Supplementary material

Ambient air quality in the Surat Basin, Queensland

Overall assessment of air quality in region from 2014-2018

Sarah J. Lawson, Jennifer C. Powell, Julie Noonan, Erin Dunne and David Etheridge. Report for GISERA, project G3

August 2018

Appendix A

A.1 Air quality measurement details

A.1.1 Summary of measurement techniques undertaken at ambient air quality stations (Ecotech)

Table A. 1 Details of measurements made by Ecotech at ambient air monitoring stations

Parameter	Instrument/s	Method/s	Description
Nitric oxide (NO) Nitrogen dioxide (NO_2) Nitrogen oxides (NO_x)	Ecotech Serinus 40 or Ecotech EC9841T	Australian standard method AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of nitrogen oxides– chemiluminescence method
		Ecotech laboratory method	In-house method 6.1 Nitrogen oxides by chemiluminescence
Carbon monoxide (CO)	Ecotech Serinus 30 or Ecotech EC9830T	Australian standard method AS 3580.7.1-2011	Methods for sampling and analysis of ambient air. Method 7.1: Determination of carbon monoxide - direct reading instrumental method
		Ecotech laboratory method	In-house method 6.3 Carbon monoxide by gas filter correlation spectrophotometry
Ozone (O_3)	Ecotech Serinus 10	Australian standard method AS/NZS 3580.6.1-2011	Methods for sampling and analysis of ambient air. Method 6.1: Determination of ozone – Direct reading instrumental method
		Ecotech laboratory method	In-house method 6.7 Ozone by UV photometry
TVOC	Baseline 9000	Australian standard method AS 3580.11.1-2013	Methods for sampling and analysis of ambient air. Method 11.1 Determination of volatile organic compounds – Methane and non-methane volatile

			organic compounds – Direct reading instrument method
		Ecotech laboratory method	In-house method 6.6 Hydrocarbons –methane, non-methane, total by flame ionization detection (FID)
TSP, PM10, PM2.5 (Fidas)	Fidas 200	Ecotech laboratory method based on Fidas instrument manual	In-house method 7.7 – PM10 and PM2.5 Particles – Light Scattering Method Using Palas Fidas® 200 Series Monitors
Carbon dioxide/methane	Picarro G2301 or LGR GGA	Ecotech laboratory methods	Methane and Carbon dioxide by Cavity Ring-Down Spectroscopy (CRDS). Laser absorption spectroscopy method.
Meteorology measurements (continuous sampling/insitu analysis)			
Vector Wind Speed (Horizontal)	RM young 85000	Australian standard method AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
		Ecotech laboratory method	In-house method 8.1 Wind speed (Horizontal) by anemometer (ultrasonic)
Vector Wind Direction	RM young 85000	Australian standard method AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
		Ecotech laboratory method	In-house method 8.3 Wind direction by anemometer (ultrasonic)
Temperature	MetOne 062MP	Australian standard method AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
		Ecotech laboratory method	In-house method 8.4 Temperature ambient by thermoelectric techniques
Relative Humidity	Vaisala HMP155	Australian standard method AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air

			quality monitoring applications
		Ecotech laboratory method	In-house method 8.5 – Relative humidity by hygrometer
Rain	Hydrological Services TB6	Australian standard method AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
		Ecotech laboratory method	In-house method 8.7 – Rainfall by tipping bucket rain gauge
Solar and net radiation	Middletone Solar Pyranometer SK-01-D2	Australian standard method AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
		Ecotech laboratory method	In-house method 8.6 – Global solar radiation and Net radiation by pyranometer and net pyradiometer

A.1.2 Ambient air quality station measurement specifications and uncertainty

Table A. 2 Details of measurement specifications and uncertainty for measurements made at ambient air quality stations

Site	Parameter	Units	Resolution	Uncertainty	Measurement Range
H, M, C	NO, NO_x	ppb	1 ppb	±14 ppb K factor of 2.01	0 to 500 ppb
H, M, C	NO_2	ppb	1 ppb	±16 ppb K factor of 2.01	0 to 500 ppb
B, T	NO, NO_x	ppb	1 ppb	± 10 ppb K factor of 2.00	0 ppb to 250 ppb
B,T	NO_2	ppb	1 ppb	± 12 ppb K factor of 2.01	0 ppb to 250 ppb
H, M, C	CO	ppm	0.1 ppm	±1.1 ppm K factor of 2.00	0 to 50 ppm
B	CO	ppm	0.001 ppm	±0.002 ppm	1 to 5 ppm
H, M, C, B, T	O3	ppb	1 ppb	± 16 ppb between 0 - 125 ppb K factor of 2.02	0 ppb to 500 ppb
H, M, C	CH_4 (VOC1000)	ppm	0.1 ppm	4% of reading at span value K factor = 2	1 to 2000 ppm
H, M, C	NMHC	ppm	0.1 ppm	4% of reading at span value	1 to 2000 ppm

	(VOC1000)			K factor = 2	
H	CO_2 [a] (Picarro G2301)	ppm	0.1 ppm	0.05 ppm	0 to 1000 ppm
H	CH_4 [a] (Picarro G2301)	ppm	0.1 ppm	0.001 ppm	0 to 20 ppm
M, C	CH_4[a] (LGR GGA)	ppm	0.1 ppm	<1% without calibration	0.1-100 ppm
M, C	CO_2[a] (LGR GGA)	ppm	0.1 ppm	<1% without calibration	200-20000 ppm
H, M, C	Vector Wind Speed	m/s	0.1 m/s	±0.22 m/s or 3 % of reading (whichever is greater) K factor of 1.96	0 to 20 m/s
H, M, C	Vector Wind Direction	°	1°	±4° K factor of 2.11	0 to 360° Starting threshold: 0 m/s
H, M, C	Solar Radiation	W/m2	1 W/m2	±5 % of reading or ±32 W/m² or whichever is greater K factor of 1.96	0 to 1100 W/m2
H, M, C	Rainfall	mm	0.2 mm	±0.60 mm or 7.5 % of reading, whichever is the greater K factor of 2.14	Rainfall rates of 0 to 80 mm/hr
H, M, C	Ambient Temperature	°C	0.1 °C	±0.25 °C K factor of 2.01	0 to 50 °C
H, M, C	Relative Humidity	%	1 %	±5 % K factor of 2.31	0-100 %
H, M, C	TSP, PM_{10}, PM_4, $PM_{2.5}$, PM_1 (Dust)[b]	µg/m³	0.1 µg/m³	PM_{10} 91.% of reading at 50 µg m^{-3} $PM_{2.5}$ 16.8% of reading at 30 µg m^{-3}	0 to 10,000 µg/m³

a) Measurement of carbon dioxide and methane by cavity ring-down spectroscopy is not covered by Ecotech's NATA scope of accreditation. Manufacturer instrument manuals are followed for recommended calibration intervals (see A.4.2). Instrument response was checked using overnight spans and zeroes and against methane measurements from another co-located instrument using a different measurement technique. Specifications are taken from manufacturer Specifications sheet

b) Measurement of ambient TSP, PM_{10}, PM_4, $PM_{2.5}$, PM_1 using the Fidas 200 (optical light scattering spectroscopy) is not covered by Ecotech's NATA scope of accreditation. Instrument performance was determined via a comparison against a reference method at the Miles Airport site (see A.2)

H=Hopeland, M=Miles Airport, C=Condamine, T=Tara, B=Burncluith

A.1.3 Gases measured with Radiello passive samplers

Table A. 3 list of gases measured with VOC Radiello passive samplers in this study

VOC name	CAS Number
Benzene	71-43-2
Bromochloromethane	74-97-5
Butanol	35296-72-1
2-butoxyethanol	111-76-2
Butyl acetate	123-86-4

Carbon tetrachloride	56-23-5
Chlorobenzene	108-90-7
Cyclohexane	110-82-7
Cyclohexanone	108-94-1
n-decane	124-18-5
14-Dichlorobenzene	106-46-7
12-Dichloroethane	107-06-2
1,2-Dichloropropane	78-87-5
N-Dodecane*	112-40-3
Ethyl acetate	141-78-6
Ethylbenzene	100-41-4
2-ethylhexanol	104-76-7
Ethyl-tert-butyl ether	637-92-3
n-Heptane	142-82-5
n-Hexane	110-54-3
Isobutanol	78-83-1
Isooctane	540-84-1
Isopropylbenzene	98-82-8
1-Methoxy-2-propanol	107-98-2
1-Methoxy-2-propyl acetate	108-65-6
Methyl methacrylate	80-62-6
Methylcyclohexane	108-87-2
Methylcyclopentane	96-37-7
Methylethylketone	78-93-3
Methylisobutylketone	108-10-1
2-Methylpentane	107-83-5
3-Methylpentane	96-14-0

Methyl-ter-butyl ether	1634-04-4
Naphthalene	91-20-3
N-Nonane	111-84-2
N-Octane	111-65-9
n-Propylbenzene	103-65-1
Styrene	100-42-5
Tetrachloroethylene	127-18-4
Toluene	108-88-3
1,1,1-Trichloroethane	71-55-6
Trichloroethylene	79-01-6
Trichloromethane	67-66-3
1,2,4-Trimethylbenzene	95-63-6
N-Undecane	1120-21-4
o-Xylene#	95-47-6
m&p-Xylenes#	108-38-3 / 106-42-3

* dodecane not reported in this study, see Lawson et al., (2018a)

m and p xylenes and o xylene reported together as 'sum of all xylenes' in this study

Table A. 4 List of gases measured using Radiello aldehyde samplers in this study

Aldehyde	**CAS number**
Formaldehyde	50-00-0
Acrolein*	107-02-8
Acetaldehyde	75-07-0
Propanaldehyde	123-38-6
Butanaldehyde	123-72-8
Pentanaldehyde	110-62-3
Hexanaldehyde	66-25-1
Benzaldehyde	100-52-7
Glutaraldehyde	111-30-8

***acrolein not reported in this study, see Lawson et al (2018a)**

A.1.4 **Radiello Passive Sampler measurement and analytical technique**

Table A. 5. Summary of Radiello analytical techniques.

Integrated passive sampling/off-site analysis			
Individual volatile organic compounds (VOCs)	Radiello cartridges: white diffusive body code 120; adsorbing cartridge code 130.	VOCs sampled by passive diffusion onto activated charcoal adsorbent and chemically desorbed with CS2 and analysed by GC-FID. Exposure period is recorded.	SGS laboratory method: MA-5.RAD.02 Volatile Organics in Air, reported in µg/m3 based on Radiello manual Edition 01/2006 method D1: determination of concentration in air based on exposure period, sampling rate and mass/tube.
			SGS laboratory method: MA-5.RAD.03 Volatile Organics in Air, reported in µg/tube based on Radiello manual Edition 01/2006 method D1: determination of mass of VOCs on tube. Extraction by CS2, separation using capillary gas chromatography and identification/quantification with mass spectrometry (MS)
Individual aldehydes	Radiello cartridges: blue diffusive body code 120-1; chemiadsorbing cartridge code 165.	Aldehydes sampled by passive diffusion onto 2,-4-dinitrophenylhydrazine (2,4-DNPH)-coated Florisil to form 2,4-DNP-hydrazones. Exposure period is recorded.	SGS laboratory method MA-1159.RAD.01 Aldehydes in Air, reported in µg/m3, based on Radiello manual Edition 01/2006 method C1: determination of concentration in air based on exposure period, sampling rate and mass/tube
			SGS laboratory method MA-1159.RAD.02 Aldehydes in Air, reported in µg/tube based on Radiello manual Edition 01/2006 method C1: determination of mass of 2,4-DNP-hydrazones on tube. Extraction in acetonitrile, separation using reverse phase high performance liquid chromatography and identification/quantification with selected ion monitoring (SIM) mass spectrometry (MS)
Hydrogen sulphide (H_2S)	Radiello cartridges: white diffusive body code 120; chemiadsorbing cartridge code 170	Hydrogen sulphide is sampled by passive diffusion onto zinc acetate-impregnated polyethylene to form zinc sulphide. Exposure period is recorded.	SGS laboratory method MA-1538.RAD.01 Hydrogen Sulphide in air, reported in ppb, based on Radiello manual Edition 01/2006 method H1: determination of concentration in air based on exposure period, sampling rate and mass/tube
			SGS laboratory method MA-1538.RAD.02 Hydrogen Sulphide in air, in µg/tube based on Radiello manual Edition 01/2006 method H1: determination of mass of sulphide on tube. Sulfide is extracted in water and is reacted to form methylene blue, which is quantified by visible spectrometry.

For more detail about the measurements from this study, please refer to Appendices in the following reports

Lawson, S.J., Powell, J, Noonan, J, Dunne, E, Cheng, M, Selleck, P., Harnwell, J and Etheridge, D (2018a). An assessment of ambient air quality in the Surat Basin, Queensland. Interim data summary report 2014- 2016. 234 p GISERA website: Available: https://gisera.csiro.au/project/ambient-air-quality-in-the-surat-basin/

Lawson, S.J., Powell, J., Noonan, J. Selleck, P.W. and Etheridge, D. (2018b). Ambient air quality in the Surat Basin, Queensland. Final data summary January 2017 – February 2018. GISERA website: Available: https://gisera.csiro.au/project/ambient-air-quality-in-the-surat-basin/

Appendix B

B.1 Monthly meteorological statistics for gas field sites for 2015 – 2018

Table B. 1 Monthly wind statistics for gas field sites for entire study

	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine
	Wind % capture			Vector average wind speed (m s^{-1}) , wind direction (deg)			Max, min wind speed, (m s^{-1})		
Jan-15	19	–	–	–	–	–	–	–	–
Feb-15	96	–	–	3.5, 103	–	–	0.6, 9.5	–	–
Mar-15	100	–	–	1.6, 61	–	–	0.2, 8.2	–	–
Apr-15	81	–	–	1.1, 124	–	–	0.2, 8.5	–	–
May-15	100	–	–	1, 185	–	–	0.0, 8.0	–	–
Jun-15	100	–	–	1.4, 125	–	–	0.0, 8.5	–	–
Jul-15	99	81	–	0.4, 184	0.4, 135	–	0.1, 7.8	0.3, 8.7	–
Aug-15	100	100	–	0.5, 218	0.3, 236	–	0.1, 10.9	0.2, 9.3	–
Sep-15	100	100	–	0.7, 131	0.5, 91	–	0.2, 8.2	0.2, 8.7	–
Oct-15	97	89	–	2.7, 64	2.8, 62	–	0.1, 10.1	0.4, 8.5	–
Nov-15	99	85	–	2.1, 29	2.2, 32	–	0.2, 8.8	0.0, 8.9	–
Dec-15	99	81	–	2.8, 67	3, 61	–	0.5, 8.2	0.4, 8.6	–
Jan-16	52	17	–	–	–	–	–	–	–
Feb-16	96	82	–	2, 106	1.5, 98	–	0.2, 7.9	0.5, 7.7	–
Mar-16	100	37	81	2.6, 82	–	2.1, 75	0.0, 7.5	–	0.1, 5.8
Apr-16	100	98	98	2.2, 95	2.2, 86	1.8, 74	0.1, 9.0	0.1, 7.2	0.2, 5.4
May-16	100	100	99	0.4, 180	0.1, 105	0.4, 71	0.1, 8.8	0.2, 8.0	0.0, 5.8

Jun-16	100	100	100	0.5, 190	0.3, 209	0.4, 72	0.1, 8.9	0.2, 7.7	0.1, 8.1
Jul-16	71	100	100	–	0.6, 216	0.2, 119	–	0.2, 8.6	0.1, 8.8
Aug-16	100	100	100	0.4, 111	0.4, 65	0.9, 58	0.0, 7.9	0.1, 8.2	0.0, 7.5
Sep-16	100	100	99	0.5, 3	0.7, 359	0.9, 34	0.0, 10.7	0.1, 12.2	0.2, 7.8
Oct-16	100	99	100	0.3, 19	0.6, 9	0.9, 35	0.1, 8.9	0.1, 8.8	0.0, 7.9
Nov-16	99	99	99	0.5, 62	0.7, 55	1.2, 46	0.2, 8.7	0.4, 8.0	0.1, 8.3
Dec-16	99	100	100	2.4, 50	2.2, 41	2.9, 40	0.3, 8.9	0.1, 8.1	0.2, 9.1
Jan-17	46	92	100	–	1.3, 73	3.3, 50	–	0.1, 7.6	0.4, 7.9
Feb-17	92	100	79	1.9, 81	1, 90	2.6, 54	0.1, 7.3	0.1, 8.0	0.2, 9.0
Mar-17	45	98	92	–	1.1, 114	1.8, 60	–	0.2, 8.8	0.1, 10.0
Apr-17	65	100	100	–	1.4, 122	1.5, 82	–	0.1, 6.9	0.1, 6.1
May-17	98	100	100	1.2, 119	1.1, 114	1.4, 74	0.0, 7.0	0.2, 6.2	0.1, 7.3
Jun-17	71	99	64	–	1.1, 197	–	–	0.1, 6.1	–
Jul-17	44	100	–	–	0.4, 351	–	–	0.0, 8.5	–
Aug-17	100	19	–	0.8, 255	–	–	0.0, 7.9	–	–
Sep-17	100	45	–	0.8, 311	–	–	0.0, 8.6	–	–
Oct-17	98	100	–	1.4, 81	1, 68	–	0.1, 10.7	0.2, 8.9	–
Nov-17	24	21	–	–	–	–	–	–	–
Dec-17	0	0	–	–	–	–	–	–	–
Jan-18	0	0	–	–	–	–	–	–	–
Feb-18	31	22	–	–	–	–	–	–	–

Table B. 2 Monthly atmospheric pressure statistics for gas field sites for entire study

	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine
	Station pressure % capture			Pressure avg (stdev), mbar			Pressure min., max., mbar		
Jan-15	31	–	–	–	–	–	–	–	–
Feb-15	99	–	–	978 (4)	–	–	970, 987	–	–
Mar-15	99	–	–	978 (4)	–	–	970, 988	–	–
Apr-15	81	–	–	983 (4)	–	–	973, 991	–	–
May-15	100	–	–	985 (5)	–	–	976, 995	–	–
Jun-15	100	–	–	988 (4)	–	–	979, 995	–	–
Jul-15	99	84	–	987 (4)	987 (4)	–	978, 996	969, 996	–
Aug-15	100	100	–	985 (3)	985 (3)	–	975, 992	975, 992	–
Sep-15	100	100	–	985 (3)	985 (3)	–	976, 994	976, 994	–
Oct-15	97	89	–	987 (4)	987 (4)	–	974, 997	974, 997	–
Nov-15	99	85	–	978 (3)	978 (3)	–	969, 985	969, 985	–
Dec-15	99	81	–	980 (3)	980 (3)	–	971, 987	970, 987	–
Jan-16	46	17	87	–	–	1013 (5)	–	–	1000, 1020
Feb-16	96	82	61	976 (4)	975 (3)	–	966, 987	966, 982	–
Mar-16	98	37	84	981 (3)	–	979 (4)	969, 986	–	968, 985
Apr-16	100	97	98	984 (2)	984 (2)	984 (2)	979, 990	979, 990	979, 989
May-16	100	99	100	983 (3)	983 (3)	982 (3)	973, 991	973, 990	973, 990
Jun-16	100	100	100	984 (6)	983 (6)	983 (6)	970, 997	970, 997	970, 997
Jul-16	100	100	100	985 (4)	985 (4)	985 (4)	966, 994	976, 994	976, 993
Aug-16	100	100	100	985 (5)	985 (5)	984 (5)	972, 994	971, 994	970, 994
Sep-16	97	100	99	982 (5)	981 (5)	981 (5)	970, 993	969, 993	969, 992
Oct-16	100	99	100	982 (3)	981 (3)	981 (3)	973, 989	973, 989	972, 989

