

Geoscientific Contributions for a Better Understanding of the Arctic System

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Report of an International Workshop



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The transformation of the Arctic due to climate change has wide-ranging impacts on the region's people and ecosystems, not least because of the increasing accessibility of a more and more open Arctic Ocean. This concerns specifically the wide Arctic continental shelves that are expected to contain thus far undiscovered oil and natural gas resources. Against this background, geosciences can provide policy makers and stakeholders with essential knowledge to better understand and consequently respond to the uncertainties inherent in Arctic change processes.

To highlight current and potential geoscientific contributions for a better understanding of the Arctic System, the Federal Institute for Geosciences and Natural Resources [BGR], the German Arctic Office at the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, GEOMAR Helmholtz Centre for Ocean Research Kiel, and the Institute for Advanced Sustainability Studies e.V. Potsdam organized a workshop at the BGR in Hannover on 31 January and 1 February 2018, generously funded by the German Science Foundation [DFG]. Leading experts from various geoscientific backgrounds provided key note talks on the changing environment in the Arctic, geological and climatic history, natural resources and exploration activities, impacts of hydrocarbon exploration and exploitation, and governance and the legal regime of the Arctic.

On day two of the workshop the participants, including senior and early career researchers from geosciences, environmental assessment, economics, political science and law, and humanities from Germany and abroad, formed three breakout groups to develop input for geoscientific contributions for a better understanding of the Arctic system. The groups focused on "Past, Present and Future of the Arctic", "Natural Resources: exploration and exploitation", and "Economic, legal and social risks and impacts". The results of the breakout groups will provide a roadmap for a white paper outlining concrete ideas how geosciences in interdisciplinary cooperation with other disciplines can contribute to cutting edge Arctic research efforts and science-policy-society interactions. Recipients of the white paper include among others the German Science Foundation and the International Arctic Science Committee [IASC].

Geoscientific knowledge and research interest in relation to the Arctic

Participants compiled a number of scientific topics that outline the current knowledge gaps in geoscientific research on the Arctic. Tackling these issues will significantly improve our understanding of the Arctic we see today and will see in the future. Among the identified topics are improved efforts to understand the full dimensions of climate variability from geological records as the current instrumental record is too short and anthropogenic influences and natural variability need to be separated. Further efforts are needed to enhance our process understanding through climate reconstructions and paleo-modelling, for example to enable models to reproduce modern sea ice decrease. Participants further highlighted the need to delve deeper into the geodynamic evolution of the Arctic in deep time, i.e. linking paleoenvironmental history and resources and reconstruct past climates in different ocean-continent configurations.

Achieving knowledge enhancements on these topics requires Arctic wide coverage of data and studies to improve our circumpolar understanding of climate variability, for example through wide-range drilling initiatives as well as observing systems that monitor ice and coastal zone dynamics. Also new, environmentally friendly low-impact remote sensing methods have to be applied to study mineral resources and its distributions.

Building on existing and future research efforts, geoscientists could more strongly highlight the societal services that geosciences could provide and that are relevant for legal, political, and economic processes and decision-making alike. These range from services in relation to resource characterization, including mapping, resource assessment, feasibility studies, and exploration models of mineral and energy resources as well as water, soil, and aggregates.

With solid knowledge about resource characteristics, geosciences can further contribute to resource management and the related regulatory framework through controlled resource assessment, identification of usage conflicts, design of effective monitoring systems, and research on full cycle management. This, in turn, can feed into decision-making and information processes on various scales, ranging from northern communities to regional and national policy-makers as well as industry and the general public.

All these are important pieces in the overall task of responsible resource development to which geosciences can provide a significant contribution, including adaptation strategies to geo-hazards with impacts on health and infrastructure, damage control, and improvement of living conditions in the north. This, in turn, feeds back into resource characterization in the sense of assigning resources and their (non)development a role for societal development and/or protection.

Knowledge transfer for geoscientific services

In order to develop and promote concepts to transfer geoscientific knowledge, it is essential to firstly engage more strongly in interdisciplinary communication and collaboration activities, for example with experts from legal, economic, political science, and anthropology backgrounds. This will reveal exciting new research fields. Examples for interdisciplinary topics in this regard are the clarification of legal concepts that are based on geological understandings, for example in relation to the United Nations Convention on the Law of the Sea, or studies on the possible political consequences of geoscientific data acquisition and interpretation. Second, knowledge transfer for geoscientific services has to be discussed with decision-makers and Arctic communities in order to ensure the right fit between societal and scientific questions and answers.

Joint interdisciplinary strategies of researchers from geosciences, environmental assessment, economics, political science and law, and humanities have to be established to find modern concepts of sustainable development to manage upcoming challenges related to the impact of climate change in the Arctic. The strategies will initiate an iterative interaction process between science, communities, and policy all through the research process. Such initiatives need to be accompanied by efforts to acquire the necessary research funding for science-policy-society engagement as well as by a new measurement of scientific output in the sense of acknowledgement of publicly relevant contributions. To ensure the cutting-edge characteristic of such research efforts and according services, early career researchers, indigenous and traditional knowledge as well as international collaborations between Arctic and non-Arctic research organizations should be encouraged.



40 scientists from Canada, Denmark, Germany, Norway, Russia, The Netherlands, and USA participated in the workshop “Geoscientific Contributions for a better understanding of the Arctic System” funded by the DFG. [Photo: Federal Institute for Geosciences and Natural Resources]

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