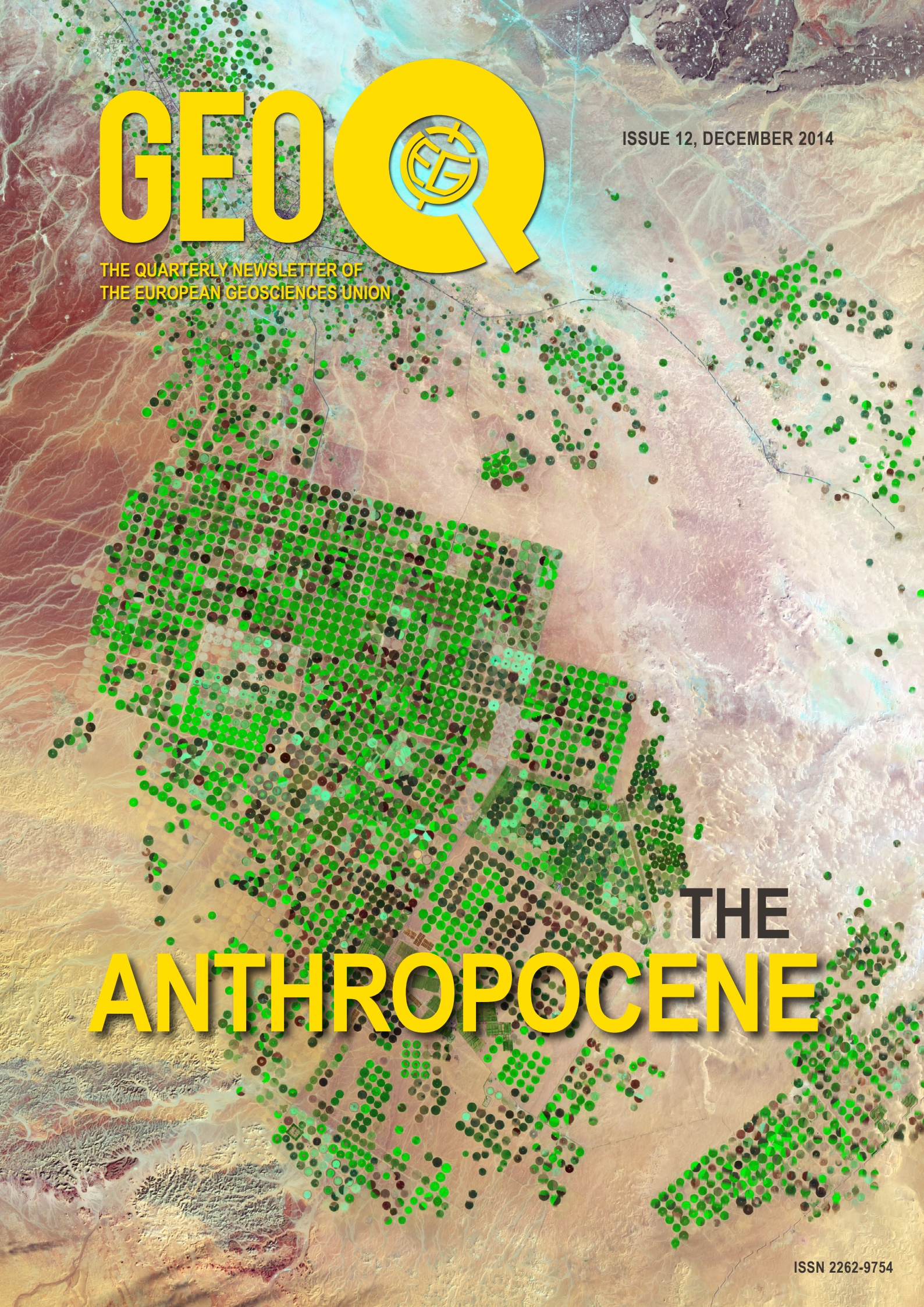
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EDITORIAL

This is the last issue of GeoQ. From January onwards, we are changing the quarterly PDF newsletter format that started with The Eggs over a decades ago, and continued when the publication was revamped and renamed GeoQ three years ago. The EGU has grown significantly in the past few years. This is reflected in the record-breaking number of participants at our annual General Assembly, the larger number of open access journals we publish, and the planned staff increase at the EGU office in Munich. We now publish information – from press releases and EGU news to journal highlights and General Assembly updates – on our websites, blog and social media channels at a rate that a quarterly newsletter cannot keep up with.

To inform our members about EGU activities on a more regular basis, we are introducing a shorter email newsletter, which we will send out every month from 2015 onwards. The new EGU newsletter will keep some of the popular sections of GeoQ, such as Journal Watch and EGU News, but we will abandon the interactive PDF format to make the newsletter more functional and easier and quicker to read.

But before we move on to a more frequent newsletter, we have an excellent final issue of our GeoQ(uarterly)! It is dedicated to a very interdisciplinary and timely theme: The Anthropocene.

The Deutsches Museum (the largest science and technology museum in the world, based in Munich) is opening a major gallery in December dedicated to the age of humans. Moreover, October saw the first meeting of the Anthropocene Working Group, the International Commission on Stratigraphy body in charge of examining whether humans have impacted the Earth significantly enough to merit defining a new geological epoch, an era of humanity's own making. In this issue (see External News), the Anthropocene Working Group writes a report on the outcome of that meeting, including future steps being taken to formalise the Anthropocene epoch.

The last issue of GeoQ also features articles on interesting research related to the different ways in which humans are affecting the Earth's systems. Sara Mynott explores how major engineering works, such as the Suez Canal, have irreversibly affected natural ecosystems. Jonathan Fuhrmann focuses on the Himalayas, explaining how dark aerosols of human origin are affecting the ice, snow and water availability in the Third Pole. Tim Middleton looks at the Amazon in the Anthropocene, pointing out that signs of human presence in the rainforest can be traced back hundreds, or even thousands, of years. And, in the EGU Voice section, the EGU President writes about new thinking, data and models for doing geosciences in the Anthropocene.

This newsletter also informs members about recent EGU events and activities. For example, in the EGU News section we announce the winners of the 2015 EGU's awards and medals. Congratulations to all for their important contributions to the Earth, planetary and space sciences! Also of highlight is the forthcoming EGU General Assembly, taking place in Vienna, Austria, from 12 to 17 April. Don't forget to **submit your abstracts to the conference by January 7**.

Thank you for reading GeoQ, and I hope you like the new EGU newsletter we have in store for you. Check www.egu.eu/newsletter in the coming weeks for more information.

Bárbara Ferreira
GeoQ Chief Editor & EGU Media and Communications Manager
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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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DESIGN: André Roquette

COVER PHOTO: Crop Circles in the Desert, a NASA Earth Observatory image created by Robert Simmon and Jesse Allen, using Landsat data provided by the United States Geological Survey.

GEOQ ISSUE 12
DECEMBER 2014

Ecosystem engineering: how the Suez Canal changed the sea

Humans have been dramatically altering the Earth's surface since the first farmers took to taming the land. Since then buildings have risen, mountains have been bored and great continents have been carved apart. The Suez Canal, which joined the Red Sea with the Mediterranean some 140 years ago, was an amazing feat of engineering, but it irreversibly altered the biology of the Mediterranean basin. A new study published in Frontiers in Marine Science reveals how human activity following the canal's construction is changing the shape of the Mediterranean Sea.

Beneath the sea's surface, invertebrate larvae drift along the currents. As adults many of them won't be able to move far. Some won't be able to move at all, so this is their chance to spread as they bring their genes to a new stretch of the sea. Fish, on the other hand, swim freely in the ocean, their only hindrance being where the sea meets the land and they can swim no further. Humans, for the most part, move on the ocean in vessels capable of carrying them, their cars and cargo. Land barriers also get in their way, but unlike fish, humans have the ability to break through them.

In 1869, engineers did just that. They dug, dredged and flooded a 164-kilometre-long channel between the Red and Mediterranean Seas to form the Suez Canal. This act of engineering created a 7,000 km shortcut in the trade route to India and still presents a vital trade link between Europe and the Middle East. But the channel provides a highway for more than meets the eye. Since its construction, over 400 alien species have spread from the Red Sea to the Mediterranean, and are building strongholds in the sea's eastern margins. Some of these species are fundamentally altering Mediterranean ecosystems.

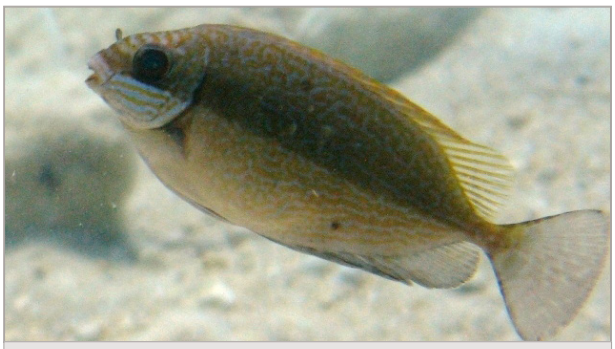
This move to the Med is known as Lessepsian migration, after Ferdinand de Lesseps, who managed the canal's construction, and most of it has occurred in the last 50 years. Most species move along the Suez in one direction. The Red Sea is extremely salty and nutrient-poor, so any species hoping to spread from the Med to the Red is faced with a more challenging environment, and one that they are not well equipped to handle. Those going the other way, however, are rewarded with a sea rich in nutrients.

While some alien species can have a positive impact on an ecosystem, either by fulfilling a need in an area under stress, or by providing an additional food source, others can become invasive, displacing native species and degrading local habitats. Roughly one fifth of the known species in the Mediterranean Sea aren't found anywhere else in the world, but many of these are at risk of being outcompeted by new arrivals from the Red Sea. Indeed, in certain areas, where there is a high concentration of alien species, they have caused a shift to a completely new habitat.

The Suez Canal, which now stretches some 193 kilometres from the Red Sea to the Mediterranean, provides a highway for ships and invasive species alike. (Credit: NASA)

In the easternmost part of the Mediterranean, fish trawls close to the coast land a catch containing so many alien species that they outnumber the natives. Some of the most destructive migrants to make the journey from the Red Sea are rabbitfish. Named for their rabbit-like mouths, these voracious herbivores graze on lush brown algae to get their energy. But in some areas, their grazing is so intense that large stretches, once covered in a rich algal carpet, are now barren rocky zones. These fish are critically altering shallow habitats in the eastern Mediterranean, and their impact is likely greater than all the alien fish in the Med combined.

Using data from the European Alien Species Information Network, Stelios Katsanevakis and his international team were able to map



One of the rabbitfish responsible for severely degrading algal forests in the eastern Medditeranean. (Credit: Roberto Pillon)

how human activities have helped spread non-native species in the Mediterranean. While the canal provides a highway for marine migration, alien species don't have to make the journey alone and many hitch a ride on shipping vessels, either on their hulls or in their ballast water, bringing new species to far stretches of the Mediterranean Sea. Some 300 species have made it to the Med as stealthy passengers and have established themselves around the sea's major ports and harbours.

The Red Sea isn't the only source of alien species. Around the world, ships shift cargo and vast volumes of oil from one coast to another and with each journey they carry the risk of introducing a new species when they come into port. One such hitchhiker is the invasive Australian grape algae, which smothers local algae communities and is now widely established along the Mediterranean coast.

Humans are aiding the spread of alien species further through aquaculture, where species are brought to a new site as commodities and contaminants, though this route makes up a much smaller contribution than shipping and the Suez. And while measures are in place to reduce the risk of alien species introduction, preventing the spread of yet more invasives in the sea is an impossible task. As the climate warms, conditions in the Med will be even better for Lessepsian migrants, so the problem – considered to be one of the greatest biogeographic changes on the planet – is set to worsen.

When we look back at the fossil record, we can see where species originated, expanded and increased their range – changes that have happened over hundreds to millions of years. If we were to look back at our impact on the planet, even in the last century alone, we would see astounding shifts in species, not only in the ocean, but also on land. Together with the collapses brought about by hunting, fishing, habitat change and more, this record is worthy of the name Anthropocene.

Sara Mynott

PhD Student, University of Exeter

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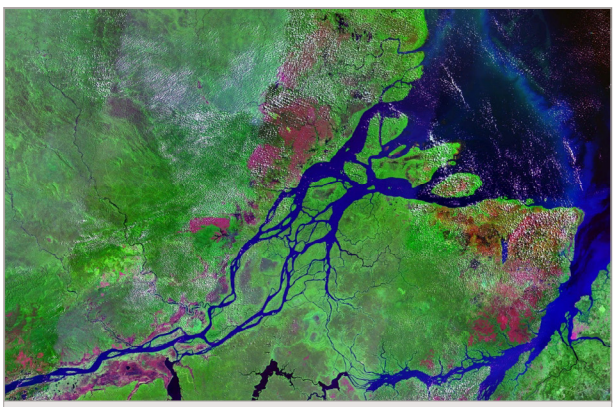
The Amazon and the Anthropocene

The Amazon rainforest covers seven million square kilometres of the Earth's surface. It contains 2,000 different species of birds and mammals, 40,000 plant species, and around 2.5 million insect species. It is surely one of Earth's few remaining natural paradises.

Or is it? Many natural landscapes, including the Amazon rainforest, are readily romanticised in the popular imagination. But by the 1970s we had began to realise that human activity in the Amazon is not just a recent phenomenon; the Amazon isn't as pristine as we had supposed. According to Anna Roosevelt, Professor of Anthropology at the University of Illinois in Chicago, and others, the Amazon was home to as many as five million people in AD1500 and evidence of human presence extends back at least 13,000 years.



Satellite image of mouths of the Amazon River in Brazil. (Credit: NASA)

The start of the Anthropocene epoch is much debated: some scientists believe it should coincide with the start of the Industrial Revolution, whilst others suggest an Early Anthropocene, beginning thousands of years previously. However, a growing body of evidence from the Amazon would seem to imply that human impacts can be traced back a long way – evidence that would therefore support the Early Anthropocene hypothesis. So how do we know about these human activities?

