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Editorial

Research on Climate Change and Its Impacts Needs Freedom of Research

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1. Background

Climate change captured my interest as a teenager when, at the dining table, my dad talked about potential anthropogenic climate changes. He brought up subjects such as "climate could change if the Siberian Rivers were to be deviated to the South for irrigation of the (semi) arid areas of the former Soviet Union". Other subjects were afforestation in the Sahel to enhance precipitation recycling, deforestation in the Tropics that could have worldwide impacts on climate, the local climate impacts of the Merowe High Dam in its vicinity and downstream, Atlantropa, a new ice age, and the increase in days with sunshine after the introduction of the high-chimney policy in the Rhein-Ruhr area, just to mention a few.

Various investigations from different, independent researchers showed evidence for climate change at various spatial and temporal scales. The causes of climate change are manifold. They range from astronomical changes, changes in the distribution of continents including mountain ranges and heights, volcanic eruptions, evolution of the biosphere, to anthropogenic impacts, among many others. Anthropogenic impacts encompass, but are not limited to, emission of greenhouse gases (e.g., water vapor, carbon dioxide, methane, nitrous oxide, ozone) as well as trace gases that are precursors for aerosols, land-cover changes for food production, grazing, hunting, wood harvesting, housing, recreation, water storage, and transportation, as well as openpit mining, oil and gas drilling. Even emission-control measures, to protect human health, may impact the local, and potentially regional, climate as aerosol-precursor concentrations, and particle concentrations and their composition may

change. Teleconnections can propagate regional change signals to areas far downwind of the initial changes. This means climate change needs no passport or visa to enter another country. We are all in it together.

A habitable, reachable planet is hard to find. Thus, just the idea that the activity of humankind may impact the climate of our "spaceship" Earth can be frightening, even terrifying, and may cause stress. As with handling any other stress, it is important to stay cool. Doing so enables researchers to gather the facts (knowledge, data), think, build hypotheses and test them, identify gaps in the knowledge, think about what data one would need to close these gaps, build new hypotheses, gather further data and/or develop and improve models to test the hypotheses, and so on. Scientific data-based knowledge is critical for understanding natural and anthropogenic impacts on climate, feedback mechanisms between various processes and components of the Earth system, sensitivities, uncertainties, and the magnitude of various natural and anthropogenic impacts. Such understanding and knowledge are urgent needs for cost-effective and ethical decisions for all living beings on Earth, and a growing world population with its growing water, food, and energy demands.

Being aware that climate change has always happened, humankind cannot afford to split into groups that are not willing and/or even not able to talk to each other. Humankind cannot afford that their scientists waste their time on being captivated by interest groups, and petty discussions for/about funding, and lose the freedom of research.

Scientific debate is fruitful, necessary and will always exist. Recall when physicists disputed about the wave and particle structure of electro-magnetic waves, or the validity of the general theory of relativity. In the end, it turned out both times that both arguments were right. The discrepancies were due to the experimental design and the point they were coming from.

Most likely climate science is at the dawn of something similarly exciting. In the interest of freedom of research and progress in climate research, we should not ask to which group a scientist and/or his/her research "belongs". Instead, we, as the climate science community, have to ask questions like: Why do we get results that have to be interpreted in one or the other way? Did we, by accident, capture a special case such as mechanics within the relativity theory? Are we overlooking something? What impacts have closing/installing of observational sites and improved measurements for knowledge about the climates of the globe? Can we demonstrate that Earth system models, climate models or even very simple models are able to capture past observations? Which opportunities have we overlooked and tools do we have available that could advance climate research? For instance, a great, often overlooked, capability of models is that they can be used to learn/examine what is important when, and where.

If the same hypothesis is once rejected based on a dataset used, and once accepted based on another dataset, the logical next step is to compare the two datasets, and to investigate the reasons. Is one or are both datasets biased and/or contaminated by changes in the instrumentation, the measurement protocol, or in the environment other than climate change? What different information do the two datasets hold that led to the different answers? Can we find other data to figure out whether we are dealing with a special case? Are we overlooking a process that only becomes important under certain circumstances? Are we facing something similar to the UV-catastrophe in the Rayleigh-Jeans law? *Climate* wants to be a forum to stimulate such questions, ideas, and discussions.

2. *Climate's* Goal

The goal of *Climate* is to follow where good science leads, regardless of the conclusions that have to be drawn from that science, *i.e.*, to apply the principles of freedom of research to advance climate research. As in any other science, climate science only progresses through discussion, and the shared search for the relevant mechanisms/truth. Science is discussion and testing of hypotheses, trying to prove a hypothesis as right or wrong. Thus, *Climate* and I, as *Climate*'s Editor-in-Chief (EIC), embrace professional scientific discussions that are based on data, no matter whether the data stem from direct or indirect observations, remote sensing, modeling, or were derived from sources like ice-cores or sediments.

3. Strategic Plan: Holding on to Freedom in Research

Unfortunately, some interest groups may be fixated on outcomes, and may be even willing to abuse the scientific process to produce the desired outcome and/or suppress an undesired outcome. Their influence in, and impact on, society at-large goes far beyond what is obvious on first view. Editors and reviewers need to be on their guard, to prevent manipulation of the scientific process.

