

Bolin Centre for Climate Research

Report 2017





Bolin Centre Vision

Our vision is the Bolin Centre as the nationally leading and an internationally recognised centre for interdisciplinary climate research and a primary Swedish contact point for scientists, media and the public on issues relating to the past, present and future climate.

Bolin Centre Mission

The mission of the Bolin Centre is to create and communicate fundamental knowledge about climate and the Earth system as part of an evolving global effort to understand and adapt to the Earth's changing climate.

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Attendees at AGU Fall Meetings. Photo: Annika Burström and Inês Jakobsson.

The Bolin Centre for Climate Research

The Bolin Centre is a multi-disciplinary consortium of more than 350 scientists in Sweden who conduct research, graduate education and outreach related to the Earth's climate. It was formed in 2006 and comprise of Stockholm University, the KTH Royal Institute of Technology and the Swedish Meteorological and Hydrological Institute (SMHI). The Bolin Centre is named in honour of Professor Bert Bolin of Stockholm University, a world leader in climate and carbon cycle research.

The Bolin Centre focuses on extending and disseminating knowledge about the Earth's natural climate system, climate variations, climate impacting processes, climate modelling, human impact on the climate and climate impacts on ecosystems, biodiversity and human conditions as well as how society can minimise negative impacts through responsible management. It contributes to the knowledge base for climate mitigation and adaption policies nationally and internationally.

The Bolin Centre is named after Professor Bert Bolin of Stockholm University, one of the founders of the Intergovernmental Panel on Climate Change (IPCC). Publication of the first IPCC report led to the recognition of the need for cross-disciplinary collaboration on climate science at Stockholm University. This resulted in a Climate Research School being established in 2005 and shortly thereafter the research program SUCLIM (Stockholm University Climate Research Centre) being awarded a 10 year Linneaus grant from the Swedish government in 2006.

In 2008, SUCLIM was renamed the Bert Bolin Centre for Climate Research, a name which was shortened to the Bolin Centre for Climate Research in 2013. From 2010, the Swedish Hydrological and Meteorological Institute (SMHI) and the KTH Royal Institute of Technology joined the Bolin Centre in a collaboration aimed at strengthening climate modelling within the centre. This initiative was funded as a strategic research area (SFO) by the Swedish government.

In June 2016, the Bolin Centre merged with another strategic research area at Stockholm University: EkoKlim. This merger widened the scope of the Bolin Centre to include the impacts of climate change on landscape processes and biodiversity.

Following this merger, the combined SFO funding of the Bolin Centre exceeds 30 MSEK annually.

Partners



**Stockholm
University**

www.su.se

SMHI

www.smhi.se



www.kth.se

www.bolin.su.se

Bert Bolin (1925-2007): A world leading scientist and science organiser

Bert Bolin joined the newly created Department of Meteorology at Stockholm University¹ in 1948 as an assistant to Professor Carl-Gustaf Rossby. With short intervening periods, Bert Bolin remained an active member of the department staff until his death in 2007.

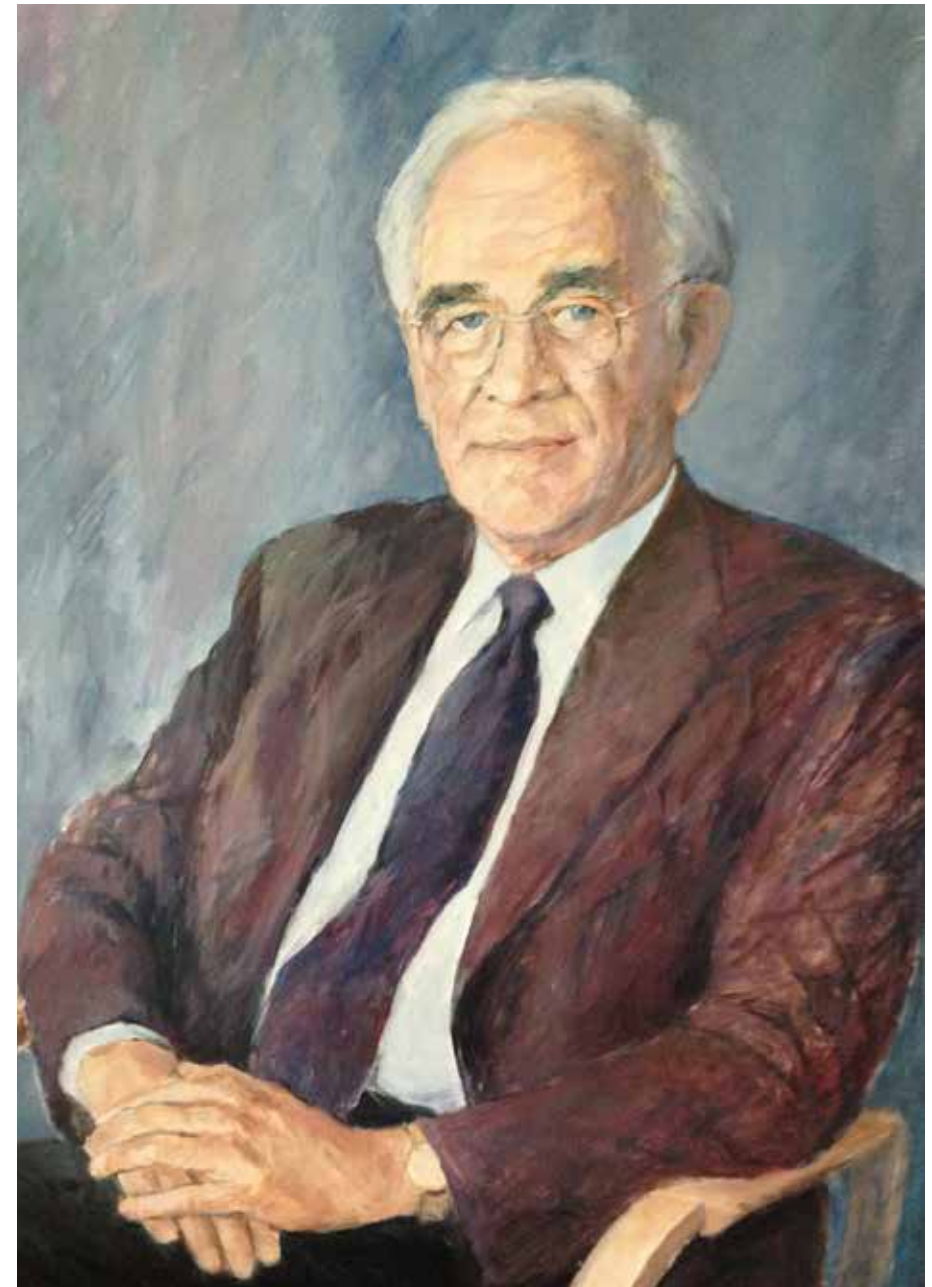
During a productive period as Rossby's student he wrote several fundamental papers on atmospheric circulation and on the basic principles for numerical weather prediction. After he received his PhD in 1956, he broadened his interests to include studies of biogeochemical cycles of key life elements. This became the introduction to his world leading research on the carbon cycle in the atmosphere, oceans and biosphere.

Bert Bolin was not only a prominent scientist. His role as an inspirer and organiser of international climate research has been of outstanding importance. Due to his broad and deep scientific knowledge, his unusual ability to see the big picture, his eminent ability to express himself orally and in writing, and his diplomatic talent, he became the natural leader. He initiated several research programmes focusing the global environment including the World Climate Research Programme (WCRP) and the International Geosphere-Biosphere Programme (IGBP).

Bert Bolin's most important achievement was his contribution to the formation and development of the Intergovernmental Panel on Climate Change (IPCC) under the UN. He chaired this panel during its first ten years (1988–1997). His extremely important role as the founder and initial leader of IPCC has been testified by many. IPCC received the Nobel Peace Prize in 2007.

The legacy of Bert Bolin remains alive among climate scientists at Stockholm University and at many other places through the inspiration that he brought about with lectures, supervision, his scientific approach and his engagement to make research results available to policy makers and the public.

Henning Rodhe
Bert Bolin's student, colleague and friend



The Bolin Centre for Climate Research is named in honour of Professor Bert Bolin of Stockholm University, a leader in climate and carbon cycle research and one of the founders of the Intergovernmental Panel on Climate Change (IPCC) which received the Nobel Peace Prize in 2007. Painting and photo by Carin Adler.

¹Stockholm University was formed 1960 from Stockholms Högskola, which was founded 1878.

Bolin Centre organisation

The Bolin Centre aims to bring climate scientists together. The centre comprises eight cross-disciplinary research areas, within which scientists from different disciplines join together to tackle key questions about climate. The Bolin Centre organises regular seminars, workshops, conferences, outreach projects, summer schools and mentoring.

www.bolin.su.se/about-us



Research Area 1

Ocean-atmosphere dynamics and climate

Research Area 2

Clouds, aerosols, turbulence and climate

Research Area 3

Hydrosphere, cryosphere and climate

Research Area 4

Biogeochemical cycles and climate

Research Area 5

Historical to millennial climate variability

Research Area 6

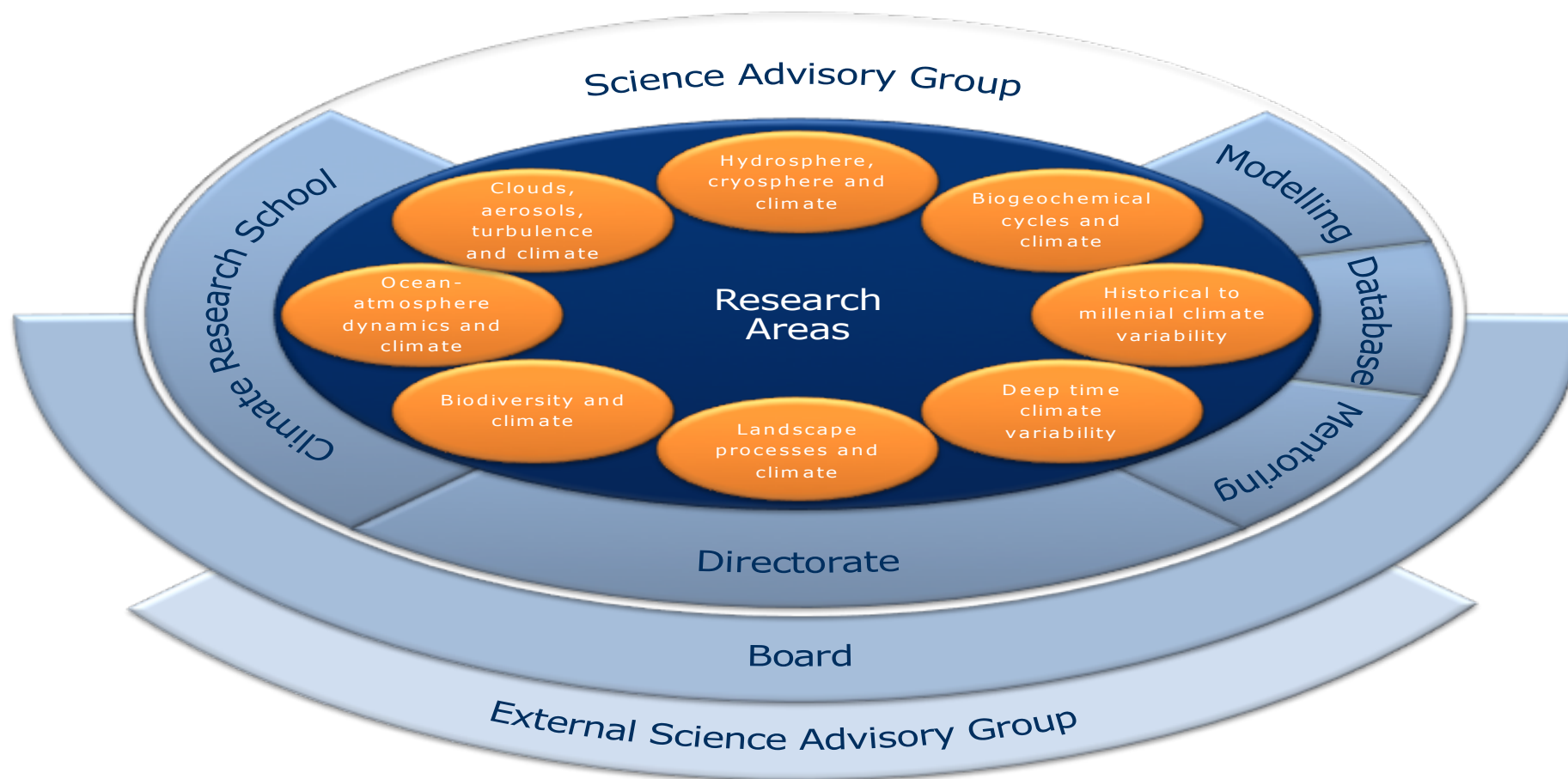
Deep time climate variability

Research Area 7

Landscape processes and climate

Research Area 8

Biodiversity and climate



The Bolin Centre is built around its eight multi-disciplinary research areas, each of which is led by two (or sometimes three) scientists. The centre hosts a research school and an open access database as well as providing communication support and support for climate modelling activities. There is also a mentoring programme which is open to all of its members.

The directorate comprises two co-directors and two communicators and coordinators, who share the day-to-day tasks of centre operations.

All research area co-leaders, coordinators and the directorate meet regularly in the Science Advisory Group (SAG), working to facilitate excellence in climate-related science conducted by the Bolin Centre members.

The Bolin Centre is led by its board, which includes heads of participating departments at Stockholm University, representatives from KTH Royal Institute of Technology and Swedish Hydrological and Meteorological Institute (SMHI), and external members.

The Bolin Centre receives guidance from its External Science Advisory Group (ESAG). These internationally recognised leaders in climate science visit the Bolin Centre annually at its internal conference: the Bolin Days.

The operational philosophy of the Bolin Centre is one of mutual respect and trust – a philosophy which is reflected in the form of paired leadership which is applied throughout the organisation.

Director's corner

The Bolin Centre has evolved from an idea among a few inspired individuals to a thriving node embracing more than 350 scientists focusing on science, education and outreach related to the Earth's climate. The Bolin Centre is a common effort, and its success is the success of its members.

On entering our third year as co-directors of the Bolin Centre, we would like to express our gratitude to our members for making the Bolin Centre an internationally recognised environment for excellence in climate research, education and outreach.

We welcome new co-leaders to our research area and members to our Board and External Science Advisory Group.

We specifically thank our members for the hard work that has made the merger of the Bolin Centre and EkoKlim a success. Our eight research areas work excellently together while at the same time, each retains its own unique character. This collaborative diversity is one of the Bolin Centre's strengths.

Climate research is at the core of our activities and not only excellent scientific productivity (see "Appendix 2: Publications" on page 48) but also international collaboration (see the bibliometric analysis at "Appendix 1: Facts & figures" on page 42) testifies to its success.