Two lines of evidence are crucial: the soil and the trees themselves. So-called anthropic black soils are, in essence, buried rubbish dumps from former settlements. They tend to consist of ash, fish bones, manure, excrement and burnt plant materials, resulting in a nutrient and carbon-rich soil. Fragments of pottery have confirmed that these soils are of human origin. Some of the best studies have conducted detailed stratigraphic analysis of these soils and their surrounding horizons, anlaysing artifacts from individual layers and dating the sediments to build up a complete history of occupation.

Geoglyphs on deforested land at the Fazenda Colorada site in the Amazon rainforest. (Credit: Sanna Saunaluoma)

Furthermore, they appear to be widespread: as much as ten percent of Amazonia may be covered by anthropic black soils.

The second clue is more subtle. The first human inhabitants of the Amazon, the Paleoindians, are thought to have been foragers, eating fish from the rivers and fruits and nuts from the trees. But when populations began to settle they would cut wood and discard seeds in the vicinity of their settlement. Over time this would have changed the make-up of the forest, producing small concentrations of palm groves and fruit trees. The Amazonian rainforest is traditionally thought to be very diverse such that individual trees in any one particular species are widely spaced. Therefore, concentrations of a specific species are very noticeable. Some of the groves that were created at prehistoric settlements are still intact today and are now major resources. However, the extent of these anthropic forests isn't known and a major challenge for future research is to map their distribution across the entire Amazon basin since doing so would give an indication of the extent of human settlement.

Since the first sedentary sites around 9,000 years ago, there are numerous other indications of large human communities in the Amazon. The oldest of these is from the Faldas de Sangay culture in Ecuador: between 1400 and 2700 years ago an urban-scale development of soil mounds and connecting roads existed in the middle of the western Amazon jungle. The requisite anthropic black soils have been discovered on the tops of the mounds along with fine art, pottery, sculptures and tools. Meanwhile, at Marajo Island, right at the mouth of the Amazon River, more than 400 earth mounds have been discovered over an area of 20,000 square kilometres and are up to 1300 years old. Discoveries like these came as a real surprise: until lately it had been thought the soil quality throughout much of the Amazon was too poor to support static societies of any great size, but these and other major earthworks would seem to suggest otherwise.

The most curious signs of human habitation, though, are features called geoglyphs, large-scale designs etched into the ground. The Nazca Lines, in the Nazca Desert of southern Peru, are probably the most famous example. But in the dense jungle of the Amazon, it is only recently that whole series of geometric shapes have been revealed due to the ongoing deforestation. Now, hundreds of these enigmatic structures have been discovered hidden beneath the canopy. One of the clearest is at Fazenda Colorada in the state of Acre on the western tip of Brazil. A giant circle, diamond, and square were dug into the ground more than a thousand years ago. Their purpose is much debated in the academic literature, but it has been suggested that they might serve a religious or political function.

The research that has accumulated over the last few decades is incontrovertible: the Amazon is not the untouched, exotic paradise we thought it was. Furthermore, the long history of human habitation in the Amazon indicates that people in former ages were able to live in the forest, changing its composition and structure in a way that was compatible with its survival. Perhaps we ought to be trying to do the same?

Tim Middleton

Freelance Science Writer and PhD Student, University of Oxford

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No black-and-white issue: how dark aerosols affect the icy heights of the Himalayas

More than a billion people depend on water that runs off from the glaciers of the Himalayas for drinking water, irrigation and hydroelectric power. However, the pressures placed on this enormous water resource by anthropogenic climate change are still surprisingly poorly understood. The importance of better quantifying the effects of human-made changes and their future impacts is clear: not only do more people depend directly on the ice in Earth's 'Third Pole' than that in Greenland or Antarctica, the complex topography of the Himalayas also means that it is impossible to extrapolate from relatively few studies to a larger scale.

An aerosol known as black carbon – droplets or particles of soot suspended in the atmosphere – is of particular concern. A by-product of the incomplete combustion of fossil fuels, it is the most light-absorbing aerosol we know. Emissions of black carbon have skyrocketed over the last 250 years, coinciding with the beginning of

Light absorbing impurities in snow are present on snow and glacier melt in the mountains and polar regions of the globe. This picture shows the Colorado Rocky Mountains snowpack with dust from deserts of the western US. (Credit: T. H. Painter, Snow Optics Laboratory, JPL/Caltech)

the industrial revolution. Some argue that the proposed Anthropocene era should cover this period because of the way in which we humans have shaped the Earth system since the onset of industrialisation. Others suggest that the Anthropocene began much earlier and spans several millenia, but as far as black carbon emissions are concerned, the last two centuries mark a significant deviation from background concentrations. Now, the impact of black carbon on high Himalayan glaciers is the focus of a recent study published in the journal The Cryosphere.

Black carbon has been found to be the second most important anthropogenic emission – behind carbon dioxide, but ahead of methane – in terms of its impact on global radiative forcing. This means that it increases the amount of solar radiation absorbed by the Earth system instead of being reflected back into space. But black carbon has been found to remain in the atmosphere for much less time than previously thought.

The short residence time of black carbon in the atmosphere means that large amounts of the material are deposited on the ground – or, in the case of the Himalayas, on snow or ice. The black particles lower the albedo of the white ice and snow, meaning that far more solar radiation is absorbed rather than reflected. To quantify how much extra melting black carbon has caused in the Himalayas over the last decade, Patrick Ginot of the University of Grenoble and his co-investigators studied a shallow ice core containing ice accumulated from 1999 to 2010 at the summit of Mera Peak in northeastern Nepal, at 6,376 m above sea level.

The researchers chose the inaccessible study site on purpose. Very few studies of the impact of black carbon on glacier mass balance exist from altitudes of above 6,000 m, where its aerosol effect increases considerably. Since ice persists year-round, black carbon deposits become part of the layers of ice as they accumulate year after year; its abundance can be measured in the ice core. Finally, Mera Peak is situated on the south side of the Himalayas, where the monsoon and the westerly winds that prevail during the rest of the year supply air from different parts of the world and with different black carbon concentrations.

Measuring the concentrations of black carbon and dust in the ice core, Ginot and his colleagues found that black carbon peaked immediately before and after each monsoon. During this time, air is transported up from India and displaces the westerly winds that usually dominate. During the monsoon itself, however, black carbon is washed out of the atmosphere by rain before the air reaches the Himalayas.

Despite its strong effect on albedo, black carbon proved not to be the only important driver of changes in ice melt at the summit of Mera Peak. The amount of dust, another material that lowers the albedo of ice, was up to 1,000 times greater than the amount of black carbon in the ice core. Using models to simulate the energy balance of the glacier and the net amount of energy available for melting, the researchers calculated that black carbon and dust together could have caused up to a quarter of all ice melt over the 2009–10 period.

The consistently high levels of dust throughout monsoon and non-monsoon periods suggest that its source is local and relatively nearby. To verify whether the strong contribution of dust to glacier melt is a local anomaly, Ginot and his colleagues plan to collect another ice core from a different high-altitude site.

While the team did not detect a rising trend in the black carbon content of the ice at Mera Peak over the last decade, the subject warrants further study, particularly as black carbon patterns are known to be much more complex in the Himalayas than in the other two great reservoirs of ice in Greenland and Antarctica. It remains to be seen whether measures to cut down black carbon emissions in India and worldwide will continue to be effective. If concentrations of this dangerous aerosol can be reduced, millions of people may continue to rely on the mighty rivers flowing down from the Himalayas as their main water source.

The number of ways in which the growing human population has affected the Earth system in the last 10,000 years is beyond counting, making an exact definition of an era such as the Anthropocene a challenging issue. This study of black carbon in the Himalayas contributes to one of the most prominent debates at present, relating to emissions of aerosols such as black carbon and other particles contributing to global climatic change over the last few centuries.

Jonathan Fuhrmann
Assistant Comunications Officer at the Society for General Microbiology

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Letter from the EGU President

New thinking, data and models for doing geosciences in the Anthropocene

In my letter in the September issue of GeoQ I noted: "It may no longer suffice to treat humans as boundary conditions in an isolated way but as an integral part of the coupled human-nature system when advancing Earth system sciences in the Anthropocene." Now, in December, we have a full issue dedicated to the Anthropocene. In this letter I would like to propose three theses on doing geosciences in the Anthropocene and illustrate them with examples:

- Thesis 1: We need a new thinking to treat humans as an integral part of the geosystem.
- Thesis 2: There are (new) data that allow such integration.
- Thesis 3: We need new models that capture the co-evolution of people and the geosystem.

New thinking. Most textbooks start from the assumption that the geosystem can best be studied without human effects. There are of course very good reasons for leaving out humans, as they add enormously to the complexity. Yet, there is an increasing number and variety of patterns that can no longer be explained without integrating anthropocenic processes. A new thinking that revolves around the dynamic coupling of geo-processes and human action/reaction is therefore needed: a genuine two-way coupling rather than boundary conditions that have been the norm in the past. An example of this new thinking has been furnished by Kandasamy et al. (2014) who analysed the drivers of a 'pendulum swing' between agricultural development and environmental health in the Murrumbidgee River basin, Australia, in the 20th century. They explained how societal norms, policy frameworks, water fluxes and quality in the landscape depended on each other, resulting in an emergent behaviour that could not possibly be understood by looking at individual factors in isolation. Often such systems are 'slow-fast systems' that produce interesting dynamics by the coupling across space and timescales.

Nightlights across the Nile River and Delta region. (Source: Ceola et al. 2014)

New data. For better understanding how humans are integrated in the geosystem, data are needed that reflect this coupling. The past approach has often been to consider the human fingerprint a nuisance and filter it out to get 'clean' data. Yet, perhaps now is the time to leave the human effect in the data and seek to represent the entire system. Even more importantly, there is a need for new data, or use of existing data in a new way, that exactly addresses the human component. An example of this new data and data use has been furnished by Ceola et al. (2014) who analysed satellite nightlight data to show that nocturnal lights close to rivers are consistently related to flood damages. They found increasing nightlights to be associated with flood damage intensification around the world. The nightlight data are an excellent example of creative research where data collected for completely different reasons are used in a geoscience context to unravel new patterns of human-geosystem interactions.

New models. As the complexity of coupled systems increases, modelling becomes increasingly difficult. Once political processes come in, for example, there is little hope of deterministic descriptions. I believe there are opportunities for new model types that conceptualise processes in an integrated way, taking advantage of co-evolutionary principles of the geosystem, including humans. While such models are not inconsistent with micro-scale physics and chemistry, they exploit laws at more integrated scales. An example of a simple model deciphering co-evolutionary characteristics has been furnished by Gao et al. (2014) who inferred the water storage capacity of the root zone at the catchment scale from effective rainfall and plant transpiration. They demonstrated that the ecosystems dynamically design their root systems to bridge droughts that re-occur every two decades but no more than that, as it is increasingly expensive in terms of carbon allocation to roots. These kinds of models may play an increasingly important role in understanding the patterns we see in the Anthropocene.

Obviously, many other recent examples of creative thinking, data usage, and modelling exist across the geosciences. If interested, you may want to explore this emerging research direction starting from papers such as those mentioned here. Creativity is the key, and we can learn from each other across different disciplines in the geosciences. The theme of the next EGU General Assembly, A Voyage Through Scales, is intended to work as a coherent thread, fostering creativity across the geosciences.

Günter Blöschl
EGU President

Division reports

News brought to you from three EGU divisions

In each edition of GeoQ division presidents or deputy presidents contribute reports that update EGU members with news from their divisions. Issue 12 gives voice to Charlotte Krawczyk (Seismology), Norma B. Crosby (Solar–Terrestrial Sciences) and Susanne Buiter (Tectonics and Structural Geology).

Seismology

The ongoing work of the EGU Seismology (SM) Division is guided by the idea that a broadening of our research topics and an opening to wider, interdisciplinary collaborations within the EGU will foster the scientific exchange and will address the growing need for the combination of basic science and applied topics. Here, seismology as a discipline is significant since it contributes to a large variety of both basic and applied thematic fields and urgent questions. SM, therefore, wants to strengthen its value by enhancing the development from static to dynamic models, from acquisition parameters to petrophysical properties, and from geomodels to geotechnical applications. Thereby, our ability to make relevant predictions for the future is also growing.

This concern shaped the SM programme at the EGU 2014 General Assembly and also continues its way in the call for abstracts for the 2015 meeting. Here, we give particular emphasis to the programme sub-group 'Geophysical imaging of the Earth's interior across scales' that is immediately linked to next year's General Assembly theme, A Voyage Through Scales. Approximately half of all sessions proposed in the SM group are co-organised sessions. They connect not only to tectonics, geodynamics or natural hazards (the nearest solid Earth divisions), but also interact with geophysical instrumentation, hydrology, geomorphology, cryosphere or soil system sciences.

Highlights at the 2014 General Assembly included the Beno Gutenberg Medal Lecture by Gregory Beroza and the poster sessions that demonstrated the activity of the SM group and its need for discussion in addition to oral presentations. Three outstanding student posters (OSP) were identified this year that will be awarded during the Division Meeting next year. Many thanks to Valentí Sallarés (Barcelona) for organising the OSP awards during the last two years, and welcome to Laura Peruzza (Trieste) who is volunteering for this from now on.

Our division communication was greatly enhanced by the set-up of two web-based platforms driven by the SM Young Scientist Representative Matthew Agius (Malta): a seismoblog and a Facebook page are waiting for your clicks, messages, and input.

The community itself drives the division forward. Therefore, please don't forget to leave a time slot free in your 2015 General Assembly schedule for the Division Meeting, which will be held during the lunch break immediately preceding the Beno Gutenberg Medal Lecture. Since I will step down after four years of activity, the Division Meeting 2015 will also be the opportunity to welcome our new division president that we will elect this fall.

