出國報告（出國類別：會議）

參加第 6 屆國際環境資訊會議

服務機關：行政院環境保護署
姓名職稱：顏瑞錫技士
曾灼灼設計師
派赴國家：泰國
報告日期：96 年 12 月 21 日
出國時間：96 年 11 月 20 日至 24 日

表一　　公 務 出 國 報 告 簡 表

出國計畫名稱：參加第 6 屆國際環境資訊會議

出國人姓名/職稱/服務單位：顏瑞錫技士　　環保署監資處
曾灼灼設計師　環保署監資處

出國日期：民國 96 年 11 月 20 日至 11 月 24 日

出國期間概況紀要：

活動日期	活動內容	活動地點
11/20	啟程	台北至泰國曼谷
11/21-23	參加第 6 屆國際環境資訊會議	泰國曼谷
11/24	返程	泰國曼谷至台北

行程成果評估及心得建議：

國際環境資訊會議係國際間針對環境資訊科學發展相關課題之主要研討會，係由加拿大 Regina 大學與國際環境資訊協會(International Society for Environmental Information Sciences)共同發起，在國際間享有聲譽。

本次參加由加拿大 Regina 大學與 ISEIS 在泰國曼谷共同舉辦的第 6 屆國際環境資訊會議，我國提供環境監測資料管理及環境資料庫建置之經驗與成就等 2 篇論文，均獲發表，成功彰顯台灣在環保工作上的績效。並收集有關氣候變化、水資源管理與環境監測及環境資訊專題等 20 餘項共 90 餘篇論文，以供業務推動參考。

未來除了提出環境監測資料管理及環境資料庫建置成果之外，亦可提出其他面向的執行經驗與成果，以彰顯台灣在環保工作上的績效。

目錄

參加「第 6 屆國際環境資訊會議」

出國報告

壹、會議背景說明

一、國際環境資訊會議係國際間針對環境資訊科學發展相關課題之主要研討會，於西元 2002 年由加拿大 Regina 大學與國際環境資訊協會(International Society for Environmental Information Sciences)共同發起，在國際間享有聲譽。

二、前述會議每年於加拿大、美國、中國大陸等不同的國家舉辦，今年來到東南亞的泰國舉辦，共同研討有關氣候變化、水資源管理與環境監測及環境資訊專題等議題。

三、泰國原名暹邏，位於中國和印度間中南半島之心臟地帶，全國均尊崇佛教。多個世紀以來，一直是東南亞地區宗教、文化和多個民族的匯集地。泰國面積約五十萬平方公里，與法國國土相若，人口約六千餘萬。泰國西北與緬甸爲鄰，東北接寮國、東連柬埔寨，南部與馬來西亞接壤。從地域上劃分，泰國共有五個主要區域：（一）北部山區叢林，林中日常工作仍靠大象操作。而冬季氣候清涼，可種植櫻桃和桃子。（二）東北部屬湄公河流域，是山巒起伏的高原地帶，亦爲五千六百年前上古銅器時代文化薈萃的區域，沿岸平地擁有無數大小不一的優美海灘，成爲發展夏日旅遊業的據點。（三）東部與高棉爲鄰，是山脈縱橫交錯構成的地形，點綴著平原與森林，其中最著名的景點就是芭達雅。（四）中部平原土地肥沃，盛產大米和水果，山脈和河谷縱橫交錯，是發展水力發電的理想地區。（五）南部半島除擁有迷人景色外，更蘊藏天然資源如錫礦、橡膠園和漁產。

四、泰國首都曼谷，是一個同時兼具古老氣息和現代風情的東方大城，也是一個處處充滿著讚歎與美麗的地方。這個城市是於西元 1782 年由卻克里（Chakri）王朝的帝王所建立的，也是政治、商業與文化中心。不僅在地理上位居輻輳點，更是旅遊觀光的重要據點。曼谷目前人口約 700 萬人，湄南河貫穿整個曼谷市，爲曼谷市帶來了繁榮與商機，也因此贏得「東方威尼斯」的美名。

貳、會議經過

一、2007 年第 6 屆國際環境資訊會議於今年 11 月 21 日至 23 日在泰國的首都曼谷召開，共有加拿大、美國、日本、澳洲、印度、伊朗、香港、中國大陸、泰國及我國等百餘位學者專家與會，並發表 20 餘項 90 餘篇論文。我國由環保署監資處顏瑞錫技士及曾灼灼設計師參加，會議議程及相關資料詳附件一。

二、會議地點是在位於泰國曼谷的聯合國大廈二樓及三樓會議室，與會學者專家大多數是被安排於與大會簽約的 Amari Watergate Hotel 住宿，其距離會場之車程約 30 分鐘。我國代表則是於 Royal Princess Hotel 住宿，僅需步行約 20 分鐘，即可抵達會場。

三、11 月 21 日：開幕及議題討論

（一）由大會會主席加拿大 Regina 大學 Paitoon Tontiwachwuthikul 博士致詞，歡迎來自世界各國的學者專家參與第 6 屆環境資訊會議，共同關心及研討有關水資源管理、氣候變化及環境資訊專題討論相關議題。

（二）我國投稿的 1 篇論文－「A Layer-based Approach for Streamlining and Integrating Environmental Monitoring Data」（如附件二），獲得大會接受發表，並張貼於論文海報區。這篇文章提出多層次及流線化的環境監控網路系統體系的綜合架構，並以台灣空氣品質監控網路（TAQMN-2）爲例，證明其可行性及實用性，其過程包括數據收集，數據計算，數據貯存，及數據傳播與應用。

（三）第一位 Keynote Speakers 是來自加拿大的 Malcolm Wilson 博士，他是 IPCC Working Group III 的成員(該組織獲得 2007 年諾貝爾和平獎)，他也是 Regina 大學的能源與環境辦公室的主任，以及國際二氧化碳捕獲測試中心的主任。演講主題是溫室氣體的效應及因應對策，並說明溫室氣體是真正的全球性議題，不僅西方的加拿大冰川在節節後退、漸漸地消失中，東方的氣候也在變遷中。這是一個無國界及無東西方界線的議題，各國應該要真正地重視其衝擊。自最近一次的冰河時期迄今，大氣中的二氧化碳濃度的變化，在冰河時期(約 4~5

萬年)的二氧化碳約 200 ppm，在 1 萬年前的二氧化碳濃度約 250 ppm，最近已升高到 280~290 ppm，且呈直線上升的趨勢。再則，分別以西元 1975 至 1995 年間的日最高溫，以及預測西元 2041 至 2050 年間的日最高溫繪製分布圖中可發現，每年的日最高溫落在攝氏 34~39 度的日數，由西元 1975 至 1995 年間的每年 1 天，提高爲每年 3.5 天。爲因應氣候的變遷，目前已著手進行二氧化碳封存技術的研究，例如地下含水層每年可儲存 100 萬頓的二氧化碳，由位於美加邊境的美國區域供應二氧化碳，將二氧化碳導入加拿大 Weybum 進行封存處理。

（四）第二位 Keynote Speakers 是來自北京大學的 Jinren Ni 博士，由他指導的論文超過 200 篇。演講的主題是快速界定永續性，並分析其與大陸洪災分布的關係研究。研究中先定出可以做爲永續性的指標項目，再將其定義權重，界定可以計算永續性的方式。依其定義的指標，界定大陸各區的永續性，再將大陸歷年全區的洪災資料與前述界定的永續性資料進行統計分析，得出二者的相關性及其在大陸的趨勢。

（五）在不同的會議室，與會各國學者分別報告有關氣候變化、水資源管理及環境資訊專題討論相關議題共 26 篇論文，包括氣候變化的影響、水中氮污染的影響與移除技術、CO_2 捕獲技術、氫與生質燃料的發展、地理資訊系統應用於環境監測等研究成果。

（六） 日本 Chuang Hui-Ping 報告的主題是「Mitigation of Nitrogen Pollution in Water body by Incorporating the DHS(Down-Flow Hanging Sponge) Systems and Autotrophic Nitrogen Removal Technologies」，這篇文章說明氮是在地球裡的一種重要的元素，它主要是以無機物的固態型式存在，與生命體的生命週期有關。近年來，氮污染已是有名的環境公害，並引起大家的關注。常見移除氮的方法都是透過硝化作用及除去氮素的方式，這是需要高成本、大量的能源、通風設備及碳的供給。所以，爲了節省成本，在這篇研究中，透過 DHS（Down-Flow Hanging Sponge）反應裝置將有助於降低氮排除的成本，並在低氧的供給下，透過 DHS 反應系統可移除氮效能 80%。

四、11 月 22 日：議題討論

（一）與會各國學者報告有關水資源管理、氣候變化及環境資訊專題討論相關議題共 52 篇論文，包括水域生態問題、資源永續性、水中氯化物的影響、工廠廢水處理後的水用途、CO_2 排放與減量、住宅區與工業區的空氣污染監測、GIS 應用於環境監測等研究成果。

（二）我國以簡報方式報告「Application of Web-GIS for Display and Integration of Water Quality Information」（獲大會接受發表，如附件三），這篇論文闡述如何以淺顯易懂的方式，同時呈現具有文字、數字、時空分佈特性的水質監測結果。並突破以往以表格及清單的方式，利用網際地理資訊系統在空間資訊展示上的優勢及 Ajax (Asynchronous JavaScript And XML)高互動性的整合性技術。在電子地圖上的測站位置以顏色變化方式，呈現台灣各水體（包含了 Rivers and Streams、Reservoirs、Marine Surface Water、Groundwater 等等）歷史或即時、靜態或動態的水質變化。對於測站水質的時空統計結果，則以即時運算出的圓餅圖及直方圖等方式呈現。此外，結合「RPI 的定義、polygon split method、color gradient function」等，則提供另一種更能吻合實際河川水質變化的情況；對於不同機關之間監測數據，則採用「Web-GIS 的緩衝區分析」和「相關統計圖形」，成功完成整合及展示。

（三）泰國 Chalermchai Pawattana 報告的主題是「Floodwater retention planning using GIS and hydrodynamic model: a case study for the Chi River Basin, Thailand」，這篇論文是以 Chi River 爲研究對象，這條河川是泰國東北的生命線，其附近的盆地經常出現洪水和乾旱之現象，GIS 及水力模型應用於洪水保留計畫之研究，可把洪水儲存起來，在乾旱季節釋放出來給農業和家庭使用。

（四）加拿大 Faranak Amirsalari 報告的主題是「Landsat Derived Impervious Surface Area and Potential Water Quality Impacts: A Case Study in the GTA」，這篇論文是利用 Landsat 圖形進行多倫多區域（GTA，Great Toronto Area）都市發展之時間數列分析(從 1985 到 2005 年)，並將氯化物當作水質指標，研究顯示不透水地表區域的增加將會導致 GTA 氯化物濃度的增加。城市化的結果將增加不

透水地表的面積，亦將直接影響特定地區的水文特性。因此，在這個領域上，適當的城市規劃與發展及監控，是一項很重要的環境工作。

（五）大會安排於 Amari Watergate Hotel 舉辦晚宴，感謝各國學者專家參與本次會議。

五、11 月 23 日：議題討論

（一）與會各國學者報告有關水資源管理、氣候變化及環境資訊專題討論相關議題共 15 篇論文，包括地下水污染監測及環境風險評估、統計分析應用於水質監測、水管理問題的自動化模式、COD 檢測的染料廢水減量、地理資訊系統於有害廢棄物運輸的應用、運用 GIS 的空氣污染模式等研究成果。

（二）加拿大 New Brunswick 大學 Hui Ning Xiao 教授報告的主題是「Environmental Risk Assessment for Groundwater Contamination through Integrated Fuzzy Techniques」，這篇研究論文是發展新的風險評估方法，它是基於模糊模式實驗 (fuzzy modeling)和模糊(fuzzy)相關分析來解析由地下儲槽的滲漏對於地下水污染所引起的環境危險。並經由一個西加拿大的案例研究，顯示在不同系統狀況中，以模糊模式(fuzzy modeling)實驗可用來檢查模式產出的系統不確定性的影響。這些顯著的影響使得危機評估的系統的可信性從低程度變化至更高程度變化。相反地，一個更高程度的可信性將導致更多決定性的結果。此外，根據模糊模式試驗(fuzzy modeling)的風險評估，對於一個包含複雜的相互關係及存在許多的不確定因素的系統而言，它是相當有用的。這將使得工程師有一個系統化和一致性的方法來評估不確定性的影響和環境危險，就如同產生合乎需要的場址補救行動。

（三）伊朗 S.A.A. Sajadi 報告的主題是「Preservation of water resources and environment by means of doing statistical studies on water qualit」，這篇論文是研究調查一條主要的伊朗河川幾個鹹化的上游河段，依據取自當年的各季節離子化水質樣本和在研究區域內所做的污染物統計分析，它顯示這些水質遭重金屬污染，如沒有採取行動停止排入這條主要河流(儘管該河川已被稀釋)，這些污染水用於灌溉或者飲用水將導致衛生和環境發生問題。爲了防止這些問題發

