

Appendix

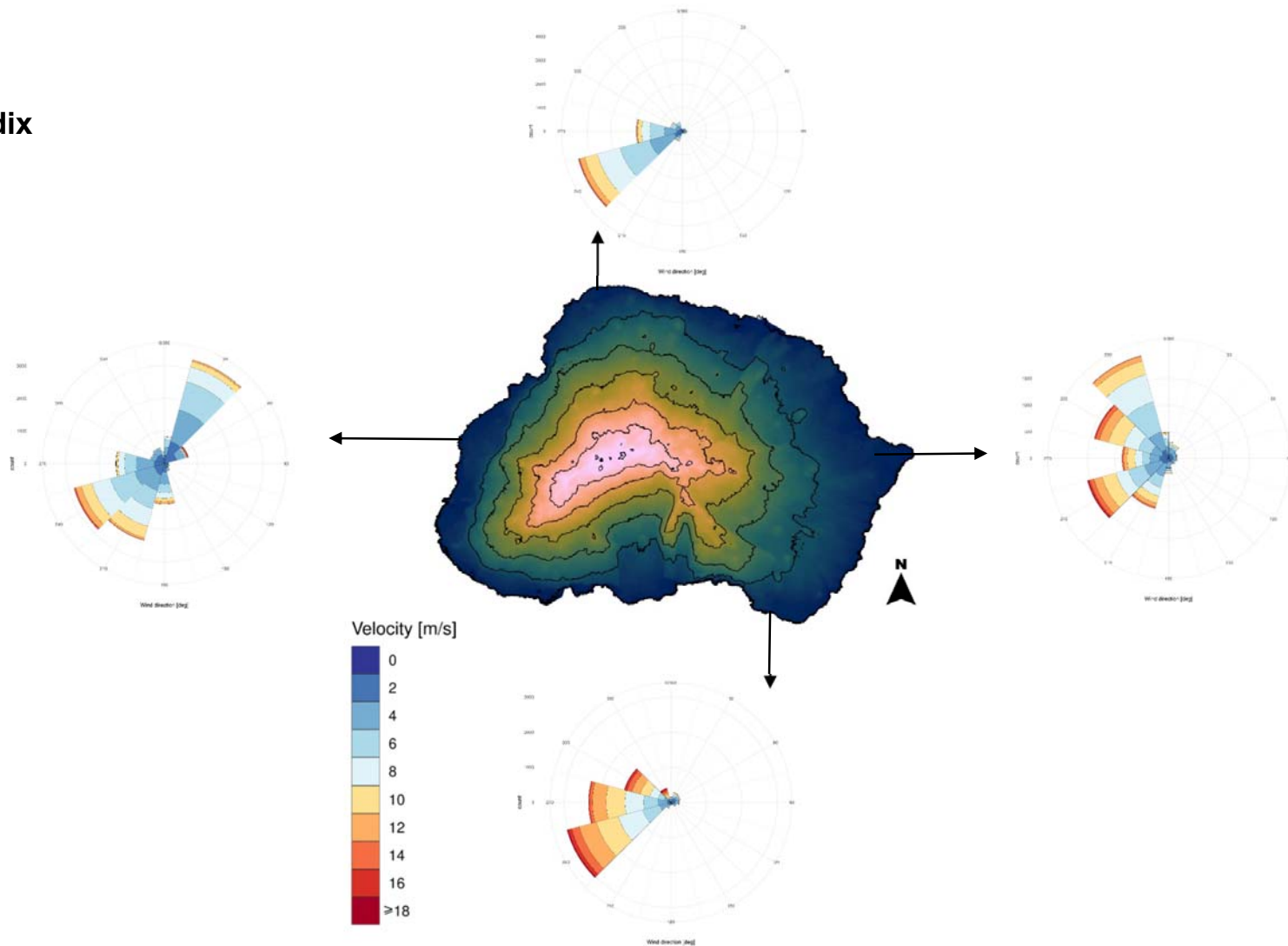


Figure A1 Wind roses (indicating 0 or 360 degrees at the top, with direction increasing clockwise) from four wind stations located on the North, East, West, and South sides of Marion Island. Wind roses were drawn using data recorded between January and December 2020.

