

Breaking records – How high temperatures in the Arctic affect European society

Scope of the policy briefing

The Arctic has been warming twice as rapidly as the global average over the past 50 years. Yet, despite this clear trend, the speed of change in the Arctic is faster than anticipated. In November 2016, the temperature over the Arctic Ocean hit an unprecedented high – with temperatures as much as 20° Celsius higher than the monthly mean. The Arctic winter maximum sea ice extent in 2017 was the lowest in the 38-year satellite observation record. The 2016-2017 winter was an exceptionally warm period in the Arctic, however, we are likely to observe similar extreme events more frequently in future.

The warming of the Arctic and the increase in extreme warm periods have profound implications for people, resources and ecosystems over all of Europe, both in the high and mid-latitudes. Understanding the reasons and effects of Arctic change has thus become critical for elaborating policies in Europe, including those relating to climate change, energy security, innovation and economic growth.

The first EU-PolarNet and European Polar Board lunchtime policy briefing set out to give policy makers an overview of the state-of-the-art research on abnormal temperatures in the Arctic and their consequences for Europe. The following report is a summary of the issues presented and discussed during the event.

About EU-PolarNet (www.eu-polar.net)

EU-PolarNet is a Horizon2020 Coordination and Support Action. Its ambition is to connect science with society. As the world's largest consortium of scientific expertise and infrastructure for polar research, the consortium aims to develop effective research strands and successful partnerships that will address the urgent need for knowledge about changes in the Polar Regions. Outcomes from this research will inform policy decisions that address the global imperative for a low-carbon future. EU-PolarNet moreover benefits from its close cooperation with the European Polar Board (EPB), as outcomes from EU-PolarNet will add long-term value to EPB activity in providing strategic science policy advice to the European Commission and other international bodies.

About the European Polar Board (www.europeanpolarboard.org)

The European Polar Board (EPB) is an independent organisation that focuses on major European strategic priorities in both the Arctic and the Antarctic regions. Current EPB membership includes research institutes, funding agencies, scientific academies and polar operators from across Europe. Since 2015, the EPB has been an independent entity, with its Secretariat hosted by the Netherlands Organisation for Scientific Research (NWO) in The Hague. Established in 1995, the EPB was earlier an Expert Board of the European Science Foundation, formed to provide strategic advice on Arctic and Antarctic issues. The EPB envisions a Europe with a strong and cohesive polar research community and wherein decisions affecting or affected by the polar regions are informed by independent, accurate, and timely advice from the EPB. The EPB has a mission to improve European coordination of Arctic and Antarctic research, by optimising the use of European polar research infrastructures. We promote multilateral collaborations between our Members and provide a single contact point for the global polar community. We advance the collective knowledge of polar issues, particularly in the context of European societal relevance.

Agenda

Lunchtime policy briefing	
Conference Date	Thursday, 22 nd June 2017, 11:30 – 14:00
Conference Location	EU Liaison Office of the German Research Organisations 8 th floor, Rue du Trône 98, 1050 Brussels
<p>Lunchtime policy briefing:</p> <p><i>“Breaking records – How high temperatures in the Arctic affect European society”</i></p> <p>Chair: Karin Lochte, Director of the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Germany and EU-PolarNet Coordinator</p>	
Time	
11:30 – 11:45	<p>Welcome and setting the scene</p> <p>Karin Lochte (EU-PolarNet Coordinator)</p> <p>Attilio Gambardella (Policy Officer, Unit Climate action and Earth observation, Directorate General for Research and Innovation, European Commission)</p>
11:45 – 12:15	<p>Keynote address</p> <p><i>“The heat is on: How is Europe affected by a warming Arctic?”</i></p> <p>Dirk Notz (Head of Research Group on Sea ice in the Earth System, Max Planck Institute for Meteorology, Germany)</p>
12:15 – 13:00	<p>Panel discussion</p> <p><i>“Arctic change – Research needs for informed decision-making”</i></p> <p>Volker Rachold (Head of the German Arctic Office)</p> <p>Kirsi Latola (University of the Arctic Thematic Networks Director)</p> <p>Frej Sorento Dichmann (Senior Advisor Danish Agency for Science, Technology and Innovation)</p> <p>Eva Krüemmel (Co-founder of ScienTissiME, Research and Policy Consulting; Consultant on Environment and Health for the Inuit Circumpolar Council - Canada)</p>
13:00 – 14:00	Joint lunch and further discussions

Introductions

Karin Lochte

Director of the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research and EU-PolarNet Coordinator, Germany



Prof Dr Karin Lochte is the director of the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine situated in Bremerhaven, Germany, since November 2007. She is a member of several national and international boards and scientific committees. She was a member of the German Scientific Council, which advises the German Federal and Länder state Government on development of universities, science and research. She is also Vice President of the Scientific Committee on Antarctic Research and member of the Senate of the Leibniz Association. She received her PhD in Marine Biology at the University College of North Wales, UK in 1984. Prof Dr Lochte represents the Helmholtz Association on the European Polar Board.

