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The Challenge of Climate Change for Security

Helga Kromp-Kolb

Climate Change creates significant challenges to security that cannot be met with military means. Uncertain though worst-case scenarios must be, they cannot be excluded and must be prepared for. The international trust needed can only be developed if present wars – declared or not – are ended. It is in the DNA of the OSCE to provide a platform for exchange in difficult times to strengthen co-operation to address the challenges caused by climate change.

What is certain knowledge?

Empirical science

Climate science comprises natural sciences, social sciences and cultural sciences. This article focuses on the natural sciences, i.e. the processes in the atmosphere and their interactions with other spheres, such as the hydrosphere, the cryosphere, the lithosphere and the biosphere. Climate science in the narrower sense is an empirical science and relies on measurements and observations. There can be certainty regarding these, but climate science can never, strictly speaking, provide proof for the causes of natural processes. The theory that global warming is caused by increasing GHG concentrations in the atmosphere is, however, sufficiently tested to rely on, and it definitely explains more observations than any other theory of climate change.

Even though, for practical purposes, the basic hypothesis is not in question, there are many aspects that are less well established and require further research. The Intergovernmental Panel on Climate Change (Mastandrea et al., 2010) has developed a matrix by which uncertainties are rated: Data availability and reliability and the agreement between different explanations for the data are each rated as low, medium or high. When both are high, the results are considered robust and political or economic decisions can be based on them. If both are low, scientific understanding is uncertain and more data gathering, and research are needed. It is essential to emphasize that it is not a question of the number of scientists or the standing of those supporting an explanation, it is the congruity of the explanations that matters.

Present understanding

Global warming, or global heating, as some prefer to call it, has reached a level of +1.2°C compared to pre-industrial levels on the global average. In preparation for the COP21 in Paris, there was a scientific and political consensus that 2°C above pre-industrial levels was the utmost warming acceptable in view of the temperature range experienced during the Holocene (the last 10.000 years), as well as in view of the consequences expected for the global food supply and for extreme weather events. The pledge to make efforts to limit global warming to +1.5°C in addition to keeping warming to "well below" those +2°C in the Paris Agreement was due to political pressure made primarily by the Small Island States. As there was little scientific basis for 1.5°C, the IPCC was asked to clarify whether 0.5°C less warming justifies the associated significant political and economic challenges. What does +1.5°C mean for the climate, for the GHG budget and for the measures that would need to be taken?

To answer these questions, scientific publications over the next few years focussed on scenarios with small temperature increases. The results were surprising, and the IPCC report (IPCC, 2018) concluded that every tenth of a degree of warming matters. For example, at +2°C, 2 billion people would be affected by extreme heat waves at least once every 20 years, while at +1.5°C only 700 million would be affected. At +2°C about 21% of the land area would be subjected to flooding along rivers, at +1.5°C only about 11%; the North Pole would become ice-free in 3 to 5 years at the end of summer in one case, in 40 years in the other. So, the difference between 2°C and 1.5°C is huge in terms of effects.

Many climate elements, as well as parts of the biosphere, respond at even smaller temperature increases than scientists previously expected. Since the effects typically grow exponentially rather than linearly, even small temperature differences or minor misjudgements can have far-reaching consequences.

Current policies lead to a temperature increase of about 2.8°C by the end of the century. Implementing current national pledges will only reduce this rise to 2.6°C for unconditional pledges or 2.4°C for conditional pledges. However, mitigation thus so far has stayed well behind the commitments made

in Paris (UNEP, 2022). Therefore, scientists started looking more closely at what +3°C, +4°C or more warming would mean for the climate and what consequences such warming would have. This will be discussed later.

The farther scenarios move beyond the empirical evidence, the higher the uncertainties involved. These are partly due to ignorance, that is incomplete understanding of the systems, partly due to insufficient data or bad quality data, and partly to issues not yet regarded (the unknown unknowns). Besides there are also those surprises always inherent in complex systems as well as unpredictable, voluntary human decisions.

On the whole, models do very well regarding large-scale average temperatures, but there is less reliability in other parameters. No single-year forecasts can be made, but long-term trends are robust. Regarding extreme events, only statistical probabilities can be inferred.

