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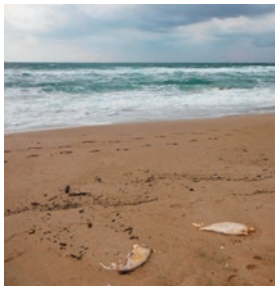

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A Novel Approach to Increasing Analysis and Mapping Capacity

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International Inspiration

Our world today is one of increasing globalisation, because of the internet, extensive travel, international trade and blurring boundaries: a global village where everybody knows everything about everybody else. There are more possibilities and opportunities for today's generation than there have ever been before. Cooperation at international level, open borders and trade agreements have made the world seem a smaller place with better welfare and well-being for many of us (although I am aware that there is a large group of people who are not benefiting from globalisation as such, and this a great responsibility for those who are). Within the geomatics community, we became convinced of the benefits of international cooperation way before the rest of the world did. Surveying and mapping long struggled with differences in geodetic systems and the resulting inability to supplement national systems with supranational products. The need for global maps boosted a process that started back in the 19th century to come up with a unified geodetic system from the 1950s onwards.
In Europe, a recent next step has been the INSPIRE Directive – only introduced in 2007 and already well underway to completion and full implementation in 2020. INSPIRE aims to establish an infrastructure for sharing and opening up spatial information to support sustainable development in the Member States of the European Union. This edition of *GIM International* includes an interview with Joeri Robbrecht, policy analyst with the Directorate-General Environment of the European Commission under which INSPIRE has always resided (see page 12). INSPIRE, although certainly not fully embraced in the beginning, is now proving how the European Union is capable of implementing an EU-wide infrastructure for (geo)data sharing that is now being increasingly used by governments, public administrations, small and medium-sized enterprises and citizens alike. Robbrecht considers the biggest achievement to be the availability of a European framework for sharing spatial data between public administrations. That achievement will make policymaking more efficient and effective; a lot of the Member States who are now seeing the benefits of INSPIRE will make the move towards e-government in the near future. If INSPIRE reaches that goal, it may serve as inspiration – in fact, it already is – for other regions to implement such a framework.


Photography: Arie Bruinsma

▲ *Durk Haarsma, publishing director*

Nowadays we are seeing a trend towards shying away from international cooperation, withdrawing from international bodies, calling globalisation a bad thing, returning to a national basis and even re-closing borders because of a fear of the unknown. I think that geomatics can serve as an example of how international cooperation can help to make the world a safer and better place that benefits its citizens. A project like INSPIRE can even serve as inspiration for internationalisation.

Small Unmanned Aerial Systems for High-throughput Phenotyping

Phenotyping is an important agricultural approach that combines methodologies and protocols to quantify plant growth, structure and composition at different scales of organisation, from organs to canopies. The interest in accurate phenotyping is motivated by the global challenge of ensuring crop yield for food and fuel generation using fewer resources while reducing the environmental impact (e.g., diminishing agricultural land, efficient use of nitrogen fertilisers, and correlating genotype and phenotype traits for advancing crop yield). Traditional phenotyping is based on destructive, labour-intensive and time-consuming approaches that are mainly conducted in a controlled environment with limited coverage such as greenhouses. Such limitations are the cause of phenotyping being the bottleneck of advancing crop yield while reducing the impact of agricultural practices on the environment (e.g. reducing the use of nitrogen-based fertilisers). Therefore, novel phenotyping techniques are critical to alleviate the above-mentioned challenges. In this regard, directly georeferenced passive and active imaging sensors operating in different portions of the electromagnetic spectrum could be utilised for innovative high-throughput phenotyping, which is non-destructive and non-invasive while being capable of providing abundant and diversified information. Mobile sensor systems onboard tractors, tethered balloons, manned aircrafts, and unmanned aerial systems (UASs) are becoming popular thanks to their potential for collecting data that is conducive to automated phenotyping. Among the above-mentioned mobile platforms, small unmanned aerial systems (sUASs) are rapidly gaining momentum as one of the best approaches for high-throughput plant phenotyping. The ability of sUASs to fly lower compared with manned aerial systems allows them to collect geospatial data at high resolution while covering larger areas than wheel-based systems. The low cost of consumer-grade sUASs is another advantage that makes them more appealing.

Utilising sUASs, which are equipped with directly georeferenced imaging sensors, for precision agriculture in general and high-throughput phenotyping in particular is an important application that is gaining significant attention from researchers in the mapping and plant science fields. As can be seen in Figure 1, a low-cost sUAS can be used for image acquisition according to a preset flight plan. Acquired images can then be manipulated for the generation of important products such as orthophotos and height maps (Figures 2 and 3). However, RGB-based images are not sufficient for the derivation of all the necessary phenotype traits for advancing crop yield, such as plant stress level, leaf pigment analysis, leaf area index and plant structure. Therefore, in addition to RGB cameras, sUASs should be also equipped with hyperspectral and laser scanning systems. However, the limited endurance and payload constraints are key challenges when dealing with consumer-grade sUASs. In order for sUASs to be utilised for high-throughput phenotyping while considering the desired sensors as well as the imposed payload and cost constraints, members of the professional and research community are faced with the following challenges:

1. Improving the geometric fidelity of remotely sensed data from sUASs using consumer-grade imaging and direct georeferencing sensors.
2. Integration of multi-sensory data captured by imaging systems operating in different portions of the electromagnetic spectrum to derive higher-quality geometric and spectral plant traits.
3. Reducing the level of required technical expertise to operate and process the acquired data through the development of robust data processing algorithms with built-in quality assurance and quality control protocols.

Acknowledgement
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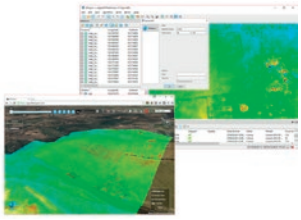
Agisoft Incorporates 4DMapper Direct Integration API



4DMapper has been integrated into PhotoScan.

Photogrammetry software company Agisoft has integrated 4DMapper's direct-upload API in its latest release of PhotoScan Professional. This value-add will make it easier for PhotoScan users to share large files created using the software by streaming the data to recipients' browsers. Traditionally data produced by photogrammetry software was delivered using blind cloud sharing services, FTP, hard-drive delivery or GIS servers. Recipients then needed capable computers, software or plug-ins to access and use this data. Now, this data moves quickly to web browsers without any software.

▸ **http://bit.ly/1ThAkIe**

Top Gear USA Captures Rubicon Trail in 360 Degrees

NCTech, the developer of reality imaging systems, revealed that its iSTAR panoramic camera has been used by the *Top Gear* USA television show to create the first-ever virtual online experience of the infamous Rubicon Trail, using high-resolution 360-degree imaging. The images are being uploaded to Google Maps to provide a visual online record of the *Top Gear* team's journey – a route that Google's Street View cars could never access. The Rubicon Trail is a 35km-long route, part road and part 4x4 trail, located in the Sierra Nevada in California. It is viewed as one of the most difficult off-road vehicle routes in the world. With an average driving speed of 3km/h during the trail section, it takes several days to complete.

▸ **http://bit.ly/1NCIEFa**

The Top Gear team with iSTAR at the start of the Rubicon Trail.

Keynotes of Geomatics Experts on Video

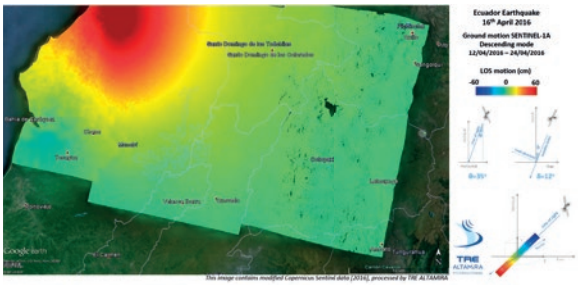
The first GIM International Summit was held in the very heart of Amsterdam, The Netherlands, from 10-12 February 2016. The programme comprised thought-provoking topics presented by top keynote speakers from both inside and outside the geomatics field. Visit www.gim-international.com/gimsummit-2016 to watch the videos and learn more about the outcomes of this inspiring event!

OGC Seeks Comments on Charter for Land Administration Domain Working Group

Members of the Open Geospatial Consortium (OGC) are requesting comments on the draft charter for an OGC Land Administration Domain Working Group (DWG). Worldwide, effective and efficient land administration is an ongoing concern. Key is the ability of land administration frameworks to support the regulatory and policy environments at regional and national levels. The draft DWG charter defines the role for OGC activities related to land administration and is now available for review. Only 40 countries around the world have mature land information systems. Of the remaining nations, only 10% have some land administration capability in place – others are non-existent, or are manual paper-based systems subject to limited public access and a significant risk of data loss due to disasters. Challenges exist to guide developing nations in a programmatic way to establish cost-effective interoperable land administration capability, to upgrade current manual processes, and to field solutions that are automated and are flexible to new data sources and new technologies.

▸ **http://bit.ly/1VT6Dmy**

Ecuador Earthquake Captured by Sentinel-1



Sentinel-1 ground motion map.

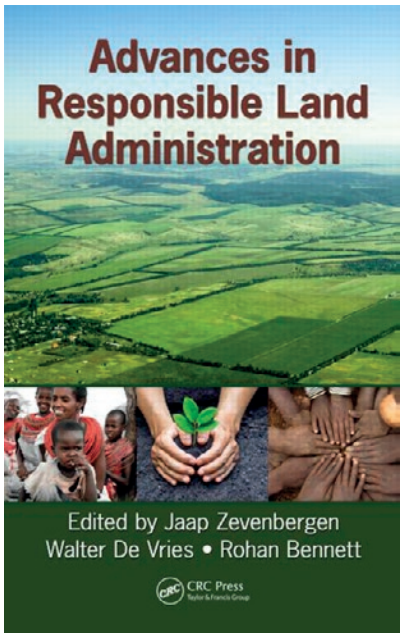
Altamira Information, headquartered in Spain, has created a new Sentinel-1 ground motion map and interferogram showing the massive earthquake that hit Ecuador on 16 April with a magnitude of 7.8. Two Sentinel-1 images have been used: one pre-event image acquired by the satellite on 12 April and the other post-event, captured on 24 April. The quake occurred as the result of shallow thrust faulting on or near the plate boundary between the Nazca and South America plates, according to the United States Geological Survey (USGS). Ecuador lies above the plate boundary where the Nazca Plate subducts beneath the South American Plate at a velocity of 61mm/year. With at least 654 people killed and more than 16,600 injured, this quake was the worst natural disaster in Ecuador since the 1949 Ambato earthquake.

▸ **http://bit.ly/1T5QkwZ**

Advances in Responsible Land Administration

Advances in Responsible Land Administration is an interesting and well-elaborated book explaining new methods that challenge conventional forms of land administration. The book is particularly timely and valuable in unfolding the innovative approaches to designing land administration systems in developing countries.

The book is edited by the well-known academics Jaap Zevenbergen, Walter de Vries and Rohan Bennett. Various chapters in the book seem to draw from recent thesis work at ITC, University of Twente, The Netherlands, and it includes a range of empirical studies from the East African region. Each chapter therefore contributes different pieces to the puzzle, ultimately painting a bigger picture of innovative and responsible land administration.



The book aims to address the limitations of conventional land administration research, advance the scientific discourse and contribute to best practices. This approach opens up a broad range of issues for discussion that are dealt with in three sections: New Inspirations, Creating Innovative Designs, and Measuring the Impacts. The final chapter of the book looks ahead to the future direction of responsible land administration.

The term 'responsible land administration' refers to incorporating innovations with an understanding of the possible ethical and societal implications. By introducing this concept, the authors add a new notion to conventional approaches by aligning the administration with the ever-changing dynamics of societal demands. This is also clearly in line with the Voluntary Guidelines for Responsible Governance of Tenure as published by FAO in 2012, whereby responsible governance encompasses socioeconomic development, poverty reduction and food security.

The book is empirically driven and presents up-to-date data from real cases in Rwanda, Ethiopia, Tanzania, Uganda and Kenya. The New Inspirations section includes the analysis of contemporary change forces such as pro-poor land administration, food insecurity, rapid urbanisation, post-conflict contexts and technological innovation. The Creating Innovative Designs section of the book explores innovative methods and techniques for capturing and updating data as well as simple methods for addressing land fragmentation and supporting pastoralists' temporal land rights. The Measuring the Impacts section covers the consequences of land administration measures in relation to, among other things, land use change, environmental protection and displacement situations. This section also includes an interesting chapter on the impact of using STDM for pro-poor land recordation. The final section is a chapter synthesising the key concepts, ideas and findings from the book. Most chapters are nicely illustrated, although the book would have benefited greatly from having its images presented in colour.

The book is very well structured thanks to the same overall headings being used throughout the chapters. It thereby also represents a significant attempt to develop a coherent theoretical foundation for further research in this area.

I can recommend this book to all land professionals and academics engaged in the land sector who are committed to developing the role of land management and administration for building a sustainable future.

CRC Press, 2015, 305 pages.
ISBN 9781498719599

Your Blog on the *GIM International* Website?

At *GIM International,* we are always searching for great stories and the most relevant news. However, we are sure there is much more going on than our editorial team can cover alone. So we are encouraging geomatics professionals to share their insights too. Are you interested in writing a blog about an exciting or unusual survey or project? Or perhaps you would like to inform our readers about a game-changing innovation? If so, let us know! We are keen to expand our coverage with your blogs. Contact our editorial manager, Wim van Wegen (wim.van.wegen@geomares.nl), to discuss your ideas. He is looking forward to hearing what you would like to share with our extensive worldwide readership!

