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WHY THEY DRIVE SUGAR-POWERED CARS IN BRAZIL

TEN CLIMATE RESEARCHERS REPORT

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New Stories of Earth System Research made in Hamburg

CONTENT

THE LATEST NEWS FROM CLIMATE RESEARCH

Saving money, while protecting the climate at the same time? It may sound like a contradiction – but in Brazil it has worked like a charm. The people living there persuaded the automotive industry to produce “sugar-cars”, which run on climate-neutral fuels. Which factors were most important in this development? The experts at the Center for Earth System Research and Sustainability (CEN) are currently pursuing answers to these questions. This booklet offers glimpses behind the scenes of their work. For instance, you’ll learn whether offshore wind turbines affect coastal temperatures, and how many trees are currently growing on the Earth – and how they shape our climate.

Once a month, our researchers discuss their work in the *Hamburger Abendblatt*. In the following pages, we’ve gathered ten of these articles.

Enjoy browsing!

GLOBAL COUNT: THREE TRILLION TREES WORLDWIDE

Green lungs, air filters, air conditioners – forests are real multi-talents, performing important functions for the climate: they convert carbon dioxide into oxygen, clean the air, and the crowns turn the sun's energy into steam, which has a cooling effect on the atmosphere.

Since forests store vast amounts of carbon, their destruction means that this carbon is released into the atmosphere – mainly as carbon dioxide. Intact, species-rich forests are particularly productive and bind large amounts of carbon. But just how many of these forests exist around the globe and how many trees are there in total?

To answer these questions, my colleagues and I investigated a very special forest in Kyrgyzstan. Although there are few forests in the former Soviet Republic, a unique ecosystem can be found in the high mountain steppes of the Tian Shan Mountains: the wild walnut and fruit forests with around 180 different tree and shrub species, where huge gnarled walnut trees grow alongside wild apples, pears and plums. These forests are the largest of their kind in the world.

How are these landscapes responding to climate change? To what extent are they used by the local population? We've investigated these questions and at the same time measured and counted the trees with the help of GPS and conventional tape measures. Our mapping in this remote region is part of a major international study assessing the world's trees, which has counted over three trillion trees around the globe – seven times more than previously thought.

To date, estimations have been based solely on satellite images. These are often inaccurate since they mainly visualize the trees' crowns, and the young trees in the lower layers are not included. Forest inventories, soil data and mapping, like our assessment, help to complete the picture. More than 400,000 data sets from 50 countries were incorporated in the study, which has allowed us to say far more accurately how much land is covered by trees and how dense these forests are.

But the surprisingly high number of trees is just one side of the coin; our study has shown that forests around the globe are disappearing at an ever-increasing rate. Currently more than 15 billion trees are being burned or felled every year, which has a two-fold effect on the atmosphere: firstly, burning produces the greenhouse gas carbon dioxide, while at the same time the destroyed trees are no longer available to store carbon.

The walnut forests in Tian Shan are also in jeopardy, as they have been intensively used since the dissolution of the Soviet Union. Kyrgyzstan is a poor country with high levels of unemployment, and trees are often cut down illegally for firewood. What's more, sheep and goats graze under the trees – which also puts a strain on the forest since the animals mainly feed on young plants, causing the forests to over-age. To curtail overgrazing, we have suggested steps to promote more sustainable land use. Only then we can better protect these unique forests in the future.

Dr. Peter Borchardt is part of the Biogeography and Landscape Ecology Working Group at Universität Hamburg's Institute of Geography, and of the University's Center for Earth System Research and Sustainability.

WHY THEY DRIVE SUGAR-POWERED CARS IN BRAZIL

Being able to run on the fuel of your choice, depending on which is currently the most affordable – what may sound like a dream to many drivers in Germany has long since become a reality in Brazil. Nearly all of the vehicles now on Brazil's roadways are what have been dubbed flex-fuel cars; they are compatible with both gasoline and bioethanol, which is produced using climate-neutral methods in Brazil.