In 2017 and 2018, we also welcome a range of new activities, including:

- The Bolin Centre Seminar Series: A series, with contributions from all research areas which fosters academic exchange and discussion.
- The Bolin Centre Climate Festival: A 3-day event in connection with the Bert Bolin Climate Lecture that attracts over 1300 participants and focuses on climate change and what we can do to combat it.
- Masters in Climate Science led by our Climate Research School.
- The Bolin Centre Journal Club: a forum for postdoctoral scientists to meet and discuss scientific papers.

Co-directors



Nina Kirchner
nina.kirchner@natgeo.su.se



Alasdair Skelton
alsadair.skelton@geo.su.se

***Alone I go faster, but
together we go further***

African wisdom



Iceberg outside Greenland. Photo: Martin Jakobsson

Ocean-atmosphere dynamics and climate

We do fundamental research on the dynamics of the atmosphere and oceans and their influence on climate. We apply and develop theory and conceptual models to gain insight into the underlying mechanisms that govern the oceanic and atmospheric circulation. This understanding is then used to interpret simulations using complex global climate models aimed at understanding past and present climates as well as to predict future climate change.

Main activities of Research Area 1 (RA1) included the organisation and co-funding of three highly successful workshops that were held at Stockholm University. In addition, RA1 supported research activities, such as field work and conference attendance, through two openly announced calls.

Workshop on the Eocene–Oligocene Climate Transition, 1–3 February, 2017

The workshop was jointly organised with Research Area 6 and focused on mechanisms involved in the dramatic cooling trend of the Earth's climate that emerged about 34 million years ago. The workshop brought together a focused collection of deep-time paleoclimate modellers and proxy analysts to make progress on this problem. A tangible outcome of the workshop is a review paper on the Eocene-Oligocene transition that is now in preparation.

Workshop on Extreme Weather Events and Novel Predictability Pathways, 5–6 October 2017

The workshop gathered scientists from a diverse

range of backgrounds and industry experts from six countries to focus on understanding and prediction of societally relevant extreme weather events such as extra-tropical cyclones and precipitation extremes. A report on this meeting is in press in the *Bulletin of the American Meteorological Society*, <https://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-17-0296.1>.

Workshop on physical oceanography of the Southern Ocean, 9–10 October 2017

The goal of this workshop was to share some of the latest advances in the study of the Southern Ocean, and to foster scientific exchanges at the Swedish and international level. The Southern Ocean is home to the world's largest current system, the Antarctic Circumpolar Current, which redistributes heat and carbon at the global scale and is a major driver of the Atlantic Meridional Overturning Circulation which warms the European climate.

Co-leaders



Agatha de Boer
agatha.deboer@geo.su.se

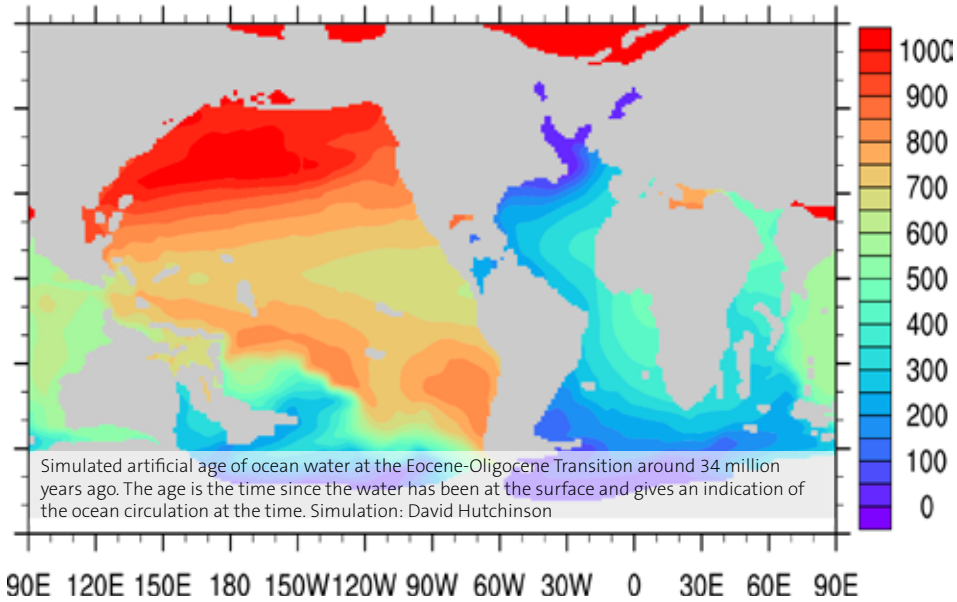


Rodrigo Caballero
rodrigo.caballero@misu.su.se



Johan Nilsson
johan.nilsson@misu.su.se

(b) Arctic Closure Age at 2500 m (years)



The Kerguelen islands are located in the latitude band of the Roaring Forties. The photo was shot from the beach of Cap Ratmanoff at the easternmost part of the main island. The westerly wind was 30 m/s, forcing us to stay in the wooden cabin and to stop our bio-logging research activities. The wildlife (King Penguins here) didn't seem very disturbed by this extreme weather. Photo: Etienne Pauthenet



Low pressure system over Iceland. Photo: Courtesy of NASA

Clouds, aerosols, turbulence and climate

We investigate the role of clouds, turbulence and aerosols in the climate system and develop approaches for representing them in large-scale models. We use experimental data from detailed laboratory experiments, extensive field campaigns and long-term observations, in combination with models ranging from molecular-scale to fully coupled Earth system models.

Clouds, aerosols and their interactions with each other and with the climate remain the main uncertainty in future climate projection. Within Research Area 2 (RA2), we work across scales to improve understanding, observation and model representation of these highly important processes.

At the beginning of 2017 Frida Bender, an expert in aerosol-cloud-climate interactions, and Matthew Salter, an expert in ocean-atmosphere interactions, took over the leadership of RA2.

During 2017, RA2 has supported research and collaboration within the research area in several ways. In spring, a workshop was organised, bringing together more than 30 RA2 scientists from Stockholm University, the KTH Royal Institute of Technology as well as the Swedish Hydrological and Meteorological Institute (SMHI).

Our continual call for proposals from research area members has resulted in funding for a wide range of activities: We have sent PhD students

and young researchers to present their research at international conferences and to participate in summer schools and supported research visits at foreign institutions.

We have also hosted visits from collaborators from outside Sweden, financed workshops organised by research area members and supplied funds for instrumentation used for critical measurements of aerosols, clouds and turbulent fluxes.

Towards the end of 2017 we supported a number of initiatives that are critical to the success of the upcoming Microbiology-Ocean-Cloud-Coupling in the High Arctic (MOCCHA) campaign that will take place in summer 2018 using the I/B Oden within which a number of research area members will participate.

Co-leaders



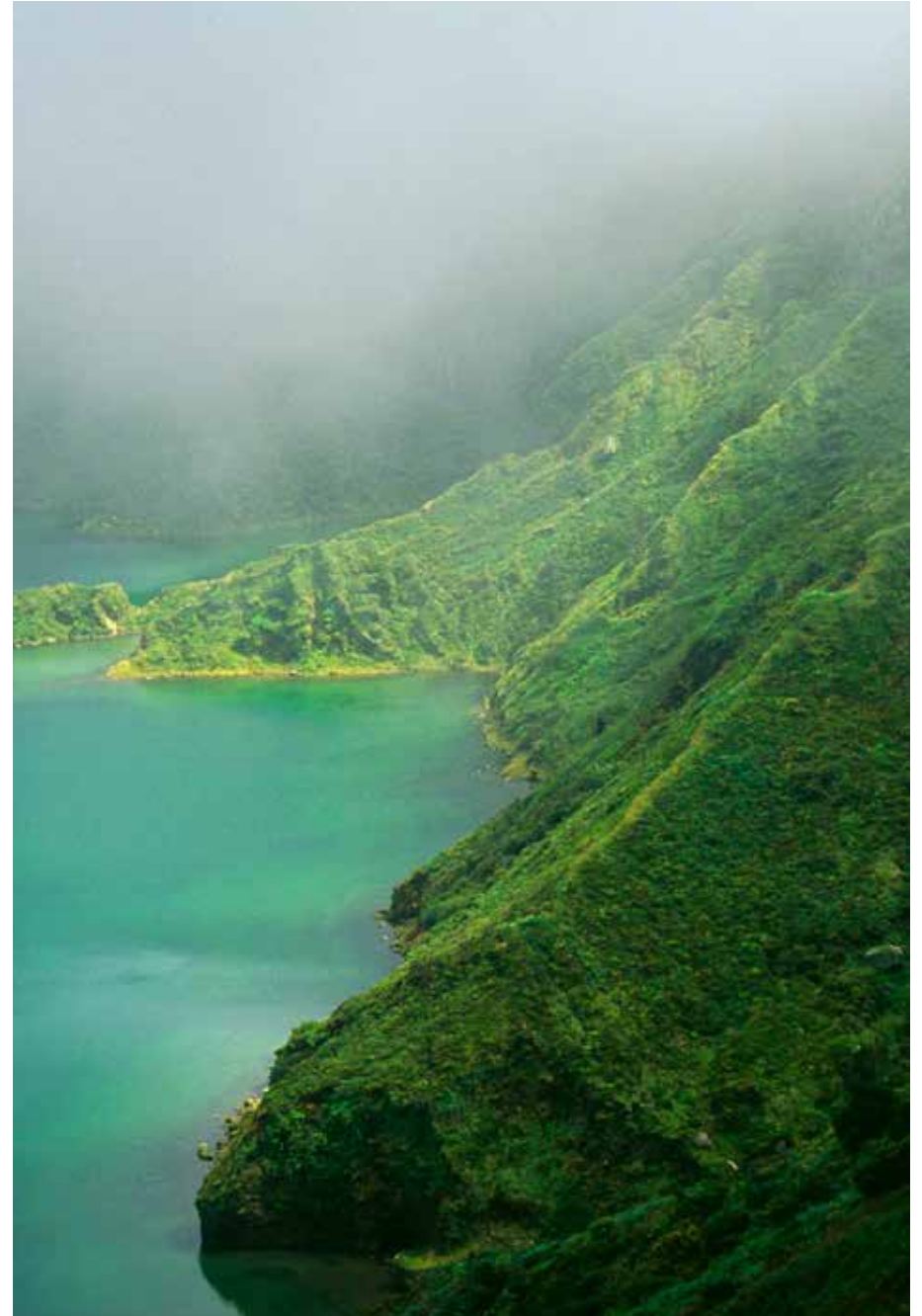
Frida Bender
frida.bender@misu.su.se



Matthew Salter
matthew.salter@aces.su.se



The Åre Research Station. Photo: Paul Zieger



The crater lake Lagoa do Fogo on the island of São Miguel, the Azores. Photo: Martin Jakobsson



The Zeppelin station at Ny-Ålesund, Svalbard. Photo: Paul Zieger

Hydrosphere, cryosphere and climate

Water circulation at or near Earth's surface occurs by rainfall, evapotranspiration, surface water and groundwater flows. Frozen water forms snow cover, glaciers, ice sheets and permafrost. We study couplings between water in all physical states and climate systems. This includes effects of natural or man-made changes in land cover, vegetation and water flow paths. We also explore the effects of climate change on water-borne flows of substances including contaminants.

In 2017 Jerker Jarsjö, Magnus Mörrth and Margareta Hansson stepped down as co-leaders of Research Area 3 (RA3) and Arvid Bring (Department of Physical Geography, Stockholm University) and Anne Soerensen (Department of Environmental Science and Analytical Chemistry, Stockholm University) took over the leadership.

In RA3 we focused our funding scheme on helping a large range of smaller initiatives to get started by distributing a maximum of 100,000 SEK per grant application. We thus funded 13 research projects.

Six of the projects were funded during an open call in June where 400,000 SEK was distributed. An additional 300,000 SEK was distributed during the year (running deadline).

RA3 supported fieldwork far from Sweden (Argentina, Iran, Greenland and Idaho, USA) and closer to home (the Baltic Sea, Norway and northern Sweden). About half of the projects were related to changes in the Arctic and sub-Arctic

landscape with a focus on permafrost, dissolved organic carbon transport and water budgets.

Furthermore, several applications to attend and present climate related research at conferences and international meetings were funded, as well as an outreach project on creating comic strips to illustrate permafrost research. An example can be seen on page 43 and all the comic strips are available at frozengroundcartoon.com.

RA3 also co-hosted a Bolin Centre seminar by Assistant professor David Christian Finger from Reykjavik University on October 26, as part of a joint RA3–RA7 project.

Co-leaders



Arvid Bring
arvid.bring@natgeo.su.se



Anne Soerensen
anne.soerensen@aces.su.se



Ylva Sjöberg doing field work, Greenland. Photo: Emma Johansson



Water quality monitoring in the Gialova Lagoon, Greece. Photo: Stefano Manzoni



Waterfall near Cwm Porth in the Brecon Beacons National Park, Wales. Photo: Karin Jonsell

Biogeochemical cycles and climate

We study interactions between climate and carbon-nutrient cycles through Earth system modelling, experimental and observational studies. Questions include: How much carbon dioxide and methane will be released from thawing permafrost on land and under the sea? How efficiently are carbon and nutrients used at the organism level to the global scale and across environmental and climatic gradients?

Research within Research Area 4 (RA4) addresses biogeochemical feedbacks in Earth's climate system produced by perturbations from human activities.

Our ongoing studies address interactions among components of the Earth system from microscales to global scales with field-, experimental- and modelling-based efforts in terrestrial and marine environments with a focus on the Arctic, the sub-Arctic and the Baltic Sea.

Current modelling efforts investigate the coupling of dynamic vegetation models to climate indices. An important aspect is to understand vegetation carbon turnover rates.

We also collaborate to improve existing Earth system model structures to better describe soil carbon sensitivity to global warming. Global data on soil carbon, ecosystem productivity and climate are combined to show long-term sensitivity of soil carbon turnover. New data syntheses and conceptual modelling approaches apply the concept of carbon use efficiency across spatial and temporal scales in aquatic and terrestrial systems.

We have developed new marine models that include dynamic C:N:P ratios during photosynthetic C fixation to improve pCO₂ predictions in the Baltic Sea.

A particular focus of biogeochemical research is the study of the fate of the large amount of organic carbon and methane stored in terrestrial and sub-sea permafrost. A long-term focus of several research groups is the potential CH₄ release from terrestrial, limnic and marine Arctic and sub-Arctic environments, such as thawing terrestrial and submarine permafrost and destabilising gas hydrates.

A second major research topic is land-to-ocean carbon fluxes in the Siberian Arctic and the fate of the transported carbon in the shelf sea and the potential for Arctic ocean acidification due to the mineralisation of this carbon to CH₄ and CO₂.

A novel aspect of RA4 activities involves experimental studies to investigate the formation mechanisms of ikaite minerals as potential mediators for CO₂ storage as hydrated CaCO₃ minerals.

