



**GRSG Newsletter**  
**Issue 70**  
**July 2014**



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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

Antarctica Peninsula from Sentinel-1A. ©ESA

Acquired on 13 April 2014 at 23:57 GMT (14 April at 01:57 CEST) by Sentinel-1A, this image shows a transect over the northern part of the Antarctica Peninsula. It was acquired in the satellite's 'strip map' mode with a swath width of 80 km and in dual polarisation. The colours indicate how the land, ice and water reflect the radar signal differently. Image available [here](#) and details of copyright are detailed [here](#).

# GRSG Committee



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## Committee



Dear Members,

Welcome to the 70<sup>th</sup> edition of the GRSG Newsletter.

Hopefully you will all have received the second call for papers for this year's GRSG. This will be our silver anniversary meeting and as such we have decided to theme the conference around 25 years of Geological Remote Sensing. To mark such an occasion we will return to our home in the Geological Society of London for the three-day meeting taking place on the 15<sup>th</sup> to the 17<sup>th</sup> of December 2014.

Six keynote presentations will provide the common theme to the meeting. Five of these will open the main sessions of the conference and focus on how remote sensing has developed, what the pinnacle moments and applications have been and how things might look in the future for the application areas of:

- **Oil and Gas:** Martin Insley (*Tullow Oil*)
- **RS and disaster management :** Richard Teeuw (*Portsmouth University*)
- **Mineral Exploration:** Dan Taranik (*Exploration Mapping*)
- **Engineering applications:** Jason Manning (*Arup*)
- **InSAR and Geohazards:** TBC

The remaining keynote will open the conference, this will be given by the founding chairman of the GRSG, Geoff Lawrence and will be entitled '**25 years of Geological Remote Sensing: Then and Now**'. The usual interesting and varied programme will be interspersed with social and networking opportunities during coffee and lunch breaks but also during the traditional wine reception (this year including 25<sup>th</sup> birthday cake!), icebreaker and conference meal.

The deadline for abstracts this year is the 1<sup>st</sup> of September if you intend to present at the December 2014 meeting (oral presentation or poster) we would encourage you to send in an abstract soon. Online registration is also now open ([www.grsg.org.uk](http://www.grsg.org.uk)) and we strongly encourage early registration as places are limited and the meeting is expected to be popular. This is also true of sponsorship, the GeolSoc venue has more limited exhibition space than last year's venue so we strongly encourage potential sponsors to get in touch early to reserve a space.

The call for papers is in this newsletter on page 11, so please take a look, consider submitting an abstract and pass it on to your colleagues and place on noticeboards where appropriate.

Enjoy the newsletter,

Best Wishes



Luke Bateson (GRSG Chairman)  
[chairman@grsg.org](mailto:chairman@grsg.org)



# Editor's message



Dear all,

It seems apt to choose one of the first images published from Sentinel-1 for the front cover. The satellite, and the subsequent sensors to go up over the next few years, will monitor the state of the planet and the data will fuel many geological studies over the next few decades. This image gives us a taster of what the satellite has yet to bring us. In light of the InSAR data anticipated from Sentinel, Amy Parker in this issue has reviewed the [past, present and future of InSAR studies at volcanoes](#). In this issue we have the usual [News and Developments](#) section as well as a second call for papers for our 25<sup>th</sup> Anniversary AGM in 2014. Abstract submission is open now!

Jennifer Harris, a 2013 student award winner, has written an article about her PhD project on [Multispectral imaging for Martian exploration](#). We also include an article from ITC that describes [oil and gas seeps in the Zagros Mountains](#). Again, there's lots of student activity in this issue. Xue, our student rep, attended RSPSsoc's student conference [Wavelength](#) and gives us a summary of what happened. We announce the winners of the 2014 [Student Award winners](#), which awards students £750 towards fieldwork, imagery or conference costs. We also have further details of our very first [Remote Sensing careers evening](#) at the Geological Society, London. This event will be of interest to all members, and non-members, of GRSG.

As always, I hope you enjoy reading this issue and please feel free to send contributions. Any feedback is always welcome.

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 68) are available on the website  
<https://www.grsg.org.uk/newsletters/>

## UrtheCast's first release of Earth imagery



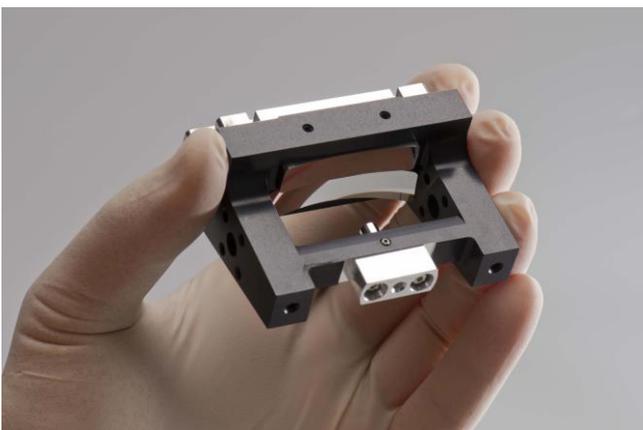
UrtheCast has announced its first release of Earth imagery, captured by UrtheCast's medium-resolution camera (MRC) onboard the International Space Station (ISS). The MRC is a multispectral, nadir-pointing imager that captures 6-meter class, 50-km wide swaths of still imagery, which will be made commercially available on the UrtheCast platform.

While the images will be made available on an individual basis, they will also be processed and constantly streamed to the UrtheCast platform. This will be realized on the interactive platform as a near realtime flyover view of the planet directly below the ISS as it orbits the globe 16 times every day.

Picture: Dubai Credit: Urthecast

Source: [http://www.urthecast.com/firstflight?utm\\_source=UrtheCast+List&utm\\_campaign=63c74c4ca9-NewsLetter\\_6\\_06\\_2013&utm\\_medium=email&utm\\_term=0\\_47adfb0637-63c74c4ca9-411634493](http://www.urthecast.com/firstflight?utm_source=UrtheCast+List&utm_campaign=63c74c4ca9-NewsLetter_6_06_2013&utm_medium=email&utm_term=0_47adfb0637-63c74c4ca9-411634493)

## Hyperspectral cubesat



A new hyperspectral camera able to fit in the palm of a hand, compact enough to fly on CubeSat-sized missions, is being developed by ESA.

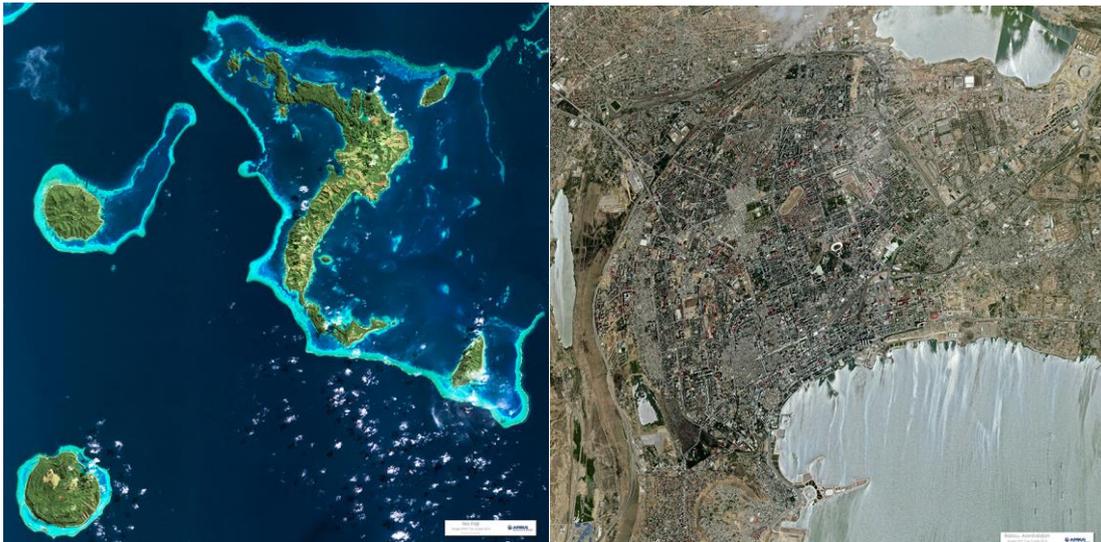
Hyperspectral instruments divide up the light they receive into hundreds of very narrow, adjacent wavelengths to reveal 'spectral signatures' of particular features, crops or materials, providing valuable data for fields such as mineralogy, agricultural forecasting and environmental monitoring.

These cameras are typically bulky items of 100 kg or more, requiring costly full-sized satellites. But advanced electronics and new materials and methods are opening up new possibilities for miniaturising payloads.

ESA is now working on a hyperspectral instrument to be carried inside the CubeSat standard, meaning a 10 cm cube – a litre – weighing no more than 1.33 kg

Source: [http://www.esa.int/Our\\_Activities/Technology/Hyperspectral\\_imaging\\_by\\_CubeSat\\_on\\_the\\_way](http://www.esa.int/Our_Activities/Technology/Hyperspectral_imaging_by_CubeSat_on_the_way)

## First SPOT7 images released



Airbus Defence and Space has published the first images obtained from the SPOT 7 satellite, three days after its launch on 30 June. These images show highly diverse landscapes, revealing SPOT 7's full potential in terms of natural resource and urban zone mapping and agri-environmental monitoring.

The SPOT 6/7 constellation is now in place and considerably improves the capabilities and performance offered by SPOT 5, which has been in operation since 2002 and which is scheduled to be decommissioned from commercial service during the first quarter of 2015. This new constellation offers a higher resolution, greater programming reactivity and a much higher volume of images acquired daily (in monoscopic or stereoscopic mode).

Pictures: SPOT7 images of Fiji (left) and Baku, Azerbaijan (right)

Source: <http://www.astrium-geo.com/en/5928-first-images-from-spot-7-satellite-within-three-days-after-launch>

## Google buys Skybox

Google confirmed it has purchased satellite firm Skybox Imaging for \$500m and say the move will “keep our maps accurate with up-to-date imagery”. Google plans to use Skybox's satellite, which is already in orbit, to supplement the material it licenses from more than 1,000 sources, including other satellite companies such as DigitalGlobe and Astrium.

