經濟部

行政院及所屬各機關出國報告

（出國類別：出席國際會議）

參加第二十三屆亞洲遙感探測國際研討會報告

服務機關：經濟部水利署臺北水源特定區管理局
出國人　職稱：課長
姓名：劉秀鳳
職稱：工程員
姓名：魏俊生
出國地區：尼泊爾加德滿都
出國期間：91 年 11 月 25 日至 91 年 11 月 29 日
報告日期：92 年 2 月 24 日

行政院及所屬各機關出國報告提要　　系統識別號　c09200877

出國報告名稱：參加第二十三屆亞洲遙感探測國際研討會報告　頁數 34　含附錄：否

出國計畫主辦機關/聯絡人/電話

劉秀鳳/經濟部水利署臺北水源特定區管理局/水質保護課/課長/29173282

魏俊生/經濟部水利署臺北水源特定區管理局/水土保持課/工程員/29173282

出國類別：□1 考察 □2 進修 □3 研究 □4 實習 ■5 其他（出席國際會議）

出國期間：91 年 11 月 25 日至 91 年 11 月 29 日

出國地區：尼泊爾加德滿都

報告日期：92 年 2 月 24 日

分類號/目：

關鍵詞：遙感探測應用，水源保護，GIS，GPS

內容摘要：（二百至三百）

一、目的：宣揚我國將地理資訊、遙感探測運用水源區保護之執行績效，藉國際學術交流吸收世界各國最新研究技術與經驗作爲本會施政之參考，並於會中發表「走動式地理資訊系統應用於水資源保育」論文。

二、過程：自 91 年 11 月 24 日至 91 年 11 月 29 日參加研討會及發表學術論文、與各國學者專家交流討論。

三、心得：1 公元 2003 年將有超過 60 顆民用人造衛星環繞地球，其解析度已達水平 60 公分(例如：捷鳥衛星 QuickBird)。人造衛星雷射測距儀 (LIDAR) 之高程精度爲 20 公分。此種遙感探測進步科技，對於水源保護工作應可大幅提昇效率。

2. 此次國際大型會議,所發表學術論文以遙感探測整合應用爲主題,全方位討論各方面問題,共發表 290 篇論文。以水資源保護爲主題較少僅 13 篇(摘要詳如附錄三)。政府部門應用地理資訊系統、遙感探測、網際網路則多所討論。

3. 綜觀 2003 年起全世界遙感探測整合應用趨勢爲網際網路化,擴大民眾與政府之間的互動,救災與環保借助於地理資訊系統、人造衛星定位系統、遙感探測,注重空間資訊的時效性、安全性與品質、資料共享、多媒體與立體動態展示。本局推行水資源保護工作,已達上述各種標準,方向亦符世界最新潮流。

四、建議：1.遙感探測技術日新月異，我國宜多派員出席並定期參加各種國際性學術研討會議，以便隨時掌握最新資訊，並將之應用於實際執行成效，對機關業務推行具績效提昇、人才培育等正面意義。

2. 本局應用遙測技術配合地理資訊系統應用於集水區之經營管理已行之多年，近來更推展應用於網際網路之功能，若野外現場能再配合個人數位助理(PDA)、GPS 定位儀及數位相機等設施並以手機結合 GPRS 數位行動傳輸，將現場狀況即時傳回中心，將使水資源經營管理工作之效能

更上一層樓。

3．論文發表後，主持人尼泊爾教授認爲本計畫相當實用，建議轉換成英文介面，以利其他國家使用。故若經費許可，建議轉換其他語言介面，以宣導我國利用遙感探測、地理資訊系統、人造衛星定位系統於水源區保護之執行成效。

本文電子檔已上傳至出國報告資訊網

出國報告名稱：參加第二十三屆亞洲遙感探測國際研討會報告

出國計畫主辦機關名稱：經濟部水利署臺北水源特定區管理局

出國人姓名/職稱/服務單位：(若二人以上，則列○○○等人)

劉秀鳳/經濟部水利署臺北水源特定區管理局/水質保護課/課長/29173282

魏俊生/經濟部水利署臺北水源特定區管理局/水土保持課/工程員/29173282

出國計畫主辦機關審核意見：

□1. 依限繳交出報告

□2. 格式完整

□3. 內容充實完備

□4. 建議具參考價值

□5. 送本機關參考或研辦

□6. 送上級機關參考

□7. 退回補正，原因：

□(1)不符原核定出國計畫

□(2)以外文撰寫或僅以所蒐集外文資料爲內容

□(3)內容空洞簡略

□(4)未依行政院所屬各機關出國報告規格辦理

□(5)未於資訊網登錄提要資料及傳送出國報告電子檔

□8. 其他處理意見：

目次

壹、 目的

第二十三屆亞洲遙感探測國際研討會（ACRS2002）訂於九十一年十一月二十五日~十一月二十九日在尼泊爾加德滿都舉行，本次大會主題含有一高解析度影像應用、地形圖與數值高程、森林資源保育、水文與水資源保育、土地利用與變遷監測等；其討論主題與本局歷年來執行水資源保護工作（如水土保持、造林、土地使用、水質水量保護、使用分區規劃、集水區經營等）所運用之地理資訊系統、衛星定位、衛星影像遙感探測、數值地圖資料庫等最先進科技息息相關。為宣揚本局將地理資訊系統結合遙感探測運用於水源區保護之績效，並藉國際學術交流吸收世界各國最新科技及研討技術與經驗作為本局施政之參考，本局受邀於會中發表「走動式地理資訊系統應用於水資源保育」論文(MOBILE GEOGRAPHIC INFORMATION SYSTEMS FOR WATER RESOURCE PROTECTION)，由課長劉秀鳳、工程員魏俊生代表本局參加該國際研討會並於會議中宣讀論文，期能透過與世界各國學者專家在地理資訊系統業務應用科技問題上相互交換經驗與心得，以增進水資源保護與經營管理成效。

有鑒於本局為國內唯一執行集水區水資源保護、經營管理機關，且歷年來執行績效卓著，與使用地理資訊系統、電腦圖等最先進科技有極大之助益，故有必要藉本次國際研討會宣揚本局將網際網路地理資訊運用於水源區保護及相關經營管理經驗，供世界各國參考。並可藉國際學術交流機會，與世界各國不同領域學門之學者專家做雙向溝通討論，期能吸收世界各國最新研究技術與經驗，作為本局施政之參考。

貳、過程

應邀參加第二十三屆亞洲遙感探測國際研討會論文發表行程表

日期	起迄地點	內容	停留天數
91.11.24	本局→中正機場→曼谷轉機至尼泊爾加德滿都	出發	1
91.11.25~91.11.29	尼泊爾加德滿都	參加研討會及發表論文	5
91.11.30	尼泊爾加德滿都轉機至曼谷→中正機場→本局	回程	1

參、研討會重要內容

一、 研討會名稱：第 23 屆亞洲遙感探測國際研討會

(The 23rd Asian Conference on Remote Sensing)

二、 大會日期：自民國 91 年 11 月 25 日 至 民國 91 年 11 月 29 日

三、 開會地點：尼泊爾加德滿都

四、 主辦單位：

1. 亞洲遙感探測學會

2. 尼泊爾國家測量局

五、 參加單位

亞洲遙感探測學會會員國有 22 國家與地區，另外贊助會員國有加拿大、法國、荷蘭、瑞典、瑞士。我國爲國家會員(China Taipei), 2000 年曾在台北市主辦第 21 屆亞洲遙感探測國際研討會。此次參加國家至少有 17 國（地區），包含日本、韓國、新加坡等。

六、 亞洲遙感探測國際研討會歷史：

第 1 屆至第 23 屆大會分別在不同國家舉辦,1980 第一屆地點爲泰國曼谷,依續爲：

屆別	年	主辦國家	地點
1	1980	泰國	曼谷
2	1981	中國	北京
3	1982	孟加拉	達卡
4	1983	錫蘭	可倫坡
5	1984	尼泊爾	加德滿都
6	1985	印度	海德拉巴
7	1986	韓國	漢城
8	1987	印尼	雅加達
9	1988	泰國	曼谷
10	1989	馬來西亞	吉隆坡
11	1990	中國	廣州
12	1991	新加坡	新加坡
13	1992	蒙古	烏蘭巴托
14	1993	伊朗	德黑蘭
15	1994	印度	班卡洛
16	1995	泰國	納可拉加西瑪
17	1996	錫蘭	可倫坡
18	1997	馬來西亞	吉隆坡
19	1998	菲律賓	馬尼拉
20	1999	中國	香港
21	2000	中華民國	台北
22	2001	新加坡	新加坡
23	2002	尼泊爾	加德滿都
24	2003	韓國	釜山

七、 亞洲遙測大會內容：

分爲專題演講、口頭專題報告、壁報交談式展示、遙測相關科技產業展示,現地考察等方式。

專題演講爲:

1. 題目：太空製圖

主講人：德國 Konecny 教授(世界航空測量暨遙感探測學會前會長)

內容:

傳統製圖經由航空攝影測量已經成功的提供約 1:200000 的比例製作全球圖像，但最有用的比例 1:50000 的圖像僅製做了 2/3 的全球面積，在已開發國家這是一個嚴重的缺失，但是從衛星影像製圖上可以彌補這些既有的缺失，進而提供即時的資訊。

本文詳列光學及雷達衛星感應器的發展史，但現有衛星感應器最高解析設備遠比航空照像昂貴，而未來以小型衛星操作儀器將更具有價格競爭力。電腦軟體有效地處理航空及衛星影像資料導致數位製圖技術的進步。雷達干涉技術有利於小比例數值高程模式(Digital elevation model，DEM)的發展，使得利用衛星資料可以完整的取得圖像。

1.製圖

製圖的目的可提供地球表面的模型，可以用來航海及記錄自然社會經濟環境的發展情況。從前製圖的技術受限於科技取得地表特性的能力，故以前只有地區性的測量。在十四、十五世紀時製圖的重點被放在用來探險的航海圖上，到十七世紀時，三角測量技術發展使得可在一定距離進行測量，輔以天文定位使得大面積（國家）的地表解碼技術首次運用於軍事用途。使得歐洲國家可以利用飛機大量製作中比例尺地圖。

然而非歐系國仍需要新的科技來製作精密的地圖，後來 1903 年飛機的發明及 1915 年航空照像製圖技術解決了此問題，在第二次世界大戰中利用航空攝影測量的技術製作出了各大洲的地圖。在 1945 年航空攝影測量技術也被用於開發中的拉丁美洲、亞洲、非洲大陸，聯合國祕書處依照全球測量的報告，發行全球地圖。1990 年在 1:200000、1:100000、1:50000 和 1:25000 的比例下地形測量製圖的情況，如附表 1 。

大陸 比例	非洲	亞洲	澳洲& 大洋洲	歐洲	前蘇維 埃聯邦	北美	南美	全球
1:200000	89.1%	100%	100%	90.9%	100%	99.2%	84.4%	90.2%
1:100000	21.7%	66.4%	54.4%	87.5%	100%	37.3%	57.9%	58.9%
1:50000	41.1%	84%	24.3%	96.2%	100%	77.7%	33%	56.1%
1:25000	2.9%	15.2%	18.3%	86.9%	100%	45.1%	7%	33.3%

表 1:地形測量製圖的狀況

大陸 比例	非洲	亞洲	澳 洲 & 大洋洲	歐洲	前 蘇 維 埃聯邦	北美	南美	全球
1:200000	10.9%	15.4%	2.9%	59.9%	-	51.9%	2.2%	3.4%
1:100000	28.8%	0.2%	0.7%	55.9%	-	0.2%	0	0.7%
1:50000	18.4%	5.7%	13.1%	45.9%	-	21.4%	6.1%	2.3%
1:25000	14.0%	27.7%	15.8%	52.5%	-	32.2%	0	5.0%

表 2 : 1980 –1987 年全球地形測量製圖的更新比例

這總結說明全球 100%的陸地可包括在 1:200000 比例的地圖，這也是大家所需要的，但約有 2/3 的地區的需求是 1:50000 比例的地圖。大部分的圖像係以向量及數位導向技術製作，不幸的是，這都不是即時圖像(最少都是 20 年以前的資料)，目前的航空攝影測量製圖則又貴又慢，這些問題對歐洲及已開發國家是沒有關係的，但對開發中國家卻形成嚴重問題。

目前新的即時製圖技術於 1957 年蘇聯發射 Sputnik 衛星後，成功地開發出來，此技術係利用太空衛星對地球表面照像。1961 年第一顆氣象衛星 TIROS 和美國太空總署 NOAA 衛星傳輸氣象資料(以不到 1km 的地面解析度)，雖可供全球氣象需求，但是每二週更新一次及低解析度仍是不敷所需。

針對中解析度的地球資源量測開始於 1972 年美國 Landsat 衛星，其配備有多波段掃描器(Multispectral Scanner，MSS)，將解析度提升到 80m，1982 年 Landsat 衛星配備 TM(Thematic Mapper)感應器更提升到 30m 的解析度，此變化已可將其運用到監測農業土地利用及森林變化及災難事件(包括洪水、火災、地震)，1978 美國太空總署發射 Seasat 衛星及 1991 年歐洲太空總署(ESA)發射 ERS 衛星，成功的使用大氣雷達系統，而更詳細的傳送氣候圖資料，但在地形製圖上需要更多的數據，而這些資料在 1980 年代是被軍方所管制的。1986 年法國 SPOT 衛星發射後，證實要提高解析度的關鍵在於人爲操縱的無人飛行器的照像技術及數位光學感應器，而目前 SPOT 衛星的地面解析度已進步到 0.6m。

2.衛星光學感應器

中解析度到高解析度的光學感應器的歷史，見附表 3。

(1968)1998	Corona	3m	軟片	立體
1972	Landsat MSS	80m	數位	-
1982	Landsat TM	30m	數位	-
1983	Metric Camera-SL	10m	軟片	立體
1984	Large Format Camera	5m	軟片	立體
1986	Spot P	10m	數位	(立體)
1987	KFA 1000	7m	軟片	立體
1991	KVR 1000	2m	軟片	TK350(立體)
1993	MOMS 02	5m	數位	立體
1996	MOMS 02-P	6m	數位	立體
1996	IRS 1C/D	6m	數位	(立體)
1999	Ikonos 2	1m	數位	立體
2000	EROS A1	1.8m	數位	(立體)
2001	Quickbird	0.6m	數位	立體
2002	Spot 5	2.5m	數位	(立體)

表 3 :高解析度光學系統的歷史(光學系統)

有系統的高解析影像研究開始於 1968 年美國陸軍的 Corona 計劃，首次以全景照相底片作出高解析度影像，1998 年美國聯邦地質調查所(US

Geological Survey，USGS)又將其作成低價的地圖，1983 年德國 ESA 開始製作高解析度(10m)的立體地形圖，約佔地球表面積的 10%。

1984 年在美國 NASA 的帶領下用 FLG 技術將立體圖像地面解析度提升至 5m，1986 年 SPOT 衛星用 10m 全色解析度開啓西方數位高解析度感應影像，蘇聯在 1980 及 1990 年代繼續使用光學底片影像系統，如 1987 年 KFA 1000 達到 7m 的解析度及 1991 年 KVR 1000 提升到 2m 的解析度。

1993 年太空梭載著第一部數位感測器 MOMS 02 將解析度提升到 5m，從 1996 年到 2000 年蘇聯 MIR 太空站也有 6m 的解析度。從 1996 年開始開發中國家也開始進入太空量測，印尼 IRS 1C/D 也達到 6m 解析度。

最高立體影像的解析度是美國軍方 KH11、KH12 的商業冒險計劃所展開，Ikonos 2 在 1999 年達到 1m 的解析度。2000 年以色列發射 EROS A1 衛星達到 1.8m 的解析度。美國地球觀測(EARTH WATCH)衛星和捷鳥 QUICKBIRD)衛星超越到 0.6m 的立體影像解析度。法國在 2002 年也發射了 SPOT 5 衛星，其也達到了 2.5m 的解析度。其他高解析度影像的計劃，諸如:2003 年印度 Cartosat 衛星、2004 年日本 ALOS 衛星、2004 年中國及巴西 CBERS 衛星均將達到 2m 的解析度。地球觀測和太空量測將在 2004 及 2005 年達到 0.5m 的解析度。

3.雷達感應器

雷達衛星感應器的發展如表 4。雷達量測的好處是可提供全天候、不計雨晴的感應資料，雷達衛星取得資料係以反射原理傳達，與光學照相不同，而且雷達衛星的資料可以補充光學影像的不足，但卻無法取代。

年	衛星名稱	發射國家	辦理單位	像素大小	高程準確範圍
1978	Seasat	美國	NASA		
1991	ERS 1/2	歐洲	ESA	12 m	5 to 100 m
1994	JERS 1	日本	NASDA		
1995	Radarsat	加拿大	Radarsat	6 m	
1995	Almaz	俄羅斯	Int.		
2000	SRTM-CBand	美國		15 m	10 m
2000	SRTM-XBand	德國	NASA/NI	15 m	5 m
2002	Envisat	歐洲	MA	12 m	
			DLR		
預計 2004 年後發射			Astrium		
	High resolution				
	system	俄羅斯		1 m	
	Terrasar	德國		4 m	
	SAR-Lupe	德國		1 m	

表 4: 雷達衛星的歷史

衛星雷達系統的好處是雷達的頻率是一致的，經由接收到散射的訊號，不只可以得到物體間的距離，也可以決定空中的方位角，甚至利用二

個不同天線所收到的訊號，在干涉的原理下可以得到高程。特別是 ERS-1 及 ERS-2 這二顆衛星，一前一後發射，差不多同天進入相同軌道運行，其傳送的資料，其精確度在無陰影處可達 5m，但在有陰影處卻只能達 100m，這是在未來發展上需克服的問題。

4.小型衛星照相機

私人發射商用小型衛星打破了政府應用大型衛星的獨占局面。1993 年韓國與葡萄牙合作首次發射迷你及微衛星搭載小型衛星攝影機，而 1999 年印度 DLR Tulsat 衛星已可經由光學感應器得到 6m 解析度的圖像，稍後蘇聯 UOSAT 2 衛星的解析度達到 10m。其他發射小型衛星成功者，例如 1999 年韓國的 KITSAT 衛星、馬來西亞的 TIUUGSAT 衛星及 2000 年中國的神舟一號，SURREY 大學宣稱這些小型衛星可以達到大型衛星 95%的成果，只要用到 5%的成本；若要達到 70%的成果，成本更可降到 1%。表 5 是未來幾年內將準備發射的小型衛星。

任務	發射國家	發射日期	解析度	攝影寬度
Meisat	韓國		8.5 m	47 km
Khrumichev	俄羅斯		8 m, 3-5 m radar	
S. Res. Inst.	俄羅斯		1 m radar	10 km
Rapideye	德國		6.5 m	4 satellites
Tubitac	土耳其			
Rocsat	台灣		8 m	24 km
Hypseo	義大利		5 m pan	20 km

Topsat	英國		2.5 m	
Sunsat	南非		5-10 m	80 km
KAIST	韓國		2.5 m pan	20 km
Interferom.	DLR/CNES		1-3 m	
Cartwheel	for Envisat		radar	
			interferometry	

表 5: 計劃發射的小型衛星

5.數位製圖技術

航空攝影測量利用電腦自動將光學影像製成數位圖像取代傳統圖像用人力轉成數位圖像，因其可自動定位及自動計算高程，利用模式及對位重疊影像技術可以修正衛星影像造成的誤差。以 GPS 作對位影像、導向及座標定位技術可正確定位地形影像，並利用統計資料可修正其可靠性。近來 P/C 數位光學補償程式的應用，被國際承認是有效的，其中包括漢諾威大學研發的 SIDIPC(簡易數位航空攝影測量)，也有以下特性：

- 半自動測點，在相片上轉移和控制點。
- 航空和衛星感應器的偵測程式。
- 航空三角定位定向束叢，可達 6000 影像及 20 萬個點，並可與 GPS 及 INS 併用定位及定向資料。
- 以過濾能力數值高程程式與影像合併。
- 地形、對位解碼

歐洲提出 Ikonos 2 衛星單影及立體影像的價格約 29$/km^2，(美國的特殊報價降至 7$/km^2)，Carterra 公司可將影像投影至平面，其差異是因衛星軌道運行的原因，在山區可產生達僅 200m 的差異。然而地面控制及數位高程模式是可以減少地形的誤差，可藉雙重線性方程式來修正至 4m。藉由 Iknos 2 也可以得到相同效果(4m)。

所以昂貴的太空影像高準確性產品技術，可藉助適合的軟體程式自已取得，目前 1:40000 比例平面像素 0.5m 的圖像，價格約 100$/km^2，以 1:10000 比例平面 1m 像素，價格約 23$/km^2，包含空中三角定位、影像與地形比對，這些都比 Carterra 公司都還要便宜。

6.成本因素

數位航空攝影量測的成本可以依如下的國際標準所定:

航空照像	4000$(儀器設備使用費)加每張圖 10$
掃描像片	15$/一張圖像
航空三角照片	25$/一張圖像
數位高程模式	120$/一張圖像
數位對位	30$/一張圖像
修飾	20$/一張圖像

以立體工作站而言，將一幅影像數位化，它的費用會隨影像的精細度而變化:

例如: 鄉間地形　10hr/每一影像

都市地形　100hr/每一影像

已開發國家的人工成本高於　　50$/hr

低開發國家的人工成本低於　　20$/hr

這是把圖像解壓縮成 GIS 資料的費用。

價格=生產成本價+經常性支出+利潤+風險，除了成本外，其他的因素通常被國際性的計劃所取決。

在航空影像製圖上價格取決於比例尺及淨影像量

如一張圖的尺寸　a'×a'=23×23cm，這個地區包含一張圖片是 a ×a

a = (h/f)a'

f = 焦距

h = 飛行高度

因照像時靠著正向 60%的重疊，側面 70%重疊就產生了一個 b=0.4a，每一趟飛行有一個 q 值，q = 0.7 a，所以這些平整的模型地區變成 b×q=0.28a2 平整模型地區的產生以 1:13000 的圖像來說，飛行面積是 2.5 km^2，若以 1:40000 就是 23.7 km^2。若這些圖像是用 15 μm 掃描會產生一個地面像素 20cm，比例尺爲 1:13000 之圖形，比例尺爲 1:40000 地面像素就是 60cm。

根據如上的成本資料一張 1:13000 的比例照片 20cm 的像素可以以 180$/$km^2$完成，1:40000 比例的照片經由 12.5 μm 的掃描會產 50cm 像素可以以 23$/$km^2$完成。20cm 的航線製圖，它的比例是 1:2000，價格爲 1200$/$km^2$，以 50cm 的航線製圖，比例是 1:10000 要 150$/$km^2$。這麼貴的原因是因要產生數值高程，數值高程的好處是不會改變，除非有重大災難發生。