EU-PolarNet's coordinator, Karin Lochte, introduced the policy briefing's topic by referring to recent news reports about high temperatures in the Arctic and posed the question how this will affect the European society. She took up the much-quoted statement that "what happens in the Arctic does not stay in the Arctic". The changes in the high latitudes will have an effect on people in the lower latitudes – both positively and negatively – and will hence also influence European policymaking. She listed a range of sectors that will be or already are affected by Arctic change, such as fisheries, transport, tourism, energy, agriculture and health. She emphasized the need to understand the changes and their associated risks and to act upon these in the best possible way. In closing, Karin Lochte underlined the importance of an ongoing dialogue between science, policy and other stakeholders.

Attilio Gambardella

Policy Officer at the Climate Action and Earth Observations Unit in the DG Research & Innovation of the European Commission



Dr Attilio Gambardella is responsible for the development of the EC Polar research policy and is the project officer of the EU-PolarNet project. Before taking his current position, he was working at the Joint Research Centre of the European Commission and previously in the academic sector field dealing mainly with Earth Observation research for the marine environment. He graduated in Nautical Sciences and later received the Ph.D. degree in electronic and computer science engineering.

EU-PolarNet's Policy Officer, Attilio Gambardella, referred to the project's objectives in his opening address. These include delivering a strategic framework and mechanisms to prioritise science, optimising the use of polar infrastructure, and brokering new partnerships that will lead to the co-design of polar research projects that deliver tangible benefits for society. The consortium, he stated, functions as a voice of the European polar community and as such, assists the European Commission in developing research policies. He stressed the importance of using science in policymaking and raised the question how research results can facilitate action in order to cope with the challenges of Arctic change.

Keynote

“The heat is on: How is Europe affected by a warming Arctic?”

Dirk Notz

Head of Research Group on Sea ice in the Earth System, Max Planck Institute for Meteorology, Germany



Dr Dirk Notz is head of the research group "Sea ice in the Earth System" at the Max Planck Institute for Meteorology in Hamburg, Germany. In addition, he is adjunct associate professor at the University Centre in Svalbard, Norway. He obtained his PhD in Applied Mathematics from the University of Cambridge, UK (2006). In his research, he combines insights from field experiments in the Arctic, from laboratory experiments and from modelling work to better understand the role of sea ice for the changing climate of our planet. He is actively involved in the policy and stakeholder dialogue, and has won several prizes for his intelligible presentation of science to the general public.

Dirk Notz began his keynote talk with a historical anecdote, telling the story of a German Arctic expedition in 1912 that ended fatally for eight out of twelve members, as the ship was enclosed by ice and the team had to overwinter. In 2007, Dirk Notz followed the traces of the expedition and found a landscape that had profoundly changed. There was no ice to be found far and wide that could have trapped the ship and so the scientists had to sail considerably further North to reach the first ice floes.

Observed changes in the Arctic

With this historical reference, Dirk Notz outlined one of the most prominent changes in the Arctic: the decline of the Arctic sea ice. Since the 1960s, the ice cover has shrunk by half in both extent and thickness, leading to a total sea ice reduction of 75 per cent in volume. In addition, as the older (thicker) ice disappears, the ice cover becomes more vulnerable.

The Arctic, he stated, has warmed two to three times as fast as the global average and thus stands out as a hotspot of global warming. Besides the retreating sea ice, Arctic change also manifests itself in an expanding vegetation, thawing permafrost and decreasing snow cover – all of these with the potential to contribute to further warming.

