



THE QUARTERLY NEWSLETTER OF
THE EUROPEAN GEOSCIENCES UNION

ISSUE 7, SEPTEMBER 2013

YOUNG SCIENTISTS

Articles on research by young scientists

New EGU young scientists website

Being a young scientists representative for the EGU

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EDITORIAL

A substantial number of EGU members are young researchers and over a third of participants at our annual General Assembly are graduate and undergraduate students. Therefore, it makes sense for the EGU to develop new products aimed specifically at young scientists.

This is why I couldn't be more pleased to announce the latest change to GeoQ: on suggestion from our readers, we've just introduced a brand new section in the EGU newsletter dedicated entirely to young scientists. The new section replaces On the Web, which was less successful among our readers and whose content is easily transferred elsewhere in the newsletter or to the [EGU blog](#).

Doing more for young scientists was the driving force behind creating a [new EGU website for young scientists](#) and [adding several young researchers to our blog network](#). And, of course, it is also what motivated the creation of the new GeoQ Young Scientists section and the theme of this edition of the newsletter. The cover, featuring recent recipients of the Division Outstanding Young Scientists Awards and the Arne Richter Award for Outstanding Young Scientists, reflects this.

In this issue of GeoQ, all stories in the Articles section feature young scientists. Adam Booth, a young researcher himself, writes about the work of Monika Ivandic, a post-doctoral researcher in geophysics at Uppsala University in Sweden, on seismic monitoring of CO₂ sequestration. Eline Vanuytrecht, also a young researcher, reports on the work of yet another Sweden-based young scientist: her article features Wim Clymans' research on the biogeochemical silicon cycle. Becky Summers' story is on icequakes, the exciting research topic of Emma Smith, a PhD student at the British Antarctic Survey.

The EGU News section is also of particular, but not exclusive, interest to young scientists, featuring more information about the new EGU website for young scientists and the most recent additions to our blog network. This section also highlights the upcoming EGU

elections: until 30 September, we ask members to propose candidates for Union president/vice-president and general secretary.

On the first Young Scientists section of the newsletter, we feature an article by Jennifer Holden. Being the young scientists representative for the Natural Hazards Division and having worked in the EGU Executive Office for a year on outreach to young researchers, Jennifer is in excellent position to advise young scientists interested in getting involved with the EGU and its activities. In her article, she explains what it means to be a division young scientists representative and what you can gain from it.

I hope everyone, students and early career researchers in particular, enjoy this edition of GeoQ. For more information about EGU activities and products for young scientists, make sure to contact EGU Communications Officer Sara Mynott (mynott@egu.eu), who is now the EGU Office contact person for young researchers.

Bárbara Ferreira
GeoQ Chief Editor & EGU Media and Communications Manager



The current and previous editions of the EGU newsletter (GeoQ and The Eggs) are available online at www.egu.eu/newsletter.

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COVER PHOTO: Montage of photographs of EGU young scientist awardees in 2012 and 2013. For more information check the [Arne Richter Award for Outstanding Young Scientists](#) and [Division Outstanding Young Scientists Award](#) pages on the EGU website.

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Carbon: captured!

Anthropogenic emission of carbon dioxide is a key influence on the global climate change that has been observed over the last century. While government agencies set long-term goals to cut carbon emissions, pioneering research is exploring ways of dealing with today's problem today. Carbon capture and storage (CCS) represents one promising fix to this challenge: we're familiar with extracting oil, gas and water from deep subsurface reservoirs, so why not inject our waste emissions back underground and make use of some spare space? [Dr Monika Ivandic](#), a post-doctoral researcher in geophysics at [Uppsala University](#) in Sweden, is using seismic imaging methods to monitor CCS operations as part of the [CO₂SINK](#) and [CO₂MAN](#) projects, making sure that captured carbon stays well-and-truly captured.

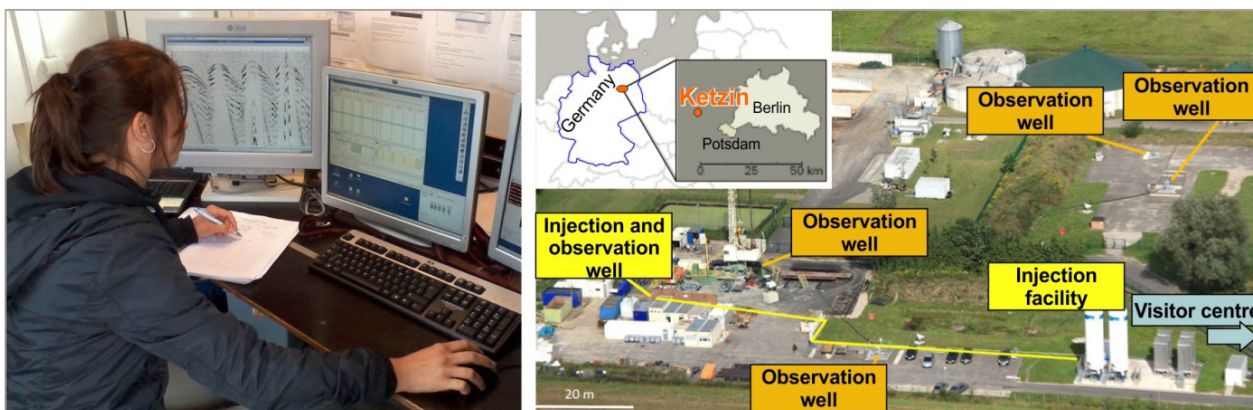
"Our projects examine whether geological storage is an option for reducing CO₂ emissions," Ivandic says. "A critical component of long-term CCS is our ability to adequately monitor the movement of CO₂ in the subsurface." So how is this done? In essence, Ivandic conducts time-lapse photography of the subsurface CO₂ plume, only at the seismic scale. By repeating a seismic survey at the same site, she builds up a series of images from which the growing subsurface volume of CO₂ can be monitored. "Time-lapse seismic surveys have been widely adopted for measuring subsurface fluid flow," she tells me. The general trick is that gas injection changes the physical properties of the subsurface reservoir – for example, reducing its bulk density – which in turn changes the reservoir's seismic response. Careful seismic data acquisition and processing can then map where those changes are taking place.

The gas injection in question takes place west of Berlin at the [Ketzin CCS study site](#), Europe's first and longest-lived on-shore CO₂ storage facility (Martens et al., 2011). Since 2008, Ketzin has been pumping CO₂ into saline sandstone aquifers, sealed beneath impermeable mudstones some 640 m below the ground. In 2005, prior to the start of CCS operations, researchers performed a baseline seismic survey and then repeated it for comparison in 2009 and 2012, in which time over 65,000 tonnes of CO₂ had been injected.

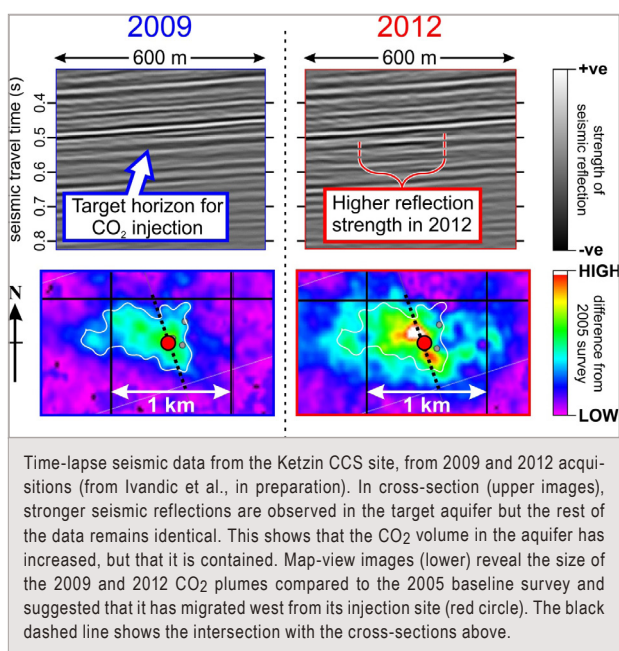
With some pride, Ivandic states that "the monitoring methods used at Ketzin are among the most comprehensive in the field of CO₂ storage." Injection will cease this year, marking the first time that a CCS reservoir has been monitored throughout and beyond its operational cycle.

Ivandic's seismic images (next page) show clear changes in the subsurface – both in cross-sectional (upper) and plan (lower) views – which are directly attributable to the growing gas plume. Of course, there's a real need for such comprehensive study: the problem with injecting thousands of tonnes of free-spirited gas into the ground is that it doesn't always stay where you need it to. In fact, Ketzin itself proves that you should always expect the unexpected. Theoretically, the CO₂ was expected to migrate north into the highest part of the reservoir. "That's not what we're observing at the moment," says Ivandic, who tells me that lithological variations in the reservoir are causing the gas to head west. "In spite of very detailed data, fine-scale reservoir structure can be difficult to discover and can seriously affect the CO₂ migration. That's why time-lapse seismic imaging of the CO₂ plume evolution during and after injection is crucial." The next seismic survey is scheduled for 2015, and Ivandic is "really curious to see how the reservoir and plume will behave once the site is closed. An exciting period is ahead of us!"

Despite its unexpected migration, the good news at Ketzin is that the CO₂ looks to be locked away. But such operations are clearly not without risk, and Ivandic's group has navigated a fine line between scientific discovery, environmental legislation and societal impact. "The safety of the sequestration process is the most crucial aspect, for both man and nature, and thus for other CCS projects." Some commercial injection operations have encountered strong opposition from local German stakeholders, but Ketzin has been well-accepted by local politicians and public alike. While this is partly down to its non-commercial scale, it is also related to the fact that Ivandic's group has actively engaged with the local community, for example by holding weekly outreach and education events at a [visitor centre](#).



Left: Dr Monika Ivandic oversees seismic acquisitions at the experimental site in Germany. Right: Aerial view over the Ketzin CCS facility, close to Berlin, Germany (Adapted from <http://www.co2ketzin.de/en/pilot-site-ketzin/summary.html>)



Worldwide, interest in CCS is growing – something Ivandic has experienced first-hand. Many countries, including her homeland of Croatia, have no CCS operations but have estimated their potential storage capacity from data archives or from regional distributions of suitable reservoirs. Such estimates keep increasing, but [The World-watch Institute](#) suggests that today's seven active and planned CCS operations [could only store 0.5% \(35 million tonnes\) of the CO₂ emitted in 2010](#) – hence CCS does not yet provide the answer to the global emissions challenge. Nonetheless, CCS expertise is in

demand and, this year, Ivandic has completed a marathon schedule of workshop and conference attendance presenting CO₂MAN's latest observations ([including at April's EGU General Assembly](#)). Indeed, she was surprised to find that “the work and results attracted the attention of scientists not even involved in CCS projects!” Clearly, the world is becoming fascinated by grounded gas.

Adam Booth

Post-doc at Imperial College London, UK

More information

Monika Ivandic obtained her PhD from IFM-GEOMAR (Kiel, Germany) in 2008, then worked back in her native Croatia on a variety of geophysical projects for geotechnical and civil engineering applications, and started her post-doc at Uppsala in 2011. For those embarking on a post-doctoral career, Monika has the following advice. “Be ready for short-term contracts. More than a third of academics are on temporary contracts, a situation which results in frequent changes of job and city.” However, such diversity also brings rewards. “It brings a lot of excitement and dynamics to your life! And as for the science, that's always a new page in your career.”

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The real Silicon Valley

On the pathways of silicon on its way to the sea

Everybody knows Silicon Valley, but how many people can tell you about the importance of silicon in nature? One who surely can is Dr Wim Clymans. He is a young post-doctoral scientist at the Geology Department of Lund University in Sweden who dedicates his research to silicon and its biological role. “Silicon is highly underappreciated!” he starts. “People know oxygen, carbon, maybe nitrogen and phosphorus, but hardly anybody has heard of silicon as an important nutrient. Yet, it is vital for plankton in the oceans and other small forms of life in rivers. Silicon forms one of the base components for a well-balanced food system and is, therefore, very relevant,” he explains. “Silicon travels from the land to the ocean via rivers and over-land flow in the valleys but, on its way, it can be fixed by vegetation. In our research, we delve deeper into the pathways of silicon on its road to the sea. This is important because, due to human interventions and climatic changes, the supply of silicon from the land to the sea may become distorted and the precious food system in rivers and seas may be altered.”

Clymans and his colleagues have monitored several river catchments. In the old Meerdaal Forest in Belgium, for example, they took measurements for three years, equipping the area with devices to

monitor the rainfall, the flow in the main stream and the presence of silicon in water samples. They examined this element in more than 800 samples of soil and river water that were collected in the course of this three-year period, which included some storm episodes.

