

**Supplementary Table I.** Generalised Logistic Model selection outputs for chinstrap penguins, macaroni penguins and Antarctic fur seals. Models were selected based on Akaike Information Criteria values corrected for small sample size (AICc). The strength and direction of relationships of explanatory parameters remained consistent for all weighted models, even though the selection of the optimal model was not always absolute.

Model MAC #L	Intercept	FSLE	SSHA	SSHA grad	SST	SST grad	FSLE:SSHA grad	SSHA :SST	SSHA :SST grad	SSHA grad: SST	SSHA grad: SST:grad	df	ΔAICc	weight
928	1.92	0.54	-1.42	0.43	0.69	-0.36	-	-	1.39	-1.15	0.96	9	0.00	0.36
960	1.91	0.68	-1.45	0.39	0.77	-0.38	-0.26	-	1.39	-1.21	0.92	10	0.47	0.29
992	1.93	0.56	-1.48	0.41	0.76	-0.37	-	-0.21	1.49	-1.18	0.97	10	1.90	0.14
1024	1.92	0.69	-1.49	0.39	0.82	-0.38	-0.26	-0.18	1.48	-1.23	0.93	11	2.43	0.11
672	1.26	0.49	-1.21	0.25	0.53	0.04	-	-	0.95	-	0.47	8	6.26	0.02
148	1.48	0.44	-1.40	-	-	0.25	-	-	1.24	-	-	5	6.38	0.01
704	1.23	0.59	-1.21	0.23	0.59	0.05	-0.18	-	0.93	-	0.41	9	7.49	0.01
156	1.41	0.46	-1.26	-	0.18	0.23	-	-	1.09	-	-	6	7.55	0.01
160	1.39	0.47	-1.17	0.21	0.39	0.28	-	-	0.95	-	-	7	8.16	0.01
664	1.42	0.44	-1.51	0.01	-	0.09	-	-	1.32	-	0.33	7	8.23	0.01
736	1.26	0.49	-1.21	0.25	0.53	0.04	-	0.01	0.94	-	0.47	9	8.31	0.01
152	1.48	0.44	-1.41	0.04	-	0.27	-	-	1.25	-	-	6	8.33	0.01
192	1.33	0.61	-1.18	0.20	0.49	0.25	-0.26	-	0.93	-	-	8	8.46	0.01
448	1.63	0.66	-1.26	0.23	0.50	0.20	-0.32	-	1.11	-0.46	-	9	8.48	0.01
<b>MAC #U</b>														
1024	-2.51	0.20	-0.94	0.46	4.43	1.69	0.65	2.27	-1.05	-1.85	2.67	11	0.00	0.74
896	-1.93	0.22	-0.70	0.32	2.58	0.35	0.65	1.09	-	-2.21	2.86	10	2.25	0.24
832	-1.59	0.19	-0.55	0.24	0.80	0.02	0.56	-	-	-2.24	2.69	9	8.95	0.01
830	-1.31	0.14	-	-0.28	0.32	-0.03	0.59	-	-	-1.97	2.75	8	9.60	0.01
960	-1.53	0.02	-0.52	0.21	0.82	-0.29	0.59	-	0.34	-2.35	2.82	10	9.63	0.01
<b>MAC #V</b>														
736	-1.30	0.34	-0.61	0.15	0.32	-0.70	-	0.26	-0.58	-	0.24	9	0.00	0.17
672	-1.35	0.37	-0.53	0.14	0.15	-0.61	-	-	-0.42	-	0.22	8	0.64	0.13
664	-1.43	0.38	-0.65	0.18	-	-0.55	-	-	-0.38	-	0.25	7	1.55	0.08
768	-1.28	0.32	-0.61	0.15	0.33	-0.71	0.05	0.28	-0.59	-	0.24	10	1.61	0.08
992	-1.29	0.34	-0.62	0.16	0.31	-0.69	-	0.27	-0.59	-0.05	0.29	10	1.78	0.07
156	-1.26	0.36	-0.51	-	0.22	-0.64	-	-	-0.50	-	-	6	2.48	0.05
704	-1.34	0.36	-0.53	0.14	0.15	-0.62	0.03	-	-0.41	-	0.21	9	2.53	0.05
928	-1.35	0.37	-0.54	0.15	0.14	-0.61	-	-	-0.42	-0.02	0.23	9	2.62	0.05
220	-1.21	0.34	-0.56	-	0.35	-0.72	-	0.20	-0.64	-	-	7	2.92	0.04
160	-1.27	0.40	-0.51	0.12	0.19	-0.70	-	-	-0.50	-	-	7	2.95	0.04
224	-1.22	0.39	-0.57	0.12	0.32	-0.78	-	0.20	-0.64	-	-	8	3.29	0.03
696	-1.42	0.37	-0.65	0.19	-	-0.56	0.03	-	-0.38	-	0.25	8	3.41	0.03
1024	-1.27	0.33	-0.62	0.17	0.32	-0.70	0.04	0.29	-0.60	-0.05	0.28	11	3.46	0.03
416	-1.31	0.39	-0.51	0.10	0.22	-0.70	-	-	-0.46	0.09	-	8	3.82	0.03
480	-1.26	0.38	-0.57	0.10	0.35	-0.77	-	0.20	-0.59	0.08	-	9	4.25	0.02