Nov-16	99	99	99	978 (4)	978 (4)	977 (4)	966, 987	966, 987	966, 986
Dec-16	99	100	100	978 (4)	977 (4)	977 (4)	967, 986	967, 986	966, 986
Jan-17	46	92	100	–	976 (3)	976 (3)	–	967, 982	966, 982
Feb-17	91	100	79	978 (4)	977 (4)	977 (4)	966, 985	966, 985	965, 984
Mar-17	44	98	92	–	977 (2)	976 (2)	–	966, 982	966, 981
Apr-17	65	100	100	–	984 (3)	983 (3)	–	975, 991	975, 990
May-17	98	100	100	985 (2)	985 (3)	984 (3)	980, 992	979, 992	979, 992
Jun-17	71	100	63	–	987 (2)	–	–	981, 994	–
Jul-17	44	100	–	–	986 (3)	–	–	978, 994	–
Aug-17	100	19	–	983 (3)	–	–	974, 990	–	–
Sep-17	100	44	–	982 (4)	–	–	973, 991	–	–
Oct-17	100	100	–	981 (4)	980 (4)	–	971, 989	970, 989	–
Nov-17	100	91	–	981 (3)	980 (3)	–	972, 989	972, 989	–
Dec-17	96	85	–	977 (3)	976 (3)	–	969, 984	969, 982	–
Jan-18	100	100	–	976 (4)	976 (4)	–	965, 984	965, 984	–
Feb-18	91	88	–	976 (4)	977 (4)	–	956, 984	968, 984	–

Table B. 3 Monthly solar radiation statistics for gas field sites for entire study

	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine
	Solar radiation % capture			Solar rad. avg, (stdev.), Wm^{-2}			Solar rad. Min., max., Wm^{-2}		
Jan-15	44	–	–	–	–	–	–	–	–
Feb-15	99	–	–	285 (354)	–	–	1, 1169	–	–
Mar-15	98	–	–	268 (348)	–	–	1, 1075	–	–
Apr-15	79	–	–	193 (284)	–	–	1, 931	–	–
May-15	97	–	–	165 (252)	–	–	1, 844	–	–
Jun-15	96	–	–	134 (212)	–	–	1, 740	–	–
Jul-15	97	81	–	155 (232)	160 (228)	–	1, 791	2, 736	–
Aug-15	99	100	–	205 (290)	201 (278)	–	1, 942	2, 886	–
Sep-15	99	93	–	266 (349)	260 (349)	–	0, 1055	2, 1053	–
Oct-15	97	84	–	298 (373)	281 (369)	–	0, 1086	2, 1047	–
Nov-15	97	85	–	302 (380)	314 (389)	–	0, 1144	2, 1152	–
Dec-15	99	80	–	305 (385)	296 (370)	–	0, 1189	2, 1156	–
Jan-16	52	17	–	–	–	–	–	–	–
Feb-16	92	78	–	276 (365)	276 (370)	–	0, 1167	2, 1170	–
Mar-16	91	37	81	212 (305)	–	247 (327)	0, 1036	–	3, 1044
Apr-16	97	97	98	216 (303)	209 (299)	227 (306)	0, 944	2, 949	3, 930
May-16	95	99	99	158 (242)	173 (248)	176 (250)	0, 802	2, 770	3, 795
Jun-16	98	100	100	110 (178)	117 (184)	117 (183)	0, 715	2, 680	3, 689
Jul-16	92	100	98	129 (219)	152 (227)	148 (226)	0, 797	2, 760	3, 770
Aug-16	92	95	100	162 (260)	190 (279)	193 (276)	0, 941	2, 883	3, 889
Sep-16	99	85	99	220 (312)	207 (317)	210 (305)	0, 1076	2, 1050	3, 1033
Oct-16	99	91	98	300 (384)	280 (386)	282 (372)	0, 1153	2, 1125	3, 1127

Nov-16	97	93	98	319 (401)	311 (400)	321 (400)	0, 1210	2, 1175	3, 1166
Dec-16	97	96	94	309 (385)	315 (392)	332 (396)	0, 1197	2, 1189	3, 1197
Jan-17	46	87	96	–	316 (398)	317 (385)	–	2, 1219	3, 1143
Feb-17	91	94	75	322 (392)	314 (403)	340 (403)	0, 1148	2, 1154	3, 1095
Mar-17	43	81	84	–	189 (315)	234 (330)	–	2, 1094	3, 1044
Apr-17	61	90	96	–	237 (330)	225 (303)	–	2, 1001	3, 979
May-17	91	95	98	151 (242)	185 (264)	178 (253)	0, 820	2, 827	3, 789
Jun-17	64	99	61	–	172 (243)	–	–	2, 721	–
Jul-17	40	97	–	–	179 (257)	–	–	2, 774	–
Aug-17	92	18	–	195 (291)	–	–	0, 940	–	–
Sep-17	97	39	–	283 (361)	–	–	0, 1014	–	–
Oct-17	99	92	–	227 (327)	228 (345)	–	0, 1162	2, 1209	–
Nov-17	24	20	–	–	–	–	–	–	–
Dec-17	0	0	–	–	–	–	–	–	–
Jan-18	0	0	–	–	–	–	–	–	–
Feb-18	24	14	–	–	–	–	–	–	–

Table B. 4 Monthly rainfall statistics for Gas field sites for entire study

	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine
	Rainfall % capture			Rainfall, total, mm			Rainfall, min., max., mm		
Jan-15	40	–	–	–	–	–	–	–	–
Feb-15	99	–	–	65.1	–	–	0.0, 36.6	–	–
Mar-15	100	–	–	109.5	–	–	0.0, 35.1	–	–
Apr-15	81	–	–	44.7	–	–	0.0, 9.1	–	–
May-15	100	–	–	27.8	–	–	0.0, 5.4	–	–
Jun-15	100	–	–	14.1	–	–	0.0, 3.5	–	–
Jul-15	99	81	–	17.1	20.8	–	0.0, 3.7	0.0, 5.6	–
Aug-15	100	100	–	33.1	58.2	–	0.0, 5.9	0.0, 15.6	–
Sep-15	100	100	–	28.1	15.8	–	0.0, 9.6	0.0, 6.8	–
Oct-15	97	89	–	13.6	5.2	–	0.0, 5.9	0.0, 3.4	–
Nov-15	99	86	–	48.9	40.0	–	0.0, 19.8	0.0, 9.4	–
Dec-15	99	81	–	70.3	54.8	–	0.0, 4.7	0.0, 6.2	–
Jan-16	52	17	–	–	–	–	–	–	–
Feb-16	96	82	–	54.3	52.4	–	0.0, 19.9	0.0, 14.4	–
Mar-16	100	37	81	57.1	–	23.8	0.0, 13.2	–	0.0, 14.2
Apr-16	100	98	98	7.0	5.4	1.4	0.0, 5.4	0.0, 3.0	0.0, 0.6
May-16	100	100	99	13.2	15.8	16.4	0.0, 3.3	0.0, 3.4	0.0, 4.0
Jun-16	100	100	100	50.3	50.6	47.2	0.0, 7.4	0.0, 10.6	0.0, 9.4
Jul-16	100	100	100	48.2	44.4	52.0	0.0, 9.9	0.0, 6.8	0.0, 15.6
Aug-16	100	100	100	48.7	36.6	36.2	0.0, 21.5	0.0, 11.2	0.0, 6.2
Sep-16	99	100	99	164.1	145.4	130.4	0.0, 20.0	0.0, 9.4	0.0, 9.4
Oct-16	100	99	100	16.9	60.8	45.6	0.0, 3.0	0.0, 27.6	0.0, 11.6

Nov-16	99	99	99	31.2	11.4	9.0	0.0, 6.8	0.0, 3.8	0.0, 2.4
Dec-16	99	100	100	38.8	46.6	48.4	0.0, 6.3	0.0, 19.2	0.0, 12.8
Jan-17	46	92	100	–	72.4	73.2	–	0.0, 27.6	0.0, 13.6
Feb-17	92	100	79	25.5	24.8	5.6	0.0, 12.9	0.0, 7.8	0.0, 2.0
Mar-17	45	98	92	–	111.8	107.4	–	0.0, 17.2	0.0, 10.6
Apr-17	65	100	100	–	0.4	1.2	–	0.0, 0.2	0.0, 0.6
May-17	97	100	100	17.1	17.8	13.0	0.0, 7.0	0.0, 6.0	0.0, 8.4
Jun-17	71	100	64	–	8.4	–	–	0.0, 2.8	–
Jul-17	44	100	–	–	14.6	–	–	0.0, 5.6	–
Aug-17	100	19	–	60.7	–	–	0.0, 35.1	–	–
Sep-17	100	44	–	0.0	–	–	0	–	–
Oct-17	100	100	–	103.1	103.1	–	0.0, 18.2	0.0, 19.8	–
Nov-17	100	91	–	54.8	25.8	–	0.0, 12.9	0.0, 13.4	–
Dec-17	96	85	–	62.0	34.6	–	0.0, 16.0	0.0, 11.6	–
Jan-18	100	100	–	10.8	0.6	–	0.0, 8.0	0.0, 0.6	–
Feb-18	91	88	–	112.6	138.8	–	0.0, 12.5	0.0, 16.6	–

Table B. 5 Month temperature statistics for gas field sites for entire study

	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine
	Temperature 10 m % capture			Temp. 10m, avg. (stdev.), °C			Temp. 10m, min., max., °C		
Jan-15	40	–	–	–	–	–	–	–	–
Feb-15	99	–	–	24.6 (4.2)	–	–	16.6, 33.2	–	–
Mar-15	100	–	–	25.4 (4.9)	–	–	11.5, 39.7	–	–
Apr-15	81	–	–	18.4 (5.0)	–	–	5.4, 29.2	–	–
May-15	100	–	–	15.3 (4.8)	–	–	1.5, 27.0	–	–
Jun-15	100	–	–	13.6 (5.0)	–	–	-1.4, 22.6	–	–
Jul-15	99	81	–	11.8 (5.3)	12.9 (5.3)	–	-0.8, 24.5	1.2, 24.7	–
Aug-15	100	100	–	13.6 (6.0)	14.3 (5.6)	–	-1.1, 26.3	2.0, 26.6	–
Sep-15	100	100	–	16.4 (5.1)	17.1 (4.8)	–	3.2, 28.2	5.6, 28.7	–
Oct-15	97	89	–	21.7 (5.2)	22.5 (4.9)	–	8.3, 32.8	12.0, 33.0	–
Nov-15	99	85	–	24.8 (5.0)	25.8 (5.1)	–	15.1, 36.6	15.5, 37.1	–
Dec-15	99	82	–	24.0 (4.3)	24.8 (4.5)	–	15.4, 35.1	16.1, 36.1	–
Jan-16	52	17	–	–	–	–	–	–	–
Feb-16	96	82	–	25.7 (4.7)	26.9 (5.0)	–	17.1, 37.5	18.6, 38.3	–
Mar-16	100	37	82	24.4 (4.2)	–	25.6 (4.7)	16.0, 33.1	–	15.6, 37.3
Apr-16	100	98	98	21.9 (4.6)	22.7 (4.7)	22.6 (5.0)	10.8, 32.4	11.8, 33.0	8.9, 33.9
May-16	100	99	99	17.5 (5.9)	18.4 (5.5)	17.4 (6.3)	1.1, 29.7	2.8, 30.7	1.4, 30.7
Jun-16	100	100	100	13.7 (4.5)	13.9 (4.4)	13.7 (4.6)	0.8, 30.1	2.2, 30.7	0.1, 30.4
Jul-16	100	100	100	13.3 (5.1)	13.5 (5.0)	13.0 (5.3)	0.4, 26.2	2.4, 26.4	-0.6, 25.9
Aug-16	100	99	100	13.8 (5.0)	14.3 (4.7)	14.1 (5.0)	1.8, 24.1	3.8, 24.6	1.4, 24.5
Sep-16	100	100	99	16.8 (4.0)	17.2 (3.9)	16.9 (4.1)	6.2, 26.1	7.8, 26.5	6.0, 26.3

Oct-16	100	99	100	19.0 (5.9)	19.4 (5.5)	19.1 (5.9)	5.6, 31.2	7.6, 31.4	5.8, 31.3
Nov-16	99	99	99	23.6 (5.2)	24.1 (5.1)	23.9 (5.2)	10.6, 34.0	12.8, 34.0	9.2, 34.0
Dec-16	99	100	100	26.6 (5.3)	27.2 (5.3)	27.2 (5.3)	13.9, 40.4	15.4, 40.4	14.8, 40.5
Jan-17	46	92	100	–	28.2 (4.6)	28.1 (4.5)	–	18.1, 39.0	18.4, 38.9
Feb-17	92	100	79	27.4 (5.4)	28.3 (5.5)	29.1 (5.2)	15.8, 41.3	16.7, 42.2	16.3, 41.8
Mar-17	45	98	92	–	25.0 (4.1)	24.7 (4.1)	–	12.2, 33.5	12.2, 33.7
Apr-17	65	100	100	–	19.3 (4.5)	19.2 (4.7)	–	5.5, 27.5	4.5, 27.6
May-17	98	100	100	17.1 (4.6)	17.6 (4.5)	17.4 (4.7)	3.1, 27.3	6.3, 27.9	2.5, 27.8
Jun-17	71	100	64	–	14.5 (5.0)	–	–	2.3, 24.5	–
Jul-17	44	100	–	–	14.3 (5.4)	–	–	0.2, 25.9	–
Aug-17	100	19	–	14.6 (6.4)	–	–	-0.6, 29.8	–	–
Sep-17	100	45	–	19.6 (7.4)	–	–	2.4, 37.4	–	–
Oct-17	100	100	–	21.3 (4.3)	21.7 (4.6)	–	12.2, 33.3	12.1, 34.3	–
Nov-17	99	91	–	21.8 (4.7)	22.5 (4.6)	–	9.2, 31.9	10.9, 32.1	–
Dec-17	96	85	–	25.6 (4.9)	26.7 (5.0)	–	13.8, 37.0	14.4, 37.6	–
Jan-18	100	100	–	27.1 (4.6)	28.0 (4.6)	–	16.8, 38.6	17.4, 39.2	–
Feb-18	91	88	–	25.4 (5.5)	25.6 (5.7)	–	14.8, 39.9	14.9, 40.4	–

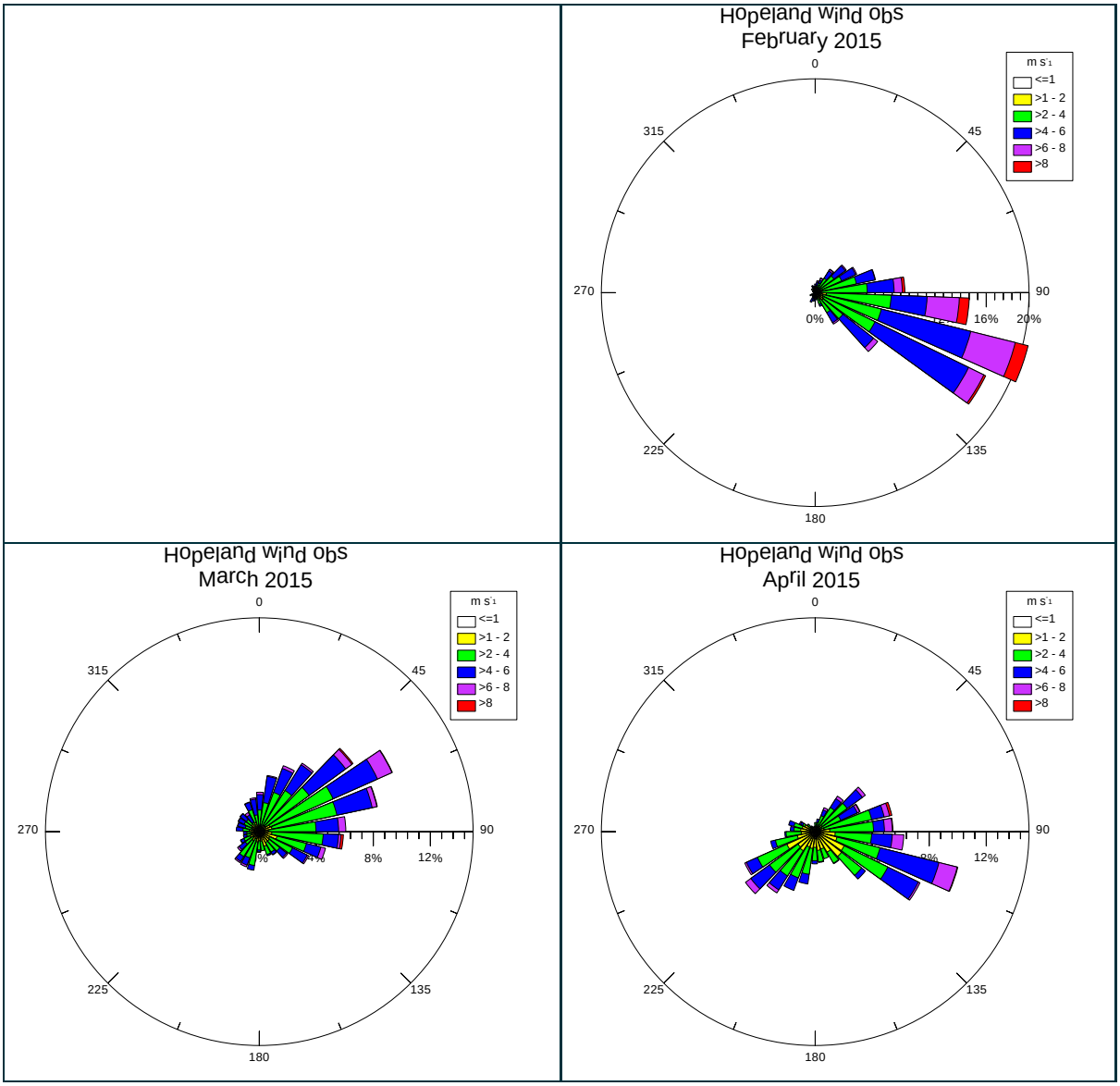
Table B. 6 Monthly relative humidity statistics for gas field sites over entire study

