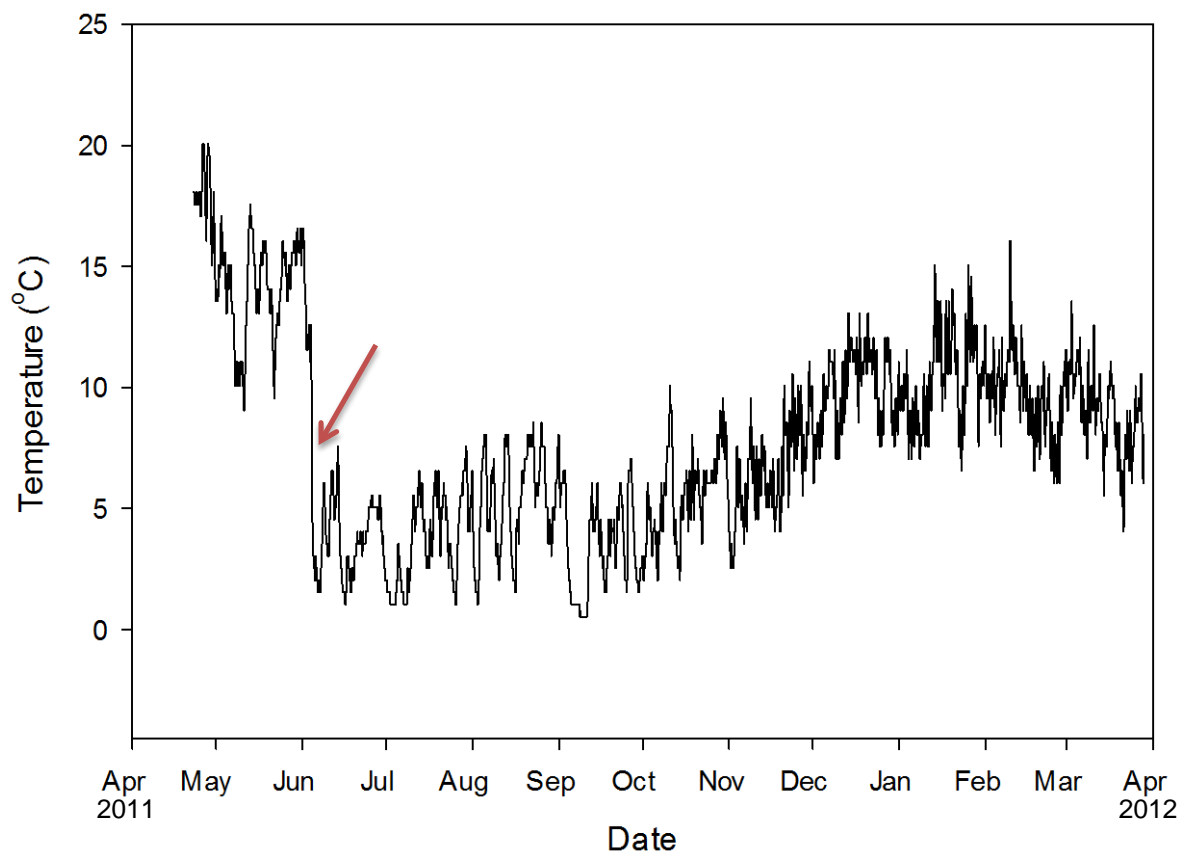


## Supplemental material

### Further support for thermal ecosystem engineering by wandering albatross on Marion Island

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**Fig. S1.** An example of an occupied nest (April 2011 – April 2012) where the chick had died in June 2011 soon after iButtons were deployed. A substantial drop in temperature was observed at this time (indicated by the red arrow).

**Table SI.** The mean, mean daily minimum, mean daily maximum, absolute minimum and absolute maximum temperatures are shown for each month between May 2011 and March 2012 for occupied nests (ON), soil adjacent to occupied nests (OS), abandoned nests (AN) and soil adjacent to abandoned nests (AS).