Key Topic of Intergeo 2016: Smart City

By taking 'Smart City' as a key topic, Intergeo 2016 is focusing on a multi-faceted issue that will shape the future. The preview of the leading international event for the geospatial community in Hamburg, Germany, was attended by renowned experts from industry, science and public authorities. During their discussions, they were all in agreement that cities must and will become more intelligent – not because that is a natural consequence of digitalisation, but because it benefits society. Intelligent geodata is a crucial prerequisite for any such development. In April, the patron of Intergeo, the DVW German Society for Geodesy, Geoinformation and Land Management, gathered together experts from the worlds of business, public authorities and science to talk about this year's key topic: 'Smart City'. The event, which was held at Hamburg's Agency for Geoinformation and Surveying, centred on issues such as what an intelligent, digital city might look like and what role geoinformation could play as cities and metropolitan regions become 'smart'.

▸ **http://bit.ly/27uDYbv**

BY **WILLI WENDT**, FRAUNHOFER INSTITUTE FOR INDUSTRIAL ENGINEERING, GERMANY

3D-GIS: a Technology Waiting to Be Explored and Used

3D-GIS tools are very powerful. They add a third dimension to the already very strong and useful 2D-GIS functionalities, allowing complex sets of information to be combined with maps, plans and any other visual representations of spatial areas. Moreover, 3D-GIS opens up a very new form of geoanalysis, providing results that can be understood by various audiences – whether highly specialised civil servants involved in complex planning processes, local decision-makers tasked with choosing between planning alternatives or citizens seeking transparent processes and participation rights.

For the latter two groups, the core value of 3D-GIS seems obvious. Highly complex sets of information can be visualised in a comprehensible manner. Citizens can gain a first-person insight into planned development projects (e.g. in front of their own property), helping them to understand possible individual consequences of plans. Decision-makers also benefit from this high comprehensibility, even though they require a greater level of detail in order to be able to decide on alternatives. Again, 3D-GIS not only provides a highly detailed representation of the real or the planned city, but it can also visualise all types of information linked with the model. In this context, decision-makers can be supported by additional information about the planning alternatives, such as energy efficiency, solar energy potential, traffic volumes or predicted emissions, in order to make information-based decisions.

▲ *Willi Wendt.*

Despite the significant role of visualisation in, for example, decision support, the planning experts do not only require solutions that help them to visualise plans and projects. In addition, they have a strong need for applications that simulate the effects and impact of planning alternatives on various thematic topics such as energy efficiency, climate compatibility or noise emissions for different building arrangements. Last but not least, the local planning experts benefit most from cross-sectoral datasets and applications. Comprehensive planning processes can only really be supported by linking simulation results for traffic, emissions, energy efficiency, climatological effects and suchlike.

Despite the opportunities of 3D-GIS as outlined above, it should be stated that this technology is currently lacking applications that serve the actual end-user needs. Due to their high complexity, the existing 3D-GIS tools are not yet ready for use by everyone, especially on the level of data analysis and provision. Two examples of existing market-ready applications are 3D solar cadastres and flood simulation tools. Both were requested by a specific group of end users to facilitate analysis based on specific demands and needs. Additionally, various 3D citizen participation tools are currently in development and are being tested in pioneer cities for formal as well as informal planning processes.

Nevertheless, this lack of applications should not be regarded as a burden. Instead, we should acknowledge the opportunity to design 3D-GIS applications that really address end-user needs and allow for the best possible benefit of 3D-GIS. Therefore, I am strongly in favour of an end-user-driven application development process and would encourage cities to participate in this process. Those who overcome their fear of such new technologies and participate in the development process of novel applications will benefit the most, receiving applications that fit their specific needs and help them to solve their problems. ◀

Willi Wendt is a rural and regional planning engineer and works as a senior researcher for the Fraunhofer Institute for Industrial Engineering (Fraunhofer IAO) in Stuttgart, Germany. His research focus lies on city system design and city resilience – two topics that are highly relevant for 3D-GIS solutions. He is currently in charge of the scientific design of the 'Smarter Together' EU Lighthouse project which seeks to stimulate co-created city development processes between the three partner cities: Lyon, Munich and Vienna.
✉ willi.wendt@iao.fraunhofer.de

Pegasus:Backpack.

Leica Geosystems Honoured for Wearable Reality Capture Innovation

The Pegasus:Backpack, Leica Geosystems' wearable reality capture technology, has been honoured with a prestigious Red Dot Design Award for 2016. An independent panel of 41 experts selected the Pegasus:Backpack as a winner after judging more than 5,200 products from 57 nations based on strict criteria including degree of innovation, formal quality, functionality and ecological compatibility. As one of the world's first wearable reality capture technologies, the innovative Leica Pegasus:Backpack enables professionals to document any space, whether indoors or outdoors, and create 3D views for accurate mapping.

▸ **http://bit.ly/1qq6Dwr**

5 Questions to...

Super Wang

Super Wang, the CEO of Supergeo, founded Supergeo in 2001. The company now is a key player in the GIS industry. *GIM International* took the opportunity to ask him 5 questions.

Which national and global developments trigged you to found Supergeo in 2001, 15 years ago?

At that time, I had been working as a GIS specialist for several years and was quite well-known in Taiwan's geospatial industry. Through my professional experience I was aware of the industry trend: exciting prospects for GIS development in emerging countries lay ahead, especially in the Asian countries. Most of them had large populations and territories, but they also faced difficulties in terms of further development, such as the lack of technologies for effective governance. There had to be an increasingly important role in these countries for GIS, as a key technology for modern management. Also, major GIS companies often lacked sufficient localisation, customisation and support in this region. After considering these factors, I decided it was a good time to fill the market niche by developing a new GIS software brand.

From serving the local market of Taiwan you evolved into an international player. Which challenges did you overcome, which ones still lie ahead of you and what distinguishes Supergeo from other global GIS players?

The hurdles we face are mostly about branding and marketing. Supergeo offers a complete geospatial solution, from field data collection to web map publishing. But when compared to other global players, it becomes apparent that we need more reliable partners in potential regions and we also want to indentify an effective marketing strategy to become more influential. In the past, the most significant advantages of Supergeo were our efficient support and our pricing. As mentioned above, major GIS firms could not provide appropriate products to meet the needs. But Supergeo does have that ability, since we wish to spread the power of GIS to more people with reasonable pricing and timely support. Recently, Supergeo has gradually altered course. To empower different industries making decisions based on spatial insights, we are now focusing more heavily on developing our state-of-the-art mobile GIS apps and solutions, which are easy to learn and easy to use for everyone.

The third dimension and the time component are becoming increasingly important, especially in dynamic urban conglomerates but also in hazard-prone areas. How are you responding to these challenging societal demands?

Supergeo is keen to capitalise on the emerging trend of GIS and respond to societal demands. In our latest product – SuperGIS Desktop 10 – we will enable users to create 3D visualisations with ease and it also has a novel tool that can dynamically display data with its temporal attributes. In terms of hazard prevention and response, we integrated various types of socioeconomic and environmental data to build a multifunctional online platform for the Atomic Energy Council of Taiwan using our web GIS technology and won the Asian Geospatial Excellence Award 2012. Furthermore, we developed Incident Command System, which can instantly display and query emergency situations for Taipei City Fire Department, and this project received the World Geospatial Excellence Award 2014. Furthermore, integrating urban hazard management and 3D environment, Supergeo has created an urban pipeline platform with SuperGIS 3D Earth Server. We are well prepared to meet these challenging demands with our latest GIS technologies

How is your relationship with academia around the globe and how does that affect your R&D budget?

We always stay close to academia to access the latest ideas and technologies, because innovation remains a core value for Supergeo. In Taiwan, we continuously support and collaborate with the Laboratory for Geospatial Computational Science and Spatial Information Research Center from National Taiwan University. Internationally, Supergeo has also cooperated with Kuwait Institute for Scientific Research and we have empowered several universities to build their geospatial programmes with our special GIS package, including in Italy, Hong Kong, India, Malaysia and the Philippines. Based on a successful assessment, Supergeo is willing to support various research and educational projects with a considerable budget.

Which knowledge and skills would you expect from young professionals with a background in technology who want to build their career within your company?

For product designers and GIS analysts, the key ability would be the awareness of geography and the environment. I believe that in these positions people should know how to solve problems with GIS, so young professionals with related backgrounds such as geography, geosciences, forestry, surveying and urban planning are preferred. Other than that, it is also important to have sufficient knowledge about the IT industry. They must understand the trends like cloud technology, big data and the Internet of Things (IoT) to develop products based on the latest technologies. For programmers in the research and development department, it is important to have a passion for maps, which will help them to communicate with product designers more smoothly and build the products to meet demands more efficiently.

www.supergeotek.com

GIM INTERNATIONAL INTERVIEWS JOERI ROBBRECHT

INSPIRE Boosts Spatial Data Sharing

The INSPIRE Directive was introduced in 2007 and should reach full implementation in 2020. Today, over halfway through the process, various important milestones have already been achieved while others still lie ahead. For *GIM International*, this seems an ideal moment to join Joeri Robbrecht, policy analyst for the DG Environment of the European Commission, in reflecting on the journey so far and looking ahead to the future direction.

What is the European Commission's opinion of the current state of implementation?

The European Commission has assessed the state of implementation and the fitness of the INSPIRE Directive for its intended purpose. The efforts made by the Member States have resulted in good progress but overall there are still significant differences between Member States and several implementation gaps have been identified. Based on the outcome of this fit-for-purpose evaluation of the Directive, an implementation strategy is being developed together with the Member States to ensure that future implementation actions will maximise the societal and environmental benefits from the Directive.

Are you seeing usage growth?

The beating heart of INSPIRE is the infrastructure behind it. As with every infrastructure, the success of INSPIRE is measured by its usage – but it's not easy to measure the use of the infrastructure quantitatively. INSPIRE is implemented as a federated network of information providers built on existing spatial data infrastructures (SDIs) in the individual Member States. Every Member State has a different approach to assessing the use of its SDI which makes it difficult to make an objective comparison between Member States and gain a holistic view of the global usage of the infrastructure. More important than the number of service requests or the amount of spatial datasets is the actual use of the available information by public administrations, businesses and citizens in applications and processes that support environmental policies and drive e-government. End-user applications are essential to show the benefits of the infrastructure. Since we have not yet reached the full extent of the implementation of the Directive (e.g. data harmonisation deadlines in 2017 and 2020), its use at EU level is still limited. However, it's a very good sign that we're seeing the emergence of more and more applications and portals in the Member States that are use INSPIRE data and network services to support public administration processes or enable these assets to be integrated in business value chains. Over the coming years, the INSPIRE implementation strategy will pay special attention to aligning INSPIRE with digital agenda and e-Government initiatives to further promote the uptake of INSPIRE within a larger digital community.

Who are the users of INSPIRE?

The users are professionals, public administrations, non-governmental organisations, businesses and citizens…every conceivable kind of user. The INSPIRE Directive opens up a wealth of spatial information that is useful for a myriad of practical situations. Geoprofessionals have the necessary instruments to directly access the core services of the infrastructure, whereas for non-professionals it is key to offer user-friendly applications that provide access to the information within a context that is relevant to them. Over the past period, INSPIRE implementation has mainly been focused on the technical 'plumbing' and the regulatory framework for data sharing. These are necessary prerequisites, but alone they are not enough to add value for public administrations, businesses or citizens. To bridge the 'last mile' to the end user and show the real value and benefit of the INSPIRE Directive, user interfaces such as web applications or mobile apps that satisfy specific information needs are essential. There are already plenty of examples of good practices across Europe. For example, the Flemish geoportal (www.geopunt.be) illustrates the use of INSPIRE as a driver for applications and services that are used by both professionals and non-professionals relating to socioeconomic development, the environment, disaster management, etc. Data is made available in various ways: 'as is' for proficient geoexperts, as an INSPIRE network service for geoexperts and casual GIS users, as a REST ('*Representational State Transfer', Ed.*) service for mobile and web application IT integrators, and within context-specific applications for policymakers, non-geospatial domain experts and citizens. This has resulted in a toolbox with custom-fitted instruments for different types of users. Specific services for geolocation, places of interest, parcels, elevation and suchlike have been developed on top of authoritative data sources for public reuse within public and private-sector applications and processes. By combining location-based and layer-based information in an intuitive user interface, the

user benefits from the possibility to aggregate different data sources to answer everyday life questions: Is there a childcare facility or school close to my work or home? Is this area prone to flooding? Are there any current or scheduled roadworks on my route to work?

What have been the main benefits of INSPIRE so far?

The main benefit of INSPIRE today is the availability of a European regulatory framework for sharing spatial data between public administrations. From day one, the Directive has been a boost and a driver for the sharing of geospatial data. Data that had been locked away for many years has finally found its way to other public administrations, businesses and citizens. In general that has resulted in more efficient and effective public administration processes and policymaking. Some Member States immediately recognised the intrinsic value of spatial data for wider civil society and the economy and they used INSPIRE as leverage for open data programmes. It is good to see that more and more Member States are embracing this good practice and opening up their data beyond the data-sharing scope of INSPIRE.

What are European citizens noticing of these benefits?

We're mainly seeing the first real benefits at local and national level. At European level we will have to wait until the Directive reaches its full potential. A lot of data has been made available, but until that data has been harmonised across Europe – the data harmonisation deadlines are in 2017 for Annex I, and in 2020 for Annexes II and III – the offering lacks the necessary consistency for pan-European applications. DG Environment, as the main public sector client at European level, has identified this as an issue and is preparing a set of actions together with the Member States to build the capacity and capability to deliver on INSPIRE at European level too. The 'Fitness Check on Environmental Monitoring and Reporting' initiative as part of the Commission's 'BETTER REGULATION' package has been selected as a priority use case for implementation.

What are the most important goals still to be achieved for INSPIRE?