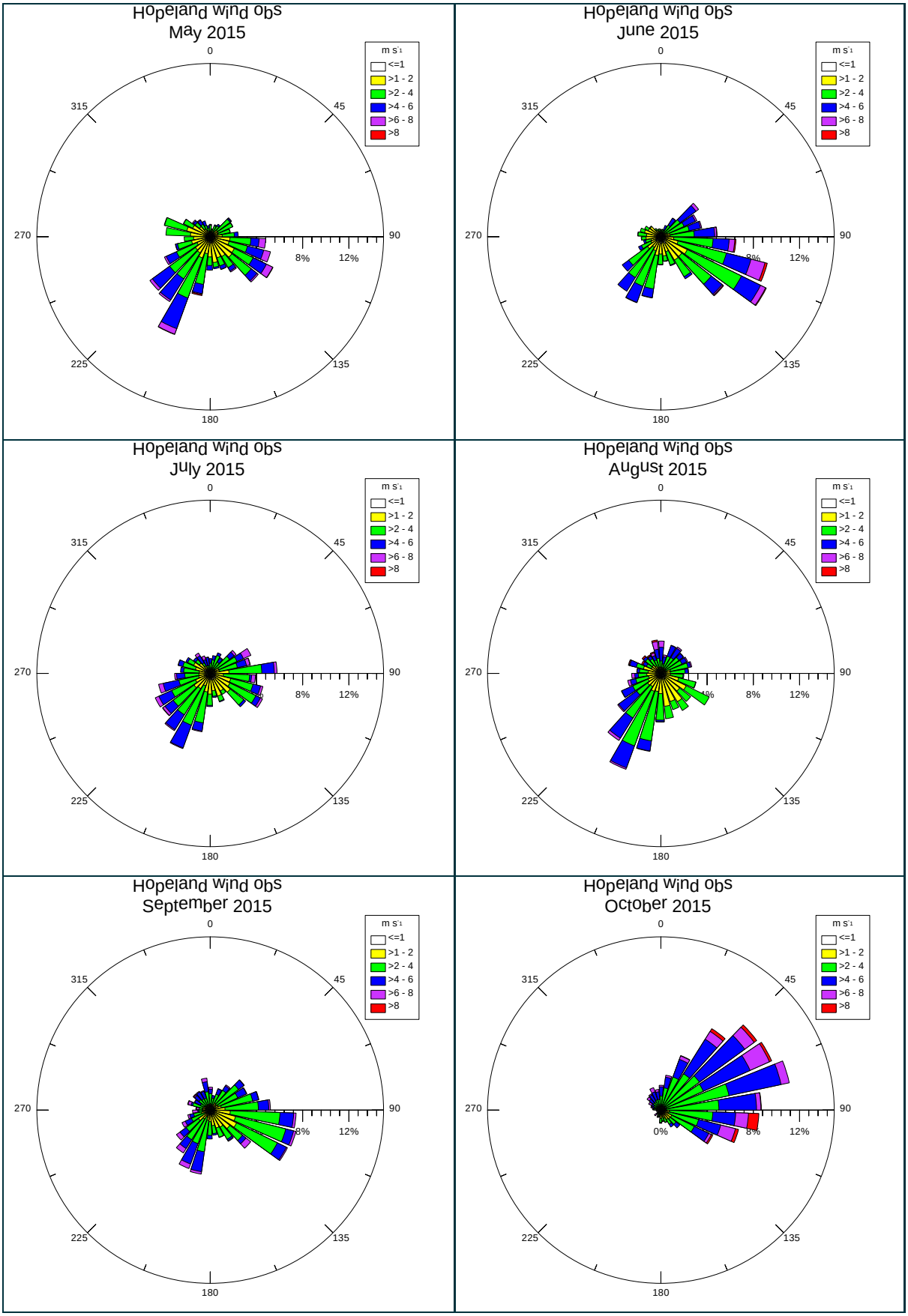
	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine	Hopeland	Miles Airport	Condamine
	Relative humidity % capture			Rel. humidity, avg. (stdev.), %			Rel. humidity, min., max., %		
Jan-15	37	–	–	–	–	–	–	–	–
Feb-15	99	–	–	63 (18)	–	–	22, 97	–	–
Mar-15	8	–	–	–	–	–	–	–	–
Apr-15	0	–	–	–	–	–	–	–	–
May-15	63	–	–	–	–	–	–	–	–
Jun-15	100	–	–	75 (19)	–	–	28, 100	–	–
Jul-15	99	81	–	72 (20)	68 (21)	–	27, 99	23, 99	–
Aug-15	100	100	–	63 (22)	60 (22)	–	22, 99	15, 99	–
Sep-15	100	100	–	60 (22)	55 (21)	–	22, 99	18, 98	–
Oct-15	97	89	–	55 (22)	49 (21)	–	16, 98	9, 94	–
Nov-15	99	85	–	60 (20)	54 (21)	–	15, 99	0, 98	–
Dec-15	99	82	–	63 (21)	57 (20)	–	24, 99	22, 99	–
Jan-16	52	17	–	–	–	–	–	–	–
Feb-16	96	82	–	62 (23)	55 (24)	–	16, 99	14, 98	–
Mar-16	100	37	84	65 (20)	–	60 (20)	27, 99	–	25, 99
Apr-16	100	98	98	62 (21)	57 (20)	57 (20)	23, 98	22, 98	20, 98
May-16	100	99	99	61 (21)	57 (21)	61 (21)	13, 98	12, 98	14, 99
Jun-16	100	100	100	76 (17)	74 (17)	76 (17)	33, 99	32, 99	33, 98
Jul-16	100	99	100	73 (19)	71 (19)	74 (19)	28, 99	29, 99	29, 99
Aug-16	100	100	100	68 (20)	67 (20)	68 (20)	25, 99	24, 99	24, 99
Sep-16	100	100	99	72 (19)	71 (19)	72 (20)	29, 99	29, 99	30, 99
Oct-16	100	99	100	58 (22)	57 (21)	59 (23)	21, 99	19, 98	16, 98

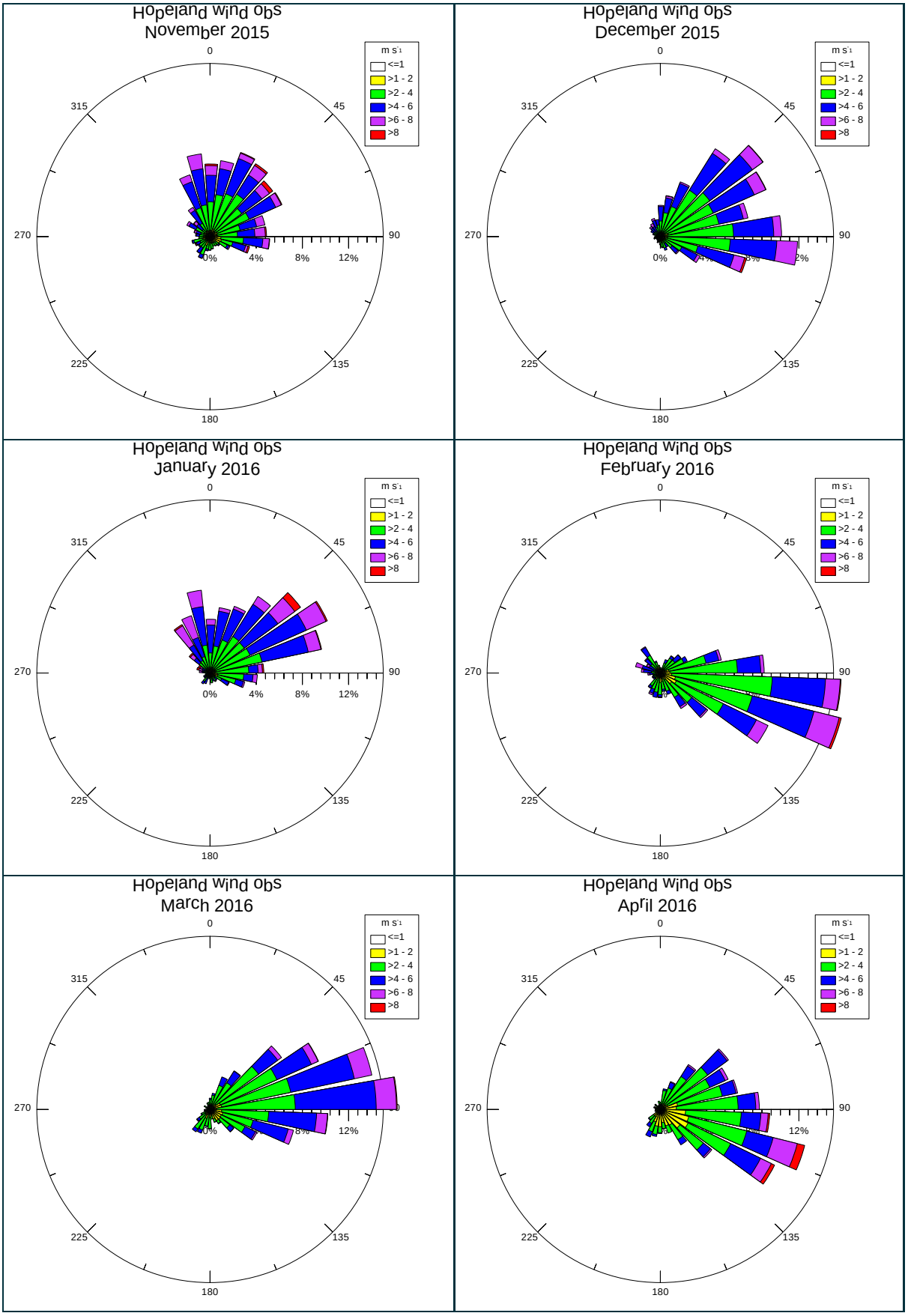
Nov-16	99	99	99	47 (22)	44 (21)	44 (20)	11, 95	11, 94	11, 92
Dec-16	99	100	100	54 (22)	52 (21)	53 (21)	11, 96	10, 96	11, 97
Jan-17	46	92	100	–	57 (19)	58 (19)	–	21, 98	21, 97
Feb-17	92	100	79	52 (21)	49 (21)	46 (18)	15, 98	9, 98	10, 94
Mar-17	45	98	92	–	65 (21)	66 (21)	–	13, 99	14, 99
Apr-17	65	100	100	–	63 (19)	63 (18)	–	26, 97	24, 97
May-17	98	100	100	69 (21)	66 (21)	66 (20)	27, 100	26, 99	28, 99
Jun-17	71	100	64	–	63 (20)	–	–	23, 99	–
Jul-17	44	100	–	–	61 (24)	–	–	16, 99	–
Aug-17	100	19	–	52 (25)	–	–	13, 100	–	–
Sep-17	100	45	–	41 (19)	–	–	11, 92	–	–
Oct-17	100	100	–	72 (22)	68 (22)	–	19, 100	18, 100	–
Nov-17	99	91	–	58 (22)	54 (21)	–	19, 99	18, 99	–
Dec-17	96	85	–	56 (22)	52 (21)	–	15, 99	14, 99	–
Jan-18	100	100	–	54 (23)	49 (21)	–	12, 100	11, 100	–
Feb-18	91	88	–	67 (24)	64 (23)	–	16, 100	16, 100	–

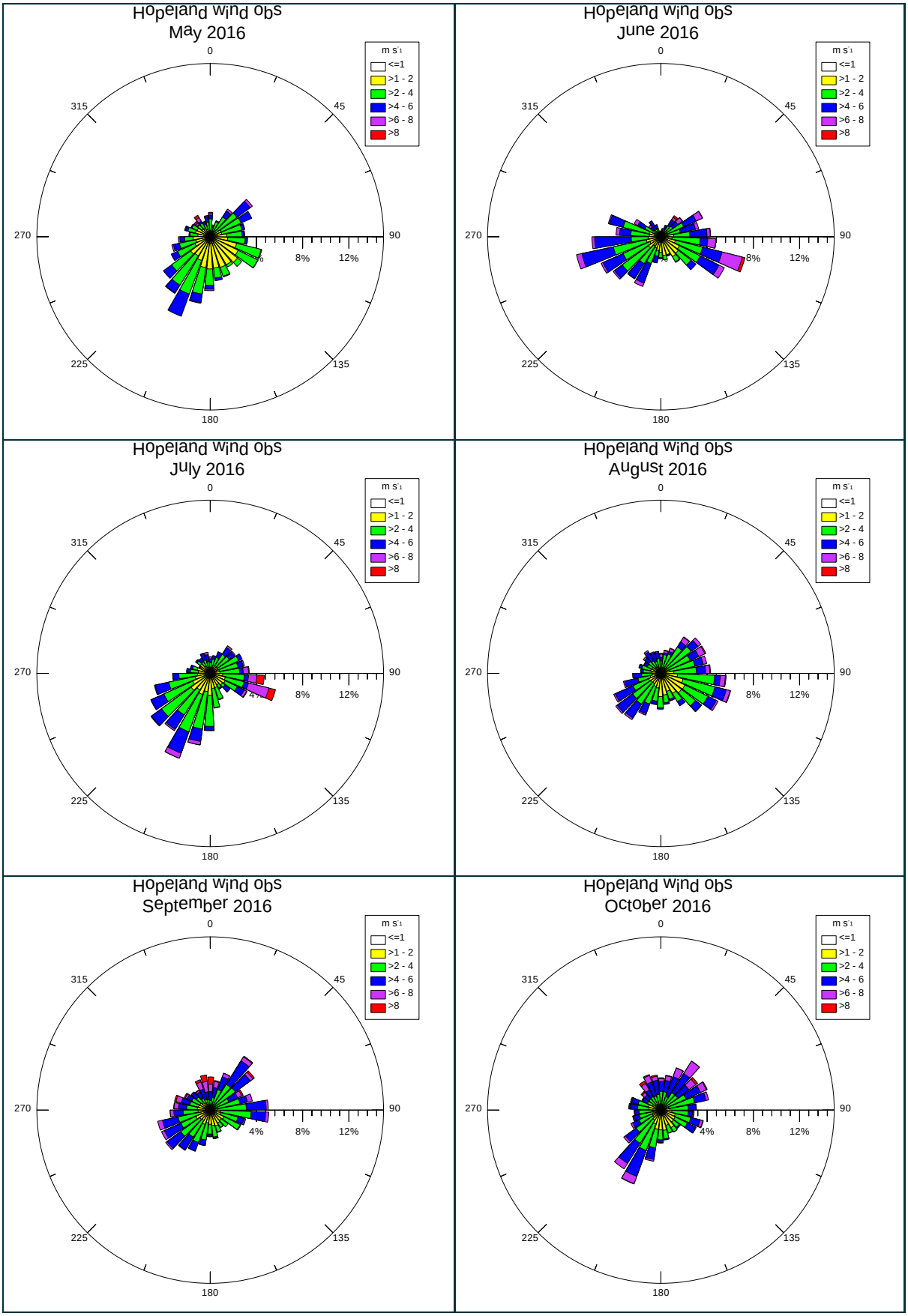
B.2 Monthly wind roses from observerations for entire monitoring period (2015-2018)

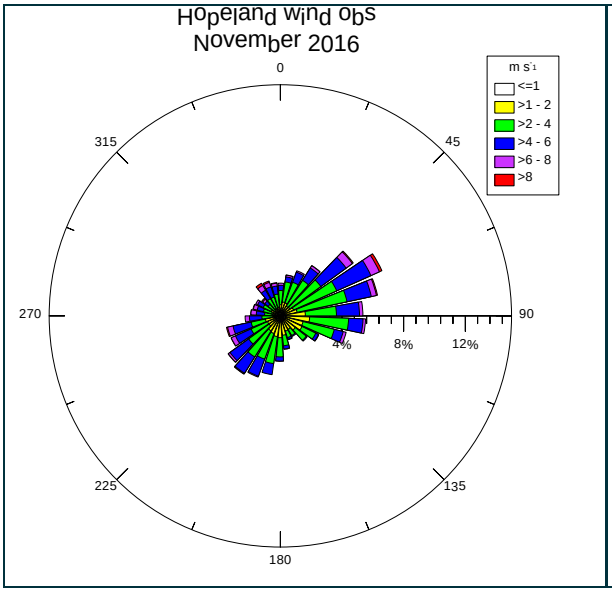
B.2.1 **Hopeland**

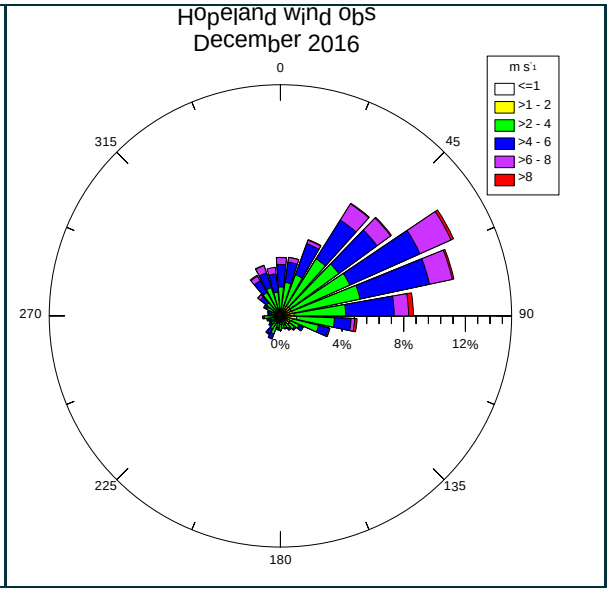


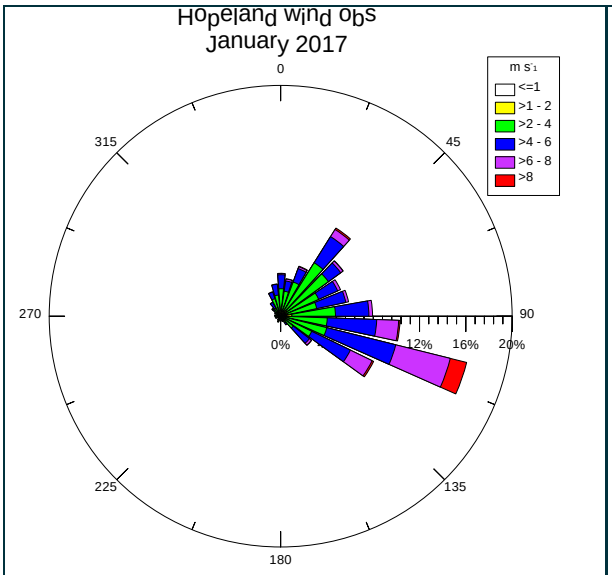

Hopeland wind obs
May 2015
Hopeland wind obs
June 2015
Hopeland wind obs
July 2015
Hopeland wind obs
August 2015
Hopeland wind obs
September 2015
Hopeland wind obs
October 2015
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
8%
12%

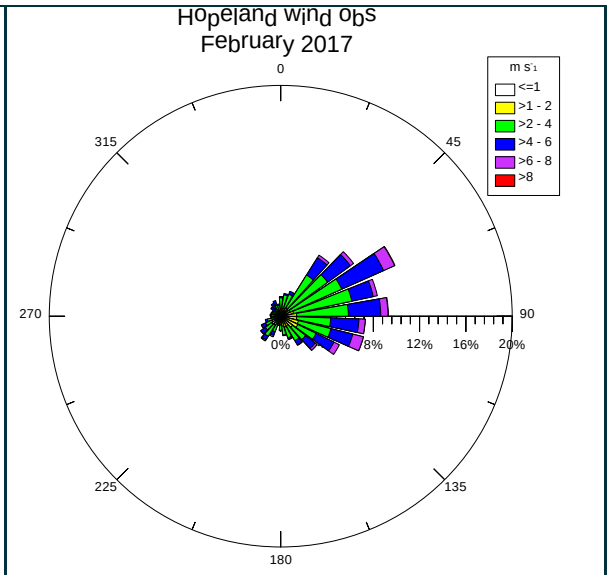

Hopeland wind obs
November 2015
Hopeland wind obs
December 2015
Hopeland wind obs
January 2016
Hopeland wind obs
February 2016
Hopeland wind obs
March 2016
Hopeland wind obs
April 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
12%

