

Asymmetry in carbon dioxide emissions and removals could skew climate targets: research

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Changes in climate resulting from carbon dioxide (CO₂) emissions into the Earth's atmosphere are not equal to the climate changes from deliberate CO₂ removals—and assuming such a balance could lead to different climate outcomes that may skew climate targets, according to new Simon Fraser University-led research.

"Because of the complexity of the Earth's system, things are not as simple as "one ton of CO₂ in, equals one ton of CO₂ out," says Kirsten Zickfeld, a distinguished professor of climate science in SFU's

Department of Geography, and lead author of a new paper published this week in the journal *Nature Climate Change*. "CO₂ emissions are more effective at raising atmospheric CO₂ concentration than CO₂ removals are at lowering it."

According to Zickfeld, this "asymmetry" implies that a larger amount of CO₂ removal is required to compensate for a given amount of CO₂ emissions if the atmospheric CO₂ concentration is to remain unchanged.

Researchers used a series of climate model simulations to test whether the change in climate resulting from CO₂ emissions and removals is asymmetric. Their results showed that the rise in the atmospheric CO₂ concentration following an [emission](#) is larger than the decline following a removal of the same magnitude.

Findings of the study infer that balancing a given amount of CO₂ emissions with an equal amount of CO₂ removals could lead to a different climate outcome than avoiding the CO₂ emissions.

"Our study suggests that assuming exact balance between CO₂ emissions and an equal amount of CO₂ removals in a net-zero framework risks blowing climate targets," she says.

While Zickfeld says that balancing emissions with CO₂ removals of the same magnitude could lead to different [climate](#) outcomes, further study is needed to learn more about the extent of this effect.

More information: Kirsten Zickfeld et al, Asymmetry in the climate–carbon cycle response to positive and negative CO₂ emissions, *Nature Climate Change* (2021). [DOI: 10.1038/s41558-021-01061-2](https://doi.org/10.1038/s41558-021-01061-2)

Provided by Simon Fraser University

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