Screenshot of the EGU Seismology Division Facebook page.

Charlotte Krawczyk
SM Division President

Solar–Terrestrial Sciences

At the 2014 General Assembly, the Solar–Terrestrial Sciences (ST) Division programme was comprised of six sub-groups (Sun and Heliosphere; Magnetosphere; Ionosphere and Thermosphere; Theory, Simulations, Solar System Plasma Physics; Space Weather and Space Climate; Society, Education and Public Outreach). Like every year, there were new sessions as well as the traditional ST sessions. Overall, oral sessions were well attended, and poster sessions were very successful and well appreciated by the participants.

At ST division level Rumi Nakamura was awarded the 2014 Julius Bartels Medal for her outstanding contributions to the understanding of the complex plasma physical processes within the magnetosphere and the magnetotail of the Earth through all phases of the substorm cycle. The 2014 Hannes Alfvén Medal was awarded to Karl Schindler for his illuminating contributions to the dynamics of the solar corona, the magnetosphere and astrophysical plasmas through elegant theoretical analyses of fundamental plasma phenomena such as equilibria, stability, current sheets and reconnection. Recently, the 2015 awards and medals were announced; they will be awarded at the upcoming 2015 General Assembly.

Noé Lugaz was awarded at Union level, receiving the 2014 Arne Richter Award for Outstanding Young Scientists for his innovative contributions to the understanding of coronal mass ejections. Furthermore, the 2014 Jean Dominique Cassini Medal & Honorary

Membership was awarded to Stamatios M. Krimigis for his key discoveries and his seminal contributions in solar, interplanetary, magnetospheric and planetary physics. The award was also bestowed in recognition of his leadership in the design and implementation of new experiments and new space science missions and his pivotal role in space science policy.

At the EGU 2014 General Assembly, the ST Division Meeting was attended by more than 100 people. The new EGU By-Laws were highlighted and Olga Malandraki was approved for the role of 2015 ST Deputy President by the meeting participants. Furthermore, ST officers and ST Division Medal Committees for 2015 were also approved. The Union Assembly Outstanding Student Poster (OSP) Award 2013 for ST was awarded to Beate Krøvel Humberset for the poster entitled 'Untangling the space-time ambiguity of pulsating aurora', and Beate was approved by the meeting participants to be the Division's first Young Scientist Representative. Mike Pinnock gave a presentation on the ST journal Annales Geophysicae (ANGEO); the community is encouraged to submit their work to this open access journal. The updated ST Education and Public Outreach (EPO) webpage was presented by Athanasios Papaioannou and includes EPO sub-webpages covering websites, books, and videos; inputs from the community are very welcome.

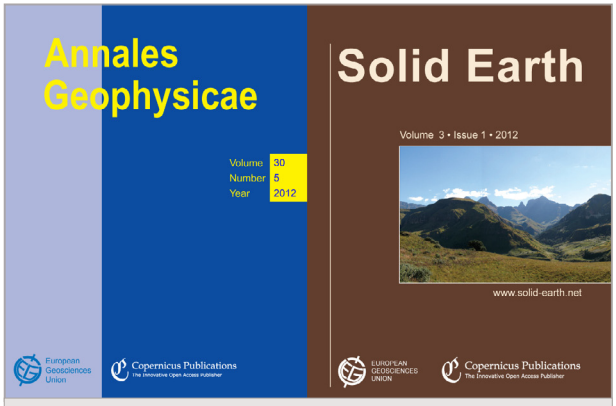
Next year will see a new ST President and therefore I would like to end this short report by thanking both the ST Scientific Officers, as well as the ST Liaison Officers, who have contributed enthusiastically to the ST Division during these last four years. Finally, I would like to thank all the participants that have attended ST sessions and contributed to their success: without *you* there would be no unique EGU meeting.

Norma B. Crosby
ST Division President

TS Tectonics and Structural Geology

The activities of the Division of Tectonics and Structural Geology (TS) focus on rock deformation at all scales, from microstructures to plate tectonics, and from extension, via oblique deformation, to shortening. The division therefore covers a wide range of topics and we can only achieve our goal of understanding Earth dynamics through close collaboration with many disciplines. I am very pleased to see our interdisciplinary character reflected in our session programme for the 2015 General Assembly! Next year, our programme will have several PICO sessions, we are organising workshops for the first time, and we have many new topics – do check out our programme!

Over the last year, we have established closer links with our sister organisation, the Structural Geology and Tectonics Division of the Geological Society of America (GSA), through co-organised sessions at our respective meetings. We will follow this up also in 2015, starting with the session 'Mountains across the oceans: Caledonian, Variscan and Appalachian orogenies through time', which will appear at EGU2015 and GSA2015.



Annales Geophysicae and Solid Earth are the EGU open access journals most closely associated with the ST and TS divisions, respectively.

Since early this year, Charlotte Fillon is our Division Young Scientist (YS) Representative. Young scientists have their own forum and webpages and are not only represented at the division level, but also in the EGU Programme Committee. For TS, we had a first YS meeting at the 2014 GA and we are planning to follow up with YS short courses and hopefully a reception at the 2015 GA.

Our division medal, the 2015 Stephan Mueller Medal, will be awarded to Evgueni Burov. He will hold a medal lecture at the General Assembly 2015 and I hope you will all join in celebrating this prestigious award! After an evaluation of over 110 posters, the TS Outstanding Student Poster Award for 2014 was awarded to Adina Pusok. A big thank you to all judges, it is only because of your volunteer work that so many student posters can be evaluated!

Further division news is that the Emile Argand Conference on Alpine Geological Studies will be held in Briançon in the French Alps from 13–20 September 2015. The 3rd EGU Summer School on Structural Analysis of Crystalline Rock is planned for August 2015. Keep an eye on our website and the meeting calendar to find Tectonics and Structural Geology meetings of interest.

Finally, I would like to draw your attention to the EGU open access journal Solid Earth which received its second impact factor of a good 2.155. Solid Earth is dedicated to multidisciplinary research on the composition, structure and dynamics of the Earth from the surface to the deep interior at all spatial and temporal scales. This is a perfect fit for research related to our division and I would encourage everyone to consider submitting the results of their latest research to the journal.

Information about TS and its activities can be found on our webpage and now also on Facebook. Follow us for division news!

Susanne Buiter
TS Division President

EGU announces 2015 awards and medals

The EGU has named the 35 recipients of next year's Union Medals and Awards, Division Medals, and Division Outstanding Young Scientists Awards. These individuals, from both European and non-European countries, are honoured for their important contributions to the Earth, planetary and space sciences. They will receive their prizes at the EGU 2015 General Assembly, which will take place in Vienna on 12–17 April. The EGU has also announced the winners of the Outstanding Student Poster (OSP) Awards corresponding to the 2014 General Assembly.

The following individuals will receive 2015 Union Medals and Awards:

- **Hubert Savenije** – Alexander von Humboldt Medal
- **Sergej Zilitinkevich** – Alfred Wegener Medal
- **Carlo Laj** – Arthur Holmes Medal
- **Jonathan I. Lunine** – Jean Dominique Cassini Medal
- **Manuele Faccenda, Katrin Schroeder, Francesca Pianosi** and **Jérémie Mouginot** – Arne Richter Award for Outstanding Young Scientists

The following individuals will receive 2015 Division Medals:

- **Gregory Houseman** – Augustus Love Medal
- **Göran Ekström** – Beno Gutenberg Medal
- **Kristine M. Larson** – Christiaan Huygens Medal
- **Peter Janssen** – Fridtjof Nansen Medal
- **Robert L. Lysak** – Hannes Alfvén Medal
- **Nick van de Giesen** – Henry Darcy Medal
- **Wolfgang Schlager** – Jean Baptiste Lamarck Medal
- **Diane McKnight** – John Dalton Medal
- **Sami Solanki** – Julius Bartels Medal
- **Daniel Schertzer** – Lewis Fry Richardson Medal
- **Michiel van den Broeke** – Louis Agassiz Medal
- **Toshihiko Shimamoto** – Louis Néel Medal
- **Paul Valdes** – Milutin Milankovic Medal
- **Ingrid Kögel-Knabner** – Philippe Duchaufour Medal
- **Alfredo M. Lagmay** – Plinius Medal
- **Heather Viles** – Ralph Alger Bagnold Medal
- **John C. Eichelberger** – Sergey Soloviev Medal
- **Evgueni B. Burov** – Stephan Mueller Medal
- **Geoffrey Blewitt** – Vening Meinesz Medal

The following individuals will receive 2015 Division Outstanding Young Scientist Awards:

- **Richard Davy** – Atmospheric Sciences (AS) Division
- **James Rae** – Biogeosciences (BG) Division
- **Jeremy D. Shakun** – Climate: Past, Present & Future (CL) Division
- **Krzysztof Sośnica** – Geodesy (G) Division
- **Omar Bartoli** – Geochemistry, Mineralogy, Petrology & Volcanology (GMPV) Division
- **Bertrand Bonfond** – Planetary and Solar System Sciences (PS) Division
- **Patrick Grunert** – Stratigraphy, Sedimentology and Palaeontology (SSP) Division
- **Paulo Pereira** – Soil System Sciences (SSS) Division

The EGU Awards Committee received 121 applications for the 2015 awards, with 19% of them nominating female scientists (17% of this year's awardees are female). For more information about the awards above, including application and selection criteria and how to apply, please check the Awards & Medals page on the EGU website.

In addition to the Union and Division Awards and Medals, the EGU also bestows a number of poster awards to students taking part in its annual General Assembly. These OSP Awards aim to further improve the overall quality of poster presentations and foster students' excitement to present posters at a large scientific conference. The list of recipients of the 2014 OSP Awards is now available online on the EGU website. For more information about the OSP awards, including application criteria and how to apply in 2015, please check the OSP page.

An earlier version of this article was published on the EGU website.

A few of last year's awardees pose with the EGU President and Vice-President at the EGU 2014 Awards Ceremony. (Credit: EGU/Foto Pfluegl)

EGU 2015: call for papers open until early January

From now, up until 7 January 2015, you can submit your abstract for the upcoming EGU General Assembly (EGU 2015). In addition to established scientists, PhD students and other early career researchers are welcome to submit abstracts to present their research at the conference. The deadline for the receipt of abstracts is **07 January 2015, 13:00 CET**.

Further, the EGU encourages undergraduate and master students to submit abstracts on their dissertations or final-year projects. The EGU recognises that there are many outstanding students who would benefit from attending and presenting at the General Assembly and, therefore, provides a discounted registration rate to this group. Interested undergraduates can apply to present a poster (or talk) on research undertaken in a laboratory setting, on a mapping or field project they've been involved in during their degrees, or any other research project of relevance.

See you next year! (Credit: EGU/Stephanie McClellan)

You can browse through the EGU 2015 sessions on the conference website. Clicking on 'please select' will allow you to search for sessions by Programme Group and submit your abstract to the relevant session either as plain text, LaTeX, or a MS Word document. Further guidelines on how to submit an abstract are available on the EGU 2015 website.

An innovative presentation format – Presenting Interactive Content, better known as PICO – has been implemented at the General Assembly since 2013. PICO sessions bring together the advantages of both oral and poster sessions, allowing authors to present the essence of their work and follow it up with interactive discussion. Please note that some sessions are 'PICO only' sessions, meaning you cannot select oral/poster preference.

EGU 2015 will take place from 12 to 17 April 2015 in Vienna, Austria. For more information on the General Assembly, see the EGU 2015 website and follow us on Twitter (#EGU15 is the conference hashtag) and Facebook.

An earlier version of this article was published on the EGU blog, GeoLog.

Open access: access to knowledge

In a post on the EGU blog, GeoLog, Sam Illingworth, a Lecturer at Manchester Metropolitan University and the EGU Young Scientist Representative on the Programme Committee, writes about the Open Access movement and how it contributes to provide a wider access to knowledge.

"Access to knowledge is a basic human right." Yet sadly as scientists we are often forced to operate in a framework in which this is not always the case. The week of 20–26 October saw the celebration of the eighth Open Access Week, and whilst there have undoubtedly been many achievements by the Open Access (OA) movement since 2009, there is still a long way to go before mankind's basic human right to knowledge is restored.

So why all the big fuss about OA in the first instance? If you are reading this as a layperson or as a scientist at the outset of their scientific career, then you may be surprised to find out that it costs (often large sums of) money to read online research articles. Even if these fees are not being charged to you personally, the chances are that it is costing your research institution or library thousands of pounds/euros/dollars that could otherwise be spent on research, resources, jobs, or infrastructure (as an example, in 2009, Clemson University in the US, an institute with less than 17,000 students, spent an astonishing $1.3 million on journal subscriptions to the publishing magnate Elsevier alone).

Over the past 30 years, journal prices have out priced inflation by over 250%; but it wasn't always like this. In the past journals existed for two reasons: as an affordable option for scientists to publish their work in (as opposed to the more expensive option of personally-published books), and as a place where members of the general public and the wider scientific community could find out about the advances in science that their taxes were helping to fund. Sadly, in recent times many journals seem to have lost their way on both counts, hence the need to open it up again.

The beginning of the modern OA movement can be traced back to the 4th July 1971, when Michael Hart launched Project Gutenberg, a volunteer effort to digitise and archive cultural works for free. However, it wasn't until 1989 (and with the advent of the Internet) that the first digital-only, free journals were launched, amongst them Psycoloquy by Stevan Harnad and The Public-Access Computer Systems Review by Charles W. Bailey Jr.

Since then, the OA movement has grown considerably, although it is important to note that publishing articles so that they are free for

all is itself not without expense. Despite the lack of print and mailing costs, there are still large infrastructure and staffing overheads that need to be taken into consideration, and so rather than make the reader pay, alternatives have to be found.

One alternative, known as the **Gold route** to OA, is to make the author(s) of the article pay for the right to have their research accessible by all. Many journals already require an Article Processing Charge (APC) to be paid before publication, and so some journals have simply elected to add an additional charge if the author wants to make their journal open to the general public.