Month	Habitat type	Mean	Daily minimum	Daily maximum	Absolute minimum	Absolute maximum
May' 11	ON	12.1	11.4	12.9	8.6	15.2
	OS	5.4	4.5	6.7	2.1	2.1
	AN	5.3	4.7	6.1	2.6	8.1
	AS	4.8	3.2	6.6	1.0	9.5
June' 11	ON	12.3	11.3	13.5	5.1	18.7
	OS	3.7	3.1	4.7	1.6	7.4
	AN	3.7	3.3	4.3	1.6	7.6
	AS	3.1	2.2	4.1	0.5	6.5
July' 11	ON	13.5	12.2	15.1	3.6	20.7
	OS	3.8	2.9	4.7	1.1	7.4
	AN	3.7	3.1	4.3	1.1	6.6
	AS	3.0	2.4	4.1	0.5	7.5
Aug.2011	ON	15.9	12.7	19.1	4.1	22.2
	OS	5.5	4.1	6.4	1.6	8.6
	AN	5.0	4.4	6.1	1.6	8.1
	AS	4.6	3.6	5.8	1.5	9.0
Sep.2011	ON	11.2	8.9	13.6	0.1	21.7
	OS	3.8	2.6	4.8	0.6	7.4
	AN	3.4	2.9	4.2	0.6	7.1
	AS	2.9	1.9	4.4	0.0	8.0
Oct.2011	ON	12.9	9.4	17.1	5.1	23.7
	OS	5.9	4.3	7.6	1.8	11.9
	AN	5.2	4.2	6.2	1.6	10.1
	AS	5.7	3.7	8.2	1.5	13.0
Nov.2011	ON	7.6	3.8	12.4	1.6	15.7
	OS	6.9	5.3	9.0	2.6	12.7
	AN	6.2	5.1	7.1	2.6	9.2
	AS	7.1	4.0	10.5	1.0	14.5
Dec.2011	ON	10.8	6.6	15.1	3.1	21.7
	OS	10.2	8.3	12.2	5.6	16.7
	AN	9.2	8.2	10.2	5.6	12.2
	AS	10.3	8.1	13.1	4.5	18.5
Jan.'12	ON	10.7	9.6	12.1	7.1	15.7
	OS	10.5	8.5	13.1	6.6	17.7
	AN	9.6	8.5	10.7	6.1	13.7
	AS	10.4	9.6	11.4	7.5	13.5
Feb.'12	ON	9.9	9.0	11.2	6.1	15.2
	OS	9.7	8.0	12.0	5.3	17.4
	AN	9.2	8.2	10.1	5.6	13.7
	AS	9.2	8.2	10.3	6.5	13.0
Mar.'12	ON	9.0	8.1	10.1	4.6	13.2

OS	8.8	7.6	10.4	4.1	13.9
AN	8.4	7.6	9.1	4.1	11.6
AS	8.3	7.6	9.4	5.5	11.5

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**Table SII.** Outputs of the Generalized linear models (Gaussian distribution of errors, log-link for absolute minimum and maximum only) comparing monthly temperature parameters (i.e. mean, daily minimum and maximum, and absolute minimum and maximum temperatures from May 2011 to March 2012) of occupied nests with that of adjacent soils (OS), abandoned nests (AN) and soils adjacent to abandoned nests (AS).