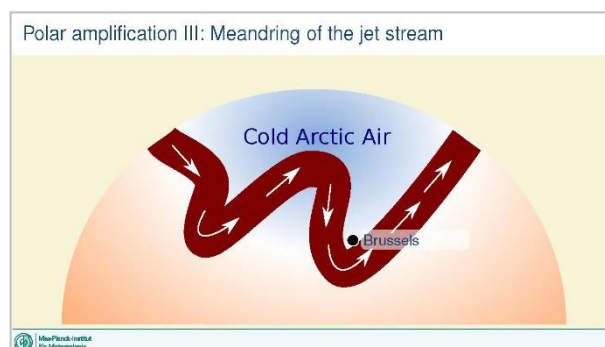
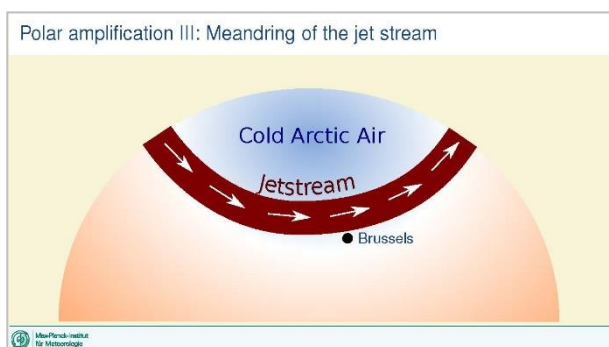
Human impact on the climate system

Subsequently, Dirk Notz briefly introduced the climate system by outlining three major factors that can change the Earth's temperature: changes in the reflective properties of a surface (albedo), changes in the composition and amount of greenhouse gases in the atmosphere and changes in the amount of sunlight reaching the Earth's surface. Out of these, the human-induced changes of the CO₂ concentration is the most profound factor driving the ongoing climate change. He pointed out a clear correlation between the increase in CO₂ emissions and the decrease of sea ice, supported by both observations and model simulations.

Extreme warm temperatures in the Arctic

He then set out to explain why the Arctic warms faster than regions at lower latitudes – a phenomenon known as polar amplification. Firstly, adding greenhouse gases to the atmosphere leads to a stronger warming in colder than in warmer regions. Secondly, the reduction of ice and snow, and the increase in vegetation cover, darkens the Earth's surface and reduces albedo. Instead of reflecting the larger proportion of solar radiation, darker surfaces absorb more than they reflect and thus heat up more strongly. Thirdly, the meandering of the jet stream: The decreasing temperature gradient between the Arctic and lower latitudes causes an instability and consequently a meandering of the jet stream. This

in turn causes temperature anomalies, depending on the positioning and amplitude of the jet stream meander, which allow warm air masses to travel northwards into the Arctic. Together, these three factors have led to extreme warm events in the Arctic. These events, he noted, have always been around, but are getting more frequent and usual.



Consequences for Europe

Turning to the consequences of a warming Arctic for Europe, Dirk Notz indicated that extreme weather events in the mid-latitudes are likely to intensify and become more frequent. The melting of the Greenland ice sheet is a major contributor to global sea level rise, while the input of freshwater is likely to affect the ocean circulation, thus potentially weakening the Gulf Stream. In addition, as the Arctic opens up, economic activities are expanding, including shipping activities, tourism and the extraction of natural resources.

In closing his talk, Dirk Notz, noted that the human civilisation is adjusted to the current climate state (in terms of locations of cities, agriculture, insurances, etc.) and that human induced changes in the Arctic are challenging the status quo of the climate, which is a possible indicator of upcoming challenges to human civilisation.

Questions from the audience

Is the ice melting in both the Arctic and Antarctic?

Dirk Notz: As temperatures in the Antarctic are well below freezing, warming has had less effect on sea ice. The extent of sea ice there is mostly determined by winds, which are blowing the ice away from the coast. Last year, however, a sudden decline in Antarctic sea ice was observed. The question thus arises if this was an exceptional event or a change in the system. Concerning ice masses on land, the situation is similar to Greenland: an overall melting of land ice can be observed and thus some areas of Antarctica will contribute to sea level rise, particularly on the Antarctic Peninsula and the Amundsen Coast of West Antarctica.

Is the warming causing more evaporation and could more clouds have a cooling effect?

Dirk Notz: Just little cooling effects are expected as we already have clouds today. However, it strongly depends on the type of clouds; some high clouds could actually cause further warming as they trap outgoing heat radiation with minimal effect on incoming solar radiation reaching the Earth surface. We thus need to understand, which types of clouds are forming.

Does the increased vegetation in the Arctic not absorb more CO₂ and therewith slow warming?

