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Supporting Online Material for

Reduced North Atlantic Deep Water Coeval with the Glacial Lake Agassiz Fresh Water Outburst

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This PDF file includes:

Materials and Methods
Figs. S1 to S4
Table S1
References

Supporting Online Material

Materials and methods

Stable Isotopes.

Core MD03-2665 was sampled continuously at 1 cm interval. Each sample was placed in distilled water and left for 12 hr on a shaking table to disaggregate. The samples were then wet sieved into two fractions: >63-µm and >150-µm. Following this, the coarse fraction was dried and transferred to sample glasses. The planktonic foraminiferal isotopic analyses were performed on 8 to 10 individual tests of *Neogloboquadrina pachyderma* sinistral coiling, selected from the 150-250-µm size fraction, whereas the benthic foraminiferal isotopic analyses were performed on 1-2 specimens of the epifaunal benthic foraminifera *Cibicidoides wuellerstorfi,* picked from the >250-µm fraction. Due to the low abundance of *Cibicidoides wuellerstorfi,* not all samples could be run as duplicates or triplicates. Replicate analyses were done if sufficient foraminifera were found. The final *Neogloboquadrina pachyderma* sinistral coiling oxygen isotope record corresponds to average values of 2 replicates every 4 cm (0-340 cm), and high-resolution measurements (1 every cm) from 253-400 cm. Replica values for *Cibicidoides wuellerstorfi* δ^{13}C‰ VPDB with an averaged mean are plotted in figure S1 below. Replica values for *Neogloboquadrina pachyderma* sinistral coiling δ^{18}O‰ VPDB with an averaged mean are plotted in figure S2 below.

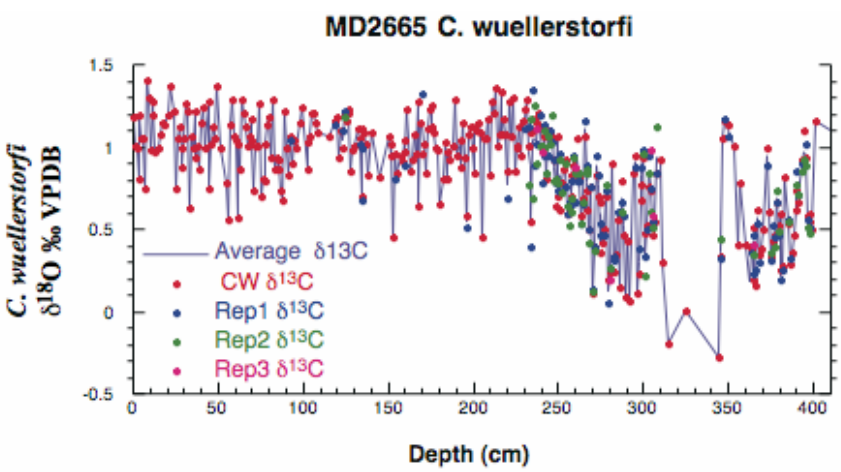

Figure S1 Replica values for *Cibicidoides wuellerstorfi* δ^{13}C‰ VPDB (red, blue, green and pink dots) with an averaged mean (purple line) from core MD03-2665 plotted versus depth.

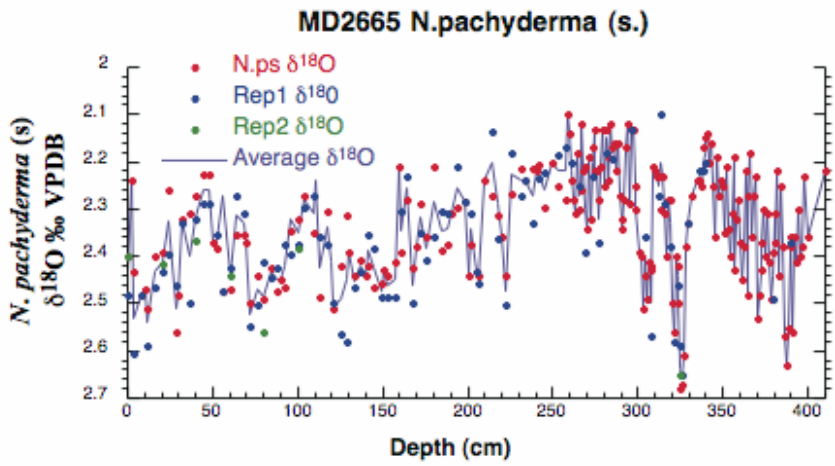

Figure S2 Replica values for *Neogloboquadrina pachyderma* sinistral coiling $\delta^{18}O$‰ VPDB (red, blue and green) with an averaged mean (purple line) from core MD03-2665 plotted versus depth.