<b>960</b>	-1.34	0.36	-0.53	0.15	0.15	-0.61	0.03	-	-0.42	-0.02	0.23	10	4.54	0.02
<b>192</b>	-1.26	0.39	-0.51	0.13	0.19	-0.70	0.04	-	-0.50	-	-	8	4.74	0.02
<b>256</b>	-1.20	0.37	-0.57	0.13	0.34	-0.79	0.05	0.22	-0.65	-	-	9	4.80	0.02
<b>448</b>	-1.30	0.38	-0.51	0.11	0.22	-0.70	0.04	-	-0.45	0.09	-	9	5.53	0.01
<b>152</b>	-1.35	0.43	-0.66	0.17	-	-0.63	-	-	-0.46	-	-	6	5.53	0.01
<b>512</b>	-1.24	0.35	-0.57	0.11	0.36	-0.79	0.06	0.22	-0.60	0.09	-	10	5.64	0.01
<b>148</b>	-1.36	0.36	-0.68	-	-	-0.53	-	-	-0.47	-	-	5	6.88	0.01

Model	Intercept	FSLE	SSHA	SSHA grad	SST	SST grad	FSLE:SSHA grad	SSHA :SST	SSHA :SST grad	SSHA grad: SST	SSHA grad: SST:grad	df	ΔAICc	weight
<b>CHIN #24</b>														
<b>512</b>	-1.41	1.08	-0.93	-2.56	-1.45	-0.15	-0.46	-0.57	0.86	-1.85	-	10	0.00	0.57
<b>1024</b>	-1.41	1.08	-0.90	-2.53	-1.43	-0.18	-0.47	-0.54	0.87	-1.82	0.05	11	1.97	0.21
<b>480</b>	-1.26	0.90	-0.99	-2.64	-1.25	-0.14	-	-0.56	0.83	-1.96	-	9	2.74	0.14
<b>992</b>	-1.26	0.90	-0.96	-2.60	-1.23	-0.17	-	-0.53	0.84	-1.92	0.06	10	4.67	0.05
<b>960</b>	-1.66	1.13	-0.34	-1.88	-1.32	-0.51	-0.48	-	1.07	-1.46	0.22	10	8.24	0.01
<b>448</b>	-1.70	1.11	-0.35	-1.89	-1.37	-0.41	-0.46	-	1.04	-1.55	-	9	9.01	0.01

