C. 付録

5th Digital Earth Summit 記録

Contents

Welcome Message

Chancellor, Prof. Atsuo Iiyoshi, Chubu University

On behalf of the greater community in Japan dedicated to the DE activities, it is my honor to submit a proposal for hosting the 5th Digital Earth Summit, 2-4 November in Nagoya, Japan. IDEAS (International Digital Earth Applied Science Research Center, Chubu University) and DE community of Japan are fully committed to provide a world-class venue for continuing the tradition of bringing nations and institutions of the world together for the purpose of sharing the accomplishments in applying advanced technologies and information to the goal of sustainable living on the planet.

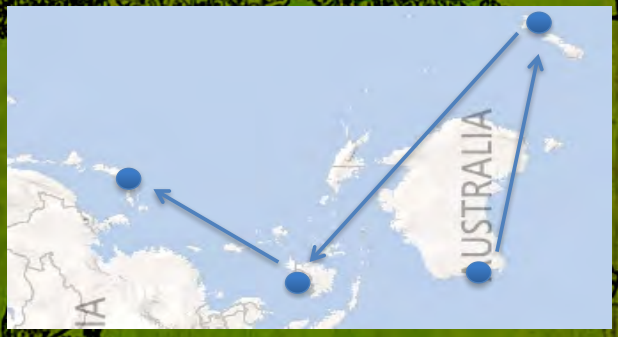
This 5th summit will focus on ESD (Education for Sustainable Development) and Citizen Science, i.e., what Digital Earth can contribute for ESD and Citizen Science. It will be a side-event of the World Conference on ESD, End of the Decade meeting, Nagoya, Japan

Location of Nagoya

Past Venue

Symposium
1999 Beijing, China
2001 Brundswick, Canada
2003 Brno, Czech
2005 Tokyo, Japan
2007 Berkley, USA
2009 Beijing, China
2011 Perth, Australia
2013 Sarawak, Malaysia

Summit
2006 Auckland, New Zealand
2008 Berlin, Germany
2010 Nessebar, Bulgaria
2012 Wellington, New Zealand
2014 Nagoya, Japan



Recent DE Events;
Great variability in Latitude

Background

Aichi-Nagoya and International Events on Sustainability

2014 World Conference on ESD, End of the Decade meeting

2010 CBD (Convention on Biological Diversity) COP10

Hop, Step, Jump!!

2005 2005 Japan International Exposition
Theme: *Nature's Wisdom*

2005~2014 : UN Decade of Education for Sustainable Development(ESD)

Background

2005: Aichi EXPO

Theme:
Nature's Wisdom

EXPO 2005 AICHI JAPAN emphasized the close links binding humanity to nature in the 21st century through its theme of "Nature's Wisdom."

The EXPO gave visitors a chance to experience at first-hand the leading-edge technologies, new social systems and future lifestyles that may provide solutions to the many serious issues now facing the entire world. This was also an opportunity for people from all nations to share their varied insights and unique approaches, and to lay the foundations for working together on a global scale. We believe this EXPO will leave an enduring legacy for our children and for the whole world, and we extend our heartfelt thanks and appreciation to all who participated, and to the vast numbers of visitors who came from all over the world.

http://www.expo2005.or.jp/en/

Background

2010: Biodiversity COP10

The tenth meeting of the Conference of the Parties to the Convention on Biological Diversity was held at the Nagoya Congress Centre in the City of Nagoya, Aichi Prefecture, Japan, from 18 to 29 October 2010.

The outcomes of CBD COP10 are adaptation of **Nagoya Protocol on ABS and Aichi Target (Post 2010 Target), as well as launching UN Decade of Biodiversity (2011-2020).**

Achievements of the COP10

- ◎ **Nagoya Protocol on ABS**
- ◎ **Aichi Target (Post 2010 Target)**
- ◎ **UN Decade of Biodiversity (2011-2020)**

Background

2014: World Conference on ESD (UNESCO)

Nagoya Congress Center

2009 Mid of decade Conference (Bonn)

- Education for Sustainable Development means including key sustainable development issues into teaching and learning; for example, climate change, disaster risk reduction, biodiversity, poverty reduction, and sustainable consumption. It also requires participatory teaching and learning methods that motivate and empower learners to change their behavior and take action for sustainable development. Education for Sustainable Development consequently promotes competencies like critical thinking, imagining future scenarios and making decisions in a collaborative way.
- Education for Sustainable Development requires far-reaching changes in the way education is often practiced today.
- UNESCO is the lead agency for the UN Decade of Education for Sustainable Development (2005-2014).
- http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/

Conference Venue

Wink Aichi

Name	Winc Aichi
Location	4-38 Meieki Nakamuraku Nagoya Aichi Japan 450-0002
Contac	TEL: 052-571-6131
Access	3Min from Nagoya Station
URL	http://www.winc-aichi.jp/

Accommodation

Hotel	URL	Price (USD)	Star
Nagoya Marriott Associa	http://www.associa.com/english/nma/	180	5
the Westin Nagoya Castle	http://www.castle.co.jp/wnc/en/aboutus/index.html	170	5
Royal Park Inn Nagoya	http://www.royalparkhotels.co.jp/en/hotel_list/nagoya.html	140	4
Daiwa Roynet Hotel Nagoya-Ekimae	http://www.daiwaroynet.jp/english/index.html	120	3
Hotel Louest Nagoya	http://www.louest.co.jp/e_home.html	80	2

Tour

Nagoya Castle

Castle tower

Nagoya Castle was constructed in 1612 by order of Tokugawa Ieyasu (*1). Although burned down in World War II, five levels of large castle towers (about 48m) and small castle towers were rebuilt in 1959 with a pair of golden shachihoko (legendary dolphin-like fish) perched on the castle roof. The restoration of Hommaru Palace (*2) in Nagoya castle started in 2009, for a cost of 15 billion yen, and you can visit the restoration site. It receives 1,520,000 visitors a year.

*1 Tokugawa Ieyasu:
The warlord of the Age of Civil Wars (the end of 15th century to the end of 16th century). He united the whole country and founded the shogunate in Edo (now Tokyo). He was born in Aichi and was one of three great Japanese warlords, along with Oda Nobunaga and Toyotomi Hideyoshi.

*2 Hommaru Palace:
It was originally built to be the offices and residence for the founding Lord of the Owari Clan, Tokugawa Yoshinao (*Please see the footnote of "i".).

Nagoya Hospitality Warlord Group

Aichi Hospitality Princess Group

Name	Nagoya Castle
Location	1-1 Hommaru, Naka-ku, Nagoya 460-0031, Japan
Contact	Nagoya Castle Administration Office Tel: +81(0)52-231-1700 Person in charge: Tatsuya Nakane E-mail: nagoyajo@shiminkeizai.city.nagoya.lg.jp
Access	From Nagoya Station - Drive for about 10 minutes via general road
URL	http://www.nagoyajo.city.nagoya.jp/13_english/index.html

Tour

Nagoya City Science Museum

Appearance of the planetarium

Scene of the planetarium show

Tour of the largest planetarium in the world

The Nagoya City Science Museum is a comprehensive museum located within the Shirakawa Park (*), a forest park of art and science.

The museum was renovated and reopened on March 19, 2011. It attracted 1.27 million people by the end of 2011.

It has "Brother Earth", the world's largest planetarium which is listed in the Guinness Book of Records.

There are about 250 varieties of exhibits and demonstrations such as large-scale exhibitions, which offer visitors the opportunity to experience the marvels of nature and to feel closer to science.

*Shirakawa Park:

Park located in the central area of Nagoya City.

There is a science museum and an art museum in the park.

Name	Nagoya City Science Museum
Location	17-1, Sakae 2-chome, Naka-ku, Nagoya 460-0008, Japan
Contact	Tel: +81-(0)52-201-4486 +81-(0)52-231-9771 (Group Reservations) Person in Charge: Norifumi Hiramatsu
Access	From Nagoya Station - Drive for about 10 minutes via general road
URL	http://www.ncsm.city.nagoya.jp/en/index.html

Tour

Magome

http://www.japan-guide.com/e/e6076.html

Magome is a post town in the Kiso Valley, which served travelers of the Nakasendo, a major route connecting Tokyo with Kyoto during the Edo Period.

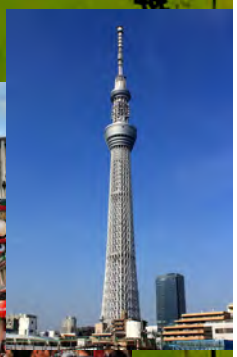
The town has been beautifully restored with a broad stone walkway lined with carefully tended foliage. Magome's embellished preservation contrasts with the rugged authenticity of neighboring Tsumago. The two towns are connected by the Magome-Tsumago Trail, a route which was part of the Nakasendo.

While exploring Magome, visitors will surely come across the name Shimazaki Toson. Born in Magome in 1872, Toson is a highly regarded figure in Japanese literature. In his novel Yoakemae (Before the Dawn), he famously describes life in the area during the early years of the Meiji Restoration. Its often quoted first line reads "The whole of the Kisoji lies in the mountains."

http://www.japan-guide.com/e/e6076.html

Name	Magome village
Location	4300-1 Magome Nakatsugawa Gifu Japan
Contac	0573-69-2653
Access	Magome is connected by bus with JR Nakatsugawa Station, the closest train station. The one way trip takes 30 minutes and costs 540 yen. Buses depart roughly once an hour (see timetable).
URL	http://www.japan-guide.com/e/e6076.html

Good Access to Various Sites in Japan



5th Digital Earth Summit 2014 Nagoya/Japan

Warmest Invitation to Digital Earth community from Japan

5th Digital Earth Summit

国際GISセンター長　教授　福井弘道

2014年11月9～11日、ウインクあいち（名古屋市）で、5th Digital Earth Summitが開催された。以下は福井弘道教授（国際GISセンター長）によるサミットの概要である。

中部大学国際GISセンターと知の統合基盤デジタルアース研究センターは、ISDE（International Society for Digital Earth）が主催する「Digital Earth Summit 2014 国際会議」の現地実行委員会を担当し、2014年11月9日から11日までウインクあいちで第5回デジタルアースサミット（5th Digital Earth Summit）を開催しました。

デジタルアースの取り組み

デジタルアース（以下DE）とは、地上を俯瞰（ふかん）する衛星写真や地図にさまざまな情報を重ね合わせて統合することが可能な情報基盤のことで、環境問題や災害などの全体像を分かりやすく提示して解析、対応策を検討、合意形成に貢献するものです。中部大学は国内唯一のDEの共同利用・共同研究拠点を設置し、DEの具体的な構築、技術基盤の開発とともに、それを大規模広域自然災害や地域から地球までの環境問題など、具体的な社会的要請の高い課題へ応用する取り組みを行っています。

DEの学術からの国際的な取り組みとしては、1999年から2年ごとに国際会議が開催され、2006年にはISDEが設立されるとともに、中間年にDEに関する特定のテーマに焦点を当てたデジタルアースサミットを開催しています。また2008年からは、学術誌『IJDE（International Journal of Digital Earth）』が発刊されています。

サミットの内容

今回の名古屋会議は第5回サミットであり、テーマは2014年11月10日から開催された「ESDに関するユネスコ世界会議」にあわせて、「Digital Earth for ESD」でした。20カ国を超える海外から約80人、国内参加者を含めおよそ140人の参加があり、環境、災害、エネルギーなどの地球規模の諸課題に対して、DEによるさまざまなアプローチの最新研究事例が報告され、Systems ThinkingやCritical ThinkingによるESDや市民科学を強力に支援・推進するツールとしてのDEの活用方法についての議論が行われました。

冒頭、前文部科学大臣政務官の上野通子参議院議員からごあいさついただき、その後、世界のDE研究を主導する研究者らの基調講演、JAXAや企業の企画展示、各分科会などが行われました。

基調講演では、まず総合地球環境学研究所（地球研）の安成哲三所長から、国際科学会議のFuture Earthが紹介され、プラットフォームとしてのDEへの期待が語られました。今後具体的に中部大学はDEで、地球研に協力することになっています。次に、オハイオ州立大学のSui教授は、市民科学や参加型GIS、ビッグデータ等によるDEを利用したクラウドソーシングの可能性について、「DEからGlobal Brainへ」という言葉を紹介して語られました。NASAのTrent博士からは、OMEGA（Offshore Membrane Enclosures for Growing Algae）プロジェクトを持続可能な社会の構築のために推進しようとの提案がありました。これは、藻を生産して同時に廃水を浄化し、さらに二酸化炭素の放出を減らしながらバイオ燃料を作り出すグリーンテクノロジーです。そのためには各分野の技術を統合する必要があり、これはDEの基盤技術と通じるものがあります。GISソフトの開発ベンダーであるESRI社のGould博士からは、DEやGISの技術と空間的な思考は、問題解決型の学習や協働活動が生み出すイノベーションの基盤であり、従来型の教育形態を変革しうるESDに不可欠なものであると指摘されました。

これらの基調講演は、相互に関連する内容に富み、多くの参加者の感銘と共感を得る内容でした。

DEと市民科学の視点から特に、球面ドーム型投影装置を活用した博物館からのDEへのアプローチと空の産業革命と言われているUAV（Uninhabited Aerial Vehicle：無人航空機）の利用に焦点を当てた、展示やワークショップも行われました。

プラネタリウムで プロジェクションマッピングも

サミット前の8日夜には名古屋市科学館の協力を得て、プラネタリウムでフルドームマッピングムービー「Digital Earth Mapping for ESD」を開催しました。世界最大のプラネタリウムのドームスクリーン上に、地球の現在・過去・未来を通じた環境情報や社会経済情報を可視化して、科学コミュニケーションを活性化する試みです。これは、名古屋で開催する室内では初めてのプロジェクションマッピングで、広く一般市民にも開放され200人を超える参加があり、その映像による没入感覚など好評を得ました。

さらに、サミット終了の翌日12日には、名古屋国際会議場でESDユネスコ世界会議併催イベントとして「5th Digital Earth Summit開催報告」が行われ、朝一番の会議でしたが50人を超える参加がありました。基調講演や、エアドームを用いた特設展示ブースの概要を報告するとともに、世界会議出席者へ向けてDEのESDへの有効性が強調されました。

サミットで講演する福井教授

5th Digital Earth Summit へのお誘い

中部大学 国際 GIS センター長　福井弘道

5th Digital Earth Summit への参加登録、発表（口頭、ポスター）の登録、企業展示、スポンサーの登録をお待ちしております。(http://isde-j.com/summit2014)

Digital Earth とは

情報化社会の本質は、サイバースペースにおける意志決定が、リアルワールドに先導的な役割を果たすことにあります。従って、実物世界のメタファーとして、いかに情報が欠落することなくサイバースペースを構築するか、またそれをどのように利用するかは重要な課題です。サイバースペースを、デジタル化された地理空間情報に基づいて構築することによって、実空間から仮想空間への正確な写像が可能になり、様々な自然現象や社会経済活動などを仮想空間上に可視化できます。また同時に、この仮想空間を共有している人間と、コミュニケーションを行い、相互理解・協調作業の場を提供することになります。地理空間情報を多解像度や多次元で高度に活用することによって、再構築されるサイバースペースは「デジタルアース」と呼ばれています。デジタルアースは、地球上の様々な問題複合体の全体像に漸近することを可能とするツールです。

5th Digital Earth Summit

ISDE（International Society for Digital Earth）　は、2006 年から国際シンポジウムの行われない年に、特定のテーマに焦点を絞った Digital Earth Summit を開催しています。これまで、オークランド、ベルリン、ネサバル、ウェリントンの各都市で行われ、2014 年には、11 月 9 日から 11 日の 3 日間、名古屋市のウインクあいちを会場に 5th Digital Earth Summit が開催されます。

今回の Summit のテーマは Digital Earth for ESD(Education for Sustainable Development）であり、同年 11 月 10 日から 12 日までの 3 日間で行われる「持続可能な開発のための教育（ESD）に関する UNESCO 世界会議」と関連します。

Summit では、多くの企画展示や世界の Digital Earth 研究を主導する研究者の基調講演等が予定されています。その中でも今回の Summit の特徴的な企画として、「博物館からの Digital Earth へのアプローチ」を企画しています。Denver Museum of Nature and Science 等が主導する Worldviews Network（http://worldviews.net）では、球面ドーム型投影装置や最新の情報表現技術を用いて、博物館のある地域から、その地域とデジタルアースとのつながりを可視化する取り組みを行っています。Worldviews Network の提供するコンテンツや、360 度カメラ画像、無人飛行機による広角撮影画像など、球面ドームシアターを用いた上映会を、Summit 会場にて行います。

中部大学国際 GIS センターは、今回の Summit の現地実行事務局をつとめています。皆さまの積極的なご参加をお待ちしております。

5th Digital Earth Summit 開催概要

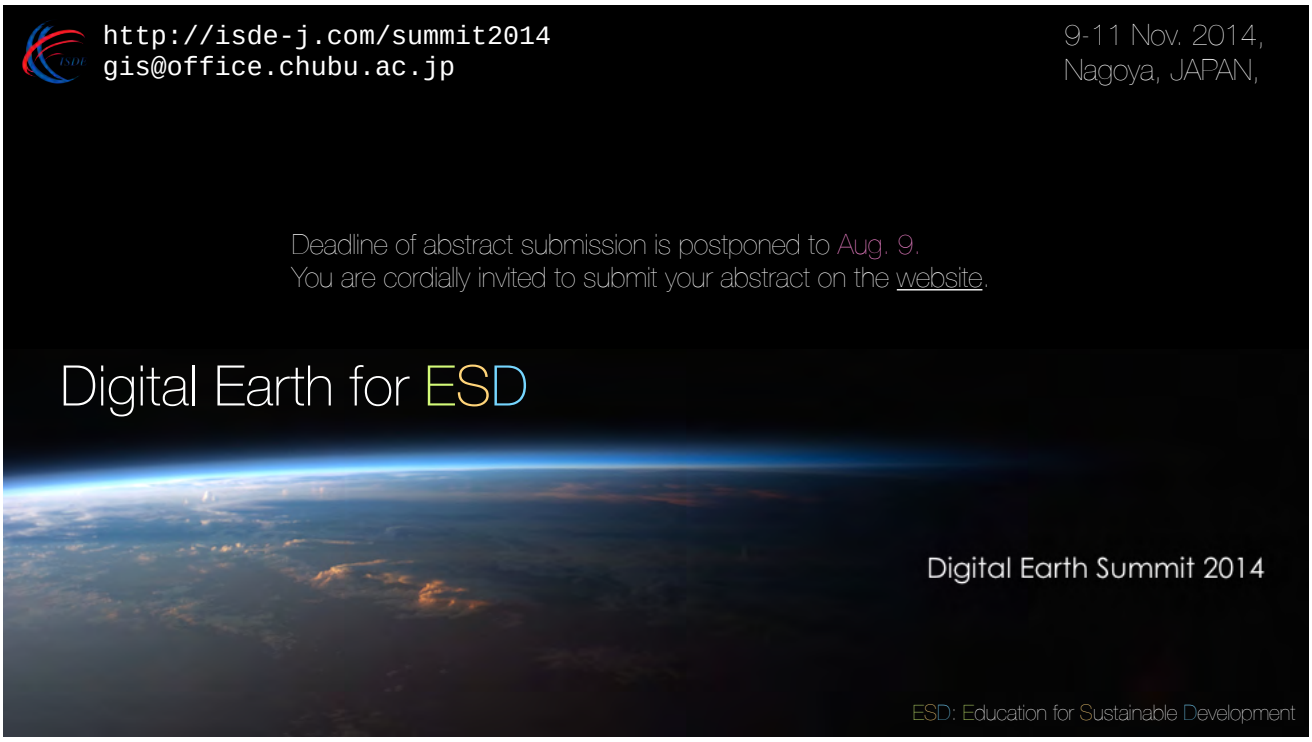
日　時：2014年11月9、10、11日
場　所：名古屋市　ウインクあいち
テーマ：Digital Earth for ESD（Education for Sustainable Development）
発表カテゴリ：