Number one on the list of operational targets for INSPIRE implementation is mitigating existing implementation gaps and bringing all Member States to a comparable level of INSPIRE maturity. Knowledge sharing, best practices, reusable components and financing through European funds to build capacity are all instruments that can be used to achieve this objective. Goal number two will be the implementation of the interoperability requirements, especially compliance with the INSPIRE data specifications, as the last phase of INSPIRE implementation. High on the agenda for the Commission is the use of INSPIRE as a spatial information provisioning process for regulatory monitoring and reporting, allowing reporting obligations for the Member States to be streamlined and hence lowering the administrative burden. For EU-level applications, cross-border and cross-sectoral use of spatial information is an important objective in support of the European Commission's Digital Single Market strategy. Supporting the ability for SMEs ('small and medium-sized enterprises', Ed.) to move products built around INSPIRE data and services quickly and seamlessly into new markets within the EU will support growth and create jobs.

Is INSPIRE ready for geoinformation crowdsourcing?

Yes, INSPIRE is ready! The Directive and the infrastructure do not impose any limitations on the way data is acquired. I don't see any technical problems either. The eEnvPlus project (http://www.eenvplus.eu) was finished recently which used INSPIRE to implement a wide range of uses cases, including crowdsourcing apps and a web application for decentralised data management. Crowdsourcing is about opening up your data to the public and providing feedback mechanisms for the data to be updated. Whether you are ready for crowdsourcing or not depends on your local or national data policy culture. Some Member States and some administrations have embraced open data while others are keeping the door shut as long as possible and sitting on their data for whatever reason (source of income, trust, data quality, liability…). INSPIRE gives public administrations the opportunity to take the first step towards opening up their data – crowdsourcing might be the next.

Is INSPIRE ready to link with data collected by Galileo or GPS?

Linking with other data is an application-level issue. It is possible to build any mobile or web-positioning application based on GPS/Galileo that uses INSPIRE data as background or thematic layers. And the Sentinel satellites of another EU space flagship programme, Copernicus, are of course also already in orbit. INSPIRE, Copernicus and Galileo complement each other: INSPIRE provides in-situ data for Copernicus and context data for Galileo – road networks and buildings for vehicle navigation, for example; Galileo provides the positioning, geolocation and tracking component; and Copernicus provides timely satellite data and images for monitoring and analysis.

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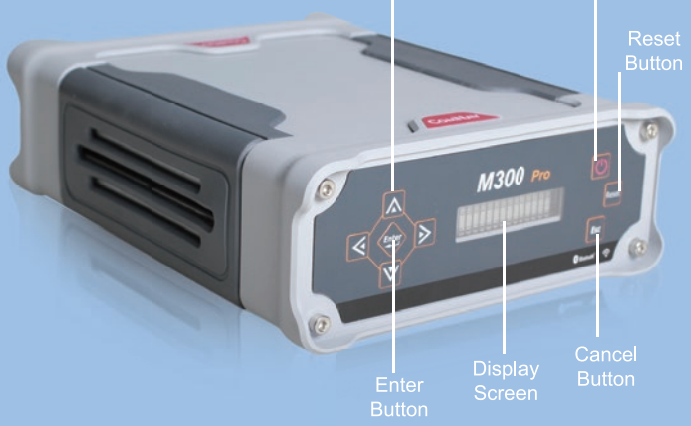

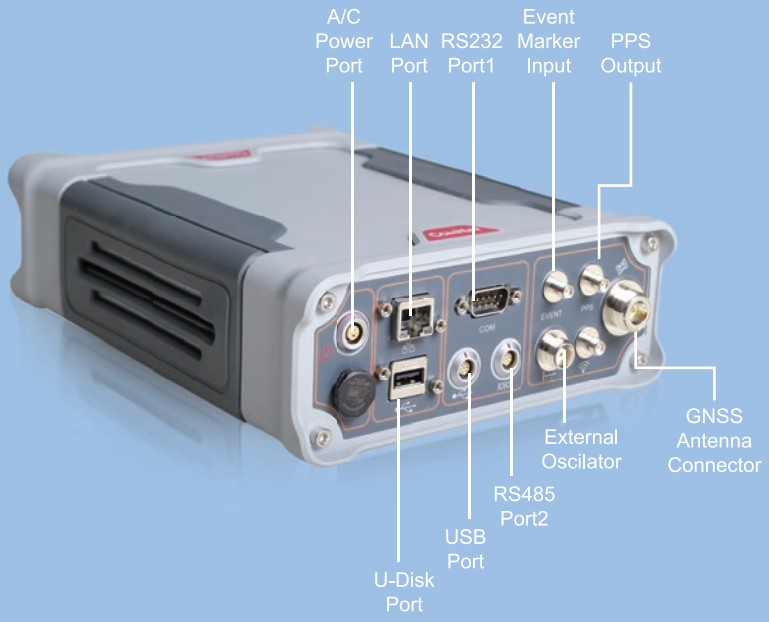

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Can INSPIRE and/or governments keep pace with the technical possibilities that are out there?

That's a difficult question and, for governments, the answer depends on other factors such as their attitude to a digital society, their agility, their information culture, etc. Within the INSPIRE community we are well aware of current and possible future challenges. Better alignment of INSPIRE with the EU Digital Agenda and national digital strategies by also adopting de facto technical specifications and standards beyond the geospatial domain (e.g. W3C) should generate a larger community for future maintenance of the infrastructure. Several actions have been initiated under the ISA programme, such as Are3na and EULF to bridge the gap between the geospatial and the digital communities. This will be continued under the new ISA² programme. But ultimately it is clear that you can't keep running after new communication protocols, encoding methods or channels. Nowadays, people like to choose their own channels through which they want to receive information. Some still use web portals, others swear by messaging or mobile platforms. The investment in evolutionary maintenance of infrastructure components can become very high if you want to support all the available options to disseminate your spatial information. We will have to be smart about it. But we have a strong, motivated and very skilled INSPIRE community so I am sure we will find a way. ◂

EC Disclaimer: This article solely represents the views of its author and cannot in any circumstances be regarded as the official position of the Commission.

Joeri Robbrecht

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CAPTURING THE WORLD'S MOST REMOTE INHABITED ISLAND

UAS Survey of Rapa Nui

Unmanned aerial systems (UASs) can be easily transported and this beneficial feature makes them ideal for photogrammetric surveys of remote spaces. Rapa Nui, the most isolated inhabited place on the planet, took UAS photogrammetry to the limit; challenges included cloud cover, windy weather conditions and the vast size of the island. The resulting orthoimagery and digital surface models will support archaeological documentation and research. The archaeological features will be archived in a single, detailed database. The authors discuss this exciting and challenging adventure.

The existence of Rapa Nui was first recorded in European annals by Roggeveen. The Dutch admiral set foot on the island on Easter Sunday in 1722, and so it was baptised Easter Island (*Isla de Pascua* in Spanish). The photogrammetric UAS survey concerning the capture of the entire island of Rapa Nui is aimed at the creation of a comprehensive database for supporting a variety of tasks, including environmental protection, risk assessment of natural hazards and heritage documentation. The images will also support the identification and classification of all archaeological features distributed over the island. The project has been initiated by the Chilean Council of National Monuments (DIBAM) and financed by the Undersecretary of Regional and Administrative Development (SUBDERE).

SOURCE DATA

This will mark the first time that all cultural heritage objects of the island are documented in a single, detailed and complete database. Added to this, the integration of map data and a digital surface model (DSM) with data on land use, hydrology, geomorphology and other available data will support the standardisation of the future archaeological investigations on the island. Standardisation

▲*Figure 1, Remote location of Rapa Nui in the Pacific Ocean.*

▲ *Figure 2, Fixed-wing UAS used in the survey.*

▲ *Figure 3, Ground control station.*

▲ *Figure 4, Part of the orthomosaic.*

Brand	AG-Wing
Weight [kg]	1.9
Max. payload [kg]	0.6
Max. stay in the air [min]	45
Max. speed [km/h]	75
ø / wingspan [cm]	155
Camera	SONY APS-C 20mp

▲ *Table 1, Basic features of the fixed-wing UAS used to capture Rapa Nui.*

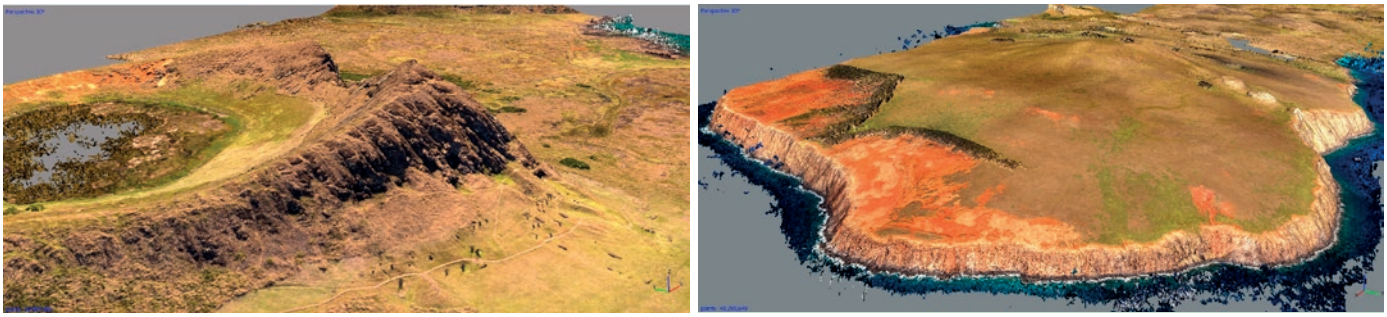
is a wish of the Chilean Council of National Monuments, particularly because systematisation of the research efforts is important for the protection of the island's cultural heritage and for maintenance measures to preserve the monuments. A comprehensive database containing detailed and precise information on the layout of the island and the distribution of its monuments will enable visual inspection to prioritise conservation of statues, archaelogical remains and other heritage objects. These efforts require long-term planning and the geodata collected by photogrammetric means will provide the essential, underlying source data.

SITE AND EQUIPMENT

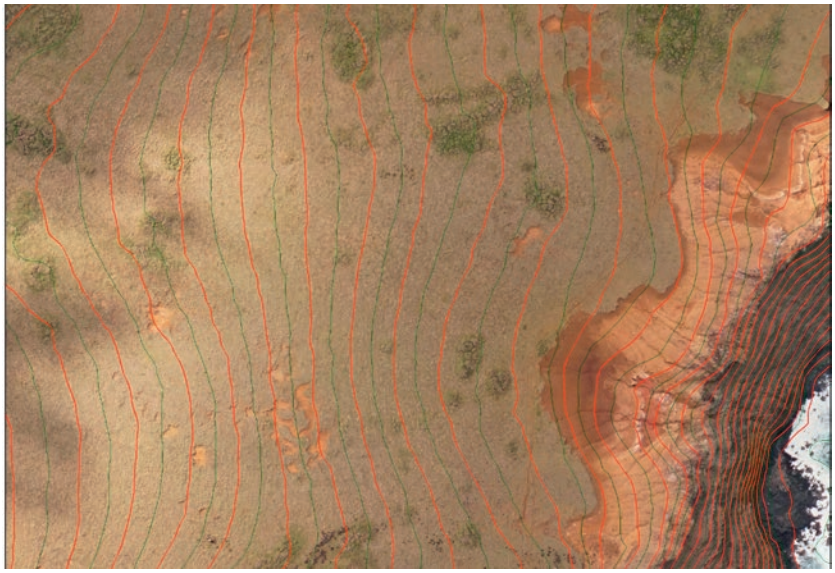
Belonging to the territory of Chile, the island of Rapa Nui is located in the middle of the Pacific Ocean and covers 164 square kilometres (Figure 1). Its maximum altitude is 507 metres. The island has a tropical rainforest climate with the lowest temperatures occurring in July and August and the highest ones in February. Its isolated location exposes the island to winds which help to keep the temperature fairly cool. The UAS needed to withstand the constant September winds blowing over the island, ranging in strength from 14km/h to 25km/h. Furthermore, the size of the island required a UAS which could cover long distances in one and the same flight. As a result, a fixed-wing UAS was chosen, specifically the AG-Wing (Figure 2). Some basic features of the fixed-wing UAS are shown in Table 1. The UAS was provided and operated by the manufacturer IDETEC. Another climatological limitation was the presence of clouds at around 500m above ground level. To enable flying underneath the clouds, the cameras were equipped with wide-angle lenses of focal length 24mm and 35mm.

UAS SURVEY

The aerial survey was conducted in September 2015. The capture of the entire island took two operators using two UASs simultaneously for ten days in total. The flights were remotely controlled and monitored using one ground control station (Figure 3). During 52 flights, each with a path length of 25km to 28km, 21,840 images in total were recorded with an along-track overlap of 90% and an across-track overlap of 70%. The ground sampling distance (GSD) of the images was 12cm. All images were free of clouds. For conducting aerotriangulation necessary for georeferencing



▲ *Figure 5, Two parts of the digital landscape model.*



▲ *Figure 6, Example of the digital map, scale 1:500 (not reproduced to scale here).*

the images, 67 ground control point (GCPs) were measured with double frequency GNSS in static mode, resulting in a planar precision of better than 5cm and a height precision of 10cm. After aerotriangulation the root mean square error (RMSE) appeared to be 3.6cm and the GSD error 0.77.

PROCESSING

Aerotriangulation of the 20,000-plus images and the subsequent creation of a DSM, orthoimages and a digital map at scale 1:500 were performed with the software package Agisoft PhotoScan Pro. Figure 4 shows a small part of the orthomosaic created of the entire island. The resulting DSM contains 11 points per square metre. From the point cloud, two raster DSMs were compiled: a so-called standard model with a grid spacing of 56cm and a high-resolution model with a grid spacing of 30cm. Figure 5 shows two parts of the digital landscape model created by superimposing the orthomosaic over the digital surface model. Figure 6 shows a part of the digital map consisting of the orthomosaic superimposed with contour lines. The processing from imagery to end products could be completed within 50 working days by one operator using two workstations simultaneously.