Brazil has implemented this technology in record time: in 2002 flex-fuel engines weren't even on the market, yet only two years later 60 percent of new cars were flex-fuel. How did the new technology spread at such breathtaking speed?

To answer that question, I spoke with government officials, politicians, engineers, auto managers and lobbyists in Brazil and analyzed studies and documents from the years before and during the flex-fuel boom. What I found surprised me: prior to the boom, the most important decision-makers in the political and commercial sector showed no interest whatsoever in the flex-fuel technology. Yet it spread like wildfire.

GNV	1,89⁹
D DISEL S10	2,89⁹
D DIESEL	2,74⁹
E ETANOL	2,49⁹
G GASOLINA COMUM	3,39⁹
G GASOLINA ADITIVADA	3,39⁹

The explanation: the essential impulse came from Brazil's car owners themselves.

Before the flex-fuel boom, Brazilians either drove vehicles that ran on conventional gasoline, or that ran on bioethanol. The Brazilian government had provided major incentives for bioethanol production and the manufacture of ethanol-fuelled cars. The problem for drivers: fuel prices varied so drastically to match changing government policies that sometimes gasoline was cheaper; at others, ethanol was. In response, many Brazilians simply put whatever was cheaper in their tanks – but in the long run, most vehicles couldn't take the constant switching back and forth. Taxis breaking down in the middle of the street was a common sight.

What happened next is what we researchers call a "bottom-up process," i.e. a process that is set in motion from below, and not imposed "from above" by the top management or the state: engineers working in research and development began experimenting with software that could modify motors to accept both types of fuel or mixture. One engineer told me how he first tried out the software in his wife's car, since he didn't get any pay for his experiments.

Engineers, subcontractors and software developers started exchanging notes on the flex-fuel technology across company borders, until the top managers finally recognized the huge demand and seized the opportunity to capitalize on it.

By purchasing flex-fuel cars by the million, Brazil's citizens adapted to an inconsistent government policy, which alternated between promoting one fuel industry and then the other. As a result, many Brazilians even view the flex-fuel car as their "national car," one which optimally fits their country's unpredictable political changes of course.

Dr. Daniele Vieira do Nascimento completed her doctorate at Universität Hamburg's Faculty of Business, Economics and Social Sciences and is a former member of the Cluster of Excellence CliSAP. Today, she works for UNESCO.

CLIMATE POLITICS HAVE TO BE EXPLAINED BETTER

The 2015 United Nations Climate Change Conference in Paris attracted global media coverage to climate change – which held its fair share of opportunities and risks alike. My research group explored the effects of the media coverage.

For the purpose of our study, we surveyed 2,000 people in Germany before, during and after the Climate Change Conference in Paris. How well informed were those surveyed regarding the goals of the Conference? What was their stance on climate change? Were they prepared to personally take action – and did their readiness to do so change during the Conference? Although roughly three in four had heard about the Conference through the media, prior to the event less than one in three could name its concrete goals or explain the two-degree target.

When media coverage concentrates on such major events, it holds certain risks: the public's expectations can be quite high, and if politicians can't agree on binding goals, widespread resignation can follow. The 2009 Climate Change

Conference in Copenhagen, which drew 3,200 journalists, is a good example: after the disappointing outcomes, less than half as many journalists attended the conferences in the next few years, and in some media the coverage disappeared completely. With the Climate Change Conference in Paris, interest once again rose, as a long hoped-for global climate agreement finally seemed to be within reach.

For me as a communications researcher, this was an exciting time. My teammates and I investigated how debates evolve, and the roles played by journalists, the scientific community, and other actors. These actors are expected to concisely explain complex climate research scenarios, or the political debates at climate conferences.