<b>CHIN #29</b>														
<b>992</b>	-0.84	0.18	-0.42	0.86	-0.88	0.03	-	-0.31	0.34	-0.44	0.61	10	0.00	0.13
<b>672</b>	-0.87	0.23	-0.24	0.67	-0.84	-0.02	-	-	0.23	-	0.54	8	0.35	0.11
<b>928</b>	-0.99	0.22	-0.23	0.76	-0.97	0.01	-	-	0.29	-0.25	0.60	9	0.42	0.11
<b>991</b>	-0.82	-	-0.40	0.82	-0.88	0.02	-	-0.39	0.32	-0.51	0.60	9	0.71	0.09
<b>1024</b>	-0.90	0.21	-0.38	0.88	-0.93	0.05	0.11	-0.29	0.33	-0.47	0.60	11	0.97	0.08
<b>960</b>	-1.04	0.26	-0.20	0.80	-1.02	0.03	0.12	-	0.29	-0.30	0.60	10	1.09	0.08
<b>704</b>	-0.89	0.25	-0.21	0.68	-0.86	0.00	0.08	-	0.22	-	0.52	9	1.67	0.06
<b>736</b>	-0.80	0.22	-0.29	0.67	-0.79	-0.01	-	-0.09	0.22	-	0.53	9	2.10	0.05
<b>927</b>	-1.01	-	-0.15	0.68	-0.99	-0.01	-	-	0.26	-0.29	0.58	8	2.84	0.03
<b>671</b>	-0.88	-	-0.15	0.58	-0.85	-0.04	-	-	0.18	-	0.51	7	3.34	0.03
<b>544</b>	-0.85	0.18	-0.24	0.67	-0.81	0.06	-	-	-	-	0.50	7	3.36	0.02
<b>768</b>	-0.83	0.24	-0.25	0.68	-0.82	0.00	0.08	-0.07	0.22	-	0.52	10	3.56	0.02
<b>541</b>	-0.87	-	-	0.62	-1.06	0.04	-	-	-	-	0.49	5	3.98	0.02
<b>542</b>	-0.86	0.13	-	0.68	-1.12	0.07	-	-	-	-	0.50	6	4.01	0.02
<b>574</b>	-0.89	0.19	-	0.70	-1.10	0.08	0.13	-	-	-	0.48	7	4.05	0.02
<b>576</b>	-0.87	0.22	-0.21	0.69	-0.84	0.08	0.11	-	-	-	0.48	8	4.17	0.02
<b>735</b>	-0.76	-	-0.24	0.60	-0.77	-0.03	-	-0.15	0.18	-	0.50	8	4.52	0.01
<b>543</b>	-0.86	-	-0.17	0.60	-0.83	0.03	-	-	-	-	0.48	6	4.58	0.01
<b>608</b>	-0.77	0.17	-0.30	0.68	-0.75	0.07	-	-0.10	-	-	0.49	8	5.00	0.01
<b>800</b>	-0.87	0.17	-0.24	0.69	-0.83	0.07	-	-	-	-0.04	0.50	8	5.34	0.01
<b>830</b>	-0.94	0.19	-	0.74	-1.14	0.10	0.15	-	-	-0.10	0.50	8	5.74	0.01
<b>797</b>	-0.90	-	-	0.65	-1.10	0.06	-	-	-	-0.08	0.51	6	5.76	0.01
<b>607</b>	-0.75	-	-0.26	0.62	-0.75	0.04	-	-0.15	-	-	0.47	7	5.79	0.01
<b>832</b>	-0.92	0.21	-0.21	0.72	-0.88	0.10	0.12	-	-	-0.09	0.50	9	5.93	0.01
<b>798</b>	-0.88	0.13	-	0.70	-1.14	0.08	-	-	-	-0.04	0.51	7	5.99	0.01
<b>640</b>	-0.82	0.21	-0.25	0.69	-0.80	0.08	0.10	-0.07	-	-	0.47	9	6.04	0.01
<b>799</b>	-0.90	-	-0.17	0.63	-0.87	0.05	-	-	-	-0.09	0.50	7	6.30	0.01