在德國國土測量要求 ±1 dm 的準確度，或是用立體航空測量照像達到

±2~±5 dm 的準確度。最近用雷射掃描，結合數值地表模組(Digital Surface models，DSM)，可以產生 ±1.5dm 的精確度，價格卻較高，但是它的好處是可以收到建築物屋頂、樹頂或是地面的訊號。還有一種較便宜的方式藉由空載雷達干涉器精確度可達 1m。衛星雷達干涉器精確度爲±5m 的範圍，所以用數值正射像片來產生數值高程模組可以降低成本。

7.整合

衛星影像製圖並不是可有可無，它的好處是取決於資料數，在 DLR 的計劃中已經證實了在科索夫對災難救助系統很有幫助。爲了取得發生危機地區及時資訊，以下的資料來源被整合到整個資料系統。

- NATO 的 1:50000 的地圖
- 1:100000 的歐洲 Corine 陸地地圖
- 干涉器的數值高程(ERS 1 號及 2 號衛星所產生的數值高程)
- 從 Landsat TM、IRS1C/D、KVR1000 和 Ikonos 2 衛星所得到的最新影像，最容易由視覺判釋作成地圖。
- 地區性低精密度之 GPS 量測減少陸地、鐵路或橋樑的損壞。
- 小地區的數位像片因爲多媒體的使用可以很容易評估小地區的損害程度。

8.總結

太空製圖帶來如下的結論:

- 衛星照像產生 0.6m 像素，製作 1:5000 的地圖就會產生 2~4m 之物體辨識度。

- 5m 解析度未來是可見的。
- 在相同性能下，目前所使用的高解析度的衛星影像製圖遠比用航空攝影來的貴，但是也有一定的軍事市場。
- 在未來，大型衛星與小型衛星將有激烈的競爭。
- 1m 的雷達干涉系統和 1m 的雷達影像系統可以補充光學照像的不足。

地面地形圖比航線圖來的便宜。

各種來源整合是必須的。

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2. 題目：數值高程前景

主講人：英國倫敦大學 Doman 教授(世界航空測量暨遙感探測學會秘書長)

內容:

這篇文章將討論數值高程(Digital elevation models，DSM)發展及最近的研究，由很多感測器得到的資料可以用在數值高程模式上，界定它的優缺，也有很多數值高程的運用及發展模式結果，現在新的研究，已經可以適當改善立體對位，以便有更好的地表圖像及資料整合的使用。

1.前言

從不同型式的探測資料所得到的數值高程已經變成一個主要的產品，原因如下:

新的科技例如干涉器，提供立體影像一個新的來源，比使用數位影像及自動立體對位更簡單。許多新的應用被研發，包括 3D 城市模組和視覺化系統。然而，隨著產品被大量研發出來，數值高程的應用也產生了很多的問題。

主要問題是經由自動定位系統所產生的數值高程的可信賴度。曾發生過多次，地形圖像可藉由日期地表高程資料產生，然而在陡坡時轉換成大比例大面積圖像時易發生大的錯誤。那時就必須花很大工夫來修正數值高程資料，IfSAR(interferometric Synthetic Aperture Radar，合成孔徑雷達干涉器)也有相同問題。LIDAR(Light detection and ranging，雷射雷達)就沒有這個問題，但它只能應用在大比例尺的工作上，且無法產生圖像。上述的結論歸

納於表 1。

	特性	問題	註解
航空照像	二個垂直影像	封閉性(局限)	理論與方法均成熟
空載三排掃描器	向前向下向後，須GPS/INS 定位定向，可同時取得多光譜的資料	一直校正，大部份的計算均需校正	HRSC 在對位影像的產品成功的被應用
中解析度的衛星影像 (SPOT，IRS，ASTER)	一整排線性掃描器系統，有不同型態的線性掃描系統和穩定的軌道，很少人用	在短時間內得到立體的圖像是有問題的，用在SPOT和IRS衛星上	普遍被使用，可以從掃描器上得到大量的資料
高解析度的衛星影像 (Ikonos，Quickbird)	小於1m的解析度和高效率和精密的位置	價格，立體影像與外部定位資料不易取得	比較少與數值高程搭配使用
LIDAR	x、y、z 軸的直接獲得	高價，寬度取幅太窄	在某些地方用的不錯

表 1.由光學資料產生數值高程的問題

高解析度衛星，例如，Ikonos 與捷鳥衛星得到的立體影像用在數值高程上有一個問題，投射角度很大，可以高達 45u。密合度與校正是需要的，且這些資料的正確性是依靠內部與外部的定向資料這些資料是無法被使用者控制的，必須藉用供應商所提供的系數來修正。在地形學分析上，更多數值高程所需要的資料與技術已被發展出來，如果要應用在水文及地形高程，高解析度是需要的。數值高程產生的方法及如何應用是需要被檢查的，比如使用的補像方法，是最適當的嗎?差補法所用的網格是否適當?有無資料遺失?是否可利用更多不同來源的資料整合得到更準確的數值高程。本篇文章將討論中到大比例尺的數值高程，並且把在高解析度及範圍外的地區從 LIDAR 所產生的數值高程僅視爲資料的補充。我們將首度探討數值高程的產生方法而不是感應器的使用，在整個相關的過程中，我們將檢討數值高程的改進方法以及不同的應用。

2.數位地形模式(Digital Terrain Model，DTM)的產生

2-1.立體影像定位

數值高程從光學影像所產生的原理，現在已可以利用軟體自動修正。多年開發的軟體和設備，例如 SOCET 機組由 Leica Geosystems 公司及 Match-T 所銷售，現在被廣泛使用。整套軟體常應用在大比例尺上。在例行性的編輯上，這些自動的角度是被限制的，一般這些軟體可以用在航空照片及衛星影像上，這種軟體對正射影片的產生是很理想的，因爲只需一點點的編輯，但是對於除錯是有限的，例如，建築物、樹木，將只能在 DSM(數位表面模式)的準確度中被修正。所以在大比例尺上這個模式是不適用的，實際

的正射影像可由一整排的數位掃描器，利用演算法，產生地形圖，使用二張即可得到真實的正射影像，這個主題在下面將會進一步討論。

自動立體對位產生 DSM 的模式，是由感應器首次所產生出來的地形，例如樹梢，還有建築物跟其他的物體，這些用在正射影像和視覺化是非常有用的。而且可以用在小比例尺的應用上，DTM 則用在大比例尺上。經由過濾的演算法產生一個凸地表的模組，這種方法經常利用到 LIDAR 和 IfSAR 的資料。

2-2.合成孔徑雷達干涉器(IfSAR)

IfSAR 係用來搜集影像並藉不同相差產生數值高程。這些技術曾在歐洲藉 ERS 取得資料，最近更藉 SRTM(太空梭雷達地形任務)收集整個地球表面影像得到介於 60 μm 和 50 μm 的資料並換算出整個國家的數值高程，如德國及英國。SRTM 僅是資料傳遞轉換成數值高程的結果，在美國爲水平 30m 間距，其它地方則爲 100m 間距，一般垂直間的精確性則在 8-10m，空載 IfSAR 系統也可用在地區性數值高程其典型的水平間距爲 5m 及垂直間距 1m。

在 SRTM 和空載系統之前同時在單一傳遞模式可得到 2 個影像，IfSAR 的主要問題是，則因在不同時間取得的影像而缺乏連貫性，而導致資料有間斷，除非取得複合傳遞資料，來彌補這個差距。例如在英國(Morley et al 2000 地圖專案)就藉 ERS 的四個相近的完全傳輸資料完成全國的數值高程，此舉實在是重大的成就。

以 IfSAR 算出數值高程的軟體有其特定性，而且其資料 nd 是不易得到。因此只有一些廠商如 PCI 在出售。

2-3. 討論

幾乎全世界藉由以 30m 格狀間距或 SPOT、IRS、ASTER、ERS 等衛星感測資料，顯示這些資料是可以用來產生數值高程的。SRTM IfSAR 亦可算出數值高程，高解析度的空載資料可以從光學及雷達感應器獲得，藉此可產生小區域或大範圍的數值高程，衛星高解析度光學感應器也可以產生數值高程，但這個資料較不常用於此目的。垂直間的精度取決於地形與地表的狀況及同時取得近似同步影像的能力。這類資料主要用正射影像及影像地圖的製作，SPOT 感應器特別被使用於現今地圖上不存在的地區，以及難以靠近的地區。數值高程亦廣泛運用於水文研究及大型防災預測，如洪水、土石流、火山爆發、地震此類。近來數值高程用在預測洪水肆虐、大範圍地區的安全及防治相當重要的，此類大面積的應用以空載 IfSAR 最有用，並輔以 LIDAR 做小面積的資料補充。

3.數值高程品質的改善

3-1 資料取得

數值高程的精度因下列因素修整、編輯、和修改而異:

- 來源資料和高程的精度
- 地形特徵
- 取樣方法
- 插入法
- 代表性

精度和間距的關係是高度依賴地形的自然性，光學資料的 Ackerman 程式(1980 年)是被廣泛使用的:

$\sigma z^2 = (a*b)^2+d^2$

σz^2: 數值高程中內插任意點的變異

d : 間距

a : 地形比例因子

b : 測量誤差

除地形外，所有的因素變數取決於感應器，一個較高的感應度是來自於較小的間距及較小的量測誤差，較好的感應器可以得較高的準確度。現行最好的感應器是高解析度光學感應器，例如 Ikonos 和 Quickbird 衛星，但是如上所討論的，這個資料是昂貴的，因此不用在大範圍的數值高程。立體光學感應器如 ASTER 衛星，其資料對人們而言是較易取得的，但是數值高程產生的準確度就不如 SPOT 及 IRS 現行的資料高，因爲它的像素尺寸較大。較好的解析度將來自日本的 ALOS PRISM2.5m 像素尺寸的三維立體資料。這個任務的主要目的是產生地區性的數值高程及 PRISM 數值高程的規格是 10m 水平間距 5m 垂直準確度，其正確性與費用有關，如圖 1。

在使用 IfSAR 量測的地區中 SRTM 的資料是極有用，因其可近距離全面涵蓋。然而其精度仍不如 SPOT、ENVISAT、RADARSAT 和 ALOS PALAR 用在 IfSAR 數值高程未來具潛力。它也可以證明空載 IfSAR 可以很經濟的產生地區性的數值高程，如 Intermap 於英國蘇格蘭和威爾斯等地作出 5m 水

平間距 1m 垂直精度(有些地方可達 0.5m)，如表二。

搭載器具/感應器種類	格點間距	垂直精度	註解
中解析度衛星(例如 SPOT,IRS,ASTER 衛星)	30m	10m	可靠資料和軟體，易因雲、閉合和去關連性而產生誤差
高解析度衛星影像(如 Ikonos,Quickbird 衛星)	5m	2m	高精度、窄寬幅和高費用
SPOT 5 衛星		<10m	以改進的解析度和立體追蹤性得到 SPOT1-4 的連續性
ALOS PRISM	10m	5m	區域性數值高程的高潛力
ERS 的 IfSAR	30m	10m	多方傳輸可產生較佳結果，但可能因重疊、去關連和閉合而發生問題
SRTM	30m	10m	好的全球性覆蓋，在美國以外的地方只有 100 公尺的資料
空載的 IfSAR	5m	0.5m	涵蓋小區域可得高品質解析

表 2:取得資料一覽表

3-2.地形代表性的修正

地形特性尺寸受限於取像的像素大小，其可以用修正軟體加以改進。最常用的是插補法。大地科學家引用一些如動力換式，地理資訊統計和模糊分類(Wilson)，可對一些不確定的比例大小和副網格作修正，2002 年 Hutchinson 指出數值高程內插法的重要性。

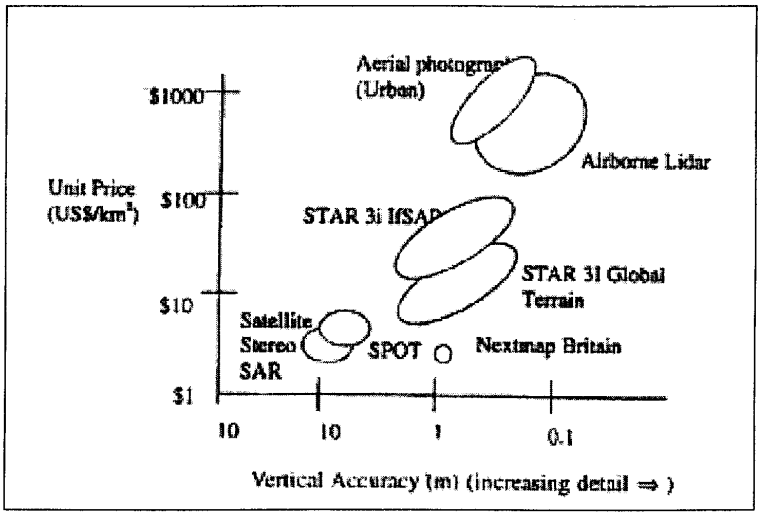

圖 1.數值高程結果和垂直間精度的費用關係

3-3 立體對位的修正

立體定位補像幾何法已發展多年，其包括複雜的解碼。因此，有許多缺點待解決。新技術如微波轉移用於影像定位較佳。比較如表 3 。

方法	例子	註解
基準線的應用	(Sohn and Dowman，2001) 結論引用 2D 基準線	軟體易取得但無法全部使用

	結論引用 3D 基準線	用於建築物的研發模式
	數值高程的改進	壓縮 對於地圖上取得或是人工測量在定義基準線時會有問題
微波		不普遍使用
新的策略	資料整合	大部份可建立在幾何學上推算但需更多資料
符合多方意見	Rosenholm，(1987)	可有較佳的結果，但需更多資料

表 3.立體對位改進的技術

3-4 資料整合

當資料的取得愈來愈便宜；衛星感應器愈來愈多時，資料整合的機會就大大的增加。Fox 和 Gooch(2001 年)，曾利用相同資料卻得到二個數值高程，必須修正結果。

Honikel(2002 年)建議以下列步驟來修正資料:

- 將全部資料轉換成同系統同單位，並作資料排列。
- 資料的整合:即資料被歸類和合併時，相同的資料要合併，不正確的資料須刪除。
- 經多方觀察判斷，決定的最佳最終數值高程。

Honikel 整合 ERS 衛星的 IfSAR 資料以及 SPOT 取得的數值高程，證實比原始的數值高程結果更佳，他利用 SPOT 數值高程修正未連線的圖像並刪除系統性的變化，整合的資料可以減少大錯誤，並得到較佳的判斷點。如果不同時間多次製作圖像也可以將相關資料結合。以下，我們提出以下的相關技術:

- 在不同間距整合資料後可從單點得到較佳的估算

例如:Hahn 和 Samadzadegan(1999 年)使用微波去整合不同解析度和精度的數值高程。

- 不同性質的資料整合

例如:IfSAR 併合高價高精度 SPOT 在某些特定狀況可得較佳結果，其結果視方向及時間差而異，立體 SAR 也可以於 SPOT 衛星上使用，也可得到相同結果。LIDAR 可在光學資料的定位下，指出建築物或樹木的位置。

- 由粗略到精密作業的融合

例如:粗略數值高程可供作精確數值高程的初始值，並明示作業可能產生的問題。粗略數值高程也有助於去除 IfSAR 資料中未閉合和大氣影響或基準點產生誤差的影響(Honikel ，2002 年)

- 整合不同類型的資料

例如:在定位作業中用於河川、高程、湖泊基準線

資料整合的二個一般問題:

(1)何階段該整合?

(2)如何在不規則的網狀資訊中利用完整的資訊?

3-5 干涉器作業

IfSAR 資料的利用仍在研究開發中，最近資料整合(Honikel ，2002 年)，和多次傳輸曾被使用，利用 SRTM 和空載 IfSAR 由單方資料傳輸顯示其加強的過程，可得到可靠及準確的結果。

4.未來方向

由 SRTM 、IKONOS 及空載 IfSAR 已證實較佳的感應器可產生較佳的數值高程。未來，可研究 ALOS RRISM 、PALSAR 和 ENVISAT 可產生較廣泛性的可用資料。資料整合技術也可產生較佳的數值高程，但需較高的費用及資料群組，及較多的作業程序，但如果未來如 SRTM 的資料取得費用較低時，且 ERS 的資料易取得時，上述方法亦是不錯的選擇。然而，我們仍需更有效、更低價和自動化的產品，因此需在這方面作更多的研究以找出對數值高程更合適的策略及突破。

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口頭專題報告共 32 場次，壁報 3 場次。

討論主題爲:

1. 地理資訊系統、人造衛星定位系統及資料整合
2. 土地利用
3. 防災與救災
4. 航空測量
5. 林業
6. 由太空探測地球
7. 山區環境與製圖
8. 都會區製圖
9. 高解析度資訊蒐集系統
10. 合成口徑雷達
11. 資料處理方法與模擬
12. 數值亞洲
13. 超高解析度製圖
14. 土壤與農業
15. 水資源
16. 地質與地形
17. 教育
18. 生態、環境與碳循環
19. 基礎建設規劃與管理
20. 海洋與海岸監測

大會共發表 290 篇論文，我國發表 25 篇論文排名第二，僅次於日本。

八、 我國參加大會情況：

包括行政院國家科學委員會衛星研究中心、國立政治大學、國立中央大學、國立交通大學、國立成功大學、國立屏東科技大學、工研院能資所、經濟部水利署的官員、教授、博士、學者、學生超過 29 人，在中華航空測量暨遙感探測學會理事長李三畏先生的帶領下，參加全亞洲最重要的遙感探測學術會議。有四位教授主持專題討論。出席人員共發表論文 25 篇。

九、 本局發表之論文：

本局發表論文題目爲『走動式地理資訊系統應用於水資源保育』(MOBILE GEOGRAPHIC INFORMATION SYSTEMS FOR WATER RESOURCE PROTECTION)。

論文中文摘要如後：

走動式地理資訊系統應用於水資源保育

伍木林　陳久雄　劉秀鳳　魏俊生

摘　要

經濟部水利署台北水源特定區管理局應用遙感探測、地理資訊系統及人造衛星定位系統技術於水資源保育已有 10 年以上歷史。台北水源特定區管理局設立目的，主要為永續供應大台北地區四百萬人口高品質之自來水。大台北地區自來水之品質名列台灣地區前茅，可為台北水源特定區管理局管理績效之證明。

台北水源特定區管理局水資源保育業務，並不限於傳統水資源管理工作，業務繁雜有如縣政府。諸如:水土保持工程、污水下水道管理、建物管制、垃圾清運管理、土地利用違規查報取締、土地使用分區、造林、水資源管理。業務需兼顧室內與野外現場。整合遙感探測、地理資訊系統、人造衛星定位系統(GPS)三種技術，可使水資源保育工作不限於傳統方法。

本文目的是說明如何開發走動式地理資訊系統，以及如何應用於水資源保育工作。野外現場使用以個人數位助理(PDA)為主，軟體以 ArcPad 為主，取其整合遙感探測、地理資訊系統、人造衛星定位系統之能力。整合遙感探測、地理資訊系統、人造衛星定位系統之時，需要另行撰寫程式，作為資料輸入與資料庫管理。尤其是個人化應用模組之開發，可提升使用者的興趣與意願。水資源保育工作以地籍資訊為最基本，可進一步整合土地利用違規查報取締、違建取締、水污染防治及污水下水道管理。現場工作時，PDA 與 GPS 合併使用，可立即得知地段、地號、土地所有權人、通訊處。其他相關資訊如: 土地使用分區、污水下水道配置。ArcPad 提供地圖與影像之展示、縮放、圖層開啟與關閉、GPS 功能。其餘資料庫管理與相關文書工作需另行撰寫程式。受限於 PDA 的記憶容量及螢幕解析度，個人電腦上需要很多準備工作，最後才將資料與程式下傳至 PDA。ArcPad 對於地圖、影像與屬性資料之超連結，方便簡易。土地使用分區、建物圖、污水下水道工程設計圖、以及崩塌地位置圖隨時加入，當作新圖層。事實上 ArcPad 在室內與室外，PDA 與個人電腦上功能皆可取。將來研究方向為擴大 PDA 在台北水源特定區管理局水資源保育工作之應用領域。

註: 本文發表於 2002 年 11 月 25-29 日在尼泊爾首都加德滿都舉辦之第 23 屆亞洲遙感探測國際研討會。

肆、心得：

一、 公元 2003 年將有超過 60 顆民用人造衛星環繞地球，其解析度已達水平 60 公分(例如：捷鳥衛星 QuickBird)。人造衛星雷射測距儀(LIDAR) 之高程精度爲 20 公分。此種遙感探測進步科技，對於水源保護工作應可大幅提昇效率。

二、此次國際大型會議,所發表學術論文以遙感探測整合應用爲主題,全方位討論各方面問題,共發表 290 篇論文。以水資源保護爲主題較少僅 13 篇（論文摘要詳如附錄三）。政府部門應用地理資訊系統、遙感探測、網際網路則多所討論。

三、綜觀 2003 年起全世界遙感探測整合應用趨勢爲網際網路化,擴大民眾與政府之間的互動,救災與環保借助於地理資訊系統、人造衛星定位系統、遙感探測,注重空間資訊的時效性、安全性與品質、資料共享、多媒體與立體動態展示。本局推行水資源保護工作,已達上述各種標準,方向亦符世界最新潮流。

伍、建議：

一、遙感探測技術日新月異，我國宜多派員出席並定期參加各種國際性學術研討會議，以便隨時掌握最新資訊，並將之應用於實際執行成效，對機關業務推行具績效提昇、人才培育等正面意義。

二、 本局應用遙測技術配合地理資訊系統應用於集水區之經營管理已行之多年，近來更推展應用於網際網路之功能，若野外現場能再配合個人數位助理(PDA)、GPS 定位儀及數位相機等設施並以手機結合 GPRS 數位行動傳輸，將現場狀況即時傳回中心，將使水資源經營管理工作之效能更上一層樓。

三、 論文發表後，主持人尼泊爾教授認爲本計畫相當實用，建議轉換成英文介面，以利其他國家使用。故若經費許可，建議轉換其他語言介面，以宣導我國利用遙感探測、地理資訊系統、人造衛星定位系統於水源區保護之執行成效。

陸、附錄：

附錄一：會議議程

Programme Outline

FIRST DAY		
Nov 25 2002		
0800-0930	Registration	Registration desk
1100-1300	**OPENING CEREMONY**	Sagarmatha Hall
	Refreshment	Rock Garden
1300-1400	Lunch Break	
1400-1430	KEYNOTE ADDRESS 1 Prof.Dr.Armin Gruen " Earth Observation and Mountains"	Sagarmatha Hall
1430-1500	KEYNOTE ADDRESS 2 Prof.Dr.Gottfried Konecny "Mapping from Space"	Sagarmatha Hall
1500-1530	KEYNOTE ADDRESS 3 Prof.Dr.Ian Dowman " Digital Elevation Models: where do we go from here ?"	Sagarmatha Hall
1530-1600	KEYNOTE ADDRESS 4 Prof.Dr.Martien Molenaar "Methodological Issues Related to Global Change Monitoring with Remote Sensing"	Sagarmatha Hall
1600-1630	Tea/Coffee Break	Rock Garden
1630-1700	TECHNICAL INFORMATION 1	Sagarmatha Hall
1700-1730	TECHNICAL INFORMATION 2	Sagarmatha Hall
1730-1800	TECHNICAL INFORMATION 3	Sagarmatha Hall