With regard to the coverage of the UN Climate Change Conference in Paris, they only partly succeeded. Once the Conference was over, some of those surveyed had learned something new: 36 percent (compared to 28 percent previously) were familiar with its goals, and 21 percent (compared to 14 percent previously) knew what the two-degree target meant. On the other hand, 80 percent of those surveyed still didn't realize that human beings hadn't yet reduced their greenhouse-gas emissions. As such, it became apparent that the journalists had conveyed key information on the event itself, e.g. its main goals; but they hadn't succeeded in communicating fundamental background information.

Climate change conferences generally do little to change individuals' attitudes on climate change or climate policy. That being said, they can produce a calming effect, which is what prompted us to title our article in the journal Nature Climate Change (October 2017) "The appeasement effect": after the conference, significantly more respondents were convinced that the international community was capable of combating global warming through climate agreements. Fewer respondents (than before the event) felt that Germany should assume a leading role in this context. Further, there was no rise in the readiness to personally take action.

Apparently, the much-celebrated Paris Conference eased many people's minds. But now more than ever, we need critical investigative journalists and alert citizens, who can monitor whether or not their governments actually live up to their promises on climate policy. And politics will only change when administrations that break their promises are at serious risk of not being re-elected.

Prof. Michael Brüggemann is a communications researcher at the Faculty of Business, Economics and Social Sciences and a member of Universität Hamburg's Center for Earth System Research and Sustainability.

LARGE-SCALE OFFSHORE WIND PARKS OFFER A COOLING EFFECT ON LAND

The principle is as old as the windmill: if the wind is strong enough, the blades start turning, converting the moving air's energy into mechanical energy. Today's turbines use the same approach to produce electricity, accounting for a good 18 percent of Germany's energy mix – and that number is growing.

There is great potential in wind parks on the ocean, where the wind blows stronger and more consistently than on land, allowing offshore parks to generate more power, more consistently. However, these giant rotors also slow the air currents over the ocean. Could this aspect have an effect on coastal climates? To date, there has been very little research on this potential regional influence.

To address that gap, I chose to simulate a scenario for the year 2050 involving 9,000 wind turbines in the German Bight. This would be a true "offshore giant" with a total output of 90 gigawatts, enough to cover the needs of roughly 90 million households. Given that such an enormous wind park wouldn't leave sufficient room for ship traffic, the example is pure fiction. However, it allows us meteorologists to make accurate assessments concerning the effects of large-scale offshore parks. And today other countries are already constructing huge facilities of their own: China is currently working on an offshore park with a planned capacity of 20 gigawatts, scheduled for completion by 2020.

With the help of a computer model, I calculated how the rotors' movement would affect the temperature and winds during the summer months. Our atmospheric transport and flow model METRAS is based on physical equations that are solved in three dimensions; this allowed me to find values for the wind, temperature and humidity.

The bottom line: intensive wind energy utilization in the German Bight would cause average summer temperatures to drop by ca. 0.3 degrees Celsius along Germany's North Sea coast – both during the day and at night. In the daylight hours even Hamburg, 100 kilometers away, would be cooled by 0.1 degrees. But where does this effect come from?

The heat transfer between the ocean and atmosphere is crucial. If we look at the daytime and nighttime temperatures together, on average the North Sea is warmer than the atmosphere during the summer. Together with the wind, the ocean slightly warms the air. If giant rotors are added to the equation, they reduce the wind speed, weakening the heat transfer

between water and air in the process. As a result, the air in the vicinity of the wind park will become somewhat cooler. And the west wind transports that cooler air to Schleswig-Holstein and Hamburg.

But large wind parks also produce a second effect. When the rotors draw energy from the wind and reduce the airflow, the "missing" wind at the height of the rotors is drawn from nearby air layers. As such, the turbines can alter the winds even at great distances. Yet both effects are reversible. My simulations show that the changes to the temperature and winds dissipate within a few hours of the turbines being shut down.

Dr. Marita Boettcher is a member of Universität Hamburg's Center for Earth System Research and Sustainability and completed her doctorate at the University's Meteorological Institute.

