

1 **Supplemental Information**

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Table S1: Number of BMUs, mean downwelling longwave radiation ($W m^{-2}$) and mean 20 m wind speed ($m s^{-1}$) (from left to right, separated by a forward slash (/) in each column) for each regime annually and seasonally at South Pole. Rows that list the basic near-surface stability regimes are shown with gray shading. Regimes with less than 10 observations annually or seasonally are listed in italics and red text. A triple dash (“---”) indicates this regime is not observed annually or seasonally.

South Pole					
Regime	Annual	Summer	Fall	Winter	Spring
NN	66 / 174 / 4.5	64 / 173 / 4.5	<i>1 / 204 / 2.4</i>	---	<i>1 / 200 / 3.6</i>
NN-WSA	85 / 172 / 5.5	78 / 171 / 5.4	<i>3 / 184 / 4.2</i>	---	<i>4 / 176 / 8.8</i>
NN-MSA	177 / 160 / 6.2	150 / 159 / 5.8	<i>3 / 159 / 9.4</i>	<i>1 / --- / 9.8</i>	23 / 164 / 8.6
NN-SSA	275 / 156 / 7.2	122 / 158 / 5.1	22 / 167 / 8.3	42 / 144 / 9.5	89 / 155 / 8.9
VSM-WSA	100 / 163 / 4.3	99 / 163 / 4.3	---	---	<i>1 / --- / 10.2</i>
VSM-MSA	388 / 144 / 4.5	362 / 145 / 4.4	<i>5 / 186 / 4.2</i>	---	21 / 130 / 6.5
VSM-SSA	955 / 136 / 6.5	262 / 147 / 5.0	194 / 142 / 6.2	194 / 125 / 7.8	305 / 130 / 7.2
WS	23 / 144 / 6.2	17 / 133 / 5.7	<i>1 / 168 / 2.6</i>	<i>1 / 106 / 10.2</i>	<i>4 / 187 / 8.3</i>
WS-MSA	62 / 140 / 7.7	36 / 133 / 6.7	<i>5 / 146 / 8.7</i>	<i>5 / 154 / 11.0</i>	16 / 145 / 8.8
WS-SSA	208 / 138 / 9.3	32 / 136 / 6.6	29 / 128 / 9.5	70 / 142 / 9.7	77 / 137 / 10.0
MS	363 / 135 / 4.4	278 / 137 / 3.9	17 / 138 / 6.0	<i>3 / 123 / 9.6</i>	65 / 129 / 5.8
MS-SSA	751 / 125 / 6.2	235 / 131 / 4.8	171 / 132 / 6.2	67 / 125 / 8.7	278 / 117 / 6.8
MS-VSSA	517 / 112 / 8.0	<i>1 / 126 / 5.4</i>	152 / 121 / 7.3	177 / 108 / 8.5	187 / 108 / 8.1
MS-ESSA	236 / 98 / 8.5	---	49 / 104 / 7.5	128 / 98 / 8.9	59 / 96 / 8.6
SS	1157 / 117 / 5.1	192 / 128 / 3.7	419 / 119 / 5.2	126 / 115 / 7.1	420 / 110 / 5.1
SS-VSSA	1032 / 101 / 6.8	<i>1 / --- / 3.8</i>	322 / 107 / 6.2	377 / 97 / 7.3	332 / 101 / 6.9
SS-ESSA	409 / 92 / 7.5	---	96 / 96 / 7.0	230 / 89 / 7.7	83 / 94 / 7.7
VSS	1076 / 98 / 5.4	<i>6 / 129 / 5.5</i>	354 / 104 / 4.7	398 / 90 / 6.1	318 / 100 / 5.2
VSS-ESSA	274 / 92 / 6.5	---	68 / 95 / 6.1	151 / 90 / 6.6	55 / 95 / 6.5
ESS	433 / 91 / 5.2	---	104 / 95 / 4.9	241 / 88 / 5.3	88 / 93 / 5.0

8 *Table S2: Number of BMUs, mean downwelling longwave radiation ($W m^{-2}$) and mean 20 m wind speed*
9 *($m s^{-1}$) (from left to right, separated by a forward slash (/) in each column) for each regime annually and*
10 *seasonally at Dome C. Rows that list the basic near-surface stability regimes are shown with gray*
11 *shading. Regimes with less than 10 observations annually or seasonally are listed in italics and red text. A*
12 *triple dash (“---”) indicates this regime is not observed annually or seasonally.*

