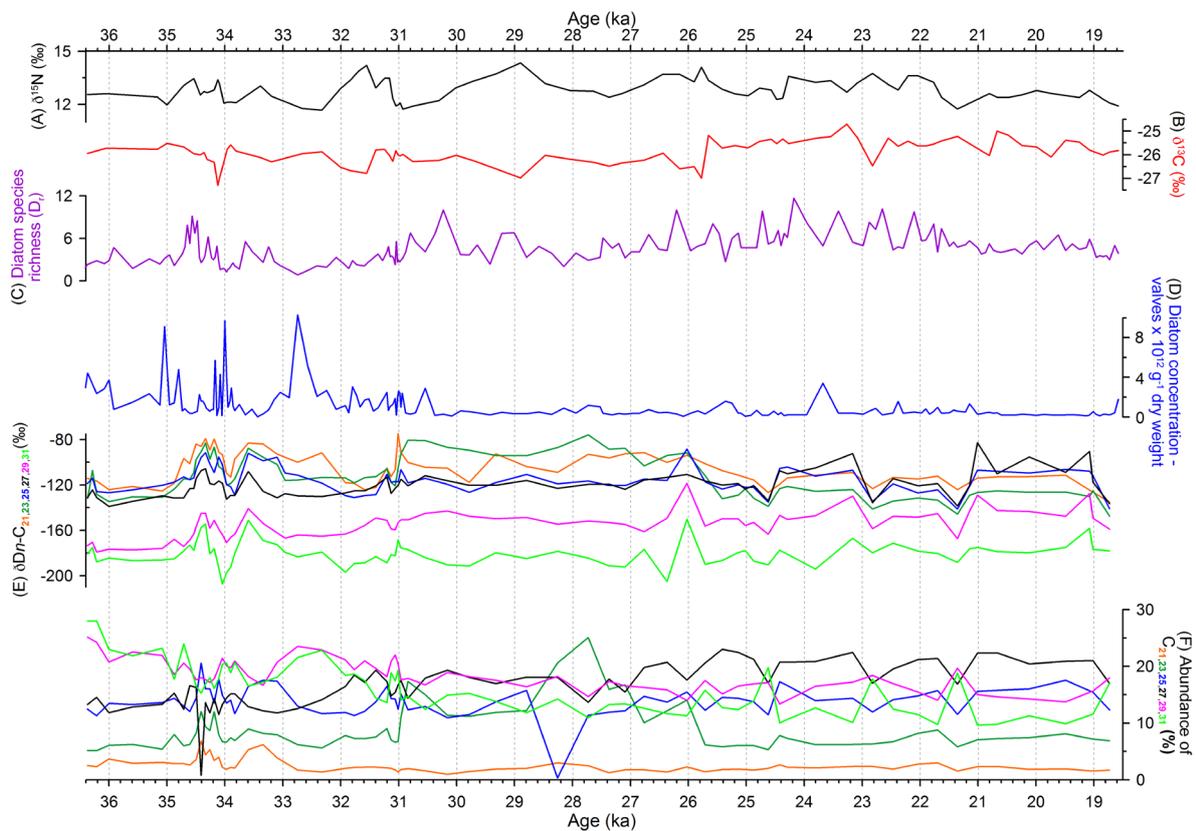
