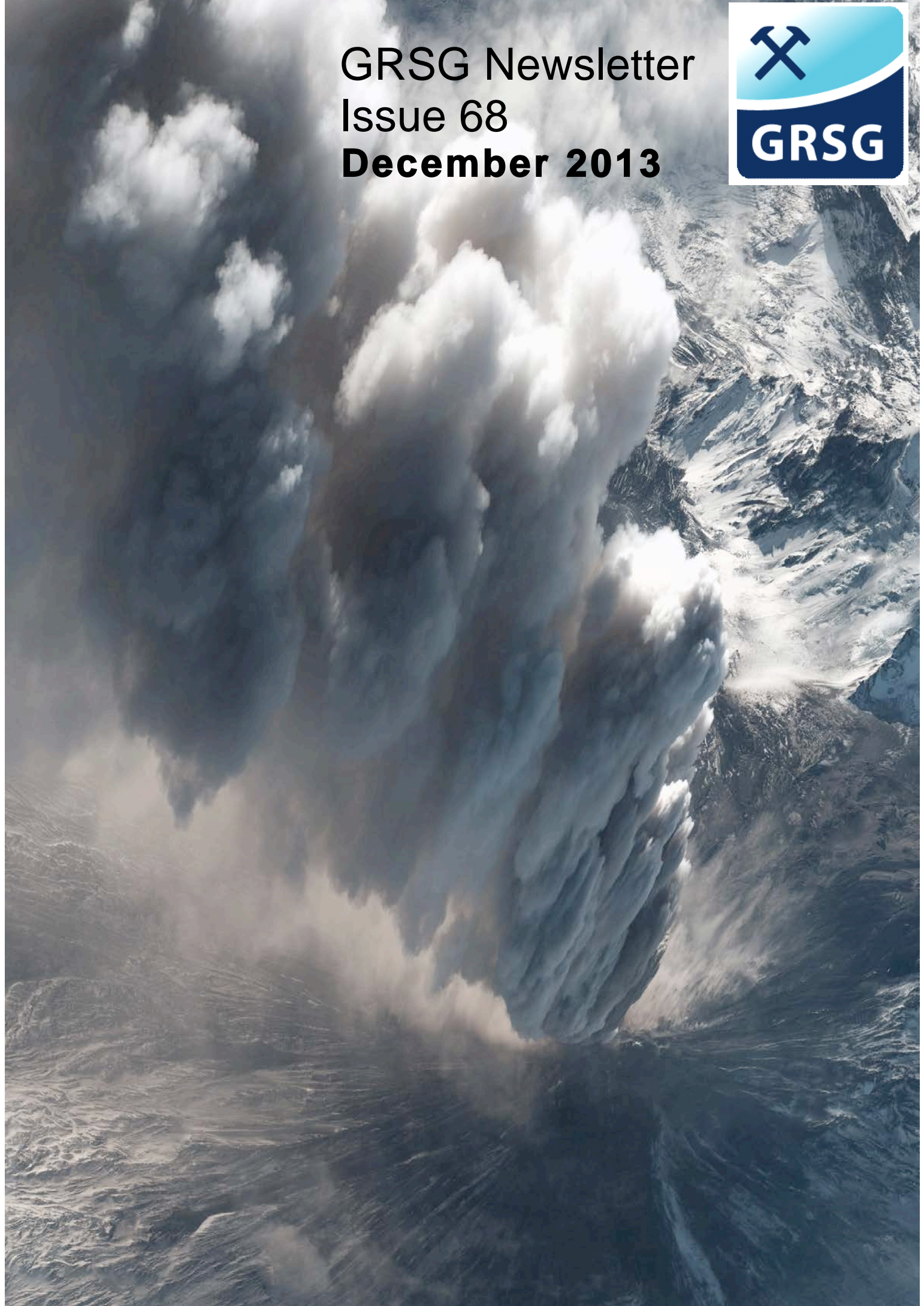


GRSG Newsletter  
Issue 68  
**December 2013**



# GRSG committee



If you would like to know more of our aims or would like to join the GRSG and receive the Newsletter regularly please contact one of our Committee Members

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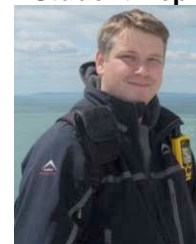
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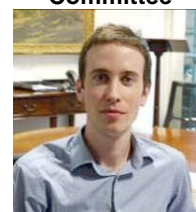
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## Committee





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The Geological Remote Sensing Group (GRSG) is a Special Interest Group affiliated jointly with The Geological Society of London and the Remote Sensing and Photogrammetry Society. It was founded in 1989 to raise awareness and encourage the use of remote sensing technologies in the geoscientific and related communities. The GRSG seeks to represent the views of industry, government and academic individuals and organisations - resulting in a balanced scientific, technological and commercial viewpoint.

## Front Cover

Ongoing eruption of Klyuchevskaya volcano, Kamchatka, Russia, imaged on 19<sup>th</sup> October 2013 ©DigitalGlobe Inc, All Rights Reserved.

# Chairman's message



Dear Members

December has arrived again, with the highlight of the GRSG calendar soon upon us and I look forward to seeing many of you at our annual meeting next week in Berlin. I am pleased to report that the meeting has had strong interest, with attendees registered from 24 countries and we can look forward to it being a full and productive meeting.

Finalising the programme for the 2013 AGM meeting was a particular challenge this year because of the large number of abstracts received that were of such high quality. Regrettably we have had to decline some good presentations. The abstracts were reviewed by the committee and the choices of acceptance were a joint decision. The programme provides a balanced programme with session themes matching the original call for papers - by presenting the '*Status and Developments in Geological Remote Sensing*'- and we look forward to lots of fruitful discussion. The programme includes three keynotes by: Trude King (USGS), Ernst Hauber (DLR) and Andreas Müller (DLR-DFD), and two invited presentations (Uwe Meyer, BGR; and Ian Evans, University of Durham). As in previous years we shall be making most of the presentations available on our website after the meeting. The meeting will also include posters.

For the 24<sup>th</sup> Annual Meeting we have excellent interest and support from our commercial sponsors, with currently 21 conference sponsors confirmed of which 16 will have booths at the Berlin meeting. This gathering of different companies provides a great opportunity for all in the remote sensing community to get up to speed with the latest offerings and developments and help with both generating business and collaboration. All done, of course, in the friendly circle of friends that GRSG members/community are part of. The various social and networking sessions that have been arranged include an ice-breaker on Sunday evening (8/12), a wine reception on Monday (9/12), and a conference dinner with the dinosaurs at the Museum für Naturkunde (10/12).

Thank you for your continued support and please do help in spreading the word about GRSG to colleagues or other contacts that you feel may benefit from becoming a member of GRSG.

Finally, I wish to tell you that this will be my last GRSG Chairman's message, as at the upcoming AGM in Berlin I will be standing down from my role as Chairman and from the GRSG committee. It has been a great privilege and pleasure to undertake this role and to have been involved with the committee for 9 years and to have made good connections and friends with various GRSG members. But it is time to pass on the baton. I wish the committee well with their future endeavours – rest assured plans are already in place for 2014 which should be a wonderful silver jubilee meeting celebrating the 25<sup>th</sup> anniversary of GRSG. I will of course be remaining a member and supporter of GRSG so will still see many of you at future meetings.

The GRSG does have a unique role for the remote sensing community – bringing together those passionate about remote sensing from different overlapping areas of interest and application within the various earth science disciplines - this mix is a wonderful cocktail. Keep drinking the cocktail!

Enjoy this newsletter and I look forward to seeing many of you in Berlin.

Jason Manning (GRSG Chairman)



Jason Manning  
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# Editor's message



Dear all,

It is with great pleasure that I send out the winter edition newsletter - my first since becoming the Editor. I joined the Committee last summer and somehow, before I knew it, I've been lucky enough to become the Newsletter Editor. It's been great piecing together this edition, meeting many of you virtually and getting to grips with the position. I'd like to take this opportunity thank Charlotte for all her excellent work in the past and helping with the handover. She's always been available for any questions I've had, making for a smooth transition. Charlotte has always been very enthusiastic about the position and I hope to enjoy it as much as she did.

As my PhD focuses on the remote sensing of volcanoes it seems appropriate that the front cover of my first edition is of the eruption at Klyuchevskaya volcano, Russia. At time of writing, the volcano is still restless with continuing gas and steam emission. I promise in the future to try not to be so biased with satellite images of volcanoes!

Over the last few months, the Committee has been gearing up for the AGM in Berlin. This edition has all you need to know about the upcoming meeting; we have an excellent programme lined up and for those who unfortunately cannot make the meeting, presentations will be made available on the website in the near future. All information about the AGM can, of course, be accessed on our website.

I am also pleased to include two articles in this issue from the 2013 student award winners, Yu Zhou and Amy Woodget. This issue is also packed out with the usual selection of remote sensing news and developments, future meetings and new publications.

Many thanks again to all those who contributed to this issue and welcomed me in my new role. As always if you have any items of interest to the GRSG in the form of articles, front cover images, news items, events or conference write ups etc then please do send them through to me. Likewise if you have any feedback on the newsletter, how we can improve it, or what you like/don't like then please contact me.

I look forward to meeting many of you in a few weeks in Berlin,

All the best

Elspeth Robertson  
GRSG Newsletter Editor - [newsletter@grsg.org.uk](mailto:newsletter@grsg.org.uk)

As some of you may know GRSG now has its own group pages on both LinkedIn (over 1,700 members!) and Facebook but now we are also on Twitter under @grsg\_geolsoc. Search for us under GRSG – Geological Remote Sensing Group (LinkedIn and Facebook) and join in the discussions and meet other like-minded people. For more information on these groups please contact Huma Irfan.

All past GRSG newsletters (numbers 1 to 67) are available on the website  
<https://www.grsg.org.uk/newsletters/>

# News and Developments



## €5,000 first prize for writing a remote sensing lesson

*Do you use Earth Observation data for teaching? Or do you use EO data as part of your work and have an idea for a training package?*

The European Space Agency is funding a competition with prizes of €5000, €3000 and €2000 as part of the LearnEO! Project. The prizes will be awarded for the best on-line lessons that provide examples of how satellite data from ESA missions can contribute to better understanding of the world we live in and the challenges we face. The competition is open to individuals or teams, and the lessons can be suitable for high school/6th form, undergraduate or postgraduate level. Hands-on activities must use Bilko software. More details and registration at <http://www.learn-eo.org/>.

The closing date for registration is 5 **January 2014** and for competition entries is 31 **January 2014**. Detailed rules for the competition may be found in Terms and Conditions of the Competition ([http://www.learn-eo.org/comp/LearnEO\\_Competition\\_Rules\\_201309.pdf](http://www.learn-eo.org/comp/LearnEO_Competition_Rules_201309.pdf))



## ESA's Swarm Trio successfully launched

The European Space Agency's Swarm mission to map the strength and direction of the Earth's global magnetic field in unprecedented detail launched successfully on 22<sup>nd</sup> November. They were deployed at an altitude of 490km, in a polar orbit.

For four years, Swarm will study the mysteries of Earth's magnetic field, its interactions with the solar wind and its links to global change.

As well as furthering science, the measurements delivered by the three Swarm satellites will be valuable for a range of applications. For example, the data will be put to practical use to help improve the accuracy of navigation systems including those systems carried on satellites, to advance earthquake prediction and to improve the efficiency of drilling for natural resources.

Source:

<http://www.bbc.co.uk/news/science-environment-25028502>

[http://www.esa.int/Our\\_Activities/Observing\\_the\\_Earth/The\\_Living\\_Planet\\_Programme/Earth\\_Explorers/Swarm/ESA\\_s\\_magnetic\\_field\\_mission\\_Swarm](http://www.esa.int/Our_Activities/Observing_the_Earth/The_Living_Planet_Programme/Earth_Explorers/Swarm/ESA_s_magnetic_field_mission_Swarm)

Image credit: ESA



## Happy Birthday, Space Station!

On the 20<sup>th</sup> November, the International Space Station celebrated its birthday, 15 years after the first module was launched in 1998.

The Space Station is the largest cooperative project ever carried out in science, involving NASA, ESA, Roscosmos, the Canadian Space Agency and the Japan Aerospace Exploration Agency.

On 20 November 1998 a Russian Proton rocket lifted off from the Baikonur space centre in Kazakhstan carrying Zarya, the Station's first component. Three weeks later, on 4 December, the Space Shuttle delivered Unity, the Station's second module, which was attached to Zarya on 6 December.



Image credit: ESA

Source:

[http://www.esa.int/Our\\_Activities/Human\\_Spaceflight/International\\_Space\\_Station/Happy\\_birthday\\_Space\\_Station](http://www.esa.int/Our_Activities/Human_Spaceflight/International_Space_Station/Happy_birthday_Space_Station)

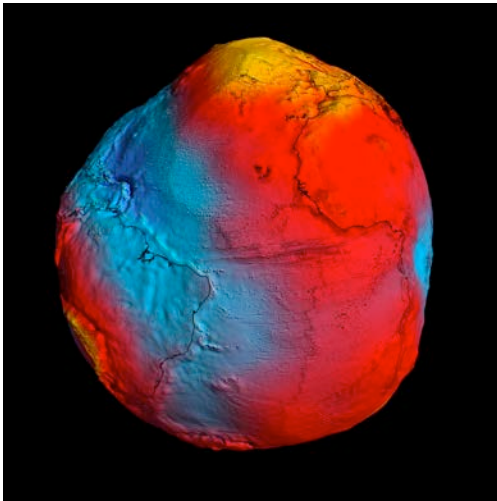
## Defying Gravity

To celebrate the ISS's birthday, grab your 3D glasses and take a virtual space walk of the International Space Station! Catch the video on [ESA's YouTube](#) channel or click here: "[3D virtual spacewalk outside the International Space Station](#)"



*Screenshot from ESA's 3D spacewalk*

## GOCE completes mission and gives into gravity



Launched in March 2009, the Gravity field and steady-state Ocean Circulation Explorer – GOCE – has mapped variations in Earth's gravity with unrivalled precision. The result is the most accurate shape of the 'geoid' – a hypothetical global ocean at rest – ever produced, which is being used to understand ocean circulation, sea level, ice dynamics and Earth's interior.

