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Climate and weather at 3 degrees more

An Earth as we do not (want to) know it

What does 3 degrees of global warming mean for us? So far, according to the Intergovernmental Panel on Climate Change[1] , we have reached 1.1 degrees of warming, relative to the late 19th century (which is generally used as the base period in this article because it is also the basis for the Paris target of 1.5 degrees). We are already seeing many negative consequences. Three degrees of warming would be almost 3 times as much. However, the consequences would be considerably worse than just 3 times the previous impacts, as we will see in this paper.

A useful perspective on a warming of 3 degrees is provided by the history of the Earth. According to current knowledge, one has to go back about three million years, to the Pliocene, to find a similarly high global temperature. This already indicates that large parts of today's biosphere are not evolutionarily adapted to such a warm earth. Many species would not survive it. In the Pliocene, our ancestors, the australopitheci, still lived partly on trees.

The global temperature trend over the last 20,000 years since the peak of the last ice age can now be reconstructed quite accurately thanks to numerous sediment and ice cores (Fig. 1). The graph shows three important things:
(1) Today's temperatures already exceed the range of experience of the Holocene and thus of the entire history of human civilisation since humans developed agriculture and became sedentary. (2) Modern global warming is about ten times faster than the natural warming from the Ice Age into the Holocene, making adaptation massively more difficult. (3) Modern warming will continue for tens of thousands of years - unless gigantic amounts of carbon dioxide can be actively removed from the atmosphere.

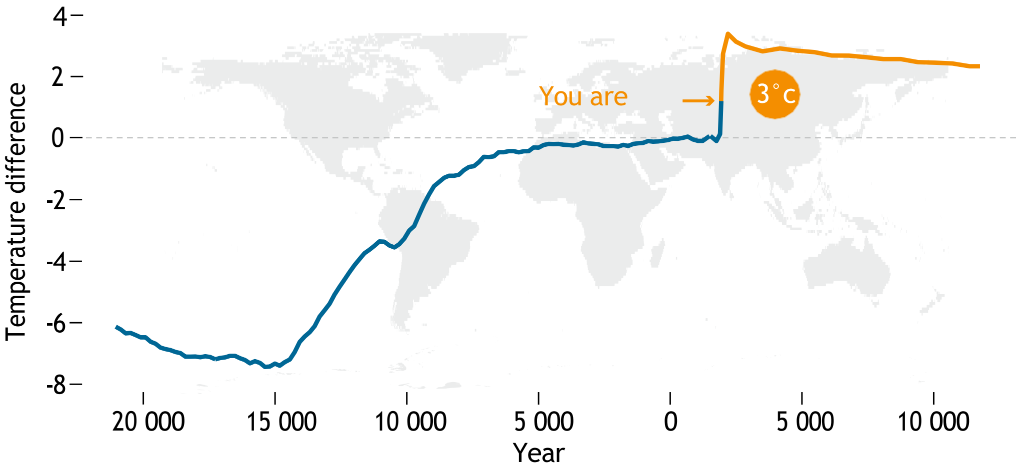

Figure 1

Course of global temperature since the last ice age (about 20,000 years before our era) and for the next 10,000 years under a scenario with 3 degrees of global warming.[2]

Model simulations at the Potsdam Institute for Climate Impact Research (PIK), which correctly reproduce the ice age cycles of the last three million years (driven by the known Milankovich Earth cycles), show that we have probably already added enough CO_2 to the atmosphere to prevent the next ice age, which would otherwise be due in 50,000 years. If we heat up the earth by as much as 3 degrees, the natural ice age cycles of the next half a million years will probably not occur. A few generations of humans change our planet Earth massively and for long geological periods.

In Germany, we have already reached around 2.3 degrees of warming (Fig. 2). Because Germany is a land area, this is not surprising, since many land areas are warming about twice as fast as the global mean, 70 per cent of which is formed by ocean temperatures. The average warming of all land areas in 2020 was 2.0 degrees Celsius. With 3 degrees of global warming, we can therefore expect around 6 degrees of warming.

An annual average of six degrees Celsius - that's a lot. That would make Berlin warmer than Madrid is today. And while some might dream of Mediterranean conditions, this completely new climate will not please farmers or the local flora and fauna at all. The past three dry heat summers since 2018 have already led to serious forest dieback.