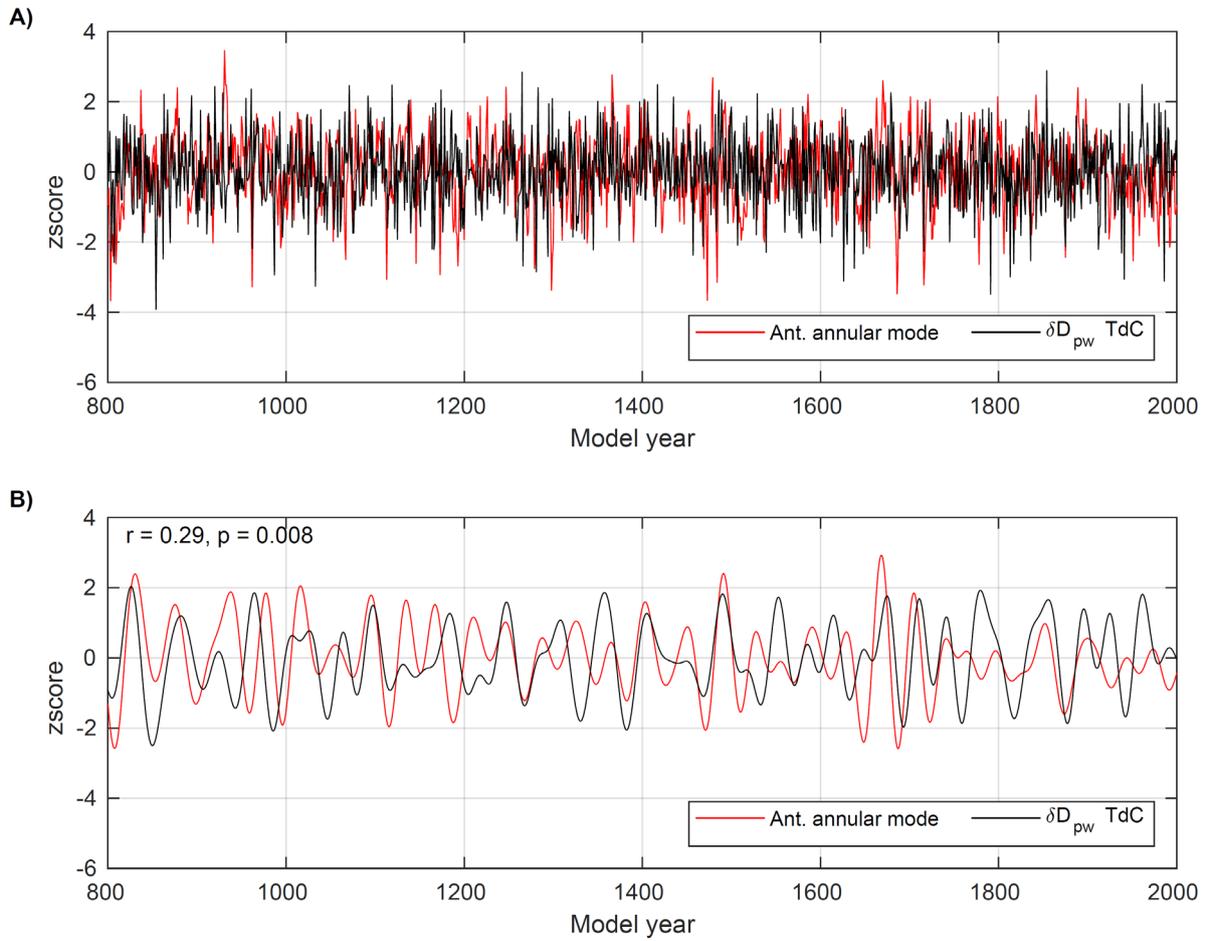