GOCE's innovative ion engine, responsible for keeping the satellite at an incredibly low orbit of under 260 km, together with its accelerometer measurements have also provided new insight into air density and wind speeds in the upper atmosphere.

On 21 October, the mission came to a natural end when it ran out of fuel. Over three weeks the satellite gradually descended.

Figure: *New GOCE Geoid*

Source: [http://www.esa.int/Our\\_Activities/Observing\\_the\\_Earth/GOCE/GOCE\\_gives\\_in\\_to\\_gravity](http://www.esa.int/Our_Activities/Observing_the_Earth/GOCE/GOCE_gives_in_to_gravity)

## But before GOCE's demise, it observed an earthquake gravity scar

ESA's GOCE satellite has revealed that the devastating Japanese earthquake of 2011 left its mark in Earth's gravity – yet another example of this extraordinary mission surpassing its original scope.

GOCE mapped Earth's gravity with unrivalled precision for over four years, but nobody really expected the data to show changes over time.

Careful analysis shows the effects of the 9.0 earthquake that struck east of Japan's Honshu Island on 11 March 2011 are clearly visible in GOCE's gravity data.

Large earthquakes clearly not only deform Earth's crust, but can also cause tiny changes in local gravity.

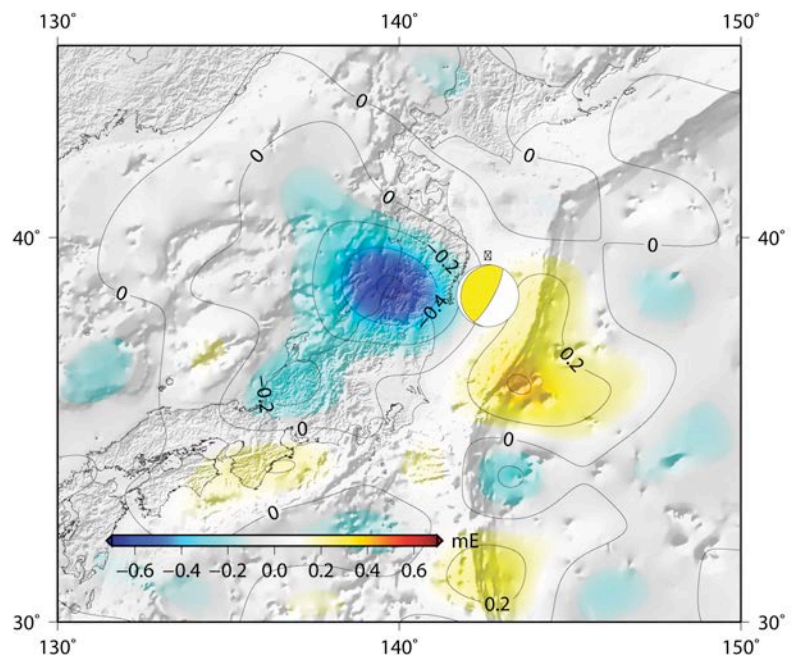


Figure: *Changes in Earth's gravity field resulting from the earthquake that hit Japan on 11 March 2011 ( $mE=10^{-12}s^{-2}$ ). A combination of data from ESA's GOCE mission and the NASA–German Grace satellite, shows the 'vertical gravity gradient change'. The 'beachball' marks the epicentre.*

Source:

[http://www.esa.int/Our\\_Activities/Observing\\_the\\_Earth/GOCE/Earth\\_s\\_gravity\\_scarred\\_by\\_earthquake](http://www.esa.int/Our_Activities/Observing_the_Earth/GOCE/Earth_s_gravity_scarred_by_earthquake)



## Africa's ups and downs

Another video ESA recently released an animation of a flythrough the East African Rift showing how satellite radars have observed inflating and subsiding volcanoes and faults throughout the East African Rift. For example, Envisat found that the dormant Mount Longonot in Kenya rose by 9 cm from 2004 to 2006 (screenshot above).

The animation includes radar data from the Japanese ALOS satellite showing the ground displacement following a series of earthquakes around Karonga, Malawi. The visualisations are based on results by Juliet Biggs from the University of Bristol in the UK.

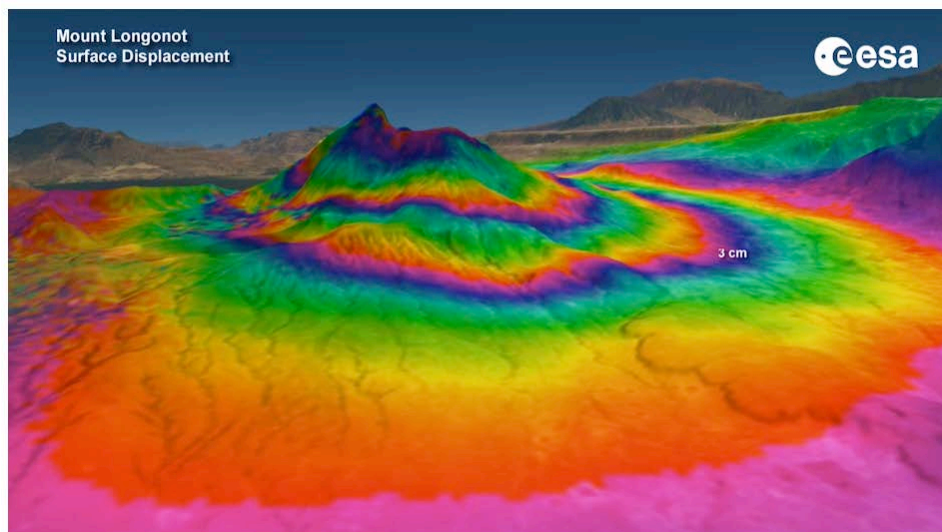


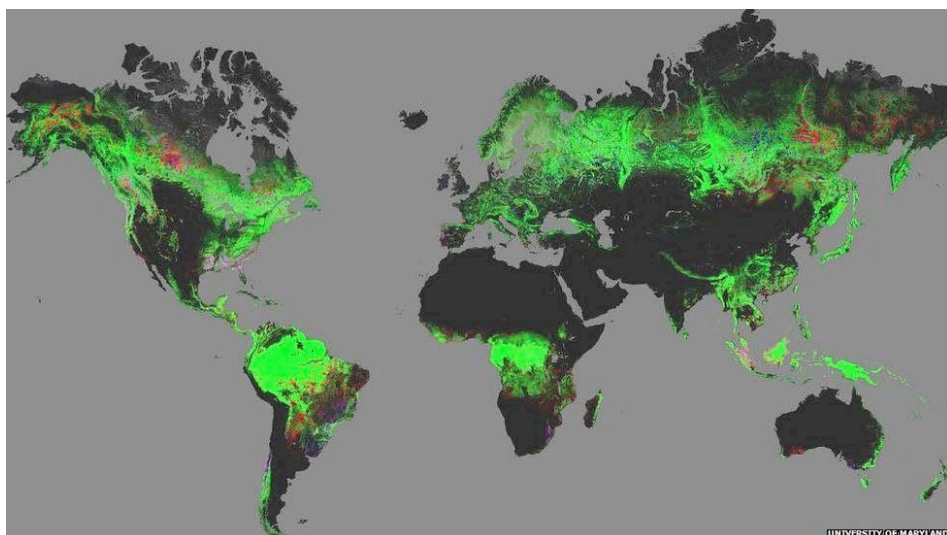
Figure: *Flying through the East African Rift – screenshot of the InSAR measurement at Longonot volcano*

Watch the video here:

[http://www.esa.int/Our\\_Activities/Observing\\_the\\_Earth/Highlights/Africa\\_s\\_ups\\_and\\_downs](http://www.esa.int/Our_Activities/Observing_the_Earth/Highlights/Africa_s_ups_and_downs)

Credits: Planetary Visions/NERC-COMET/JAXA/ESA

## Global Forest Change mapped by Google Earth



In a collaboration led by researchers at the University of Maryland, A new [high-resolution interactive global map](#) of forest loss and gain has been created with the help of Google Earth.

By applying algorithms to time-series data researchers could measure global land dynamics, such as forest extent and change. Mapping global forests over time not only enables many science applications, such as climate change and biodiversity modeling efforts, but also informs policy initiatives.

This product is the first of its kind, a global 30m resolution thematic map of the Earth's land surface that offers a consistent characterization of forest change at a resolution that is high enough to be locally relevant as well. It captures myriad forest dynamics, including fires, tornadoes, disease and logging.

The satellite data came from the Enhanced Thematic Mapper Plus (ETM+) sensor onboard the NASA/USGS Landsat 7 satellite and is at a resolution that is high enough to be locally relevant.

Figure: The map shows forest change from 2000-12. Green areas are forested; red suffered forest loss; blue showed forest gain; pink experienced both loss and gain. Credit: University of Maryland

Source: <http://www.bbc.co.uk/news/science-environment-24934790>  
<http://googleresearch.blogspot.co.uk/2013/11/the-first-detailed-maps-of-global.html>

and

## WorldDEM™ sample imagery available

The WorldDEM™ is a global elevation dataset of unprecedented quality, accuracy, and coverage and will be available from 2014 for the Earth's entire land surface - pole to pole.

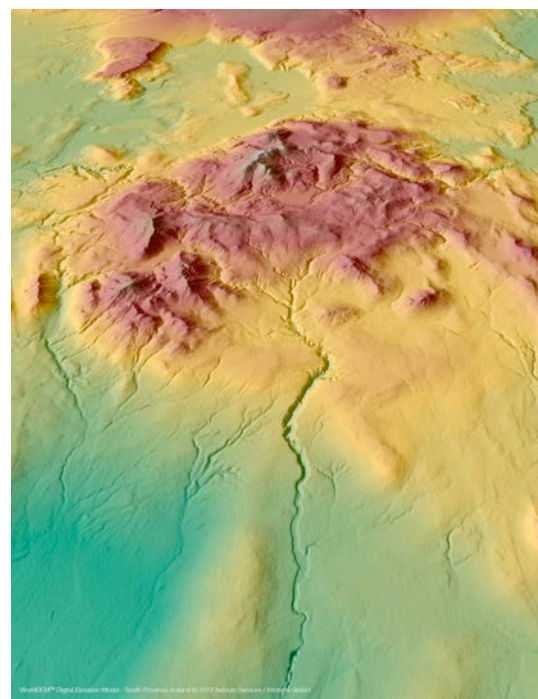
Sample imagery is now available from [ASTRIUM's website](#)

The WorldDEM™ is intended to be the replacement data set for SRTM and will have the following unique features:

- Vertical accuracy: 2m (relative) / 10m (absolute)
- 12m x 12m raster
- Global homogeneity

Figure: WorldDEM™ Digital Elevation Model of an area in South Province, Iceland. Copyright: 2012 Astrium Services / Infoterra GmbH, available for download on website.

Source: <http://www.astrium-geo.com/worlddem/>



## Pakistan's quake island measured by satellites



A new island, named Zalzala Koh, emerged offshore near the town of Gwadar following the magnitude 7.7 earthquake on 23 September.

Pléiades satellite imagery has revealed the dimensions of the near-circular island, measured by Astrium Services. The island itself is round and relatively flat, with cracks and fissures and measures approximately 1.7 x 1.6 km.

Geologists think the new island, named Zalzala Koh, is made of erupted mud, spewed from the seafloor when either trapped gases escaped or subsurface water was violently expelled.

Figure: Zalzala Koh Island, Pakistan Pléiades Satellite

Source: <http://www.astrium-geo.com/en/5393-pleiades-reveals-the-dimensions-of-the-island-emerged-off-the-pakistan-coast>

For more news and information about GRSG check out the news feed on our new website!

<http://www.grsg.org.uk/>



# 2014 AGM Conference Theme



## 'Status and Developments in Geological Remote Sensing'

9<sup>th</sup> - 11<sup>th</sup> December 2013, Berlin, Germany

The 24<sup>th</sup> annual meeting of GRSG will cover a wide range of remote sensing themes, including:

- New sensors, technological developments, analytical methods & algorithms
- Data fusion; Bridging the divide between data and applications
- Latest developments, research and applied uses of RS for:
  - Mineral exploration
  - Oil & Gas
  - Geological applications (lithostructural mapping, tectonics and seismology)
  - Geomorphology
  - Geohazards, engineering/geotechnical and environmental/contamination
  - Terrain, bathymetry and DEM analytical techniques
  - Classification, multi-temporal analysis and modelling
- Planetary science & comparative geomorphology
- Hyperspectral & Multispectral; Radar / InSAR; optical & high resolution

**Conference Venue:** Sachsen-Anhalt Landesvertretung, Luisenstrasse 18, Berlin-Mitte, 10117 Berlin

The meeting will be accompanied by a small exhibition from leading organisations and companies in the field of geological remote sensing.