SECOND DAY				
NOV 26 2002	**Room A**	**Room B**	**Room C**	**Room D**
0830-1030	GPS/GIS.1	LUC.1	HDM.1	PHM
1030-1100	Tea/Coffee Break			
1100-1300	GPS/GIS.2	LUC.2	HDM.2	
1300-1400	Lunch Break			
1400-1530	**Poster Session in Room F**			
1530-1600	Tea/Coffee Break			
1600-1730	FOR.1	EOS	ENV.1	
1900-2130	**General Meeting (National Delegates Only)**			

THIRD DAY				
NOV 27 2002	**Room A**	**Room B**	**Room C**	**Room D**
0830-1030	GPS/GIS.3	ADP.1	URB.1	HAD
1030-1100	Tea/Coffee Break			
1100-1300	SAR.1	ADP.2	URB.2	**Student Session**
1300-1400	Lunch Break			
1400-1530	**Poster Session in Room F**			**Digital Asia**
1530-1600	Tea/Coffee Break			**Special Session**
1600-1730	SAR.2	VHR.1	ENV.2	***Till 1800***
1830-2100	**Conference Dinner - Hyatt Regency Hotel**			

FOURTH DAY				
NOV 28 2002	**Room A**	**Room B**	**Room C**	**Room D**
0830-1030	SOL/AGR.1	ADP.3	WRS	GEO
1030-1100	Tea/Coffee Break			
1100-1300	SOL/AGR.2	ADP.4	EDU.1	
1300-1400	Lunch Break			
1400-1530	**Poster Session in Room F**			
1530-1600	Tea/Coffee Break			
1600-1730	FOR.2	VHR.2	EDU.2	
1900-2130	**General Meeting (National delegates Only)**			

FIFTH DAY			
NOV 29 2002	**Room A**	**Room B**	**Room C**
0830-1030	EEC	MGT	CZM
1030-1100	Tea/Coffee Break		
1100-1300	CLOSING CEREMONY		

Room E
Exhibition 25-28 November 2002

Session	Code
Data processing, Algorithm and Modelling	ADP
Earth Observation from Space	EOS
Ecology, Environment & Carbon Cycle	EEC
Education	EDU
Forestry	FOR
Geology / Geomorphology	GEO
GIS,GPS & Data Integration	GPS/GIS
Hazard Mitigation and Disaster Management	HDM
Hyperspectral Data Acquisition and Systems	HAD
Infrastructure Planning and Management	MGT
Land Use Land Cover	LUC
Mountain Environment and Mapping	ENV
Oceanography and Coastal Zone Monitoring	CZM
Photogrammetry	PHM
SAR / InSAR	SAR
Soil and Agriculture	SOL/AGR
Urban Mapping	URB
Very High Resolution Mapping	VHR
Water Resources	WRS
Digital Asia-Special Session	SPS
Poster Session	POS
Student Session	STS

DAY-2 Tuesday Nov 26 2002 ROOM A
0830-1030 GIS, GPS & Data Integration GPS/GIS.1

37 **GIS TECHNOLOGY TRENDS: AN ESRI PERSPECTIVE**
Jim Henderson.
ESRI, 380 New York Street, Redlands, CA 92373-8100, USA

287 **APPLICATION OF RIVER BASIN CHARACTERISTICS IN HYDROLOGICAL MODEL ON THE BASIS OF GIS**
Prof. Zhang Xingnan, Jing Liyang,
Water Resources Development and Utilization Laboratory, Hohai University, Nanjing 210098, China.

52 **GLOBAL POSITIONING SYSTEM ON CADASTRAL SURVEY OF NEPAL**
Krishna Adhikary,
Geodetic Survey Branch, Survey Department, Minbhaban, Kathmandu, Nepal

189 **DEVELOPMENT OF A SIMULATION SYSTEM FOR ASSESSING THE LAYOUT OF PSEUDOLITE**
Yongcheol Suh, Yusuke Komsh, Ryosuke Shibasaki,
Center for Spatial Information Science, University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo 153-8505, Japan.

219 **SHARING GEOGRAPHIC INFORMATION ON THE INTERNET - ICIMOD'S METADATA/ DATA SERVER SYSTEM USING ARCIMS**
Sushil Pandey, Birendra Bajracharya,
International Centre for Integrated Mountain Development (ICIMOD), G.P.O.Box 3226, Kathmandu, Nepal

87 **STUDY ON GIS SPATIAL PROCESSES MODELING SYSTEM**
Yong He, Fulin Bian,
School of Remote Sensing and Information Engineering, Wuhan University,
129 Luoyu Road, Wuhan, 430079, China

33 **THE MAPPING METHOD BY EQUATION AT ADDING DISKS FOR STRIPING IN GIS**
Yuhyeon Bak, 102-409, Changsoo Kim**, Youngha Kim**, Dongjae Kang***
* Sanho apartment, Tanhang-dong, Seo-gu, Daejeon, South Korea
** 161 Gajeong-dong, Yuseong-gu, Daejeon, South Korea

207 **COMMUNITY GIS OR COMMUNITY VS GIS**
Bal Krishna
Associate Editor, Gis@development, G-4, Sector 39, Noida-201 301, Uttar Pradesh, India.

DAY-2 Tuesday Nov 26 2002 ROOM B
0830-1030 Land Use / Land Cover LUC.1

222 **REGIONAL LAND COVER MAPPING OF THE HINDU KUSH-HIMALAYAN (HKH) REGION: AN APPROACH TO UNDERSTAND THE DYNAMICS OF LAND USE AND LAND COVER CHANGE**
Sushil Pradhan,
ICIMOD, Nepal

47 **GEOGRAPHIC INFORMATION SYSTEMS AND MULTIPLE GOAL ANALYSIS FOR SPATIAL LAND USE MODELLING IN INDONESIA**
Edi Suhaedi, Graciela Metternicht, Graham Ludwick,
Department of Spatial Sciences, Curtin University of Technology, GPO Box U 1987,
Perth WA 6845, Australia

5 **CHANGING URBAN LAND USE AND ITS IMPACT ON THE ENVIRONMENT (A CASE STUDY OF JAIPUR CITY)**
Dr.K.N. Joshi,
Institute of Development Studies8-B, Jhantana Institutional AreaJaipur-302 004, India

263 **EVALUATION OF BIOLOGICAL RICHNESS USING REMOTE SENSING AND GIS - A CASE STUDY OF BIRSA MUNDA ZOOLOGICAL PARK, JHARKHAND, INDIA**
Richa Sharma, Mahendra Nathawat**, Ashok Pandey****
* 1968-A, Poultry Farm Lane (Gulmohar Park Lane), Lower Burdhwan Compound, Ranchi, Jharkhand 834 001, India
** Department of Remote Sensing, Birla Institute of Technology, Mesra, Ranchi 835 215, India
*** Director, Bhawan Birsa Zoological Park, Ranchi, 835 219, India

249 **INTEGRATED ANN MODELLING FOR ASSESSMENT OF RUNOFF DUE TO LAND-USE CHANGE USING REMOTE SENSING**
Dr. Madhav Narayan Shrestha,
Assistant Manager, Nepal Water Supply Corporation GPO Box # 3610Kathmandu, Nepal

136 **LINEAR MIXTURE MODELING FOR QUANTIFYING VEGETATION COVER USING TIME SERIES NDVI DATA**
Dr. Lin Zhu, Ryutaro Tateishi,
Center for Environmental Remote Sensing (CEReS) Chiba University1-33 Yayoi-cho, Inage-ku, Chiba 263-8522, Japan

31 **MICROWAVE REMOTE SENSING FOR LAND COVER IDENTIFICATION**
Dr. Sunantha Kingpaiboon,
Agricultural Engineering Department, Faculty Of Engineering, Khon Kaen University
Khon Kaen 40002, Thailand

DAY-2 Tuesday Nov 26 2002 ROOM C
0830-1030 Hazard Mitigation and Disaster Management HDM.1

101 **IDENTIFYING THE THREAT OF DEBRIS FLOW TO MAJOR ARTERIAL ROADS USING LANDSAT ETM+ IMAGERY AND GIS MODELING - AN EXAMPLE FROM CATANDUANES ISLAND, REPUBLIC OF THE PHILIPPINES**
Honda Kiyoshi, Guy Picton Phillipps*, Noburu Yokoyama***
* Asian Centre for Research on Remote Sensing, Asian Institute of Technology, PO Box 4, Klong Luang, Pathumthani 12120, Thailand
** Nippon Koei Consulting Engineers, Tokyo, Japan

48 **SATELLITE IMAGERY INTERPRETATION FOR LANDSLIDE STUDIES IN THE HIMALAYAS**
Dr. David Petley, Andrew Hart,
Landslide Risk Assessment in the Rural Access Sector, Jhamsikhel, Lalitpur, Nepal

23 **PROBLEMS AND ACCURACY OF PHOTOGRAMMETRIC VOLUME ESTIMATION OF LANDSLIDE INDUCED BY EARTHQUAKE**
Shue-chia Wang,
Department of Surveying Engineering, Cheng Kung University1, University Road, 701Tainan, China Taipei

245 **FLOOD RISK AND HAZARD MAPPING USING REMOTE SENSING AND GIS TECHNIQUES, BAROTSE FLOODPLAIN, WESTERN PROVINCE, ZAMBIA.**
Allan David Mulando,
Zambia Meteorological Department, Remote Sensing and GIS Unit, P.O. Box 30200, Lusaka, Zambia

53 **BIVARIATE - STATISTICAL MODEL FOR LANDSLIDE HAZARD ZONATION: A CASE STUDY OF BHAISE - DAMAN AREA OF CENTRAL NEPAL**
Ganga Tuladhar, Sagat Sikrikar, Dinesh Nepali
Department of Mines and Geology, Lainchaur, Kathmandu, Nepal

247 **GUIDELINES FOR COMMUNITY MANAGEMENT IN LANDSLIDE RISK AREAS OF EAST-COAST GULF WATERSHED OF THAILAND**
Mr. Patiwet Chalermpong,
Geo-Informatics Database Section, Geo- Informatics Division, Geo- informatics and Space Technology Department Agency (Public Organization), 196 Phahonyothin Road, Chatuchak, Bangkok 1090, Thailand

252 **APPLICATION OF REMOTE SENSING AND GIS FOR EARTHQUAKE STUDY "A CASE STUDY OF BHUJ EARTHQUAKE 2001"**
Narender Verma, Dr.N.S. Rathore***
* Research scholar, Department of geography, CSSH, M L Sukhadia University, Udaipur 313001 Rajasthan, India
** Associate Professor, India

DAY-2 Tuesday Nov 26 2002 ROOM D
0830-1030 Photogrammetry PHM

255 **APPLICATION OF GIS DATA AND GROUND SURFACE MODELS**
Mohan Kumar Dangal,
Managing Director, Integrated Research Application and Development IRAD Kathmandu, Nepal

82 **IMAGE ORIENTATION BY FITTING LINE SEGMENTS TO EDGE PIXELS**
Sendo Wang, Yi-Hsing Tseng,
No. 1, University Road, Tainan City 70101, China Taipei

46 **A STUDY ON DIGITAL ORTHOPHOTO GENERATION OF MOUNT EVEREST REGION**
Toya Nath Baral, Rabin K. Sharma***
* Kathmandu Valley Mapping Project, Survey Department, Kathmandu, Nepal
** Planning Section, Survey Department, Kathmandu, Nepal

105 **AUTOMATIC DEM EXTRACTION FROM AN IKONOS STEREO PAIR OVER AN URBAN AREA**
Mr Im Yong-Jo, Kim Taejung,
SaTReC, KAIST373-1 Kusong-dong, Yusong-gu, Daejeon 305-701, Korea

128 **THE POSITIONING OF SPOT STEREO IMAGES WITH A LOCAL ORBIT**
Dr Jung-Sheng Hsu, Ji-Rung Chen,
Department of Surveying and Mapping Engineering, Chung Cheng Institute of Technology, Yuansuiin, Tashi, Taoyuan 335, China Taipei

27 **CONTRIBUTION OF DIGITAL PHOTOGRAMMETRY**
Kandage Sanath Kumara Wijayawardana,
Photogrammetric Unit, Survey Department P.O.Box 506, Narahenpita, Sri Lanka

12 **APPLICATIONS OF REMOTE SENSING DATA IN IRAN & DEM AND DSM GENERATION OF IRAN**
Maryam Soheili Majd,
Iranian Remote Sensing Center (IRSC) No. 22, 14th Street, Saadat Abad, Tehran 19979, IRAN

198 **FINITE ELEMENT METHOD FOR RECTIFICATION OF ARCHITECTURAL HERITAGE IMAGES OF NATIONAL IMPORTANCE**
Kamal Jain, P. K. Garg,
Department of Civil Engineering, Indian Institute of Technology, Roorkee- 247667, India

DAY-2	Tuesday Nov 26 2002	ROOM A
1100-1300	GIS, GPS & Data Integration	GPS/GIS.2

137 **DEVELOPMENT OF A SIMULATION SYSTEM TO DELINEATE AVAILABILITY OF GNSS WITH 3-D DIGITAL MAP**
Tomohiro Hakamata, Yongcheol Suh, Ryosuke Shibasaki, Yusuke Konishi.
Center for Spatial Information Science, Institute of Industrial Science, University of Tokyo
4-6-1 Cw-503 Komaba, Meguro-ku, Tokyo 153-8505, Japan

42 **INTER-ACTIVE MAPS FOR (LOCAL AND/OR WEB) PRESENTATION PURPOSE**
Jeroen van den Worm,
Int. Inst. for Geoinformation Sciences & Earth Observation (ITC), Hengelosestraat 99,
P. O. Box 6, 7500AA, Enschede, The Netherlands.

54 **A DATA STRUCTURE BASED ON CONNECTING RELATIONS FOR GIS NETWORKS**
Ya Wang,
School of Remote Sensing and Information Engineering, Wuhan University,
129 Luoyu Road, Wuhan, 430079, China

227 **PARTICIPATORY COMPREHENSIVE PLAN BASED ON VIRTUAL GEOGRAPHICAL ENVIRONMENT**
Xiang Li, Hui Lin,
Joint Laboratory for GeoInformation Science, Room 615, Esther Li Building, The Chinese University of Hong Kong, Sha Tin, N. T., Hong Kong

40 **DEVELOPMENT OF A SPATIAL DATABASE ON THE REMAINS OF ANCIENT VILLAGES IN NORTHEAST THAILAND**
Nagata Yoshikatsu, Wnlailak Songsiri, Sritakra Vaitibhotama,
Media Center, Osaka City University, Sugimoto, Sumiyoshi, Osaka 558-8585, Japan

221 **MOUNTAIN GIS PORTAL - A STEP TOWARDS REGIONAL SPATIAL DATA INFRASTRUCTURE IN THE HINDU KUSH-HIMALAYAN (HKH) REGION**
Birendra Bajracharya, Bazanta Shrestha,
International Centre for Integrated Mountain Development (ICIMOD), G.P.O Box 3226, Kathmandu, Nepal

146 **QUALITY CONTROL ISSUES ON REAL-TIME ESTIMATION OF IONOSPHERIC DELAY USING GPS MEASUREMENTS**
Luo-Sheng Lin,
Department of Land Economics, National Chengchi University, No. 64, Section 2,
Chihnan Road, Taipei 116, China

141 **DIGITAL ASIA: DEVELOPMENT OF THE DATA-SHARING MECHANISM FOR GEO-SPATIAL INFORMATION IN ASIA**
Dr Kiyoshi Hinda, Yoko Makino, Venkatesh Raghavan, Phisan Santitamnont, Surat Lerlum,
AIT, ACRoRS/STAR/SATAsian Institute of Technology, P.O Box 4,
Klong Luang, Pathumthani, 12120, Thailand

DAY-2	Tuesday Nov 26 2002	ROOM B
1100-1300	Land Use Land Cover	LUC.2

55 **APPLICATIONS OF REMOTE SENSING IN THE ASSESSMENT OF LAND COVER CHANGES IN TROPICAL RAIN FOREST TO SUPPORT SUSTAINABLE NATURAL PRODUCTION FOREST MANAGEMENT (SNPFM) IN EAST KALIMANTAN, INDONESIA**
Dr Yousif Hussin, Padam Dahal, Edwin Keizer,
ITC, Hengelosstraat 997500 AA Enschede, Netherlands

83 **A STUDY ON THE CHANGING CHARACTERISTICS OF LAND USE AS COMMONS IN ROVIANA, WESTERN PROVINCE, SOLOMON ISLANDS USING HIGH RESOLUTION SATELLITE DATA AND AERIAL PHOTOGRAPHS**
Takuro Furusawa, Krishna Pahari*, Masahiro Umezaki**, Ryutaro Ohtsuka**
* Department of Human Ecology, University of Tokyo,7-3-1, Hongo,Bunkyo-ku, Tokyo 1130033, Japan
** Department of International Health Development, Graduate School of Tokyo Medical and Dental University, Japan

211 **SHORT-TERM CHANGE DETECTION WITH PRECISE GEOMETRIC CORRECTION AND SUB-PIXEL LAND-COVER CHARACTERIZATION OF MODIS**
Kei Oyoshi, Wataru Takeuchi, Yoshifumi Yasuoka,
Institute of Industrial Science, University of Tokyo4-6-1 Komaba, Meguro,
Tokyo 153-8505, Japan

203 **LAND COVER CLASSIFICATION AND INTERPRETATION OF NASA/JPL AIRSAR DATA BASED ON SCATTERING MECHANISMS AND STATISTICAL DISTRIBUTION**
Leong Keong Kwoh, Soo Chin Liew, Ken Yoong Lee,
Centre for Remote Imaging,Sensing and Processing National University of Singapore, Block SOC1, Level 2, Lower Kent, Ridge Road Singapore 119260 Singapore

192 **MONITORING OF LANDUSE USING 3S'S**
Raghunath Jha, Mike Hawkes***
* IOE, Pulchowk, Nepal
** Basett Rimal, Peter Moss, HIWMP, Nepal

132 **RECONSTRUCTION OF LONG TERM LAND COVER CHANGES BY A MAXIMUM LIKELIHOOD INTERPOLATION METHOD USING GENETIC ALGORITHM**
Mr Masahiko Nagai, Ryotaku Shibasaki, Huang Shaobu,
Center for Spatial Information Science, University of Tokyo, Cw-503, Block C, 4-6-1,
Komaba, Meguro-ku, Tokyo

79 **AN AGRICULTURAL LAND USE ANALYSIS BY THE SPATIAL INTEGRATION DATA MAP**
Mr Kiyoyuki Yaota, Takebe Takashi, Kiyoshi Tori, Yoshiaki Mori,
Research Fellow of the Japan Society for the Promotion of Science, 4-12-3 Akasakadai Sakai,
Osaka, 590-0144, Japan

81 **A STUDY ON LAND USE/COVER CLASSIFICATION WITH TEXTURAL ANALYSIS USING MULTI-TEMPORAL JERS-1 (SAR) L-BAND IN ARID AND SEMI-ARID AREA (A CASE STUDY IN NORTHEASTERN JORDAN)**
Hussam Al-Bilbisi, Ryutaro Tateishi,
Center for Environmental Remote Sensing, Chiba University 1-33,Yayoi-cho,
Inage-ku,Chiba-shi, 263-8522, Japan

DAY-2	Tuesday Nov 26 2002	ROOM C
1100-1300	Hazard Mitigation and Disaster Management	HDM.2

201 **DISASTER MITIGATION AND CIVIL DEFENCE IN TIROL/AUSTRIA**
Bernd Noegler, Marcel Innerkofler,
Regional Government of Tirol/Austria, Federal Warning Center, Tirol,
Adamgasse 22A-6020, Innsbruck, Austria

71 **DEFORESTATION IN GREAT ARAVALLI MOUNTAIN REGION OF INDIA**
Dr. Narpat Singh Rathore,
Associate Professor in Geography, M. L. Sukhadia University, E-2, University Quarter, Durga Nursery Road,
Udaipur - 313001 (Raj.), India

109 **LANDSLIDE HAZARD MAPPING IN NEPAL: A COMPARATIVE EVALUATION OF HAZARD MAPS OF THE UPPER EAST RAPTI WATERSHED, CENTRAL NEPAL**
Vishnu Dangol, Prakash Das Ulak,
Department of Geology, Tri-Chandra Campus, Tribhuvan University, Kathmandu, Nepal

125 **VISIBLE AND NIR REFLECTANCE SPECTRA OF THE COMPONENTS OF A LANDSLIDE ZONE IN THE NILGIRIS, SOUTH INDIA**
Jayaseelan Sangaravelu, Sanjeev Shanmugam,
Centre for Geoscience and Engineering, Anna University, Madras-25, India

188 **FIRE DETECTION TECHNOLOGY IN MONGOLIA**
Saniaa Tiva, Peter Gross**, Yoshiaki Honda**
* Center for Environmental Remote Sensing of Chiba University, 1-33 Yayoi-cho, Inage-ku, Chiba, 263-8522, Japan
** PROCUL Consulting Birkwaldale 18 A, D-70299 Wittnau, Germany

138 **A GEOGRAPHICALLY ENCODED LOCUST IMPACT MINIMIZATION INFORMATION SYSTEM (GEO-LIMIS) FOR WEST KAZAKHSTAN**
D. Wood, D. Dutta**, E. Zakarin***, S. Bhaiwetekar**, B. Chandrasekharan**, A McCardle*, L Spivak***, J. Sharma***
* 13800 Commerce Parkway Richmond, British Columbia V6V 2J3, Canada
** Regional Remote Sensing Service Centre Government of India, CAZRI Campus, Jodhpur 342 003, India
*** Space Research Institute Ministry of Education, Science and Technology, 15 Schevchenko Str.Almaty 480100

187 **MONITORING OF ILLEGAL DUMPING USING SATELLITE IMAGES**
Shiro Ochi, Nobuaki Ishihara**, Masayuki Tamura***, Yoshifumi Yasuoka***
* CW-503, Institute of Industrial Science, University of Tokyo 4-6-1 Komaba, Meguro-ku, Tokyo, 153-8505, Japan
** 4-6-1 Komaba, Meguro-ku, Tokyo, 153-8505, Cw-503, Institute of Industrial Science, University of Tokyo Japan
*** 16-2 Onogawa, Tsukuba, Ibaraki 305-0053, Japan.