<b>CHIN #31</b>															
671	-5.99	-	-7.24	2.55	3.19	3.08	-	-	3.09	-	1.49	7	0.00	0.24	
672	-6.26	0.38	-7.48	2.67	3.24	3.11	-	-	3.20	-	1.50	8	0.86	0.16	
735	-5.87	-	-7.21	2.55	3.02	2.99	-	-0.36	3.02	-	1.38	8	1.65	0.11	
927	-5.91	-	-7.19	2.56	3.20	3.04	-	-	3.05	0.08	1.49	8	2.01	0.09	
736	-6.14	0.42	-7.47	2.69	3.03	3.00	-	-0.45	3.11	-	1.36	9	2.29	0.08	
704	-6.35	0.21	-7.59	2.78	3.29	3.16	-0.41	-	3.24	-	1.49	9	2.32	0.08	
928	-6.09	0.45	-7.39	2.73	3.29	2.99	-	-	3.08	0.23	1.49	9	2.56	0.07	
768	-6.24	0.22	-7.64	2.85	3.04	3.04	-0.53	-0.58	3.14	-	1.32	10	3.37	0.05	
960	-6.13	0.28	-7.52	2.93	3.39	3.00	-0.56	-	3.07	0.37	1.49	10	3.54	0.04	
991	-5.94	-	-7.27	2.54	2.96	3.02	-	-0.45	3.06	-0.10	1.36	9	3.66	0.04	
992	-6.10	0.44	-7.44	2.71	3.07	2.98	-	-0.38	3.08	0.07	1.38	10	4.34	0.03	
1024	-6.15	0.26	-7.58	2.91	3.16	2.98	-0.57	-0.42	3.07	0.20	1.36	11	5.28	0.02	

<b>Model</b>	<b>Intercept</b>	<b>FSLE</b>	<b>SSHA</b>	<b>SSHA grad</b>	<b>SST</b>	<b>SST grad</b>	<b>FSLE:SSHA grad</b>	<b>SSHA :SST</b>	<b>SSHA :SST grad</b>	<b>SSHA grad: SST</b>	<b>SSHA grad: SST:grad</b>	<b>df</b>	<b>ΔAICc</b>	<b>weight</b>	
<b>AFS #B543</b>															
960	1.02	0.13	-0.35	0.35	-0.35	0.43	0.06	-	0.15	-0.41	0.12	11	0.00	0.22	
928	1.03	0.17	-0.35	0.35	-0.36	0.45	-	-	0.15	-0.39	0.10	10	0.35	0.19	
416	1.05	0.17	-0.33	0.33	-0.36	0.46	-	-	0.14	-0.32	-	9	0.66	0.16	
448	1.04	0.14	-0.33	0.33	-0.34	0.45	0.05	-	0.14	-0.32	-	10	1.22	0.12	
1024	1.04	0.13	-0.37	0.37	-0.37	0.45	0.07	-0.06	0.14	-0.48	0.13	12	1.49	0.10	
992	1.05	0.17	-0.36	0.36	-0.39	0.46	-	-0.05	0.14	-0.45	0.11	11	1.98	0.08	
480	1.06	0.17	-0.34	0.34	-0.37	0.46	-	-0.03	0.14	-0.35	-	10	2.58	0.06	
512	1.05	0.14	-0.34	0.34	-0.36	0.46	0.05	-0.03	0.14	-0.36	-	11	3.11	0.05	