Clymans detected notable differences in the amount of silicon in the stream in winter/spring and in summer/autumn. In a [recent paper](#) published in *Biogeochemistry*, he elucidated the reasons for this variation: “In contrast to larger and less densely forested areas, water stays only a few hours in the stream before it leaves our catchment and the stream is largely shaded. Biological activity in the river is thus low, and so is the uptake of silicon within the river. This led us to conclude that the seasonal variation must be related to processes that occur on the land, and to the connection between the land and the river.” Moving the focus to the land, Clymans explains the varying link between the water in the soil around the stream and the stream itself: “In winter and spring, the soil water is in close contact with the stream because the soil is wet. Thus, rain easily drains via the soil to the river. In summer and autumn, the soil is drier and the connection between the soil water and the stream

is much weaker.” This is one explanation for the varying amount of silicon in the river over the seasons.

In addition, the researchers also revealed that the amount of silicon in the soil water – affected by vegetation and soil disintegration – itself varies. Soil disintegration results in the release of silicon while uptake by vegetation can temporarily hold it. The dominance of one process over the other is highly dependent on temperature and differs among the seasons. Yet, for a long time, there has been a balance between the uptake and release of silicon over the years in old forests. “It is not inconceivable that global warming can distort this balance in the future,” reasons Clymans.

Exciting storms

More exciting than the rippling water during most of the year were the occasional storms. During these events, the team automatically collected samples covering the entire storm period. They found that during a heavy rain shower, the amount of silicon in the river did not decrease drastically. This may sound counterintuitive because we could expect that heavy rainfall, which can temporarily increase the volume of water leaving the catchment up to 100 times, would wash down the catchment and lead to a drop in silicon following the first rain peak. “We observed that the amount of silicon in the river water only drops slightly and recovers quickly after a storm,” explains Clymans. “Thus, silicon is not merely washed out of the soil by rain water.” The researchers realised that there should be a second mechanism in action, keeping the element at a roughly constant concentration in the river. When it rains, silicon-poor rainwater flushes ‘old’ silicon-rich soil water out of the soil and into the river water, which maintains the supply of silicon.

Despite this tendency towards a constant silicon concentration in the river, Clymans fears that disturbances of the natural balance can have a large impact. “From our study, it is clear that the age-old water cycle in the forest is the major control factor on the pathways of silicon. We, humans, can have a large impact on this through the expansion of agricultural land or climatic changes induced by the emission of greenhouse gases. This inevitably alters the transport of



Wim Clymans probing the forested ‘silicon valleys’ at Forêt de Houssière, Belgium. (Credit: L. Fondu)

silicon to the oceans. At the bottom of the food chain, changes in silicon supply can get a whole cascade going: a known consequence is the harmful bloom of algae, which lowers the oxygen in the river and leads to the death of fish.”

And could these changes in the silicon cycle affect Silicon Valley, or at least the production of the silicon-based microchips used in our computers and smartphones? “No, they are quite unrelated, Clymans answers. “Our research focuses on the biological form of silicon while microchips are made of pure silicon crystals, which do not disintegrate easily and will probably never run out. But the biological form of silicon is of interest in our daily lives in another way. Humans profit from silicon uptake as it strengthens bone structure, lowering the incidence of osteoporosis and fractures. A principle dietary source of silicon is beer! Belgian colleagues of mine [have shown](#) that the complexity and length of the Belgian brewing process causes Belgian beers to be especially rich in silicon. So, cheers!”

Eline Vanuytrecht

PhD researcher at KU Leuven, Belgium

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Icequakes!

Scientists at the British Antarctic Survey are monitoring the rumbling of ice streams to discover what makes them flow

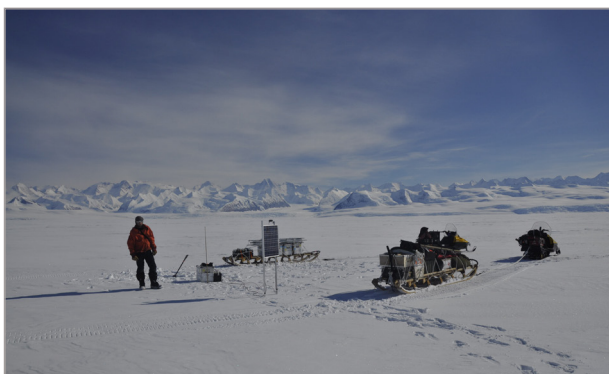
Antarctica is a hostile continent. For half of the year not even the Sun dares to show its face. On the surface the white wilderness appears frozen in time but underneath it there is a stirring world that scientists are only just beginning to uncover.

Woven through the giant ice sheet, which consumes an area bigger than Europe, are networks of ice streams. These are fast flowing passages of ice that, like arteries that move blood around the human body, are a main mechanism for transporting fresh water off the continent and into the ocean.

Ice streams and outlet glaciers are considered to be significant if not dominant causes of the recent Antarctic ice sheet mass loss (Rignot et al. 2008). Some suggest the flow could even speed up in response to warming oceans as ice streams are the fastest responding component of an ice sheet system.

Buried

Understanding the dynamics of ice streams is important to help predict their future contribution to global sea level rise. However, the



Recording icequakes at Rutford Ice Stream. (Credit: Andy Smith)

ice-bed interface, which accommodates the movement of the ice stream, is difficult to access. In situ measurements are challenging as the bed is usually buried under kilometres of ice.

[Emma Smith](#), PhD candidate at the British Antarctica Survey (BAS) is using seismic data to study icequakes – microseismic movement – at the Rutford Ice Stream, West Antarctica. After starting a career in engineering, she moved into exploration geophysics and spent several years working in the oil and gas industry before returning to research.

Antarctica is divided into East and West by the stretch of the Transantarctic Mountains. The West Antarctic Ice Sheet reaches out like a tentacle to the southern tip of South America and contains enough water to raise global sea levels by five meters.

The Rutford Ice Stream is a typical Antarctic outlet glacier sitting in a deep trough. It moves about one meter a day.

“By far, it is not one of the fastest flowing,” says Smith. For example the Pine Island Glacier, the longest and fastest moving glacier in Antarctica, can move almost 10 meters a day.

Varying in width from 20 to 30 kilometres and being over two kilometres deep in places, the Rutford Ice Stream flows for more than 150 kilometres before it reaches the Ronne Ice Shelf and starts to float. It drains a land area of 49,000 square kilometres in the West Antarctic Ice Sheet.

Listen closely

To study the stream, Smith uses a technique derived from classic earthquake monitoring called passive microseismic monitoring. It consists in placing geophones – devices that convert ground motion into voltage – on the ice stream surface to record the icequakes produced as it moves over its bed.

Using the data obtained in this way, Smith can then get information about the basal conditions and physical properties of the ice. Ice streams generally have water present at the bed. This water is either surface meltwater that has reached the base or results from the fact that the ice at the bottom is under so much pressure that it has melted at the pressure melting point. “The water allows movement of the ice by providing lubrication – otherwise the ice would be frozen onto solid rock,” she says.

Rumbled

However, what the stream is sitting on also controls the speed of its movement. Motion at its bed can change depending on whether the ice stream is moving across soft sediment or sliding over hard rock. Smith found icequakes to be clustering at particular sources at or near the ice-bed interface. “This is telling us the mechanism for accommodating movement is happening in a repeating manner,” she says.

Analysis of these data is allowing Smith to build up a picture of the mechanisms that cause the icequakes to occur, meaning she can then better understand how the stream moves. Using the information from the icequakes, Smith can also construct models to illustrate the basal dynamics over space and time.

Parts of the bed deform as the ice moves over and can form large mounds – some as high as 500 meters wide and 50 meters high. In other parts, the ice stream slides over its bed with little deformation. For example, areas of the ice stream bed interpreted as basal sliding show a greater roughness than those with a deforming bed. A rougher bed could be an indication of higher basal friction and so this could explain the increased levels of seismicity detected in those areas.

Looking back

For the past 25 years, BAS have been busy working around Rutford to try and create a full representation of what is happening in this polar area. “The research we are doing can be combined together to get a bigger picture of what’s going on,” Smith says.

Palaeo-ice streams could give us a glimpse into the future. Comparing present ice streams with previous glaciations can give clues on the Rutford Ice Stream condition. O’Cofaigh and collaborators found in 2005 that deglaciation of deep marine troughs can occur rapidly over just 100 to 1000 years.

However, there are significant differences between past and present. Past ice streams have exposed bedrock but no evidence has been found of this at Rutford. This could be by chance or it may indicate high erosion rates and deep scouring events that characterise the final demise of an ice stream. A process that palaeo-ice streams have already suffered and a fate the Rutford Ice Stream may have yet to come.

Becky Summers
Freelance science writer

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Division reports

News brought to you from five EGU divisions

In each edition of GeoQ division presidents contribute reports updating EGU members with news from their divisions. Issue 7 gives voice to Andreas Lang (Geomorphology), Nicholas Arndt (Geochemistry, Mineralogy, Petrology & Volcanology), Gerrit de Rooij (Hydrological Sciences), Shaun Lovejoy (Nonlinear Processes in Geosciences) and Peter Brandt (Ocean Sciences).

Geomorphology

The Geomorphology (GM) Division programme at the EGU 2013 General Assembly continued the success of past years and saw stable abstract numbers (compared to 2012), verifying the meeting as the leading annual event for geomorphology globally. A total of 1009 abstracts (including co-organised sessions) were presented filling room 21 all week, two full days in room 22 and several other locations across the conference centre.

The 2013 Bagnold Medal has been awarded to [James W. Kirchner](#) for his outstanding contributions to our understanding of geomorphological processes using innovation and rigor in data analysis, and slicing through the complexity of Earth's surface systems to uncover the underlying physics. The Medal Lecture entitled 'The physics and chemistry of Earth's dynamic surface' was preceded by a reception sponsored by the British Society for Geomorphology and their journal *Earth Surface Processes and Landforms*.

For the first time an outstanding young geomorphologist was successful at Union level: [Simon Mudd](#) received an EGU Arne Richter Award for Outstanding Young Scientists. He was rewarded for his exceptionally innovative modelling studies that combine chemical weathering and physical erosion processes to shed new light on how climate change and tectonic forcing determine hill-slope morphology and soil thickness.

The 2012 Outstanding Student Poster Award was awarded to [Wout van Dijk](#) from the University of Utrecht for his poster 'Experimental meandering: from braided towards meandering by the addition of cohesive floodplain material'.

The workshops for young researchers continue to be the highlight of the GM programme. In 2013 they focused on 'Dating techniques in geomorphology' with Kevin Norton & Geoff Duller, 'Open access publishing' with Tom Coulthard & Richard Gloaguen, 'Meet the Master' with Heather Viles and 'Supervising Master's and PhD students' with François Métivier & Markus Stoffel. Due to the great success and excellent feedback received, the workshops for young researchers will continue to be part of the GM programme in future. They also serve as models for other divisions that are planning to introduce similar workshops.

Another division highlight at the General Assembly was the launch of the new EGU journal *Earth Surface Dynamics* ([ESurf](#)), an international scientific journal dedicated to the publication and discussion of high quality research on the physical, chemical and biological processes shaping Earth's surface and their interactions on all scales. The main subject areas of *ESurf* comprise field measurements, remote sensing and experimental and numerical modelling of Earth surface processes and their interactions with the lithosphere, biosphere, atmosphere, hydrosphere and pedosphere. *ESurf* offers EGU-style open access publishing after a public peer-review and interactive public discussion process.

The GM Division team has also seen some changes: Paul Bishop (University of Glasgow) replaced Gerard Govers as Chair of the Medal Committee. Jantien Baartman (Wageningen University) will help coordinate the scientific programme in the area of overlap with the Hydrological Sciences and Soil System Sciences Divisions. Further, Lucy E. Clarke from the University of Hull has agreed to act as young scientists representative for the division. The full division structure, the sciences officers and their contact details can be found on the [division website](#).

For further details, please consult the presentation from the division business meeting [online](#).

*Andreas Lang
GM Division President*

Geochemistry, Mineralogy, Petrology & Volcanology

The [Goldschmidt](#) conference was held in Europe in 2013 and as usual the Geochemistry, Mineralogy, Petrology & Volcanology (GMPV) Division suffered the consequences. A significant number of geochemists, petrologists and mineralogists chose to attend the meeting in Florence and many volcanologists preferred the meeting of the International Association of Volcanology and Chemistry of the Earth's Interior ([IAVCEI 2013](#)) in Japan. This meant that the number of GMPV abstracts at the EGU General Assembly was 40% down on the previous year. The upside is that we can look forward to a bumper year in 2014 when Goldschmidt is on the far side of the USA.