- Education for Sustainable Development
- Citizen Science and Voluntary GI
- Digital Earth Infrastructure（Acquisition, Archive, Web Service）
- Big Data
- Visualization and Scientific Communication
- UAV（Unmanned Aerial Vehicle）
- Disaster Management
- Environment and Agriculture
- City Planning, Geodesign, and Digital City
- Digital Earth Curriculum Development

参加登録費：

	Early Bird Rate (Mar. 9 – Sep. 9)	Regular Rate (Sep. 10 – Nov. 11)
General	JPY 36,000	JPY 40,000
Student（under 30）	JPY 18,000	JPY 20,000
Senior（over 65）	JPY 18,000	JPY 20,000
Welcome Reception（Nov. 9）	Free of Charge	
Banquet（Nov. 10）	JPY 8,000	

連絡先：中部大学国際GISセンター
〒487-8501　愛知県春日井市松本町1200番地
Phone: 0568-51-9894
Email: gis@office.chubu.ac.jp


http://isde-j.com/summit2014
gis@office.chubu.ac.jp
9-11 Nov. 2014,
Nagoya, JAPAN,
Deadline of abstract submission is postponed to Aug. 9.
You are cordially invited to submit your abstract on the website.
Digital Earth for ESD
Digital Earth Summit 2014
ESD: Education for Sustainable Development

5th Digital Earth Summit

Digital Earth for ESD

Nov. 9-11, 2014 @ Nagoya, JAPAN

http://www.isde-j.com/summit2014/

Digital Earthは、米国元副大統領アル・ゴアの提唱した構想です。サイバースペース上に構築される多次元・多解像度の地球を用いて、環境・災害等の地域から地球レベルのリスクを捉え直し、合意形成や意思決定を支援する手法を提供する新しい科学として近年注目されています。

ESD（Education for Sustainable Development）は、１１月１０日から１２日まで名古屋で行われる「持続可能な開発のための教育（ESD）に関するUNESCO世界会議」のテーマで、Digital Earthは、ESDに非常に有効なツールと考えられています。

日時：２０１４年１１月９日（日）－１１日（火）

※９日は一般公開（登録不要、無料）します。
皆さまのご参加をお待ちしております。

会場：愛知県産業労働センター ウインクあいち

主催：International Society for Digital Earth

現地実行委員会：中部大学国際GISセンター

基調講演１：総合地球環境研　安成哲三「Future Earth*」
基調講演２：NASA　Jonathan Trent「OMEGA計画**」
基調講演３：オハイオ州立大　Daniel Sui「参加型GISで地域を変える」
基調講演４：Esri　Michael Gould「問題を基盤とした学習とイノベーションのプラットフォームとしてのGIS」

*Future Earth：国際科学会議（ICSU）の推進する地球環境研究の新たな枠組。
**OMEGA計画：バイオ燃料用藻類を海上で培養。最新複合技術のプラント形成計画。

後援：JAXA、愛知県（申請中）、名古屋市（申請中）

協賛

Gold Sponsor：ESRIジャパン株式会社

Silver Sponsor：株式会社ファルコン、アジア航測株式会社

Bronze Sponsor：株式会社パスコ、日本スペースイメージング株式会社、株式会社デジタルアースラボ、NTT空間情報株式会社、教育産業株式会社、株式会社IHI

お問い合わせ先

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E-mail: gis@office.chubu.ac.jp

CHUBU UNIVERSITY

プログラム

11月9日	ウインクあいち 大ホール（同時通訳）			902
9:30-10:00	**開会挨拶** 学校法人中部大学　飯吉厚夫 理事長 前文部科学政務官　上野通子 参議院議員 ISDE 会長　John Richards 教授 中部大学国際GISセンター長　福井弘道 教授			
10:00-10:30	**基調講演１** 人間文化研究機構総合地球環境学研究所所長　安成哲三 教授			
10:30-10:50	**休憩**			
10:50-11:20	**基調講演２** オハイオ州立大学　Daniel Sui 教授			
11:20-11:50	**基調講演３** NASA　Jonathan Trent 博士			
11:50-12:20	**基調講演４** Esri　Michael Gould 博士			
12:20-14:00	**Lanch Break**			
PM	**伊勢湾台風55周年映画「それぞれの伊勢湾台風」** **※一般公開枠（登録不要、無料）**	**小ホール** **ポスター、企業展示**	14:00-15:00 15:00-15:30 15:30-16:30	**セッション：ESD1** **休憩** **セッション：環境1**

11月10日		小ホール		902	1002
		ポスター、企業展示	9:30-10:30 10:30-11:00 11:00-12:00 12:00-14:00 14:00-15:00 15:00-15:30 15:30-16:30	**セッション：デジタルアース基盤技術1** **休憩** **セッション：デジタルアース基盤技術1** **都市計画、ジオデザイン、デジタル都市** **昼食休憩** **セッション：可視化1** **休憩** **セッション：災害**	**特別企画：UAV** 防災科学技術研究所、他 **特別企画：最新衛星紹介** JAXA

11月11日	ウインクあいち 大ホール	小ホール		902	1002
		ポスター、企業展示	9:30-10:30 10:30-11:00 11:00-12:00	**セッション：ESD2** **休憩** **セッション：環境2**	**セッション：農業** **休憩** **セッション：可視化2、市民科学**
12:00-14:00	**総括、弊会**				

Welcome Address

On behalf of the greater community in Japan dedicated the Digital Earth enterprise, it is my honor to submit this proposal for hosting the 5th Digital Earth Summit, November 9-11 in Nagoya, Japan. International Digital Earth Applied Science Research Center (IDEAS), Chubu University and Digital Earth community of Japan are fully committed to providing a world-class venue for continuing the tradition of bringing together nations and institutions of the world for the purpose of sharing the accomplishments in applying advanced technologies and information to the goal of sustainable living on the planet.

This 5th summit will focus on ESD (Education for Sustainable Development) and Citizen Science, i.e., what Digital Earth can contribute for ESD and Citizen Science. It will be a side-event of the World Conference on ESD, End of the Decade meeting, Nagoya, Japan.

Chancellor, Chubu University
Prof. Atsuo IIYOSHI

Important Dates

Nov.	2013	Announcement and call for papers
May	2014	Notification of abstract
Jul.	2014	Deadline for papers
Sep.	2014	Early registration closed
Oct.	2014	Final Program

Conference Venues

International Symposium on Digital Earth

1999	Beijing, CHINA
2001	Fredericton, CANADA
2003	Brno, CZECH
2005	Tokyo, JAPAN
2007	Berkley, USA
2009	Beijing, CHINA
2011	Perth, AUSTRALIA
2013	Kuching, MALAYSIA
2015	Halifax, CANADA

Digital Earth Summit

2006	Auckland, NEW ZEALAND
2008	Berlin, GERMANY
2010	Nesebar, BULGARIA
2012	Wellington, NEW ZEALAND
2014	**Nagoya, JAPAN**

About ISDE

Digital Earth is a global initiative to construct a comprehensive virtual representation of the planet. It is a collaborative effort between Earth sciences, space sciences and information sciences to monitor and forecast natural and human phenomena. The International Society for Digital Earth is a non-political, non-governmental and not-for-profit international organization, principally for promoting academic exchange, science and technology innovation, education, and international collaboration towards Digital Earth.

ISDE Website (http://www.isde-digitalearth.org)

5th Digital Earth Summit

Digital Earth for ESD
(Education for Sustainable Development)

Nov. 9–11, 2014 Nagoya, JAPAN

International Digital Earth Applied Science Research Center (IDEAS), Chubu University

Address: Matsumoto-cho 1200, Kasugai, Aichi 487-8501, JAPAN

E-mail: gis@office.chubu.ac.jp

Tel: +81-568-51-9959

Fax: +81-568-51-4736

CHUBU UNIVERSITY

Digital Earth for ESD

This planned Digital Earth Summit will focus on how Digital Earth technology and activities has contributed or will contribute to ESD (Education for Sustainable Development). “Education for Sustainable Development allows every human being to acquire the knowledge, skills, attitudes, and values necessary to shape a sustainable future (UNESCO, http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development)”, thus, Digital Earth technology is one of the key technologies to support ESD by visualizing complicated earth system, social system, not only for current situation but from past to future. We planned Digital Earth Summit on the occasion of UNESCO’s World Conference on ESD that will be held in Nagoya, Japan Nov. 10-12, 2014.

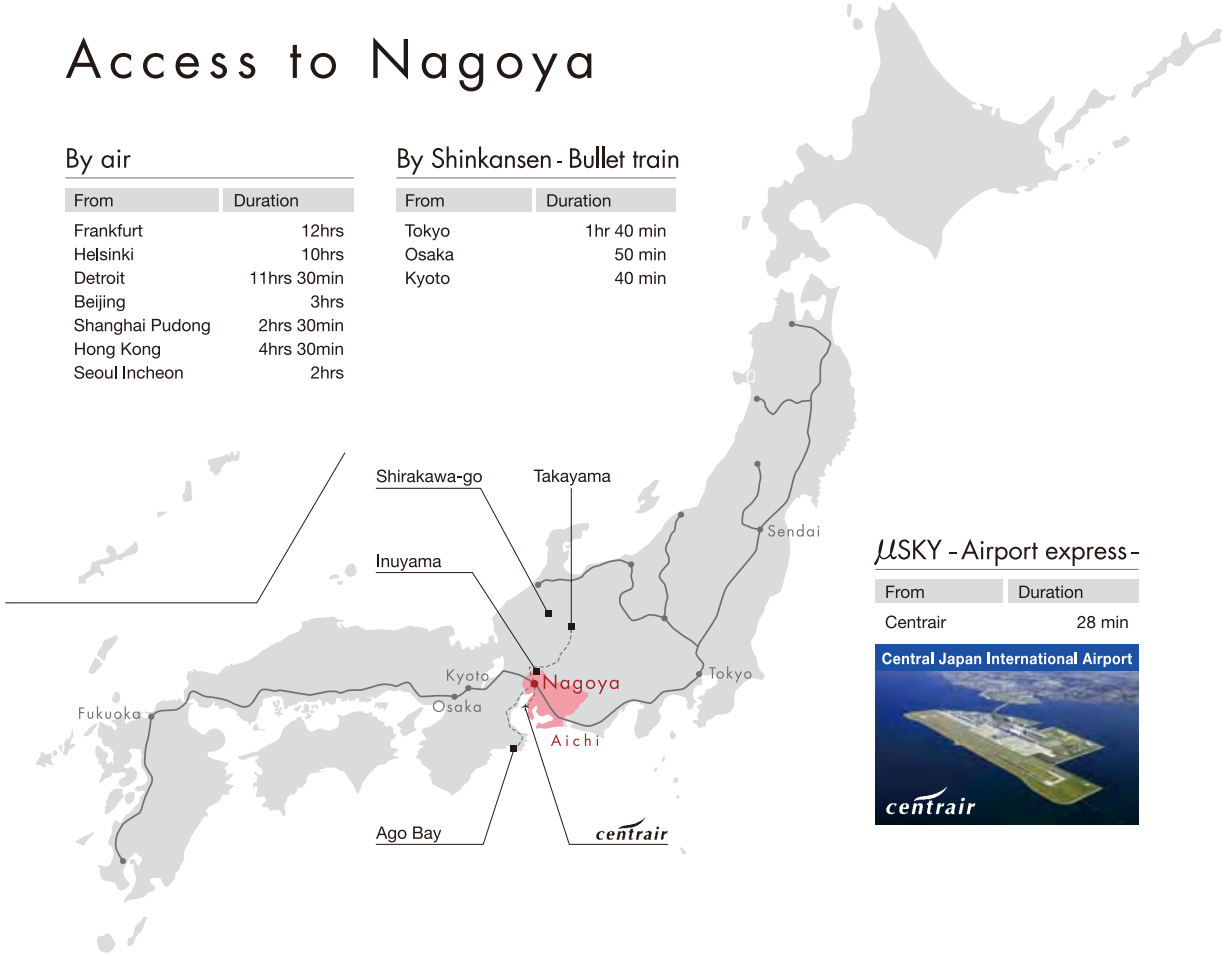
Access to Nagoya

By air

From	Duration
Frankfurt	12hrs
Helsinki	10hrs
Detroit	11hrs 30min
Beijing	3hrs
Shanghai Pudong	2hrs 30min
Hong Kong	4hrs 30min
Seoul Incheon	2hrs

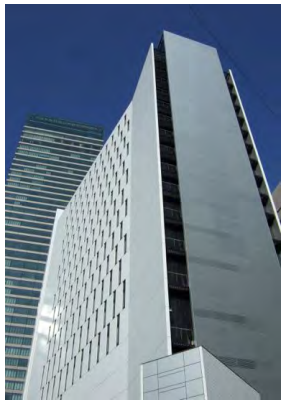
By Shinkansen - Bullet train

From	Duration
Tokyo	1hr 40 min
Osaka	50 min
Kyoto	40 min



μSKY - Airport express -

From	Duration
Centrair	28 min



WINC AICHI

Address: Meieki 4-4-38, Nakamura, Nagoya, Aichi 450-0002, JAPAN

Tel: +81-52-571-6131

Fax: +81-52-571-6132

URL: http://www.winc-aichi.jp

WINC AICHI

5th Digital Earth Summit

Digital Earth For ESD

Program and Abstracts

9-11 Nov. 2014

WINC Aichi, Nagoya, JAPAN

Jointly organized by ISDE, ISDE, CHUBU UNIVERSITY

Welcome Address

On behalf of the greater community in Japan dedicated the Digital Earth enterprise, it is my honor to host the 5th Digital Earth Summit, November 9-11 in Nagoya, Japan. International Digital Earth Applied Science Research Center (IDEAS), Chubu University and Digital Earth community of Japan are fully committed to providing a world-class venue for continuing the tradition of bringing together nations and institutions of the world for the purpose of sharing the accomplishments in applying advanced technologies and information to the goal of sustainable living on the planet. This 5th Summit will focus on ESD (Education for Sustainable Development), i.e., what Digital Earth can contribute for ESD. It will be a side-event of the UNESCO World Conference on ESD, End of the Decade Meeting, Nagoya, Japan.

Prof. Atsuo IIYOSHI, Honorable Chair of LOC, Chancellor, Chubu University

Digital Earth for ESD

This planned Digital Earth Summit will focus on how Digital Earth technology and activities has contributed or will contribute to ESD (Education for Sustainable Development). Digital Earth technology is one of the key technologies to support ESD by visualizing complicated earth system, social system, not only for current situation but from past to future. We planned Digital Earth Summit on the occasion of UNESCO's World Conference on ESD that will be held in Nagoya, Japan Nov. 10-12, 2014.

Greetings from Nagoya

Here in Nagoya, the core city of the central Japan region, visitors will be fascinated by what they discover; culture is embraced by its long history, beautiful scenery changes with the four seasons, and with Japanese hospitality time flows smoothly. For the Digital Earth Summit 2014, come to Nagoya and have an unforgettable experience. We look forward to welcoming you.

Prof. Hiromichi FUKUI, Chair of LOC, Director, IDEAS, Chubu University

Program Committee

John RICHARDS	President, International Society for Digital Earth
Mike GOODCHILD	Professor, University of Carifornia, USA
Milan KONECNY	Professor, Masaryk University, Czech Republic
Guo HUADONG	Professor, Chinise Academy of Science, China
Fred CAMPBELL	Canada FC Consultant Ltd., Canada
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Mario HERNANDEZ	Senior Programme Specialist for Remote Sensing Activities, UNESCO
Temenoujka BANDROVA	Professor, University of Architecture, Civil Engineering and Geodesy, Bulgaria
Gábor Remetey FÜLÖPP	Secretary-general, Hungarian Association for Geo-information, Hungary
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David RHIND	Professor City University London, UK
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Luke DRISKELL	USA
Richard SIMPSON	CEO/Executive Director, Spatial Industries Business Association, Australia
Manfred EHLERS	Professor, University of Osnabrueck, Germany
Vladimir TIKUNOV	Professor, M.V. Lomonosov Moscow State University, Russia
Timothy W. FORESMAN	President, International Center for Remote Sensing Education, USA
John TOWNSHEND	Professor, University of Maryland, USA
Hiromichi FUKUI	Director, International Digital Earth Applied Science Research Center, Chubu University, Japan
Terence van ZYL	Professor, African Advanced Institute for Information and Communications Technology, South Africa
Yola GEORGIADOU	Professor, Univerisity of Twente, Netherlands
Changlin WANG	Professor, Chinese Academy of Science, China
Armin GRÜN	Professor, Eidgenössische Technische Hochschule Zürich, Switzerland
Peter WOODGATE	CEO, Cooperative Research Center for Spatial Information, Australia
Changchui HE	Food and Agriculture Organization, UN
Guanhua XU	Member of the 16th Communist Party of China Central Committee, China

Local Organizing Committee

Ryosuke SHIBASAKI	Professor, Center for Spatial Information Science, The University of Tokyo, JAPAN
Yasushi YAMAGUCHI	Professor, Graduate School of Environmental Studies, Department of Earth and Environmental Sciences, Nagoya University, JAPAN
Keiji YANO	Professor, Department of Geography, Ritsumeikan University, JAPAN
Asanobu KITAMOTO	Associate Professor, National Institute of Informatics, Research Organization of Information and Systems, JAPAN
Chiharu MASAKI	President, ESRI Japan Inc., JAPAN
Atsushi CHIBA	President, NEXT Publishing Inc., JAPAN
Hiromichi FUKUI	Professor, Director of International Digital Earth Applied Science Research Center, Chubu University, JAPAN
Kiyoshi HONDA	Professor, International Digital Earth Applied Science Research Center, Chubu University, JAPAN
Kiyoshi TAKEJIMA	Associated Professor, International Digital Earth Applied Science Research Center, Chubu University, JAPAN
Satoru SUGITA	Lecturer, International Digital Earth Applied Science Research Center, Chubu University, JAPAN