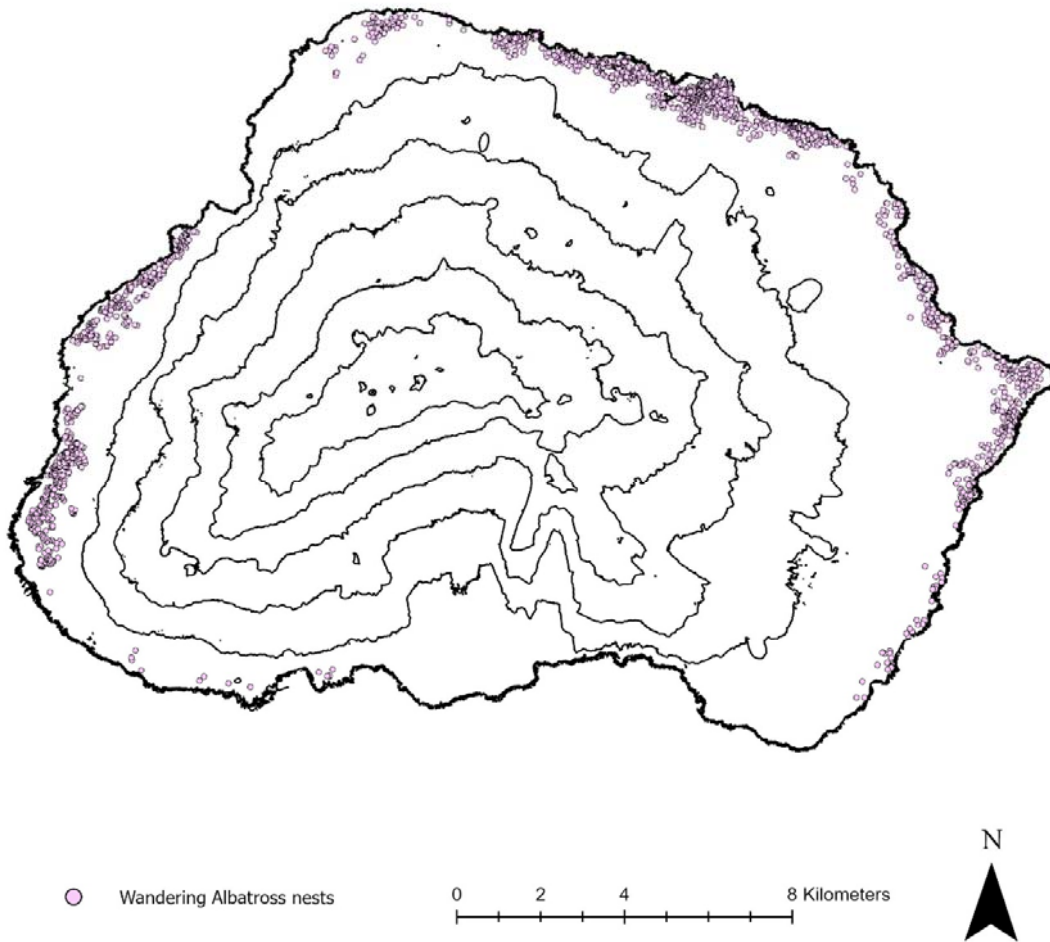


Figure A2 Locations of Wandering Albatross nests on Marion Island in January 2017. Contours are plotted at 200 m intervals.

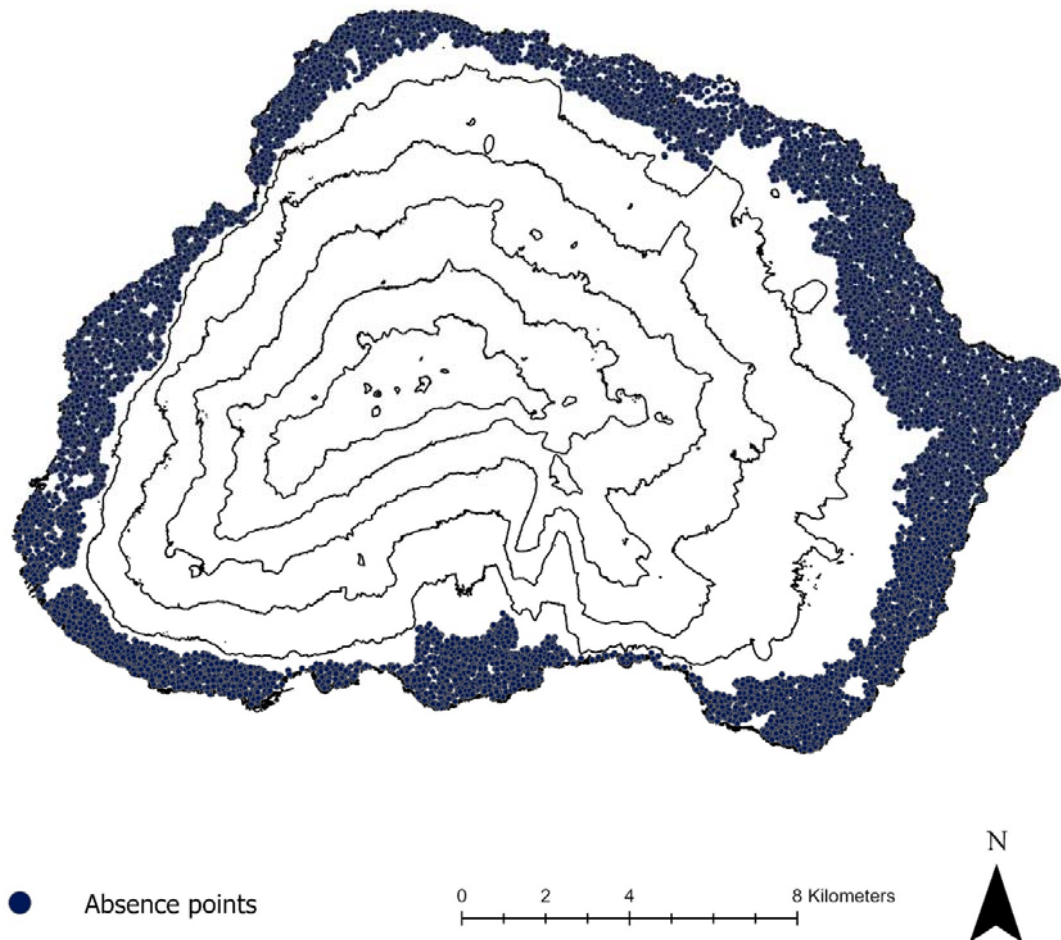


Figure A3 Locations of absence points generated on Marion Island based on the nest locations from January 2017. All absences were at least 30 m from any Wandering Albatross nest, and a minimum of 30 m from one another. Absences were restricted to areas lower than 100 m in elevation, with a slope less than 45 °, and were excluded from areas classified as lakes or with scoria geology. Contours are plotted at 200 m intervals.