In spite of the competition, the GMPV division organised many very successful sessions at this year's General Assembly. For example, our ongoing series on the early Earth continued, we had two very interesting sessions on how magma chambers work, our collaboration with the Geodynamics and Tectonics Divisions was evident in several co-sponsored sessions on the mantle, and as usual we had a series of strong volcanology sessions. In addition, Catherine McCammon gave an excellent Bunsen Medal Lecture.

Our cooperation with the Volcanology, Geochemistry, and Petrology (VGP) section of the American Geophysical Union (AGU) continues, aided by close cooperation with Catherine McCammon, the present VGP president, and Catherine Chauvel, the future president. Raj Dasgupta delivered the VGP Kuno Medal Lecture in one of our sessions, and three other sessions were co-sponsored by GMPV and VGP. Over ten sessions proposed for this year's AGU Fall Meeting have been slated for co-sponsorship by GMPV.

Max Wilke, our Mineralogy Officer, finished his 5-year stint and to replace him we needed to appoint two others. Fabrizio Nestola of the University of Padova in Italy and an expert in high-temperature mantle mineralogy will assure continued collaboration with the Geodynamics Division, and Andrew Putnis of the University of Münster in Germany and an authority on metamorphism and low-temperature mineralogy, will strengthen EGU activities in these fields.

Nicholas Arndt
GMPV Division President

Hydrological Sciences

This year, the International Association of Hydrological Sciences decade that focused on Predictions in Ungauged Basins draws to a close. In an ironic twist, nature reminded us the prediction in lavishly gauged basins can still be elusive: Europe was quite unprepared for the [floods in the Danube and Elbe basins](#) in May and June.

The heavy rains in late spring [were related to](#) the north-eastern trajectory of low-pressure systems emanating from the Mediterranean that carried moist air to the central European mountain ranges, where the air lost much of its water. The effect of the abundant rainfall was compounded by the subsurface component of the terrestrial hydrological cycle. Snowfall late in winter thawed in the spring wetting the soil, and copious rainfall not long after snowmelt further elevated groundwater levels and diminished the air-filled pore space in the soil above it. With the potential for subsurface storage of additional water severely compromised, much of the heavy rain of May was carried off to the river systems by surface runoff. This caused their water levels to rise dramatically, breaking records in some places.

The trajectory taken by the low-pressure systems is not that unusual and large volumes of snowmelt or spring rains will also occur from time to time. We may therefore anticipate both conditions occurring in tandem sometime in the future. To avoid loss of life and massive material damage, the various affected countries are currently debating preventive measures. A few observations can offer guidance to this debate.

[Satellite imagery by NASA](#) showed that large sections of the Elbe and its tributaries occupied a much broader area than usual, but nevertheless were mostly contained within their floodplains. Only on a limited number of locations did the dams break and larger areas flooded.

Yet the property damage was huge. In some locations older buildings withstood being flooded much better than nearby newer ones. The older constructions were often designed with occasional flooding in mind, evidenced for instance by elevated foundations, tiles on



Passau, the Bavarian town where the Danube is joined by the rivers Inn and Ilz, was one of the worst affected by the June floods. (Credit: Stefan Penninger)

the ground floor and inner walls and wide staircases in brickwork. It seems building activities increasingly take place in what was considered the river floodplain a few decades ago, but without taking this into account in the design. Furthermore, the resulting constriction of the flow bed is often not compensated for (e.g., by deepening the river bed or removing obstacles to the flow elsewhere in the cross-section of the riverbed/floodplain). Consequently, the water level corresponding to a given discharge will have to increase. Instead of simply making dams and dikes higher and stronger, it is increasingly argued that it would be better to allow the river to use a wider bed or one with fewer obstacles. It should be noted that measures that ensure a more effective discharge through the river bed should first be executed downstream, lest upstream measures increase the risk of flooding downstream by delivering the water faster.

The severity of the 2013 European floods was for a considerable part linked to the lack of storage in the unsaturated zone. It stands to reason to find ways to increase storage within the catchment to reduce the contribution of overland flow to river discharge. By gradually releasing stored water, the signal pulse can be damped. Some have advocated building storage reservoirs in the mountainous parts of basins of flood-prone rivers, but the ecological and esthetic impact of a sizeable number of reservoirs that need to be empty most of the time makes them unappealing. The management of such reservoirs has little room for error: fill them too early and the storage they provide will not be available when needed; fill them too late and the high-water signal will not be damped. It appears more attractive and feasible to build rainfall capturing reservoirs in cities. There, they could effectively dampen the effect or rapid discharge of water falling on roofs and pavement through sewage systems. The ever increasing paved area (cities and roads) within catchments contributes noticeably to the reduction of subsurface storage of water, and makes rivers respond to rainfall with more spiked discharge peaks.

In rural regions, designating areas relatively close to rivers and streams, in which the groundwater table is kept low by a drainage system and the soil remains permeable, can increase storage. The latter can be achieved by tillage or by choosing vegetation with sturdy roots that create a macropore network, such as trees. When such areas are permitted to be flooded in case of exceptionally high water they can provide even more storage and a damped transmission of the discharge peak downstream. Between floods, such areas can remain productive.

As a final measure, some places could be selected for controlled flooding to protect other areas when the dams are threatened. In

such places, farms and other buildings could be placed on artificial mounds and cattle should be able to flee to higher grounds as well.

The lessons for the management of major rivers and their flood-plains are clear. It is now time to heed these lessons by implementing wise policies and by taking the right measures in a timely fashion. The scientific community can help to achieve this by communicating effectively with those responsible for policy making, land and water management and land-use planning.

Gerrit H. de Rooij
HS Division President

Ocean Sciences

After a few years acting as vice-president of the Ocean Sciences (OS) Division, the EGU 2013 General Assembly was my first conference as president. As in the many years before in which I attended the conference (since my first time as a young student in the 90s), the OS programme covered a large range of topics from general circulation and the oceans role in climate to shelf and coastal oceanography, marginal seas, ocean biogeochemistry, theory and dynamical processes as well as operational oceanography and instrumentation.

In the past few years, we could see the great development of the EGU, particularly its General Assembly. For example, the OS programme of the 2013 meeting included a great number of abstracts: nearly 300 oral and more than 500 poster presentations. A highlight of the 2013 OS programme was the lecture by the Fridtjof Nansen medalist Harry Bryden who presented exciting results regarding the variability of the Atlantic meridional overturning circulation. Another highlight was the introduction of [PICO](#) presentations, which combine short oral presentations with in-depth discussion between the presenter and the attending scientists in front of wide touch-screen displays. I think these presentations represent a stimulating means of scientific discussions and direct interaction among scientists, and we aim to develop them further.

At this point I want to thank the previous OS presidents, particularly my predecessor Bernard Barnier. I am also thankful to the whole OS team including the Nansen Medal Committee who contributed significantly to the development of the division and helped me start as the new president.

One of the main axes of OS activities is the Ocean Science journal. During the last few years, the number of submitted abstracts and accepted papers increased considerably, which shows the increased impact of this open-access journal in the scientific community. This success can be traced back to the great work of the team of editors and reviewers who make the journal more and more attractive for readers and authors.

With the General Assembly, the Ocean Science journal and the outreach and education activities, we aim to further develop into a productive environment for scientists from Europe and all over the world to achieve progress in the various ocean science disciplines and to have beneficial interactions with other fields of the geosciences. We also aim to provide a platform for researchers, particularly young scientists, to present their results, and network within the research



PICO presentations at the 2013 General Assembly (Credit: Sue Voice)

community, as well as to actively play a role in developing the future of the EGU and its OS Division.

Peter Brandt
OS Division President

Nonlinear Processes in Geosciences

As the new president of the Nonlinear Processes in Geosciences (NP) Division, I would like to warmly thank Henk Dijkstra, my predecessor, for the last four years. The following summary (referring to the past year) mostly concerns achievements under his mandate.

First, I'd like to introduce the new NP executive, which has some old faces as well as some new ones. Stefano Pierini is the new Science Officer for Dynamical Systems Approaches to Problems in the Geosciences (NP2), François Schmitt is the Officer for Scales, Scaling and Nonlinear Variability (NP3), Reik Donner is in charge of Time Series and Patterns (NP4), Olivier Talagrand is Officer for Predictability (NP5), Turbulence, Transport and Diffusion (NP6) is overseen by Jose Redondo, while Vincent Rey and Valerio Lucarini are the Officers for Nonlinear Waves (NP7) and Nonlinear Stochastics (NP8), respectively. Daniel Schertzer (Publications), Shaun Lovejoy (President and Programme Group Chair), Isabel de Lima (Scientific Affairs) and August Gires (Webmaster) are also part of the new executive. The new Richardson Medal Committee is composed of: C. Nicolis (Chair), H. Swinney, J. Kurths, S. Fauve and K. Fraedrich.

Thanks to the NP community, the 2013 General Assembly featured 377 NP abstracts in 18 NP sessions and 11 co-organised sessions. In addition, there were three NP short courses: 'Nonlinear time series analysis' by R. Donner and S. Barbosa, 'Tipping points in the geosciences' by M. Ghil, P. Ditlevsen and H.A. Dijkstra and 'Predictability in theory and predictability in practice' by L. Smith.

I should also mention the following NP honours: [Auguste Gires](#) received the 2012 Outstanding Student Poster Award, while the 2013 Outstanding Young Scientist Award and the 2013 Lewis Fry Richardson Medal were awarded to [Yongxiang Huang](#) and [Jürgen Kurths](#), respectively

Thank you for all your efforts. I'm looking forward to seeing you all in Vienna in 2014!

Shaun Lovejoy
NP Division President



Resource site for young scientists launched



Young scientists at the EGU 2013 General Assembly

Early career researchers make up a large proportion of the EGU membership and (graduate and undergraduate) students regularly make up about a third of General Assembly participants. With so many young scientists involved in the EGU, we wanted to produce something that caters for them – the [young scientists' website](#).

The new website is a hub of information on [careers](#), [events](#) and [resources](#) that relate to young scientists in the Earth, planetary and space sciences.

Young scientists are also invited to [get involved](#) in the Union's activities. Please check the new website at <http://www.egu.eu/young-scientists/> for more information.

Earlier versions of this article were published on [the EGU website](#) and on the [EGU blog](#).

Six new blogs join the EGU Blog Network



Montage of banner images featured in the new blogs of the EGU network

Since it started, the [EGU Blog Network](#) has had great coverage of [geochemistry](#), [palaeontology](#) and [geoscience in development](#), but what about the other fields in the geosciences? Over the past couple of months we've been seeking out some fantastic Earth science bloggers who are keen to share their knowledge, experiences and the latest research in their fields with you.

The new geoscience blogs cover mineralogy, climate change and volcanology as well as the atmospheric, Quaternary and soil sciences. Like other blogs on the network, their aim is to put complex

scientific research into context and share recent findings beyond the usual suspects, opening science up to a much wider audience.

So, without further ado, welcome to:

[Four Degrees](http://blogs.egu.eu/4degrees/) – <http://blogs.egu.eu/4degrees/>

A climate blog by [Flo Bullough](#) and [Marion Ferrat](#) where they will discuss issues in environmental geoscience from the scientific literature, political chamber and the media. They will be putting research into a policy framework and taking a look at current problems from an inter-disciplinary perspective.

Geology Jenga – <http://blogs.egu.eu/geojenga/>

A Quaternary science blog by [Laura Roberts](#) and [Daniel Schillereff](#) where, focussing on science from the Quaternary period, they will share snippets from their own research disciplines to provide a more holistic understanding of landscape evolution.

Polluting the Internet – <http://blogs.egu.eu/hazeblog/>

An atmospheric science blog by [Will Morgan](#), who has been polluting the internet with excellent science. He will explore all aspects of air pollution and atmospheric science, focussing on what the impact of aerosols, both natural and man-made, is on atmospheric processes.

An Atom's-Eye View of the Planet – <http://blogs.egu.eu/atoms/>

A mineralogy blog by [Simon Redfern](#), an esteemed professor and science communicator, where he explores how the solid Earth responds to changing temperature, pressure and chemistry. Wondering what minerals are up to? He will explain mineral processes from the biosphere to the deepest inner core.

Between a Rock and a Hard Place – <http://blogs.egu.eu/bar/>

A volcanology blog by [Elspeth Robertson](#) and [Charly Stamper](#). Look out for some explosive action on this one as volcanologists Charly and Elspeth bring you the latest in volcanological research and share their experiences during their first footholds in academia.