Co-leaders



Christian Beer
christian.beer@aces.su.se



Volker Brüchert
volker.bruchert@geo.su.se



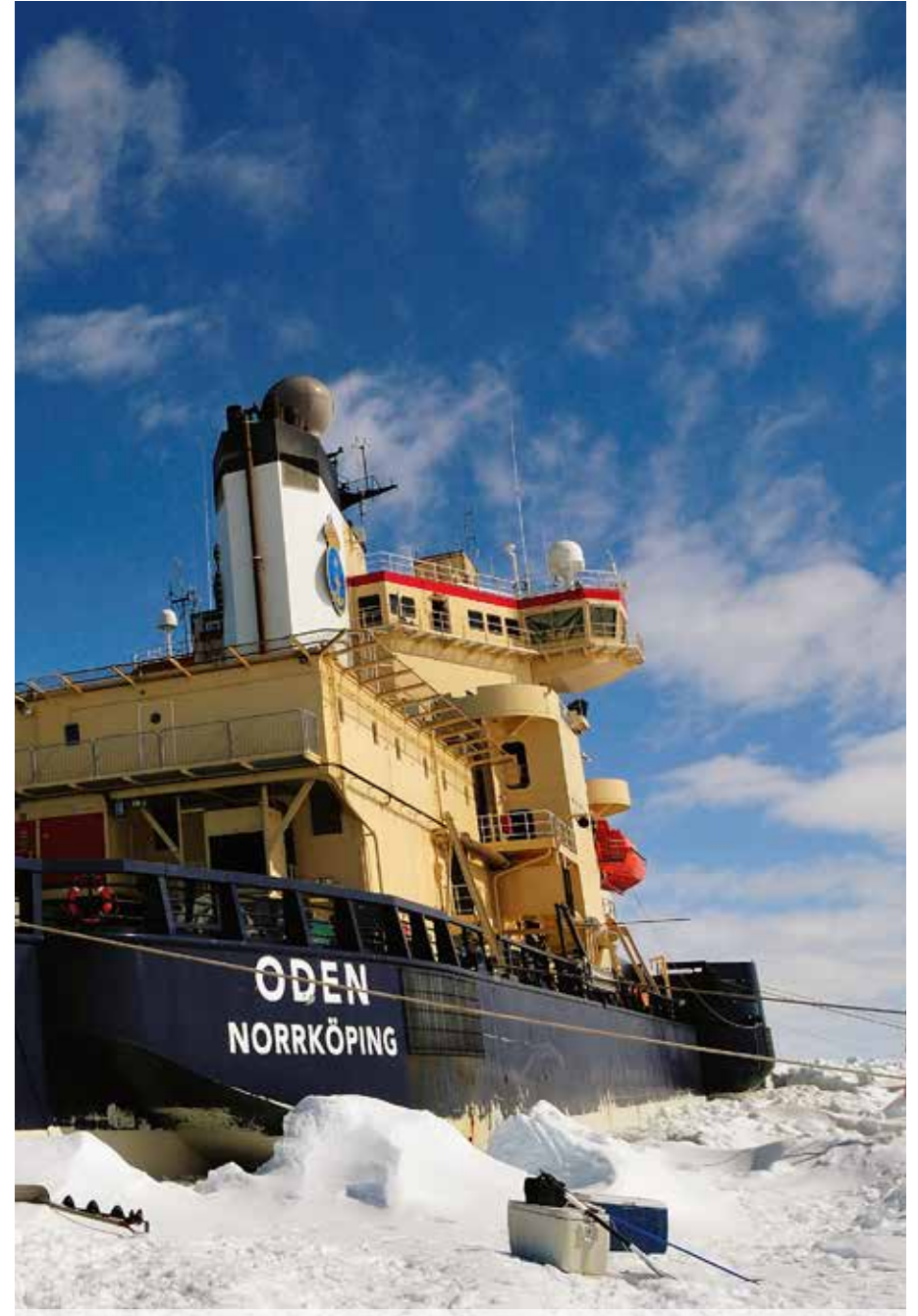
Gustaf Hugelius
gustaf.hugelius@natgeo.su.se



Gustaf Hugelius and Matthias Siewert coring permafrost in Arctic Russia. Photo: Matthias Siewert



Thawing coastal permafrost in Arctic Canada. Note Prof. Hugues Lantuit for scale. Photo: Gustaf Hugelius



Swedish icebreaker Oden at the SWEDARP 2008/2009 Oden Southern Ocean expedition. Photo: Björn Eriksson

Historical to millennial climate variability

We reconstruct past climate evolution by investigating natural records such as marine, lake and terrestrial sediment cores, ice cores, cave deposits, tree rings, landforms and historical documents. By developing appropriate statistical methods and comparing with climate model simulations, we aim to better understand and interpret past climate variability on historical and millennial timescales.

Funding data initiatives

Research Area 5 (RA5) funded a number of projects in terms of supporting fieldwork and analytical costs, such as for looking at peatland development, carbon accumulation and permafrost history in Finnmark, northern Norway.

Funding modelling initiatives

Supported by Bolin Centre RA5 and RA6, Swedish Research Council (VR) and Past Global Changes (PAGES), we hosted the 1st Paleoclimate Modelling Intercomparison Project (PMIP) phase 4 conference in September 2017, which brought together 160 researchers from 24 countries, including 14 scientists from the Bolin Centre. New, in-depth analyses from PMIP3 were presented as well as some first results from the new PMIP4 simulations. A large number of Early Career Scientists were actively involved in the conference and PMIP activities.

Funding networking initiatives

This year RA5 was able to support conference attendance for several members to the PAGES

Open Science Meeting in Zaragoza, Spain and the European Geoscience Union (EGU) General Assembly in Vienna, Austria. We were also able to support increased collaboration through visits to other research groups (Laboratory for Sciences of Climate and Environment, LSCE, France, National Center for Scientific Research, CNRS, France and University of Cambridge, UK) and workshops like those on dating paleoclimate records (Campeche, Mexico) and lake modelling (Berlin, Germany).

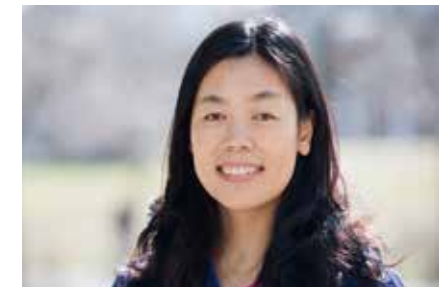
Funding education initiatives

Co-funded by Swedisch Foundation for International Cooperation in Research and Higher Education (STINT) and Lanzhou University in China, we organised a summer course on climate model simulations in June 2017. We had 42 participants and 7 PhD students from Sweden.

Co-leaders



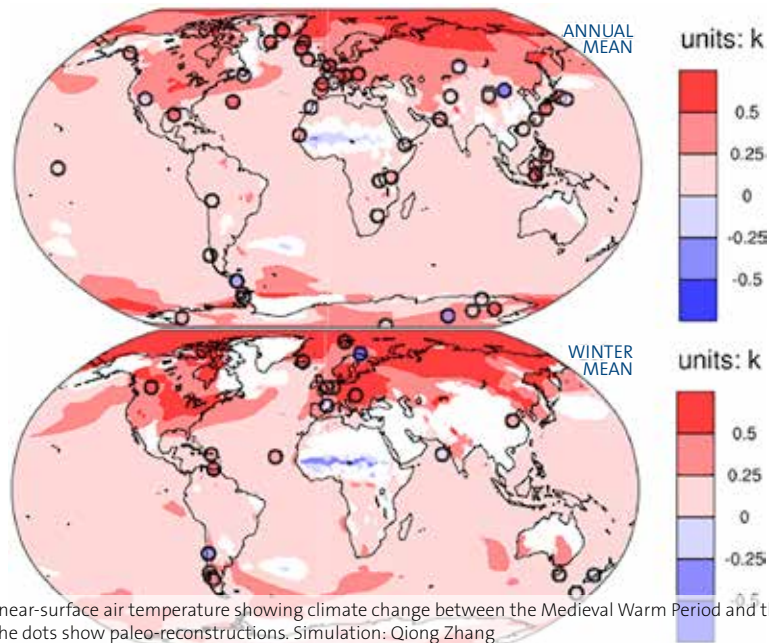
Malin Kylander
malin.kylander@geo.su.se



Qiong Zhang
qiong.zhang@natgeo.su.se



Drakensburg, eastern portion of the Great Escarpment in South Africa. Photo: Malin Kylander



EC-Earth near-surface air temperature showing climate change between the Medieval Warm Period and the Little Ice Age. The dots show paleo-reconstructions. Simulation: Qiong Zhang



Akkaneewut (Nut) Chabangborn and Barbara Wohlfarth doing sediment coring in Lake Pa Kho, northern Thailand. The study of lake sediments from the Asian monsoon region allows researchers to reconstruct changes in Asian monsoon variability. Photo: Ludvig Löwemark

Deep time climate variability

To appreciate the full range of Earth's climate variability it is necessary to look far back into geologic time where we find intervals when the world has been much warmer or colder than today. Our mission is to reconstruct and interpret past climate variations on long timescales by comparing computer simulations and data from natural archives such as rocks, sediments and fossils. This helps us place limits on natural climate variability and better understand the Earth system.

During 2017, Research Area 6 (RA6) continued to fund a range of activities that are fundamental to advancing climate research, maintaining visibility in the national and international arena, and delivering research findings to wider audiences.

A considerable part of our budget was dedicated to scientific meetings, including a workshop on the 'Eocene-Oligocene climate transition' (marking the glaciation of Antarctica 34 million years ago), co-organised with RA1 at Stockholm University in February. The workshop brought together 30 world experts, with a review paper in preparation.

RA6, together with RA5, contributed to the Palaeo Arctic Spatial and Temporal (PAST) Gateways conference at the University of Gothenburg in May.

We also contributed (with Research Area 1 and Research area 5) to the Palaeoclimate Modelling Intercomparison Project (PMIP) conference held at

Stockholm University in September.

In addition, RA6 supported attendance for PhD students, postdocs and academic staff at six international conferences and awarded five grants to support fieldwork, including to Antarctica, Oman and Idaho, USA.

RA6 members published numerous peer-reviewed articles, contributed to several review papers, participated in outreach activities and funded visits for international experts to initiate new collaborations – one together with the Swedish Museum of Natural History.

A variety of these activities have led to successful external grant applications (EU Horizon 2020, Swedish Research Council, VR, and Swedish Environmental Protection Agency).

Co-leaders



Helen Coxall
helen.coxall@geo.su.se



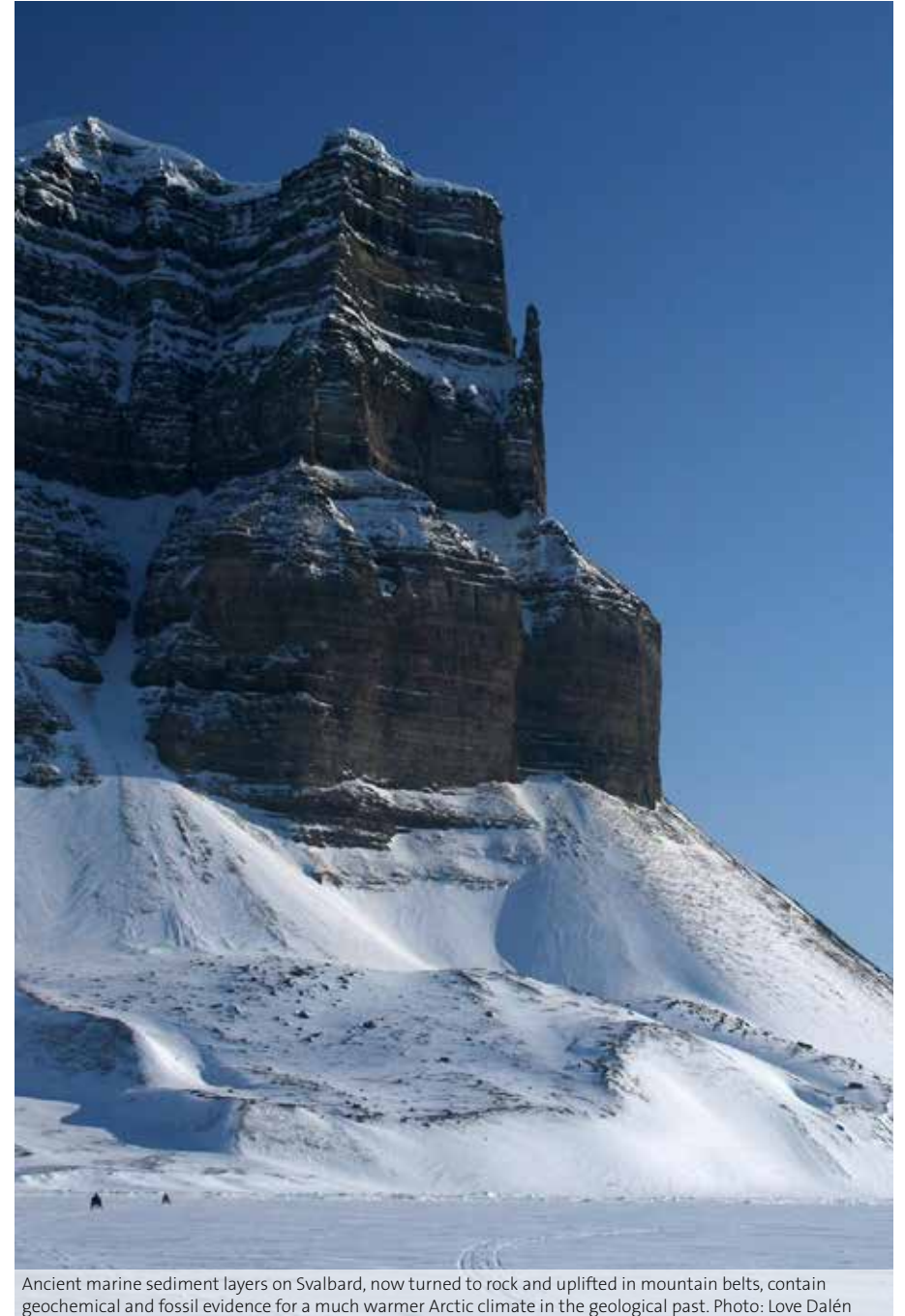
Margret Steinhorsdottir
margret.steinhorsdottir@nrm.se



RA6 co-leaders Margret Steinthorsdottir and Helen Coxall during fieldwork in Clarkia, Idaho, USA. Fossil plant leaves from the mid Miocene (ca. 23 million years ago) were excavated and transported to Stockholm for palaeo-climate analysis. The fossil plants lived at a time of rapid global warming called the Mid Miocene Climatic Optimum, a parallel to the anthropogenic global warming happening today. Photo: Margret Steinthorsdottir and Paul Pearson



A view from a deep cave in the Azores where RA6 member Anna Neubeck sampled microorganisms, hypothesised to have similar metabolism as the earliest life on Earth - which used chemical energy from water-rock interactions - to better understand early atmospheres and climate. Photo: Anna Neubeck



Ancient marine sediment layers on Svalbard, now turned to rock and uplifted in mountain belts, contain geochemical and fossil evidence for a much warmer Arctic climate in the geological past. Photo: Love Dalén

Landscape processes and climate

The combined effects of changes in climate, land use and water use may heavily influence natural resources in terrestrial and marine environments in the coming decades. To meet these challenges we bring together natural and social scientists to do coordinated research on ecosystems. We focus on multi-scale processes of climate, biodiversity, ecosystem services and adaptive governance across landscape.