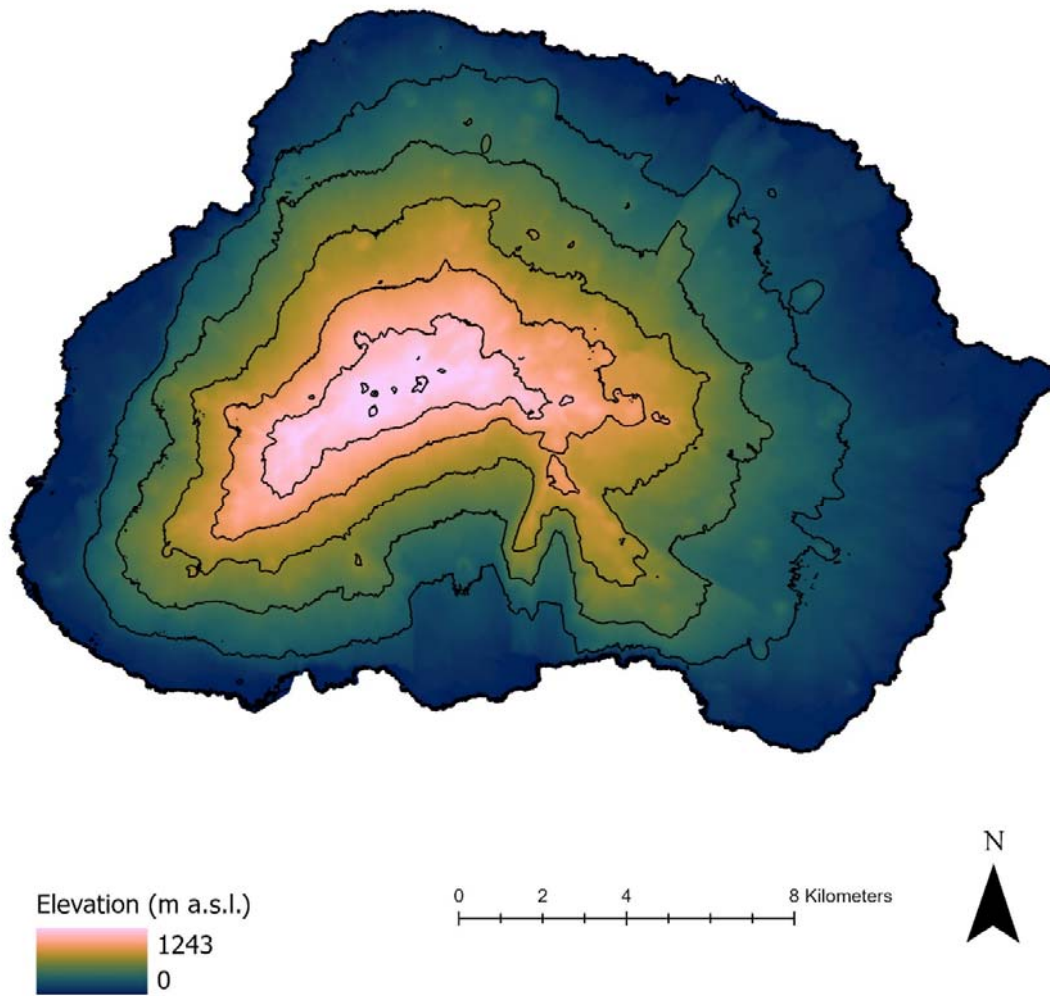


Figure A4 Digital Surface Model of Marion Island, based on DRDLR (2019). Lighter colours indicate higher elevations, while darker colours indicate lower elevations. Contours are plotted at 200 m intervals.