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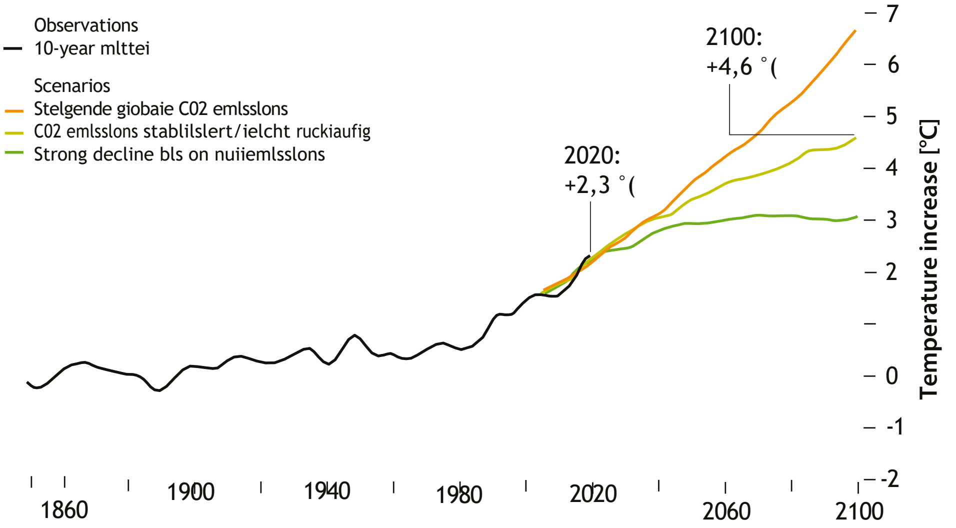

Figure 2

Temperature trend in Germany according to data from the Berkeley Earth Surface Temperature Project. The scenario with 3 degrees of global warming lies between the light green and orange coloured future scenarios.[3]

Extreme heat

Even more important than the average temperatures are the extremes. Where people in Germany used to groan under a heat record of 39 degrees Celsius, it is more likely to be 45 degrees. Or even more, if the soils have dried out, which can intensify the heat. The summer of 2003, which was "summer of the century", claimed around 70,000 heat-related deaths in Europe.[4] The peak in excess mortality in France (where the focus of the heat was) was significantly higher than the spikes during the Covid 19 pandemic. The city of Paris had to set up refrigerated tents for the many dead in August 2003 because the morgues were overcrowded.

The cooling system of the human body works by sweating, i.e. by evaporating water on the surface of the skin, and this depends on temperature and humidity - the more humid the air already is, the lower its ability to absorb further water vapour and the worse the evaporative cooling works. The relevant measure of heat stress is the cooling limit temperature: the lowest temperature that can be reached by direct evaporative cooling. It is also called wet bulb temperature because it can be measured with a ventilated thermometer wrapped in wet cloth.

The human body's stress limit is a sustained cooling limit temperature of 35 degrees Celsius, but even below 30 degrees it becomes dangerous, because we have to keep our body temperature at around 37 degrees and also be able to dissipate the heat generated by metabolism and movement in the body. In the heat wave of 2003, cooling limit temperatures of 28 degrees Celsius occurred in Europe.

At a humidity of 70 per cent (typical for Germany in summer), the cooling limit temperature of 35 degrees, which is lethal even for healthy people, is reached after a few hours at an air temperature of 40 degrees Celsius. Today, this cooling limit temperature is rarely exceeded for a short time anywhere on earth, and when it is, it is mainly in the Persian Gulf or on the Mexican coast. According to a recent study[5] , the frequency of dangerous values has already more than doubled since 1979, and in the Persian Gulf, monthly values of sea water temperatures exceeded the 35-degree limit for the first time in 2017 - the moisture-saturated breeze from the sea can be deadly at such temperatures. In Qatar, since May 2021, workers have been allowed to work in the summer between 10 and

3.30 p.m. no longer work outdoors.

With a global warming of 3 degrees - which, as I said, is equivalent to 6 or more degrees on many land areas - the areas that are deadly hot during heat waves will expand massively, making it increasingly dangerous to stay outdoors and thus impairing field work in agriculture, for example.