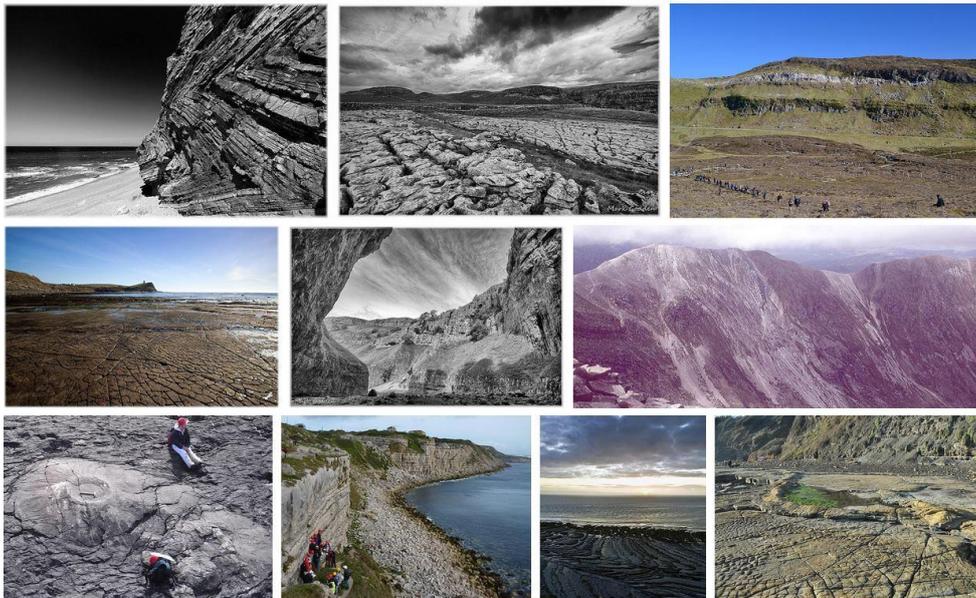
Skybox's satellites offer video images and stills at a resolution of just over 1m per pixel - which can track single cars travelling along a road. Skybox sent its first high-resolution satellite, SkySat-1, in to space last December and plans to launch 24 satellites.



Picture credit: Omaha Beach, Skybox

Source: <http://www.theguardian.com/technology/2014/jun/10/google-skybox-imaging-acquisition-satellites> & <http://www.bbc.co.uk/news/technology-27785546>

## 100 Great Geosites



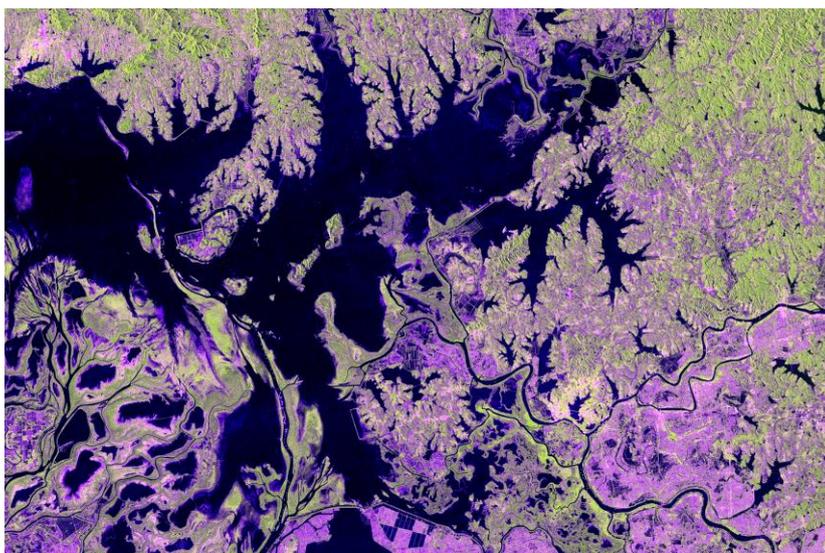
As part of [Earth Science Week 2014](#), The Geological Society and partner organisations are celebrating this unique geo-heritage by launching a list of 100 Great Geosites across the UK and Ireland.

Submissions are now closed but you can check out nominations on twitter using [#100geosites](#), or on the project's Facebook page at [www.facebook.com/100geosites](http://www.facebook.com/100geosites). The final list will be launched in October 2014 for [Earth Science Week](#) (13 – 19 October), and to celebrate Rob Butler, Chair of our Geoconservation Committee, is giving a talk at the Society. All are welcome; [find out more and enter the ballot for places](#).

Source:

[http://www.geolsoc.org.uk/100geosites?utm\\_medium=email&utm\\_source=MyNewsletterBuilder&utm\\_content=#subscriber\\_id#&utm\\_campaign=The+Geological+Society+of+London+Newsletter+-+Issue+237+1412107849&utm\\_term=Visit+the+website+for+more+information](http://www.geolsoc.org.uk/100geosites?utm_medium=email&utm_source=MyNewsletterBuilder&utm_content=#subscriber_id#&utm_campaign=The+Geological+Society+of+London+Newsletter+-+Issue+237+1412107849&utm_term=Visit+the+website+for+more+information)

## Sentinel sample images released



Additional Sentinel-1 sample products have been made available on the [Sentinel Data Hub](#).

Sentinel-1A is still being commissioned and the satellite is not yet in its reference orbit, the product quality at this stage is preliminary and is not intended to reflect the final quality level of the future operational products.

These products are available to all users. They are intended to allow familiarisation with Sentinel-1 data and to support future activities that will, for instance, require integration of Sentinel-1 products in user processing chains.

Picture: Poyang Lake, China. Credit: ESA

Source: <https://earth.esa.int/web/quest/missions/esa-future-missions/sentinel-1/news/-/article/new-sentinel-1-sample-products-available>

## First Image Data Acquisition by DAICHI-2 (ALOS-2)



FUYO-1 SAR,  
April 21, 1992,  
(Resolution: about 18 m)

DAICHI PALSAR,  
April 27, 2006,  
(Resolution: about 10 m)

DAICHI-2 PALSAR-2,  
June 19, 2014  
(Resolution: about 3 m)

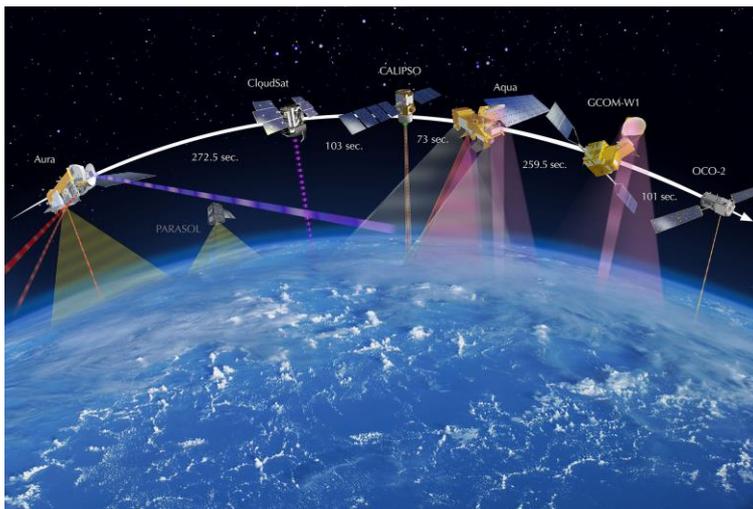
The Japan Aerospace Exploration Agency (JAXA) acquired images from the Phased Array Type L-band Aperture Rader-2 (PALSAR-2)\* aboard the Advanced Land Observing Satellite-2 “DAICHI-2” (ALOS-2). The DAICHI-2 was launched on May 24, 2014, and it is currently under initial functional verification. The images were captured during the verification stage.

The DAICHI-2's observation data is expected to contribute to understanding damages from a disaster, monitoring deforestation, and sea ice observation in the Sea of Okhotsk and Arctic area.

The image shows the PALSAR-2 Urayasu city area on the right, and, for comparison, the images of the same area taken by two other L-band synthetic aperture radars. One was shot by the ALOS and the other is the Japanese Earth Recourse Satellite-1 (JERS-1 or FUYO-1).

Source: [http://global.jaxa.jp/press/2014/06/20140627\\_daichi2.html](http://global.jaxa.jp/press/2014/06/20140627_daichi2.html)

## Orbiting Carbon Observatory-2 (OCO-2) launched

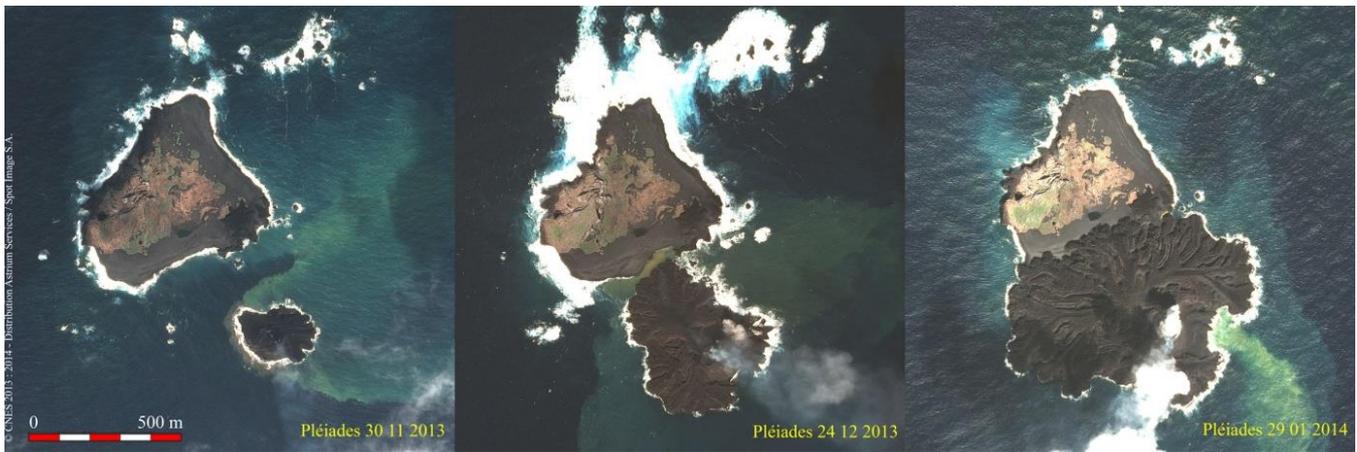


Nasa has launched a mission dedicated to measuring carbon dioxide from space. The [Orbiting Carbon Observatory-2 \(OCO-2\)](#) will help pinpoint the key locations on the Earth's surface where the gas is being emitted and absorbed. The \$468m (£273m) mission should operate for at least two years. Its key objective is to trace the global geographic distribution of CO<sub>2</sub> in the atmosphere - measuring its presence down through the column of air to the planet's surface. This should give scientists a better understanding of how the greenhouse gas cycles through the Earth system, influencing the climate.

