Heating our climate damages our economies: Study reveals greater costs than expected

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Rising temperatures due to our greenhouse gas emissions can cause greater damages to our economies than previous research suggested, a new study shows. Scientists from the Potsdam Institute for Climate Impact Research (PIK) and the Mercator Research Institute for Global

Commons and Climate Change (MCC) took a closer look at what climate change does to regions at the sub-national level, such as US states, Chinese provinces or French départments, based on a first-of-its-kind dataset by MCC. If CO_2 emissions from burning fossil fuels are not reduced rapidly, a global warming of 4°C until 2100 can make that regions lose almost 10% of economic output on average and more than 20% in the tropics.

"Climate damages hit our businesses and jobs, not just polar bears and coral reefs," says Leonie Wenz from PIK, one of the two authors of the study. "Rising temperatures make us less productive which is relevant in particular for outdoor work in the construction industry or agriculture. They affect our harvests and they mean extra stress and thus costs for our infrastructure as for instance computer centers need to be cooled. By statistically evaluating climate and economic data from the past decades, we found that the aggregated economic damages from rising temperatures are even greater than previously estimated because we looked at the sub-national effects which provide a more comprehensive picture than national averages."

Damages from weather extremes would come on top

Previous research suggested that a 1°C hotter year reduces economic output by about 1%, whereas the new analysis points to output losses of up to three times that much in warm regions. Using these numbers as a benchmark for computing future damages of further greenhouse gas emissions, the researchers find significant economic losses: 10% on a global average and more than 20% in the tropics by 2100. This is still a conservative assessment since the study did not take into account damages from, for example, extreme weather events and sea-level rise, which will also be substantial but are hard to pin down for single regions.

The new insight was made possible by building a novel MCC-dataset of

climate and economy for 1500 regions in 77 states around the world that, for some regions, dates back to the 1900s. Data coverage is best for industrialized countries, however, with economic information lacking in particular for large parts of Africa. While the calculations show a substantial impact on economic production, they do less so for permanent economic growth reductions, which might be a reason for hope once emissions are reduced. Importantly, the damages are distributed very unevenly across the world with tropical and already poor regions suffering most from continued warming whereas a few countries in the North might even profit.

The economic cost of each ton of CO_2 emissions: 70-140 US-dollars

The findings have important implications for climate policy, and namely CO_2 pricing. "If you update the widely-used climate-economy model DICE developed by Nobel prize winner William Nordhaus with the statistical estimates from our data, the costs of each ton of carbon emitted to society are two to four times higher," highlights the lead-author of the study, Matthias Kalkuhl from MCC. "According to our study, every ton of CO_2 emitted in 2020 will cause economic damage amounting to a cost between 73 to 142 dollars in 2010 prices, rather than 37 dollars shown by the DICE model. By 2030, the so-called social cost of carbon will already be almost 30 percent higher due to rising temperatures."

By way of comparison: the carbon price in European emissions trading currently fluctuates between 20 and 30 euros per ton; the national carbon price in Germany rises from 25 euros next year to 55 euros in 2025. These current carbon prices thus reflect only a small part of the actual climate damage. According to the polluter-pays principle, they would need to be adjusted upwards significantly.

More information: Matthias Kalkuhl et al, The impact of climate

conditions on economic production. Evidence from a global panel of regions, *Journal of Environmental Economics and Management* (2020). DOI: 10.1016/j.jeem.2020.102360

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