Before analyses the foraminiferal shells were ultrasonically rinsed for 20 seconds in methanol to remove fine-grained particles. The methanol was removed using a syringe and the samples dried in a drying cabinet. The foraminifer shells were then loaded into individual reaction glasses, and each sample was reacted with three drops of H_3PO_4 using an automated Kiel device preparation line. Isotope ratios were measured on a Finnigan MAT 251 mass spectrometer (*Neogloboquadrina pachyderma* sinistral coiling) and on a Finnigan MAT 253 mass spectrometer (*Neogloboquadrina pachyderma* sinistral coiling and *Cibicidoides wuellerstorfi*) at the stable isotope laboratory at BCCR/Department of Earth Sciences, University of Bergen. The working standard measured parallel with the samples is Carrera Marble (CM03). The isotopic values are calibrated to VPDB using NSB-19. Long-term analytical precision (1σ) of the standards over a time interval of several months is 0.1‰ and 0.04‰ for $\delta^{18}O$ and $\delta^{13}C$ respectively for samples weighing 7-50µg on the MAT 253 system and <0.08‰ and 0.04‰ for $\delta^{18}O$ and $\delta^{13}C$ respectively for the MAT 251 system.

Magnetic properties.

For the analyses of the magnetic properties, core MD03-2665 was sub-sampled using u-channels, which were measured in the shielded room of the magnetic laboratory of the LSCE. The u-channels were using a 2G-Enterprises Model 755 cryogenic magnetometer at 2 cm intervals. The spatial resolution of the pick-up coils is ~ 4.5 cm. Edge effects were removed from the final data. Anhysterestic Remanent Magnetization (ARM) was produced in line along the Z-axis of the u-channels with 0.1 T peak AF in a 50 m T DC field. ARM was demagnetized with 10 AF steps from 10 to 80mT. Isothermal Remanent Magnetization was induced stepwise using an in-line pulsed solenoid with fields of 0.05, 0.1, 0.2, 0.3, 0.5 and 1T. A reverse IRM was then imparted in a field of 0.3 T to calculate the S-ratio. The 1T IRM was AF demagnetized using the same steps as for ARM. Low-field magnetic susceptibility was measured on a separate set-up using a Bartington MS2C

45 mm diameter coil, which has the same spatial resolution as the cryogenic magnetometer.
An alternating gradient magnetometer (AGM 2900) was used for hysteresis analysis of small amounts of sediment taken at 10 cm intervals through the Holocene. The sampling interval was reduced to 1 between 0 and 55 cm and between 200 and 350 cm and to 20 cm between 352 and 450 cm.

X-ray fluorescence (XRF) logging.
Semi-quantitative major and minor element determinations were carried out at Royal NIOZ with the AVAATECH XRF core scanner (*S1*) . These analyses were performed on the surface of the u-channels with a step size of 5 mm, operating voltage of 10kV and count time of 30 seconds per sample. Results are presented as total XRF counts which correspond to the peak areas for respective elements.

Calcium carbonate content.
The carbonate content (in %) have been measured using the manocalcimeter of the IDES Department at the University of Orsay (France). 100 mg samples taken at 10 cm interval in the core have been mixed with HCl (6N) in a closed vial (22.4 cm^3). The manocalcimeter has systematically been standardized so that 1 bar corresponds to 100 mg of $CaCO_3$.

Chronology
We obtained 23 accelerator mass spectrometry (AMS) ^{14}C ages on mixed planktonic foraminifera (Table S1), including 6 dates across the critical time interval from 8.2-8.5 ka calendar. Radiocarbon ages have been converted into calendar ages with the CALIB (rev 5) software (*S2*) and the MARINE04 calibration dataset (*S3*). Most dates were calibrated with a constant surface reservoir age of 400 years. However, for two dates corresponding to pronounced planktonic foraminiferal $\delta^{18}O$ maxima, we applied an additional reservoir age correction (ΔR = 128±23a, average deviation for the East Greenland Current, see http://radiocarbon.pa.qub.ac.uk/marine/). Estimated mean sedimentation rates are ~90cm/ka for the early Holocene (10.7-8.5ka), ~225cm/ka from 8.5-8.2ka, and ~40cm/ka thereafter (Figure S3 and S4 below). Taking calendar ages at face value, very high sedimentation rates occur coevally with the onset of changes in our proxy records, consistent with our interpretation of the sedimentological proxy anomalies as an instantaneous event (see text).