The other main alternative is the **Green route** to OA, which involves the author placing their journal in a central repository, which is then made available to all. The journal in which the article was originally published will usually enforce an embargo period of a number of months or years that must pass before the published articles can be placed in these repositories, although this can often be circumnavigated by uploading final, 'accepted for publication', drafts of the article. You can read more about OA subject repositories in this article.

Both of these approaches to OA have their respective advantages and disadvantages, and normally research intuitions and/or funding bodies guide the route that researchers choose. The Research Councils UK (RCUK), for example, have a policy (which can be found here) that supports both the Gold and the Green routes to OA, though it has a preference for immediate access with the maximum opportunity for reuse. It is worth noting at this point that another key aim of the OA movement is that published research is free to reuse in future studies. This might seem like a fairly trivial point, but currently for any articles published in closed access journals, express permission is needed from the publishers if the results are to be used in any future studies.

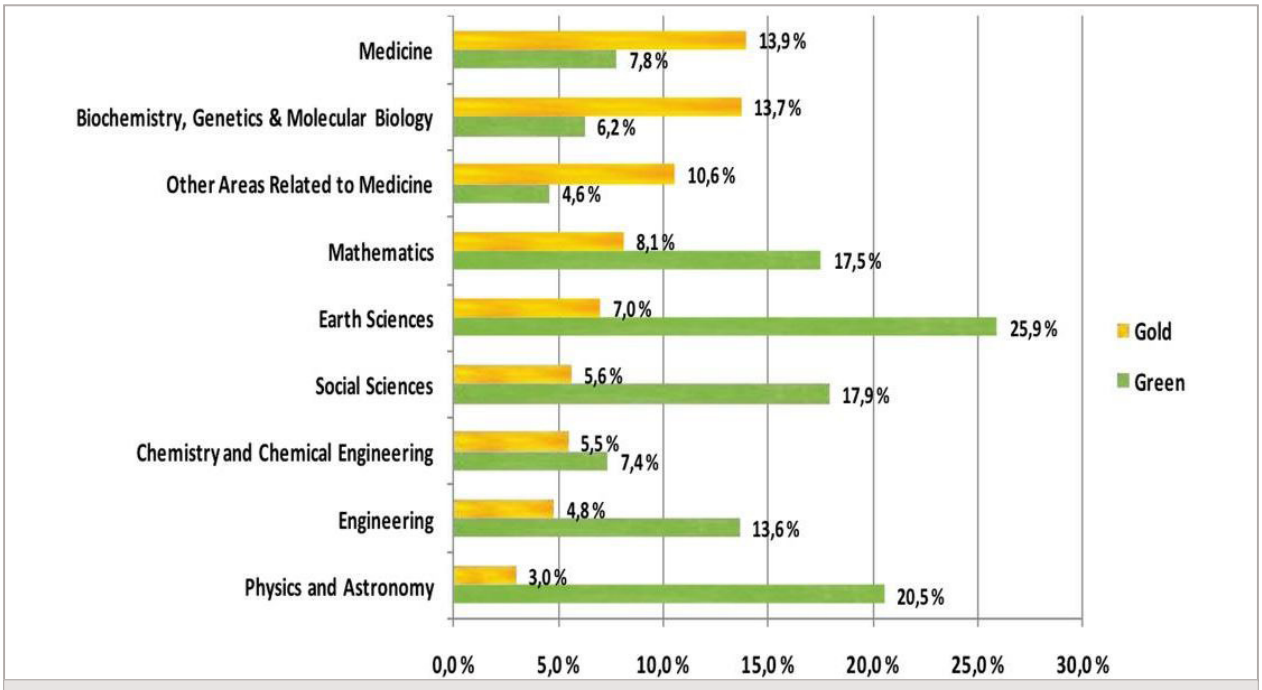
The major barrier that still needs to be overcome with regards to OA is determining who pays for the right to free access. At the moment many governments have a centralised pot, which they allocate to their different research institutes. However, issues arise when one considers the limitations that this imposes on poorer countries, institutes, research disciplines, and independent researchers. There is also the minefield of determining who gets how much and why. My own institute, Manchester Metropolitan University, has only been allocated enough funds to pay for 7 academic papers a year via the Gold route to OA. When you consider that some researchers would hope to publish that many papers themselves on a yearly basis, there is clearly a disconnect. It is for these reasons that many are pushing for OA 2.0, an initiative in which articles are, in the words of EGU's former executive secretary Arne Richter, "Free to Read, Free to Download and Free to Publish." However, such an approach will require a major change in the modus operandi of almost all publishing companies. It is worth noting that Copernicus, who are responsible for publishing the majority of EGU's affiliated journals are very strong proponents of the Open Access movement, and have been one of the leading lights in an otherwise murky world.

The sad truth of the matter is that many of the more traditional journals are now run as big-business, moneymaking machines, safe in the knowledge that they can get away with charging large fees, because scientists are still desperate to publish in places with a 'high-impact'. However, if enough scientists rise up and move away from these restrictive journals, and migrate towards those with an OA policy, then the impact factors will soon follow suit (in fact, there is already strong evidence that publishing in an OA journal will result in more citations for your research). Only then can we begin to reinstate knowledge as a basic human right available to all, rather than as an expensive luxury dolled out to the privileged few who can afford it.

Sam Illingworth

Lecturer at Manchester Metropolitan University and EGU Young Scientist Representative on the Programme Committee

An earlier version of this article was published on the EGU blog, GeoLog.



A sea of golden green: the availability of gold and green OA journal articles by scientific discipline in 2009. (Source: Björk et al. 2010)

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Highs and lows: height changes in the ice sheets mapped

EGU press release on research published in The Cryosphere

Researchers from the Alfred Wegener Institute in Germany have used satellite data to map elevation and elevation changes in both Greenland and Antarctica. The new maps are the most complete published to date, from a single satellite mission. They also show the ice sheets are losing volume at an unprecedented rate of about 500 cubic kilometres per year. The results are now published in The Cryosphere, an open access journal of the European Geosciences Union (EGU).

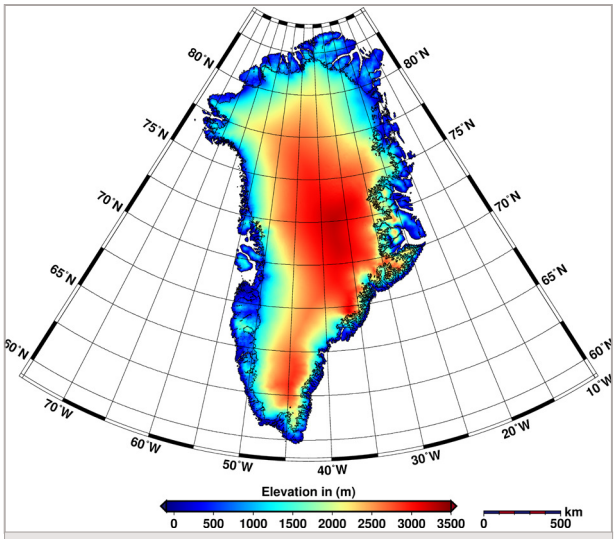
"The new elevation maps are snapshots of the current state of the ice sheets," says lead-author Veit Helm of the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI), in Bremerhaven, Germany. The snapshots are very accurate, to just a few metres in height, and cover close to 16 million km^2 of the area of the ice sheets. "This is 500,000 square kilometres more than any previous elevation model from altimetry – about the size of Spain."

Satellite altimetry missions measure height by bouncing radar or laser pulses off the surface of the ice sheets and surrounding water. The team derived the maps, which show how height differs across each of the ice sheets, using just over a year's worth of data collected in 2012 by the altimeter on board the European Space Agency satellite CryoSat-2. These 'digital elevation models' incorporate a total of 7.5 million elevation measurements for Greenland and 61 million for Antarctica.

In addition to showing the highs and lows of the ice sheets at present, the study also highlights how the elevation has changed over the 2011–2014 period. Ice sheets gain mass through snowfall and lose it due to melting and accelerating glaciers, which carry ice from the interior of the ice sheet to the ocean. The researchers say it's important to understand how ice thickness across Greenland and Antarctica has changed to model ice movements, and find out just how much ice sheets contribute to sea level rise.

The team derived the elevation change maps using a staggering 200 million data points for Antarctica and 14.3 million for Greenland collected by CryoSat-2 over the three-year period. The maps published in The Cryosphere reveal that Greenland alone is reducing in volume by about 375 cubic kilometres per year. The two ice sheets combined are thinning at a rate of 500 cubic kilometres per year, the highest rate observed since altimetry satellite records began about 20 years ago. The researchers say the ice-sheets annual contribution to sea level rise doubled since 2009.

"Since 2009, the volume loss in Greenland has increased by a factor of about 2, and in the West Antarctic Ice Sheet by a factor of 3," says AWI glaciologist Angelika Humbert, another of the study's authors. Both the West Antarctic Ice Sheet and the Antarctic Peninsula, on the far west of the continent, are rapidly losing volume. By contrast, East Antarctica is gaining volume, though at a moderate rate that doesn't compensate the losses on the other side of the continent.



New elevation model of Greenland derived from CryoSat-2. More elevation and elevation change maps are available online. (Credit: Helm et al., The Cryosphere, 2014)

The areas where the researchers detected the largest elevation changes were Jakobshavn Isbrae (Jakobshavn Glacier) in Greenland – recently found to be moving ice into the ocean faster than any other ice-sheet glacier – and Pine Island Glacier (PIG) in Antarctica. The new study confirms that PIG, like other glaciers in the West Antarctic, has been thinning rapidly in recent years.

The researchers highlight the role of CryoSat-2 and its radar altimeter (also known as SIRAL) in producing the height maps, particularly in regions where the surface slopes steeply and elevation changes are more pronounced. "These areas can be difficult to measure, but SIRAL enabled us to continuously observe the surface of the ice sheets with high precision and dense coverage, better than any previous system," says Helm.

This press release was originally published on the EGU website.

Reference

Helm, V., Humbert, A., and Miller, H.: Elevation and elevation change of Greenland and Antarctica derived from CryoSat-2, The Cryosphere, 8, 1539-1559, doi:10.5194/tc-8-1539-2014, 2014

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Atmospheric Chemistry and Physics (ACP)

Mapping the physico-chemical properties of mineral dust in western Africa: mineralogical composition

Recently, several ground-based and airborne field campaigns have allowed the exploration of the properties and impacts of mineral dust in western Africa. This paper explores these observations to provide a quantitative view of the mineralogical composition and its variability according to source region and time after transport.

Reference

Formenti, P. et al.: Mapping the physico-chemical properties of mineral dust in western Africa: mineralogical composition, Atmos. Chem. Phys., 14, 10663–10686, doi:10.5194/acp-14-10663-2014, 2014

Constraining CO_2 emissions from open biomass burning by satellite observations of co-emitted species: a method and its application to wildfires in Siberia

A method to constrain carbon dioxide (CO_2) emissions from open biomass burning by using satellite observations of co-emitted species and a chemistry transport model is proposed and applied to the case of wildfires in Siberia.

Reference

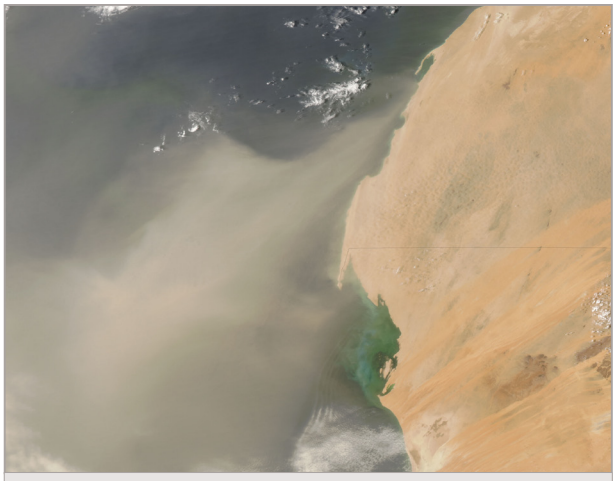
Konovalov, I. B. et al.: Constraining CO_2 emissions from open biomass burning by satellite observations of co-emitted species: a method and its application to wildfires in Siberia, Atmos. Chem. Phys., 14, 10383–10410, doi:10.5194/acp-14-10383-2014, 2014

Tropospheric ozone increases over the southern Africa region: bellwether for rapid growth in Southern Hemisphere pollution?

Increases in tropospheric ozone based on ozonesonde records (early 1990s to 2008) over subtropical stations in Irene (South Africa) and Réunion have been reported. Over Irene a large increase in the urban-influenced boundary layer (BL) was also observed. This paper shows that the Irene BL trend is at least partly due to a gradual change in the sonde launch times.

Reference

Thompson, A. M. et al.: Tropospheric ozone increases over the southern Africa region: bellwether for rapid growth in Southern Hemisphere pollution?, Atmos. Chem. Phys., 14, 9855–9869, doi:10.5194/acp-14-9855-2014, 2014



Dust plume off western Africa. (NASA image courtesy of Jeff Schmaltz, MODIS Rapid Response Team, Goddard Space Flight Center)

Molecular corridors and kinetic regimes in the multiphase chemical evolution of secondary organic aerosol

Based on molecular identification of secondary organic aerosol (SOA) oxidation products, the authors show that the chemical evolution of SOA from a variety of volatile organic compound precursors adheres to characteristic 'molecular corridors' with a tight inverse correlation between volatility and molar mass.

Reference

Shiraiwa, M. et al.: Molecular corridors and kinetic regimes in the multiphase chemical evolution of secondary organic aerosol, Atmos. Chem. Phys., 14, 8323–8341, doi:10.5194/acp-14-8323-2014, 2014

Quantification of ice nuclei active at near 0 °C temperatures in low-altitude clouds at the Puy de Dôme atmospheric station

In this study, cloud water was collected aseptically from the summit of Puy de Dôme (1465 m a.s.l., France) within contrasted meteorological and physico-chemical situations. Total and biological (i.e. heat-sensitive) ice nuclei were quantified by droplet-freezing assay between −5 °C and −14 °C.