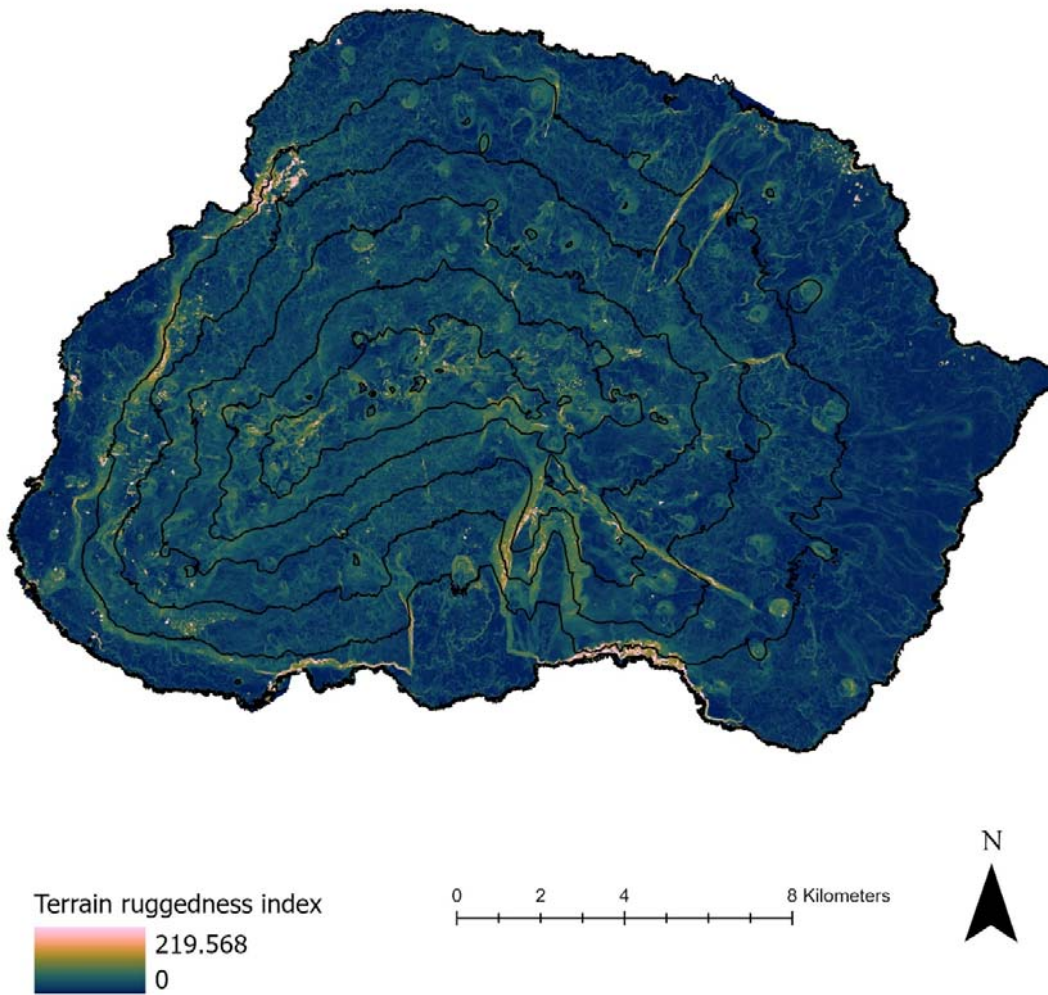
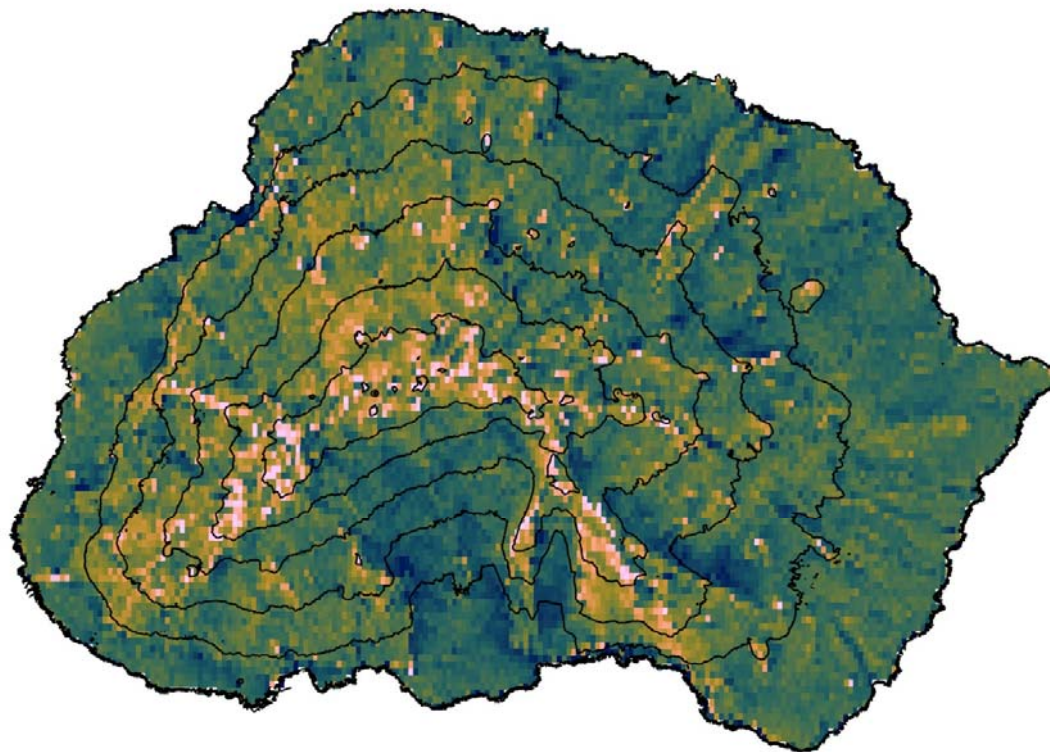


Figure A5 Terrain Ruggedness Index values across Marion Island. Lighter colours indicate more rugged terrain, while darker colours indicate less rugged terrain. Contours are plotted at 200 m intervals.



Wind velocity (m.s^{-1})

Value



0 2 4 8 Kilometers



Figure A6 Wind velocity on Marion Island, based on Goddard (2021). Lighter colours indicate higher wind velocity, while darker colours indicate lower wind velocity. Contours are plotted at 200 m intervals.