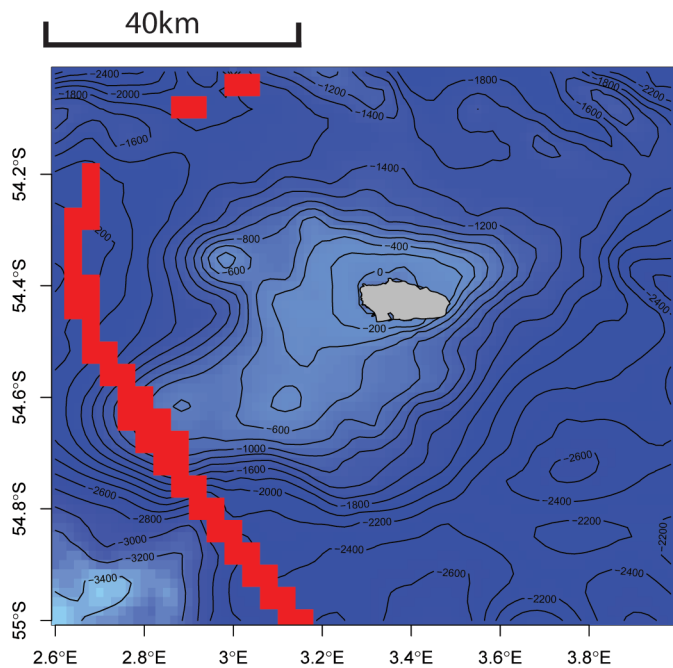
<b>AFS #B629</b>															
991	-0.65	-	-0.13	0.26	-0.09	0.09	-	-0.26	-0.22	-0.51	0.22	10.00	0.00	0.29	
992	-0.66	0.04	-0.12	0.26	-0.09	0.09	-	-0.25	-0.22	-0.50	0.23	11.00	1.31	0.15	
479	-0.63	-	-0.11	0.31	-0.08	0.11	-	-0.24	-0.33	-0.44	-	9.00	2.02	0.11	
863	-0.69	-	-0.10	0.26	-0.08	0.03	-	-0.30	-	-0.55	0.36	9.00	2.96	0.07	
927	-0.74	-	-0.04	0.33	-0.11	0.08	-	-	-0.24	-0.39	0.20	9.00	3.19	0.06	
1024	-0.65	0.04	-0.12	0.26	-0.09	0.09	0.02	-0.25	-0.22	-0.49	0.24	12.00	3.24	0.06	
480	-0.63	0.03	-0.11	0.31	-0.08	0.11	-	-0.23	-0.33	-0.43	-	10.00	3.61	0.05	
928	-0.74	0.05	-0.03	0.32	-0.11	0.09	-	-	-0.24	-0.39	0.21	10.00	3.98	0.04	
864	-0.70	0.04	-0.09	0.26	-0.08	0.03	-	-0.29	-	-0.54	0.37	10.00	4.33	0.03	
415	-0.71	-	-0.03	0.37	-0.10	0.10	-	-	-0.33	-0.34	-	8.00	4.34	0.03	
797	-0.79	-	-	0.33	-0.11	0.01	-	-	-	-0.42	0.35	7.00	5.38	0.02	
416	-0.71	0.04	-0.02	0.37	-0.10	0.11	-	-	-0.34	-0.33	-	9.00	5.53	0.02	
512	-0.63	0.03	-0.11	0.31	-0.08	0.11	0.01	-0.23	-0.33	-0.42	-	11.00	5.59	0.02	
960	-0.73	0.05	-0.03	0.33	-0.11	0.09	0.02	-	-0.24	-0.38	0.21	11.00	5.89	0.02	
798	-0.79	0.05	-	0.33	-0.11	0.02	-	-	-	-0.42	0.36	8.00	6.21	0.01	
896	-0.69	0.04	-0.09	0.26	-0.08	0.03	0.01	-0.29	-	-0.53	0.38	11.00	6.29	0.01	
799	-0.79	-	0.01	0.34	-0.11	0.01	-	-	-	-0.42	0.35	8.00	7.39	0.01	
448	-0.71	0.04	-0.02	0.37	-0.10	0.11	0.01	-	-0.34	-0.33	-	10.00	7.49	0.01	

<b>AFS #B800</b>														
<b>896</b>	0.18	0.09	-0.09	1.50	-0.05	-0.34	0.27	0.99	-	1.24	0.38	11.00	0.00	0.43
<b>1024</b>	0.28	0.08	-0.08	1.39	0.00	-0.22	0.27	1.06	0.22	1.13	0.38	12.00	1.37	0.21
<b>864</b>	0.16	0.23	-0.23	1.38	-0.07	-0.25	-	0.97	-	1.22	0.27	10.00	2.59	0.12
<b>992</b>	0.26	0.23	-0.23	1.27	-0.03	-0.12	-	1.05	0.22	1.11	0.27	11.00	3.88	0.06
<b>336</b>	0.27	0.24	-0.24	1.33	-0.26	-	-	0.91	-	1.06	-	8.00	4.62	0.04
<b>368</b>	0.30	0.18	-0.18	1.38	-0.28	-	0.11	0.90	-	1.04	-	9.00	5.73	0.02
<b>352</b>	0.31	0.25	-0.25	1.33	-0.26	0.08	-	0.89	-	1.10	-	9.00	6.37	0.02
<b>863</b>	0.07	-	-	1.27	-0.06	-0.36	-	0.95	-	1.15	0.29	9.00	6.62	0.02
<b>830</b>	-0.46	0.08	-0.08	1.37	-0.71	-0.28	0.26	-	-	1.19	0.37	9.00	6.79	0.01
<b>480</b>	0.43	0.24	-0.24	1.19	-0.20	0.23	-	0.99	0.27	0.98	-	10.00	7.31	0.01
<b>384</b>	0.34	0.19	-0.19	1.37	-0.28	0.10	0.12	0.89	-	1.09	-	10.00	7.37	0.01
<b>991</b>	0.19	-	-	1.13	0.00	-0.20	-	1.05	0.27	1.02	0.29	10.00	7.48	0.01
<b>512</b>	0.48	0.18	-0.18	1.23	-0.21	0.25	0.12	1.00	0.28	0.96	-	11.00	8.29	0.01
<b>832</b>	-0.40	0.08	-0.08	1.38	-0.77	-0.23	0.27	-	-	1.18	0.34	10.00	8.54	0.01