OCO-2 will fly along the same path as NASA satellites [CALIPSO](#) (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation) and [CloudSat](#), which monitor minute particles in the atmosphere called aerosols, and clouds, respectively.

Source: <http://www.nasa.gov/jpl/oco2/a-train-atmosphere-20140703/#.U8Wao41dWs0>  
& <http://www.bbc.co.uk/news/science-environment-28089165>

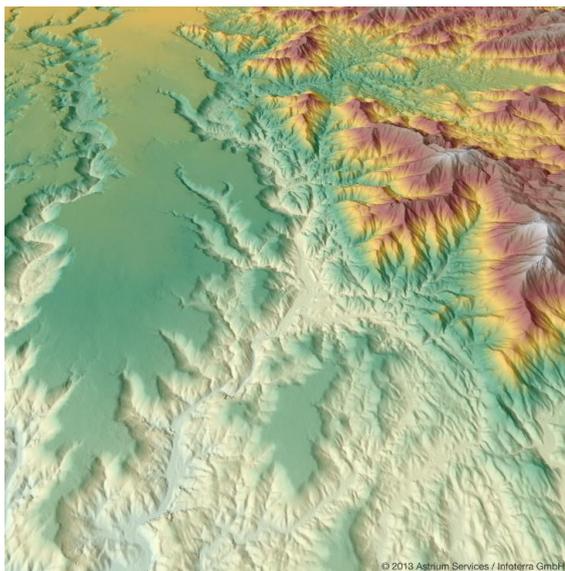
## Caught on satellite: Japanese Islands merge



Pleiades, the twin satellites operated by Airbus Defence and Space, captured the birth of a new volcanic island in the waters offshore Japan. In just two months, it had merged with a neighbouring island. The new island emerged from the Pacific Ocean on 21<sup>st</sup> November 2013, south of the island of Nishino, in the Ogasawara archipelago, more than 1,000 km south of Tokyo.

Source: <http://www.astrium-geo.com/en/5624-two-japanese-islands-merge-together-under-the-watchful-gaze-of-pleiades> & <https://twitter.com/DigitalGlobe/status/439433587050704896/photo/1>

## WorldDEM update



Airbus Defense and Space has commercially launched WorldDEM™, a Digital Elevation Model (DEM) that provides pole-to-pole coverage. It allows customers to improve the quality of DEM applications in a host of industries including defense and aviation, oil, gas and mining.

The new model is based on data acquired by the high-resolution radar satellites TerraSAR-X and TanDEM-X, whose mission is to produce a global DEM at HRTE3 level, representing a significant jump forward in accuracy. In terms of resolution, it is setting new standards by providing 12-metre grid spacing globally, compared to 90-metre grid spacing on the existing global dataset from the Shuttle Radar Topography Mission (SRTM). The German Aerospace Center (DLR) is operating the mission and generating the global TanDEM-X DEM as a basis for WorldDEM™.

WorldDEM™ guarantees a standardized global DEM with no regional or national border divides.

Picture: WorldDEM™ - Hejaz, Saudi Arabia

Source: <http://www.astrium-geo.com/en/5734-airbus-defense-and-space-sets-new-accuracy-and-quality-standards-for-global-elevation-models-with-worlddem-launch>

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

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



# 14 AGM: second call for papers



Geological Remote Sensing Group GRSG

## 25 Years of Geological Remote Sensing

15<sup>th</sup> - 17<sup>th</sup> December 2014  
The Geological Society, London

### SECOND CALL FOR PAPERS

The Geological Remote Sensing Group (GRSG) announces the second call for papers for the 25<sup>th</sup> Anniversary meeting. To celebrate our 25<sup>th</sup> anniversary we have invited the founding chairman, Geoff Lawrence, to give a keynote presentation which will track how Geological remote sensing has progressed and will be entitled **'25 years of Geological Remote Sensing: Then and Now'**. There will also be keynotes throughout the conference explaining the history and significance of remote sensing applied to the following areas:

- **Oil and Gas:** Martin Ansley (*Tullow Oil*)
- **RS and Disaster management:** Richard Teeuw (*Portsmouth University*)
- **Mineral Exploration:** Dan Aranik (*Exploration Mapping*)
- **Engineering Applications:** Mason Manning (*Arup*)
- **In SAR and Geohazards:** TBC

As usual, abstracts are welcome on a wide range of remote sensing themes, including:

- **Retrospective viewpoints** (see keynotes above)
- **New sensors:** technological developments, analytical methods & algorithms
- **Latest developments in:**
  - Mineral exploration
  - Oil & Gas
  - Geological applications, Geomorphology, Geohazards
  - Terrain, Bathymetry and Elevation models
  - Classification, multi-temporal analysis and modelling
- **Planetary science & comparative geomorphology**
- **Hyperspectral & Multispectral; Radar & InSAR; Optical & high resolution**

**Abstracts (Oral Presentations and Posters):** Title, Author(s) and 300 word abstract should be sent to [agm@grsg.org.uk](mailto:agm@grsg.org.uk) by the 1st September 2014.

For further information, sponsorship opportunities and logistics: <https://www.grsg.org.uk/>

**Important dates:**

Call for papers closes: 1<sup>st</sup> Sept 2014

Registration show open see: <https://www.grsg.org.uk/>



The Geological Society

serving science & profession



## Attention all students!!



**GRSG Membership for students is only £7!** As a GRSG student member you are able to apply for the annual Student Award (see the next page for further details), you can get exclusive access to the current and old Newsletter issues, as well as receive invitations to careers webinars and events.

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 Xue Wan ([x.wan12@imperial.ac.uk](mailto:x.wan12@imperial.ac.uk)) or the GRSG Membership Secretary, Huma Irfan ([membership@grsg.org.uk](mailto:membership@grsg.org.uk)).

# Student Award winners

It is our pleasure to announce the following Student Awards 2014 winners:

**David Mackenzie** (University of Oxford) – “Earthquake hazard and tectonic shortening in the Kazakh Tien Shan”

**Negin Fouladi Moghaddam** (Monash University) – “Subsurface structural properties retrieval using space-borne SAR interferometry deformation maps”

**Stuart Turner** (University of Leicester) – “Mineralogical characterisation of Martian impact craters using CRISM data – the search for future landing sites”

Each year the Geological Remote Sensing Group (GRSG) offers up to three awards of £750 each. Our thanks go to all those who applied for our award this year. It is great to have a spread of applications from both UK as well as international institutions.

The application for GRSG student award 2015 will be announced at our GRSG Silver Anniversary Conference (15<sup>th</sup>-17<sup>th</sup> December 2014).

Congratulations to all of you!

# Student Careers Event



The postponed GRSG and BARSC (British Association of Remote Sensing Companies) Careers event will take place On Friday the 3<sup>rd</sup> October at university College London. Due to the delay, we have the opportunity to make the event even better; along with BARSC we are working with another significant organisation to provide even greater exposure for students to the remote sensing industry and we also welcome any ideas that you might like to see at an event like this.

The free event will provide university students and recent graduates with the chance to meet a variety of remote sensing companies who operate in the UK and internationally. The event will be of interest to those with and interest in any area of remote sensing and not limited to those with a geological background.

The event will involve a series of short presentations by individuals working in the remote sensing industry, with the aim of providing attendees with an insight into the diverse range of roles and the varied career paths within the sector (both geological and non-geological). The talks will be followed by a drinks reception where students are encouraged to network with members of industry and find out more about potential employers.

We will announce the new date shortly and please feel free to distribute the event to anyone who may be interested in attending.

## Job opportunity



In the frame of the ongoing GeoRisCA and coming RESIST projects, please find attached a call for 4 positions available at:

- The European Center of Geodynamics and Seismology (ECGS): **1 PostDoc**
- The Royal Museum for Central Africa (RMCA): **1 PhD + 1 PostDoc**
- The Centre Spatial de Liège (CSL-ULg): **1 PhD**

Thank you for circulating the information to any interested and relevant candidates.

**François Kervyn**, *Natural Hazards & Cartography Unit, Earth Science Dept., RMCA,*  
[francois.kervyn@africamuseum.be](mailto:francois.kervyn@africamuseum.be)

**Nicolas d'Oreye**, *Dept. Geophysics/Astrophysics, ECGS/NMNH, Gd Duchy of Luxembourg,*  
[ndo@ecgs.lu](mailto:ndo@ecgs.lu)

**Dominique Derauw**, *Centre Spatial de Liège, Belgium,* [dderauw@ulg.ac.be](mailto:dderauw@ulg.ac.be)

[See end of newsletter for the job description and application procedure](#)

# GRSG Careers Webinar



Last November, the GRSG North America Committee hosted a “Careers in Remote Sensing and GIS” Webinar. The webinar will shortly be available to watch on the GRSG website. The flyer below describes the webinar format and the speakers.