DURING 52 FLIGHTS, 21,840 IMAGES WERE RECORDED WITH AN ALONG-TRACK OVERLAP OF 90% AND AN ACROSS-TRACK OVERLAP OF 70%

CHALLENGES

To ensure the continuity of the survey and to guarantee high-quality radiometry and geometry of the images, the UAS platforms required permanent maintenance while the inertial measurement unit (IMU) had to be calibrated regularly. In general, these precautions have to be taken whenever one captures large, isolated areas such as Rapa Nui. In order to cope with shadows from clouds or poor lighting conditions which frequently occur in the island's unstable weather conditions, more flights and more images were taken than would be necessary when capturing smaller areas. In order to capture areas within a radius of seven kilometres around the launch site, 16 launch and landing sites were selected that were well distributed over the island. Because the terrain conditions around the launch sites differed, the flight planning could not be done in the office but instead had to be carried out on-site while in the field.

ACKNOWLEDGEMENTS

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CRIME SCENE INVESTIGATION USING ADVANCED GIS ANALYSIS

GIS Investigation of Mass Dolphin Death

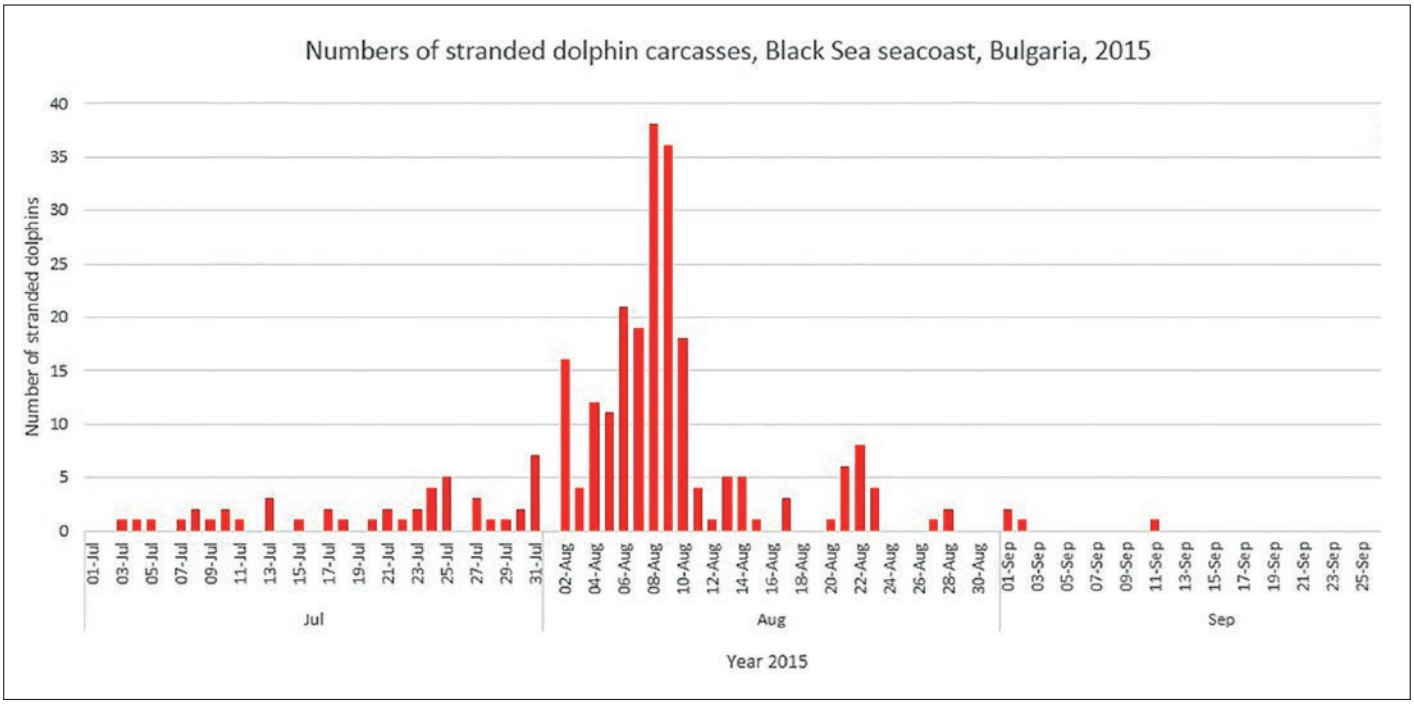
In the summer of 2015, more than 300 dead dolphin calves were found along the Bulgarian Black Sea coast. As no governmental institution investigated this strange case, an international team of scientists was brought together to collect and analyse various types of data. Using the MOTHY model and the available data, more than 50,000 points were reconstructed in reverse time from 252 different representative trajectories of dead dolphin bodies floating in the sea. To determine the exact place of death of the dolphins, advanced geographic information system (GIS) analysis was performed on the available time-aware data. This unique interdisciplinary approach has enabled the scientists to discover the possible cause of death for probably thousands of dolphin calves.

A wildlife disaster unfolded on the Bulgarian Black Sea coast in the summer of 2015. Hundreds of dead baby dolphins (*Phocoena phocoena*, harbour porpoises) were discovered on beaches along the 378km-long coastline. In July and August, carcasses of baby dolphins were washed up on almost all Bulgarian beaches, particularly after strong winds. Due to the specific sea currents in the Western Black Sea at that time of the year, only a small percentage (5-10%) of carcasses reached the shore. As the number of registered cases amounted to more than 300, it was suspected to be a very large-scale wildlife disaster which most likely involved thousands of dolphin victims. The incidents were found to be periodic in time, which gave the scientists a clue about the possible cause. There were no cases along the coastlines of neighbouring Romania and Turkey, but it was evident that most of the carcasses had been in the water for more than 20 days. Due to the complexity of the case it was important to obtain as much data as possible, and to structure and analyse it using different approaches in order to identify the probable cause of death.

COLLECTING DATA

Most of the sightings and information about the deaths came from citizens and tourists. The state institutions lacked data because there were no prior procedures in place for such incidents. However, the non-governmental organisation called Save Koral Beach immediately devised a workflow for collecting valuable data and created an emergency network of supporters, colleagues, concessionaires, beach tenants, lifeguards, divers, surfers, spear fishermen, fishermen and tourists. Social networks, in particular the 'Save the Dolphins' Facebook group, were used to record sightings and for communication purposes, such as for collecting information details and exchanging

▲ *Figure 1, Carcasses of dolphin calves. Over 300 dead dolphin calves were washed ashore along the Bulgarian Black Sea coast throughout August 2015.*



▲ *Figure 2, Number of stranded dolphin carcasses in the summer of 2015.*

photos and information. The huge response soon revealed that the number of dead dolphins was far higher than initially expected (Figure 1). The collected data consisted of detailed information including location, time and photos. All the data received was directly published online via a web map application (http://dolphins.koralbeach.com) so that everyone could check their own sighting and give further detailed descriptions if needed. The largest number of cases was found to have occurred between 1 and 12 August 2015 (Figure 2). Therefore, this period was chosen for detailed analysis and investigation. From the photos for each case, experts determined the approximate time of death of each dolphin. Subsequently 28 representative cases were chosen within that time period, spread evenly throughout the Bulgarian Sea coastal region. Data was organised in a geodatabase containing the coordinates and time of appearance of each carcass, time of death, photos and other attribute information.

THE MOTHY MODEL

The next step was to identify the place of origin of this wildlife disaster. Simulations of the time-reverse movement of dolphin carcasses were performed using the MOTHY numerical model. That model was developed around 20 years ago by the French national weather service Météo-France, initially to simulate the drift of containers on the surface of the sea and the movement of oil spills but was later expanded with other functionalities to support search and rescue operations. The MOTHY model can also predict the movement (or simulate reverse-time trajectories) of animal carcasses, as was required in this study. The numerical model needs bathymetric data, information about the location of the stranded dolphin carcasses and an estimate of the time period of their drift in days. It also needs meteorological information, such as data about the winds at an altitude of 10 metres above the surface of the sea and the atmospheric pressure data for the entire period of the simulation. The weather data in this study came from the regional atmospheric model ALADIN which is used by the Bulgarian national weather service, the National Institute of Meteorology and Hydrology (NIMH). Data on sea current fields at the mixed-level depth of the Black Sea obtained from the American ocean model HYCOM was additionally used as input. Using all these data inputs, the MOTHY model simulates first surface currents and

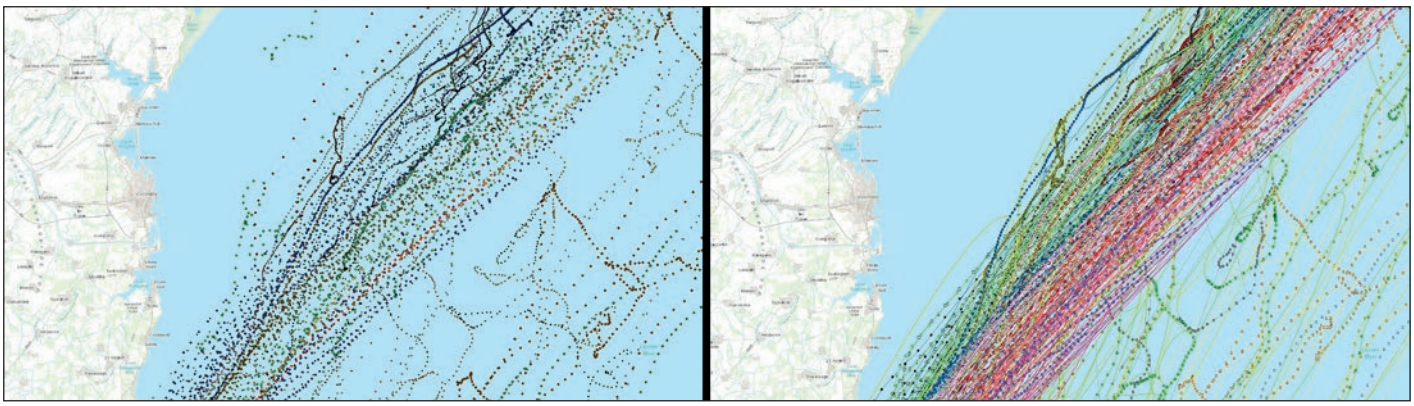


Figure 3, Points (left) and trajectories (right) computed using the MOTHY model when searching for the place and time of the incidents.

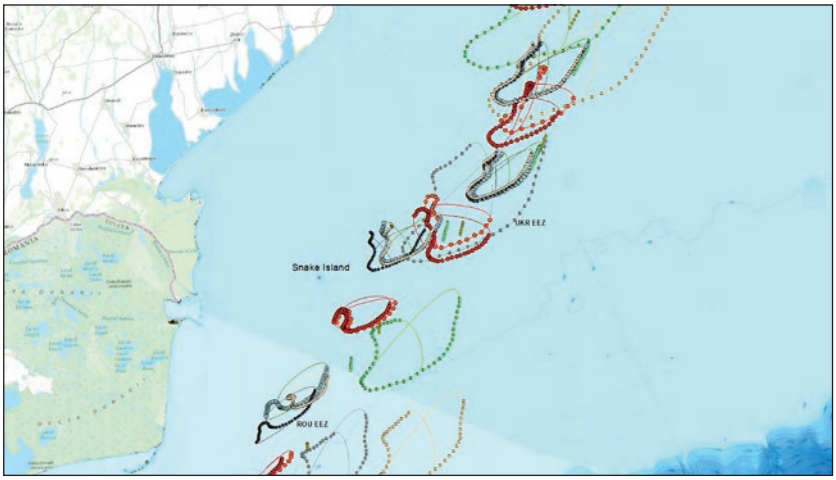


Figure 4, The place of the occurrence after GIS analysis.

subsequently the movement of the floating objects, taking currents, wind, buoyancy and turbulence into account. The output of the model is a set of back trajectories for different levels of immersion of the carcasses.

TRAJECTORIES

For the 28 selected cases, 252 trajectories (nine per case) were computed for varying levels of immersion. Approximately 50,000 possible points were obtained from these trajectories: one point for every three hours during 25 days (or less) in reverse time (Figure 3). The raw data obtained from the model was reformatted for advanced time analysis using Esri's Tracking Analyst, an extension for ArcGIS for Desktop. A time window of one day and three days for every trajectory was used to compensate to some degree for the potential time errors in the data. All 252 trajectories were investigated in reverse time in the hope of identifying a concentrated cloud of trajectory points somewhere in the sea. Eventually such a concentration was indeed found, located 35km northeast of Snake Island in the Exclusive Economic Zone of Ukraine in the Black Sea (Figure 4). Some of the carcasses were found hundreds of kilometres away from there after more than 20 days of floating in the sea.