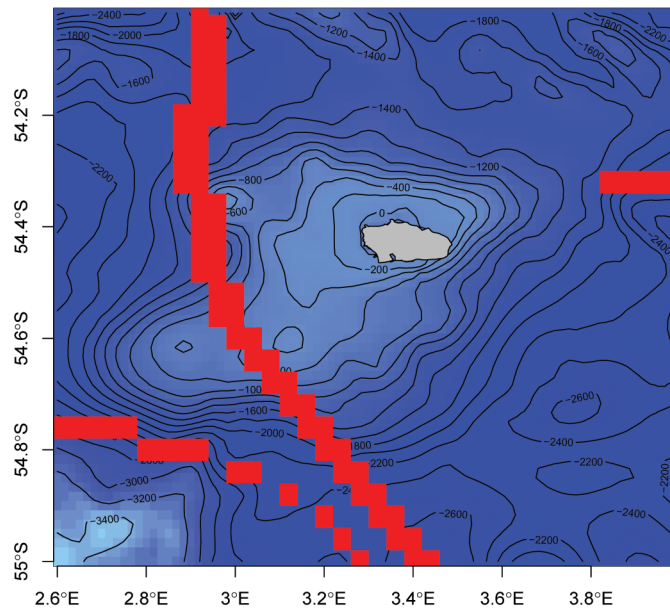
<b>AFS #B893</b>														
<b>960</b>	1.02	0.13	-0.35	-0.19	-0.35	0.43	0.06	-	0.15	-0.41	0.12	11.00	0.00	0.22
<b>928</b>	1.03	0.17	-0.35	-0.21	-0.36	0.45	-	-	0.15	-0.39	0.10	10.00	0.35	0.19
<b>416</b>	1.05	0.17	-0.33	-0.24	-0.36	0.46	-	-	0.14	-0.32	-	9.00	0.66	0.16
<b>448</b>	1.04	0.14	-0.33	-0.22	-0.34	0.45	0.05	-	0.14	-0.32	-	10.00	1.22	0.12
<b>1024</b>	1.04	0.13	-0.37	-0.21	-0.37	0.45	0.07	-0.06	0.14	-0.48	0.13	12.00	1.49	0.10
<b>992</b>	1.05	0.17	-0.36	-0.23	-0.39	0.46	-	-0.05	0.14	-0.45	0.11	11.00	1.98	0.08
<b>480</b>	1.06	0.17	-0.34	-0.24	-0.37	0.46	-	-0.03	0.14	-0.35	-	10.00	2.58	0.06
<b>512</b>	1.05	0.14	-0.34	-0.23	-0.36	0.46	0.05	-0.03	0.14	-0.36	-	11.00	3.11	0.05

**FSLE** - Finite Scale Lyapunov Exponent; **MSLA** - Mean Sea Level Anomaly; **SST** – Sea Surface Temperature; **grad** – in all cases refers to the gradient of the respective variable.