## GRSG North America

### Student Webinar: Careers in Remote Sensing and GIS

- **Date: Wednesday, November 20, 2013**
- **Time: 11:00 am – 12 pm Mountain Time (12 – 1 pm EST, etc.)**
- **Format:** Short Presentations, followed by Q & A session
- **Presenters:**
  - Ben Clarke, Nexen Global Exploration (10 min)**
  - Lorraine Tighe, Intermap (10 min)**
  - Bob Brovey, Brovey and Associates (10 min)**
- **Series of Topics Covered:**
  - Introductory Slide(s) – Position, Education, Experience, Contact Info.
  - Description of Role/Position/Job – Skills Required / ‘tools for success’, Rewards
  - Career Opportunities – Rewards, Sectors– Industry (e.g. Majors), Government/Public, Academia > What can you do to aid your own success...
- **Hosted by Spatial Energy**



# 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 CGG Services (UK) Ltd) 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)



***Xue Wan, Imperial College London & GRSG student representative***

The RSPSoc Wavelength conference is an international conference for students and young professions interested in remote sensing, photogrammetry and earth observation related research. This year, the Wavelength conference was held on 14-16th April in the beautiful town of Great Malvern, Worcestershire. I attended this conference to announce for GRSG student award. My research interest is 3D reconstruction based on multi-view remote sensing imagery. In this conference, I was impressed to see some geological related research, for example forest monitoring and landslide detection, are based on new sensors and vehicles, for example UAV(Unmanned Aerial Vehicle) or even smartphone. UAV-based solutions are ideal to provide repeatable high-resolution imagery rapidly and to aid in hard to reach areas. The growing number of applications for UAV-based solutions also attracts the attention of industry. In the conference, Simon Mears, Key Account Manager from Leica Geosystems Ltd presented a new generation of UAV named Aibotix.

I had a good time in this conference. The social activity of Malvern Hills walk gave me a fantastic view of the beautiful farms. The conference is well organised, and offered a wonderful opportunity for young scholars in remote sensing to communicate with each other.



ExoMars is an upcoming joint European/Russian Mars exploration program. It will comprise of two missions, the first will be the launch of a trace gas orbiter in 2016 followed in 2018 by a rover. The primary focus of the mission will be to search for signs of habitability and life from both the sky and the ground. The rover will be equipped with a large suite of instruments to investigate the geochemical makeup of its landing site. One of these instruments is the PanCam, an instrument type that has a long and successful pedigree in Martian exploration with previous ground-based vehicles including Spirit, Opportunity and Curiosity rovers all carrying a similar instrument type. The PanCam (Panoramic Camera) system is a multispectral stereoscopic camera system. It is made up of two wide angle cameras (WAC) separated by 50cm on an optical bench and one narrow angle high resolution camera (HRC). The WACs are each fitted with a wheel in front of their optics containing a number of wide band and narrow band spectral filters enabling the construction of both RGB images and multispectral image sets spanning 440-1000nm [figure 1].



**Figure 1:** a) Aberystwyth University PanCam Emulator (AUPE) with key features highlighted; b) the inside of one of the filter wheels

Instruments that will be ultimately sent to Mars must comply with strict anti-contamination and planetary protection guidelines, and as such cannot be used in field tests prior to launch. Instead prototypes and emulators such as the Aberystwyth University PanCam Emulator (AUPE) are used throughout the development of the PanCam to ensure it is producing scientifically useful data and that this data can be readily processed and understood. Field tests are crucial to the development of new instruments, both to ensure the fidelity of the data returned when used in real environmental conditions, and to enable the creation of best practice processing and analysis techniques, to ensure the most efficient and effective use of these data.

In the summer of 2013 myself and colleagues from Birkbeck University of London, the University of Edinburgh and Aberystwyth University took AUPE and two VNIR spectrometers, one of which was on loan from the NERC Field Spectroscopy Facility, to Námafjall in Iceland. Námafjall lies in the Icelandic volcanic zone and is a popular tourist destination due to its active hydrothermal vents and stunning (and rather alien looking) multi-coloured rocks and soils [figure 2]. This alteration of basaltic lava through hydrothermal activity is a process that is thought to have occurred at some

point on Mars making this an ideal analogue environment to test Martian exploration instrumentation. My PhD is focused on the use of VNIR reflectance spectroscopy using existing instrument types to identify hydrothermal environments on the Martian surface and PanCam is an important instrument in this context.



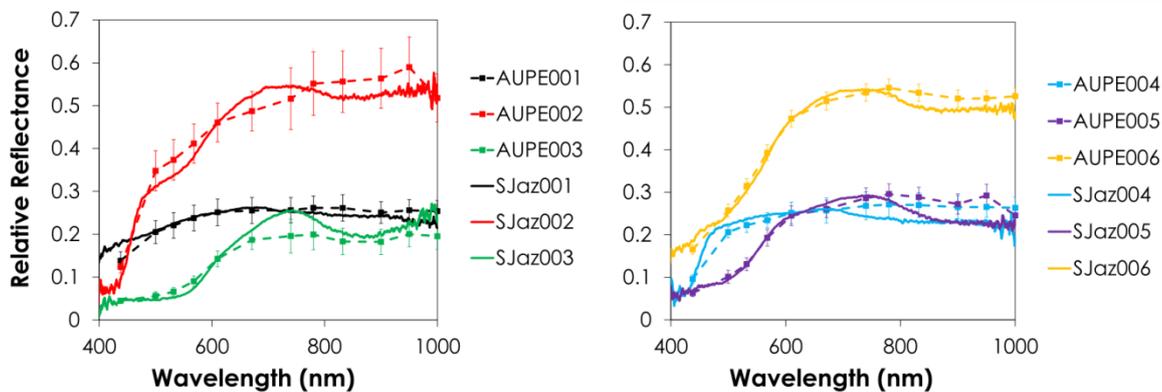
**Figure 2:** Námafjall in Iceland showing a wide range of colours, textures and structures, and numerous active vents

Our primary aims in the field were to collect a full suite of AUPE data products (multispectral image sets, RGB panoramas and high resolution context HRC shots) covering the range of geological features in the area, together with point spectra and rock and soil samples taken from within the AUPE field-of-view to mineralogically characterise the target sites [figure 3].



**Figure 3:** a) using an ASD Fieldspec Pro to collect in-situ VNIR spectra from targets within each region imaged by AUPE; b) AUPE in action

Back in the office the first issue was to ensure the accuracy of the data returned by AUPE. Point spectra taken in-situ were compared with spectra extracted from the AUPE multispectral image sets and found to largely agree within a reasonable error range [figure 4].



**Figure 4:** Some example spectral results showing the in-situ field spectrometer measurements as the solid lines and the corresponding AUPE ROI spectral measurements as dotted lines. Most of the key spectral features are captured by AUPE. The error bars shown correspond to one standard deviation of the average of the pixels that made up each ROI.

The second issue was to check if the full suite of AUPE data products were enough to correctly identify this type of environment. The wavelength range that PanCam is restricted to due to engineering constraints, unfortunately does not extend far enough into the infrared to cover many of the key diagnostic absorptions found in hydrothermal minerals. However when the spectra are taken together with HRC shots of key textural and structural features and RGB panoramas showing wider geological context, the minerals present were able to be accurately narrowed down to specific suites. All together this would be enough to allow a field geologist to make a confident assessment of the type of environment being imaged. Initial results were presented in March 2014 at the 45<sup>th</sup> Lunar and Planetary Science Conference in Houston, USA and are now being prepared for publication.

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## Acknowledgements

This fieldwork would not have been possible without funding from the Geological Remote Sensing Group as well as the Department of Earth and Planetary Sciences at Birkbeck University of London and the Earth and Space Foundation. Equipment on loan from the NERC Field Spectroscopy Facility was also crucial to this work.

## Photo Credits

Photos were taken by Dr Pete Grindrod, Dr Claire Cousins, Mr Matt Gunn and Ms Jennifer Harris

# Two decades of volcano deformation from InSAR: the past, present and future

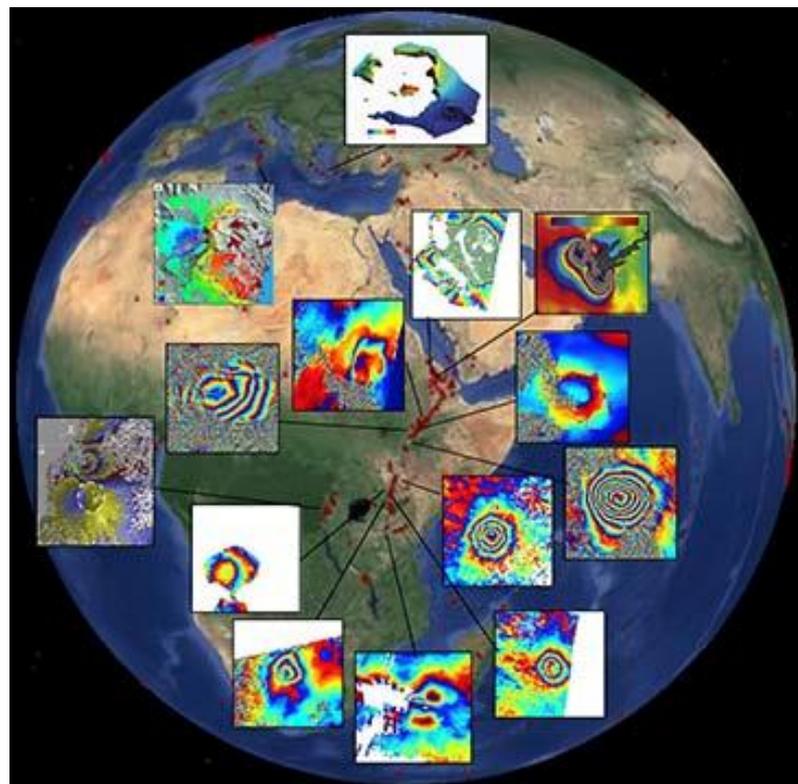


As we await the routine arrival of data from the new European Space Agency Sentinel-1 satellite, it is time to reflect on the past two decades of InSAR and synthesise observations of volcano deformation. A recent study led by the University of Bristol clearly highlights the importance of ground deformation as an indicator of a volcano's long-term eruptive potential. Using InSAR

observations at over 500 volcanoes, the study showed that many (46%) of deforming volcanoes went on to erupt, and almost all (94%) non-deforming volcanoes did not erupt (Biggs et al., 2014). The wide range of observations collated in this study also demonstrates that InSAR is an ideal tool to gauge the eruptive state of volcanoes on an individual, regional and global basis.