G-Soil – <http://blogs.egu.eu/gsoil/>

A soil science blog coordinated by [Antonio Jordan](#) and the [G-Soil team](#). The EGU's own Soil System Sciences Division have put together a great blog that brings soil science into the public eye, detailing the latest research in the field and highlighting the importance of soils to both people and the environment.

We hope you look forward to reading them – we certainly do!

Earlier versions of this article were published [on the EGU website](#) and on the [EGU blog](#).

EGU election for president/vice-president and general secretary: propose a candidate

The autumn 2013 election, where 2013 EGU members will be able to vote for the next president/vice-president and general secretary, is taking place from 1 November to 1 December.

From now until 30 September, you are kindly asked to propose a candidate to either vacancy by filling in the online [proposal form](#).

You are welcome and encouraged to nominate yourself. If you are nominating someone else, please ensure you get the candidate's consent.

More information about the election is available from the [elections page](#) on the EGU website.

An earlier version of this article was published [on the EGU website](#)





Could planting trees in the desert mitigate climate change?

EGU press release on research published in *Earth System Dynamics*

As the world starts feeling the effects of increasing atmospheric carbon dioxide and consequent global temperature rise, researchers are looking for a Plan B to mitigate climate change. A group of German scientists has now come up with an environmentally friendly method that they say could do just that. The technique, dubbed carbon farming, consists in planting trees in arid regions on a large scale to capture CO₂. They publish their study today in *Earth System Dynamics*, a journal of the European Geosciences Union (EGU).

“Carbon farming addresses the root source of climate change: the emission of carbon dioxide by human activities,” says first-author Klaus Becker of the University of Hohenheim in Stuttgart.

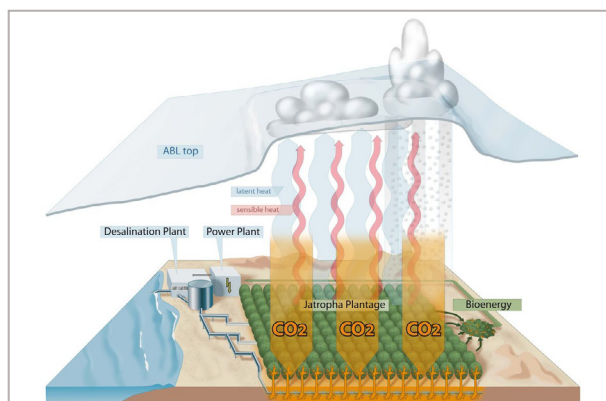
“Nature does it better,” adds Becker’s colleague Volker Wulfmeyer, “if we understand and can make use of it in a sustainable manner.”

When it comes to sequestering carbon from the atmosphere, the team shows that *Jatropha curcas* does it better. This small tree is very resistant to aridity so it can be planted in hot and dry land in soil unsuitable for food production. The plant does need water to grow though, so coastal areas where desalinated seawater can be made available are ideal.

“To our knowledge, this is the first time experts in irrigation, desalination, carbon sequestration, economics and atmospheric sciences have come together to analyse the feasibility of a large-scale plantation to capture carbon dioxide in a comprehensive manner. We did this by applying a series of computer models and using data from *Jatropha curcas* plantations in Egypt, India and Madagascar,” says Wulfmeyer.

The new *Earth System Dynamics* study shows that one hectare of *Jatropha curcas* could capture up to 25 tonnes of atmospheric carbon dioxide per year, over a 20 year period. A plantation taking up only about 3% of the Arabian Desert, for example, could absorb in a couple of decades all the CO₂ produced by motor vehicles in Germany over the same period. With about one billion hectares suitable for carbon farming, the method could sequester a significant portion of the CO₂ added to the atmosphere since the industrial revolution.

But there are more advantages. Carbon farming’s price tag ranges from 42 to 63 euros per tonne of CO₂, making it competitive with other CO₂-reduction techniques such as carbon capture and storage. Further, after a few years, the plants would produce bioenergy (in the form of tree trimmings) to support the power production required for the desalination and irrigation systems.



Processes involved in carbon farming. Technological and economic issues include the set up and operation of desalination plants and large-scale irrigation and their power supply, such as the production of bioenergy from the plantation. Land-surface-atmosphere processes, including heat release and CO₂ absorption, also play a role in carbon farming. These modify the atmospheric boundary layer (ABL, the lowest part of the atmosphere) in such a way that may lead to the formation of clouds and precipitation. (Credit: Becker et al. 2013)

“From our point of view, afforestation as a geoengineering option for carbon sequestration is the most efficient and environmentally safe approach for climate change mitigation. Vegetation has played a key role in the global carbon cycle for millions of years, in contrast to many technical and very expensive geoengineering techniques,” explains Becker.

The main limitations to implementing this method are lack of funding and little knowledge of the benefits large-scale plantations could have in the regional climate, which can include increase of cloud coverage and rainfall. The new *Earth System Dynamics* paper presents results of simulations looking into these aspects, but there is still a lack of experimental data on the effects of greening arid regions. Also, potential detrimental effects such as the accumulation of salt in desert soils need to be evaluated carefully.

The team hopes the new research will get enough people informed about carbon farming to establish a pilot project. “We strongly recommend more emphasis is put on this technology – at both small and large scales – and that more research is done to investigate its benefits in comparison to other geoengineering approaches,” concludes Wulfmeyer.

This press release was originally published [on the EGU website](#)

Reference

Becker, K. et al.: [Carbon farming in hot, dry coastal areas: an option for climate change mitigation](#), *Earth Syst. Dynam.*, 4, 237–251, 2013



Cluster spacecraft detects elusive space wind

EGU press release on research published in *Annales Geophysicae*

A new study provides the first conclusive proof of the existence of a space wind first proposed theoretically over 20 years ago. By analysing data from the European Space Agency's Cluster spacecraft, researcher Iannis Dandouras detected this plasmaspheric wind, so-called because it contributes to the loss of material from the plasmasphere, a donut-shaped region extending above the Earth's atmosphere. The results are published today in [Annales Geophysicae](#), a journal of the European Geosciences Union (EGU).

"After long scrutiny of the data, there it was, a slow but steady wind, releasing about 1 kg of plasma every second into the outer magnetosphere: this corresponds to almost 90 tonnes every day. It was definitely one of the nicest surprises I've ever had!" said Dandouras of the Research Institute in Astrophysics and Planetology in Toulouse, France.

The plasmasphere is a region filled with charged particles that takes up the inner part of the Earth's magnetosphere, which is dominated by the planet's magnetic field.

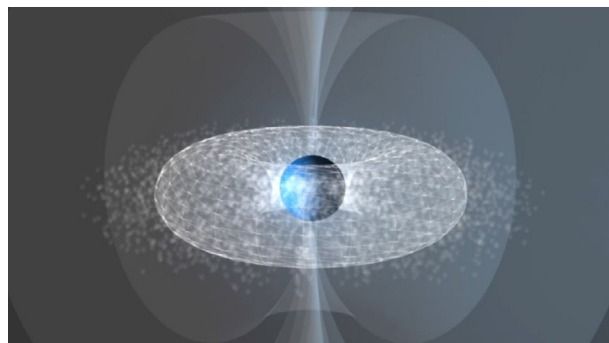
To detect the wind, Dandouras analysed the properties of these charged particles, using information collected in the plasmasphere by ESA's Cluster spacecraft. Further, he developed a filtering technique to eliminate noise sources and to look for plasma motion along the radial direction, either directed at the Earth or outer space.

As detailed in the new [Annales Geophysicae study](#), the data showed a steady and persistent wind carrying about a kilo of the plasmasphere's material outwards each second at a speed of over 5,000 km/h. This plasma motion was present at all times, even when the Earth's magnetic field was not being disturbed by energetic particles coming from the Sun.

Researchers predicted a space wind with these properties over 20 years ago: it is the result of an imbalance between the various forces that govern plasma motion. But direct detection eluded observation until now.

"The plasmaspheric wind is a weak phenomenon, requiring for its detection sensitive instrumentation and detailed measurements of the particles in the plasmasphere and the way they move," explains Dandouras, who is also the vice-president of the [EGU Planetary and Solar System Sciences Division](#).

The wind contributes to the loss of material from the Earth's top atmospheric layer and, at the same time, is a source of plasma for the outer magnetosphere above it. Dandouras explains: "The plasmaspheric wind is an important element in the mass budget of the plasmasphere, and has implications on how long it takes to refill this region after it is eroded following a disturbance of the planet's magnetic field. Due to the plasmaspheric wind, supplying plasma – from the upper atmosphere below it – to refill the plasmasphere is like pouring matter into a leaky container."



This animation (click to play or view [online](#)) shows the Earth's plasmasphere – the innermost part of our planet's magnetosphere – and the plasmaspheric wind, an outward flow of charged particles. The doughnut-shaped plasmasphere is centred around the Earth's equator and rotates along with it. The steady plasmaspheric wind continuously transfers material from the plasmasphere into the magnetosphere, releasing about 1 kg of plasma every second – almost 90 tonnes a day – into the outer magnetosphere. (Credit: ESA/ATG medialab)

The plasmasphere, the most important plasma reservoir inside the magnetosphere, plays a crucial role in governing the dynamics of the Earth's radiation belts. These present a radiation hazard to satellites and to astronauts travelling through them. The plasmasphere's material is also responsible for introducing a delay in the propagation of GPS signals passing through it.

"Understanding the various source and loss mechanisms of plasmaspheric material, and their dependence on the geomagnetic activity conditions, is thus essential for understanding the dynamics of the magnetosphere, and also for understanding the underlying physical mechanisms of some space weather phenomena," says Dandouras.

Michael Pinnock, Editor-in-Chief of [Annales Geophysicae](#) recognises the importance of the new result. "It is a very nice proof of the existence of the plasmaspheric wind. It's a significant step forward in validating the theory. Models of the plasmasphere, whether for research purposes or space weather applications (e.g. GPS signal propagation) should now take this phenomenon into account," he wrote in an email.

Similar winds could exist around other planets, providing a way for them to lose atmospheric material into space. Atmospheric escape plays a role in shaping a planet's atmosphere and, hence, its habitability.

This press release was originally published [on the EGU website](#)

Reference

Dandouras, I.: [Detection of a plasmaspheric wind in the Earth's magnetosphere by the Cluster spacecraft](#), Ann. Geophys., 31, 1143–1153, 2013



Atmospheric Chemistry and Physics (ACP)

Absorptivity of brown carbon in fresh and photo-chemically aged biomass-burning emissions

In this paper, researchers report on experiments conducted to investigate light absorption of organic aerosol in fresh and photo-chemically aged biomass-burning emissions.

Reference

Saleh, R. et al.: [Absorptivity of brown carbon in fresh and photo-chemically aged biomass-burning emissions](#), *Atmos. Chem. Phys.*, 13, 7683–7693, 2013

ACE–FTS observations of acetonitrile in the lower stratosphere

This work reports the first infrared satellite remote-sensing measurements of acetonitrile in the Earth's atmosphere using solar occultation data from the Atmospheric Chemistry Experiment Fourier transform spectrometer (ACE–FTS) between 2004 and 2011.

Reference

Harrison, J. J. and Bernath, P. F.: [ACE–FTS observations of acetonitrile in the lower stratosphere](#), *Atmos. Chem. Phys.*, 13, 7405–7413, 2013

Impacts of aircraft emissions on the air quality near the ground

The continuing increase in demand for commercial aviation transport raises questions about the effects of resulting emissions on the environment. Here, the authors investigate, using a global chemistry transport model, to what extent aviation emissions outside the boundary layer influence air quality in the boundary layer.

Reference

Lee, H. et al.: [Impacts of aircraft emissions on the air quality near the ground](#), *Atmos. Chem. Phys.*, 13, 5505–5522, 2013

Halogen species record Antarctic sea ice extent over glacial–interglacial periods

Here, the authors present speciation measurements of bromine and iodine in the TALDICE (TALos Dome Ice Core) ice core (159°11' E, 72°49' S; 2315 m a.s.l.) spanning the last 215 ky. Based on the results obtained, they propose the use of both halogens for examining Antarctic variability of past sea ice extent.

Reference

Spolaor, A. et al.: [Halogen species record Antarctic sea ice extent over glacial–interglacial periods](#), *Atmos. Chem. Phys.*, 13, 6623–6635, 2013

A decadal satellite analysis of the origins and impacts of smoke in Colorado

In this article, the authors analyse the record of aerosol optical depth measured by the MODerate resolution Imaging Spectroradiometer (MODIS) aboard the Terra satellite. They combine this with measurements of surface particular matter (PM_{2.5}) to investigate the impact of fires on aerosol loading and air quality over Colorado from 2000 to 2012.