Extreme precipitation and droughts

Temperatures still behave approximately linearly - that is, they increase in proportion to our cumulative emissions of carbon dioxide. Unfortunately, this is not true for many effects of warming. Many physical effects increase more than proportionally. This is true, for example, of the atmosphere's ability to absorb water vapour. This increases exponentially with temperature. This is stated in the Clausius-Clapeyron equation, an elementary law of physics about the saturation vapour pressure of water vapour that has been known since the 19th century.

The same increase also applies to the "vapour hunger" of the atmosphere. The steam hunger is the amount of water vapour that the air can still absorb at a given relative humidity. This is relevant because as the earth heats, the relative humidity remains approximately constant, and therefore the steam hunger increases exponentially. It is this hunger for vapour in the air that on hot days

Figure 3

California has been in a severe drought for years. Devastating fires are the result.[6]

causes soils and vegetation to dry out, withering crops and increasing the risk of forest fires.

Extreme precipitation has also already significantly increased in the measured data - as predicted by climate models for three decades. This applies to the global total, but is now also the case for many regions.[7] Because of the stronger natural fluctuations on a regional scale and the smaller number of cases of extremes, the signal becomes statistically detectable later, the smaller the region under consideration. The current report of the Intergovernmental Panel on Climate Change also includes Central and Northern Europe among the regions where an increase can already be detected. In 2020, a study by ETH Zurich also showed for Germany, the Netherlands and Switzerland that a statistically relevant increase in extreme rainfall events is observed in these countries.[8]

Overall, precipitation increases worldwide with warming because the evaporation rate from the oceans increases by about 3 per cent per degree. However, almost the entire increase comes from the sky in heavy rainfall events, for which the amount of water vapour in saturated air masses is important, which, according to the Clausius-Clapeyron equation mentioned above, increases by 7 per cent per degree of warming - i.e. faster than the water supply through evaporation. As a result, heavy rainfall increases, days with little precipitation tend to decrease and periods without precipitation become longer. Overall, therefore, both heavy rainfall events and periods of drought increase.

The destruction that extreme precipitation can cause has been demonstrated in Germany, for example, by the Elbe flood in 2002, the great floods on the Danube and Elbe in 2015, the flash flood in Braunsbach in 2016 and the devastating Ahr valley flood in 2021.

There are also large regional and seasonal differences in precipitation. Certain regions such as the Mediterranean, the Midwest of the USA, South Africa and Australia are increasingly drying out. For agriculture and natural ecosystems, drought is relevant as a loss of soil moisture and drying out of vegetation. Drought understood in this way increases even if precipitation remains unchanged, because in a warmer climate water loss through evaporation increases. The current IPCC report also sees an observed increase in drought caused by anthropogenic warming for the majority of the world's land areas.

In addition to the simple mechanism that warm air can absorb more water vapour, there are also changes in atmospheric dynamics. Current research indicates that persistence, i.e. the duration of certain weather conditions, has increased in large parts of Europe in recent decades.[9] Thus, a few hot days turn into a health-threatening heat wave, or a dry phase into a prolonged drought. This increasing per- sonality is attributed to a slowing of the general westerly wind circulation, including the jet stream in summer, which is probably related to the strong warming of the Arctic land areas.[10] According to a recent study, the Arctic has actually warmed four times more than the rest of the globe over the last 40 years,[11] which reduces the temperature gradient from the tropics to the Arctic that drives the mid-latitude westerly winds. In addition, there are occasional strongly roiled waves in the jet stream that reach around the entire northern hemisphere, causing simultaneous extremes there.[12] A nightmare scenario for some climate researchers is a simultaneous drought with crop failures in the large granaries of the northern hemisphere in western North America and Russia, in western Europe and Ukraine.[13] Already in the drought and fire catastrophe in the summer of 2010, Russia stopped exporting grain because of crop failures, which drove up prices massively among buyers in North Africa and thus contributed to the "Arab Spring", which was also ignited by high bread prices. Similarly, the revolt in Syria that began in March 2011 followed the worst drought there in more than a century of weather records.[14] Conflict-ridden, weak states can be destabilised by extreme events and crop failures, with implications for global politics.

Tropical cyclones

Tropical cyclones are a significant hazard in the tropical and subtropical regions of the world. For example, in September 2017, Category 5 Hurricane Maria destroyed large parts of the island of Puerto Rico and caused more than 3,000 lives. Global warming charges tropical cyclones with additional energy - because these storms draw their destructive power from the heat energy stored in the upper ocean. This is why they only form in regions with water temperatures above 26.5 degrees; in more temperate latitudes, the seawater has so far simply been too cold. Therefore, climate researchers have been predicting for decades that tropical storms would become stronger. For a long time, however, an increase could not be proven with data. Not because the data did not show an increase (they did), but because it was unclear how reliably the older data depicted the strength of tropical storms and whether some tropical storms far from land areas were not even recorded before the satellite era.

