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CLUSTER OF EXCELLENCE
CLIMATE, CLIMATIC CHANGE, AND SOCIETY (CLICCS)

POSSIBLE, BUT NOT PLAUSIBLE

WILL THE WORLD ACHIEVE DEEP DECARBONIZATION BY 2050?

03
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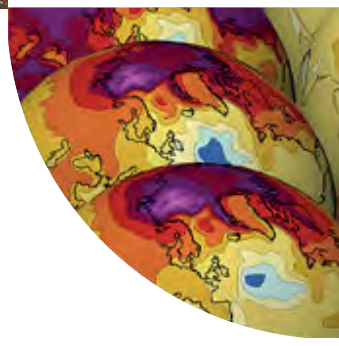


CLICCS QUARTERLY

NEWS FROM CLIMATE RESEARCH

IS THE 1.5-DEGREE TARGET STILL PLAUSIBLE?

If the world is to limit global warming to 1.5 degrees Celsius, there will have to be a fundamental transformation in practically all areas of life toward net-zero emissions by 2050. Many states and organizations have set themselves ambitious targets for carbon neutrality, and at the same time, young people around the globe have campaigned for this goal with climate protests and school strikes. But is this enough? Is achieving deep decarbonization by 2050 currently plausible at all?

More than 40 CLICCS researchers have, for the first time, systematically addressed this question and published their findings in the *Hamburg Climate Futures Outlook*. The short answer is: no, deep decarbonization by 2050 is not plausible.

The scholars assessed ten key social factors that are relevant to cutting emissions, so-called drivers. These included the United Nations' climate governance, corporate strategies and climate-related legal proceedings, as well as climate protests, consumer behavior, and journalism.

According to the study, none of these drivers currently indicates a move away from fossil fuels that would be sufficient to achieve the net-zero goal by 2050. Six of them show movement toward a partial decarbonization, while two others – our consumer behavior, and corporate strategies – are actually hindering decarbonization.

What role do technologies that remove CO_2 and other greenhouse gases from the atmosphere play? The analysis shows that the various removal methods cause side effects, such as a tremendous demand for land and water. Large-scale implementation is therefore not currently plausible. Accordingly, whether or not we can achieve net-zero will mainly depend on how much humankind can reduce emissions.

Societies have to fundamentally change their behavior

Together with new findings on climate sensitivity, the *Outlook* narrows down the range of global warming by the year 2100: it's currently not plausible that, compared to the preindustrial era, the global mean temperature will rise by less than about 1.7 degrees Celsius or by more than ca. 4.9 degrees.

Although deep decarbonization isn't currently plausible, the scenario is by no means impossible: new resources and synergies can be unlocked when individual social drivers "activate" each other, for example when climate protests and new policies lead companies to roll out more effective climate mitigation strategies. The COVID-19 pandemic has shown how quickly and fundamentally societies can change their behavior. Governments rapidly ratified laws that directly affected citizens' private lives, and most people accepted and adhered to them.

Lastly, the *Outlook* stresses that the actual transformation into a climate-neutral world will take far more to achieve than many people realize. The course for our climate future is being set in the political community and many other parts of society – what matters most now is to steer it toward decarbonization.

uhh.de/cliccs-climate-outlook-en

WHEN FOOD AND BIODIVERSITY COMPETE

Securing global food supplies and preserving biodiversity: both are so-called sustainable development goals, but the two don't always go hand in hand. In many places, there is competition for the same areas. What's more, rising temperatures and more frequent extreme weather events threaten biodiversity and harvests alike. How can we produce enough food and also designate sufficient protection areas under these conditions? Dr. Kerstin Jantke and her colleagues investigate these questions and develop solutions.

"We use crop-growth models to simulate how, despite climate change, sufficient food could be produced while at the same time reducing greenhouse gas emissions," says Jantke. "We also investigate various future scenarios. After all, how and where particular crops are produced as well as how they are distributed are key factors. Added to this is the question of what people's diets will look like in the future."

In order to identify suitable areas for preserving biodiversity, Jantke and her team have developed a system for evaluating potential sites. According to Jantke: "We will only be able to make agriculture, nature conservation and climate protection more effective and sustainable if we take into account – and reduce – conflicting interests, so-called trade-offs." uhh.de/cliccs-theme-c2

Removing CO_2 from the atmosphere: Jens Hartmann is a geologist at CLICCS and researching the weathering of rocks.

TWO-FOLD EFFECT

Prof. Hartmann, the weathering of rocks can help to remove CO_2 from the atmosphere. How does it work?
In order to achieve the Paris climate goals, we need to actively remove carbon dioxide from the atmosphere. Through afforestation, fixation in biochar, or by storing greenhouse gas underground – or by accelerating the natural weathering of rocks. This process consumes CO_2, which is removed from the surrounding air.

