University – Hanoi. Thereafter, he worked as a Government Officer in Vietnam Administration Seas and Islands, before moving to Vietnam Institute of Meteorology, Hydrology and Climate Change. In August 2011, he enrolled in the PhD program at Asian School of the Environment (Nanyang Techonological University – Singapore) under the supervision of Associate Professor Adam Switzer and obtained Ph.D in 2017. During his PhD, he has focused on using various statistical techniques to study different data sets from coastal hazard-related processes including tsunamis, storms and inter-annual sea-level change.

Education

- 2017, Ph. D, Asian School of the Environment (ASoE), Nanyang Techonological University, Singapore
- 2009, M.S, HaNoi University of Science, Vietnam National University.
- 2006, B.S, HaNoi University of Science, Vietnam National University

Work Experience (most recent)

- 11/2010- : Researcher, Vietnam Institute of Meteorology, Hydrology and Climate Change.
- 3/2010-10/2010: Officer, Vietnam Administration Seas and Islands.
- 2009-2010: Researcher, Center For Environmental Fluid Dynamics.

Research Interests

- Sea-level changes at multi-scales, storm surges, storms and tsunamis deposits
- Vulnerability of the climate change, risk assessments

Bayesian Inference for Extreme Values: Implication for Extreme Sea-level Studies in the East Sea of Viet Nam

Pham Tien Dat
Center for Marine HydroMeteorology Research (CMHR)

Abstract

Extreme events (e.g., storms and tsunamis) are now major threats to low-lying and densely populated coastal cities around the world. Strong storms may raise sea level up to few meter-height above normal tidal ranges. While extensive effort has been put on mean sea level, patterns of extreme sea level are less well studied. One of flaws in extreme sea-level studies is that extreme sea levels have been widely studied using stationary assumtions and thus, the future return sea levels are underestimated. To overcome that, we need a new approach that be able to capture non-stationary signals of extreme sea levels. In this study, I will discuss the use of Bayesian inference for Generalized Extreme Value (GEV) distribution and its implication for extreme sea-level studies in the East Sea of Viet Nam. We use three hourly sea-level datasets from Hon Dau, Son Tra and Vung Tau tide gauges to charaterize the temporal variations along Viet Nam's coastline. The results show that the Bayesian inference-based model is able to catch the interannual variability of the return water levels and that the 50-year return level at Hon Dau tide gauge has been increased recently compared to that of Da Nang and Vung Tau. Our results provide new insights into extreme studies and can contribute to preparing for coastal hazards at Viet Nam's coastline.

Dr.		Director
Hsiao-Yuan (Samuel) Yin		**Debris Flow Disaster Prevention Center, Soil and Water Conservation Bureau, Council of Agriculture**
		Email: sammya@mail.swcb.gov.tw

Biography

Hsiao-Yuan (Samuel) Yin obtained the Ph.D. in Hydraulic & Ocean Engineering Department, National Cheng Kung University, Taiwan in 2005. After that, he became the postdoctoral fellow in Earth & Planetary Science Department, University of California, Berkeley, U.S. in 2009 studying the landslides simulation and field observation. During the graduate student period in 2001, he entered the Soil and Water Conservation Bureau (SWCB), Council of Agriculture and took charge of landslides and debris flows using engineering constructions as well as slope land disaster mitigation works. Dr. Yin now is the adjunct assistant professor in the International Master Program on Natural Hazards Mitigation and Management (iNHMM) of National Cheng-Kung University. The iNHMM is an international all-English master degree program which focuses on learning the causes of natural disasters and their preventions.

Education

- Postdoctoral Fellow, Department of Earth & Planetary Science, University of California, Berkeley, U.S. 2009.
- Ph.D., Hydraulic and Ocean Engineering, National Cheng-Kung University, Tainan, Taiwan, 2005.

Work Experience (most recent)

- Director, Debris Flow Disaster Prevention Center, Soil and Water Conservation Bureau, Council of Agriculture, Executive Yuan, Taiwan (2015—Present)
- Adjunct Assistant Professor, International Master Program on Natural Hazards Mitigation and Management, National Cheng-Kung University Tainan, Taiwan(2015—Present)
- Lecturer, Workshop on Water Resources Management, International Cooperation and Development Fund, Taiwan (2015—Present)
- Lecturer, Summer Training Course for Slope Land Disaster Reduction, Ministry of Science and Technology, Taiwan(2013—Present)
- Lecturer, International Training Workshop on Natural Disaster Reduction, National Science and Technology Center for Disaster Reduction, Taiwan (2012—Present)

Research Interests

- Soil and water conservation, Debris flow disaster management, Landslide monitoring, Sabo engineering and erosion control

Nationwide Decision Support System for Debris Flow Disaster Management in Taiwan

Chen-Yang Lee and Hsiao-Yuan (Samuel) Yin
Soil and Water Conservation Bureau, Council of Agriculture, Taiwan

Abstract

Due to the fragile geologic structure and torrential rainfall brought by typhoons, debris flows have become one of the most serious disasters in recent years in Taiwan. The Soil and Water Conservation Bureau (SWCB), Council of Agriculture, is the national level department in charge of the debris flow disaster management according to the Disaster Prevention and Protection Act. In this paper, a nationwide decision support system—Debris-flow Disaster Management Information System established by SWCB is introduced. By the way of advanced information techniques and user-friendly interface through the internet, the system provides the state-of-art debris flow knowledge and real-time debris flow warning information to various agencies of debris flow disaster management as well as to the general public. A rainfall-based debris flow warning model is also introduced herein. This warning model has effectively helped us in the debris flow management, including the people evacuation, risk warning and debris flow knowledge education.

Dr.		Associate Researcher
Jui-Yi Ho		**APEC Research Center for Typhoon and Society/ Taiwan Typhoon and Flood Research Institute, National Applied Research Laboratories**
		Email: juiyiho@narlabs.org.tw

Biography

Dr. Jui-Yi Ho is currently an Associate Researcher at Taiwan Typhoon and Flood Research Institute. He received his Ph.D from Department of River and Harbor Engineering, National Taiwan Ocean University in 2011 and completed two years of postdoctoral studies at GIS research Center. His research topic was about shallow landslides prediction and rainfall-runoff modeling.

Education

- B.S. in Department of River and Harbor Engineering, National Taiwan Ocean University, Taiwan. (September 2001 – July 2005)
- M.S. in Department of River and Harbor Engineering, National Taiwan Ocean University, Taiwan. (September 2005 – July 2007)
- Ph.D. in Department of River and Harbor Engineering, National Taiwan Ocean University, Taiwan. (September 2007 –January 2011)

Work Experience (most recent)

- Associate Researcher, Taiwan Typhoon and Flood Research Institute, Taiwan (February 2016 – Present)
- Assistant Researcher, Taiwan Typhoon and Flood Research Institute, Taiwan (February 2013 –2015)
- Postdoctoral Research Fellow, Geographic Information System Research Center, National Taiwan Ocean University, Taiwan, (February 2011 – January 2013)

Research Interests

- Shallow landslide prediction
- Rainfall-runoff modeling
- Geographic information system

Development of Physical-based Rainfall-runoff Model and Shallow Landslide Model

Jui-Yi Ho[1], Kwan Tun Lee[1,2]

[1] APEC Research Center for Typhoon and Society/Taiwan Typhoon and Flood Research Institute, National Applied Research Laboratories

[2] Department of River and Harbor Engineering, National Taiwan Ocean University

Abstract

Heavy rainfall brought by typhoons has been recognized as a major trigger of landslides in Taiwan. On average, three or four typhoons strike the island every year, and cause large amounts of shallow landslides in mountainous region.A shallow landslide prediction model based on infinite-slope model and TOPMODEL was developed. In considering detail topographic characteristics of the subcatchment, the proposed model can estimate the change of saturated water level during rainstorms, and then link with the slope instability analysis to clarify whether shallow landslides can occur in the subcatchment.