The main focus for Research Area 7 (RA7) during 2017 has been to start up new extensive research projects.

We have had an application process with fifteen applications, where we funded four projects on different scientific themes: water use in tropical agricultural systems, ecosystem services in Swedish wetlands, teleconnections of water tipping points, and coffee diseases and climate change.

Three new research projects have also been initiated by each of the research area leaders on effects of climate and land use on grassland ecosystems, water-related risks from hydro-climatic and land-use changes and the role of microclimate for habitat tracking of forest plants.

Altogether, seven projects have started with the ongoing or finished recruitment of five PhD students and two postdocs. All of the projects involve collaboration between one or several research areas at Bolin Centre and collaborations

between departments.

We have also financed a number of smaller projects such as organisation of workshops, analysis of collected samples and pilot studies for eight RA7 members. Four new integration projects financed through the Bolin integration initiative have also started together with scientists from other RAs.

During 2018, the various RA7-funded large and small projects will present their results in seminars and during the Bolin Days.

We invited Prof. Kevin Bishop as a representative of the RA7 research for a Bolin seminar in October. In December we arranged an internal workshop with a focus on RA7 questions in Africa with twenty participants. This was an initiative to foster new contacts and future collaborations and new projects within RA7.

Co-leaders



Kristoffer Hylander
kristoffer.hylander@su.se



Zahra Kalantari
zahra.kalantari@natgeo.su.se



Regina Lindborg
regina.lindborg@natgeo.su.se



Kristoffer Hylander and Beyene Zewdie in a shaded coffee plantation in Ethiopia. Photo: Ayco Tack



Photo: Sara Cousins



Carbon forestry accounts for a large share of the internationally agreed emissions reductions and African countries have committed to restore large areas of degraded forests. To increase carbon storage the aim is to exclude traditional pasture burning and reduce grazing. This can cause loss of biodiversity, loss of livelihoods, and the build-up of surface fuels, increasing wildfire risk, this in a changed climate with more frequent extreme fire weather. Bale Mountains REDD+ project, Ethiopia. Photo: Maria Johansson

Biodiversity and climate

We investigate how climate influences ecological and evolutionary processes in natural populations. Field observations and experiments are used to examine effects on abundance and distribution of single species, as well as how climate affects interactions between species, community structure and ecosystem functioning. We also use this information to develop methods to mitigate negative effects of climate change on biodiversity.

In April Research Area 8 (RA8) organised a workshop with 16 participants at Tovetorp field station to discuss research applications to the research area.

We funded six projects with seed money: *Fågelkalendern* (Kullberg), *Historical land use changes and the effect on tree growth in the archipelago* (Rocha), *Putting the μ in butterfly microclimates: characterization of abiotic climatic variability on scales that matter* (Lehmann), *Local climate and habitat pressure in Swedish oak forests across time and space* (Brown), *Using museum DNA samples to help untangle demographic and adaptive effects on genetic variation in butterfly life cycle regulation* (Lindestad), *The impact of heating on a multitrophic food web on oak* (Tack).

We had two calls for applications for PhD/postdoc projects. In the first round we received six applications of which we funded one project

called *Climate, life-history and a multitrophic food web on oak* to Ayco Tack. In the second call we received 15 applications (decisions due in 2018).

Two PhD students, Avaro de la Nada and Nina Roth, and two postdocs, Alicia Valdes and Diana Posledovich, were appointed during the autumn.

Professor Susan Harrison (University of California, USA) gave a seminar *Climate as a Driver of Declining Plant Community Diversity (...and a small ray of hope)* in September. Professor Jens-Christian Svenning (Aarhus university, Denmark) visited in December and gave a seminar titled *Long-term biodiversity-climate disequilibria – a macroecological perspective*.

Four applications from Research Area 8 were awarded integration funding.

Co-leaders



Sara Cousins
sara.cousins@natgeo.su.se



Johan Ehrlén
johan.ehrlen@su.se



Karl Gotthard
karl.gotthard@zoologi.su.se



In the geothermally heated Hengill area on Iceland effects of variation in soil temperatures on the performance of different plant species are investigated by Bryndis Marteinsdottir and Johan Ehrlén. Photo: Katarina Fast Ehrlén



Philipp Lehmann and Caroline Greiser deploying data loggers for the estimation of microclimate over several years in a variable landscape with fields, forest and wetlands, Tovetorp research station, Sweden. Photo: Karl Gotthard



Within Research Area 8 we investigate how climate influences ecological and evolutionary processes in natural populations. One example is the seasonal emergence of insects and flowering of plants in early spring such as the emergence of the Small Tortoiseshell butterfly and the flowering of Goat Willow. We do research on how the timing of such events are affected by climate, and how climate-induced changes in different species influence patterns of biodiversity across time and space. Photo: Christer Wiklund

The Bolin Centre Climate Research School

The Climate Research School provides a platform for PhD students to interact with climate scientists from neighbouring disciplines and organises interdisciplinary climate related courses to masters and PhD students within the Bolin Centre. A summer school focusing at a specific research topic is given regularly. Financial support allows PhD students to participate in conferences, field courses and workshops.

During 2017 the Bolin Centre Climate Research School (CRS) organised and supported the following courses:

Historical Perspectives on Climate Change Science

When did we first realise that humans can influence the climate? How did the central ideas about climate change evolve, and how good is our understanding actually of past, present and future climates?

Proposal writing and presentation techniques

The course prepares students for relevant forms of scientific presentation, especially written proposals and oral proposals. The course will be practice oriented with opportunities to develop, present and receive feedback and constructive criticism. The best proposals are rewarded with financial support.

Scientific writing

The course is an introduction to the writing of scientific articles and it is designed for PhD students.

Atmospheric science at high latitudes: Online data storage and visualisation tools

The goal of the course is to train the next generation of climate scientists on how to integrate different eScience tools and infrastructures for interpreting the climate system and its components using a holistic approach. The course was held at the Hyttiälä Forestry Field Station in southern Finland between 23 October and 2 November 2017.

Resources and support

The CRS also offers financial support to PhD students. In 2017 we were able to support the participation of 24 students in international conferences, workshops and courses at institutions outside Stockholm University.

Chair



Hans-Christen (HC) Hansson
HansChristen.Hansson@aces.su.se

Director of Studies



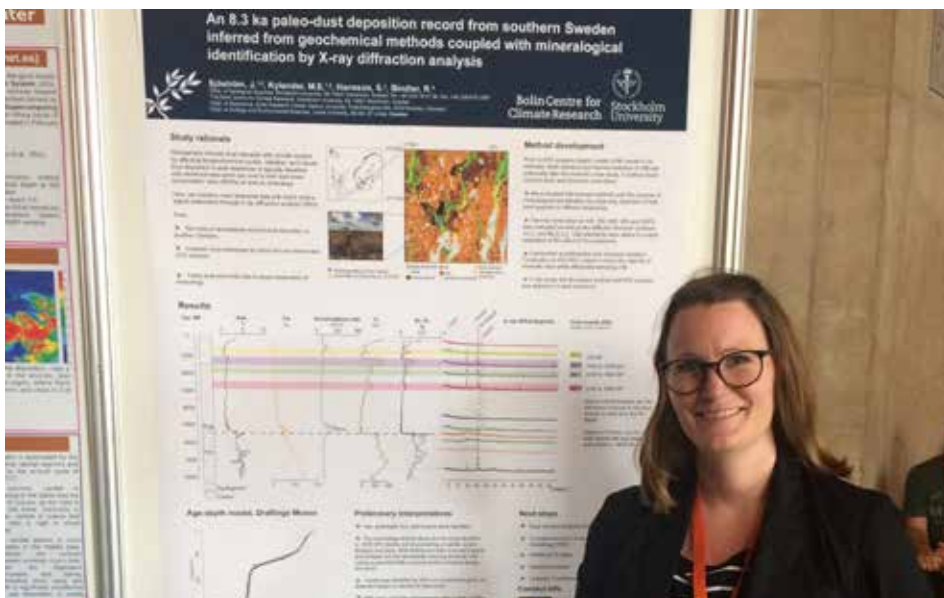
Björn Gunnarson
bjorn.gunnarson@natgeo.su.se



Field lecture on Snowball Earth at the Bolin Centre Summer School *Isotopes in Climate and the Earth System* on Islay, Scotland. Photo: Karin Jonsell



Learning how to do peat coring at the Bolin Centre Summer School *Isotopes in Climate and the Earth System* on Islay, Scotland. Photo: Karin Jonsell



Jenny Sjöström presenting her work at the Past Global Changes (PAGES) Open Science Meeting 2017 in Zaragoza, Spain. Photo: Malin Kylander

The Bolin Centre Database

The Bolin Centre Database is a resource that scientists at the centre, and their collaborators, can use to provide open access to their climate and Earth system data. The database staff can also help our scientists to visualise their data and give advice on data sharing.

Data contributions from Bolin Centre scientists come from many different research activities around the globe. This includes both longer-term large research projects and monitoring programmes that require a solid host and individual scientists who share a wide range of datasets from finished or ongoing projects.

During 2017, we published 23 new datasets with metadata and we made continuous efforts to improve our services to contributors and users of the database. We are evaluating different database management systems, long-term storage solutions and metadata profiles. Our website has been adapted for search engine optimisation and we are preparing for the launching of a new visually attractive website layout.

To inform scientists in the centre about our services, we made a presentation at the Bolin Days (22-23 Nov 2017) where we also had a help desk. We have initiated a collaboration with the Stockholm University Library in the context of ongoing overarching work at our university regarding the handling of research data.

The Bolin Centre Database currently hosts 102 datasets having metadata and 8 thematic data presentations with tailor-suited visualisations of many more individual datasets.

Examples of Bolin Centre Database data types:

- Chemical composition of atmospheric aerosols
- Palaeoclimatological indicators in tree rings, peat, rocks, and lake and ocean sediments
- Ocean chemistry data
- Bathymetric chart data and seismic profiles
- Ship track data from research expeditions
- Reconstructions of past ice sheet configurations and other landforms
- Glacier monitoring data
- Weather observation data
- Micrometeorological data
- Atmosphere and ocean turbulence data
- Hydrological data
- Land-cover data and soil carbon data.

We have a goal of becoming internationally recognised as a trusted repository for research data.

Coordinator



Anders Moberg
anders.moberg@natgeo.su.se

Technical database manager



Rezwan Mohammad
rezwan.mohammad@geo.su.se

www.bolin.su.se/data
bolindata@su.se



Bolin Centre for Climate Research

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Bolin Centre Database

Open Access to data from the Bolin Centre for Climate Research

Popular searches: Moberg, Jakobsson, Atmosphere, Tarfala



Bolin Centre modelling

Numerical models of the global climate system are essential in research carried out at the Bolin Centre. Earth system models are used across the research areas to study topics covering deep ocean circulation, land surface processes, atmospheric composition and dynamics, and upper atmospheric physics. Bolin Centre researchers also participate in the development of the next generation of Earth system models.

The annual application for the continuation of the Bolin Centre's computational project at the Swedish National Infrastructure for Computing (SNIC) was approved. This secured the Bolin Centre's access to computational resources for the period July 2017 to June 2018.

An inventory has been conducted of available computational resources and usage within the Bolin Centre.

A collaborative project was started with the National Supercomputer Centre (NSC) climate modelling application expert for developing a Bolin Centre module on the supercomputer Triolith. The module was launched in July 2017. It provides a flexible framework for the Bolin Centre technical support for installing software of specific interest for the Bolin Centre users.

Active management of the Bolin Centre data storage project at NSC led to an increase of 70TB for the users. At the same time the paleoclimate

modelling part of the storage has been separated from the Bolin Centre storage project.

An introductory seminar to computing system at NSC has been developed for new PhD students and employees. All new PhD students who started in 2017 and are using the Bolin Centre computing resources have attended the seminar.

The Bolin Centre is participating in the development of the next version of EC-Earth towards the next phase of the Coupled Model Intercomparison Project (CMIP), CMIP6.

Representatives took part in the annual EC-Earth development meeting held in Helsinki in May 2017. The Bolin Centre also participated in the annual Nordic Infrastructure on Earth System Modeling, NordicESM, meeting.