But in the meantime, a real climatic increase in tropical storm intensity can be detected in the data.[15] The current IPCC report states for the first time that the proportion of particularly strong tropical storms (categories 3 to 5) has increased, for which anthropogenic climate change is the main cause. Anyone familiar with the IPCC's extremely cautious and restrained statements on this from earlier reports will understand the significance of this conclusion. In addition, there is evidence that tropical storms can intensify more rapidly, travel more slowly (affecting areas below the storm for longer) and move to higher latitudes - in Europe, for example, off the coast of Portugal.

It has long been undisputed that extreme precipitation, which is often the main reason for the devastation caused by tropical storms, has increased due to warming, for which the Clausius-Clapeyron equation can again be used, and here in particular the increase in evaporation of warmer seawater under the storm. Hurricane Harvey hit Houston in August 2017 and became the costliest tropical storm in US history (125 billion US dollars in damage), on a par with Hurricane Katrina in New Orleans in 2005 (Fig. 5). Harvey brought the heaviest rainfall ever recorded in the USA: The maximum was 1,539 millimetres of rainfall in 4 days. For comparison: the 3-day precipitation total in the Ahr valley was 115 millimetres during the flood in July 2021.

It is also undisputed that rising sea levels due to global warming aggravate storm surges caused by tropical or other storms.

Figure 4

View of New Orleans devastated and flooded by Hurricane Katrina.[16]

are caused. It is often the last additional decimetres that cause the most damage, when the water penetrates areas where no one had previously expected a storm surge. Like Hurricane Sandy in 2012, whose storm surge flooded tunnels of the New York underground. Or Typhoon Haiyan, whose storm surge in 2013 leveled the city of Tacloban in the Philippines and claimed over 6,300 lives.

Sea level and ice sheets

The perspective of Earth's history also helps when it comes to sea level. During the Pliocene three million years ago, sea level was between 5 and 25 metres higher than today because there was much less ice on the continents. Conversely, at the peak of the last ice age 20,000 years ago, sea level was 120 metres lower than today. The continental ice masses that currently exist, especially in Antarctica and Greenland, are so large that they can provide enough water for 65 metres of global sea level rise.

Our Australopitheci ancestors in the Pliocene are unlikely to have been bothered by the higher sea level. But our planet's current coastlines are home to more than 130 million cities, as well as other infrastructures such as ports, airports and around 200 nuclear power plants with seawater cooling (such as Sizewell B on the British North Sea coast). Even one metre of sea rise would be a disaster. So far, the rise since the late 19th century has been around 20 centimetres, which is already causing problems on some coasts. Not only during storm surges, but even during normal tidal cycles, which occasionally cause streets in cities on the east coast of the USA, for example, to be submerged in what is called "nuisance flooding" - not a disaster, but a nuisance.

In the case of sea level rise, it looks like the speed of the rise (at least so far) is increasing approximately proportionally to the temperature rise. This means that after 3 degrees of warming, sea level should rise roughly three times as fast as today. This is partly because the warmer it gets, the faster the continental ice masses melt. The rise in sea level is already accelerating - this is not only visible in the long data series of harbour gauges, but meanwhile even within the satellite measurements that have only been ongoing since 1993 (Fig. 5).

However, there are also more complex effects here that add to this simple logic. For ice does not simply melt on the surface, it also slides into the sea, or better: it flows like a viscous slow river. If meltwater gets under the ice, this reduces the ground friction and the ice flows faster. Accordingly, the sea level rises even faster. In Antarctica, moreover, the ice shelves floating on the sea, which are located in front of the outlet glaciers, are gradually disappearing because they melt from below in the warmer sea water. The ice shelves in turn slow down the flow of further continental ice, so that after their disappearance the ice flows into the sea accelerate.