The subcatchment on No. 9A Highway at 10.2 K was selected as the test sites for landslide predictions. Hydrological data and landslide observed records from 2010 to 2017 were used to verify the applicability of the model. Three indexes including the probability of detection (POD), false alarm ratio (FAR), and threat score (TS) are adopted to assess the performance of the model. The results indicated that the POD for the landslide prediction by using the proposed model is 1.00, the FAR is 0.25, and the TS is 0.53. It is promising to apply the proposed model for landslide early warnings to reduce the loss of life and property.

Mr.		Senior Weather Specialist
Christopher F. Perez		**Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA)**
		Email: cfperez21@gmail.com

Biography

As a Senior Weather Specialist, I am tasked to supervise forecasters in the formulation and dissemination of the various weather forecasts, advisories and weather, conduct media briefings, attend meetings with the NDRRMC and other affiliated government institutions during the event of a tropical cyclone, and occasionally deliver lectures/short talks about the weather bureau's meteorological, climatological, and hydrological products and services to other government organizations and to private institutions as well whenever invited.

Education

- January – December 2011, Master in Climate Change, Australian National University
- June 1994 – April 2000, Bachelor of Science in Electronics and Communications Engineering, Polytechnic University of the Philippines

Work Experience (most recent)

- July 13, 2016 – present, Senior Weather Specialist, Weather Forecasting Section, PAGASA
- October 16, 2012 – July 12, 2016, Weather Specialist II, Weather Forecasting Section, PAGASA
- January 10, 2005 – October 15, 2012, Weather Specialist I, Weather Forecasting Section, PAGASA
- August 14, 2003 – January 9, 2005, Weather Facilities Technician I, Instruments Development and Research Unit, PAGASA

Research Interests

- weather forecasting
- climate change

Validation of Landfall Intensity of Typhoon "Ferdie" (Meranti) over Extreme Northern Luzon

Christopher F. Perez

Weather Forecasting Section, Weather Division, PAGASA

Abstract

Typhoon "Ferdie" (international name: Meranti) was one of the strongest tropical cyclones to directly hit the Philippines in 2016. Developed from an area of active disturbance over the Northern Marianas, Meranti underwent rapid intensification over the Philippine Sea while moving generally west-northwestward before making landfall over Itbayat Island, Batanes at 1700 UTC 13 September with a Dvorak-estimated peak intensity of 61 m/s and 925 hPa. Despite the absence of the Doppler weather radar at Basco, Batanes, the presence of two synoptic stations over Batanes allowed the validation of the estimated intensity of Meranti at landfall, especially since the eye of the typhoon passed directly over the Itbayat (98132) station. Mean sea level pressure observations derived from microbarograms of Itbayat and Basco (98134) stations during the passage revealed a slightly more intense tropical cyclone at landfall than Dvorak estimates suggest. These surface data suggests that Meranti could be the most intense tropical cyclone at landfall, in terms of central pressure, over the Philippines for the 2016 typhoon season.

Ms.		Engineer
Hsiaochia Yen		**Research and Technology Development Team of Soil and Water Conservation Bureau, Council of Agriculture**
		Email:scyen0724@mail.swcb.gov.tw

Biography

From hydrological and hydraulic analysis and watershed planning, learned from first job of Engineering Consultants to as a engineer, first line staff, takes in charges of debris flow disaster prevention, I recognize that Soil and. Water Conservation Engineering should been multi consideration and taken actions that suit local circumstances. Furthermore, combine using technology with database from research is the important step to develop trend of Soil and Water Conservation. And we are committed to that.

Education

- 2005-2007, Master Department of Soil and Water Conservation, National Chung Hsing University.

Work Experience (most recent)

- 2007-2010, Engineer, Long-Time Engineering Consultants, LTD.
- 2010-2017 Engineer, Nantou Branch, Soil and Water Conservation Bureau Council of Agriculture, Executive Yuan.
- 2017- present, Engineer, Research and Technology Development Team of Soil and Water Conservation Bureau Council of Agriculture, Executive Yuan.

Research Interests

- Watershed management
- Design of soil and water conservation engineering
- Hydrological and hydraulic analysis

The Engineering and Disaster Prevention since 1999 Earthquake (Ml=7.3) in Jiufengershan, Central Taiwan

Hsiaochia Yen
Research and Technology Development Team of Soil and Water Conservation Bureau

Abstract

An earthquake occurred with a magnitude of 7.3 on Richter Scale in Jiufengershan, central part of Taiwan on September 21, 1999. It caused two landslide dams due to dip slope collapsed and debris deposited. Jiufengershan is a classroom in nature of the dynamic earth. What we treat this area after the landslide is not only original construction but combines nature ecological guide. Furthermore, we keep focus on monitoring and disaster prevention t. From this historical record of the ground, we learned long term geomorphological evolution and provide the principle of treatment for such kind of catastrophic disaster in the future.

附 錄 2.

水利署王藝峰副署長簡報

Typhoon & Cloudburst Disaster Management under Extreme Climate in Taiwan

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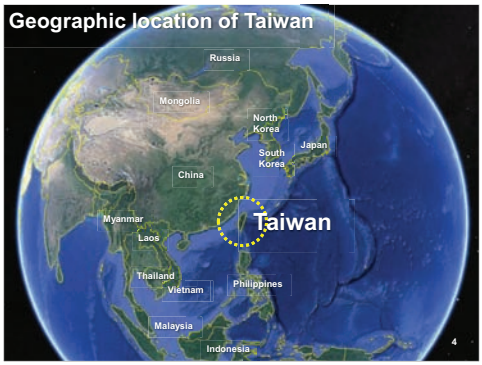
Water Resources Agency
Sept. 26, 2017

