Paleoceanography

Supporting Information for

East Asian winter monsoon variations and their links to Arctic sea ice during the last millennium, inferred from sea surface temperatures in the Okinawa Trough

Dongling Li, Tiegang Li, Hui Jiang, Svante Björck, Marit-Solveig Seidenkrantz, Longbin Sha, Karen Luise Knudsen

Contents of this file

Figures S1 and S2, Tables S1, S2 and S3

Introduction

The supporting information contains two figures (Figure S1 and Figure S2) and three tables (Table S1, S2 and S3). Figure S1 shows a CCA biplot of diatom taxa and environmental variables. Figure S2 shows the abundance of Tropical diatom species in core MD05-2908. Table S1 shows the data of age model, corresponding to the material and methods in the main article. Table S2 shows locations of the surface sediment diatom samples for the diatom-based SST_W transfer function. Table S3 shows the reconstructed SST_W data in the southern Okinawa Trough.

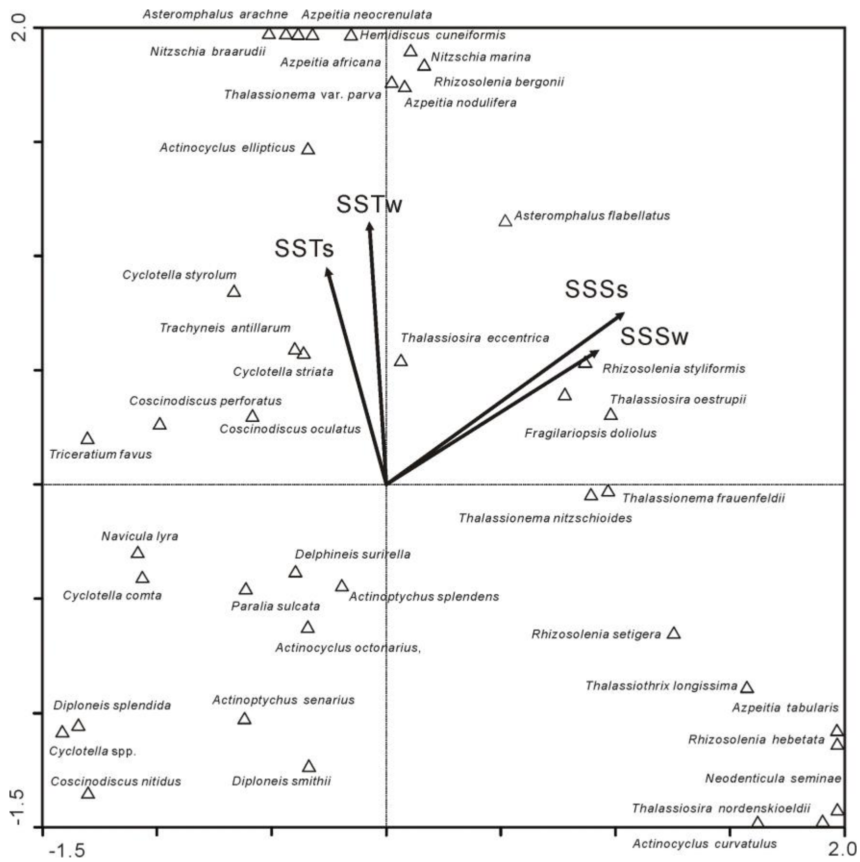

Figure S1. CCA biplot of diatom taxa and environmental variables based on diatom analyses from surface sediments and modern environmental conditions at each sample site in the western Pacific marginal seas [*Huang et al.*, 2009]. SST_S=summer sea surface temperature, SST_W=winter sea surface temperature, SSS_S=summer sea surface salinity, SSS_W=winter sea surface salinity.