#### Social events:

- |                         |                   |                                 |
|-------------------------|-------------------|---------------------------------|
| • Sunday 8 Dec. 19:30   | Ice-breaker       | Daimlers, Unter den Linden 14   |
| • Monday 9 Dec. 17:30   | Wine Reception    | Landesvertretung Sachsen-Anhalt |
| • Tuesday 10 Dec. 19:00 | Conference Dinner | Museum für Naturkunde           |

For further information, on-line registration, sponsorship opportunities and logistics see [www.grsg.org.uk](http://www.grsg.org.uk)



The GRSG (est. 1989) is a Joint Specialist Group of the Remote Sensing and Photogrammetry Society and the Geological Society of London

# AGM: Programme Overview



Ice-breaker (Sunday 8 Dec, from 7.30pm)  
Daimlers, Unter den Linden

## **Monday 9 December 2013**

08:30 Registration & Coffee  
09:30 Welcome by GRSG & DGPF  
09:40 Keynote 1 – Trude King (USGS)  
AM1 Mineral Exploration 1  
AM2 Geological Mapping 1  
PM1 Oil & Gas  
PM2 Geohazards and Environment 1  
17:10 GRSG AGM  
17:30 Conference Wine Reception – Landesvertretung Sachsen-Anhalt

## **Tuesday 10 December 2013**

08:30 Registration  
09:00 Welcome by DLR  
09:10 Keynote 2 – Ernst Hauber (DLR)  
AM1 Hyperspectral  
AM2 New Developments, Techniques and Sensors 1  
PM1 DEM and Geomorphology  
PM2 Geological Mapping 2  
  
19:00 Conference Dinner (by reservation) – Museum für Naturkunde

## **Wednesday 11 December 2013**

08.30 Registration  
09:00 Welcome by BGR  
09:05 Keynote 3 – Andreas Muller (DLR)  
AM1 Mineral Exploration 2  
AM2 New Developments, Techniques and Sensors 2  
PM1 InSAR  
PM2 Geohazards and Environment 2  
16:45 Conference Close

# AGM: Detailed Programme



## Day 1 - Monday, 9 December 2013

<b>08:30-09:30</b>	<b>Registration &amp; Coffee</b>	
<b>09:30</b>	<b>Welcome</b>	Welcome + Introduction to the GRSG, GRSG Chairman: Jason Manning (Arup)
		Welcome by DGPF, Cornelia Glaesser (MLU)
<b>09:40</b>	<b>Keynote: Spectroscopic Remote Sensing: A Tool for Resource Evaluations in Afghanistan</b>	<b>Trude King, USGS, Colorado, US</b>
<b>AM1</b>	<b>Mineral Exploration 1</b>	Session Chair: Trude King (USGS)
10:10	Application of airborne Hyperspectral technology for mineral target detection in Southern Africa	Alex Fortescue, Southern Mapping, South Africa
10:30	Crystallinity variations of hydrothermal smectite-illite and kaolinite minerals by using reflectance spectra in the Rodalquilar Au deposit, Spain	Adriana Guatame, TU Delft, Netherlands & University of Twente, NL
10:50	Mineral Deposit Characterization from Airborne and Spaceborne Imaging Spectroscopy Data, Geological Application Examples to the EnMAP Mission	Christian Mielke, GFZ Potsdam, Germany
<b>11:10-11:40</b>	<b>Coffee Break 1</b>	
<b>AM2</b>	<b>Geological Mapping 1</b>	Session Chair: Friedrich Kuehn
11:40	Lithological mapping using spectral remote sensing: a global feasibility study	Stephen Grebby, British Geological Survey (BGS), UK
12:00	Utilisation of the Cosmo-SkyMed Constellation for geologic monitoring applications	Robert Siegmund, GAF AG, Germany
12:20	Close range hyperspectral and lidar integration products for value-added communication of geological results	Simon Buckley, Uni CIPR, Norway
<b>12:40-13:40</b>	<b>Lunch</b>	
<b>PM1</b>	<b>Oil &amp; Gas</b>	Session Chair: Mike Hall (Astrium)
13:40	Close range hyperspectral imaging applied to coal mining: a feasibility study.	Tobias Kurz, Uni CIPR, Norway
14:00	Spectral imaging for the estimation of mineral/petrophysical properties of shale gas drill core	Benoit Rivard, University of Alberta, Canada
14:20	WorldDEM – Supporting the Upstream Oil and Gas Project Lifecycle	Michael Hall, Astrium, UK
14:40	Mapping of Geologic Substrates Impregnated With Liquid Hydrocarbons Using Proximal and Airborne Hyperspectral Remote Sensing	Carlos Souza Filho, Uni Campinas, Brazil
<b>15:00-15:30</b>	<b>Coffee Break 2</b>	
<b>PM2</b>	<b>Geohazards and Environment 1</b>	Session Chair: Jason Manning (Arup)
15:30	Defeating Oil Piracy Using Remotely Sensed Imagery and GIS: The Emergent Synthesis Approach	Sean Anklam, SpecTIR, Reno NV
15:50	Hyperspectral surveying for the identification and mapping of asbestos mine waste in South Africa	Henk Coetzee, Council for Geoscience of South Africa, SA
16:10	Ground Motion in UK Coal Fields; a Case Study of the South Wales Coalfield	Luke Bateson, BGS, UK
16:30	Hyperspectral analysis of materials from iron and steel production using reflectance spectroscopy in a case study in Thuringia, Germany	Michael Denk, Uni Halle, Germany
16:50	Monitoring of Earth Surface Terrain Motion with Satellite Radar interferometry	Thomas Bahr, Exelis Vis, Germany
17:10	<b>GRSG AGM</b>	The Geological Remote Sensing Group Annual General Meeting (AGM)
17:30	<b>Wine Reception – sponsored by Geosense</b>	Venue - Landesvertretung Sachsen-Anhalt

## Day 2 - Tuesday, 10 December 2013

<b>08:30</b>	<b>Registration &amp; Coffee</b>	
<b>09:00</b>	<b>Welcome</b>	Welcome + Introduction to GRSG, GRSG Chairman Jason Manning (Arup)
		Welcome by DLR (DLR)
<b>09:10</b>	<b>Keynote, Morphometrics on Mars and Earth – comparative geomorphology</b>	<b>Ernst Hauber, Institute of Planetary Research, German Aerospace Center (DLR)</b>
<b>AM1</b>	<b>Hyperspectral</b>	Session Chair: Cornelia Glaesser (MLU)
09:40	Near-Infrared CRISM Investigations of Hydrothermally Altered Amazonian Impact Craters on Mars	Stuart Turner, University of Leicester, UK
10:00	Hyperspectral & Thermal airborne mapping system developments at ITRES	Jason Howse, ITRES, Canada
10:20	The new multi-sensor SisuROCK	Rainer Bärs, SPECIM, Finland
<b>10:40-11:10</b>	<b>Coffee Break 1</b>	
<b>AM2</b>	<b>New Developments, Techniques and Sensors 1</b>	Session Chair: Dietmar Backes (UCL)
11:10	Beneath the Earth's cover – Connecting geophysics and remote sensing	Uwe Meyer, <b>&lt;Invited Speaker&gt;</b> BGR, Germany
11:30	The Hexagon Cloud - A Dynamic Network of Content, Software and Solutions	Oliver Zimmermann, Intergraph & Ruediger Wagner, Leica Geosystems
11:50	RIEGL Lidar Technology for Static and Kinematic Scanning Outstanding Performance by Cutting Edge Technology	Thomas Gaisecker, Riegl, Austria
12:10	Unmanned airborne surveying: innovation and exciting developments	Marc Goossens, Geosense, Netherlands
<b>12:30-13:30</b>	<b>Lunch</b>	
<b>PM1</b>	<b>DEM and Geomorphology</b>	Session Chair: Marc Goossens (Geosense)
13:30	Geomorphometrics - extracting landforms from DEM'S	Ian Evans, <b>&lt;Invited Speaker&gt;</b> University of Durham, UK
13:50	Using GIS for analysis of surface roughness in Sveta Magdalena paleo-landslide in the Rebrnice area, SW Slovenia	Tomislav Popit, University of Ljubljana, Slovenia
14:10	Handling of very large DEMs (ca. 1 TB) for efficient geomorphic and geologic interpretation: visualization of young glacial/periglacial phenomena in the Bodensee-Oberschwaben area (southern Germany)	Elena Beckenbach, University of Stuttgart, Germany
14:30	MACS – Modular Airborne Camera Systems for flexible photogrammetric high-resolution products	Tilman Bucher, DLR, Germany
14:50	Terrain objects for digital landslide mapping	Clemens Eisank, University of Salzburg, Austria
<b>15:10-15:40</b>	<b>Coffee Break 2</b>	
<b>PM2</b>	<b>Geological Mapping 2</b>	Session Chair: Eric Peters (Consultant)
15:40	Geological interpretations of landslide structures in Southern Kyrgyzstan using TerraSAR-X radar and high resolution optical remote sensing data	Hans Ulrich Wetzel, GFZ Potsdam, Germany
16:00	RapidEye Base Map and Monitoring solutions for The Energy and Mining Sectors	Andrew Pylypchuk, (presented by Scott Douglass) RapidEye AG, Germany
16:20	Preliminary results from atmospheric correction and geological mapping using airborne hyperspectral data in Antarctica	Martin Black, British Antarctic Survey (BAS), UK
16:40-17:00	Lineament analysis in northern Colombia, South America	Mauricio Baquero, Corporación Geológica ARES, (CGARES), Colombia
19:00-22:00	<b>Reception &amp; Conference Dinner (by reservation, payment required)</b>	Museum für Naturkunde Natural History Museum

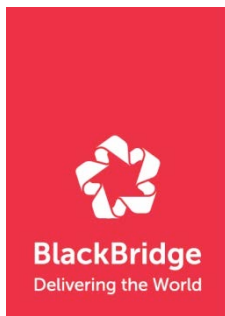
## Day 3 - Wednesday, 11 December 2013

<b>08:30-09:00</b>	<b>Registration &amp; Coffee</b>	
<b>09:00</b>	<b>Welcome</b>	
09:05	<b>Keynote, EnMap - the new hyperspectral satellite system, new strategies in hyperspectral mineral analysis</b>	<b>Andreas Müller</b> <b>German Aerospace Center (DLR-DFD)</b>
<b>AM1</b>	<b>Mineral Exploration 2</b>	Session Chair: Christian Fischer (DLR)
09:35	Mapping Ni-Cu (PGE) bearing ultramafic rocks with airborne and simulated EnMAP satellite hyperspectral imagery, Nunavik, Canada	Derek Rogge, DLR, Germany
09:55	A new approach in the detection of hydrothermal mineral alterations using remote sensing data: a case study from Lake Victoria Goldfields, Tanzania	Elisante Mshiu, Uni Halle, Germany
10:15	Imaging Spectroscopy and Geochemical Analysis of two Rare Earth Elements Mineralized Intrusive Complexes (Epembe Carbonatite Complex in Northern Namibia and Tantalite Valley Pegmatites in Southern Namibia)	Nina Boesche, Potsdam, Germany
10:35	A comparison of mineral classification results from handheld and image spectroscopy against geochemistry from drill core and chip trays	Conrad Wright, Terra Core International (TCI), US
<b>10:55-11:20</b>	<b>Coffee Break 1</b>	
<b>AM2</b>	<b>New Developments, Techniques and Sensors 2</b>	Session Chair: Charlotte Bishop (CGG)
11:20	Status of TanDEM-X DEM Performance	Birgit Wessel, DLR, Germany
11:40	TerraSAR-X-based settlement detection for permanently cloud-covered areas using ENVI-SARscape	Michael Fuchs, BGR, Germany
12:00	Benefit of scale-wavelength decomposition of hyperspectral reflective signals for classification and quantification in a study of a lignite mining site	Christoph Ehrler, DLR, Germany
12:20	WorldView-3 Increases DigitalGlobe's Capabilities	Dave Benson, DigitalGlobe, UK
<b>12:40-13:40</b>	<b>Lunch</b>	
<b>PM1</b>	<b>InSAR</b>	Session Chair: Luke Bateson (BGS)
13:40	Validation of TERRAFIRMA WAP terrain motion products of Greece	Athannassis Ganas, National Observatory of Athens (NOA), Greece
14:00	Realising the potential of satellite InSAR	Harry McCormack, NPA Satellite Mapping, CGG, UK
14:20	PSInSAR data and geological hazards in urban areas: the PanGeo service for Roma and Palermo	Valerio Comerchi, Geological Survey of Italy (ISPRA), Italy
14:40	Contributions of BGR to the Copernicus projects Terrafirma and PanGeo	Corinna Wolf, BGR, Germany
<b>15:00-15:30</b>	<b>Coffee Break 2</b>	
<b>PM2</b>	<b>Geohazards and Environment 2</b>	Session Chair: Huma Irfan (Geonergy)
15:30	Monitoring of Slope Stability of Tailings Dams in South Africa Using Satellite Interferometry	Michael Riedmann, Astrium
15:50	EO-based tools and methods to assess environmental and societal impacts of mining	Stephane Chevrel, BRGM, France
16:10	Earth-observed based erosion study for dam sites, Morocco	Bernd Schulte, GAF AG, Germany
16:30	<b>Conference Wrap up</b>	
16:45	<b>End of Conference</b>	
	<b>After-glow</b>	

# AGM: Conference Sponsors







#### **Additional Thanks –**

**GRSG committee work and meetings are organised fully by a voluntary committee. Considerable thanks are due to all committee members giving their time and effort. We thank also the various companies and organisations that committee members work for who support committee members (and organising committee) in undertaking their committee work. Without this support the GRSG meetings would not be possible. These organisations include:**

- **Arup**
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- **BGS (British Geological Survey)**
- **CGG NPA Satellite Mapping Ltd**
- **DLR (German Aerospace Center / Deutsches Zentrum für Luft- und Raumfahrt e.V.)**
- **Geonergy Ltd**
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- **University of Bristol**
- **University of Portsmouth**

# AGM: Conference Exhibitors



Exhibitors Booths – Room 4	
	CGG NPA Satellite Mapping
	Digital Globe
	Intergraph
	Itres
	RIEGL
	Southern Mapping
	Spectral Evolution
	Sphere Optics
	TerraCore International
Exhibitors Booths – Room 5	
	Astrium
	Earth Server
	Exelis
	Geosense
	Specim
	SpecTIR
	TRIGIS

# AGM: 2013 GRSG Committee & Organising Committee



## GRSG Committee

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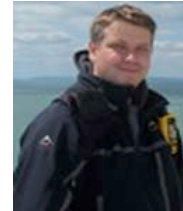
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## Attention all students!!