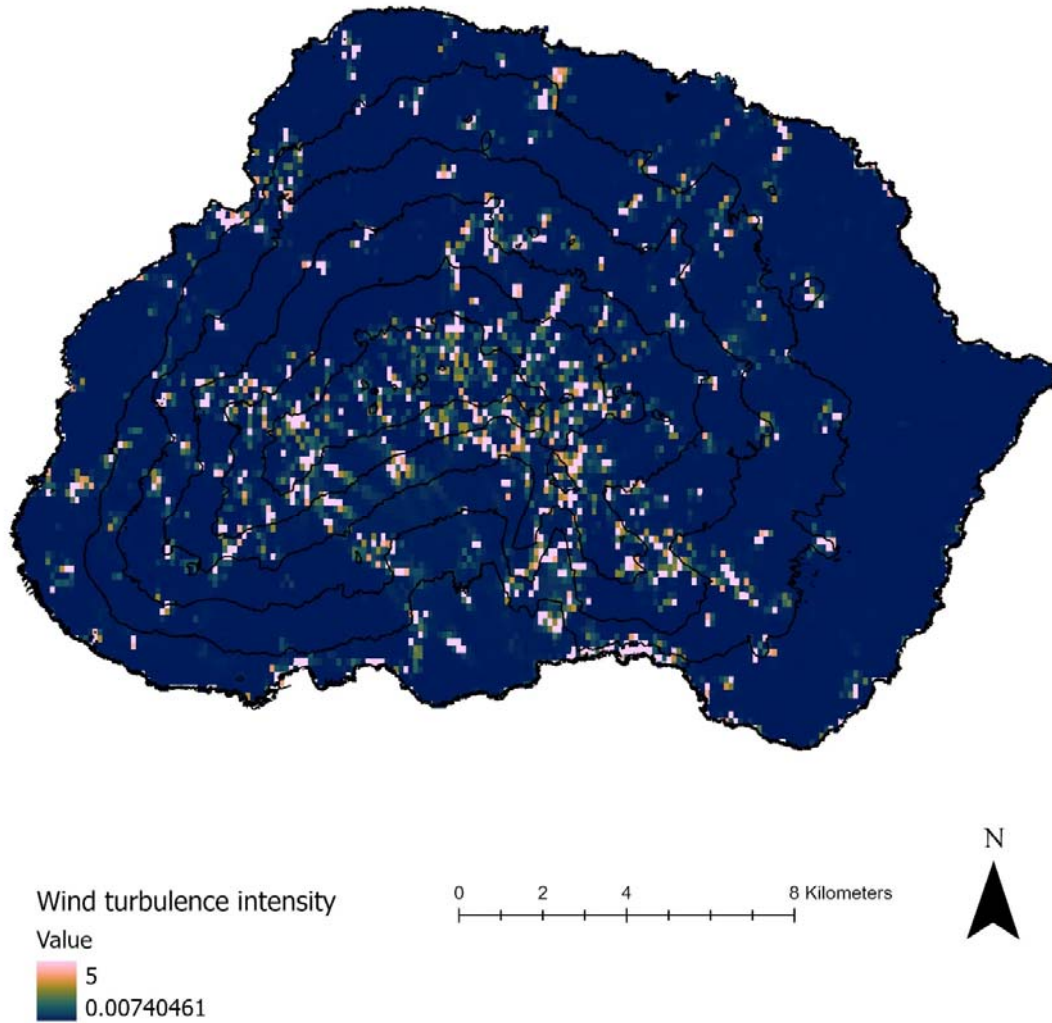


Figure A7 Wind turbulence intensity on Marion Island, based on Goddard (2021). Lighter colours indicate higher wind turbulence, while darker colours indicate lower wind turbulence. Contours are plotted at 200 m intervals. For island-scale visualisation of wind turbulence, all turbulence values >5 were set to a value of 5 ($<0.2\%$ of the dataset).