DAY-2	Tuesday Nov 26 2002	ROOM F
1400-1530	Poster	POS.1

69 **MONITORING OF AGRICULTURAL AREA TREND IN EASTERN NILE DELTA IN EGYPT USING LANDSAT ETM+ DATA**
Mohamed Aboelghar, Ryutaro Tateishi,
Center for Environmental Remote Sensing CERes, Chiba University1-33 Yayoi-cho,
Inage-ku Chiba, 263-8522, Japan

142 **UNCERTAINTY ISSUE ANALYSIS IN THE URBAN VEHICLE TRAVEL TIME ESTIMATION**
Mr Zhuang Yan, Yang Yue,
National Laboratory for Information Engineering in Surveying, Mapping and Remote Sensing (LIESMARS)
129#, Luoyu Rd., Wuhan University, Wuhan City 430079, P.R.China

251 **A STUDY ON BEHAVIOR MODELING OF PEDESTRIAN**
Kay Kitazawa,
Shibasaki lab. Cw-501, Institute of Industrial Science, The University of Tokyo,
4-6-1 Komaba, Meguro-ku, Tokyo 153-8505, Japan

237 **AGRICULTURAL LAND USE MANAGEMENT IN IRRIGATION PROJECT OF SOUTHERN TAIWAN**
Kiyoshi TORII, Jenn Ming You*, Yoshiaki Mori*, Chih-Hung Tan***
* Graduate School of Agriculture, Kyoto Univ., Sakyo, Kyoto, Japan
** Agric. Research Center196-1, Chung Yuan Rd., ChungLi, 32043, China Taipei

135 **INCORPORATING SPATIAL INFORMATION INTO FUZZY CLUSTERING OF MULTISPECTRAL IMAGES**
Yuttapong Rangsanseri, Pumrai Thinnaqshima, Jirasak Sittigorn,
Dept. Telecommunications Engineering, King Mongkut's Institute of Technology,
Ladkrabang, Bangkok 10520, Thailand

238 **ROLE OF REMOTE SENSING TECHNOLOGY ON MONITORING LARGE IRRIGATION PROJECT IN NORTH BANGLADESH**
Muhammad Bari, Noor Md. Rahmatullah**, Kiyoshi TORII***
* Dept of Water Resources Engineering, Bangladesh University of Engineering & Tech (BUET), Ramna, Dhaka 1000
** Graduate School of Informatics, Kyoto Univ. Yoshida, Sakyo, Kyoto, Japan

68 **LAND COVER SUB PIXEL CLASSIFICATION USING LINEAR MIXTURE MODEL ON LANDSAT ETM+ DATA IN EGYPT**
Mohamed Aboelghar, Ryutaro Tateishi, Tsolmon Renchin,
Center for Environmental Remote Sensing CERes, Chiba University1-33 Yayoi-cho,
Inage-ku Chiba, 263-8522, Japan

144 **USING SHADOW ON THE GROUND CAST TO ORIENT HIGH RESOLUTION SATELLITE IMAGE**
Miss Yoko Yamada,
kanto-shoho-sokuryoubu, Kokudochiriinn (Geographical Survey Institute), kudan-dai2 goudoucyousha,
9F,1-1-15,kudan-minami,Tokyo chiyoda-ku,102-0074, Japan

173 **ACQUISITION METHOD OF GROUND CONTROL POINTS FOR HIGH RESOLUTION SATELLITE IMAGERY**
Takao Kadota,
185 Miyanokuchi Tosayamada-choKami-gunKochi 7828502, Japan

171 **DIGITAL SOLUTION OF LENS DISTORTION**
Hao-Hsiang Hsiang, Shih-Yuan Lin,
Department of Land Economics, National Chengchi University, 64 Tzunan Rd., Sec.2, Wenson, Taipei 11623, China Taipei

133 **UTILIZATION OF JERS 1 SAR AND LANDSAT TM FOR NATURAL HAZARD MONITORING IN SOUTHERN LUZON AREA, PHILIPPINES - CONTRIBUTIONS FOR ASSESSMENT AND DEVELOPMENT**
Michael Lituanas, Jerry Salvador,
PETROLAB Mines and Geosciences Bureau, North Avenue, Diliman Quezon City 1104 National Capital Region, Philippines

254 **STUDIES ON GARLIC FARMLAND EXTRACTION BY REMOTELY SENSED DATA**
Chi Nan Wu, Tzu Yi Liao,
W300/ERL/ITRI, Bldg.24, 195 Sec.4, Chung Hsing Rd., Chutung 310, China Taipei

250 **FEATURE OBJECT DETECTION ON THE URBAN ROAD SURFACE BY THE APPLICATION OF THREE-LINE SCANNER IMAGERY**
Sompoch Pantawongkrur, Ryotsuke Shibasaki,
Center of Spatial Information Science, University of Tokyo,4-6-1, Cw503, Komaba, Meguru-Ku, Tokyo 153-8505, Japan

242 **MONITORING OF MISRATAH COSTAL ZONE USING REMOTE SENSING AND GIS**
Tarq Hamed Alimezughi, Abdulhakim Khmag,
Swani Street, P.O Box 81826 Tripoli, Libya

57 **THE APPLICATIONS OF REMOTE SENSING AND GIS IN THE ASSESSMENT OF SOME ECOLOGICAL CRETERIA AND INDICATORS FOR SUSTAINABLE MANAGEMENT OF TROPICAL FOREST IN EAST KALIMANTAN, INDONESIA**
Yousif Ali Hussin, Robert Aguma, Alfred De Gier,
Forest Science Division, International Institute for Geo-informatics Sciences and Earth Observation, ITC, 7500 AA, Enschede , The Netherlands

84 **EVALUATION OF HABITAT FOR ECOSYSTEM IN IRIOMOTE ISLAND USING GIS AND REMOTE SENSING**
Tomoe Saito,
1700 Magechi, Kumagaya, Saitama, 360-0194, Japan

76 **HYDRAULIC ANALYSIS OF SUBMERGENCE DAMAGE BY TYPHOON 9918**
Keisuke Saito, Susumu Ogawa*, Masaharu Umezaki**, Krishna Panari***, Hongwei Jiang****
* 1700 Magechi, Kumagaya, Saitama 360-0194, Japan
** Section of International Health, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo, Tokyo 113-8519, Japan
*** Department of Human Ecology, University of Tokyo, 7-3-1 Hongo, Bunkyo, Tokyo 113-0033, Japan

DAY-2	Tuesday Nov 26 2002	ROOM A
1600-1730	Forestry	FOR.1

41 **GEOMATICS IN PARTICIPATORY COMMUNITY-BASED FOREST RESOURCES INVENTORY IN THE MIDDLE MOUNTAINS OF NEPAL**
Bhuban Shrestha,
ICIMOD/ PARDYP, Nepal

6 **REFLECTANCE OF AVHRR LIB CORRELATED TO MODIS L13A REFLECTANCE FOR A DIACHRONIC VEGETATION STUDY OF GUJARAT**
Yann Chemin,
206/7 Kamathawatte Road, Rajagiriya, Sri Lanka

15 **DISTRICT-WISE FOREST AREA VARIATION IN SRI LANKA FROM 1992 TO 2001 FOR SUPPORTING THE NATIONAL PHYSICAL PLANNING POLICY**
Yann Chemin, Jagath Ranawake***
* Independent Researcher in Remote Sensing Applications206/7 Kamathawatte Road, Rajagiriya Sri Lanka
** Information and Scientific Research Unit - National Physical Planning Department, Ministry of Western Region Development, Government of Sri Lanka, 5th Floor, "Sethsiripaya", Battaramul, Sri Lanka

32 **CHANGE DETECTION OF GHESHM ISLAND EMPHASIZING MANGROV FOREST**
Farzaneh Rahimi,
Iranian Remote Sensing Center (IRSC), No22 14th st. saadat abad ave.,Tehran, Iran

91 **CONTRIBUTION OF NON TIMBER FOREST PRODUCT FOR SUSTAINABLE RESOURCE MANAGEMENT (A CASE STUDY FROM FOUR BUFFER ZONE COMMUNITY FORESTS OF ROYAL BARDIA NATIONAL PARK)**
Ganesh Raj Acharya,
Kathmandu, Nepal

62 **APPLICATION OF REMOTE SENSING USING GEOGRAPHIC AND SOCIOECONOMIC DATASETS FOR SUSTAINABLE DEVELOPMENT OF THE FOREST RESOURCES IN NEPAL**
Dr. A.N. Das, B.N. Oli,
Department of Forest Research and Survey, BabarMahal, Kathmandu, Nepal

DAY-2	Tuesday Nov 26 2002	ROOM B
1600-1730	Earth Observation from Space	EOS

246 **SATELLITE IMAGE MAP OF THAILAND**
Mrs. Ramping Simking, Mrs. Siwarak Tunteropas,
Geo- Informatics Database SectionGeo- Informatics Division, Geo- informatics and Space Technology Department Agency (Public Organization), 196 Phahonyothin road, Chatuchak, Bangkok, 1090, Thailand

226 **ACCURACY AND APPLICATION OF REMOTE SENSING IN NEPAL**
Punya Prasad Oli,
P.O.Box. 9847, Handigau, Kathmandu-5, Nepal

282 **SATELLITE REMOTE SENSING OF CLOUD OPTICAL THICKNESS AND DROPLET EFFECTIVE RADIUS**
Zhao Fengsheng,
National Satellite Meteorological Center, Beijing 100081, China

14 **LANDSAT ETM+, TERRA MODIS AND NOAA AVHRR: ISSUES OF SCALE AND INTER-DEPENDENCY REGARDING LAND PARAMETERS.**
Thomas Alexandridis, Yann Chemin***
* 13 Milona Street, Thessaloniki 54636, Greece
** 206/7 Kamathawatte Road, Rajagiriya, Sri Lanka

273 **UTILIZATION OF CASI DATA, AIRBORNE CNIR VIDEO IMAGES AND BALLOON AERIAL PHOTOGRAPHY FOR VEGETATION MAPPING OF KUSHIRO WETLAND IN NORTHEAST HOKKAIDO, JAPAN**
Mr. Michiru Miyamoto, Kunihiko Yoshino, Koji Kushida,
Biological Environmental Engineering, Graduate School of Agricultural and Life Sciences, University of Tokyo, 1-1-1 Yayoi, Bunkyo-Ku, Tokyo, 113-8657, Japan

DAY-2	Tuesday Nov 26 2002	ROOM C
1600-1730	Mountain Environment and Mapping	ENV.1

236 **SPATIAL DATABASE DEVELOPMENT FOR THE INVENTORY OF GLACIERS AND GLACIAL LAKES IN THE IDENTIFICATION OF POTENTIAL DANGEROUS GLACIAL LAKES OF NEPAL USING GIS AND REMOTE SENSING**
Samjwal Bajracharya, Pradeep Mool**, Sharad Joshi****
* Department of Geology, Tri-Chandra multiple Campus, Tribhuvan University, Nepal
** Mountain Environment and Natural Resources' Information Systems, ICIMOD, Nepal
*** Water and Energy Commission Secretariat of HMG NepalSinghs Durbar, Kathamndu Nepal, P. O. Box: 1340, Nepal

193 **LANDSLIDE-ENHANCEMENT IMAGES FOR THE STUDY OF TORRENTIAL-RAINFALL LANDSLIDES**
Jin-King Liu, C C Wang,
6L200, 195-6 Sec.4, Chung-Hsing Road, Hsin-Chu Hsien 310, China Taipei

89 **MONITORING A WATERSHED MANAGEMENT PROJECT SITE BY REMOTE SENSING: A CASE STUDY OF THE UPPER ANDHI KHOLA WATERSHED IN NEPAL**
Mayumi Yamada, Krishna Pahari***
* Imperial College, University of LondonWye, Ashford, Kent, TN25 5AH, UK
** Department of Human Ecology, University of Tokyo7-3-1, Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

94 **EVALUATION OF SPATIAL RESOLUTION OF SATELLITE DATA ON SNOW COVER ESTIMATES**
Mr Parhemmat Jahangir, Pakkah-e-Hejrat**, Mr Bahram Saeghanian*, Pakkah-e-Hejrat***
* Faculty MemberSoil Conservation and Watershed Management Research Center (SCWMRC), Opposite of
** Shahli Avenue, Ashen Avenue, Kilometer 8 of Makhsoos Karaj Road, Tehran, Iran

122 **REMOTE SENSING AND GIS IN WATERSHED AREA MANAGEMENT**
Shanti Karanjit, Dr. Vrishali Deosthali***
* Kathmandu Don Bosco College, CPO #973,NPC 329, Kathmandu, Nepal
** Department of Geography, University of Pune, Pune 411007, India

90 **SNOW COVER MAPPING FROM MIXED SNOW-CLOUD NOAA IMAGERY**
Jahangir Parhemmat, Bahram Saeghanian*, Hossain Sedghi***
* Soil Conservation and Watershed Management Research Center (SCWMRC), P.O. Box: 13445-1136Tehran, Iran
** Shahid Chamran Ahwaz University, Ahwaz, Iran

DAY-3	Wednesday Nov 27 2002	ROOM A
0830-1030	GIS,GPS & Data Integration	GPS/GIS.3

269 **TOWARDS STRATEGIC PLANNING FOR BUILDING LAND INFORMATION SYSTEM IN NEPAL**
Arbind Man Tuladhar*, Krishna Rai BC**, Nama Raj Budhathoki***
* International Institute for Geo-Information Science and Earth Observation, The Netherlands
** Department of Survey, Nepal
*** Department of Land Information and Archive (DoLIA), Nepal

278 **HYDRO-METEOROLOGICAL INFORMATION SYSTEM: THE FIRST IMPLEMENTATION OF MULTI-USER GEODATABASE CONCEPT IN NEPAL**
Mukesh Kumar, Nama Raj Budhathoki**, Sunil Kansakar****
* World Distribution Nepal/PO Box. 11291, Siddhi Bhawan, Kamipath Kathmandu, Nepal
** Department of Land Information and Archive (DoLIA), Nepal
*** Department of Hydrology and Meteorology (DHM), Nepal

202 **MOBILE GEOGRAPHIC INFORMATION SYSTEMS FOR WATER RESOURCE PROTECTION**
Ma-Lin Wu, Chiou-Hsiung Chen**, Shiow-Feng Lin** Jiun-Sheng Wee***
* Civil Engineering Department, National Pingtung University of Science and Technology, 39-13 TongZong Road, Dali, Taichung County, 41244, China Taipei
** Taipei Watershed Management Bureau, WRA, MOEA5, Lane 45, Sec. 1, Pershin Road, Hsien-Ten, Taipei 231, China Taipei

66 **RECONSTRUCTING 3D WET REFRACTIVITY STRUCTURES OF THE LOWER TROPOSPHERE FROM GPS MEASUREMENTS**
Yuei-An Liou, Ya-Jen Lin, Chen-Ching Chiang, Cheng-Yung Huang,
Center for Space and Remote Sensing Research, and Institute of Space Sciences, National Central University, Chung-Li 320, China Taipei

183 **MODELING MOBILE OBJECTS IN DISTRIBUTED COMPUTING ENVIRONMENT**
Rong Xie, Ryosuke Shibasaki,
Centre for Spatial Information Science, The University of Tokyo, 4-6-1 Kombada, Meguro-kuTokyo 153-8508, Japan

279 **HOPFIELD NEURAL NETWORK AND QUASI-LINEAR TRANSFORM MODEL FOR SIMULATION LONGSHORE CURRENT PATTERN FROM RADARSAT**
Maged Marghany, University College Science and Tecnology Malaysia, Institute of Oceanography (INOS), 21030 Mengabang Telipot, Kuala, Terengganu, Malaysia

176 **SNAPSHOT TECHNIQUE FOR SHARED LARGE STORAGE IN SAN ENVIRONMENTS**
Mr YoungHo Kim, ChangSoo Kim, BumJoo Shin,
Computer System Department Computer and Software Research Laboratory,
ETRI (Electronics and Telecommunications Research Institute), 161Gajeong-Dong, Yuseong-GuDaejeon, 305-350, Korea

DAY-3	Wednesday Nov 27 2002	ROOM B
0830-1030	Data Processing, Algorithm and Modelling	ADP.1

145 **APPLICATION SPECIFIC COMPRESSION FOR MINI-SATELLITES WITH LIMITED DOWNLINK CAPACITY**
Tobias Trenschel, Timo Bretschneider, Graham Leedham,
Nanyang Technological University, School of Computer Engineering, Blk N4, 2A-32, Nanyang Avenue Singapore 639798, Singapore

205 **EXTRACTION OF LINEAR FEATURES FROM VEHICLE-BORNE LASER DATA**
Dinesh Manandhar, Ryosuke Shibasaki,
Shibasaki Lab Centre for Spatial Information Science, The University of Tokyo, Komaba, Japan

99 **LARGE AREA CHANGE DETECTION BY DIFFERENCING RADIOMETRICALLY-NORMALIZED IMAGES**
Dr Itthi Trisirisatayawong, Wallapa Sanchinchom,
Department of Survey Engineering,g Chulalongkorn University, Bangkok 10330, Thailand

209 **PC CLUSTERS AS A PLATFORM FOR IMAGE PROCESSING: PROMISES AND PITFALLS**
Kurt T. Rudahl, Sally E. Goldin,
Goldin-Rudahl Systems, Inc.6 University Drive, #213 Amherst, MA 01002, USA

233 **AN AUTO-MULTIVARIATE MODEL OF MUNTJACS HABITAT USE FOR A GEOGRAPHIC INFORMATION SYSTEM IN SOUTHERN TAIWAN**
Yi-Ching Lin, Kurtz Jan-Chyi Pei***
* Department of Environmental Design Hwatan University(Hwatan Road, Shihting, Taipei County, China Taipei
** Institute of Wildlife Conservation, National Pingtung University of Science and Technology, Neipu, Pingtung, China Taipei

114 **A NEW METHOD FOR IMAGE RECOGNITION BASED ON MATHEMATICAL MORPHOLOGY**
Yuxuan Guan,
School of Remote Sensing and Information Engineering, Wuhan University, 129 Luoyu Road, Wuhan, 430079, China

153 **COLLABORATING REMOTE SENSING WITH HISTORICAL LIMNOLOGICAL DATA TO MAP PRIMARY PRODUCTIVITY AT A EUTROPHIC LAKE**
Dr Pranab Jyon Baruah, Masayuki Tamura, Yoshifumi Yasuoka,
Yasuoka Lab. Room Ce509, Institute of Industrial Science (IIS), Komaba 4-6-1, Meguro-ku, Tokyo 153-8505, Japan

001 **AUTOMATED DEM GENERATION FROM SPOT IMAGERY**
Zhen Xiong, Xianjing Huang, Leong Keong Kwoh, Soo Chin Liew,
Centre for Remote Imaging, Sensing and Processing, National University of Singapore, Blk. S17 Level 2, Lower Kent Ridge Road, Singapore 119260

DAY-3	Wednesday Nov 27 2002	ROOM C
0830-1030	Urban Mapping	URB.1

231 **3D BUILDING MODEL RECONSTRUCTION BY USING TLS IMAGERY**
Masatumi Nakagawa,
1-47-12-1110 Sekiguchi, Bunkyo-ku, Tokyo, Japan

170 **REMOTE SENSING TO ANALYZE THE CHANGES OF SURFACE BIOPHYSICAL PARAMETERS IN VIETNAM'S URBANIZED AREA**
Hung Tran, Yoshifumi Yasuoka,
4-6-1 Komaba, Meguro-kuTokyo 153-8505, Japan

218 **INTEGRATION OF GIS BASED SUITABILITY ANALYSIS AND MULTI-CRITERIA EVALUATION FOR URBAN LAND USE PLANNING; CONTRIBUTION FROM THE ANALYTIC HIERACHY PROCESS**
Padma Weerakoon,
Dept of Estate Management & Valuation University of SriJayawardenepura Nugegoda, 132/5, Hiripitiya, Pannipitiya, Sri Lanka

44 **URBAN MAPPING FOR LOCATION OF HOSPITALS IN A GROWTH CENTER: A CASE STUDY OF KHAMMAM IN THE STATE OF ANDHRA PRADESH IN INDIA.**
Dr (Mrs). Ghali Padma Rani, Dr. Satish Kumar***
* Scientist, SE, Mission Operation and Health Analysis Group (MOHA), ISRO Satellite Tracking and Commanding Center (ISTRAC), Bangalore, India.
** Scientist SE, Landuse, landcover and cartographic Division, National Remote Sensing Agency, Hyderabad, India

267 **AN APPROPRIATE URBAN MANAGEMENT DECISION WITH A REMOTE SENSING AND GIS TECHNOLOGY INTEGRATION APPROACH: A PILOT STUDY OF KATHAMNADU METROPOLITAN CITY IN NEPAL.**
Mr. Tika Ram Adhikari, Mr. Purusottam Singh,
Kathmandu Valley Mapping Programme, P.O. BOX 20444 , Tripureshower, Kathmandu, Nepal

166 **USING A MULTI-SENSOR APPROACH TO MONITORING URBAN GROWTH IN HANOI**
Karen Seto, Nguyen Dinh Duong***
* Institute for International Studies Stanford University Encina Hall East, E413Stanford CA 94305-6055, USA
** Department of Environmental Information Studies and Analysis Hoang Quoc Viet, Cau GiayHanoi, Vietnam

232 **3D URBAN MAPPING BASED ON THE IMAGE SEGMENTATION USING TLS DATA**
Katsuyuki Nakamura, Masatumi Nakagawa, Ryosuke Shibasaki,
4-6-1 Komaba, Meguro-kuTokyo, 153-8505, Japan

181 **ORTHOPHOTO MAPPING: A FUNDAMENTAL DATA LAYER FOR URBAN GIS IN NGII IN NEPAL**
R.R. Chhatkuli,
NGIIP, Survey Department Kathmandu, Nepal

DAY-3	Wednesday Nov 27 2002	ROOM D
0830-1030	Hyperspectral Data Acquisition and Systems	HAD

210 **COMPUTATION OF ATMOSPHERIC WATER VAPOUR MAP FROM MODIS DATA**
Agnes Lim, Chew Wai Chang, Soo Chin Liew, Leong Keong Kwoh,
Centre for Remote Imaging, Sensing and Processing (CRISP), National University Singapore, Blk. SOC1 Level 2, Lower, Kent Ridge Road, Singapore 119260,Singapore

185 **HYPERSPECTRAL REMOTE SENSING OF RIPARIAN VEGETATION AND LEAF CHEMISTRY CONTENTS**
Toshimori Takahashi, Yoshifumi Yasuoka,
Yasuoka Lab, Institute of Industrial Science (IIS), The University of Tokyo 4-6-1 Komaba, Meguro-ku, Tokyo

154 **DATA EXPLORATION AND ANALYSIS OF HYPERSPECTRAL IMAGES: VISUALIZATION AND SYMBOLIC DESCRIPTION**
Pai-Hui Hsu, Yi-Hsing Tseng,
No.1, University RoadTainan, 701, China Taipei