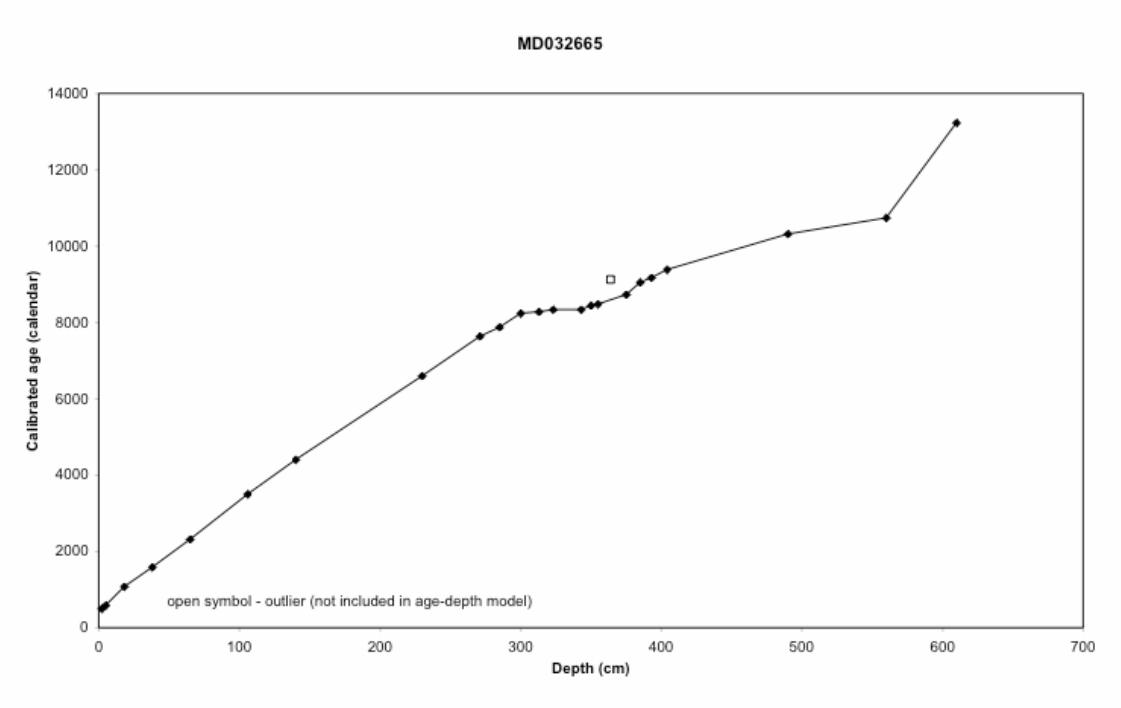

Figure S3. Age-depth relationship of core MD03-2665; 0-700 cm

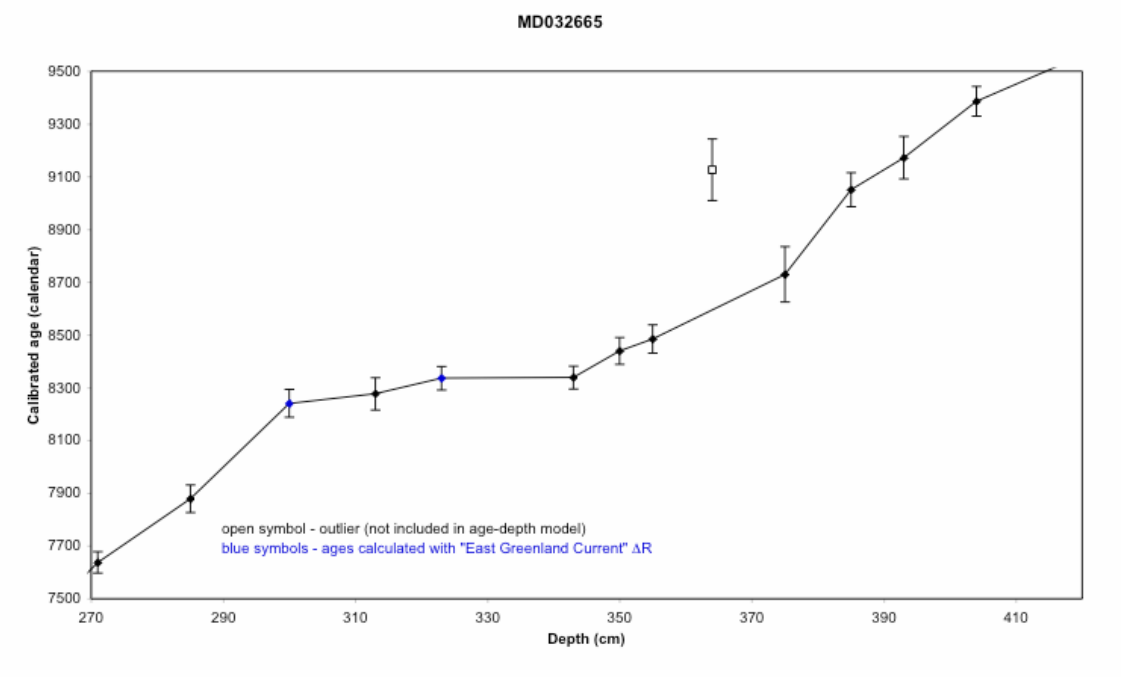

Figure S4. Age-depth relationship of core MD03-2665 with focus on the high-resolution interval from 270-420 cm

Table S1 Radiocarbon ages from core MD03-2665 determined by accelerator mass spectrometry

Depth (cm)	Lab code [a]	Species [b]	Uncorrected ^{14}C age (yr) ± 1σ error	Calendar age BP [c] (median probability)	1σ age range	Remarks
2	KIA	Gbull	890 ± 30	504	482-525	
5	KIA	NPD	995 ± 25	582	549-613	
18	KIA	Gbull	1525 ± 35	1080	1034-1140	
38	KIA	mixed Gbull + NPS	2020 ± 30	1585	1529-1624	
65	KIA	Gbull	2635 ± 30	2320	2288-2348	
106	KIA	Gbull	3605 ± 45	3501	3438-3559	
140	KIA	Gbull	4280 ± 30	4400	4343-4447	
230	KIA	Gbull	6160 ± 30	6597	6550-6644	
271	KIA	mixed Gbull + NPS	7175 ± 30	7638	7592-7673	
285	KIA	mixed Gbull + NPS	7415 ± 50	7879	7829-7933	
300	KIA	NPD	7895 ± 40	8241	8186-8291	ΔR of 128±23a applied (see table caption)
300	*KIA*	*NPD*	*7895 ± 40*	*8361*	*8328-8392*	
313	KIA	mixed Gbull + NPS	7810 ± 35	8277	8214-8338	
323	KIA	mixed Gbull + NPS	7995 ± 40	8336	8294-8384	ΔR of 128±23a applied (see table caption)
323	*KIA*	*mixed Gbull + NPS*	*7995 ± 40*	*8453*	*8401-8499*	
343	KIA	mixed Gbull + NPS	7870 ± 55	8339	8298-8384	
343	KIA	mixed Gbull + NPS	7795 ± 45	8265	8212-8317	duplicate analysis (not used)
350	KIA	mixed Gbull + NPS	7980 ±45	8440	8384-8487	