## The Past

Since the early 1990s, InSAR data has revolutionised the way in which ground deformation is used as a tool for monitoring and understanding volcanoes. Simple observations of ground motion have long provided insight into the eruptive cycles and magmatic plumbing systems of volcanoes worldwide, but many techniques, such as leveling, are limited to repeat surveys in summer seasons,



A summary of just some of the successful volcano InSAR studies used in the study of Biggs et al., (2014)  
Image credit: University of Bristol press release

requiring weeks of precise measurements to produce only 10s-100s of data-points. In-situ monitoring equipment, such as continuous GPS, is capable of providing geodetic measurements at much higher temporal resolution, but only record motion at a single or small network of points. With the introduction of InSAR came the ability to record ground deformation at millions of data-points, over 10s of km<sup>2</sup>, with repeat times up to every 12 days.

## The Present

Our understanding of volcanic systems has increased inline with these technological developments. From studies based upon InSAR observations, we have learnt about the passage of magma through the crust, hydrothermal systems, conduit processes, plus properties of the



In the past, lengthy ground based surveys were the only way to monitor ground deformation at volcanoes  
Image credit: USGS (J.D. Griggs)

magma itself such as its compressibility. In the last 18 years, 198 volcanoes have undergone systematic InSAR observations of ground deformation (Biggs et al., 2014). Many of these volcanoes have long histories of unrest, warranting systematic measurements, however, the real power of satellite remote sensing is realised when researchers find previously unstudied volcanoes, often considered to be dormant, that are in fact deforming. This is particularly significant in developing countries, which host many of the world's volcanoes, as remote sensing may provide the only indicators of escalating unrest and ultimately, impending eruption.

However, not is all as rosy as it seems. Caveats lie in the actual application of the data, which, in many volcanic settings, can be extremely challenging. Coherence is lost due to snow cover, glaciers, and dense forests, as well as the steep edifice topography and instability of recently deposited material. Where we are able to retrieve signal, interferograms are often dominated by atmospheric noise due to stratified water vapour surrounding the edifice, causing a signal that is correlated with elevation. This is particularly challenging, as volcanic deformation is also commonly correlated with edifice topography.

However, just as the technology has improved, so have methods for dealing with noise sources and the loss of signal due to conditions on the ground. Multi-temporal analysis techniques (that combine multiple interferograms in time) have been instrumental in the improvement of InSAR data analysis. This includes techniques that assume the signal remains constant over time, such as stacking and rate-map formation, and those that are used to investigate the temporal evolution of the signal, such as time-series from small baseline or persistent scatterer interferograms. There have also been advancements in dealing with atmospheric noise via the use of weather models and additional meteorological data. These kinds of advanced InSAR methods are becoming more and more accessible and commonplace, as software for techniques such as StaMPS (Hooper et al., 2007) and  $\pi$ -RATE (Biggs et al., 2007; Wang et al., 2009) is available freely online, along with global weather model data.

My own work has involved testing multi-temporal analysis techniques at Medicine Lake Volcano, northern California, where subsidence has been ongoing since the 1950s. Medicine Lake Volcano, along with the other volcanoes of the Cascade volcanic arc, is one such region where the application of InSAR has been hindered by incoherence and atmospheric noise. I have been investigating the advantages of using multi-temporal analysis techniques, finding that  $\pi$ -RATE and StaMPS offer up to a 60% improvement in coherence compared to raw ENVISAT interferograms.

The testing and development of such advanced analysis techniques will be key to the success of data from the new generation of SAR satellites.

## The Future

The global coverage of Sentinel-1 will no doubt result in the identification of more actively deforming volcanoes, with more routine data collection allowing for a greater number of systematic



Sentinel-1A launched in April 2014  
Image credit: European Space Agency

studies of both new and existing cases of volcanic unrest. One of the limitations of past InSAR analysis has been the use of such data as a retrospective monitoring tool. With the rapid acquisition rate (12 days) of Sentinel-1, moving closer towards near real-time monitoring will be a key focus of those involved in assessing volcanic hazards. This will be in conjunction with establishing bulk automated processing routines to deal with the abundance of new data.

What is clear is that ahead of us lies better quality data at better temporal resolution, allowing the community to

make more detailed observations of volcanic deformation, strengthening existing knowledge, shedding new light, and ultimately allowing us to better protect those who live in the shadow of volcanoes. Now is the time: we are “gearing up for a new era in Earth observation” (ESA Sentinel-1 website).

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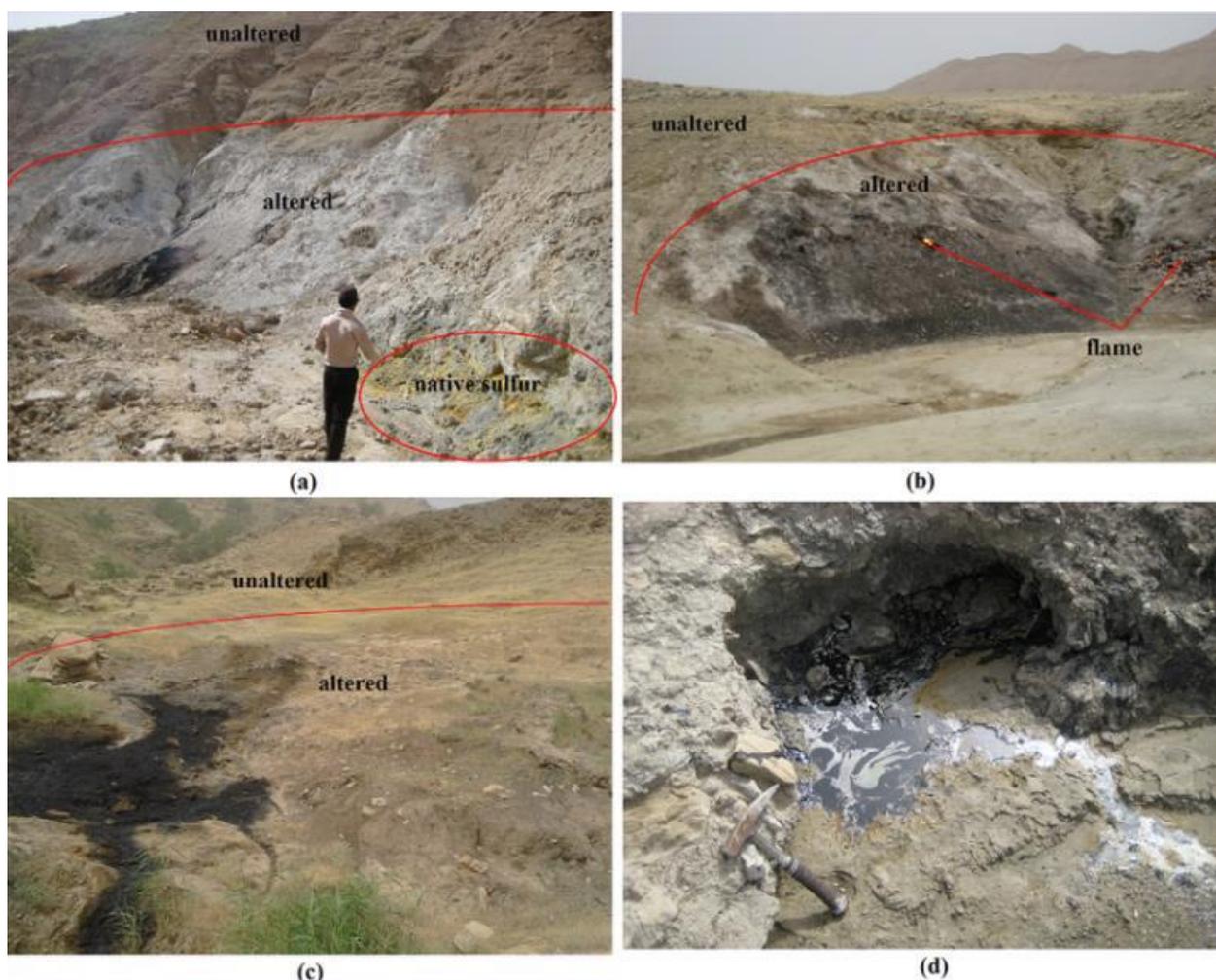
# Characterization and remote detection of onshore hydrocarbon seep-induced alteration



*Freek van der Meer & Frank van Ruitenbeek  
University of Twente, Faculty ITC, Enschede, The Netherlands*

On, March, 6 2014, Mrs. Sanaz Salati successfully defended her PhD dissertation with the title 'Characterization and remote detection of onshore hydrocarbon seep-induced alteration' at the at the University of Twente (Enschede, the Netherlands).