		Estimate	s.e.	<i>t</i>	<i>P</i>
<b>May 2011</b>					
Mean	intercept	13.080	0.811	16.137	<0.0001
	type (AN)	-7.804	1.025	-7.612	<0.0001
	type (AS)	-8.497	1.025	-8.287	<0.0001
	type (OS)	-7.669	0.951	-8.068	<0.0001
Daily minimum	intercept	12.222	1.129	10.824	<0.0001
	type (AN)	-7.586	1.428	-5.311	<0.0001
	type (AS)	-9.069	1.428	-6.350	<0.0001
	type (OS)	-7.016	1.324	-5.299	<0.0001
Daily maximum	intercept	13.956	0.931	14.985	<0.0001
	type (AN)	-8.021	1.178	-6.809	<0.0001
	type (AS)	-7.578	1.178	-6.433	<0.0001
	type (OS)	-7.340	1.092	-6.721	<0.0001
Absolute minimum	intercept	5.640	0.003	2147.634	<0.0001
	type (AN)	-0.022	0.003	-6.642	<0.0001
	type (AS)	-0.027	0.003	-7.916	<0.0001
	type (OS)	-0.022	0.003	-7.034	<0.0001
Absolute maximum	intercept	2.792	0.062	44.741	<0.0001
	type (AN)	-0.672	0.113	-5.929	<0.0001
	type (AS)	-0.538	0.104	-5.192	<0.0001
	type (OS)	-0.554	0.091	-6.073	<0.0001
s.e. = standard error					

table S2 cont.

**June 2011**

		Estimate	s.e.	<i>t</i>	<i>P</i>
Mean	intercept	11.702	0.857	13.648	<0.0001
	type (AN)	-8.079	1.085	-7.449	<0.0001
	type (AS)	-8.864	1.085	-8.173	<0.0001
	type (OS)	-7.897	1.005	-7.855	<0.0001
Daily minimum	intercept	10.491	0.747	14.050	<0.0001
	type (AN)	-7.378	0.944	-7.812	<0.0001
	type (AS)	-8.499	0.944	-8.999	<0.0001
	type (OS)	-7.353	0.876	-8.398	<0.0001
Daily maximum	intercept	12.838	0.971	13.223	<0.0001
	type (AN)	-8.626	1.228	-7.024	<0.0001
	type (AS)	-8.974	1.228	-7.308	<0.0001
	type (OS)	-8.209	1.138	-7.210	<0.0001
Absolute minimum	intercept	5.631	0.002	3013.779	<0.0001
	type (AN)	-0.016	0.002	-6.666	<0.0001
	type (AS)	-0.020	0.002	-8.310	<0.0001
	type (OS)	-0.016	0.002	-7.073	<0.0001
Absolute maximum	intercept	2.862	0.076	37.778	<0.0001
	type (AN)	-0.898	0.163	-5.518	<0.0001
	type (AS)	-0.956	0.170	-5.611	<0.0001
	type (OS)	-0.881	0.135	-6.518	<0.0001

s.e. = standard error

table S2 cont.

**July 2011**

		Estimate	s.e.	<i>t</i>	<i>P</i>
Mean	intercept	11.857	0.817	14.512	<0.0001
	type (AN)	-8.348	1.034	-8.077	<0.0001
	type (AS)	-8.967	1.034	-8.676	<0.0001
	type (OS)	-8.062	0.958	-8.415	<0.0001
Daily minimum	intercept	10.490	0.715	14.677	<0.0001
	type (AN)	-7.609	0.904	-8.416	<0.0001
	type (AS)	-8.442	0.904	-9.338	<0.0001
	type (OS)	-7.508	0.838	-8.958	<0.0001
Daily maximum	intercept	13.288	0.940	14.137	<0.0001
	type (AN)	-9.104	1.189	-7.657	<0.0001
	type (AS)	-9.510	1.189	-7.999	<0.0001
	type (OS)	-8.632	1.102	-7.832	<0.0001
Absolute minimum	intercept	5.624	0.003	1833.989	<0.0001
	type (AN)	-0.011	0.004	-2.776	0.0129
	type (AS)	-0.013	0.004	-3.407	0.0034
	type (OS)	-0.010	0.004	-2.754	0.0136
Absolute maximum	intercept	2.917	0.082	35.525	<0.0001
	type (AN)	-0.997	0.191	-5.221	<0.0001
	type (AS)	-0.916	0.179	-5.119	<0.0001
	type (OS)	-0.886	0.147	-6.025	<0.0001

s.e. = standard error

table S2 cont.