Sponsors, Supporters, Media Partners and Exhibitors

Gold Sponsor: Esri JAPAN

Silver Sponsor: Asia Air Survey Co., LTD. and FALCON Corporation

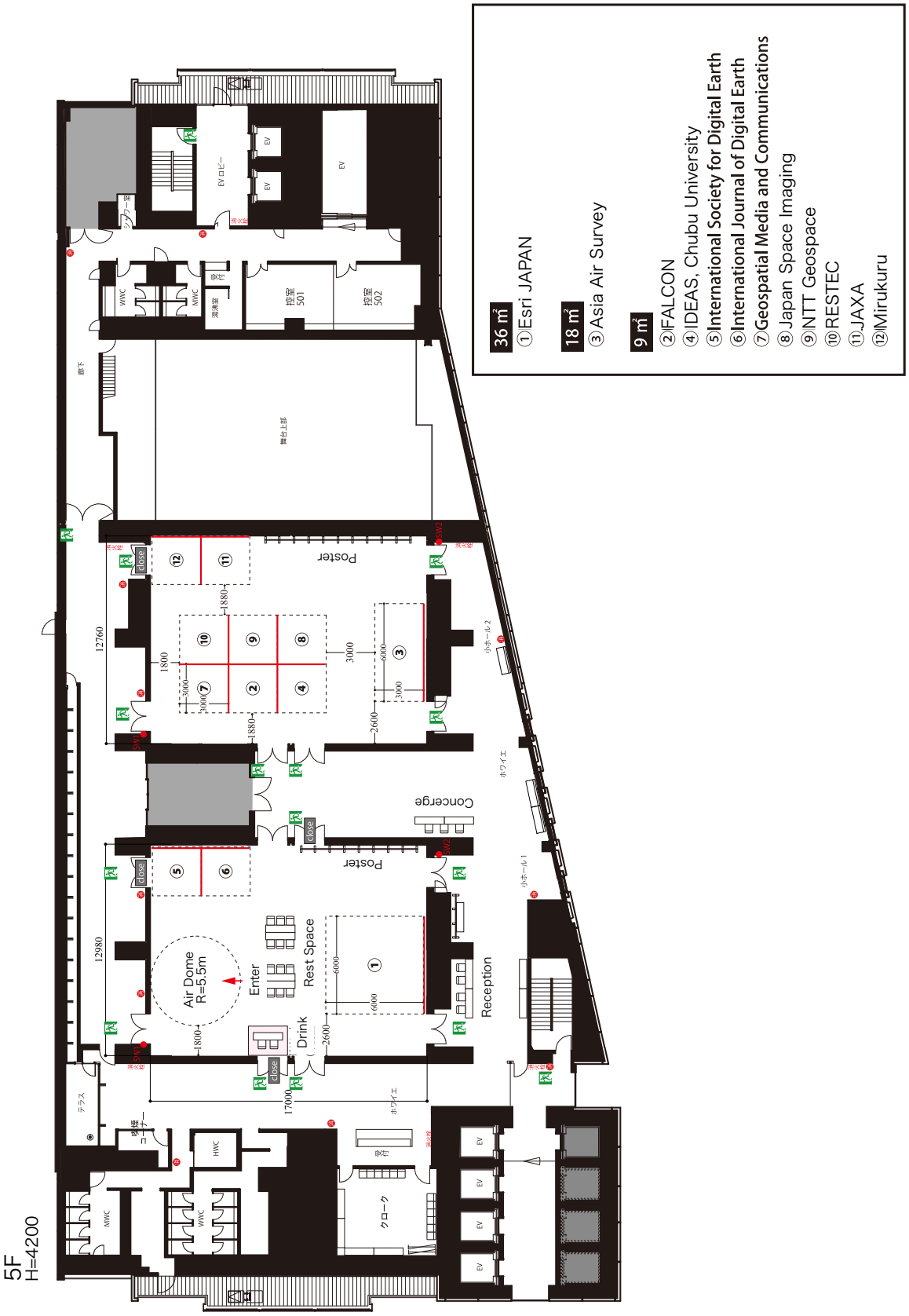
Bronze Sponsor: PASCO Corporation, Japan Space Imaging Corporation, Digital Earth Lab. Corporation, Kyoiku Sangyo Co., LTD., IHI Corporation, NTT Geospace Corporation

Supporter: Japan Aerospace Exploration Agency

Media Partner: GeoConnexion, Geospatial Media and Communications

Exhibitor: IDEAS, Chubu University, International Society for Digital Earth, International Journal of Digital Earth, Remote Sensing Technology Center Japan, and Mirukuru Corporation

Exhibition Space (Small Hall, WINC Aichi)



Conference Program

Nov. 9	Winc Hall, WINC AICHI			902
9:30-10:00	**Opening Address** Prof. Atsuo IIYOSHI, Chancellor, Chubu Univ. Ms. Michiko UENO, Former Vice-minister of MEXT Prof. John RICHARDS, President, ISDE Prof. Hiromichi FUKUI, Director, IDEAS, Chubu Univ.			
10:00-10:30	**Keynote 1** Prof. Tetsuzo YASUNARI, D.G., Research Institute for Human and Nature			
10:30-10:50	**Break**			
10:50-11:20	**Keynote 2** Prof. Daniel SUI, The Ohio State University			
11:20-11:50	**Keynote 3** Dr. Jonathan TRENT, NASA			
11:50-12:20	**Keynote 4** Dr. Michael GOULD, Esri			
12:20-14:00	**Lanch Break**			
PM	**55th Memorial Movie, Ise-wan Typhoon**	**Small Hall**	14:00-15:00	**ESD1**
		Poster, Exhibition	15:00-15:30	**Break**
	Open to Public (no charge, no registration)		15:30-16:30	**ENV1**

Nov. 10		Small Hall		902	1002
			9:30-10:30	**INFR1**	**Special Session: UAV**
			10:30-11:00	**Break**	**NIDE, etc.**
			11:00-12:00	**INFR2, CITY**	
		Poster, Exhibition	12:00-14:00	**Lanch Break**	
			14:00-15:00	**VIS1**	**Special Session: Latest Sattelites**
			15:00-15:30	**Break**	**JAXA**
			15:30-16:30	**DIS**	

Nov. 11	Winc Hall, WINC AICHI	Small Hall		902	1002
			9:30-10:30	**ESD2**	**AGR**
		Poster, Exhibition	10:30-11:00	**Break**	**Break**
			11:00-12:00	**ENV2**	**VIS2, CZSC**
12:00-14:00	**Closing**				

Nov. 12	Nagoya Congress Center
9:00-10:30	**Joint Session of UNESCO World Conference on ESD** **"Report of the 5th Digital Earth Summit"**

CITY: City Plannning, Geodesign and Digital City, CZSC: Citizen Science and Voluntary GI
VIS: Visualization and Scientific Communication, INFR: Digital Earth Infrastructure, DIS: Disaster
ENV: Environment, AGR: Agriculture, ESD: Education for Sustainable Development,

Day 1 9th November, 2014 / Sunday

Session : Opening Address

Venue : Winc Hall
Time : 9:30 - 10:00

Prof. Atsuo IIYOSHI, Chancellor, Chubu University
Ms. Michiko UENO, Former Vice-Minister of MEXT
Prof. John RICHARDS, President, ISDE
Prof. Hiromichi FUKUI, Chair of LOC, Director, IDEAS, Chubu University

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Session : Keynotes

Venue : Winc Hall
Time : 10:00 - 12:20
Chair : Guo HUADONG

10:00 - 10:30	Keynote1 “Future Earth and Its Implication in Asia and Pacific” Prof. Tetsuzo YASUNARI, D.G., Research Institute for Human and Nature
10:30 - 10:50	Break
10:50 - 11:20	Keynote2 “Transforming Society by Volunteered Geographic Information (VGI)” Prof. Daniel SUI, The Ohio State University
11:20 - 11:50	Keynote3 “OMEGA: A Systems Approach to Sustainable Development” Dr. Jonathan TRENT, NASA
11:50 - 12:20	Keynote4 “GIS as a Platform for Problem-based Learning and Innovation” Dr. Micheal GOULD, Esri

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Session : Poster and Exhibition

Venue : Small Hall
Time : 12:00 - 16:30

Session : Documentary Movie

Venue : Winc Hall
Time : 14:00 - 16:30

55th Memorial Movie, Ise-wan Typhoon

Session : ESD1 (Education for Sustainable Development)
(15min presentation and 5min discussion)

Venue : 902
Time : 14:00 - 15:00
Chair : Mario HERNANDEZ

14:00 - 14:20 ESD1-1 "Geoinformatics Education in China"
Deren LI, Wuhan University
14:20 - 14:40 ESD1-2 "GIS Training: Case of UAE"
Mohamed YAGOUB, UAE University
14:40 - 15:00 ESD1-3 "GIS Curriculum for Field Worker"
Kiyoshi TAKEJIMA, Chubu University

Session : ENV1 (Environment)
(15min presentation and 5min discussion)

Venue : 902
Time : 15:30 - 16:30
Chair : Manfred EHLERS

15:30 - 15:50 ENV1-1 "Using Remote Sensing Techniques and Geographic Information System (GIS) for Combating Desertification in the Shobak Area-Jordan"
Entisar ELHIHI, Royal Jordanian Geographic Centre
15:50 - 16:10 ENV1-2 "The Characteristics Analysis of Thermokarst Lake Ice in the Qinghai-Tibet Plateau Using Envisat-ASAR Imagery"

	Zhen LI, Chinese Academy of Science
16:10 - 16:30	ENV1-3 “The Multichannel Spectroellipsometric System for Monitoring Aquatic Environment”
	Ferdenant MKRTCHYAN, Institution of Russian Academy of Science

Day 2 10th November, 2014 / Monday

Session : Poster and Exhibition

Venue : Small Hall
Time : 9:30 - 16:30

Session : INFR1 (Digital Earth Infrastructure)
(15min presentation and 5min discussion)

Venue : 902
Time : 9:30 - 10:30
Chair : Peter WOODGATE

9:30 - 9:50	INFR1-1 "Computation of Ship Geometry and Category Identification Using TerraSAR-X data (SPOT and STRIP)" Balasubramaniam MADHAVAN, National Field Research Center for Environment Conservation
9:50 - 10:10	INFR1-2 "Introduction of ALOS World 3D -Global dataset of high-resolution topography and colored images-" Hiroto NAGAI, Japan Aerospace Exploration Agency
10:10 - 10:30	INFR1-3 "Panorama Shooting and Hosting Platform for Nature Monitoring" Soko AOKI, Kadinche Corporation

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Session : Special Session: UAV (Unmanned Aerial Vehicle)

Venue : 1002
Time : 9:30 - 12:00
Chair : Hiroshi INOUE, National Research Institute for Earth Science and Disaster Prevention

Applications of Small UAV to Disaster Research

Session : INFR2 (Digital Earth Infrastructure) and CITY (City Planning, Geodesign and Digital City)
(15min presentation and 5min discussion)

Venue : 902
Time : 11:00 - 12:00
Chair : Changlin WANG

11:00 - 11:20 INFR2-1 "Development of Digital Oman Environmental and Biodiversity Atlas-OEBA"
Balasubramaniam MADHAVAN, National Field Research Center for Environment Conservation

11:20 - 11:40 INFR2-2 "Real-Time Information Fusion for Navigation in Dense Crowds"
Manfred EHLERS, University of Osnabrueck

11:40 - 12:00 CITY-1 "Modeling Urban Expansion: A Case Study in Santa Rosa, Laguna, Philippines"
Gemmalyn MAGNAYE, University of the Philippines Los Banos

Session : VIS1 (Visualization and Scientific Communication)
(15min presentation and 5min discussion)

Venue : 902
Time : 14:00 - 15:00
Chair : Jean SEQUEIRA

14:00 - 14:20 VIS1-1 "Automatic Generation of 3D Building Models for Sustainable Development"
Kenichi SUGIHARA, Gifu Keizai University

14:20 - 14:40 VIS1-2 "A Comparative Study of Digital Terrain Data for Visibility Analysis in the Planning and Management of Scenic Resources"
Toru OTAWA, University of Idaho

14:40 - 15:00 VIS1-3 "Visualizing the Past: Utilization of CORONA Satellite Image as a Base Map of Historical WebGIS of Asia"
Nobuya WATANABE, Chubu University

Session : Special Session: Latest Satellites, JAXA
(15min presentation and 5min discussion)

Venue : 1002
Time : 14:00 - 15:30
Chair : Yutaka KANEKO, Japan Aerospace Exploration Agency

14:00 - 14:20 SP2-1 “Water-related Disasters and Precipitation Remote Sensing from Space”
Misako KACHI, Japan Aerospace Exploration Agency

14:20 - 14:40 SP2-2 “Monitoring the Forest/Non-forest from Space Using the PALSAR and PALSAR-2”
Masanobu SHIMADA, Japan Aerospace Exploration Agency

14:40 - 15:00 SP2-3 “Space-based Greenhouse Gas Monitoring by GOSAT”
Kei SHIOMI, Japan Aerospace Exploration Agency

15:00 - 15:20 SP2-4 “Practical Applications Utilizing QZS-1 "Michibiki"”
Kazuhiro YOSHIKAWA, Japan Aerospace Exploration Agency

Session : DIS (Disaster)
(15min presentation and 5min discussion)

Venue : 902
Time : 15:30 - 16:30
Chair : Milan KONECNY

15:30 - 15:50 DIS-1 “Exploring the Relative Performance of ASOS and RSA Weather Data in Explaining Historical Weather Related Disaster Damage”
Chul SOHN, Gangneung-Wonju National University

15:50 - 16:10 DIS-2 “Evaluation of DEM Generation Based on Interferometric SAR Using TanDEM-X Data”
Ram AVTAR, United Nations University

16:10 - 16:30 DIS-3 “Education for Disaster Prevention and Preparedness by Using Digital Earth -Introducing a Case of Chubu University-”
Jun IZUTSU, Chubu University

Day 3 11th November, 2014 / Tuesday

Session : Poster and Exhibition

Venue : Small Hall
Time : 9:30 - 12:00

Session : ESD2 (Education for Sustainable Development)
(15min presentation and 5min discussion)

Venue : 902
Time : 9:30 - 10:30
Chair : Temenoujka BANDROVA

9:30 - 9:50 ESD2-1 "Aqua Republica Serious Game Competition on Water Resource Management for Schools in Asia Pacific Region"
David WORTLEY, Gamification and Immersive Technologies Strategic Solutions

9:50 - 10:10 ESD2-2 "GIS as a Platform for Problem-based Learning and Critical Thinking"
Michael GOULD, Esri

10:10 - 10:30 ESD2-3 "Digital Earth as a Platform for Synthesis of Knowledge and ESD (Education for Sustainable Development)"
Hiromichi FUKUI, Chubu University

Session : AGR (Agriculture)
(15min presentation and 5min discussion)

Venue : 1002
Time : 9:30 - 10:30
Chair : Gábor Remetey FÜLÖP

9:30 - 9:50 AGR-1 "Digital Earth for Sustainable Agriculture: Case of Land Suitability Study for Viticulture in Inland Northwest Region of the United States"

Toru OTAWA, University of Idaho

9:50 - 10:10 AGR-2 “TanDEM-X Based InSAR Techniques to Monitor Oilpalm Plantation area”
Ram AVTAR, United Nations University

10:10 - 10:30 AGR-3 “Agriculture Information Service Platform Based on OGC Standard and Crop Modeling”
Kiyoshi HONDA, Chubu University

Session : ENV2 (Environment)
(15min presentation and 5min discussion)

Venue : 902
Time :11:00 - 12:00
Chair : Hiromichi FUKUI

11:00 - 11:20 ENV2-1 “Regional Estimation for Existing Global Land Cover Datasets by Field Investigation in Inner Mongolian Desert Steppe Region, CHINA”
Bayaer WULIANGHA, Inner Mongolia Normal University

11:20 - 11:40 ENV2-2 “Forest Disturbance and Regeneration in Northeastern Europe”
Anton KARDAKOV, Estonian University of Life Sciences

11:40 - 12:00 ENV2-3 “Spatio-temporal Pattern of Terrestrial Ecosystem in Ghana Using Remote Sensing Data”
Ram AVTAR, United Nations University

Session : VIS2 (Visualization and Scientific Communication) and CZSC (Citizen Science and Voluntary GI)
(15min presentation and 5min discussion)

Venue : 1002
Time : 11:00 - 12:00
Chair : Hugh MILLWARD

11:00 - 11:20 VIS2-1 "Digital Archive of Community Memories Before the 2011 Tohoku Earthquake and Tsunami in Japan - Rebuilding Lost Place and Landscape Using CityEngine"
Akinobu MURAKAMI, University of Tsukuba

11:20 - 11:40 VIS2-2 "Map Based Querying of Spatial Data Focused on Search for Spatial Similarities"
Karel STANEK, Masaryk University

11:40 - 12:00 CZSC-1 "The Role of Social Geo-participation in the Creation of the Smart City for Plock"
Robert OLSZEWSKI, Warsaw University of Technology

Session : Panel Discussion "Digital Earth for ESD"

Venue : Winc Hall
Time : 12:00 - 12:30
Chair : John RICHARDS

Session : Closing Ceremony

Venue : Winc Hall
Time : 12:30 - 13:00
Chair : Guo HUADONG

12:30 - 12:40 "Invitaion to the 9th International Symposium on Digital Earth"
Hugh MILLWARD, Saint Mary's University

12:40 - 12:50 "Exchange the Frag of Digital Earth Summit and Invitation to the 6th Summit"

12th Nov.

9:00 - 10:30 "Report of the 5th Digital Earth Summit", Joint Session of UNESCO World Conference on ESD at Nagoya Congress Center, Shiratori

Posters

Venue : Small Hall

CITY-P1 “A Novel Image Fusion Method Using DSM and Spectral Un-mixing of Pixels”
Linhai JING, Chinese Academy of Science

CITY-P2 “Auckland's Shifting Diversity”
Nitin MUKKOTH VALAPPIL, GIS Consultant (India)

CITY-P3 “Study on the 3D Underground Spatial Decision Support System in Guangzhou”
Jiangmin HE, Guangzhou Urban Planning Bureau

CZSC-P1 “Research and Application of Street View based on China Digital Ocean”
Lingchong KANG, National Marine Data and Information Service

DIS-P1 “Glacier and Slope Formation Monitoring in New-Zealand Using UAV Based Imagery”
Christopher GOMEZ, University of Canterbury

DIS-P2 “Storm Surge Modeling, Visualizing and Information Service System in East China Sea”
Zengan DENG, National Marine Data and Information Service

ENV-P1 “Structure from Motion for Pointclouds Creation from Historical Imagery and UAV: Monitoring Floodplain Vegetation Evolution in 3D”
Christpher GOMEZ, University of Canterbury

AGR-P1 “Microwave Radiometry Monitoring of Soil-plant Formation”
Ferdenant MKRTCHYAN, Institution of Russian Academy of Science

UAV-P1 “Enabling a Science Support Structure for NASA's Global Hawk UASs”
Donald SULLIVAN, NASA

UAV-P2 “Aerial Photogrammetry of Damages by Heavy Intensive Rainfall in Nagiso and Takayama Using UAV”
Satoru SUGITA, Chubu University

Abstracts

Keynote 1: Future Earth and Its Implication in Asia and Pacific

Tetsuzo YASUNARI

Research Institute for Humanity and Nature

Profile:

Current Position: Director-General, Research Institute for Humanity and Nature. Professional Career: Director-General, Research Institute for Humanity and Nature (4/2013-). Designated Professor, Hydrospheric Atmospheric Research Center (HyARC), Nagoya University. (4/2012-3/2013). Professor, Hydrospheric Atmospheric Research Center (HyARC), Nagoya University. (8/2002-3/2012). Leader, Global COE program “From Earth System Science to Basic and Clinical Environmental Studies” (2009-2012). Leader, the 21st Century COE Program "The Sun-Earth-Life Interactive System (SELIS)" (2003-2008). Visiting Professor, Department of Earth & Planetary Science, the University of Tokyo. (4/2003-3/2006) . Professor, Climatology & Meteorology, University of Tsukuba. (4/1992-7-2002) . Associate Professor, Climatology & Meteorology, University of Tsukuba. (6/1990-3/1992) . Assistant Professor, Climatology & Meteorology, University of Tsukuba. (8/1984-8/1985) . Visiting Scientist, Department of Meteorology, Florida State University (8/1984-8/1985) . Research Associate, Center for Southeast Asian Studies, Kyoto University. (4/1977-3/1982). Higher Degrees: D.Sc., Meteorology & Climatology (Kyoto University, 1981). M.S., Meteorology (Kyoto University, 1974). Awards: Chichibuno-Miya Memorial award (as a group member) 1980. Yamamoto Prize, Meteorological Society of Japan 1981. Research Award (Gakkai-sho), Meteorological society of Japan 1986. Nikkei Prize for Global Environmental Study and Technology 1991. Fujiwara Prize, Meteorological Society of Japan 2002. International Award, Japanese Society of Hydrology and Water resources 2006.