Dome C					
Regime	Annual	Summer	Fall	Winter	Spring
NN	<i>9 / 140 / 4.3</i>	<i>9 / 140 / 4.3</i>	---	---	---
NN-WSA	21 / 146 / 3.5	21 / 146 / 3.5	---	---	---
NN-MSA	33 / 141 / 4.7	33 / 141 / 4.7	---	---	---
NN-SSA	24 / 152 / 5.3	21 / 152 / 4.9	<i>2 / 162 / 7.3</i>	<i>1 / --- / 10.2</i>	---
VSM-WSA	82 / 123 / 3.3	81 / 123 / 3.2	<i>1 / --- / 4.4</i>	---	---
VSM-MSA	267 / 119 / 3.4	219 / 123 / 3.4	23 / 109 / 3.6	<i>3 / 84 / 4.0</i>	22 / 95 / 3.1
VSM-SSA	102 / 126 / 5.3	46 / 131 / 3.3	28 / 112 / 6.5	<i>4 / 178 / 15.8</i>	24 / 123 / 6.2
WS	52 / 127 / 4.5	50 / 127 / 4.3	---	---	<i>2 / 134 / 8.8</i>
WS-MSA	78 / 130 / 5.9	68 / 128 / 5.5	<i>3 / 135 / 7.2</i>	<i>1 / --- / 12.7</i>	<i>6 / 142 / 8.8</i>
WS-SSA	23 / 125 / 7.3	13 / 132 / 4.8	<i>3 / 98 / 10.2</i>	<i>4 / 118 / 12.1</i>	<i>3 / 123 / 8.7</i>
MS	364 / 118 / 5.5	246 / 122 / 5.3	44 / 116 / 5.3	12 / 132 / 9.0	62 / 104 / 5.8
MS-SSA	241 / 114 / 6.6	38 / 123 / 5.8	86 / 115 / 6.0	12 / 130 / 8.4	105 / 110 / 7.3
MS-VSSA	53 / 105 / 9.8	---	20 / 113 / 8.0	15 / 101 / 11.7	18 / 100 / 10.2
MS-ESSA	<i>8 / 99 / 12.0</i>	---	<i>2 / 84 / 10.3</i>	<i>5 / 111 / 12.8</i>	<i>1 / 106 / 11.1</i>
SS	1450 / 97 / 5.1	53 / 120 / 4.8	473 / 102 / 4.8	545 / 90 / 5.1	379 / 96 / 5.5
SS-VSSA	223 / 94 / 8.2	<i>4 / 132 / 7.0</i>	69 / 93 / 7.5	58 / 99 / 9.5	92 / 91 / 7.9
SS-ESSA	90 / 80 / 10.1	---	20 / 78 / 8.6	43 / 83 / 11.2	27 / 78 / 9.5
VSS	997 / 88 / 6.2	11 / 124 / 4.6	284 / 94 / 5.9	454 / 83 / 6.2	248 / 89 / 6.5
VSS-ESSA	120 / 82 / 8.8	---	29 / 84 / 8.0	64 / 82 / 9.8	27 / 81 / 7.4
ESS	910 / 79 / 7.7	<i>1 / 156 / 5.5</i>	219 / 83 / 7.3	522 / 76 / 8.0	168 / 81 / 7.3

13 *Table S3: Number of BMUs, mean downwelling longwave radiation ($W m^{-2}$) and mean 20 m wind speed*
 14 *($m s^{-1}$) (from left to right, separated by a forward slash (/) in each column) for each regime annually and*
 15 *seasonally at McMurdo. Rows that list the basic near-surface stability regimes are shown with gray*
 16 *shading. Regimes with less than 10 observations annually or seasonally are listed in italics and red text. A*
 17 *triple dash (“---”) indicates this regime is not observed annually or seasonally.*