156 **COMPARISON OF CHANGE DETECTION TECHNIQUES IN CHITWAN DISTRICT OF NEPAL**
Rajesh Acharya,
International Institute for Geo-Information Science and Earth Observation (ITC) Rural Land Ecology Hengelosestraat 99, P.O. Box 6, Personnel Box-b07500 AA Enschede, The Netherlands

DAY-3 Wednesday Nov 27 2002 ROOM A
1100-1300 SAR / InSAR SAR.1

86 ESTIMATION OF DISCHARGE OF AMAZON RIVER AND ITS BRANCHES FROM JERS-1 SAR IMAGES
Mr Kyoichiro Katabira, Mr Susumu Ogawa, Mr Takako Sakurai,
Rissho University, 1700 Magechi, Kumagaya, Saitama360-0194, Japan

11 OIL SPILL DETECTION WITH THE RADARSAT SAR IN THE WATERS OF THE YELLOW AND EAST CHINA SEA
Andrei Yu. Ivanov, Ming-Xia He**, Ming-Qiang Fang***
* P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences Nakhimovsky pr. 36, Moscow 117851, Russia
** Ocean Remote Sensing Laboratory, Ocean University of Qingdao, Yushan Road 5, Qingdao, Shandong, 266003, China

131 OBSERVATION OF THE RICE PADDY FIELDS USING AIRBORNE SAR (PI-SAR) DATA
Mr Naoki Ishitsuka, Genya Saito, Kazuo Ouchi,
National Institute for Agro-Environmental Sciences, 3-1-3 Kannondai Tsukuba Ibaraki, 305-8604, Japan

51 ERROR ANALYSIS ON DEMS DETERMINED BY NASA/JPL AIRSAR IN TAIWAN
Jaan-Rong Tsay, Ji-Gang Lin,
Department of Surveying Engineering, National Cheng Kung University, University Road 1, 70101 Tainan, China Taipei

178 FINDING THE RELATIONSHIP BETWEEN VEGETATION INDEX AND COHERENCE SIGNATURE TO UTILIZE THE PRODUCT OF RADAR INTERFEROMETRY IN LANDCOVER
Mitsuharu Tokunaga, T.Thuy Vu**,*
* Environment System Engineering Kanazawa Institute of Technology, 7-1, Ogigaoka, Nonoichi-shikawa, 921-8501, Japan
** P.O. Box 4, Klong Luang, Pathumthani, 12120, Thailand

280 AIRSAR ALONG TRACK INTERFEROMETRY FOR SHORELINE CHANGE MODELING
Maged Marghany,
University College Science and Technology Malaysia Institute of Oceanography (INOS), 211030 Mengabang Telipot, Kuala,Terengganu, Malaysia

DAY-3 Wednesday Nov 27 2002 ROOM B
1100-1300 Data Processing, Algorithm and Modelling ADP.2

177 WAVELET-BASED FILTERING THE CLOUD POINTS DERIVED FROM AIRBORNE LASER SCANNER
T.Thuy Vu,
P.O. Box 4, klong LuangPathumthani, 12120, Thailand

22 KNOWLEDGE BASED OBJECT EXTRACTION TECHNIQUE
Mohamed Abdel-salam,
Research Assistant Department of Geomatics Engineering, The University of Calgary 2500 University Drive N.W Calgary, AB, T2N 1N4, Canada

24 CAPABILITY OF THE FIRST MALAYSIAN MICRO SATELLITE -TIUNGSAT-1 MSEIS (MULTI SPECTRAL EARTH IMAGING SYSTEM) FOR VEGETATION STUDIES
Kanniah Kasturi Devi,
Department of Remote Sensing, Faculty of Geoinformation Science & Engineering, Universiti Teknologi Malaysia, 81310 Skudai Johor Bahru, Malaysia

61 THE POLYNOMIAL LEAST SQUARES (POLES) OPERATION: A METHOD FOR REDUCING NOISE IN NDVI TIME SERIES DATA
Mr. Jose Edgardo Aban, Mr. Renchin Tsolmon, Dr. Ryutaro Tateishi,
Tateishi Laboratory Center for Environmental Remote Sensing, Chiba University,
1-33 Yayoi,Inage,Chiba 263-8522

117 A MANAGEMENT SYSTEM OF THE GROUND CONTROL POINT DATABASE FOR ROCSAT-2 REMOTE SENSING IMAGES
Dr. Chih-Li Chang, Chen Ta-Ko,
National Space Program Office8F, 9 Prosperity 1st Road, Science-Based Industrial Park, Hsinchu City, Taiwan 300, China Taipei

75 A LOSSLESS COMPRESSION WITH LOW COMPLEXITY TRANSFORM
Kobchai Dejhan, Sompong Wiseiphanichkij*, Fusak Cheevasuvit*, Somsak Mitaiha*, Winai Vorrawat**, Chaicharin Soonyeekan****
* Faculty of Engineering and Research Center for Communications and Information Technology, King Mongkut's Institute of Technology, Ladkrabang, Bangkok 10520, Thailand
** National Research Council of Thailand, Phaholyothin Road, Jatachuk, Bangkok 10900, Thailand
*** Aeronautical Radio of Thailand, 102 Ngamduplee, Tungmahamek, Bangkok 10120, Thailand

DAY-3 Wednesday Nov 27 2002 ROOM C
1100-1300 Urban Mapping URB.2

213 MONITORING OF LONG-TERM URBAN EXPANSION BY THE USE OF REMOTE SENSING IMAGES FROM DIFFERENT SENSORS
Shigenobu Tachizuka, Tran Hung, Yoshifumi Yasuoka, Shiro Ochi,
Institute of Industrial Science University of Tokyo, 4-6-1 Co-503 Komaba Meguro, Tokyo 153-8505, Japan

268 URBAN LAND USE/LAND COVER MAPPING USING HIGH RESOLUTION SATELLITE IMAGERY: A CASE STUDY OF KATMANDU METROPOLITAN CITY, NEPAL
Mr. Tika Adhikari,
P.O.BOX 20444, Kathmandu Valley Mapping Programme, Tripureshwor, Nepal

234 TREND OF URBANIZATION IN THE SUBURBS OF A LARGE CITY IN SOUTH TAIWAN
Jenn Ming You, Kiyoshi Tori*, Shu-Shr Yeh**, Yoshiaki Mori**
* Faculty of Agric. Kyoto Univ., sakyo, Kyoto, Japan
** 176, Lien-Tan Rd., Tso-Inn, Kaonsiung Tsao Jun memorial Foundation, China Taipei

151 A RESEARCH FOR THE EXTRACTION OF 3D URBAN BUILDING BY USING AIRBORNE LASER SCANNER DATA
Guoxin Tan, Ryosuke Shibasaki***
* Shibasaki Labinstitute of Industrial Science University of Tokyo, 4-6-1, Komaba, Meguro-ku, Tokyo 153-8505, Japan
** Center for Spatial Information Science, University of Tokyo, 4-6-1, Komaba, Meguro-ku, Tokyo 153-8505, Japan

270 BUILDING URBAN DIGITAL CADASTRAL DATABASE FOR KATHMANDU METROPOLITAN CITY: CHALLENGES AND OPPORTUNITIES
Sarojani Joshi, Bimal Adhikari, Indra Sharan KC, Arthur Neher,
Kathmandu valley Mapping Programme, 115 Saraswoti Marg, Radha Bhawan, Kathmandu, Nepal

216 CHARACTERIZATION OF URBAN HEAT RADIATION FLUX USING REMOTE SENSING IMAGERY
Masanobu Nakamura, Yujiro Hirano, Shiro Ochi Yoshifumi
Yasuoka Laboratory, Institute of Industrial Science, University of Tokyo, 4-6-1 Komaba, Meguru-ku Tokyo, 153-8505, Japan

85 COMBINATION OF MULTISPECTRAL AND SAR REMOTE SESNING DATA FOR URBAN STUDY
Nguyen Dinh Duong,
Institution of Geography, Hoang Quoc Viet, Cau Giay, Hanoi, Vietnam

DAY-3 Wednesday Nov 27 2002 ROOM D
1400-1800 Digital Asia-the Potential of OpenGIS and WebGIS - Special Session SPS

300 INTRODUCTION OF DIGITAL ASIA NETWORK (DAN)
Shin-ichi Sobue
National Space Development Agency of Japan, 2-4-1 Hamamatsu-cho, Minato, Tokyo 105-8060, Japan

307 DIGITAL ASIA: ITS TECHNICAL ASPECTS, -- INTERPORABILITY IN DA: STANDARDS, ISSUES AND SOLUTIONS
Prof. Hiromichi Fukui
Keio University, Japan

304 THE SUMMARY OF OGC
Takashi Araki
NSDIPA, Japan

303 OPEN SOURCE SOFTWARE SOLUTIONS AND ITS POTENTIAL FOR SPATIAL DATA INFRASTRUCTURE DEVELOPMENT
Phisan Santitamont, Venkatesh Raghavan**, Kiyoshi Honda****
* Survey Engineering Department, Chulalongkorn University, Bangkok 10330, Thailand
** Osaka City University, 3-3-138
** Sugimoto Sumiyoshi-ku, Osaka 558-8585, Japan
*** ACRoRS, Asian Institute of Technology, Pathumthani 12120, Thailand

301 FOREST MONITORING PROTOTYPE SYSTEM USING WEB MAPPING TECHNOLOGY
Kaori Kuruma, Shin-ichi Sobue** Osamu Ochiai***
* Remote Sensing Technology Center of Japan, Roppongi First Bldg. 12F, 1-9-9 Roppongi, Minato-ku, Tokyo 106-0032, Japan
** National Space Development Agency of Japan

306 DEVELOPING AN AGRICULTURAL, ENVIRONMENTAL, AND NATURAL RESOURCES MAPPING AND DECISION SUPPORT SYSTEM (DSS) FOR SOUTHEAST ASIA
David B. Hannaway, Christopher Daly*, Christopher**, Soraya Runckel**, Alan Cooper***, Roger Kravnick****
* Oregon State University, USA
** Runckel and Associates, USA
*** ANE-Asia, LLC., Thailand

302 APPLICATION OF WEBGIS IN THE PRIVATE SECTOR
Koichi Hirata
Senior Researcher, Geographic Information Institute, PASCO Corporation, Higashiyama 1-1-2, Meguroka, Tokyo, Japan

305 LAND COVER DATA AND DESERTIFICATION DATA OF ASIA
Ryutaro TATEISHI
Center for Environmental Remote Sensing, Chiba University,1-33 Yayoi-cho, Inage-ku, Chiba 263-8522, Japan

DAY-3 Wednesday Nov 27 2002 ROOM F
1400-1530 Poster POS.2

102 A GIS EDUCATIONAL MANUAL FOR ENGINEERS
Mr Kouchi Hirata,
Pasco Corporation, Higashiyama 1-1-1, Higashiyama Build. Meguroku, Tokyo, Japan

126 A COM BASED FRAMEWORK FOR MANAGEMENT AND VISUALIZATION OF LARGE-SCALE DEMS
Wang Yongjun, Gong Jianguo,
National Laboratory for Information Engineering in Surveying, Mapping and Remote Sensing (LIESMARS), 129 Luo Yu Road, Wuhan 430079, China

78 A CASE STUDY OF MANGROVE FOREST MONITORING IN CAN GIO DISTRICT, SOUTHERN VIETNAM
Kazuyo Hirose, Yuichi Maruyama**, Yuichi Shiokawa**, Tran Triet***,*
*Do Van Quy****, Huynh Thi Minh Hang******
* 3-12-1, Kachidoki, Chuo-ku, Tokyo 104-0054, Japan
** Earth Remote Sensing Analysis Center (ERSDAC)
*** Ho Chi Minh City University, Department of Botany
**** Geological Survey of Vietnam, South Vietnam Geological Mapping Division
***** Ho Chi Minh City University of Technology, Faculty of Geology and Petroleum

184 AN AGRICULTURAL MAP OF ASIAN REGION USING TIME-SERIES AVHRR NDVI DATA
Izumi Nagatani, Genwa Saito*, Haruo Sawada***
* National Institute for Agro-Environmental Sciences 3-1-3 Kannondai, Tsukuba, Ibaraki, 305-8604, Japan
** Forestry and Forest Research Institute, Japan

199 DEVELOPMENT OF A MOBILE GEOGRAPHIC INFORMATION SYSTEM FOR SIDE -WALK TREE MANAGEMENT
Ing-Luen Shaw, Mu-Lin Wu***
* Taiwan Forestry Bureau, COA2, Sec. 1,Hang-chow South Road Taipei 100, China Taipei
** Civil Engineering Department, National Pingtung University of Science and Technology, 39-13 Tong Zong Road, Dali, Taichung County, 41244, China Taipei

118 MONITORING THE DYNAMICS OF COASTAL ENVIRONMENT USING RS/GIS TECHNIQUES
Donald Urquhart, Kono Yasuyuki,
Center for Southeast Asian Studies, Kyoto University, 46 Shimoadachi-cho Yoshida Sakyo-ku, Kyoto 606-8501, Japan

186 THE CHANGE OF MASAN HARBOR DURING 50 YEARS
Dr. Jeon Sung-woo, Hei-chul Jung, Sung-hwan Cho,
Korea Environment Institute Research Planning & Coordination Division 613-2 Bulkwang-dong, Eunpyung-guseoul 122-706, South Korea

206 MONITORING AEROSOL DISTRIBUTION OVER THE OCEAN IN THE SOUTHEAST ASIAN REGION USING MODIS DATA
Chew Wai Chang, Agnes Lim, Soo Chin Liew, Leong Keong Kwoh,
Centre for Remote Imaging, Sensing and Processing National University of Singapore, Block SOC-1, Level 2, Faculty of Science Lower Kent Ridge Road Singapore 119260, Singapore

225 A METHOD OF GENERATING FREE ROOT WALK-THROUGH ANIMATION USING VEHICLE-BORNE VIDEO IMAGE
Jun Kunagai,
Center for Spatial Information Science Institute of Industrial Science,
The University of Tokyo, 4-6-1 Komaba, Meguro-ku Tokyo 153-8505 Japan

229 A STUDY ON ARCHITECTURE CONSTRUCTION OF GIS COMPONENT REPOSITORY
Myung-Hee Jo, Yun-Won Ju,
Department of Urban Information Engineering, Kyungil University33, Buho-ri, Hayang-up, Kyungsan-si, Kyungsan bukdo, 712-701, Korea

134 RAILWAY TIME TABLE INFORMATION SYSTEM
Kamal Jain, V Phani Kumar,
Department of Civil Engineering, Indian Institute of Technology, Roorkee-247667, India

212 DEVELOPMENT OF GIS-BASED CRIME ESTIMATE SYSTEM IN SHIBUYA AREA, TOKYO
Akiko Ogawa, Ryosuke Shibazaki,
Center for Spatial Information Science Institute of Industrial Science,
University of Tokyo 4-6-1 Komaba, Meguro-ku, Tokyo 153-8505, Japan

243 A STUDY ON THE MODELING OF HUMAN SPATIAL BEHAVIOR USING AGENT
*Hiroyuki Tanaka, Ryosuke Shibasaki,*Shibasaki Laboratory,
Institute of Industrial Science, University of Tokyo 4-6-1 Komaba,
Meguro-kuTokyo 153-8505

228 A SPECTRAL CHARATERISTIC ANALYSIS OF DAMAGED PINE WILT DISEASE AREA IN INKONOS IMAGE
Joun-Bum Kim, Myung-Hee Jo** Jae-Jae-Hyeon Park***
* Korea Forest Research Institute, 719-1, Gazoa-dong Chinju, 660-300, S. Korea
** Department of Urban Information Engineering, Kyugil University, 719-1 Gazoa-dong, chinju, 660-3000, Korea

DAY-3 Wednesday Nov 27 2002 ROOM A
1600-1730 SAR / InSAR SAR.2

38 APPLICATION OF AIRSAR DATA TO OIL PALM TREE CHARACTERIZATION
Laili Nordin, Shahruddin Ahmad, Mariamni Halid,
Malaysian Centre for Remote Sensing (MACRES), No. 13 Jalan Tun Ismail, 50480 Kuala Lumpur, Malaysia

158 INTERNAL WAVE DETECTION IN SAR IMAGE
Mr Yessy Arvelyna, Masaki Oshima,
Tokyo University of Mercantile Marine, C/O Professor Masaki Oshima, Department of Ocean Information System Engineering, 2-1-6 Ecchujima, Koto-kuTokyo 135-8533, Japan

9 IMPROVED OBJECT CLASSIFICATION THROUGH THE COMBINATION OF VNIR, MULTI-FREQUENCY SAR AND MULTI-POLARMETRIC SAR: A CASE STUDY FROM SOUTH AUSTRALIA
David Bruce,
Spatial Measurement and Information Group, University of South Australia,
GPO Box 247, Adelaide, Australia

95 TESTS ON DETERMINING DIGITAL ELEVATION MODELS FROM ERS TANDEM DATA
Prof John Trinder,
University of NSW, School of Surveying and SIS,UNSW, Sydney 2052 NSW, Australia

111 THE USE OF C-BAND INTERFEROMETRIC AIRSAR DATA FOR ANALYZING THE CHARACTERISTICS OF FOREST STANDS
Prof Kyu-Sung Lee, Kim Du-Ra, Sun-IL Lee,
Inha University, Dept. of Geoinformatic Engineering 253 Yonghyun-dong, Inchon, S. KOREA

96 DETECTION OF OIL SPILL POLLUTION USING RADARSAT SAR IMAGERY
Miss Rosfinah Samad, Shatrri Mansor,
Malaysian Centre For Remote Sensingno.13, Jalan Tun Ismail, 50480 Kuala Lumpur, Malaysia

DAY-3 Wednesday Nov 27 2002 ROOM B
1600-1730 Very High Resolution Mapping VHR.1

108 DIGITAL ORTHOMOSAICS AS A SOURCE OF CONTROL FOR GEOMETRICALLY CORRECTING HIGH RESOLUTION SATELLITE IMAGERY
Dr Dare Paul, Clive Fraser, Nicki Pendlebury,
Department of Geomatics, University of Melbourne Victoria, 3010, Australia

214 SIMULATED RECOVERY OF INFORMATION IN SHADOW AREAS ON IKONOS IMAGE BY COMBING ALS DATA
Takashi Nakajima, Guo Tao, Yoshifumi Yasuoka,
Institute of Industrial Science, The University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo 153-8505, Japan

18 SNAKE-BASED APPROACH FOR BUILDING EXTRACTION FROM HIGH-RESOLUTION SATELLITE IMAGES AND HEIGHT DATA IN URBAN AREAS
Tao Guo, Yoshifumi Yasuoka,
Yasuoka Lab.Institute of Industrial Science, The University of Tokyo, Ce-509, 6-1, Komaba 4 Chome Meguro, Tokyo 153-8505, Japan

17 PRODUCE ORTHOIMAGE FROM IKONOS DATA
Abnn Yazdani,
Iranian Remote Sensing Center (IRSC), No. 22, 14th Street, Saadat Abad Avenue, Tehran 19979943 13, Iran

172 EXTRACTION OF BRIDGE POSITIONS FROM IKONOS IMAGES FOR ACCRUACY CONTROL OF BRIDGE DATABASE
Jong-Hyeok Jeong, Masauka Takagi,
Dept. of Infrastructure Systems Eng., Kochi University of Technology 185 Miyanokuchi, Tosayamada-cho, Kami-gun Kochi 782-8502, Japan

104 SEMI AUTOMATIC TRACKING OF ROAD CENTERLINES FROM HIGH RESOLUTION REMOTE SENSING DATA
Miss Seung-Ran Park, TAejung Kim,
SaTReC, KAIST 373-1 Kusong-dong, Yusong-gu, Daejeon 305-701, Korea

DAY-3 Wednesday Nov 27 2002 ROOM C
1600-1730 Mountain Environment and Mapping ENV.2

72 A HIGH RESOLUTION 3D MODEL OF MOUNT EVEREST.
Prof. Armin Gruen, Prof. Shunji Murai***
* ETH Hoenggerberg CH 8093 Zuerich, Switzerland
** Institute of Industrial Science, University of Tokyo, Japan

123 WATERSHED MANAGEMENT APPROACH USING GRASS GIS
Dr. Raghunath Jha,
GPO 8975, EPC 1970 Kathmandu, Nepal

164 THE DEVELOPMENT OF SCIENCE AIRSHIP FOR ENVIRONMENTAL MONITORING
Prof Choi Chul-Uong, Young-Seop Kim, Sung-Hwan Cho,
Dept of satellite information science 599-1, daeyeon 3-dong, nam-gu, Pusan, 608-737, S.Korea

169 PARTICIPATORY WATERSHED MANAGEMENT PLANNING FOR THE SUSTAINABLE DEVELOPMENT-TINAU SUB-WATERSHED, PALPA NEPAL
Shyam Sundar Shrestha,
Watershed Conservation Officer, Department of Soil Conservation and Watershed Management, Ministry of Forests and Soil Conservation, His Majesty's Government of Nepal, Nepal

230 CORRELATION ANALYSIS OF SURFACE TEMPERATURE AND PHYSICAL ENVIRONMENT IN MOUNTAINOUS AREA USING RS AND GIS
Myung-Hee Jo, Hyoung-Sub Kim**, Yun-Won Jo**, Joon-Bum Kim****
* Department of Urban Information Engineering, Kyungil University, 33 Buho-ri, Hayang-up, Kyungsan-si, Kyungsan buk-do, 712-701, Korea
** Urban Information Cadastral Engineering of Kyungil University, Korea
*** Korea Forest Research Institute, Korea

239 STUDY OF GLACIERS, GLACIAL LAKES AND GLACIAL LAKE OUTBURST FLOODS (GLOF) IN THE HIMALAYA USING REMOTE SENSING DATA AND GIS TECHNIQUES
Pradeep Mool,
Mountain Environment and Natural Resources' Information Systems (ICIMOD), Nepal

DAY-4 Thursday Nov 28 2002 ROOM A
0830-1030 Soil and Agriculture SOL/AGR.1

147 APPLICATION OF COMBINED SPECTRAL-BASED AND SPATIAL-BASED APPROACHES FOR IMPROVED MIXED-VEGETATION CLASSIFICATION USING IKONOS
Aniek Widayani, Bruno Verbist*, Allard Meijerink**,*
* International Centre for Research in Agroforestry - Southeast Asian Programme (ICRAF SEA), PO Box 161, Bogor
** International Institute for Geo-Information Science and Earth Observation (ITC), P.O. Box 6, 7500 AA Enschede, The Netherlands

28 IMAGE TRANSFORMATIOM AND GEO-STATISTICAL TECHNIQUES TO ENHANCE AND MAP SOIL FEATURES: AN APPLICATION IN ASSESSING SEDIMENTATION PROBLEM IN SOUTHERN NEPAL
Dhruba Pikha Shrestha,
International Institute for Geo-Information Science and Earth Observation (ITC), P.O. Box 6, 7500 AA Enschede, The Netherlands