Reference

Joly, M. et al.: Quantification of ice nuclei active at near 0 °C temperatures in low-altitude clouds at the Puy de Dôme atmospheric station, Atmos. Chem. Phys., 14, 8185-8195, doi:10.5194/acp-14-8185-2014, 2014

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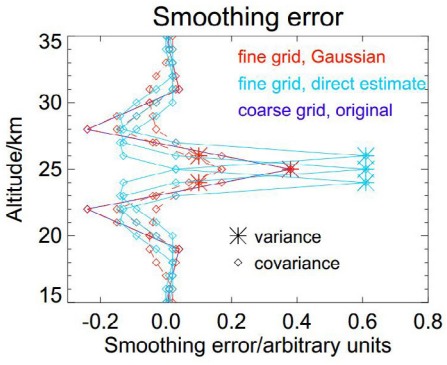
Atmospheric Measurement Techniques (AMT)

Smoothing error pitfalls

The difference due to the content of a priori information between a constrained retrieval and the true atmospheric state is usually represented by a diagnostic quantity called smoothing error. In this paper it is shown that the concept of the smoothing error as a component of the retrieval error budget is questionable because it is not compliant with Gaussian error propagation.

Reference

von Clarmann, T.: Smoothing error pitfalls, Atmos. Meas. Tech., 7, 3023–3034, doi:10.5194/amt-7-3023-2014, 2014



Smoothing error vs. altitude in a case study analysed in von Clarmann (2014).

Biogeosciences (BG)

Gas emissions at the continental margin west of Svalbard: mapping, sampling, and quantification

The authors mapped, sampled, and quantified gas emissions at the continental margin west of Svalbard in late summer 2012. They found that gas emissions occurred widespread between about 80 and 415 m water depth, which indicates that hydrate dissolution might only be one of several triggers for active hydrocarbon seepage in that area.

Reference

Sahling, H. et al: Gas emissions at the continental margin west of Svalbard: mapping, sampling, and quantification, Biogeosciences, 11, 6029–6046, doi:10.5194/bg-11-6029-2014, 2014

Release of hydrogen peroxide and antioxidants by the coral *Stylophora pistillata* to its external *milieu*

This paper presents a laboratory characterisation of hydrogen peroxide (H_2O_2) and antioxidant activity release kinetics by intact, non-stressed *Stylophora pistillata*. Experimenting with bleached and non-bleached corals and different stirring speeds, the authors explored the sources and modes of H_2O_2 and antioxidant release.

Reference

Armoza-Zvuloni, R. and Shaked, Y.: Release of hydrogen peroxide and antioxidants by the coral *Stylophora pistillata* to its external *milieu*, Biogeosciences, 11, 4587–4598, doi:10.5194/bg-11-4587-2014, 2014

Diverse coral communities in mangrove habitats suggest a novel refuge from climate change

Risk analyses indicate that more than 90% of the world's reefs will be threatened by climate change and local anthropogenic impacts by the year 2030 under 'business-as-usual' climate scenarios. This paper characterises the first natural, non-reef coral refuge from thermal stress and ocean acidification and identifies resiliency factors for mangrove–coral habitats.

Reference

Yates, K. K. et al.: Diverse coral communities in mangrove habitats suggest a novel refuge from climate change, Biogeosciences, 11, 4321–4337, doi:10.5194/bg-11-4321-2014, 2014

Corals growing under a mangrove canopy and attached to mangrove prop roots including a colony of *Colpophyllia natans*. (Source: Yates et al. 2014)

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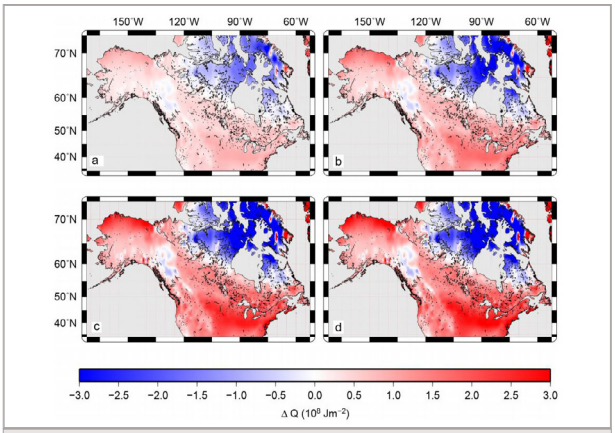
Climate of the Past (CP)

Numerical studies on the Impact of the Last Glacial Cycle on recent borehole temperature profiles: implications for terrestrial energy balance

In this paper, the authors provide the first estimate of the impact of the development of the Laurentide ice sheet on the estimates of energy and temperature reconstructions from measurements of terrestrial borehole temperatures in North America.

Reference

Beltrami, H. et al.: Numerical studies on the Impact of the Last Glacial Cycle on recent borehole temperature profiles: implications for terrestrial energy balance, Clim. Past, 10, 1693–1706, doi:10.5194/cp-10-1693-2014, 2014



Heat content contribution per unit area from the Last Glacial Cycle. (Credit: Beltrami et al. 2014)

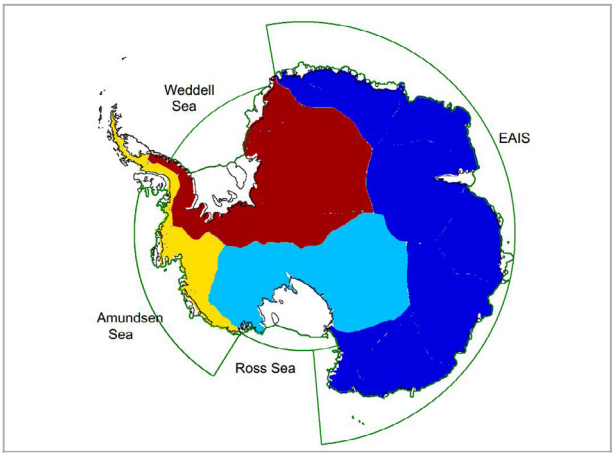
Earth System Dynamics (ESD)

Projecting Antarctic ice discharge using response functions from SeaRISE ice-sheet models

In this paper, the authors attempt to estimate the uncertainty range of future ice discharge from Antarctica by combining uncertainty in the climatic forcing, the oceanic response and the ice-sheet model response. The dynamic ice-sheet response is derived from functions for basal ice-shelf melting for four different Antarctic drainage regions using experiments from the Sea-level Response to Ice Sheet Evolution (SeaRISE) intercomparison project.

Reference

Levermann, A. et al.: Projecting Antarctic ice discharge using response functions from SeaRISE ice-sheet models, Earth Syst. Dynam., 5, 271–293, doi:10.5194/esd-5-271-2014, 2014



The four different basins for which ice-sheet response functions are derived in Levermann et al. 2014.

Geoscientific Instrumentation, Methods and Data Systems (GI)

Determining the focal mechanisms of the events in the Carpathian region of Ukraine

The paper is devoted to mathematical modelling of propagation of seismic waves in inhomogeneous media. The trial and error method for determining the angles of orientation of fault plane and earthquake mechanism has been proposed. The graphic and trial and error approaches have been applied for determining the source parameters of earthquakes in the seismically active region of Eastern Carpathian.

Reference

Pavlova, A., Hrytsai, O., and Malytskyy, D.: Determining the focal mechanisms of the events in the Carpathian region of Ukraine, Geosci. Instrum. Method. Data Syst., 3, 229–239, doi:10.5194/gi-3-229-2014, 2014

An autonomous adaptive low-power instrument platform (AAL-PIP) for remote high-latitude geospace data collection

This paper presents the development considerations and design for ground-based instrumentation that is being deployed on the East Antarctic Plateau along a 40° magnetic meridian chain to investigate interhemispheric magnetically conjugate geomagnetic coupling and other space-weather-related phenomena.

Reference

Clauer, C. R. et al.: An autonomous adaptive low-power instrument platform (AAL-PIP) for remote high-latitude geospace data collection, Geosci. Instrum. Method. Data Syst., 3, 211–227, doi:10.5194/gi-3-211-2014, 2014

A framework for benchmarking of homogenisation algorithm performance on the global scale

The International Surface Temperature Initiative is striving towards substantively improving our ability to robustly understand historical land surface air temperature change at all scales. A key recently completed first step has been collating all available records into a comprehensive open access, traceable and version-controlled databank.

Reference

Willett, K. et al.: A framework for benchmarking of homogenisation algorithm performance on the global scale, Geosci. Instrum. Method. Data Syst., 3, 187–200, doi:10.5194/gi-3-187-2014, 2014

The origin of noise and magnetic hysteresis in crystalline permalloy ring-core fluxgate sensors

In certain polycrystalline permalloy fluxgate sensors, a single phenomenon may cause both fluxgate noise and magnetic hysteresis; explain Barkhausen jumps, remanence and coercivity; and avoid domain denucleation. This phenomenon, domain wall reconnection, is presented as part of a theoretical model.

Reference

Narod, B. B.: The origin of noise and magnetic hysteresis in crystalline permalloy ring-core fluxgate sensors, Geosci. Instrum. Method. Data Syst., 3, 201–210, doi:10.5194/gi-3-201-2014, 2014

Protection against lightning at a geomagnetic observatory

The Sinji Vrh Geomagnetic Observatory, built on the brow of Gora, the mountain above Ajdovščina in Slovenia, is very often struck by lightning. This manuscript analyses the formation of lightning in the area and ways of protecting the observatory.

Reference

Čop, R. et al.: Protection against lightning at a geomagnetic observatory, Geosci. Instrum. Method. Data Syst., 3, 135–141, doi:10.5194/gi-3-135-2014, 2014

Geoscientific Model Development (GMD)

Short ensembles: an efficient method for discerning climate-relevant sensitivities in atmospheric general circulation models

This paper explores the feasibility of an experimentation strategy for investigating sensitivities in fast components of atmospheric general circulation models.

Reference

Wan, H. et al.: Short ensembles: an efficient method for discerning climate-relevant sensitivities in atmospheric general circulation models, Geosci. Model Dev., 7, 1961–1977, doi:10.5194/gmd-7-1961-2014, 2014

MOMBA 1.1 – a high-resolution Baltic Sea configuration of GFDL's Modular Ocean Model

This article presents a new coupled ocean-circulation–ice model configuration of the Baltic Sea. The model features, contrary to most existing configurations, a high horizontal resolution of one nautical mile (1.85 km), which is eddy-resolving over much of the domain.

Reference

Dietze, H., Löptien, U., and Getzlaff, K.: MOMBA 1.1 – a high-resolution Baltic Sea configuration of GFDL's Modular Ocean Model, Geosci. Model Dev., 7, 1713–1731, doi:10.5194/gmd-7-1713-2014, 2014

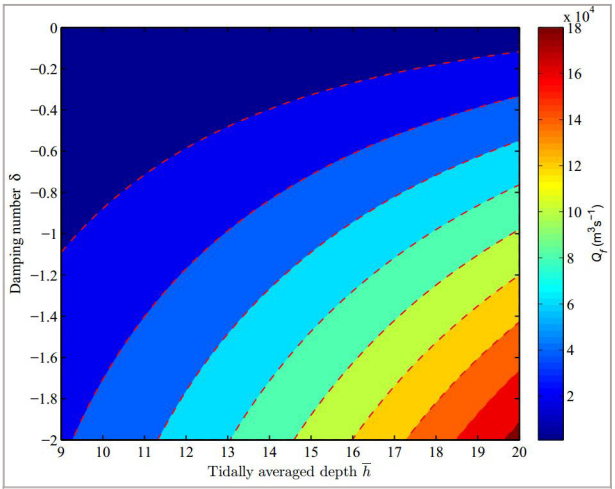
Hydrology and Earth System Sciences (HESS)

Analytical approach for predicting fresh water discharge in an estuary based on tidal water level observations

As the tidal wave propagates into an estuary, the tidally averaged water level tends to rise in a landward direction due to the density difference between saline and fresh water and the asymmetry of the friction. The effect of friction on the residual slope is even more remarkable when accounting for fresh water discharge. In this study, the authors investigate the influence of river discharge on tidal wave propagation in the Yangtze estuary with specific attention to residual water level slope.

Reference

Cai, H., Savenije, H. H. G., and Jiang, C.: Analytical approach for predicting fresh water discharge in an estuary based on tidal water level observations, Hydrol. Earth Syst. Sci., 18, 4153–4168, doi:10.5194/hess-18-4153-2014, 2014



Contour plot of the predicted fresh water discharge at x = 456 km as a function of the tidally averaged depth and the damping number. (Source: Cai et al. 2014)

Natural Hazards and Earth System Sciences (NHESS)

The XWS open access catalogue of extreme European windstorms from 1979 to 2012

This papers introduces the XWS (eXtreme WindStorms) catalogue, which consists of storm tracks and model-generated maximum 3 s wind-gust footprints for 50 of the most extreme winter windstorms to hit Europe in the period 1979–2012. The catalogue is intended to be a valuable resource for both academia and industries such as (re)insurance, for example allowing users to characterise extreme European storms, and validate climate and catastrophe models. It is available at http://www.europeanwindstorms.org.

Reference

Roberts, J. F. et al.: The XWS open access catalogue of extreme European windstorms from 1979 to 2012, Nat. Hazards Earth Syst. Sci., 14, 2487–2501, doi:10.5194/nhess-14-2487-2014, 2014

Ocean Science (OS)

Changes in extreme regional sea surface height due to an abrupt weakening of the Atlantic meridional overturning circulation

As an extreme scenario of dynamical sea level changes, regional sea surface height (SSH) changes that occur in the North Atlantic due to an abrupt weakening of the Atlantic meridional overturning circulation are simulated. Two versions of the same ocean-only model are used to study the effect of ocean model resolution on these SSH changes: a high-resolution strongly eddying version and a low-resolution version in which the effect of eddies is parameterised.