And it gets even more complicated: the continental ice has tipping points. A tipping point is the point at which further development into a fundamentally different state becomes an unstoppable self-runner, driven by self-reinforcing feedback effects. The ice sheet on Greenland has such a tipping point, at which point it will melt completely. The reinforcing feedback consists in the fact that the surface of the approximately 3,000-metre-thick ice sheet automatically reaches ever deeper and thus warmer layers of air,

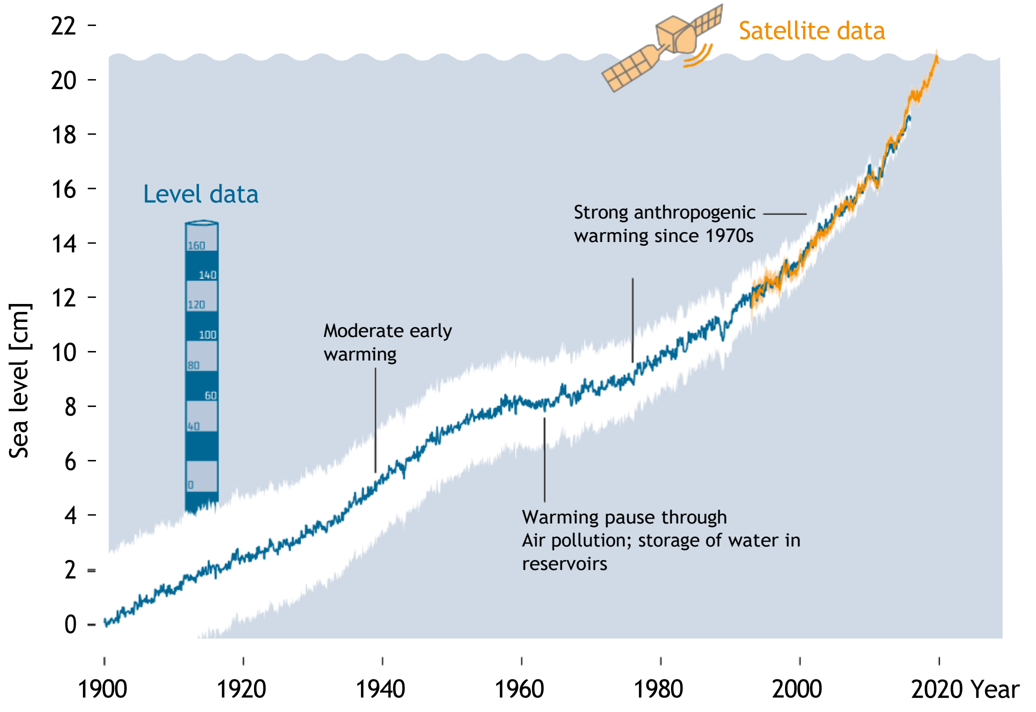

Figure 5

Development of global sea level, measured from harbour gauges (blue) as well as from satellites (orange). Over the last 60 years, the rise has accelerated continuously.[17]

the more the ice thickness decreases. Therefore, at a certain point, the ice will melt completely, even without further global warming. The end result is that global sea levels will rise by 7 metres due to the loss of Greenland ice. This tipping point is probably somewhere between 1 and 3 degrees of global warming.[18]

The situation is similar with the West Antarctic Ice Sheet - here we are talking about a further 3 metres of sea rise, but due to a different feedback effect, the marine ice sheet instability, which can cause continental ice to slide unstoppably. There are studies that suggest that this tipping point has already been passed and that the loss of this ice sheet has thus already been triggered.[19]

The current IPCC report expects a sea level rise of 70 centimetres (compared to the late 19th century) before the end of this century with a warming of 3 degrees Celsius. The 1-metre mark will be reached between 2100 and 2150. However, with regard to sea-level rise, there are significant upside risks - that is, things could get much worse if large ice masses are destabilised, especially in Antarctica. The IPCC writes that with high emissions, even more than 2 metres by 2100 and even 5 metres by 2150 cannot be ruled out, i.e. a global catastrophe of unimaginable proportions.

This risk assessment is new for the IPCC. In the 4th report of 2007, it had still given a range of 26 to 59 centimetres between 1990 and 2100 for the highest emission scenario, which corresponds to about 41 to 74 centimetres relative to the late 19th century (and that in an emission scenario with up to 5.2 degrees of warming). On the risk of ice sliding, the IPCC wrote that this could possibly add 10 to 20 centimetres, so that in any case less than 1 metre could be expected by 2100, even with extreme warming.