1 **SUPPLEMENTARY INFORMATION**



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 3 **Figure S1.** Proxies in the sediment core from 1st Pond, Nightingale Island, not shown elsewhere. (A)
 4 $\delta^{15}\text{N}$ values on bulk sediment. (B) $\delta^{13}\text{C}$ values on bulk sediments. (C) Diatom species richness (D_r),
 5 calculated as a function of number of species identified (S_i) and total number of counted diatoms (T_d)
 6 such that $D_r = 100 \cdot S_i / T_d$; a few samples with <100 counted diatom valves were omitted. (D) Diatom
 7 concentrations, shown as diatom valves per gram dry weight of the sediment. (E) δD values (‰) of the
 8 six different alkanes measured, $n\text{-C}_{21}$ =orange, $n\text{-C}_{23}$ =dark green, $n\text{-C}_{25}$ =blue, $n\text{-C}_{27}$ =black, $n\text{-}$
 9 C_{29} =purple and $n\text{-C}_{31}$ =light green. (F) The relative abundance (%) of the six alkanes with the same
 10 color symbols as above. All proxies are related to age on the x-axes.

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Figure S4. Simulated precipitation weighted annual mean δD at TdC and the Antarctic Annular Mode, comparing δD at TdC with the Antarctic Annular Mode (1st principal component of sea level pressure south of 20°S). A) Annual data. B) Band-pass filtered data for cycles between 30 and 100 year periodicity. The correlation between the two time series is significant ($r = 0.29$, $p < 0.01$) taking autocorrelation into account (Ebisizaki, 1997).

47 **Table S1.** Radiocarbon measurements of 41 bulk sediment samples from 1st Pond, Nightingale Island. All
 48 samples measured at Lund University Radiocarbon Laboratory, Department of Geology.
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Sample depth (cm) ± 0.5 cm	¹⁴ C age yr BP	±1σ	Laboratory number	SH Cal13 age range yr BP (2σ)
620,5	15450	90	LuS 9718	18866-18472
628,5	15920	90	LuS 9716	19435-18912
639,5	17120	110	LuS 9481	20921-20285
662,5	18280	110	LuS 9480	22383-21830
668	18850	105	LuS 10322	22949-22433
674,5	19090	120	LuS 9715	23340-22576
677	19380	105	LuS 10323	23595-22970
682	19930	110	LuS 10324	24240-23617
684,5	20450	130	LuS 9479	25026-24163
693,5	20350	110	LuS 9879	24825-24067
704,5	18510	120	LuS 9478	22576-21967
714,5	21300	150	LuS 9672	25881-25254
724,5	22050	150	LuS 9477	26605-25920
729	20560	130	LuS 10325	25151-24313
732,5	22700	150	LuS 9671	27351-26554
744,5	23350	170	LuS 9476	27795-27276
763,5	25550	200	LuS 9475	30294-29087
775,5	24100	170	LuS 10326	28509-27760
783	27240	200	LuS 10306	31416-30894
786,5	26950	220	LuS 9474	31277-30722
796,5	26835	200	LuS 10307	31205-30673
806,5	27050	220	LuS 9473	31329-30778
816,5	28040	200	LuS 10308	32498-31314
826,5	27800	200	LuS 9472	32071-31136
835	28660	200	LuS 10309	33344-31881
840	29200	350	LuS 999	34038-32418
850	26210	200	LuS 10310	30890-29850
855	29870	250	LuS 9141	34425-33545
855	30530	400	LuS 10000	35229-33814
863,5	26140	170	LuS 9878	30815-29826
870	30330	250	LuS 10311	34753-33877
873,5	29550	300	LuS 9661	34215-33014
883,5	30400	250	LuS 9471	34803-33921
893,5	28200	250	LuS 9660	32795-31394
899	29520	250	LuS 10312	34112-33110
903,5	28050	220	LuS 9470	32561-31306
913,5	29900	300	LuS 9659	34551-33505
923,5	30900	250	LuS 9469	35318-34261
928	32430	300	LuS 10313	37246-35583
933	32010	300	LuS 9140	36481-35167
936	32950	300	LuS 10314	38078-36233

Table S2. Proxy methods performed in the study, type of proxy, number of "species/variables" used from each proxy and number of analyzed samples for each proxy. + denotes that additional calculations can be used from the variable.

Proxy methods	Type of proxy	Number of "species/variables"	Number of sample levels
Magnetic susceptibility	Geophysical	1	637
Biogenic silica	Biologic	1	310
Total organic carbon, TOC	Biologic, chemical	1	309
Nitrogen, N	"	1	309
C/N ratio	"	2	309
Diatom analysis	Biologic	33+	179
Insolation	Physical	2	176
XRF analysis	Chemical, physical	34+	156
$\delta^{13}\text{C}$	Biologic, chemical	1	83
$\delta^{15}\text{N}$	"	1	83
δD analysis of <i>n</i> -alkanes	Biologic, chemical	6+	71
GDTG analyses	"	2	65
Pollen analysis	Biologic	28+	64