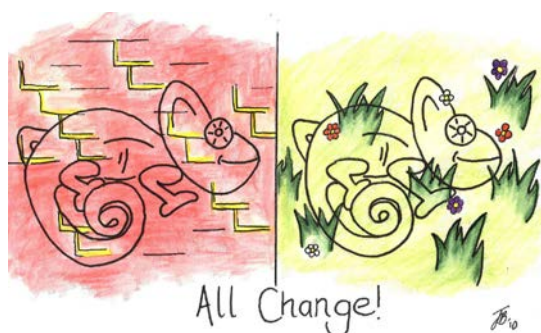
Students are also reminded that membership fees are being held at only £7 to encourage more student members to join GRSG. If you would like to join you can do so online at <https://www.grsg.org.uk> or if you would like to know more information please contact the GRSG Student Representative Mathias Leidig ([Mathias.Leidig@port.ac.uk](mailto:Mathias.Leidig@port.ac.uk)) or the GRSG Membership Secretary, Huma Irfan ([membership@grsg.org.uk](mailto:membership@grsg.org.uk)).

## Fieldwork Bursary



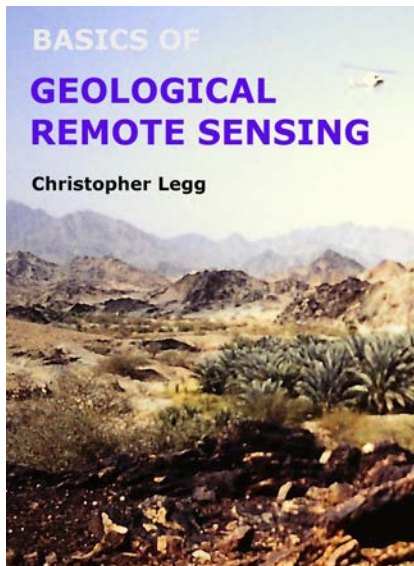
Nigel Press was very honoured by the GRSG's gesture in making him Life-time Member of the GRSG following the support of Nigel Press Associates Ltd (now Fugro NPA) in GRSG activities for a number of years. Recognising that there is still much needed scientific progress to be made in our discipline, he wanted to offer some continuing contribution for the future in return. Nigel is therefore pleased to announce that a fieldwork bursary fund run by his family is being opened to Members of GRSG. The Fund provides a few bursaries each year, mainly to MSc students, to undertake fieldwork which has a humanitarian, sociological or environmental benefit, and ideally is carried out in conjunction with an NGO. Selection of projects is made purely on merit; last year The Fund partly supported a GRSG member, Naomi Morris, on a very ambitious trip to work on geo-hazards in Papua New Guinea, other recipients included undergraduates from Oxford who worked on the Colima volcano in Mexico and L'Aquila earthquake site in Italy.

More details on this opportunity and how to apply can be found at [www.lydiapress.org](http://www.lydiapress.org)



# NEW Book: Basics of Geological Remote Sensing

Christopher Legg



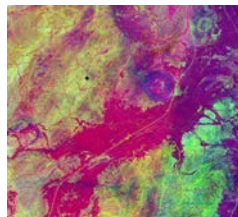
## A NEW LOW-COST E-BOOK ON GEOLOGICAL REMOTE SENSING

Aimed at all geologists who are not already remote sensing specialists, but particularly at students and geologists in the developing world.

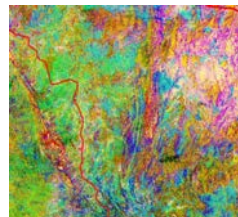
The emphasis is on free and low-cost data, and on free or open-source software

Based on the author's long experience of geological remote sensing in Africa, the Middle East, Europe and Australia, the book includes -

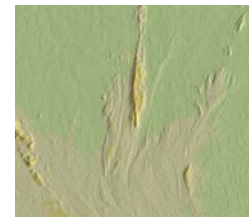
- principles of remote sensing
- main archive and operational sensor systems
- basics of image processing applied to geology
- integration of remote sensing into geological mapping and mineral exploration
- uses of remote sensing in environmental monitoring and reporting
- remote sensing for production and exploration intelligence
- sources of imagery and other data
- numerous links to other publications and free sources of information



Landsat 8 thermal composite



ASTER SWIR decorrelation stretch



Hillshaded ASTER DEM

The book uses examples from Africa, the Middle East and Australia, and is linked to online courses in geological remote sensing with sample data-sets

The e-book will be published in all major formats, suitable for e-readers, tablets and laptops, in early December 2013. The initial pricing is planned to be US\$5 or UK£3

# NEW Special Publication: Remote Sensing of Volcanoes and Volcanic Processes



This Geological Society of London Special Publication volume focuses on how advances in both remote sensing and modelling can be brought together to improve our understanding of the behaviour of active volcanoes. It includes review papers, papers reporting technical advances and case studies showing how the integration of remote-sensing observations with models can be put to good use.

**Remote Sensing of Volcanoes and Volcanic Processes**  
Integrating Observation and Modelling

Edited by  
D. M. Pyle, T. A. Mather and J. Biggs

Volcanoes have played a profound role in shaping our planet, and volcanic activity is a major hazard locally, regionally and globally. Many volcanoes are, however, poorly accessible and sparsely monitored. Consequently, remote sensing is playing an increasingly important role in tracking volcano behaviour, while synoptic remote sensing techniques have begun to make major contributions to volcanological science. Volcanology is driven in part by the operational concerns of volcano monitoring and hazard management, but the goal of volcanological science is to understand the processes that underlie volcanic activity. This volume shows how we may reach a deeper understanding by integrating remote sensing measurements with modelling approaches and, if available, ground-based observations. It includes reviews and papers that report technical advances and document key case studies. They span a range of remote sensing applications to volcanoes, from volcano deformation, thermal anomalies and gas fluxes, to the tracking of eruptive ash and gas plumes. The result is a state-of-the-art overview of the ever-growing importance of remote sensing to volcanology.

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**Remote Sensing of Volcanoes and Volcanic Processes**  
Integrating Observation and Modelling

Edited by  
D. M. Pyle, T. A. Mather and J. Biggs

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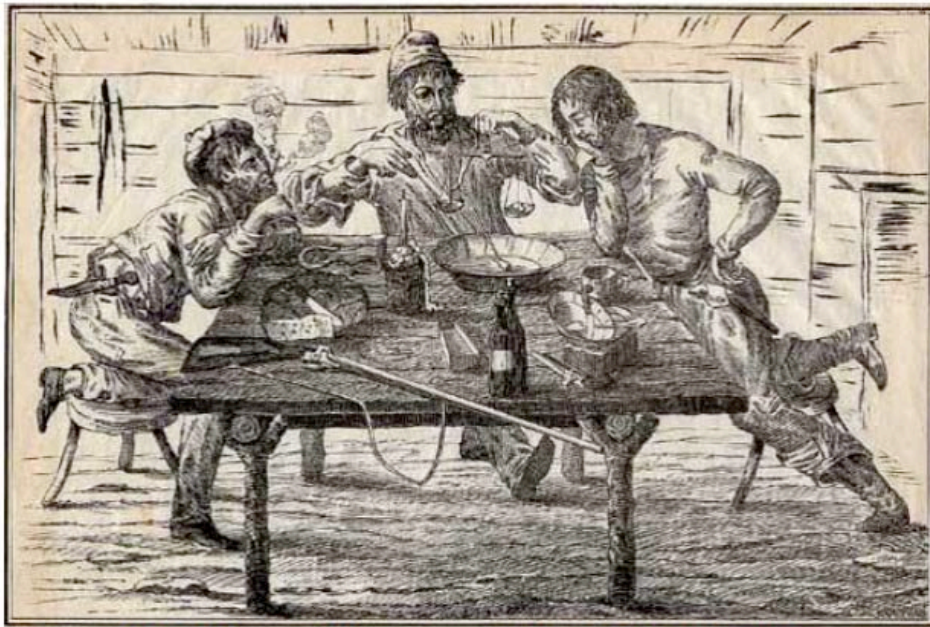
**Cover illustration:**  
A false-colour SPOT5 image of Longonot volcano, Kenya. Longonot volcano is a trachytic stratovolcano rising 2776 m above sea level, situated south of Lake Nakusha. Data provided via the European Space Agency by CNES as a Third Party Mission.  
Image edited by Espeth Robertson.

# Demise of the Captain's Cabin



With sadness we have to report that the Captain's Cabin pub – the long-standing watering-hole for GRSG committee and members, close to Burlington House, is no more!

Apparently the whole block is to be redeveloped – losing the pub. This certainly marks the end of era, but does provide for new opportunities.



**GRSG Committee plans at the Captain's Cabin**

Figure 1: Cartoon from August 2002 GRSG Newsletter

There may be a need for the committee to go on a reconnaissance field trip (a.k.a. pub crawl) to find a suitable alternative. The Glassblower, Chequer's Tavern, Red Lion could be good starting points.



Figure 2: GRSG conference 'after-glow' at the Captain's Cabin (Some of the current GRSG Committee: Eric, Huma, Jason, Charlotte and Dietmar)

# Active tectonics in the Weihe graben in northern China: the 1556 M8 Huaxian earthquake



Yu Zhou, University of Oxford

During the past 50 years, China has seen rapid growth both in its economy and population. Take Xi'an, for example. From 1978 to 2007, the area of the city tripled and the population increased by 67% (Fig. 1), increasing seismic risks in the highly populated region. One aspect of my work has been to investigate active faulting and tectonics in the Weihe graben (Fig. 2), in which Xi'an is situated, and which forms the southern boundary of the Ordos Plateau.

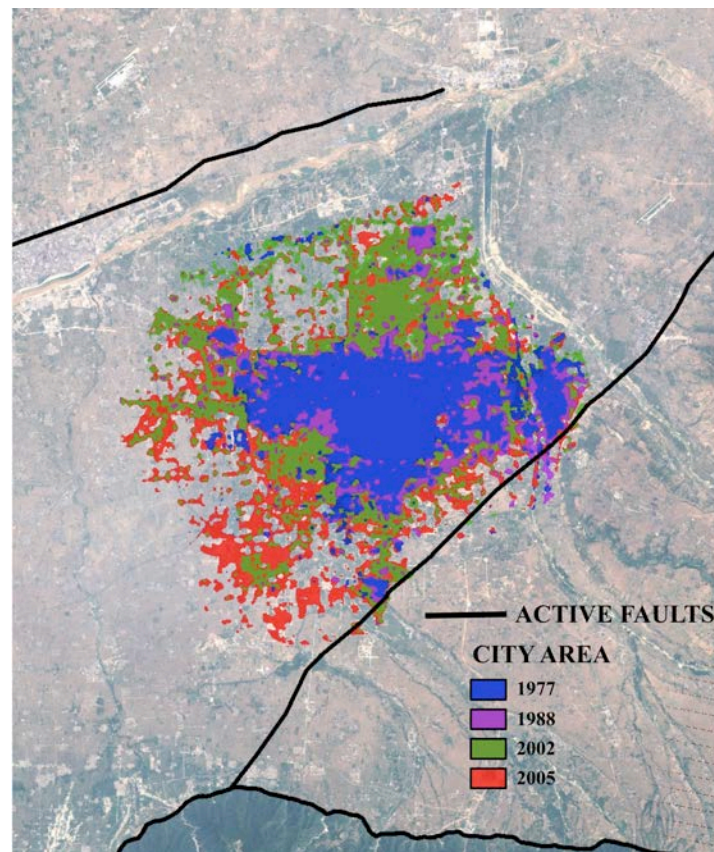


Figure 1: Area changes of Xi'an. City areas are extracted from Landsat images using supervised classification algorithm. From 1978 to 2007, the area of Xi'an tripled and the population increased by 67%, concomitantly increasing the seismic risks.

The Ordos Plateau has been a stable block since Mesozoic time. In contrast, its margins have been tectonically active from the Eocene when fault-bounded subsiding grabens started to form and grow. This activity may be associated with the Himalayan orogeny and the uplift of Tibet. The grabens are seismically active. Since 780 B.C., 51 earthquakes with  $M > 6$  have been recorded, including the M8 1556 Huaxian earthquake that resulted in the greatest known death toll from an earthquake of over 800,000. Despite the



proven record of earthquakes in the region, the distribution and rates of active faulting are relatively poorly described. Geomorphological observations from remote sensing data (Landsat and SPOT-5 DEM, Fig. 3) provide clear evidence that many of the basin-bounding normal faults around the Weihe graben are currently active.