Outline

- Water Environment
- Challenge
- Action
- Vision

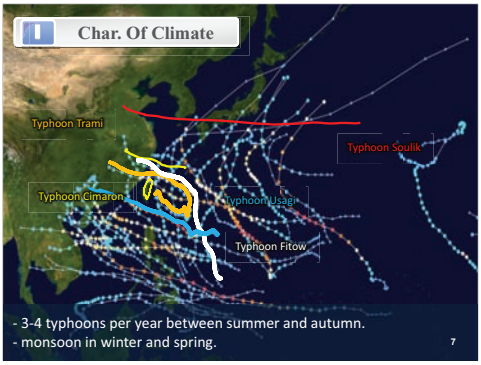
Water Environment

Geographic location of Taiwan



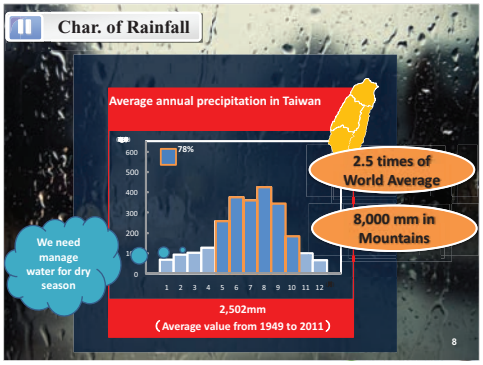
Taiwan

I Char. Of Climate

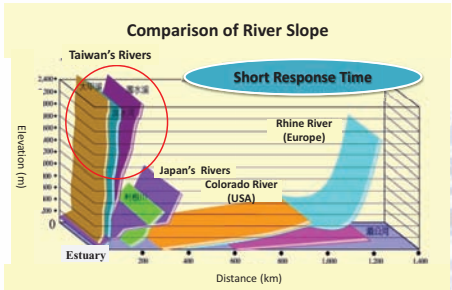


- 3-4 typhoons per year between summer and autumn.
- monsoon in winter and spring.

II Char. of Rainfall



III Char. of Rivers & Reservoirs



IV Char. of Natural Disasters

- *Major natural disasters*

Earthquakes **Typhoons**

Challenges

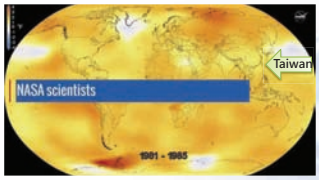
I Climate Change

Temp.

Global temperature is gradually rising

- 2017 is the second-hottest year on record, behind only 2016

by Gavin Schmidt, director of NASA's Goddard Institute for Space Studies



By the end of the 21st century	AR5 (2013)
Temperature rise	Worst case 4.8℃
Sea level rise	Worst case 82cm

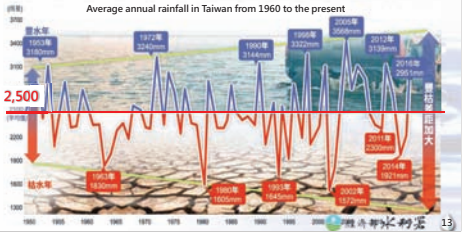
Source: NASA, IPCC

Rainfall

Violent ups and downs of annual rainfall trends between wet and dry years

- Average annual rainfall in Taiwan is about 2,500mm. Violent ups and downs between wet and dry years become more serious because of extreme rainfall under climate change.

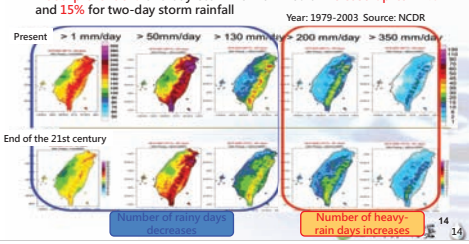
Average annual rainfall in Taiwan from 1960 to the present



Rainfall

By the end of this century the number of rainy days decreases but that of heavy-rain days increases

- Water resources: 7% rainfall reduction in wet season and 14% in dry season
- Flood prevention: one-day storm rainfall would increase up to 14% and 15% for two-day storm rainfall



Sea Level

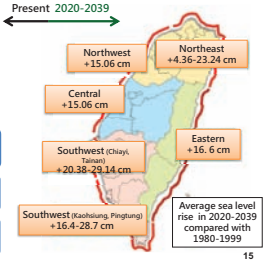
Sea level rising gradually

- The sea level is rising around Taiwan whether it is now or in the future

Present (measured data)

Present 2020-2039

- Keelung (1954-2009) Rising rate: 1.95-2.72mm/year
- Taichung (1972-2009) Rising rate: 2.64-3.88mm/year
- Tainan (1979-2009) Rising rate: 3.69-6.07mm/year
- Pingtung (1976-2009) Rising rate: 4.63-6.56mm/year
- Taitung (1976-2009) Rising rate: 6.33-9.66mm/year



II Urbanization

Urbanization increase surface runoff

III Improper Development

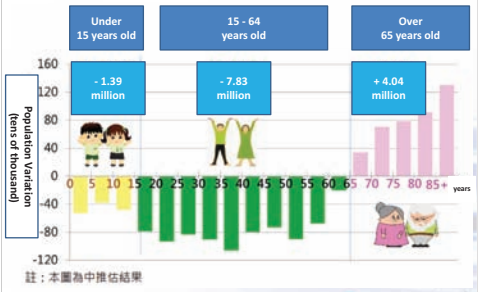
Ultra-pumping groundwater induced Land subsidence

Improper reclamation induced Landslides and water turbidities

2004 Typhoon Aere- Shimen Reservoir

Aging

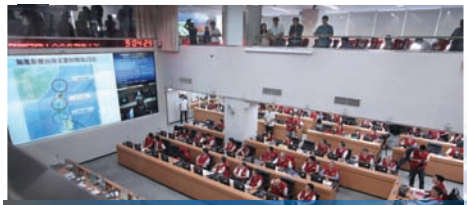
2016 v.s. 2061



註：本圖為中推估結果

Action

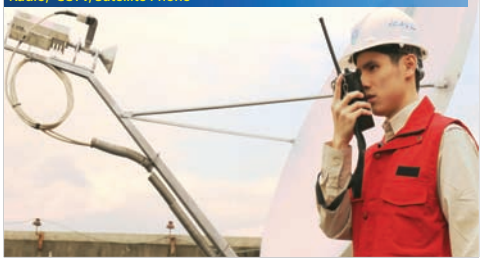
Successful Water Disaster Prevention System



A Team
Emergency Management Center

Disaster Emergency Communication System

Radio, CCTV, Satellite Phone



118 CCTV For all day monitoring

站名	日	改善前	改善後
玉峰大橋 (第四河川局)			
大洲一號橋 (第六河川局)			
渡頭堤防 (第六河川局)			
後庄 (第五河川局)			

1015 Mobil Pumps

22 Counties regular exercise

Early Warning

Four Steps of Early Warning for Typhoon-driven Floods
→Release Warning →Take Actions

1 Initiation: Risk assessment and forecast
- Assess high-risk rivers
- Assess areas prone to flooding

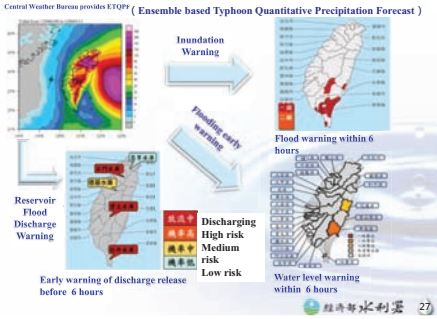
2 Preparation: Disaster prediction
- Provide information on water resources early warning

3 Response: Disaster monitoring
- Water resources early warning
- Release instant warning
- Collect on disaster information and respond

4 Restoration: Continuous disaster monitoring, prevention of secondary disasters
- Water resources early warning
- Release instant warning
- Collect information on disasters and repair

Early Warning by Using the Forecasted Rainfall Data

Central Weather Bureau provides ETQPF (Ensemble based Typhoon Quantitative Precipitation Forecast)



Develop disaster prevention tools to provide instant water information and early warning

Smart Phone APP

Monitor disaster

Monitor disaster events

Flooding Information collected by Local Calls

Recovery

Repair reconstruction

Public participation

1,578 volunteers
They helped report 10,470 water disaster cases.

