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Reconciling glacial cycle atmospheric radiocarbon and carbon dioxide signatures

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The mechanisms causing the glacial-interglacial range of ∼90ppmv are still not fully understood. The deep Pacific is a potential isolated storage reservoir of respired carbon related to reduced ocean ventilation at this time. During the initial deglaciation (18-14kyr BP), atmospheric carbon dioxide concentrations increased by ∼40ppmv. Corresponding records of atmospheric radiocarbon concentration display a massive decrease of 190‰ which also suggest the sudden release of a large store of carbon that has been isolated from the atmosphere for a significant period of time.
In this study we have used an Earth system model of intermediate complexity, GENIE (Grid ENabled Integrated Earth) to investigate the influence of plausible physical changes in ocean circulation on deep Pacific storage of carbon, and the impact on atmospheric carbon dioxide and distribution of carbon isotopes. We perform transient simulations of the last glacial cycle (120kyr) to examine the sensitivity of Pacific carbon storage to prescribed ocean circulations and sea-ice cover, including freshwater hosing to simulate Heinrich events. In particular we present modelled changes in carbon dioxide and radiocarbon, which produce deglacial changes consistent with available palaeo-records in terms of time scale and magnitude.