INTACT NATURAL HABITATS HELP TO REDUCE GREENHOUSE GASES

Corn and canola as far as the eye can see – plants that are processed into biogas and biodiesel can be found in many agricultural fields throughout Europe. Bioenergy is considered to be a climate-friendly solution, because during combustion plants release only the amount of carbon dioxide that they removed from the atmosphere during their growth.

Wind energy is also intended to reduce greenhouse gases. But those approaches that help the climate can harm nature: regarding corn and canola fields, monocultures and pesticides are a major problem. Wind turbines disrupt bird migration routes and can be deadly for birds and bats. These examples show how difficult it is to mitigate climate change while also preserving vital habitats for plants and animals.

As an environmental scientist, I work together with economists to investigate how the goals of nature and climate protection can be reconciled in a cost-effective manner. Currently, our research focuses on those soils that make an important contribution to the climate. They are the largest depot

for organic carbon, containing twice as much carbon as the atmosphere. In this regard, protected areas like intact moors and swampland, as well as riparian zones, are real treasure troves. Not only do they offer habitats for endangered species; they also bind far more carbon in their soils than other areas: though only 12 percent of the worldwide land area is protected, it stores 15 percent of the Earth's total soil carbon. As such, intact ecosystems are good for animals and plants alike – not to mention the climate. But when soils are laid dry, carbon is released in the form of greenhouse gases.

In order to determine how much European protected areas can potentially contribute to climate protection, we explored the European Union's designated Natura 2000 areas. Three factors were decisive: spatial data like the size and borders of the areas, the amount of carbon dioxide in the upper soil layer and the average price per hectare. We interlinked this data with the help of geo-informational systems, computer-based programs that process spatial data. We then used that information to create a grid gathering more than 4 million datasets, which we evaluated statistically. Since high resolution was one of our foremost priorities, the grid's mesh size is only one kilometer.

Our analyses show that protected areas are often home to high soil carbon levels: on average, soils from the Natura

2000 areas contain 7.5 percent carbon, a level about ten percent higher than that in non-protected areas. We also discovered that protected areas are often characterized by lower agricultural productivity than adjacent lands: at the time of the investigation the average land price in the Natura 2000 areas was about 6,000 euros per hectare, compared to slightly more than 7,000 in non-protected areas.

Our new method will also allow us to identify still unprotected areas with high carbon content and low land prices, which could help to expand the European network of protected areas in a climate-friendly and cost-efficient manner. If protected areas were more actively integrated into climate policy, greenhouse-gas emissions could be reduced using more natural approaches.

Dr. Kerstin Jantke is a member of Universität Hamburg's Center for Earth System Research and Sustainability and works at the University's Sustainability and Global Change Research Unit.

THE RIDDLE OF THE MISSING SWARM FISH

Off the coast of southwest Africa, the cold Benguela Current flows toward the Equator. Though the region normally is one of the richest sources of fish on the planet, the fish population dropped rapidly in the 1980s.

Instead of the once-abundant schooling fish, like sardines and herrings, fishers suddenly began hauling in masses of jellyfish – and the residents of Angola, Namibia and South Africa lost an important source of income. Could this have been an early sign of climate change?

Researchers around the world are analyzing the Benguela region and the changes at work there, assessing various sub-processes so as to eventually grasp the whole puzzle. My own research focuses on the question of how ecosystems in the region are responding to the global climate change.

The Benguela region is one of the major upwelling areas, where water from the ocean depths rises to the surface. Upwelling involves a complex interplay of winds and ocean movements due to the Earth's rotation. The southeasterly

trade wind, which blows constantly there, pushes the surface water out to sea. Balancing this factor, at the coast cold water rises to the surface from depths as great as 200 meters, transporting large quantities of nutrients with it. This allows vegetable and animal organisms to thrive, in turn providing optimal feeding grounds for fish.

In the course of our research project, we have now succeeded in fitting together some of the pieces of the Benguela puzzle. My colleague Nele Tim and I first investigated where the water flows at which times. By combining data from ocean sediments, meteorological records and computer simulations, we were able to determine that the upwelling is not a constant phenomenon; there are variations from season to season, and over longer timeframes ranging from years to decades. Further, there are differences between the northern and southern Benguela region.