Scientific freedom requires that researchers can pick their research interest. This means they have the intellectual freedom to choose an aspect of the complex climate system and just investigate that aspect's role for another aspect of the climate system, or in the climate system, or on another system. This freedom, however, comes with the responsibility of the researcher to apply the best science and data available. When challenging the current status quo of theory/interpretation, the new theory/interpretation also must account for the differences, and must also be applicable to what has been proven to be correct based on scientific data.

To guarantee freedom in research, it is essential to have editors and reviewers, who are committed to freedom in research. Thus, they must be willing to accept a paper even if they disagree with the results/conclusions from the bottom of their hearts. A paper can be published as long as:

- the science presented in the paper is original;
- the hypothesis is clearly stated and tested with appropriate methods/experimental design and accepted or rejected based on the data;
- the results are derived correctly, based on the most recent and complete data of that kind available;
- the applied method is suitable and correctly used for the task at hand;
- the assumptions are specified, and reasonable/valid for the conditions under investigation, and their limitations for the validity and interpretation of the results are clearly indicated;
- the conclusions are backed up by data/analyses; and
- the research is described in such clarity that the results can be reproduced.

I am committed to the freedom of research and hence willing to do this and have always handled the editorial and review processes this way.

Every editor, reviewer, or reader has to evaluate whether the stream of argumentation is valid in conjunction with the method performed, under the assumptions made, and using the most complete data that exists. When further data becomes available, scientists have to look at them. They will have

to examine whether the extended dataset still validates their prior conclusions and/or whether the conclusions/theory have to be revised/extended based on the additional data. Doing so is an original piece of work even though the author(s) have done similar work before. It is part of the science process.

Editors, editorial board members (EBMs), reviewers, and readers should always be aware that any article they read is based on the investigations the author(s) made. Every paper only looks at a small aspect of the very complex climate system that we are far away from understanding in its full complexity and impacts. They also should be aware that the conclusions presented in an article are the conclusions of the author(s). These conclusions are based on the (limited) data and the processes the authors have looked at under the assumptions that they made. Their discussion and conclusions are in no way the opinion of the publisher, reviewers, handling editor, editorial board members or editor-in-chief.

To ensure freedom in research, we need qualified reviewers for the review process. Benevolent or unqualified reviewers may do more damage to the sanctity of the peer-review process than benefit science/author(s). Reviewers serve to examine the bullet points listed above. Reviewers should be well aware that they are anonymous to the author(s) of the paper and the readers of *Climate*, but not to the editors, and hopefully act accordingly and provide thorough, professional high quality reviews. Excellent reviewers give the author(s) fruitful, constructive comments, and suggestions that improve the paper, strengthen the argumentation, and remove weak points if there are some that are fixable. The reviewers also give their assessment and recommendations to the editor, *i.e.*, what the reviewer expects to be the outcome when the author(s) address the points/revise the paper. Once the reviews are in, the handling editor checks whether the comments of the reviewers are justified, which involves reading the paper again. Based on the quality and fairness of the reviews, the editor decides how to proceed.

Everybody will agree that reviews that are hostile, or say just "reject", or "great paper, can be published as is" without giving reasons for rejection or acceptance, respectively, are futile. In such cases, it is required to request a quality professional review. Contradictory reviews (1 reject, 1 minor revision) require an additional review, too. If the revisions are called "major", but are actually minor, and the other reviewer says "reject" and the arguments for rejection are weak, lacking, or do not apply at all, an additional review needs to be requested.

Once the author(s) send the revised version, the reviewers and editor check that the revisions were done in an appropriate manner. Doing so involves reading the revised paper. It is the right (and custom) of any (managing) editor to accept a paper when it is positively reviewed, and revised according to the reviewers' suggestions and comments. Under the right of freedom of research, every editor has to do so even when they dislike the outcome of the research.

When a paper is submitted to *Climate,* one of the editors does a first screening to decide whether or not the paper fits into the journal's scope, is of interest for the audience of *Climate*, and is scientifically sound, no matter whether or not the editor shares the view/opinion of the author(s). MDPI's managing editors and/or their editorial assistants recruit the reviewers. This policy ensures that *Climate* is a forum for all climate researchers, who generate hypotheses and data-driven research on climate. The intention of *Climate* is to be a forum to stimulate, contribute to, and foster fruitful scientific discussions of all aspects of climate to push climate science forward.

In my experience so far, MDPI operates a rigorous peer-review process together with strict ethical policies and standards (for details on the ethics policies and review process see http://www.mdpi.com/journal/climate/instructions). Like all journals of MDPI, *Climate* is a member of the Committee on Publication Ethics (COPE). I embrace MDPI's policies and stand fully behind them. I have disclosed my conflicts of interests to MDPI, and do not handle papers where I see a potential conflict of interest.

4. Conclusions

For fast progress in science, there is an urgent need to respect and apply principles of freedom in research. Climate scientists have to work together for a better climate in climate research by following other scientists' research, not to pull them down, but to understand from what point of view they are coming from. Probably everyone, who conducted their research responsibly, holds a piece of the climate mosaic in their paper. When we are also open to look at other arguments, we might broaden our field of view. It may help us grasp the big picture faster than progress would be possible if we just look in one direction.

I am looking forward to everybody's contributions to progress in climate research, to gain better understanding of the Earth's climate system, and to the publication of these results in *Climate*. The fact that you read this editorial identifies you already as someone who really cares about freedom of research and climate, and as someone who is interested in solving the climate issues, rather than in politics and opposing others' opinions.

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