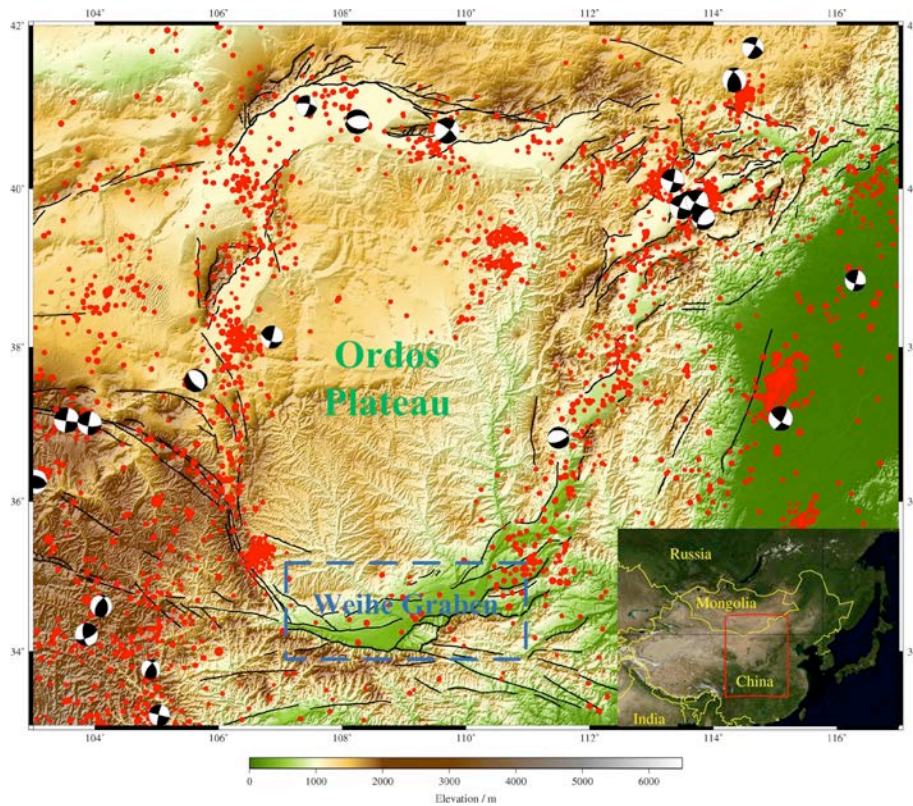


Figure 2: Seismicity map of the Ordos Plateau showing epicentres (in red) from the ISC website (<http://www.isc.ac.uk>) and focal mechanisms of larger events from the global CMT catalogue. The Ordos Plateau is a stable block. In contrast, the margins of the Ordos are tectonically active.

The study of earthquake geology involves more than sitting in a comfortable office, processing satellite images on powerful computers and then weaving a story from the data. Field observations are essential to validate the observations from remote sensing. So in April, I set out to do my first fieldwork in the Weihe graben, with my supervisor Dr. Richard Walker. We spent 5 days visiting a number of sites along the Huashan Range-Front fault where the 1556 earthquake ruptured. During the investigation, we saw the continuous and consistent ~8m scarp over the entire fault-length (Fig. 4). We also found evidence for higher scarps (for example, Site 1 on Fig. 3), which may represent some pre-historic events. To test whether the 8m scarp was formed in the 1556 earthquake, we collected samples for dating from soil layers exposed in the scarp. Charcoals in a paleosoil above river gravels give an age of ~2000 years, which suggests the 8m scarp was not formed in the 1556 earthquake, and is instead likely to be a composite of at least two events. We also collected samples from some of the higher scarps and hope to be able to work out the earthquake recurrence intervals.

We also visited the North Qinling fault (see Site 2 on Fig. 3) which separates the Weihe graben and Qinling mountain. The fault runs 200 km from Baoji to Lantian. We found a ~7.5 m fault scarp and collected OSL samples for dating (Fig. 5).

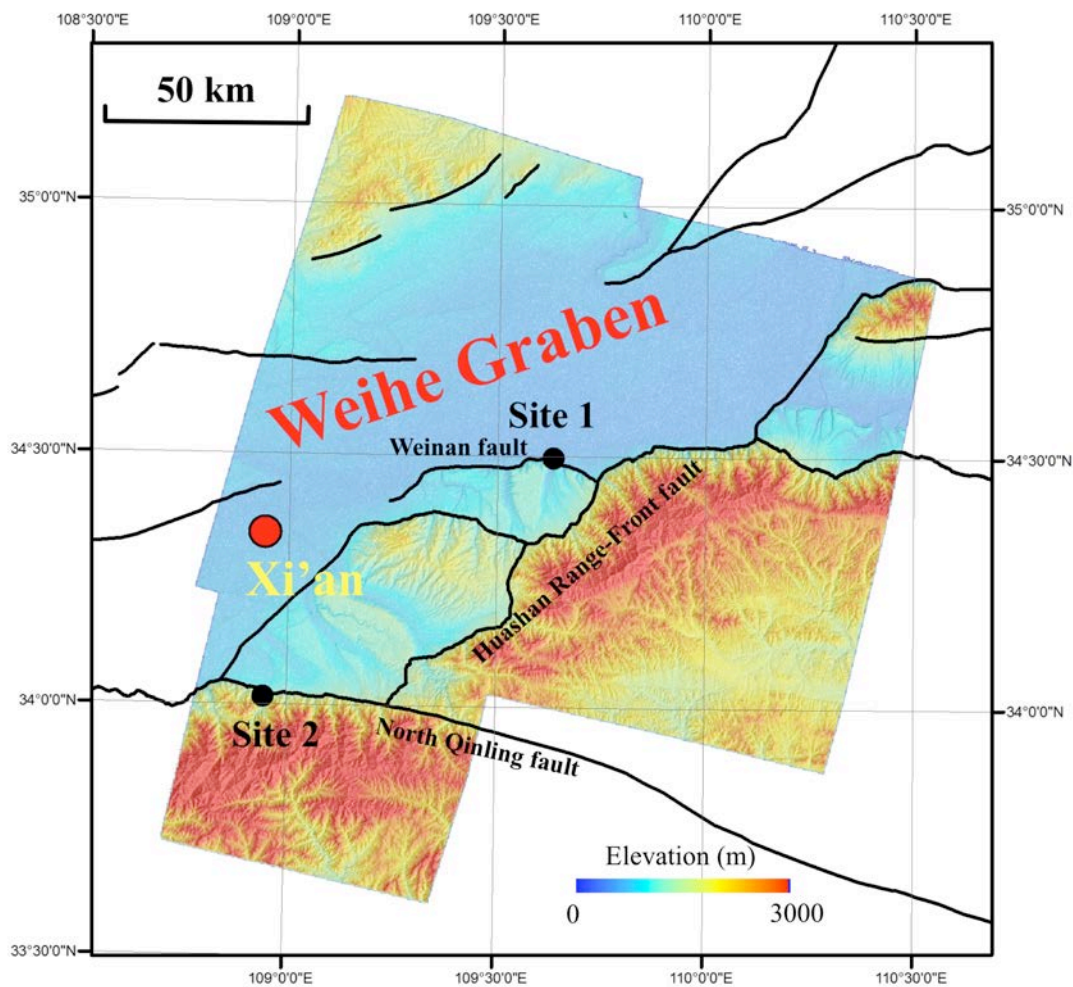


Figure 3: Field sites in the eastern part of the Weihe graben. Basemap is a 10 m resolution DEM which is constructed using 10 SPOT-5 images (2.5 m resolution), and filtered point clouds from SRTM (90 m resolution) and ASTER GDEM (30 m resolution). Black lines indicate active faults bounding the graben. Offset river terraces provide clear evidence that many faults are currently active.

April is a good time for holidays in central China. However, for doing fieldwork, it is problematic as there has been considerable growth of vegetation by then. Even worse, the dramatic modification of the landscape by human activities (e.g., construction and farming) in the past 400 years imposes great challenges on our fieldwork which relies on identifying sometimes subtle signs of active faulting in the landscape. However, from the preliminary carbon dating results, we believe that there are more interesting stories to be told. Therefore, I am planning to go back to do more fieldwork next year in collaboration with Richard and scientists from the China Earthquake Administration. The GRSG student award will be used as partial funding towards the fieldwork in March 2014. We plan to use terrestrial LiDAR and stereo Pleiades imagery to produce precise digital elevation models in our future work to figure out the earthquake history and Holocene slip rates and be better prepared for understanding the present hazard.

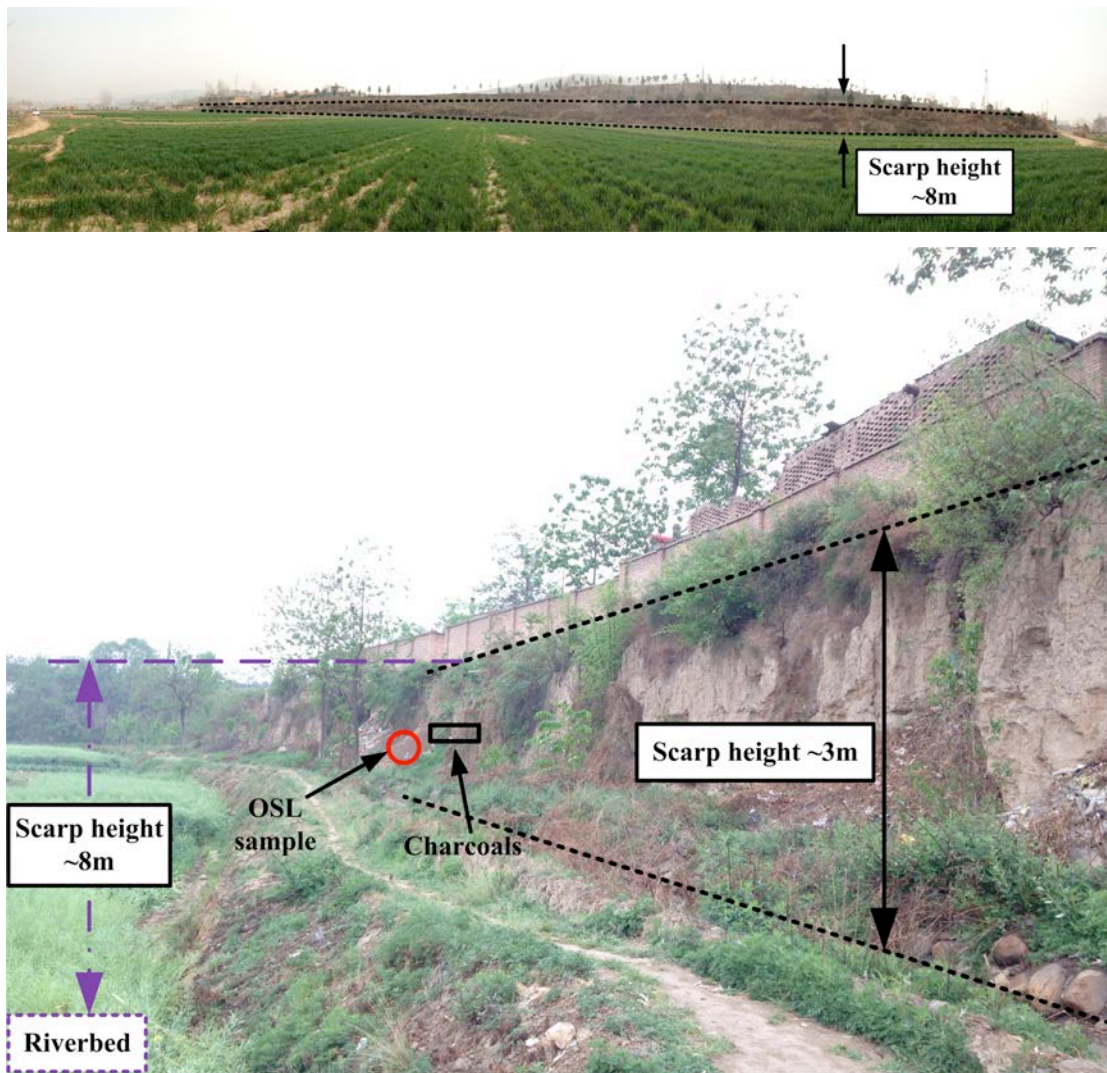


Figure 4: During the investigation, we saw a continuous and consistent ~8m scarp over the entire fault-length. To test whether the 8m scarp was formed in the 1556 earthquake, we collected samples for dating from a paleosol layer overlying uplifted river gravels. The charcoals in the paleosol give an age of ~2000 years, which suggests the 8m scarp was not formed in the 1556 earthquake.

## Acknowledgements

I am extremely grateful to the Geological Remote Sensing Group for providing funds towards my future fieldwork. Many thanks also go to the China Earthquake Administration of Shaanxi Province for supporting me in the field.

# Unmanned Aerial Systems and Structure from Motion for Quantifying Fluvial Topography



Amy Woodget, University of Worcester

## Quantifying Fluvial Topography

The geomorphology of a river system is a key part of the physical habitat template and therefore has a direct impact on the ecological health of the fluvial environment. This PhD work considers the quantification of topography – a specific element of fluvial geomorphology defined as the size and shape of the channel bed (submerged) and the banks (emergent).

Traditionally, fluvial topography is quantified using fixed cross sections where point measurements are taken at regular intervals using tape measures, depth poles, GNSS devices or total stations. These approaches are time consuming, labour intensive and provide limited spatial coverage. Remote sensing techniques have also been used for characterising fluvial topography and include the spectral-depth relationship approach, digital photogrammetry and laser scanning including airborne, terrestrial and bathymetric. Whilst such approaches provide continuous spatial coverage, they are each limited in some way by factors including cost, the need for intensive fieldwork, limited spatial resolution or coverage, or lack of sensor availability.

Recent research however, suggests that the use of cutting-edge unmanned aerial systems (UAS) combined with novel 'Structure-from-Motion' (SfM) photogrammetry algorithms may provide an alternative (e.g. Fonstad et al., 2013). UAS are capable of rapid, repeatable and inexpensive acquisition of accurate and detailed aerial imagery which may be used with SfM processes to quantify topography. The approach remains in its infancy though, and has seen very limited application to fluvial environments. As a result, rigorous comparative studies against existing techniques are required.



Figure 1. The Draganflyer X6 UAS and flying at Coledale Beck.

## UAS and SfM

My PhD research aims to assess the use of imagery collected from the University of Worcester's Draganflyer X6 UAS (Figure 1) and processed using an SfM-photogrammetry approach for the generation of topographic datasets at the mesohabitat scale. This scale of assessment typically covers river reaches from ten metres to a few hundred metres in length and is generally acknowledged to be meaningful in terms of habitat and ecological assessment (Newson and Newson 2000, Fausch et al., 2002).