Reference

Brunnabend, S.-E. et al.: Changes in extreme regional sea surface height due to an abrupt weakening of the Atlantic meridional overturning circulation, Ocean Sci., 10, 881–891, doi:10.5194/os-10-881-2014, 2014

The Cryosphere (TC)

The effect of changing sea ice on the physical vulnerability of Arctic coasts

Sea ice limits the interaction of the land and ocean water in the Arctic winter and influences this interaction in the summer by governing the fetch. In many parts of the Arctic, the open-water season is increasing in duration and summertime sea-ice extents are decreasing. Sea ice provides a first-order control on the physical vulnerability of Arctic coasts to erosion, inundation, and damage to settlements and infrastructures by ocean water. This paper focuses on how the changing sea-ice cover has influenced coastal erosion over the satellite record.

Reference

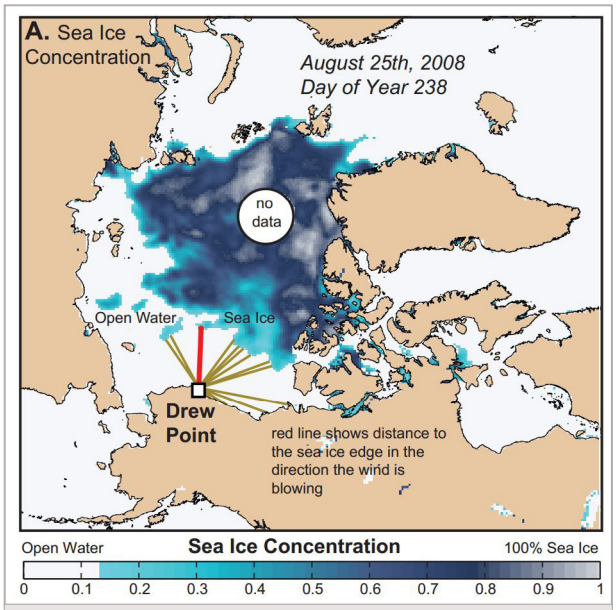
Barnhart, K. R., Overeem, I., and Anderson, R. S.: The effect of changing sea ice on the physical vulnerability of Arctic coasts, The Cryosphere, 8, 1777–1799, doi:10.5194/tc-8-1777-2014, 2014

The length of the world's glaciers – a new approach for the global calculation of center lines

Glacier length is an important measure of glacier geometry. Nevertheless, global glacier inventories are mostly lacking length data. Only recently have semi-automated approaches to measure glacier length been developed and applied regionally. In this study, the authors present a first global assessment of glacier length using an automated method that relies on glacier surface slope, distance to the glacier margins and a set of trade-off functions.

Reference

Machguth, H. and Huss, M.: The length of the world's glaciers – a new approach for the global calculation of center lines, The Cryosphere, 8, 1741–1755, doi:10.5194/tc-8-1741-2014, 2014



Arctic sea-ice concentration on 25 August 2008. (Source: Barnhart et al. 2014)

Sensitivity of the dynamics of Pine Island Glacier, West Antarctica, to climate forcing for the next 50 years

The authors employ a 3D, higher-order model to simulate the evolution of Pine Island Glacier over the next 50 yr in response to changes in its surface mass balance, the position of its calving front and ocean-induced ice shelf melting.

Reference

Seroussi, H. et al.: Sensitivity of the dynamics of Pine Island Glacier, West Antarctica, to climate forcing for the next 50 years, The Cryosphere, 8, 1699–1710, doi:10.5194/tc-8-1699-2014, 2014

The Anthropocene: an update

The Anthropocene Working Group provides an update on the discussions on formalising the Anthropocene as a geological epoch.

Study of, and interest in, the Anthropocene – the concept that humans have changed the geology of the Earth sufficiently to mean that a new epoch of planetary history has begun – has grown exponentially since the term was introduced at the beginning of this millennium (Crutzen & Stoermer 2000; Crutzen 2002). Interest in the concept has been wide-ranging, and distributed amongst the humanities, social sciences, and the Earth and natural sciences.

One specific aspect of research is the formal examination of the term to determine whether it might be formalised, and become a part of the Geological Time Scale. This followed initial analysis by the Stratigraphy Commission of the Geological Society of London, in which the potential of the term for formalisation was explored (Zalasiewicz et al. 2008), and the subsequent setting up, the following year, of an Anthropocene Working Group (AWG) of the Subcommission on Quaternary Stratigraphy, itself a component part of the International Commission on Stratigraphy. The AWG has no power of decision-making (that is the prerogative of the higher bodies in the formal hierarchy) but has the opportunity to examine the evidence both for and against potential formalisation.

The AWG includes both Earth scientists and representatives of a wider array of disciplines, as the analysis involves examining evidence of contemporary global change and, in effect, translating these into geological, and more specifically stratigraphic, terms. Thus, physical changes to the Earth surfaces may be interpreted in terms of lithostratigraphy, biotic change as biostratigraphy, anthropogenic chemical changes as chemostratigraphy, and so on. The work of the AWG is published in scientific papers, with two major volumes produced to date (Williams et al. 2011; Waters et al. 2014). A summary volume of evidence, together with recommendations, is projected for 2016, to approximately coincide with the next International Geological Congress.

This represents an ambitious schedule for a problem that is arguably more complex than that represented by elapsed geological time intervals (where formal assessment can take several decades). This is because of the level of interdisciplinarity study required, the diverse nature of the evidence and, not least, because the Anthropocene is clearly in its very early stages: its ultimate 'full' development and duration cannot yet be determined. Nevertheless, it is hoped that a reasonable, if interim, assessment can be made.

The AWG met for the first time in October of this year in Berlin, kindly hosted (and made possible) by the city's Haus der Kulturen der Welt. Seventeen of the then 35 (now 37) members of the AWG present debated the major issues that surround the Anthropocene, notably its geological reality, its definition (how it should be characterised and when it should be held to begin), its suitability for formalisation, and the outline of further work on this topic. In brief, the outcome of the meeting was:

- There was universal agreement among the attending members that the most fundamental aspect of the Anthropocene – that humans have altered geologic processes across the Earth system sufficiently to cause a planetary transition to a new period of geological time – is clearly a real event within a deep-time context, and is producing geologic signatures.
- All attending members agreed that for the above reason, the formal recognition of the Anthropocene as an interval of geologic time is useful, and should be pursued further towards an agreement for its formal recognition.
- At this point, the timing of onset of the Anthropocene has not been formally recognised, though specific proposals to do so are emerging and gaining evidence. The main proposed levels have been an 'early Anthropocene' beginning, linked to the origin and spread of agriculture, thousands of years ago; a beginning coincident with that of the Industrial Revolution, in the late 18th century; and one coincident with the Great Acceleration (Steffen et al. 2007) of the mid-twentieth century. The last of these currently has most support within the group, and specific levels within this are currently being analysed (e.g. Zalasiewicz et al., in press), while alternatives are also being explored (Edgeworth et al., in submission).
- The AWG is continuing to collect evidence, and is planning for further collaborative work and workshops to develop a formal proposal to recognise the Anthropocene to be presented to the International Geological Congress in 2016.

The Anthropocene Working Group

Notes

Further information on the activities of the AWG is available online at: http://quaternary.stratigraphy.org/workinggroups/anthropocene/.

References

Crutzen, P. J. & Stoermer, E. F.: The "Anthropocene", Global Change Newsletter, 41, 17–18, 2000

Crutzen, P. J.: Geology of mankind, Nature, 415, 23, 2002

Edgeworth, M. et al.: Diachronous beginnings of the Anthropocene – the stratigraphic bounding surface between anthropogenic and non-anthropogenic deposits, The Anthropocene Review (in submission)

Steffen, W., Crutzen, P. J. and McNeill, J. R.: The Anthropocene: are humans now overwhelming the great forces of Nature?, Ambio, 36, 614–621, 2007

Waters, C. N. et al.: A Stratigraphical Basis for the Anthropocene, Geological Society of London, Special Publication 395, 2014

Williams, M. et al. (eds): The Anthropocene: a new epoch of geological time?, Phil. Trans. R. Soc. A., 369, 833–1112, 2011

Zalasiewicz, J. et al.: Are we now living in the Anthropocene?, GSA Today, 18 (2), 4–8, 2008

Zalasiewicz, J. et al.: When did the Anthropocene begin? A mid-twentieth century boundary is stratigraphically optimal, Quatern. Int. (in press)

Planet Press: EGU news for children!

The EGU has launched an educational initiative called Planet Press to bring new geoscientific research to children. Planet Presses are short versions of our press releases – articles for journalists based on scientific research published in EGU journals – written in child-friendly language. The project aims to get children (mainly 7–13 year olds), and their parents and educators, interested in and engaged with up-to-date scientific research and news.

Planet Press started a few months ago with only some of EGU's press releases written in a language clear to young children. Now, all of EGU's 22 science press releases issued to date have a corresponding kids version. Each Planet Press has been reviewed by at least one researcher (working in the scientific area of the press release) and by one educator. This ensures the content is scientifically accurate and that the language used is appropriate for the 7–13 age range. Each text is accompanied by an image and a print-friendly PDF.

In addition to making sure each Planet Press is clear and accurate, we have also been collaborating with teachers and scientists from across Europe (and further afield) to translate the texts. Thanks to their help, all texts have been translated to Serbian, and we have also published some translations in Spanish, French, Italian and Turkish. If you'd like to help us achieve our goal of having all texts translated in the official European Union languages, please contact Bárbara Ferreira at media@egu.eu.

We believe sharing new and exciting geoscientific research with children can inspire them to develop an interest in the Earth, planetary and space sciences. If you are a parent or an educator, you are encouraged to use Planet Press as an educational tool, to teach or to discuss geoscientific discoveries with your children.

Logo of the Planet Press initiative.

The EGU is grateful to the many volunteer reviewers and translators who have helped us with this project. Planet Press is inspired by Space Scoop, an initiative by UNAWE (EU Universe Awareness) aimed at keeping children up-to-date with the latest astronomical discoveries.

An earlier version of this article was published on the EGU website.

BACK TO CONTENTS

Interview with Nick Dunstone, an outstanding young scientist

In this issue, we talk to Nick Dunstone, the winner of a 2014 EGU Division Outstanding Young Scientists Award, who studies the Earth's climate and atmosphere, including how they are impacted by natural variation and anthropogenic emissions.

Nick Dunstone, a climate scientist at the Met Office Hadley Centre in the UK, was the EGU's Climate Division Outstanding Young Scientist Awardee in 2014.

First, could you introduce yourself and tell us a bit about what you are working on at the moment?

My name is Dr Nick Dunstone and I am a climate scientist working at the Met Office Hadley Centre in the UK. Here I work within the Monthly to Decadal Climate Prediction group which focuses on developing regional climate prediction capability for all areas of the globe. The monthly to decadal timescale (often referred to as 'near-term' prediction) is an emerging and challenging field of climate prediction which attempts to span the void between shorter term weather forecasts (days to weeks) and longer term climate projections (many decades to centuries) using numerical climate models. So, similar to a weather forecast, near-term climate predictions are initialised close to the observed state of the climate and yet, similar to a climate projection; they also include the projected changes in external forcings such as greenhouse gases, anthropogenic aerosols and the solar cycle. Much of my research over the last few years has concerned the amount of predictability in the climate system arising from slowly varying internal processes (for example, slowly varying ocean dynamics) versus how much is driven by external forcings (e.g. anthropogenic emissions).

Earlier this year, you received a Division Outstanding Young Scientists Award for your work on the coupled ocean-atmosphere climate system and its predictability. Could you tell us a bit more about the research you have developed in this area?

Some of my work has considered the role of internal ocean dynamics in driving predictability in the atmosphere. Often we think of the tropical regions as being the engine of the climate system, driving some of the variability in the mid-latitude atmosphere. However, this is not always the case and especially on longer timescales (multi-annual to decadal), the mid-latitudes can drive tropical variability. My colleagues and I illustrated this using a set of idealised climate model experiments that tested the impact of initialising the state of different parts of the world's oceans. The results showed that it was key to initialise the ocean's sub-surface temperature and salinity (and so density) in the high latitude North Atlantic to have skill in predicting the multi-annual frequency of model tropical Atlantic hurricanes. This is intimately linked to correctly initialising the model's Atlantic meridional overturning circulation, and to the question of what sub-surface ocean observations would be needed to do this. I have also worked on how external forcings, such as anthropogenic emissions from industrial pollution, may impact regional climate variability.

A lot of the work you have developed focuses on the anthropogenic impact on the Earth's atmosphere and climate. What does your research tell us about the extent of the impact of human activities on the Earth's natural systems?

In the last couple of years we have examined the possible impact of anthropogenic aerosol emissions on multi-decadal changes in climate variability. We found that when the latest generation of climate models include the historical inventory of anthropogenic aerosol emissions, they are capable of better reproducing the phases of observed multi-decadal variability in North Atlantic temperatures. In our Met Office Hadley Centre climate model, we find that this is principally due to the inclusion of aerosol-cloud interactions. When aerosols are present in clouds they can modify the cloud droplet size (known as the 1st aerosol indirect effect), increasing the reflectivity of the clouds and hence decreasing the amount of solar radiation reaching the ocean surface. Variations in aerosol emissions from North America and Europe due to socioeconomic changes (e.g. rapid post-war industrialisation in the 1950s and 1960s and then the introduction of clean-air legislation in the 1970s and 1980s) then drive fluctuations in North Atlantic temperatures in our climate model. Furthermore, we also showed that the frequency of model North Atlantic hurricanes is also driven primarily by anthropogenic aerosol changes and that it is in phase with the observed changes in Atlantic hurricane frequency. Further work needs to be done to understand if this aerosol mechanism is truly operating in the real world. If so, then our work suggests a significant role for humans in unwittingly modulating regional climate variability (especially in the

North Atlantic) throughout the 20th century. This also has profound implications for the next few decades, as North America and Europe continue to clean-up their industrial aerosol emissions, whilst the impact of short-term increases in aerosol emissions from developing economies (e.g. China and India) also needs to be studied. Of course, at the same time, the signal of greenhouse gas warming is likely to become more dominant with associated climate impacts.