生，可藉由統計分析研究水質做爲水資源和環境保護工作上的參據，以轉移這些上游河川的污染。

參、心得與建議

一、心得

（一）環境污染與保護是跨國界的議題，本次會議議題範圍涵括氣候變化、水資源管理、環境監測及資訊專題等面向，我國提出環境監測資料管理及環境資料庫建置成果，包括利用 Web-GIS 空間資訊展示和空間資料分析的優勢，以圖形化的方式，呈現台灣空氣與水質監測資訊，更將 GIS 應用在不同機關的水質監測資料整合等，成功彰顯台灣在環保工作上的績效。

（二）利用 fuzzy 模式及其相關性分析之研究，可分析地下儲槽的滲漏所造成的地下水污染，藉以評估不確定的影響及環境風險，值得參考。

（三）Chi River 是泰國東北的生命線，其附近的盆地經常出現洪水和乾旱之現象，爲解決乾旱季節用水問題，該國學者提出利用 GIS 及水力模型先將洪水儲存起來，在乾旱季節釋放出來給農業和家庭使用之研究，似乎是項可行的做法。

（四）利用網際地理資訊系統（GIS）在空間資訊展示上的優勢及 Ajax (Asynchronous JavaScript And XML)互動性的整合性技術，應用於水質監測及空氣污染監測之之研究，是一項不錯的環境資訊研究工作，值得參考。

（五）使用 Landsat 圖形分析多倫多區域都市發展(從 1985 到 2005 年)之不透水地表區域與水中氯化物濃度之相關性，以瞭解城市規劃與發展，對地表環境的影響，並將其視爲重要的環境工作，值得借鏡。

二、建議事項

（一）環境污染與保護是跨國界的議題，涵括氣候變化、水資源管理、環境監測及資訊專題等面向，建議除了提出環境監測資料管理及環境資料庫建置成果之外，亦可提出其他面向的執行經驗與成果，以彰顯台灣在環保工作上的績效。

（二）本署已研訂完成「環境水質監測資料電子交換作業規範」，並將其做爲水質監

測資料交換的作業準則，以整合各機關水體水質監測資料，待完成階段工作後，其成果亦可做爲國際交流項目之一。

（三）國際交流均以英文爲主，我國許多的網頁資訊要提供英文的版本，才能有交流的實質效果。目前本署已建置英文網站，研究成果報告(含英文摘要)透過內部管控流程並已上網公開，本署英文網站除了持續充實其內容外，若有持續的更新維護機制，將可提升我國環保技術資訊分享的能力。

第 6 屆國際環境資訊會議主辦國家－泰國

資料來源：泰國觀光局網站(http://www.tattpe.org.tw/)

第 6 屆國際環境資訊會議地點－泰國首都曼谷

資料來源：泰國觀光局網站(http://www.tattpe.org.tw/)

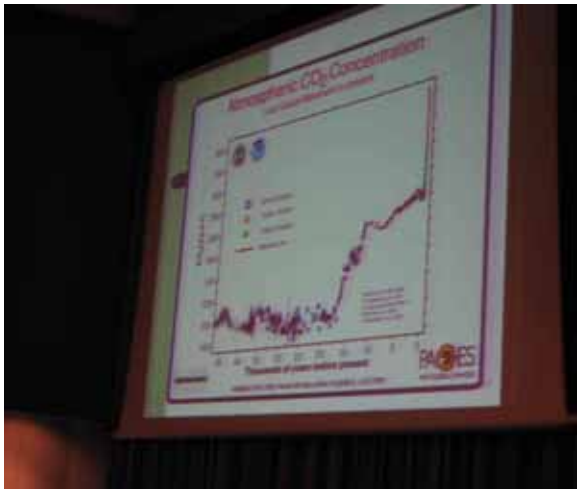
第 6 屆國際環境資訊會議地點－泰國曼谷

第 6 屆國際環境資訊會議地點－泰國首都曼谷聯合國大廈

第 6 屆國際環境資訊會議註冊區區

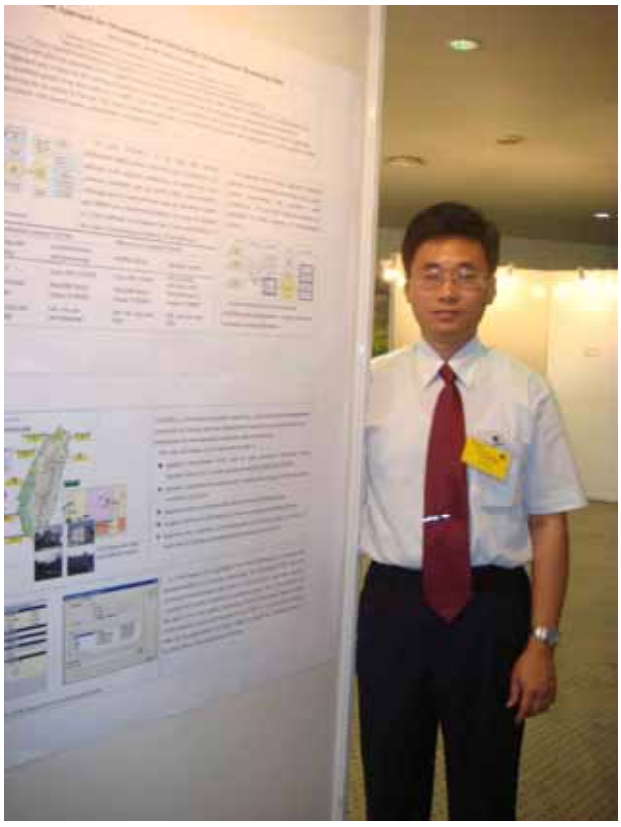
會議開幕

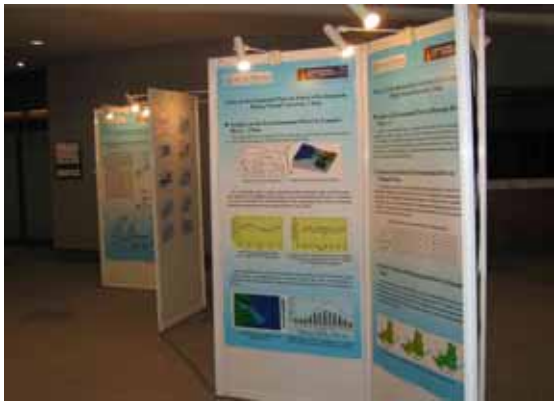
二氧化碳減量議題



我國以海報方式發表論文－「A Layer-based Approach for Streamlining and Integrating Environmental Monitoring Data」

各國以海報方式發表的論文區

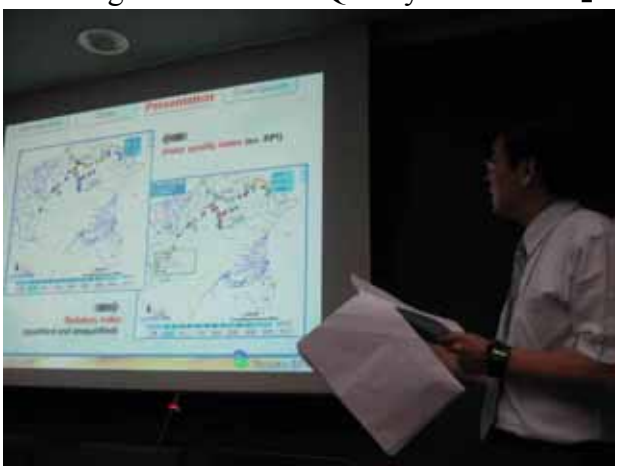




與 Regina 大學 Raphael Idem 博士(左圖左一)和 Nader Mahinpey 博士(右圖左二)合影

報告「Application of Web-GIS for Display and Integration of Water Quality Information」

報告「Application of Web-GIS for Display and Integration of Water Quality Information」

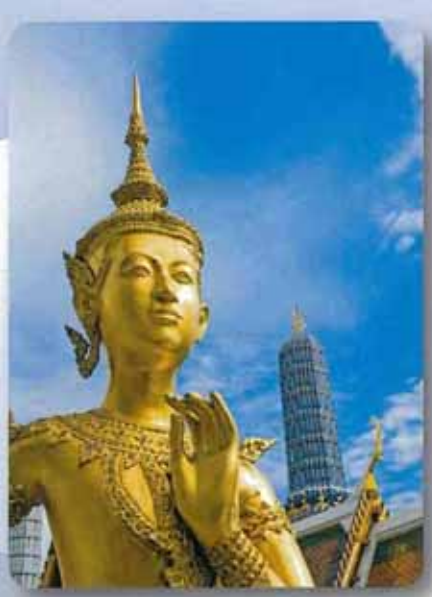


與加拿大 Regina 大學 Christine W.chan 教授（右三）合影

與大會主席 Paitoon Tontiwachwuthikul 合影

與中國大陸謝敏博士(右二)合影

附件一



ISEIS

6th International Conference on Environmental Informatics





November 21-23, 2007, Bangkok, Thailand
ISEIS2007: Emerging Environmental Challenges and Opportunities

Jointly organized by University of Regina (Canada)
and the International Society for Environmental Information Sciences (ISEIS)

UNIVERSITY OF REGINA

ISEIS

Welcome Message from the Conference Chair

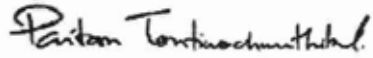
Welcome to ISEIS 2007. Traditionally, our conference theme, "Environmental Informatics", will explore the application of systems sciences and information technology to environmental management. The ISEIS event provides a unique gathering place for researchers, educators and practitioners from many disciplines to interact and learn from each other's knowledge and experience. For this year, we have added and put more focus on the climate change and the water resources issues, which are the current environmental challenges of our time and next generations to come.

Of nearly 200 submissions received from authors around the globe, over 100 were selected for oral and poster presentations in technical sessions. Each paper was typically assigned to the scientific committee for review before inclusion into the 2007 Volume of Environmental Informatics Archives (EIA). Further selections will be performed after the conference for consideration of publication in Journal of Environmental Informatics (JEI). To complement the technical sessions, we are delighted to have several renowned keynote speakers to enrich our experience:

- *Dr. Malcolm Wilson, Member of IPCC Working Group III (which received the Nobel Peace Prize in October 2007)*
- *Dr. Edward McBean, Canada Research Chair Tier 1 in Water Supply Security*
- *Dr. Jinrin Ni, Professor of Environmental Studies, Peking University*
- *Lionel Kambeitz, CEO of HTC Purenergy Corp.*
- *Dr. Gordon Huang, Canada Research Chair Tier 1 in Energy and Environment*
- *Dr. Guanggian Wang, Professor of Water Resource Engineering, Tsinghua University*
- *Dr. Raphael Idem, HTC Industrial Research Chair in Clean Energy*
- *Dr. Christine W. Chan, Canada Research Chair Tier 1 in Energy Informatics*
- *Dr. Zhifeng Yang, Professor of Environmental Engineering, Beijing Normal University*

Thank you to all authors, co-authors, and presenters for your hard work in answering the call for papers. I also want to thank the members of the scientific committee and the organizing committee. We are indebted to many of them for offering constructive suggestions and for graciously donating their time in paper reviews. Thanks are also due to the University of Regina and other sponsors which have given us strong support in various forms and means.

Finally, I hope you will find this conference a rewarding and memorable experience. We wish you a very enjoyable stay in Bangkok and other parts of Thailand.



Dr. Paitoon (PT) Tontiwachwuthikul, P.Eng.
Dean and Professor of Engineering
Co-founder, the International Test Centre for CO_2 Capture (ITC)
University of Regina, CANADA

Conference Chair

Paitoon Tontiwachwuthikul, University of Regina, CANADA

Conference Co-Chairs

Gordon Huang, University of Regina, CANADA

Scientific Committee

Chair: Ni-Bin Chang, University of Central Florida, USA

Co-Chair: Christine W. Chan, University of Regina, CANADA

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- Sufu Hu, Southern Illinois University at Edwardsville, USA
- Simon Jones, RMIT University, AUSTRALIA
- Jonathan Li, University of Waterloo, CANADA
- Yitian Li, Professor, Wuhan University, CHINA
- Xiaoping Liu, Changsha University of Technology, CHINA
- Duowen Mo, Peking University, CHINA
- Jin-Ren Ni, Peking University, CHINA
- L.H. Shih, National Cheng Kung University, TAIWAN
- Guangqian Wang, Tsinghua University, CHINA
- Xinhao Wang, University of Cincinnati, USA
- Malcolm Wilson, University of Regina, CANADA
- I.X. Xu, University of Windsor, CANADA
- Zhifeng Yang, Beijing Normal University, CHINA
- S.C. Yeh, National Kaohsiung Normal University, TAIWAN
- Scott Yeomans, York University, CANADA
- Yongping Yang, North China Electric Power University, CHINA
- Yongyuan Yin, University of British Columbia, CANADA
- Guangming Zeng, Hunan University, CHINA
- Huaidong Zhou, Institute of Water Environment, IWHR, CHINA

Organizing Committee

Chair: Pronnapa (Alex) Sanongboon, University of Regina, CANADA

Co-Chair: Vuttichai Kaewkrajang, THAILAND
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- Yu Li, North China Electric Power University, CHINA
- Lei Liu, Dalhousie University, CANADA
- Jitsopa Suebsir, University of Regina, CANADA
- Huayong Zhang, North China Electric Power University, CHINA

www.rid.go.th

RID Royal Irrigation Department (RID) has been entrusted with the duty to provide the water such as to store and conserve, to regulate, to distribute, to release or allocate water for agriculture, energy, domestic consumption, industry and also including prevention of damage causing by water, and inland navigation within irrigation area (since, 1902).