We then looked into the wind conditions, which are the motor of the water movements. We statistically evaluated parameters like air pressure and the intensity of coastal air currents. The results show that three factors intensify upwelling in the Benguela region: a stronger high-pressure area over the South Atlantic, a more powerful southeasterly trade wind, and a greater pressure differential between the ocean and adjacent land. These factors have a major influence on water circulation, and with it, the food supply for local organisms. If for example the high-pressure area over the South Atlantic begins to falter, the trade wind will do likewise and upwelling will decline.

In order to gauge how climate change is impacting these processes, Nele Tim used computer models to analyze the past 1,000 years – and found the natural fluctuations in wind conditions are so great that the effects of anthropogenic climate change haven't yet affected them. However, if the amount of greenhouse gas emissions rises unabated through 2100, it could greatly intensify upwelling, with incalculable consequences for the ecosystem as a whole.

Prof. Kay-Christian Emeis is a member of Universität Hamburg's Center for Earth System Research and Sustainability, and Director of the Institute of Biogeochemistry at the Helmholtz Centre Geesthacht.

WILL THE CLIMATE PHENOMENON EL NIÑO AFFECT HAMBURG?

Every two to seven years, it turns the entire Pacific on its head: El Niño, a climate phenomenon that can spark extreme weather events around the globe. The warm surface waters of the Pacific no longer flow from east to west, but from west to east – i.e., from Southeast Asia toward South America.

The atmosphere is also affected: because the air circulation changes, there's no more precipitation over Southeast Asia. At the same time, South America can expect to see warmer coastal waters and heavy rainfall.

In my working group at Universität Hamburg's Institute of Oceanography, our goal is to be able to better predict such El Niño events. The more accurate we are, the better the countries affected can prepare for the often devastating impacts.

But making prognoses for up to the next six months is extremely difficult. With the weather forecast (for the next 14 days) and the climate prognosis (available for the next few decades), we already have two established tools at our disposal. Yet they're based on completely different

approaches. The seasonal prognosis falls exactly in the gap between the two.

With the help of a special trick, we can bridge that gap: we have adapted a tried and trusted climate simulation so that we can constantly supply it with new, real weather data. That's no mean feat, since the models aren't actually designed to accommodate new data once they're already running. In our method we "feed" the simulation the latest readings on the atmosphere, ocean and sea ice every month, and then determine the probable "general weather situation" for the next half-year.

But how reliable are the results? To answer that question, we used our model to "back-forecast" the past 35 years; from that time on, there is sufficient data to allow us to check.

We entered the recorded weather data for each month, then used the model to prepare a prognosis for the next six months – and did so for the entire 35 years. In the next step, we compared the results with the actual recorded data for the respective timeframe. What we found: the method works; in most cases, we were able to accurately "predict" past El Niño events.

But what would a strong El Niño mean for Hamburg? To find out, we're exploring how El Niño affects Europe in general. Fundamentally speaking, it can have a cooling effect – though initially only a difference of ca. 0.1 degree Celsius. But even such a small change in temperature can produce extremely cold winters.

So should we always expect long, frosty winters in El Niño years? Not necessarily, because the weather here is especially chaotic and unpredictable. Whereas the weather in the Pacific is almost entirely determined by El Niño, here it depends on a broad range of factors. El Niño can be a major one – but doesn't necessarily have to be. The undisputed number one on the list is the wrestling match between the Azores High and Icelandic Low: roughly one out of two winters in Hamburg is shaped by which of the two comes out on top.

Prof. Johanna Baehr is a Professor at Universität Hamburg's Institute of Oceanography and a member of its Center for Earth System Research and Sustainability.

