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Glacier mass loss: past the point of no return

Researchers from the Universities of Bremen and Innsbruck show in a recent study that the further melting of glaciers cannot be prevented in the current century - even if all emissions were stopped now. However, due to the slow reaction of glaciers to climate change, our behaviour has a massive impact beyond the 21st century: In the long run, five hundred meters by car with a mid-range vehicle will cost one kilogram of glacier ice. The study has now been published in Nature Climate Change.

In the "Paris Agreement", 195 member states of the United Nations Framework Convention on Climate Change have agreed to limit the rise in global average temperature to significantly below 2°C, if possible to 1.5°C above pre-industrial levels. This should significantly reduce the risks of climate change. What does this plan - if successful - mean for the evolution of glaciers? Climate researchers Ben Marzeion and Nicolas Champollion from the Institute of Geography at the University of Bremen and Georg Kaser and Fabien Maussion from the Institute of Atmospheric and Cryospheric Sciences at the University of Innsbruck have investigated this question by calculating the effects of compliance with these climate goals on the progressive melting of glaciers. "Melting glaciers have a huge influence on the development of sea level rise. In our calculations, we took into account all glaciers worldwide - without the Antarctic and Greenland ice sheets and peripheral glaciers - and modelled them in various climate scenarios," explains Georg Kaser.

One kilogram of CO_2 emitted costs 15 kilograms of glacier ice.

Whether the average temperature rises by 2 or only 1.5°C makes no significant difference for the development of glacier mass loss over the next 100 years. "Around 36 percent of the ice still stored in glaciers today would melt even without further emissions of greenhouse gases. That means: more than a third of the glacier ice that still exists today in mountain glaciers can no longer be saved even with the most ambitious measures," says Ben Marzeion.

However, looking beyond the current century, it does make a difference whether the 2 or 1.5°C goal is achieved. "Glaciers react slowly to climatic changes. If, for example, we wanted to preserve the current volume of glacial ice, we would have to reach a temperature level from pre-industrial times, which is obviously not possible. In the past, greenhouse gas emissions have already triggered changes that can no longer be stopped. This also means that our current behaviour has an impact on the long-term evolution of the glaciers - we should be aware of this," adds glaciologist Kaser. In order to make these effects tangible, the scientists have calculated that every kilogram of CO_2 that we emit today will cause 15 kilograms of glacier melt in the long term. Calculated on the basis of an average car newly registered in Germany in 2016, this means that one kilogram of glacier ice is lost every five hundred meters by car," clarifies Ben Marzeion.

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Glaciers make the consequences of climate change already clearly visible today, as this example shows: Our photo is of the Hintereisferner glacier on Weißkugel Mountain in Tyrol.
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