Vision

By our full supply of irrigation water, agricultural productivity will be enhanced, thus raises quality of life of farmers and strengthens the country's economic stability.

Responsibilities

1. Be a main organization in water resources development for sufficient utilization and in response to the potential of each basin;
2. Manage water allocation to every stakeholder in equitable and sustainable manners;
3. Encourage people participation in water management at all levels for sustainable and utmost benefits of water management and development; and
4. Prevent and mitigate water hazards.

Objectives

1. **Increase of Irrigated Areas** Aiming at increasing irrigated areas for enhancing agricultural productivity, the Department will be in readiness in construction ,study, survey, design; as well as acquiring land and undertaking the construction of large scale and medium scale irrigation projects and water development for rural and community area projects.
2. **Development of Irrigation Projects' Efficiency** The Department will promote and support projects that increase working efficiency of irrigation operation projects, irrigation system maintenance projects and irrigation rehabilitation projects.
3. **Water Hazard Prevention and Mitigation** The Department will promote and support the construction and installation of warning system as well as the protection and mitigation of areas affected by flood, climate change issues, and other water hazards in both agricultural area and economic zone.
4. **Participation in Water Management and Public Relations** The Department will promote and support participation of all sectors in water management by developing the potential of water users organization in water management , strengthening local communities and enhancing proactive public relations of irrigation works.
5. **Increase of Administration Efficiency** To increase the Department's administration efficiency especially in the aspects of time and cost reduction; and productivity increase, the Department feels the needs to develop and enhance human resources development systematically so that its human resources will be able to undertake the Department's tasks and responsibilities effectively. Moreover, the Department will undertake the project that will monitor and evaluate its performances systematically and continuously especially the RID Transparency Project.

ITC International Test Centre for CO2 Capture
www.co2-research.ca

Human activities and their reliance on energy derived from the combustion of fossil fuel, are one of the main contributors of greenhouse gases (GHGs) to the atmosphere. These gases, which include carbon dioxide (CO_2), methane and oxides of nitrogen, trap heat and warm the air.

There is a risk that increasing emissions of GHGs will change our planet's climate. Furthermore, under the 1997 Kyoto Protocol, industrialized countries indicated their intent to reduce collective emissions of GHGs by 5.2 per cent below 1990 levels by the period 2008 to 2012. Canada's target is 6 per cent below 1990 levels.

Due to the energy intensive nature of Saskatchewan's economy, and indeed emerging economies, including facilities such as coal-fired electrical generating stations, refineries, and fertilizer plants, significant volumes of CO_2, the leading greenhouse gas released by human activity, are emitted. It is crucial that we seek economical ways of reducing these emissions.

This situation presents Canada with the opportunity to take a leadership role in reducing emissions by the development of technologies to capture CO_2, and subsequently use and store it instead of releasing it into the atmosphere. At the same time, this action will enable industry to continue to use economical and reliable fossil fuel resources for power generation and to sustain its competitive position.

According to International Energy Agency (IEA) Coal Research, CANMET Western Research Center as well as Fluor Corporation of USA, our research group at the University of Regina is considered to be one of the world-class and most active research groups on CO_2 capture and separation technologies. Over the past 10 years, our research group has been working on advanced CO_2 separation technologies. The main target application areas are industrial gas processing and CO_2 removal from flue gases and other industrial gas streams. The ultimate goal of the research program is to develop more effective CO_2 separation processes to remove CO_2 from the above-mentioned applications. We are working on a number of fundamental and industry research projects that deal with or are related to high efficiency CO_2 separation processes.

Our world-class laboratory facilities contain a field demonstration plant, a multi-purpose technology development plant, and various other pilot plant units for testing high efficiency gas treating systems. We have different sizes of absorption and regeneration towers packed with a variety of high performance packings as well as membrane absorption units.

The ultimate goal of the research program is to develop more effective CO2 separation processes to remove CO_2 from flue gases, industrial gas processing plants and other industrial gas streams.

TISTR is a leading organisation among ASEAN member countries for promoting innovation in novel integrated technologies, and a centre for advanced services, with good governance and endeavours to create a learning society.

www.tistr.or.th

TISTR's development of research to curb global warming

Global warming is caused by a massive increase in anthropogenic greenhouse gas concentrations, for instance, carbon dioxide in the Earth's atmosphere, thus trapping solar radiation and warming the planet's surface or so-called "the greenhouse effect". The most powerful greenhouse gas these days is Carbon dioxide, which is emitted to the atmosphere through the burning of fossil fuels such as coal and oil.

In order to alleviate the global warming phenomenon, it is necessary to boost for the utilisation of alternative energy which can be found from various sources, namely, biomass fuel, hydropower, wind power, solar power, hydrogen fuel cells, and nuclear power.

The Thailand Institute of Scientific and Technological Research (TISTR), a national leading R&D organisation, has placed emphasis on the development of alternative energy in order to control global warming which has triggered life and social threatening. With the distinctive potential and expertise in R&D, TISTR has been conducting many strands of research projects to tackle the global warming problems as follows:

- Ethanol...alternative energy from agricultural produce
- Bio-diesel...green energy for the future
- Bio-gas
- Biomass

Any enquiries, please contact the Thailand Institute of Scientific and technological Research (TISTR), 35 Mu 3, Technopolis, Tambon Khlong 5, Khlong Luang district, Pathum Thani 12120. Tel. 025779000.

MTEC The National Metal and Materials Technology Center (MTEC) is operating as one of the technology centers under the National Science and Technology Development Agency (NSTDA), The Ministry of Science and Technology (MOST).

www.mtec.or.th

The National Metal and Materials Technology Center (MTEC) was founded as a special kind of government organization which supports materials science and technology research and development, including manufacturing and design for both public and private companies and institutions, Located within Thailand Science Park, facilitates as a perfect cooperative atmosphere which propels and sustains industrial development, economic growth and environmental well being of the nation.

Objectives

1. To promote, support and perform as well as coordinate research, development and engineering including technology transfer to industrial sector.
2. To develop technological infrastructure and human resource development in related fields.
3. To coordinate and facilitate strategic collaboration and linkage between various research units, educational institutions, industrial sector and related international institutions.

Projects

- The Establishment of the Advanced Dental Technology Center
- Innovative/Novel Ceramic Paper Sheets
- The Development Compressor for environment (Eco-Compressor)
- Manufacturing process improvement with cleaner technology and the university network for internship program in cleaner technology of fiscal year 2005
- Pilot model of fuel cell to provide electricity for household and community
- Large Bus Design and Construction/Development Project
- Sky Lab Tricycle Design and Construction/Development Project
- Designing and development of production equipment for metal casting
- The Study and Assessment of the Stray Current from the Blue Line Mass Transit System (BMCL)
- Construction of Environmental Low Load Type Advanced Production Processes of Parts for Car in Thailand which Uses Metal Injection Moulding (MIM) Process
- Prototype plant for the production of powder metal
- Thailand's First Testing Laboratory for biodegradability of Plastic
- The establishment of Trace Element Analysis Laboratory (TEA Lab)

Conference Programme

November 21, 2007 Conference Room 1

Time

09:00 - 17:00 Conference registration

09:00 - 10:00 Poster setup and coffee break

10:00 - 10:20 Welcome and opening remarks

10:20 - 11:00 Keynote: Mitigation, Impacts, Adaptation and Vulnerability of Climate Change Problems: Where West meets East? by Dr. Malcolm Wilson

11:00 - 11:40 Keynote: Rapid Zonation on Sustainability and Interpretation in terms of Flood Hazard Distribution in China by Dr. Jinren Ni

11:40 - 12:20 Keynote: Desertification Trends and Impending Water Crises by Dr. Edward McBean

12:20 - 13:30 Luncheon

13:30 - 15:10 Climate Change Issue - Chair: Malcolm Wilson

13:30 - 14:05 Recent Development on CO2 Capture Technologies by Raphel Idem

14:05 - 14:40 CCS Series: World's 1st Modular CO2 Capture Units for CO2 Storage and EO by Lionel Kambeitz

14:40 - 15:10 Watershed management under changing climatic conditions by Gordon Huang

15:10 - 15:30 Coffee break

15:30 - 17:00 Climate Change Issue - Chair: Malcolm Wilson

15:30 - 16:05 Clean Coal Technology for Next Generation Power Plants by Nader Mahinpey

16:05 - 16:40 Future Generation of Hydrogen and Biofuel by Raphel Idem

16:40 - 17:00 Consumers' Preference for Small-lot GHG Emission Credits Attached to the Automobile Insurance by Yoshikuni Yoshida

18:30 - 21:30 Dinner at Siam Niramit (Extra ticket required)

November 21, 2007 Meeting Room G

Time

09:00 - 17:00 Conference registration

13:30 - 15:10 General Topics - Session Chair: Jinren Ni

13:30 - 13:50 Monitoring Sparse Perennial Vegetation Cover over Australia using Sequences of Landsat Imagery by Jeremy F Wallace

13:50 - 14:10 A Layer-based Approach for Streamlining and Integrating Environmental Monitoring Data by Lienyao Lee

14:10 - 14:30 Performance Studies Of Hybrid Reactor For The Treatment Of Sago Wastewater by K.Gopalakrishna

14:30 - 14:50 Field Scale Mapping of Soil Salinity on Spatial Interpolation Techniques, Case Study: Khorat Basin, Nakhon Ratchasima Province, Thailand by

Piyakarn Teartisup

14:50 - 15:10 Using noise map to evaluate the environmental quality of Tainan, Taiwan by Yu-Hao Lin

15:10 - 15:30 Coffee break

15:30 - 17:10 General Topics - Session Chair: Moe M.S. Cheung

15:30 - 15:50 Sorption Isotherms of New Types of Zeolites and Soils for Some Heavy Metals by May Thant Zin

15:50 - 16:10 Formation and Calculation of Hydroxyl Radical in the Optimal Photocatalytic Process using the Taguchi method by Chen-Yu Chang

16:10 - 16:30 Mitigation of Nitrogen Pollution in Water body by Incorporating the DHS (Down-Flow Hanging Sponge) Systems and Autotrophic Nitrogen Removal Technologies by Chuang Hui-Ping

16:30 - 16:50 Methodology for immune-based algorithm on solving minimum-cost problem of water distribution network by Chien-Wei Chu

18:30 - 21:30 Dinner at Siam Niramit (Extra ticket required)

November 21, 2007 Meeting Room F

Time

09:00 - 17:00 Conference registration

13:30 - 15:10 General Topics - Session Chair: Yuefei Huang

13:30 - 13:50 Responding to an Oil Spill Disaster: Data Management Support for the Rehabilitation of Guimaras Island, Philippines by Evan Anthony V. Arias

13:50 - 14:10 Analysis of Transport Use by Providing Environmental Information by Katsuhito Nakazawa

14:10 - 14:30 Surveying the Jagorood river's self-purification by S.A.A. Sajadi

14:30 - 14:50 Forecasting of Damage Length of Maritime Structures Caused by Typhoons Based on Improved MWS Method by Ryusuke Hashimura

14:50 - 15:10 Software Design for Simulating Microbial Bioprocesses in Bioreactor by Nikhil

15:10 - 15:30 Coffee break

15:30 - 17:10 General Topics - Session Chair: Bin Chen

15:30 - 15:50 Selenium Induced Reduction of Pyrene Toxicity in Bacteria by N. Tejo Prakash

15:50 - 16:10 Innovative Design of Low Impact Development in Support of Green Building Initiative by Ammarin Makkeasorn

16:10 - 16:30 The Interval Linear Programming: A Revisit by Feng Zhou

16:30 - 16:50 Application of the Taguchi experimental design to the optimization of UV/TiO2 and UV/H2O2 process for copper complexes treatment by Huey-Lih Shyu

18:30 - 21:30 Dinner at Siam Niramit (Extra ticket required)