Coordinator



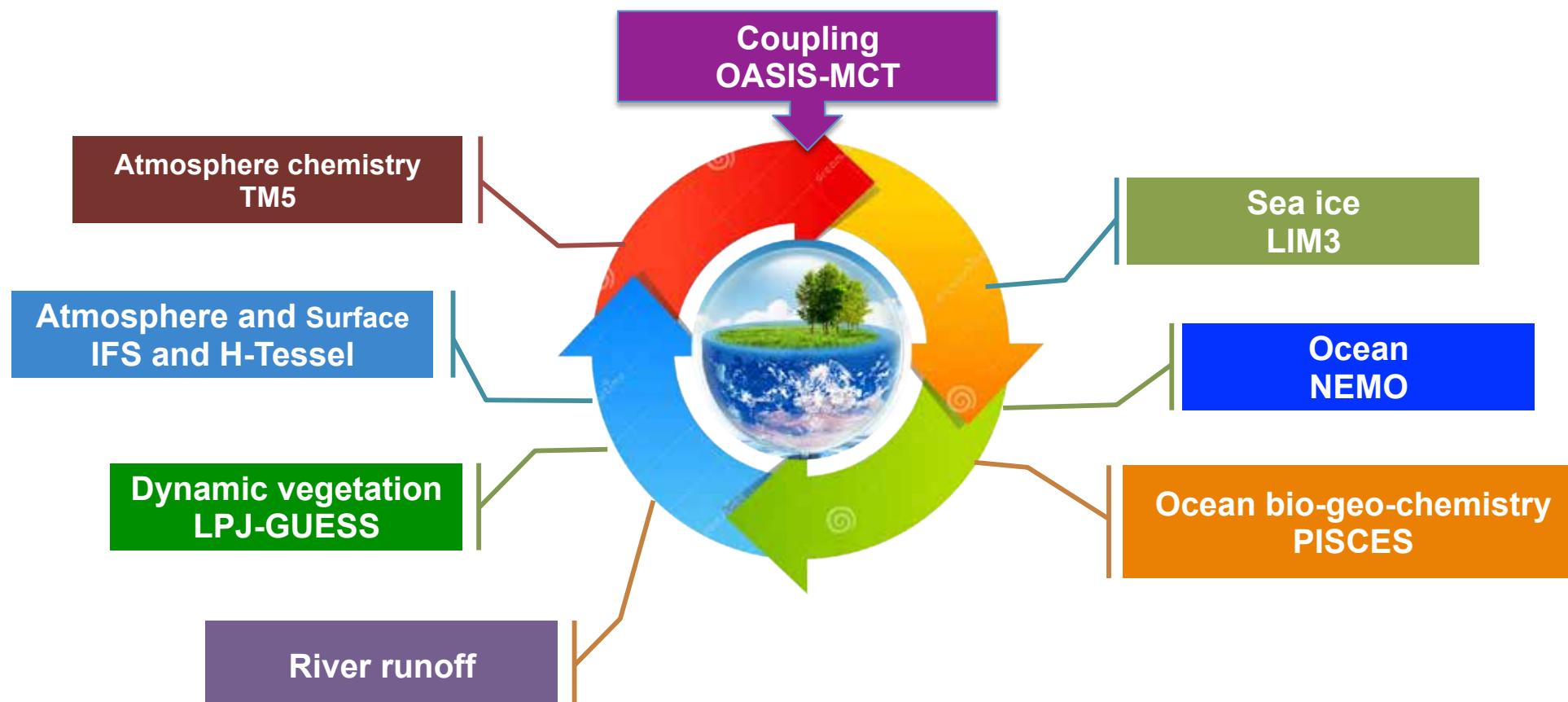
Kristofer Döös
doos@misu.su.se

Scientific programmer



Anna Lewinschal
anna@misu.su.se

EC-Earth - Earth System Model



The Bolin Centre mentoring programme

The Bolin Centre mentoring program is a voluntary initiative that links up interested junior and senior scientists in a mentor-mentee relationship. The programme normally runs from the Bolin Days in November each year for at least one year at a time. The programme started in 2012 and normally has 20–30 pairs of mentee and mentors.

The Bolin Centre mentoring programme continues to grow in popularity and is now in its 5th year.

In 2017 the programme paired 22 mentees with mentors and there are 23 pairs signed up for 2018.

That the programme add value to the careers of many Bolin Centre scientists is evident in selected feedback of the 2017 mentees:

“I have found it useful to openly discuss my research problems, interactions with other researchers, the nature of criticism and feedback in science, and other issues. It’s also great to get a perspective of someone who is not connected to my project, but is very experienced and knowledgeable about this kind of work. I wish I had sought out something like this program when I was a PhD student. I think that would have helped me back then.”

“The program has been incredibly helpful. At the time I reached out I was the middle of my PhD, I had not much supervisor time and had serious concerns about getting delayed. The mentorship has helped to keep focused and get back on track.”

“Personally the program was very helpful to me. One important point for me is that I have three male supervisors, so having a female as a mentor is extra important. What I like the most in the program is the freedom to choose the informal contact, since in the academic world everything is already so formal.”

Coordinators



Agatha de Boer
agatha.deboer@geo.su.se



Malin Kylander
malin.kylander@geo.su.se

Characteristics of the programme

Voluntary

All mentees and mentors volunteer. This means the programme is always only as big as the need it fulfils.

Confidential

We never mention who signs up unless permission is given such as for marketing. Mentee-mentor interactions are also strictly confidential.

Cross-departmental

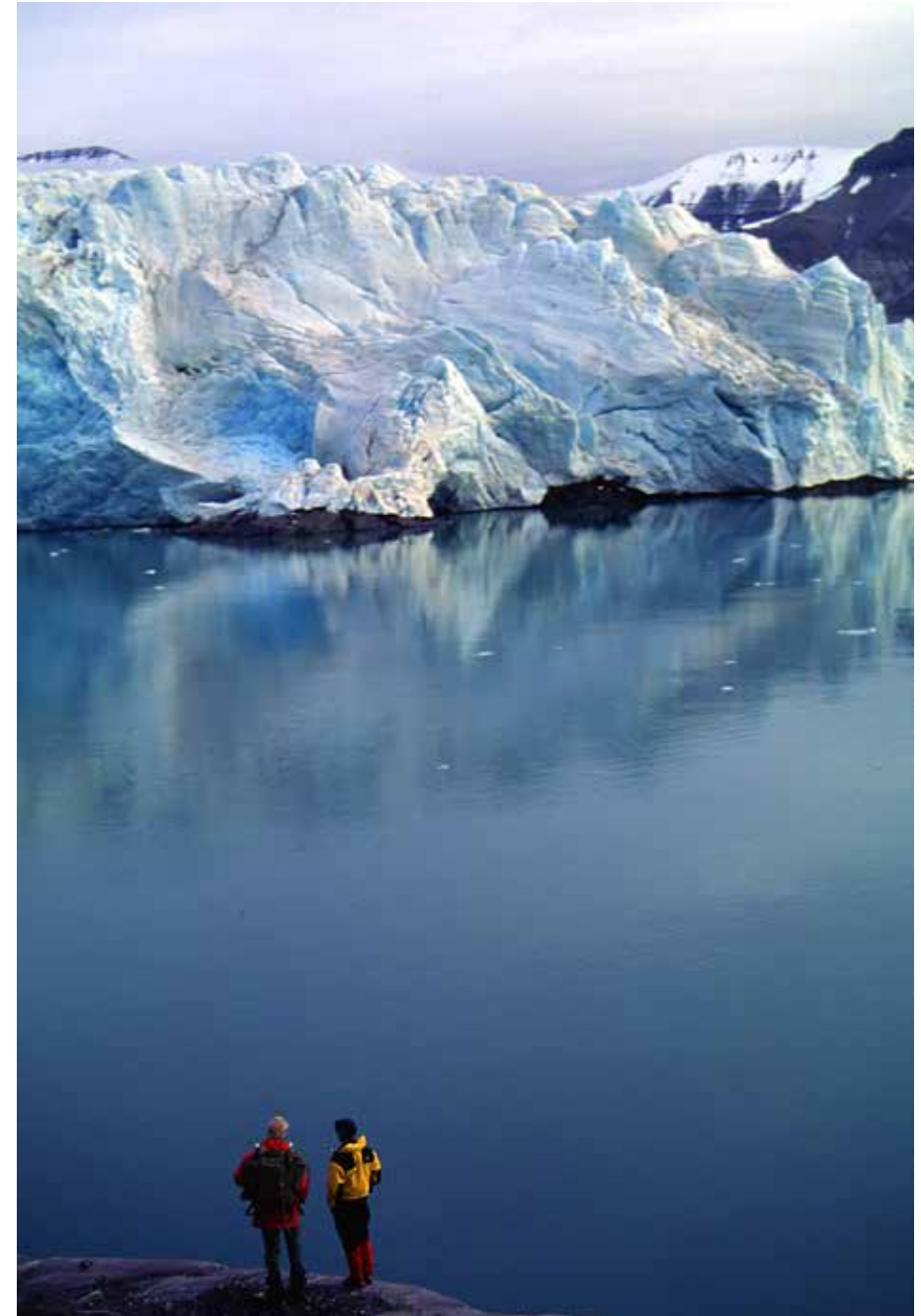
The mentees are signed up with mentors in other departments to provide more objectivity and avoid conflict of interest.

Mentee-driven

The mentees make the first contact and decide the frequency and format of the meetings. This is because the needs of every mentee are individual and a single format will not be optimal for all.

Annual

The programme runs annually from the Bolin Days. After that pairs may wish to continue formally, informally, sign up for new pairs, or leave the programme.



Nordenskiöldbreen, Svalbard. Photo: Martin Jakobsson

Bolin Centre coordination & communication

The coordinators & communicators handle the coordination, communication and administration of the Bolin Centre. They organise events such as the conference the *Bolin Days*, outreach events such as the *Climate Festival* and marketing of the Bolin Centre e.g. with a booth at an international conference. The internal and external communication are also managed by the team as well as the *Bolin Centre Seminar Series*, various internal meetings and the administration.

A focus area during 2017 was to strengthen the collaboration between Centre members. The yearly conference the *Bolin Days* was an important part of this and 204 members joined in, which was a record. We launched the *Bolin Centre Seminar Series* with the aim to bring the researchers together regularly. We also started the SAG Fikas, which is monthly informal meetings for the Research Area co-leaders. The *Bolin Centre Newsletter* has been upgraded to become a weekly update.

Our external communication efforts were focused on four big events: the *Climate Festival*, *Bert Bolin Climate Lecture* and *Bert Bolin Science Seminar*, *ForskarFredag* and an exhibition booth at the American Geophysical Union, AGU, *Fall Meeting*.

Results from the *Climate Festival* included 1324 registered participants who took part in various activities, listened to popular science lectures and visited our activity area with 21 exhibitors. The *Climate Festival* gained wide media coverage.

The Bert Bolin Climate Lecture and Science Seminar 2017 was given by Dr. Thomas Cronin, US Geological Survey, and was attended by more than 200 people. The lecture was hosted by Stockholm University's Faculty of Science.

We participated in *ForskarFredag* for the first time with a pre-bookable activity. The event was fully booked with five school classes.

The Bolin Centre had a booth at the *AGU Fall Meeting* for the fifth time running and the turnout was phenomenal. Our canvas bags were again seen all over town.

A communication strategy and communication plan for 2018 was developed to make the most of our future communications efforts. We also visited the *SciFest* in Uppsala, the *International Science Festival* in Gothenburg, *Kunskapscentrum för klimat Anpassning* and *Visualiseringscentrum* in Norrköping to get input for coming events.

Coordinators & communicators



Annika Burström
annika.burstrom@su.se



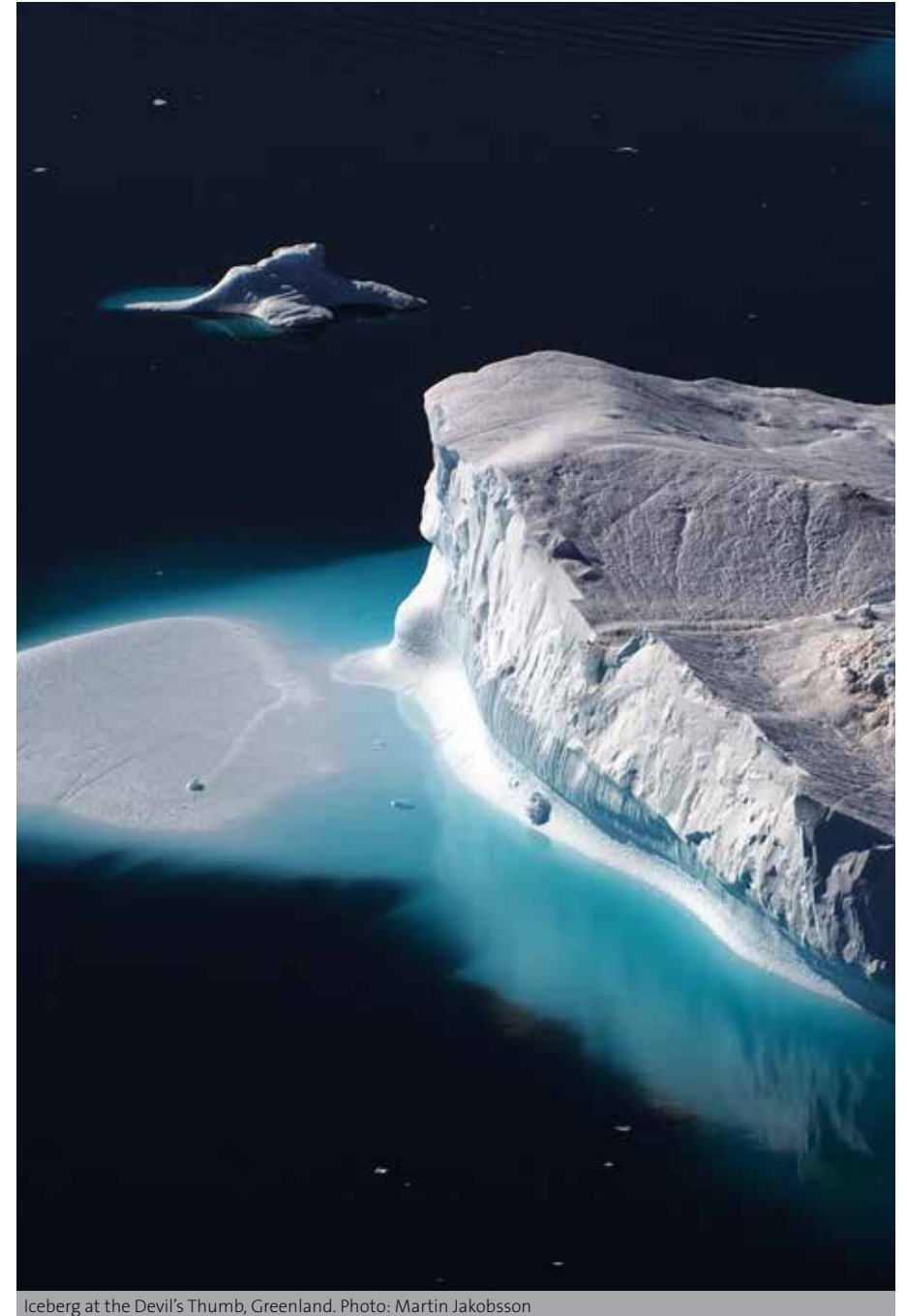
Karin Jonsell
karin.jonsell@su.se



Experiment to show how carbon dioxide contributes to the acidification of the Earth's oceans. Photo: Niklas Björling



The Bolin Centre booth at the AGU Fall Meeting was a smash hit as usual. Photo: Annika Burström



Iceberg at the Devil's Thumb, Greenland. Photo: Martin Jakobsson

The Bert Bolin Climate Lecture

Prof. Bert Bolin of Stockholm University was a leader in climate and carbon cycle research and one of the founders of IPCC which received the Nobel Peace Prize in 2007. To honour Prof. Bolin, the Faculty of Science at Stockholm University established the annual Bert Bolin Climate Lecture. The distinguished Bert Bolin Climate Lecturer is invited to Stockholm in May to hold a popular science lecture and a science seminar at the Bolin Centre for Climate Research.

The 10th Bert Bolin Climate Lecture was given on May 18th 2017 by Dr Thomas (Tom) Cronin of the US Geological Survey at Stockholm University's Aula Magna.

Addressed to a public audience, Cronin's Bert Bolin Climate Lecture was titled *Biological response to climate change: What would Bolin say?*

The lecture focused on how species and ecosystems have been exposed to numerous challenges ranging from variability in temperature, sea level, pH and biochemistry as the climate has changed over geological history, often to extremes unknown in human history.

Cronin discussed further the geological record of biological responses to climate change, and explained how it provides unique, under-appreciated and often misunderstood insights into today's biological systems.