**August 2011**

		Estimate	s.e.	<i>t</i>	<i>P</i>
Mean	intercept	14.202	0.959	14.811	<0.0001
	type (AN)	-9.208	1.213	-7.591	<0.0001
	type (AS)	-9.578	1.213	-7.896	<0.0001
	type (OS)	-8.876	1.124	-7.893	<0.0001
Daily minimum	intercept	11.952	0.761	15.709	<0.0001
	type (AN)	-7.824	0.962	-8.130	<0.0001
	type (AS)	-8.492	0.962	-8.824	<0.0001
	type (OS)	-7.737	0.892	-8.672	<0.0001
Daily maximum	intercept	16.236	1.179	13.775	<0.0001
	type (AN)	-10.329	1.491	-6.929	<0.0001
	type (AS)	-10.446	1.491	-7.007	<0.0001
	type (OS)	-9.801	1.382	-7.092	<0.0001
Absolute minimum	intercept	5.628	0.004	1322.555	<0.0001
	type (AN)	-0.013	0.005	-2.438	0.0260
	type (AS)	-0.015	0.005	-2.704	0.0151
	type (OS)	-0.012	0.005	-2.459	0.0250
Absolute maximum	intercept	3.036	0.078	39.139	<0.0001
	type (AN)	-0.953	0.174	-5.474	<0.0001
	type (AS)	-0.873	0.163	-5.341	<0.0001
	type (OS)	-0.853	0.136	-6.279	<0.0001

s.e. = standard error

table S2 cont.  
**September 2011**

		Estimate	s.e.	<i>t</i>	<i>P</i>
Mean	intercept	10.816	0.645	16.778	<0.0001
	type (AN)	-7.709	0.815	-9.454	<0.0001
	type (AS)	-7.582	0.815	-9.298	<0.0001
	type (OS)	-7.108	0.756	-9.403	<0.0001
Daily minimum	intercept	8.275	0.388	21.330	<0.0001
	type (AN)	-5.897	0.491	-12.020	<0.0001
	type (AS)	-6.245	0.491	-12.730	<0.0001
	type (OS)	-5.529	0.455	-12.150	<0.0001
Daily maximum	intercept	13.266	0.975	13.608	<0.0001
	type (AN)	-9.302	1.233	-7.544	<0.0001
	type (AS)	-8.739	1.233	-7.087	<0.0001
	type (OS)	-8.555	1.143	-7.484	<0.0001
Absolute minimum	intercept	5.615	0.002	2785.229	<0.0001
	type (AN)	-0.004	0.003	-1.521	0.1470
	type (AS)	-0.004	0.003	-1.649	0.1180
	type (OS)	-0.002	0.002	-0.725	0.4780
Absolute maximum	intercept	3.012	0.078	38.427	<0.0001
	type (AN)	-1.077	0.195	-5.531	<0.0001
	type (AS)	-0.971	0.178	-5.441	<0.0001
	type (OS)	-0.989	0.151	-6.550	<0.0001

s.e. = standard error



table S2 cont.  
**October 2011**

		Estimate	s.e.	<i>t</i>	<i>P</i>
Mean	intercept	12.318	0.408	30.170	<0.0001
	type (AN)	-7.257	0.516	-14.050	<0.0001
	type (AS)	-6.646	0.516	-12.870	<0.0001
	type (OS)	-6.400	0.479	-13.370	<0.0001
Daily minimum	intercept	9.285	0.259	35.860	<0.0001
	type (AN)	-5.154	0.328	-15.730	<0.0001
	type (AS)	-5.442	0.328	-16.610	<0.0001
	type (OS)	-4.857	0.304	-15.990	<0.0001
Daily maximum	intercept	15.256	0.802	19.026	<0.0001
	type (AN)	-9.122	1.014	-8.994	<0.0001
	type (AS)	-7.292	1.014	-7.190	<0.0001
	type (OS)	-7.507	0.940	-7.984	<0.0001
Absolute minimum	intercept	5.625	0.002	2616.849	<0.0001
	type (AN)	-0.010	0.003	-3.594	0.0022
	type (AS)	-0.010	0.003	-3.590	0.0023
	type (OS)	-0.008	0.003	-3.228	0.0049
Absolute maximum	intercept	3.098	0.077	40.458	<0.0001
	type (AN)	-0.843	0.158	-5.347	<0.0001
	type (AS)	-0.481	0.123	-3.917	0.0011
	type (OS)	-0.623	0.116	-5.359	<0.0001