Enterprise participation

Since 2012, enterprise help disaster monitoring

Since 2015, enterprise sponsor Flood prevention community operation

Vision

Forward-Looking Infrastructure Development Program for improvement of water environment

Develop the water environment construction projects according to the consensus of Taiwan Water Forum

◆ Project focus

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Aim

- To increase regular water supply by 110 thousand tons/day for approx. 330 thousand people
- To increase emergency water supply by 1,200 thousand tons/day

Strategy

- Diversified water sources to improve regular and emergency water supply capacity
- Better management and application of technology to encourage development and upgrade of water industry.
- Conservation of reservoir watershed. Reduction and removal of sediments in reservoirs.
- Improve water supply in off-shore islands and areas without access to tap water.

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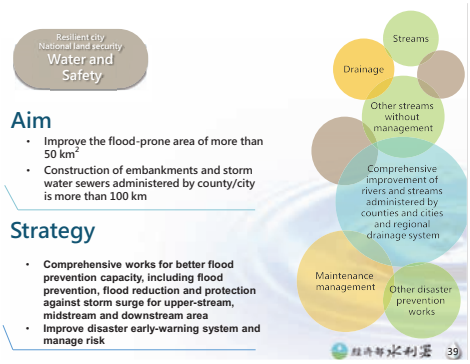
Aim

- Improve the flood-prone area of more than 50 km²
- Construction of embankments and storm water sewers administered by county/city is more than 100 km

Strategy

- **Comprehensive works for better flood prevention capacity, including flood prevention, flood reduction and protection against storm surge for upper-stream, midstream and downstream area**
- **Improve disaster early-warning system and manage risk**



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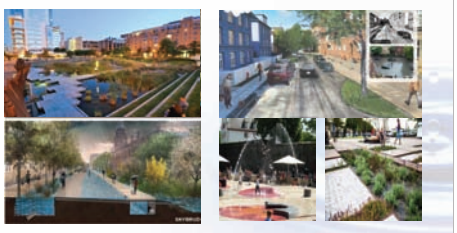
Integrate urban & disaster management

Cloudburst management toolbox



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Detention Pond

Qiuhonggu Plaza, Taichung

- Total area of 30,000 M³

Smart disaster management

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Conclusions

Disaster Prevention is the most important responsibility for Government ！

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Facing the challenges, we intend to create a water-friendly living environment that is resilient to drought and flood in Taiwan.

44

We are looking for opportunities of international collaboration to share experiences, resources, talents and growth up with our partners.

45

Thank You for Your Attention!

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Vietnam & Taiwan

	Vietnam	Taiwan
Area	331,688 km²	36,188 km²
Population	95.0 million	23.5 million
Terrain	• Mountain and hills accounted for 4/5 of the total area • Highest point of 3,143 meter (Monut Fansipan)	• Mountain and hills accounted for 2/3 of the island's total area • Highest point of 3,952 meter(Mount Jade) • More than 260 mountains that higher than 3,000 meters

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附 錄 3.

水利署第十河川局林益生課長簡報

經濟部

Flood control project and flood mitigation strategies for Taipei area

Lin Yi-Sheng(林益生)

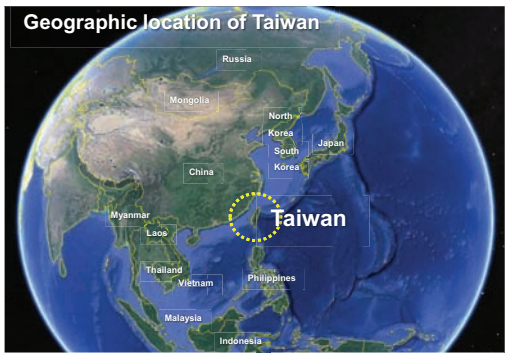
Section Chief

水利署第十河川局

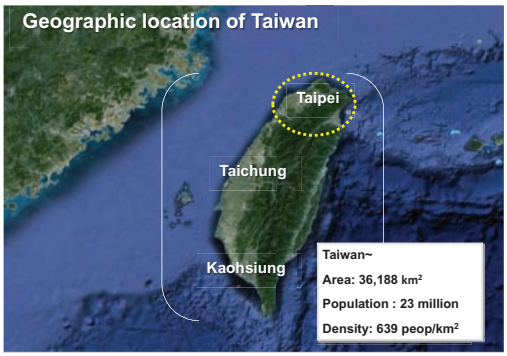
經濟部水利署

WATER RESOURCES AGENCY

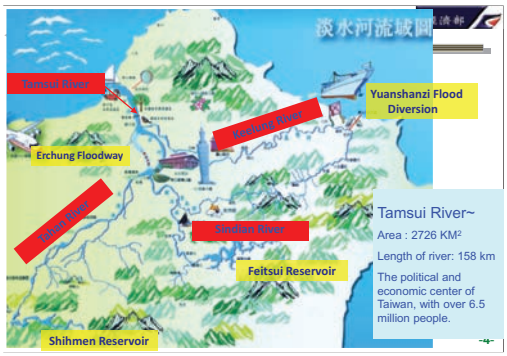
Geographic location of Taiwan



Geographic location of Taiwan

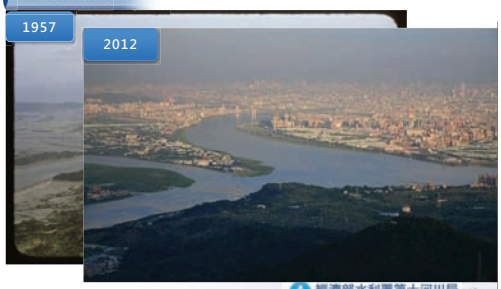


Taiwan~
Area: 36,188 km²
Population : 23 million
Density: 639 peop/km²



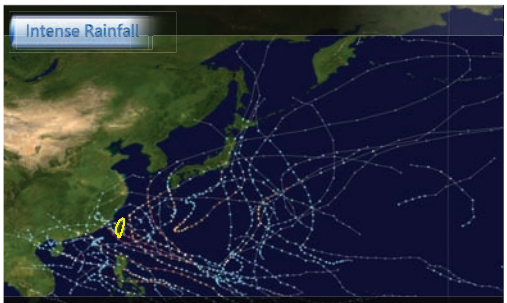
Tamsui River~
Area : 2726 KM²
Length of river: 158 km
The political and economic center of Taiwan, with over 6.5 million people.

Urbanization



https://picasaweb.google.com/TomJones96/195758Taiwan

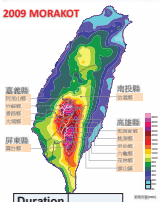
Intense Rainfall



- 3-5 typhoons per year.
- High intensity and long duration.