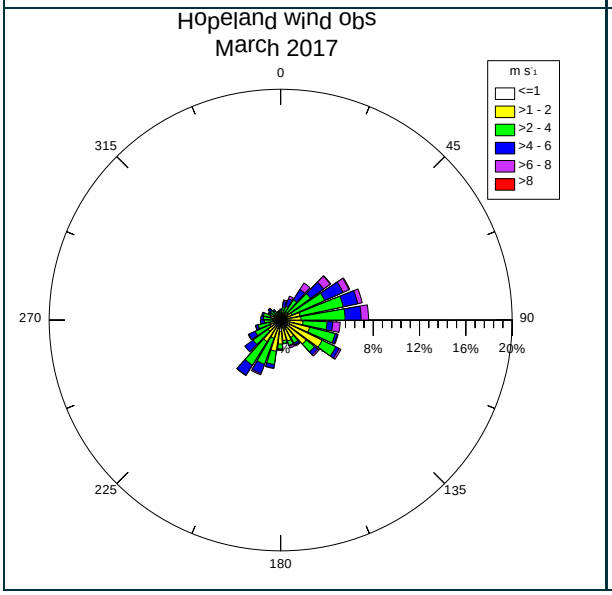

Hopeland wind obs
May 2016
Hopeland wind obs
June 2016
Hopeland wind obs
July 2016
Hopeland wind obs
August 2016
Hopeland wind obs
September 2016
Hopeland wind obs
October 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%

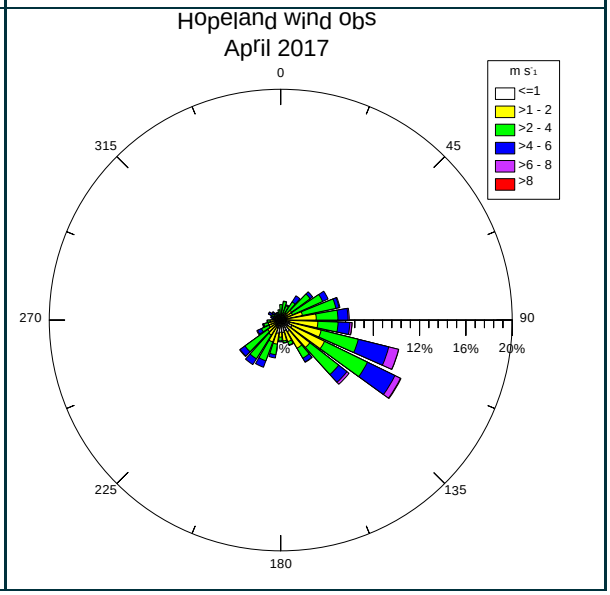

Hopeland wind obs
November 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%

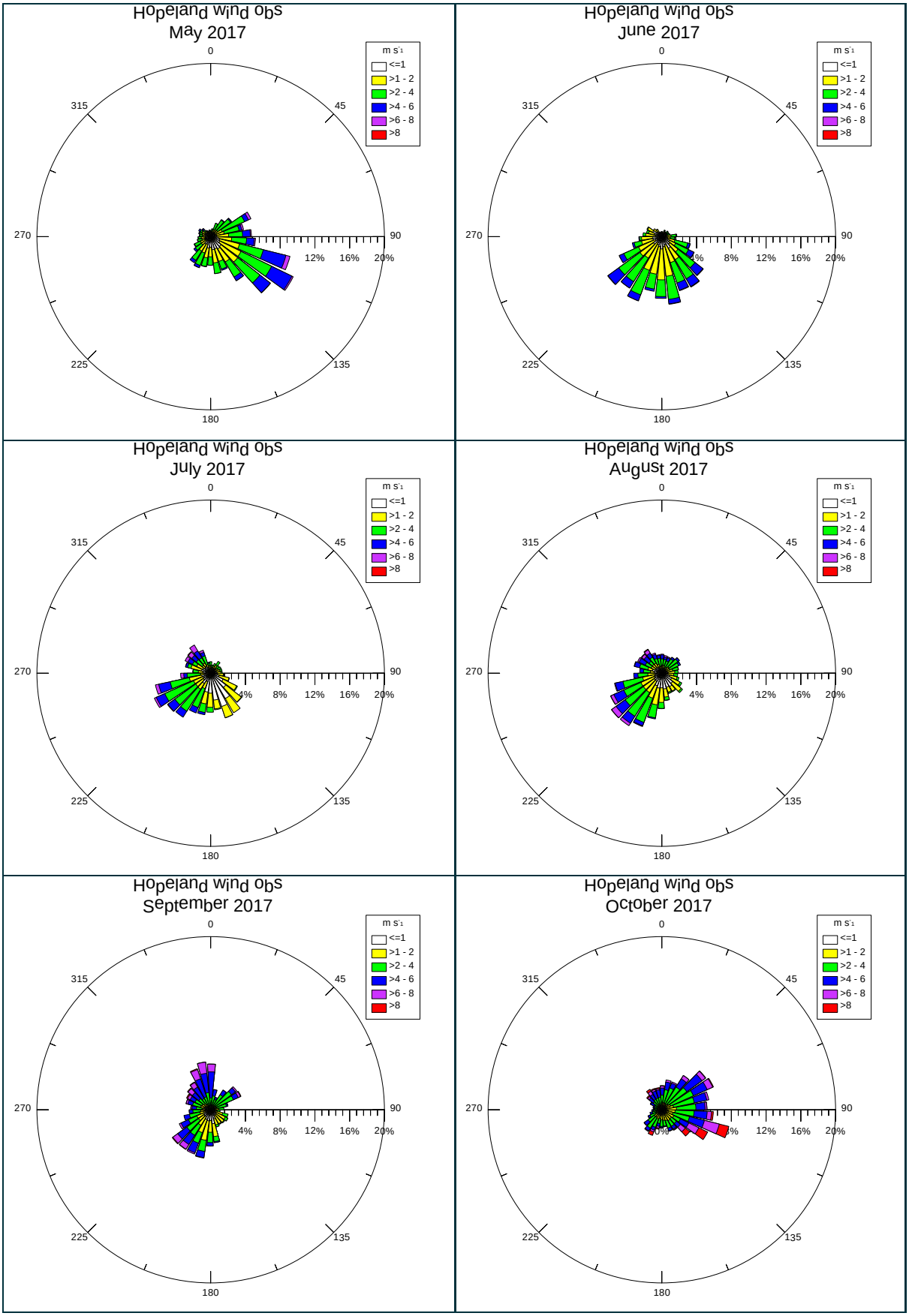

Hopeland wind obs
December 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
12%

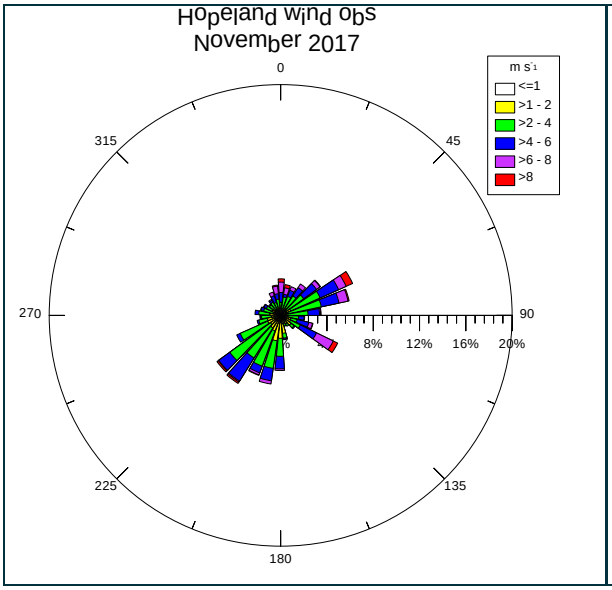

Hopeland wind obs
January 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
12%
16%
20%


Hopeland wind obs
February 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
8%
12%
16%
20%

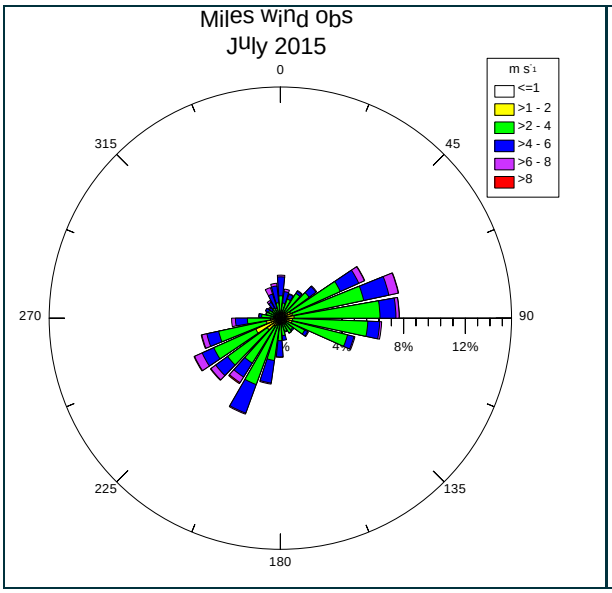

Hopeland wind obs
March 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
8%
12%
16%
20%

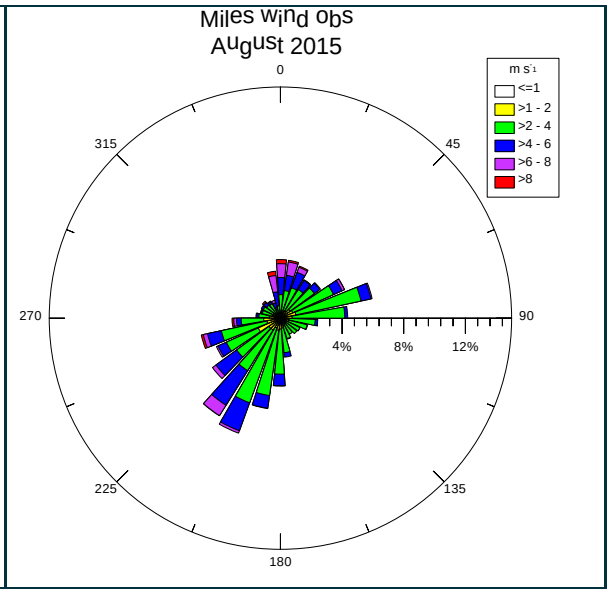

Hopeland wind obs
April 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
12%
16%
20%

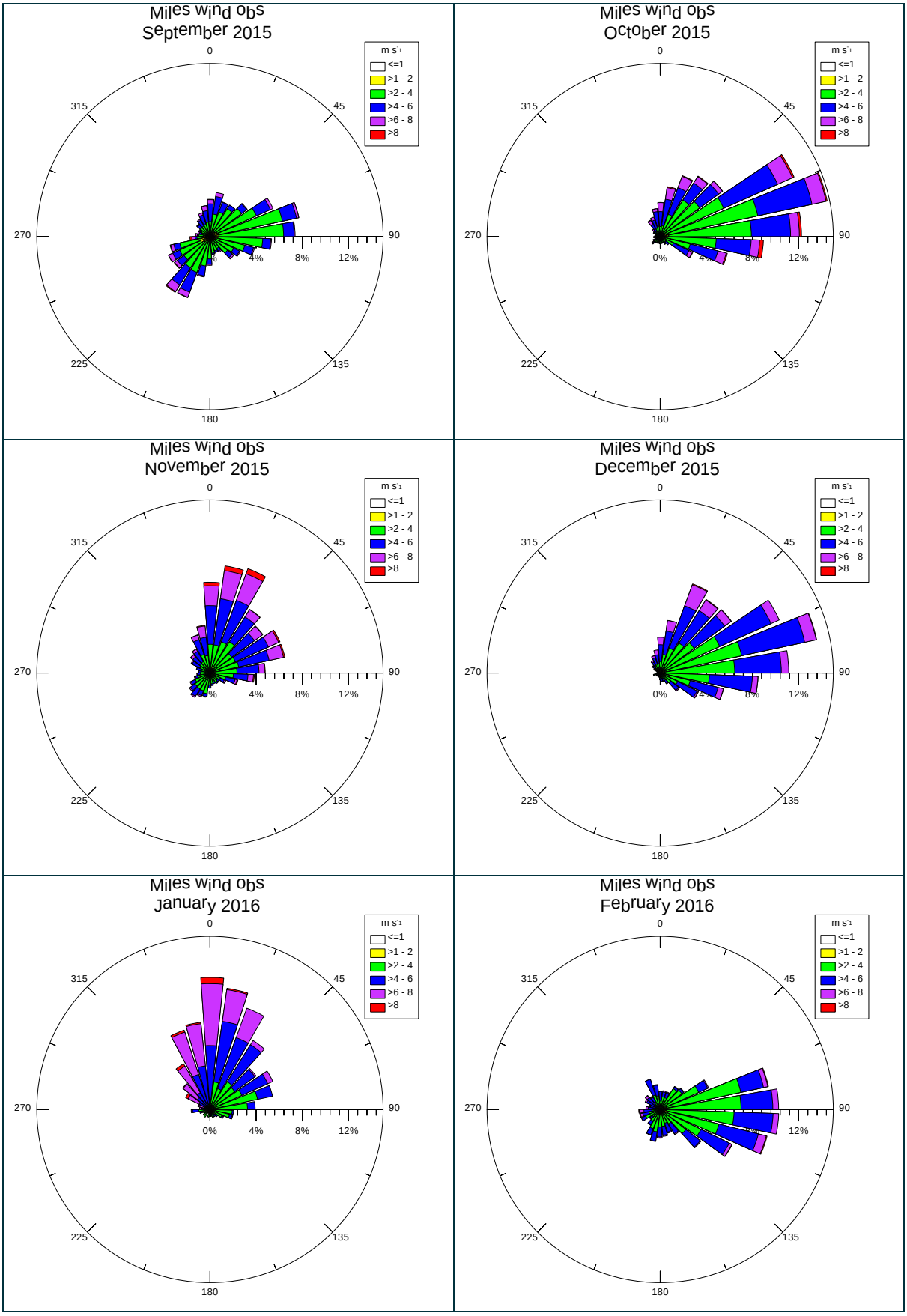

Hopeland wind obs
May 2017
Hopeland wind obs
June 2017
Hopeland wind obs
July 2017
Hopeland wind obs
August 2017
Hopeland wind obs
September 2017
Hopeland wind obs
October 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%
16%
20%