Abstract:

Future Earth (FE) has been launched as an international initiative to promote research for global sustainability by the international science and technology alliance with partnership of the International Council for Science (ICSU), the International Social Science Council (ISSC), the Belmont Forum of funding agencies, the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), the United Nations University (UNU), and the World Meteorological Organization (WMO) as an observer (Future Earth, 2013). Future Earth will provide a single overarching structure for researchers, funders, service providers, and users, and integrates the existing Global Environmental Change (GEC) programmes. The GEC programmes have provided foci for several extensive international and multi-disciplinary networks of researchers investigating key human-environmental dynamics. Future Earth would develop a new generation network building on these. Future Earth proposes national and regional level committees, in addition to the regional nodes. The most essential issue for the overall FE activity towards global sustainability will be how to integrate efforts and activity of solving environmental problems and achieving sustainability for local to regional scales.

Keynote 2: Transforming Society by Volunteered Geographic Information (VGI)

Daniel SUI

The Ohio State University

Profile:

Daniel Sui is currently a Professor of Geography and Distinguished Professor of Social & Behavioral Sciences at the Ohio State University. He also serves as Chair of Geography since July 2011. He served as Director of the Center for Urban & Regional Analysis (CURA) (2009-2012) and Director of Geographic Analysis Core for the Institute of Population Research (IPR). Prior assuming his current position at OSU in July 2009, Daniel Sui was a professor of geography (1993-2009) and holder of the Reta A. Haynes endowed chair (2001-2009) at Texas A&M University. His research current interests include GIScience theory, open/alternative GIS, spatial-temporal synergetics, volunteered geographic information, and crowdsourcing geographic knowledge production. Sui was a 2009 Guggenheim Fellow, 2006 winner of the Michael Breheny Prize for best paper in environment and planning, and 2014 recipient of the distinguished scholar award from the Association of American Geographers. Sui has also been selected as the 2015 Public Policy Scholar in residence at the Woodrow Wilson International Center for Scholars. He served on the U.S. National Mapping Science Committee for two terms (2007-2013) and currently serves as editor-in-chief for GeoJournal. More information about Sui's current research can be found at: http://www.geography.ohio-state.edu/our-department/faculty-more/sui

Abstract:

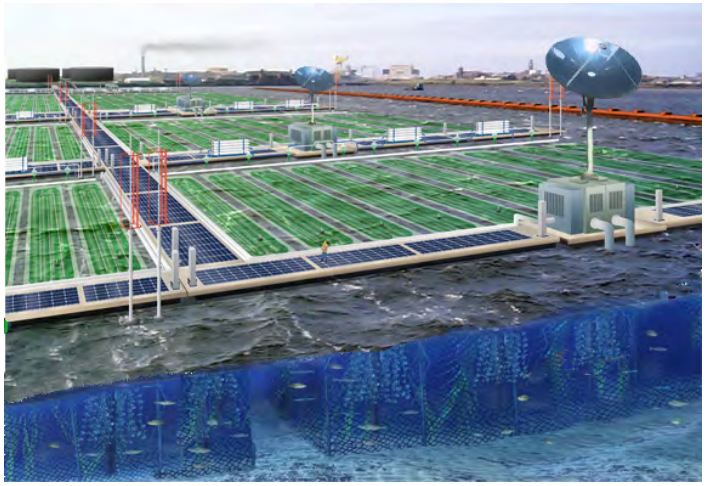
The phenomenal growth of user-generated content via crowdsourcing in general and volunteered geographic information (VGI) in particular during the past ten years is transforming society in multiple ways. The talk presents a synoptic overview on the impacts of VGI on society and its new challenges for GIScience. As VGI is rapidly merging with the big data deluge that is flooding the digital earth, this talk also calls for a shift of our attention from digital earth to the emerging global brain, which has been playing increasingly important roles in shaping we are and what we are doing collectively as a society.

Keynote 3: OMEGA: A Systems Approach to Sustainable Development

Jonathan TRENT
NASA

Profile:
After earning a Ph.D. in marine biology at Scripps Institution of Oceanography, Jonathan did postdoctoral research at the Max Planck Institute for Biochemistry in Germany, the University of Copenhagen in Denmark, and the University of Paris in France. He returned to the USA to work at the Boyer Center for Molecular Medicine at Yale Medical School and then Argonne National Laboratory before moving to NASA Ames Research Center. In addition to working at NASA, Jonathan is an adjunct professor at UC Santa Cruz and a fellow of the California Academy of Sciences. Jonathan's research has ranged from marine biology to molecular medicine, from astrobiology to nanotechnology. He recently started a grass-roots movement called "Global Research into Energy and the Environment at NASA (GREEN) in which he developed OMEGA as a life-support system for "Spaceship Earth." He was the NASA Project Scientist for a $10M OMEGA feasibility study that ended in 2013 and became the founding director of the OMEGA Global Initiative in 2014. He lectures on sustainability all over the world.

Abstract:
Sustainable development is frequently defined as: "… *development that meets the needs of the present without compromising the ability of future generations to meet their own needs.** To meet these requirements in a world approaching the upper limits of growth will require revolutions in resource management and system-level planning on an unprecedented scale. Using principles developed for "life support" in extremely resource-limited environments (e.g., Mars or outer space), we designed a life-support system for coastal cities called OMEGA (Offshore Membranes for Growing Algae).



Artist's conception of an integrated OMEGA system for cultivating microalgae (green tubes), cleaning wastewater, sequestering CO2, and producing energy from sunlight (biofuels and concentrated solar thermal, photovoltaic and in some locations wind). Food is produced underwater by aquaculture.

OMEGA addresses the needs for sustainable food, clean water and clean energy, while improving the coastal environment and promoting blue-green economies. The OMEGA infrastructure provides access to offshore sites for aquaculture that expands local food production and provides an economic foundation for other OMEGA activities. OMEGA treats wastewater currently pumped offshore and transforms it into algal biomass and in some locations back into drinking water. The algal biomass is transformed into biofuels that do not compete with agriculture for land. Thus OMEGA provides energy from sunlight using the nutrients in wastewater and CO2 from flue gas sources on shore to produce algal biofuels. The offshore platform can also support alternative energy technologies from solar electricity and hot water, wind, or Rankine-cycle gradients. OMEGA improves the environment by meticulously treating the

wastewater that currently pollutes coastal waters and by capturing carbon that would otherwise contribute to global warming. By optimizing the use of waste, space, and resources for services and products, as well as by mitigating environmental impacts, OMEGA promotes the development of sustainable, environmentally friendly, blue-green economies. The OMEGA technology takes us beyond the limits of current coastlines and prepares future generations for sea-level rise that will move these coastlines inland.

After five years of feasibility testing in laboratory experiments, seawater tanks, and in a marine-laboratory harbor, it is time to deploy a large-scale (approx. 1-hectare) integrated OMEGA system as a demonstration near a coastal city. The OMEGA Global Initiative (OGI) identified Japan as a potential world leader in future OMEGA development and implementation; Japan has ideal offshore sites near coastal cities, experts in engineering and science, popular and political commitments to sustainable development. We will discuss OMEGA, its potential future in Japan and elsewhere, and the role of digital Earth technologies in educating us all for sustainable development.

*World Commission on Environment and Development (WCED). Our common future. Oxford: Oxford University Press, 1987 p. 43.

Keynote 4: GIS as a Platform for Problem-based Learning and Innovation

Michael GOULD
Esri

Profile:
Dr. Michael Gould is global education manager at Esri, Inc. In that role he supports education projects in collaboration with 84 Esri regional offices such as Esri Japan. He received the PhD in Geography/GIS from National Center for Geographic Information and Analysis (NCGIA), Buffalo, New York. He is now completing a certificate program in Innovation from Stanford University. Early in his career he worked as a programmer at Harvard University, and as GIS analyst at an environmental research company. He has taught GIS in Spain for more than 15 years at Universitat Jaume I, where he is co-founder of the Erasmus Mundus *Master in Geospatial Technologies*, and the Marie Curie doctoral program in *Geoinformatics* for open cities.

Abstract:
Education for sustainable development requires students to do more than look at maps to see what exists and where things are. To become effective decision makers and innovators, students need to reach the point of being able to ask what-if questions, to study trends and patterns, to make predictions, and to propose changes in the world. Using maps in a Geographic Information Systems (GIS) can foster spatial and critical thinking.Spatial thinking is not merely a cognitive development studied by educational psychologists, but is a set of specific skills that are in demand by employers in both commercial and research institutions.GIS was created 50 years ago to better manage and make sense of large amounts of land inventory data and to help answer what-if questions. Since the 1980s, GIS has been used in thousands of universities and, more recently, has found its way into secondary schools. Many of these schools have not progressed beyond the point of "using GIS (a new technology) in class" and have not yet reached the desired effect of GIS in education: Problem-based learning and innovation. In this presentation I discuss cases in which students are grappling with data, thinking critically, and using GIS to solve problems, and the corresponding benefits, in places like Rwanda, Abu Dhabi, and the USA. We show the cycle of geographic inquiry: Asking questions, collecting data, exploring and analyzing data, and finally acting on geographic knowledge. This last step is important, because identifying problems and criticizing is easy; however, proposing viable alternatives and improvements is a skill which takes practice and mentorship inside the classroom or outside. We also make the case that today's modern web- and mobile-based GIS platform is helping spread its adoption beyond the innovators and early adopters to the "early majority" in Rogers (1995) diffusion of innovations model. The platform also encourages online sharing of maps and multimedia presentations, which encourages learners to publish their results, their theories, their proposals, to gain feedback, and build a community of learners. Regions and countries that are moving in this direction are helping to provide society with young people with 21st-century employment skills.

ESD1-1: Geoinformatics Education in China

Deren LI and Peng YUE
Wuhan University

The paper will give an overview of the current status of education in Geoinformatics in China. First, the paper will provide a general review of the scientific and technological development of Geoinformatics in China. It then presents how the development affects the education and training in China. In the paper, universities and institutes in China that can award academic degrees related to Geoinformatics will be summarized. Next, the paper will report the work having been done by the expert group on Surveying and Mapping, including the revision of discipline catalogue and guide for graduate education and requirements. A list of typical curriculain Geoinformatics education is suggested. Finally, activities on promoting the graduate student exchange platform will be presented.

ESD1-2: GIS Training: Case of UAE

Mohamed YAGOUB
UAE University

GIS skills required can be classified according to the type of jobs needed and consequently any training can be tailored to address these needs. The implication of this is that GIS training objectives and period of study are varied. This ranges from direct industrial training in system specifics and more general education in GIS. This article examines the prerequisites and training for skilled GIS analyst. The UAE University GIS training model is addressed. In general, the model is designed to provide GIS education and keeping a balance between conceptual, technical, and societal issues. More technical models such as web-based GIS, street mapping, and smart phone applications are on their way to be added to the training.

ESD1-3: GIS Curriculum for Field Worker

Kiyoshi TAKEJIMA
Chubu University

As you see cellular phone has become popular all over the world recent years. But GIS has come out much earlier than the cellar phone and it is still on the way to its popularization. Why? I have a view that the matter is the content of GIS education.

I have been engaged myself to GIS training course as the lecturer/instructor for more than 14 years, then I found a significant error in GIS education, which is the gap of their mind between lecturers and trainees.

There are two types of trainees. One type of trainee has curiosity in GIS and enthusiastic to master it. The other type of trainee is mandatorily required to master GIS to complete their task. The former one doesn't require any lessons. He can master GIS by himself with his high motivation. Also he will be willing to ask about GIS to senior GIS engineer, or search through the web sites. I could say that most of lecturers are former type, and most of trainees are the latter type. We need more latter type of persons for GIS education field. Many of lecturers are enthusiastic however they usually don't take trainees' situation into their account. When trainee couldn't catch up the lesson, lecturer tends to take the problem as only trainees' side of problem. I call it big gap of mind between lecturers and trainees.

I made up 4 clear points to improve this condition of GIS education. These are "GIS House", "Learning triangle", "Bruce Lee operation" and "The visualization of their achievement".

First of all, trainees must have enough computer literacy also deep understanding for map projections and file formats in advance. GIS, computer literacy, map projections and file formats are all related and its structure is liken to construction of a house. The roof can't be built without foundation - computer literacy, and 2 pillars – map projection and file formats. I call those relations "GIS house". GIS is consisting of various techniques and related to knowledge so the curriculum should be constituted through the concept of GIS House.

There are four stages in GIS learning. Trainees are learning GIS for solving problems. To solve the problem, he needs to understand many techniques/module. Even if he doesn't understand certain GIS operation, more experience of imitating GIS operations makes him to be able to understand it. To be able to imitate techniques/modules, he has to know what GIS can do in the first place. Those stages of "solve", "understand", "imitate" and "know" are related and formed in to a triangle shape. GIS curriculum also should be constituted through the concept of "Learning triangle".

In one of the "Bruce Lee" movies, there is a one called "Game of Death". In this movie, Bruce Lee couldn't go for the next enemy without defeating the first one in front of him. This is the same concept of learning technique. When trainees try to master GIS, learning step-by-step is important. Most of GIS trainings are going fast in a tight schedule. Especially tight for beginners. Those trainees might lose their motivations.

Even if we made systematic curriculum, it doesn't mean anything if trainees stop learning. Not only curriculum but also to foster motivation is important for GIS training. We can find a clue in TOYOTA's education method. It's called "The visualization of achievement". In their factory, all employees can see the technical achievements of each engineer written on the board in front of their unit. By adopting "Visualization of achievement", TOYOTA keeps qualifying their car production level and fostering engineers' motivation so as to improve their works. I have tried to use the stamp card in my GIS training class as "Visualization of achievement". I asked trainees to show the card on the right corner of their desk. Trainee can get stamp on their card only when they passed examination. The stump card helped to keep their motivation and also made them easier to find someone to ask the question other than lecturer.

ENV1-1: Using Remote Sensing Techniques and Geographic Information System (GIS) for Combating Desertification in the Shobak Area-Jordan

Entisar ELHIHI
Royal Jordanian Geographic Centre

The climate changes recorded in the past two decades and the subsequent negative changes in many physical and biological systems in the fragile arid and semi-arid areas, aroused the interest of local and international institutions. As Jordan is located in the marginal zone between the desert and the Mediterranean region, has also been affected by these negative changes which reflected on the environment in various forms of desertification. This led the scientific institutions to conduct the research and studies and to exploit all the scientific and technical capabilities to identify indicators of desertification in the Kingdom. Aiming to reduce the continuous deterioration and to find appropriate ways to rehabilitate the affected areas.

The project aims to investigate and monitor desertification indicators and its spatial and geographical characteristics in the Shobak area using remote sensing and GIS techniques. In addition to identify the natural and anthropogenic factors causing desertification in the study area. Later to develop plans that will combat desertification and reduce its effects in order to maintain and manage the natural resources to ensure sustainability.

The methodology is based on identifying the indicators of desertification using remote sensing techniques and to monitor their changes by Change Detection method. Two radiometrically and geometrically corrected Landsat images were used. The Landsat-8 ETM recorded on February, Landsat-7 ETM recorded on October 2000 and Landsat-5 TM recorded in August 1984. Aerial photographs of the year 1953 and 2000 was also used to study the changes in the forest. As well as, thematic maps such as topographic maps at scale 1 ¥ 50000 and 1 ¥ 100,000, geological maps and soil maps at scale 1 ¥ 50,000 and 1 ¥ 250000 were also used in the study area.

ENV1-2: The Characteristics Analysis of Thermokarst Lake Ice in the Qinghai-Tibet Plateau Using Envisat-ASAR Imagery

Zhen LI
Chinese Academy of Science

A thermokarst lake is an important indicator of changes in climate, which cause considerable thermal distribution to the surrounding permafrost, giving rise to anomalous ground-temperature conditions and open-talik information below some lakes. More than 1500 lakes are distributed on the Qinghai-Tibet Plateau (QTP), the majority of lakes in Chinese permafrost regions are thermokarst features. The imaging radar has demonstrated the capability to determine when and which lakes freeze or do not freeze, and the potential to estimate the ice thickness of tundra lakes using SAR backscattering coefficients, and to extract deformation by interferometry.

In this paper, the temporal variability of C-band backscattering of thermokarst lakes at Beiluhe test area, is located on the central QTP, were examined by 45 ENVISAT-ASAR imageries acquired in freeze up, ice duration and break-up stages. Using alpine meadow backscattering as refer, the ice phenology on the QTP can be well identified, and the backscattering coefficient of radar is increasing as the ice thickness growth when ice duration, though some confusion may be occur by the coherent effect of thin ice and the variable of scattering mechanism during break-up. Then, an electromagnetic model was developed to simulate these individual contributions from interfacial surfaces scattering, volume scattering of bubbles, and volume-surface interaction scattering, for better understanding and explaining SAR behaviour response for lake ice change. The variation of simulated VV backscatter matched with ASAR observation in experiments area, and sensitivity analysis for the backscattering were carried out respectively to bubble size, bubble shape, ice temperature, ice density, and the roughness at ice-water interface. Finally, the deformation of thermokarst lakes regions is extracted by SAR interferometry.

The results showed that the ice layer volume scattering and ice-water surface scattering were the two major scattering components in C-band VV polarization, which is also affected by the increase of bubble size, ice density and roughness of ice-water interface. According to this study, it is difficult to infer the thickness from thin ice from the radar backscattering due to the phase interference effect during freeze-up. When ice duration, the radar signature proved to be able to monitor the ice thickness over lake and deformation around the lake, which means the SAR provide a good tools for mapping and monitoring thermokarst lakes on the QTP.

ENV1-3: The Multichannel Spectroellipsometric System for Monitoring Aquatic Environment

Ferdenant MKRTCHYAN, Vladimir KRAPIVIN, and Vladinir KLIMOV
Institution of Russian Academy of Science

The creation of multichannel polarization optical instrumentation is topical for the real-time ecological control of aquatic environment. It should be mentioned that efficient solution of these multiparametric problems greatly depends on the precision of ellipsometric devices and the possibility of using a wide spectral range. Spectral measurements in an aquatic environment provide an information basis for the application of modern algorithms for the recognition and identification of pollutants.

