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Global warming risk 'much higher'

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Global temperatures will rise further in the future than previous studies have indicated, according to new research from two scientific teams.

They both used historical records to calculate the likely amplification of warming as higher temperatures induce release of CO₂ from ecosystems.

They both conclude that current estimates of warming are too low, by anything up to 75%.

The research will be published in the journal *Geophysical Research Letters*.

The studies challenge the consensus view of the Intergovernmental Panel on Climate Change (IPCC), the global body charged with collating and analysing climate science.

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It predicts that the global average temperature would rise by between 1.5C and 4.5C if human activities were to double the amount of carbon dioxide (CO₂) in the atmosphere.

That figure, known as the climate sensitivity, results from a

combination of two factors:

- the direct impact of rising CO₂ on the greenhouse effect
- various "feedback" mechanisms which amplify the rate of warming, such as changes in the Earth's reflection of sunlight as ice melts

The new research adds a third component, by calculating the likely contribution of carbon dioxide released from natural ecosystems such as soil as temperatures rise.

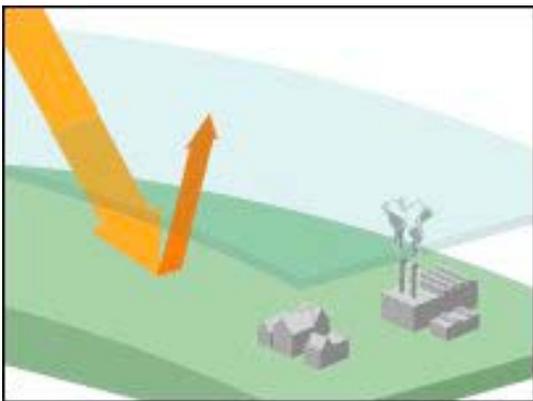
This would add to the CO₂ produced through human activities, raising temperatures still further.

Soil cycle

To calculate this extra warming, both research groups have looked back into the Earth's history.

Regularly, spells of relatively high temperatures have produced rises in atmospheric carbon dioxide concentrations, which have fallen again as colder conditions took over.

The theory is that in warm spells, ecosystems such as soils, forests and oceans retain less carbon.



As the Earth's surface is now warming again, the process might be expected to repeat itself, with higher temperatures again causing the biological world to release CO₂ into the atmosphere, complementing the gas coming from homes, factories and vehicles.

To calculate the relationship between temperature rise and carbon release, the US study examined a period of about 400,000 years using

data from the Vostok ice core of Antarctica.

The European group worked on a much shorter period, looking back to the "Little Ice Age", a period in the middle of the last millennium when the northern hemisphere experienced relatively low temperatures.

"Our group used long time periods, over entire glacial and interglacial cycles, to get this relationship between climate and carbon," explained John Harte from the University of California, Berkeley.

"The European team looked at a much more modern period, and also used a different analytical method," he told the BBC News website.

The European group calculates that temperature rises in the future have been underestimated by between 15% and 78%; the US team expresses its results in a different way, giving a climate sensitivity of between 1.6 and 6.0C.

"We don't get very different answers," observed Professor Harte.

"And using different periods is very helpful, because we know the results are more robust."

Future issues

Both scientific teams admit their work is not as precise as they would like, and that uncertainties remain.

One particular issue is whether the past accurately reflects the future. Do forests and soils behave now, in an era of vast deforestation and widespread fertiliser use, just as they did 100,000 or even 1,000 years ago?



That remains unproven; and climate "sceptics" will undoubtedly seize on this as evidence that the new research is flawed, though they will have to admit that it is substantially grounded in data and not computer

models, often the target of their ire.

The researchers counter that they have not found reasons why carbon feedback mechanisms should be different in the future. And even if differences do arise, they say, future feedback could be stronger as easily as it could be weaker.

"We have, in fact, been conservative on several points," said Marten Scheffer from Wageningen University in the Netherlands, leader of the European group.

"For instance, we do not account for the greenhouse effect of methane, which is also known to increase in warm periods."

Currently the IPCC is reviewing its latest major study, the Fourth Assessment Report, which will be released next year.

The first draft, of which BBC News has seen a leaked copy, suggests it has not radically changed its projections for temperature rise since its last report in 2001.

A climate sensitivity of up to 4.5C translates to a maximum likely temperature rise of about 5.8C by the end of this century; whereas in these two studies, the US team calculates up to 7.7C, with the European group's maximum value even higher.

"In view of our findings," observes Marten Scheffer, "estimates of future warming that ignore these [carbon feedback] effects may have to be raised by about 50%."

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