November 22, 2007 Conference Room 1

Time

08:30 - 17:00 Conference Registration

08:30 - 10:10 Water Resource Management - Session Chair: Gordon Huang

08:30 - 09:00 Keynote: Ecological issues of water networks in China by Zhifeng Yang

09:00 - 09:30 Keynote: Sedimentation problems of the Three Gorge Project in China by Guangqian Wang

09:30 - 09:50 Theoretical framework of the urban river restoration planning by Yanwei Zhao

09:50 - 10:10 Hong Kong, the Pearl River Delta, and Resource Sustainability by 2030: An Opportunity for Technological Leadership by Moe M.S. Cheung

10:10 - 10:30 Coffee break

10:30 - 12:10 Water Resource Management - Session Chair: Zhifeng Yang

10:30 - 10:50 Impact of Chloride Concentrations on Surface Water Quality of Urban Watersheds Using Landsat Imagery by Faranak Amirsalari

10:50 - 11:10 Floodwater retention planning using GIS and hydrodynamic model: a case study for the Chi River Basin, Thailand by Chalermchai Pawattana

11:10 - 11:30 Study on the Conditionings of Water Treatment Plant Sludge by Xie Min

11:30 - 11:50 One-Dimensional Numerical Model for Unsteady-Flow in Large-Scale Conveyance Channel with Complex Inner Boundary Conditions by Cheng Zhang

11:50 - 12:10 Urban ecosystem health assessment for typical cities in China based on set by Meirong Su

12:10 - 13:30 Luncheon

13:30 - 15:10 Water Resource Management - Session Chair: Guangqian Wang

13:30 - 13:50 Classification and Codification Methods of Stream networks in a River Basin: A Review by L. Zhang

13:50 - 14:10 Landsat Derived Impervious Surface Area and Potential Water Quality Impacts: A Case Study in the GTA by Faranak Amirsalari

14:10 - 14:30 An Inexact Fuzzy Nonlinear Optimization Model for Supporting Decisions of River Water Quality Management by Hui Ning Xiao

14:30 - 14:50 Rule-based Expert System for Sensor Deployment in Drinking Water Systems for Rural Communities by Ammarin Makkeasorn

14:50 - 15:10 Measurement and evaluation of Eco-efficiency of material metabolism in typical cities China by Yan Zhang

15:10 - 15:30 Coffee break

15:30 - 16:50 Water Resource Management - Session Chair: Changbo Jiang

15:30 - 15:50 Impact of tidal effects on water quality simulation of rivers running through urban area – a case study in northern Taiwan by Chihhao Fan
15:50 - 16:10 Municipal Solid Waste Management under Uncertainty: An Interval-Fuzzy Two-Stage Stochastic Programming Approach by Hui Ning Xiao
16:10 - 16:30 GIS Application for Landslide Risk Area Assessment in Yom Watershed, Thailand by Sura Pattanakiat
18:30 - 21:30 Conference Banquet at Amari Watergate Hotel

November 22, 2007 Meeting Room G
Time
08:30 - 17:00 Conference Registration
08:30 - 10:10 Climate Change Issues - Session Chair: Edward McBean
08:30 - 09:05 A comprehensive kinetic study on the absorption of carbon dioxide in various promising aqueous and non-aqueous amine solutions by Amr Henni
09:05 - 09:25 Determination of Landfill Operation Factors Affecting Leachate Characteristics in Tropical Climatic Conditions by Ruwini Weerasekara
09:25 - 09:45 Carbon Dioxide Absorption into MEA-Methanol Hybrid Solvent by P. Usubharatana
09:45 - 10:05 Acoustic Methods for Identification and Measurement of the Fluid-fluid Interface in Porous Medium for CO2 Sequestration by Raman Paranjape
10:10 - 10:30 Coffee break
10:30 - 12:10 Climate Change Issues - Session Chair: Jintana
10:30 - 10:50 Carbon Dioxide Emissions Control Policy under Uncertainties of the Probability and Impact of Abrupt Climate Change Event by Takanobu Kosugi
10:50 - 11:10 The evaluation of CO2 emission reduction in Japan utilizing the interregional repercussion model on the freight transportation by Yoshikuni Yoshida
11:10 - 11:30 Comparative analyses of sector-based approaches and national numerical targets as Post-Kyoto frameworks by Ryuuji Matsuhashi
11:30 - 11:50 Direct and Indirect Impacts of Households by Region of China on CO2 Emissions by Zheng Lu
11:50 - 12:10 Short-term Stream Flow Forecasting with the aid of Global Climate Change Indices by Ammarin Makkeasorn
12:10 - 13:30 Luncheon
13:30 - 15:10 Workshop on Informatics: Boon
13:30 - 14:10 Innovative Applications of Artificial Intelligence in Energy and Environment by Christine Chan
14:10 - 14:30 The Application model of Data-mining-based Intrusion Detection Technology by Guobin Li
14:30 - 14:50 Integration of Environmental Monitoring and Analyzing Software with an

Internet based Alert and Presentation model. Case study: The Metropole Watch project in Bangkok, Thailand by Per Henrik Johansen

14:50 - 15:10 A Qualitative Decision Support for Environmental Impact Assessment Using Fuzzy Logic by Kevin Fong-Fey Lui

15:10 - 15:30 Coffee break

15:30 - 16:50 Workshop on Informatics: Raphel Idem

15:30 - 15:50 Research on the Intelligent Environment of Pervasive Computing by Guobin Li

15:50 - 16:10 Application of Web-GIS for Display and Integration of Water Quality Information by Wanyi Cheng, Lienyao Lee

16:10 - 16:30 Dominance-Based Rough Set for Tehran Seismic Vulnerability Assessment by Amiri, A. R.

16:30 - 17:00 A Decision Support System for Monitoring and Diagnosis of Carbon Dioxide Capture by Christine Chan (and discussion)

18:30 - 21:30 Conference Banquet at Amari Watergate Hotel

November 22, 2007 Meeting Room F

Time

08:30 - 12:00 Conference Registration

08:30 - 10:10 General Topics - Session Chair: Huaicheng Guo

08:30 - 08:50 Selenium Accumulation and Se-Induced Anti-Oxidant Activity in Allium cepa by N. Tejo Prakash

08:50 - 09:10 Integrated Water Resources and Water Environment Management in Zhangweinan Canal Subbasin, China by Chunhui Li

09:10 - 09:30 Environmental Flows for the Critical Habitat in the Yangtze Estuary by Rui Zhao

09:30 - 09:50 Analysis of Leachate Characteristics of Municipal Solid Waste Dumps- A Case Study by Anita Agrawal

09:50 - 10:10 Process-orientated Hillslope Soil Erosion Model for the Loess Plateau, China by T.J. Li

10:10 - 10:30 Coffee break

10:30 - 12:10 General Topics - Session Chair: Pronnapa Sanogboon

10:30 - 10:50 Stepwise Cluster Analysis Methodology Study for Urban Nonpoint Source Pollution in Los Angeles by W.T. Liu

10:50 - 11:10 An interval-parameter two-stage stochastic chance-constrained integer programming model for inter-basin water resources management systems under uncertainty by Yuchao Han

11:10 - 11:30 Optimization of hidden nodes and training times in ANN-QSAR model by Gao Dawen

11:30 - 11:50 Functional clustering of random curves by Stefano Antonio Gattone
11:50 - 12:10 Development and Applications of a Local Water Poverty Index in Taiwan by Shin-Cheng Yeh
12:10 - 13:30 Luncheon
13:30 - 15:10 General Topics - Session Chair: Zhifeng Yang
13:30 - 13:50 A study on measures to activate CDM taking project risks into consideration by Ryuuji Matsuhashi
13:50 - 14:10 Semiconducting Gas Sensors, Remote Sensing Technique and Internet GIS for Air Pollution Monitoring in Residential and Industrial Areas by Ornprapa Pummakarnchana
14:10 - 14:30 Waste Characteristics Influenced by Recent Management Strategies for MSW Reduction and Recycling in Taiwan by Yu-Min Chang
14:30 - 14:50 Thailand Life Cycle Inventory Database by Thumrongrut Mungcharoen
14:50 - 15:10 Optimizing Water Usage in a Conventional Industrial Wastewater Treatment Plant by Cheng Nan Chang
15:10 - 15:30 Coffee break
15:30 - 16:50 General Topics - Session Chair: Huaicheng Guo
15:30 - 15:50 The Environmental Impact of the Increasing of Energy Consumption Efficiency in Iran Petrochemical Industry by Kiomars Sohaili
15:50 - 16:10 Better City Environment through ISO 14001 Applications and Strategic Decision Making Process by Matiar Rahman
16:10 - 16:30 Extraction Information of Environmental Changes from Satellite Image by Nang MyaMyaNwe
18:30 - 21:30 Conference Banquet at Amari Watergate Hotel

November 23, 2007 Conference Room 1
Time
08:30 - 12:00 Conference Registration
08:30 - 10:10 Water Resource Management - Session Chair: Baoshan Cui
08:30 - 08:50 Environmental Risk Assessment for Groundwater Contamination through Integrated Fuzzy Techniques by Hui Ning Xiao
08:50 - 09:10 Environment, Demand for Health and Economic situation of Bhutan by Selvaraj M.
09:10 - 09:30 Daily Rainfall Disaggregation at One-hour Timescale for Hydrologic Modeling in the Xiaoli River basin by L. He
09:30 - 09:50 An Implementation of an Automatic Modeling Tool for Waste Management Problems by Nawapunth Manusitthipol
09:50 - 10:10 Optimization of Limited Water Level of the Three Gorges Project in Flood Period by Yi Tian Li

10:10 - 10:30 Coffee break
10:30 - 12:10 Water Resource Management - Session Chair: Gordon Huang
10:30 - 10:50 Self-tuning control model for water regulation in the Tarim River basin by R.H. Liu
10:50 - 11:10 State and space algorithm of downstream water-level control for multi-pool canals by Yizi Shang
11:10 - 11:30 Preservation of water resources and environment by means of doing statistical studies on water quality by S.A.A. Sajadi
11:30 - 11:50 An Inexact Two-Stage Quadratic Program for Water Resources Planning by Gordon Huang
11:50 - 12:10 Discussion by Gordon Huang
12:10 - 13:30 Luncheon
13:30 - 15:10 General Topics - Session Chair: Guobin Li
13:30 - 13:50 Optimization of a Ultrasound-Assisted Nanoscale Fe/Fenton Process for Dye Wastewater Through a Statistical Experiment Design Method by Ling-Ling Hsieh
13:50 - 14:10 The Application of Geographic Information System and Multi Criteria Decision Analysis: Toward Hazardous Waste Transport Sustainability by Sathaporn Monprapussorn
14:10 - 14:30 Emergy synthesis for the urban ecosystem health of four municipalities in China by Gengyuan Liu
14:30 - 14:50 A GIS-based Air Pollution Modeling in Tehran by Amiri, A. R.
14:50 - 15:10 Optimization of Limited Water Level of the Three Gorges Project in Flood Period by Yi Tian Li
15:10 - 15:30 Coffee break
15:10 - 15:30 Closing remarks

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Time
08:30 - 12:00 Conference Registration
08:30 - 10:10 Workshop - Session Chair: TBA
08:30 - 08:50 Workshop opening
08:50 - 09:50 Panel discussion
09:50 - 10:10 Discussion by Mr. Jess
10:10 - 10:30 Coffee break
10:30 - 12:10 Workshop - Session Chair: TBA
10:30 - 12:10 General group discussion
12:10 - 13:30 Luncheon
13:30 - 15:10 Workshop - Session Chair: TBA

13:30 - 14:50 Activities by Prem
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60700048

General Topics

APPLICATION OF WEB-GIS FOR DISPLAY AND INTEGRATION OF WATER QUALITY INFORMATION

Lienyao Lee, Yu-Chi Chu*

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Abstract

Government agencies have sought to use a simple, clear and unified method for expressing descriptions, numerals, and space-time distribution of water quality monitoring results. Instead of tables and detailed lists, this study attempts a new approach by utilizing the superiority of spatial information display in Web-GIS and the highly interactive integrated technique from Ajax (Asynchronous JavaScript and XML). It presents different water qualities with color changes at each sample site on the electronic map, including past or immediate changes, and continuous quality changes. This method also uses pie charts and histograms to provide immediate space-time statistics. In addition, by combining the polygon split method and color gradient with the RPI (River Pollution Index) definition, it can provide another condition to closely matche practical river quality changes. Furthermore, it successfully integrates and displays different official monitoring results with both buffer analyses of Web-GIS and statistical graphs. As an example of practicality, the Taiwan Water Quality Data System (TWQDS) has been implemented using the proposed system architecture to justify its feasibility.