Multichannel spectroellipsometric system(MSS) that will differ from modern foreign analogues by the use of a new and very promising method of ellipsometric measurements, an original element base of polarization optics and a complex mathematical approach to estimating the quality of a water object subjected to anthropogenic influence.

The system will be trainable to the recognition of pollutants of aquatic environment. Also, unlike foreign analogues, the system has no as well as rotating polarization elements. This allows one to increase the signal-to-noise ratio and the long-term stability of measurements, to simplify and reduce the price of multichannel spectroellipsometers.

A compact measuring - information multichannel spectroellipsometric system is applied for monitoring the quality of natural and waste water, that is based on the combined use of spectroellipsometry and training, classification, and identification algorithms.

The MSS can be used in different fields where the quality of water should be estimated or the presence of a particular set of chemical elements should be revealed. The MSS solves these problems by real-time monitoring of the aquatic environment. In the stationary version it allows the tracking of the dynamics of water quality in a stream, and when placed on a ship, it allows the measurement of water parameters along the route.

The functionality of the MSS can be extended by increasing the volume of standards in the knowledge base. The use of a natural light source allows the examination of soils, the indication of oil products on a water surface, the determination of the degree of the pollution of atmospheric air and the estimation of the conditions of other objects of the environment, whose spectral images may change.

An adaptive spectroellipsometric technology may be applied to following areas:

Estimation of natural and wastewater quality;

Analysis of liquids in medicine, biochemistry, food industry.

Measurement of the mineralization level and chemical pollution of reservoir depending on the pollution type.

Estimation of water salinity variations.

Testing the organic pollution clots in water environment.

INFR1-1: Computation of Ship Geometry and Category Identification Using TerraSAR-X data (SPOT and STRIP)

Balasubramaniam MADHAVAN* and Tadashi SASAKAWA**
*National Field Research Center for Environment Conservation
**PASCO Corporation

Keywords: SAR, Ship-detection, Polarisation, scatterer, Incidence Angle, Baye statistics, Thresholding, Hough Transformation, Ship-Centreline, Speckle processing

SAR imagery application for the ocean has a long history and greatly acknowledged. Ship detection using SAR relies either on the detection of the ship itself or detection of the ship wake. In modelling ship research using SAR data, ship backscattering alone was not considered. Instead simple search for anomalies in the background has been studied which affect the ship detectability. Ships are typically constructed from large flat metal sheets and hence are usually radar bright and easily detectable in SAR imagery.

X band imagery in HH polarization is preferred for detecting ships as ship-sea contrast is usually higher for HH polarizations. Conversely VV is preferred for wake detection as the lower backscatter at HH decreases rapidly with increasing incidence angle, resulting in ship wakes rarely being seen in HH polarized images. Since the interaction mechanism between ship and sea is double bounce scattering it is expected that RR, or right-right circular polarization will also be a good polarization for ship signature enhancement. Larger incidence angles give better ship discrimination in high wind conditions. SAR image intensity depends on the direction of the wind relative to the SAR look direction and adds that the presence of wind streaks can indicate wind direction.

In the present study, chiefly backscatter from the ship forms basis for ship detection algorithm. Methodology involves speckle filtering, segmentation, and Baye's evidence modelling. A hierarchical design for extracting ship features and recognizing ships from SAR images has been tested. Targets are segmented from the image background using directional thresholding and region merging processes. Ship end-points are then identified through a ship centerline detection algorithm.

Segmentation from the ocean clutter is performed in two steps: noise removal and merging of small regions. The mean and variance of noise are estimated on the image border for each column/row assuming the target is centred in the image window. Residual small non-connected clutter regions are further discarded if they are isolated and their spatial extent is above an empirically determined threshold.

The resulting segmented image is binarised and used in the ship centreline detection algorithm. Category discrimination is based on the radar scatterers distribution in ship's nine sections along the ship's range profile. A 3-layer neural network has been trained on simulated scatterers distributions and supervised by a rule-based expert system to perform this task. Line ship type is then estimated using a Bayes classifier based on the ship length. It was noticed that segmentation and centreline detection are sensitive to ship aspect angle because of the different radar scattering signature.

Ship Classification, identification and class declaration have been achieved robustly. Our high-level ship classifier developed in this study provided dimension of ships and category (Line or Merchant). Thirteen types of ships are identified in the present research.

INFR1-2: Introduction of ALOS World 3D -Global dataset of high-resolution topography and colored images-

Hiroto NAGAI and Takeo TADONO
Japan Aerospace Exploration Agency

Japan Aerospace Exploration Agency is now generating "ALOS World 3D" (AW3D), which is a global dataset of digital surface model (DSM) and high-resolution satellite image. The DSM is generated using triplet or stereo images acquired by the Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM) onboard Advanced Land Observing Satellite (ALOS) from 2006 to 2011. It has a 2.5 m spatial resolution, and a pan-sharpened and ortho-rectified satellite image generated by panchromatic image from PRISM and visible color image from Advanced Visible and Near Infrared Radiometer type 2. Synthesizing 3-million scenes to improve data accuracy and to avoid temporary cloud cover, this product covers the global land surface with the spatial resolution and height accuracy of 5 m (RMSE), which contributes not only to earth sciences but also to practical applications including hazard assessments, civil engineering, environmental management, making and updating of national maps, and other various kinds of public and commercial uses.

Dataset generation of AW3D started from 2014 in collaboration with NTT DATA and RESTEC aiming to complete in 2016. AW3D consists of 1-degree square tiles on geographic coordinate system. The spatial resolution of 5 m is superior to the currently available global DEMs such as GTOPO30, SRTM, ASTER GDEM, and WorldDEM. Package of DSM and ortho-rectified image enable immediate use of three-dimensional visual observation, professional geospatial analysis, and physical outputs (e.g. art works, topographic models by 3D printer, and educational materials). On the other hand, difficulties of data generation in deserts with homogeneous sand surface, frequently cloud-covered regions, steep mountain slopes are recognized. For these areas, further validation and improvement should be considered.

AW3D will thus provide high-quality dataset of topography and surface imagery covering almost all of the global land surface, which will be one of the promising geospatial infrastructures. Its high accuracy and preferable usefulness ensure further development of digital applications to solve international issues, to promote innovative industrial outputs, and to offer creative use of geospatial information.

INFR1-3: Panorama Shooting and Hosting Platform for Nature Monitoring

Soko AOKI, Kazutaka UCHIDA, Tsuyoshi TANAKA, and Shun FUKUMOTO
Kadinche Corporation

Introduction: Remote sensing of nature environment is executed from satellites in the space, flying machines on the air, and cameras on the ground. Conventional ground settled cameras had issues of coverage area, image resolution, and efficient data management system. To overcome these issues we designed and implemented panorama shooting and hosting platform.

Panorama Shooting Robot Camera: General single-lens reflex cameras and web cameras are popular shooting devices in nature monitoring such as mountain monitoring and forest monitoring. However because the camera is fixed and has the limitation of resolution depend on its performance, the coverage area and resolution is not big enough for precise analysis. We developed a super high-resolution remote monitoring system using a robot head to overcome these issues above. The system consists of 2 cameras, 1 robot head, and 1 network connected computer. The system first shoots a photo of environment using camera No.1 with wide lens. This step executes weather decision module because in cloudy and rainy weather it is no use to shoot photos. The weather decision module looks at the histogram of image to decide the weather condition. If the weather is fine, camera No.2 shoots multiple photos using robot head. Since this camera No.2 is placed on a robot head, it can change its direction and take hundreds of photos with zoom lens. In this way, coverage area is expanded and the resolution of photo is increased. These multiple photos will be stitched together to a giga-pixel panorama photo.

Cloud Based Panorama Management System: After acquiring the panorama photo data we need the panorama photos hosting and managing system. We developed a cloud computing based panorama hosting and authoring system called Panoplaza. Users can upload panorama photos onto the cloud storage. Since panorama photos can cover full 360 degrees the management system can have panorama specific features such as angle setting, making virtual tours, and item tagging. The angle setting feature let users control limit vertical and horizontal field of view. The virtual tour features let users link multiple panorama photos each other. The viewers can move from one spot to another spot by clicking on the panorama link tag on the panorama photos. The item tagging feature let users create clickable hot-spot on the photos. When viewers click on the hot-spot the content will show the detailed description or memo of that item. The system also let users upload map images to create clickable map. If viewers click on the map, the content shows panorama photo of that position.

Prototype: The first working prototype is installed in Tateyama Murodou Mountain Lodge in Toyama prefecture Japan in collaboration with National Institute of Environmental Studies Japan. The system takes photos every hour from sunrise to sunset and sends data to online storage every night. The researcher can use the data to analyze the vegetation status and snow falling and melting status on mountain surface of mount Tateyama.

Future Work: For future work, the system needs to cope with unstable electricity and network condition of mountain lodge. We are also thinking to design and implement image analysis using time-spatial comparison to detect huge change in the environment such as finding animals and detecting land slides. We are also searching for collaborative partner in South Asian countries who are interested in using this system to monitor Himalayan ranges.

Conclusion: We designed and implemented shooting and hosting system for high resolution panorama photos for monitoring natural environment. The system is good at getting the surface information of natural environment and provide easy to use panorama photo management tool. The prototype is installed in a mountain lodge in Japan. We will continue brushing up the system to cope with unstable operating environment.

INFR2-1: Development of Digital Oman Environmental and Biodiversity Atlas-OEBA

Balasubramaniam MADHAVAN and Saif SHAQSI
National Field Research Center for Environment Conservation

Keywords: Digital Atlas, Environment, Biodiversity, Database, GIS, RDBMS, Encyclopedia, Scalabe.

Habitat loss and fragmentation are major threats to biodiversity in Sultanate of Oman. Yet there are no well-developed methods for quantifying and predicting impacts of fragmentation on biodiversity in Oman. The NFRCEC envisioned to make a Digital Atlas to bring the benefit of a national environmental and biodiversity atlas to the country and proposes to bridge the gap of availability of most-current E & B data in the country. The NFRCEC-Oman has developed a POC for Digital "Oman Environmental and Biodiversity Atlas-OEBA" which is a comprehensive guide to the Sultanate of Oman's environmental and biological resources which shows up all the flora and fauna.

Since 2009, the NFRCEC has been involved in a number of field based research projects aimed at developing a databases. The OEBA denotes a collection of maps, providing an encyclopaedic wealth of information on the gazelle, Tahr, Leopard, Turtles, Reptiles, other wild animals, Mangroves, coral, whale, dolphin and other marine life and land in Oman.

The Digital Atlas answers such questions as why should we care about biodiversity, what plants and animals occur in Oman, how have they been lost or become threatened, and what preservation and restoration strategies are underway for the protection of the state's wildlife species. From college students to outdoor enthusiasts, environmental planners to policy makers, the OEBA will appeal to anyone with an interest in Oman's biological resources.

Initial database models related to birds, reptiles, turtle, wild animals, corals, marine, crop science and plants in the Sultanate of Oman are included in the Digital Atlas. Complete data processing and modelling tools such as RDBMS, Remote Sensing, and GIS are developed. A preliminary web-based clearing-house with geospatial administration system-WEBGIS is designed to maintain records in the OEBA.

The planned algorithm, design, networking protocol, and program are scalable. The scalable system will suitably be efficient and practical when applied to large situations. For example, a large input data set, a large number of outputs and users, and a large number of participating nodes in the case of a distributed system.

INFR2-2: Real-Time Information Fusion for Navigation in Dense Crowds

Manfred EHLERS*, Florian HILLEN*, Bernhard HOEFLE**, Oliver MEYNBERG***, and Peter REINARTZ***
*University of Osnabrueck
**University of Heidelberg
***German Aerospace Center

In our presentation, we propose a navigation system for smartphones which enables visitors of very large events to avoid crowded areas or narrow streets and to quickly navigate out of a dense crowd. To achieve this, real-time information from two types of sensor data are fused. First, optical images acquired and transmitted by a real-time airborne camera system are used to compute an estimation of a crowd density map. For this purpose, a patch-based approach with a Bag-of-Visual-Words Framework for texture classification in combination with an interest point detector and a smoothing function is used. Second, GPS location information and current movement speed of the visitors are obtained via a smartphone app and are analyzed to improve the people density estimation. The fused density information is afterwards used for a least-cost (or shortest-route) navigation out of the congested area. Two possible use cases are presented, namely (i) an emergency application and (ii) a basic navigation application. Finally, a prototype of the complete real-time information fusion system is implemented as a proof of concept.

CITY-1: Modeling Urban Expansion: A Case Study in Santa Rosa, Laguna, Philippines

Gemmalyn MAGNAYE, Nathaniel C BANTAYAN, Cristino TIBURAN, and Dante VERGARA
University of the Philippines Los Banos

Urban growth is the major driving force of urban expansion. This land use change may have adverse impact on the environment as it may alter natural processes. Urban planners need information about the dynamics of urban growth as these may greatly affect the basic amenities provided to the community. Determining the spatial distribution of urban expansion is beneficial in preparing Comprehensive Land Use Plans (CLUP), as this knowledge will serve as guide future plans and policies concrening land uses. In this study, land use change to urban areas in Sta. Rosa City, Laguna, Philippines was modeled. Using GIS and remote sensing, five land classifications were identified: tree patches, bare soil, built-up, grassland, and ricefield based on the Landsat TM images for 1992 and 2006. The projection of the land use change for 2020 was carried out using Land Change Modeler (LCM). The following causal factors were considered: proximity to roads (primary, secondary, South Luzon Expressway), distance to infrastructures (colleges, hospitals, activity centers), and distance to existing urban areas. The results revealed that by 2020, built-up areas will comprise the largest land use in Sta. Rosa City, most of which were converted from grasslands. The barangay with the largest built-up area will still be Brgy. Don Jose, which is where most establishments are located. The model was validated by generating a projected 2013 land use map and was compared to an actual 2013 Landsat OLI image. Overall accuracy was at 84.61%, while average producer's accuracy was 84.17%, and average user's accuracy was 84.32%.

VIS1-1: Automatic Generation of 3D Building Models for Sustainable Development

Kenichi SUGIHARA*, Xinxin ZHOU**, and Zhenjiang SHEN***
*Gifu Keizai University
**Nagoya Bunri University
***Kanazawa University

3D city models are important in urban planning for sustainable development. Urban planners will draw the maps for efficient land use and a compact city. 3D city models based on these maps are quite effective in understanding what if this alternative plan is realized, what image of a sustainable city will be. To facilitate public involvement for sustainable development, 3D models simulating the town in future can be of great use.

To generate real-world 3D city models, the 3D shapes and material attributes of buildings and other objects need to be reconstructed. In the reconstructing process, the image data will be acquired by taking photographs of the objects in the city. But, when thinking of the future layout for the compact city and sustainable development, we cannot take photos of the future of the city and planning roads. Usually and traditionally, urban planners design the town layout for the future by drawing the maps, using GIS or CAD packages.

There may be several plans (digital maps) for urban planning. If the integrated system immediately converts these maps into 3D city models, the system surely supports the researchers and urban planners investigating the alternative idea. Thus, we propose the GIS and CG integrated system for automatically generating 3D building models, based on proposed digital maps.

However, enormous time and labour has to be consumed to create these 3D models, using 3D modeling softwares such as 3ds Max or SketchUp. For example, when manually modeling a house with roofs by Constructive Solid Geometry (CSG), one must use the following laborious steps:
(1) Generation of primitives of appropriate size, such as box, prism or polyhedron that will form parts of a house. (2) Boolean operations are applied to these primitives to form the shapes of parts of a house such as making holes in a building body for doors and windows. (3) Rotation of parts of a house. (4) Positioning of parts of a house. (5) Texture mapping onto these parts.

In order to automate these laborious steps, we are proposing a GIS and CG integrated system that automatically generates 3D building models, which constitute 3D urban models are approximate geometric 3D building models that citizens and stakeholder can recognize as their future residence or real-world buildings. 3D building models are automatically generated based on building polygons or building footprints on a digital map, which shows most building polygons' edges meet at right angles (orthogonal polygon).
A complicated orthogonal polygon can be partitioned into a set of rectangles. The proposed integrated system partitions orthogonal building polygons into a set of rectangles and places rectangular roofs and box-shaped building bodies on these rectangles. In order to partition complicated orthogonal building polygons, a useful polygon expression (RL expression: edges' Right & Left turns expression) and a partitioning scheme was proposed for deciding from which vertex a dividing line (DL) is drawn.

In the digital map, not all building polygons are precisely orthogonal. However, building polygons are expected to be orthogonal for creating 3D building models. When placing a set of boxes as building bodies for creating building models, there may be gaps or overlaps between these boxes if building polygons are not precisely orthogonal. In this paper, the new methodology is proposed for rectifying the shape of building polygons and generating 3D building models without any gap and overlap.

VIS1-2: A Comparative Study of Digital Terrain Data fro Visibility Analysis in the Planning and Management of Scenic Resources

Toru OTAWA
University of Idaho

Recent improvements in digital technologies are rapidly changing the analyses of viewsheds often performed for scenery management. This is particularly true for the geospatial data used for viewshed calculations. A digital elevation model (DEM) was once used to calculate viewsheds in the early days of GIS applications. The emergence of light detection and ranging (LiDAR) data which are likely to have higher spatial resolutions than traditional DEMs contributed to the improvements of calculation accuracy greatly. The objective of this study is to validate that the LiDAR data calculate and predict a viewshed better than the traditional low-resolution DEMs with 10 and 30m spatial resolutions. It is to transform the presumed obvious notion into a proven fact. Using digital terrain data acquired for part of the Nez Perce National Forest in Idaho, the variations for viewshed calculations were scrutinized in depth. Four hundred eighty four (484) observation points were selected randomly to compute viewsheds from the 1m-pixel, bare-earth LiDAR data and from the traditional 10 and 30m DEMs. The comparison of their root-mean-squared-error (RMSE) values proves the newer generation of digital terrain data produces more realistic viewsheds than ones generated from the traditional DEMs. Analyses of variance and t-tests show the viewsheds calculated from various terrain models are statistically different. Therefore, findings from this study suggest that high-quality LiDAR data, if available, should be used for decision-making in planning for the preservation and enhancement of the scenic resources.