McMurdo					
Regime	Annual	Summer	Fall	Winter	Spring
NN	28 / 232 / 5.2	15 / 244 / 5.4	<i>6 / 222 / 3.1</i>	<i>1 / 243 / 11.7</i>	<i>6 / 212 / 5.8</i>
NN-WSA	70 / 220 / 4.8	30 / 238 / 5.0	18 / 210 / 3.9	<i>7 / 211 / 6.9</i>	15 / 204 / 4.5
NN-MSA	72 / 208 / 5.6	31 / 236 / 5.0	13 / 200 / 6.5	12 / 184 / 6.9	16 / 188 / 4.9
NN-SSA	43 / 187 / 6.4	<i>9 / 229 / 7.8</i>	<i>8 / 192 / 9.7</i>	14 / 157 / 5.8	12 / 188 / 3.9
VSM-WSA	75 / 205 / 2.8	35 / 227 / 2.4	20 / 191 / 3.0	<i>7 / 165 / 3.2</i>	13 / 200 / 3.1
VSM-MSA	148 / 188 / 4.3	43 / 223 / 4.0	37 / 187 / 4.6	35 / 161 / 4.4	33 / 184 / 4.1
VSM-SSA	103 / 181 / 5.1	12 / 224 / 5.2	30 / 189 / 7.1	34 / 168 / 4.3	27 / 172 / 4.0
WS	10 / 197 / 5.3	<i>1 / 276 / 5.4</i>	<i>1 / 250 / 16.0</i>	<i>5 / 181 / 4.5</i>	<i>3 / 179 / 3.1</i>
WS-MSA	11 / 205 / 6.8	<i>1 / 266 / 10.4</i>	<i>2 / 209 / 8.0</i>	<i>6 / 200 / 6.7</i>	<i>2 / 189 / 4.0</i>
WS-SSA	<i>9 / 144 / 7.0</i>	---	<i>2 / 123 / 9.3</i>	<i>4 / 147 / 6.0</i>	<i>3 / 155 / 6.8</i>
MS	85 / 173 / 2.5	10 / 235 / 2.3	16 / 190 / 2.8	36 / 148 / 1.9	23 / 172 / 3.3
MS-SSA	44 / 165 / 3.3	<i>3 / 255 / 3.9</i>	<i>8 / 176 / 4.9</i>	25 / 157 / 2.6	<i>8 / 158 / 3.4</i>
MS-VSSA	<i>4 / 158 / 5.5</i>	<i>1 / 198 / 7.6</i>	---	<i>3 / 144 / 4.9</i>	---
MS-ESSA	---	---	---	---	---
SS	67 / 161 / 3.0	<i>1 / 227 / 3.6</i>	18 / 175 / 5.3	31 / 149 / 2.0	17 / 164 / 2.4
SS-VSSA	<i>7 / 147 / 3.8</i>	---	<i>1 / 212 / 7.7</i>	<i>6 / 136 / 3.1</i>	---
SS-ESSA	<i>1 / 139 / 0.2</i>	---	---	<i>1 / 139 / 0.2</i>	---
VSS	<i>9 / 139 / 2.4</i>	---	---	<i>6 / 145 / 1.7</i>	<i>3 / 128 / 3.7</i>
VSS-ESSA	---	---	---	---	---
ESS	---	---	---	---	---

18 *Table S4: Number of BMUs, mean downwelling longwave radiation ($W m^{-2}$) and mean 20 m wind speed*
 19 *($m s^{-1}$) (from left to right, separated by a forward slash (/) in each column) for each regime annually and*
 20 *seasonally at Neumayer. Rows that list the basic near-surface stability regimes are shown with gray*
 21 *shading. Regimes with less than 10 observations annually or seasonally are listed in italics and red text. A*
 22 *triple dash (“---”) indicates this regime is not observed annually or seasonally.*

Neumayer					
Regime	Annual	Summer	Fall	Winter	Spring
NN	53 / 261 / 8.9	28 / 263 / 7.4	<i>2 / 261 / 6.0</i>	<i>4 / 235 / 9.4</i>	19 / 264 / 11.3
NN-WSA	147 / 263 / 11.1	82 / 271 / 10.9	17 / 260 / 10.0	15 / 227 / 10.5	33 / 261 / 12.8
NN-MSA	136 / 248 / 12.6	43 / 257 / 10.0	26 / 247 / 12.6	18 / 227 / 13.9	49 / 247 / 14.5
NN-SSA	38 / 232 / 14.0	<i>4 / 270 / 11.5</i>	<i>9 / 245 / 15.2</i>	13 / 223 / 15.7	12 / 222 / 12.3
VSM-WSA	93 / 245 / 4.3	57 / 254 / 4.2	18 / 246 / 2.8	<i>7 / 205 / 6.9</i>	11 / 219 / 5.8
VSM-MSA	115 / 227 / 6.7	32 / 241 / 5.3	25 / 239 / 6.4	22 / 207 / 7.9	36 / 218 / 7.5
VSM-SSA	62 / 213 / 7.8	19 / 220 / 4.4	<i>9 / 230 / 9.3</i>	15 / 208 / 9.1	19 / 200 / 9.7
WS	43 / 224 / 7.9	10 / 255 / 8.7	<i>7 / 213 / 6.2</i>	10 / 204 / 7.3	16 / 223 / 8.5
WS-MSA	46 / 223 / 9.6	10 / 236 / 8.8	<i>7 / 243 / 10.2</i>	23 / 215 / 9.8	<i>6 / 206 / 9.4</i>
WS-SSA	14 / 223 / 11.4	<i>2 / 266 / 9.6</i>	<i>3 / 256 / 15.4</i>	<i>8 / 198 / 10.7</i>	<i>1 / 240 / 7.9</i>
MS	179 / 201 / 5.2	43 / 231 / 4.3	38 / 219 / 4.9	56 / 169 / 6.2	42 / 195 / 5.2
MS-SSA	72 / 181 / 5.7	<i>7 / 221 / 4.4</i>	14 / 203 / 4.7	35 / 169 / 6.2	16 / 172 / 6.1
MS-VSSA	---	---	---	---	---
MS-ESSA	---	---	---	---	---
SS	199 / 179 / 5.0	21 / 222 / 5.3	41 / 203 / 3.7	99 / 160 / 5.2	38 / 180 / 5.4
SS-VSSA	<i>3 / 183 / 5.7</i>	---	---	<i>3 / 183 / 5.7</i>	---
SS-ESSA	---	---	---	---	---
VSS	19 / 162 / 6.0	---	<i>6 / 182 / 4.7</i>	10 / 159 / 6.7	<i>3 / 132 / 6.2</i>
VSS-ESSA	---	---	---	---	---
ESS	<i>1 / 150 / 11.5</i>	---	---	<i>1 / 150 / 11.5</i>	---