The Bolin Climate Lecturer is appointed by the Dean of the Faculty of Science of Stockholm University. Nominations can be made by all Bolin Centre members in response to a call issued during the autumn term by the Bolin Centre directorate.

Lecturers

2008

Prof. Susan Solomon

2009

Prof. Venkatachalam "Ram" Ramaswamy

2010

Prof. Robert J. Charlson

2011

Prof. Ralph Keeling

2012

Prof. Sherilyn Fritz

2013

Prof. Warren M. Washington

2014

Prof. Corinne Le Quéré

2015

Prof. Ulrike Lohmann

2016

Sir Brian Hoskins

2017

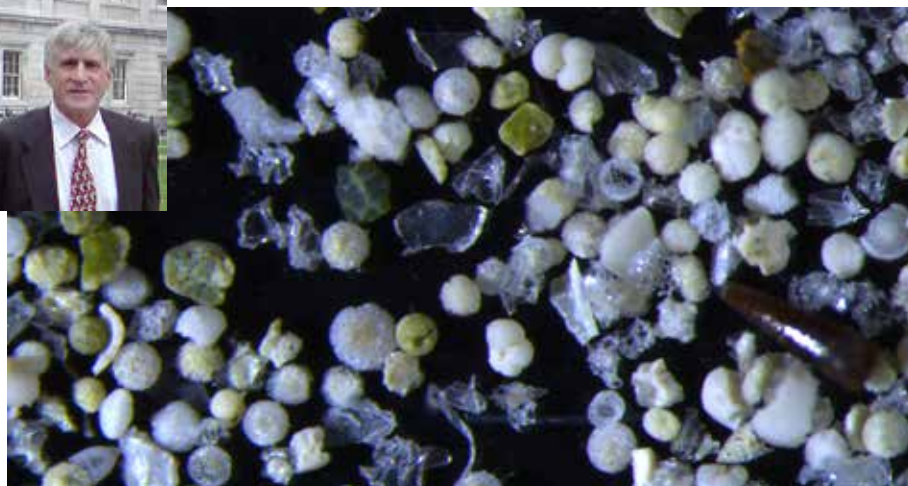
Dr. Thomas Cronin



Bolin Centre Seminar

by the Bert Bolin Climate Lecture speaker

Contemporary Issues in Sea Level Change: Geological Perspectives



Credit: Helen Coxall

Sea-level change is one of the most widely discussed and often misunderstood topics in modern environmental sciences. Given the relatively short record of tide gauges and even shorter period of satellite observations, the two main sources of modern sea level history, it is imperative to rely on geological records to understand sea-level patterns, rates, and causes. We will trace the history of research on sea level from the 1960s to the present day drawing on three distinct but interconnected sources of paleosea level history: paleo-shorelines [coral reefs, tidal marshes, other coastal features], marine foraminiferal oxygen isotope records of ice volume and ocean temperature, and glaciological studies of past ice sheets and ice shelves.

Three geological periods will be discussed. First, the Pliocene (5.3-2.6 million years ago) is known as a period of high sea level (~ 20 meters above present day, elevated atmospheric CO₂ concentrations (~ 350-400 ppmv) and relatively warm climate. Second, we will examine the last 500,000 years of the Quaternary, when warm, interglacial periods experienced higher-than-present sea level but CO₂ concentrations near preindustrial levels (~ 280 ppmv). Finally, we consider late Holocene sea level (the last few thousand years), a period often used as a "stable" baseline for interpretation of modern sea level rise, despite extensive climatic, glacial and oceanographic variability. We conclude that paleo-sea level research raises concerns about the rate at which sea level can rise, to a large degree from decreased glacial ice volume, with minimal external forcing.

Speaker: Dr. Thomas Cronin, U.S. Geological Survey

Date: Thursday 18 May, 2017, 10:00–11:00

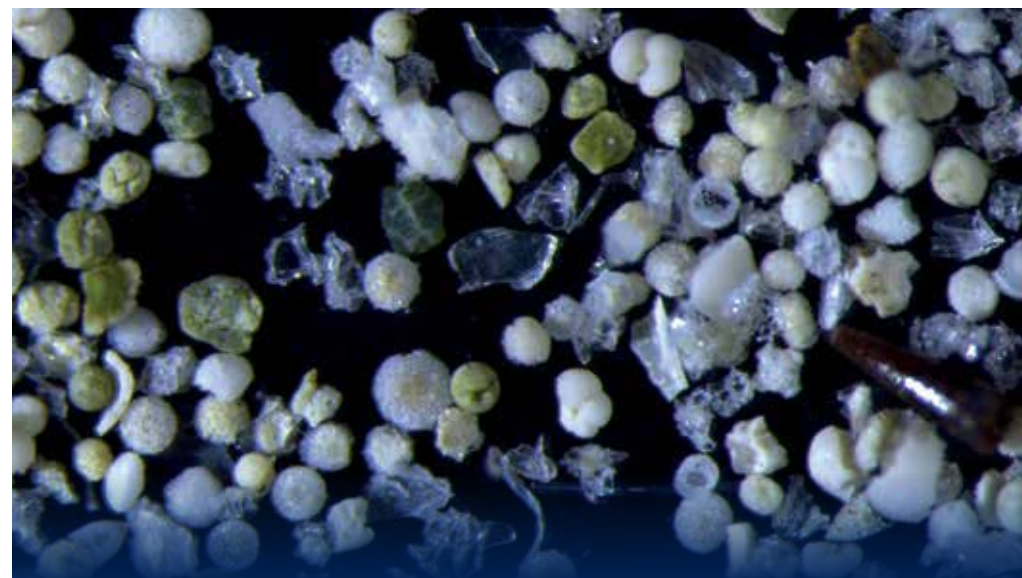
Place: Nordenskiöld room, Geoscience Building
The lecture will be streamed and saved on the Bolin Centre website

Bolin Centre for Climate Research

A collaboration between Stockholm University, KTH and the Swedish Meteorological and Hydrological Institute
www.bolin.su.se



Stockholm
University



Bert Bolin Climate Lecture 2017

Biological response to climate change: What would Bolin say?

Speaker: Dr. Thomas Cronin, U.S. Geological Survey and
Georgetown University, Walsh School of Foreign Service

The lecture will be given in English.

Coffee and refreshments will be served after the lecture.

More information about the lecture at science.su.se

Welcome!

18
MAY

FREE ENTRANCE ▶ Time and venue: 2 pm

Aula Magna, Stockholm University



Stockholm
University

The Bolin Centre board

The Bolin Centre is led by the Bolin Centre Board which comprises representatives from all its collaborative partners: Six departments at Stockholm University, the Swedish Meteorological and Hydrological Institute (SMHI) and the KTH Royal Institute of Technology. In addition, the board includes an external member and a student representative.

Prof. Ove Eriksson

Dep. of Ecology, Environment and Plant Sciences (DEEP)

ove.eriksson@su.se

Prof. Magnus Breitholtz

Dep. of Environmental Science and Analytical Chemistry (ACES)

magnus.breitholtz@aces.su.se

Prof. Rodrigo Caballero

Dep. of Meteorology (MISU)

rodrigo.caballero@misu.su.se

Prof. Gia Destouni

Dep. of Physical Geography (NG)

georgia.destouni@natgeo.su.se

Prof. Cynthia de Wit

Chair of the Bolin Centre

Cynthia.deWit@aces.su.se

Prof. Erik Kjellström

Rosby Centre, Swedish Meteorological and Hydrological Institute (SMHI)

erik.kjellstrom@smhi.se

Prof. Martin Jakobsson

Dep. of Geological Sciences (IGV)

martin.jakobsson@geo.su.se

Prof. Bengt Karlsson

Dep. of Zoology

bengt.karlsson@su.se

Prof. Dan Henningson

KTH Royal Institute of Technology

henning@mech.kth.se

Johannes Morfeldt, MSc

Swedish Environmental Protection Agency

johannes.morfeldt@naturvardsverket.se

Caroline Greiser, PhD student

Dep. of Ecology, Environment and Plant Sciences (DEEP)

caroline.greiser@su.se

Associate Prof. Nina Kirchner

Ex Officio

Co-Director of the Bolin Centre

nina.kirchner@natgeo.su.se

Prof. Alasdair Skelton

Ex Officio

Co-Director of the Bolin Centre

alasdair.skelton@geo.su.se

Annika Burström, MSc

Ex Officio

Coordinator & communicator at the Bolin Centre

annika.burstrom@su.se

Karin Jonsell, PhD

Ex Officio

Coordinator & communicator at the Bolin Centre

karin.jonsell@su.se

Runa Jacobsson

Ex Officio

Economy Administrator at the Bolin Centre

runa.jacobsson@geo.su.se



Photo: Björn Eriksson

The External Science Advisory Group

The Bolin Centre has appointed an external scientific advisory group (ESAG) comprised of leading national and international scientists within climate research. The group's main tasks are to inform the Bolin Centre of its strengths, weaknesses and possibilities for development as well as increase the Bolin Centre's contacts to international networks and research groups within the climate research area.

Prof. Deliang Chen

August Röhss Chair, Dep. of Earth Sciences; Assistant Dean for Research, Faculty of Science, University of Gothenburg, Sweden
deliang@gvc.gu.se

Prof. Eystein Jansen

Academic Director Academia Europaea Bergen Knowledge Hub. Former director of the Bjerknes Centre for Climate Research; Dep. of Earth Science, University of Bergen, Norway
eystein.jansen@uib.no

Prof. Karen Kohfeld

Climate, Oceans, and Paleo-Environments (COPE) Lab at Simon Fraser University, Canada
kohfeld@sfu.ca

Prof. Anders Lindroth

Professor in Physical Geography & Ecosystem Science at the Dep. of Physical Geography and Ecosystems Analysis, Lund University, Sweden
Anders.Lindroth@nateko.lu.se

Prof. Camille Parmesan

NMA Chair in Public Understanding of Marine Science & Human Health at the School of Biological & Marine Sciences, Plymouth University, UK
camille.parmesan@plymouth.ac.uk

Prof. Raymond T. Pierrehumbert

Halley Professorship of Physics at the Dep. of Physics at University of Oxford, UK
raymond.pierrehumbert@physics.ox.ac.uk

Prof. Andrea Rinaldo

Director of Laboratory of Ecohydrology (ECHO), École Polytechnique Fédérale de Lausanne, Switzerland
andrea.rinaldo@epfl.ch



Small weather balloon at the Arctic Summer Cloud Ocean Study (ASCOS) expedition to the Arctic. Photo: Thorsten Mauritsen

Appendix 1: Facts & figures

PhD thesis completed during 2017

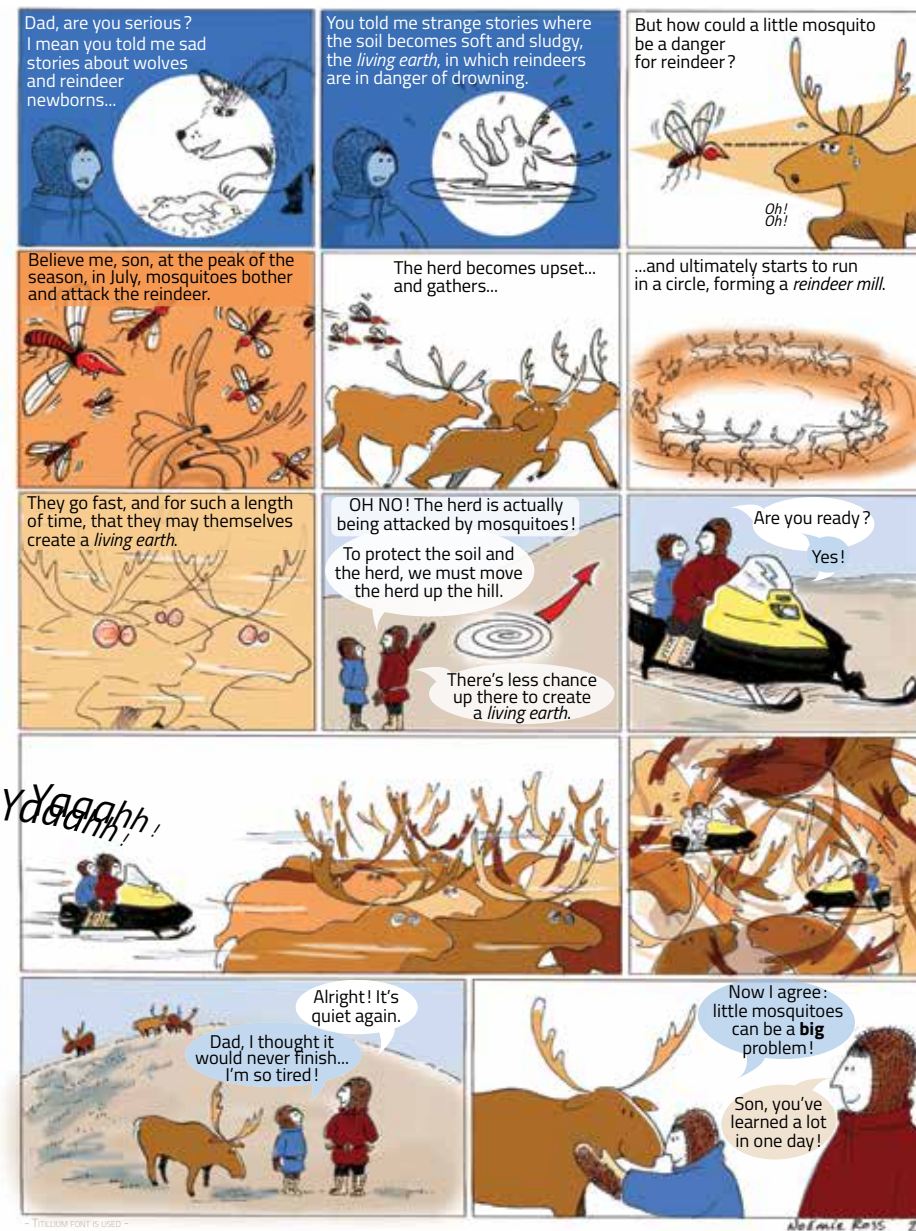
- **Juan Camilo Acosta Navarro:** *Anthropogenic influence on climate through changes in aerosol emissions from air pollution and land use change.*
- **Ekaterina Fetisova:** *Towards a flexible statistical modelling by latent factors for evaluation of simulated responses to climate forcings.*
- **Henrik Grythe:** *Quantification of sources and mechanisms of atmospheric aerosol particles.*
- **Sonja Kaiser,** Faculty for Chemistry and Geosciences, Friedrich-Schiller-University Jena, Germany: *Process-based modelling of the methane balance in periglacial landscapes.*
- **Alexander Koutsouris:** *Building a coherent hydro-climatic modelling framework for the data limited Kilombero Valley of Tanzania.*
- **Norris Lam:** *Modeling rating curves from close-range remote sensing data: Application of laser and acoustic ranging instruments for capturing stream channel topography.*
- **Alexander Lewerentz:** *Fluid-induced alteration of metasedimentary rocks in the Scottish Highlands.*
- **Juri Palmtag:** *Landscape partitioning and burial processes of soil organic carbon in contrasting areas of continuous permafrost.*
- **Jan Pietron:** *Sediment transport from source to sink in the Lake Baikal basin: Impacts of hydroclimatic change and mining.*
- **Sofie Safeyeh Soltani:** *Hydrological Transport in Shallow Catchments: tracer discharge, travel time and water age.*
- **Matthias Siewert:** *High-resolution mapping and spatial variability of soil organic carbon storage in permafrost environments.*
- **Gustav Strandberg:** *Modelling regional climate-vegetation interactions in Europe - A palaeo perspective.*
- **Josefin Thorslund:** *Hydrological Spreading of metal pollution and Wetlands as Nature-based Solutions.*