THE RAW DATA OBTAINED FROM THE MODEL WAS REFORMATTED FOR ADVANCED TIME ANALYSIS USING ESRI'S TRACKING ANALYST

ILLEGAL TURBOT FISHING

The time of the occurrence of the selected cases was also determined and was found to be between 25 and 26 July 2015. Knowing the place and time of the incident was the first step towards discovering the cause. During deeper analysis of the remaining available data it was established that some of the dolphin calves also died around 1 August 2015 in the same place, so there was clearly some evidence of a cyclical event. In most cases it was not possible to determine the exact cause of death by necropsy because the carcasses had already spent such a long time in the sea. However, necropsy was able to prove that drowning had been the cause of death for some of the dolphins. Drowning of dolphin calves mostly happens when they are caught in fishing nets as by-catch. Illegal, unreported and unregulated (IUU) fishing is one of the most devastating activities in our seas and unfortunately it is happening all over the world. The Black Sea is notorious for such activities, especially illegal turbot fishing by gillnets. The area around Snake Island is one of the Black Sea's richest places in terms of wildlife, including the turbot population. The illegal turbot gillnets are often hundreds of kilometres long and are the main cause of death globally, especially for Phocoena phocoena due to the specific anatomy and behaviour of this species. Although the scientists now knew the place, time and cause of death, the next challenge was to find the offender. Historical data of marine traffic (marinetraffic.com) based on the automatic identification system (AIS) was obtained and analysed, but this produced no results due to the fact that illegal fishing boats never activate their AIS. However, before completing the crime scene investigation, a thorough analysis of the data of all cases in the summer of 2015 made it possible to mark several places in the Black Sea where illegal fishing of turbot might be occurring.

FUTURE PREVENTION

The Black Sea is an arena for IUU fishing, gas and oil investigation and production, military activities and pollution, with an evident lack of adequate control. The approach explained in this article can be used for a wide range of applications, investigations or rescue missions at sea, without the actual need for satellite and sensor data, border police or military information. Many people contributed their expertise to this dolphin crime scene investigation, which has also helped to stimulate the widespread communication of this topic. The authors hope that publicity for this severe wildlife disaster in the summer of 2015, causing the death of probably thousands of dolphin calves, can prevent further depletion of the small population of *Phocoena phocoena*, turbot and other marine wildlife species in the Black Sea. ◂

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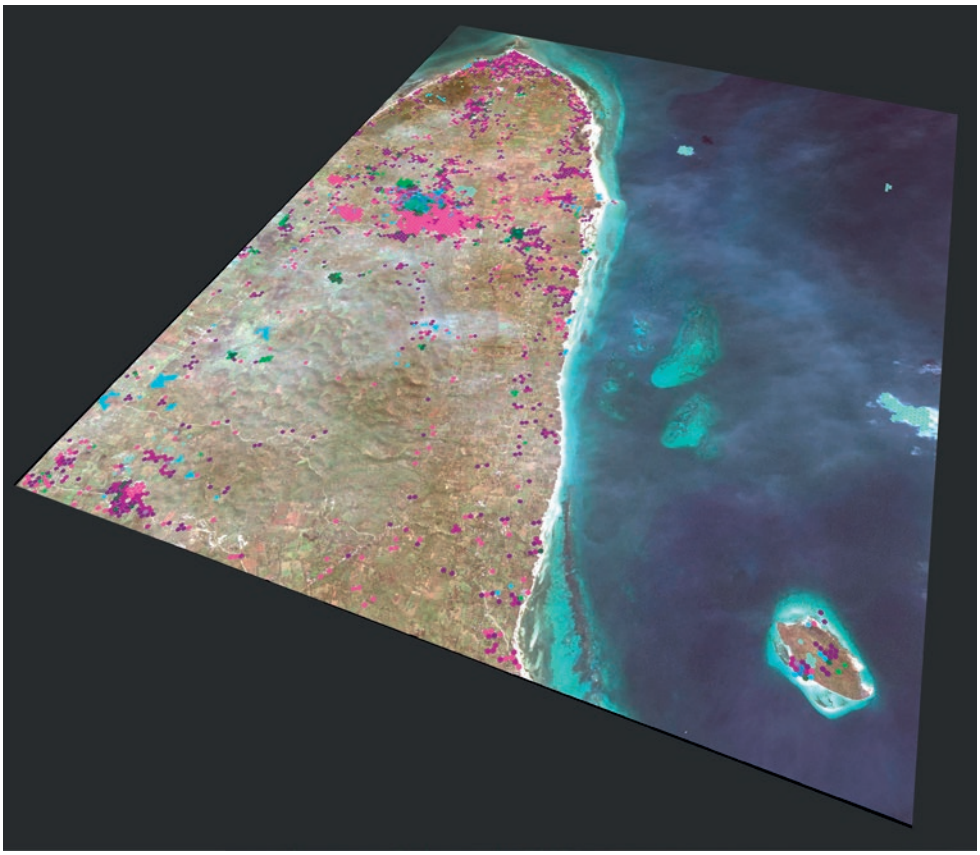
A NOVEL APPROACH TO INCREASING ANALYSIS AND MAPPING CAPACITY

Game-based Crowdsourcing for Image Analysis

Complex image analysis is a task at which humans are still far better than computers. While computers can conduct simple analysis, they are not yet effective at reliable feature identification and classification, such as to identify where illegal logging is occurring for example. A huge amount of spatial imagery is available nowadays, both of the Earth and other planets, but – in view of the large number of possibilities and the sheer volume of data – there are not enough experts to analyse it all. This article describes a novel approach that can increase image analysis and mapping capacity founded on game-based crowdsourcing.



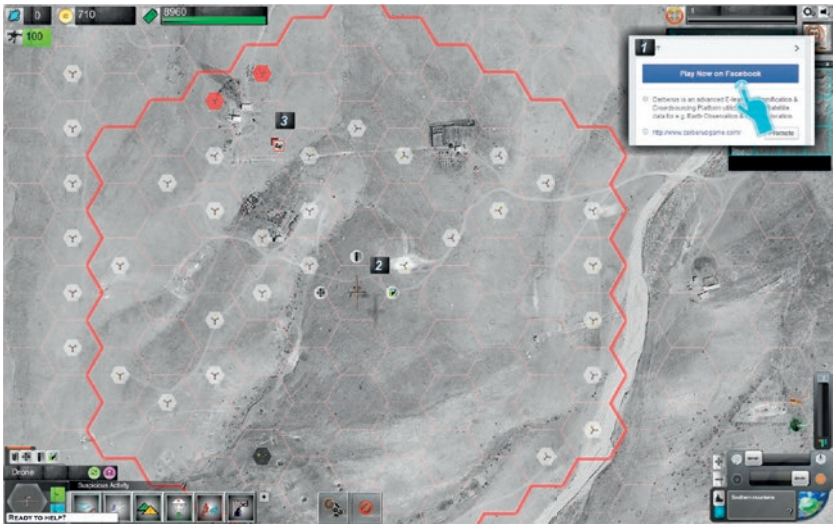
▲ *Figure 1, Mapped destruction caused by Typhoon Haiyan. Dark purple and bright purple hexagons represent areas with completely demolished and damaged property, respectively. Bright blue hexagons represent clouds, indicating a lack of certainty about these areas.*

The approach presented in this article by the Dutch start-up BlackShore began as an experiment to help NASA scientists explore the surface of a planet similar to Earth. Deep canyons, traces of rivers, mineral deposits and evidence of past volcanic activity must be mapped in order to learn more about the history of the solar system. Those and many other geological features can be spotted in imagery collected continuously by NASA's Mars Reconnaissance Orbiter. To extract more from all that valuable data, the then-novel concept of crowdsourcing was proposed to increase the number of 'brains' performing image analysis. The idea was to visualise the Martian satellite imagery in a computer game and ask the players, the 'crowd', to map out land features requested by researchers from the planetary exploration domain. While the players were learning about Mars, being inspired by the planet's beauty and doing their mapping job, they were also continuously contributing to scientific research. The experiment showed that the crowd of players performed the task faster, more thoroughly and just as accurately as the experts, as long as the computer game taught the players what to look out for and kept them motivated. With the idea validated on the analysis of imagery of Mars, BlackShore entered the Business ▶

Incubation Programme of the European Space Agency (ESA). It proceeded to evolve its computer game called Cerberus, originally developed for Martian imagery, into a game ready to map Earth and to discover markets where there could be a need for crowd-generated data augmenting satellite imagery, such as in the case of disaster mapping.

PRINCIPLE OF OPERATION

The purpose of the game is to make a map showing the features of interest, such as trees, based on satellite imagery. The images are divided into hexagonal tiles which are tagged by the players according to the dominant feature in each tile. The rationale is that, if a lot of users mark the same object in a tile, the Cerberus system treats it as a real object and then draws the object on the output map, which is compatible with any geographical information system (GIS). The algorithm which combines all the results from the crowd automatically filters out the outliers. For example, if only three out of a hundred people identify the feature in a particular location, the system ignores it and will not put the feature on the output map. However, when ten or more people click on the same spot, the system considers this to be the truth and the feature is drawn on the output map. It is important to ensure that the crowd delivers accurate results and that players do not just click randomly. Achieving the best results requires a mix of a smart scoring scheme, e-learning components to educate players prior to participation in the game, and smart game mechanics. Players are awarded a higher score for clicks which later result in a real feature, implying they have made a meaningful contribution. A player needs to have a minimum score to advance in the game, thereby creating an incentive for every player to do a good job. Interestingly, this results in the crowd noticing more features than individual experts and mapping being completed more rapidly and essentially for free, without quality being compromised.



▲ *Figure 2, Detecting IS activity on Mount Sinjar, Iraq (image courtesy: BlackShore & European Space Imaging).*

TYPHOON HAIYAN

The Cerberus game was evolved to enter new markets for crowd-based image analysis, such as disaster mapping. It was used successfully to map the damage caused by Typhoon Haiyan which struck the Philippines in late 2013. Using very-high-resolution satellite imagery captured right after the skies cleared, the crowd managed to map out more than 8,000 features for an area of 25km^2 in the space of one and a half days. The map features included the level of destruction to property, blocked roads and damage to key infrastructure such as harbours. In addition, clouds visible in the image were mapped too. This indicated mapping areas with a reduced certainty level to field workers using the maps, which is crucial for people's confidence in the maps.

REFUGEES

Another interesting application involved the attempt to help refugees in Iraq. In the summer of 2014, when villages surrounding Mount Sinjar were attacked by members of Islamic State (IS), many of the local population fled to the mountains. The crowd analysed ultra-high-resolution satellite imagery of the mountain range to help map suspicious activity, to identify the location of refugees and to designate safe drop areas for supplies. Within less than a day, the crowd had detected a number of refugees who would not have been spotted by sight alone and also discovered a location which may have been the site of a mass execution. The security aspect posed an extra challenge in this case: how could terrorists, for example, be prevented from participating in the game and making use of the fresh satellite imagery? To counter this, various security measures were put in place, including excluding entire countries from participation, preventing

▲ *Figure 3, Mapping logging and agriculture in Ghana using Sentinel-2 multispectral imagery and the Cerberus gaming platform (image courtesy: BlackShore & European Space Imaging).*

users from downloading the satellite products themselves and preventing the disclosure of exact geolocations to the crowd. Access to the generated maps is restricted to BlackShore and its clients only.

USING OPEN SATELLITE IMAGERY

So far, Cerberus has relied on commercial and hence costly satellite imagery because of the ultra-high resolution. However, funded by the European Space Agency, a feasibility study was recently conducted of performing crowdsourcing using open satellite imagery originating from the Sentinel-2 satellite. The study focused on the detection of illegal forestry and aiding farmers in developing countries. Making use of the Sentinel-2 multispectral capabilities, the crowd was able to help generate a map covering an area of 500km^2 of Ghana under threat from deforestation. The long-term plan is to ask the crowd to monitor farming activities in Ghana to ensure that farmers can continue to work on their existing plots of land – for example by helping to detect diseases at an early stage – and to help plan irrigation systems. In this way, crowdsourcing technology helps to reduce the need to cut down trees to create fertile ground, helps to increase production yields and thus helps economies to grow while preserving the rainforests.

ARTIFICIAL INTELLIGENCE

Today, the human brain is still better at recognising objects in images than computers are, especially when logic is needed. Humans are also able to react to unexpected features which were not the original subject of the analysis – for example, in the case of a mass grave or a ship that has run aground. These are all anomalies that would be picked up by the crowd, whereas if a computer had not been programmed to expect such features beforehand it would simply not see them. Furthermore, even if a computer would learn from one case, that knowledge may not be applicable to the next case; damage signatures, buildings, typical vegetation imagery and even sunlight can all be different in each new case. While computers cannot completely take over from humans yet, humans and artificial intelligence (AI) can be combined by using crowd input to train artificial intelligence systems. In illustration of this, imagine that an area of 1,000km^2 has been struck by a tsunami. The crowd could map the first 100km^2, then an AI system would be trained using that map. The AI system could subsequently automatically analyse the remaining 900km^2 with the crowd then being engaged again to verify the computer's output. ◂

HANS VAN 'T WOUD

Hans van 't Woud is the founder of BlackShore, which is currently taking the crowdsourcing platform Cerberus to the next level. His educational background includes communication and multimedia design followed by human-centred multimedia completed at the University of Amsterdam with a focus on serious gaming, crowdsourcing and e-learning.

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No 2999

MONITORING RESPONSES OF VEGETATION TO CLIMATE CHANGE

Thermal Infrared Reveals Vegetation Stress

Climate change or other environmental changes may affect the health of plants. Conventional methods for determining how vegetation responds to changes in temperature and humidity measure the reflectance of the visible and near-infrared part of the electromagnetic (EM) spectrum on the leaves. By using a non-destructive thermal infrared spectrometer, the authors demonstrate that persistent stress also affects the thermal infrared emissivity of plants. This finding paves the way for using thermal spectroscopy to monitor responses of vegetation to climate change.

Detection of vegetation stress has been mainly done through visible (VIS) and near infrared (NIR) spectroscopy, partly because most (satellite) sensors and spectrometers cover these wavelengths and also because it was assumed that stress would not affect the wavelengths above 2.5µm. Advances in spectrometers for capturing thermal infrared (TIR) (3µm and upwards) makes it possible to accurately capture the emissivity of vegetation in the TIR spectrum and so to challenge the above-mentioned assumption. Emissivity is the relative emission of electromagnetic radiation compared to the emission of a perfect black body as defined by Boltzmann.