23 *Table S5: Nu Number of BMUs, mean downwelling longwave radiation ($W m^{-2}$) and mean 20 m wind*
 24 *speed ($m s^{-1}$) (from left to right, separated by a forward slash (/) in each column) for each regime*
 25 *annually and seasonally at Syowa. Rows that list the basic near-surface stability regimes are shown with*
 26 *gray shading. Regimes with less than 10 observations annually or seasonally are listed in italics and red*
 27 *text. A triple dash (“---”) indicates this regime is not observed annually or seasonally.*

Syowa					
Regime	Annual	Summer	Fall	Winter	Spring
NN	152 / 236 / 7.2	39 / 245 / 5.3	38 / 245 / 7.2	32 / 236 / 11.6	43 / 220 / 5.5
NN-WSA	891 / 234 / 6.2	270 / 239 / 5.2	253 / 247 / 6.4	109 / 227 / 8.8	259 / 219 / 6.1
NN-MSA	317 / 220 / 5.7	78 / 223 / 4.0	83 / 238 / 7.2	68 / 210 / 6.3	88 / 208 / 5.4
NN-SSA	24 / 214 / 4.1	<i>7 / 243 / 4.9</i>	<i>5 / 188 / 3.7</i>	<i>5 / 221 / 3.9</i>	<i>7 / 195 / 3.8</i>
VSM-WSA	1015 / 226 / 5.4	270 / 239 / 4.6	291 / 239 / 5.8	194 / 208 / 6.3	260 / 212 / 5.2
VSM-MSA	883 / 205 / 5.1	157 / 226 / 4.7	224 / 228 / 5.5	309 / 182 / 4.8	193 / 196 / 5.3
VSM-SSA	110 / 196 / 5.2	15 / 245 / 3.2	18 / 213 / 6.8	50 / 180 / 5.1	27 / 187 / 5.3
WS	730 / 234 / 9.7	118 / 253 / 8.3	200 / 248 / 9.7	239 / 222 / 10.5	173 / 222 / 9.5
WS-MSA	216 / 204 / 6.7	15 / 240 / 6.9	62 / 225 / 8.1	94 / 186 / 6.4	45 / 202 / 5.4
WS-SSA	18 / 191 / 6.5	---	<i>4 / 213 / 5.1</i>	<i>6 / 179 / 8.2</i>	<i>8 / 190 / 5.9</i>
MS	1460 / 192 / 6.5	172 / 227 / 6.9	295 / 214 / 7.4	640 / 178 / 6.4	353 / 184 / 6.2
MS-SSA	133 / 182 / 4.6	<i>7 / 218 / 5.1</i>	25 / 207 / 5.4	62 / 171 / 4.1	39 / 178 / 4.7
MS-VSSA	<i>3 / 154 / 1.1</i>	---	---	<i>2 / --- / 1.2</i>	<i>1 / 165 / 1.0</i>
MS-ESSA	---	---	---	---	---
SS	404 / 176 / 5.4	21 / 223 / 8.3	64 / 199 / 5.5	232 / 168 / 5.1	87 / 169 / 5.5
SS-VSSA	<i>7 / 167 / 2.2</i>	---	<i>1 / 196 / 2.1</i>	<i>5 / 156 / 1.5</i>	<i>1 / 193 / 5.6</i>
SS-ESSA	---	---	---	---	---
VSS	26 / 154 / 4.4	---	<i>3 / 183 / 8.1</i>	14 / 150 / 4.4	<i>9 / 150 / 3.1</i>
VSS-ESSA	---	---	---	---	---
ESS	<i>1 / 156 / 7.2</i>	---	---	<i>1 / 156 / 7.2</i>	---