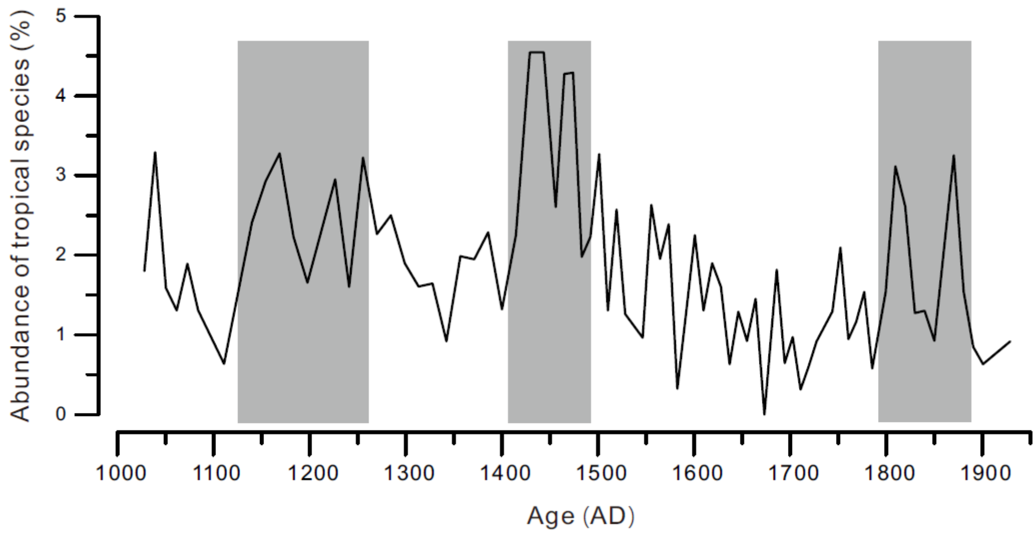

Figure S2. The abundance of Tropical diatom species (*Azpeitia nodulifera*, *Rhizosolenia bergonii* and *Alveus marina*) in core MD05-2908.

Table S1. AMS ^{14}C age determinations from core MD05-2908 [*Li et al.*, 2009]. The ^{14}C ages were calibrated using the OxCal v. 4.13.9 program *[Ramsey*, 2008] with the marine calibration curve Marine09 [*Reimer et al.*, 2009] and ΔR = 35±25 [*Hideshima et al.*, 2001]. The agreement index between the sample and reservoir-corrected is provided in brackets. Age ranges for reservoir-corrected ages are provided as 68.2% confidence intervals. The modelled age is based on the depositional model option in OxCal with a *k* value of 5 yielding A_{model} = 85.2% [*Li et al.*, 2012].

Core depth (cm)	Materials	^{14}C age (cal. a BP, ±1σ)	Reservoir-corrected AMS^{14}C age range (cal. a BP)	Modelled age (cal. a BP)
10~16	*G. sacculifer*+*G. ruber* (white)	470±30	82~0 (68.2%)	43±32
102~108	*G. sacculifer*+*G. ruber* (white)	600±45	266~135 (68.2%)	159±40
210~216	*G. sacculifer*+*G. ruber* (white)	650±30	307~226 (63.1%) 205~200 (1.6%) 160~149 (3.6%)	271±33
410~416	*G. sacculifer*+*G. ruber* (white)	900±25	514~463 (68.2%)	497±25
610~616	*G. sacculifer*+*G. ruber* (white)	1370±40	929~815 (68.2%)	859±49
810~816	*G. sacculifer*+*G. ruber* (white)	1570±25	1146~1045 (68.2%)	1139±25

Table S2. Locations of the surface sediment diatom samples.