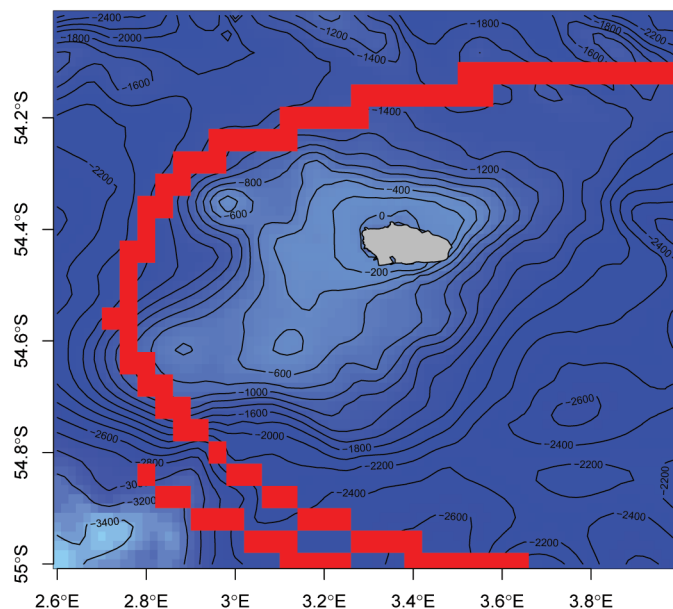
30th January 2008



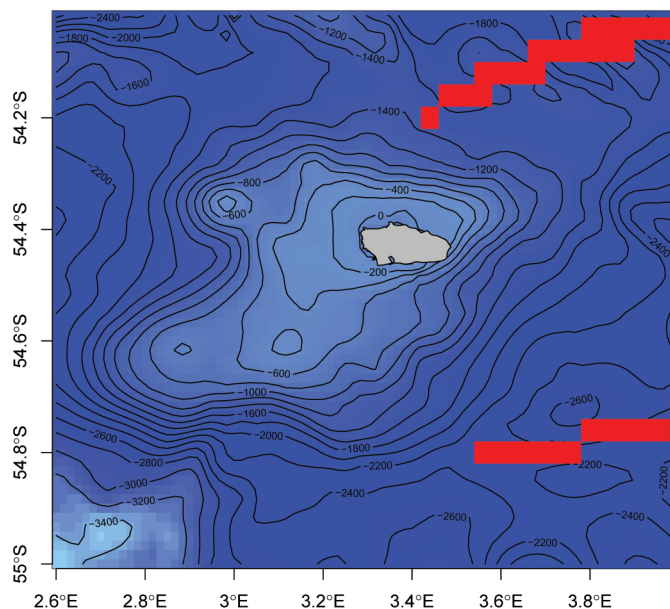
27th February 2008



30th March 2008

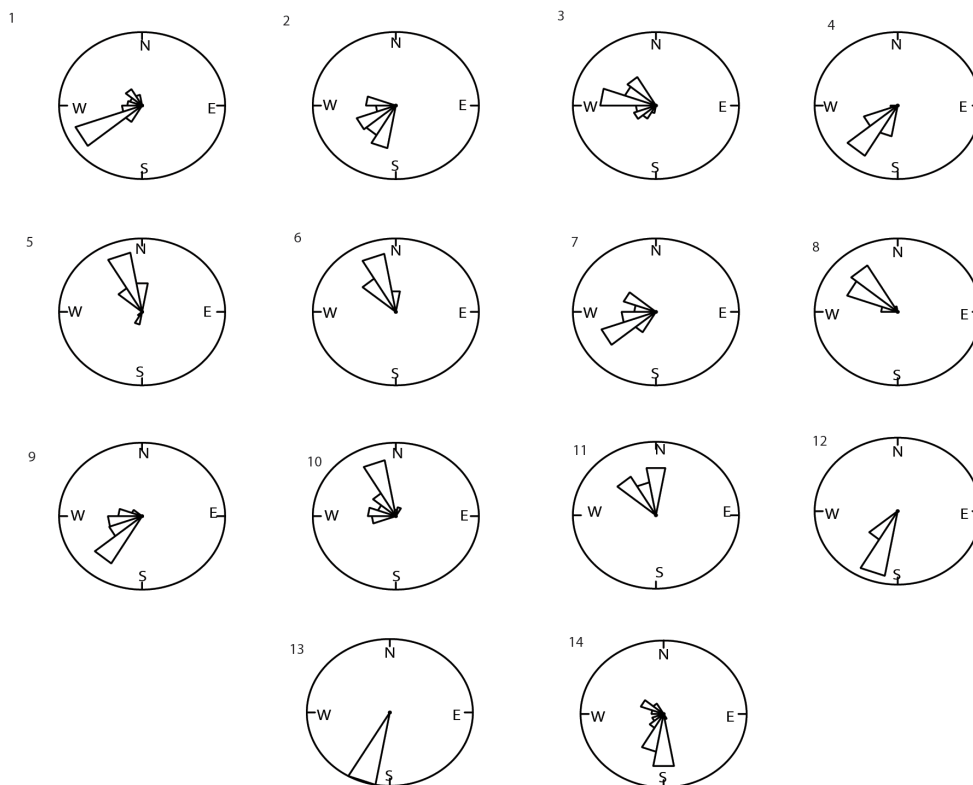


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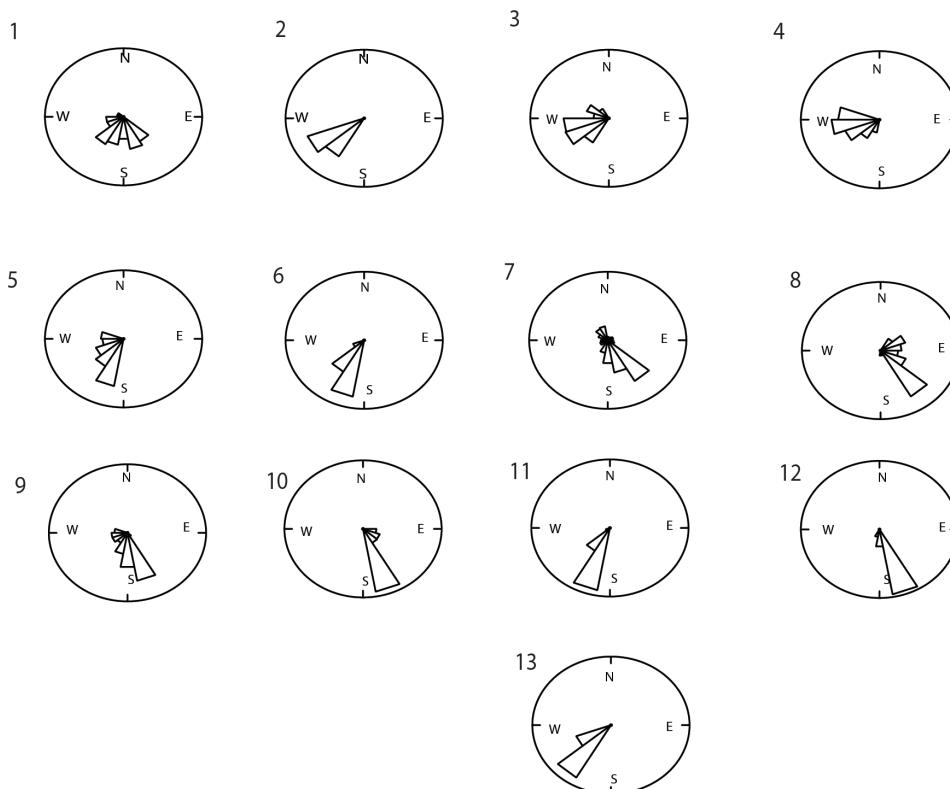


**Supplementary Fig. 1.** Relative positions of Lagrangian Coherent Structures (LCS) which represent submesoscale fronts (eddies, filaments and transport barriers) in the immediate vicinity of Bouvetøya during the study period (approximately monthly). LCS with FSLE values  $> 0.1 \text{ d}^{-1}$  shown in red. Note the front approximately 40km to the west and south of the colony that persisted throughout January, February and March 2008.

Antarctic fur seal #B629



Antarctic fur seal #B893



**Supplementary Fig. 2.** Mean direction of travel from Bouvetoya of two Antarctic fur seals (#B629 and #B893) tracked from end of January to mid-April 2008. Foraging trips are ordered chronologically from earliest (1) to last (n).