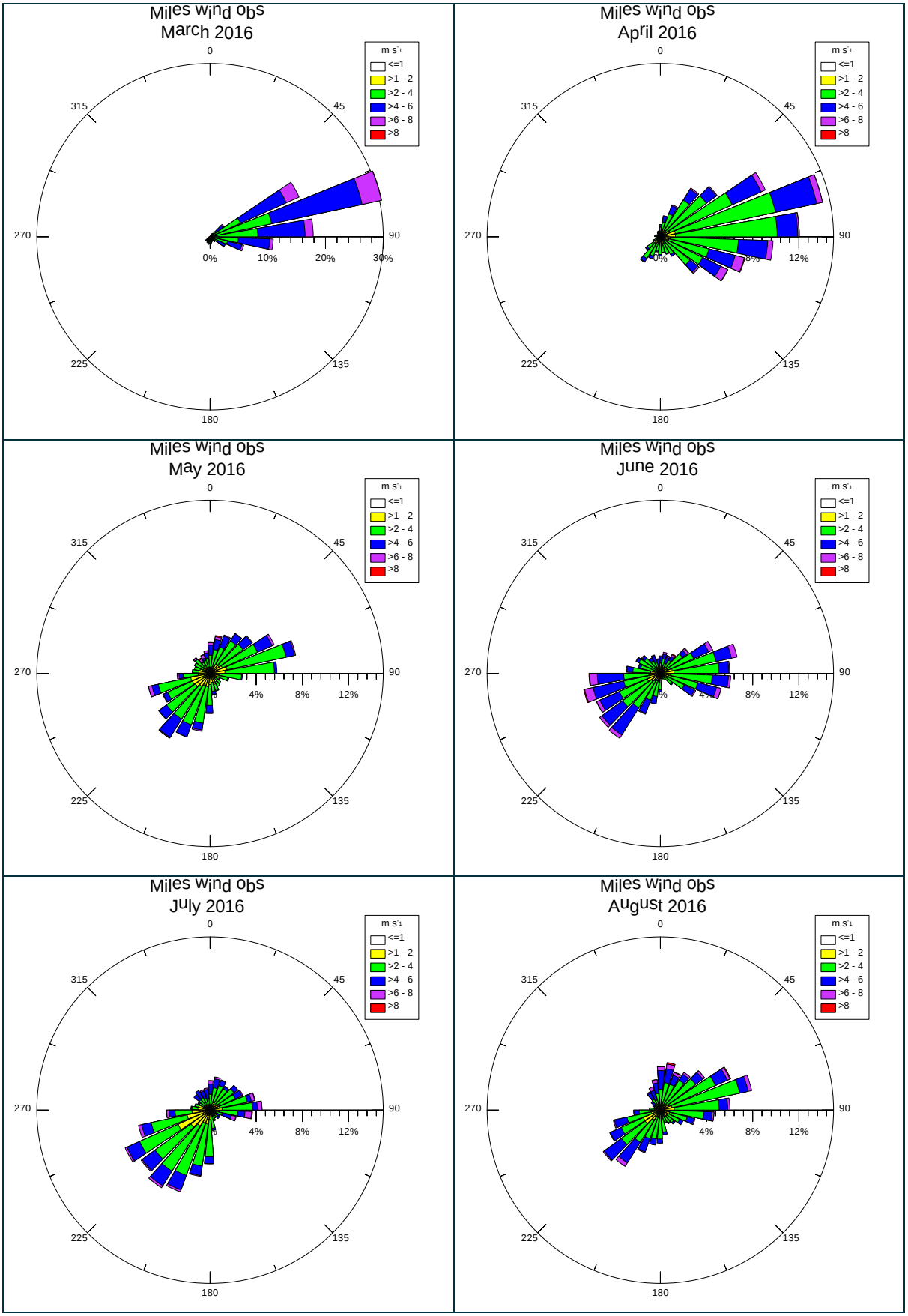


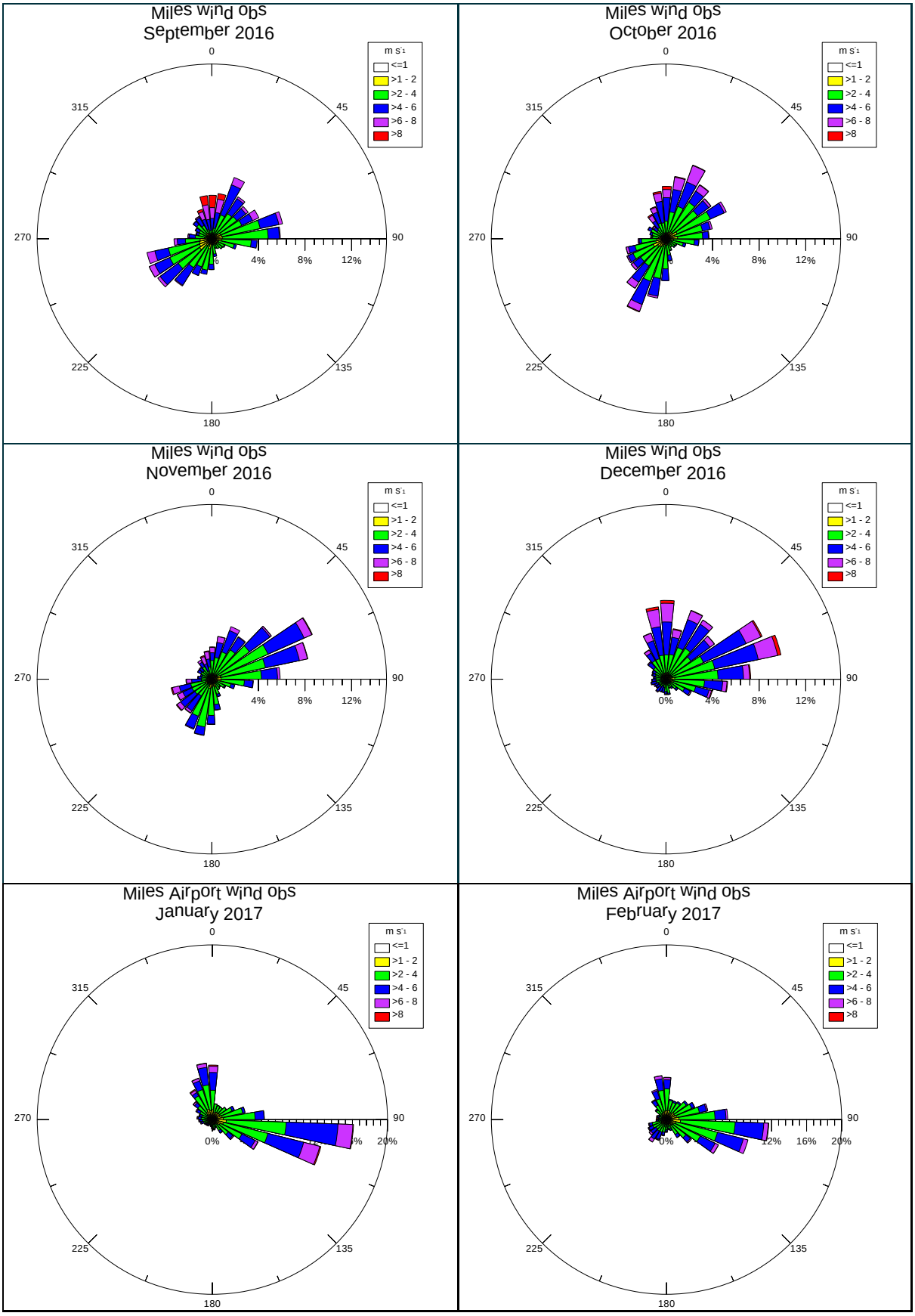
B.2.2 **Miles Airport**

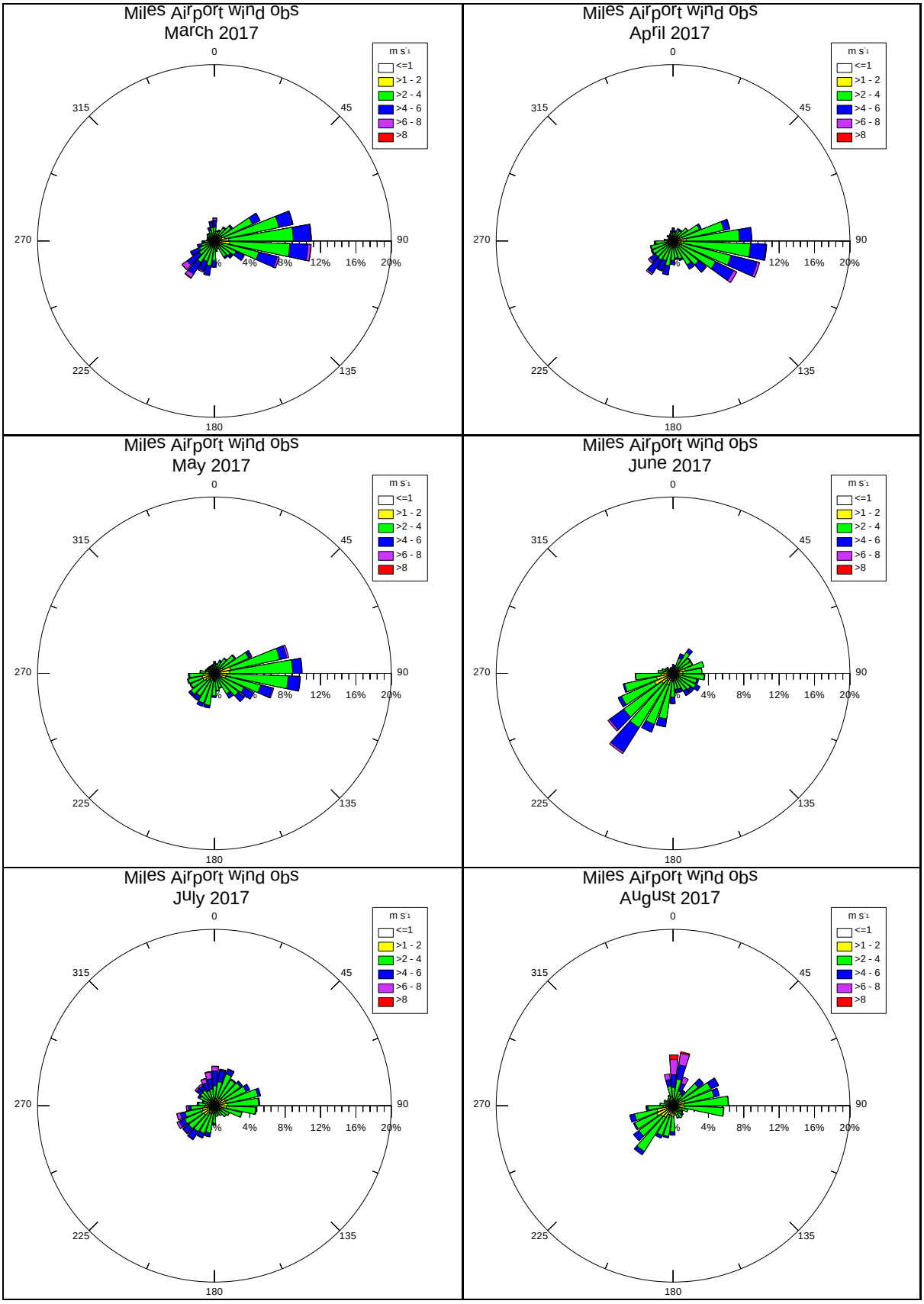


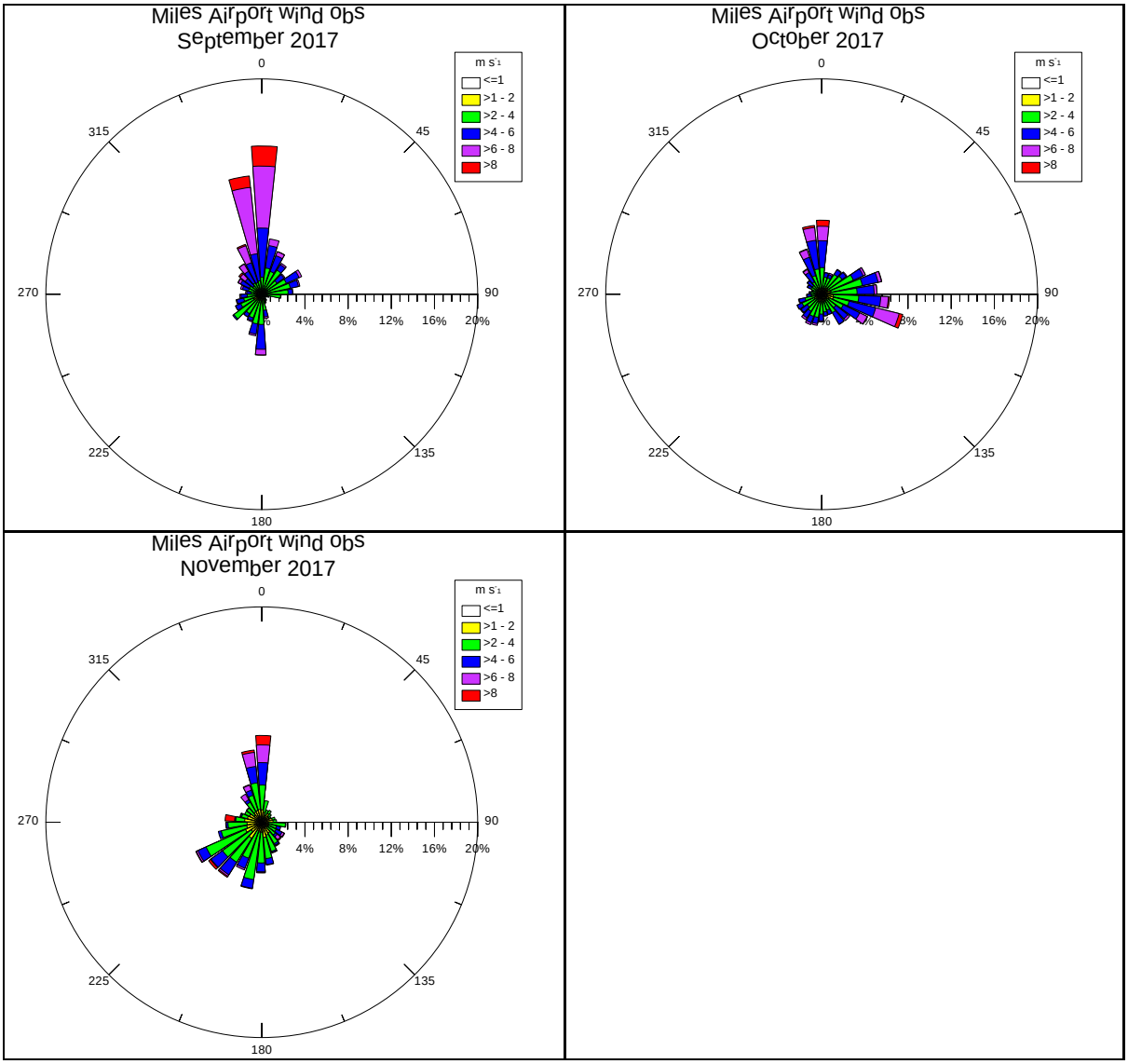



Miles wind obs
September 2015
Miles wind obs
October 2015
Miles wind obs
November 2015
Miles wind obs
December 2015
Miles wind obs
January 2016
Miles wind obs
February 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
12%

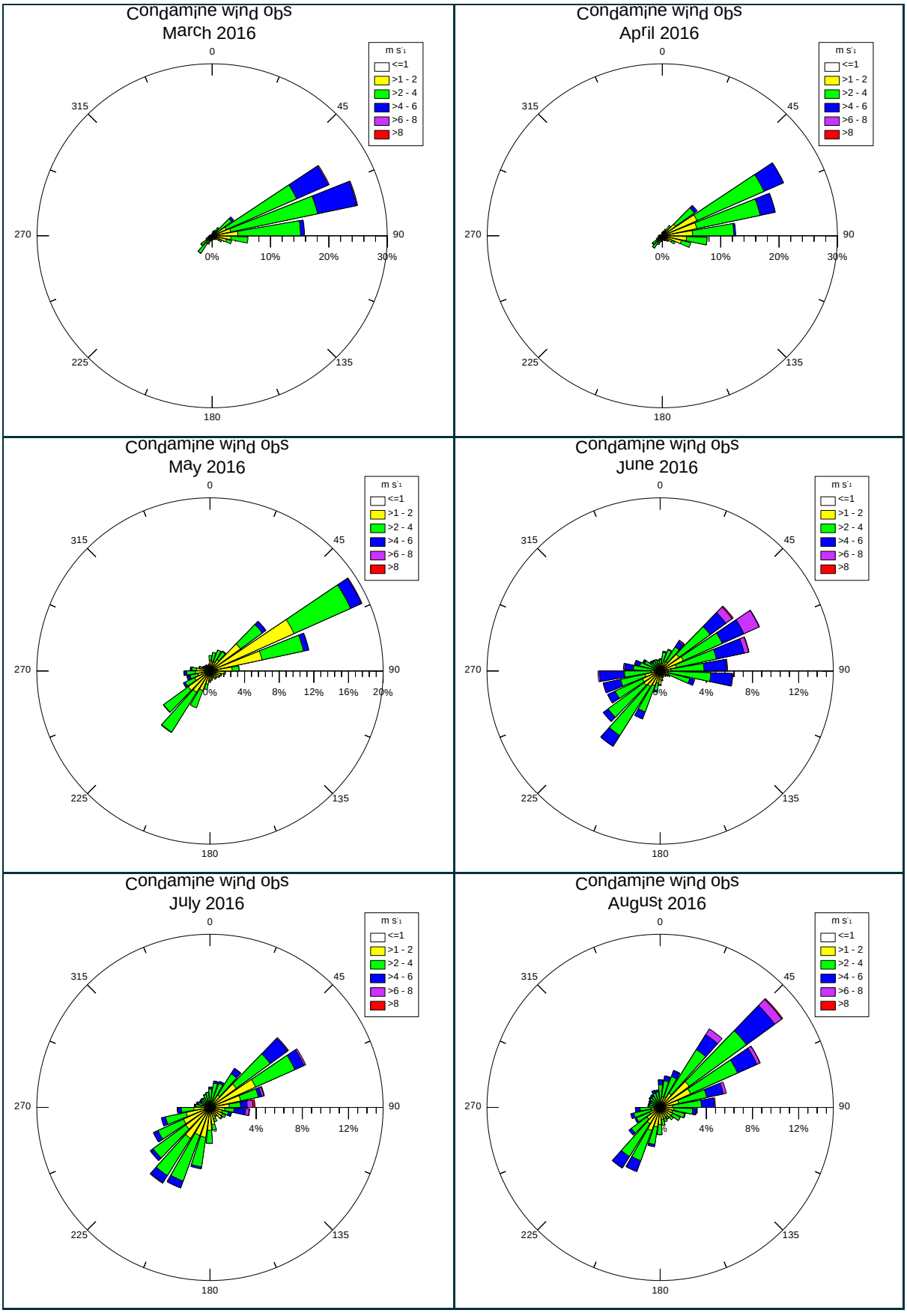

Miles wind obs
March 2016
April 2016
May 2016
June 2016
July 2016
August 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
10%
12%
20%
30%

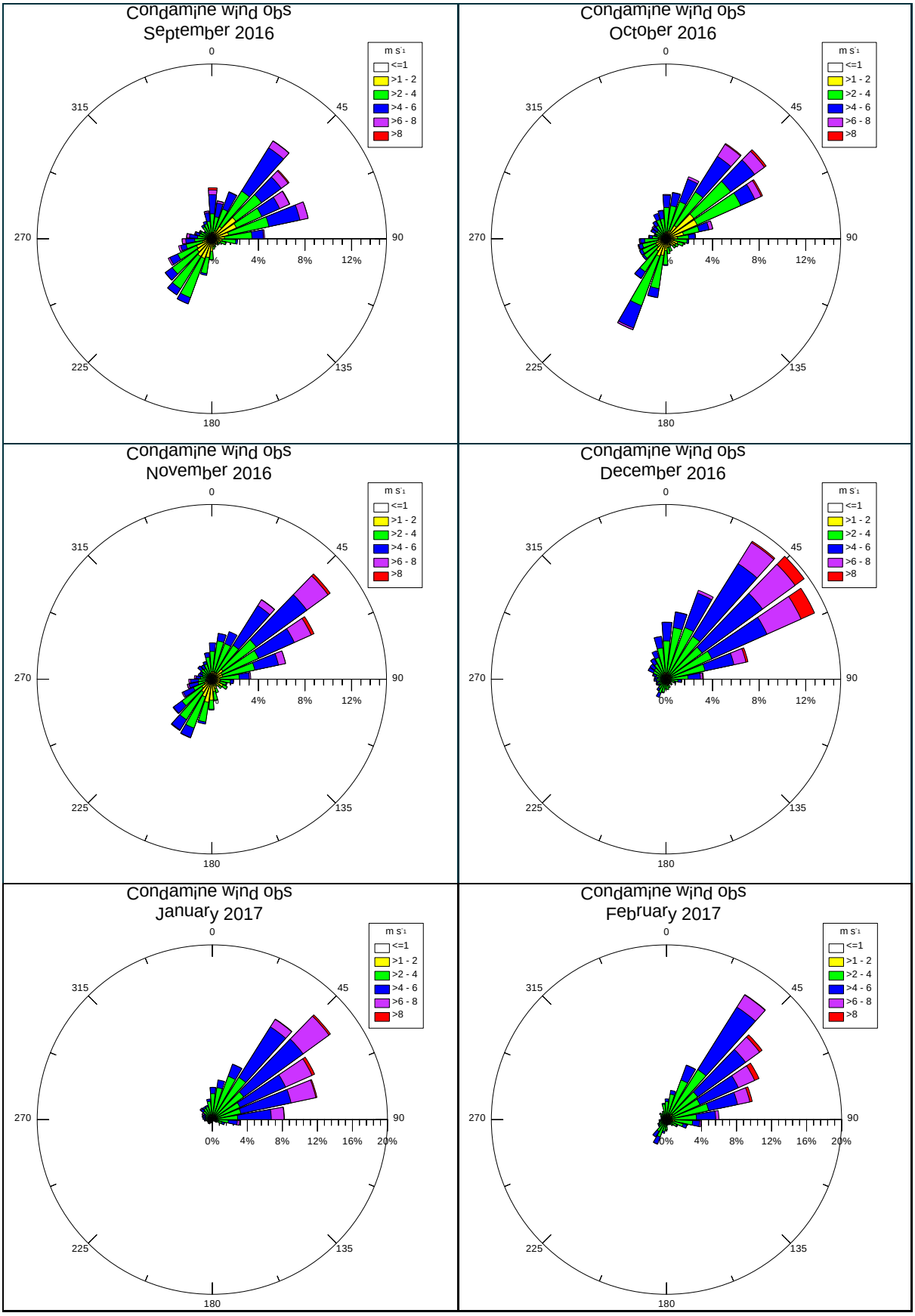

Miles wind obs
September 2016
Miles wind obs
October 2016
Miles wind obs
November 2016
Miles wind obs
December 2016
Miles Airport wind obs
January 2017
Miles Airport wind obs
February 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%
16%
20%