The relation between global warming and cumulative CO_2-emissions since pre-industrial levels is linear and can be used to derive the amount of emissions that would lead to +1.5°C warming. Subtracting the emissions already made defines the CO_2-budget still available. Due to the uncertainties involved, calculations can be made for different probabilities of reaching the Paris goals. On the global scale 1.5°C could be achieved with 50% probability if 500 Mt of CO_2 were not exceeded, starting 2020. This implies that emissions would have to be reduced by 50% by 2030 and reach net zero by 2050. This enormous challenge cannot be met by purely technological means, it requires transforming the economic and financial systems and developing a new understanding of mankind's relationship to nature.

Budgets for individual countries are typically calculated based on their population, although other metrics are also being discussed. For Austria, the budget at the beginning of 2022 was calculated to be 430 Mt CO_2 if Austria is to contribute its share to reaching the 1.5°C goal with a 50% probability, and 240 Mt CO_2 if the goal is to be reached with 66% probability (Climate Change Centre Austria [CCCA] et al., 2022). At present CO_2 emission rates these budgets would be exhausted by the end of 2025 or 2027 respectively.

What range of developments?

Quality of past climate projections

Before entering into the scenario calculations of the climate models, just a brief reflection on the quality of past projections. As mentioned above, real developments were always found to be within the range of the calculated projections. However, changes in temperature or sea level rise tended to be near the top of the range of calculated changes; model calculations thus definitely tend to underestimate developments. It also means that developments considered more unlikely than such located in the centre of the range, tend to materialize.

This would be of lesser consequence, would not impacts typically increase exponentially with climatic change. One degree warming at 15°C is of a much lesser effect than 1 degree warming at 20°C. This non-linear growth of impacts leads to gross underestimation of risks if defined as the likelihood of occurrence multiplied by impact. Low likelihood and high-impact developments cause the highest risk. Focussing on the temperature increases considered more likely and on those considered desirable might therefore mean that risks due to climate change are grossly underrated.

Climate stabilised at 1.5°C

In the best of cases, the Paris goal is achieved, and climate will stabilise at +1.5°C above pre-industrial levels. Even in this case, the climate would be quite different from the present climate. Maximum temperatures would be 3 to 4°C higher in Europe, and present-day extremes would be normal temperatures. Summers like the heat summer of 2003 would occur every 2-3 years, and on a global level, about 700 million people would live under heat stress. Some cities would not be inhabitable for parts of the year. In central Europe 2.6 months of drought per year are to be expected, in the Mediterranean area even 3.7 months. In northern Europe, 500-year floods could occur every 100 years and globally 70-90% of all coral reefs would be endangered. Sea level would rise by an average of 4 mm/a. In spite of these substantial changes, humanity can adapt to a stabilized climate at +1.5°C – although the Global South would need support (IPCC, 2023).

Self-reinforcing processes and tipping points

In the worst case, self-reinforcing processes and tipping points built into the climate system will not allow stabilization. A simple example of a self-reinforcing loop in the climate system is the increasing evaporation from the oceans as a result of warming. The water vapour introduced into the atmosphere acts as a greenhouse gas and increases warming, which in turn increases evaporation, and so forth. Fortunately, there are also stabilising feedback processes (negative feedback) in the climate system: More moisture in the atmosphere not only increases the greenhouse effect but also facilitates cloud formation. Clouds can reflect the sun's rays and thus contribute to cooling. Because less water evaporates as a result, the greenhouse effect decreases, it becomes cooler and less water evaporates, there are fewer clouds, radiation increases, and the cycle begins again. In total, scientists have identified 41 such feedback processes, 27 of which lead to a gradual or rapid worsening of climate change, while seven stabilise the climate and for the remaining seven it is not entirely clear how they behave (Ripple et al., 2023).

There are also limits in the climate system beyond which a return to the previous state is not possible. Just as snow becomes warmer and warmer as temperatures rise, but melts when the zero-degree limit is exceeded, there are other tipping points in nature that - once exceeded - can no longer be reversed. If temperatures fall below zero again after the snow has melted, the thawed water will turn into ice, but not back into snow. Self-reinforcing processes in the climate system make the crossing of climatic tipping points more likely.