Surface samples	Latitude (N)	Longitude (E)	winter SST (℃)	Surface samples	Latitude (N)	Longitude (E)	winter SST (℃)
B22	38°00'	121°45'	4.70	JP62	35°59.9'	132°48.0'	12.85
B70	40°20'	120°45'	0.00	JP63	36°25.6'	133°19.3'	12.70
B72	39°35'	119°30'	1.00	JP64	36°20.2'	133°37.3'	12.80
B76	39°50'	120°50'	1.80	JP65	35°49.7'	135°14.2'	12.85
B78	38°40'	121°00'	5.20	JP66	36°10.0'	135°05.7'	12.80
B79	38°48'	120°45'	5.10	JP67	36°37.7'	134°53.3'	12.60
B80	39°10'	121°15'	0.50	JP68	36°40.3'	134°18.64'	12.70
B82	39°40'	121°00'	2.00	JP69	36°34.1'	133°39.0'	12.70
B83	39°35'	120°25'	2.00	JP70	36°50.0'	137°11.0'	12.80
B84	38°38'	120°00'	3.70	JP73	37°14.4'	137°35.1'	12.60
B86	39°00'	119°30'	3.00	JP74	37°30.0'	137°55.6'	12.20
B87	38°38'	119°18'	3.30	JP75	37°30.0'	137°29.9'	12.20
D-C1-3	26°02.5´	124°32.5´	22.79	JP76	39°40.0'	139°02.0'	11.30
D-C2-2	26°21.9´	125°26.6´	22.44	JP77	38°58.0'	137°54.2'	11.20
D-Z6-3	27°01.7´	126°32.6´	22.95	JP78	38°16.1'	138°36.5'	11.75
D6335	28°00'	123°30'	18.10	NL120-80	21°00.0'	108°25.1'	20.78
D7190	30°30'	128°30'	20.40	NL20-170	20°20.1'	111°30.0'	22.32
D7191	30°30'	129°00'	20.75	NL210-185	19°50.1'	108°10.1'	21.56
H129	39°10'	122°40'	3.50	NL210-205	19°00'	108°15.0'	22.32
H160	38°50'	122°20'	5.00	NL210-225	18°40.1'	108°20.1'	22.69
H2329	35°00'	121°00'	8.00	NL210-245	18°19.9'	108°30.1'	22.95
H2349	35°00'	121°15'	8.20	NL220-110	21°00.0'	112°30.0'	21.71
H2376	35°20'	121°10'	8.40	NL220-130	20°50.1'	112°40.1'	21.83
H242	38°10'	123°00'	6.20	NL220-150	20°40.1'	112°45.0'	21.97
H25	37°00'	122°50'	4.00	NL220-170	20°19.9'	112°50.1'	22.30
H279	37°45'	122°00'	4.25	NL220-50	21°30'	112°00'	21.32
H457	35°40'	124°00'	9.60	NL220-70	21°20'	112°10'	21.42
H492	35°20'	121°30'	8.60	NL220-90	21°10'	112°25'	21.52
H624	34°30'	124°30'	10.60	NL360-115	20°40'	113°50'	22.14
H67	35°00'	121°40'	8.80	NL360-160	19°45'	114°00'	22.84
H87	34°00'	121°40'	6.00	NL360-70	21°15'	113°50'	21.70
JP10	43°28'	137°51'	3.90	NL360-85	20°50'	113°50'	22.03
JP12	39°51'	139°04'	11.20	NL370-20	22°00'	113°40'	21.23
JP13	40°46'	133°12'	4.40	NL440-105	21°45'	114°40'	21.41
JP16	39°18'	137°39'	10.60	NL440-120	21°30'	114°50'	21.65
JP17	39°02'	137°07'	11.00	NL440-160	21°15'	114°50'	21.83
JP18	38°49'	136°36'	11.10	NL440-180	20°50'	114°55'	22.19
JP20	37°57'	132°21'	11.30	NL440-40	22°00'	114°30'	21.29
JP21	38°56'	131°55'	7.90	NL440-60	22°25'	114°35'	21.08