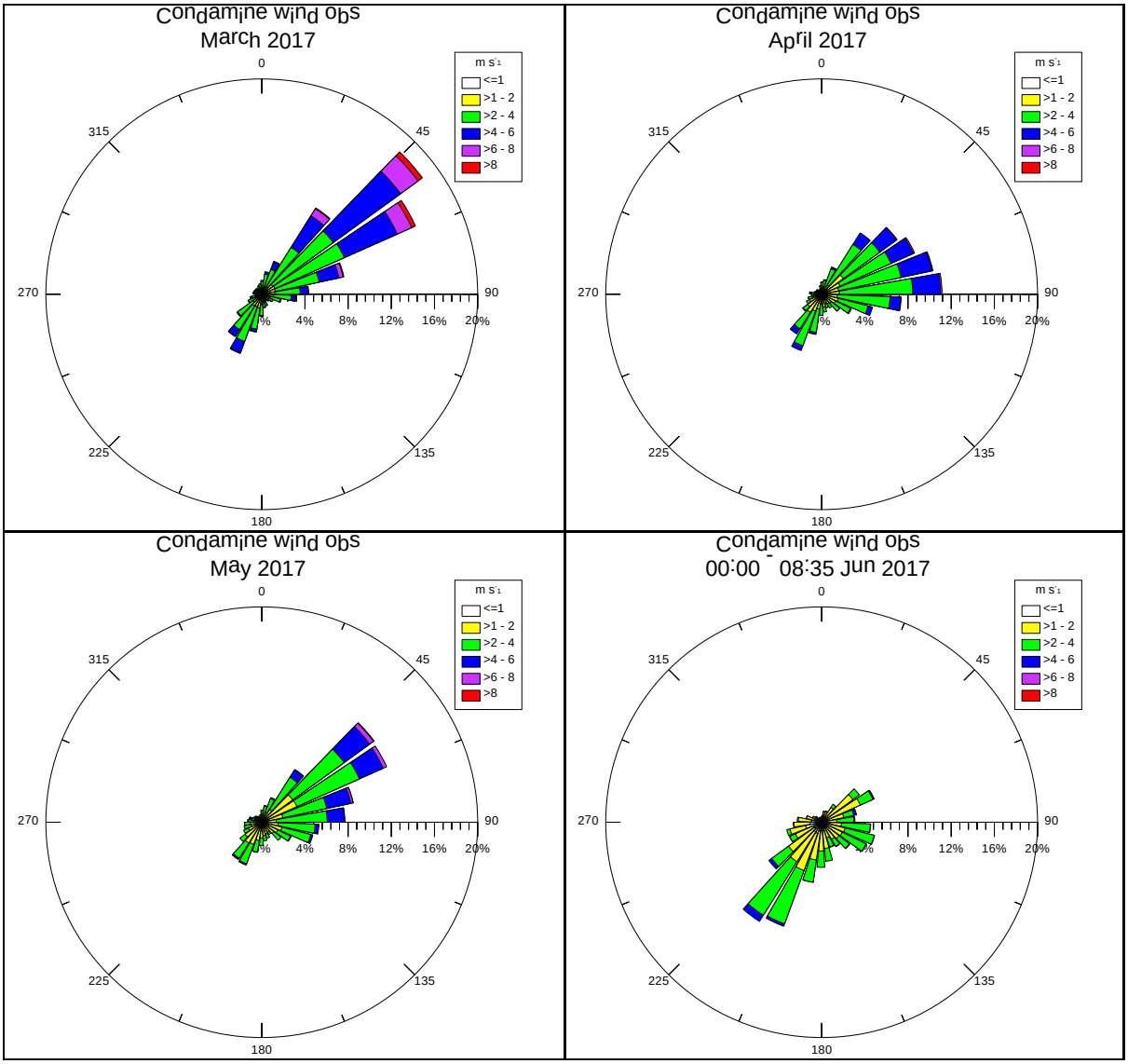

Miles Airport wind obs
March 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%
16%
20%
Miles Airport wind obs
April 2017
Miles Airport wind obs
May 2017
Miles Airport wind obs
June 2017
Miles Airport wind obs
July 2017
Miles Airport wind obs
August 2017


Miles Airport wind obs
September 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%
16%
20%
Miles Airport wind obs
October 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
12%
16%
20%
Miles Airport wind obs
November 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%
16%
20%

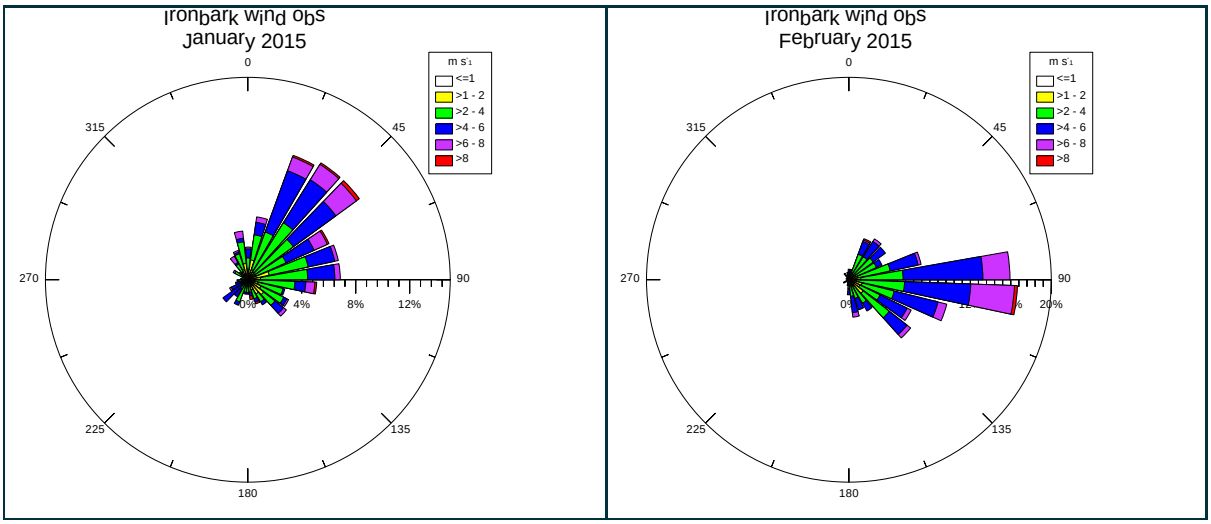
B.2.3 **Condamine**

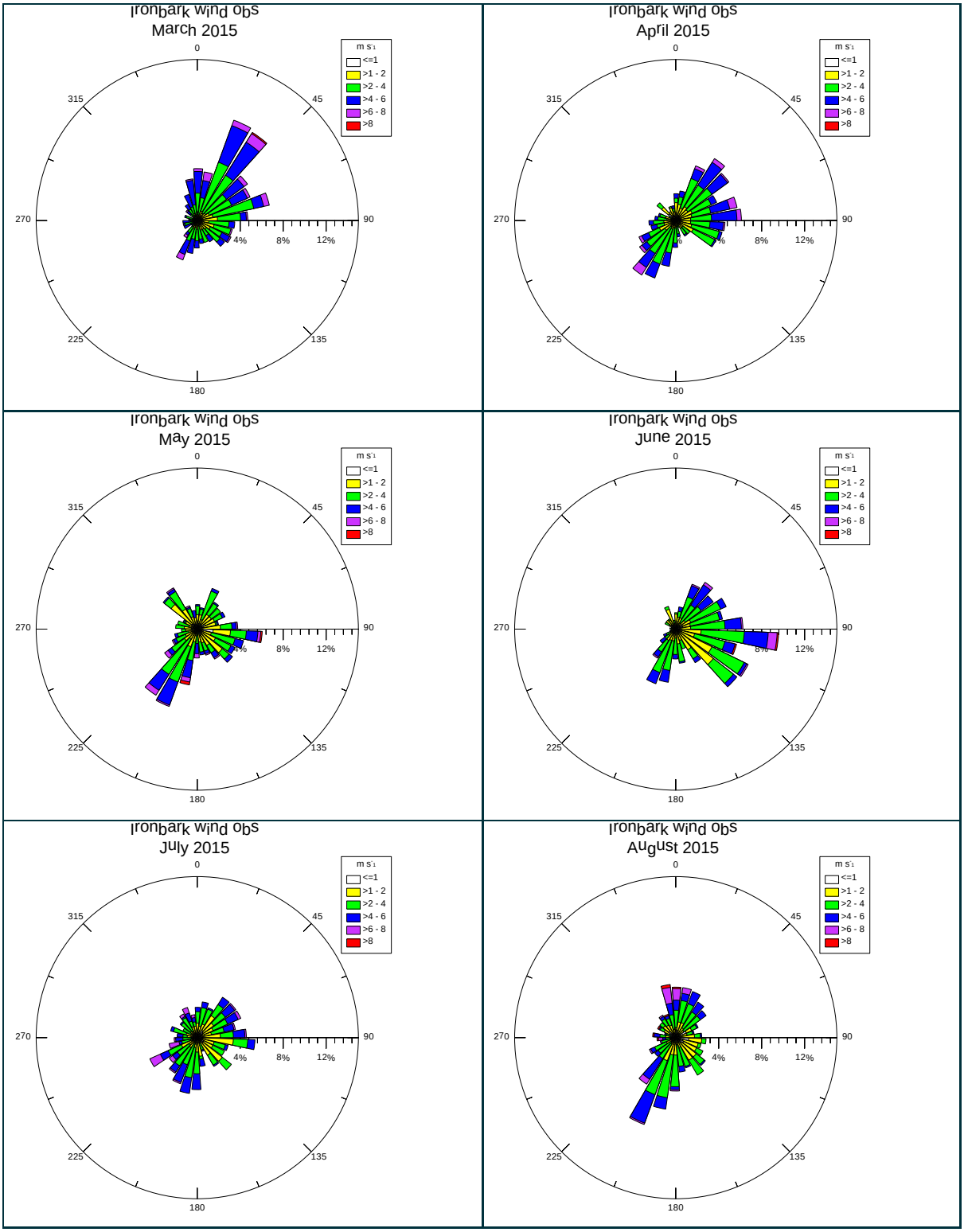


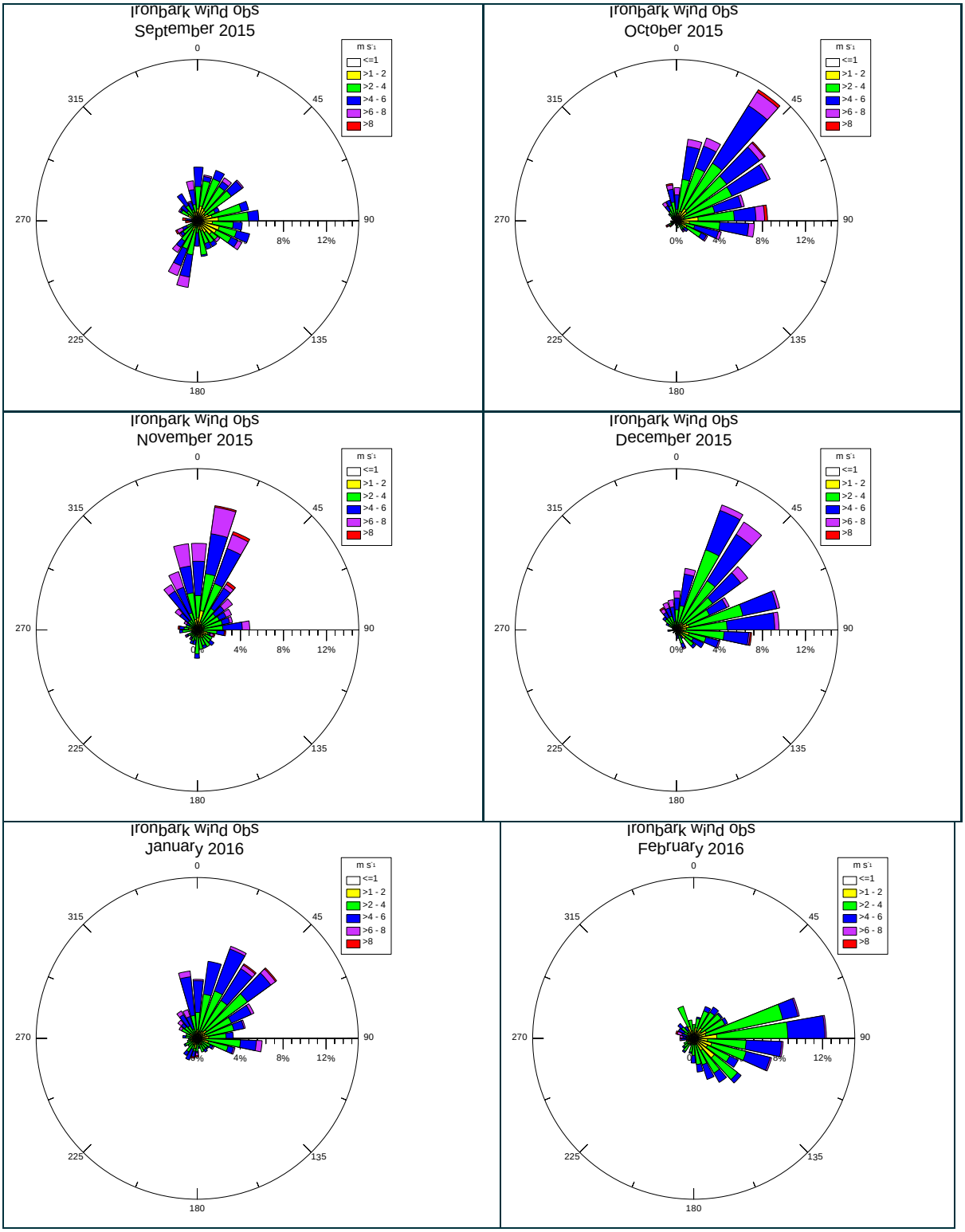

Condamine wind obs
September 2016
Condamine wind obs
October 2016
Condamine wind obs
November 2016
Condamine wind obs
December 2016
Condamine wind obs
January 2017
Condamine wind obs
February 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
12%
16%
20%