A number of colleagues, including myself, were of the opinion at the time that the IPCC was significantly underestimating sea level risks - not least because the measured rise to date was already around 50 percent faster than in the IPCC's model scenarios. In addition, the IPCC assumed that Antarctica would contribute practically nothing to the future rise, again in contrast to the ice loss already shown by satellite data. However, anyone in climate research who takes a more pessimistic view of things than the traditionally very cautious IPCC must deal with being accused of "alarmism" in some media - even if the assessment is correct and later shared by the IPCC.

The current IPCC report further warns that sea levels will continue to rise for years after global temperatures have stabilised, and that the rise is irreversible over human time - with "very high certainty". In its landmark ruling on climate protection in 2021, the Federal Constitutional Court emphasised intergenerational justice. When sea levels rise, countless generations after us will have to suffer the consequences of our decisions today. And not only because of a higher sea level, to which we could adapt in the course of a century. But because sea levels will continue to rise for millennia, at 3 degrees of warming by about a metre per century, eroding the earth's coastal zones, washing away beaches, threatening all infrastructure with ever-increasing storm surge risks, and making permanent coastal cities as we know them today almost impossible.

The tipping points of the climate system

In the case of the ice sheets, we have already mentioned two tipping points of the climate system at which further development becomes an unstoppable self-runner and thus gets out of control. There are more such tipping points, because ultimately all that is needed is a reinforcing feedback, a simple non-linearity, as occurs in many physical systems. For example, a kayak will right itself if you tilt it a little to one side - it stabilises itself in a horizontal position and resists attempts to tip it. But only up to a certain point - from then on it continues to turn on its own and now stabilises itself in a new position: upside down. This critical point is literally the tipping point.

Greenland also has two stable equilibria under today's climatic conditions: with the ice sheet as we know it today and without it. The ice is self-stabilising because once it is there, the surface is not stable due to the

3,000-metre-thick layer of ice is so cold that it does not melt. This is called ice-height feedback. If, on the other hand, the ice were gone, Greenland, which is then close to sea level, would not be cold enough to form a new ice sheet and would remain permanently ice-free. The Greenland ice sheet was formed in a colder climate during one of the earlier ice ages.

Such tipping points exist not only in physics, but also for eco-systems, which stabilise themselves, but can also "tip over" if a stress limit is exceeded. The human body also regulates its own temperature - up to a critical load limit, above which the self-cooling system is overloaded, organs increasingly fail and the person finally dies. So we too have our personal tipping point. This also applies to societies - the fall of the Berlin Wall was a tipping point of the GDR state. The term tipping point does not describe a value judgement, but merely a certain type of dynamic; the change that is triggered can of course also be desirable, that is in the eye of the beholder.

An overview of the most important tipping points of the climate system is shown in Figure 6. All of these tipping points are at risk of being exceeded at 3 degrees of global warming. For some, such as the Greenland ice sheet and the West Antarctic ice sheet, this is even very likely, and for the Arctic summer sea ice cover and the Earth's coral reefs it is even certain. The IPCC concludes that at 2 degrees of warming, almost all coral reefs will die; if we limit this to 1.5 degrees, we could still save 10 to 30 percent of the corals. Our planet has already been in a global coral die-off since 2015.[20]