355	KIA	mixed Gbull + NPS	8030 ±45	8485	8426-8535	
364	GifA	mixed Gbull + NPS	8500 ± 90	9135	9009-9242	outlier (not used)
375	KIA	mixed Gbull + NPS	8215 ± 45	8730	8623-8835	
385	KIA	mixed Gbull + NPS	8435 ± 50	9051	8981-9111	
393	KIA	Gbull	8535 ± 50	9172	9092-9254	
404	KIA	mixed Gbull + NPS	8705 ± 45	9386	9340-9442	
490	GifA	mixed Gbull + NPS	9460 ± 70	10318	10225-10392	
560	GifA	Gbull	9850 ± 60	10744	10601-10879	
610	GifA	NPS	11770 ± 70	13235	13175-13296	

[a] KIA – Leibniz Labor für Altersbestimmung und Isotopenforschung, Kiel, Germany; GifA - Laboratoire des Sciences du Climat et de l'Environnement, sur-Yvette, France [b] Gbull – *G. bulloides*; NPD – *N. pachyderma*(d); NPS – *N. pachyderma*(s)

[c] ^{14}C ages were converted into calendar ages with the CALIB vs.5 software and the MARINE04 calibration dataset. We applied a standard 400a reservoir age correction in most cases, and an additional ΔR for two dates to account for enhanced influence of the East Greenland surface current (inferred from pronounced planktonic foraminiferal $\delta^{18}O$ maxima) *Ages in blue are for the standard 400a reservoir effect causing age reversals*

References and notes

S1. T. O. Richter *et al.*, in *New techniques in Sediment Core Analyses* G. Rothwell, Ed. (Geol. Soc. London Spec. Publ., 2006), vol. 267, pp. 39-50.
S2. M. Stuvier, P. J. Reimer, *Radiocarbon* **35**, 215 (1993).
S3. K. A. Hughen *et al.*, *Radiocarbon* **46**, 1059 (2004).