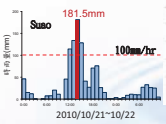
Intense Rainfall

2009 MORAKOT



Duration (hours)	mm
24	1,624
48	2,361
72	2,748
Total	2,884

2010 MEGI



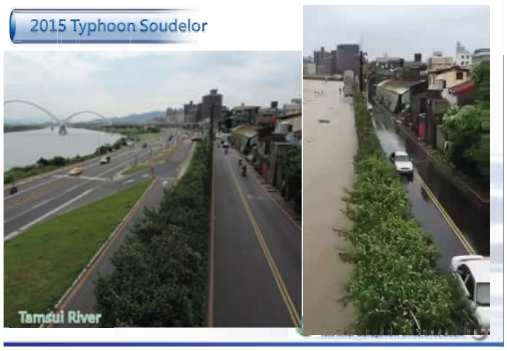
Duration (hours)	mm
1	181
3	444
24	1,084
Total	1,333

2015 Soudelor

Duration (hours)	mm
1	92
6	420
24	722
Total	777

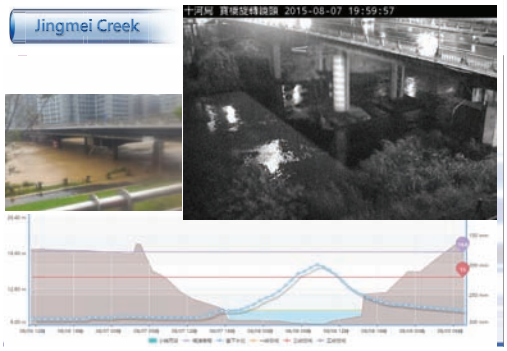
2015 Typhoon Soudelor

2015 Typhoon Soudelor



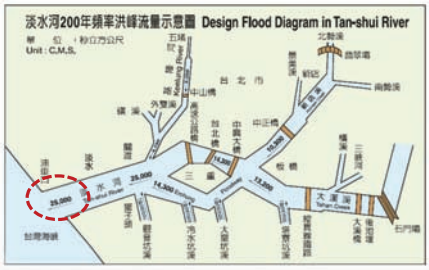
2015 Typhoon Soudelor

Jingmei Creek



Tamsui River Flood Control Project

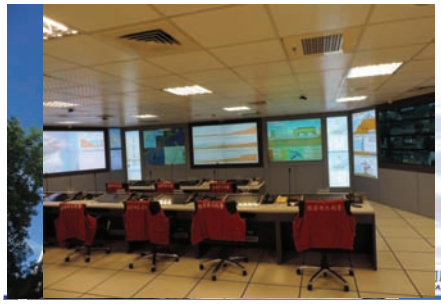
Since 1973~ 1999 NTD 111.4 Billion≒ USD 3.7 Billion



Tamsui River Flood Control Project

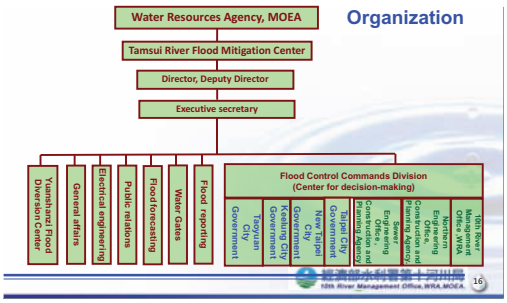
Tamsui River Flood Control Project

Tamsui River Flood Mitigation Center



Tamsui River Flood Mitigation Center

Organization



Hydrological Monitoring

- 145 Rain-Gauge Stations (WRA 25,CWB116.....)
- 85 Water Level Stations

Observe every 10mins

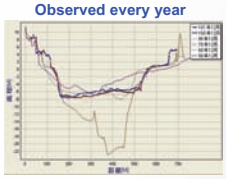
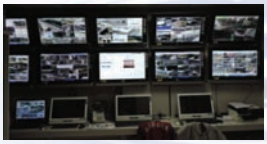
Multiplex system (wireless,internet..)

Open data (web,App..)

- 29 CCTV

Hydrological Monitoring

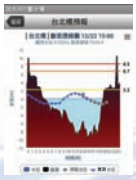
- River cross sections observation
- Since 1969~
- 524 Sections
- Observed every year
- Watergate and Pumping Station monitoring system
- 180 Pumping Stations
  (Pumping capacity > 2000 CMS)
- 53 Evacuation Gates

經濟部水利署第十河川局 10th River Management Office, WRA, MOEA 18

Flood Forecasting System

- Since 1996
- REFOR (Real Time Flash Flood Forecasting Model,2004, Developed by WRA10)
- Realtime function
  - ◎Work 24 hours everyday
  - ◎Collect data & Forecaste every 10 mins
  - ◎Provide 6-hour forecast data
  - ◎Forecasting data combine map display
- Stand Alone function
  - ◎Simulate under various hydrologic conditions

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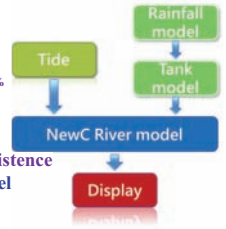
Flood Forecasting System

- Rainfall
  - Observation data Persistence
  - CWB QPESUMS
  - Typhoon Climatology
    - Average
    - Cumulative probability 90%, 75%
  - TTFRI ensemble forecast
- Runoff：tank model
- Reservoir：realtime discharge Persistence
- River：Unsteady xxx model
- River mouth：
  - Tide
  - Pressure estimate storm surge



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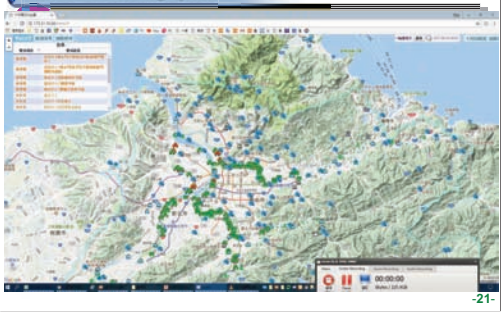
Flood Forecasting System



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The other Tools

Develop disaster prevention tools to provide instant water information and early warning

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Water information APP & web

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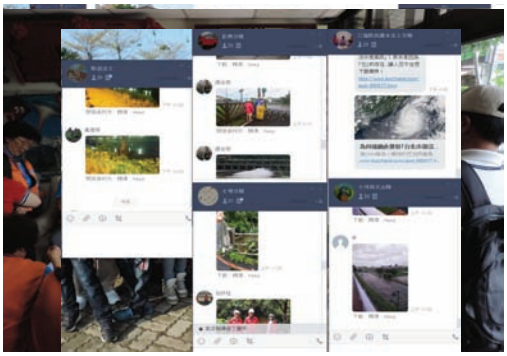


Flood prevention exercises

Conclusions

Thrive in calamity and perish in soft living.

~Mencius(B.C.372~289)

- Taiwan has been facing serious natural challenges. We have made significant efforts in hazard prevention and mitigation.
- Change tradition： Take more proactive approach for disaster prevention and evacuation.
- Work together：The government also needs to work with the public and enterprises to reduce the impact of disaster.