EQUIPMENT

The instrument used to capture the emissivity in the TIR domain of the EM spectrum was a customised Bruker Vertex 70 Fourier Transformed Infrared (FTIR) spectrometer, which is an industry standard (Figure 1). A gold-coated integrating sphere was mounted to an external port of the spectrometer for collecting the energy emitted by leaves in the spectral range from 1µm to 16µm in a non-destructive manner. The common method requires pulverisation of the leaves, which destroys the structure of the leaves. In the authors' set-up, the emissivity of individual leaves can be measured without picking the leaf from the plant by placing a leaf in front of the measurement port of the sphere. This keeps the leaf surface, with all its intricate developmental information, intact and enables repeat measurements to be conducted on the same leaf. Furthermore, the measurements can be compared with the output of TIR sensors mounted on airborne and satellite platforms much more effectively.

SPECIES

Two types of plants – beech and rhododendron – were selected for conducting the study. Both species can grow in mountains but also at low altitudes. They can

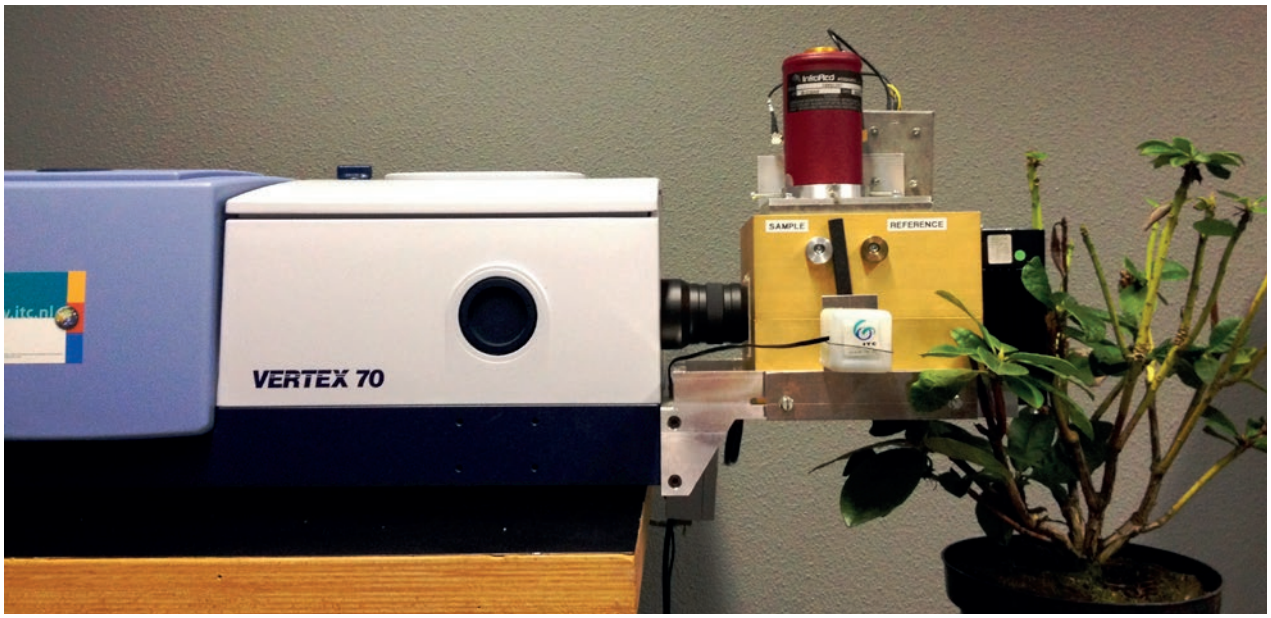
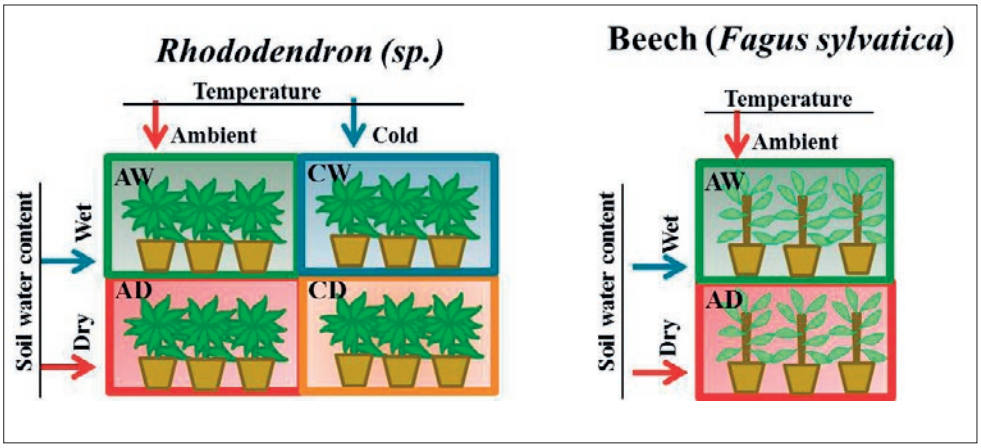


Figure 1, Thermal infrared spectrometer.



▲ *Figure 2, Stress conditions for rhododendron (left) and beech. AW: ambient and wet; AD: ambient and dry, CD: cold and dry, CW: cold and wet.*

cope with high and low rainfall and high and low temperatures. Their stress responses to unfavourable conditions are therefore a good model for testing how stress is reflected in the emissivity of the TIR domain. Both species, planted in pots, were cultivated in a controlled environment for one growing season. The rhododendron plants were exposed to both water stress and temperature stress for a period of six months, from July to December, and underwent four treatments (Figure 2). rhododendron plants drought was simulated by reducing the water supply to 20% of the field capacity and covering the pots with plastic to avoid effects of rainfall while being placed outdoors. The control group was watered weekly up to field capacity. The amount of water was controlled by weighing the pots. For both the rhododendron plants and beech plants, temperature stress was simulated by placing the plants for three months in a cooled greenhouse in the

CAPTURING TIR EMISSIVITY MAKES IT POSSIBLE TO DETECT RESPONSES OF VEGETATION TO CLIMATE CHANGE AT AN EARLIER STAGE

The beech plants were only exposed to temperature stress (two treatments: ambient and dry) and the experiment lasted three months, from July to September. For the summer and for three months outdoors in the autumn. The control group was placed for three months outdoors in the summer and for three months in a greenhouse in the autumn at a mean temperature of 19.1°C (Figure 3). In each treatment 15 plants of each of the species were used, requiring 60 rhododendron plants and 30 beech plants. Five healthy and representative leaves of the 90 plants were marked (Figure 4) and measured at the start and again at the end of the growing season.

RESULTS

Some parts in the TIR domain show changes when plants grow under stressful conditions compared to plants which grow under ambient conditions and changes in emissivity can be seen especially in the longer wavelengths (7 to 14μm). However, the two species respond differently. In the beech plants the emissivity drops, while in the rhododendron plants the emissivity increases under stressful conditions. These different responses may possibly be caused by differences in the species' survival strategies.

OUTLOOK

Operational TIR sensors, including the SEBASS and Hyper-Cam sensors, are mainly used for geological exploration and assessing the chemical composition of gaseous and solid substances. This study shows that these sensors also have potential for vegetation monitoring and can complement the conventional VIS and NIR methods. The results have been achieved under controlled laboratory conditions. In practice, TIR sensors will be mounted on an aircraft or satellite platforms, and water vapour in the atmosphere strongly interferes with TIR energy emitted from the ground. Nevertheless, TIR sensors enable monitoring

▲ *Figure 3, Temperature-controlled conditions in a greenhouse.*

▲ *Figure 4, Marked leaves.*

of how plants respond to climate change. In view of global warming, plants that are temperature-limited, such as at higher altitudes in mountainous regions, will be released from temperature stress and this will be reflected in their emissivity values. This could be a precursor for more dramatic changes in land cover as a result of climate change, such as trees colonising at higher altitudes where they have previously been unable to grow. Therefore, capturing their TIR emissivity will make it possible to detect responses of vegetation to climate change at an earlier stage.

CONCLUDING REMARKS

The mechanism underlying the emissivity in the TIR domain and the responses to changing environmental conditions require further analysis. This proof of concept is a first step in unravelling how capturing TIR emissivity can contribute to monitoring vegetative responses to climate change. ◂

FURTHER READING

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- Hecker, C., Hook, S., van der Meijde, M. (2011) Thermal infrared spectrometer for earth science remote sensing applications – Instrument modifications and measurement procedures. *Sensors* 11, pp. 10,981-10,999
- Ullah, S., Schlerf, M., Skidmore, A.K., & Hecker, C. (2012) Identifying plant species using mid-wave infrared (2.5-6μm) and thermal infrared (8-14μm) emissivity spectra, *Remote Sensing of Environment* 118, pp. 95-102

THOMAS GROEN

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RECOVERY FROM DISASTER – FIG WORKING WEEK 2016, NEW ZEALAND

It's Always about **People!**

"It's always about people," said Lianne Dalziel, Mayor of Christchurch. Disaster loss increases every year in terms of mortality, the number of people affected and economic and environmental impact. Surveyors and geodesists play a crucial role in disaster mitigation, preparedness, response and recovery.

The annual FIG Working Weeks are exciting events, bringing together the international community of surveyors to experience interesting plenary and technical sessions, workshops, a trade exhibition and a variety of side events and social functions. The 2016 Working Week in Christchurch, New Zealand, attracted almost 700 colleagues from 70 countries.

In the opening ceremony Sir Tipene O'Regan from the Heritage Name Commission of New Zealand's Geographic Board talked about inheritance identity and the way the original tribes are 'reinventing' and 'reconstructing' themselves after the colonisation. Their first question is not "Who are you?" but "Where are you from?". The participants were then welcomed by Mark Allen, president of the New Zealand Institute of Surveyors, Simon Ironside, co-conference director, and FIG President Prof Chryssy Potsiou – with impressive introductions to the theme of the event.

GOOD COORDINATES

The theme of the 2016 Working Week was 'Recovery from Disaster'. This reflects New Zealand's experiences while recovering from the 2011 Christchurch earthquake sequence. Many inhabitants worldwide face various disasters such as flooding, storms, tsunamis, droughts and the after-effects. Surveying and spatial professionals are key actors in improving, simplifying and shortening disaster mitigation, rehabilitation and reconstruction. Disaster loss increases every year in terms of mortality, the number of people affected and economic and environmental impact. Mayor Dalziel made the statement of the week, inspired by a FIG poster: "Good coordination starts with good coordinates". Duncan Gibb, founding general manager of the Stronger Christchurch Infrastructure Rebuild Team (SCIRT) shared his experiences, which were about leadership, communication, collaboration with people and ways surveyors generate solutions.

▲ *The international participants were greeted with a Maori welcome dance.*

ROLE OF SURVEYORS

Ms Margareta Wahlström, keynote speaker at the opening ceremony, led the United Nations Office for Disaster Risk Reduction until the end of 2015. "How can you get politicians to follow your advice?" she asked rhetorically, before stating that the real issue is influence. Disasters are political issues. The crucial role of surveyors needs to be marketed.

"NMAs (*national mapping agencies, Ed.*) should be in the position to generate, maintain and provide quality geospatial information and services across all phases of the emergency cycle," said Dr Hiroshi Murakami, deputy director general of the Geospatial Information Authority from Japan. Meanwhile, Prof Dr Jixian Zhang presented a very comprehensive overview of solutions from China.

ACTIONABLE AGENDA

Gregory Scott, leader secretariat for the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), presented the global perspective with impressive statistics on disaster loss – both in terms of numbers of affected people (more than 1.5 billion) and in money (more than one trillion dollars). The Post-2015 Development Agenda is actionable, and data about people and place is an indispensable element in this agenda.

FIG President Potsiou stated that "FIG will move toward more holistic, multi-sector partnerships to more systematically address the global challenges, including dealing with disasters and achieving secure land rights for all by 2030. FIG has developed a close relationship with important international

institutions. FIG strongly believes in the power of joint research with the UN and the World Bank, in advising on smart, evidence-based solutions that shape the development agenda. FIG will coordinate more of what we do so that we are more strategic and ensure that priority goes to activities with the highest returns. FIG will do more to build on new technologies, create new opportunities for surveyors, and capitalise on more affordable high-resolution spatial data".

YOUNG LEGS, GREY HAIR

"What about Land Surveyors without Borders?" asked Keith Bell from World Bank. And: "Can FIG lead national professional bodies to put surveyors on the pro bono humanitarian map?" Today we have developed a network of Young Surveyors; a new generation of global surveyors, working at the local level yet aware of the global issues and contributing solutions to the global agenda. Their young legs combined with the grey hair of our experienced experts will make the difference. They can develop the capacity and approaches explained by Sam Johnson from the Student Volunteer Army. We need action, not expensive administration with hierarchy. High-resolution cloud-free imagery will soon be available, standards are available, the Open Geospatial Consortium offers to operationalise them helped by the geospatial industry: all achievable within a fit-for-purpose approach.

FROM MAPS TO MODELS

Mark Nichols from Trimble gave a fascinating overview of the future related to the developments in spatial modelling, cloud-based solutions, crowdsourcing and virtual reality. He furthermore gave an impressive description of Trimble's role after the earthquake, helping Christchurch to keep its commercial sector alive.

THE CONFERENCE

A series of interesting papers were presented – papers and presentations can be found at the FIG website. Special symposia were organised on History, Small Island Developing States, the Social Tenure Domain Model, and Reference Frames. Special sessions were organised in cooperation with both UN-Habitat/GLTN and FAO. FIG Platinum sponsors Esri and Trimble were well represented at a remarkably comprehensive exhibition. The local hosts had done their utmost in organising this very successful event. FIG was honoured to contribute to this global exchange of knowledge and congratulated the New Zealand Institute of Surveyors (NZIS) for facilitating this event so efficiently.

