Geophysical Research Abstracts, Vol. 9, 08758, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08758

Ventilation of the deep western North Atlantic during recent millennia

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We have measured D14C on benthic foraminifera from two high deposition rate core sites in the western North Atlantic to evaluate the nature of water mass change during Holocene climate changes. We found that core top (zero age) benthic foraminifera have a D14C of -129 permil on the Bermuda Rise (4.6 km), whereas D14C during the beginning of the Little Ice Age (LIA) was -86 permil after "undecaying" the data based on the planktonic foram calendar age. The core top result is consistent with WOCE 14C data for the waters bathing the Bermuda Rise. If we consider deep waters in the western North Atlantic to be a mixture of northern and southern source end members with D14C of -70 permil and -160 permil, respectively, we estimate bottom waters today at are a 50/50 mixture, whereas during the LIA the mixture was greater than 90 % northern source water. At ∼4.0 km on Laurentian Fan the results are similar, but attenuated. Five hundred years ago D14C was ∼-80 permil whereas in the past 100 years it was as low as –130 permil. At each site, ventilation was better (more northern source water) during the LIA than during the Medieval Warm Period, and bottom waters were even younger during the 1500 yr B.P. cold event. These results are inconsistent with both d13C and Cd/Ca data, and suggest that during the most recent of the millennial cold episodes of the Holocene, North Atlantic Deep Water was enhanced rather than suppressed. This outcome is consistent with more extreme negative phases of the North Atlantic Oscillation during cold events, if greater convection in the Greenland Sea led to greater overflow at Denmark Strait. If this is correct, then climate change caused MOC change, not vice versa.