BARIUM IN MICROFOSSILS CONFIRMS CLIMATE CHANGES IN THE MEDITERRANEAN

Under my microscope, I can see tiny calcium carbonate shells that could fit on the head of a pin. These remnants of prehistoric life forms look like tiny snails or clams. The microfossils were trapped beneath the Mediterranean Sea for millennia, until a research ship collecting sediment cores from the seafloor retrieved them and sent them to me at Universität Hamburg's Institute for Geology. The fossils offer us insights into the climate during the Earth's recent geological history.

For my latest research project, I looked for traces of the chemical element barium in the calcium carbonate shells. Why? Because the level of barium tells me how much freshwater flowed from the Nile into the Mediterranean back then, and how much rainfall there was in the Nile catchment area. There are only very small amounts of barium in seawater; the vast majority of the barium only came with the flow of freshwater from the Nile. The more precipitation there is, and the more

water flows into the Nile's catchment area, the more barium is leached from the riverbed, transported to the Mediterranean and ultimately accumulates in microscopic life forms' calcium carbonate shells.

This new method allows researchers to draw direct conclusions on precipitation levels and can also be used to support other findings – such as those from analyzing vegetation data. The study shows: in sediment cores from the eastern Mediterranean – the area where Cyprus now lies – the layers starting from roughly 12,000 years ago, the beginning of the current interglacial, contain much higher barium levels. This trend peaked ca. 9,000 years ago, remaining constant for roughly a millennia before levels began dropping again. This development matches that of sunlight – though with a slight chronological lag. Given the higher amounts of sunlight, the tropical rain belt shifted to the north, the West African summer monsoon intensified and more freshwater flowed into the sea.

The consequences of this inflow were drastic. Since freshwater is lighter than saltwater, it rested atop the seawater like a lid. As a result, the vertical water circulation was interrupted and the deeper water layers were no longer oxygenated. Starting at a depth of 1,800 meters, there was no more oxygen and no more life – for 4,000 years. The eastern Mediterranean was

essentially like a giant version of a hypoxic lake, which we sometimes see in particularly hot summers. Making matters worse, this condition was reinforced by mild winters: the surface water never grew cold and heavy enough to sink lower and "kick-start" the water circulation.

Throughout our history, seawater circulation has been interrupted roughly every 23,000 years. Accordingly, many researchers are currently investigating this unusual phenomenon. My findings can be used to help verify the results of computational climate models, and to help interpret today's climate changes. For example, if the current warming results in a shift of the rain belt in the Sahel zone, it will mean more freshwater in the Nile and my study will become especially relevant for those people living in the Mediterranean.

Dr. Valerie Menke is a geologist and earned her doctorate at Universität Hamburg's Center for Earth System Research and Sustainability.

OUR OCEANS ARE GROWING WARMER – INCLUDING THE NORTH SEA

How is climate change affecting the North Sea? From the Wadden Sea in the English Channel to the sheer cliffs of the Shetland Islands, researchers are investigating that question. Together with my colleagues at the Helmholtz Centre Geesthacht, I am looking into how seas and coasts are influenced at the regional level.

Collaborating with international researchers, we've compiled in 2016 the latest findings on the entire North Sea region in a single report. It's a veritable treasure trove for oceanographers like me, and for decision-makers of all kinds – because changes in sea levels affect e.g. the planning of coastal protection measures. And factors like which fish species migrate to other waters and which new ones take their place are important for the fishing industry. For instance, today there are more sardines in the North Sea, because the waters have grown warmer.

The analyses confirm: sea levels in the North Sea have risen by ca. 15 centimeters over the past 100 years, and show

no sign of slowing down. At the same time, the sea has grown significantly warmer since the late 1980s. Though there have been natural fluctuations since the beginning of record-keeping, temperatures in the North Sea have risen by an average of 1.5 degrees Celsius in the past three decades – far more than in the past. The observational data can't tell us whether or not these changes are the result of greenhouse-gas emissions.