▲ *Participants were brought to a sports arena for the Working Week by buses because the conference centre was damaged during the earthquakes.*

▲ *Plenary Hall was decorated in true Maori style – here with Mark Allen, NZIS, Mayor Lianne Dalziel, President Potsiou, Margareta Wahlström, UNISDR, Hon Nicky Wagner and Duncan Gibb.*

▲ *The new FIG Council for the term 2017-18 – Rudolf Staiger, Mikael Lilje, President Chryssy Potsiou, Orhan Ercan, Diane Dumashie and Louise Friis-Hansen.*

GENERAL ASSEMBLY

The 39th General Assembly elected two new vice presidents: Orhan Ercan from Turkey and Mikael Lilje from Sweden. The new team of vice presidents for FIG President Chryssy Potsiou for the term 2017-2018 now comprises: Rudolf Staiger, Diane Dumashie, Mikael Lilje and Orhan Ercan. Another exciting election was the close-run vote for the venue for Working Week 2020, in which Amsterdam, The Netherlands, was eventually chosen over Interlaken, Switzerland. At the end of the event, the FIG flag was handed over to Helsinki, Finland, which will be the host of the FIG Working Week in 2017

CLOSING REMARKS

In her closing remarks, FIG President Potsiou pointed out that "humanity has lived with natural disasters for centuries but their impact was not felt to the same extent in the past as is experienced now: the more the people, the more the development, the greater the loss. In surveyors' understanding, good coordinates lead to good land administration, insurance and compensation for better recovery". ◀

More information
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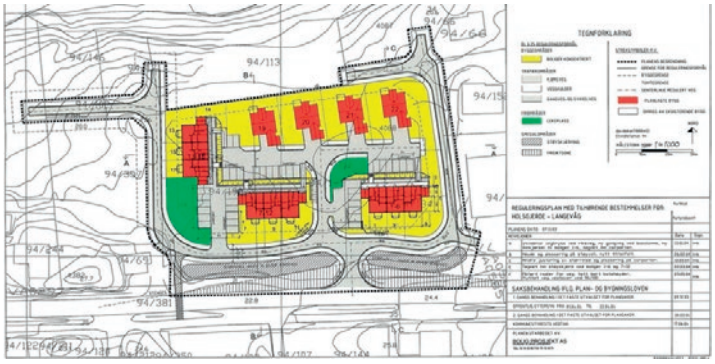
NORKART

New 3D Map Solution Covering Norway

Worldwide, most municipalities are still making regular 2D maps for online publication, including maps for zoning plans, municipal plans, property borders as well as approved sites for new construction projects. However, the 'man on the street' has little or no knowledge of how to read such maps. Norkart in Norway has now launched a brand-new 3D map solution, Kommunekart 3D, which covers the whole country and has the potential to revolutionise map use.



▲ *Figure 1, Langevaag close to the city of Aalesund, zoning plan in 2D. Source: Sula municipality, Norway.*

The key aims of 3D visualisation are more simplicity, greater equality and better understanding. People outside the geomatics business often perceive maps and map data as complicated, but the usage of 3D enables everything from zoning plans (see Figure 1) to major road and public transport developments to be visualised easily (see Figures 2). This gives both internal and external target groups new insights into the geography of their municipality, neighbourhood or surroundings.

Every month ***GIM International*** invites a company to introduce itself in these pages. The resulting article, entitled Company's View, is subject to the usual copy editing procedures, but the publisher takes no responsibility for the content and the views expressed are not necessarily those of the magazine.

CHALLENGING GOOGLE

The new Kommunekart 3D map solution could give the Norwegians a more accurate and detailed model than Google can offer. Providing useful, informative and easily understandable maps to the Norwegian people is one of Norkart's main tasks. The firm has a close partnership with the Norwegian Mapping Authority and distributes software to handle all kinds of geomatics-related data. This partnership brings a common map database containing the most precise vector data from all municipalities. (e.g. Figure 3). This data is used for map production, case management, engineering and geographic analysis as well as in creating the 3D buildings at level of detail 2 (LoD2) for the map solution. This solution will provide completely new application possibilities, partly because it depicts all the country's buildings with excellent elevation models and a sun/shade functionality.

TAILORED MAPS

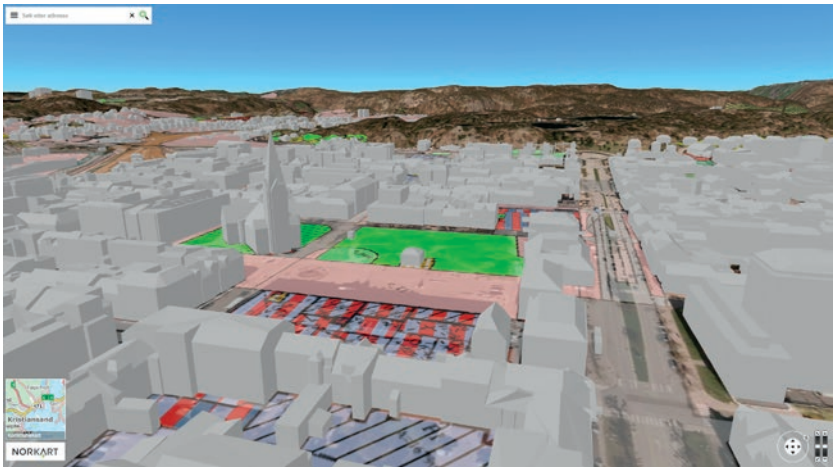
The municipalities are able to provide useful and valuable information to the public, and can tailor parts of the maps with their own data, e.g. adapted for their own citizens. Specifically, they can use the solution to add 3D buildings, oblique photos, textures or similar data of their own to give an even more realistic point of view, and approach level of detail 3 (LoD3) or even 4 (LoD4). For example, a proposed new building could easily be fitted into an existing 3D model (Figure 4). This combination of geographical data and 3D mapping solutions will create substantial value and gains.

BEHIND THE SCENES

Since last autumn, Norkart has been working in cooperation with the Swedish company Agency9. The synergies from this cooperation have resulted in two advancements: the addition of CityPlanner software (editing, publishing, and planning assistance) to the portfolio and the application programming interface (API) to develop new programs/solutions based on a well-founded platform. The API is known as 3D Maps SDK. Developers from both companies have worked together to prepare the new 3D map solution and are now continuously evolving it with new and easy-to-understand content in support of the above-mentioned key aims of 3D visualisation.

FIRST STEPS

A number of prerequisites are involved in ensuring that a new solution functions perfectly



▲ *Figure 2, Kristiansand city, buildings in LoD2 with zoning plans. Source: Kommunekart 3D*

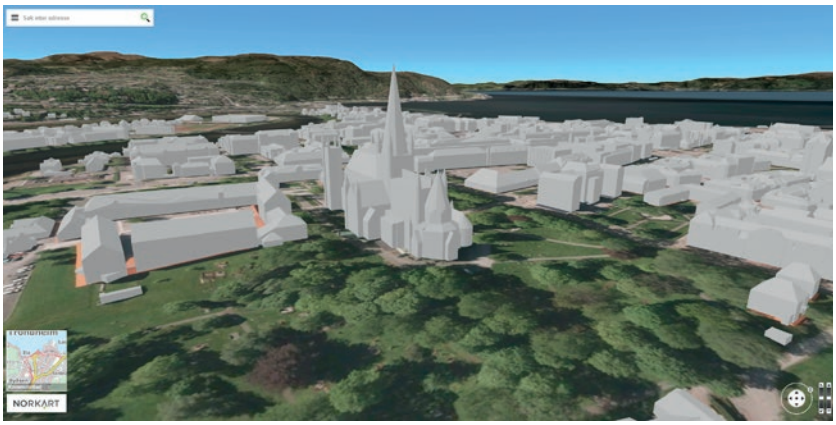
anywhere, anytime, on all platforms. Data has to be simple yet contain enough information. Data reading has to be fast. Firewalls must be opened. The API has to be repeatedly tweaked. Kommunekart 3D started with the idea of developing a useful 3D client which could reuse accurate data, provide new opportunities, be fast, be functional and, last but not least, be easy to use. It also had to be dynamic to work well on all platforms: smartphones and tablets as well as desktops. Improvements were made to the data enhancement, data flow, processing data, reading data and other elements affecting the 3D map solution. The official version of Kommunekart 3D was released on 9 March 2016 during the Norwegian Geomatics Days. In the current evolution, rooftops will be changed from grey to a light red colour to create even more distinction between walls and rooftops.

NEW DEVELOPMENTS

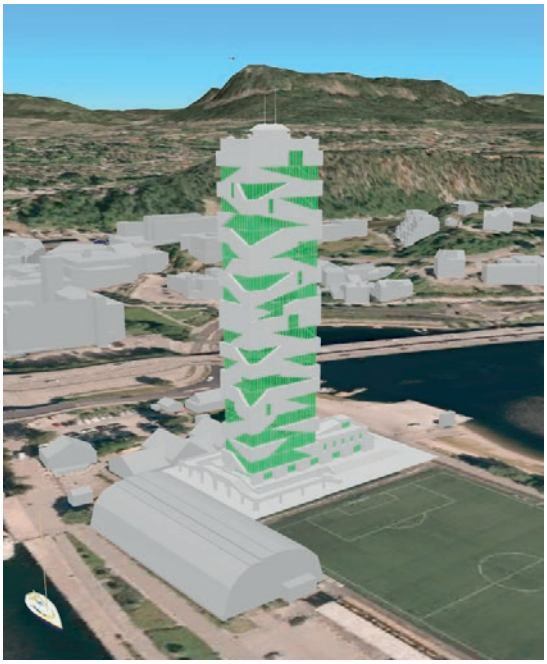
Many general improvements have already been made to the 3D model and more will follow continuously in the future. At the top of the agenda is an easier dataflow, and a solution seems to be just around the corner. Too many data processing steps currently hamper the progress, and a fully automatic pipeline would be best. In the next release, a 'Help' button is planned and there will also be a new button to adjust time and date for sun/shade analysis. Another element that will probably be implemented in the next release is Get Feature Info (GFI) which allows users to click anywhere on the map or on a building to obtain information about that exact point and area – anything ranging from zoning information such as statutory data and applicable provisions to a direct URL link to the website of the nearest cinema.

ROUTE PLANNER

A route planner with fly-through mode will be implemented in a release in the near future. Many people like to see where they are going beforehand and a 3D visualisation will offer a much better experience. There are plans to make it possible to incorporate intermediate stops if desired, i.e. to plan a route from A to B via C, D and E. For the longer term, the company is considering route-planning ideas relating to road, rail and air travel, as well as pedestrians, water flows, buildings during the construction period, changing zoning plans over a period of time, in combination with live data from e.g. traffic, FlightRadar24, social media and much more. ◀



▲ *Figure 3, Nidaros Cathedral in Trondheim, precise vector data in 3D. Source: Kommunekart 3D*



▲ *Figure 4, Kadettangen in Sandvika city, new imagined building in 3D. Source: Kommunekart 3D*

KENNETH ØYEN-ERIKSEN

Kenneth Øyen-Eriksen is project leader and GIS consultant/specialist at Norkart. Kenneth holds a bachelor in geomatics from the University of Oslo, Norway, with one additional year at the Norwegian Joint Staff Engineering College. Before joining Norkart, he previously spent seven years working at Terratec, an aerial survey company, and close to ten years in the GIS/geomatics business. He has expertise and knowledge in 3D modelling and mapping, topographic mapping, oblique photography, volume estimations and digitising.
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Thanks to the people who contributed to this project from Norkart (Frederic Dumont Kristiansen, developer, Rune Aasgård, developer, Gløer Winsvold, production manager, Stein Mjaaland, GIS specialist, and Aksel Olsen, head of development department) and from Agency9 (Tomas Karlsson, head developer).

More information
Kommunekart 3D: 3d.kommunekart.com
CityGML: www.opengeospatial.org/standards/citygml
About PostgreSQL: www.postgresql.org

Review of Fourth High Level Forum on UN-GGIM in Addis Ababa

▲ *UN-GGIM High Level Forum in Addis Ababa, Ethiopia.*

The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), in collaboration with the government of Ethiopia and the United Nations Economic Commission for Africa (UNECA), organised the Fourth High Level Forum on United Nations Global Geospatial Information Management in Addis Ababa, Ethiopia, from 20-22 April 2016.

The High Level Forum was opened by H.E. Dr Mulatu Teshome, president of the Federal Democratic Republic of Ethiopia. Christiaan Lemmen represented FIG at the event and made the opening remarks on behalf of the Joint Board of Geospatial Information Societies. On behalf of Prof Chris Rizos, chair of the board, Dr Lemmen congratulated UN-GGIM on placing 'Good Land Governance for the 2030 Agenda' in the context of geospatial information management. He stated that good land governance requires good land administration which provides information and documentation about who owns or uses what, and where. Land administration gives an overview of people-to-land relationships. It is about linking people to spaces. At a global level, 70% of those relationships are currently not documented. Dr Lemmen further stated that information about who, what and where can only be generated with the support of the geospatial disciplines. The Joint Board of Geospatial Information Societies deals with a broad range of geospatial technologies and applications, including satellite and drone imaging and mapping, geodesy, precise positioning, geoinformation science, cartography, spatial data infrastructure and many surveying sub-disciplines. Land administration has a geospatial component providing an overview of parcels or spatial units. Relationships between people and land may be of a formal, informal or customary nature. Many of those relations are not recognised and at this point in time there is no inclusiveness for all. Meanwhile, populations and cities are growing and the pressure on land and natural resources is continuing to increase significantly, which can easily lead to disputes and conflicts. A fit-for-purpose approach to land administration has been developed by global stakeholders. It is a gender-sensitive, transparent and highly participatory approach which can be implemented quickly with the support of geospatial technologies.
The challenge for the global land community and for the global geospatial information associations is clear: to secure land rights for all people, in all places, at all times. The biggest challenge is to keep the information on those land rights up to date and accessible. It now depends on political willingness and capacity development.