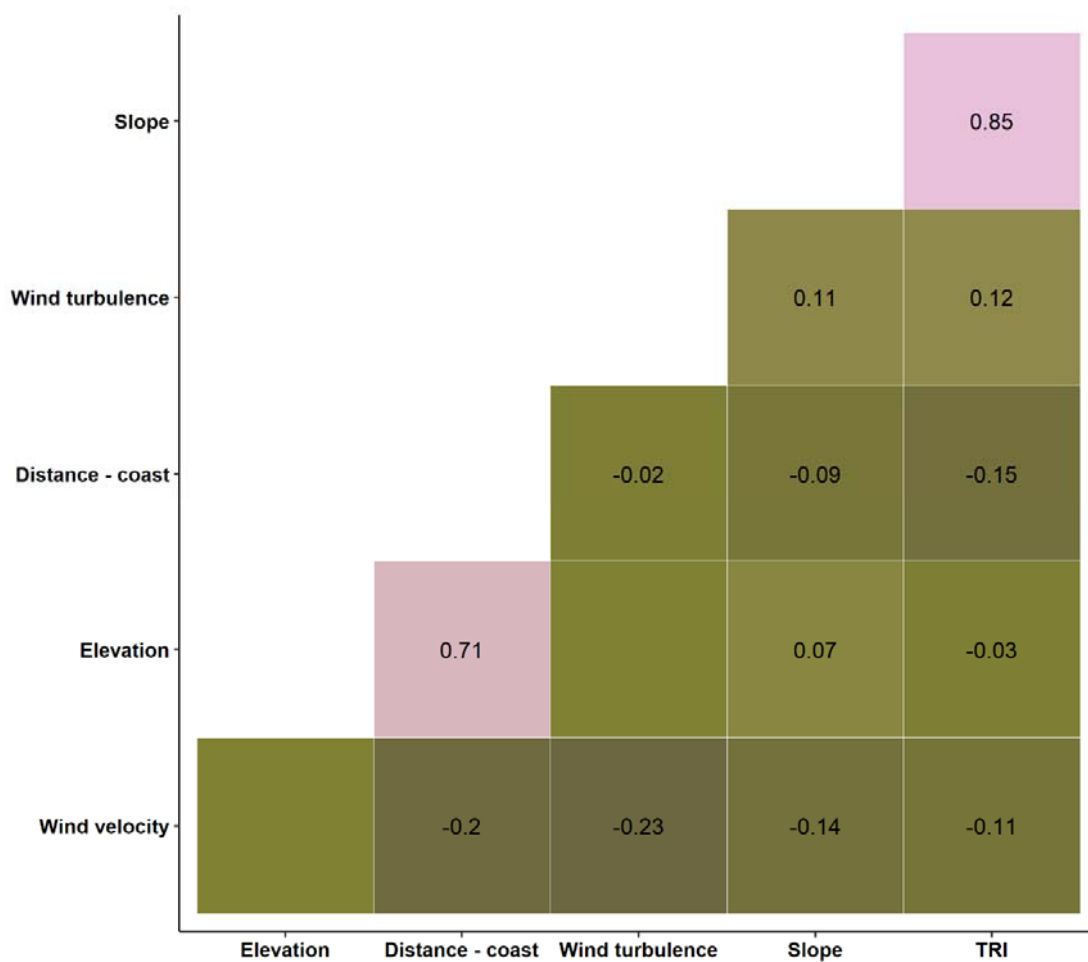


Figure A8 Correlation matrix showing significant Pearson correlation coefficients between all of the continuous predictor variables initially considered (based on data from the 2017 breeding season). Cells with no values indicate no significant correlation. TRI = terrain ruggedness index. Distance - coast = shortest distance to the coast line.