Reference

Val Martin, et al.: [A decadal satellite analysis of the origins and impacts of smoke in Colorado](#), *Atmos. Chem. Phys.*, 13, 7429–7439, 2013

Formation of aqueous-phase α -hydroxyhydroperoxides (α -HHP): potential atmospheric impacts

The focus of this work is on quantifying the degree of the aqueous-phase formation of α -hydroxyhydroperoxides (α -HHPs) via reversible nucleophilic addition of H₂O₂ to aldehydes.

Reference

Zhao, R. et al.: [Formation of aqueous-phase \$\alpha\$ -hydroxyhydroperoxides \(\$\alpha\$ -HHP\): potential atmospheric impacts](#), *Atmos. Chem. Phys.*, 13, 5857–5872, 2013

Classifying organic materials by oxygen-to-carbon elemental ratio to predict the activation regime of Cloud Condensation Nuclei (CCN)

The results presented in this paper suggest that atmospheric particles dominated by hydrocarbon-like organic components do not activate CCN (i.e., insoluble regime) whereas those dominated by oxygenated organic components activate CCN (i.e., highly soluble regime) for typical atmospheric cloud life cycles.

Reference

Kuwata, M. et al.: [Classifying organic materials by oxygen-to-carbon elemental ratio to predict the activation regime of Cloud Condensation Nuclei \(CCN\)](#), *Atmos. Chem. Phys.*, 13, 5309–5324, 2013

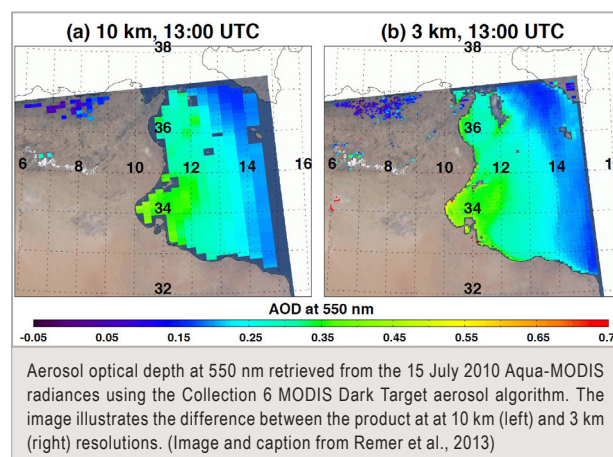
Atmospheric Measurement Techniques (AMT)

MODIS 3 km aerosol product: algorithm and global perspective

After more than a decade of producing a nominal 10 km aerosol product based on the dark target method, the MODerate resolution Imaging Spectroradiometer (MODIS) aerosol team will be releasing a nominal 3 km product as part of their Collection 6 release. This new product is expected to become an important tool for the aerosol community.

Reference

Remer, L. A. et al.: [MODIS 3 km aerosol product: algorithm and global perspective](#), *Atmos. Meas. Tech.*, 6, 1829–1844, 2013



Biogeosciences (BG)

Increased soil temperature and atmospheric N deposition have no effect on the N status and growth of a mature balsam fir forest

Nitrogen (N) is a major growth-limiting factor in boreal forest ecosystems. Increases of temperature and atmospheric N deposition are expected to affect forest growth directly and indirectly by increasing N availability due to higher rates of N mineralization. Here, the authors report on experiments conducted on a mature balsam fir stand in Canada to understand the potential impacts of these changes.

Reference

D'Orangeville, L. et al.: [Increased soil temperature and atmospheric N deposition have no effect on the N status and growth of a mature balsam fir forest](#), *Biogeosciences*, 10, 4627–4639, 2013

Impact of change in climate and policy from 1988 to 2007 on environmental and microbial variables at the time series station Boknis Eck, Baltic Sea

The temporal development of phytoplankton was monitored from 1988 to the end of 2007 at the time series station Boknis Eck in the western Baltic Sea. The results are reported in this paper.

Reference

Hoppe, H.-G. et al.: [Impact of change in climate and policy from 1988 to 2007 on environmental and microbial variables at the time series station Boknis Eck, Baltic Sea](#), *Biogeosciences*, 10, 4529–4546, 2013

Seasonal measurements of total OH reactivity emission rates from Norway spruce in 2011

One way to investigate the chemical interplay between biosphere and atmosphere is through the measurement of total hydroxyl (OH) reactivity, the total loss rate of OH radicals. This study presents the first determination of total OH reactivity emission rates based on a branch cuvette enclosure system mounted on a Norway spruce throughout spring, summer and autumn 2011.

Reference

Nölscher, A.C. et al.: [Seasonal measurements of total OH reactivity emission rates from Norway spruce in 2011](#), *Biogeosciences*, 10, 4241–4257, 2013

Iodine-129 concentration in seawater near Fukushima before and after the accident at the Fukushima Daiichi Nuclear Power Plant

Anthropogenic radionuclides were released into the environment in large quantities by the Fukushima Daiichi Nuclear Power Plant accident. To evaluate accident-derived ^{129}I , the ^{129}I concentrations in seawater before and after the accident were compared.

Reference

Suzuki, T. et al.: [Iodine-129 concentration in seawater near Fukushima before and after the accident at the Fukushima Daiichi Nuclear Power Plant](#), *Biogeosciences*, 10, 3839–3847, 2013

Climate of the Past (CP)

LGM permafrost distribution: how well can the latest PMIP multi-model ensembles perform reconstruction?

In this paper, global-scale frozen ground distribution from the Last Glacial Maximum (LGM) is reconstructed using multi-model ensembles of global climate models, and then compared with evidence-based knowledge and earlier numerical results. Modeled soil temperatures, taken from Paleoclimate Modelling Intercomparison Project phase III (PMIP3) simulations, are used to diagnose the subsurface thermal regime and determine underlying frozen ground types for the present day and the LGM.

Reference

Saito, K. et al.: [LGM permafrost distribution: how well can the latest PMIP multi-model ensembles perform reconstruction?](#), *Clim. Past*, 9, 1697–1714, 2013

On the effect of orbital forcing on mid-Pliocene climate, vegetation and ice sheets

In this article, the authors present results from modelling of the mid-Pliocene warm period (3.3–3 million years ago) using the Earth system model of intermediate complexity CLIMBER-2 analysing the effect of changes in boundary conditions as well as of orbital forcing on climate.

Reference

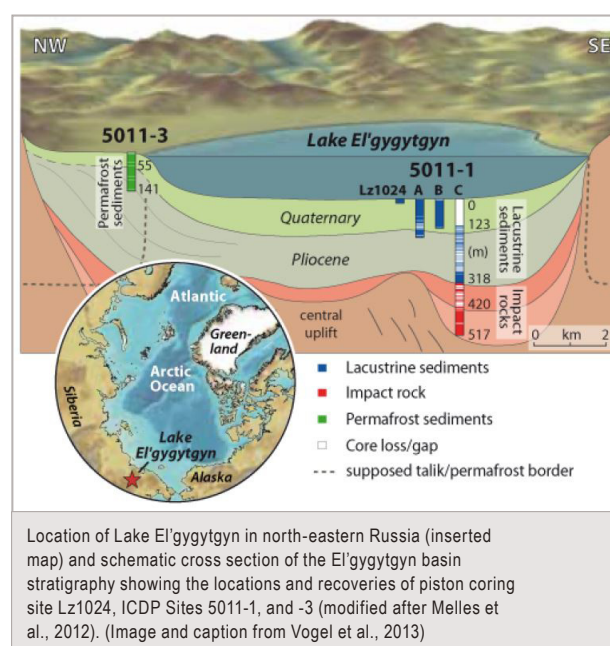
Willeit, M., Ganopolski, A., and Feulner, G.: [On the effect of orbital forcing on mid-Pliocene climate, vegetation and ice sheets](#), *Clim. Past*, 9, 1749–1759, 2013.

Detailed insight into Arctic climatic variability during MIS 11c at Lake El'gygytyn, NE Russia

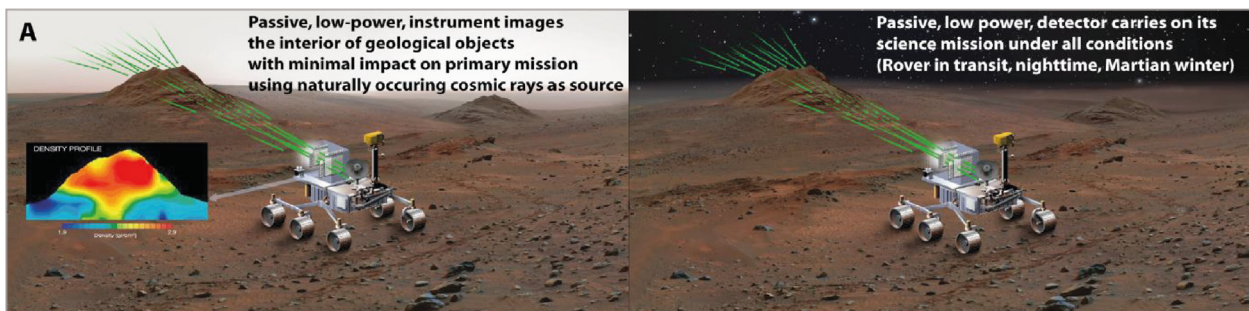
This articles presents a detailed multi-proxy record of the climate and environmental evolution at Lake El'gygytyn, Far East Russian Arctic during the period 430–395 ka covering the marine isotope stage (MIS) 12/11 transition and the thermal maximum of super interglacial MIS 11c.

Reference

Vogel, H. et al.: [Detailed insight into Arctic climatic variability during MIS 11c at Lake El'gygytyn, NE Russia](#), *Clim. Past*, 9, 1467–1479, 2013



Geoscientific Instrumentation, Methods and Data Systems (GI)



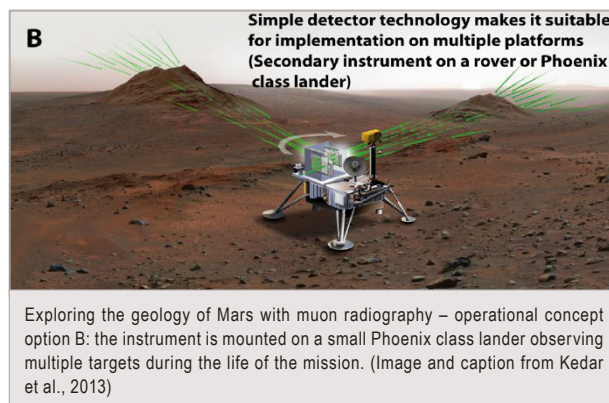
Exploring the geology of Mars with muon radiography – operational concept option A: muon instrument mounted as a secondary instrument on a rover. Muons generated by interactions of primary cosmic rays in the planet's atmosphere (green spheres) pass through a geologic object of interest, and are partially absorbed by the object. A passive muon detector composed of parallel scintillating plates on a lander or a rover records the tracks of the muons. These are analysed on site to determine the direction from which they entered the detector and the amount of energy absorbed by the target. The observations are distilled into a density image of the geological target, much like an X-ray radiograph would, except using muons as a passive source of radiation. (Image and caption from Kedar et al., 2013)

Muon radiography for exploration of Mars geology

Preliminary estimates of muon production on Mars indicate that the near horizontal Martian muon flux, which could be used for muon radiography, is as strong or stronger than that on Earth, making the technique suitable for exploration of numerous high priority geological targets on Mars. The results are reported in this paper.

Reference

Kedar, S. et al.: [Muon radiography for exploration of Mars geology](#), Geosci. Instrum. Method. Data Syst., 2, 157–164, 2013



Hydrology and Earth System Sciences (HESS)

Comparative assessment of predictions in ungauged basins – Part 2: Flood and low flow studies

The objective of this paper is to assess the performance of methods that predict low flows and flood runoff in ungauged catchments. The aim is to learn from the similarities and differences between catchments in different places, and to interpret the differences in performance in terms of the underlying climate-landscape controls.

Reference

Salinas, J. L. et al.: [Comparative assessment of predictions in ungauged basins – Part 2: Flood and low flow studies](#), Hydrol. Earth Syst. Sci., 17, 2637–2652, 2013

Palaeoclimatological perspective on river basin hydrometeorology: case of the Mekong Basin

The main aim in this paper is to develop a river basin scale approach for assessing interannual hydrometeorological and discharge variability on long, palaeological, time scales. For the development of the basin-wide approach, the authors used the Mekong River basin as a case study area, although the approach is also intended to be applicable to other basins.