s.e. = standard error

table S2 cont.  
**November 2011**

		Estimate	s.e.	<i>t</i>	<i>P</i>
Mean	intercept	8.763	0.521	16.834	<0.0001
	type (AN)	-2.764	0.658	-4.198	0.0006
	type (AS)	-1.856	0.658	-2.818	0.0119
	type (OS)	-1.792	0.610	-2.936	0.0092
Daily minimum	intercept	5.401	0.982	5.502	<0.0001
	type (AN)	-0.492	1.242	-0.396	0.6970
	type (AS)	-1.214	1.242	-0.978	0.3420
	type (OS)	-0.184	1.151	-0.160	0.8750
Daily maximum	intercept	13.635	0.830	16.431	<0.0001
	type (AN)	-6.385	1.050	-6.083	<0.0001
	type (AS)	-2.821	1.050	-2.688	0.0156
	type (OS)	-4.391	0.973	-4.513	0.0003
Absolute minimum	intercept	5.619	0.003	1641.753	<0.0001
	type (AN)	-0.0001	0.004	-0.018	0.9860
	type (AS)	-0.005	0.004	-1.110	0.2820
	type (OS)	0.001	0.004	0.164	0.8720
Absolute maximum	intercept	2.792	0.066	42.253	<0.0001
	type (AN)	-0.506	0.108	-4.705	0.0002
	type (AS)	-0.071	0.086	-0.828	0.4193
	type (OS)	-0.231	0.083	-2.770	0.0131

s.e. = standard error

table S2 cont.  
**December 2011**

		Estimate	s.e.	<i>t</i>	<i>P</i>
Mean	intercept	11.055	0.333	33.187	<0.0001
	type (AN)	-1.844	0.421	-4.377	0.0004
	type (AS)	-0.971	0.421	-2.305	0.0341
	type (OS)	-0.934	0.391	-2.392	0.0286
Daily minimum	intercept	8.214	0.608	13.513	<0.0001
	type (AN)	0.062	0.769	0.080	0.9370
	type (AS)	-0.369	0.769	-0.480	0.6370
	type (OS)	0.158	0.713	0.222	0.8270
Daily maximum	intercept	15.031	0.946	15.893	<0.0001
	type (AN)	-4.809	1.196	-4.020	0.0009
	type (AS)	-3.150	1.196	-2.633	0.0174
	type (OS)	-2.651	1.109	-2.391	0.0287
Absolute minimum	intercept	5.622	0.003	1620.944	<0.0001
	type (AN)	0.008	0.004	1.885	0.0766
	type (AS)	0.004	0.004	0.964	0.3485
	type (OS)	0.008	0.004	1.941	0.0690
Absolute maximum	intercept	3.135	0.079	39.657	<0.0001
	type (AN)	-0.614	0.138	-4.447	0.0004
	type (AS)	-0.212	0.109	-1.937	0.0695
	type (OS)	-0.327	0.104	-3.150	0.0058

