SPRINGER BRIEFS IN EARTH SYSTEM SCIENCES

Gesche Krause *Editor*

Building Bridges at the Science-Stakeholder Interface

Towards Knowledge Exchange in Earth System Science

Springer

SpringerBriefs in Earth System Sciences

More information about this series at http://www.springer.com/series/10032

Gesche Krause
Editor

Building Bridges at the Science-Stakeholder Interface

Towards Knowledge Exchange in Earth System Science

Springer

Editor
Gesche Krause
Earth System Knowledge Platform (ESKP)
Alfred Wegener Institute Helmholtz Centre
for Polar and Marine Research
Bremerhaven
Germany

ISSN 2191-589X ISSN 2191-5903 (electronic)
SpringerBriefs in Earth System Sciences
ISBN 978-3-319-75918-0 ISBN 978-3-319-75919-7 (eBook)
https://doi.org/10.1007/978-3-319-75919-7

Library of Congress Control Number: 2018932518

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Foreword

The role of societal relevance of Earth system science at the onset of the Anthropocene

Global change presents an enormous challenge for the future stability of societies and also for the work of science. In this respect, important tasks for science are the assessment of potential risks and discussions with stakeholders on how to mitigate, avoid or respond to negative developments. Hence, it requires a change of scientific approaches in many ways. This does not imply that all of science has to serve in a direct manner to societal needs, but that an increasing awareness and contribution to the challenges of the Anthropocene are necessary.

What does this mean for Earth system science? First of all, it means that there needs to be a more intense exchange with different actors of society. Relevant issues have to be defined both from the side of the society and from science, and by this interaction, the research should reflect a joint approach. Earth system research questions cannot be resolved by natural science alone, but require close collaboration with other fields, such as social sciences, law, politics, economics, technology and many others. Finally, effective communication of scientific knowledge to stakeholders is essential to raise awareness, establish meaningful dialogues and develop solutions. Scientists recognize this need of communication, but despite many efforts it is still felt to be insufficient.

This book gives an overview of different activities of the Earth System Knowledge Platform (ESKP) at the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research to enhance knowledge transfer and dialogues with various societal actors. It spans data products and modelling with relevance for society, as well as different forms of exchange with stakeholders. It shows how natural science research is making an effort to address societal challenges in Earth system science. I hope that these examples stimulate many people from science and society to expand and to develop new approaches to societal relevant research, to knowledge transfer activities, and to improve scientific advice in the Anthropocene.

Karin Lochte

Acknowledgements

First, we gratefully acknowledge the funding from the Helmholtz Association Portfolio Topic ESKP, which has acted as the central pillar and driver for moving towards explorative knowledge transfer processes.

The staff in the ESKP Coordination Office at the Helmholtz Centre Potsdam (GFZ), German Research Centre for Geosciences, is thanked for their commitment to the development of an overarching platform under which the knowledge of all HGF Institutes in the Research Field Earth and Environment are collated. Our collaborators at the other research centres, at the German Aerospace Centre (DLR), at the Research Centre Jülich (FZJ), at the GEOMAR Helmholtz Centre for Ocean Research Kiel, at the Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research (HZG), at the Karlsruhe Institute of Technology (KIT) and at the Helmholtz-Centre for Environmental Research (UFZ) are thanked for fruitful engagements and a very collegial working atmosphere.

Without the willingness of our various stakeholders to embark on this journey with us, the topics and successive research efforts would not have taken place to this extent. There have been numerous exchanges, ranging from fisherfolk along the North Sea coast, multiple authorities and governmental institutions, NGOs as well as private sector representatives, to name but a few. Without their curiosity, energy and motivation to share their knowledge and perspectives outside their direct realm of everyday work, knowledge dialogues between science and society would not be possible.

On a more personal note, this book would not have been possible without the tremendous support of all colleagues of the Alfred Wegener Institute (AWI), but also by the various stakeholders that all have supported in one way or another, our effort to bridge science and society in the meaningful exchange and transfer of knowledge.

We take this opportunity to also acknowledge the support and involvement of some people very central to this initiative. First and foremost we thank the former director of the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI), Prof. Dr. Karin Lochte, for her wonderful continuous support and

trust in our knowledge transfer efforts! Without her positive and supportive attitude, utilizing the available funding to conduct exploratory projects on knowledge transfer in this somewhat unique way would not have been possible. We acknowledge also the continuation of this positive support by the AWI's new director, Prof. Dr. Antje Boetius, and we look forward to her ongoing engagement with this initiative.

Warm thanks also go out to Dr. Heike Wolke and Dr. Karsten Wurr, the former and current administrative directors of the Alfred Wegener Institute for their ongoing support and for making the rather unusual project setups possible. In this regard, also a special "thank you" to Carlo Ungermann and Astrid Feuster from the finances division who supported us with always good spirits and a cheerful smile whilst tackling the everyday handling and challenges of the ESKP@AWI projects. Dr. Angelika Dummermuth is thanked for her willingness to readily share her expertise and insights into the particularities of Helmholtz administration whenever it was needed.

Prof. Dr. Thomas Jung is greatly acknowledged twofold for his support—first, in his role of being the head of the Climate Dynamics section and his openness to link ESKP@AWI to his research team, but also secondly, and more importantly, providing his continuous support as responsible spokesperson for the research programme PACES II (Polar Regions and Coasts in the Changing Earth System) of the AWI.