JP23	39°01'	131°00'	8.00	NL50-175	20º30'	109º30'	21.60
JP25	37°56'	131°01'	11.70	NL5045	20º05'	111º05'	22.47
JP26	37°00'	130°59'	12.40	NL5149	21º00'	111º00'	21.68
JP27	36°30'	130°59'	12.70	NL7127	21º30'	113º50'	21.54
JP28	35°58'	131°02'	13.00	NL80-110	20º30'	111º45'	22.20
JP29	36°00'	131°31'	12.95	NL80-130	21º00'	108º50'	20.93
JP3	46°57'	139°36'	2.00	NL80-180	20º10'	111º50'	22.48
JP30	39°47'	139°18'	11.30	NL80-60	20º50'	109º10'	21.13
JP32	37°45'	137°47'	12.10	NL80-90	20º50'	111º40'	21.86
JP33	38°12'	137°24'	11.75	NL8026	22º25'	115º20'	20.98
JP34	38°40'	137°10'	11.30	NL8132	23º20'	117º05'	20.75
JP36	36°29'	132°31'	12.50	NL90-105	21º25'	108º35'	20.66
JP37	37°42'	131°30'	12.00	NS17921	14°54.7'	119°32.3'	27.00
JP38	38°11'	131°22'	11.10	NS17922	15°25.0'	117°27.5'	25.90
JP4	46°16'	138°56'	3.20	NS17925	19°51.5'	119°02.8'	24.20
JP40	38°18'	130°25'	10.50	NS17926	19°00.0'	118°44.0'	24.30
JP41	38°00'	129°50'	10.50	NS17932	19°57.0'	116°02.3'	23.00
JP42	37°40'	130°11'	11.50	NS17934	19°01.9'	116°27.7'	23.75
JP43	37°07'	130°25'	12.20	NS17937	19°30.1'	117°40.0'	23.75
JP45	36°11'	131°08'	12.90	NS17940	20°07.0'	117°23.0'	23.30
JP46	35°59.2'	130°27.86'	13.00	NS17943	18°57.0'	117°33.2'	24.00
JP47	36°25.6'	134°10.0'	12.80	NS17946	18°07.5'	114°15.0'	24.00
JP48	37°34.6'	131°58.9'	12.00	NS17949	17°20.9'	115°10.0'	24.50
JP49	37°43.8'	135°10.7'	12.10	NS17950	16°05.6'	112°53.8'	24.88
JP50	43°00.3'	138°28.1'	5.00	NS17952	16°40.0'	114°28.4'	24.67
JP51	36°17.0'	134°34.0'	12.85	NS17953	14°33.0'	115°08.6'	25.80
JP55	39°38.0'	137°28.0'	10.80	NS17954	14°45.5'	111°31.6'	25.20
JP58	39°42.0'	134°01.5'	7.30	NS17956	13°50.9'	112°35.3'	25.83
JP6	45°30'	139°05'	3.90	NS17957	10°53.9'	115°18.3'	27.00
JP60	36°47.3'	134°57.5'	12.55	NS17958	11°37.1'	115°04.9'	26.86

Table S3. Diatom-based reconstructed winter sea surface temperature (SSTw) during the last millennium in the southern Okinawa Trough.

No.	**Depth (cm)**	**Age (AD)**	**SST_W (℃)**
1	2	1929	15.47
2	18	1901	15.64
3	26	1891	16.61
4	34	1881	17.06
5	42	1870	18.65
6	58	1850	17.81
7	66	1840	17.20
8	74	1830	16.91
9	82	1820	18.71
10	90	1810	19.61
11	98	1800	17.81
12	110	1785	16.95
13	118	1777	17.13
14	126	1769	16.95
15	134	1761	16.61
16	142	1752	17.52
17	150	1744	16.84
18	166	1728	16.68
19	174	1719	15.11
20	182	1711	14.07
21	190	1703	18.13
22	198	1694	15.22
23	206	1686	18.30
24	218	1673	16.86
25	226	1664	17.15
26	234	1655	16.55
27	242	1646	17.08
28	250	1637	16.05
29	258	1628	16.77
30	266	1619	17.63
31	274	1610	17.10
32	282	1601	17.06
33	290	1592	16.90
34	298	1583	14.67
35	306	1574	17.79
36	314	1565	17.18
37	322	1556	17.09
38	330	1547	16.58
39	346	1528	16.94
40	354	1519	17.11

41	362	1510	15.85
42	370	1501	17.03
43	378	1492	15.84
44	386	1483	16.26
45	394	1474	18.94
46	402	1465	18.22
47	410	1456	17.28
48	418	1444	18.73
49	426	1429	19.29
50	434	1415	17.53
51	442	1400	15.07
52	450	1386	16.79
53	458	1371	16.01
54	466	1357	16.81
55	474	1342	16.22
56	482	1328	15.70
57	490	1313	17.47
58	498	1299	16.00
59	506	1284	17.40
60	514	1270	16.47
61	522	1256	17.58
62	530	1241	15.79
63	538	1227	18.79
64	554	1198	17.52
65	562	1183	17.78
66	570	1169	17.23
67	578	1154	17.36
68	586	1140	17.04
69	602	1111	15.81
70	618	1084	15.88
71	626	1073	16.23
72	634	1062	16.21
73	642	1050	16.09
74	650	1039	16.97
75	658	1028	16.14
76	666	1017	16.73