Pre-industrial emissions still causing temperatures to rise: study

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A climate model accounting for the carbon dioxide (CO_2) released into our atmosphere before the industrial revolution has been used to show the detrimental effect of carbon emissions on global temperature in the long-term.

In a study published today in IOP Publishing's journal *Environmental Research Letters*, researchers from the Carnegie Institution for Science have shown that pre-industrial emissions from land use changes are responsible for about nine per cent of the increase in today's global mean temperature since that era.

"The relatively small amounts of carbon dioxide emitted many centuries ago continue to affect atmospheric carbon dioxide concentrations and our climate today, though only to a relatively small extent," said co-author of the study Julia Pongratz.

"But looking into the past illustrates that the relatively large amount of carbon dioxide that we are emitting today will continue to have relatively large impacts on the atmosphere and climate for many centuries into the future."

Having modelled pre-industrial emissions from around the world, the researchers calculated the effect on emissions of the five-fold population increase between 850 and 1850 AD.

This pre-industrial millennium of population growth was dominated by

South and East Asia: China and India alone account for half of the population growth which led to the world's first living billion by 1850.

The researchers' model suggests that between 20 and 40 per cent of China and India's entire history of CO_2 emissions comprises pre-industrial emissions related to this population growth and demonstrates that these emissions are still having a detrimental effect on our climate today.

Land use changes – the change in vegetation cover due to agriculture and forestry – were the main causes of carbon emissions before the industrial revolution and still have an effect on today's temperature because the uptake of the excess CO_2 in the atmosphere by the oceans and vegetation happens at a very slow pace.

On top of that, when land was cleared for farming, part of the carbon was released immediately into the atmosphere by being burned; however, the rest, including that from roots and wood products, decays over years and centuries, meaning it is still being emitted into the atmosphere today.

The consequences of pre-industrial emissions for today's climate may be relevant for political discussions on how to distribute the burden-sharing of greenhouse gas reduction commitments, which are based on attributing today's climate change to different countries.

Questions still remain over whether countries should be held responsible for past emissions at a time when their effect was not known, or if present generations should be held responsible for historical activity; however, the researchers' results show that accounting for pre-industrial emissions shifts the attribution of global temperature increase from the industrialised to less-industrialised countries by two to three per cent.

The researchers note, however, that their work is not designed to blame people in the developing world for today's climate problems, particularly considering the much larger climate impact being made by modern industrialized nations on a daily basis.

Co-author of the study, Ken Caldeira, said: "Accounting systems are not natural facts, but human inventions. Once an accounting system is defined, it becomes a matter of scientific investigation to determine what numbers should go in the ledger, but broader questions of who is responsible for what and who owes what to whom are judgments that lie outside the scope of science."

More information: Attribution of atmospheric CO2 and temperature increases to regions: importance of preindustrial land use change, by Julia Pongratz and Ken Caldeira 2012 *Environ. Res. Lett.* 7 034001: iopscience.iop.org/1748-9326/7/3/034001/article

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