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Dating rapid climate change in the North Atlantic during Heinrich Stadial 1

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Paleoclimate records from the North Atlantic show some of the most iconic signals of abrupt climate change during the ice ages. Here we use radiocarbon as a tracer of ocean circulation and air-sea gas exchange to investigate potential mechanisms for the abrupt climate changes seen in the North Atlantic over the last deglaciation. We have created a stack of North Atlantic surface radiocarbon reservoir ages over the past 20,000 years, using new synchronized age models from thirteen sediment cores refined with thorium normalization between tie-points. This stack shows consistent and large reservoir age increases of more than 1000 years from the LGM into HS1, dropping abruptly back to approximately modern reservoir ages before the onset of the Bolling-Allerod. We use the intermediate complexity earth system model cGENIE to investigate the potential drivers of these reservoir age changes. We find that sea ice, circulation and CO_2 all play important roles in setting the reservoir age. We use these coherently dated records to revisit the sequence and timing of climatic events during HS1 and the last deglaciation, and show that Laurentide Heinrich Events are a response to stadial conditions, rather than their root cause.