139 THE EVALUATION OF RICE PADDY USING VARIOUS IMAGE CLASSIFICATION METHODS
Kuo-Hsin Hsiao, Chi-Chiung Lan, Wei-Chen Hsu,
Researcher, Energy and Resource Laboratories, Industrial Technology Research Institute, W300 ERL/ITRI, Bldg. 24, No. 195, Sec. 4, Chung Hsing Rd.Chungtung, Hsinchu, Taiwn 310, China Taipei

143 FORECASTING SUGAR CANE PRODUCTION IN HARYANA STATE, INDIA USING SATELLITE DATA
R.S. Hooda, M. Yadav, V.S. Arya, J. Prasad,
Haryana State Remote Sensing Application Centre (HARSAC) CCS Haryana Agricultural University Campus, Hisar 125 004

45 C-BAND/HH BACKSCATTERING CHARACTERISTICS OF PADDY FIELDS: IMPLICATIONS FOR RICE-GROWTH MONITORING
Donald M. Ugsang, Kiyoshi Honda**, Genya Saito****
* Center for Southeast Asian Studies, Kyoto University, 46 Shimoadachi-cho, Yoshida Sakyo-kuKyoto 606-8501, Japan
** Asian Center for Research on Remote Sensing, AIT, P.O. Box 4, Klong Luang, Pathumthani 12120, Thailand
*** National Institute of Agro-Environmental Sciences, 3-1-1 Kannondai Tsukuba, Ibaraki, Japan

67 AN INVENTORY OF CURRENT SOIL FERTILITY STATUS OF MAHOTTARY DISTRICT, NEPAL
Mr Satya Mandal,
Soil Testing and Service Section, DOA, P.O.Box 10522 Kathmandu, Nepal

10 MAPPING OF RICE CULTIVATION AREAS IN NORTH OF IRAN, USING MULTITEMPORAL DATA OF AVHRR
Abdolreza Ansari Amoli,
Iranian Remote Sensing Center (IRSC) No 22, 14th st., saadat abad aveTehran, Iran

59 MAPPING SOIL NITROGEN STATUS BY USING ADS40 TO AID PRECISION FARMING
Bhunneshwar Prasad Sah, Sakae Shibusawa**, Tumuyuki Sahama*, Curolina Hache**, Yuko Kato***
* PASCO Corporation1-1-2 Higashiyama, Meguro-ku, Tokyo 153-0043, Japan
** Tokyo University of Agriculture and Technology 3-5-8 Saiwai-Cho, Fuchu, Tokyo 183-8509, Japan

DAY-4 Thursday Nov 28 2002 ROOM B
0830-1030 Data Processing, Algorithm and Modelling ADP.3

115 ON-BOARD MULTISPECTRAL ALIGNMENT FOR IMPROVED CLASSIFICATION AND COMPRESSION RESULTS
Timo Bretschneider, Tobias Trenschel.
School of Computer Engineering, Nanyang Technological University Blk. N4 #02a-32, Nanyang Avenue 639798, Singapore

80 ON THE PERFORMANCE OF JPEG 2000 FOR AERIAL PHOTO COMPRESSION
Tian-Yuan Shih,
Department of Civil Engineering, National Chiao-Tung University,1001 Ta-Hsueh Road, Hsin-Chu, China Taipei

116 MODEL-IMAGE FITTING USING GENETIC ALGORITHMS FOR BUILDING EXTRACTION FROM AERIAL IMAGES
Chih-Chiao Lin, Sendo Wang, Yi-Hsing Tseng,
Department of Surveying Engineering, National Cheng Kung University#1 University Road, Tainan 701, China Taipei

179 IMPROVING MAXIMUM LIKELIHOOD CLASSIFICATION ACCURACY USING A-PRIORI PROBABILITY
Ali Alesheikh, Fariba Sadeghi Naeni Fard***
* Assistant Professor Dept. of Geodesy and Geomatics Eng., K.N. Toosi University of Technology Valy_Asr St.,Mirdamad CrossTehran,19967-15433, Iran
** Graduate Student, Dept. of Geodesy and Geomatics Eng., K.N. Toosi University of Technology, Valy_Asr St., Mirdamad Cross,Tehran, 19967-15433 ,niran

120 AN EFFICIENT AND ACCURATE ARTIFICIAL NEURAL NETWORK THROUGH INDUCED LEARNING RETARDATION AND PRUNING TRAINING METHODS SEQUENCE
Kazunori Kohyama, Joel Bandibas***
* National Institute of Livestock and Grassland Science 768 Senbonmatsu, NishinasunoTochigi Prefecture 329-2739, Japan
** National Institute of Advanced Industrial Science and Technology (AIST), Institute of Geoscience, Asian Geoinformation Research Group1-1-1 Higashi Tsukubaibaraki Prefecture 305 8567, Japan

195 REMOTE SENSING FOR LAKE WATER MONITORING: METHODS AND ALGORITHMS
Eugenio Zilioli, Claudia Giardino***
* Via Bassini, 15I-20133 Milano, Italy
** CNR-IREA Via Bassini, 15I-20133 Milano, Italy

119 BLUR IDENTIFICATION IN SATELLITE IMAGERY USING IMAGE DOUBLETS
Timo Bretschneider,
School of Computer Engineering Nanyang Technological University Blk. N4 #02a-32, Nanyang Avenue, Singapore, 639798, Singapore

190 TARGET POSITIONING USING OBJECT TRACKING TECHNIQUE FOR VIDEO IMAGES
Min-Hsin Chen,
Center for Space and Remote Sensing Research, National Central University, Chung Li, China Taipei

DAY-4 Thursday Nov 28 2002 ROOM C
0830-1030 Water Resources WRS

43 GIS APPLICATION FOR WATERSHED BOUNDARY CLASSIFICATION
Vidhaya Treio-ges,
Assistant Professor, Department of Land Resources and Environment, Faculty of Agriculture, Khon Kaen University, Khon Kaen, 40002,Thailand

16 TEMPORAL WATER DEPLETION FROM PUBLIC RS DATA.THE DISTRICTS AND IRRIGATION ZONES OF FERGHANA PROVINCE, UZBEKISTAN.
Yann Chemin, Alexander Platonov***
* PhD student in remote sensing applications (AIT-STAR) 20/7 Kanathawatte Road, Rajagiriya, Sri Lanka
** Leading Engineer - programmer (GIS/RS), Scientific information center of inter state cordination on water commission of the Central Asia, B11, Karasu-4, Tashkent 700187, Uzbekistan

275 THE STUDY OF THE ABILITY OF AVHRR-LAC AND GAC IMAGES ON ESTIMATING THE LAKE SURFACES AND SMALL MARSHLANDS AREAS
Hamid Taheri Shahraini, Ahmad Abrishamchi, Massoud Tajrishi,
Civil Engineering Department of Sharif University of Technology, Tehran, Iran

276 A COMPARISON BETWEEN DIFFERENT METHODS FOR THE SEPARATION OF WATER AND WETLANDS IN A SMALL LAKE BY LANDSAT-TM IMAGES
Hamid Taheri Shahraini, Massoud Tajrishi, Abbas Alimohammadi, Ahmad Abrishamchi,
Civil Engineering Department of Sharif University of Technology, Tehran, Iran

272 UTILITY OF GROUND WATER AND SURFACE WATER OF RANCHI DISTRICT USING REMOTE SENSING DATA GIS
Dr. A.K. Singh,
Remote Sensing Dept., B.I.T Mesra, India

215 BIO-PHYSICAL CONDITION OF ANDHI KHOLA WATERSHED TO ESTIMATE THE LIFE SPAN OF PROPOSED DAM
Kiran Maila,
Project Development Department, Nepal Electricity Authority, Kathmandu, Nepal

264 NATURAL RESOURCES MANAGEMENT FOR RAINFED AREAS - A REMOTE SENSING AND GIS APPROACH
Venkateswariu P., Gokhale K.V.G.K.**, Anji Reddy M.**
* Centre for Environment, J.N.T. University, Masab Tank, Hyderabad- 500028, India
** Principal, Vidya Bharati Inst. of Tech.(formerly Head, Civil Engg. dept. I.I.T.Kanpur)201 Sai Towers, Bapuji Nagar Nacharam, Hyderabad 500076, India

DAY-4 Thursday Nov 28 2002 ROOM D
0830-1030 Geology / Geomorphology GEO

65 LANDSAT-TM IMAGES IN GEOLOGICAL MAPPING OF SURNAYA GAD AREA, DADELDHURA DISTRICT, WEST NEPAL
L. N. Rimal, A. K. Duvadi, S. P. Manandhar,
Department of Mines and Geology, Lainchaur, Kathmandu, Nepal

258 THE STUDIES ON THE GEOLOGICAL REMOTE SENSING FOR QINGHAI-TIBET PLATEAU RISING
Xuezheng Yu,
China Aero-Geophysical survey and Remote Sensing Center for Land and Resources, Beijing 100083, China

29 APPLICATION OF DEM DATA TO GEOLOGICAL INTERPRETATION: THONG PHA PHUM AREA, THAILAND
Sunwa Saraprirome, Adichat Surinkum, Pirat Sukunthipong,
Department of Mineral Resources, Rama 6, Ratchathevee, Bangkok 10400,Thailand

60 SPECTRAL DISCRIMINATION OF ROCK TYPES IN THE ARAVALLI MOUNTAIN RANGES OF RAJASTHAN (INDIA) USING LANDSAT THEMATIC MAPPER DATA
Dr. Nilanchal Patel,
Reader, Department of Remote Sensing, D-56, BIT Campus, Birla Institute of Technology, Mesra, Ranchi (Jharkhand), India

93 ENGINEERING AND ENVIRONMENTAL GEOLOGICAL INVESTIGATION OF DHARAN AREA USING RS AND GIS TECHNIQUES
A. K. Duvadi, S. M. Sikrikar, L. N. Rimal, G. B. Tuladhar, B. M. Jnawali, S. P. Manandhar,
Department of Mines and Geology, Lainchaur, Kathmandu, Nepal

DAY-4 Thursday Nov 28 2002 ROOM A
1100-1300 Soil and Agriculture SOL/AGR.2

244 SOIL EROSION MODELLING USING REMOTE SENSING AND GIS: A CASE STUDY OF JHIKHU KHOLA WATERSHED, NEPAL
Manish Kokh-Shrestha,
Banepa - 3 Kabhre, Nepal

253 MONITORING AND ASSESSING RICE CROP WITH MULTI-TEMPORAL RADARSAT FINE BEAM MODE DATA IN PATHUMTHANI AND AYUATTHIYA PROVINCE OF THAILAND,
Mona Lucou, Ryuzo Yokoyama*, Genya Saito***
* Asian Center for Research on Remote Sensing (ACRoRS), School of Advanced Technologies Asian Institute of Technology, P.O. Box 4 Klong Luang Pathumthani 12120, Thailand
** National Institute of Agro-Environmental Sciences, 3-1-1 Kannondai Tsukuba, Ibaraki, 305-8604, Japan

64 QUANTITATIVE ASSESSMENT OF TEMPERATURE MITIGATION EFFECT OF RICE PADDY BY LANDSAT AND NOAA/AVHRR
Chih Hung Ton, J. H. Chen, C. E. Kan,
Agricultural Engineering Research Center, 196-1 Chung Yuan Rd, ChungLI, 320, China Taipei

223 APPLICATION OF THE USLE MODEL AND THE MORGAN MODEL FOR SOIL EROSION MAPPING: THE CASE STUDY IN TAMBON KHAO HIN SORN, AMPHOE PHANOMSARAKAM, CHACHOENGSAO PROVINCE, THAILAND
K. Iamjornrat, M.Van Molle**, V. Heyvaert***
* Surveying and Cartographic Division Land Development Department Bangkok 10900, Thailand
** Department of Geography, Vrije Universiteit Brussel, Belgium

174 THE INFLUENCE OF SOIL CONDITION TO SATELLITE IMAGE IN MONGOLIAN GRASSLAND
Atsuo Yoshino,
185 Miyanokuchi Tusayamada-cho, Kami-gun Kochi 7828502, Japan

266 AGRO-CLIMATIC ZONING FOR CROP SUITABILITY ASSESSMENT USING GIS
Shamla Rasheed, Vidhya Rangasamy**, Kappusamy Venugopal****
* Research Scholar, Institute of Remote Sensing, India
** Lecturer, Institute of Remote Sensing, India
*** Director, Institute of Remote Sensing, Annauniversity, India

208 CALIBRATION OF BRDF EFFECTS IN PADDY FIELD REFLECTANCE FROM TEMPORAL MODIS IMAGES
Junichi Susaki, Keisarou Hara*, Koji Kajiwara**, Yoshiaki Honda***
* Tokyo University of Information Sciences1200-2, Yato-cho, Wakaba-kuChiba, 265-8501, Japan
** Center for Environmental Remote Sensing (CERes), Chiba University, 1-33 Yayoi, Inage-ku, Chiba, Japan

13 ASSESSING DESERT VEGETATION COVER USING REMOTELY SENSED DATA: A CASE STUDY FROM THE STATE OF QATAR
Md. Abu Syed, Dr. Abdulali Mohammed Sadiq Abdulla***
* Remote Sensing Specialist, Scientific and Applied Research Centre (SARC), University of Qatar, P.O. Box # 2713, Doha, Qatar
** Assistant Professor, Geology Department, Faculty of Sciences, University of Qatar, P.O. Box # 2713, Doha, Qatar

DAY-4 Thursday Nov 28 2002 ROOM B
1100-1300 Data Processing, Algorithm and Modelling ADP.4

113 AUTOMATIC BUILDING OUTLINE RECONSTRUCTION USING TOPO MAP AND STEREO IMAGES
Mr. Yi-Chen Shao, Prof. Liang-Chien Chen,
Department of Civil Engineering, China Institute of Technology No.278, Academy Rd., Sec. 3, NanKang Area, Taipei, Taiwan 115, China Taipei

110 CAMERA MODELLING FOR SATELLITE IMAGERY: PERFORMANCE ANALYSIS OF ALGORITHM
Mr Myungjin Choi, Mr Kim Tae-Jung,
373-1, Guseong-dong, Yuseong-gu, Daejeon 305-701, S. Korea

140 BAYESIAN CLASSIFICATION FOR RICE CROP INTERPRETATION
Chi Chung Lau, Kuo Hsin Hsiao,
Researcher, Energy and Resource Laboratories, Industrial Technology Research Institute, W300 ERL ITRI, Bldg 24, No. 195, Sec. 4, Chung Hsing Rd.Chutung, Hsinchu, Taiwan 310, China Taipei

106 AUTOMATIC PRECISION CORRECTION OF SATELLITE IMAGES BY GCP CHIP MATCHING AND RANSAC
Taejung Kim, Yong-Jo Im,
SaTReC, KAIST373-1 Kusong-dong, Yusong-gu, Daejeon 305-701, Korea

241 AUTOMATION AND APPLICATION OF TEXTURE MAPPING FOR 3D MODELING OF THE WORLD HERITAGE
Yoshinori Sasaki, Mazafumi Nakagawa, Ryosuke Shibasaki,
4-6-1 Komaba, Meguro-kuTokyo, 153-8505, Japan

160 ATMOSPHERIC CORRECTION FOR HOTSPOTS DETECTION AND SUBPIXEL FIRE TEMPERATURE RETRIEVAL IN MODIS
Agnes Lim, Soo Chin Liew, Kim Hwa Lim, Leong Keong Kwoh,
Centre for Remote Imaging Sensing and Processing (CRISP) National University of Singapore, Blk SOC1 Level 2, Lower Kent Ridge Road Singapore 119260, Singapore

162 THE TWO-DIMENSIONAL POLYNOMIAL LEAST SQUARES (POLES) FILTER: A METHOD FOR REDUCING HIGH AND LOW VALUE NOISE IN SATELLITE DATA
Mr Jose Edeardo Aban, Ryuiaro Tateishi,
Center for Environmental Remote Sensing, Chiba University, Tateishi Laboratory Center for Environmental Remote Sensing, Chiba University 1-33 Yayoi, Inage, Chiba 263-8522, Japan

281 SUPER RESOLUTION SIGNAL PROCESSING ALGORITHM FOR GROUND PENETRATING RADAR
Shanker Shrestha, Ikuo Arai,
Arai Lab, Electronics Engineering Department The University of Electro-Communication 1-5-1 Chofu, Tokyo 182 8585, Japan

DAY-4 Thursday Nov 28 2002 ROOM C
1100-1300 Education EDU.1

56 CURRICULUM DESIGN FOR A UNIVERSITY GRADUATE COURSE ON ADVANCED TOPICS IN GIS FOR NATURAL RESOURCES MANAGEMENT
Dr. Yousif Ali Hussin,
Associate Professor of Remote Sensing and GIS, Forest Science Division, The International Institute for Geo-information Science and Earth Observation ITC, Hengelosstraat 99, 7500 AA Enschede, The Netherlands

256 DOCUMENTATION OF ACRS PAPERS ON INTERNET
Pravin Kumar,
GIS Development G-4, Sector-39, NOIDA 201301, India

200 FIELD OBSERVATION USING FLYING PLATFORMS FOR REMOTE SENSING EDUCATION
Jun Nogami, Do Minh Phuong, Dr. Michiro Kuzunagi,
STAR (Space Technology Applications & Research Program), SAT (School of Advanced Technologies), AIT (Asian Institute of Technology), P.O.Box 4, Klong Luang, Pathumtani 12120, Thailand

257 HUMAN RESOURCE DEVELOPMENT FOR SURVEYING AND PRODUCTIVE MANAGEMENT OF LAND RESOURCES IN NEPAL
Hari Prasad, Mahendra Prasad Sigdel***
* Principal School of Geomatics, Kathmandu, Nepal
** Chief Survey Officer, Survey Department, Kathmandu, Nepal

100 THE APPLICATION OF GIS TO SCHOOL MAPPING IN BANGKOK
Miss Yoko Makino, Seisuke Watanabe,
ACRoRS/STAR/SAT, Asian Institute of Technology, P.O Box 4, Klong Luang, Pathumthani 12120, Thailand

DAY-4	Thursday Nov 28 2002	ROOM F
1400-1530	Poster	POS.3

286 **THE DYNAMIC REMOTE SENSING MONITORING OF EIGHT OUTLETS IN PEARL RIVER ESTUARY**
Huang shufeng, Li Jiren, Xu Mei,
Remote Sensing Technique Application Center, China Institute of Water Resources & Hydrology, 20 Che Gong Zhuang Xi Lu Haidian DistBeijing, China

25 **AGRICULTURAL LAND COVER MAPPING IN MOUNTAINOUS AREA WITH LINEAR MIXTURE MODELING: A CASE STUDY IN PANGALENGAN, WEST JAVA, INDONESIA**
Ketut Wikantika, Satoshi Uchida*, Yukio Yamamoto***
* Development Research Division, Japan Intl. Research Center for Agricultural Sciences (JIRCAS), 1-1 Ohwashi, Tsukuba, Japan
** Japan Intl. Research Center for Agricultural Sciences (JIRCAS), 1-1 Ohwashi, Tsukuba, Japan

196 **MULTITTEMPORAL ANALYSIS OF AVHRR NDVI IMAGERY ON KOREAN PENINSULA USING HARMONIC COMPONENT**
Sanghoon Lee,
Department of Industrial Engineering, Kyungwon University, San 65 Bokjeong-dong Sujeong-gu Seongnam-si Kyunggi-do 461-701, S. Korea

152 **APPLICATION OF CANNY EDGE DETECTOR IN REMOTE-SENSING IMAGERY**
Punya Thitimajshima, Yuttapong Rangsanseri,
Department of Telecommunications Engineering, Faculty of Engineering, King Mongkut s Institute of Technology, Ladkrabang, Bangkok 10520, Thailand

161 **FIELD WORKS IN MANGROVE FOREST ON STAND PARAMETERS AND CARBON AMOUNT AS FIXED CARBON DIOXIDE FOR COMBINING WITH REMOTE SENSING DATA**
Mr Kazuhiro Sato, Ryutaro Tateishi, Hiraka Tateda, Shunichi Sugino,
Faculty of Agriculture, University of the Ryukyus, Senbaru 1, Nishihara, Okinawa 903-0213, Japan

163 **THE CHANGE OF COASTAL LINE DURING 50 YEARS AT THE PUSAN**
Prof Kim young-seup, Chul-woong Chon, Kwang-woo Nam,
Dept. of satellite information science, 599-1,daeyeon 3 dong,name gu, 608-737, Korea

148 **ESTIMATE OF INSOLATION USING GMS AND DEM DATA FOR THE PURPOSE OF SUITABILITY MAPPING OF AGRICULTURE**
Mr Jun Otojawa, Hokuto Kano, Ryutaro Tateishi,
Chiba University, 263-8522 Yayoi-cyo1-33 Inage-ku Chiba-shi, Chiba-ken, Japan

159 **EXPERIENCES IN FOREST MONITORING OF FIRE-DAMAGED BY USING MULTI-SENSOR DATA**
Chuen Kim,
Kookmin University, Dept. of Forest Resource, 861-1, Jeongnungdong, Sungbukgu, Seoul 136-702, Korea

39 **REGIONAL MINERAL MAPPING AND STRUCTURAL ANALYSES FOR MINERAL RESOURCE EXPLORATION, CENTRAL MYANMAR TO NORTHWESTERN CHINA**
Shuichi Miyatake,
Metal Mining Agency of Japan,1-24-14 Toranomon, Minato-ku,Tokyo 105-0001, Japan

259 **WILDLIFE CORRIDOR MAPPING BETWEEN ROYAL BARDIA NATIONAL PARK, NEPAL AND KATARNIYAGHAT WILDLIFE RESERVES, INDIA BY USING GIS**
Sangita Kharel, Rana Bahadur Chhetri*, Sanjaya Nath Khanal*, Shanta Raj Jnawali**, Shankar Raj Pathak****
* Kathmandu University, Dhulikhel, P.O.Box- 6250, Banepa, Kavre, Nepal
** Bardia Conservation Program, King Mahendra Trust For Nature Conservation, Bardiya, KMTNC, Kathmandu, Nepal
*** Local Governance Pmgram, United Nations Development Programme, Kathmandu, Nepal

283 **APPLICATION OF REMOTE SENSING TO WATER RESOURCES MANAGEMENT IN ARID REGIONS OF CHINA**
Li Jiren Yan Mingu,
Remote sensing Technology Application Center, Ministry of Water Resources, 20 West Chegongzhuang Road, Beijing

260 **STUDY ON LAND USE OF PROPOSED BLACKBUCK CONSERVATION AREA, KHAIRAPUR, BARDIA AND HABITAT OPTIONS FOR TRANSLOCATION AT ROYAL SUKLAPHANTA WILDLIFE RESERVE BY USING GIS.**
Pradeep Khanal, Sanjay Nath Khanal**, Shanta Raj Jnawali***, Shanker Raj Pathak*****
* MSc. 3 rd semester, Department of Biological and Environmental Sciences, School of Science, Kathmandu University, Dhulikhel, Nepal
** Associate Prolesor, School of Science, Kathmandu University, Nepal
*** Program Director/King Mahendra Trust for Nature Conservation, Bardia Bardiya, Nepal
**** Gis Specialist (Advisor), LGP/UNDP, POB: 107, Kathmandu, Nepal

217 **REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM FOR RUNOFF COEFFICIENT ESTIMATION IN TAIWAN**
C. H. Tan, S. S. Yeh**, A. M. Melesse****
* 196-1 Chung Yuan Rd. Chungli, 320, China Taipei
** Tsao-Jun Memorial Foundation for R&D for Agriculture and Irrigation, China Taipei
*** Agricultural and Biological Engineering Dept., University of Florida, U.S.A.