Keyword(s): Web-GIS, Ajax, Water Quality, RPI

A Layer-based Approach for Streamlining and Integrating Environmental Monitoring Data

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Abstract. Environmental monitoring data plays an important role to support environmental decision-making. The tasks of collecting, managing, and accessing a large volume of environmental monitoring datasets has become ever more challenging due to the expansion of various newly available instruments, measurements, as well as diverse and complicated data storage systems. This paper presents a comprehensive system architecture which adopts multi-layer approach and is based on the web-based platform for integrating environmental data management, ranging from data collection to applications. As an example of practicality, the second phase Taiwan Air Quality Monitoring Network (TAQMN-2) has been implemented using the proposed system architecture to justify its feasibility. The overall structure of TAQMN-2 is described, and two major subsystems, data collection manager (DCM) and data access manager (DAM), are illustrated in detail. Taiwan EPA benefited greatly from the results of TAQMN-2, not only in terms of streamlining the air quality data management but also in upgrading work performance on improving the air quality in Taiwan. The main advantages of our approach are: (1) replace conventional DAS with an open standards web-based server attached with a PLC system making the monitoring work more flexible, (2) provide a platform for automatically tracking data lineage during monitoring workflow execution, (3) support tasks to systematically collect diversity monitoring data, (4) require minimal modifications to migrate existing monitoring systems, (5) improve the scalability of environmental monitoring projects, in terms of both ease of adding and modifying components in each layer. The usage of proposed approach is not restricted to air quality data management; it is also suitable for other domains of environmental science with limited tuning, adjustments, or augmentation.

Keywords: Environmental monitoring data, data integration, air quality data management, TAQMN-2

1. Introduction

Environmental monitoring data is the foundation for understanding and managing our living planet. It also plays an important role in supporting environmental decision-making. The tasks of collecting, managing, and accessing a large volume of diverse monitoring datasets has become ever more challenging due to the expansion of various newly available instruments, measurements, as well as diverse and complicated data storage systems. Over the past few years, a number of studies and efforts have been made on the issue of data management for environmental monitoring; what seems to be lacking, however, is a comprehensive and integrated system architecture that can streamline and consolidate the data management processes for environmental monitoring. The processes should include the data collection, data computation, data storage, as well as data dissemination and applications.

This paper presents a comprehensive system architecture, which adopts multi-layer approach and is based on the web-based platform for monitoring data management, ranging from data collection to applications. Our purpose is to consider the streamlining of data management processes for environmental quality monitoring. As an example of practicality, the second phase Taiwan Air Quality Monitoring Network (TAQMN-2) has been implemented using the proposed system architecture to justify its feasibility.

The following section describes the overall characteristic and features of a multi-layer system architecture mainly for environmental monitoring data management. Based on the proposed architecture, section 3 will illustrate the details of the TAQMN-2 project, including the overall structures and two major components, data collection

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manager and data access manager. A number of concrete results produced by TAQMN-2 are given in section 4. We will conclude with discussion on the future work in section 5.

2. System Architecture

As shown in Figure 2.1, the system architecture adopts a multi-layer approach to facilitate seamless interaction from the data collection to data applications of environmental monitoring. Each layer is comprised of several components which interact within the layer and communicate with other layers. We explain the roles and functionalities of each layer as follows:

- Collection layer: comprises a number of apparatuses such as sensors and instruments responsible for measuring environmental quality. These apparatuses are connected to a programmable logic controller (PLC) and form the front line for monitoring data collection and gathering. The PLC uses a standard interface to adapt digi-tal/analogy signals coming from the apparatuses and convert the signals to numerical data. There is an on-site database dedicated to storing these data, converting them into XML format files, and then transmitting them to the transmission layer. Unlike traditional data acquisition systems (DAS) which usually use proprietary for-mats and protocols, our system adopts a series of open standards such as HTTP and TCP/IP for connecting monitoring apparatuses and IT devices, making the collection layer an Internet-based application.
- Transmission layer: (i) apply virtual private network (VPN) technology which integrates with the comprehensive firewall and router features. It supports connection for a secure data transmission over the Internet. (ii) use Microsoft Message Queuing (MSMQ) technology as a data transmission platform that bridges the collection layer and manipulation layer. The MSMQ provides guaranteed messaging, priority-based messaging and enables applications running at different times to communicate across networks that may be temporarily offline.
- Manipulation layer: performs several procedures for data pre-processing. When data is gathered from the monitoring sites, it moves through the staging server along with an intermediary store. The staging server is the place where all collected monitoring data is put together and prepared for loading into the database. It is like an assembly plant or a construction area. In this area, we examine collected data, perform the various functions for data quality assurance and resolve inconsistencies. Once the data is finally prepared, it will temporarily reside in the intermediary data stores waiting to be loaded into the monitoring database.
- Storage layer: mainly consists of a commercial database management system (DBMS) along with a set of toolkits that may construct and maintain the metadata for underlying monitoring data. As the monitoring data increases with different formats both in syntax and semantics, the metadata acts like a nerve centre in the storage layer. Furthermore, in order to provide data services more efficiently and widely, this layer may also aggregate data and functionalities from other sources such as the meteorological offices which may provide data on environmental resources in particular weather forecast information.
- Application layer: provides a number of applications and services for data retrieval, analysis, as well as data disseminations. Since the system uses a web-based as a standard user interface, a variety of advanced applications such as data mining and data visualization can also be attached as part of the systems. This makes our system more flexible and scalable than client-server architecture. The user interface for most applications uses Web standards: XHTML and CSS are used for presentation; JavaScript and ASP.NET are used to handle user interaction. In addition, Web Services related standards and technologies such as SOAP, WSDL, and AJAX are adopted to deal with the communication and integration issues with other environmental data resources.

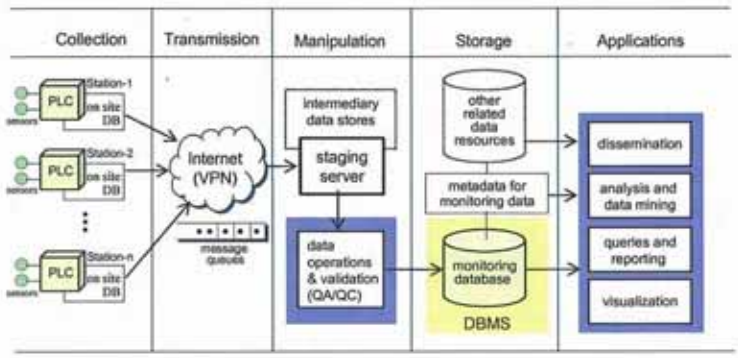


Figure 2.1. System architecture for environmental monitoring data management – ranging from data collection to data applications.

Our approach can be easily applied to different subjects of environmental monitoring such as water quality monitoring and hazardous waste monitoring. We also believe that our solutions are applicable to other domains of environmental science. For example, the data management problems for ecology and natural resource observation may also be applied to the proposed system architecture with limited tuning, adjustments, or augmentation.

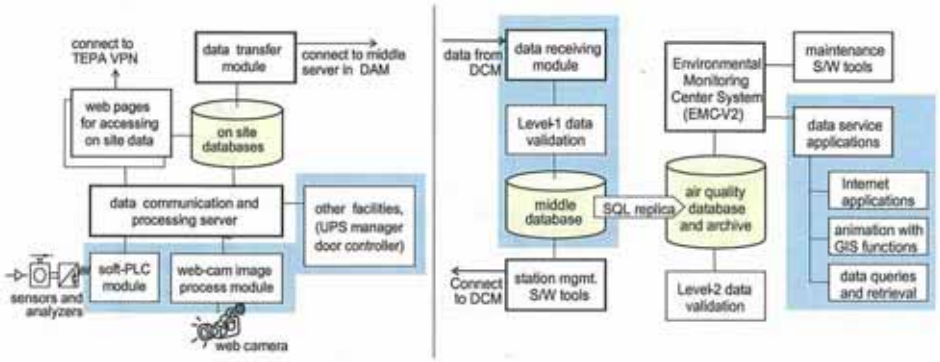
3. TAQMN-2 Project

Air quality and water quality are the primary targets of Taiwan's environmental monitoring efforts. Over the last ten years, Taiwan has developed diverse, advanced monitoring systems. These systems not only provide residents with an abundant source of information on environmental quality, but also provide opportunities for international technology exchange and environmental cooperation.

The Taiwan EPA began monitoring air quality in 1980. At the beginning there were nineteen stations situated in Taiwan's major cities. In 1993, the government developed the Taiwan Air Quality Monitoring Network, abbreviated TAQMN. The scope was to install up to 66 air quality monitoring stations, two mobile vans equipped with monitoring facilities, one quality assurance laboratory, and a data management centre. This network has been operating since September 1993. In recent years, aside from replenishing the network with more sophisticated equipment and ex-pansions we have also been dedicated to converting the former standalone systems into a more flexible and config-urable environmental information system. In our vision, the new age of environmental monitoring systems need not only provide qualitative and instantaneous records, they need to be useful analytically and able to forecast more ac-curately. Many air quality control measures have to be based on the outcomes of monitoring processes.

TAQMN-2 was a four-year project from 2002 to 2006 to enhance the capability of air quality monitoring in Taiwan, adopting the proposed system architecture for the whole spectrum of data management. TAQMN-2 successfully demonstrates the applicability of our approach and verifies the expected benefits by describing a compelling case in the domain of environment data management.

TAQMN-2 has led the establishment of 76 monitoring stations in different regions of the country. The pollutants monitored in TAQMN-2 stations include of PM10, carbon monoxide, sulfur dioxide, nitrogen dioxide, and ozone. The meteorological instruments produce parameters, such as wind direction, wind speed, temperature, dew point and precipitation, which can make the air quality forecasting more accurate. Some sophisticated equipment has been added to the list in order to measure acid rain, hydrocarbons, PM2.5, ultraviolet-type B, etc.



(a) data collection manager. (b) data access manager.

Figure 3.1. TAQMN-2 overall structures.

3. 1. Overall structures

Figure 3.1 depicts the overall structures of TAQMN-2. First, we implement a subsystem called data collection manager (DCM) to collect the data from each station. The stations feed the measurements into the DCM, which also collects data from other monitoring facilities such as the web-cam images (for security consideration) and the power system monitoring data. After the DCM receives hourly measurements, it deposits them into a collective on-site database and uses MSMQ technology to transmit the data. Secondly, in the manipulation layer, there are software modules to validate measurements, tools to check and do data maintenance. Thirdly, by using the data access manager (DAM) in the storage layer, different applications can access the data accordingly. In the application layer, there are web applications to provide the on line statistics and provide information for air quality forecast. For data dissemi-nation, TAQMN-2 can transfer the statistics and forecast data via web pages, toll free phones, TV, radios, and newspapers.

To keep TAQMN-2 as an open and flexible architecture which allows different types of hardware and software work together seamlessly, we employ the most common standards and the most widely used products. Table 3.1 summarizes the implementation environment of TAQMN-2, ranging from hardware platform to software development tools. Although most system software such as operating systems and DBMS are commercial products, it is easy to migrate to a free software environment like Linux and MySQL if the scale of monitoring systems is of suitable size.

Table 3.1. TAQMN-2 implementation environment.

	Data collection manger (DCM)		Data access manager (DAM)	
	gathering and collecting	communication and processing	middle server	database server
H/W	Soft-PLC	Xeon (DP) 2.4GHZ	Xeon MP 1.5GHZ	HP RX-5670 HP MSA-1000
OS	Build-in Kernel	Win2000 Server	Win2000 Server	Win2000 Server
Data storage	Text Files	Oracle 9i DMBS	Oracle 9i DMBS	Oracle 9i DMBS
Development tools	Ladder, Java and C language	MS .Net and Java language	MS .Net, Java and SQL	MS .Net, Java and SQL

3.2. Data collection manager (DCM)

As shown in Figure 3.1(a), the DCM is comprised with a number of mentoring facilities, equipments and software

modules. For collecting monitoring data, we connect most of the air quality sensors and analyzers to a SoftPLC. The SoftPLC has three modules, digital input (DI), analog input (AI) and high level language (HLL), that adopt different methods to collect data and convert the data into a text file, then store the file in the built-in memory of SoftPLC ready to be accessed by the data communication and process server. Some specific devices such as web-cams, UPS, and door controllers are connected to data communication and process servers directly since their interface are relatively simple and ready to connect to the Ethernet.

Data communication and processing are the main services in the DCM. The DCM gathers all monitoring data, computes hourly average values for each measurement, and uses SQL procedures to store the data into an on-site database. For ensuring the correctness of each analyzer, the DCM periodically issues a series of collaboration commands to trigger the SoftPLC and corresponding monitoring analyzers to perform collaboration procedures. In general, the collaborated information is sent and the results of collaborations are collected in XML format. Therefore, they can easily be integrated into the on-site database and be presented on web pages.

The DCM also generates web pages allowing users to access the row data, the status of equipment, as well as collaboration records and the web-cam images stored in the on-site database by a common web browser. However, this access can be done only via the VPN within TEPA for security considerations.

