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Radiocarbon simulations for the Last Glacial Maximum and Heinrich event 1: a model - data comparison

M. Butzin (1), M. Prange (2) and G. Lohmann (3)

(1) University of Bremen, Center for Marine Environmental Sciences, D-28334 Bremen,
(2) University of Bremen, Research Center Ocean Margins, D-28334 Bremen,
(3) Alfred Wegener Institute for Polar and Marine Research, D-27570 Bremerhaven
(contact: mbutzin@marum.de)

We present simulations of oceanic radiocarbon for the Last Glacial Maximum, using a three-dimensional global ocean circulation model forced with glacial background states according to various reconstructions. The aim of our sensitivity studies is to reconcile available radiocarbon data from marine sediments with reconstructed sea surface temperatures and estimated sea ice production rates. In the simulation with the best agreement with radiocarbon observations, North Atlantic Deep Water export is reduced by 40% compared to present day, while Antarctic Bottom Water flow is intensified to similar strength in the South Atlantic. Transient simulations show that glacial freshwater discharge into the North Atlantic can cause abrupt increases of atmospheric radiocarbon as observed during Heinrich event 1. However, the effect is only significant in scenarios with a massive short-time discharge at the beginning which is followed by low-level freshwater input for the rest of the event, or if it is assumed that the meridional overturning circulation was already in a modern operational mode.