285 **THE TEMPORAL-SPATIAL DISTRIBUTION OF NDVI AND ITS INFLUENCE TO THE NPP OF FOREST AND CULTIVATED LAND**
Yan LI, Shaolin Peng**, Qifang Liao***, Shendong Liao****
* Computer Science Department, South China Normal University, Guangzhou 510631, China
** South China Institute of Botany, Chinese Academy of Sciences Guangzhou 510650, China
*** Guangzhou Institute of Geography, Guangzhou 510070, China

284 **THE STUDIES ON THE GEOLOGICAL REMOTE SENSING FOR QINGHAI-TIBET PLATEAU RISING LOCUS**
Yu Xuezheng,
Aero Geophysical Survey & Remote Sensing Center, Beijing 100083, China

49 **LANDSLIDE HAZARD POTENTIAL AREA IN 3 DIMENSION BY REMOTE SENSING AND GIS TECHNIQUE**
Boonruck Pinmakanon,
Land Use Planning Divisionland Development Department, Paholyothin Rd. Jatujak, Bangkok 10900, Thailand

DAY-4	Thursday Nov 28 2002	ROOM A
1600-1730	Forestry	FOR.2

204 **DEVELOPING THE FOREST FIRE EXTINGUISH EQUIPMENT MANAGEMENT SYSTEM USING GPS AND GIS**
Myung-Hee Jo, Hyeun-Sik Kim**, Dong-Ho Shin**
* Department of Urban Information & Cadastral Engineering, Kyunil University, 33 Buho-ri, Hayang-up Kyungsan-si, Kyungsan bukdo, 712-701, S. Korea
** Korea Forest Service, Korea

167 **MONITORING FOREST RESOURCES USING REMOTE SENSING DATA**
Rishi Ram Sharma,
Remote Sensing Officer Department of Forest Research and Survey Babarmahal, Kathmandu P.O. Box 3103, Nepal

191 **DETECTING DEFORESTATION IN THE TROPICS USING CHANGE VECTOR ANALYSIS WITH PATTERN DECOMPOSITION COEFFICIENTS**
Mui-How Phua, Naoyuki Furuya**, Satoshi Tsuyuki****
* School of International Tropical Forestry Universiti Malaysia Sabah, Locked bag 2073, 88999 Kota Kinabalu Sabah
** Forestry and Forest Products Research Institute, Matsunosato 1, Kukizaki-cho, Inashiki ward, Ibaraki, Japan 305-8687, Japan
*** Graduate School of Agricultural and Life Sciences, The University of Tokyo, 1-1-1 Yayoi, Bunkyo-kuTokyo 113-8657, Japan

92 **ALIGNMENT AND LOCATING FOREST ROAD NETWORK BY BEST-PATH MODELING METHOD**
Mr Muhamed Kamal Azidy Musa,
Malaysian Centre For Remote Sensing (MACRES), No.13 Jalan Tun Ismail, 50480 Kuala Lumpur, Malaysia

274 **TROPICAL FOREST MAPPING AND DEFORESTATION ASSESSMENT USING L-BAND RADAR**
Shakil Ahmad Romshoo,
Earth Observation Research Center (EORC), National Space Development Agency of Japan (NASDA), Harumi 1-8-10, Harumi island triton square office tower X 22, Chuo-Ku, Tokyo, Japan

248 **USE OF GIS BASED TECHNOLOGY FOR COMMUNITY FOREST BOUNDARY SURVEYING IN NEPAL**
K. P. Acharya,
Research Officer, Department of Forest Research and Survey Kathmandu, GPO Box 9136, Nepal

DAY-4	Thursday Nov 28 2002	ROOM B
1600-1730	Very High Resolution Mapping	VHR.2

70 **PROSPECTS FOR MAPPING FROM HIGH-RESOLUTION SATELLITE IMAGERY**
Clive Fraser,
Department of Geomatics, University of Melbourne, Melbourne VIC 3010, Australia

103 **DEVELOPMENT OF SATELLITE IMAGE GROUND RECEIVING AND PROCESSING SYSTEM FOR HIGH RESOLUTION SATELLITES**
Dr Moon-Gyu Kim, Taejung Kim, Sung-Ok Park, Jihyun Shin, Myungjin Choi, Yong-Jo Im, Jongjoo Lee,
SaTReC, KAIST, 373-1 Kusong-dong, Yusong-gu, Daejeon 305-701, Korea

112 **UPDATING GEOGRAPHIC INFORMATION USING HIGH RESOLUTION REMOTE SENSING OPTICAL IMAGERY**
Nab Raj Subedi,
National Geographic Information Project, Survey Department, Min Bhawan, Kathmandu, Nepal

129 **THE GENERATION OF TRUE ORTHOPHOTOS FROM IKONOS GEO IMAGES**
Liang-Chien Chen, Chiu-Yueh Lo,
Center for Space and Remote Sensing Research, National Central University, Chung-Li, China Taipei

149 **AN ALGORITHM FOR GEOMETRIC CORRECTION OF HIGH RESOLUTION IMAGE BASED ON PHYSICAL MODELING**
Yong-Yao Lee,
National Space Program Office, 8F, 9 Prosperity 1st Road, Science Based Industrial ParkHsinchu, China Taipei

DAY-4 Thursday Nov 28 2002 ROOM C
1600-1730 Education EDU.2

19 **EDUSPACE,THE EUROPEAN EARTH OBSERVATION WEBSITE FOR SECONDARY SCHOOLS**
Dr. Juerg Lichtenegger.
ESA/ESRIN C.P.64 via Galileo Galilei-00044 Frascati, Italy

182 **TELE-EDUCATION SYSTEM FOR RS/GIS IN THE INTERNET SATELLITE AGE**
Dr. Michiro Kusanagi, Jun Nagami, Duong Van Hieu,
STAR (Space Technology Applications & Research Program), SAT (School of AdvancedTechnologies), AIT (Asian Institute of Technology), P.O.Box 4, Klong Luang, Pathumtani 12120, Thailand

157 **GLOBALIZATION OF INTERNATIONAL EDUCATION- ITC'S CHALLENGE OF MAINTAINING QUALITY**
Sjaak J.J. Beerens, Ineke G.T.M. ten Dam**,*
* Director, External Affairs, International Institute for Geo-Information Science and Earth Observation, P.O. Box 6, 7500 Enschede, The Netherlands
** Education Specialist, Education Affairs International Institute for Geo-Information Science and Earth Observation, P.O. Box 6, 7500 Enschede, The Netherlands

220 **ISSUES IN GIS EDUCATION- EXPERIENCES FROM THE HINDU KUSH-HIMALAYAN (HKH) REGION**
Basanta Shrestha, Birendra Bajracharya,
International Centre for Integrated Mountain Development (ICIMOD), G.P.O.Box 3226, Kathmandu, Nepal

265 **GIS PROGRAMME WITH A HOLISTIC APPROACH**
M S Nathawat,
Professor & Head, Department of Remote Sensing, Birla Institute of Technology (A Technical University), Mesra 835 215, Ranchi, Jharkhand, India

DAY-5 Friday Nov 29 2002 ROOM A
0830-1030 Ecology, Environment & Carbon Cycle EEC

150 **ESTIMATION OF TERRESTRIAL CARBON FLUXES BY INTEGRATING REMOTE SENSING WITH ECOSYSTEM MODELLING**
Mr Manzul Kumar Hazarika, Y. Yasuoka***
* Institute of Industrial Science, C-Block, Room No. Cc-509 University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo, Japan
** University of Tokyo, Institute of Industrial Science, C-Block, Room No. Cc-509, University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo 153-8505, Japan

2 **REMOTE SENSING IN FOREST ECOSYSTEM ANALYSIS**
Venkata Ravi Sankar Vallabhajosyula,
S/O V.L.N Rao1-108-2-2 Street No 3, Bhavaninagar Nacharam, Hyderabad Pin-500076, Andhra Pradesh, India

63 **A STUDY ON LAND USE AND ENVIRONMENT IN TONZA CITY AREA IN HAINAN PROVINCE, CHINA: TWENTY YEARS OF CHANGE**
Krishna Pahari, Masahiro Umezaki, Jiang Hong WEI,
Department of Human Ecology, Faculty of International Health, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

277 **NATURAL RESOURCE MANAGEMENT FOR AGRO-ECOLOGICAL ZONING: A CASE STUDY OF RUPANDEHI DISTRICT**
Suresh K. Rai, S. P. Pandey,
Soil Science Division, Khumaltar Nepal Agricultural Research Council, Nepal

97 **COMPARISON OF ESTIMATION VARIANCE OF RAINFALL MAP AND SMOKE INDEX MAP DERIVED FROM AVHRR-GAC IMAGES**
Hamid Taheri Shahraini, Bahram Saghafian,
Civil Engineering Department of Sharif University of Technology, Tehran, Iran

20 **ENVIRONMENTAL SENSITIVITY INDEX (ESI) MAPPING FOR OIL SPILL IN SOUTH EAST ASIA: THE CASE OF BATANGAS BAY, PHILIPPINES**
Abigail Joy Ramos, Jose Noel Dumaup,
LBI Building#57 Kalayaan Avenue, DiliimanQuezon City, 1101, Philippines

36 **LAND USE OF THE LI-SPEAKING PEOPLE IN A MOUNTAINOUS AREA OF HAINAN ISLAND, CHINA: IMPACT OF NATIONAL NATURE RESERVE, ESTABLISHED IN 1986**
Masahiro Umezaki, Krishna Pahari**, Hongwei Jiang***
* Section of International Health, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo, Tokyo 113-8519, Japan
** Department of Human Ecology, University of Tokyo 7-3-1 Hongo, Bunkyo, Tokyo 113-0033, Japan

DAY-5 Friday Nov 29 2002 ROOM B
0830-1030 Infrastructure Planning and Management MGT

175 **DESIGN AND DEVELOPMENT OF A PHYSICAL LAND SUITABILITY SYSTEM BY USING GEOGRAPHIC INFORMATION SYSTEM FACILITIES IN ORDER TO USE IN REGIONAL & LOCAL PLANNING IN IRAN.**
Mehrdad Nemarzadeh,
Room No. 125, 1 st. floor, Central Building of Ministry of Agricultural Jahad, Keshavarz Blvd.Tehran - 14155, Iran

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* Malaysian Centre for Remote Sensing (MACRES), No. 13, Jalan Tun Ismail 50480, Kuala Lumpur, Malaysia
** Remote Sensing Department, Faculty of Engineering and Geoinformation Science, Universiti Teknologi Malaysia, Locked Bag 791, 80990 Johor Bahru, Malaysia

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* Centre For Geoscience and Engineering, Anna University, Madras - 600 025, India
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* Bangladesh Space Research and Remote Sensing Organisation (SPARRSO), Dhaka - 1207, Bangladesh
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LBI Building#57 Kalayaan Avenue, DiliimanQuezon City 1101, Philippines

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O. Quader, Z. Islam, H. Rahman, M. Rahman, M.H. Sarkar, A.Salam Khan,
Bangladesh Space Research and Remote Sensing Organization (SPARRSO), Agargaon, Dhaka-1207, Bangladesh

附錄二：研討會論文發表全文

MOBILE GEOGRAPHIC INFORMATION SYSTEMS FOR WATER RESOURCE PROTECTION

Mu-Lin WU[a], Chiou-Hsiung CHEN[b], Shiu-Feng LIU[b], Jiun-Sheng WEY[b]

[a]Civil Engineering Dept., National Pingtung Univ. of Science and Technology, 39-13 TongZong Road, Dali, Taichung County, 41244, TAIWAN, Email: mlwu@seed.net.tw
[b]Taipei Watershed Management Bureau, WRA, MOEA, 5, Lane 45, Sec. 1, Peihsin Road, Hsien-Ten, Taipei 231, TAIWAN, Email: jiunshen@wratb.gov.tw

KEY WORDS: Water resource protection, GIS, GPS, remote sensing.

ABSTRACT:

Implementations of Geographic information systems, remote sensing, and GPS for water resource protection at Taipei Watershed Management Bureau (WRATB) have been pursued for more than a decade. The objective of water resource protection management at WRATB is to provide sustainable drinking water for about four millions people in Taipei. The quality of drinking water in Taipei is one of the best in Taiwan. This is a nice proof of well-done job at WRATB. Water resource protection at WRATB is not simple a job of traditional water management. WRATB is more like a county government agency rather than a typical water resource management authority. WRATB has to take care of soil and water conservation, sewage management, house management, garbage collection, illegal land use enforcement, tree plantation, and water resource management simultaneously. Jobs have to be done in office and in the open field efficiently. Integration of remote sensing, GIS, and GPS in the past several years for water resource protection at WRATB has provided options other than traditional approaches. The objective of this paper is to discuss how mobile GIS was developed and implemented at WRATB. A personal digital assistant (PDA) device is one sort of palm-size computers for open field implementations. ArcPad 6.0 software was chosen for PDA to integrate GPS, GIS, and remote sensing in the open field. Microsoft embedded visual Basic was the programming language for attribute manipulation and data base operations for PDA. Customized and personalized field solutions for water resource protection were then can be done in an easy way. Parcel information is the key component for field operations such as illegal land use enforcement, illegal housing enforcement, water pollution control, and sewage management. With a little bit of visual Basic programming, the owner and address for

a given piece of land parcel can be extracted on a PDA which was attaching to a hand-held GPS device in the open field. Display, query, and map navigation were done by ArcPad. Customized data base manipulations were accomplished with embedded visual Basic programs. The rest of field operations and paper works were taken cared by Basic programs as well. PDA has its drawbacks to overcome such as 32 MB RAM or 64 MB RAM and a 320X240 display resolution. The most important part of the whole process is to accomplish all types of customization in the personal computers and then deployed to PDA. One of nice functions provided by ArcPad is hyperlinks between map components and their relevant attributes of the data bases. Additional information such as zoning codes, house site maps, sewage facility maps, and land slide sites were then added as additional map layers. In short, mobile GIS for water resource protection at WRATB have paved a way for jobs can be done easily both in office and in open field. More applications of PDA and mobile geographic information systems for water resource protection at WRATB were scheduled for further studies.

1. INTRODUCTION

Taipei Watershed Management Bureau (WRATB) is one of the eleven watershed management authorities in Taiwan. It is in charge of water resource protection in order to provide sustainable drinking water for about four millions population in Taipei. There are five townships, two major watersheds, one large reservoir, and 717 square kilometres under its jurisdiction. Management prescriptions of water resource protection at WRATB are not confined to traditional approaches. Remote sensing, geographic information systems (GIS), and global positioning systems (GPS) are the three key components for water resource protection. Water resource protection at WRATB is not simple a job of traditional water management only.

The quality of drinking water in Taipei is one of the best in Taiwan. This is a nice proof of well-job done at WRATB. WRATB is more like a county government rather than a typical water resource management authority. At WRATB, both daily operations and long-term management have to looking into those businesses that seem not quite relevant with traditional water resource management such as housing management, house construction supervision, illegal land use enforcement, tree plantation, garbage collection and management. Remote sensing, GIS, and GPS have been implemented to solve problems encountered on water resource protection for many years. This is not a description of working history at WRATB. A series of development have been performed for more than a decade (Wu, et al. 2002). Integration of remote sensing, GIS, and GPS may be the first stage of development for water resource management at WRATB. Web-based GIS may be the second stage of

development. Mobile GIS is the current stage of development at WRATB.

Adequate spatial information can be extracted on the right spot with finger touch in real time is a must for management of water resource protection at WRATB. Both daily operations and long-term management of water resource protection at WRATB have to look into a single watershed, a given township, a single spot, and the whole area simultaneously. How to make the management of water resource protection simple and efficient is the major goal of implementations of GIS.

The objective of this paper is to discuss how mobile geographic information systems were developed and implemented at Taipei Watershed Management Bureau.

2. DEVELOPMENT OF MOBILE GEOGRAPHIC INFORMATION SYSTEMS

Development of geographic information systems at WRATB was a time consuming and expensive process. Data bases have to be set up in the first place. Integration of remote sensing, GIS, and GPS needs more technical effort than budget. Web-based GIS with all Chinese-menu driven is almost a must such that every technician would like to implement for day to day operations at WRATB. Task-oriented application modules that can be customized and personalized for solving certain problems encountered on water resource protection are the key components where mobile GIS can be successful and operational.

2.1 Data Bases Manipulation

Mobile GIS usually implemented a PDA (personal digital assistant) device as its major computer. Although a PDA device is cheap and convenient in the open field, its drawbacks consist of limited data capacity, 32 or 64 mega-bytes, and low display resolution, 320 by 240. Data bases that can be implemented in the open field have to be downsized and categorized in the personal computers and then download into a PDA device.

One single sheet of digital map has to be simplified as many layers as possible in one place but may be needed to organize several similar layers into on single layer for field implementations. Data bases for a given township, a given watershed, a given village, and a given sheet of map have to be manipulated and set up, and they are ready for implementations both in the office and in the open field.

Land parcel information, both maps and attributes, is the basic information for water resource protection management. More than 320,000 pieces of land parcel attributes and maps have

been set up in the data bases. Hyperlinks of attributes and its land parcel maps can be done automatically. Cadastral maps usually come with many types of scale and coordinate systems. They have been rectified and transformed into topographic coordinate system such that overlay with other maps can be done correctly and smoothly. The x and y coordinates for a given location that generated by a GPS device can be shown on a PDA device right away and the associated cadastral information can be inquired accordingly. Further management prescriptions can be adopted as well.

2.2 Software Integration

The Microsoft Windows CE 3.0 Chinese version was implemented for PDA devices. Colour display is a must for a PDA device. ArcPad is the main software for mobile GIS but is not the only one. Microsoft eMbedded Visual Basic was the main program language for data base manipulation and paper works in a PDA device. The data base management program for a PDA device is Pocket Access. It is easy to convert an Access file with MDB extension into Pocket Access file with CDB extension.

The data base file format implemented by ArcPad is DBF. Data base file format has to convert into DBF that can be accepted by ArcPad. The main data bases were stored in Microsoft Access MDB format and SQL Server. It is not difficult to convert into DBF. However, Hyperlinks between DBF and ArcView Shape files need some programming effort. Then, ArcView shape files can be converted into new files for ArcPad in a PDA device. Image file format acceptable by ArcPad is JPG for low resolution and SID for high resolution. For those high resolution image files with very large size say, 500 mega-bytes, ECW file format by Ermapper can be implemented in ArcView without any charge. ArcPad implements XML (extensible mark-up language) as its map documents. It will be convenient if one can modify ArcPad map documents to show some personal flavour. In this case, a little bit of XML knowledge is required.

One of several nice properties of ArcPad is that a point information with x and y coordinates given by a hand-held GPS device can make integration of remote sensing, GIS, and GPS easily.

2.3 Task-Oriented Application Modules

Customization and personalization are two big reasons for implementation of ArcPad. Usually, application modules were developed only to meet some requirements at a department-level at WRATB. There are five departments at WRATB. Each department has their own jobs to be

done in order to protect water resource at WRATB. Task-oriented application modules were developed on a build-to-order basis to solve problems encountered at every department. But it is more desirable that application modules can be developed to meet requirement at a personal level. With some manipulations of the data bases, it is not difficult for development of application modules using ArcPad and a PDA device together.

3. IMPLEMENTATION OF MOBILE GIS

There are five departments at WRATB. Each department have several types of management to be done in order to pursue water resource protection. Whenever one type of jobs that requires maps and x, y coordinates, mobile GIS can be implemented. Although mobile GIS is mainly for implementations in the open field, it is very convenient for indoor implementations as well. It is a simple a process that personal computers were used instead of PDA devices. On the other hand, the whole process is more powerful that drawbacks of a PDA device can be got away.

3.1 Water Quality and Quantity Monitoring

There are two major watersheds at WRATB. Water quality and quantity monitoring is one of the several essential processes for water resource protection. Both water quality and water quantity are required for protection at WRATB. Twelve monitoring stations and four gauge stations were set up at three major rivers. Locations of these stations have been verified by GPS devices and shown on the map ready for field inspection. A PDA device was mainly used for field data collection and comparison with the data stored in the data bases. Water pollution monitoring and control have been managed based on analysis of data collection on those stations. Fortunately, water quality is always good enough for drinking water.

3.2 Land Use Monitoring and Enforcement

Land use classification of the two watersheds has been done recently. Land use maps at a scale of 1:5,000 have been converted from MapInfo file format into ArcView shape file format. The landslide layer was extracted as a single map and serves as the basic map information for landslide management. Vector maps such land uses can be converted into high resolution image files that they can serve as background information. Since the x and y coordinates were retained in the image files, land uses information can be implemented in the open field as a single layer. However, a single land use image file for a given sheet of map at a scale of 1:5,000 has a file size of more than 150 mega-bytes. With the help of image compression software, the large image file size is not a problem at all. On the contrary, it can

be implemented in a more user-friendly way.

Remote sensing is good for land use monitoring. SPOT satellite images with a pixel resolution of 12.5 meters are the typical images for large area monitoring. Several SPOT images taken at different dates were built into the data bases. All SPOT images are ready for overlay with the vector maps in the data bases. Land use enforcement requires cadastral information for a given piece of land. Zoning information and sewage facility information are the two other types of information may be essential for management prescriptions.

3.3 Cadastral Information

Cadastral information for a given piece of land is the most important information required for water resource protection management at WRATB. Cadastral maps at a scale of 1:5,000 and their associate attributes were built into the data bases. Hyperlinks between land parcel and its attributes were accomplished such that cadastral information can be extracted in several ways. Cadastral information can be extracted and inquired in ArcView, ArcPad, ArcExplorer, and Microsoft Internet Explorer. In the open field, a PDA device and a hand-held GPS device would indicate cadastral information for a given piece of land such as land parcel number, land owner, address with the help of ArcPad. This is one type of inquiry between maps and its attributes. Attribute inquiry can be done by Pocket Access in PDA and by Visual Basic in personal computers.

3.4 Landslide Management

There are many landslide sites to be monitored closely at WRATB. Landslide site maps have been extracted from the land use maps at a scale of 1:5,000. One SPOT satellite image was overlay as the background information. Although the landslide maps were extracted from more than 70 sheets of maps at a scale of 1:5,000, its file size is small enough for PDA and ArcPad implementation. Soil and water conservation engineering needs location of every single site of landslide at WRATB. What kind of management prescriptions for a given landslide site can be taken accordingly. Long-term monitoring of landslides are possible and efficiently.