- **Niels Weiss:** *Permafrost carbon in a changing Arctic: On periglacial landscape dynamics, organic matter characteristics, and the stability of a globally significant carbon pool.*

External grants awarded during 2017

- **Australian Nuclear Science and Technology Organisation (ANSTO):** *Terrestrial stable isotope record of the warmest interval in recorded Earth History—Cretaceous Oceanic Anoxic Event 2.* Chris Mays. 16.0 kAUD
- **Australian Nuclear Science and Technology Organisation (ANSTO) and Bragg Institute:** *Experimental method for optimum imaging of first southern Gondwanan fossiliferous amber.* Chris Mays. 28.4 kAUD.
- **Australian Synchrotron:** *Identifying the source of the oldest known amber of southern Gondwana.* Chris Mays. 57.6 kAUD.
- **EC Horizon 2020:** *Nansen Environmental and Remote Sensing Center, INTAROS.* Partner for Stockholm University Michael Tjernström. 266 kEURO
- **EC Horizon 2020:** *Nunataryuk: Permafrost thaw and the changing Arctic coast, science for socio-economic adaptation.* Gustav Hugelius 536 kEURO and Örjan Gustafsson 556 kEURO.
- **EC-RISE:** *Prediction of Air Pollution in Latin America and Caribbean (PAPILA).* PI for Stockholm University Radovan Krejci. 100 kEURO for Stockholm University.
- **The Icelandic Research Fund:** *Sustainable urban drainage in cold climate.* Johanna Sörensen medsökande. 43 MISK.
- **Knut and Alice Wallenberg Foundation (KAW):** *Arctic Climate across spatial and temporal scales (ACAS).* PI Michael Tjernström. 29.9 MSEK.
- **Mannerfelt fund:** *Research travel grant.* Josefin Thorslund. 8.95 kSEK.

- **Robert Blackwood Research Seed Scheme:** *Amber as a portal into ancient greenhouse ecosystems of Southern Australia.* Chris Mays. 22.5 kAUD
- **Swedish Foundation for International Cooperation in Research and Higher Education (STINT):** *ASIAQ- The Arctic Science Integration Quest.* Nina Kirchner et al. 1.74 Mkr.
- **Swedish Foundation for International Cooperation in Research and Higher Education (STINT):** *Atmospheric extremes in the Antarctic marginal ice zone.* Gabriele Messori.
- **Swedish Foundation for Strategic Research (SSF):** *FlowZoom.* Co-PIs Rodrigo Caballero and Gunilla Svensson. 5 MSEK.
- **Swedish National Space Board (Rymdstyrelsen):** *In Influence of Absorbing Aerosols on Clouds in the Climate System.* Main PI Annica Ekman for joint project Stockholm University and SMHI. 3.9 MSEK.
- **Swedish Research Council (VR):** *Ancient sedimentary DNA may hold the key to understanding widespread changes in Fennoscandic lake water chemistry.* Love Dalén. 3.48 MSEK.
- **Swedish Research Council (VR):** *Evolutionary dynamics of genome erosion in the woolly mammoth.* Love Dalén. 4.1 MSEK.
- **Swedish Research Council (VR):** *North Atlantic Deep Water formation initiated by closure of the Barents Sea Seaway –a potential trigger for Antarctic glaciation.* Agatha De Boer and Helen Coxall. 3.8 MSEK.
- **Swedish Research Council (VR):** *Spatial pattern of autotrophic respiration and net primary production and their uncertainties of northern hemisphere temperate and boreal forests.* Christian Beer. 1.95 MSEK.
- **Swedish Research Council (VR):** *Life history evolution across climate clines.* Karl Gotthard. 3.1 MSEK.
- **Swedish Research Council (VR):** *Uncovering the genomic mechanisms of a life history decision.* Co-applicant Karl Gotthard. 2.80 MSEK.
- **Swedish Research Council (VR):** *Grand Challenges in Climate Research: Thawing Permafrost in the Arctic AND Brown Cloud Emissions from India and China.* Örjan Gustafsson. 50 MSEK.



Research Area 3 has funded an outreach project on creating comic strips to illustrate permafrost research. The project is called *A frozen-ground cartoon*. Two books have been printed in both English and Swedish. All comic strips are available at frozengroundcartoon.com.

- **Swedish Research Council (VR):** *Carbon release from permafrost in the siberian-arctic under warming climate.* Örjan Gustafsson. 3.7 MSEK.
- **Swedish Research Council (VR):** *The evolutionary physiology of hypo metabolism.* Philipp Lehmann. 3.38 MSEK.
- **Swedish Research Council (VR):** *Observing internal waves in the ocean with sound.* Jonas Nycander. 3.36 MSEK.
- **Swedish Research Council (VR):** *Research school for Upper Secondary School Teachers of Natural Science and Geography, focusing on Climate and the Environment.* Alasdair Skelton. 11.6 MSEK.
- **Swedish Research Council (VR):** *A Terrestrial Carbon Source hypothesis for deglacial CO₂ rise, TERRACASE.* Rienk Smittenberg. 3.00 MSEK.
- **Swedish Research Council (VR):** *The Impact of Environmental Stress and Hybridization on Biodiversity.* Rike Stelkens. 4.20 MSEK.
- **Swedish Research Council (VR):** *Methane hydrate stability in a changing Arctic Ocean.* Christian Stranne. 3.15 MSEK.
- **Swedish Research Council (VR):** *Sotets livscykel.* Johan Ström. 3.00 MSEK.
- **Swedish Research Council (VR):** *The physics of Arctic warm-air intrusions.* Michael Tjernström. 3.66 MSEK.
- **Swedish Research Council (VR):** *Simulating green Sahara with an Earth System Model.* Qiong Zhang. 3.28 MSEK.
- **Swedish Research Council for Sustainable Development (FORMAS) projects for future research leaders:** *The missing link: How does climate affect human conflict and cooperation through water?*, PI Arvid Bring. 3.00 MSEK.
- **Swedish Research Council for Sustainable Development (FORMAS):** *Ocean-induced changes at calving glacier margins: data, uncertainty, and simulation.* PI Nina Kirchner. 2.9 Mkr. **Swedish Research Council for Sustainable Development (FORMAS) projects for future research leaders:** *Klimatförändringarnas inverkan på diapaus: implikationer för skadeinsekter.* Philipp Lehmann. 2.90 MSEK.
- **Swedish Research Council for Sustainable Development (FORMAS):** *Diversified Salix plantations for mitigation of climate change:*

Linking above-ground plant traits to below-ground bioenergetics. Co-applicant **Stefano Manzoni**. 3.00 MSEK.

- **Swedish Research Council for Sustainable Development (FORMAS):** *NonTarget Atmospheric Observatories (NTAO) for Organic Contaminant Discovery.* Main PI Jonathan Martin. 3 MSEK.
- **Wallenberg Academy Fellow:** *How do manmade emissions affect the clouds?* Claudia Mohr. 14 MSEK.
- **Wallenberg Academy Fellow:** *Does evolution move faster thanks to hybrids?* Rike Stelkens.

Prizes awarded during 2017

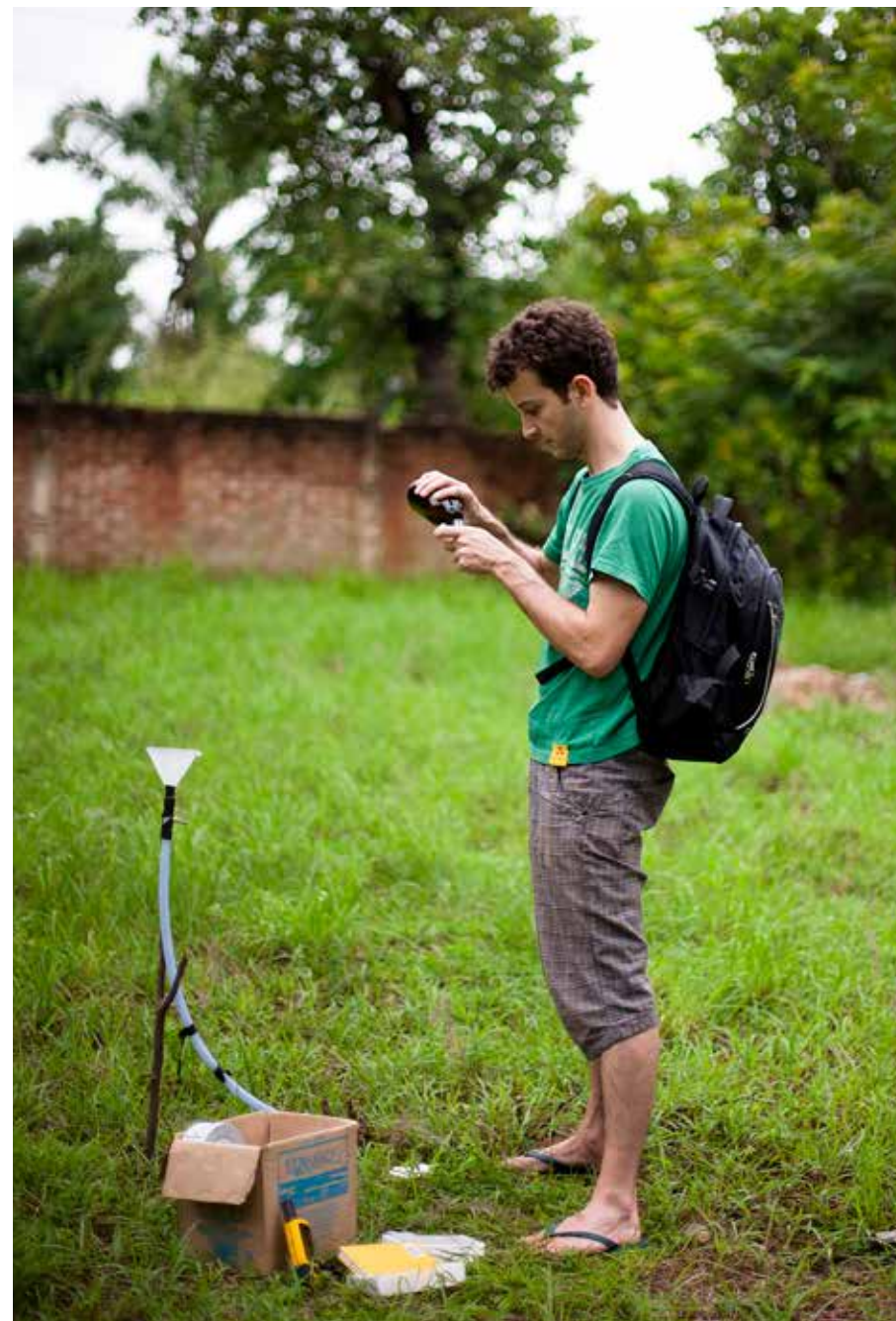
- **Claudia Mohr** was awarded the 2018 Atmospheric Sciences Division Outstanding Early Career Scientist Award from the EGU.
- **Stefano Manzoni** was awarded the 2017 Junior Marchi Lecturer, Gruppo Italiano di Idraulica.
- **Johanna Sörensen** has been awarded the New generation-prize from the The Swedish Association for Water.

Invited talks during 2017

- **Anders Angerbjörn** was invited to talk at the University of Toronto, Scarborough, Canada. Title: *Population ecology in northern mammals and birds with a conservation perspective.*
- **Anders Angerbjörn** was invited to talk at the Trent University, Ontario, Canada. Title: *Response of arctic predators to fluctuating prey populations.*
- **Christian Beer** was invited to the BIOGEOMON, 9th International Symposium on Ecosystem Behavior, Litomyšl Chateau, Czech Republic. Title: *Northern high latitude carbon mean residence times across systems and scales.*
- **Gudrun Brattström** gave an invited talk at the 6th Nordic-Baltic Biometric Conference, 2017. Title: *Climate time series: signal, noise and additivity.*
- **Volker Brüchert** was invited to the 7th YES-SETAC Meeting. Title: *Coupled carbon biogeochemical cycles and climate change.*
- **Rodrigo Caballero** was invited to the European Meteorological

Society Annual Meeting, Dublin, June 2017. Title: *Extreme cold over North America and storminess in Europe orchestrated by stationary Rossby wave packets from the Pacific.*

- **Helen Coxall** gave an invited talk at the Lund University. Title: *Onset of North Atlantic deep water formation in the late Eocene.*
- **Love Dalén** was an invited speaker at Zoology 2017 conference, Wageningen, The Netherlands. Title: *Quantifying genome erosion using ancient DNA.*
- **Love Dalén** was an invited speaker at International Plant and Animal Genome XXV, San Diego, USA. Title: *A status update on rhino reference genome assemblies.*
- **Love Dalén** was an invited speaker at International Plant and Animal Genome XXV, San Diego, USA. Title: *Quantifying the genomic consequences of demographic declines.*
- **Love Dalén** was an invited speaker at Darwin's Birthday Debate, Natural History Museum London, UK. Title: *Recalibrating canid evolution using ancient DNA.*
- **Love Dalén** was an invited speaker at University of Alaska, Fairbanks, USA. Title: *Using ancient genomes to explore the evolutionary history of Pleistocene Megafauna.*
- **Love Dalén** was an invited speaker at The Swedish Book Fair, Gothenburg, Sweden. Title: *The hunt for DNA from the last mammoths.*
- **Annica M. L. Ekman** was a plenary invited speaker at the European Aerosol Conference, Zurich, 28th of August to 1st of September, 2017. Title: *How do changes in regional aerosol particle emissions affect climate in other regions of the world?*
- **Nina Kirchner** gave an invited talk at the Svalbard Science Forum, Oslo. Title: *Long Term Underwater Sensing (LoTUS) at calving fronts in western Spitsbergen.*
- **Malin Kylander** gave an invited talk at the BIOGEOMON, 9th International Symposium on Ecosystem Behavior, Litomyšl Chateau, Czech Republic. Title: *A high peat and carbon accumulation event driven by changes in dust mineralogy.*
- **Stefano Manzoni** was a plenary invited speaker at the BIOGEOMON, 9th International Symposium on Ecosystem



Alexander Koutsouris doing field work. Photo: Sophia Olsson

Behavior, Litomyšl Chateau, Czech Republic. Title: *Nutrient constraints on metabolism from microbial communities to ecosystems*.