In view of steadily rising GHG emissions over the past few years scientific publications have focussed on tipping points and the consequences of passing them. (Lenton et al., 2023; Kemp et al., 2022; Armstrong McKay et al., 2022; Sharpe & Lenton, 2021; Xu et al., 2020; Lenton et al., 2019; Steffen et al., 2018) Present understanding has identified about 16 neuralgic systems that control the Earths entire climate system. These include, for example, the position and intensity of the Gulf Stream as an engine of the global ocean circulation, the Amazon Forest as an important reservoir of moisture, the monsoon system, and ice sheets at the South and North Poles, including Greenland. Four of these may pass their tipping point at less than 1.5°C warming: the West Antarctic Ice Sheet, the Greenland glaciers, the boreal

forests of the Northern Hemisphere and the coral reefs of the Australian South Pacific. Some tipping points may already have been passed, while we are approaching others threateningly.

Tipping points can reinforce each other. Rockström summed this up in a succinct presentation at the World Economic Forum 2023 with the best-researched example:

> "Accelerated melting of the Greenland ice sheet, due to a warming that is four times faster than the planet as a whole; cold fresh water is released into the North Atlantic, slowing the overturning ocean circulation and thus shifting the entire monsoon system further south. This triggers droughts and forest fires in the Amazon rainforest (another tipping element of the system). Warm surface water retained in the Southern Ocean accelerates the melting of the West Antarctic ice sheet. The North Pole is linked to the South Pole in regulating the stability of the entire Earth system."

This chain of events would mean that Europe becomes significantly colder, drier and stormier, precipitation patterns shift southward, fertile areas dry out, sea levels rise regionally, oxygen supply to the deep ocean stops, affecting parts of the marine ecosystem, and the ocean absorbs less CO_2. Recent studies based on different methods and data types, move the tipping point of the Atlantic circulation forward in time, even into the first half of this century (Rahmstorf et al., 2015; Ditlevsen & Ditlevsen, 2023) Further warming will increase the probability of reaching and exceeding the tipping point.

Hothouse Earth

The long-term development of the Earth's climate system reveals that the Earth, for much of its existence, was much warmer than it is today. Over the last about 800,000 years, a comparatively cold period in the life of the Earth, there has been an oscillation between two semi-stable conditions, a warmer and a cold state (ice ages), one cycle taking roughly 100,000 years. The triggering mechanism for the change from the warm to the cold state and vice versa was the pulsation of the elliptic trajectory of the Earth around the sun. The present warming caused by increasing GHG concentrations, is about to move the Earth's climate out of this temperature range. As paleo records do not show another semi-stable state beyond about 1.5°C this could set it on a path of continuous warming, called hothouse Earth.

If this possibility is taken into account, then the decision humanity now faces, is to either stabilise the climate at 1.5°C or to accept constant heating. As a warming of +1.5°C will be exceeded in the early 2030s - if stabilization is to be achieved, measures are needed that will take effect in this decade. It is this urgency that makes the climate issue so special. Even though these considerations are not based on sound scientific evidence, exceeding these tipping points is "too risky to bet against" (Lenton et al., 2019, p.592). The biodiversity issue is possibly similarly urgent, but it is less well understood and not the subject of this text, although climate change and biodiversity loss are closely interrelated.

Security policy implications

Climate crisis is a societal and a political crisis

Independent of the validity of the hothouse Earth hypothesis, unabated climate change will have serious societal consequences. It is often overlooked that the consequences of climate change are by no means limited to the climate but have considerable impacts on society. The gap between rich and poor will widen, as global warming has economic consequences, mainly, but not only, for the poor. This is true for countries as well as individuals. Many countries find themselves in a climate trap – whatever progress in well-being is made is periodically destroyed by severe climate events, such as tropical storms, floods and heat waves, devastating infrastructure, agricultural produce and land, as well as making people homeless. The struggle for resources – water, fertile land, space to live, … – will increase, and water shortage, food shortage, and sea level rise will lead to mass migration. Attempts of segregation by the "haves" are a breeding ground for terrorism and raise the potential for war (Schwartz & Randall, 2003; Welzer, 2008). This in turn can lead to political instability, food and resource shortages aside from biodiversity loss and loss of ecosystem services (Kemp et al., 2022). These and other processes involved are part of reinforcing loops that exacerbate the issues.