What is your view on having the Anthropocene accepted as a formal geological epoch? Do you think there are scientific grounds to define the Anthropocene in such a way, or at least in what your research area is concerned?

This is an interesting question but not one that I've thought very much about! From a climate scientist perspective, I think it is fairly obvious that we have entered a time when the human fingerprint extends to all (or at least very nearly all) environments on Earth. We see the fingerprint in the concentration of greenhouse gases and water vapour in the atmosphere, land and sea-surface temperatures, deep-ocean warming, ocean sea-level rise, ocean acidification, etc... If physical climate changes alone were the main criterion, then surely there would be no doubt that we have entered a new epoch. Beyond this though, the wider Earth biological system is also being impacted by human activity. For example, previous epochs have also been defined based upon mass species extinction, so there may also be a case here for viewing the Anthropocene as a time when the actions of humanity have led to species extinction. Of course there are then questions about how to define the beginning of this new epoch. Many suggest a geophysical marker such as the 1940s and 1950s when radionuclides from nuclear detonations first became present. Or would it be when the atmospheric CO_2 concentration started to rise above pre-industrial levels in the early nineteenth century? Or would it be earlier still, when we started significantly altering the land-surface via large-scale deforestation? Then when would the Anthropocene end? Could we envisage a time in the future when we effectively remove our influence on the climate system, e.g. returning the atmospheric constituents to pre-industrial ratios? Or, rather more grimly, would the Anthropocene only truly be over when our species itself becomes extinct? Whilst these are very interesting 'dinner-table' type discussions, from a working climate scientist viewpoint the definition seems largely academic and we'd probably be better off investing our time into researching how we are changing the planet and predicting the associated climate impacts!

On a different topic, according to your page on the Met Office website, you started your career in science as an astrophysicist. Could you tell us a bit about how you made the transition from astrophysics to climate science, highlighting any difficulties you may have had with making such a career change and how you overcame them? What advice would you have for young scientists looking to make a similar move?

To a large extent I think 'science is science'! Many of the skills are very transferable, especially between physical, computationally based, subjects, where numerical modelling skills are essential. I've now met a surprising number of climate scientists who are ex-astronomers, or from some other branch of physics. I think what you need most of all is the drive for learning new things, and making new discoveries, about the physical world in which we live. I found that this is very transferable, applying equally to astrophysics and climate science. I think you settle into a subject slowly and even though I've been working in climate science for over 6 years now, I still have lots to learn about our existing understanding of climate system, and that's exciting. The important thing to realise however, is that you can still make important and useful contributions to a new field quite quickly, especially one as broad as climate science, given the right guidance or supervision.

Finally, could you tell us a bit about your future research plans?

We need to progress both our understanding of natural (internal) variability in climate models and improve the fidelity of important climate teleconnections (processes linking variability in one part of the climate system with climate impacts in a remote region). At the same time we need to progress our understanding of the relative roles of external vs internal forcing in driving variability and extremes in the climate system. On the shorter (seasonal) timescales I am interested in what drives the year-to-year variability in the winter North Atlantic Oscillation, which our latest Met Office seasonal climate prediction systems can now predict with surprisingly good skill. Much of this work I hope to develop during my new post as manager of the Global Climate Dynamics group in the Met Office Hadley centre that I will start in December.

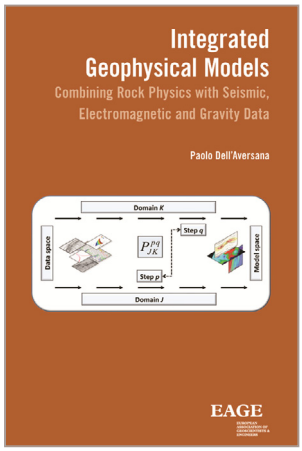
Interview conducted by Bárbara Ferreira

EGU Media and Communications Manager and GeoQ Chief Editor

GEOQ BOOKS

Integrated Geophysical Models

Combining Rock Physics with Seismic, Electromagnetic and Gravity Data



By Paolo Dell'Aversana

EAGE PUBLICATIONS

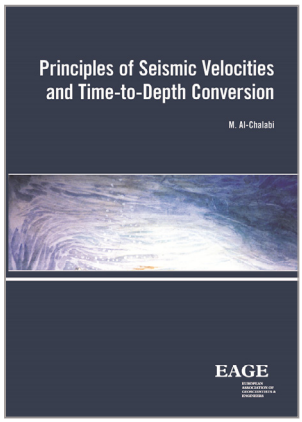
244 pages | Paperback
1st edition | 2014
ISBN 9789073834927

Price: €75 (€60 for EAGE members)

Publisher's summary (abridged)

The growing interest for electromagnetic and gravity methods, together with the availability of high quality seismic data, justifies the development of efficient methodologies for combining heterogeneous geophysical information into multi-parametric models. This book discusses different approaches for building integrated geophysical models using seismic, electromagnetic and gravity data. The book focuses mainly on land and offshore geophysical data acquired at the surface. However, also borehole data is considered as a fundamental support for geophysical integration. Integrated acquisition techniques will be included in the discussion, but the focus is mainly on integrated model building.

Principles of Seismic Velocities and Time-to-Depth Conversion



By M. Al-Chalabi

EAGE PUBLICATIONS

491 pages | Hardback
1st edition | 2014
ISBN 9789073834873

Price: €125 (€99 for EAGE members)

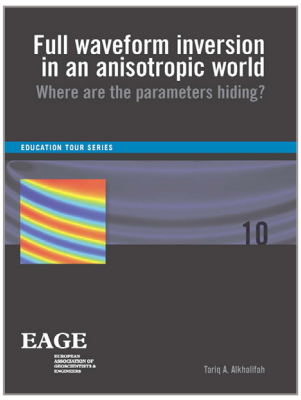
Publisher's summary (abridged)

Despite its fundamental importance for acquiring an accurate picture of the subsurface, the topic of time-to-depth conversion on the basis of true propagation velocities has never been addressed in the form of a comprehensive, dedicated book. The present book has long been overdue for bridging this obvious gap in geoscience. Geophysicists proficient in data processing fully appreciate that depth imaging, despite the excellence achieved in data quality and lateral positioning, does not amount to true or accurate depth conversion. This is because modelling 'velocities' in processing (described in the book as 'pro-velocities') can often be quite different from the actual propagation velocities. The book is written for the interpretation geophysicist working in exploration and development and for the seismic processor seeking a wider perspective on the quality of output and on the provision of the data to help the 'frontline' geoscientist. The geologist using geophysical methods as a tool at various levels of detail in the evaluation of the subsurface, and the geoscientist at large, may also find the manuscript useful.

BACK TO CONTENTS

Full waveform inversion in an anisotropic world

Where are the parameters hiding?



By T.A. Alkhalifah

EAGE PUBLICATIONS

204 pages | Paperback
1st edition | 2014
ISBN 9789073834835

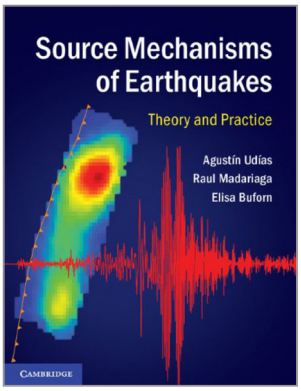
Price: €75 (€60 for EAGE members)

Publisher's summary (abridged)

This book offers a gentle yet scientific introduction to the hot topic of full waveform inversion (FWI) with a focus on its practical application to anisotropic media. It includes discussion of a mix of classical developments in FWI based on a simple framework, as well as critical new developments that address current challenges. Recent FWI case study results, as well as our experience with imaging seismic data, suggest the necessity of taking the anisotropic nature of the Earth into consideration. Unlike elasticity or attenuation, anisotropy actually affects the kinematics of the wavefield, in addition to the amplitudes. Many practical implementations of FWI ignore the elastic nature of the Earth and use the S-wave free acoustic assumption by reducing the impact of amplitudes. The importance of including at least acoustic amplitudes is, however, becoming more and more apparent. The goal of this book is to provide a recipe for practical anisotropic FWI, with proper FWI setups and anisotropy parameter representations.

Source Mechanisms of Earthquakes

Theory and Practice



By A. Udías, R. Madariaga, E. Buforn

CAMBRIDGE UNIVERSITY PRESS

311 pages | Hardback
1st edition | April 2014
ISBN 9781107040274

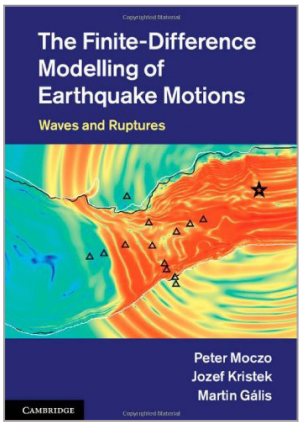
Price: £45 (~€57)

Publisher's summary

This book presents an innovative new approach to studying source mechanisms of earthquakes, combining theory and observation in a unified methodology, with a key focus on the mechanics governing fault failures. It explains source mechanisms by building from fundamental concepts such as the equations of elasticity theory to more advanced problems including dislocation theory, kinematic models and fracture dynamics. The theory is presented first in student-friendly form using consistent notation throughout, and with full, detailed mathematical derivations that enable students to follow each step. Later chapters explain the widely-used practical modelling methods for source mechanism determination, linking clearly to the theoretical foundations, and highlighting the processing of digital seismological data. Providing a unique balance between application techniques and theory, this is an ideal guide for graduate students and researchers in seismology, tectonophysics, geodynamics and geomechanics, and a valuable practical resource for professionals working in seismic hazard assessment and seismic engineering.

Book review: The Finite-Difference Modelling of Earthquake Motions

Waves and Ruptures



By P. Moczo, J. Kristek, M. Gális

CAMBRIDGE UNIVERSITY PRESS

383 pages | Hardback
1st edition | April 2014
ISBN 9781107028814

Price: £75 (~€95)

Numerical modelling plays a major role in many modern scientific branches. Accurate methods combined with detailed models give the possibility to scientists to test their hypotheses. In seismology, the need of sophisticated wave propagation tools started to grow a while ago to narrow the gap between observation and theory. Despite all the approximate methods already available at the time, seismologists started to generate synthetic seismograms extensively by using numerical methods in the seventies. Synthetic waveforms, in contrast with real waveforms recorded by seismometers, are generated on Earth models providing a suitable method to test scientists' predictions. Soon, numerical methods found their way to a wide range of topics from local to global seismology and the new methods started to emerge in order to enhance the modelling accuracy and efficiency.

Among all the numerical methods, maybe the Finite Difference Method (FDM) is the most convenient one to start with due to its simple approach: taking differences from the neighboring points. Albeit simple, there are many challenges arising to adapt this method for different applications such as earthquake ground motion.

The Finite-Difference Modelling of Earthquake Motions, Waves and Ruptures, by Peter Mocza, Jozef Kristek and Martin Gális, is the first book that provides seismologists with a comprehensive introduction to FDM by explaining the method and its applications in earthquake motion. Its main target audiences are academic researchers and graduate students in seismology and geophysics who want to get familiar with numerical seismological techniques. Yet, it is a good reference for those who are familiar with the method but want to learn the details in applying numerical methods to real problems.

The eminent board of authors has a long history in developing and applying Finite-Difference (FD) and hybrid Finite-Difference-Finite-Element methods in seismology. It is clear that a good effort was put into collecting some of their major contributions in the book, which resulted in well written chapters with informative figures. It covers the basics required to understand the method combined with detailed derivations of the equations and advanced examples. Maybe one of the main features of the book is its systematic sectioning, making it easy for the reader to refer to the desired section.

In Part I, the reader gets familiar with the governing equations, the equation of motion and the constitutive law of different media, in the forms usable for FD schemes with an overview over different initial/boundary conditions. These are followed by detailed explanations and formulations of rheological models of a continuum media. The chapter finishes with a comprehensive description on earthquake sources.

The numerical part of the book matures in Part II. After an overview on different numerical methods in solving seismological equations, the authors introduce FDM and explain the basic properties of this method. This consists of spatial FD grids, derivation of the equations and time schemes. An instructive section in this chapter is the application of the FD to the 1D problem, avoiding any complications introduced by three-dimensional domains. However, this has been treated later in this part by explaining the method in 3D media. In all these sections, special attention is given to the accuracy, error analysis and stability of the method as well.

The book goes one step further than pure FDM, and it explains the Finite Element (FE) method, in which the boundary conditions at the free surface can be more easily incorporated. Afterwards, the authors explain a method that combines the advantages of FE and FD in the form of a hybrid FD–FE method.

In the last part, the method is applied to a realistic scenario: modelling of earthquake motion in the Mygdonian basin. This chapter gives a good overview on verification and validation to evaluate the accuracy and reliability of numerical methods in a real example.

One of the remarkable aspects of this book is its usability for a wide range of audience. It has a smooth approach in developing and explaining the required ingredients to introduce and apply the method. In each section, a list of references is provided for further reading in the topic. It covers a variety of challenges that seismologists encounter in using and choosing the convenient forward modelling codes for their applications. Moreover, the book tries to cover lots of topics scattered in different research articles in one book and explains them in a concise way. This is indeed an advantage; however, in some sections, the details can go beyond the patience of non-experienced readers. This can be easily avoided by carefully

selecting the relevant and more general sections for those who do not want to go through all the details.

All in all, The Finite-Difference Modelling of Earthquake Motions, Waves and Ruptures is an excellent book for starting, as well as broadening the knowledge, in numerical seismological techniques. It covers not only the main aspects of computational methods, and in particular FDM, but also familiarises the readers with the applications of the method for more advanced seismological problems.