- **Stefano Manzoni** was invited to give a talk at the EGU General Assembly. Title: *Disentangling temporal and stoichiometric controls on decomposer community traits – An analytical modelling approach*.
- **Britta Sannel** gave an invited talk at the conference Globalizing polar issues: High altitudes meet high latitudes in Crans-Montana, 2017, arranged by the Swiss Polar Institute.
- **Frederik Schenk** was invited to the seminar series Coastal Ocean Dynamics at the Institute for Coastal Research, Helmholtz-Zentrum Geesthacht, Geesthacht, Germany. Title: *Towards a long-term consistent atmospheric re-analysis dataset since the 19th century*.
- **Qiong Zhang** gave an invited talk at Lund University in November 2017. Title: *Towards the earth system version of EC-Earth: applications and perspective*.

Notable outreach activities not organised centrally

- **Anders Angerbjörn** did a pod cast about being a arctic fox scientist <https://podtail.com/sv/podcast/vilse/-10-anders-angerbjorn-fjallravsforskaren>.
- **Arvid Bring** was a member of a panel of climate scientists and journalists at the press showing of Al Gore's film *An Inconvenient Sequel*.
- **Helen Coxall** organised a primary school interactive activity called *Climate change and life, lessons from the geological past* at the Futura School in Stockholm.
- **Helen Coxall** was involved as the Scientific adviser and 'scientist in focus' in a book-section on *Ocean acidification in the past* for primary school teaching Science and Technology for All.
- **Steffen Kiel** was organizer and actor of the Citizen Science Day at Swedish Museum of Natural History.
- **Nina Kirchner** and **Kjell Blomgren**, *Bildningspodden*, the Education Pod of Stockholm University, www.bildningspodden.se, Episode #55, on Climate Change (Klimatförändringar). Moderated by Magnus Bremmer.

- **Nina Kirchner** participated in *Arctic Traces: Polar expeditions*. An evening at The Nordic Museum, Stockholm, together with Bea Uusma and Peder Roberts, moderated by Lotten Gustafsson Reininus. www.su.se/om-oss/evenemang/oppna-forelasningar/arktiska-spår-polarexpeditioner-1.321219
- **Malin Kylander** has worked with Per Brahegymnasium in Jönköping.
- **Stefano Manzoni** had an outreach project "La terra e' viva – viva la terra!" at the kindergarten of Carisio, Italy. Activities involved explaining about decomposition and how soil microorganisms help providing food (nutrients) to plants, and ultimately to people. This project has been covered by a local newspaper with the article: *Lezioni sull'ambiente: docente attorniato da bambini curiosi* (in Italian), by Pier Emilio Calliera, La Sesia (Vercelli, Italy, 12-22-2017).
- **Britta Sannel**, together with three young school girls from Abisko investigated the impacts of climate change on permafrost in northern Swedish peatlands in a children's TV-program entitled 'De yttersta barnen', produced by Utbildningsradion (UR). The program was recorded in the autumn 2016, but it was launched in the spring 2017.
- **Alasdair Skelton** was involved in several Upper secondary school diploma projects on Snowball Earth.
- **Malin Ödalen** supervised three gymnasium students coming to MISU for a week to do a research project. They were analysing output from some future scenario runs with GENIE-RCP8.5, RCP6.0 and their own mitigation scenario with 40% reduction in emissions every decade. One specialised in effects on ocean circulation and temperature, one of them on biological effects such as acidification and one of them on sea-ice and sea level rise. Malin: "I found it to be a great experience, but most of all, I see how much they learnt in such a short time and how eager they are to spread the knowledge."

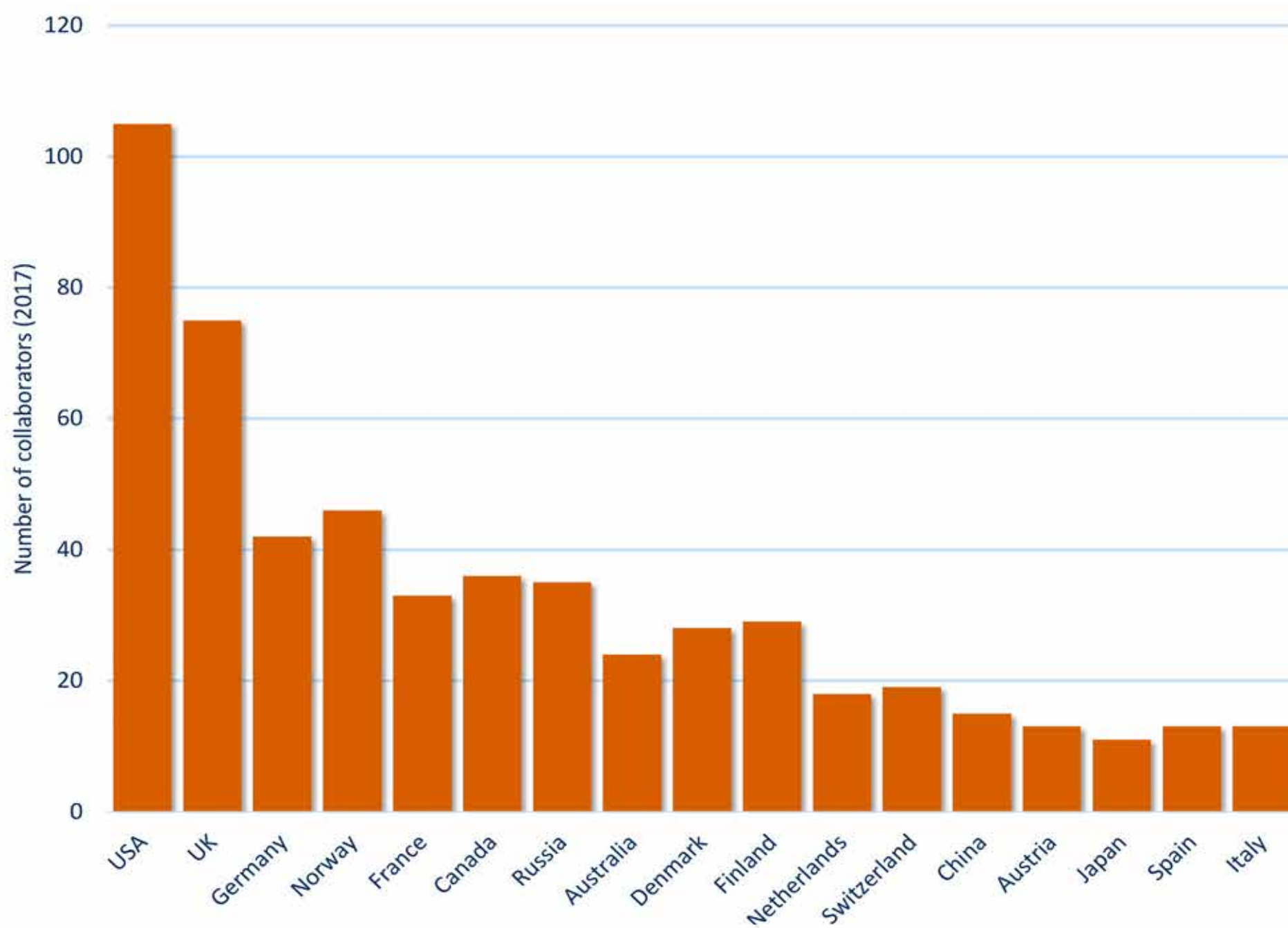


The interactive activity *Climate change and life, lessons from the geological past* at the Futura School in Stockholm. Photo: Helen Coxall.

Appendix 2: Publications

At least 225 climate-related publications were published by Bolin Centre scientists in 2017.

- Aalto, J., Riihimäki, H., Meineri, E., Hylander, K. and Luoto, M., 2017. Revealing topoclimatic heterogeneity using meteorological station data. *International Journal of Climatology*: 37, 544–556. <https://doi.org/10.1002/joc.5020>
- Aben, R. C. H., Barros, N., van Donk, E., Frenken, T., Hilt, S., Kazanjian, G., Lamers, L. P. M., Peeters, E.T. H. M., J., Roelofs, G. M., de Senerpont Domis, L.N., Stephan, S., Velthuis, Van de Waal, M., D. B., Wik, M., Thornton, B. F., Wilkinson, J., DelSontro, T. & Kosten, S., 2017. Cross continental increase in methane ebullition under climate change. *Nature Communications*: 8. <https://doi.org/10.1038/s41467-017-01535-y>
- Acosta Navarro, J. C., Ekman, A. M. L., Pausata, F., Lewinschal, A., Varma, V., Seland, Ø., Gauss, M., Iversen, T., Kirkevåg, A., Riipinen, I., Hansson, H.-C., 2017. Future response of temperature and precipitation to reduced aerosol emission as compared with increased greenhouse gas concentrations. *Journal of Climate*: 30, 939–954. <https://doi.org/10.1175/JCLI-D-16-0466.1>
- Ahlm, L., Jones, A., Stjern C. W., Muri, H., Kravitz, B., and Kristjánsson, J. E., 2017. Marine cloud brightening - as effective without clouds, *Atmos. Chem. Phys.*: 17, 13071–13087. <https://doi.org/10.5194/acp-17-13071-2017>
- An, W., Hou, S., Zhang, Q., Zhang, W., Wu, S., Xu, H., Pang, H., Wang, Y. and Liu, Y., 2017. Enhanced recent local moisture recycling on the northwestern Tibetan Plateau deduced from ice core deuterium excess records. *Journal of Geophysical Research: Atmospheres*: 122. <https://doi.org/10.1002/2017JD027235>
- Anderson, B. T., Hassanzadeh, P., and Caballero, R., 2017. Extratropical atmospheric blocking as an initiator of El Niño/Southern Oscillation events. *Sci. Rep.*: 7, 10145.
- Anderson, L. G., Björk, G., Holby, O., Jutterström, S., Mörth, C. M., O'Regan, M., Pearce, C., Semiletov, I., Stranne, C., Stöven, T., Tanhua, T., Ulfsbo, A. and Jakobsson, M., 2017. Shelf–Basin interaction along the East Siberian Sea. *Ocean Sci.*: v. 13, no. 2, p. 349–363. <https://doi.org/10.5194/os-13-349-2017>
- Anderson, L.G., Ek, J., Ericson, Y., Humborg, C., Semiletov, I., Sundbom, M., and Ulfsbo, A., 2017. Export of calcium carbonate corrosive waters from the East Siberian Sea. *Biogeosciences*, 14, 1811–1823. <https://doi.org/10.5194/bg-14-1811-2017>
- Andrén, E., Telford, R. J., and Jonsson, P., 2017. Reconstructing the history of eutrophication and quantifying total nitrogen reference conditions in Bothnian Sea coastal waters. *Estuarine, Coastal and Shelf Science*: 198, 320–328. <https://doi.org/10.1016/j.ecss.2016.07.015>
- Audusseau, H., Le Vaillant, M., Janz, N., Nylin, S., Karlsson, B., and Schmucki, R., 2017. Species range expansion constrains the ecological niches of resident butterflies. *Journal of Biogeography*: 44, 28–38. <https://doi.org/10.1111/jbi.12787>
- Auffret, A.G., Kimberley, A., Plue, J., Skånes, H., Jakobsson, S., Waldén, E., Wennbom, M., Wood, H., Bullock, J.M., Cousins, S.A.O., Gartz, M., Hooftman, D.A.P. & Tränk, L., 2017. HistMapR: Rapid digitization of historical land-use maps in R. *Methods in Ecology and Evolution*.
- Bartlett, R.E., Bollasina, M.A., Booth, B.B.B., Dunstone, N.J., Marengo, F., Messori, G., and Bernie, D.J., 2017. Do differences in future sulphate emission pathways matter for near term climate? A case study for the Asian Monsoon. *Clim. Dyn.* <https://doi.org/10.1007/s00382-017-3726-6>



The distribution of the Bolin Centre's international collaboration. Data: Gabor Schubert.

- Baskaran, P., Hyvönen, R., Berglund, S.L., Clemmensen K., Lindahl B., and Manzoni, S., 2017. Modelling the influence of ectomycorrhizal decomposition on plant nutrition and soil carbon sequestration in boreal forest ecosystems. *New Phytologist*: 213(3), 1452–1465. <https://doi.org/10.1111/nph.14213>
- Bender, F. A.-M., Engström, A., Charlson, R. J., and Wood, R., 2017. Evaluation of hemispheric asymmetries in marine cloud radiative properties. Accepted for publication in *J. Clim.*
- Berglund, S., Döös, K., Nycander, J., 2017. Lagrangian tracing of the water-mass transformations in the Atlantic Ocean. *Tellus, Series A: Dynamic Meteorology and Oceanography*: 69(1), 1306311. <https://doi.org/10.1080/16000870.2017.1306311>
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Early autumn morning at the Stockholm University campus. Photo: Karin Jonsell.

Appendix 3: Contact information

www.bolin.su.se
bolin@su.se

Chair of the board



Cynthia de Wit
cynthia.dewit@aces.su.se
+46 70 888 71 80

Co-director



Nina Kirchner
nina.kirchner@natgeo.su.se
+46 70 609 05 88

Co-director



Alasdair Skelton
alsadair.skelton@geo.su.se
+ 46 76 770 76 99

Coordinator & communicator



Annika Burström
annika.burstrom@su.se
+46 72 148 91 49

Coordinator & communicator



Karin Jonsell
karin.jonsell@su.se
+46 70 206 2445

Economy administrator



Runa Jacobsson
runa.jacobsson@geo.su.se
+46 70 358 03 07

Website administrator



Inês Jakobsson
ines.jakobsson@geo.su.se
+46 73 727 34 08



The Geoscience building at Stockholm University where many of the Bolin Centre scientists work. Photo: Orasis.



Bolin Centre for Climate Research

The Bolin Centre is a multi-disciplinary consortium of more than 350 scientists in Sweden who conduct research and graduate education related to the Earth's climate. It was formed in 2006 by Stockholm University, the KTH Royal Institute of Technology and the Swedish Meteorological and Hydrological Institute (SMHI).

The Bolin Centre focuses on extending and disseminating knowledge about the Earth's natural climate system, climate variations, climate impacting processes, climate modelling, human impact on the climate and climate impacts on ecosystems, biodiversity and human conditions as well as how society can minimise negative impacts through responsible management.

The Bolin Centre for Climate Research is named in honour of Professor Bert Bolin of Stockholm University, a leader in climate and carbon cycle research and one of the founders of the Intergovernmental Panel on Climate Change (IPCC) which received the Nobel Peace Prize in 2007.

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