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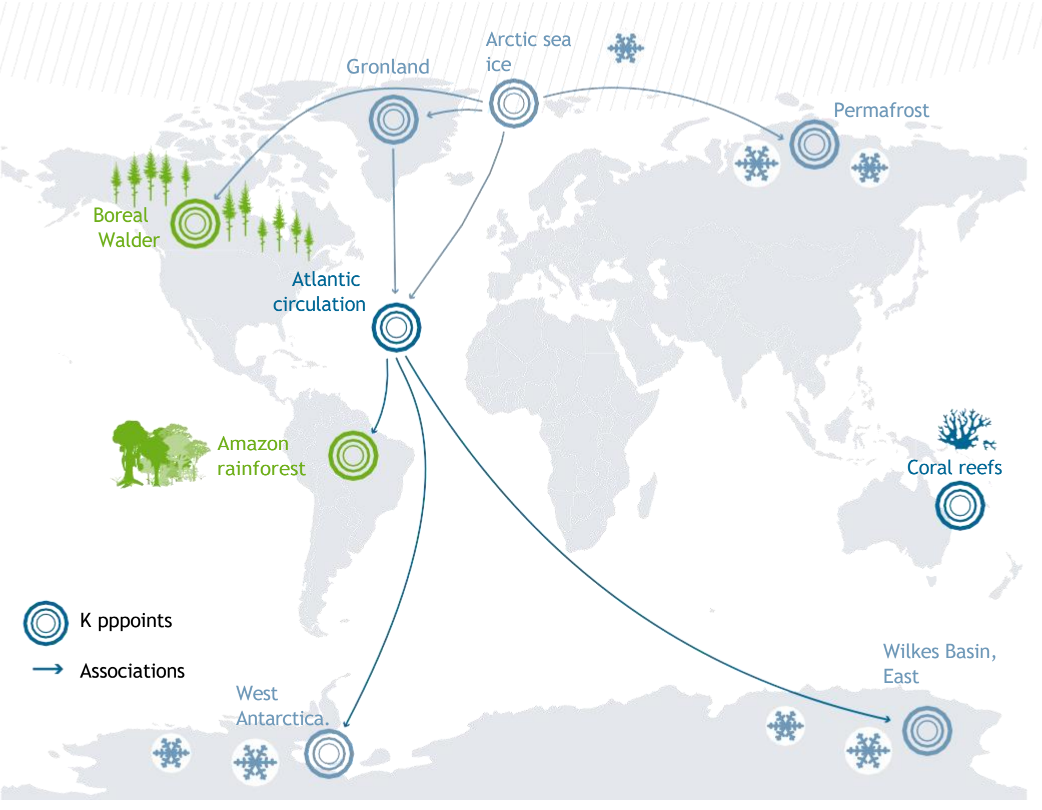

Figure 6

Some of the most important tipping elements of the climate system. The arrows indicate interactions whereby the subsystems could cause each other to overturn.[21]

The Atlantic circulation (often called the Gulf Stream system) is a large circulation of the Atlantic Ocean in which warm surface water flows from the South Atlantic across the equator to the far north of the Atlantic, where it cools and releases heat into the air. The whole thing works like a central heating system for the North Atlantic region all the way to Europe. This current is endangered above all by freshwater input due to increased precipitation and ice melt. Freshwater is lighter than salt water and thus hinders the sinking of the water into the depths and thus the drive of the Atlantic circulation. Models suggest a weakening of the current due to global warming, but the extent of this is uncertain, ranging from very small to 50 per cent this century. There is serious evidence that many models systematically overestimate the stability of the Gulf Stream system. A striking cooling of the waters in the subpolar North Atlantic since the middle of the 20th century

Figure 7

Coral bleaching on the edge of the Great Barrier Reef near the Australian city of Townsville. From about 2 degrees of warming, all coral reefs could die.[22]

indicates a weakening of 15 per cent so far.[23] A study published in 2021 already sees signs that we are approaching the tipping point of the Atlantic circulation. If this is confirmed, it will be extremely worrying.[24]

The consequences of a break in the flow would be massive and unforeseeable, ranging from extreme weather in Europe to the collapse of important ecosystems in the North Atlantic to increased sea level rise on the US coast (up to an additional one metre).

The rainforests of the Amazon region are already directly affected by climate change. Satellite data and on-site measurements have shown that increasing droughts are transforming the Amazon forest from a carbon sink into a carbon source.[25] Already today, parts of the tree populations are not able to cope with the new climate conditions and are dying. At least as important is the expansion of agriculture and the associated deforestation, which exacerbates the effects of climate change. As a result, the Amazon forest is losing resilience as deforestation continues. The tipping point leading to widespread loss of this unique ecosystem will be reached at lower global warming the more deforestation occurs. Today's forest loss is already estimated at 20 per cent.

With increasing warming, the existence of coniferous forests in the north, which are adapted to cold climatic conditions, may also be increasingly threatened, among other things by fire and insect infestation. In recent years, there have already been extensive forest fires in Canada (e.g. Fort McMurray 2016) and Russia (2010 in the European part) and even within the Arctic Circle (2017 in Greenland, 2018 in Sweden). In the transition zone of the northern forest belt to the steppe, tree stand regeneration may be threatened by increasing drought and heat stress.

