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Ocean circulation changes at the PETM: A fully coupled GCM study

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A substantial transient warming of the Earth's surface occurred 55.5 million years ago (Ma) (the 'Paleocene/Eocene Thermal Maximum' or 'PETM'), synchronous with a carbon isotopic excursion interpreted as recording a massive release of carbon to the ocean and atmosphere. Although the PETM represents a potential analogue for future global change, little is currently certain about the source, quantity, or rate of carbon release, nor of the impact of major reorganizations in ocean circulation that took place at this time.

In this study, we use the fully coupled atmosphere-ocean GCM, HadCM3L, to investigate possible changes in ocean circulation at this time. We carry out a sensitivity study to CO_2 concentration during the Eocene, and find a significant change in both the Atlantic and Pacific overturning, given increased levels of CO_2. This change in circulation could provide a potential trigger for methane hydrate destabilization.