On the top right of Figure 3.1(a), the data transfer module is in charge of sending the measurement data to the DAM for further processing. The data transfer module adopts Microsoft Message Queuing (MSMQ) technology as the mechanism of data transmission. This mechanism can deal with the re-transmission process appropriately when the system confronts a network disconnect problem. Therefore, we won't lose any data from the DCM.

3.3. Data access manager (DAM)

The DAM can be divided into two subsystems, middle server and database server, based on the functionalities of services. The design concept of the middle server is to overcome the difficulties when writing mass data (like time series data) into a database, since it might slow down the performance of whole systems. The middle server plays the role of staging servers in the manipulation layer described in Section 2. The database server is dedicated to storing detailed data and is responsible to the application developments. Thus, it can be viewed as an reflection of the storage layer and application layer described in Section 2.

As shown on the left of Figure 3.1(b), the data receiving module accepts data from the DCM, and triggers the Level-1 data validation procedures, which include data effectiveness checking and thresholds checking. All the validation rules are stored in a predefined profile. The inspected data are then stored in the middle database. The middle server is also responsible for the configuration management of each monitoring station. A set of software tools in the middle server are dedicated to performing management functions remotely. For example, users with certain privileges can issue commands to reset the parameters stored in an on-site database.

Once the data passes Level-1 validation and are stored in middle database, we adopt a "read-only materialized view replication" process to maintain data consistency between the middle server and database server. Then, we perform Level-2 validation in the database server to ensure other data quality factors such as data completeness, consistency and credibility.

The Environmental Monitoring Centre System (EMC-V2), as shown on the top middle of Figure 3.1(b), operates at the heart of the TAQMN-2. EMC-V2 supplies the user with a robust interface for performing a number of specialized functions. The principles of EMC-V2 are to provide a generic mechanism for accessing air quality data and serving as a focal point for data application developments. A set of software tools have been implemented and operated suc-cessfully for data maintenance, data services and application developments. We will demonstrate some of the con-crete results in Section 4.

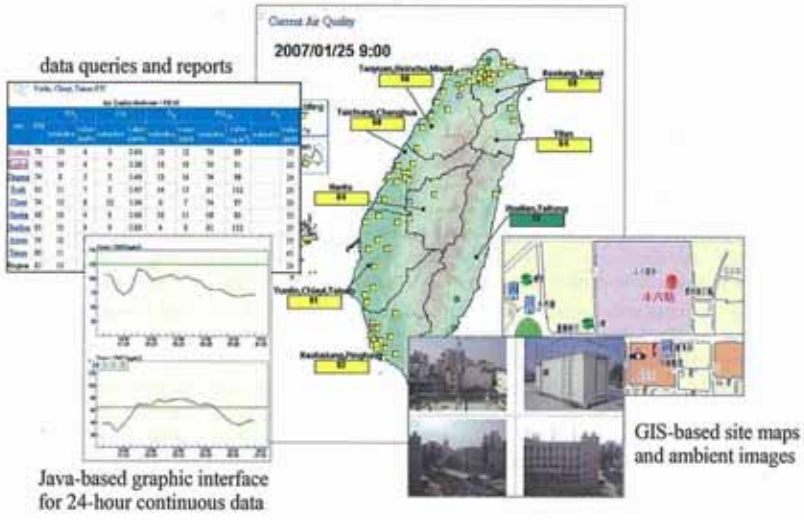


Figure 4.1. A variety of views and displays of TAQMN-2.

4. Results and lesson learned

Figure 4.1 shows some results produced by the TAQMN-2 (For details, please visit http://www.epa.gov.tw/taqmn-2/ or http://210.69.101.141/emce/). The country map shown in Figure 2 displays the current PSI value of each region. The data is updated hourly. The user can select a region to view detailed data. For example, when the region of Yunlin-Chiayi-Tainan is selected for viewing, all detailed measurements of the stations in the region are displayed as shown on the left side of Figure 2. This resembles the results of a data query or a report requirement. When user selects a specific monitoring station, the past 24 hours of data will be displayed using a Java-based graphic interface. In addition, the location of each station and the images for the surrounding status can also be displayed using a GIS-based toolkit.

(a) GIS with wind speed and wind direction. (b) an interface for data access.

Figure 4.2. Examples of the data services and applications.

A JAVA-based GIS application has been implemented to support the decision-making of air quality forecasting. As shown in Figure 4.2(a), we integrate the GIS maps with measured meteorological data such as wind direction and

wind speed to visualize the weather conditions in different areas. This is very helpful for the daily work of air quality forecasting.

Since all time series data are stored in the database server and managed by the EMC-V2, by using the interface shown in Figure 4.2(b), data can be aggregated over time, either by specifying a defined period or by using time related grouping functions such as monthly, weekly and so on. Moreover, data can be selected or filtered according to a specified condition (measured value, time period, as well as certain areas and districts). The results for a specified requirement can be shown on screen, printed out as a report or downloaded by users in EXCEL file or text file format depending on user requirements. These capacities make TAQMN-2 a very flexible and robust system, which can satisfy the requirements of a variety of users, ranging from professional to the general public.

5. Conclusion

This paper presented TAQMN-2, a web-based air quality monitoring system designed and implemented nationwide in Taiwan, with functions ranging from data collection to data retrieval. TAQMN-2 has been implemented based on the proposed multi-layer architecture for environmental monitoring data management.

The main advantages of our approach are that it:

- replaces conventional DAS with an open standards web-based server attached with a PLC system making monitoring work more flexible
- provides a platform for automatically tracking data lineage while monitoring workflow execution
- supports tasks to systematically collect diverse monitoring data
- requires minimal modifications to migrate existing monitoring systems
- improves the scalability of environmental monitoring projects, in terms of both ease of adding and modifying components in each layer

Environmental data management, analysis, communication and evaluation are essential components of environmental characterization and decision making. IT and related technologies such as DBMS, the Internet, and associated Web technologies have become an integrating force for these components. In future developments, we will adopt XML and related technologies such as Web Services SOAP, and UDDI, based on the concept of multi-layer archi-tecture, to construct a loosely couple platform for integrating heterogeneous environmental monitoring data. In ad-dition, some of the data mining methods are considered to be associated with our platform for shaping environmental data to be more useful to support the environmental decision-making.

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附件三

60700087 **General Topics**

A LAYER-BASED APPROACH FOR STREAMLINING AND INTEGRATING ENVIRONMENTAL MONITORING DATA

*Yu-Chi Chu, Jui-His Yen, Lienyao Lee**

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Abstract

Environmental monitoring data plays an important role to support environmental decision-making. The tasks of collecting, managing, and accessing a large volume of environmental monitoring datasets has become ever more challenging due to the expansion of various newly available instruments, measurements, as well as diverse and complicated data storage systems. This paper presents a comprehensive system architecture which adopts multilayer approach and is based on the web-based platform for integrating environmental data management, ranging from data collection to applications. As an example of practicality, the second phase Taiwan Air Quality Monitoring Network (TAQMN-2) has been implemented using the proposed system architecture to justify its feasibility. The overall structure of TAQMN-2 is described, and two major subsystems, data collection manager (DCM) and data access manager (DAM), are illustrated in detail. Taiwan EPA benefited greatly from the results of TAQMN-2, not only in terms of streamlining the air quality data management but also in upgrading work performance on improving the air quality in Taiwan. The main advantages of our approach are: (1) replace conventional DAS with an open standards web-based server attached with a PLC system making the monitoring work more flexible, (2) provide a platform for automatically tracking data lineage during monitoring workflow execution, (3) support tasks to systematically collect diversity monitoring data, (4) require minimal modifications to migrate existing monitoring systems, (5) improve the scalability of environmental monitoring projects, in terms of both ease of adding and modifying components in each layer. The usage of proposed approach is not restricted to air quality data management; it is also suitable for other domains of environmental science with limited tuning, adjustments, or augmentation.

Keyword(s): Environmental monitoring data, data integration, air quality data management, TAQMN-2

Application of Web-GIS for Display and Integration of Water Quality Information

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Abstract. Government agencies have sought to use a simple, clear and unified method for expressing descriptions, numerals, and space-time distribution of water quality monitoring results. Instead of tables and detailed lists, this study attempts a new approach by utilizing the superiority of spatial information display in Web-GIS and the highly interactive integrated technique from Ajax (Asynchronous JavaScript and XML). It presents different water qualities with color changes at each sample site on the electronic map, including past or immediate changes, and continuous quality changes. This method also uses pie charts and histograms to provide immediate space-time statistics. In addition, by combining the polygon split method and color gradient with the RPI (River Pollution Index) definition, it can provide another condition to closely matche practical river quality changes. Furthermore, it successfully integrates and displays different official monitoring results with both buffer analyses of Web-GIS and statistical graphs. As an example of practicality, the Taiwan Water Quality Data System (TWQDS) has been implemented using the proposed system architecture to justify its feasibility.

Keywords: Web-GIS, Ajax, Water Quality, RPI

1. Introduction

The monitoring results of water quality (including the information regarding sampling sites, environmental status at the time of sampling, and the data garnered from analysis) are the basic information primarily required for protecting water quality in our environment. The understanding and analysis of the basic information play an important role when it comes to the policies relating to the formulation of river basin protection tactics and pollutant reduction control scheme, institution of river remediation, prevention of reservoir eutrophication, groundwater pollution control and protection of coastal water quality. Thus, in addition to explicitly regulating the task in their laws, many countries also establish an exclusive organization to work on it in order to ensure the sustainable operation of water quality monitoring. In Taiwan, the water quality monitoring at rivers, reservoirs, groundwater and coastal water is mostly executed by EPA (Environmental Protection Administration).

Some countries (e.g. Japan) convert the monitoring results acquired by spending huge amounts of money with massive manpower into files or compile them as reports for the public to download, others directly present them on the webpage in the table form, still others (e.g. H.K., Denmark) use HTML Image map and Hyperlink to simultaneously post the distribution condition at the sampling sites and the monitoring results, in which some countries (e.g. the U.S.) further use script language to add some interaction effect. Regardless of what way it is presented, every government has devoted their efforts to presenting those monotonous monitoring results in a friendly way, so as to make the populace easily understood.

Water quality results have temporal and spatial variation simultaneously. Limited to its difficulty in presentation, it is usually only presented how water quality is changing with time by lines and histograms. Regarding the correlation between water quality's spatial variation or its variation with temporal and spatial distribution, it is less emphasized. Other than affecting the accuracy and reliability of subsequent analysis and research, this kind of presentation which changes with time without including spatial variation may also influence the environmental protection policies.

Furthermore, the river flow is also an indispensable reference in river water quality analysis and research. Hence, it is imperative to effectively integrate the two kinds of monitoring results in order to enhance their application value and analysis convenience.

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Since 1960, GIS (Geographic Information System) has turned out to be the optimal tool to integrate, store, analyze and present spatial information as well as its related data. It is especially so after the introduction of related database and Web-GIS concept since 2000 (Clarke, 1997; Bernhardsen, 1999). It has not only developed a new arena to use geographic information resources, but also provided the possibility of highly socializing sharing with geographic information (Bedford, 2004; Longley et al., 2005; Wang et al., 2005; Davis, 2007; Schlütera, 2007).

The purpose of this study is to use the Web-GIS and the highly interactive integrated techniques in Web to present the water quality results which show concurrent time-space variation, in the hope of presenting an array of changes in the water quality in the environment.

2. System structure and data sources

The Web-GIS service provided by the system is constructed with multiple layers. At client-side, the web server constituted by Microsoft® Internet Information Services (IIS) 6.0 and New Atlanta's ServletExec® 5.0 is used to provide related services. This study uses the highly interactive integrated technologies of Ajax (Asynchronous JavaScript And XML) in an attempt to reinforce the versatility and interaction in utilization at the client-side. Figure 1 shows system structure and data process chart.

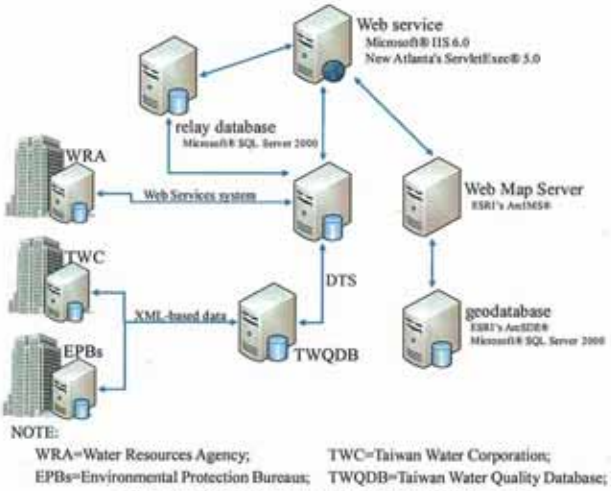


Figure 1. System structure and data process chart.

In the aspect of spatial data, this study uses the ESRI's ArcIMS® as the operation platform and ESRI's ArcSDE® as the intermediary gateway between the application system and geographic information database, so the system may effectively access the environmental geographic map (Map Datum: TWD97; Position format: TM2) stored in Microsoft® SQL Server 2000.