經濟部水利署第十河川局 10th River Management Office, WRA, MOEA 27

Thank You for Your Attention!

http://www.wra10.gov.tw

經濟部水利署第十河川局 10th River Management Office, WRA, MOEA 28

附 錄 4.

越南資源環境部氣象水文暨氣候變遷研究院(IMHEN)、農業與農村發展部防災總局文宣折頁

VIET NAM
INSTITUTE OF METEOROLOGY, HYDROLOGY AND CLIMATE CHANGE

INTRODUCTION TO VIET NAM INSTITUTE OF METEOROLOGY, HYDROLOGY AND CLIMATECHANGE (IMHEN)

ORGANIZATIONAL DIAGRAM

→ DIRECTOR GENERAL ←

- Scientific Council
- Deputy Directors General
- Sub – Institute of Hydro – Meteorology and Climate Change (in Ho Chi Minh City)
- Administrative Office
- Center for Meteorology and Climatology
- Department of Science, Training and International Cooperation
- Center for Agricultural Meteorology
- Department of Planning and Finance
- Climate Change Research Center
- Division of Hydro.Met. Equipment and Measurement Automation
- Center for Hydrology and Water Resources
- Division of Remote Sensing Application and GIS
- Center for Marine Hydro-Meteorology
- Vietnam – Korea Center for Environmental Research & Training
- Center for Environmental Research
- Hydro-Meteorology and CC Consulting and Service Center

METEOROLOGY, CLIMATOLOGY AND AGRO-METEOROLOGY

- Study on atmospheric circulations, monsoon, climate variation, climate extreme event, ENSO and its impacts, tropical meteorology and tropical cyclone;
- Apply climatology in sectors;
- Provide weather and crops yield forecasting, heavy rainfall and tropical cyclone warning, climate prediction, climate and agro-met. bulletins;
- Provide services on Agro-met. zoning, adaptability of new or hybrid varieties, sustainable agricultural development, food security and crop insurance.

HYDROLOGY, WATER RESOURCES AND MARINE HYDROLOGY

- Study scientific basic of hydrology, integrated water resources management and hydrologic forecasting technology for river basin;
- Assess impacts of climate change on water resources and water-related disaster risk management and propose adaptation measures;
- Study scientific basic, apply and transfer technology and research on forecasting, warning of marine hydro-met., environment and disaster.

ENVIRONMENT

- Monitor air and water quality and acid deposition;
- Study on air and water pollution; environmental economy; environment impact assessment; waste treatment technology.
- Environmental Protection and Cleaner Production

CLIMATE CHANGE

Study and provide services on:

- Climate change adaptation, mitigation, impacts and vulnerability, disaster risk reduction;
- Green Growth and Economics of climate change;
- Sustainable Development;
- Policy Research and Institutional Advocacy.

CONSULTING, APPLYING AND TRANSFERRING TECHNOLOGY

- License for scientific and technological activities No A277 issued on 21 August 2014;
- Decision No 2050/QD-BTNMT issued on 07 Sep 2016 on promulgating regulations on coordination of hydrometeorology forecasting between National Hydro-Meteorological Service and Viet Nam Institute of Meteorology, Hydrology and Climate change;
- Accreditation No VILAS 255, 284, 637;
- Certification Code: VIMCERTS 073,168

PhD PROGRAM

- Meteorology and Climatology;
- Hydrology;
- Oceanography;
- Natural Resources and Environment Management;
- Climate change and Sustainable Development

MAJOR ACTIVITIES AND ACHIEVEMENTS

01 Meteorology, Climatology and Agro-Meteorology

02 Hydrology, Water Resources, and Marine Hydrology

03 Environment

04 Climate change

05 Consulting, Applying and Transferring Technology

06 Ph.D Program

FOUNDATION

2014	Viet Nam Institute of Meteorology, Hydrology and Climate Change **(IMHEN)**	Ministry of Natural Resources and Environment **(MONRE)**
2003	Viet Nam Institute of Meteorology, Hydrology and Environment **(IMHEN)**	Ministry of Natural Resources and Environment **(MONRE)**
1977	Institute of Meteorology and Hydrology **(IMH)**	Vietnam Hydrometeorological Service of Viet Nam **(HMS)**

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT

VIETNAM DISASTER
MANAGMENT AUTHORITY


phongchongthientai.vn

Office: No. 2 Ngoc Ha Str., Ba Dinh Dist., Ha Noi
Tel: (84-24) 37335697 **/ Fax:** (84-24) 37335701
Email: phongchongthientai@mard.gov.vn

VIETNAM DISASTER MANAGMENT AUTHORITY

(Decision No. 26/2017/QĐ-TTg of the Prime Minister)

1. To submit to Minister of Agriculture and Rural Development for promulgation:

a) Law projects, draft resolutions by the National Assembly; decree projects, draft resolutions by the Standing Committee of the National Assembly; draft decrees and resolutions by the Government; draft decisions, instructions by the Prime Minister, and other documents on natural disaster prevention and control activities.

b) Long-term, mid-term and annual development strategies, planning and development schemes; mechanisms, policies; and state-focused programs, projects and works in the field of natural disaster management.

c) National standards, national technical codes and specialized economic-technical norms in the field of natural disaster management.

2. Technical instructions of natural disaster management.

3. Propagation, dissemination and education of law on natural disaster management.

4. To direct, monitor and organize the implementation of legal documents, mechanisms, policies, strategies, planning, programs and projects in the field of natural disaster management.

5. Prevention and control of natural disaster risks:

a) To submit to the Minister of Agriculture and Rural Development national strategies on natural disaster management; planning orientations, a list of fundamental research projects on natural disaster management; plans of management of natural disasters, floods, river bank and coastal landslide; plans of disaster prevention and control at the national level; Ministry of Agriculture and Rural Development's natural disaster prevention and control and disaster preparedness plans; instructions of procedures and methods of making and monitoring plans of preventing natural disasters, floods and riverbank and coastal landslide.

b) To instruct and monitor making, approval and implementation of disaster response plans and natural disaster prevention and control plans in accordance with socio-economic development plans and projects of localities, ministries and branches as assigned by the Minister of Agriculture and Rural Development.

c) To instruct and monitor implementation of law provisions on human resources, materials, means, equipment, essential supplies, and resources for natural disaster prevention and control activities; to monitor and supervise operations affecting works, measures of natural disaster prevention and control, and how households, individuals, domestic and international agencies and organizations operating in Vietnam comply to regulations on the natural disaster management;

d) To monitor compliance with natural disaster management regulations in construction and protection of disaster prevention and control works and works with disaster prevention and control structures; to include the issue of natural disaster prevention and control in socio-economic and sectoral development plans; and to ensure that

requirements of disaster management for new construction or upgrading of urban and rural residential areas and technical infrastructure works are met;

e) To organize implementation of national strategies for natural disaster management, and plans of natural disaster management;

f) To build and protect natural disaster management works and works with disaster prevention and control structures; to prepare human resources, materials, means, equipment, communication system, essential supplies, and resources for the natural disaster prevention and control operations by the Authority;

g) To establish and to operate a tsunami warning system and to deliver early warnings of tsunami in this system; to make response plans for natural disasters, typhoons, super storms and emergency response plans in case of floods exceeding the designed capacity or in other emergency cases.