VIS1-3: Visualizing the Past: Utilization of CORONA Satellite Image as a Base Map of Historical WebGIS of Asia

Nobuya WATANABE
Chubu University

Sharing spatial information through the internet has become much common and easy in this decade. Especially, WebGIS services distributing free to access base maps have made it much easier for any users to handle maps and map related services. Moreover, the rapid diffusion of Smart-phones has brought an enormous amount of spatially tagged real-time information into the world of geo-information. It seems that up to date spatial information (e.g. high-resolution satellite images, UAVs obtained spatial images, micro data, Open Street Maps like services) has been well equipped now and contents of virtual space is getting closer to the real world. On the other hand, historical information still seems to be lacking in the virtual space. There are many studies on old topographic maps, old aerial photographs, or old satellite images such as CORONA satellite images used in certain focuses of studies (e.g. urban changes, archaeology, disaster prevention, etc.) , but still it is rare for these data to be distributed through WebGIS for convenient use for the others. It is highly expected for these data to be prepared, when taking the rapid land use / land cover changes occurred in this several decades, especially in Asia. The original geography before the rapid urbanization is quite important in many fields, such as ecology, archaeology, disaster prevention, geography, etc. The danger of lacking knowledge or information for the past environment is strongly mentioned in the field of disaster prevention (e.g. the location of old river channel and flood). After the rapid urbanization, many of the past environments had disappeared and it is almost invisible in the real-world. However, in case of the virtual space, it is still possible to visualize these lost environments by using historical spatial information together. The main purpose of this study is to construct historical spatial data platform using CORONA satellite image as a main spatial information. CORONA is a reconnaissance satellite program which photographed the earth surface from mainly 1960s to the early 1970s. It has a wide covering area comparing with the old aerial photograph, and its resolution is comparatively high (i.e. 2m in high resolution, 6m in medium resolution). However, it is known that the image includes severe geometric distortion. This is one of the main reason which makes it difficult for the users to handle this data in GIS, even it is highly informative. In this study, ortho rectification was implemented for the CORONA images, and collection of these geo-rectified images of Asia are to be integrated as a Web GIS based historical spatial data platform. However, unexpected number of the images were covered by clouds, which made it still difficult for fulfilling the purpose. Although, some of the important rapidly urbanized large cities are included. Hence, it is expected to support the relating studies and matters by enabling the visualization of past environment in much accessible way.

SP2-1: Water-related Disasters and Precipitation Remote Sensing from Space

Misako KACHI
Japan Aerospace Exploration Agency

"Precipitation" is one of most essential parameters, which compose the water cycle. It is closely related to our everyday lives, since it is a source of fresh water that we use on a daily basis. On the other hand, precipitation is one of the hardest meteorological parameters to measure, because of its spatial and temporal variability, and lacking of ground observation data in the most of developing countries and over oceans. Satellite observations that can consistently observe broad areas are unique and effective means to achieve global scale rainfall measurement.

To meet recently emerging user needs in application to water-related disaster prevention, which require higher temporal resolution with near-real-time availability, JAXA has operated "the JAXA Global Rainfall Watch" system, which produce hourly global rainfall map data called the Global Satellite Mapping of Precipitation (GSMaP) in 0.1-dgree grid 4-hour after observation since 2007 (http://sharaku.eorc.jaxa.jp/GSMaP). The GSMaP product was developed for the Global Precipitation Measurement (GPM) mission, which is an international collaboration to achieve highly accurate and highly frequent global precipitation observations. The interests of GSMaP users covers broad fields and worldwide. Several activities to apply GSMaP data to some flood warning systems/tools are underway in collaboration with meteorological and hydrological agencies in Japan and Asian countries to utilize high temporal and spatial resolution and rapid data latency.

SP2-2: Monitoring the Forest/Non-forest from Space Using the PALSAR and PALSAR-2

Masanobu SHIMADA
Japan Aerospace Exploration Agency

Four global mosaics of Advanced Land Observing Satellite (ALOS) Phased Arrayed L-band Synthetic Aperture Radar (SAR) HH and HV polarization data were generated at 25 m spatial resolution using data acquired annually from 2007 to 2010. Variability in L-band HH and HV gamma-naught (γ0) for forests was observed between regions, with this attributed to differences in forest structure and vegetation/surface moisture conditions. Region-specific backscatter thresholds were therefore applied to produce from each annual mosaic, a global map of forest and non-forest cover from which maps of forest losses and gain were generated. The overall agreement with forest/non-forest assessments using the Degree Confluence Project, the Forest Resource Assessment and Google Earth images was 85 %, 91 % and 95 % respectively. Using 2007 as a baseline, decreases of 0.040 and 0.028 dB (with a 0.006 dB 99% confidence level) were observed in the HH and HV γ0 respectively over the same areas suggesting a decrease in forest area and/or increased smoothing of the global surface at the L-band radar observation over the four-year period. The maps provide a new global resource for documenting the changing extent of forests and offer opportunities for quantifying historical and future dynamics through comparison with historical (1992-1998) Japanese Earth Resources Satellite (JERS-1) SAR and the forthcoming (from 2014) ALOS-2 PALSAR-2 data. Four year PALSAR mosaics and the forest/non-forest data, which were generated and analyzed in this paper, are opened to the public for free downloading albeit with coarser resolutions (WWW1). Future distribution of the higher (original) resolution datasets from PALSAR as well as the ALOS-2/PALSAR-2 is planned.

SP2-3: Space-based Greenhouse Gas Monitoring by GOSAT

Kei SHIOMI
Japan Aerospace Exploration Agency

JAXA's Greenhouse Gases Observing Satellite (GOSAT) is a first dedicated satellite to monitor global greenhouse gases such as CO2 and CH4 from space since 2009. Greenhouse gases are observed by a Fourier Transform Spectrometer (TANSO-FTS) with 3 polarized SWIR narrow bands, which are 0.76, 1.6 and 2.0 microns of O2, CO2, and CH4 absorptions, and a TIR wide band from 5.5 to 14.3 microns, which includes CO2, CH4, O3 and H2O absorptions. The FTS observes globally with gridded points of 10 km FOV using discrete pointing covered 750-km swath in 3 days.
The XCO2 and XCH4 (column-averaged dry air mole fraction) are derived from the retrieved CO2 and CH4 column amounts with surface pressure. The GOSAT achieves to observe XCO2 with 2 ppm accuracy after optimization of cloud screening and aerosol estimation. Atmospheric CO2 long-term trend has measured since 1950s over 50 years. However, the CO2 measurement facilities and tools are deployed at limited locations around 200 sites. The GOSAT increases CO2 observation data in 9000 points per day not only over land but also over ocean sunglint. Global CO2 observation contributed to reduce the uncertainty of estimated CO2 flux especially in less observation points. Space-based greenhouse gas observation is investigated to carry on by the follow-on mission GOSAT-2.

SP2-4: Practical Applications Utilizing QZS-1 "Michibiki"

Kazuhiro YOSHIKAWA
Japan Aerospace Exploration Agency

In this decade, applications of space based Positioning, Navigation and Timing (PNT) services utilizing not only US. GPS but also other nations' GNSS such as Russian Glonass, Chinese BeiDou, European Galileo and Japanese QZSS, has been widely and deeply spread into our social life from dairy use of Location Based Services on smartphone's App to time synchronization among cell phone base stations network, recently, machine control using precise positioning technique like autonomous driving and precise farming are getting more and more familiar, its technology development are greatly progressed. JAXA has taken major role to conduct research and development work on the first Quasi-Zenith Satellite (QZS-1), called as "Michibiki", and through its technical validation and operation, following two benefits were demonstrated; 1) Enhancement of GPS availability by QZSS GPS complementary function and 2) Performance improvements on GPS positioning accuracy and its reliability by GPS augmentation function. The Government of Japan decided to complete four satellite constellation and to start providing operational service in 2018 after JAXA and relative research institutes' experiment have been completed successfully. Now, Cabinet Office are implementing operational system deployment. In this talk, perspective on future applications contributing to the resolution of several social problems we are facing are mentioned. Especially, the latest status of experiments with regard to Intellectual Transportation System (ITS) and Robotic farming, which JAXA is conducting demonstrations with stakeholders, are introduced.

DIS-1: xploring the Relative Performance of ASOS and RSA Weather Data in Explaining Historical Weather Related Disaster Damage

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Gangneung-Wonju National University

KMA(Korea Meteorological Administration) provides two types historical weather information to general public. This first one is ASOS (Automated Synoptic Observing System) data. This is the observed and measured weather information on point locations. The second one is RSA (Real State Analysis). RSA is the numerical weather model based reanalysis output. It includes both output from numerical weather models and historical weather data to simulate the historical weather patterns in grid format which has 5km by 5 km spatial resolution for Korean peninsula. In this study, I will analyze the relative performance of ASOS data and RSA data in explaining the physical and monetary damage from natural disasters such as typhoon. In doing so, I will estimate two types regression equations. The first includes the historical damage as a dependent variable and weather information from ASOS and other information as explanatory variables. The second includes the historical damage as a dependent variable and weather information from RSA and other related information as explanatory variables. After estimating two models, I will check which equation has more explanatory power using J-test and other statistical tests which evaluates the relative explanatory performance of two competing non-nested equation. The results from the tests will provide the usefulness of RSA data which KMA provides in conducting research about historical weather related disaster and damage.

*This study was funded by the Korea Meteorological Administration Research and Development Program under Grant APCC 2013-3150.

DIS-2: Evaluation of DEM Generation Based on Interferometric SAR Using TanDEM-X Data

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DEMs provide an important source of information about the topography of a particular area and has been used in a wide range of scientific investigations such as hydrological, geological, geomorphological, development, urban planning, and surveying. There are various methods for generating DEMs using different sensors, such as photogrammetry, radarmetry, and interferometry. InSAR has been proved to be an efficient tool to generate high precision DEMs because of its wide and continuous coverage, high precision, cost effectiveness, and ability to record data in all weather conditions (Rosen et al., 2000; Carlisle 2002). Previous studies have shown that the accuracy of a DEM depends on the location and this accuracy can be estimated by comparing the DEM data with a set of check points measured by high precision methods such as ground survey (Digital Global Positioning System (DGPS)) or LiDAR based observations (Cuartero et al., 2004). This study is focused on the generation of a Digital Elevation Model (DEM) for Tokyo, Japan from data collected by the recently launched TanDEM-X (TDX) satellite of the German Aerospace Center (DLR) using Interferometric SAR techniques. The aim of the TanDEM-X mission is to generate a consistent high resolution global DEM dataset. In order to generate an accurate global DEM using TanDEM-X data, it is important to evaluate the accuracy in different sites of the world. This study is conducted as a part of the Transformation and Resilience on Urban Coasts (TRUC) project funded by Belmont forum. TRUC focuses on identifying the interactions between biophysical, land-use and decision-making processes in urban coastal regions, including the city of Tokyo, in order to assess resilience and identify vulnerabilities. Within TRUC, we have been working on various DEMs to identify the vulnerability of urban coasts to flooding. Here, we report our efforts to generate the high resolution DEM data of Tokyo region using TanDEM-X data. This DEM data will be further evaluated and compared with other existing DEM data of Tokyo region. Based on the vertical accuracy of the DEM data further analysis will be done to identify the coastal vulnerable areas.

DIS-3: Education for Disaster Prevention and Preparedness by Using Digital Earth -Introducing a Case of Chubu University-

Jun IZUTSU
Chubu University

In Japan, many natural hazards and disasters occurred almost every year. So it is very important to study about natural hazards and disasters. However, many of university students have not been taught and educated "earth science" enough to understand these natural hazards. Because many universities (especially private universities) have not been using "earth science" at their entrance examinations.

In the case of Chubu University, "physics", "chemistry" and "biology" have been used at entrance examination, but "earth science" has not. Most of Chubu University students have not been educated "earth science" enough, but they will certainly face to the next "Nankai–trough earthquake", super typhoons and other sever natural hazards and disaster during their lifetime. Natural hazards and disasters are lectured at some faculty and course in Chubu University, in those lectures, we are introducing about some lectures using Digital Earth.

"Problem Based Learning B" is a lecture for 2nd grade students of college of engineering. In this lecture, lecturers and students discuss about many kind of problems through some simple experiments. For example, the soil liquefaction is one of problems. The soil liquefaction occurred widely in east Japan region at 2011 Tohoku Earthquake, and Nagoya region will be suffered by tsunami and liquefaction at next Nankai-trough earthquake. Firstly, students make a simple experiment of soil liquefaction by using sand (or small glass beads) and a plastic beaker to grasp the liquefaction. After the lecture of mechanism of liquefaction, students discuss which areas are dangerous and how danger or safe their home are. After discussion, they check the results of discussion and answer at Chubu University Digital Earth Room. In Digital Earth Room, we have a database of geological data acquired from large number of boring surveys. Students check their theory by using these data and hazard map issued by the city, and discuss how to prevent, mitigate and prepare the coming disaster.

Some lectures for master course students are also using Digital Earth Room. This year, graduate school of Chubu University start-up new master course "Innovative Energy Science and Engineering". This course contains energy science, geoinformatics and earth and space science to solve the various problematique which prevent sustainable developments. Now we are preparing to start doctor course of "Innovative Energy Science and Engineering" in 2016. The education using Digital Earth will be developing more.

ESD2-1: Aqua Republica Serious Game Competition on Water Resource Management for Schools in Asia Pacific RegionZ

David WORTLEY
Gamification and Immersive Technologies Strategis Solutions

This paper presentation describes the UNEP-DHI Eco Challenge Aqua Republica Serious Game Competition that has been running for two years in the Asia Pacific Region. The competition has been designed for schools and involves teams of two children developing a fictitious region called Aqua Republica. In 2014, 400 teams across Asia competed for a cash prize and a trip to the SGSC conference in Korea. Although the Aqua Republica Region is fictitious, it uses real world data collected over a period of 50 years and therefore represents an accurate simulation of the impact of social and economic development strategies on water resource management.

Aqua Republica has been designed help raise awareness of the importance and challenges of managing limited natural resources in the face of multiple and often competing demands in the drive towards a sustainable development. It is a DHI and UNEP-DHI Centre project that focuses on the development and promotion of a not-for-profit serious game in collaboration with a number of partners. The aim is to promote sustainable water resources management by sharing knowledge, raising awareness and building capacity in some of the most critical issues in water resources management. This is achieved through a computer-generated virtual environment called, Aqua Republica where participants can experience making decisions in managing a catchment in an interactive and engaging way, and in doing so, learn about the connectivity and importance of water resources, as well as the need for careful management.

While the world of Aqua Republica is fictitious, the challenges of sustainably managing a limited supply of water resources in a situation of growing demand between multiple users and uses are very much based on real life scenarios. The key objectives of the game are inspired by UNEP's ecosystem approach to Integrated Water Resources Management (IWRM), highlighting the importance of ecosystems and its importance (e.g. food security, freshwater supply and disaster risk reduction, etc.)

This paper uses Aqua Republica as an example of the potential of Gamification and Enabling Technologies to have a transformational impact in key areas of global challenges such as Sustainable Development, Health and Education and draws conclusions about the role that ISDE could play in leveraging Gamification and Enabling Technologies for the benefit of Digital Earth Applications.

ESD2-2: GIS as a Platform for Problem-based Learning and Critical Thinking

Michael GOULD and Joseph KERSKI
Esri

Education for sustainable development requires students to do more than look at maps to see what exists and where things are. To become effective decision makers, students need to reach the point of being able to ask what-if questions, to study trends and patterns, to make predictions, and to propose changes in the world. Using maps in a Geographic Information Systems (GIS) environment can foster spatial and critical thinking. Spatial thinking is not merely a cognitive development studied by educational psychologists, but is a set of specific skills that are in demand by employers in both commercial and research institutions. GIS was created 50 years ago to better manage and make sense of large amounts of land inventory data and to help answer what-if questions. Since the 1980s, GIS has been used in thousands of universities and, more recently, has found its way into secondary schools. Many of these schools have not progressed beyond the point of 'using GIS (a new technology) in class' and have not yet reached the desired effect of GIS in education: Problem-based learning and improved critical thinking. In this presentation, we discuss cases in which students are grappling with data, thinking critically, and using GIS to solve problems, and the corresponding benefits, in places like Rwanda, Abu Dhabi, and the USA. We show the cycle of geographic inquiry: Asking questions, collecting data, exploring and analyzing data, and finally acting on geographic knowledge. This last step is important, because identifying problems and criticizing is easy; however, proposing viable alternatives and improvements is a skill which takes practice and mentorship inside the classroom or outside. We also make the case that today's modern web- and mobile-based GIS platform is helping spread its adoption beyond the innovators and early adopters to the 'early majority' in Rogers (1995) diffusion of innovations model. The platform also encourages online sharing of maps and multimedia presentations, which encourages learners to publish their results, their theories, their proposals, to gain feedback, and build a community of learners.

ESD2-3: Digital Earth as a Platform for Synthesis of Knowledge and ESD (Education for Sustainable Development)

Hiromichi FUKUI
Chubu Univerisity

As we can see in problematique, such as environmental issues and disasters, the various risks we face at both local and global scale are all interrelated to each other, and also tend to suddenly emerge at very local level. Conventional science has only been able to deal with parts of these problems. The first step to build a sustainable and disaster resilient society is to monitor, identify, store the data of phenomena on the earth, then process and interpret the raw data, turn them into understandable information to display, publish and distribute. We must share a common recognition of the issues.

Therefore we need "the Digital Earth (DE)" that is a virtual representation of our planet on the internet, and enables a person to explore and interact with the vast amounts of natural, socio-economic and cultural information gathered about the earth. It is designed as a multi-dimensional, multi-scale, multi-temporal, and multi-layer information facility.

These infrastructures are using for the ESD (Education for Sustainable Development). ESD is an indispensable element for achieving sustainable development vision and participatory teaching and learning methods that motivate and empower learners to change their behavior and take action for sustainable development. To try to find solutions to problematique in practice, ESD promotes competencies and essential skills like holistic views, critical thinking, systemic thinking, imagining future scenarios and making decisions in a collaborative way. The Digital Earth can also facilitate data-intensive studies for problematiques of the 21st century as well as the above ways. We realize Digital Earth and geospatial information technologies are indispensable tool for ESD. This presentation examines how Digital Earth can help making our society "Disaster Resilient and Sustainable" as a use case. We propose Digital Earth platform as a public information base which has "cloud-based" geospatial information system and services in cooperation with multi stakeholder

AGR-1: Digital Earth for Sustainable Agriculture: Case of Land Suitability Study for Viticulture in Inland Northwest Region of the United States

Toru OTAWA
University of Idaho

Global climate change is slowly but surely making impacts on the types of agricultural commodities traditionally grown in a region. As the result, growing boundaries are shifting gradually, and the regions which were not suitable for some crops a few decades ago are now suitable for growing them. The tri-county area in north-central Idaho is one of the regions that may become highly suitable for grape production, and both the public and private sectors are now promoting the ancient commodity in this region. The primary objective of the present study is to identify and evaluate suitable areas for viticulture in the region of interest. The study used a GIS to evaluate several primary factors which may closely relate to viticulture production and operation. These factors include, but are not limited to, (a) elevations, (b) soils, (c) slopes, (d) existing land-uses including water-bodies, (e) land cover, (f) aspects and (g) accessibility from existing roads. The elevation factor largely dictates the boundaries of the American Viticulture Areas (AVA). The study identified several potentially suitable areas in accordance with the applied site-selection criteria, but these findings should be used only as guidance for further scrutiny. For example, slope inclinations should be inspected carefully due to the inherent error in digital elevation models (DEM) in the selected suitable areas. Generally, soils in the region do not present high suitability for grape production primarily due to their geological origins and history, but constraints such as the soil suitability may be overcome by developing cultivars that will meet all growing conditions in the region and/or by amending soils. Other constraints such as the inclination of slopes and aspects are fixed, and therefore may not be overcome. Therefore, it is critical that researchers model as many alternatives as one can conceive to identify most optimum areas for grape production. Overall, the current warming trends are most likely to contribute to enhanced grape production in the newly proposed AVA.