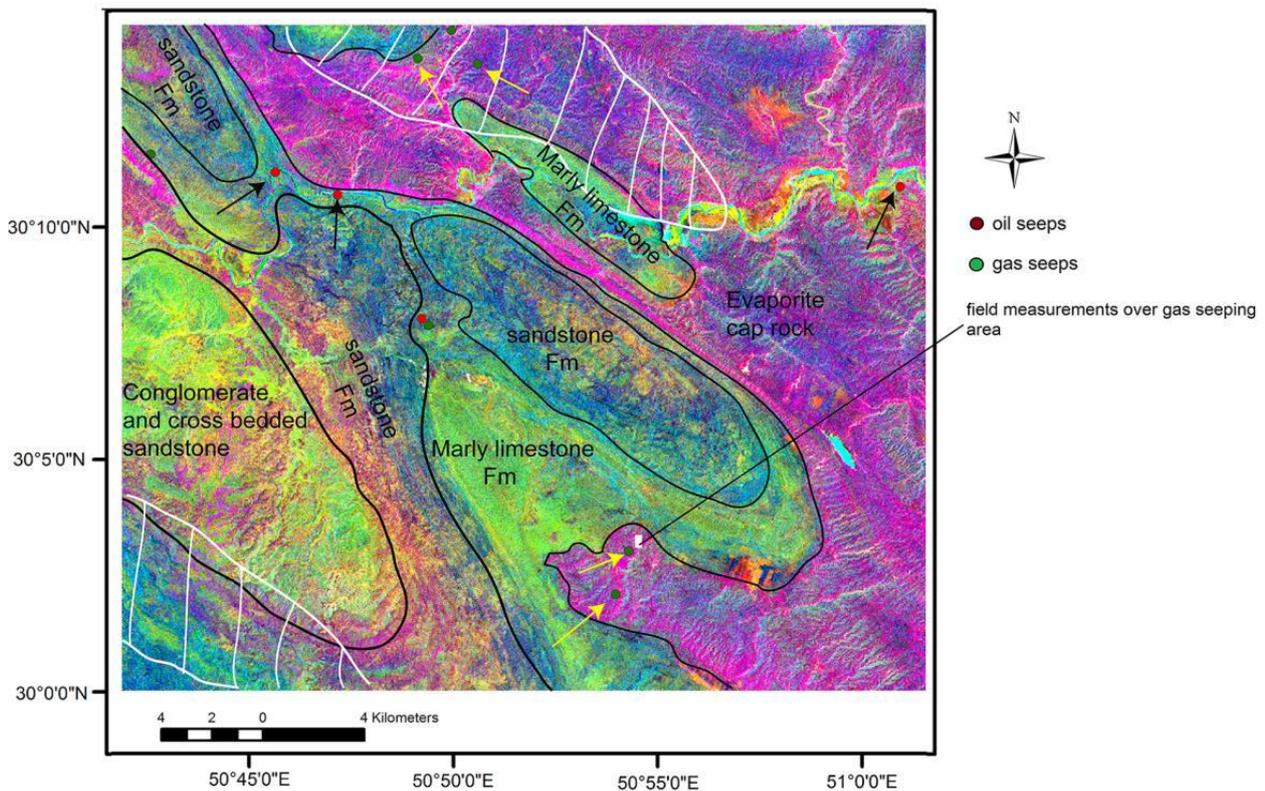
The supervisors of the work were Prof. Freek van der Meer and Dr. Frank van Ruitenbeek. The external examiners were: Prof. de Souza Filho (University Campinas, Brazil), Prof. Marsh (University of Nottingham, UK), Prof. De Jong (University of Utrecht, Netherlands) and Profs. Jetten and Su (University of Twente, Netherlands). In her thesis, Sanaz studied oil and gas seeps in the Zagros mountains and she showed a relationship between seep occurrences and the efficiency of the cap rock sealing of the reservoir.



**Figure** Typical gas (a and b) and oil (c and d) seeps in the Gachsaran and Mishan Formations in the Dezful Embayment, SW, Iran.

The PhD thesis can be downloaded from: [http://www.itc.nl/library/papers\\_2014/phd/salati.pdf](http://www.itc.nl/library/papers_2014/phd/salati.pdf)

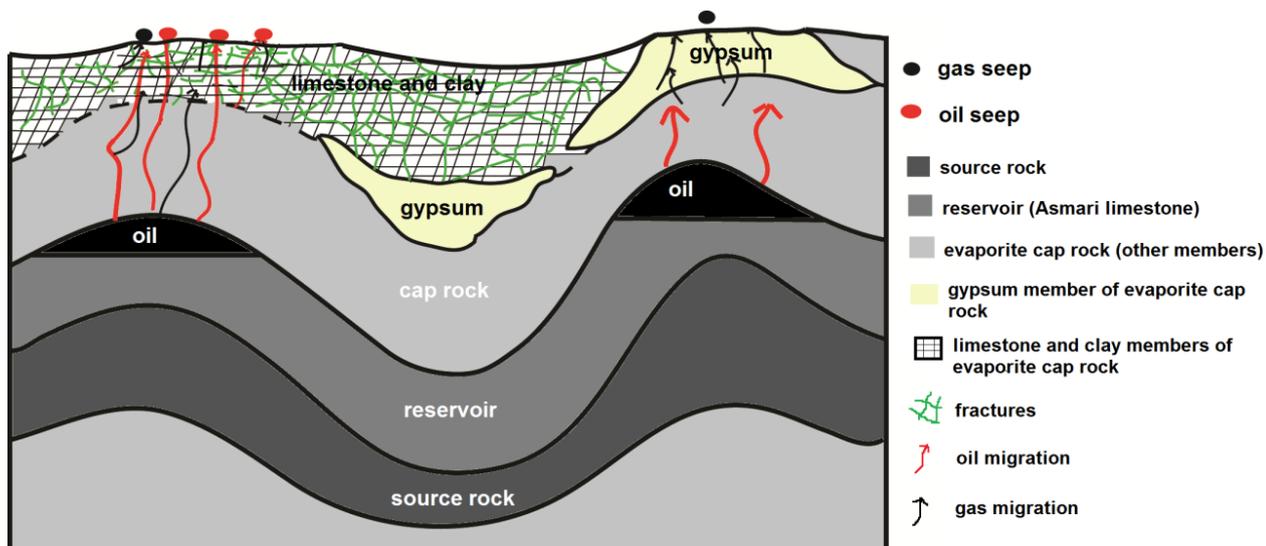
Sanaz Salati studied geology at the University of Tabriz, Iran, and received a BSc in 2003. From 2003 to 2006 she studied Economic Geology at the University of Shiraz, Iran. Her MSc research focused on the urban geochemistry of the Shiraz. In 2007, she was awarded a scholarship to study a PhD in economic geology at the University of Shiraz. From 2007 to 2009 she studied the urban geochemistry of the Shiraz as well as collaborating in several research projects. In March 2009, she started her PhD research at the faculty of Geo-Information science and Earth Observation (ITC), University of Twente, with the scholarship from the European Union (Erasmus Mundus program). At present Dr. Salati is a post-doctoral scientist in the group of Richard Gloaguen at the TU Bergakademie Freiberg.



**Figure:** ASTER color composite of Gachsaran oil field (south of the Dezful Embayment) to show the spatial distribution of oil and gas seeps with different composition of the Gachsaran cap rock (in magenta color). Ratio of  $b_4/(b_6+b_9)$  enhances gypsum (magenta color),  $(b_7+b_9)/b_8$  enhances calcite (green color),  $(b_5+b_7)/b_6$  enhances clay (blue color). Yellow arrows point to areas of the cap rock formation that are rich in gypsum and host gas seeps. Black arrows point to areas of the cap rock formation and other host rocks that are rich in clay and limestone and host oil seeps. White polygons show the extension of subsurface Gachsaran and Bibi-Hakimeh reservoirs.

Below is the summary of the dissertation:

A hydrocarbon seep occurs where due to different pressure in the earth's subsurface, liquid or gaseous hydrocarbons escape to the surface through fractures in the rock and planes of weakness between geological layers. Natural hydrocarbon seeps have long been used in petroleum exploration methods. They are the ends of migration pathways, which may provide indications of the presence of subsurface reservoirs and give the first clues to petroleum producing areas. Many of oil and gas fields around the world have been discovered as a result of drilling in seeping areas. On land, hydrocarbon seep-induced alteration has been widely studied by traditional techniques such as geochemical and geophysical analyses. These methods, however, are expensive, time consuming and only applicable to some observations collected in the field mainly around drilled areas in an active petroleum field. Thus, they cannot be used for mapping alterations and their variations related to different types of seeps and various host lithologies over a large area. Using remote sensing in hydrocarbon seep study may have two approaches; a regional view for supporting stratigraphic and structural interpretations in related basins and direct detection of spectral features of hydrocarbon seep related alteration at the surface and confirm this fact that reservoirs are not entirely sealed and hydrocarbons could escape, reach the surface, and cause alterations in soils, rocks, and vegetation.



**Figure** Schematic model of influence of cap rock heterogeneity on the type of hydrocarbon seeps occur at the surface. Red arrows show oil seep migration and black arrows display gas seep migration.

The emphasis of this thesis is on the geological application of reflectance spectroscopy and multispectral image analyses that allow detection of seep-induced alteration and petroleum basin evaluation. Integration the results obtained from remote sensing studies with geological and geochemical data allowed us to understand processes that caused alterations at the surface. The spatial pattern and spatial distribution of oil/gas seeps and their associated alterations with geological features have been quantitatively studied. The results provided us insights about (a) links between geological structures and two subsets of hydrocarbons seeps and (b) the probability of spatial association of different geological features with two sub-sets of seeps. Two potential geological formations were chosen for subsequent field and laboratory studies.

Analyses the spectral and chemical characteristics of alteration induced by hydrocarbon seep from field data aid in (a) getting a better understanding of oil and gas migration through the stratigraphy in relation to the various types of seeps in the Zagros belt and (b) investigate the potential of detection of hydrocarbon seep-induced alteration for petroleum explorations. The field observations showed that when the mineral composition of the cap rock influence the type of seep occur at the surface and the density of seeps in the stratigraphy. The results of field and lab analyses helped us to select the best suitable test area for image processing and to extract end-members from field observations to aid in image processing.

Boundaries between zones of compositional variations within evaporite cap rock in the Zagros petroleum system were mapped using ASTER imagery and gas-induced alteration was detected using the WorldView-2 and ASTER imageries. Various image processing and statistical analyses of the two datasets captured the alteration zone and potential areas of hosting gas seeps. The outcomes of this research demonstrated that the application of remote sensing study of hydrocarbon seep in the oil and gas industry could be widened by basin interpretations at a regional scale. Understanding the relationship between hydrocarbon seeps and geology provides information about petroleum basins particularly about the influence of compositional variation within the cap rock formation on the types of seeps occurring at the surface and movement of hydrocarbons in the stratigraphy. Such studies provide a framework for identifying permeable zones and evaluating the efficiency of cap rocks related to petroleum systems. This would provide valuable information about the efficiency of different types of cap rocks; thus, they can have implications for petroleum reservoirs at global scales.

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**Figure** Sanaz Salati (middle, grey-blue dress with diploma) and her committee at the public defence of the thesis.