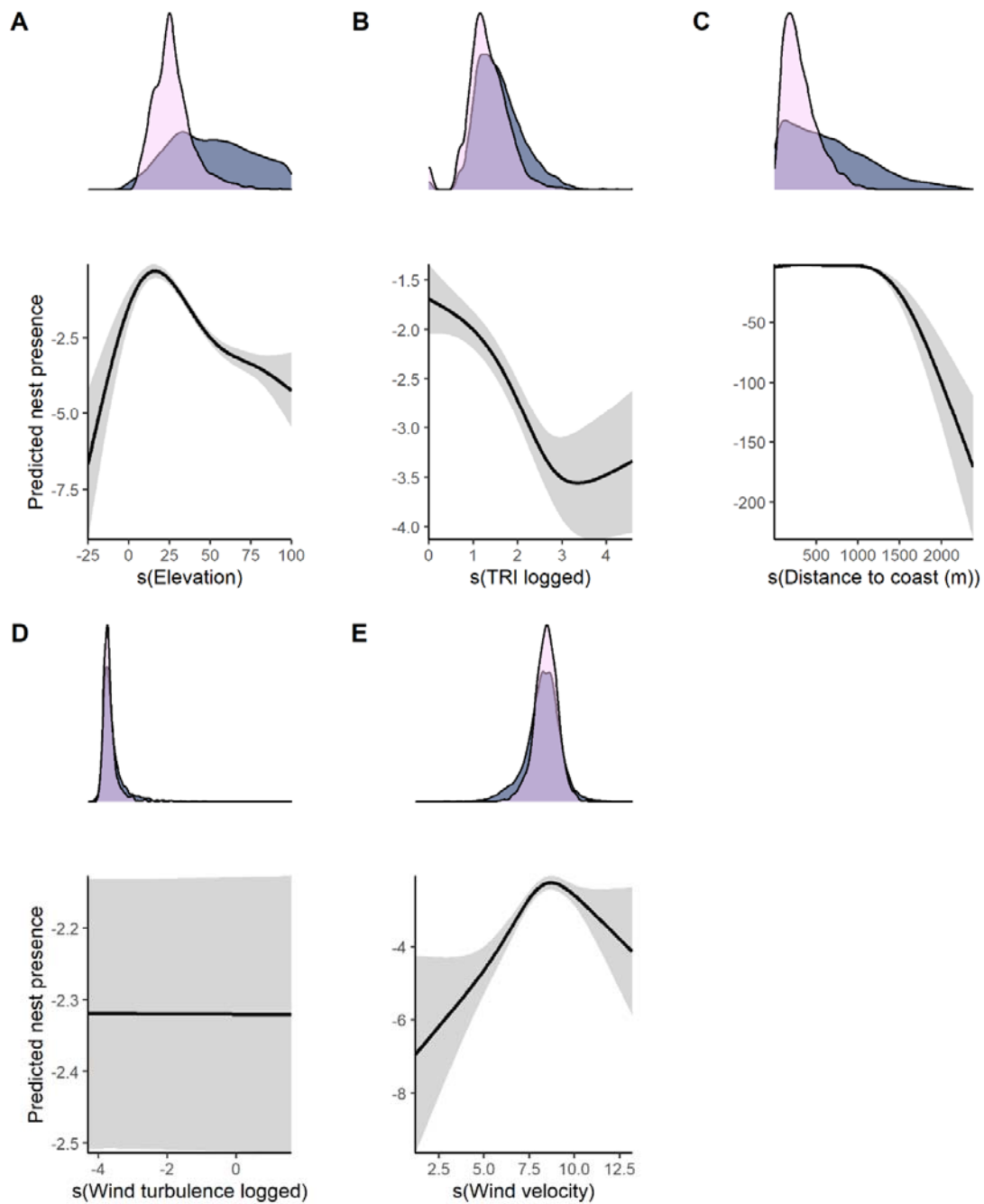


Figure A9 GAM response curves for the occurrence of Wandering Albatross nests based on data from the 2006 breeding season. A) Elevation, B) Terrain ruggedness index (logged), C) Distance to the coast (m), D) Wind turbulence (logged), E) Wind velocity ($\text{m}\cdot\text{s}^{-1}$). Light pink density plots represent data from presences and dark blue density plots data from absences. In the response curves, larger values on the y-axis represent a higher probability of occurrence.

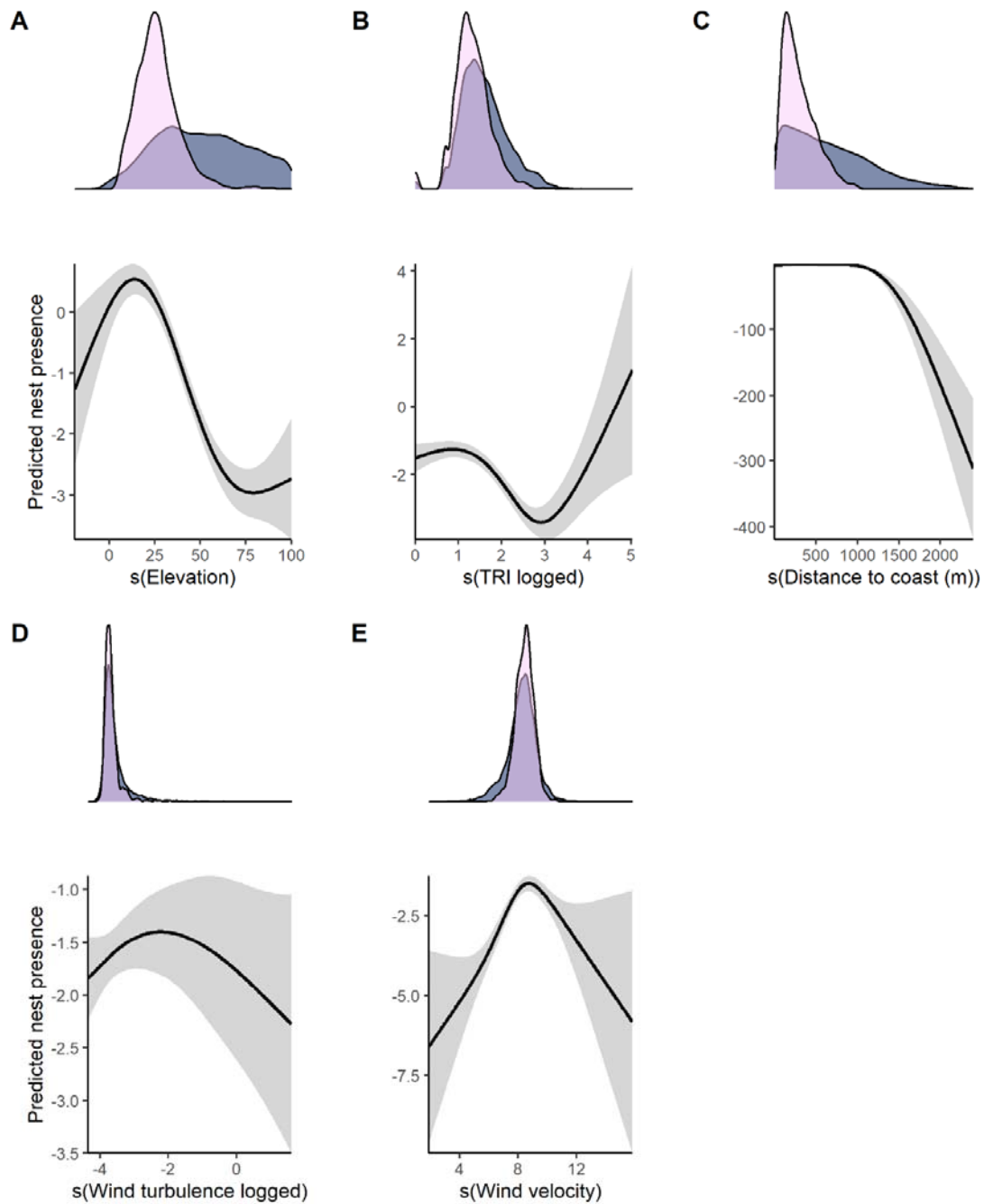


Figure A10 GAM response curves for the predicted presence of Wandering Albatross nests based on data from the 2018 breeding season. A) Elevation, B) Terrain ruggedness index (logged), C) Distance to the coast (m), D) Wind turbulence (logged), E) Wind velocity ($\text{m}\cdot\text{s}^{-1}$). Light pink density plots represent data from presences and dark blue density plots data from absences. In the response curves, larger values on the y-axis represent a higher probability of occurrence.