Dirk Notz: Simulations have rather shown that the expanding vegetation causes extra warming. The effect of absorbing CO₂ is smaller than the effect of the loss of reflective

capacities – the reduction in surface albedo. In other areas, such as in our latitudes, increasing vegetation, however, does absorb more CO₂.

Will thawing of subsea permafrost cause a methane release that succeeds human emissions?

Dirk Notz: If subsea permafrost melts, it might release methane to the atmosphere. However, scientists are less concerned about strong effects of subsea permafrost than the general public. Research has shown that bacteria take up methane that is released in the sea, if the area is not too shallow. Also the release will happen very slowly and as methane only remains in the atmosphere for 50 to 60 years this slow release will weaken the effect.

Is the decreasing volume of sea ice affecting the sea level?

Dirk Notz: No, melting sea ice does not affect the sea level as it is already floating – comparable to when ice cubes in a glass of water melt, the glass does not overflow. Melting glaciers and ice sheets on land however do contribute to sea level rise. The Greenland ice sheet is currently a major contributor to global sea level rise.

Panel

“Arctic change – Research needs for informed decision-making”

Volker Rachold

Head of the German Arctic Office



Dr Volker Rachold is the Head of the German Arctic Office, which was established in spring 2017 and serves as a central point of contact for political and scientific bodies, NGO's and German industry in regard to Arctic issues, and fosters Germany's participation in the Arctic Council's scientific activities. Previously, he served as the Executive Secretary of the International Arctic Science Committee (IASC). There his functions included guiding and overseeing IASC's activities, representing the organization on various international committees and at international meetings.

How is German society affected by Arctic change?

The loss of sea ice affects the climate in Europe and thus also in Germany. Longer-term effects are the thawing of permafrost and the release of further greenhouse gases, as well as the raising sea level, which particularly affects Northern Germany. However, there are also opportunities linked to the loss of sea ice: Germany is a big shipping nation and the opening up of the Northern Sea Route would thus be of interest. Further economic opportunities are Arctic tourism, fisheries and technology and innovation, especially in regard to green technologies. This does not mean that Germany is waiting to exploit Arctic resources. On the contrary, Germany's main interest in the Arctic is science. The German Arctic policy emphasises the need for science for sustainable development. Investments will thus be sustainable, based on good science and ensure not to harm the Arctic.

How does Germany address the effects of Arctic change?

Knowledge transfer and exchange on Arctic related issues is increasing. The German Arctic Office is a hub between different stakeholders and is establishing a dialogue between ministries: foreign ministry, ministry for science and technology, ministry for economy, ministry of transport, ministry of environment, ministry for agriculture, food and fisheries, ministry of defence.

Kirsi Latola*University of the Arctic Thematic Networks Director, Finland*

Dr Kirsi Latola is research coordinator and Director of the University of the Arctic Thematic Networks, which she has managed since its beginning in 2005. In addition to her work for UArctic, she is involved in transnational infrastructure access and stakeholder consultations. Her previous project management includes Nordic Council of Ministers funded projects on Arctic education and PhD programme on Health and Well-being. She is one of the lead authors of the assessment report "Strategic Assessment of Development of the Arctic". Dr Latola represents the Thule Institute (University of Oulu), on the European Polar Board.

How is Finnish society affected by Arctic change?

The mean temperature in Finland has already increased by 2°C, and even if the climate goals of the Paris Agreement are achieved, it is likely that Finland will warm by another 2°C. This warming already leads to shifts in the landscape and ecosystems, for example, new species (insects, pests, animals and plants) appear. The lack of snow, shorter winters and warmer autumns also lead to economic losses. This is a big issue, especially for Lapland, which has built an image as a winter wonderland. Moreover, the environmental impacts of Arctic change are often mostly severely felt by the Saami and any economic benefits of change are often in conflict with traditional livelihoods.

How does Finland address the effects of Arctic change?

Climate change is one of the key priorities of the Finnish Arctic Council chairmanship and the country will cooperate closely with the EU to address climate related issues. Furthermore, the National Energy and Climate Strategy sets targets for 80–95 % reduction in greenhouse gas emissions by 2050, which includes the following measures:

- phasing out the use of coal for energy;
- the share of transport biofuels will be increased to 30 %, and an obligation to blend light fuel oil used in machinery and heating with 10 % of bio liquids will be introduced;
- a minimum aim is to have 250,000 electric and 50,000 gas-powered vehicles on the roads;
- flexibility of electricity demand and supply and system-level energy efficiency will be improved;
- the share of renewable energy in the end consumption will increase to approx. 50 % and the self-sufficiency in energy to 55 %.