We record also our appreciation for conversations with Stefanie Klebe, whose thoughtful and creative insights into knowledge transfer were especially valuable. Without these discussions, a lot of activities of ESKP@AWI would not have moved forward in this way. This also holds true for Maximilian Schupp, whose ideas and efforts in addressing the issue of how to capture knowledge transfer are gratefully acknowledged.

Dr. Annette Breckwoldt is wholeheartedly thanked for her great efforts in pulling the necessary strings to finalize this book and being a great reviewer to all of the chapter contributions. Without her energy and mindful comments, this book would not present itself in this state. Paul Waite is thanked for his swift and thoughtful revisions of several chapter contributions of this book to "tidy" the language.

Last but certainly not least, we gratefully acknowledge the courage of our fellow researchers at the AWI, who were willing to embark on untested knowledge transfer waters! Without their trust, courage, curiosity and collegiality, our work and this book would not have been possible!

Contents

Part I
Setting the Scene

The Anthropocene—What Does It Entail for Science?

Gesche Krause

1 Introduction

Science permeates almost every aspect of modern life, sometimes in obvious and sometimes less obvious ways. Societies largely trust and expect science to inform debate, advance the standard of living and solve problems as they emerge. The Paris Climate Agreement (UN 2016) is an epitome of this *Zeitgeist* as policy makers, distinguished members acting as an extension of society, demonstrated their trust in the consensus of the scientific community and shaped future policies to tackle the predicted effects of climate change accordingly.

Humans interact with their environment in manifold ways; changing it and in turn, are themselves changed by it. However, these human-nature relationships are increasingly becoming more complex. This is reflected in the emergence of the term "Anthropocene" (Crutzen 2002), which has seen ever-increasing attention since the beginning of the new millennium. While the term is most often used in the realm of geology to discuss human impact on the Earth's geology and ecosystems, there is now a growing breadth in the discourse within Earth System Sciences (IGBP 2015). For the latter, focus has shifted away from the rather stringent search for criteria that distinguish the various geological epochs of the Earth's history, towards the identification of changes in the earth system, as voiced through the 'planetary boundary' discourse (Hamilton et al. 2015; Görg 2016). Taking account of the planetary-level thresholds, beyond which mainly anthropogenic environmental change endangers the "safe operating space" for humanity (Rockström et al. 2009), several biophysical components of the Earth System have reached a point of transition beyond threshold levels. Changes in climate, hydrological cycles, food systems, sea level, biodiversity, ecosystem services and other factors depend on the

G. Krause (✉)
Earth System Knowledge Platform (ESKP), Alfred Wegener Institute
Helmholtz Centre for Polar and Marine Science, Bremerhaven, Germany
e-mail: gesche.krause@awi.de

G. Krause (ed.), *Building Bridges at the Science-Stakeholder Interface*, SpringerBriefs in Earth System Sciences, https://doi.org/10.1007/978-3-319-75919-7_1

sensitivities of different components of the system. So far, these component changes are vastly outpacing our response capacities to mitigate drivers of global change. Furthermore, the "Anthropocene"entails a political aim: to motivate action and foster new efforts to combat climate change.

From a scientific standpoint, the "Anthropocene" discourse thus highlights the emerging agreement that current societal challenges require new ways of knowledge production and decision-making. One key aspect of science, therefore, is the involvement of actors from outside academia into the research process (i.e., transdisciplinary research), in order to integrate the best available knowledge, reconcile values and preferences, as well as to create ownership of problems and solution options (Lang et al. 2012).

Indeed, the growing interdependence of nature and society is a historical *fait accompli,* and conclusions about e.g., interdisciplinary and applied social-ecological research are drawn on this basis (Glaeser et al. 2009). That said, over the course of time, the formats of science-policy-public communication have undergone massive transformations. In the 1980s, communication was determined by "Public Understanding of Sciences" (PUS), by which emphasis was placed on advertisement for science among young academics as well as promoting a higher acceptance for science and technology at large. The basic assumption was that by improved education and information, the acceptance of science (predominately of natural sciences) would automatically increase. Over the course of time, this somewhat paternalistic view has proven wrong: better knowledge does not readily lead to better acceptance (Amel et al. 2017). This has resulted in a remarkable shift to a more two-way dialogue format between the academic knowledge realms of science and other knowledge realms of various stakeholders from the private and public sectors. The current efforts towards co-framing science present a case in point.

These widespread efforts are however, still in nascent stages in the sense of how relevant processes at this interface can be captured and evaluated. Thus the efforts of research on the necessary criteria and indicators of good (i.e. successful) knowledge exchange can be viewed as a first step toward a meaningful engagement between the different realms of knowledge. These efforts follow the plea of the ground-breaking article on sustainability science by Kates et al. (2001), which states that "participatory procedures involving scientists, stakeholders, advocates, active citizens, and users of knowledge are critically needed" (p. 641). Key arguments for this new type of research collaboration are that today's societal challenges require the constructive input from various communities of knowledge to ensure that all knowledge essentially related to the problem is incorporated. Additionally, research on solution options requires knowledge production beyond problem analysis, as goals, norms, and visions need to provide guidance for transition and intervention strategies. Fostering collaborative efforts between and among researchers and non-academic stakeholders alike promises to increase legitimacy, ownership, and accountability for the specific challenges, as well as for the solution options (Funtowicz and Ravetz 1993; Hirsch Hadorn et al. 2006; Lang et al. 2012).