AGR-2: TanDEM-X Based InSAR Techniques to Monitor Oilpalm Plantation Area

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Vegetation biophysical parameters (tree height, biomass, density, diameter at breast height (DBH), age etc.) are significant variable in the terrestrial ecosystem and play an important role in carbon cycle. These parameters can be accurately measured by collecting forest inventory data. However, in tropical developing countries forest inventory data is not sufficient to estimate forest carbon stock and its changes. Therefore, use of alternative techniques like remote sensing can provide characterization of the spatial distribution of forest and their biophysical parameters. With the recent development in the process of climate change mitigation, monitoring of forest biophysical parameters become significant to establish Measurement, Reporting and Verification (MRV) system under the Reducing Emissions from Deforestation and forest Degradation (REDD+) mechanism. Peatland forest of Southeast Asia is rich of global biodiversity and biomass but recent development activities causes change in landuse pattern such as oilpalm plantation. Optical remote sensing data is often difficult to obtain cloud-free images in tropical regions due to frequent cloud cover. Therefore, use of Synthetic Aperture Radar (SAR) data offers an alternative data source to monitor forest cover and its changes in large and remote areas of tropical forests. Longer radar wavelength L-band SAR i.e. Phased Array Type L-band Synthetic Aperture Radar (PALSAR) has been used significantly to delineate forest and forest cover change as compared to other wave-lengths because of its greater penetration through the canopy. However, PALSAR based InSAR/PolInSAR techniques are not effective to estimate canopy height because of temporal and volume decorrelation. With the advancement in the field of sensor development, these limitations can be overcome specially using single pass TanDEM-X data over vegetative area. This allows the acquisition of spaceborne polarimetric SAR data without the disturbing effect of temporal decorrelation. In this study, we tested interferometric X-band SAR (InSAR) from TanDEM-X (TDX) data. The aim of the study was to estimate vegetation height from InSAR data of TDX. The test site is an Oilpalm plantation area of Sarawak, Malaysia. The Random Volume over Ground (RVoG) model was used to inverse the vegetation height based on Interferometric coherence. Further we have estimated the growth in height using multi-temporal data. This study shows that TDX data could play a significant role to estimate height of vegetation without limitations of temporal decorrelation. However, we have faced some problem with the signal-to-noise ratio (SNR) decorrelation. TDX data provide significant results after SNR correction. This study could contribute towards characterization of oilpalm biophysical parameters and to estimate the changes in biomass.

AGR-3: Agriculture Information Service Platform Based on OGC Standard and Crop Modeling

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*****Rambhai Barni Rajabhat University

An agricultural information service platform, called FieldTouch, is being built on OGC standard web services and crop modeling framework. More than 300 farmers in Hokkaido, Japan, have been participating on this development and are utilizing the services for optimizing their daily agricultural practices, e.g., planning and targeting areas where to apply fertilizer more to enhance homogeneity of growth and robustness of crops in their fields.

FieldTouch integrates multi-scale sensor data for field monitoring, provides functionality for recording agricultural practices, then supports farmers in decision making e.g., fertilizer management. The sensor data includes RapidEye satellite images, data from field sensor networks, as well as data from national weather observation network, AMeDAS. We used “cloudSense” sensor backend service that serves meta-data and data to FieldTouch via a OGC’s standard web service; SOS (Sensor Observation Service), which brought great flexibility and enhanced automation of system’s operation.

Using agronomic data from experimental station, the cultivar parameters (genetic coefficients) of a local wheat variety were calibrated for the DSSAT (Decision Support System for Agrotechnology Transfer) crop model using data assimilation. These were built in a web-based DSSAT wheat crop model called Tomorrow’s Wheat (TMW) where in a user can explore the effects of timing of sowing at a given climatic condition, soil and crop management.

ENV2-1: Regional Estimation for Existing Global Land Cover Datasets by Field Investigation in Inner Mongolian Desert Steppe Region, CHINA

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Land cover is the physical material at the surface of the earth. Land cover changes affect local surface energy balances by changing the amount of solar energy reflected (Vargo et al. 2012), it also can influence climate through both biogeochemical or biophysical effects, therefore land cover is a very important parameter for environment of the earth surface. On the other hand, an increasing number of international environmental agreements place global change at the top of international scientific and political agendas, including the Kyoto Protocol, the Convention on Biologica Diversity, the Convention to Combat Desertification and the Ramsar Convention on Wetlands (McCallum, 2006). Global change refers to planetary-scale changes in the Earth system, and the system consists of the land, oceans, atmosphere, polar regions, life, the planet's natural cycles and deep earth processes. Based on above background, since 1990s, international scientific organizations or international science communities provide some satellite derived 1km resolution or above 1km resolution global land cover datasets and which are in wide use by the environment of earth surface related scientific project or academic research.

Accuracies of the existing global land cover data are not high (Tateishi et al. 2011). For example, concerning IGBP DISCover or GLCC ver. 1.2, Scepan (1999) reported that overall accuracy with the weight of classified area of each class is 66.9%. The MODIS 1km land cover data have a 78.3% global area-weighted accuracy (BULC website). The GLC2000 has an overall accuracy of 68.6% (Herold et al. 2006). GlobCover has an area-weighted overall accuracy of 73.1% (Defourny et al. 2009).

This study aims to regionally estimate six existing global land cover datasets by field investigation in desert steppe region, Inner Mongolia, China. these six existing global land cover datasets include: (1) Global Land Cover Characterization (GLCC v2.0), 1km resolution: the U.S. Geological Survey's (USGS) National Center for Earth Resources Observation and Science (EROS), the University of Nebraska-Lincoln (UNL) and the Joint Research Centre of the European Commission have generated a 1-km resolution global land cover characteristics data base for use in a wide range of environmental research and modeling applications (Loveland and others, 2000). The data set is derived from 1-km Advanced Very High Resolution Radiometer (AVHRR) data spanning a 12-month period (April 1992-March 1993) and is based on a flexible data base structure and seasonal land cover regions concepts (http://edc2.usgs.gov/glcc/glcc.php); (2) UMD Land Cover Classification, 1km resolution: The University of Maryland Department of Geography generated this global land cover classification collection in 1998. Imagery from the AVHRR satellites acquired between 1981 and 1994 were analyzed to distinguish fourteen land cover classes. This product is available at three spatial scales: 1 degree, 8 kilometer and 1 kilometer pixel resolutions (http://glcf.umd.edu/data/landcover/); (3) Global Land Cover 2000 (GLC2000), 1km resolution: Produced by the EC Joint Research Centre. The Global vegetation Monitoring Unit of Joint Research Centre carries out several activities related to Land Cover mapping and monitoring. In particular the GVM Unit is coordinating and implementing the Global Land Cover 2000 Project (GLC 2000) in collaboration with a network of partners around the world. The general objective is to provide for the year 2000 a harmonized land cover database over the whole globe and to achieve this objective GLC 2000 makes use of the VEGA 2000 dataset, is a dataset of 14 months of pre-processed daily global data acquired by the VEGETATION instrument on board the SPOT 4 satellite. (http://bioval.jrc.ec.europa.eu/products/glc2000/glc2000.php); (4) The MODIS Terra + Aqua Land Cover Type Yearly L3 Global 500 m SIN Grid product: This dataset is funded by NASA's Earth Science Data Systems program and it is incorporates five different land cover classification schemes, derived through a supervised decision-tree classification method (https://lpdaac.usgs.gov/products/modis_products_table/mcd12q1); (5) Global Land Cover Map (GlobCover 2009_v2.3), 300m resolution: GlobCover is an ESA initiative which began in 2005 in partnership with JRC, EEA, FAO, UNEP, GOFC-GOLD and IGBP. The aim of the project was to develop a service capable of delivering global composites and land cover maps using as input observations from the 300m MERIS sensor on board the ENVISAT satellite mission (http://due.esrin.esa.int/globcover/); and (6)The Global Land Cover by National Mapping Organizations(GLCNMO2008), 500m resolution: Land Cover Global version data (GLCNMO) have been developed by the secretariat of ISCGM in collaboration with Geospatial Information Authority of Japan (GSI), Chiba University, and NGIAs of respective countries and regions. The data have been prepared by using MODIS data with remote sensing technology. The Global Land Cover by National Mapping Organizations (GLCNMO) is geospatial information in raster format which classifies the status of land cover of the whole globe into 20 categories. The classification is based on LCCS developed by FAO. Therefore, it is possible to compare and integrate GLCNMO and other land cover data products based on LCCS (https://www.iscgm.org/gmd/). Common estimation area of six global land cover datasets is Inner Mongolian desert steppe region and it is located between east longitude 105 degrees 7 minutes to 115 degrees 12 minutes and north latitude 37 degrees 37 minutes to 45 degrees 8 minutes, has area of 112000 km2. In this study, we use spatial information technologies, such as Geographic Information System , Global Navigation Satellite System and Remote Sensing Technology, to get ground truth pictures data for approximately 100 random pixels with 1km2 ground size and which are spatially matched with above six global land cover datasets. Accuracy assessment of land cover types mainly based on ground truth pictures in 2013 and it is also using same years' Landsat images for the global land cover datasets as a additional reference information. The final results shows that there were varying levels of apparent discrepancies in estimating Inner Mongolian desert steppe region among these six global land cover datasets.

KEY WORDS: Global Land Cover Dataset, Regional Estimation, Desert Steppe Region, Inner Mongolia

ENV2-2: Forest Disturbance and Regeneration in Northeastern Europe

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Northern temperate forests suffer frequent disturbances. Natural and anthropogenic disturbances such fire and wind damage, insect damage and disease, and different harvest activity are driving forces of change causing significant influences on forest structure. Main disturbance agent in Northeastern Europe (Baltic states and western regions of Russia are considered in particular study) is clearcut harvesting, since great majority of the stands is actively managed for timber production. Another major agent is commercial thinning. Deforestation could be successfully described and mapped. Despite, the regeneration of harvested areas is complicated process, the relationship between stand age and patch radiance can be highly variable especially in young stands. Forest area increase is taken place because of afforestation of the abandoned former agricultural lands. Clearcut harvested areas are also intensively regenerating during last decades.

Undertaken study is concentrated on following forest cover changes caused by clear-harvesting activities and afforestation of former agricultural land using moderate resolution imagery obtained between 1985 and 2014. Data analysis was performed using images acquired during growing season and untraditional winter images with plane snow cover conditions, since radiance contrast between forested patches and the surrounding non-forested areas is high in these conditions and therefore classification errors are minimized.

ENV2-3: Spatio-temporal Pattern of Terrestrial Ecosystem in Ghana Using Remote Sensing Data

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Agriculture in both industrialized and developing countries is a unique sector, characterized by complex issues and problems, ranging from macro (economic) policy levels all the way to the micro (smallholder) farming household and field plot levels. Agriculture, being predominantly a (small-scale) family and/or communal enterprise differs in fundamental ways from administrative services and industrial sectors in terms of relative unpredictability, uncertainty and variability in bio-physical (soil and weather) conditions on which the primary production processes rely. Also, there is a huge diversity in production strategies and objectives among farming households as well as household individuals.

Agriculture in Africa is mainly seasonal and faces high levels of risks, which are in-turn compounded by poor infrastructure and isolated rural communities (Stoop and Hart 2005). Fluctuating market and trade conditions, as well as political instability further add to farmer uncertainty. Agriculture therefore, faces rather unique problems with respect to research and development including the planning, implementation and evaluation processes that are involved as well as the assessments of impacts at various levels (Eicher, 1999).

In African countries, sustainable agriculture is the key to the food security. However, in the present scenario of climate change that results in various climate related disasters, such as flooding and drought, causes instability in the agriculture production. Therefore, new agricultural techniques are to be developed to supply a constant yield in the climate change scenario.

The main objective of the study is to determine the impacts of climate change on various physiological processes of terrestrial ecosystem of Ghanaa) To study responses of forest ecosystem to climate variations (relation between Temperature, Precipitation with NDVI, NDWI, NDSI and other vegetation indices and b) To study land use and its changes.

This study has presented the long-term remote sensing based phenology and climate variation study of Ghana. We explore the relationship between temperature and precipitation and land surface phenology metrics to determine how influential climatic variation is on the NDVI, NDWI and NDSI. Our results shows that, in warm regions like Ghana, temperature plays significant role in modulating the seasonal cycle of vegetation. An Increase in temperature leads to decreasing NDVI and NDWI values. The effect of precipitation on NDVI and NDWI is obviously recorded; future work will focus on the correlation between precipitation and temperature, and different class of vegetations in the context of regional climate.

VIS2-1: Digital Archive of Community Memories Before the 2011 Tohoku Earthquake and Tsunami in Japan - Rebuilding Lost Place and Landscape Using CityEngine

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The sense of well-being is buoyed by strong social relations, feelings of connectedness to community. As Balducci, A. and Checchi, D. (2009) indicated, the subjective well-being would be strongly correlated with the opportunity of personal relationships, which are given by the existing social organization of life (local meeting opportunities, volunteering). The significance of "community" has been re-evaluated especially after the 2011 Tohoku earthquake and tsunami in Japan. In many parts of disaster areas, power of community contributed to cope with the difficult conditions after the disaster. In order to revitalize the local areas in Tohoku area, in both meaning of creating resilient city and of achieving well-being society, the community development must be centralized in the consideration of future plan. The feelings of connectedness to community would be fostered by having a common sense of value and it would be cultivated by having experiences in common; school days at the same local school even though the time is different, viewing the same scenery and landscape, participation in local activity and so on. Those experiences would be acquired and memorized based on places or landscapes, and those memories would be reminded linked to places. For the people of disaster area in Tohoku, however, those places or landscapes were totally lost by the tsunami. This loss is supposed to cause many difficulties to establish future revitalized town by community.

Considering this situation, we started a project in 2013 to rebuild parts of Tohoku, Japan before the 2011 Tohoku earthquake and the tsunami, to offset the loss of landscape where the community sense had been fostered for the local people. The project aimed to collect the geological information, information on houses, public facilities, agricultural land and forest, and to acquire those information from the workshop with local survivors, and then rebuilt the lost landscape by CityEngine.

Six villages; Ainokama, Fujisone, Ninokura, Hasegama, Kabasaki, and Niihama in Iwanuma city, Miyagi prefecture were selected for the sites. All villages were gone by the tsunami in 2011 and survivors; more than four hundred and fifty households who used to live in the villages are now trying to rebuild their life and to establish a new community based on the old community, in the course of relocation program.

The project combined ArcGIS Online 2D maps, CityEngine procedural design, and SmarterBetterCities' CloudCities interactive 3D viewer to achieve the purpose.

By CityEngine's procedural modeling, 3D geometries and textures would be constructed using rules without hard work of manual modeling. There, even a single procedural rule would generate many 3D models. The rule would make use of feature attribute information including building type, the number of floors, roof structure type, roof material type, wall material type, the figure of windows, street material type, vegetation type, agricultural facility type, etc., to generate a series of alternate 3D models that accurately represent the properties of each feature.

Therefore, in the project, at first, geological maps, GoogleEarth images and other old pictures taken by people before the tsunami were collected, and the location and shape of figures of each building, walls, vegetation and others were extracted based on them. Since there were many of lacking information on those villages to build models, we conducted workshops with surviving residents to learn about the landscapes, housing styles, and culture prior to the earthquake and tsunami. A series of field investigation at the villages and neighboring areas where the buildings and landscapes were not affected by the tsunami and remained even after the tsunami have been implemented to collect the information on local settings of buildings and vegetation, or their models.

We incorporated the feedback from the workshops to create a detailed reconstruction of six stricken villages in CityEngine. With those models, we created 3D scenes of the six villages in CloudCities, enabling sharing and discussion of 3D design between all stakeholders, including residents. The viewer displays 2D ArcGIS Online maps next to the 3D scene for convenient comparison.

And then, we have held several workshops in order both to acquire the feedback from the residents again to make the models more elaborated ones, and to discuss how the residents sensed the landscape in their ordinary life from the analysis of particular parts to which they paid attention in the scene. We recorded the dialogues during the workshops and analyzed them. The content, the parts to which the comment was given, how abstract or how concrete were analyzed. The change of them through the series of workshops with being developed in detail 3D scenes was also examined.

The results of analysis indicated that the comment from the residents became more concrete gradually, the local residents used to sense the village by the distance from the natural element such as sea shore or river. The significance of forest, watch tower, community hall and cemetery in their memories of landscape were also revealed. As to the change in their behavior, they learnt to tell the memories indicating the places on the scene. Through the study, it was also indicated that they attached their mind to mundane objects such as vending machines, or billboards, to which we paid little attention at first. It can be said that there is a possibility that those things are playing more important roles than expected in the landscape for their ordinal life.

The increase in the number of comments from the residents to 3D scenes provided, and the change in the contents of those comment from abstract ones to more concrete ones were observed. It indicated that they learnt to remind more things about their ordinary life by the 3D scenes we created.

In the presentation, we would introduce the procedure of constructing a digital archive of memories, and then discuss the future development and agenda.

VIS2-2: Map Based Querying of Spatial Data Focused on Search for Spatial Similarities

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The map view is one of most natural form of spatial information acquisition. Especially students of geography uses maps quite extensively in their research activities. Nevertheless in case of a large spatial extent and a huge amount of data is necessary to combine a visual geodata interpretation with another geoprocessing approaches like spatial querying and modelling. Spatial querying itself is very formalised process requiring sufficient knowledge of a database structure and functional mechanisms of a particular query language. Moreover use of non-basic spatial query imply leave the map view for a query building environment. Our aim is to simplify spatial information acquisition for geography students through integration spatial querying process into map use. In this stage isn't our ambition complete incorporation of spatial querying into the map view. We are focusing on search for spatial similarities. The spatial similarity here is considered as proximity of two configuration of spatial objects according to chosen metrics. It can be considered like reverse of one most frequent general spatial modelling task - suitability model. Principle of search for spatial similarities is to find object or place with possible manifestation of observed spatially dependent phenomenon. Such phenomenon can have either positive or negative connotations. In case of negative environmental phenomena (landslides, forest fires, danger transport accident impacts and similar) search for similarities can help identify vulnerable places or reversely we can identify similarity pattern with comparison of places affected by identical phenomenon.

There are two main background aspects of our project covered by this paper. First background issue is a visual approach to building spatial query. Generally there were several approaches to increase accessibility spatial querying. One prevalent direction is a use of diagrams with nodes representing spatial features and spatial predicates. Another direction is a definition of spatial query by sketches, either freeform or diagram based. Both mentioned approaches are different from our intention, to use the map view for query compilation. Our approach is closer to the query by example mechanism as is used in search of text documents by selection of particular term groups within the structure of a sample document. Second background issue is the theory of spatial similarity. In case of spatial similarity we can consider the similarity based on geometry, the similarity based on semantics and the similarity based on theme. There also are several proposals for metrics of particular spatial similarities. Key role in such metric plays classification of spatial relation between objects within spatial configuration.