You believe the method also has other advantages?
Ground basalt rock, which we spread on crop fields, also serves as a fertilizer. The soil becomes more fertile, and more biomass can grow. In turn, more carbon can potentially be stored. This means that the potential for removing CO_2 from the atmosphere using basalt is far greater than previously thought.

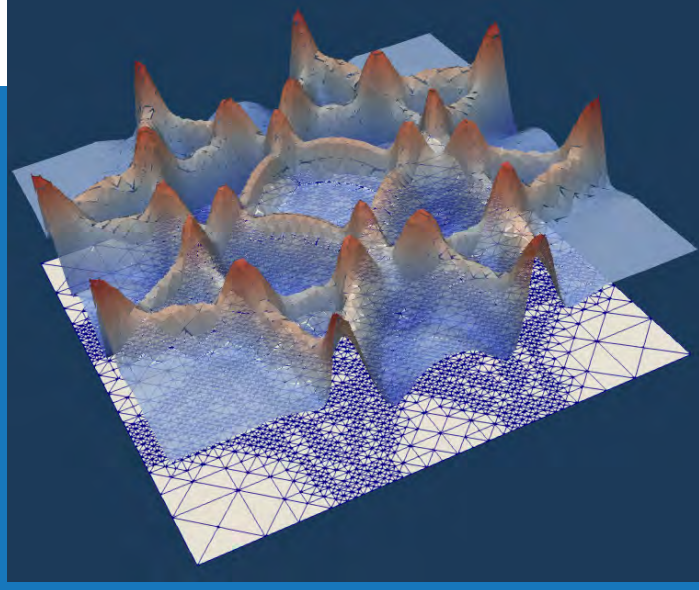
Could the process be easily implemented?
There's plenty of suitable rock available, the technology is tried and tested, and it could be rapidly scaled up. To do so, we would need to intensify basalt mining, wherever possible in remote areas and ideally using renewable energy sources. This could be a viable option in the future. Before then, however, we need more data and field experiments to rule out any unwanted side effects.
https://www.nature.com/articles/s41561-021-00798-x

MESHES THAT KNOW WHAT THEY'RE DOING

Smart math never does more work than is absolutely necessary. This not only saves time, but also memory on your hard drive. For instance, if you need to describe the dynamics of a cloud or an ocean wave, you especially need data from the edges of the object or phenomenon. After all, that's where things change rapidly, while much remains unchanged in the "middle."

Professor Jörn Behrens works with what are known as adaptive meshes, which can automatically adjust to the movements of a given phenomenon. As a result, they essentially cover its edges using a fine net, and use a coarser one where there's less going on, all in real-time.

In the graphic we can see a prototypical sample calculation: an impulse is applied to the exact middle of a square basin of water, just as if a stone were dropped in it. Our image shows the wave pattern that is produced. Below the pattern lies the adaptive mesh – with more data points at the peaks and troughs, and fewer in the calmer, flatter zones.



What else the experiment shows: there's so much going on in this water field that it's nearly completely covered with a fine mesh. In such cases, does the computing power needed for a dynamic mesh really pay off? Behrens and his colleagues have for the first time developed criteria for assessing the efficiency of these meshes, making it possible to determine whether they would pay off in a given situation.

https://link.springer.com/article/10.1007/s10915-021-01423-0

NEWS IN BRIEF

NEW YORK RAPPER TURNS CLOUD RESEARCH INTO MUSIC

The rapper Baba Brinkman and Prof. Stefan Bühler have collaborated on a one-of-a-kind project: a music video with a Caribbean feeling. How do clouds influence our climate? And in future, are the "little fluffy clouds" in the tropics more likely to fuel global warming or to slow it down?
uhh.de/cliccs-research-into-music-en

POTSDAM-BASED PHYSICIST AWARDED WLADIMIR KÖPPEN PRIZE

Dr. Jan Nitzbon recently received the Wladimir Köppen Prize 2020, awarded by the Cluster of Excellence CLICCS, for his outstanding doctoral thesis, which will help us gain a new understanding of the impacts of climate change on Arctic permafrost. Nitzbon has made an important contribution to refining simulations of climate-related changes in the permafrost.
uhh.de/cliccs-koeppen2020-en

FOCUS ON TRANSFER: FUNDING FOR CLICCS PROJECT

Success for economist Michael Tanner: through its Knowledge Transfer Fund for sustainable development, Universität Hamburg is providing 30,000 euros to support his research. He will investigate how weather forecasts and targeted information can help smallholders in Benin adapt to climate change. https://www.uni-hamburg.de/transfer/aktuelles/

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