These innovations have to be affordable to local people. Additionally, Finland is investing in research and innovation, especially in clean-tech and digitalisation.

Frej Sorento Dichmann*Senior Advisor, Ministry of Science and Higher Education, Denmark*

Frej Sorento Dichmann is a government official with 12 years' experience within the Ministry of Science and Higher Education. During this time, Mr. Dichmann has worked on labour law relating to university staff, the committees on scientific dishonesty, the EU Framework Programme (FP7), and international research collaboration. For the last four years, Frej has led a secretariat within the Danish Agency for Science and Higher Education that handles issues related to the Arctic. He holds a Master's Degree in Law and has served as an officer in the Royal Danish Air Force. Mr Dichmann is an alternate representative of the Danish Agency for Science, Technology and Innovation (DASTI) on the European Polar Board.

How is Danish society affected by Arctic change?

Denmark shares many climate change related challenges and opportunities with Germany and Finland, although it is worth noting that the Kingdom of Denmark also includes the Faroes and Greenland who face specific issues. While the focus on science in and around the Arctic (climate, marine resources, extreme weather and innovation) has increased, Denmark does not have a specific Arctic research programme. Danish Arctic science does therefore not have as visible and strong a profile as it otherwise could have. In addition, the political focus on the Arctic, especially related to adaptation, is getting stronger across several ministries. The Danish ministry of defence is responsible for stewarding the coast of Greenland. Yet, when the ice opens up and more ships are operating in the Arctic, the ministry might lack resources to handle possible accidents. Efforts to address this lack of resources and to enable Denmark to step up towards its responsibility in the Arctic are thus increasing. Furthermore, the new possibilities in the arctic could spur the wish for independence of Greenland, which in turn would affect the Danish identity and history.

How does Denmark address the effects of Arctic change?

Adaptation efforts involve local communities, the government and businesses. Main questions are: What are new areas of business? And how can Greenlandic communities adapt to a new way of life? Currently, the majority of Greenland's economy is based on marine resources. Additionally, Denmark is working towards bringing its research community together, in order to become more cooperative, to share data and avoid duplications. The future will also see a closer involvement of local Arctic communities in Arctic research. Denmark and Greenland are currently looking into the possibility to establish a research hub on Greenland, which would be open for the international science community and facilitate international collaboration.

Eva Kruemmel

Co-founder of ScienTissiME, Research and Policy Consulting; Consultant on Environment and Health for the Inuit Circumpolar Council – Canada



Dr Eva Kruemmel holds a Diplom in Biology from the University of Cologne, Germany (1998), and a Ph.D. in Biology/Environmental Toxicology from the University of Ottawa, Canada (2006). Eva started working for the Inuit Circumpolar Council (ICC) Canada in 2008. She has represented ICC in various international fora, frequently as part of the Canadian delegation, for example at UN negotiations for the Minamata Convention on Mercury, meetings of the Stockholm Convention on persistent organic pollutants (POPs), and the United Nations Framework Convention on Climate Change (UNFCCC). She also represents ICC in the Arctic Council, such as the Arctic Monitoring and Assessment Programme (AMAP), and in the Sustaining Arctic Observing Networks (SAON). Since 2016, she has been working as a consultant on research and policy advice.

Issue in the Arctic: Climate change effects on Indigenous Peoples

It is important not to forget that there are people living in the Arctic and that they are at the forefront of changes. For example, diminishing sea ice restricts mobility and hunting activities, and thawing permafrost poses structural risks to buildings and infrastructures. Furthermore, climate change mobilizes contaminants within the Arctic environment and, due to their diet, Inuit are already amongst most highly exposed people to contaminants such as persistent organic pollutants and mercury. Resource development further increases the risk of contamination, and has social-cultural impacts. Climate warming and the resulting change moreover affects wildlife in terms of population, migration, ecologic changes, habitat change and health. With hunting still being a very important source of nutritious food for many Indigenous communities, there is a big impact on local food security. All these changes, which are happening over very short timescales, have significant socio-cultural and human health impacts.