Our proposal of the map based query builder is based on several key elements which are discussed within paper.
1. A simple diagram based query definition. Graphical components of our query language are rectangular selectors for identify objects, links between selectors bearing topo-metrical relations and filters graphically setting value extent for selected object attributes.
2. A generalisation of spatial relationships for levelling of spatial similarity. Spatial relations are created by combination of topology, direction and measure. All component have ordered variants and can be gradually generalised for obtain different levels of spatially similar configurations.
3. A parameter filtering is based on sample of values combined with expected value distribution. Size and mechanism of sampling can be modified during query evaluation. In case of qualitative values can be used predefined thesauri for term similarity grouping and levelling.
4. There is one definition area and are up to three check-up areas with on fly visualisation of the search result. Sample results can be used for query correction to achieve suitable results.
5. A graphically defined query is translated into the spatial SQL for multimedia query dialect. There are variants of use custom functions for implementation of demanded topo-metrical predicates or their simplified substitutions for use basic dialect.
For use within education environment we choose implementation based on open source software tools. For map visualisation and the user interface is used HTML5 environment using javascript libraries Leaflet.js and jsjts. For a geodata storage and the processing of the compiled spatial SQL query is used spatial extension of SQLite database engine Spatialite. Reasons for choosing of these technologies and experiences with them are provided in paper.
In this stage there is the amount of manual options and parametrisation. This is suitable for geography students. For wider group of users we consider intense automatisation of spatial relationship establishment and black boxing setting of the spatial similarity level. Possibilities of next development in this direction is discussed.

CZSC-1: The Role of Social Geo-participation in the Creation of the Smart City for Plock

Robert OLSZEWSKI
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Smart City can be understood not only as a technological solution, but also as the ability to use the information resources related to all spheres of activity of a city. The realisation of the project smart Plock makes it necessary to view the inhabitants' problems from a global perspective, in particular the aspects related to the economy, human capital, ICT (Information and Communication Technology) and quality of life. In order to realise this idea it is essential to collect data from numerous registers and to process them. However, the purpose of the project is not only to integrate the existing IT systems, registers and databases, but the creation of innovative solutions which will create a synergy effect and thus to achieve a noticeable, permanent improvement of the city infrastructure and social interactions.

The main objective of the project smart Plock is to improve the quality of life of city inhabitants and to support local self-government in its activities connected with the creation of efficient, functional e-administration (innovative forms of e-services and e-infrastructure), through the development of complex systemic solutions based on telecommunication and information technology solutions.

To stimulate the activity of city inhabitants not only the development of an integrating geospatial platform is required, but first of all the implementation of the crowdsourcing idea and the creation of a geoportal enabling social participation.

Integrating Geospatial Platform

The aim of this task is to create a modular spatial information system. The GIS (geographical information system) class system will perform an integrating function in relation to domain-based IT systems. One of the elements of the realisation of the project is the creation of a 3D model of the city with use of data from laser scanning and topographic database). The developed geospatial platform will be integrated with other municipal systems, e.g. local spatial development plans, data from the flood protection system, data from road and traffic monitoring databases, data from public transport systems, environmental data and data concerning the location of: business entities, healthcare providers, tourist attractions, events related to safety etc.

Development of e-services, social participation and crowdsourcing

Spatial data and geographical information systems developed within the integrating geospatial platform will also allow for the implementation of the idea of participation-based support for investment planning and of a geoportal that will enable the inhabitants of Plock to determine the manner of spending the civil participation budget. Services based on the crowdsourcing idea and a social service that will play a significant role in urban development planning will also be implemented in the city.

All geographic information technology tools developed for Plock are based on free software, e.g. Leaflet and free data (e.g. Open Street Map). The participation geoportal for Plock is available both for desktop computers and for mobile devices, such as smartphones.

CITY-P1: A Novel Image Fusion Method Using DSM and Spectral Un-mixing of Pixels

Linhai JING, Hui LI, Ru XU YU, CHEN, Qingjie LIU, Haifeng DING, Yunwei TANG, and Qizhong LIN
Chinese Academy of Science

Remote sensing image fusion techniques are widely used to fuse a multispectral (MS) image with a panchromatic (PAN) band. Normally, an image fusion method cannot spectrally un-mix mixed MS sub-pixels to high-resolution pure pixels and offers blurred fused boundaries between vegetation and non-vegetation containing significant spectral distortions. In this paper, a novel image fusion method is proposed to improve fused images by classifying mixed MS sub-pixels with reference to a fine DEM (digital surface model) followed by setting them to high-resolution pure pixels. In this method, boundaries between vegetation and non-vegetation are delineated, adjacent objects, such as buildings, trees, grassland, and bare land, are discriminated with reference to their heights, and relevant MS sub-pixels are fused to be high-resolution pure pixels. Using high-resolution WorldView-2 MS and PAN data along with a DSM derived from stereo geoEye-1 PAN bands over Beijing urban areas, the proposed method was verified and yielded fused images with minimized spectral distortions and drastically sharpened boundaries between vegetation and non-vegetation.

CITY-P2: Auckland's Shifting Diversity

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Diversity of a city's population gives an indication of the dynamic character of the city. It also offers a glimpse into the cultural transition the city is embracing. Auckland, the largest city in New Zealand has seen a significant influx of population from within and abroad. The monitoring of urban changes, especially the ethnic fabric, constitutes an important subject of research in interpreting the developments that take place in the city. The paper aims to examine the diversity in the city centre with spatial context.

The study incorporated ethnicity and residential landscape covering key socioeconomic variables in finding a common narrative in how the city is evolving. The methodology made use of the 2013 and 2006 Statistics New Zealand Meshblocks over the city centre. Diversity index and spatial clustering were then calculated to discern shared characteristics. The spatial distribution was assessed in terms of age, income, dwelling type together with proximity to key landmarks and facilities.The study offers insights into how the demography has changed and how issues surrounding the development, especially with respect to social and economic perspectives, has become increasingly important for policy-making.

Keywords: Diversity Index, Clustering, Urban Studies, Demography.

CITY-P3: Study on the 3D Underground Spatial Decision Support System in Guangzhou

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As an important natural resource of the city, Urban underground space resources has great significance in terms of urban infrastructure construction, civil defense construction and environmental construction. It is an important indicator of urban modernization for the level of underground space resources planning, development, management. By the analysis of underground space development and utilization, Guangzhou 3D underground spatial decision support system quantified underground space data processing , visualization, real-time updates and resource sharing. This system is the basis for the rational development and utilization of urban underground space resources, serving the urban construction department , administration department , service department.

CZSC-P1: Research and Application of Street View based on China Digital Ocean

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The appearance and application of Digital Earth (DE) provides users a new way to acquaint real world. As part of DE, China Digital Ocean (CDO) has achieved great strides in converting theory into realistic system. As public portal of CDO, iOcean which provides science knowledge and popularization of marine forecast, marine exploration and marine biology, map services of China coastal area through modules such as digital marine bottom, digital islands and coast, virtual ocean museum is becoming an important window for public touching and acquainting ocean. As a service of panoramic map, street view provides user urban, street and other environmental 360-degree panorama. It appeals broad attentions for its interaction and immersion. In the present paper, the imagery of alongside the coastal zone of Weihai (CZWH) in Shandong province are captured by special vehicular platforms; the approach for processing, storage and publishing of street datasets is discussed; finally, street view services are integrated with iOcean. It provides user a new way to browse landscape of coastal area and marine tourism online.

DIS-P1: Glacier and Slope Formation Monitoring in New-Zealand Using UAV Based Imagery

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The latest report from the Intergovernmental Panel on Climate Change (IPCC) confirmed that each of the last three decades has been successively warmer, so it is not surprising that since the 1980s most glaciers worldwide have undergone significant retreat. On the West Coast of New Zealand, such retreat has been observed at Fox Glacier for several years, in turn destabilizing the slopes and putting tourists and guides at risk. It is therefore imperative to monitor on a regular basis the morphology of both the glacier and the rockfalls, in order to understand their dynamics, but also to mitigate hazards and risks and avoid a disaster. The present contribution therefore present the combination of UAV-based SfM-derived pointclouds with the mechanics model RAMMS Rockfalls, in order to assess the role of glacier retreat on slope stability and the rockfalls patterns. The results have shown that the rockfalls hazards is very much controlled by the shape of the debris and by the evolution of the topography generated by the glacier retreat. However, one must remain careful with the set of results generated by RAMMS, as the calibration of the slope parameters still need to be tested on site.

DIS-P2: Storm Surge Modeling, Visualizing and Information Service System in East China Sea

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East China Sea (ECS) Storm Surge Modeling System (ESSMS) was developed based on Regional Ocean Modeling System (ROMS). Additionally, a Globe Visualization System (GVS) was realized on the basis of World Wind for better providing users with the disaster information (e.g., typhoon track, wind speed, water level, inundation and submerge). The main functions of GVS include data indexing, browsing, analyzing as well as visualizing. GVS is capable of facilitating the precaution and mitigation of storm surge disaster in ESC in combination with ESSMS. By using ESSMS and GVS, case study was performed on the Typhoon Soulik, which was landed the coastal region of Fujian Province, China at 6pm of July 13, 2013. Modeling results showed that the maximum tide level was happened at 6pm, when the Typhoon Soulik was landed. This accordance caused significant storm surge and water level rise in the coastal region. The water level variation induced by high winds of Soulik ranges from -0.1 to 0.15m. Water level generally increased near the landing place, in particular on the left hand side of the typhoon track. It is calculated and visualized that 0.15m water level rise in this region caused a submerge increase of ~0.2 km2, which could be catastrophic to the coastal environment and living.

ENV-P1: Structure from Motion for Pointclouds Creation from Historical Imagery and UAV: Monitoring Floodplain Vegetation Evolution in 3D

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Current research in 3D spatial evolution and growth of riparian vegetation is hampered by two difficulties: (1) the lack of availability of data prior LiDAR and TLS surveys and (2) the difficulty to collect data at a frequency higher than a monthly return period (mostly because of logistics and cost related issues). In an effort to solve these two problems, this contribution presents the usage of SfM (structure from motion) derived pointclouds created from historical aerial photographs, and SfM derived pointclouds based on imagery collected using a UAV (Unmanned Aerial Vehicle), and how these dataset can be used in a diachronic manner. This contribution is articulated around three test-sites: the floodplain of the Kowhai River in New Zealand, the Tamagawa River in Tokyo and the basin of Aizu (Japan). The results have proven the technique applicable to the monitoring of floodplain vegetation, although with some limits linked to the resolution of the imagery. The lower stories of vegetation such as shrubs and grass could not be singled out from historical aerial photographs, because of resolution issues, but mature riparian vegetation and trees on the edge of terraces create sufficient angle distortion to be modeled in 3D by SfM. UAV-based photographs pointclouds were more versatile and could be calibrated to obtain the desired results. It is anticipated that the level of accuracy will enhance the fluid mechanic models that use complex floodplains as boundary conditions.

AGR-P1: Microwave Radiometry Monitoring of Soil-plant Formation

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The most important problem is the soil-plant formation (SPF) monitoring. As is well known, among the types of remote sensing techniques, microwave radiometry proves effective for observations of SPF environmental parameters. However, these observations are a function of different environmental conditions mainly depending on the SPF type. That is why it is necessary to develop data processing methods for microwave monitoring that allow the reconstruction of the SPF characteristics with consideration of the vegetation types and that provide the possibility of synthesizing their spatial distribution. The method is described to be used for the microwave monitoring of soil moisture as global water cycle component. This method is based on the empirical model of vertical profile of water moisture as function of radiobrightness temperatures.

FEATURES OF MICROWAVE SOIL MOISTURE MONITORING

The fundamental principles of soil moisture retrieval by means of the use of passive microwave sensors and microwave radiometric technique for measuring soil moisture properties have been established by Shutko and his disciples. There was realized a series of experiments in framework of which microwave radiometers were put on satellites, aircraft, and ground-based vehicles. The L-band passive microwave measurements were the most informative in these experiments.

Interrelations between the characteristics of the microwave emission field of moisted soil and of the soil liquid water content, soil density, temperature and mineralization level of liquid water are the properties studied both theoretically and by field measurements. Both research and field studies show that microwave radiometric measurements permit estimates of 7 to 10 moisture levels in the top 0.1 to 1.0 wavelengths of soil and 3 to 7 grades of the subsurface water level between 0 and 1.5-3.5 m.

The soil moisture is divided on the solidly-united, loosely-united, and free one. United moisture is the water adsorbing by ground particles surface and having the form of film with the thickness equaled no more of 6 to 8 molicular layers. The volume of united moisture in the soil layer is determined by the soil type and is fluctuated in the wide interval from 2-3 per cent for sandy soil to 30-40 per cent for clay and loess soils. United water is unattainable for the plants and do not influence on the salt regime of soil. That is why the monitoring system is to realize that kind of moisture classification in the soil.

The practice shown that independently from the climatic zone to achieve the acceptable precision in the reconstruction of vertical profile of moisture in the soil layer having the depth of one metre it is necessary to use microwave radiometers. Really there is a priori information about average soil moisture for the depths 50 cm (Ws2) and 100 cm (Ws3). The value Ws1 is estimated by means of microwave radiometers with wavelengths =10 cm and 30 cm. Then the following approximation is considerd, where unknown coefficients are calculated from the condition of minimal deviation between the and Wsi (i=1,2,3). Under this it is necessary to realize the conditrions (1). This mehodics allows o deermine he soil moisure-rereserve by means of remoe monioring on the large areas wih the error not more than 0.3 gcm-3 for the biomass of vegetable cover less 2 kgm-2 and with the error up to 0.07 gcm-3 under the biomass more 2 kgm-2.

The knowledge of function Ws(z) allows to use the model of water balance of territory to reconstruct the dynamical soil properties and other water balance elements as the functions of geophysical and ecological parameters. Experimenal valuation of thickness of upper soil layer on the lower boundary of which every six days after rain or watering the capillary connections breaking is taken place. Typical thickness of this dryed up layer oscilates between 3 and 5 cm.

APPLICATIONS

There are several types of instrumentation that can be used for environmental investigations. For examination of soil type, or surface moisture, the ones that come to mind are thermal infrared radiometers, active radar systems, and the passive microwave radiometers. System of no scanning single-beam microwave radiometers was designed in Kotelnikov's Institute of Radioengineering and Electronics.

The passive microwave systems only record the naturally emitted radiation, which is a function of the soil moisture content within the first several centimeters/decimeters and is less influenced by surface roughness. From a given height above the ground surface the radar systems have a much smaller ground sample distance, or pixel size, than the passive systems. To compensate, the passive system can be flown on light aircraft at very low altitudes, as low as 500 feet above mean terrain.

Microwave radiometers, on the other hand, measure the natural radiation at mm, cm and dm wavelengths that is primarily a function of soil moisture content in the first couple of centimeters/decimeters of the earth's surface.

Authors presents the sample of microwave radiometers application and the use of spatial interpolation methods to solve the task of agriculture fields monitoring providing the soil moisture mapping. Really this task can be solved by radiometers with 18 and 27 cm wavelengths located on the fly laboratory. The experiments of such type are realized in the climatic conditions of Moldavia, Ukraine, Bulgaria, Cuba, Vietnam, Russia, and USA. These experiments shown that use of the GIMS technology allows for the specific geophysical conditions to have practically sensible regime of monitoring. In most cases to reconstruct the spatial distribution of soil moisture with precision of 20 per cent it is necessary the fly laboratory parallel routes have high H200 m and the distance between them equales no more 500 m. Interval between the measurements, when the precision of forecast for synoptical parameters is 10 per cent and for precipitation is 15 per cent, can be equaled one month if the precision of the soil moisture estimation is planned to be less 50 per cent.

Keywords: Soil moisture, Microwave monitoring, Vegetation cover, Vertical profile, Microwave radiometry

UAV-P1: Enabling a Science Support Structure for NASA's Global Hawk UASs

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In this paper we describe the information technologies developed by NASA for the Winter/Spring 2013/2014, and Fall 2014, NASA Earth Venture Campaigns,
Hurricane and Severe Storm Sentinel (HS3) and Airborne Tropical TRopopause EXperiment (ATTREX). These campaigns utilized Global Hawk UAS vehicles equipped at the NASA Armstrong (previously Dryden) Flight Research Facility (AFRC), Edwards Air Force Base, California, and operated from there, the NASA Wallops Flight Facility (WFF), Virginia, and Anderson Air Force Base (AAFB), Guam. Part of this enabling infrastructure utilized a layer 2 encrypted terrestrial Virtual Local Area Network (VLAN) that, at times, spanned greater than ten thousand miles (AAFB <-> AFRC <-> WFF) and was routed over geosynchronous Ku band communication Satellites directly to the aircraft sensor network. This infrastructure enabled seamless hand off between Satellites, and Satellite ground stations in Guam, California and Virginia, so allowing simultaneous Aircraft Command and Control and Science operations from remote locations. Additionally, we will describe the other elements of this infrastructure, from on-board geo-enabled databases, to real time communications directly from the instruments (in some cases, more than twelve were carried, and simultaneously operated, on one aircraft) to the researchers and other interested parties, world wide.

UAV-P2: Aerial Photogrammetry of Damages by Heavy Intensive Rainfall in Nagiso and Takayama Using UAV

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Yomikaki area, Nagiso-machi, Kiso-gun, Nagano, Japan (Nashi-zawa) was heavily damaged by the mudflow accompanied by the typhoon number 8 on July 9, 2014. One life was lost, three people were injured and seven houses were destroyed in the accident. To investigate the damaged area we took aerial photographs using multi-rotor radio control helicopter (DJI Phantom 2) as a small Unmanned Aerial Vehicle (UAV) and high-performance compact digital camera (RICOH GR). Then post-processed these images. An orthophoto, three-dimensional point cloud data and A Digital Surface Model (DSM) of the area about 0.2 square kilometer along Nashi-zawa river with high resolution were generated by Agisoft PhotoScan software using Structure from Motion (SfM) algorithms. We also took aerial photos in Takayama, Gifu, Japan with same equipment to investigate the damages accompanied by the localized heavy intensive rainfall with 312.5 mm per 48 hour on August 17, 2014. These detailed situations of damage captured from aerial photogrammetry using UAV will be reported at the summit. This work was supported by JSPS Grant-in-Aid for Research Activity Start-up (25889062) and MEXT-Supported Program for the Strategic Research Foundation at Private Universities (S1201030).

Man is going to be displaced altogether as a specialist by the computer. Man himself is being forced to reestablish, employ, and enjoy his innate "comprehensivlty." Coping with the totality of Spaceship Earth and universe is ahead for all of us...

Spaceship Earth was so extraordinarily well invented and designed that to our knowledge humans have been on board it for two million years not even knowing that they were on board a ship. And our spaceship is so superbly designed as to be able to keep life regenerating on board despite the phenomenon, entropy, by which all local physical systems lose energy. So we have to obtain our biological life-regenerating energy from another spaceship the sun...

Now there is one outstandingly important fact regarding Spaceship Earth, and that is that no instruction book came with it. I think it's very significant that there is no instruction book for successfully operating our ship. In view of the infinite attention to all other details displayed by our ship, it must be taken as deliberate and purposeful that an instruction book was omitted. Lack of instruction has forced us to find that there are two kinds of berries-red berries that will kill us and red berries that will nourish us. And we had to find out ways of telling which was which red berry before we ate it or otherwise we would die. So we were forced, because of a lack of an book, to use our intellect, which is our supreme faculty, to devise scientific experimental procedures and to interpret effectively the significance of the experimental findings. Thus, because the instruction manual was missing we are learning how we safely can anticipate the consequences of an increasing number of alternative ways of extending our satisfactory survival and growth-both physical and metaphysical...

Buckminster Fuller
Operating Manual for Spaceship EARTH (1969)

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