

**Media release**

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**Limiting global warming is not enough**

**So far, international climate targets have been restricted to limiting the increase in temperature. But if we are to stop the rising sea levels, ocean acidification and the loss of production from agriculture, CO<sub>2</sub> emissions will have to fall even more sharply. This is demonstrated by a study published in «Nature» that has been carried out at the University of Bern.**

The ultimate objective of international climate policy is to prevent dangerous anthropogenic interference with the climate system. To do this, greenhouse gases are to be stabilised at a level that is acceptable for humans and for the environment. This climate goal is commonly expressed as an increase in the global mean temperature by a maximum of two degrees since pre-industrial times. This general direction is recognised by the majority of the world's governments.

But now, a study carried out by climate researchers based in Bern shows that the focus on the temperature increase alone is by no means enough to meet the ultimate, overarching objective – to protect the climate system from dangerous anthropogenic interference. This is because, according to the United Nations Framework Convention on Climate Change from 1992, the climate system comprises the «totality of the atmosphere, hydrosphere, biosphere, geosphere and their interactions». The Framework Convention also calls for the sustainability of ecosystems and food production. All of this can scarcely be realised by the two-degree target alone.

**Six targets proposed**

This is why Dr. Marco Steinacher, Prof. Fortunat Joos and Prof. Thomas Stocker are proposing a combination of six different specific global and regional climate targets (Figure 1) in their work, which has just been published in the «Nature» journal. They say that a global temperature target is «neither sufficient nor suitable» to avoid further damage that is relevant for communities and ecosystem services. These include in particular: rising sea levels, ocean acidification – which threatens coral reefs– and production on agricultural land.

### **Realistic development paths**

The main culprit in relation to these environmental changes is the emission of the greenhouse gas CO<sub>2</sub>, which is produced when fossil fuels are burned. The researchers have now used extensive model calculations to show which levels of CO<sub>2</sub> emissions would still be allowable in order to meet the proposed combined targets. The basis for the calculations is provided by a wide range of greenhouse gas scenarios that are based on realistic economic trajectories. «We can now show which total CO<sub>2</sub> emissions would be tolerable in the coming decades in order to meet each and every one of the additional climate targets – for example stable production on agricultural land and limitation of ocean acidification», says Marco Steinacher, the leading author of the study. And the researchers ask the crucial question of what would be required in order for all of the climate targets to be met. Their unambiguous answer is that CO<sub>2</sub> emissions have to be lowered even more radically than provided for by the two-degree target (Figure 2). «When we consider all targets jointly, CO<sub>2</sub> emissions have to be cut by twice as much than if we only want to meet the two-degree target», explains Steinacher. The objective of limiting ocean acidification proved particularly challenging and is achievable only through a massive reduction in the emissions of CO<sub>2</sub>.

### **Important basis for informing policy**

The three researchers, all of whom are members of the Oeschger Centre for Climate Change Research at the University of Bern, recommend that further studies of this type be carried out. However, further relevant climate targets need to be set out by policy makers and by society, they say. «Ultimately, the magnitude of environmental changes we are able to cope with and the amount of risks we are prepared to take is a social and political question. But the constant rise in CO<sub>2</sub> emissions is increasingly limiting our options to act», says Fortunat Joos. The climate physicists emphasise the fact that it is important for political decision-makers to link different climate targets to anthropogenic greenhouse gas emissions in a quantitative manner.

According to the study, in the future more detailed simulations will have to be carried out which inform about local and regional consequences of climate change. For example, these include extreme occurrences such as flooding and heatwaves. However, we do not yet have sufficient computing power to operate the complex Earth System Models needed for such probabilistic simulations.

### **Laborious computing work**

The study was made possible by using the «Bern3D-LPJ» Earth System Model developed at the University of Bern. The model is able to simulate a large number of important physical and biogeochemical processes and their interactions on a regional scale. This information is needed to formulate many additional climate targets – for example to prevent the acidification of the oceans in the Tropics. The Bern Model is so efficient that it only took a few weeks to calculate the roughly 65,000 simulations needed for the study. From this rich set of simulations, the researcher have estimated probabilities of meeting specific climate targets. This is not possible with most of the other Earth System Models currently in existence.

### **Captions**

Figure 1:

The rise in greenhouse gases caused by humans influences and alters climate and ecosystems in a variety of ways, and the effects differ from one region to the next. Multiple climate targets are necessary in order to prevent dangerous interference with the climate system and thus negative social and economic effects. With the six climate targets proposed by the climate researchers of the University of Bern in their study, different environmental changes are to be limited that can have negative effects for humans and ecosystems on land and in the ocean.

Figure 2:

The maximum quantity of CO<sub>2</sub> that can still be emitted up until the end of this century through the burning of fossil fuels in order for the climate targets still to be met. In order to achieve all six climate targets (Figure 1) jointly, the emissions have to be cut much more drastically than if global warming is only to be limited to 2°C. The grey part of the bars shows the amount of CO<sub>2</sub> that has already been emitted in the past, while the red part shows the emissions still allowable up until the year 2100 in order for the corresponding targets still to be met. The red and grey part of the bar shows the expected emissions in this decade, assuming an annual rise in emissions of 1.8%. The uncertainties created by different assumptions regarding the future emission of substances other than CO<sub>2</sub> are shown by the horizontal lines.

**Information on the publication:**

Marco Steinacher, Fortunat Joos, Thomas F. Stocker: *Allowable carbon emissions lowered by multiple climate targets*. Nature, advance online publication, 3 July 2013, doi:10.1038/nature12269.

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