Large climate uncertainty even when 1.5°C warming goal is met

The Paris climate agreement includes the aim of limiting average global warming to 1.5°C. There has previously been little research into how climate might look across the world and over time with this level of temperature increase. Climate scientists have now shown that this lower level of warming could lead to very different consequences on a regional level.

At the Paris climate conference in 2015, the nations of the world agreed that average global warming should be limited to well below 2°C, with efforts to limit warming to below 1.5°C. This may appear like focusing on a minor difference – one half degree - but it could be of paramount importance for the global climate and for humanity. This was shown in a study conducted by an international research group recently published in the journal *Nature*. The paper shows that trajectories towards a '1.5 °C warmer world' may result in vastly different outcomes at regional scales, owing to variations in the pace and location of climate change and their interactions with society's mitigation, adaptation and vulnerabilities to climate change. Even policies consistent with the 1.5 °C aim could result in some regional temperatures reaching dangerous levels for ecosystems and societies over the coming decades.

In their new study, the climate scientists show that keeping to a 1.5°C temperature increase would avoid even higher regional temperature changes than if the average temperature increased by 2°C. For example, a 9°C temperature increase on the coldest nights in the Arctic or a 5°C increase on the hottest days in the US and other mid-latitude continents.

The scientists also highlight that the way we reach the 1.5°C goal is decisive for how our climate develops. "Above all, we have to keep in view the time frame in which the climate heats up," says Dr. Sonia Seneviratne, professor of environmental systems science at the Swiss university ETH Zurich and lead author on the paper. If the world heats up by 1.5°C by 2100, but experiences periods of warming of 2°C or higher prior to that, the consequences will be more serious than if the 1.5°C temperature increase is never exceeded. This could cause irreversible damage, particularly to sensitive ecosystems. Such an extinction of species couldn't be undone, even if the level of warming was then reduced and limited to a 1.5°C increase.

All 1.5°C scenarios include a temporary temperature overshoot and use of CO_2-reducing measures. These measures include reforestation and carbon capture and storage (CCS), the capture of CO_2 from emission sources or from the atmosphere. CCS is often accompanied by the use of bioenergy to replace fossil fuels. Yet this could be risky because CCS is not yet well established and the production of bioenergy requires large areas of land, which could cause competition with food production. Drastically and quickly reducing CO_2 emissions could also be achieved with increased energy efficiency, lower energy use, additional use of renewable energies, and a global reduction in meat consumption. There is a limited remaining carbon budget for how much C02 we can emit before the world reaches an increase in global mean temperature of 1.5C.