Reference

Räsänen, T. A. et al.: [Palaeoclimatological perspective on river basin hydrometeorology: case of the Mekong Basin](#), Hydrol. Earth Syst. Sci., 17, 2069–2081, 2013

Geoscientific Model Development (GMD)

Editorial: The publication of geoscientific model developments v1.0

In this editorial, GMD Executive Editors assess the lessons learned over the first few years of the journal's life, and describe some changes to GMD's editorial policy, which will ensure that the models and model developments are published in such a way that they are of maximum value to the community.

Reference

GMD Executive Editors: [Editorial: The publication of geoscientific model developments v1.0](#), Geosci. Model Dev., 6, 1233–1242, 2013

Nonlinear Processes in Geophysics (NPG)

Clifford algebra-based structure filtering analysis for geophysical vector fields

In this paper, a new Clifford algebra-based vector field filtering method, which combines amplitude similarity and direction difference synchronously, is proposed. The method may provide a new powerful and applicable tool for geophysical vector field analysis.

Reference

Yu, Z. et al.: [Clifford algebra-based structure filtering analysis for geophysical vector fields](#), Nonlin. Processes Geophys., 20, 563–570, 2013



Aerosol sounding with LOAC at the EGU 2013 General Assembly

Remember the orange balloon flying outside the Austria Center Vienna during this year's General Assembly? It was part of an experiment to measure aerosol concentration and determine air quality at the conference. Experiment-leader Jean-Baptiste Renard reports on the results [here](#).

Measuring the concentration and mass of aerosols in the lower atmosphere is of primary importance. Their presence in the ambient air [can have direct effect on human health](#) as these pollutant particles can enter the body's airways and interfere with gas exchange in the lungs. Further, their interactions with solar radiation and clouds are likely to affect the climate and, in some occasions of very high concentrations in altitude, they can affect air traffic security.

Due to the large variety of aerosol sources, both of natural and man-made origins, and their relatively short lifetime in the atmosphere, the concentration, nature and size of the particles experience significant variability. To understand and predict aerosol impacts, it is important to develop observation and monitoring systems allowing their characterisation. To determine the size and distribution of aerosols, researchers often use optical particle counters, which work by detecting the light scattered by the suspended particles.

LOAC at the EGU General Assembly

At the EGU 2013 General Assembly, which took place in Vienna in April this year, we conducted aerosol measurements under a tethered balloon using a new kind of light aerosols counter (Fig. 1, left). The instrument, called LOAC (Light Optical Aerosols Counter), weighs 1 kg and can determine the concentration of particles in 19 size classes, with diameters from 0.3 to 50 μm . It can also inform on the main nature of the detected aerosols: carbon (such as soot), mineral (such as microscopic sands) and liquid (droplets).

We flew LOAC under a 6 m^3 tethered balloon operated by the Austrian Meteorological Office, with maximum altitudes in the 110–220 m range (Fig. 1, right). On 9 April 2013, we conducted the flights during the morning coffee break (~10:30), lunch time (~13:00) and afternoon coffee break (~15:30) while on 11 April 2013, only one flight was conducted, during the morning coffee break (~10:30). For each 30-minute session of measurements, the LOAC performed two ascents and two descents. For comparison, we also conducted indoor measurements in the main hall of the conference centre during the 10 April afternoon (15:30–16:30).

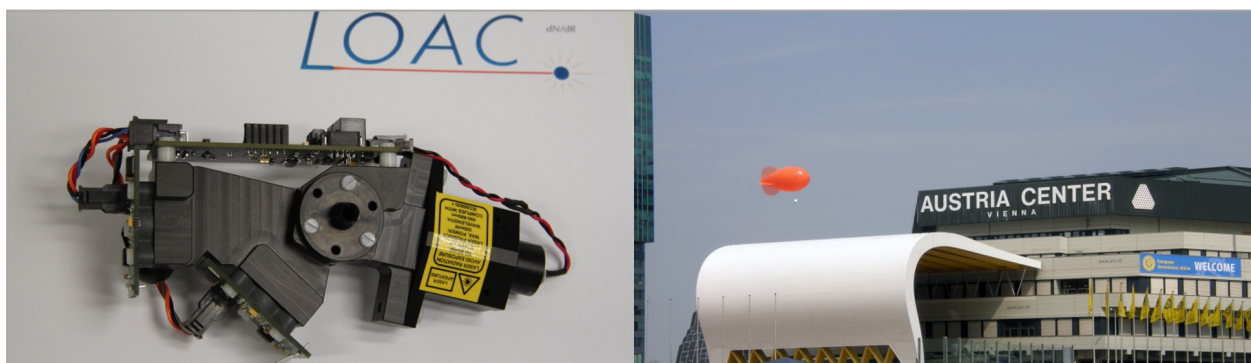


Figure 1. Left: LOAC optical chamber and electronics. Right: LOAC balloon deployment at the EGU 2013 – the aerosol counter is in the small white box under the balloon. (Credit: F. Dulac)

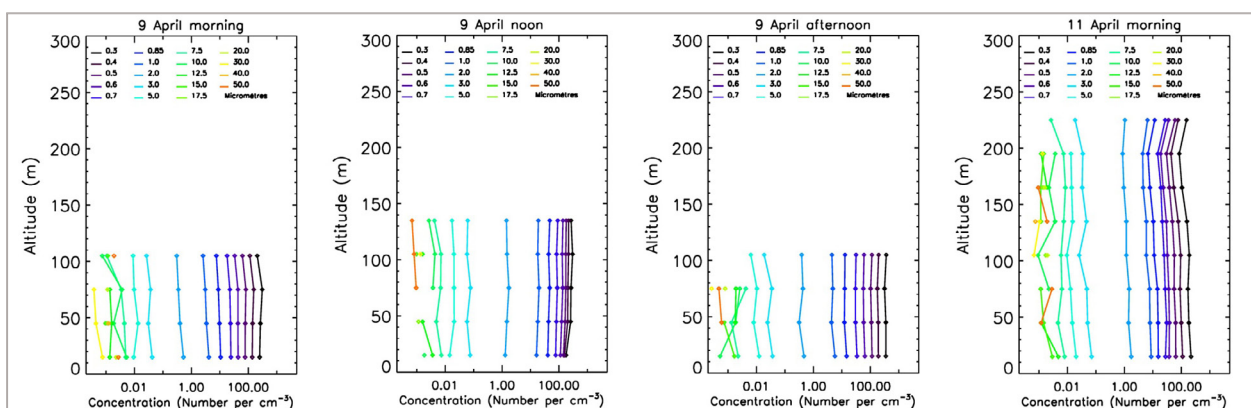


Figure 2. Vertical distributions of 19 size classes for the four LOAC flights

Aerosol concentrations at the conference

Figure 2 presents the evolution with altitude of the concentration for 19 size classes obtained during the four outdoor flights. The concentration of particles greater than $\sim 3 \mu\text{m}$ decreases with altitude because they are more massive than the smallest ones. This effect, shown in Fig. 3 for two different altitudes during the 11 April morning flight, induces changes in the size distribution.

The smallest aerosols exhibit significant variation of concentration with altitude, probably due to air masses of different origins. The size distribution of these aerosols also changes with time due to

different processes in the aerosol formation and transport during the day.

The measurements indicate various natures of particles depending on the altitude and time of measurements. During the 9 April morning flight, LOAC detected only mineral particles. At lunch time, carbon particles and large mineral particles were present at all altitudes. Then, in the afternoon, the particles were mineral for altitudes below 100 m and carbon above. On 11 April, mineral and carbon particles were present from the ground up to 150 m. Above 175 m, only carbon particles were detected, as expected for urban pollution. The presence of mineral particles below 150 m could be due to building works going on in the towers close to the conference centre. Thus, at the EGU 2013 General Assembly, mineral particles dominated the ambient air, which is unusual since carbon particles are expected to be the main population of urban aerosols.

To compare the outdoor air quality with that indoors, we present in Fig. 4 the size distribution for the aerosol measurements we conducted indoors on 10 April. The concentration of the largest particles was about five times higher than in the outdoor air, with the nature of particles being mineral and carbon. Such measurements show that the indoor air was more polluted than outside in terms of total aerosol mass, as expected since many human activities and movements were present. From the LOAC counting, it is possible to provide a rough estimation of the total mass of particles per cubic metre, assuming a mean density of 2 g/cm^3 for the particles. During peak activity, the concentration of particles smaller than $10 \mu\text{m}$ surpassed $50 \mu\text{g/m}^3$, which is the limit daily-average value defined by [EU air quality standards](#).

LOAC's uses

In conclusion, the flights conducted with LOAC under a tethered balloon allowed us to determine the vertical evolution of pollution particles up to an altitude of 200 m, and to point out an evolution of the nature of aerosols with altitude. These kinds of measurements can help distinguish between local sources and averaged ambient air above cities. Similar measurements are now conducted routinely with LOAC from the Observatoire Atmosphérique Generali touristic balloon in Paris, up to an altitude of 300 m.

LOAC is also involved in several campaigns, such as [ChArMEx](#) (studies of tropospheric pollution in the Mediterranean Sea) and AEROWAVE (studies of variability of aerosols atmospheric content up to the stratosphere) with flights under different types of balloons.

Jean-Baptiste Renard

Senior scientist at [LPC2E-CNRS](#) and Orléans University in France, on behalf of the LOAC team and collaborations

Acknowledgements

The LOAC project was funded by the French National Research Agency's ECOTECH, the Sustainable Production and Environmental Technologies programme. The instrument and the gondola were built by Environnement-SA and MeteoModem. The authors thank the EGU Atmospheric Sciences Division, especially Division President Oksana Tarasova, for their strong interest in the LOAC measurements and the General Assembly Programme Committee for making these measurements possible.

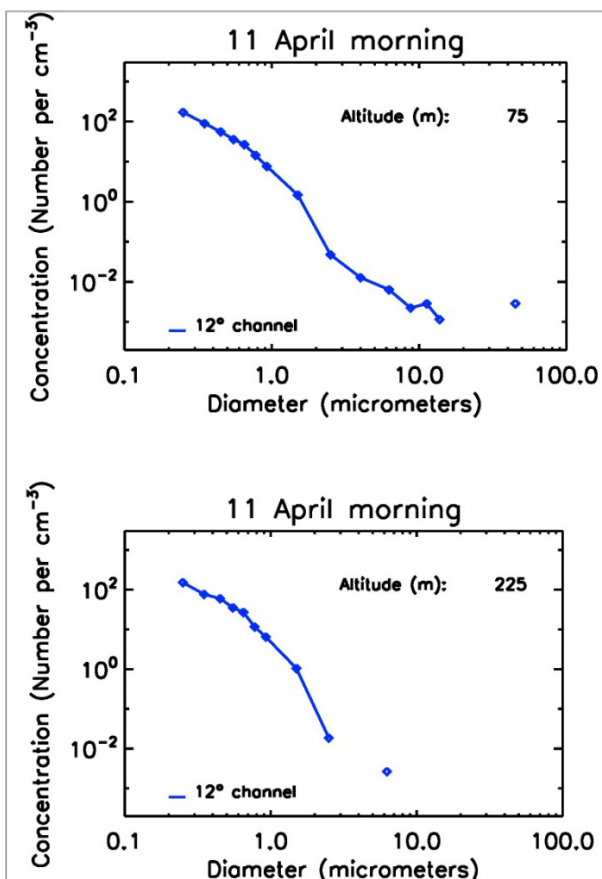


Figure 3. Size distribution at two different altitudes for the 11 April morning flight (12° channel refer to the scattering angle measurements used by LOAC for the counting)

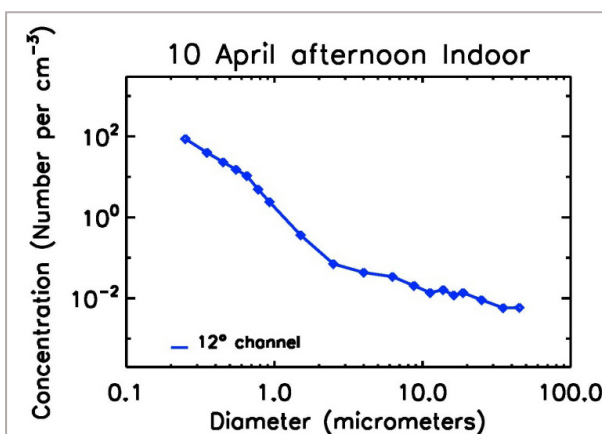


Figure 4. Indoor measurements during the 10 April afternoon coffee break

Anthropocene: the exhibition

Curators from the Deutsches Museum in Munich, Germany discuss an upcoming exhibition that will present geology and environmental issues to the public and encourage the scientific community to get involved in the project.