Initial research had investigated this approach at one site to generate topographic outputs of high spatial resolution and high accuracy. Yet further testing was required to investigate how well the technique could be applied to different river systems and how it compares to existing methods of quantifying fluvial topography. I was therefore very grateful to receive a student award from the GRSG to assist with funding data collection at a second site.



Figure 2. The field site at Coledale Beck, Cumbria.

In July 2013, a week's fieldwork was conducted at Coledale Beck (Figure 2), a small, step-pool, gravel-bed river near Keswick in the North West Lake District. This site was chosen for its topographic diversity at the mesohabitat scale and its suitability for UAS flying. Local weather conditions and an experienced pilot are critical for safe flying and acquisition of good quality imagery. The best quality imagery is typically acquired in wind speeds less than 5mph, with no gusting on clear, dry, sunny days. We had been concerned that such conditions were a rarity in the English Lake District, but fortunately we were exceptionally lucky with the hot and stable July weather. This enabled the collection of high resolution optical imagery using the Draganflyer X6 UAS along a 100m length of channel. Validation data were also collected using a total station, and alternative remote sensing data collected using a Leica ScanStation C10 terrestrial laser scanner (TLS), in collaboration with colleagues from Bath Spa University.

On return to the office, the UAS imagery was filtered for blurred or unsuitable images, and then processed using PhotoScan Pro (Agisoft LLC) – a commercially available SfM-photogrammetry software program. SfM works in a similar way to digital photogrammetry to match points within overlapping images in order to create a point cloud of the scene. The point cloud was used to generate high resolution orthophotos and DEMs of the site at Coledale Beck (Figure 3).

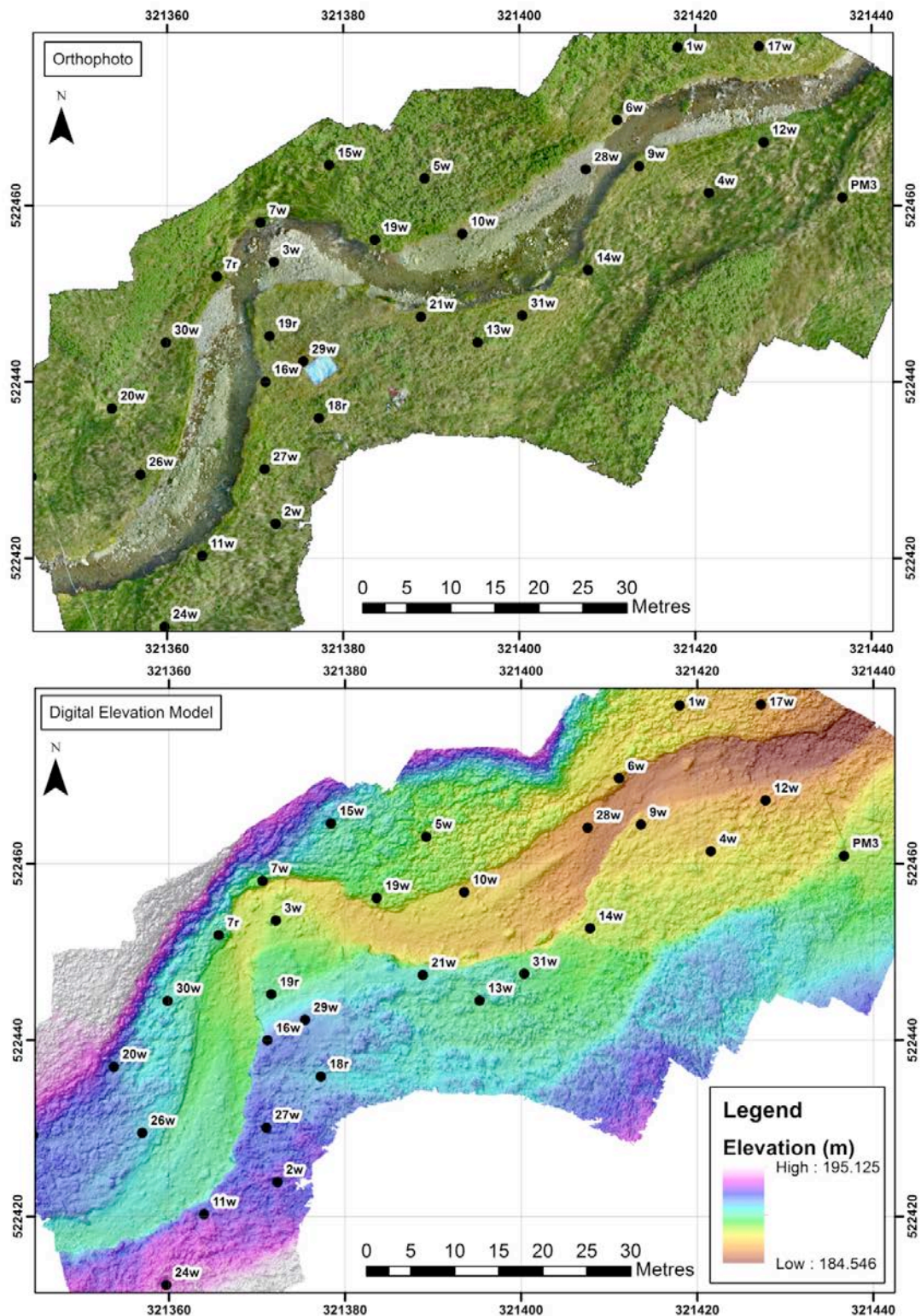


Figure 3. Orthophoto and DEM for Coledale Beck, July 2013. The black points represent the location of ground control markers laid out prior to image acquisition and used for subsequent georeferencing.

## Initial Results

A quantitative assessment of the topographic data acquired at this site is ongoing. Initial results confirm those found at the first site, indicating that this approach is capable of generating DEMs of high resolution (0.02m) with high levels of accuracy (mean error of 0.04m).

Quantitative comparison with the TLS data is ongoing. However, comparison of results with those typically obtained using TLS from within the published literature suggests that this novel method provides almost comparable levels of resolution and accuracy (e.g. Heritage and Hetherington 2007). Furthermore, working with both a UAS and TLS during this study, it was found that mobilisation and data collection was much faster with the UAS, and the platform itself is significantly less expensive to purchase in the first instance.

Wider interest in the use of UAS for acquiring remotely sensed data is growing rapidly and the initial results of this research suggest that with further refinement, the development of the UAS-SfM approach has great potential for geomorphological applications both within fluvial environments and elsewhere.

The Remote Sensing and Photogrammetry Society (RSPSoc) has an active special interest group for those interested in the use of UAS. Workshops on the use and application of UAS have been held annually by this group for the last few years – see the website for further information (<http://www.rspso.org.uk/index.php/special-interest-groups/unmanned-aerial-vehicle.html>).

## Acknowledgements

I'd like to express my thanks to the GRSG for this student award, without which this fieldwork would not have been possible. Further financial support and fieldwork assistance from supervisors and colleagues at the University of Worcester, Bath Spa University and Durham University is also gratefully acknowledged.

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# ***Understanding Earthquake Triggered Landslides: a PhD dissertation by Tolga Görüm***



*Freek van der Meer, Mark van der Meijde, Cees van Westen, University of Twente, Faculty ITC, Enschede, The Netherlands.*

On, October, 31 2013, Mr. Tolga Görüm successfully defended his PhD dissertation with the title 'Towards a better understanding of coseismic landslides: an analysis of the size, distribution pattern and characteristics of coseismic landslides in different tectonic and geomorphic environments' at the University of Twente (Enschede, the Netherlands).

The supervisors of the work were Prof. Freek van der Meer, Dr. Cees van Westen and Dr. Mark van der Meijde. In his thesis, Tolga studied four different earthquake events and analyzed over 66000 coseismic landslides under different geodynamic regimes. It is demonstrated that there are relations between fault mechanisms, type/geometry of faults and the spatial distribution of coseismic landslides.

The PhD thesis can be downloaded from: [http://www.itc.nl/library/papers\\_2013/phd/gorum.pdf](http://www.itc.nl/library/papers_2013/phd/gorum.pdf).

Below is the summary of the dissertation. The figures show examples of the work that did on the 2010 Haiti earthquake.

Earthquakes are among the most devastating geophysical processes on Earth, which have caused an estimated minimum of 13 million fatalities in the past 4000 years. Large, shallow earthquakes (>M 6.0) may trigger thousands of landslides in mountainous terrain due to the strong ground motion and the associated weakening of the hillslope materials. Generally, the destructive impact and casualties of earthquake triggered landslides are considered as a component of the earthquake damage itself, and thus their long-term economic and societal detrimental impact is generally overlooked. Yet casualties from recent earthquake-induced landslides indicate that the coseismic landslides as a secondary hazard can be very significant in major earthquakes that occur in mountainous regions.



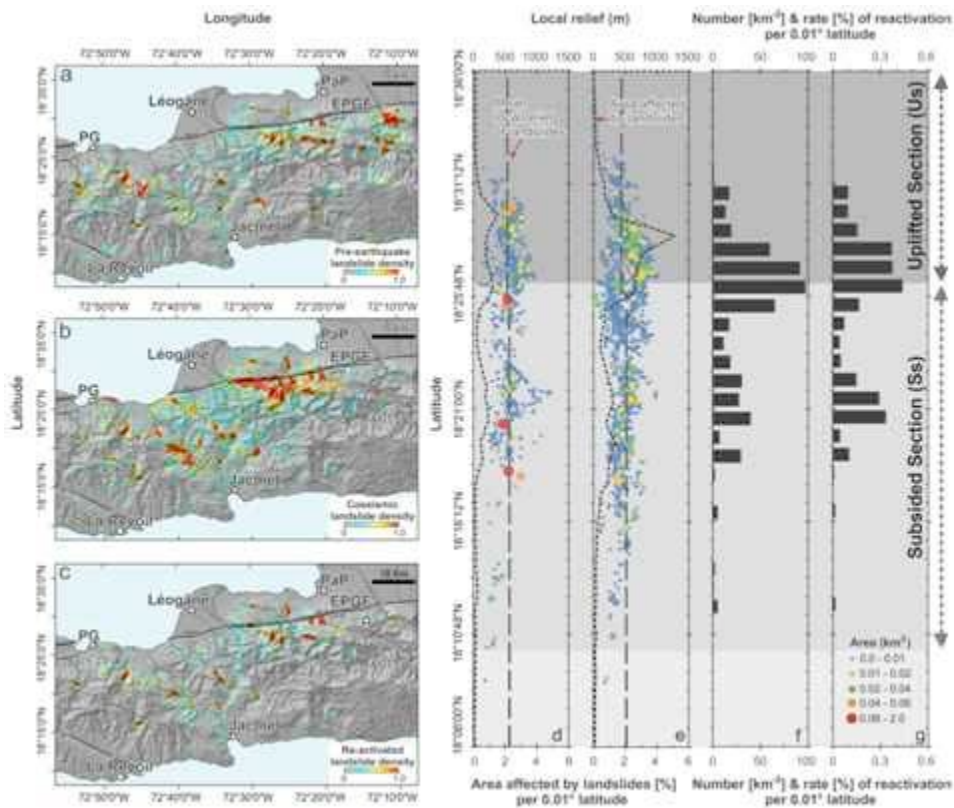


Figure 1. Regional distribution of co- and aseismic landslides, and re-activated slope failures. (a) Normalized spatial density of pre-earthquake aseismic landslides within 1-km radius (see text). (b) Spatial density of coseismic landslides. (c) Spatial density of re-activated landslides. (d and e) Fraction of area affected by (d) aseismic and (e) coseismic landslides per 0.01 latitude; circles are individual landslide locations scaled by area (see legend in panel g). Thin black dashed lines are areas affected by the landslides; thick black dashed lines are mean local relief of coseismically uplifted and subsided areas. (f and g) Histograms of (f) point density [km<sup>2</sup>] and (g) rate [%] of re-activated landslides for 0.01° latitude bins; PaP: Port-au-Prince; PG: Petit Goave. From Gorum et al. (2013).

The rate of coseismic landsliding and their distribution pattern can be highly variable in both its spatial and temporal aspects because of the variability of factors such as topography, geology, geomorphology, and the epicentral location and faulting mechanism of the seismic events. The location, type and abundance of earthquake-induced landslides in an area depend on the characteristics of the seismic parameters and on the predisposing conditions. The latter include the local and regional morphological and lithological setting, and more specifically the morphodynamics and the mechanical properties of the rocks and soils. It is generally understood that the abundance of coseismic landslides decreases markedly with distance from the epicenter and fault rupture. However, it is still not fully clear whether and how different fault types and geometries affect this decay of slope-failure density with decreasing seismic intensity in different seismo-tectonic and geomorphic environments, hampering reliable assessments of earthquake-induced landslide susceptibility.