Implementing the international agreement to stabilize the climate critically depends on getting binding commitments from the global south because present and even more so future emissions will be mainly caused by the global south due to its growing population and the rise of a middle class with higher demands on infrastructure and the amenities of life. However, alt-

hough the global south is most strongly affected by climate change, this commitment depends on concessions and financial support by the global north, as there is no doubt that the industrialized nations have caused a substantial part of man-made climate change. So far, the global north has not supported the global south to the promised extent – the global climate fund e.g. is not filled as foreseen by the Paris Agreement. During COP27, after prolonged negotiations, a fund was set up to compensate for losses and damages in the global south, but no decisions were taken on how it should be filled, or which costs would be eligible for compensation under what terms. While science has made great progress in recent years in attribution science (van Oldenborgh et al., 2021), a quantification of the share of climate change in damages caused by extreme events remains problematic in most cases.

Even though the climate issue certainly has a north-south component, it should not be overlooked, that the interests of the fossil and nuclear industries play a significant, if not the dominant role in climate politics. Thus, alliances among countries – north and south – with resources such as coal, oil or gas are not uncommon. And although it is quite clear that the Paris goals cannot be met while coal, oil and gas are being extracted and burned, the final documents of the COPs have only addressed limiting coal extraction.

As US climate activist Bill McKibben (2022) notes:

> "Justice makes progress only through politics. Balancing the world's wealth even a little is the most difficult of all political tasks. But our chances for a liveable world may depend on it." (para.12).

The climate crisis is not the only crisis

The scientists that moved the doomsday clock to 90 sec before midnight in January 2023 remarked that "we live in a time of unprecedented danger, and the Doomsday Clock reflects this reality". The main risks referred to are the risk of nuclear war, heightened by the war in Ukraine, the unabated climate crisis and the collapse of global norms and institutions needed to mitigate risks associated with disruptive technologies and biological threats. Policymakers are not acting fast enough or on a sufficient scale to secure a peaceful and livable planet. "We know what needs to be done, the scientific evidence is clear, but the political will is lacking."

Aside from these crises addressed by the doomsday clock there are other unresolved crises, such as the biodiversity crisis, the refugee crisis, the economic crises following the financial and corona crisis, the energy crisis as a result of the peace crisis, etc. It is well known that the climate crisis is a problem amplifier, but can it also be the trigger of these crises? Do these crises occur coincidentally now, do they reinforce each other or is there something common behind them? And if so, what? Dennis Meadows thinks that the multiple crises could be a consequence of reaching the limits to growth, which, due to globalisation, are being felt all over the world simultaneously. Others attribute the individual crises to different causes. But unsolved problems and the associated chaos induce governments to look for short-term solutions. The focus on such reduces the capability to solve the problems and thus enhances the number of problems and chaos – a reinforcing loop. Unfortunately, in such a situation, societies tend to value safety over freedom, and this encourages centralised or authoritarian decisions, typically taking little account of diversity or scientific evidence. Successful solutions to the multitude of problems become less likely. This could be one factor contributing to the shift away from democracies that has been observed over the last years (Freedom House, 2022). In order to break through these self-reinforcing loops long-term thinking, evidence-based decisions and participatory decision-making must be encouraged.

Full transformation of our way of doing business and of our economy

As described above, the climate at +1.5°C is far from comfortable in many parts of the world. However, in order to achieve the Paris goal a full transformation of our way of doing business and of our economy will be necessary (A. Merkel, 2021.07.15). In doing this, social and economic conditions can be significantly improved, thus solving the climate issue and most of the other issues mentioned above simultaneously. This would be fully in line with the Agenda 2030 of the United Nations and the Sustainable Development Goals.

Relying on renewable energies will completely change the geopolitical situation and some of the present trouble spots of the world will finally find peace. Conflicts might arise over other resources, but the need for these will not be of the same dimension as it was for oil. Communities will profit by producing their own energy and the money that stays in the community can be used to

finance or initiate transformation in other fields. Moving towards a circular economy implies that industry produces more durable and repairable products, and at the same time, ownership will be replaced by rentals for household goods like drilling machines, cars, etc. This will reduce the number of cars produced and, on the road, as will the shift to active mobility as public transport, bicycling and walking become more attractive. Positive impacts on health ensue from less air pollution and noise and more physical exercise. A significant contribution to better health is also to be expected from healthier food – a consequence of organic farming needed to build up resilience of soils against drought and flooding. With reduced meat consumption the available agricultural land can feed the global population even with organic farming.