The Anthropocene has emerged as a popular term used by scientists and the media to partition the current phase of Earth's history. The concept suggests that the scale of human impact on the planet has become so great that the collective action of the species will be found in the geological record. Currently there is an [Anthropocene working group of the Subcommittee on Quaternary Stratigraphy](#) who are preparing a proposal to the International Commission on Stratigraphy to have the period formalised. The proposal is not due until 2016, but before then the [Deutsches Museum](#) will hold the [Anthropocene Exhibition](#).

Although it has antecedents reaching back to the early twentieth century, such as Vernadsky's '[Noosphere](#)', the term Anthropocene has only been in use for over a decade. In 2000, Nobel Prize winning chemist Paul Crutzen described the term and later in the same year gave a further impulse to the concept with a short publication (co-authored with Eugene Stoermer) that appeared in the International Geosphere Biosphere Newsletter. Soon the term was being used in the global change community. In recent years it has spread throughout many disciplines and has struck a chord with many scholars in the humanities, where the concept appears original in its genuine challenge of nature-culture dichotomies. Recently, the [Rachel Carson Center for Environment and Society](#), a joint endeavour of Munich's Ludwig Maximilians Universität and the Deutsches Museum, hosted the conference [Culture in the Anthropocene](#) in Munich. The concept has also gained the curiosity of artists and museums looking for creative ways to explain the increasing pervasiveness of humans.

Understanding that this is both a concept with utility for science and public engagement, the Deutsches Museum has embarked upon the Anthropocene Exhibition to be opened in October 2014. The



Rudolf Diesel and Oskar von Miller, founder of the Deutsches Museum, 1897 (Courtesy of the Deutsches Museum)

exhibition team is working on taking the concept from a complex assemblage of academic insights into a collection to showcase to the public. At this stage in the planning process we can offer a few insights into the exhibition.

The exhibition

The current scale of environmental issues demands that scientists and policy makers reach the public on as wide a platform as possible. Over its long history the Deutsches Museum has sought to be one of the sites to engage the public with science and technology. From the beginning of the museum, its founder Oskar von Miller and supporters like the engineer Rudolph Diesel wanted to communicate to society "the great masterworks of the natural sciences and technology". With global industrialisation and mechanisation influencing more areas of the planet, the associated changes have reached previously unimaginable dimensions and dynamics. With this, the role of the museum has also been challenged. In a survey



Ideal Moon Landscape, by Wilhelm Kranz, 1919 (Courtesy of the Deutsches Museum)



of patrons we found that eighty percent of those interviewed wanted the museum to engage with controversial topics.

The exhibition will visualise the history, present and future of the Anthropocene. It will also display the deep interventions of humans into the geo- and biosphere over the last two centuries. It will not, however, be conceptualised as a history of decline, but as a complex story of destruction and shaping. Science and technology based concepts of transformation are not only to blame for past mistakes, but offer some of the greatest potential in moving towards a sustainable economy and society. Accepting that we are now living in the Anthropocene is not a move towards anthropocentrism but an attempt to overcome the dualism between humans and nature; this

philosophical challenge is an equally important thread to weave into the exhibition. Topics of the exhibition will include: humankind as destroyer, but also creator and designer; the anthropogenic planet that is shaped and changed by human beings; historically grown consumption patterns and lifestyles; time and space as important factors in the Anthropocene; the future as challenge but also as chance for humankind and its political institutions, social networks and dreams.

The exhibition's main goal is to inform visitors about the Anthropocene as a scientific hypothesis and a currently debated vision of the role of humans on Earth. It shows the effects of human intervention as a biological and geological actor, increasing awareness for both temporal and spatial extent of human-invoked environmental changes. By translating the concept into a three-dimensional space, the exhibition offers the general audience a unique opportunity to experience the Anthropocene and learn about the current state of scientific knowledge and ongoing discussions.

Engaging the geologic

The exhibition is planned to run for eight months. Accompanying it, will also be a catalogue, an educational program, a lecture and film series and an online exhibition with the exhibition partner, the Rachel Carson Center.

The message of the Anthropocene makes significant contribution to the ongoing conversation about the human impact on the planet. At its heart the concept is layered with the sediments of geology and in this way we are planning to have a geological trace that runs throughout the exhibition. We would like to engage with as many scholars in the Earth sciences as possible and the curatorial team invites interested scientists who would like to contribute their knowledge to the formation of the exhibition to contact us with comments and suggestions. The Anthropocene Exhibition is set to be an original and important endeavour that brings transdisciplinary scientific knowledge about the 'age of humans' to the public.

For further information contact the project manager Nina Möllers and check the [exhibition website](#).

Nina Möllers and Luke Keogh
Curator of the Anthropocene Exhibition (n.moellers@deutsches-museum.de)
and International Curatorial Fellow of the Deutsches Museum (l.keogh@deutsches-museum.de), respectively



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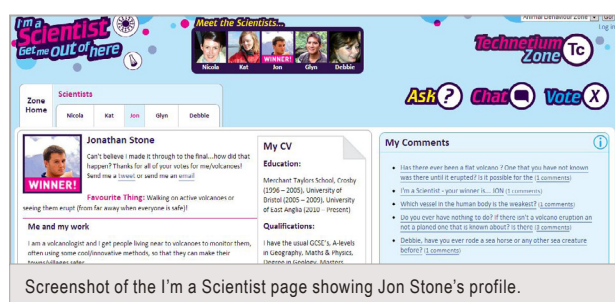
www.imggeo.net



I'm a Scientist, Get me out of Here!

Jon Stone, a volcanology PhD student at the University of East Anglia in the UK, was keen to talk about his work, to be asked questions on a topic he understood well – to really engage with young people. So when he heard about I'm a Scientist, Get me out of here!, he just had to apply.

The two-week event involves taking part in fast-paced live online chats with classes of school students. Stone explains: "I wanted to have a go at the challenge of talking to young people in that situation. School kids asking questions about what you do – where else do you get that forum? The chance to answer interesting and exciting questions motivated me: they don't ask the usual questions, but unique and wonderful things." He continues: "The format is awesome, especially for this day and age – that's how people are used to interacting with each other. Another thing is the excitement: because it had the competitive element, you want your work to be cooler than the others."



Screenshot of the I'm a Scientist page showing Jon Stone's profile.

Competing against four other scientists for student votes and the chance to win £500 to spend on further science communication, Stone was challenged to answer a huge range of questions (many, of course, related to volcanoes) and other scientists in the competition also faced some interesting geoscience questions:

- [Has there ever been a flat volcano? One that you have not known was there until it erupted?](#)
- [Do any animals live on or in volcanoes?](#)
- [What are the relationships between geysers and volcanoes?](#)
- [Would we be able to make the Earth earthquake-proof?](#)
- [What advice would you give to someone to pursue a career as an Earth scientist?](#)

Stone was enthused by the experience: "It was genuinely the most exciting two weeks of my life. I think I learnt a lot about the necessity: what's sufficient to answer this question which isn't misleading and will make them ask more questions."

He also shared his own discoveries and experiences with students:

- Student: "What's the most interesting thing you've ever discovered?" Stone: "That just because people might not want to evacuate from their home near a volcano, doesn't mean that they are stupid and don't understand science or the dangers they face."
- Student: "What is the most dangerous volcano that you have ever been to?" Stone: "Most dangerous volcano at the moment? Prob-

ably Volcan de Colima in Mexico. Most dangerous volcano for the future? Vesuvius, easily."

And it wasn't all science talk. "[Do you like Justin Bieber?](#)" turned out not to be such a trivial question: "People realising scientists can be normal is really cool and really important. I enjoyed those personal questions as much as I did the questions about science, and I didn't expect to," said Stone.

Both the scientists and the students shared a sense of humour. When asked if he felt qualified to destroy the 'one ring' in the fires of [Mount Doom](#) he answered: "If given the opportunity... yes! And I would do it a lot quicker than Frodo did..."

During the second week of the event a scientist is evicted each day until just one is left to claim the £500 cash prize. Stone couldn't have been happier to win the money, which he wasted no time in spending on a quadcopter with a camera: "Even if I had that kind of money myself, my wife wouldn't let me buy it, it would seem like a frivolous expense. If I was to give advice to other winners I'd say do something with the money that's a bit of a risk. You never have that opportunity to have a new idea and go with it."

The win gave him the chance to take photos of day-old pyroclastic flows following a volcano eruption in Ecuador. The pictures were used by the local authority to make maps and provide information about evacuations, not to mention enabling Stone to talk about his work with local children who crowded around to see the quadcopter. None of this would have been possible without the competition prize money.

Talking about his research in Ecuador was just an extension of geoscience conversations during the event: "I think the kids know a lot more than they think they do – it's about joining the dots and making connections. But they know less about Earth science than they do about classical sciences. That made it all the more fun for me."

"We're so lucky in academia because we have a flexible work schedule. The only reason I think someone wouldn't take part is if they hadn't heard about it, there isn't a comparable experience, it's a genius idea."

Hannah Sweet

Assistant Project Manager of I'm a Scientist, Get me out of here!

More information

Scientists can apply to take part in I'm a Scientist, Get me out of here! [online](#). Events run over two weeks in March, June and November, with scientists competing in either general or themed zones. Jon took part in the [Technetium Zone](#) in March 2013. The project is part-funded by the Wellcome Trust, a global charitable foundation dedicated to achieving extraordinary improvements in human and animal health. The event is currently free for schools in the UK who can sign up at <http://imascientist.org.uk/teachers>.

Being a young scientists representative for the EGU

Jennifer Holden, the young scientists representative for the Natural Hazards Division, writes about what it means to be a young scientists representative and what she's enjoyed about the role.

I was asked to be young scientists (YS) representative for Natural Hazards (NH) in 2009 by the then President of the Division Bruce Malamud. I was a PhD student at King's College London and was involved in the division as a scientific secretary for one of the sub-programme groups.

My experience isn't typical as I also spent a year in the EGU Office in Munich focusing on outreach to young scientists (amongst other things). In my first year as a young scientist (YS) representative for NH, I emailed all the people in the division who we could identify as young scientists (generally by if they'd entered the student poster award). In that email I outlined some tips for attending the General Assembly, plugged attending the Division Meeting (and the lunch that came with it, naturally), made sure people were aware of events relevant to young scientists and set-up a couple of new things too.

One was a meet-up point at the Ice Breaker event before the EGU's annual conference. When I attended my first EGU General Assembly I was lucky enough to attend with quite a few people from my department. I shared an office with them back at Kings College London and we shared an apartment at the conference. This meant my first General Assembly experience went smoothly, but talking to other young scientists, I realised that a large meeting can seem a baffling and lonely occasion. So, I set up a meeting place where people could meet other young scientists. This worked so well that the next year I set up the same thing for all divisions across the Union and they've become a regular feature at the Ice Breaker. I also set up a lunchtime meet-up where people could come along, bring their lunch and have a chance to talk to others (and maybe not eat alone). I think this worked less well as there were too many people to have a coherent group and it clashed with other events at the meeting – you learn from what doesn't work so well too! That email I sent at the start morphed into the very first [first-timer's guide to the EGU General Assembly](#).

Things that work as a YS representative are things that complement existing General Assembly activities in content and time slot. In Geomorphology, the Meet the Master sessions set up by Jens

Turowski always get rave reviews. Hydrology also has a long history of organising activities for young scientists, such as a special short course on writing research proposals. Because there is young scientist representation in these divisions, I think people in the division think about young scientists a bit more.

What have I got out of being a young scientist representative? I've got to see how a division of the EGU works from the inside: it's a great international networking opportunity, with both your peers and more senior scientists, and I've met some people I wouldn't have done otherwise. As a representative you can organise things that you've seen work well in other divisions, or organise new things that you've always wanted to happen for young scientists at the General Assembly but have not happened before. A great aspect of the EGU is that it's a bottom-up organisation. The time spent on being a young scientist representative depends on what you organise (and this includes how spread out the time commitment is). Emailing all the young scientists in a division is a relatively easy process thanks to some extensive mailing lists, but organising an event with a senior scientist will take more time and planning before the General Assembly, especially as the programme is finalised several months before the event.

If you're interested in becoming a young scientist representative for your division, first check your division webpage and if one doesn't exist, contact the division president. You don't need to be already involved in organising things at EGU at all. I (and I'm sure other existing YS reps) are quite happy to explain what we do and answer questions. I'd definitely recommend it!

Jennifer Holden
dot.rural, University of Aberdeen

More information

If you'd like to know more about being a young scientists representative for an EGU Division, please email EGU Communications Officer Sara Mynott at mynott@egu.eu or Jennifer Holden at jenniferaholden@gmail.com.