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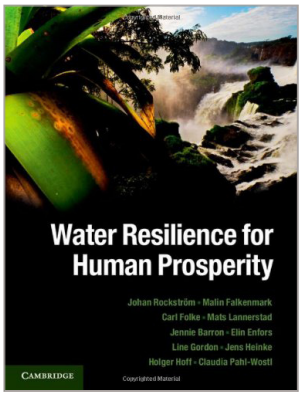
Book review: Water Resilience for Human Prosperity



By J. Rockström, M. Falkenmark, C. Folke, M. Lannerstad, J. Barron, E. Enfors, L. Gordon, J. Heinke, H. Hoff, C. Pahl-Wostl

CAMBRIDGE UNIVERSITY PRESS

311 pages | Hardback
1st edition | March 2014
ISBN 9781107024199

Price: £45 (~€57)

The concept of ecological resilience – persistence of a system through change – was introduced by the Canadian ecologist C.S. Holling in 1973. Now, over 40 years later, Water Resilience for Human Prosperity sets an ambitious goal by tackling the world's key resource in the spotlight of global change. While the book's title suggests a focus on the resilience of water resources, Rockström et al. clarify that it rather deals with the role of water in sustainable development. Thus, it addresses students, researchers, planners and decision makers; in short: everyone playing a direct or indirect role on the Earth's ecological path for the future. However, it should be said that it is more of a well-rounded textbook than a how-to guide if you are in an executive position.

The book, written by Sweden- and Germany-based researchers, is separated into nine chapters and includes up-to-date scientific references and excellent figures. The examples are manifold and relevant for practical applications: for instance, two invited authors analyse and compare the socio-economic consequences of groundwater extraction in the plains of China and North America. A summary closes every chapter and key terms are defined in a glossary. The global-level maps and graphs provide the reader with a detailed impression of where our water and sustainability problems are located. All this said, Water Resilience for Human Prosperity is a densely written volume that comes along a bit theoretical at times, but is generally tangible for the reader.

Starting with a thorough look at the role of water in the biosphere, the book then moves to human alterations of the water cycle and the complex socio-economic interrelations connected to them. On the way, it addresses today's urgent issues such as climate change, land conversion and the growth of population which, for themselves, may be worth looking into. Processes are linked from the local to the global scale and across the gap between ecology and economy. Finally, the volume offers approaches on how the resulting new dynamics can be managed.

A thematic focus is put on food production. The reason for this is a required 70% increase in production to feed the expected population in 2050, combined with the fact that water is the limiting resource for food production in many strong-growing countries. Additionally, the authors devote an extra chapter to the savannah zone, as it represents 30% of land area and population and has high agro-hydrological potential, which suggests the possibility of more than doubling the yield from farming in the future.

What I appreciated most about the book is that it does not simply collect, point out and link sustainability issues around the world, but names and explains strategies to increase water and food resilience, such as a functioning global food trade, the increase of food stocks and diet change towards a greater share of plant-based calorie intake. It is, however, realistic by admitting the challenges and limits of the various approaches.

Overall, this isn't a book you would bring on a holiday; reading Water Resilience for Human Prosperity is hard but fruitful work given how informative the volume is. If you haven't worked on water, it's a great interdisciplinary and contemporary introduction to it. If you're a hydrologist, you may still find it a valuable read, because it comprises the global, socio-economic and complex perspective of today's changing world.

Marcus Schmidt
PhD Student, Buesgen Institute – Soil Science of Tropical and Subtropical Ecosystems, Georg-August University of Göttingen, Germany

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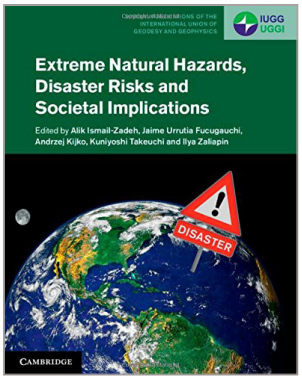
Book review: Extreme Natural Hazards, Disaster Risks and Societal Implications



Edited by A. Ismail-Zadeh, J. U. Fucugauchi, A. Kijko, K. Takeuchi, I. Zaliapin

CAMBRIDGE UNIVERSITY PRESS

413 pages | Hardback
1st edition | April 2014
ISBN 9781107033863

Price: £90 (~€114)

This volume presents a unique and interdisciplinary approach to disaster risk research, combining natural and social science on a global scale. It comprises 30 peer-reviewed chapters with contributions from 58 authors, edited by experts from around the world.

The editors are Alik Ismail-Zadeh (Karlsruhe Institute of Technology), Jaime Urrutia Fucugauchi (Universidad Nacional Autonoma de Mexico), Andrzej Kijko (University of Pretoria Natural Hazard Centre), Kuniyoshi Takeuchi (UNESCO), and Ilya Zaliapin (University of Nevada). All work actively within the field of natural hazards and risk management, and the book itself is an extension of the topics covered at the Extreme Natural Hazards and Societal Implications (ENHANS) international meetings between 2010 and 2011.

The stated main audience for this book are researchers in academia and grad students, with a secondary audience of policymakers and disaster prevention specialists, making the scope wide but with the sense that technicalities may be discussed.

The book layout begins with an introduction and review of natural hazards in general. This segment also covers the book's origins as part of the ENHANS project.

Each chapter of part two focuses on a particular hazard or technology for dealing with a hazard, and holds some of the most technical text in the volume. The book alleges to have covered every type of big natural disaster, although personally I feel they could have given some attention to extraterrestrial impacts, which are not discussed at all. There was, however, a very interesting chapter on space weather, which has clear implications for our technology-dependent world and should be discussed more outside of this text.

The four subsequent parts, from three through to six, each focus on different regions of the world: Latin America and the Caribbean, Africa, the Middle East, and Asia and the Pacific. These regions were chosen purposely as they contain a higher level of risk in relation to extreme natural hazards due to their high populations, number of developing nations, and in many areas a lack of extensive research compared to areas like Europe and North America.

These parts are comprised entirely of case studies, all very statistics-heavy, relating to discrete incidents. The whole section reads like a complete and separate case study volume, designed to give one an idea of what is and isn't possible when it comes to extreme hazards in these areas. Through it, some interesting data come out, such as the fact that Africa is so plagued by hydro-meteorological hazards that earthquakes, landslides and volcanoes only contribute to 2% of the total hazard risk – something that greatly influences policy time given towards these potentially damaging hazards in some African nations. Or the fact that many Mexican volcanoes still lack data on magma genesis, ascent and trigger mechanisms, a worrying fact for a country that has large populations living within kilometres from more than a dozen active volcanoes.

Throughout these chapters, their authors also take pains to explain and consolidate the reader's understanding of terminology, such as the differences of a hazard (a dangerous phenomenon that may cause loss) and of risk (a measure that characterises those losses resulting from a hazard). Emphasis on explaining risk mitigation as more than just an emergency response but as something that comprises of preparation in terms of policymaking, and prevention in terms of land-use planning, is noticeable throughout the volume, and this gives the volume a very responsible credence.

Part seven, on disaster risk and societal implications, was the stand-out section of the volume, and made for the most interesting and useful reading. It necessitates the prior case studies and general overviews of types of hazard in order to lend gravity to the situation, particularly for policymakers reading the text.

This final section also makes it apparent that the book is very timely indeed. The Millennium Development Goals are to be adopted in 2015 during the next World Conference on Disaster Reduction, and this book's creed seems to be to encourage people to improve the relationship between risk reduction and land-use development at the national level, and to change the fatalistic belief in policymaking that such disasters are inevitable and thus loss is unavoidable.

There are lots of progressive ideas towards the end concerning the combination of disaster policy with climate change, sea-level rise, insurance and poverty. All are key issues that are only going to become more important in the coming decades.

In all the text is not very technical. It can be read and understood by a vast majority readership – which is perfect for a book that espouses reducing barriers to knowledge in order to improve risk mitigation.

This book is an enlightening read for anyone interested in the subject of natural hazards, and is a must for anyone involved in policy, decision-making, or scientific research in this field.

Holly Ferrie
Geosciences student, Department of Environment, Earth and Ecosystems, Open University, UK

This section advertises conferences, summer schools and workshops submitted to the EGU online meetings calendar. The EGU logo marks meetings co-sponsored by the Union.

Please note that events submitted to the calendar without description or website may not be highlighted here.

EGU 2015 General Assembly

12–17 April 2015, Vienna, Austria

The EGU General Assembly 2015 will bring together geoscientists from all over the world to one meeting covering all disciplines of the Earth, planetary and space sciences. The EGU aims to provide a forum where scientists, especially early career researchers, can present their work and discuss their ideas with experts in all fields of geoscience. The EGU is looking forward to cordially welcoming you in Vienna!

Website: egu2015.eu
Abstract deadline: 7 January

EGU Topical meeting: Validation in Flood Risk Modelling

09–10 December 2014, Delft, The Netherlands

Flood risk analysis, used to make important and often expensive decisions, is complex and subject to significant uncertainty. The fact that this information is important but also uncertain has led to an increasing requirement to verify and validate flood risk analyses. This workshop provides an overview of validation and verification methods for models used in flood risk analysis, specifically for models of processes for which only limited observations are available.

Website: egu.eu/3KY3Z2

International Workshop on Polar-Lower Latitude Linkages and their Role in Weather and Climate Prediction

10–12 December 2014, Barcelona, Spain

The workshop's overall aim is to improve the polar components of the tools used for weather and climate prediction, including enhanced initialisation, which may lead to improved forecasts in the extra-polar regions. The workshop will consist of key note talks by invited speakers, poster sessions, breakout group sessions and a plenary session. The expected outcome is producing a set of recommendations that will be broadly disseminated as a report.

Website: egu.eu/8V9RA4

Thermodynamic modeling with alphaMELTS and other MELTS software

11–14 December 2014, Pasadena, CA, USA

This short course will introduce users to the underlying thermodynamics, illustrate the capabilities and potential applications of individual MELTS-type models and give participants first hand experience running MELTS. We will focus on the alphaMELTS front-end at first but will also be demonstrating a variety of interfaces supported by Caltech and OFM-Research, from the well-established (e.g. the original MELTS GUI) to the new and cutting edge (e.g. MELTS_Excel, libalphaMELTS).

Website: egu.eu/87RYMX

2014 AGU Fall Meeting

15–19 December 2014, San Francisco, United States

The Fall Meeting of the American Geophysical Union provides an opportunity for researchers, teachers, students, and consultants to present and review the latest issues affecting the Earth, the planets, and their environments in space. This meeting will cover topics in all areas of Earth and space sciences.

Website: egu.eu/2QBD5R

Annual Meeting of the Palaeontological Association

16–19 December 2014, Leeds, UK

The 58th Annual Meeting of the Palaeontological Association will begin with a symposium entitled 'The photosynthesis revolution: how plants and photosynthetic micro-organisms have bioengineered the planet' and the Annual Address will be given by Alan Haywood, on 'Understanding ancient Earth climates and environments using models and data'.

Website: egu.eu/8NYMBK

XI International Eclogite Conference 2015

31 January – 07 February 2015, Rio San Juan, Dominican Republic

The International Eclogite Conferences are organised in different countries every two years and focus on studies in the field of high- and ultrahigh-pressure metamorphism. The programme will comprise a central 4-day conference block dedicated to a wide variety of topics related to high- and ultrahigh-pressure metamorphism that will also include a 1-day syn-conference field trip. In addition, pre- and post-conference field trips will be offered.

Website: egu.eu/8P9JIY

Theoretical advances in planetary flows and climate dynamics

02–06 March 2015, Les Houches, France

The aim of this meeting is to synthesise recent progress and address outstanding fundamental issues in planetary flows, notably Earth's atmosphere and oceans. The meeting will highlight the general principles that underlie these flows and will favour multidisciplinary interactions between different scientific approaches (observations, modelling and theory).

Website: egu.eu/4ZRDTN

From Hooke to Helioseismology: The UK's contribution to seismology – past, present and future

09–10 April 2015, Leicester, England

The UK has a rich history in seismology. It is 100 years since John Milne, who defined the word 'seismometer', died. As major facets of the science are perhaps becoming 'historical' e.g. onshore controlled source crustal seismology, this meeting has been designed to explore the UK's past and present contribution to the subject. While science does not recognise national boundaries, work undertaken in the UK since the time of Hooke, through Rayleigh, Jeffreys, Bullard and more is worthy of report.

Website: egu.eu/7TY782
Abstract deadline: 20 March 2015

HydroEco2015: 5th International Multidisciplinary Conference on Hydrology and Ecology, Advances in Monitoring, Predicting and Managing Hydroecological Processes

13–16 April 2015, Vienna, Austria

The aims of this meeting are: to present new findings and approaches on interactions between hydrology and ecology; to promote interdisciplinary interactions on water related issues between hydrology, hydrogeology, biogeochemistry, microbial ecology and ecology; to explore advances in monitoring, modelling and predicting dynamics of hydroecological processes; and to discuss management approaches and applications to tackle environmental issues, including measures for ecosystem preservation and restoration.

Website: egu.eu/5ZBORP

3rd International Workshop on Rock Physics

13–17 April 2015, Perth, Australia

The workshop will review recent advances in theoretical, experimental, computational and applied rock physics and steer future research. The organisers invite everyone interested in rock physics to come to Perth and share their ideas and insights with like-minded colleagues.

Website: egu.eu/8WC9F5

Google Geo for Research and Higher Education

13 April 2015, Vienna, Austria

This workshop is intended for scientists, researchers, students and faculty who regularly work with geospatial data. You will gain hands-on introductory experience with Google's Geo cloud technologies including Google Earth Engine and Google Maps Engine. Attendance to this hands-on workshop is limited. Applications will be circulated at the end of February.

Website: egu.eu/3TVN7Q