Important considerations

Indigenous communities need to self-determine how they can adapt and deal with climate change; they must be regarded as rights holders rather than stakeholders. Research can have an impact on policies which affect Indigenous Peoples and the environment they live in and depend on. Indigenous Peoples should thus be involved in research projects from the earliest planning phases onwards and not only be consulted later as an afterthought. Improved engagement in research leads to a better understanding of local communities and their needs by researchers from outside and can assist in increased local capacity building. A positive example for Indigenous involvement is the partnership with the Canadian government in the Northern Contaminants Program. Arctic Indigenous Peoples organizations are an integral part of the management committee, which makes funding decisions, sets the research agenda, etc. Another positive example is the Arctic Council, in which Indigenous organizations have the status of Permanent Participants, and are represented alongside the eight Arctic countries.

Discussion and questions from the audience

Should the socio-economic impacts of activities conducted by lower latitude countries be taken into account when evaluating risks and opportunities? The Saami for example have a small population, but many developments affect the areas they live in, while the opportunities are mostly attractive to Southerners. It is important to keep in mind that the Sustainable Development Goals specifically also address indigenous peoples.

Volker Rachold: All opportunities and risks are associated: Where you have an opportunity, you have a risk. Germany has no rights in these areas, as it is not an Arctic country. The German industry is associated with economic development of the region, but puts a focus on sustainable development.

Karin Lochte: This is a global justice problem: the impacts of change or activities are often not felt by the actors. Often the small communities in the Arctic, or similarly, small island developing states (SIDS), feel the negative impacts, but not the benefits of the changes. It is therefore very important to create awareness about these issues.

Comment from the audience: Not doing something is often not an option, but then it should be done with prior-informed engagement. However, there is not one unified voice of the indigenous peoples, which adds difficulties. If we engage on the opportunity side, it should be possible to also set aside funds, which are market or education focused.

Kirsi Latola: There are four million people in the Arctic and not all of them are indigenous. All Arctic residents must be listened to on these issues.

Volker Rachold: Most issues affecting the Arctic are not caused in the high latitudes, yet the Arctic nations are the first to see the impacts. The Arctic Council members and the observers should take a strong and leading role in international climate negotiations.

Do we need more science or different science, which is more policy oriented and crossing more disciplines? Or should we aim for globally connected science? In the health sector, big global networks make fast progress on diseases for example.

Dirk Notz: There might be too much policy directed science, because it is easier to get funding for. However, we should keep in mind that we might be the last generation of scientists that can investigate sea ice that is more than one year old. This might change our understanding of how the Arctic works. In this regard, we would need more fundamental science.

Kirsi Latola: There is a need to communicate and promote science and to connect with the media. Scientists have to use a language that is understandable.

Frej Sorento Dichmann: Science is presenting results and recommendations, however, policy makers sometimes seem to make decisions based on gut feelings instead of on facts. The previous Greenlandic government, for example, focused on gaining independence, although a report from Danish and Greenlandic universities stated that it would take very long time before independence could be ensured.

Dirk Notz: For Arctic research it is easy to invoke emotions to get science heard.

Eva Kruemmel: Communication plays a critical role, also in involving people in local communities. They have specific research needs and hold very valid and important knowledge. Policies should not be based only on science but also on Indigenous knowledge.

Karin Lochte: Networking between policy and research communities is important in order to address the questions of relevance for society; but politicians have also to understand the importance of basic research. Global collaboration is needed in particular in standardized data collection, observations and infrastructure.

Comment from the audience: Some networks are in place between the EU, Canada and US, however, there is a big gap in collaboration with Russia.

Eva Kruemmel: Even in the Arctic Council (AC), Russian contributions to research are often lacking, although they are part of the AC.

Volker Rachold: There are many – maybe too many – science planning efforts and we are ending up with the same priorities. This is a point, where we need to be careful.

Kirsi Latola: Data from Russia is often published in Russian. Even in the Barents cooperation, which includes Finland, Norway and Russia, language poses a challenge.

Concern that newly accessible fossil fuels could deter politicians from being fully committed or even against climate change mitigation. What can be done to avoid this side effect?

Karin Lochte: The exploitation of resources is already happening. Industry and businesses, and politics are moving too fast for the science to keep up.

Dirk Notz: Perhaps it is futile to try and prevent exploitation in the Arctic, as there is so much money to be made.

Volker Rachold: We need to be realistic: the Arctic is the territory of Arctic states; they have the right to do what they want there. Not much that can be done except to educate people. The scientific community is united in its opposition to exploit the Arctic, but there is politics and money involved, which means scientists are not always listened to.