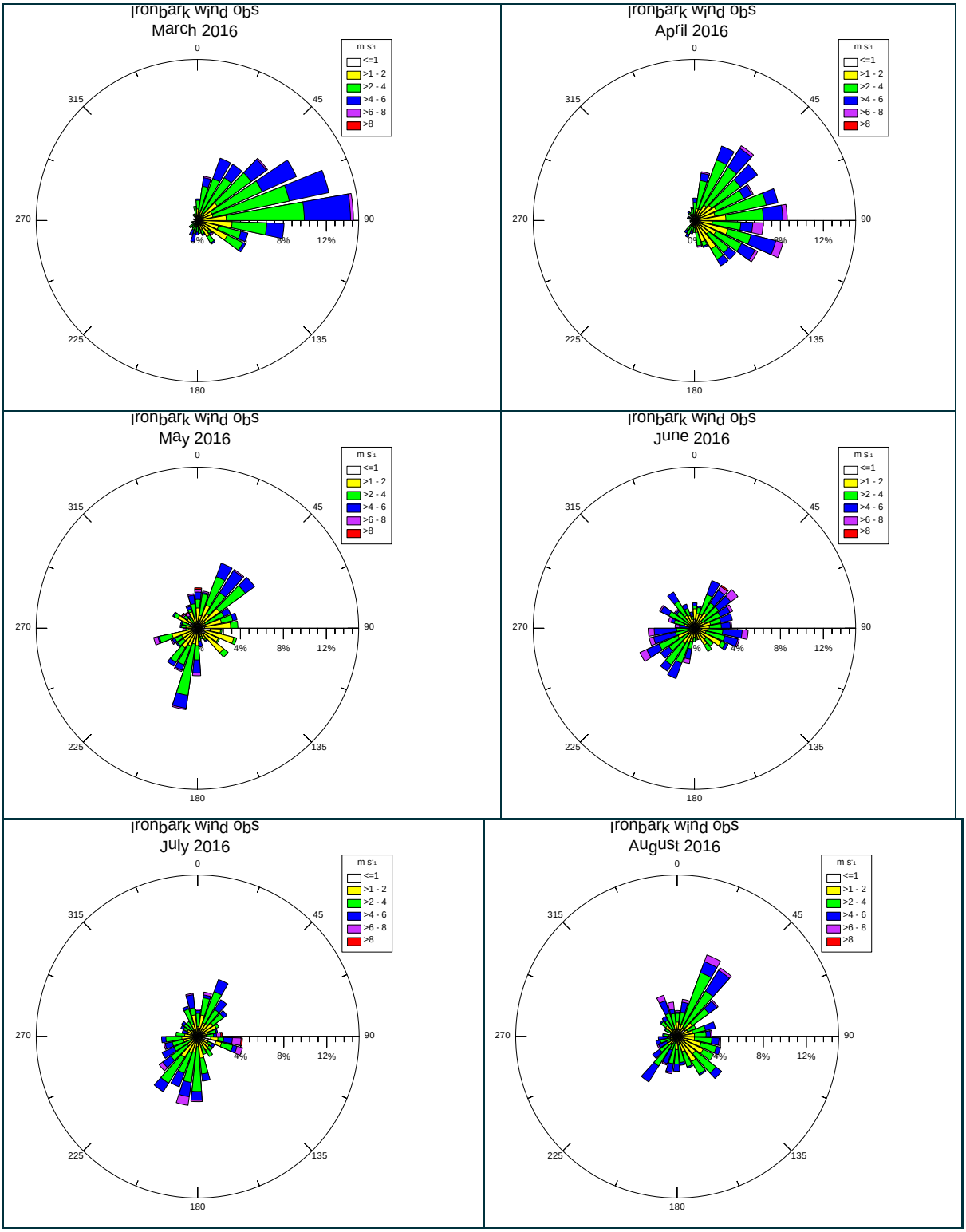


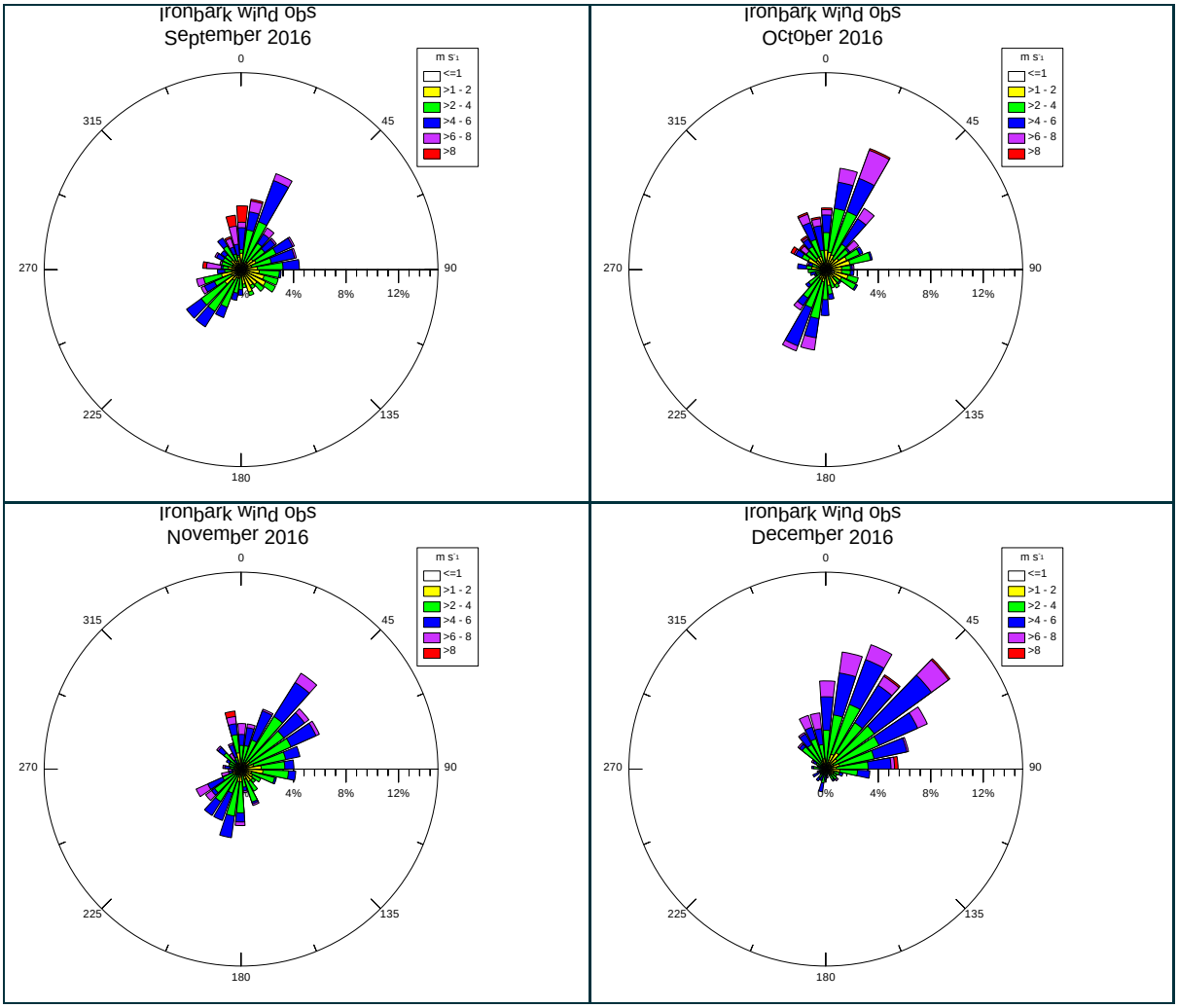
B.2.4 **Tara Region/Ironbark**

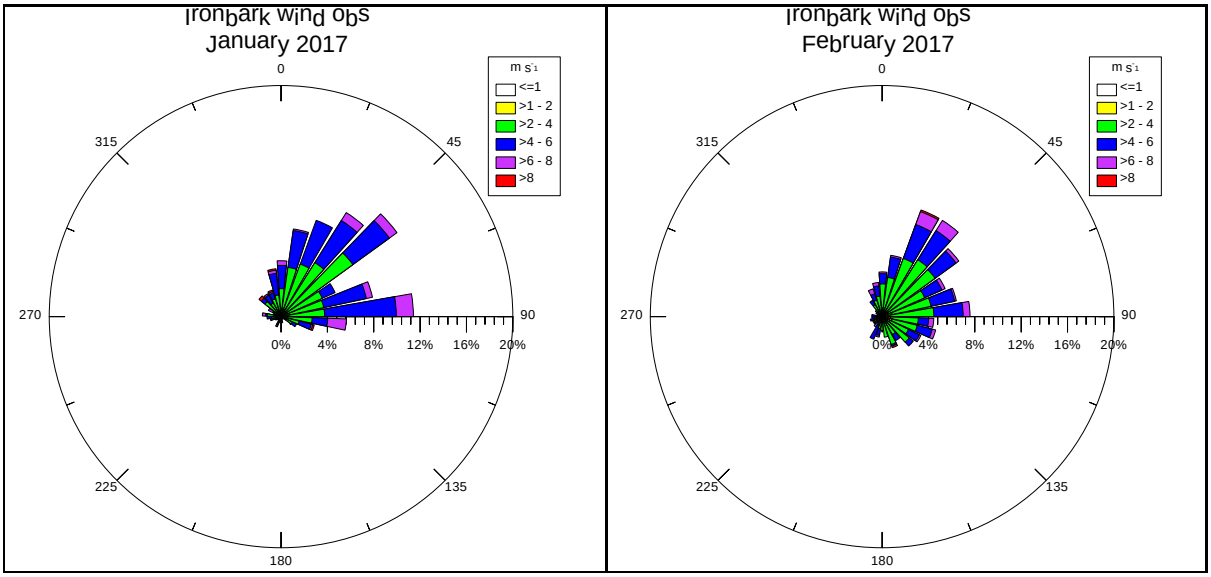


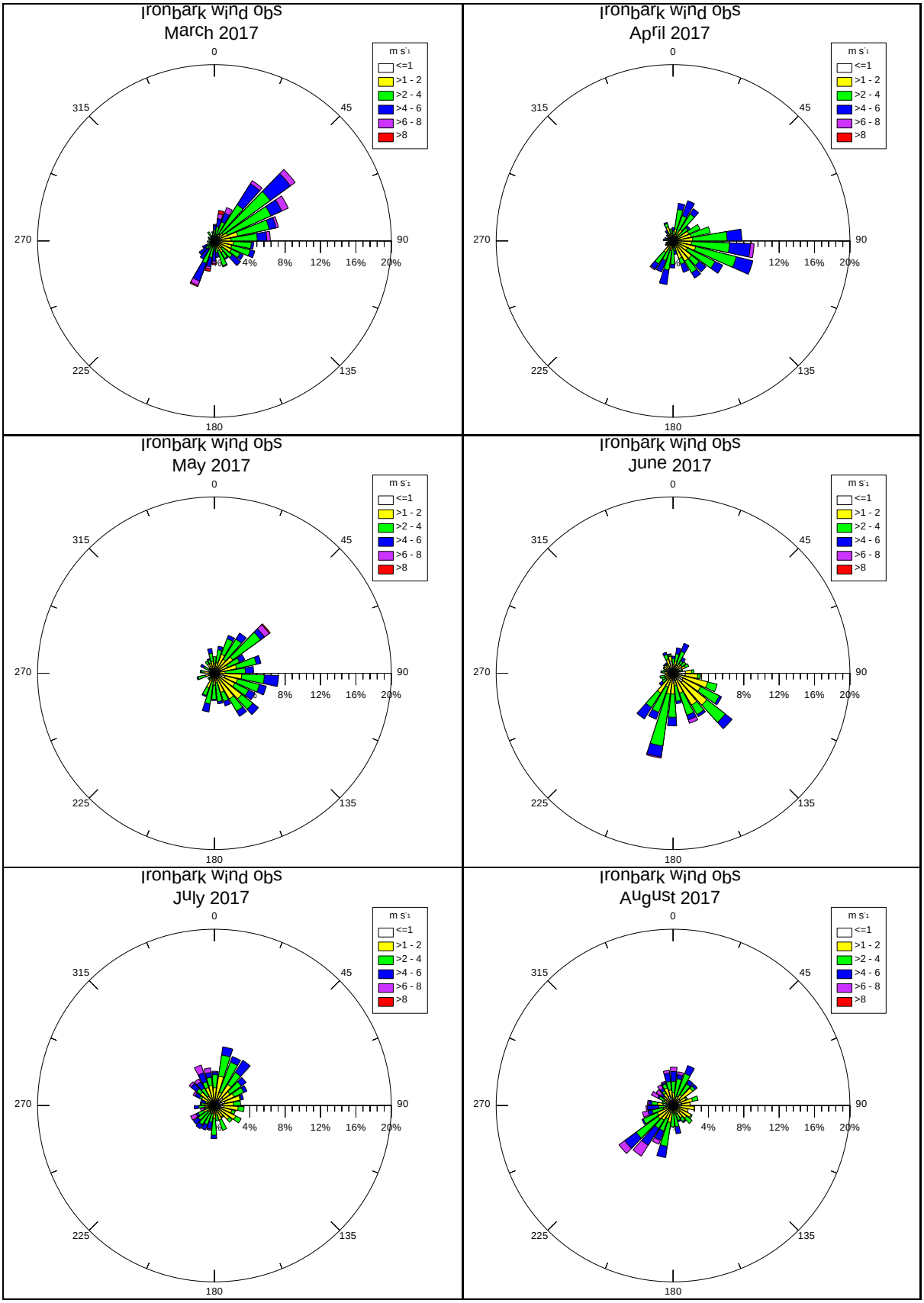

Ironbark wind obs
March 2015
Ironbark wind obs
April 2015
Ironbark wind obs
May 2015
Ironbark wind obs
June 2015
Ironbark wind obs
July 2015
Ironbark wind obs
August 2015
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%

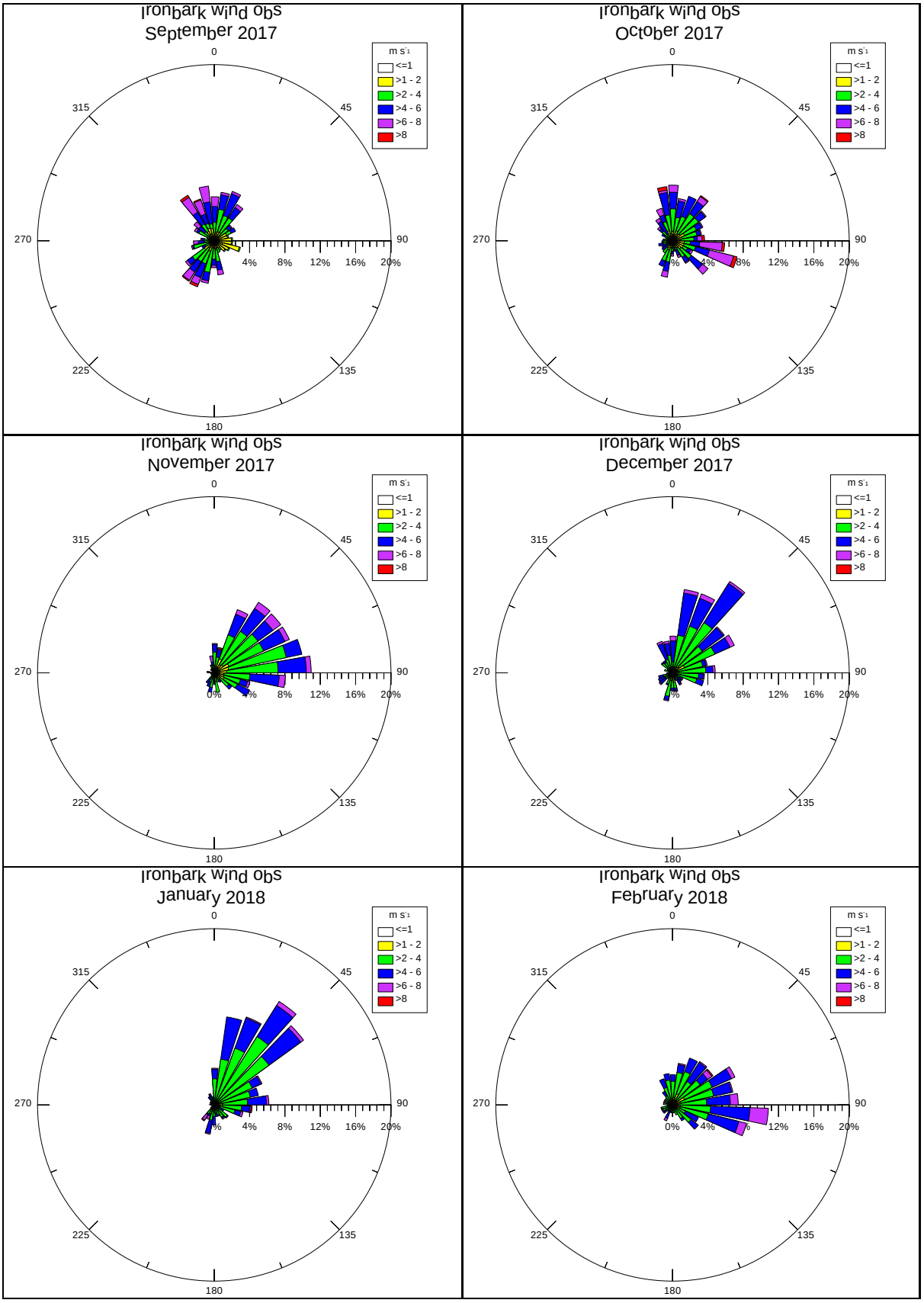

Ironbark wind obs
September 2015
Ironbark wind obs
October 2015
Ironbark wind obs
November 2015
Ironbark wind obs
December 2015
Ironbark wind obs
January 2016
Ironbark wind obs
February 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%

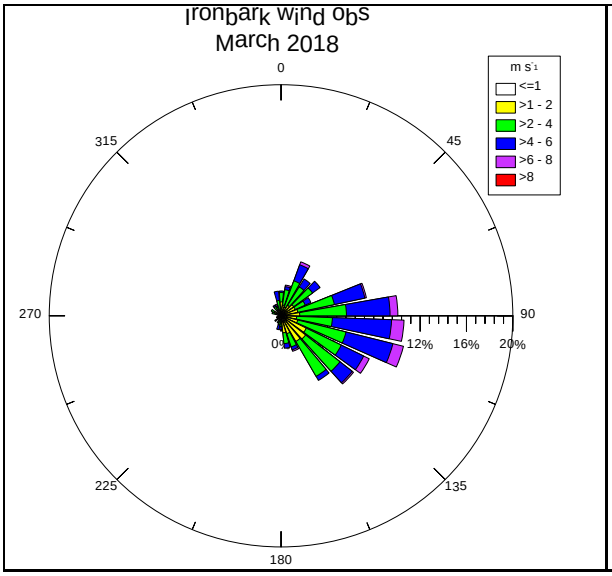

Ironbark wind obs
March 2016
April 2016
May 2016
June 2016
July 2016
August 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%


Ironbark wind obs
September 2016
Ironbark wind obs
October 2016
Ironbark wind obs
November 2016
Ironbark wind obs
December 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%

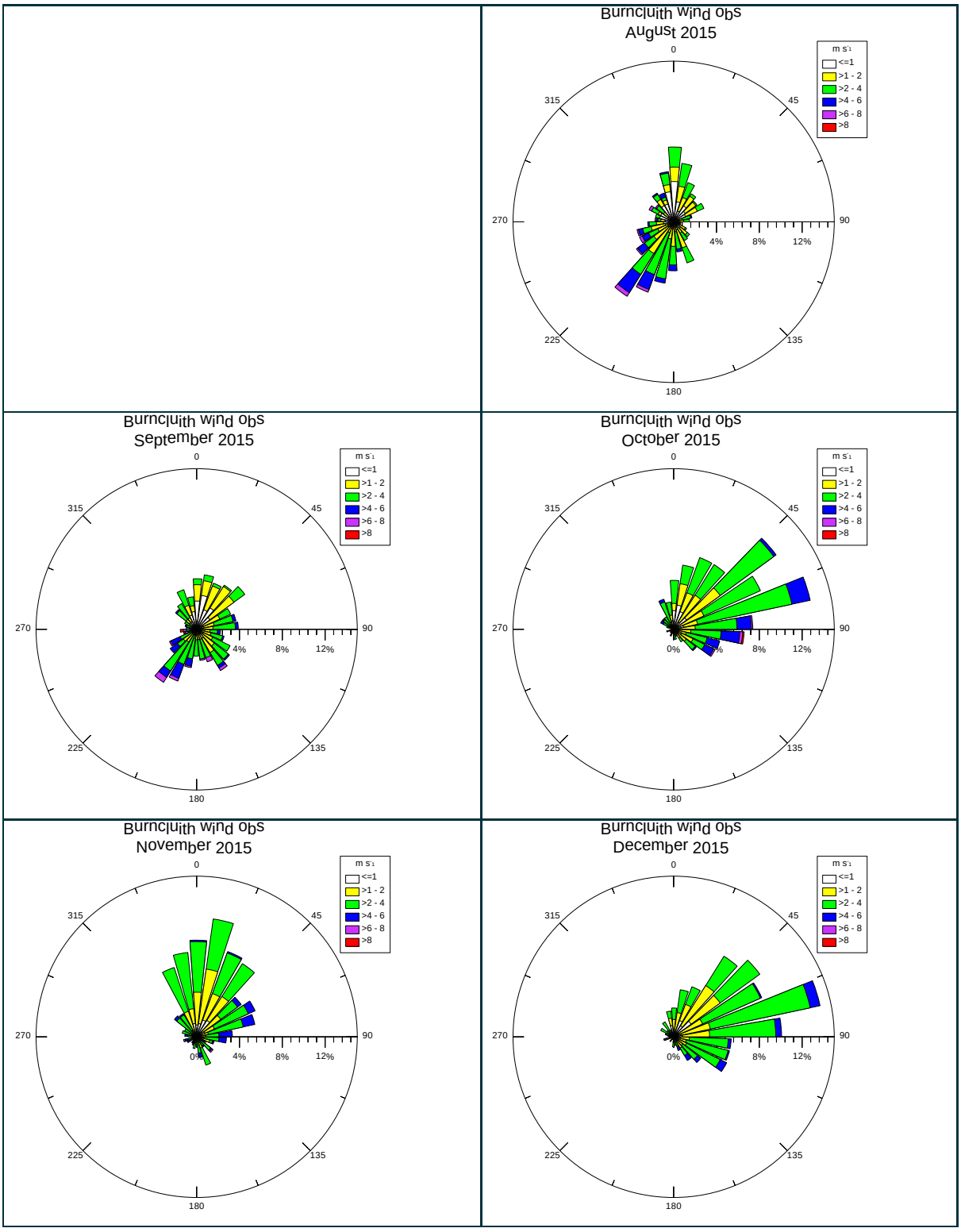

Ironbark wind obs
January 2017
Ironbark wind obs
February 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
12%
16%
20%

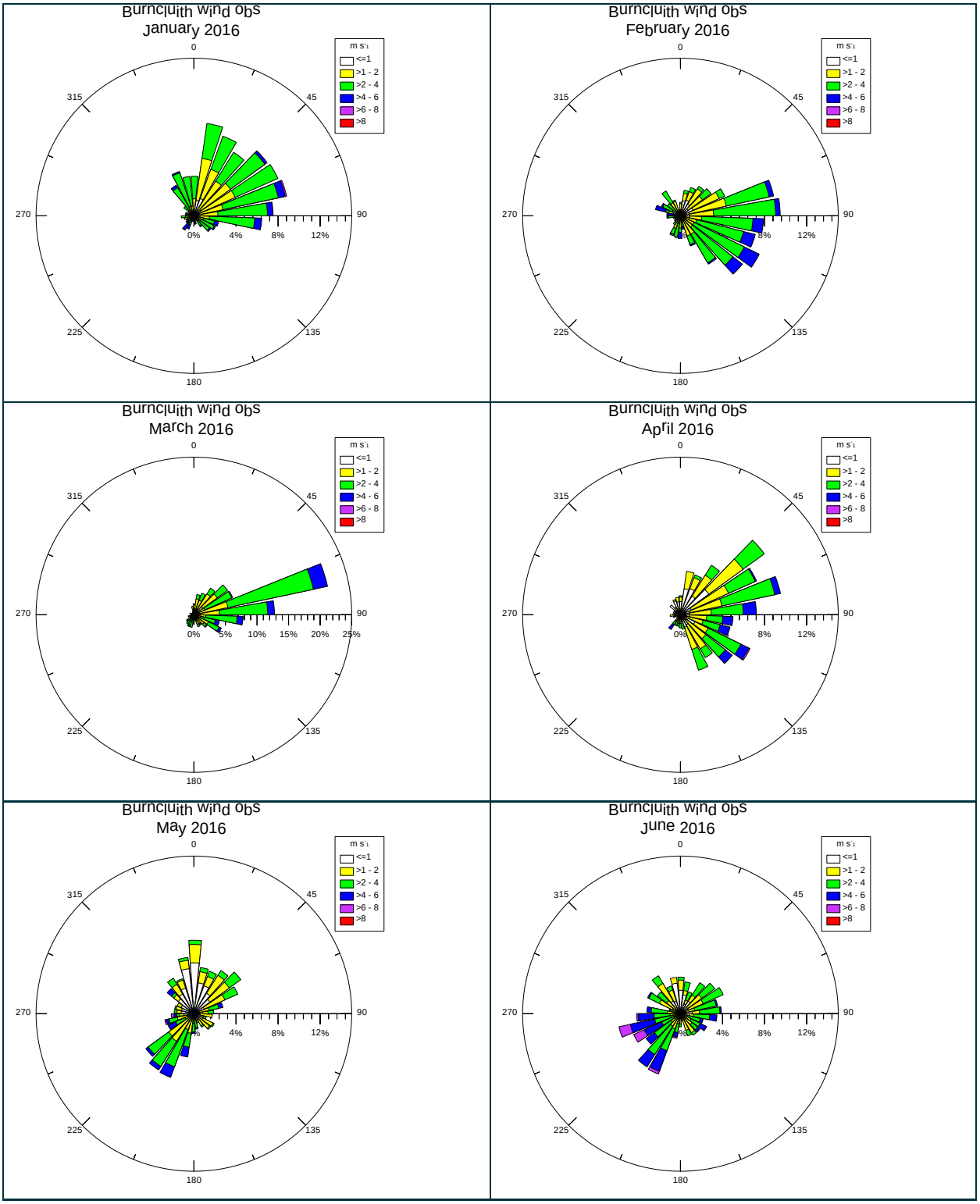

Ironbark Wind Obs
March 2017
April 2017
May 2017
June 2017
July 2017
August 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%
16%
20%