s.e. = standard error

table S2 cont.  
**January 2012**

		Estimate	s.e.	<i>t</i>	<i>P</i>
Mean	intercept	10.632	0.338	31.468	<0.0001
	type (AN)	-1.169	0.427	-2.735	0.0141
	type (AS)	-0.428	0.427	-1.001	0.3310
	type (OS)	-0.130	0.396	-0.328	0.7467
Daily minimum	intercept	8.505	0.485	17.529	<0.0001
	type (AN)	0.011	0.614	0.017	0.9870
	type (AS)	0.859	0.614	1.399	0.1800
	type (OS)	-0.019	0.569	-0.034	0.9730
Daily maximum	intercept	13.395	0.752	17.818	<0.0001
	type (AN)	-2.869	0.951	-3.017	0.0078
	type (AS)	-2.225	0.951	-2.340	0.0318
	type (OS)	-0.272	0.882	-0.309	0.7612
Absolute minimum	intercept	5.632	0.002	3056.056	<0.0001
	type (AN)	0.0004	0.002	0.163	0.8727
	type (AS)	0.005	0.002	2.279	0.0359
	type (OS)	0.001	0.002	0.318	0.7547
Absolute maximum	intercept	2.852	0.063	45.167	<0.0001
	type (AN)	-0.276	0.090	-3.056	0.0072
	type (AS)	-0.235	0.088	-2.655	0.0167
	type (OS)	-0.003	0.074	-0.039	0.9695

s.e. = standard error

table S2 cont.  
**February 2012**

		Estimate	s.e.	<i>t</i>	<i>P</i>
Mean	intercept	9.792	0.331	29.618	<0.0001
	type (AN)	-0.795	0.418	-1.901	0.0743
	type (AS)	-0.329	0.418	-0.787	0.442
	type (OS)	-0.105	0.3877	-0.271	0.7897
Daily minimum	intercept	8.006	0.475	16.858	<0.0001
	type (AN)	0.157	0.601	0.261	0.7970
	type (AS)	0.691	0.601	1.150	0.2660
	type (OS)	-0.046	0.557	-0.082	0.9360
Daily maximum	intercept	12.171	0.611	19.920	<0.0001
	type (AN)	-2.241	0.773	-2.899	0.0100
	type (AS)	-1.853	0.773	-2.398	0.0282
	type (OS)	-0.327	0.717	-0.456	0.6540
Absolute minimum	intercept	5.628	0.002	2614.939	<0.0001
	type (AN)	0.002	0.003	0.892	0.3848
	type (AS)	0.005	0.003	1.923	0.0714
	type (OS)	0.001	0.003	0.334	0.7425
Absolute maximum	intercept	2.842	0.069	41.310	<0.0001
	type (AN)	-0.221	0.096	-2.312	0.0335
	type (AS)	-0.247	0.097	-2.550	0.0207
	type (OS)	-0.008	0.081	-0.096	0.9247

s.e. = standard error

table S2 cont.  
**March 2012**

		Estimate	s.e.	<i>t</i>	<i>P</i>
Mean	intercept	8.875	0.252	35.189	<0.0001
	type (AN)	-0.675	0.319	-2.115	0.0495
	type (AS)	-0.369	0.319	-1.157	0.2633
	type (OS)	-0.059	0.296	-0.200	0.8438
Daily minimum	intercept	7.485	0.374	20.014	<0.0001
	type (AN)	-0.091	0.473	-0.192	0.8500
	type (AS)	0.382	0.473	0.808	0.4300
	type (OS)	0.049	0.439	0.111	0.9130
Daily maximum	intercept	10.642	0.415	25.619	<0.0001
	type (AN)	-1.493	0.525	-2.842	0.0113
	type (AS)	-1.478	0.525	-2.812	0.0120
	type (OS)	-0.259	0.487	-0.532	0.6014
Absolute minimum	intercept	0.0003	0.002	2443.500	<0.0001
	type (AN)	0.000	0.003	0.090	0.9290
	type (AS)	0.004	0.003	1.440	0.1680
	type (OS)	0.001	0.003	0.230	0.8200
Absolute maximum	intercept	2.661	0.062	42.588	<0.0001
	type (AN)	-0.189	0.086	-2.213	0.0509
	type (AS)	-0.185	0.085	-2.163	0.0450
	type (OS)	-0.026	0.074	-0.346	0.7337

s.e. = standard error