The educational system at all levels must be re-organised to enhance creativity in children and support their individual talents rather than shape them to fit some norm. Throughout the educational system intrinsic values should be supported and co-operation should be rated higher than competition. A general understanding of systems and their dynamics as well as interdisciplinary thinking should be taught. The economic system must evolve into a system that does not need to grow in order to be stable, and profit as an aim must be complemented by other ecological and social values. This also implies a restructuring of the financial system. A biotope of currencies, each serving a different purpose, might be a way forward. Democracy will need to adapt to the new necessities – essentially it must become more participatory to ensure that the deep cutting changes are developed in accord with society, not overwhelming it.

A good security policy for all eventualities?

Security policies must strive for peace on the one hand, ending present wars, and strengthen resilience on the other, to prepare for difficult times to come. These might as well be a result of mitigation policies in the effort to achieve the Paris goals as consequences of unmitigated climate change.

Striving for peace: The UN Sustainable Development Goals of the Agenda 2030 essentially represent two agendas: The human security agenda and the planetary boundary agenda. The challenge is to achieve both synergistically and avoid competition between them. The Agenda 2030 also states:

> "We are determined to promote peaceful, just and inclusive societies, free from fear and violence. There can be no sustainable development without peace, and no peace without sustainable development."

So far, little to no progress has been made in this respect – on the contrary, the number of wars raging – whether declared or not – and the intensity and brutality of these is increasing. Wars do not only destroy lives, health, infrastructure and nature, they also destroy trust. But without trust global problems such as climate change or biodiversity loss cannot be solved. Therefore, cease-fires and peace negotiations are of great urgency. A precondition is for political leaders to talk to each other.

Striving for peace or at least non-violent co-existence is at the core of the OSCE mission and can be considered an important contribution towards achieving sustainability. However, this does not exonerate individual countries from making their contribution. Neutral countries would be ideally placed to take a leading role in this endeavor, and Austria with its history of mediation more specifically so. However, now being a member of the European Union makes it more difficult for Austria to regain the role it had e.g. under chancellor Bruno Kreisky. The Austrian government would have to become more serious in maintaining its neutrality, as was agreed during the accession, and the European Union would be well advised to accept such a role being played by one of its members and refrain from pressing for conformity in issues that touch upon neutrality.

Strengthen resilience: The OSCE has, in Decision no. 3/21 "Strengthening co-operation to address the challenges cause by climate change", recognized the importance of the increasing challenges of climate change for the economy and the environment. It calls on participating States to individually and jointly address the challenges of climate adaptation and mitigation of adverse impacts by raising awareness, research and innovation, inclusion in national or domestic strategies, etc. It encourages participating States to make use of the OSCE as a platform of co-operation. Implementing these suggestions would not only reduce negative impacts of climate change, it would also enhance resilience against climate change and thus diminish risks of societal and political instability. At the same time, engaging in joint efforts would offer an opportunity to build-up trust amongst those involved.

The OSCE paper does not enter into a discussion on the extent of climate change that needs to be dealt with. What is needed to prepare the world for a +1.5°C climate or for hothouse Earth and for possible outcomes that lie between? Have security policies been developed for each of these outcomes or for the paths leading to them? Sensitivity to climate change, impacts and timing vary for different parts of the world, thus increasing inequity. What must be done to avoid violent conflicts under each of the pathways and scenarios and how can the challenges that go with them be met – e.g. strongly enhanced migration? In addition to the provisions listed in Decision no. 3/21, foresight work must be done, looking at a range of climate scenarios, including worst case scenarios, and the ensuing hot spots of problems. The OSCE should encourage on such analyses and give support in working out measures to prevent violent conflicts from arising at the local, regional or global scale.

Political and diplomatic co-operation at national and international levels is essential; it is clear, that the structural problems underlying climate change cannot be solved by military operations. These would but exacerbate the problems. Resources, intellectual capacities and political will must be focused on solving the problems underlying climate change and e.g. biodiversity loss, not obscuring them or delaying their resolve. The world is in a crisis and leaders need a crisis mentality. OSCE might contribute to making this understood.

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