Regional climate models, which use mathematical equations to precisely describe the physical processes at work in the North Sea system, can help us track down the causes. For example, I can feed global climate changes from different levels of greenhouse-gas emissions into the models. If the regional results change, we can safely say that rising emissions levels are the root of the problem. That's why we expect to see a number of changes in the North Sea through the year 2100: it will continue to warm and sea levels will rise, the waters will become more acidic, salinity will decrease, and fewer plankton will be produced.

Yet it's difficult to predict how pronounced these effects will be. For example: regional models project that sea levels in the North Sea will rise by 30 to 100 centimeters by 2100 – a very broad range, which is due to a number of question marks: first of all, there are uncertainties in the models themselves. Secondly, we don't know what levels of greenhouse

gases will actually be emitted in the future. Thirdly, it's difficult to estimate how much freshwater will be added from melting glaciers. Not to mention tectonic shifts, which can cause land to rise or sink locally – all of these factors also influence sea levels.

So we know changes are coming, but how extreme will they be? Our task now is to further refine the models we use, allowing them to deliver more precise forecasts.

Prof. Corinna Schrum is a Director at the Helmholtz Centre Geesthacht and a member of Universität Hamburg's Center for Earth System Research and Sustainability.

CULTURAL ANTHROPOLOGIST EXPLORES CLIMATE RESEARCH

Looking out of the window, I am glad to be inside. A severe storm is hitting Hamburg. At the same time, I start wondering: "Is this still a normal thunderstorm or is it proof that the likes are growing exceedingly violent?" When I was young, such questions and fears were still uncommon.

Today, climate change is ubiquitous. Humans all over the world are dealing with climate change impacts on nature—global and local politicians, regular people as well as climate researchers working for the Universität Hamburg's Cluster of Excellence CliSAP, myself included.

As a cultural anthropologist, I am particularly interested in tracing our climate knowledge back to its roots and in assessing the meaning of global change for humankind. I am neither developing computer simulations nor measuring the thickness of the Arctic sea ice. Instead, my focus lies on the researchers occupied with these tasks. At a birthplace of climate studies I have learned that the object of investigation poses major problems, in particular for the natural sciences.

Global change is a complex issue. It upsets the masses, harbors uncertainties, and is highly charged in political respect. Take, for instance, the pause in global warming: when comparing the global temperatures between 1998 and 2013 with predictions based on climate simulations, a single discrepancy arises. Climate skeptics embrace this as definite proof that current changes are by no means human-induced. Scientists, by contrast, grow all the more curious and continue testing, measuring, and comparing. They aim to integrate new insights into climate model adaptations in order to create more realistic simulations. The problem is that computational models are employed as vehicles for political agenda-setting.

Although a great number of natural scientists would prefer to do research without becoming entangled in politics, this is hardly possible. The UN Climate Council IPCC collects research studies from all around the world and prepares the scientific basis for governance talks such as the Paris World Climate Summit in 2015. The result was a new climate change agreement superseding the Kyoto Protocol.

Against this backdrop, researchers have become political actors. Some draw up disaster scenarios, while others emphasize the vagueness of models and numbers. Contradictory messages, however, stir up the public and undermine the credibility of science.

As a countermeasure, the ideal of the honest broker helps researchers establish their role in the cross fire between politics, the media, and the public. In determining, for example, the possible sea level rise or the probable frequency and intensity of future floods, honest brokers point out inherent inaccuracies. They are arbiters providing facts and arguments for coastal dwellers, local politicians, and administrators who are responsible for coastal protection. Hamburg's climate researchers aim to act as honest brokers.

Still an exotic notion today, in the future, cultural anthropologists with the ability to analyze climate facts and their meaning to society will be in greater demand. My colleagues and I already provide interdisciplinary workshops and until recently had a blog called *Die Klimazwiebel* (the climate onion). Our initiatives respond to the current developments because one thing is for sure: climate change will remain a political hotbed.

Dr. Werner Krauß investigated climate science from the perspective of an cultural anthropologist at Universität Hamburg's Cluster of Excellence CliSAP from 2011 to 2017.

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