3.5 Sewage Management

There are two large sewage treatment systems to manage the two major watersheds at WRATB. The whole sewage system consists of three large sewage treatment plants and nine small plants. More than 80% of households have their sewage collected to one of the three

plants. Sewage management is one of the major forces to develop mobile GIS at WRATB. Sewage data bases consist of large scale layout and construction maps. Sewage application modules have been developed to depict the collection systems rather than geographic locations. Those sewage-to-be-collected houses locate in remote areas and away from business quarters are the major priority for further sewage management. Day to day operation of sewage management has to look into sewage facility house by house. Maintenance of sewage systems is also a very delicate process. With the help of mobile GIS, sewage management is more efficient than before.

4. CONCLUSIONS

Taipei Watershed Management Bureau (WRATB) is responsible for water resource protection of two watersheds covering an area of 717 square kilometres. Its management prescriptions can not confine to traditional approaches because of four million populations in Taipei. The demand of sustainable supply of high quality drinking water is the major driving force. Watershed management is the typical top priority of water resource protection when traditional approaches were implemented. Mobile geographic information systems development and implementation for water resource protection at WRATB was one step beyond integration of remote sensing, geographic information systems, and global positioning systems.

Mobile GIS for water resource protection at WRATB have paved a smooth way for jobs can be done easily both in the office and in open field. More application modules, not discussed in this paper, for management of water resource protection at WRATB can be developed to serve more types of jobs that have to be done daily and in the long term in the near future.

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附錄三：研討會有關水資源論文之摘要

COMPUTATION OF ATMOSPHERIC WATER VAPOUR MAP FROM MODIS DATA

KEYWORDS: Modis, ATmospheric Water Vapour

Water vapour is a highly variable constituent in the atmosphere. From the visible region to thermal region of the electromagnetic spectrum, it is one of the culprits hindering the measurement of actual radiance and reflectance from the surface. Remote sensing of total columnar water vapour is made possible by the special bands included in the MODiS sensor onboard the TERRA satellite. Band 17)0.89-0.92mm), band 18(0.931-0.941mm) and band 19(0.915-0.965mm) are used for water retrieval. Together with the two non-absorption bands, band 2(0.841-0.876mm) and band 5(1.23-1.25mm), total columnar water vapour can be derived from comparison of the reflected solar radiation in the absorption band and nearly non-absorption bands. Reflectance values for a given wavelength is different for different reflectance surfaces, hence, it is not possible to obtain transmittance from a single band. If surface reflectance is constant with wavelength, then a two band ratio consisting of a absorption band and a non-absorption band can be used to compute the water vapour transmittance. If surface reflectance varies linearly with wavelength, then three band ratio is used comprising of one absorption band and two non absorption band. Lookup tables consisting of water vapour transmittance for different viewing angles and total precipitable water were generated suing MODTRAN. Total columnar water vapour for Sun-surface-sensor path is derived from the lookup tables. Retrieval of water vapour is done pixel by pixel for the entire image and hence water vapour map per day can be generated. With the water vapour map, other MODIS bands can be corrected for water vapour absorption. The water vapor distribution maps generated at different dates also enable multi-temporal monitoring of atmospheric moisture, which can be an indication of drought conditions in the region.

AGNES LIM
Centre for Remote Imaging, Sensing and Processing (CRISP), National University Singapore
Blk. SOC1 Level 2,
Lower Kent Ridge Road,
Singapore 119260, Singapore
Phone: 65-68744411
Fax: 65-67757717
Email: crslima@nus.edu.sg

CHEW WAI CHANG
Centre for Remote Imaging, Sensing and Processing (CRISP), National University Singapore
Blk. SOC1 Level 2, Lower Kent Ridge Road, Singapore 119260, Singapore
Phone: 65-68744411
Fax: 65-67757717
Email: crsccw@nus.edu.sg

SOO CHIN LIEW
Centre for Remote Imaging, Sensing and Processing (CRISP), National University Singapore
Blk. SOC1 Level 2,
Lower Kent Ridge Road,
Singapore 119260, Singapore
Phone: 65-68744411
Fax: 65-67757717
Email: crslsc@nus.edu.sg

LEONG KEONG KWOH
Centre for Remote Imaging, Sensing and Processing (CRISP), National University Singapore
Blk. SOC1 Level 2, Lower Kent Ridge Road, Singapore 119260, Singapore
Phone: 65-68744411
Fax: 65-7757717
Email: crsklk@nus.edu.sg

OIL SPILL DETECTION WITH THE RADARSAT SAR IN THE WATERS OF THE YELLOW AND EAST CHINA SEA

KEYWORDS: Radarsat, synthetic aperture radar, oil spills, detection

ANDREI YU. IVANOV
P.P.Shirshov
Institute of Oceanology,
Russian Academy of Sciences
Nakhimovsky pr. 36,
Moscow 117851,
Russia
Phone: 7 (095) 124 73 92
Fax: 7 (095) 124 59 83,
Email: ivanoff@sio.rssi.ru

MING-XIA HE
Ocean Remote Sensing
Laboratory, Ocean University of
Qingdao,Yushan Road 5, Qingdao,
Shandong, 266003
China
Phone: 86-532-2032902
Fax: 86-532-2032909
Email: mxhe@ns.qd.sd.cn

MING-QIANG FANG
Ocean Remote Sensing
Laboratory, Ocean University of
Qingdao,Yushan Road 5, Qingdao,
Shandong 266003
China
Phone: 86-532-2032902
Fax: 86-532-2032909
Email: mxhe@ns.qd.sd.cn

This application study highlights the potential of wide-swath synthetic aperture radar (SAR) imagery for the regional oil pollution monitoring. The paper presents the results of the oil spill observations with the Radarsat SAR in the Yellow Sea and East China Sea. A set of full-resolution Radarsat SAR images (in ScanSAR Narrow mode) has been collected over the China Seas in November 2000 and analyzed for presence of oil spills. By using visual and image processing methods oil spill candidates on the Radarsat SAR images have been selected, their locations defined, detection statistic estimated and possible risk areas outlined. Results show that generally small oil patches (about several km) are uniformly distributed along the main ship routes and have been probably released from ships. Large oil slicks were observed near the coastline close to big seashore cities/ports, oil exploitation areas and river mouths (the Yangtze River mouth). Additionally collected data on sea/weather conditions indicate that all oil spill candidates have been detected in a comparatively narrow range of wind conditions (winds between 5 and 10 m/s) and in a wide range of oceanographic conditions. Comparison of capabilities of the Radarsat SAR, in its ScanSAR Narrow-A mode, and the ERS-2 SAR, for oil spill detection has shown that the first one is much more valuable tool for oil spill detection/localization due to wide swath and short revisit time, but detectability essentially depends on wind conditions. The results also indicate that despite the international/domestic conventions and legislation, oil spills in the sea are still remaining a main unsolved and uncontrolled ecological problem.

THE WATERSHED BASED SEGMENTATION APPROACH FOR HIGH RESOLUTION SATELLITE IMAGES

KEYWORDS: High Resolution Satellite Images, Image Segmentation, Watershed.

LI-YU CHANG
Center for Space and Remote Sensing Research, National Central University
Tauyan
China Taipei
Fax: 886-3-4273587
Email: lychang@csrsr.ncu.edu.tw

CHIN-FAN CHEN
Center for Space and Remote Sensing Research, National Central University
Tauyan,
China Taipei
Fax: 886-3-4273587
Email: cfchen@csrsr.ncu.edu.tw

Recently, the spatial resolution of earth observation satellites is significantly increased to a few meters. Especially, the Quick Bird Satellite has the resolution near 0.6 meters for panchromatic images. Such high spatial resolution images definitely will provide lots of information for detail-thirsty remote sensing users. However, it is more difficult to develop algorithms for automated image feature extraction and pattern recognition due to the complex image content of high spatial resolution satellite images. In this study, we propose an image segmentation method based on watershed technique to perform object extrextion for high spatial resolution images. Firstly, we use a Gaussian operator as a smooth mechanism to reduce the local variance of input image. Secondly, the square sum of the images produced by Sobel operators in column and row directions is used to measure intensity of edge for smoothed image. Then, based on the watershed technique of morphological theory, the concave regions in the edge image can be detected and obtain an initial segmentation result. At last, we eliminate small segments by merging the neighboring patches based on the threshold of gray level difference and obtain a refined result.

In this study, we use panchromatic images of the Quick Bird Satellite (0.6m) as test data. Compared with the segmentation by isodata classification, the primary experimental result shows that the proposed technique can generate a more compact and meaningful segmentation result.

WATERSHED MANAGEMENT APPROACH USING GRASS GIS

KEYWORDS: Watershed management, GRASS, Erosio

RAGHUNATH JHA
GPO 8975, EPC 1970,
Kathmandu
Nepal
Phone: 981041966
Fax: +977-1-267304
Email: rnjha@ioe.edu.np,
raghunathjha@hotmail.com

The general purpose of using geographical information systems (GIS) is to collect, analyse, manipulate and display spatial data with their associated attributes. During the last decades a variety of GIS have been developed. Private companies as well as governmental, municipal organizations and universities are using these systems. Geographical information systems offer a simple and efficient way of spatial analysis.

A powerful GIS-package is the GRASS-Software. The name of GRASS-GIS is an abbreviation for "Geographic Resource Analysis Support System". It is a hybrid GIS-package - it manages raster, vector as well as point data and contains image processing modules. GRASS was released to public in the year 1989. GRASS is free GIS software available at ftp sites. It is a development of the U.S. Army Corps of Engineers, especially CERL (Construction Engineering Research Lab). Since 1997 it is maintained by "The GRASS Research Group" at Baylor University, Waco (Texas), U.S.A. Several institutes have produced such modules - for erosion predicting, watershed modelling, image classification, chemical solution transport etc.

Bagmati basin of Nepal is a basin starts from Middle Mountain, passes though Siwalik, and Terai. The Bagmati River originates from the Shivapuri Mountain, which is situated to the north of the Kathmandu valley. The river flows in a southwesterly direction across the valley and passing through a gorge called Chobhar gorge. From here the river continues flowing towards southeast and then towards south having joined by several tributaries and ultimately passing trough the Terai of Nepal and flowing into the river Ganges in India. The total catchment area at the end of the Siwalik range is nearly 4000 km2. The topography comprises narrow valleys and steep slopes including fragile Siwaliks. The monsoon rain makes the whole watershed area prone to soil erosion, galley formation and landslides in the hills and flooding in the valleys and the flood plain.

In this research authors have used GRASS GIS in watershed management, a case study in Bagmati river basin. In this study contour, landuse, soil, river network are used to generate different watershed management maps. Contour map is used to generate DEM and DEM is used to prepare slope maps. Slope map and landuse maps are combined together to find out the area of different landuse on different slopes. Soil erosion hazard map for the Bagmati catchment is calculated using Revised Universal Soil Loss Equation (RUSLE). The LS factor of this equation is calculated from DEM. The rainfall, soil factor and crop factors are taken from different researches. Erosion from each cell is calculated and re-classified into five groups (very low, low, moderate, high and very high). This map will be helpful to the planners to emphasize their effort to minimize the soil erosion.

PARTICIPATORY WATERSHED MANAGEMENT PLANNING FOR THE SUSTAINABLE DEVELOPMENT - TINAU SUB-WATERSHED, PALPA, NEPAL

KEYWORDS: Watershed management, participatory watershed management planning

SHYAM SUNDHAR SHRESTHA
Watershed Conservation Officer
Department of Soil Conservation and
Watershed Management
Ministry of Forests and Soil Conservation
His Majesty's Government of Nepal
Nepal
Email: sss@healthnet.org.np

Nepal is a mountainous country with thousands of sub-watersheds. The sub-watersheds in Nepal suffer a certain degree of degradation. Financially as well as biophysically fragile countrys government only cannot bear all the expenses for the watershed management planning. Hence, other sectors such as NGOs, INGOs and peoples participation is the most essential alternatives. Government of Nepal is forwarding its attention to manage the sub-watersheds of the country on the basis of the concept of peoples participation since last decade. Peoples participation in watershed management planning for the sustainable development is a decision tool, which guides for efficient allocation of scarce resources in minimizing advancement of degradation.

GIS APPLICATION FOR WATERSHED BOUNDARY CLASSIFICATION

KEYWORDS: Watershed boundary, GIS application, area threshold,

There were development of GIS in the function of many program computer softwares which could manipulate for geographic information in many aspects particularly classification or sketch of watershed boundary. The attained information will be useful for irrigation planning, hydrogeology, flooding protection, soil and water conservation etc. The objective of this study is to classify watershed boundary by GIS. This study was conducted by using of program computer software (IDRISI) for watershed boundary classification of Loei province Thailand. Watershed area were classified at different 3 levels : mini-watershed (area threshold = 50), medium-watershed (area threshold = 100) and macro-watershed (area thershold = 200). The result of this study show that IDRISI can easily be applied to classify watershed boundary, data correction and to be good cooperate with other program computer softwares.

VIDHAYA TRELO-GES
Department of Land Resources and Environment,
Faculty of Agriculture,
Khon Kaen University,
Khon Kaen, 40002
Thailand
Email: vidtre@kku.ac.th

SA-THAPORN PAIBOONSAK
Scientist
Department of Land Resources and Environment,
Faculty of Agriculture,
Khon Kaen University,
Khon Kaen, 40002
Thailand
Email: vidtre@kku.ac.th

TEMPORAL WATER DEPLETION FROM PUBLIC RS DATA.THE DISTRICTS AND IRRIGATION ZONES OF FERGHANA PROVINCE, UZBEKISTAN

KEYWORDS: Evapotranspiration, water depletion, remote sensing, district, irrigation system, Uzbekistan

YANN CHEMIN
PhD student in remote sensing applications (AIT-STAR)
206/7 Kamathawatte Road,
Rajagiriya,
Sri Lanka
Phone: (94)-1-886053
Email: ychemin@yahoo.com

ALEXANDER PLATONOV
Leading Engineer - programmer (GIS/RS)
Scientific Information Center of Inter State Cordination on Water Commision of the Centeral Asia \n
B11, Karasu-4, Tashkent 700187
Uzbekistan
Phone: +9998-721-2652554

The quality of decision making in water resources management is proportionally dependent on the quality (reliability, standardization, spatial and temporal dimensions) of the information pertaining to water fluxes into the unit managed, may it be an irrigation system, an administrative unit or an hydrological (sub)basin. The availability of publicly distributed daily remote sensing data through the Internet comes forth as a high-probable information source for water resources monitoring, within economically strained Central Asian countries. The case of Ferghana province of Uzbekistan in the Syr-Darya river basin, where water is managed across administrative units rather than along basin approach, is analyzed. Remote sensing is proving to be an interesting support tool to analyze variations of spatial nature of water resource depletion in Ferghana Province, but the temporal aspect of the information is of highest interest to pin-point timely restricted water scarcity in some districts and/or irrigated areas. It can be concluded that water management in the Ferghana Province can be supported by public remote sensing measurement of water depletion available within critical return periods.

A COMPARISON BETWEEN DIFFERENT METHODS FOR THE SEPARATION OF WATER AND WETLANDS IN A SMALL LAKE BY LANDSAT-TM IMAGES

KEYWORDS: Lake, wetland, landsat

HAMID TAHERI SHAHRAINI
Civil Engineering Department of Sharif University of Technology, Tehran
Iran
Email: h_taheri@mehr.sharif.edu

MASSOUD TAJRISHI
Civil Engineering Department of Sharif University of Technology, Tehran
Iran
Email: h_taheri@mehr.sharif.edu

ABBAS ALIMOHAMMADI
Civil Engineering Department of Sharif University of Technology, Tehran
Iran
Email: h_taheri@mehr.sharif.edu

AHMAD ABRISHAMCHI
Civil Engineering Department of Sharif University of Technology, Tehran
Iran
Email: h_taheri@mehr.sharif.edu

Separation of primary classes such as water bodies, by satellite images is important for different purposes. When the different wetlands are located near or around the lakes, the mapping of the lakes is rather difficult. The spectral properties of the wetland, after the growth of vegetation on it, are similar to the vegetation cover on the land with water because of the occurrence of water in wetland. The lakes of Puzak, Sabury and Hirmand are located in the southeast of Iran within the boundary between Iran and Afghanistan. These lakes have high temporal variations, with different wetlands surrounding them (especially around of the Puzak lake located in Afghanistan). In this study, different methods were used for mapping the lakes with the landsat-TM images. These methods consist of supervised classification (box, minimum distance, mahalanobis and maximum likelihood), unsupervised classification (clustering), index methods (NDWI (normalized difference water index) and wetness index), principal component analysis(PCA), determination of threshold(threshold by statistical properties of sample set and different bands) and composite of the threshold of different bands. The NDVI and FCC (false color composite) images are used to show the vegetation cover and water bodies region, respectively. These images are used as a criterion for comparing the different methods. The results show, the mahalanobis distance and maximum likelihood classification are the best methods. Also the threshold of band 4, composite of the thresholds of bands 4,5 and 6 and box classification are rather appropriate methods. Different composite of water body maps, that have been created by previous methods, are used for detecting and mapping the wetlands. The results show a composite of NDWI, NDVI and mahalanobis distance or maximum likelihood classification is a very good method for mapping the wetland regions.

UTILITY OF GROUND WATER AND SURFACE WATER OF RANCHI DISTRICT USING REMOTE SENSING DATA GIS

KEYWORDS: Irs, LISS,PAN,HYDROMORPHOLOGY,GIS,SATELLITE

Information of area under water cover and surface water delinet a indirect and direct matter of interpretation by satellite images. The study of area conducted for Hydrogeomorphological studies using IRS, ICSID, LISS-3and Pan data coupled together useful for ground water prospecting and water pollution and extract hydrological para meters of water set from the Remote Sensing and field data monitoring and field checking of in area of slope to make free passage of natural drainage channels which run off-during monsoon.Remote sensing data cover large area in compare to Geophysical prospecting and storage ground water and utility for human being ,ground water harvesting and water pollution .

A.K. SINGH
Remote Sensing Dept.
B.I.T. Mesra
India
Email:
ask_bitmisra@rediffmail.com

BIO-PHYSICAL CONDITION OF ANDHI KHOLA WATERSHED TO ESTIMATE THE LIFE SPAN OF PROPOSED DAM

KEYWORDS: Watershed, Anadhikhola

KIRAN MALLA
Project Development Department
Nepal Electricity Authority
Kathmandu
Nepal
Phone: 977-1-255841
Email: mkiran@wlink.com.np

Watershed degradation is the global problem, which is more serious in developing country like Nepal. Nepal is blessed with enormous capacity of hydropower and tapping of the country's potential of the hydropower becomes an utmost concern for the country's development. Soil erosion, which is a serious problem in hilly areas, becomes especially significant in a country like Nepal, because it is a country that is geologically young, endowed with 'slopey' fragile mountains, and built with rugged surface topography. The erosion processes in the rugged terrain watershed transports lot sediment to the reservoir and is most important factor for reducing the net storage capacity of hydropower. Therefore, monitoring and predicting of siltation of the reservoir become important for the formulation of the strategies for the sustainable management of hydropower generation.

This research deals with the ways and means of predicting of the soil erosion in Andhi Khola Watershed in Nepal using Remote Sensing and GIS. High-resolution satellite data have been found to be very effective in monitoring land cover in hilly area, but required special consideration in classification under shading effect.

Finally, with the parameters of USLE model and modifying it for soil erosion, the productive life span of the reservoir was estimated.

SOIL EROSION MODELLING USING REMOTE SENSING AND GIS:A CASE STUDY OF JHIKHU KHOLA WATERSHED, NEPAL

KEYWORDS: Soil erosion, Morgan Model, Remote sensing, GIS

MANISH KOKH-SHRESTHA
Banepa - 3 Kabhre
Nepal
Phone: 011 61190
Email: manishkokh@hotmail.com

In the process of soil erosion, nutrients rich top fertile soil is lost and it also causes environmental problems due to siltation of lakes, reservoirs and rivers. Inventory on soil loss and prediction of soil erosion hazard is vital from effective soil conservation planning of a watershed for sustainable development. Soil conservation is now a necessity in almost every country of the world under virtually every type of land use.

Information obtained using remotely sensing techniques can help decision makers to prepare resource map accurately in less time and cost. GIS, in other hand, helps in linking those maps with other information related to geographic location and helps modelling, analysing and solving complex problems.

A case study describes and assesses soil erosion in a watershed belonging to the river Jhikhu Khola, in the middle mountain region of Nepal. Using Erdas and ILWIS software, a landuse map was generated from satellite imagery of the study area.

For the estimation of Soil loss by Morgan approach, the various factor maps like kinetic energy of rainfall, Top soil rooting depth, percentage rainfall contributing to permanent interception and stream flow, Crop cover management factor, Ratio of actual to potential evapotranspiration, Soil moisture storage capacity were generated to get final output maps like Volume of overland flow; Rate of soil detachment by raindrop impact, Transport capacity of overland flow. Annual soil loss estimation is calculated by comparing two maps of soil detachment rate and transport capacity and taking the minimum value from them.

Results provided by running a soil erosion model show that rainfed agriculture is contributing maximum soil losses, 32.5 t/ha/yr. The lowers soil losses are recorded under forest cover (0.01 -0.4 t/ha/yr) and irrigated agricultural land (0.9 t/ha/yr). Average annual soil loss of the study area is 12.6 t/ha.

APPLICATION OF REMOTE SENSING TO WATER RESOURCES MANAGEMENT IN ARID REGIONS OF CHINA

KEYWORDS: Remote sensing, Water resources, Arid region

LI JIREN
Remote sensing Technology Application Center
Ministry of Water Resources
20 West Chegongzhuang Road
Beijing 100044
China
Phone: +86-10-68415522
Fax: +86-10-68714236
Email: lijiren@iwhr.com

YAN MUSUI
Remote sensing Technology Application Center
Ministry of Water Resources
20 West Chegongzhuang Road
Beijing 100044
China
Phone: +86-10-68415522
Fax: +86-10-68714236

China is lack of water resources, especially in its arid regions. So the management of water resources in these areas is very important. Remote sensing technology has its special advantage in this aspect. The paper introduces the application of remote sensing, including GIS, in this field, such as surface water resources and investigation, groundwater exploration, dynamic monitoring of ecology, salinisation, water environment and deserfication, drought monitoring, planing of water diversion project between basins and so on. It shows that remote sensing technology can play important role for West China development, especially in northwest China.

附錄四：研討會照片

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(左起：魏俊生工程員，劉秀鳳課長，李三畏理事長，伍木林教授)

論文發表

論文發表主持人

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經濟部水利署臺北水源特定區管理局
台北縣新店市北新路一段45巷5號4樓
總機：(02)29173282
傳真：(02)29180335