In terms of flow and water quality monitoring results, the system uses Web Services to get the data from the flow monitoring responsible organization – WRA (Water Resources Agency) and utilizes DTS (Data Transformation Services) to transform and pick up the data stored in TWQDB (Taiwan Water Quality Database).

TWQDB has stored a variety of water quality monitoring results coming from Taiwan's related government agencies such as EPA, TWC (Taiwan Water Corporation), EPBs (Environmental Protection Bureaus), etc. The results has been recorded according to Taiwan WQX (Water Quality Exchange Standard) and transformed into XML-based data which has to pass the validity of XML Schema before uploading to TWQDB.

In addition, the system sets a relay database between the web server and back-end database, so it can execute the procedure requiring massive calculation during noon and evening when the system has a lower load, and store the results in the relay database. In this way, the web server may directly access the advanced calculation results, and

the presenting speed during the integration and application of spatial data and water quality data can also be enhanced.

3. Data presentation

3.1 The variation of water quality at sampling sites

The information yielded from the water quality monitoring at various sampling sites is concluded into following three types:

1. Monitoring information： It includes the information relating to sampling sites, environmental status at the time of sampling, and various kinds of water quality analysis and data. The information is shown by either text or numeric figures.
2. Water quality index: It includes RPI (River Pollution Index) and WQI (Water Quality Index) used to evaluate river's pollution degree, and CTSI used to assess reservoir's eutrophication degree. The index is used as the yardstick to monitor water quality. As a matter of fact, the index itself is the water quality monitoring data converted from various equations or algorithms.
3. Statutory index: In order to fulfill environmental protection and understand water quality improvement situation, each country has its own water quality standards. However, on the other hand, it is another important matter to compare quality monitoring data with those water quality standards and find out if the results measure up (Environmental Law Library, 2007).

For monitoring information, users may use the system's data enquiry and loading functions to obtain the results of the quality monitoring of varying kinds of waterbodies (including rivers and streams, reservoirs, coastal water, and groundwater, etc.).

As to the information regarding the water quality index and statutory index, this study attempts a new approach by utilizing the superiority of spatial information display in Web-GIS and the highly interactive integrated technique from Ajax. It uses coordinates transformation technology between the TWD97-TM2 and computer screen to display the historical or real-time water quality information of waterbody by static or dynamic color changes in solid circles or squares on the electronic map. As shown in table 1, the system uses the change of colors to present water quality results.

Table 1. The system uses the change of colors to present water quality results.

Waterbody	Presented results
River	Water quality index：RPI[1]、WQI[2] Statutory index：qualified and unqualified[3]
Groundwater	Statutory index: achieved and unachieved[4]
Reservoir	Water quality index：CTSI[5]
Coastal water	Statutory index: qualified and unqualified

[1] RPI: River Pollution Index.

[2] WQI: Water Quality Index.

[3] qualified (unqualified): The analysis result is lower (greater) than the requirement for the regulation.

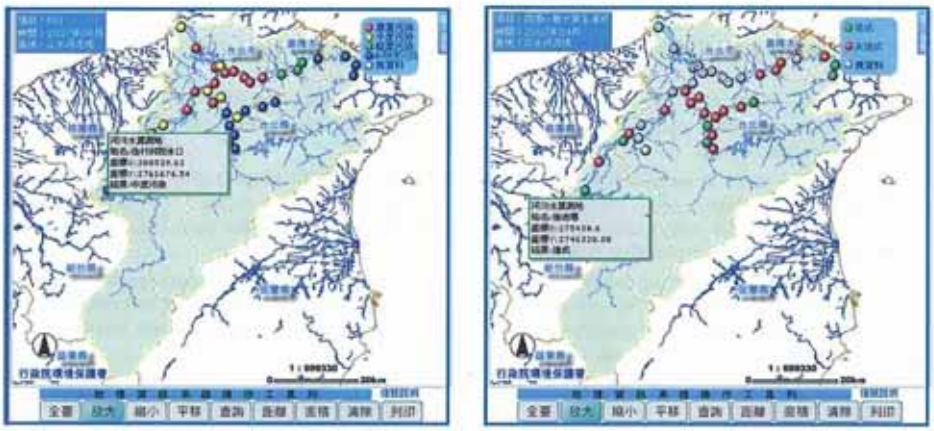
[4] achieved (unachieved): The analysis result is lower (greater) than the requirement for the relevant regulations of groundwater.

[5] CTSI: Carlson Trophic State Index.

Taking river's RPI results as an example, when users enquire for related information, the system will access the data transformed and stored in the relay database in advance and present it on the electronic map by solid dots respectively in blue color (for non-polluted result), green color (for lightly-polluted result), yellow color (for moderately polluted result) and red color (for heavily polluted result). As to the original water quality monitoring information, the attribute of onMouseOut and onMouseOver is used to show the information by moving the mouse.

As shown in Figure 2, the system displays the changes of water quality at sampling sites.

Moreover, the system combines Web-GIS to provide consecutive qualified and consecutive deteriorating information for decision makers to check and analyze.



(a) Water quality index

- blue: non-polluted result
- green: lightly-polluted result
- yellow: moderately polluted result
- red: heavily polluted result
- gray: no data

(b) Statutory index

- green: qualified result
- red: unqualified result
- gray: no data

Figure 2. The system displays the changes of water quality at sampling sites.

3-2. Water quality statistics

To give users water quality statistics in a simple, rapid and clear manner, in addition to presenting them by statistical form, the system also directly uses CHARTSYMBOL element (ArcIMS 9 ArcXML Programmer's Reference Guide, 2007) of ESRI's ArcXML® to display the statistic results of waterbody's time and space by pies or squares (e.g. to show the RPI distribution status in recent three years in each county and city). Table 2 shows the way and description that the different kinds of water quality from varying water bodies are displayed in the study. Figure 3 shows the RPI distribution in the respective administration areas in Taiwan. Figure 4 shows the eutrophication occurring in Taiwan's major reservoirs.

Table 2. The way and description the different kinds of water quality are displayed in the study.

Waterbody	Statistic compiling area	Statistic period	Display method
River	Every administrative division Every river basin	Monthly Yearly	
Groundwater	Every administrative division Every groundwater regions	Yearly	
Reservoir	Every Reservoir	Yearly Quarterly	
Coastal water	Every coastal water	Yearly	

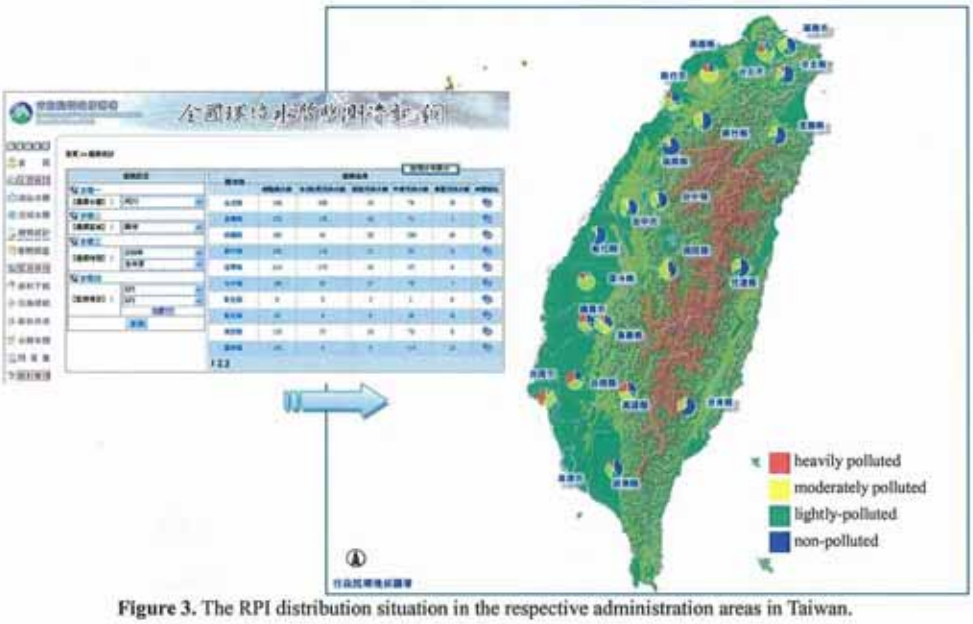


Figure 3. The RPI distribution situation in the respective administration areas in Taiwan.

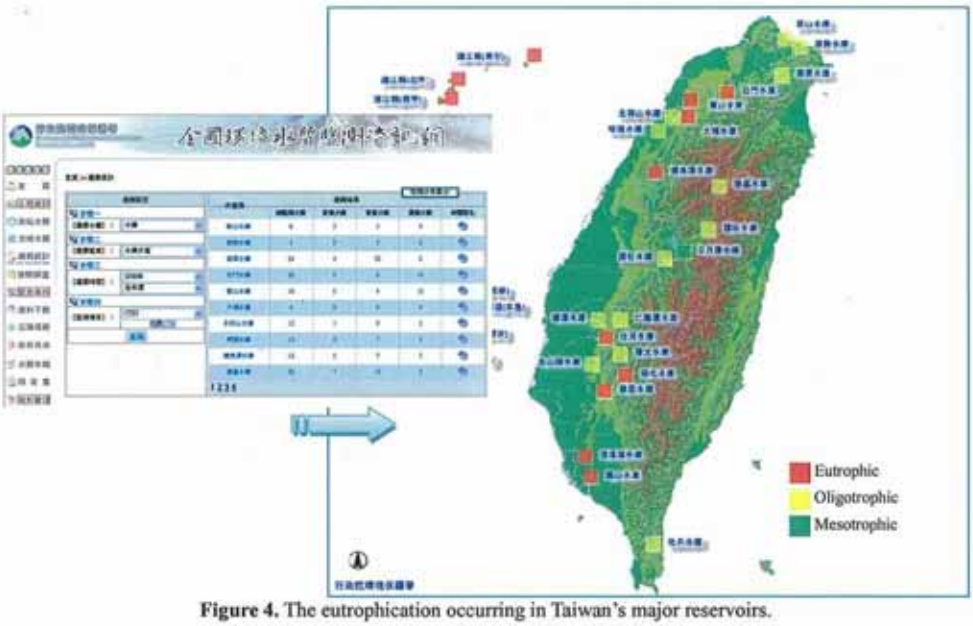


Figure 4. The eutrophication occurring in Taiwan's major reservoirs.

3-3. Time-space change of river basin water quality

By taking display effect into account, this study uses three river basins, the Danshuei River in northern Taiwan, the Wu River in central Taiwan and the Gaoping River in southern Taiwan, to explore how water quality could change simultaneously with time and space.

Given the fact that the sampling sites in the three river basins can be changeable, rather than using Flash technology, the system directly presents the effect by GIS's layer concept. In addition, in order to show the results closer to the real change of water quality, this study gives more detailed process on river polygon layers by combining RPI's definition, and the technology of polygon split method and color gradient function. Instead of using the rough splitting "between sampling sites" method, this study further splits the river basin's polygon layer between sampling sites into 8 to 16 pieces, in which each piece is respectively colored according to its RPI's definition, so as to form a spatial vision effect. Figure 7 is the demonstration of cutting manner of basin layers.

In terms of temporal vision effect, the study attains the effect by continually presenting the monthly water quality status for period of time. For the convenience to look into the change of monthly water quality, the system sets up the thumbnails next to the display zone to show the change of monthly water quality. Users may move the mouse around these thumbnails to view each month's water quality. Figure 8 shows the river basin's water quality which changes with time and space.

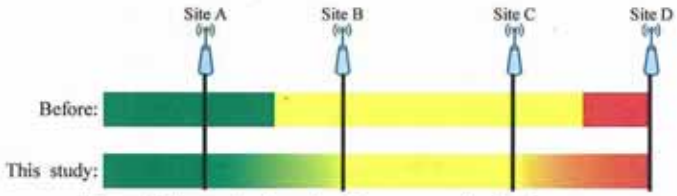


Figure 5. Demonstration of cutting manner of basin layers.