## SEPTEMBER

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

["New Sensors for a Changing World"](#)

*The GRSG is chairing a session on geological aspects*

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*



**RSPSoc 2014**  
**Annual Conference**  
Aberystwyth September 2nd - 5th  
"New Sensors for a Changing World"

**Key Dates**

- Call for Abstracts:** January 2014
- Abstract Deadline:** April 2014
- Conference:** September 2nd - 5th 2014

**Venue**

**Aberystwyth University**

Hosted by

 **Environment SYSTEMS**

 **PRIFYSGOL ABERYSTWYTH UNIVERSITY**

**Themes**

The Remote Sensing Community is entering a new era where, with the development of new ground, airborne and space borne sensors, we have new opportunities to observe, map and monitor the Earth at multiple spatial and temporal scales.

RSPSoc 2014 aims to highlight past and current **research, education and commercial** opportunities relevant to this new capability across a wide range of applications including **climate change, ecosystem dynamics, agriculture, forestry, energy, health, water and weather.**

[www.rspsoc2014.co.uk](http://www.rspsoc2014.co.uk) [info@rspsoc2014.co.uk](mailto:info@rspsoc2014.co.uk)



14<sup>th</sup> – 18<sup>th</sup>: **Near Surface Geoscience 2014**, Athens

EAGE is pleased to invite you to the [International Conference and Exhibition on Near Surface Geoscience](#), to be held from 14-18 September 2014 in Athens, Greece. Near Surface Geoscience 2014 will consist of two sub-conferences: The 20<sup>th</sup> European Meeting of Environmental and Engineering Geophysics' and the 'First Applied Shallow Marine Geophysics Conference'. The exhibition will be held parallel to both conferences and will be central place for companies from all disciplines to display their products and services.

The call for paper deadline for both conferences was 15 April 2014.

The 20<sup>th</sup> European Meeting of Environmental and Engineering Geophysics is set up to highlight new achievements of geoscientific methods applied for the investigation of the shallow parts of the earth and its surface.

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.

## DECEMBER

15<sup>th</sup> – 17<sup>th</sup>:

### **25 years of Geological Remote Sensing – GRSG AGM 2014**

The Geological Remote Sensing Group (GRSG) announces the second call for papers for the 25<sup>th</sup> Anniversary meeting. To celebrate our 25<sup>th</sup> anniversary we have invited the founding chairman, Geoff Lawrence, to give a keynote presentation which will track how Geological remote sensing has progressed and will be entitled '*25years of Geological Remote Sensing: Then and Now*'. There will also be keynotes throughout the conference explaining the history and significance of remote sensing applied to the following areas:

Oil and Gas: Martin Insley (*Tullow Oil*)

RS and disaster management : Richard Teeuw (*Portsmouth University*)

Mineral Exploration: Dan Taranik (*Exploration Mapping*)

Engineering applications: Jason Manning (*Arup*)

InSAR and Geohazards: TBC

**[See poster for the second call for papers](#)**

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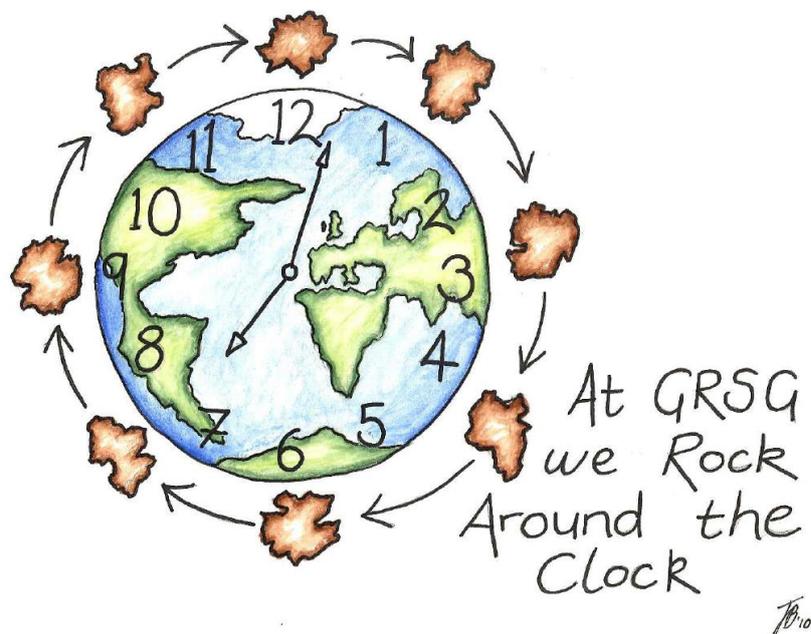
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## Astrium GEO

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## Barrick Gold Corporation

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Senior Geologist, Exploration  
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Tel: 416 3077366  
Fax: 416 8610008  
E-mail: [xzhou@barrick.com](mailto:xzhou@barrick.com)  
Website: [www.barrick.com](http://www.barrick.com)



## British Geological Survey

Luke Bateson  
Keyworth, Notts, NG12 5GG  
Tel: 0115 936 3452  
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Website: <http://www.bgs.ac.uk>



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Website : [www.erdas.com](http://www.erdas.com)

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Website: [www.exelisvis.eu](http://www.exelisvis.eu)



### **Geoimage Pty**

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### **ITC International Institute for Geo-Information**

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**Shell Exploration & Production**

**Shell International Exploration and Production**

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**Filho Geotechnologies Applied to Natural Resources Research**

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# GRSG Membership 2014

Please print out and sign the completed form (we need your signature) and scan and email or return by fax or post

[treasurer@grsg.org.uk](mailto:treasurer@grsg.org.uk)

Note membership can also be applied for on our website: <https://www.grsg.org.uk>

**Eric Peters**  
Consultant  
10 Westfield Avenue,  
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AL5 4HN  
Tel: 44 (0) 1582 713347

**(Please print all details clearly):**

Full name		
Position		
Company/Organisation		
	Billing address	Correspondence address (if different)
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Postcode/Zip		
Country		
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## PhD and Post Doc opportunities announcement

The European Center For Geodynamics and Seismology (ECGS - Luxemburg)  
The Royal Museum for Central Africa (RMCA - Belgium)  
The Spatial Centre of Liège (CSL - Belgium)

are seeking candidates for:

- 2 Post doc for 2 years
- 2 PhD for 3 to 4 years

These 4 successful candidates will strongly interact between each other and with the scientific institutes involved in the "RESIST" project (see below).

### **The Context:**

The Kivu rift area is part of the East African rift system. It is also the most-populated region of Central Africa and exposed at the same time to one of the highest level of geohazards on the continent. This studied region includes the Virunga Volcanic Province (VVP) in eastern Democratic Republic of the Congo (DRC), western Rwanda and Burundi, as well as southwest Uganda. That area cumulates a rare combination of seismic, volcanic and landslide hazards (with highly variable recurrence rates and potential impact) in conjunction with increased demographic pressure which makes Kivu particularly threatened by natural disasters.

### **The project:**

The RESIST project is the continuation of a long-standing research lead by the Royal Museum for Central Africa (RMCA), the National Museum for Natural History (NMNH) and the European Centre of Geodynamic and Seismology (ECGS). RESIST partners are RMCA, NMNH, the Spatial Centre of Liège (CSL), the Belgium Institute of Spatial Aeronomy (BIRA-IASB) and the National Aeronautics and Space Administration (NASA). RESIST is targeting the understanding of the source mechanisms driving volcanic eruptions and landslides in the region by 1) filling the gap of knowledge on ground-based level through the installation of the densest seismic and infrasound network ever deployed in the region and first UV camera for SO<sub>2</sub> monitoring and 2) combining this information with innovative Earth Observation approaches, using both archived data and new spaceborne data in radar, optic, gas and precipitation monitoring. RESIST will exploit ground-based instrument networks, field surveys and modern EO techniques (Split Band and MSBAS InSAR time-series, SO<sub>2</sub> flux, TRMM) to study and characterize the changes in the monitored parameters that could/should be considered as significant in terms of volcanic and landslide (LS) processes.

The project that will start on 1<sup>st</sup> December 2014 and last 4 years is funded by the Belgian Science Policy Office and the Luxembourg National Fund for Research in the frame of the "STEREO III" Research Program for Earth Observation. It is closely related to other past and ongoing projects:

- GORISK ([www.ecgs.lu/gorisk](http://www.ecgs.lu/gorisk)),
- GeoRisCA ([www.africamuseum.be/georisca](http://www.africamuseum.be/georisca)),
- Vi-X (<http://eo.belspo.be/Directory/ProjectDetail.aspx?projID=897>),
- AfReSlide ([www.africamuseum.be/afreslide](http://www.africamuseum.be/afreslide); <http://research.vub.ac.be/afreslide>).

### **Postdoc 1 (ECGS – Luxemburg):**

Successful candidate will contribute to "RESIST" and "GeoRisCA" (see links above), two international projects co-led by National museum of natural history and the European Center for Geodynamics and Seismology (NMNH/ECGS) and the Royal Museum for Central Africa (RMCA) and funded by BELSPO and the Luxembourg National Fund for Research (FNR).



He/She will contribute to the processing, analysis and interpretation of the large data base of space borne and ground based data acquired over the Kivu basin and the Virunga volcanoes.

Application of these methods to other targets (such as the ground deformation related to post-mining activity in the Luxembourg, French and German bordering areas) or applications suggested by the candidate can be envisaged.

**Required skill:**

The candidate should possess a Master degree in a relevant area and a PhD (<09/2014) in physics, geophysics or a related discipline. Experience in InSAR processing, InSAR time series methods and ground deformation modeling and inversion are mandatory. Additional experience in the processing of GPS and/or seismic data and/or volcanology and tectonic would be an advantage.

The candidate is expected to operate autonomously in an international project team, requiring initiatives, organizational and communication skills, and respect for project deadlines.

We expect the candidate to be fluent in spoken and written, scientific English, and if possible, in French.

**Salary:**

Salary will be based on an AFR Postdoc Grant from (FNR), topped-up by a contribution of the host institution (NMNH/ECGS). The candidate will hence contribute to a joint application to the AFR Postdoc Grant Scheme (see <http://www.fnr.lu/en/AFR-PhD-Postdoc-Grants/Postdoc-Grants>). Average success rate of applications to AFR is 50 %; success rate of former ECGS applications to AFR is 4/4.