If you have ideas or suggestions for activities for young scientists at the forthcoming General Assembly, get in touch with Sam Illingworth (samuel.illingworth@manchester.ac.uk), the Programme Committee Young Scientists Representative for the EGU 2014 conference.

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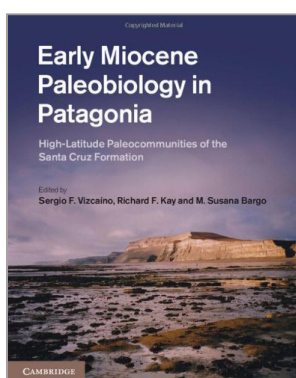
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Early Miocene Paleobiology in Patagonia: High-Latitude Paleoeocommunities of the Santa Cruz Formation

A book review



Edited by Sergio F. Vizcaíno,
Richard F. Kay, M. Susana
Bargo

CAMBRIDGE UNIVERSITY
PRESS

378 pages | Hardback
1st edition | October 2012
ISBN 978-0-52-119461-7

Price: £99 (~€115)

[Early Miocene Paleobiology in Patagonia](#) is a wonderful collection of papers dealing with high-latitude palaeocommunities of the Santa Cruz Formation, a fossil-rich rock unit in Argentine Patagonia. The papers comprise of research on palaeobiology, palaeobotany, chronology, sedimentology, palaeoenvironments, palaeoclimate, morphology and palaeoecology. With 17 contributions, this volume of over 370 pages contains a wealth of information for anyone investigating high-latitude palaeocommunities, palaeoclimate and South American geohistory.

The editors, Sergio F. Vizcaíno, Richard F. Kay and M. Susana Bargo, have a very good pedigree for editing this volume of important Argentinian science that is often lost in translation or published in obscure resources. I very much welcome this volume as the editors have covered the majority of the research disciplines required to provide a great understanding of the Santa Cruz Formation. The English throughout the volume is very good and the editors and publishers should be thanked for this.

Cambridge University Press has done a superb job on this volume, producing a very high-quality book. The text is well set out, the tables are clear, the illustrations are consistently of good quality and the photographs are very clear and well presented. It is also nice to see that each chapter has an abstract in Spanish.

As with all edited volumes the first chapter sets out the background to the book and the research focused on studying the Santa Cruz Formation. Then the volume quickly covers the topics of tephrochronology, absolute dating and geochronology. Following this are

a set of contributions that provide information on the sedimentology and stratigraphy of the Santa Cruz Formation. The understanding of the palaeoclimate and palaeoenvironment of this formation is supported by documenting evidence using trace fossil assemblages (ichnology), plant cuticle and spore/pollen assemblages, and the presence and structure of the amphibian and squamate reptile compositions.

The remaining half of the volume is dedicated to the palaeoecology and palaeobiology of the Santa Cruz Formation. These contributions include such fossils as birds, sloths, anteaters, rodents, ungulates, armadillos, glyptodonts, carnivores and primates. The volume also discusses the diversity of the mammalian and marsupial assemblages, with many of the contributions deal with taxonomy, body mass, ecology and ecomorphology. As previously mentioned, the illustrations and photographs are of high quality and these are clearly depicted in these contributions with stunning line drawings showing life reconstructions.

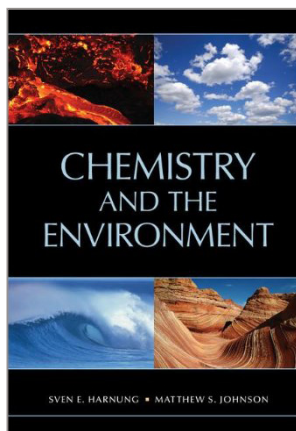
The volume ends with an excellent review of the palaeoenvironment and palaeoecology of the Miocene Santa Cruz Formation by the editors. This chapter covers the background of what is known about this formation that includes the contents of the previous contributions.

Ultimately our understanding of the Santa Cruz Formation is immensely increased by this edited volume, which is a valuable resource for any graduate student, post-doctoral researcher or lecturer who either works on the Miocene from South America or has an interest in the general understanding of this geological epoch. The volume covers all the topics required to obtain a broader understanding of the Santa Cruz Formation and each contribution has an extensive set of up-to-date references for the reader to follow up. This is a volume that you will not be disappointed in. I have enjoyed reading it so much that I wish I could take some time off to travel to Argentina and have a guided tour of the Early Miocene Santa Cruz Formation to see all the wonderful information I have read in this book.

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Reader in Stable Isotope Geochemistry
University of Durham, UK

Chemistry and the Environment

A book review



By Sven E. Harnung and
Matthew S. Johnson

CAMBRIDGE UNIVERSITY
PRESS

440 pages | Paperback
1st edition | October 2012
ISBN 978-1-10-768257-3

Price: £40 (~€47)

The origin and movement of the atoms and molecules on the Earth is, understandably, a complex, nuanced and diverse subject. Indeed, if the natural world was not complex enough already, its chemistry is further obfuscated by the interferences of human activities. It is for this reason that the achievements of this book, namely presenting a fundamental and unified course in environmental chemistry, are made more impressive.

[Chemistry and the Environment](#) is written as the ideal companion to undergraduate and graduate level courses on environmental chemistry. The authors, Sven E. Harnung and Matthew S. Johnson, both at the University of Copenhagen, are highly respected researchers within the field of environmental chemistry and have devised the book based on their own courses.

After a short introduction, the book is divided into 10 chapters. The first three introduce the Earth and the base equations that govern its dynamics. Three chapters examining the atmosphere, hydrosphere and pedosphere, respectively, follow this, while chapter 7 describes global biogeochemical cycles. The book concludes with two chapters on the chemical industry and the environmental effects of certain chemicals, and a final chapter on climate change.

At the rear of the book, the expansive appendices also provide an almost exhaustive reference for the reader – from the periodic

table to polynuclear complex equations – who might otherwise have resorted to search online for such information.

Perhaps the most impressive aspect of this book is its conciseness. Each one of its chapters could be a textbook within itself, yet the authors manage to distill each topic down to its bare essentials. Some sections, such as the climate change chapter, might have benefitted from a more thorough detail, but, in most subjects, especially the chemical kinetics and fluid dynamics sections, it reaches considerable depth. The authors present the various subjects in a coherent narrative that is not interrupted by case studies or diversions.

One aspect that seems oddly lacking for a book such as this is end of chapter exercises. These are instead available online, the address for which is hidden in small print within the copyright section. The rationale for this is that they are designed to be issued by lecturers to students. Indeed, the answers, normally rarely available and a boon for students when they are, are only available to registered lecturers at the website. I expect that this might disappoint students, many of whom might wish to use the exercises for revision and do not have access to the answers as the lecturer does not use this book or its exercises. The exercises themselves are exemplary, being a mixture of open, descriptive questions and problems of many difficulty levels. Though it would undoubtedly lengthen the book, I feel that it might have made the book more self contained and complete if these exercises had been included within the volume itself and the answers made available to all.

This book will appeal to undergraduates, graduates and professionals alike. Though its scope is necessarily broad, it manages to tackle this most interdisciplinary of subjects with clarity and breadth. Because of its logical and concise layout, it forms an ideal companion – or even, the ideal basis – for any course in environmental chemistry.

Oliver Knevitt

PhD student, University of Leicester, UK



14 Open Access Journals
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This section advertises conferences, summer schools and workshops submitted to the EGU online [meetings calendar](#). Meetings co-sponsored by the Union are highlighted with an EGU logo.

9th TOPO–EUROPE Workshop: Linking the Deep and Surface Earth

09–11 October 2013, Certosa di Pontignano, Italy

TOPO–EUROPE conferences have been held annually since 2005. This will be a three-day workshop on topics that link deep Earth tectonics with surface processes. The conference will be multidisciplinary including participants from geodynamics, tectonics, seismology, sedimentology and geomorphology. Attendance is open (subject to space limitations) and submissions are welcome on all topics relative to the cause, creation and modification of the Earth's topography.

Website: <http://www.esd.ethz.ch/topoeurope9>

VII EGFA – VII Meeting on Physical Geography and Environment: Great forest fires, erosion, degradation and rehabilitation

10–11 October 2013, Guimarães, Portugal

The main objective of VII EGFA is to stimulate a broad debate on the state of knowledge of large forest fires in Portugal and its effects at ground level, but also to spread some of the work done in recent years in Portugal, on this vast and current theme.

Website: <http://viiegfa.weebly.com/index.html>

5th EGU Leonardo Conference on Facets of Uncertainty

17–19 October 2013, Kos Island, Greece

Three different series of events, the EGU Leonardo Conference, held every year in Europe, the IAHS Statistical Hydrology (STAHY) Workshop, held every year in different parts of the world, and the Hydrofractals Conference, held every ten years, coincide in space and time: Kos Island, Greece, 17–19 October 2013. Each of these events has its own dynamics but all three have been set to focus on a common idea: the uncertainty in natural processes.

Website: <http://kos2013.org/Welcome.html>

Fighting Global Poverty: Can Geologists Help? – GfGD National Conference

23 October 2013, London, UK

This Geology for Global Development (GfGD) event will bring students and recent graduates with an interest in international development, together with a series of professionals from across the sector. The conference will explore if and how geologists can contribute to the fight against global poverty, giving a 'big picture' overview of the opportunities and careers available. The conference will also explore the skills young geologists will need to develop in order to contribute to development in an effective and sustainable manner.

Website: <http://www.gfgd.org/conferences>

19th Windy Day Meeting 2013

23 October 2013, Southampton, UK

This informal meeting of the UK aeolian research community, will be of interest to any scientist undertaking research relating to drylands, deserts, coastal dunefields, playas and processes therein. Presentations covering the application of basic physics, methodological issues and techniques to these environments are also welcome, and presentations by research students are especially encouraged.

Website: <http://esdsoton.wordpress.com/windy-day-2013/>

GSA 125th Anniversary Annual Meeting & Exposition

27–30 October 2013, Denver, Colorado, USA

This year's meeting of the Geological Society of America (GSA) affords a special opportunity to reflect on how GSA and its members are building upon the Society's long tradition of achievements and laying the groundwork for future generations of geoscientists.

Website: <http://community.geosociety.org/2013AnnualMeeting/>

International Conference on Regional Climate

04–07 November 2013, Brussels, Belgium

CORDEX 2013 brings together the international community of regional climate scientists to present and discuss results from WCRP regional climate studies, with a particular emphasis on the CORDEX initiative. The first day of the meeting will feature the IPCC and a high-level session with the participation of European Commissioners.

Website: <http://cordex2013.wcrp-climate.org/>

55th Annual Meeting of the APS Division of Plasma Physics

11–15 November 2013, Denver, Colorado, USA

The American Physical Society (APS) Division of Plasma Physics annual meeting will be held in the heart of downtown Denver, Colorado from 8:00 am Monday morning through 12:30 pm Friday afternoon. All technical sessions will be held in the Sheraton Denver Downtown Hotel.

Website: <http://www.aps.org/units/dpp/meetings/annual/>

10th European Space Weather Week

18–22 November 2013, Antwerp, Belgium

Now in its 10th year, the European Space Weather Week has grown into the main annual event in the European Space Weather calendar. The event this year will highlight key innovations in space weather research, applications and services. The agenda will be composed of plenary/parallel conference sessions, working splinter meetings and dedicated events for service end-users.

Website: <http://stce.be/esww10/>

2013 AGU Fall Meeting

09–13 December 2013, San Francisco, California, USA

The American Geophysical Union's 46th annual Fall Meeting brings together more than 24,000 Earth and space scientists, educators, students, and other leaders in San Francisco, California, 9–13

December, to present groundbreaking research and connect with colleagues.

Website: <http://fallmeeting.agu.org/2013/>

European Research Course on Atmospheres

07 January – 08 February 2014, Grenoble, France

ERCA is a course for thesis students, scientists and engineers from universities, public research institutes and private research or industrial organisations. It is an interdisciplinary course on the Physics and Chemistry of the Earth's atmosphere, the climate system and climate change, atmospheric pollution at different scales and the human dimensions of environmental changes. The course also covers other planets, satellites and space weather, amongst others.

Website: <http://erca-school.eu/>

9th International Conference on Dendrochronology

13–17 January 2014, Melbourne, Australia

Held once every four years the International Conferences on Dendrochronology have been the leading opportunity for scientists, managers and students who use tree-rings to present advances in research and new ideas on a range of issues, including climate, ecology, geomorphology, archaeology, environmental sciences, conservation and policy to an international audience.

Website: <http://www.dendro2014.com/>

EGU General Assembly 2014

Vienna, Austria | 27 April – 02 May 2014

www.egu2014.eu

Call-for-sessions deadline | 16 September
Abstract submission deadline | 16 January