Table A1 Significance and variable importance for all predictor variables when modelling the presence or absence of Wandering Albatross nests based on data from the 2006 breeding season. GAM, generalized additive model; GLM, generalized linear model. The percent deviance explained was 30.90 % for the GAM, and 29.38 % for the GLM. Since an overall p-value for categorical predictors is not reported from a GAM, the ranking of the levels is reported. Chi² values are not reported for categorical predictors in a GAM. Post = post-glacial flows, Pre = pre-glacial flows, P = sub-Antarctic polar desert, F = sub-Antarctic fellfield, M = sub-Antarctic mire-slope vegetation, C = sub-Antarctic coastal vegetation.

Predictor	GAM			GLM		
	Chi ²	p-value	Relative importance (%)	Chi ² ♦	p-value	Relative importance (%)
Elevation	430.33	< 0.001	46.49	24.25	0.13*	41.93
Distance to coast	196.56	< 0.001	21.79	399.04	<0.001*	21.71
Vegetation type		P<F<M<C	18.93	385.36	P<F<M<C	18.75
Terrain ruggedness	113.59	< 0.001	7.29	9.96	0.63*	8.74
Wind velocity	70.77	< 0.001	5.23	129.54	<0.001*	8.09
Wind turbulence	0.002	0.43	0.27	8.84	0.03*	0.70
Geology type		Post<Pre	0.006	1.23	Pre<Post	0.08

* quadratic term of that variable was significant in the GLM

♦ Chi² values for linear and quadratic terms of a predictor in the GLM were summed

Table A2 Significance and variable importance for all variables when predicting the presence or absence of a Wandering Albatross nest based on data from the 2018 breeding season. GAM, generalized additive model; GLM, generalized linear model. The % deviance explained was 34.30 % for the GAM, and 32.85 % for the GLM. Since an overall p-value for categorical predictors is not reported from a GAM, the ranking of the levels is reported. Chi² values are not reported for categorical predictors in a GAM. Post = post-glacial flows, Pre = pre-glacial flows, P = sub-Antarctic polar desert, F = sub-Antarctic fellfield, M = sub-Antarctic mire-slope vegetation, C = sub-Antarctic coastal vegetation.

Predictor	GAM			GLM		
	Chi ²	p-value	Relative importance (%)	Chi ² ♦	p-value	Relative importance (%)
Elevation	530.09	<0.001	45.66	27.41	<0.01*	43.50
Distance to coast	190.69	<0.001	21.73	473.86	<0.001*	21.41
Vegetation type		P<F<M<C	14.87	386.15	P<F<M<C	14.63
Terrain ruggedness	203.03	<0.001	9.71	52.72	0.01*	10.75
Wind velocity	100.67	<0.001	7.24	215.56	<0.001*	8.94
Wind turbulence	2.69	0.15	0.25	3.90	0.21	0.35
Geology type		Post<Pre	0.53	8.92	Pre<Post	0.42

* quadratic term of that variable was significant in the GLM

♦ Chi² values for linear and quadratic terms of a predictor in the GLM were summed

Table A3 Significance and variable importance for all predictor variables when modelling the presence or absence of Wandering Albatross nests based on spatially thinned data from the 2017 breeding season (where absences were a minimum of 300 m apart, n=2478). GAM, generalized additive model; GLM, generalized linear model. The percent deviance explained was 44.00 % for the GAM, and 39.48 % for the GLM. Since an overall p-value for categorical predictors is not reported from a GAM, the ranking of the levels is reported. Chi² values are not reported for categorical predictors in a GAM. Post = post-glacial flows, Pre = pre-glacial flows, P = sub-Antarctic polar desert, F = sub-Antarctic fellfield, M = sub-Antarctic mire-slope vegetation, C = sub-Antarctic coastal vegetation.

Predictor	GAM			GLM		
	Chi ²	p-value	Relative importance (%)	Chi ² ♦	p-value	Relative importance (%)
Elevation	124.92	<0.001	38.95	42.23	0.004*	32.76
Distance to coast	119.72	<0.001	42.78	100.58	<0.001*	41.63
Vegetation type		P<F<M<C	11.43	81.41	P<F<M<C	11.48
Terrain ruggedness	25.90	<0.001	3.63	2.95	0.92	7.38
Wind velocity	23.18	<0.001	2.83	54.05	<0.001*	6.27
Wind turbulence	0.00	0.49	0.10	0.17	0.88	0.36
Geology type		Post<Pre	0.29	0.80	Pre<Post	0.13

* quadratic term of that variable was significant in the GLM

♦ Chi² values for linear and quadratic terms of a predictor in the GLM were summed

References

Department of Rural Development and Land Reform (DRDLR). (2019). *Digital elevation model –Marion Island*, Directorate: National Geo-spatial Information, Department of Rural Development and Land Reform, Republic of South Africa.

Goddard, K. A. (2021). *Investigation of wind patterns on Marion Island using Computational Fluid Dynamics and measured data*. MEng thesis, University of Pretoria.