6. Response to natural disasters:

a) To submit to the Minister measures of mobilizing human resources, materials, means for natural disaster management and to organize how to take these measure upon their approval;

b) To assist the Minister of Agriculture and Rural Development in directing natural disaster response plans in accordance with the law provisions;

c) To instruct and monitor implementation of regulations on emergencies of diverting floods, retarding floods, and measures of population evacuation and supports for disaster-affected people;

d) To instruct, monitor and organize preventing and controlling the erosion of river bank, coast, embankment on borders and other works of natural disaster management in accordance with the law provisions;

đ) To monitor and update forecasts and warnings of natural disasters; to provide professional monitoring and supervision; to respond to climate changes and sea level rise in accordance with the Authority duties.

7. Recovery from Natural disaster consequences

a) To submit to the Minister of Agriculture and Rural Development measures of recovery and summary reports, statistics for damage caused by natural disasters across the country, proposals of emergency aids and long-term and short-term support;

b) To assist the Minister of Agriculture and Rural Development in directing disaster recovery efforts in accordance with the law provisions;

c) To instruct and supervise gathering and assessment of statistics for damage caused by natural disasters and disaster recovery efforts in accordance with law provision.

8. Communication and community-based risk management:

a) To organize disaster prevention popularization and education activities in accordance with law provisions; and to implement projects on public-awareness improvement and community-based disaster risk management.

b) To organize and participate in natural disaster management skill training courses and to organize training courses for those who are in charge of disaster prevention and control operations;

c) To supervise disaster prevention popularization and education operations in accordance with law provisions

9. Dykes management:

a) To submit the Minister of Agriculture and Rural Development the following documents:

Planning guidelines, list of fundamental research on dykes, flood prevention and control plans for dyke-bou nded rivers, and dyke planning as regulated;

Regulations on dyke classification, load permits and license granting for vehicles travelling on dykes, legal documents confirming license granting for operations on special dykes at level I, level II and level III and for construction and




upgrading of transportation works related to dykes as regulated by the law; dyke-related agreements; documents on appraisal of investment projects on using river banks without existing structures; dyke maintenance and mobilization of forces, materials and means for dyke protection in accordance with the regulations.

b) To implement the state management duty of planning flood prevention and control on dyke-bounded rivers and dyke planning; constructing, maintaining, upgrading, renovating and strengthening dykes; managing, maintaining and exploiting dykes in accordance with the law on dykes, relevant law provisions and assignment by the Minister of Agriculture and Rural Development.

10. To assist the Minister of Agriculture and Rural Development in implementing the main duties of natural disaster management and implementing the main duty of the Standing Committee for Natural Disaster management, the Standing Office of Central Committee for Natural Disaster management.

11. To manage planning and fundamental-research projects which the Directorate is in charge of as assigned by the Minister of Agriculture and Rural Development.

12. To implement a duty of collecting and managing data in the field of natural disaster management.

13. To conduct scientific researches, natural-disaster prevention and control and dyke technology transfer and to implement duties of constructing new rural areas as assigned by the Minister of Agriculture and Rural Development.

14. International cooperation in natural disaster management:

a) To submit to the Minister of Agriculture and Rural Development reports on calling for, receiving and coordinating international aids of natural disaster management as a duty of Ministry of Agriculture and Rural Development;

b) To receive information of natural disaster forecasts and warnings and other natural disaster-related information from international agencies and organizations; provide information of natural disasters for international agencies and organizations in accordance with the law provisions;

c) To serve as a coordinator in natural disaster management, in ASEAN cooperation in disaster management, in the United Nations' framework of natural disaster mitigation and in other international cooperation in natural disaster management as regulated by law and as assigned by the Minister of Agriculture and Rural Development;

d) To organize implementation of international programs, projects and cooperation activities in natural disaster and dykes management as regulated by the law and as assigned by the Minister of Agriculture and Rural Development.



15. To implement the administrative reform in alignment with the administrative reform program of the Ministry of Agriculture and Rural Development.

16. To manage the organizational structure, state employees and laborers as regulated by the law and as assigned by the Minister of Agriculture and Rural Development; to apply encouragement and reward policies and punishment policies, to hold skill training and capacity improvement training courses for the Directorate's state employees as regulated by the law.

17. To instruct and supervise associations' and non-government organizations' natural disaster management operations as assigned by Minister of Agriculture and Rural Development.

18. To implement the technical inspection in accordance with the law provisions, citizen reception, claim and complaint settlement, corruption prevention, law violation handling, and retrenchment and anti-lavishness policies as regulated by the law.

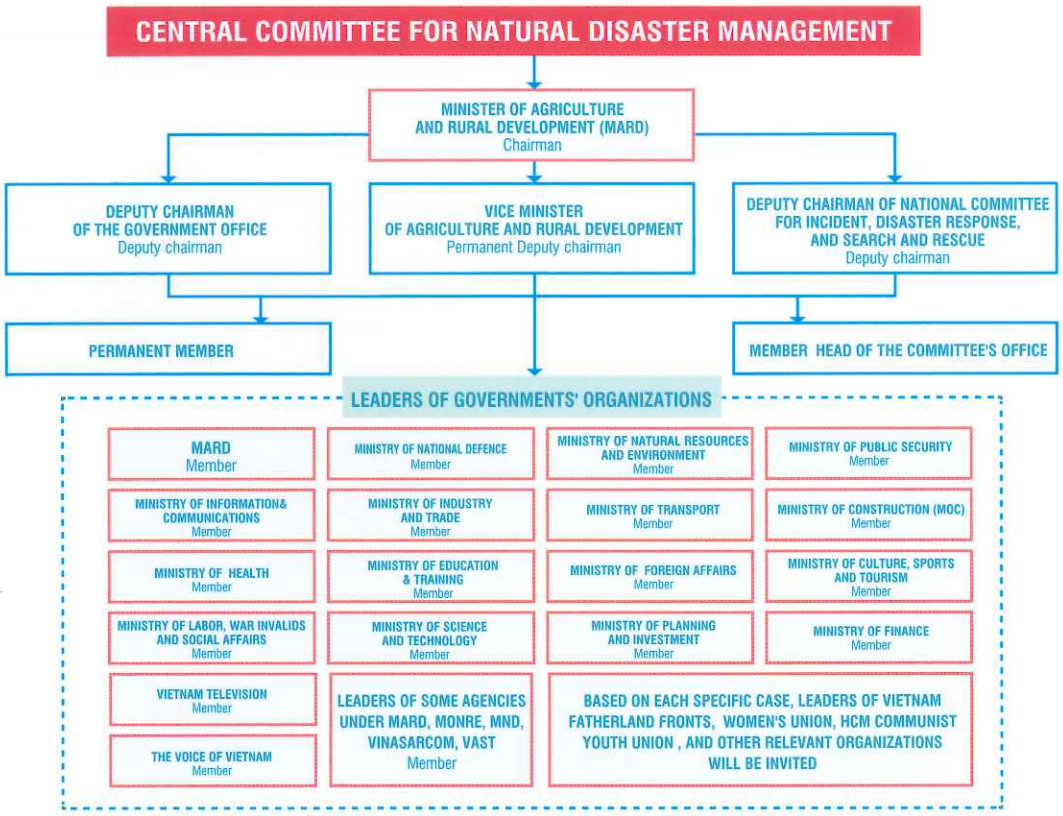
19. To manage allocated budget, properties and other resources in accordance with the law provisions.