Estimated annual gross salary (AFR Grant Scheme + host institution contribution, including employer's charges) : 69000 EUR / year

**Duration:** this is a 2 year position

**Deadlines:**

- Application to ECGS: **July 20th 2014**
- Joint application (successful candidate + ECGS) to AFR Grant Scheme: September 9th 2014.
- Funding decision: early December 2014 (average success rate of applications 50 %; success rate of former ECGS applications: 4/4)
- Start of the project: early 2015

**Application and contact:**

Please submit your application in the form of one PDF (including a motivation letter, a detailed CV, copies of certificates, and 3 letters of recommendation). Application must be addressed by e-mail to:

Dr Nicolas d'Oreye de Lantremange ([ndo@ecgs.lu](mailto:ndo@ecgs.lu)),  
Dept. Geophysics/Astrophysics  
National Museum of Natural History  
European Center For Geodynamics and Seismology  
19 rue Josy Welter  
L-7256 Walferdange  
Gd Duchy of Luxembourg

**Postdoc 2 (RMCA-Belgium):**

The successful candidate will work on the large InSAR data archive as well as on future acquisition (e.g. SENTINEL) covering the two active volcanoes of the Virunga to analyze and model the detected ground deformation patterns. He/she will also use InSAR techniques for the detection, analysis, and model inversion of ground deformations of other origins (mass movements, earthquakes). He/she will contribute to the RS multi-sensors integrated approach for the global study of the involved mechanisms.

He will actively participate to the scientific discussions with the teams involved and be involved in the RESIST and GeoRisCA projects (see links above).

**Required skill:**

The candidate is expected to hold a Master degree in a relevant area and must hold a PhD preferably in Earth Sciences, Geography, Geophysics, Remote Sensing or a significant equivalent. The ideal candidate should have an analytical mind, be experienced in InSAR processing, modeling and inversion, and be able to demonstrate an experience in the processing of (very high resolution) satellite data. A field experience (field geology and/or monitoring instrument deployment) is an asset.

The candidate is expected to operate autonomously in an international project team, requiring initiatives, organizational and communication skills, and respect for project deadlines.

We expect the candidate to be fluent in spoken and written, scientific English, and if possible, French and/or Flemish.

**Salary:**

Estimated annual gross salary (including employer's charges) : 46.000 EUR / year + holidays allowance and a year-end bonus.

**Duration:** this is a 2 year position

**Deadlines:**

- Application to RMCA: **July 20th 2014**
- Start of the contract: **at the earliest from September 2014**

**Application and contact:**

Please submit your application in the form of one PDF (including a motivation letter, a detailed CV, copies of certificates, and 3 letters of recommendation). Application must be addressed by e-mail to:

[HR-RH@africamuseum.be](mailto:HR-RH@africamuseum.be) with copy to [francois.kervyn@africamuseum.be](mailto:francois.kervyn@africamuseum.be)

Royal Museum for Central Africa  
Dept. of Earth Science / Natural Hazards Unit  
13, Leuvensesteenweg  
3080 Tervuren  
Belgium

**PhD 1 (RMCA – Belgium):**

The candidate will conduct original research in the context of the RESIST project, related to the analysis of multi-scale (remote sensing) data from very high- to low resolution data. His/her research will address the evolution over time of such EO data combined with other (ground based network, catalogues, field observations) to detect and study geohazards (landslides, volcanic activity, earthquakes) occurrence, dynamic and evolution. The candidate will confront his/her results to other approaches developed by the research group. Under the supervision of the RMCA Natural Hazards Unit team, the candidate will work in strong collaboration with the other PhD and Postdoc candidates of the RESIST project.

**Required skill:**

The PhD candidate will hold a MSc in Earth Sciences, Geography, Remote Sensing, Environmental Science, or equivalent experience. He/she should have an analytical mind, a solid working knowledge of quantitative remote sensing and GIS methods. Previous experience with applications of remote sensing to surface processes will be beneficial. The candidate is expected to be fluent in English, and have French or Flemish as mother tongue. He/she will demonstrate fluency with a publication (MSc thesis or other) as first author.

Field work in the region of interest is foreseen; the candidate should be prepared to work in a difficult environment.

**Salary:**

Grant's estimated **net** salary/month: 1800 EUR



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AFRICA

**Africa**  
TERVUREN

**Duration:** this is a 2+2 year position

**Deadlines:**

- Application to RMCA: **September 30<sup>th</sup> 2014**
- Start of the contract: **at the earliest from December 2014**

**Application and contact:**

Please submit your application in the form of one PDF (including a motivation letter, a detailed CV, copies of certificates, and 2 letters of recommendation). Application must be addressed by e-mail to:

[HR-RH@africamuseum.be](mailto:HR-RH@africamuseum.be) with copy to Dr. F. Kervyn ([francois.kervyn@africamuseum.be](mailto:francois.kervyn@africamuseum.be)) and Dr. O. Dewitte ([olivier.dewitte@africamuseum.be](mailto:olivier.dewitte@africamuseum.be))

Royal Museum for Central Africa  
Dept. of Earth Science / Natural Hazards Unit  
13, Leuvensesteenweg  
3080 Tervuren  
Belgium

**PhD 2 (CSL – Belgium):**

The Centre Spatial de Liège is seeking a candidate for a 3-year doctorate position in Synthetic Aperture Radar (SAR) advanced interferometric techniques and ground deformation studies.

The selected candidate will contribute to the development of an advanced differential interferometric processing chain combining Split Band interferometry (SBInSAR) and Multi-dimensional Small Baseline Subset (MSBAS) techniques to perform ground deformation measurement and monitoring on the areas of interest using both archived and new satellite SAR images.

Under the supervision of the CSL Signal Processing Lab team, he/she will work in strong collaboration with the other PhD and Postdoc candidates of the RESIST project.

**Required skill:**

The PhD Candidate will hold an MSc in Physics or physics engineering. He/she should have an analytical mind, a very good knowledge in signal theory and a demonstrated interest in Earth sciences. Programming skills in C are mandatory.

The candidate is expected to be fluent in English. He/she will demonstrate fluency with a publication (MSc thesis or other) as first author.

**Salary:**

Estimated annual gross salary: 45500 EUR / year

**Duration:** this is a 3 years position

**Deadlines:**

- Application to CSL: **August 20<sup>th</sup> 2014**
- Start of the contract: **at the earliest from December 2014**

**Application and contact:**

Please submit your application in the form of one PDF (including a motivation letter, a detailed CV, copies of certificates, and 3 letters of recommendation). Application must be addressed by e-mail to:

Dr. Dominique Derauw ([dderauw@ulg.ac.be](mailto:dderauw@ulg.ac.be)) (with copy to Dr. Christian Barbier ([cbarbier@ulg.ac.be](mailto:cbarbier@ulg.ac.be)))

Avenue du Pré Aily  
4031 Angleur  
Belgium

**Host institutions:**

**The European Center for Geodynamic and Seismology**



The European Center for Geodynamics and Seismology is a small research unit created in Luxembourg in 1988 in the frame of an Open Partial Agreement (OPA) established by Governments from the States Member of the European Council. ECGS is co-funded by the Grand Duchy of Luxembourg since 1994. ECGS and the National Museum of Natural History of Luxembourg closely collaborate through various projects and activities. ECGS and NMNH share a building in Walferdange offering all the required facilities: offices for permanent and visiting scientists, PhD and Postdocs, laboratory, library, strong computer infrastructure, diverse geodetic instruments as well as an apartment for visiting scientists. NMNH/ECGS developed a recognized expertise in seismology as well as spaceborne geodesy. Nowadays research activities focus on two major poles: one started in 2008 and covers seismological studies on various scales and regions, with particular emphasis on earthquake ground motion studies, real-time and engineering seismology, seismic structure investigations, wave propagation in complex media and signal processing for active and passive seismic experiments. The other pole started in 2005 and deals with spaceborne geodesy and radar interferometry (InSAR) for crustal deformation studies. That state-of-the-art space-borne geodetic technique was a natural complement to the conventional ground-based techniques used for decades at NMNH/ECGS (seismic, tilt, GPS, strainmeters, gravimeters etc..). Since 2006 NMNH/ECGS is involved in the study and the monitoring of Nyiragongo and Nyamulagira volcanoes in DR Congo.

More information on:

<http://www.ecgs.lu>

<http://www.fnr.lu/en/AFR-PhD-Postdoc-Grants/AFR-in-Brief>

<http://www.fnr.lu/en/AFR-PhD-Postdoc-Grants/Postdoc-Grants>

#### **The Royal Museum for Central Africa**

The RMCA is a federal multidisciplinary scientific institute with a focus on Africa and on Central Africa more specifically. With solid capacity (research and collections) in both Human and Natural sciences, the research is organized through three major departments: Earth sciences, Human Sciences and Biology.

The RMCA has field research activities in more than 20 African countries, and its scientific work is enhanced through development collaboration actions in Africa that directly lead to strengthening national research capacities in several African countries.

Since 2014, the Earth science Department has been restructured into 3 services including the Natural Hazards Service. Its scientific research activities are focused on the identification, assessment, study and analysis of geohazards and georisks in Africa.

More information on:

<http://www.africamuseum.be/research/earth-sciences>

<http://www.africamuseum.be/about-us/jobs>

#### **The Centre Spatial de Liège**

The Centre Spatial de Liège is part of the University of Liège. Created in 1969, the Centre Spatial de Liège is a research center dedicated to space instrumentation including environmental test facilities and high level laboratories. It works for the European Space Agency (ESA), for the space industry and for regional firms.

CSL developed a recognized expertise in the frame of SAR interferometry (InSAR), differential interferometry (DInSAR), coherence tracking, SAR polarimetry and polarimetric interferometry (PolSAR & PolInSAR), split band interferometry (SBInSAR) and spectral coherence. For each of these techniques, CSL developed and validated its own tools. Collaborations through applicative projects allows enhancing our expertise, improving existing tools and developing new techniques.

More information on:

[http://www.csl.ulg.ac.be/jcms/c\\_5053/en/home](http://www.csl.ulg.ac.be/jcms/c_5053/en/home)

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