# The radiocarbon fingerprint of different Meridional Overturning Circulations

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Changes in the strength and structure of the Atlantic Meridional Overturning Circulation (MOC) may have played a key role in abrupt palaeoclimatic transitions and could result in significant climatic impacts in the future. Carbon isotopes can be used to infer palaeoceanographic circulation changes. However, discrepancies exist in the interpretation of isotopes in geological archives. By directly simulating isotopic tracer fields within complex numerical models, tracer concentrations can be compared to observations rather than the more uncertain climatic interpretations. We simulate the radioactive isotope $^{14}C$ in the ocean component of the FAMOUS General Circulation Model to study large-scale ocean circulation, the oceanic carbon cycle, and air-sea gas exchange. This abiotic tracer implementation accounts for the effects of air-sea gas exchange, advection and radioactive decay. The model was spun-up for 10,000 years to allow $^{14}C$ concentrations in the deep ocean to equilibrate. Here, we evaluate the model's ability to reproduce $^{14}C$ distributions in the pre- and post-bomb eras. We find that the model is able to reproduce the main features of observed $\Delta^{14}C$ in the surface ocean, zonal means and depth profiles. We also use the isotope-enabled model to investigate the surface climatologies and $^{14}C$ fingerprint of different MOC stability regimes, as identified by net freshwater import into the Atlantic ($F_{ov}$). The overall aim is to improve our understanding of palaeoceanographic circulation changes at the Last Glacial Maximum (21,000 years ago) and during the last deglaciation (21,000-11,000 years ago).