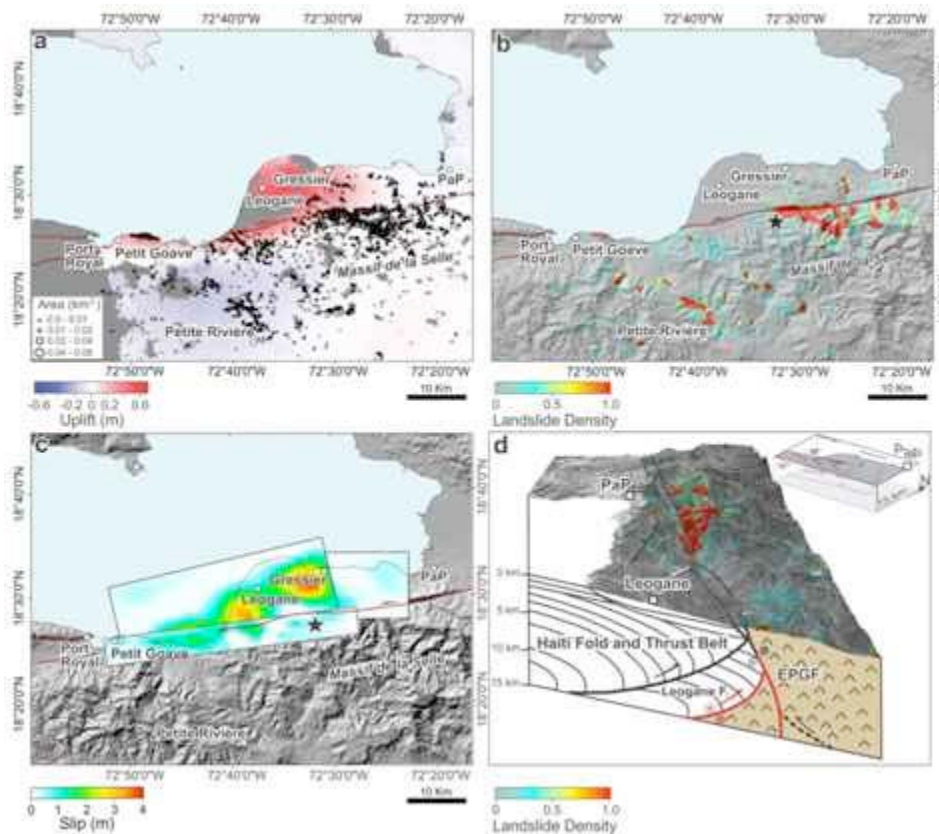


Figure 2. Distribution of coseismic deformation, slip, and landslide density. (a) Vertical-deformation signal from InSAR (after Hayes et al., 2010); black circles are mapped coseismic landslides; black star is epicenter. (b) Normalized landslide density map (cf. Figure 4.4). (c) Rupture model and coseismic slip amplitudes from inversion of InSAR data, field based off-set measurements, and broadband teleseismic body-waveform data (after Hayes et al., 2010). (d) Block diagram of the Léogâne thrust and Enriquillo-Plantain Garden Fault blind rupture. Normalized landslide density superimposed on data by Mercier de Lépinay et al. (2011). Inset block diagram shows proposed fault geometry by Hayes et al., (2010) for Haiti earthquake ruptures. Thick solid lines are surface projections of each fault; PaP: Port-au-Prince. References in Gorum et al. (2013).

This thesis presents results of a regional analysis at high spatial resolution of coseismic landslides in seismologically and geomorphologically contrasting events and landscapes. To improve the current state of coseismic landslide knowledge in a global context, the role that earthquake rupture dynamics, faulting styles, topography and rock-type may have on the size, abundance and the distribution pattern of the coseismic landslides were explored using a total of eight polygon based landslide event-inventories triggered by strike-slip and dip-slip earthquakes. The coseismic event-inventories of the 2002 Denali Fault, Alaska (Mw 7.9), 2007 Aisén Fjord, Chile (Mw 6.2), 2008 Wenchuan, China (Mw 7.9) and 2010 Haiti (Mw 7.0) earthquakes were generated within the scope of this thesis. The locations of 66,700 individual landslides in these four core study sites were mapped by visual interpretation using pre- and post-earthquake high-resolution satellite images and aerial photos.

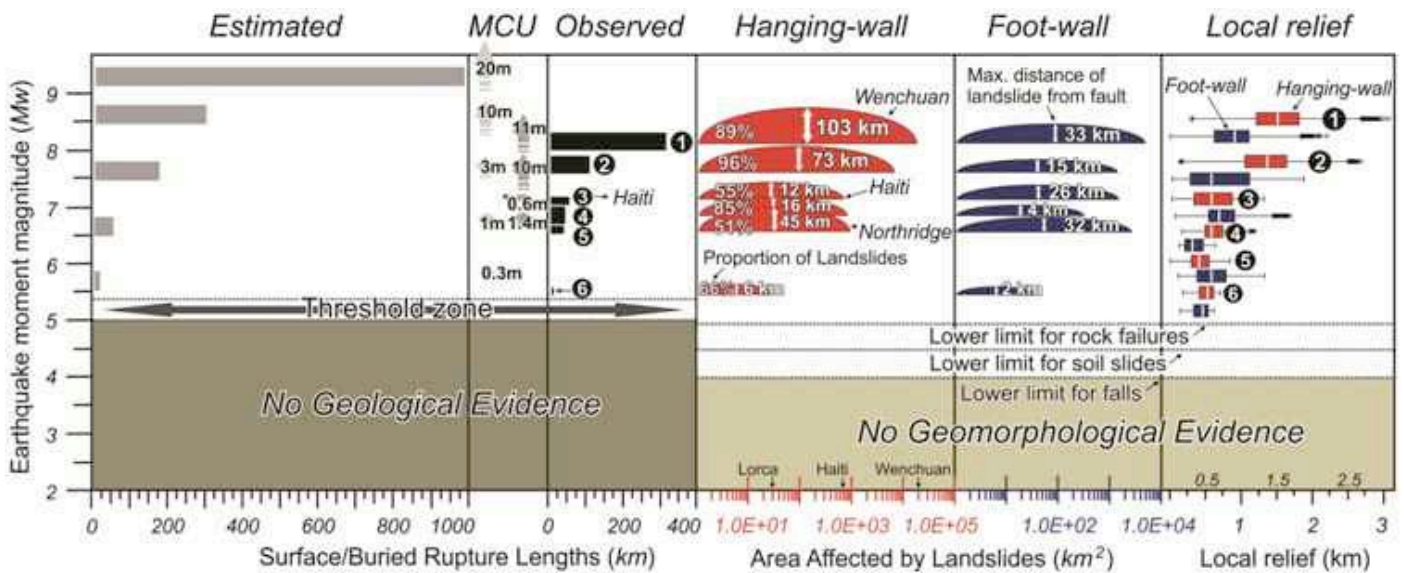


Figure 3. Summary of coseismic landslide inventory data from documented reverse or thrust-fault earthquakes. Left panel shows extent of faulting recorded in historical (grey bars) and recent earthquakes (grey bars; modified after McCalpin, 2009). Thick and thin black bars are lengths of surface and blind fault ruptures; estimates of surface rupture lengths (grey bars) and maximum coseismic uplift (light grey arrows) from Wells and Coppersmith (1994); lower limits from Bonilla (1988). Maximum coseismic uplift (MCU, dark grey arrows) and surface/blind ruptures: (1) Wenchuan, China, Mw 7.9 (Liu-Zeng et al., 2009); (2) Chi-Chi, Taiwan, Mw 7.6 (Chen et al., 2003); (3) Haiti Mw 7.0 (Hayes et al., 2010); (4) Iwate-Miyagi, Japan, Mw 6.9 (Ohta et al., 2008); (5) Northridge, USA, Mw 6.7 (Shen et al., 1996); and (6) Lorca, Spain, Mw 5.2 (Martinez-Diaz et al., 2012). Right panel shows hanging wall (red) and foot-wall (blue) areas affected by coseismic landsliding, and box-and-whisker plots of local relief. Box delimits lower and upper quartiles and median; whiskers are 5th and 95th percentiles; open circles are outliers. Landslide inventory data from Gorum et al. (2011), Liao and Lee (2000), Yagi et al. (2009), Harp and Jibson (1995), and Alfaro et al. (2012); landslide lower limits are from Keefer (1984). References in Gorum et al. (2013).

The results associated with the controls of faulting type and fault geometry on the coseismic landslide distribution characteristics reveal that the thrust/reverse faulting earthquakes induce many more landslides than normal and strike-slip faulting earthquakes. In addition, the clustering of 70-85% of the landslides triggered by intermediate- and large-sized earthquakes (e.g. Wenchuan, Denali Fault, Chi-chi and Yushu earthquakes) over the surface projection (up- and down-dip edge) of earthquake fault revealed that the fault geometry is a key restrictive factor on the spatial landslide distribution pattern. In this respect, coseismic landslide abundance and the spatial asymmetry decrease with increasing dip angle of strike-slip faults, whereas the number and the overall area affected by the coseismic landslides increases with a decrease in dip angle for thrust and reverse faults for a given magnitude. Furthermore, in this study, it is demonstrated that the landslides triggered by the surface- and blind ruptured earthquakes are significantly different both in terms of distribution pattern and the fraction of area affected by the coseismic landslides.

The comparison results of the event-inventories of six reverse or thrust-faulting earthquakes show that the mass-wasting responses to earthquakes with similar magnitudes in the hanging-wall are more pronounced and the landslides are larger in surface-ruptured earthquakes in contrast to the blind-ruptured earthquakes. Thus, in blind-ruptured earthquakes the distribution of landslides

exhibits more symmetric pattern between the fault blocks though the fraction of the area remains higher on the hanging wall side. The results from different events show that the differences and variations in rupture dynamics (depth, mode and rate of the coseismic slip), in combination with the topography and the lithology have distinctive controls on limiting the size- and spatial distribution of coseismic landslides along the surface ruptures.

From a regional geomorphological perspective, the coseismic landslide patterns in glaciated landscapes (e.g. the Denali Fault earthquake region) are considered to have a lower density, probably due to the fact that glaciers may reduce the topographic amplification although they may also significantly increase the run-out size of the landslides. In this regard, regional morphoclimatic and/or morphodynamic differences may affect the distribution characteristics, particularly the frequency-size distributions, of coseismic landslides. The variance in rollovers of magnitude-frequency distributions become more pronounced with differences in style of faulting, rupture and the topographic characteristics of the events. Therefore, landslide frequency-size distributions of different events show that future work should consider the seismic properties (i.e. magnitude, faulting mechanism and rupture dynamics) and physiographic characteristics together rather focusing on earthquake magnitude alone.

Our results call for modifications of existing models of earthquake triggered landslide susceptibility solely based on empirical relationships.

Overall, the comparison of different faulting events in diverse geomorphic environments strengthens our hypothesis that the distribution pattern, abundance, and area affected by coseismic landslides are linked closely with the fault geometry and type, the changes in geomorphic and topographic characteristics, and the rate and mode of the coseismic displacements along the surface ruptures. Based on our assessment about the combined impacts of the seismic parameters and the predisposing conditions this study suggests a new conceptual model for earthquake triggered landslide patterns, which may contribute to the current state of our understanding of coseismic landsliding in a regional context. In this manner, the proposed conceptual model may further help to the landslide research community to improve the knowledge-guided empirical susceptibility assessment for earthquake triggered landslides.

## **Reference**

Gorum, T., van Westen, C.J., Korup, O., van der Meijde, M., Fan, X., van der Meer, F.D., 2013. Complex rupture mechanism and topography control symmetry of mass-wasting pattern, 2010 Haiti earthquake. *Geomorphology* 184: 127-138.

# NOA faults: A Digital Database for Active Faults in Greece



*Athanassios Ganas, Institute of Geodynamics, National Observatory of Athens*

A first version of the digital database of Greek active faults has been constructed. The database contains 963 faults published in peer-reviewed literature. This product may be used by geologists, seismologists and engineers working with cartographic scales 1:50000 and smaller. We exercise extreme caution to users of the database working with larger scales (e.g. 1:10000). The database is a growing database and will be subject to change as new information becomes available and new maps are published on Greek faults.

The objectives of the project are:

1. To compile a digital database of fault geometry and additional attributes primarily to support seismic operations at the National Observatory of Athens (NOA).
2. To include published faults in peer-reviewed literature.
3. To create a FREE product that may be used by geologists, seismologists and engineers working with cartographic scales 1:50.000 and smaller.
4. To make it up-gradable as new information becomes available and new maps are published on Greek faults.

The database of Greek active faults (kml, txt) can be downloaded at  
[http://194.177.194.200/services/GPS/GPS\\_DATA/1\\_NOAFaults/](http://194.177.194.200/services/GPS/GPS_DATA/1_NOAFaults/)