The current focus of research is the risk of a cascade of tipping points that trigger each other like dominoes. For example, ice melt in the Arctic Ocean and on Greenland could dilute the North Atlantic water with fresh water to such an extent that the Atlantic circulation would dry up. This in turn would shift the tropical precipitation belts and could destabilise parts of the Amazon forest and the monsoons. And as if this were not enough, it could drive the Antarctic ice sheets beyond their tipping point. A quantitative assessment of these risks is still not possible.

The IPCC also attributes a strongly growing importance to tipping points. While the term "tipping point" was mentioned only 27 times in the 5th IPCC report, it was already mentioned 97 times in the 6th report.

Figure 8

In the unusually warm summer of 2004, the permafrost in the Noatak National Preserve (Alaska) thawed, causing the ground to sink over a wide area.[26]

Self-amplification of global warming

There is a great deal of public discussion about whether not only subsystems could overturn, but whether global warming as a whole could become an unstoppable self-runner after a critical point. The release of methane from permafrost is usually cited here as a reinforcing feedback. In 2018, a sensational study on this topic appeared in the scientific journal *Proceedings of the National Academy, which* went through the media as the "hot period study".[27] As a result, "hot spell" was even chosen as the word of the year 2018.

The study investigated the extent to which feedback effects in the carbon cycle, which have not yet been taken into account in climate models, could exacerbate global warming. Not only methane release from permafrost was estimated, but also CO_2 release from dying or burning forests and decreasing CO_2 uptake by the oceans.

The permafrost region is a globally significant carbon reservoir that is 1,300 to 1,600 billion tonnes of carbon and thus probably 50 per cent of the total carbon stored in the soil worldwide. The permafrost areas have already warmed by up to 4 degrees Celsius between 1990 and 2016. When the permafrost thaws, the soil carbon is decomposed by microbes. This could reduce the carbon stored in the permafrost by 15 percent by 2100.

Estimates of the carbon stored in living and dead plant material in the Amazon region (total above and below ground) range from 80 to 120 billion tonnes. If this stored carbon were to be completely released in an extreme case, this would correspond to the amount of fossil CO_2 emissions that are currently released into the atmosphere in 8 to 12 years.

The result of the calculations (which unfortunately was somewhat neglected in many media reports) was that a warming of 2 degrees could become one of up to 2.5 degrees - if, as mentioned earlier, the carbon cycle changes and feedbacks are triggered. This is by no means harmless and exacerbates the climate crisis considerably - but it does not mean that a global tipping point towards runaway warming has been passed. Fortunately, this risk is still considered very low, although it cannot be completely ruled out. The methane problem should be taken seriously in any case, but probably less dramatically this year. In the long term, however, it is, because thawing permafrost will create an uncontrollable source of greenhouse gas emissions for many centuries to come, which is likely to lead to further warming even after direct anthropogenic emissions are reduced to zero.

have been.

Conclusion

Without immediate, decisive climate protection measures, my children currently attending high school could already experience a 3 degree warmer Earth. No one can say exactly what this world would look like - it would be too far outside the entire experience of human history. But almost certainly this earth would be full of horrors for the people who would have to experience it. Weather chaos with deadly heat waves, devastating monster storms and persistent widespread droughts that could trigger worldwide famine crises. Rising sea levels that devastate our coasts. Tilting ecosystems, devastating species extinctions, burning and withering forests, acidified oceans. Failed states, huge numbers of people on the run.

That sounds dark and dystopian and it's hard for me to write that while thinking about my children. But it is likely. Most of it was predicted a long time ago and has long since been observed in its beginnings, which are by no means harmless for those affected. One just has to soberly face the fact that the described conditions in a 3-degree world will most likely not "only" be three times worse than in a 1-degree world, which will be ensured by the non-linear effects and the tipping points. I am not sure whether the halfway civilised coexistence of humans as we know it will still endure under these conditions. Personally, I consider a 3-degree world to be an existential threat to human civilisation.

What gives hope is that this 3-degree world is not an inevitable fate. It is still possible to limit warming to near the 1.5-degree mark - which was unanimously agreed by all countries in Paris in 2015 and to which almost all politicians in this country pay lip service. Global climate policy is certainly making progress: With the measures announced at the climate summit in Glasgow, the limit of 2 degrees is within reach, if these measures are not only promised but consistently implemented. But limiting the temperature to 2 degrees is not enough. In order to meet the 1.5 degree target, the world must finally switch to serious crisis mode, as the young people of *Fridays for Future* quite rightly demand. Climate protection must be given the highest priority.

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