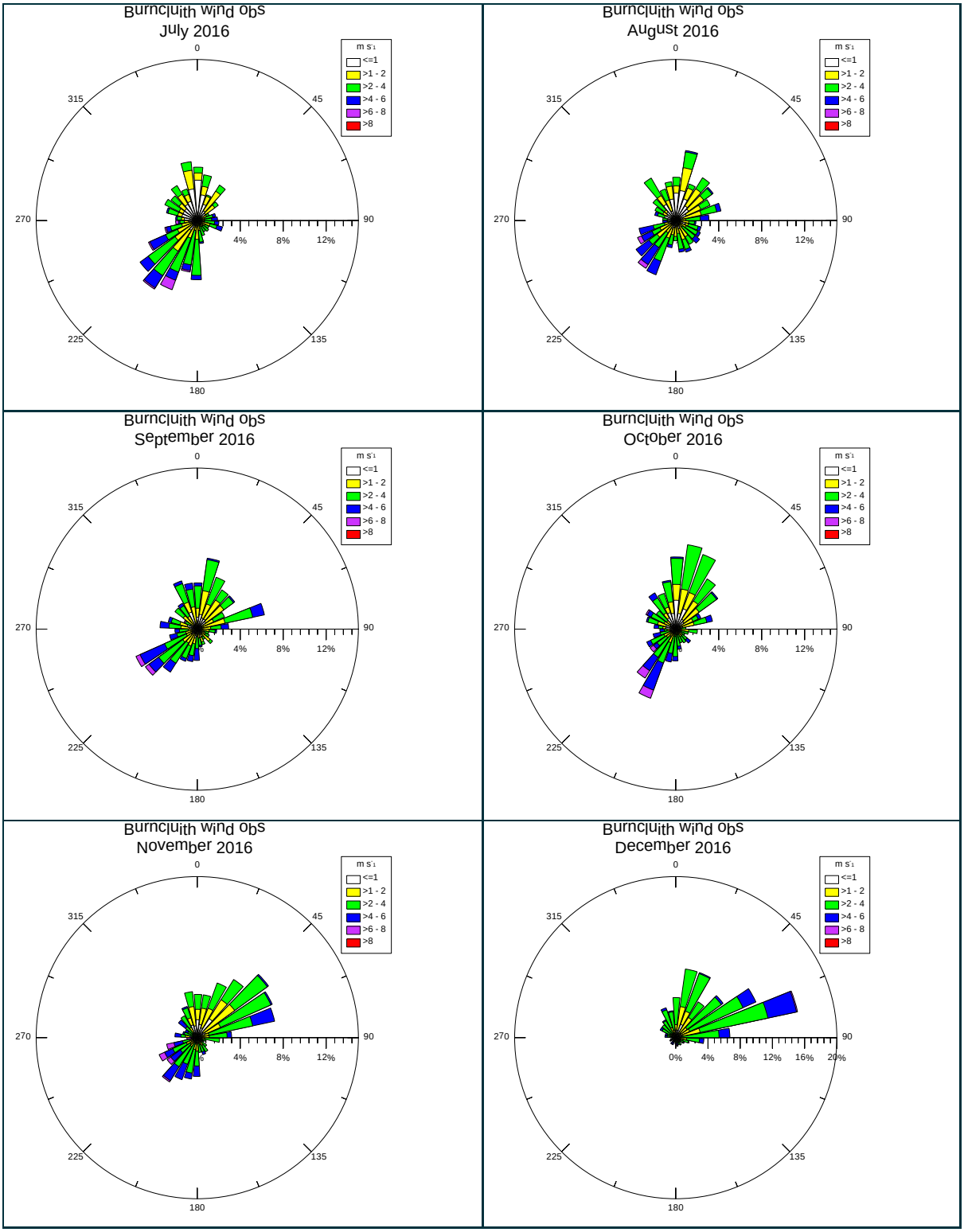

Ironbark Wind Obs
September 2017
Ironbark Wind Obs
October 2017
Ironbark Wind Obs
November 2017
Ironbark Wind Obs
December 2017
Ironbark Wind Obs
January 2018
Ironbark Wind Obs
February 2018
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
12%
16%
20%

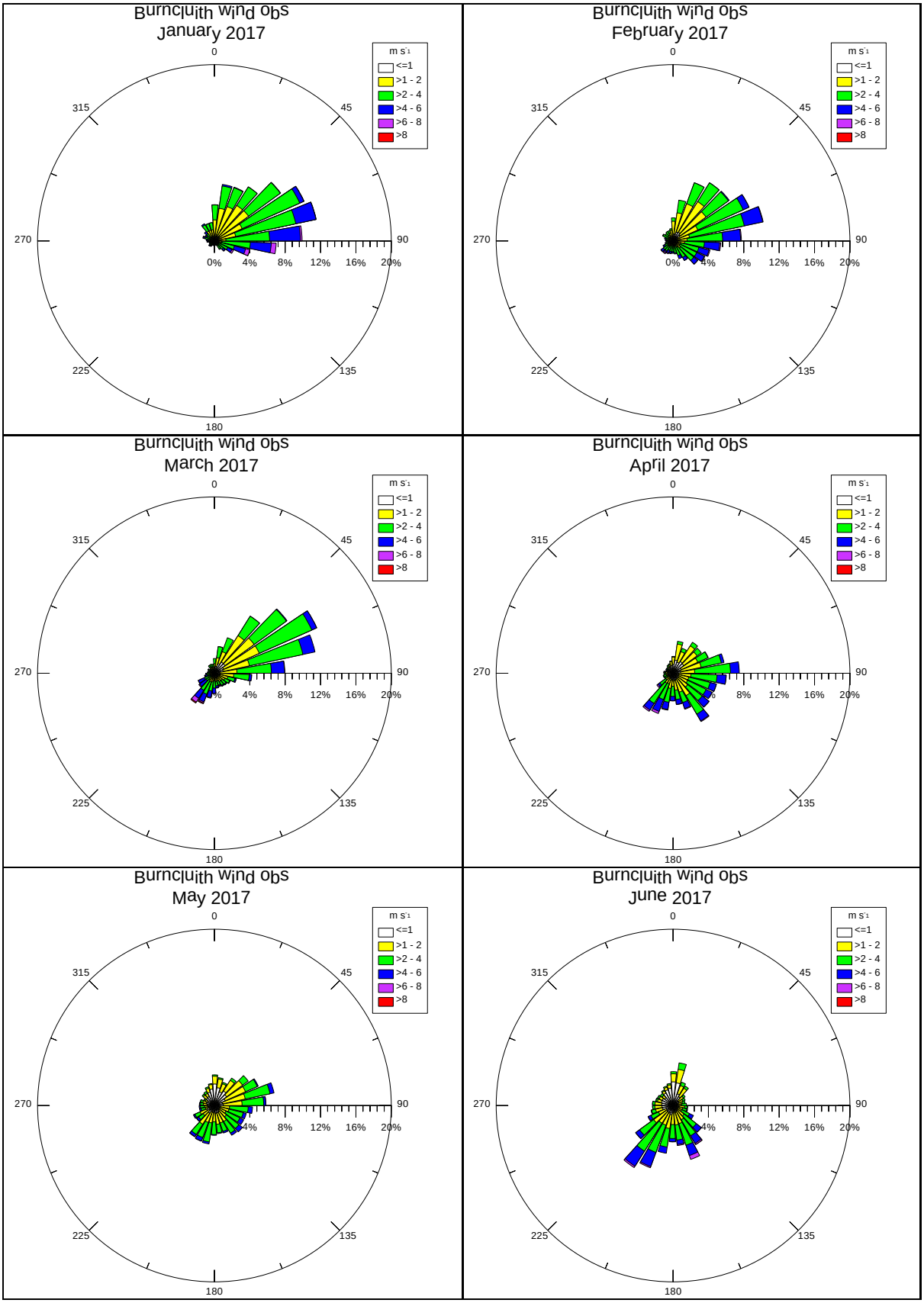

Ironbark wind obs
March 2018
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
12%
16%
20%

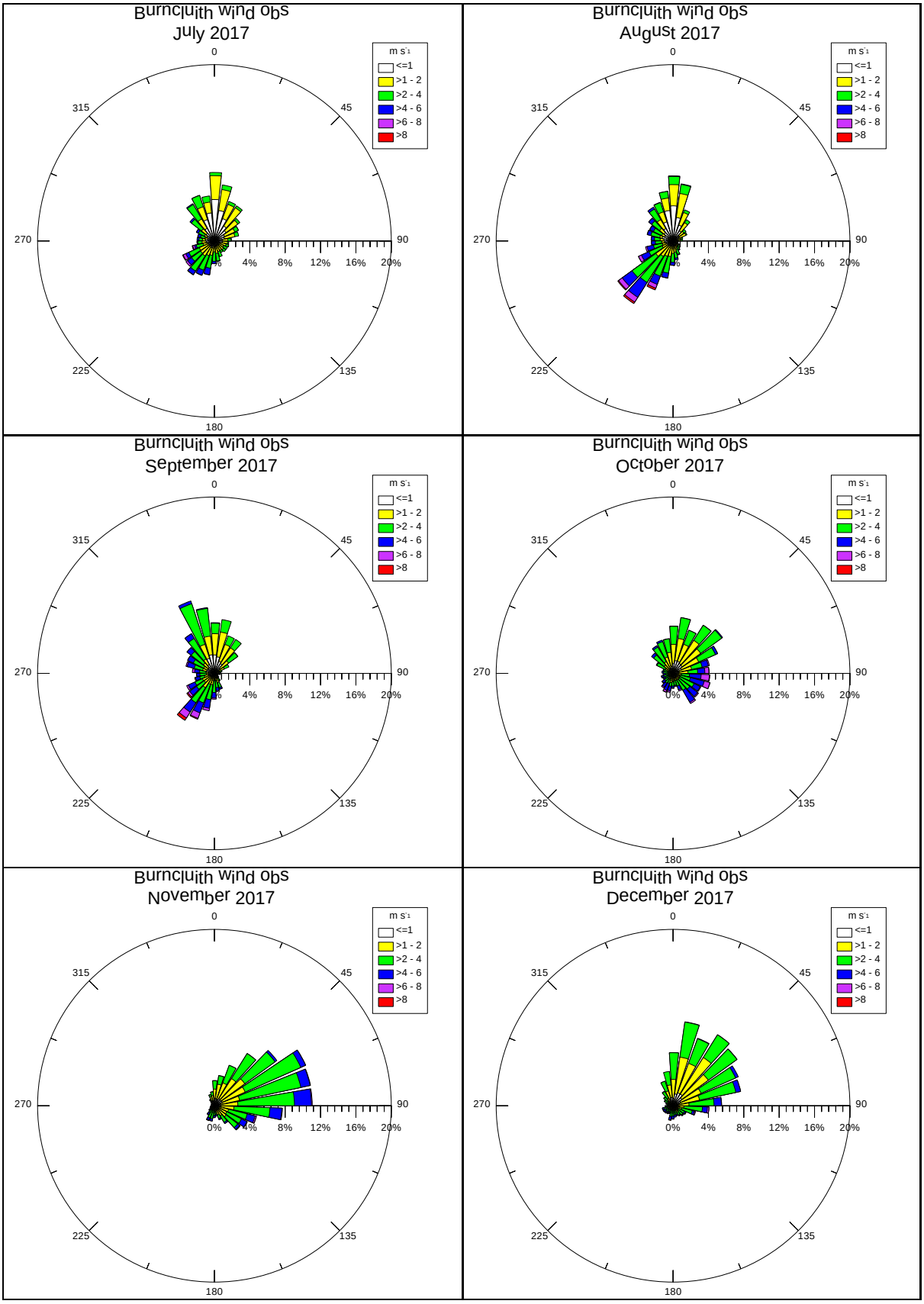
B.2.5 **Burncluith**

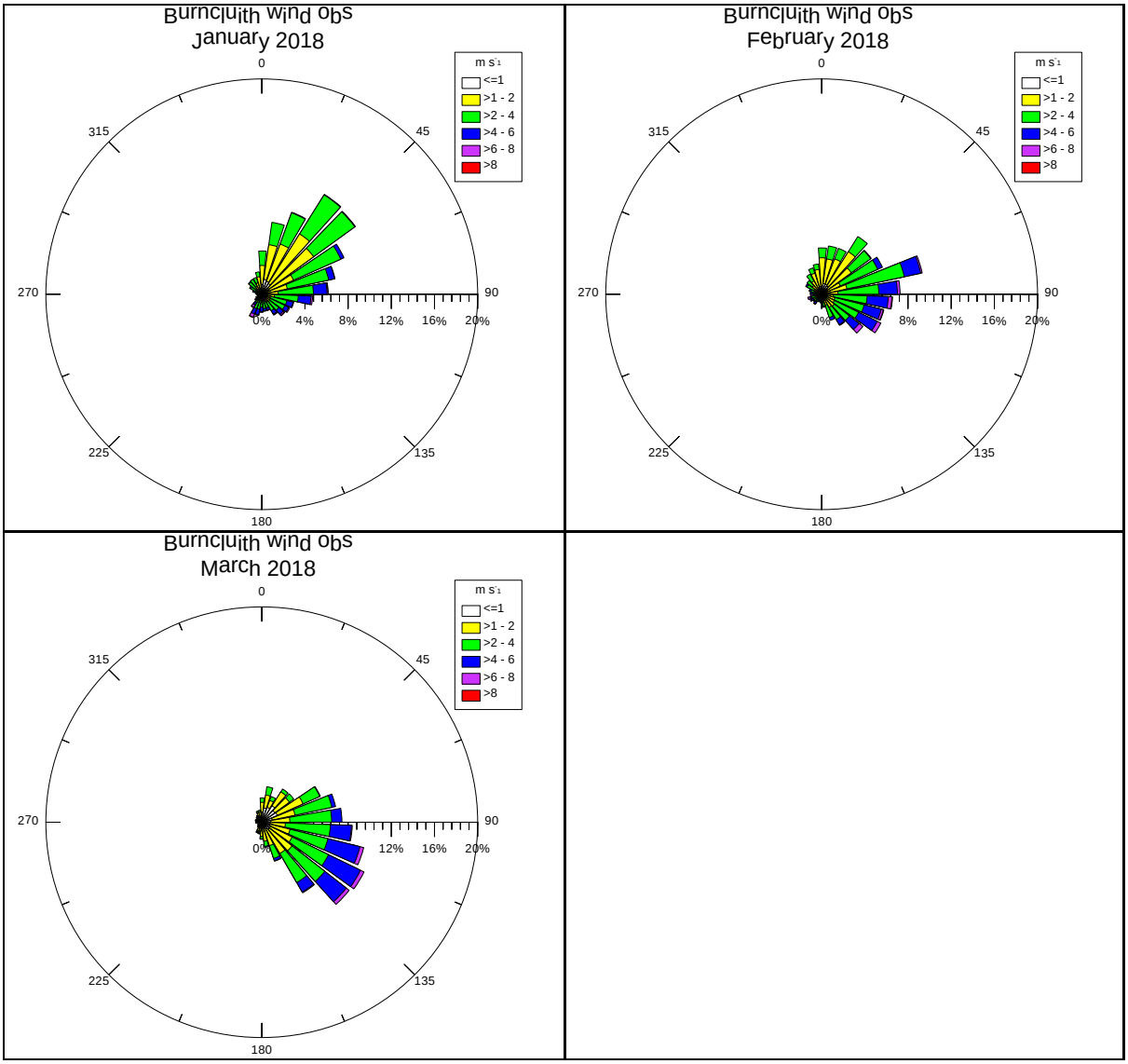



Burnclu ith wind obs
January 2016
Burnclu ith wind obs
Febr uary 2016
Burnclu ith wind obs
March 2016
Burnclu ith wind obs
Apr il 2016
Burnclu ith wind obs
May 2016
Burnclu ith wind obs
June 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
12%
5%
10%
15%
20%
25%


Burncluith wind obs
July 2016
Burncluith wind obs
August 2016
Burncluith wind obs
September 2016
Burncluith wind obs
October 2016
Burncluith wind obs
November 2016
Burncluith wind obs
December 2016
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
4%
8%
12%
16%
20%


Burncluith wind obs
January 2017
Burncluith wind obs
February 2017
Burncluith wind obs
March 2017
Burncluith wind obs
April 2017
Burncluith wind obs
May 2017
Burncluith wind obs
June 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
12%
16%
20%


Burnclu ith wind obs
July 2017
August 2017
September 2017
October 2017
November 2017
December 2017
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
12%
16%
20%


Burncluith wind obs
January 2018
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
4%
8%
12%
16%
20%
Burncluith wind obs
February 2018
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
8%
12%
16%
20%
Burncluith wind obs
March 2018
m s-1
<=1
>1 - 2
>2 - 4
>4 - 6
>6 - 8
>8
0
45
90
135
180
225
270
315
0%
12%
16%
20%

Appendix C

C.1 Event investigations - Fire Hotspot data

Hotspots referred to in Section 6 are derived from satellite-born instruments that detect light in the thermal wavelengths. The satellite data are processed with a specific algorithm that highlights areas with an unusually high temperature.

Two different satellite products were used to investigate the presence of fires in the study area in this report – Sentinel Hotspots and NASA Worldview.

Sentinel Hotspots - Sentinel is an Australian bushfire monitoring system that provides information about fire hotspots. Sources – MODIS sensor aboard NASA Terra and Aqua satellites, AVHRR (Advanced Very High Resolution Radiometer) night time imagery from NOAA satellites, VIIR on the Suomi-NPP satellite. © Commonwealth of Australia (Geoscience Australia) 2018.

NASA Worldview is a component of the NASA Earth Observing System Data and Information System (EOSDIS). The Worldview tool from NASA's Earth Observing System Data and Information System (EOSDIS) provides the capability to interactively browse historical fire data. FIRMS (Fire Information for Resource Management System) can be used to download the historical data. NASA Worldview provides fire products from the Moderate Resolution Imaging Spectroradiometer (MODIS) (MCD14DL) and the Visible Infrared Imaging Radiometer Suite (VIIRS) 375 m (VNP14IMGTDL_NRT))

The smoke plumes are observed in NASA Worldview using corrected reflectance from Suomi NPP / VIIRS, Aqua /MODIS and /or Terra / MODIS.

We acknowledge the use of data and imagery from LANCE FIRMS operated by the NASA/GSFC/Earth Science Data and Information System (ESDIS) with funding provided by NASA/HQ.