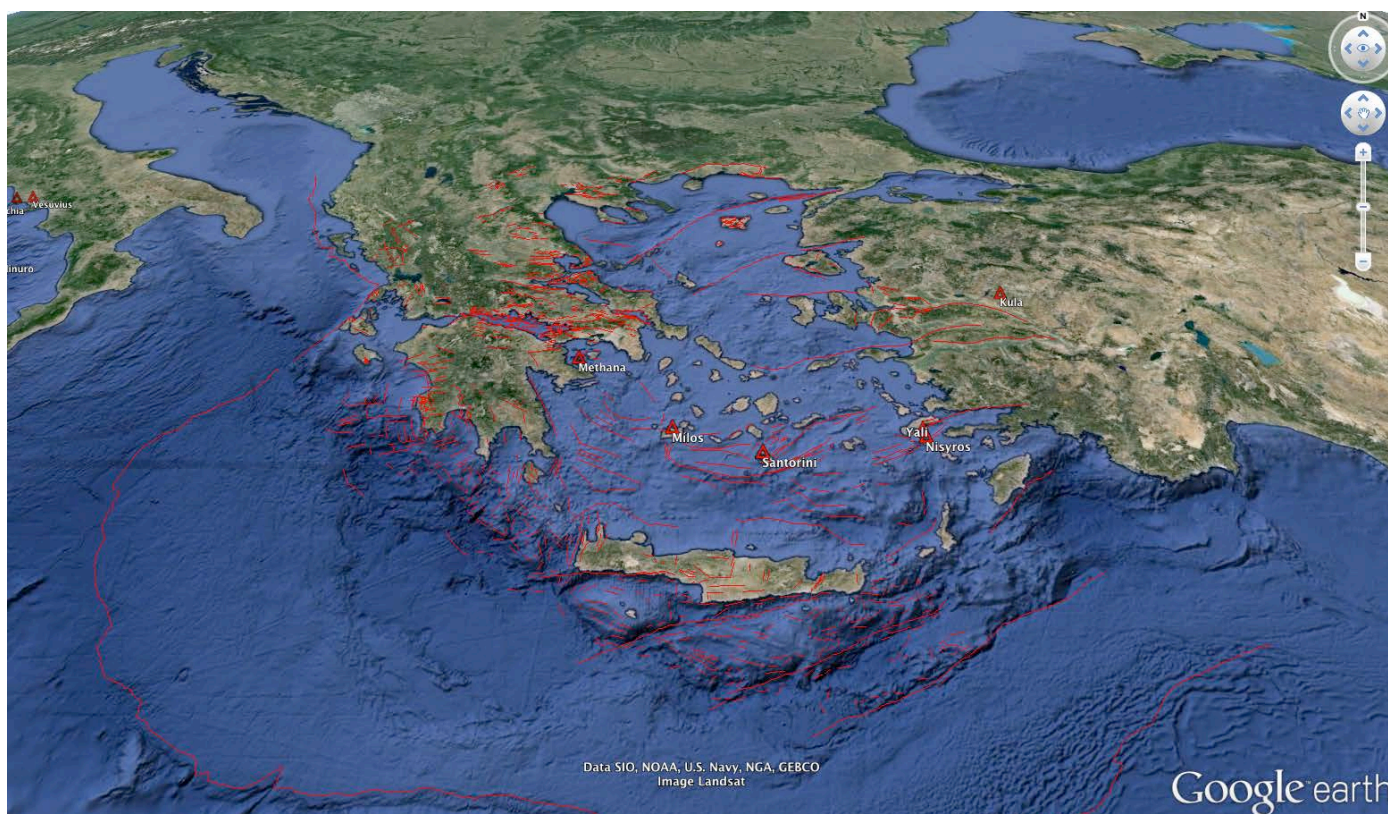


Figure: Database image

# Other Meetings



## DECEMBER

11<sup>th</sup>-12<sup>th</sup>: **PROSPEX 2013**, London UK

PESGB and DECC are pleased to bring you the 11th show in the highly successful series of Prospects Fairs: the UK's leading networking event for exploration and development

PROSPEX is a two day exhibition with a parallel speaker programme including the highly popular 'Prospectsto Go' sessions, for more information about the show, [please click here](#) or contact Ben Gardner ([ben@pesgb.org.uk](mailto:ben@pesgb.org.uk))

9th - 13th: **AGU Fall Meeting**, San Francisco, California USA

Welcome to the American Geophysical Union's 46th annual Fall Meeting! Join more than 22,000 Earth and space scientists, educators, students, and other leaders in San Francisco, California, 9-13 December, as they gather to present groundbreaking research and connect with colleagues.

The AGU Fall Meeting is the largest worldwide conference in the geophysical sciences, attracting more than 24,000 Earth and space scientists, educators, students, and other leaders. For 46 years, energized and passionate Earth and space scientists from around the world gather at the AGU Fall Meeting to connect with colleagues, broaden their knowledge base, and embrace the joy of science. The 2013 meeting takes place Monday 9 – Friday 13 December 2013.

Each year, the Fall Meeting takes place in the North, South, and West buildings of the [Moscone Center](#), at the intersection of Fourth and Howard Streets, San Francisco, CA 94103. The Moscone Center is accessible by BART and MUNI public transit lines, and also in walking distance of many hotels.

For more information, contact [fm-help@agu.org](mailto:fm-help@agu.org). or see <http://fallmeeting.agu.org/2013/>

## 2014

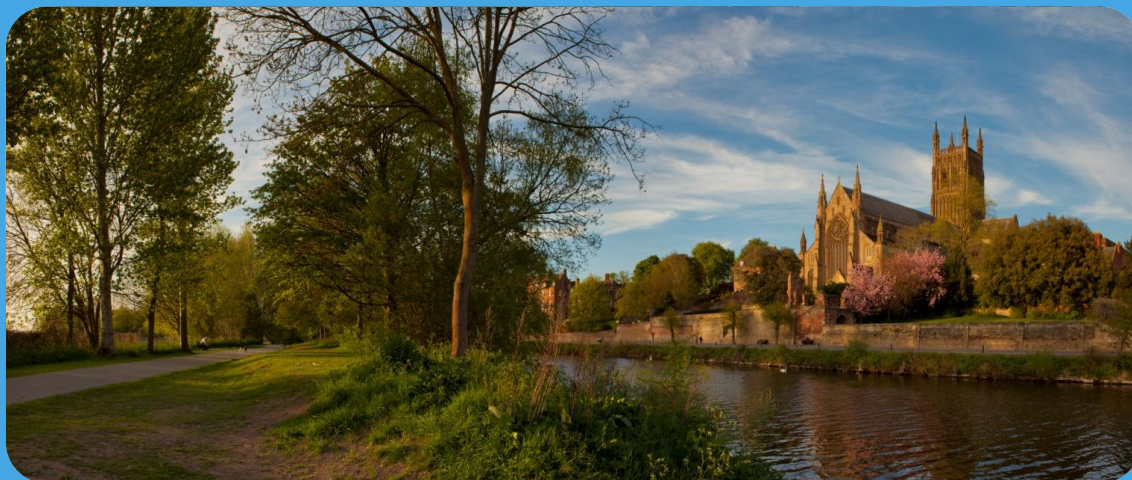
### FEBRUARY

3<sup>rd</sup> – 6<sup>th</sup>: **20<sup>th</sup> Annual Investing in African Mining INDABA**, Cape Town, South Africa

Investing in African Mining Indaba is the world's largest mining investment event and Africa's largest mining event. For 19 years, Investing in African Mining Indaba along with its partners in Africa have channeled billions of dollars of foreign investment into the mining value chain. Mining Indaba is the world's largest gathering of mining's most influential stakeholders and decision-makers vested in African mining.

**APRIL**

14<sup>th</sup> – 16<sup>th</sup>: **RSPSoc Wavelength Conference**, Worcester, UK



# Wavelength 2014

*The conference for students and new professionals  
in remote sensing and photogrammetry*

**14<sup>th</sup> - 16<sup>th</sup> April 2014**

RSPSoc's 2014 Wavelength Conference promises a variety of oral and poster presentation sessions, three career-oriented keynotes and a number of fun and friendly social events.

## **VENUE**

Malvern St. James School, Great Malvern, Worcester, WR14 3BA, UK.

## **REGISTRATION**

Open until Friday 14<sup>th</sup> February 2014.

Book your place now using the online registration facility (website below).

## **ABSTRACTS**

Please send 250-word abstracts & your preference for oral or poster presentation to [amy@rpsoc-wavelength.org.uk](mailto:amy@rpsoc-wavelength.org.uk) by Friday 17<sup>th</sup> January 2014.



For more information...

Web: [www.rpsoc-wavelength.org.uk](http://www.rpsoc-wavelength.org.uk)

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Facebook: RSPSoc Wavelength



## **APRIL/MAY**

27<sup>th</sup> – 2<sup>nd</sup> May: **EGU General Assembly**, Vienna, Austria

The EGU General Assembly 2014 will bring together geoscientists from all over the world to one meeting covering all disciplines of the Earth, planetary and space sciences. The EGU aims to provide a forum where scientists, especially early career researchers, can present their work and discuss their ideas with experts in all fields of geosciences. For the first time, in 2014, the EGU General Assembly will have a theme!

14<sup>th</sup> – 16<sup>th</sup> May: **TC IV Symposium 2014**, Suzhou, China

The Symposium, as one of the most important events of ISPRS Technical Commission IV, is to provide an inter-disciplinary forum for scientists, researchers and practitioners in the field of "Geo-spatial databases and location based services". The participants of the Symposium will present the latest developments and applications, discuss cutting-edge technologies, exchange research ideas, and promote international collaboration.

## **JUNE**

6<sup>th</sup> – 8<sup>th</sup>: **1<sup>st</sup> International Geo-Cultural Symposium "Kaldera 2014"**, Santorini

**Organizer** MESONISOS, Center of Island & Mediterranean Culture & Members of the Scientific Community of Faculty of Geology and Geo-Environment

The purpose of the symposium is to highlight and interpret the geological phenomena of the island, while also explaining their influence in its cultural evolution.

The Symposium will take place in the Conference Center of Luka & Evangelo Bellonia Foundation, which is located in Fira, the island's capital in Santorini.

16<sup>th</sup> – 20<sup>th</sup>: 34<sup>th</sup> **EARSel Symposium 2014** (European Association of Remote Sensing Laboratories), Warsaw, Poland

16<sup>th</sup> – 19<sup>th</sup>: **76<sup>th</sup> EAGE Conference & Exhibition 2014**, Amsterdam

The 76<sup>th</sup> EAGE Conference & Exhibition 2014 is the largest and most comprehensive geoscience event in the world. The six-day programme consists of a large conference and a technical exhibition presenting the latest developments in geophysics, geology and reservoir/petroleum engineering.

25<sup>th</sup> – 27<sup>th</sup>: **6<sup>th</sup> Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensing**, Lausanne, Switzerland

The aim of this workshop is to bring together all the people involved in **hyperspectral data processing**, generally speaking.

By "**data**", we mean: - signals, as provided by spectrometers and processed individually - images, from the ground using microscopes and spectrometers to airborne or satellite sensors, up to astrophysical data - models: models of the sensors or of the sensed scene, including physical considerations.

By "**processing**", we mean everything from the acquisition, the calibration to the analysis (image processing, signal processing, feature extraction, dimension reduction, unmixing and source separation, classification).



People are invited to submit new research results on the following suggested topics : - Spectrometers and hyperspectral sensors : design and calibration - Physical modeling, physical analysis - Noise estimation and reduction - Dimension reduction - Unmixing, source separation, endmember extraction - Segmentation, classification - High performance computing and compression.

## JULY

13<sup>th</sup> – 18<sup>th</sup>: **IGARSS 2014**, Quebec City, Canada

The development of new and renewable sources of energy in the context of a changing planet is a critical and important issue throughout the world. IGARSS 2014 and the 35th Canadian Symposium on Remote Sensing (CSRS) will include keynote speakers and include special sessions dedicated to the “Energy” theme.

In addition to a host of well established session themes, IGARSS 2014/35th CSRS topics will also include Earth observation for Arctic research, Earth observation for renewable energy, energy budgets and modeling, future satellite programs, global environmental change, international co-operation ( including the Committee on Earth Observation Satellites – CEOS ; Global Earth Observation System of Systems – GEOSS ), new remote sensing technologies, security and defence, sustainable development, and more. A Summer School will be held the week before the symposium.

## SEPTEMBER

2<sup>nd</sup> -5<sup>th</sup>: **RSPSoc 2014 Conference**, Aberystwyth, Wales

*"New Sensors for a Changing World"*

With platforms such as UAV's and multi-spectral LiDAR's coming online and new spaceborne sensors such as Landsat-8, Sentinel-2, ALOS-2 and WorldView-3 being launched in the run up to the conference the theme will be focused on the methods and applications applicable to these sensors or first results from these new sensors. Particular applications areas of interest are but not exclusive to the Global Earth Observation System of Systems Societal Benefit Areas areas: *Disasters, Health, Energy, Climate, Water, Weather, Ecosystems, Agriculture and Biodiversity.*

24<sup>TH</sup> – 26<sup>TH</sup>: **XX Congress of Carpathian Balkan Geological Association – CBGA2014**

The Organizing Committee of **CBGA 2014** would like to invite all interested scientists to attend the **XX Congress of Carpathian Balkan Geological Association**, a jubilee Congress, which will be held from 24 to 26 September 2014 in Tirana, Albania.

Albania, a country in the western Balkans, is noted among other Alpine terrains for its very spectacular outcrop of Jurassic ophiolites which present a complete geological section and host a lot of mineral deposits of Cr, Cu, Fe, etc. Albania has also attracted the interest of several foreign companies for its oil and gas reserves. Thanks to both small surface and good new roads, it can be visited in a few days and you can enjoy the very interesting geology and part of Albania history through the visit of the archaeological centres.

# GRSG International Reps



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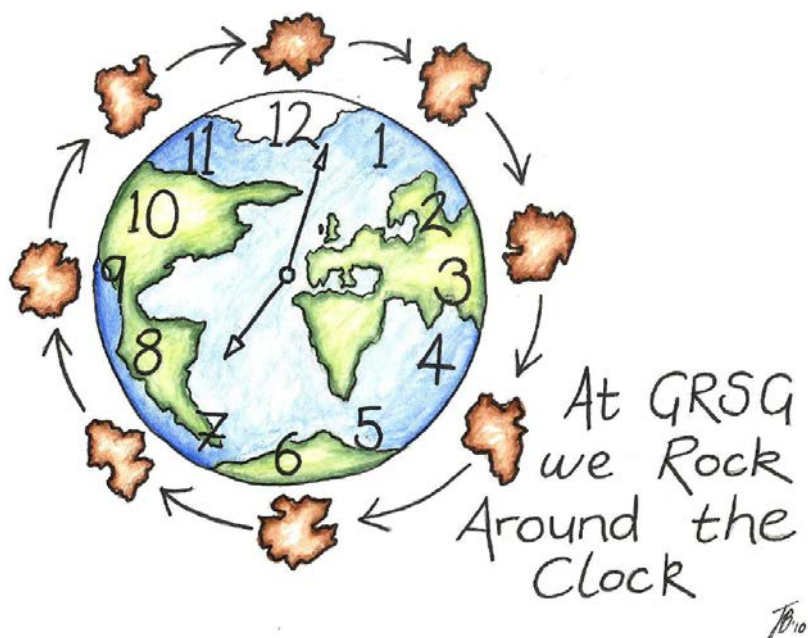
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Geological Remote Sensing Group

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