20. To manage construction investment as assigned by the Minister of Agriculture and Rural Development and as regulated by the law.

21. To implement other duties assigned by the Minister of Agriculture and Rural Development.

The office of the Central Steering Committee for Natural Disaster Management is based at the Vietnam Disaster Management Authority
Tel: (84-24) 37335697 * Fax: (84-24) 37335701
Email: phongchongthientai@mard.gov.vn * Website: www.phongchongthientai.vn

ORGANIZATIONAL CHART



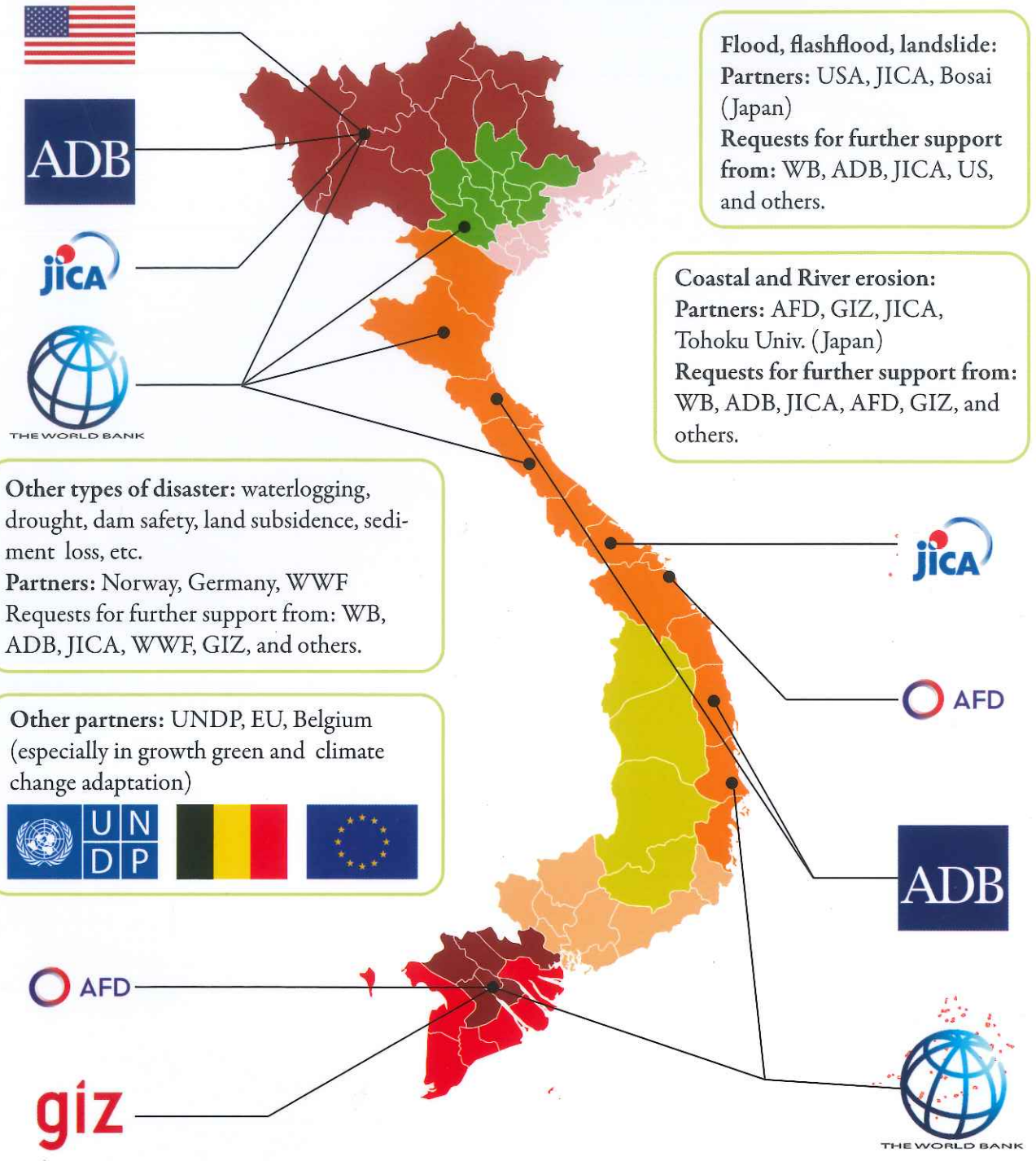
RESPONSIBILITIES

- To take charge of inter-sectoral coordination to support the Government, Prime Minister in organizing, instructing and managing activities of disaster prevention, response and recovery throughout the country;
- To give instruction in developing national strategies and plans, policies, and legal documents in disaster management; and supervising the implementation of the national strategies and plans, policies, legal documents in disaster management;
- To give instruction in developing disaster response plan;
- To give instruction and coordination in disaster response and recovery throughout the country;
- To make urgent decisions, mobilize resources from Ministries, Governmental agencies, organizations, individuals for disaster response and recovery in accordance with regulations;
- To carry out inspection and supervision of disaster management activities implemented by Ministries, sectors and provinces.

THE SOCIALIST REPUBLIC OF VIETNAM IS A MEMBER OF:

- The ASEAN Committee on Disaster Management (ACDM) since 2003
- APEC's Emergency Preparedness Working Group (EPWG APEC) since 2011
- Working Group on Disaster Risk Reduction (WRDRR) of the Typhoon Committee
- Asian Disaster Reduction Center(ADRC)
- Delta Coalition since 2015

INTERNATIONAL COOPERATION IN NATURAL DISASTER MANAGEMENT IN VIETNAM



Flood, flashflood, landslide:
Partners: USA, JICA, Bosai (Japan)
Requests for further support from: WB, ADB, JICA, US, and others.

Coastal and River erosion:
Partners: AFD, GIZ, JICA, Tohoku Univ. (Japan)
Requests for further support from: WB, ADB, JICA, AFD, GIZ, and others.

Other types of disaster: waterlogging, drought, dam safety, land subsidence, sediment loss, etc.
Partners: Norway, Germany, WWF
Requests for further support from: WB, ADB, JICA, WWF, GIZ, and others.

Other partners: UNDP, EU, Belgium (especially in growth green and climate change adaptation)

Emergency Aid:
UNICEF, The International Federation of Red Cross and Red Crescent Societies (IFRC)
Requests for further support from: UN, IFRC and others.

Community-based Disaster Management (CBDM):
CRS, PLAN, CARE, UNWOMEN, WB 5, UNDP, Malteser International
Requests for further support from: CRS, PLAN, CARE, UN, WB, UNDP and others.