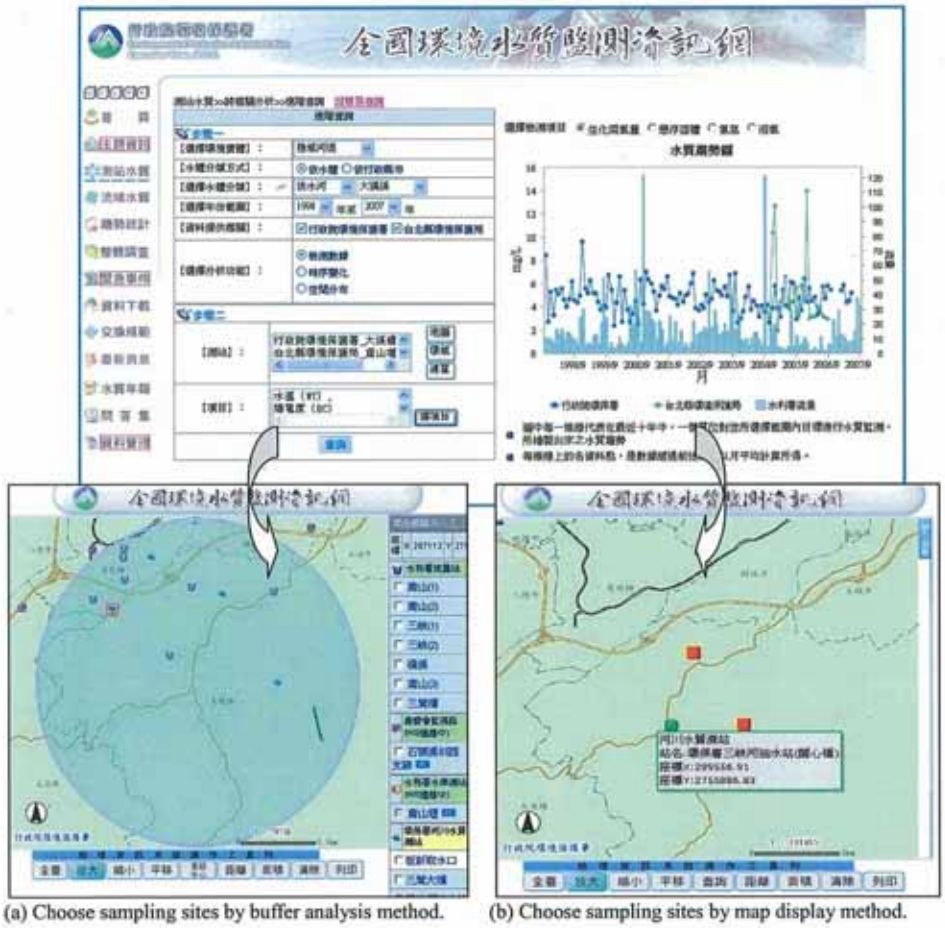
Figure 6. The time-space change of river basin's water quality in the system.

3-4. Demonstration of cross-agency integration

Due to increasing complexity in data integration of water quality monitoring results coming from different agencies, the integration task turns out to be a great challenge. With the detailed list of water quality monitoring results, water quality time sequence graph, and sampling site's spatial distribution graph in the system, users may quickly obtain EPA and EPBs' monitoring results. In the process, other than introducing Software FX's Chart FX®

to draw each sampling site's water quality which changes with time, the system also utilizes the superiority that Web-GIS has on spatial information analysis to develop "map display" and "buffer analysis", so users may select the sampling sites they require looking into.

Since river flow is one of the reasons to influence water quality, the system uses a histogram to show the river flow data on the water quality time sequence graph, so users may refer to it for analysis and comparison. Figure 9 shows the cross-agency integration and related functions.



(a) Choose sampling sites by buffer analysis method. (b) Choose sampling sites by map display method.

Figure 6. Display of the cross-agency integration and related functions.

4. Conclusion

With the increasing demand for the "right to know", it has become a way of no return for government agencies to head for computerization and transparency of water quality monitoring results. However, the key issue that makes all circles to devotedly work for is "how to have professionalism without losing friendliness and how to make it delicate without sacrificing its functionality".

Environmental problems are a spatial and time issue. This system succeeds in using the edge that Web-GIS has

on spatial information display and data analysis to present the water quality monitoring information of various water bodies by graphs, so users can quickly and simultaneously understand the status of the change over time and space and obtain statistic information. What is most notably is that Web-GIS has been innovatively applied to the integration of a variety of monitoring data from different agencies.

As many know, environmental problems involve plural sectors. In order to solve them, we usually need to concurrently refer to plenty of varying information. Since this system is built on Web-GIS, it is more in the position to combine other kinds of environmental spatial information, such as river pollution control district distribution chart, and soil texture distribution charts, etc. to advance the original presentation of the change in water quality into a tool to protect environment's waterbodies.

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6071005 **Keynote Speaker**

DESERTIFICATION TRENDS AND IMPENDING WATER CRISES

Edward A. McBean

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Abstract

Water crises in arid and semi-arid regions of the world are greatly intensifying in response to the combined effects of large population growth, periodic drought, climate change, and the mismanagement/mis-allocation of water resources. These effects are creating dramatically increased rates of desertification, which is now recognized as a serious threat to arid and semiarid environments. Desert lands now encompass 40% of the global land surface, housing a current population of one billion. With population increases and increased water use intensities, the results have dramatic implications to many parts of the world. The expansion into, and creation of, desert-like conditions in areas where such conditions do not naturally occur, is approaching serious conditions as a result of overgrazing, overcultivation, deforestation and poor/inappropriate irrigation practices. These practices are resulting in permanent challenges for governments to provide water for these areas. Situations in a number of specific areas are used to demonstrate the impending issues which are developing. The issues within basins in which water is shared between countries is demonstrated as being particularly foreboding.

Keyword(s): Arid, Semi-Arid, Climate Change, Drought, Desertification, Water Management.

PRESERVATION OF WATER RESOURCES AND ENVIRONMENT BY MEANS OF DOING STATISTICAL STUDIES ON WATER QUALITY

S. A. A. Sajadi, A. Nazari Alavi*

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Abstract

This paper examines the effect of rivers' water quality on the maintenance and improvement of environment. This research investigates several relatively salty headwaters of a big Iranian river. Based on the numerous samples taken in various seasons of the year and the measurement of ion content of the waters and consequently the statistical analyses of pollutants done within the study zone, it was revealed that these waters are contaminated by heavy metals and in case no action is taken to stop their discharge into the main river (despite being diluted as they join it) they can contaminate the waters used for irrigation or drinking purposes an issue which can cause sanitary and environmental problems. In order to prevent the occurrence of such problems, the paper examines and provides some proposals to divert these headwaters.

Keyword(s): statistical analysis, heavy metals, contaminates.

MITIGATION OF NITROGEN POLLUTION IN WATER BODY BY INCORPORATING THE DHS (DOWN-FLOW HANGING SPONGE) SYSTEMS AND AUTOTROPHIC NITROGEN REMOVAL TECHNOLOGIES

Hui-Ping Chuang, Takashi Yamaguchi, Madan Tandukar, Hideki Harada, Akiyoshi Ohashi

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Abstract

Nitrogen pollution is gathering increased attention due to well-known environmental hazards resulting from overloading of nutrients. Conventional process of nitrogen removal by nitrification and denitrification requires considerable amount of energy and cost for aeration and carbon supply. Several novel and cost-effective biological nitrogen removal processes were developed; however, there were still lots of problems associated with pervious developed reactor systems. In this study application of DHS reactor for nitrogen-removal process could provide the maximum nitrogen-removal efficiency under lower expenditure. The concentrations of nitrogen compounds in this system were maintained below 8 mg N/L in effluent under the nitrogen loading rate of 1.51 kg N/m^3-day. In addition, no withdraw sludge was observed in a DHS, decreasing further the cost for post-treatment.

Keyword(s): Ammonium, Down-flow hanging sponge (DHS) reactor, Low cost, Nitrogen pollution, Nitrogen removal process

LANDSAT DERIVED IMPERVIOUS SURFACE AREA AND POTENTIAL WATER QUALITY IMPACTS: A CASE STUDY IN THE GTA

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Abstract

Increased impervious surface is a verified consequence of urbanization. Research has shown that increases in impervious surfaces directly impacts hydrological features of a given area. This conducted research contributes to the field of remote sensing by extending the literature on the potential correlation between increased impervious surfaces and potential water quality impacts focusing on a case study in the Greater Toronto Area (GTA). This area is significant for two major reasons. First, it constitutes the largest urban metropolitan area in Canada and the fifth largest in North America. Second reason is that the GTA is located in a hydrologically sensitive area within the great lakes basin: bordering the Lake Ontario from south, and the Oak Ridges Moraine from North. Therefore, proper urban planning, development and monitoring in this area is a vital environmental task.

In our research, Landsat images from 1985 to 2005 covering the entire Greater Toronto Area were used for time-series analysis of urban growth. Recent literature on urbanization suggests that Chloride inputs from road salt applications in winter adversely impact ecosystem health and drinking water supplies in urban watersheds. More paved surfaces lead to an increase in water pollution from runoff contaminated with chemicals and road salt. Thus, Chloride was selected as water quality indicator in this study. Pixel-based (unsupervised) and supervised classification procedures were utilized in spatial and temporal estimation of impervious surface areas. Chloride concentrations were then mapped against impervious surfaces. It was shown that increased imperviousness in the past 20 years has led to increased Chloride concentrations in the GTA.

Keyword(s):

AN INEXACT FUZZY NONLINEAR OPTIMIZATION MODEL FOR SUPPORTING DECISIONS OF RIVER WATER QUALITY MANAGEMENT

X. S. Qin, G. H. Huang, H.N. Xiao, Y.P. Li*

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Abstract

This paper developed an inexact fuzzy nonlinear programming (IFNP) model for supporting decisions of water quality management under uncertainty. Methods of interval and fuzzy programming were integrated within a general frame to address uncertainties in the left- and right-hand sides of the nonlinear constraints. Uncertainties in water quality, pollutant loading, and system objective were reflected through the developed IFNP model. A case study for water quality management planning in the Changsha section of the Xiangjiang River was then conducted for demonstrating applicability of the developed IFNP model. It was also indicated that the proposed method was effective in dealing with IFNP problems; uncertainties can be communicated into optimization process and generate reliable solutions for decision variables and objectives; the decision alternatives can be obtained by adjusting different combinations of the decision variables within their solution intervals.

Keyword(s): Environment, Inexact-fuzzy programming, nonlinear optimization, uncertainty

FLOODWATER RETENTION PLANNING USING GIS AND HYDRODYNAMIC MODEL: A CASE STUDY FOR THE CHI RIVER BASIN, THAILAND

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Abstract

Chi River is the lifeline of the northeast Thailand. Chi river basin suffers recurrent flood and drought as a regular phenomenon. Fundamental solution to this problem lies in storing the flood water and uses the same in the dry months for agriculture and domestic use. An attempt is made in this study to develop a methodology to derive the suitable location for the flood retention reservoir by adopting Analytical Hierarchical Process (AHP). The parameters considered for the study are salt crust, soil drainage, slope, landuse and geological formation. AHP are used to compute the weights of the main and sub-criteria. These weights were employed to determine Water Harvesting Potential Index (WHPI). Based on the analysis the areas are categorized into excellent, good, moderate and poor classes. These are later converted into vector layer for the final water harvesting zones map. The capacity of the reservoir are computed in GIS environ using 3D analysis of digital elevation model (DEM) and the maps of water harvesting zone. MIKE11, a one dimensional, unsteady hydrodynamic model is employed to route the generated runoff of all sub-basins, which are treated as lateral inflows into the Chi channel towards downstream direction. The model simulates the water level for the existing condition and then analysis of the scenario for demonstration of the flood alleviation purpose in the year 2001. The scenario is the diversion of discharges from the river to the two reservoirs near the river with total 10.6 MCM of water storage capacity. This has reduced the water level by 11 cm on the average at the diverted locations.

Keyword(s): Chi River, GIS, AHP, Hydrodynamic model

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The meeting will be held in the United Nations Conference Centre (UNCC) located on Rajdamnern Nok Avenue and Klong Phadung Krungkasem Road, Bangkok, Thailand. The UNCC occupies approximately 18,600 square metres of land and is in close proximity to many government offices.

The UNCC, under the general management of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) is run by a professional and experienced convention team which presently provides a wide range of conference services for numerous United Nations meetings.

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Taxis are metred. They charge a minimum of 35 baht for the first 3 kilometres, and approximately 5 baht per kilometre thereafter. Make sure you have change! Passengers must pay tolls in the case of using an expressway.

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These three-wheeled open-air motorised taxis are popular for short journeys. Fares must be bargained in advance.

BTS Sky Trains and Subway (Metro)
The BTS sky train routes connect leading hotels and major shopping areas in Bangkok. The fare ranges from 10-40 baht according to the distance. The MRT subway system connects many of the top tourist attractions with the accommodation areas, markets, and the business district.

Boat
These boats are the river taxis that ply the Chao Phraya River. Most of them are just cross river ferries.

About Thailand
The kingdom of Thailand lies in the heart of Southeast Asia, making it a natural gateway to Indochina, Myanmar and Southern China. Its shape and geography divide into four natural regions: the mountains and forests of the North; the vast rice fields of the Central Plains; the semi-arid farm lands of the Northeast plateau; and the tropical islands and long coastline of the peninsula South.

The country comprises 76 provinces that are further divided into districts, sub-districts and villages. Bangkok is the capital city and centre of political, commercial, industrial and cultural activities.

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