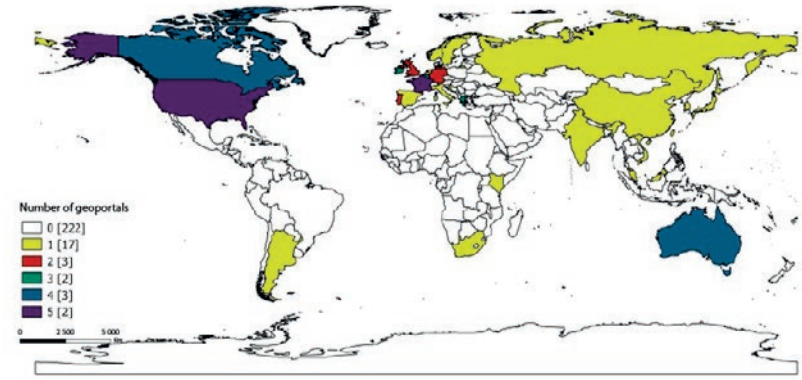
An Expert Group chaired by Kees de Zeeuw, The Netherlands, and co-chaired by Mahashe Chaka, Lesotho, decided to develop further proposals from now on. One major objective of the Expert Group is to play a leading role at the policy level by raising political awareness and highlighting the importance to decision-makers of the need for timely and fit-for-purpose land administration and management. Another objective is to encourage the use of geospatial information tools and systems to improve the legal certainty of all citizens in the world with respect to the registration of people-to-land relationships. ◀

More information
www.fig.net
ggim.un.org

GSDI Marine SDI Best Practice Project Update

The GSDI Association has part-funded a two-year research project focusing on identification of developments in marine spatial data infrastructures (SDIs) around the globe. The project grew out of research carried out by Dr Jade Georis-Creuseveau of LETG-Brest Geomer (UMR 6554 CNRS), UBO, Institut Universitaire Européen de la Mer, Plouzané, France. The project co-leaders are Dr Joep Crompvoets of KU Leuven and secretary-general of Euro SDR and Roger Longhorn, secretary-general of the GSDI Association and member of the UNESCO IOC IODE ICAN Steering Group. TKU Leuven and LETG-Brest are both GSDI Association members.
The research includes a web survey to assess the developments of national marine and coastal geoportals for web services. The initial survey led to an inventory of 35 national operational geoportals. For each geoportal, 12 characteristics were identified and measured in November 2014, March 2015 and November 2015 in order to monitor current developments. Based on the preliminary survey results, four types of geoportals were distinguished: Atlas-like, Hydrographic Office, Oceanographic/Marine Data Centre, and Hybrid geoportals.

The survey focuses on geoportals implemented by national public bodies in Europe enabling access to and use of geographic data related to marine and/or



▲ *Distribution of national marine geoportals identified.*

coastal zones. The term 'data' encompasses a broad range of items such as real-time observations, time-series data, GIS data layers, digital maps, etc.

In November 2014, 121 geoportals were assessed from 72 coastal countries. Of these, 24 geoportals were not operational at that time, seven failed to work during the period of the survey, 39 were considered to be out of the scope of the survey, and 51 were implemented by national public organisations providing access to coastal and/or marine spatial data implemented by 27 countries.

Preliminary results suggest that European developments are still underway for geoportals enabling users to access various types of data concerning coastal and marine zones. These types of data and mechanisms were stable or slightly increasing between November 2014, March 2015 and November 2015.

The results indicate that platforms allowing access to a wide range of data related to marine, coastal and land territories are not commonly found. True data harmonisation and services interoperability, which are the underpinning principles for SDIs, need to be improved.

The proposed geoportals coordinators' survey will be extended to geoportal users in order to analyse what they do with the data in their day-to-day responsibilities and to conduct a needs assessment. The combination of these approaches (geoportals, coordinators' and users' survey) will contribute to a multi-view framework in order to assess coastal/marine SDIs. ◀

More information
www.gsdi.org
http://gsdiassociation.org/index.php/projects/marine-sdi.html

Report on Third JISDM 2016

The 3rd Joint International Symposium on Deformation Monitoring (JISDM) was held at TU Wien (Vienna University of Technology), Austria, from 30 March to 1 April 2016, organised by the Research Group Engineering Geodesy of the Department of Geodesy and Geoinformation, TU Wien. It follows the more than 40 years' tradition of the FIG Symposium series on 'Deformation Measurements' and of the IAG Symposium series on 'Geodesy for Geotechnical and Structural Engineering' – one of the concrete examples of close collaboration between these two geospatial organisations. The symposium is the most important geodetic meeting worldwide dealing with the topics of geodetic monitoring and deformation analysis. During the successful three-day symposium the entire spectrum of deformation studies, technologies and applications was covered. One aim of the symposium was to highlight contributions from different fields of geodesy and geomatics, such as engineering geodesy, spatial geodesy, photogrammetry and remote sensing. Around 150 participants from 25 countries attended the symposium.
The programme of oral presentations was structured in two parallel tracks including 82 oral and nine poster presentations. The topics related to core methodological, technical and practical achievements in the field of deformation monitoring. Highlights of the conference programme included discussion of scientific progress related to the monitoring of terrain, objects and structures, such as ground subsidence, landslides, glacier movements, bridges, tunnels or wind turbines. The latest methodological developments at the theoretical level and sensor and measurement technologies, as well as applications for man-made structures and natural objects and terrain, were presented. Just some examples are areal monitoring techniques, GNSS and fibre-optics for deformation measurements, quality analysis of geodetic networks and time series, and modern approaches to structural and geomonitoring.

The programme also included two sessions dealing with 'Novel Approaches for Absolute Distance Measurements'. The respective talks were given by members of the EURAMET project, 'Metrology for Long Distance Surveying'. The opening keynote speeches dealt with the role of deformation monitoring in current global practice for structural health monitoring and lifecycle management of assets. One was presented by Helmut Wenzel from Vienna Consulting Engineers. The second, on the use of the Leica GeoMoS monitoring software package, was presented by Michael Rutschmann from Leica Geosystems. Wolfgang Niemeier from TU Braunschweig gave a laudation for Heribert Kahmen from TU Wien highlighting lifetime achievements in the field of engineering geodesy.
For the first time, the authors had the opportunity to submit their papers for peer review, with 23 papers successfully passing the review process. Ten of these reviewed papers have been selected for the first special issue of the *Journal of Applied Geodesy*. In addition, authors were given the possibility to submit revised versions of their papers for a second special issue of the *Journal of Applied Geodesy* as well as for the *Journal of Applied Geomatics*.

As a result of the success of the symposium it was decided to organise the 4th JISDM in two years' time. Its location and date will be announced in the near future. ◂

Hans Neuner, Günther Retscher, Vassilis Gikas.

More information
www.iag-aig.org

▲ *Around 150 participants from 25 countries attended the symposium.*

What's in a Name?

In the era of readily available identification of position through the medium of mobile GPS receivers, we are becoming used to WGS84 coordinates. However, the name of a place is still the most widely used reference for specifying location. Further, the names are a reflection of cognition, culture and history. The production of gazetteers is an important role for many spatial data collectors, and the representation of place names accurately and effectively is the role of the cartographer.

The subject of toponymy, the study of geographical names, has long been important at the highest level (e.g. the United Nations has an interest in the recording of, standardisation of and resolution of conflict related to place names). Both ICA and the International Geographical Union (IGU) have also set up working groups to study toponyms from their own perspective in recent decades. From 2011, these two bodies have collaborated in a successful joint body, and in 2015 this was ratified and continued as a joint Commission. Under the joint chairmanship of Prof Paulo Menezes (Brazil) and Prof Cosimo Palagiano (Italy), the group met in Rio de Janeiro last August. It was decided to adopt a number of topics of reference for further study: 'Toponymy and Education', 'unofficial, aboriginal, vernacular and historical toponyms', 'bilingual toponyms', and 'exonyms' (names given to places by those who do not live there).

Following on from the work of the previous group, the Commission will engage with important meetings and events in the field. In addition to a further symposium in Rio in March/April 2017, members met at the 29th Session of UN Group of Experts in Geographic Names (UNGEGN) in Bangkok, 25-29 April 2016, and will also meet at the IGU Congress in Beijing, 21-25 August 2016 and the International Cartographic Conference (ICC) in Washington D.C., USA, 2-7 July 2017, amongst many others. Further events of these organisations will also be attended. All information can be found at the detailed Commission website (www.igu-icatoponymy.org).

▲ *European endonyms.*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The Commission has been active in publications, usually related to active meetings and conferences. Six important, fascinating and recommended works on toponymy have resulted from its work, all published by Verlag Dr. Kovač, Hamburg (www.verlagdrkovac.de/8-34.htm). The most recent 2016 publications have been edited by Peter Jordan (Austria), a previous leader of the group, and Paul Woodman (UK), previous secretary of the British Permanent Committee on Geographic Names. Vol 6, Criteria for the use of exonyms, addresses policy and practical issues related to handling geographical names in foreign (to the non-resident) lands. This book forms the Proceedings of the 17th meeting of the UNGEGN Working Group on Exonyms (Zagreb, 2015). Vol 5, Place-name changes, discusses the reasons for, and handling of, changing toponyms and is the result of the Commission meeting in Rome in late 2014.

More information
www.icaci.org

ISPRS Congress Update: Two Months before the Opening Ceremony

Many deadlines for the ISPRS Congress are behind us. We have received more than 2,000 papers or abstracts, spanning a truly large range of topics of the individual Commissions – from remote sensing to aerial and close-range photogrammetry, and mapping and spatial information sciences. Drones, point clouds, 3D modelling, health, cultural heritage documentation – and not only from conflict areas but also disaster management, virtual reality, geovisualisation, data mining – these and many more topics will be discussed at the ISPRS Congress. All accepted papers are soon being sent to the ISPRS publisher. Both proceedings series, the ISPRS Archives and the ISPRS Annals, will be made available online at the ISPRS website on 1 July 2016.

View from St. Vitus Cathedral.

The congress programme is split into plenary sessions, parallel sessions and interactive sessions. ISPRS is also organising two new events: the National Mapping and Cadastre Agency Forum and the Space Agency Forum. They will host some of the world's top speakers, who will share their long-time experiences during the parallel sessions on Thursday 14 July and during the joint programme on Friday 15 July.

The ISPRS Congress is not only a scientific meeting. It also offers an evening programme, a programme for young scientists and for accompanying persons. The long list of exhibitors is also the guarantee of a unique opportunity to encounter top world technology within an area comprising about 3,000m^2.

Why do people take part in such an event? Some of them use the opportunity to publish in proceedings registered in the Thomson & Reuters Web of Science. Some attend the congress to combine the principle of a workshop – meeting specialists on certain topics – with meeting scientists and practitioners working in different areas. Taking part in cross-topic discussions to formulate new projects, visions or plans can be another reason to participate in the congress. It is, in fact, motivated by two main goals – an educational one (to teach and learn) and a social one. The social one is divided into discussions during coffee breaks, lunches, theatre and concert performances, a boat trip, discussions in the foyer or Zoom restaurant and in Vyšehrad, the large park near the Congress Centre. The Prague Municipality welcomes participants of scientific meetings held in the city and offers them a free one-week public transport ticket. Participants can also visit various important and interesting places within the Technical Tours offer.

In addition, some participants have been nominated to represent individual countries at the General Assembly and to decide about the next four years of ISPRS.

Have you found a reason to be one of the participants?

Lena Halounová, congress director

More information
www.isprs.org

JUNE

NORDIC UAS EVENT
Odense, Denmark
from 1-3 June
For more information:
www.nordicuasevent.com

4TH YOUNG SURVEYORS EUROPE MEETING
Amsterdam, The Netherlands
from 7-10 June
For more information:
www.fig.net/organisation/networks/ys

HXGN LIVE
Anaheim, CA, USA
from 13-16 June
For more information:
hxgnlive.com

ESRI USER CONFERENCE
San Diego, CA, USA
from 27 June - 1 July
For more information:
www.esri.com

JULY

6TH DIGITAL EARTH SUMMIT
Beijing, China
7 – 8 July
For more information:
W: www.isde2016summit.org

XXIII ISPRS CONGRESS
Prague, Czech Republic
from 12-19 July
For more information:
E: info@isprs2016-prague.com
www.isprs2016-prague.com

SEPTEMBER

GEOBIA
Enschede, The Netherlands
from 14-16 September
For more information:
www.geobia2016.com

INSPIRE CONFERENCE 2016
Barcelona, Spain
from 26-30 September
For more information:
http://inspire.ec.europa.eu

OCTOBER

INTERGEO
Hamburg, Germany
from 11-13 October
For more information:
www.intergeo.de

3D CONFERENCE ATHENS
Athens, Greece
from 18-21 October
For more information:
W: http://3dathens2016.gr

TOPCART 2016
Toledo-Madrid, Spain
from 26-30 October
For more information:
W: www.topcart2016.com/

COMMERCIAL UAV EXPO
Las Vegas, Nevada, USA
from 31 October – 2 November
For more information:
W: www.expouav.com

NOVEMBER

GLOBAL SPACE CONGRESS 2016
Abu Dhabi, United Arab Emirates
from 1-3 November
For more information:
W: http://globalspacecongress.com

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