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Impact of Climate-Carbon Cycle Feedbacks on Emission Scenarios to Achieve Stabilisation

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Stabilisation scenarios are receiving increasing amounts of interest both politically and scientifically. Instead of asking where a business-as-usual increase in CO2 emissions will lead us, society is now asking what emissions pathway is required to take us to a given climate/CO2 state. In particular, how we can avoid dangerous climate change and ensure a stable climate into the future?

However, answering such a question is complicated by the impact of future climate changes on the natural carbon cycle. The Earth's natural ecosystems (both on land and in the ocean) currently absorb roughly half of the anthropogenic emissions of CO2, thus buffering us from the full climate impact of our emissions. However, changes in the climate will affect this rate of absorption and hence influence the future rate of change of atmospheric CO2. Such feedbacks between the climate system and carbon cycle will have a significant impact on determining the emissions which are required to stabilise atmospheric CO2 at a given level.

In particular, in the same way that positive feedbacks have been found to increase the level of climate change for a given scenario of CO2 emissions, we find that to reach stabilised CO2 levels, the magnitude of permissible emissions may be significantly less than originally expected. Here we show the impact of such climate-carbon cycle feedbacks on stabilisation emissions scenarios. In particular we examine the WRE stabilisation scenarios and find that the predicted future climate carbon cycle positive feedbacks reduce the total permissible stabilisation emissions for each stabilisation level.