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Spatial analysis of $PM_{2.5}$ using a concentration similarity index applied to air quality sensor networks

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Table S1: Co-location periods for Clarity Node-S devices used in the Dungarvan sensor network. Grey cells indicate a device was not present for the co-location, blue cells indicate a device was present for part of the co-location period, and green cells indicate a device was present for the entire co-location period.

Co-location deployment period	Devices present for co-location																	
	A3	A4	A8H	A8Z	A9	AQ	AZ	A7	A6P	AJ3	AP7	AQV	ARF	AW6	AWF	AY9N	AY93	AYG
19/01/2022 – 28/01/2022																		
29/10/2022 – 22/11/2022																		
16/06/2023 – 17/07/2023																		

Table S2: Linear regression results for co-located Clarity Node-S devices when compared to the mean values of all co-located data, before and after data harmonisation procedures were carried out.

Device ID	Pre-harmonisation			Post-harmonisation		
	Slope	Intercept	R^2	Slope	Intercept	R^2
		µg m^{-3}			µg m^{-3}	
A3	1.036	0.933	0.992	1	0	0.992
A4	1.012	-0.278	0.996	1	0	0.996
A8H	0.905	0.979	0.995	1	0	0.995
A8Z	1.003	-0.302	0.997	1	0	0.997
A9	1.06	-0.535	0.979	1	0	0.979
AQ	0.989	0.859	0.997	1	0	0.997
AZ	0.979	0.079	0.997	1	0	0.997
A7	0.947	0.047	0.992	1	0	0.992
A6P	1.027	0.632	0.995	1	0	0.995
AJ3	0.989	-0.415	0.993	1	0	0.993
AP7	0.964	-0.477	0.992	1	0	0.992
AQV	1.042	0.797	0.997	1	0	0.997
ARF	1.016	-0.276	0.996	1	0	0.996
AW6	0.958	0.291	0.984	1	0	0.984
AWF	0.965	-0.554	0.989	1	0	0.989
AY9N	1.065	-0.364	0.988	1	0	0.988
AY93	0.955	0.298	0.995	1	0	0.995
AYG	0.976	-0.168	0.994	1	0	0.994

Table S3: Concentration Similarity Indices for hourly averaged $PM_{2.5}$ measured by a range of co-located PurpleAir devices. PM_{lim} = 15 µg m^{-3}, $C_{lim,\ upper}$ = 0.2, $C_{lim,\ lower}$ = 0.7.

	UNIT 2	**UNIT 3**	**UNIT 4**	**UNIT 5**
UNIT 2	1	0.98	0.99	1.0
UNIT 3		1	0.99	0.99
UNIT 4			1	0.99
UNIT 5				1

Table S4: Concentration Similarity Indices for the hourly averaged $PM_{2.5}$ measured by Clarity Node-S devices in the Dungarvan AQS network for January 2023.

	A3	**A4**	**A8H**	**A8Z**	**A9**	**AQ**	**AZ**	**A7**	**A6P**	**AJ3**	**AP7**	**AQV**	**ARF**	**AW6**	**AWF**	**AY9N**	**AY93**	**AYG**
A3	1	0.48	0.6	0.46	0.5	0.63	0.45	0.51	0.5	0.46	0.26	0.46	0.4	0.58	0.42	0.41	0.38	0.46
A4		1	0.47	0.46	0.55	0.48	0.52	0.51	0.43	0.54	0.38	0.51	0.45	0.51	0.51	0.5	0.45	0.49
A8H			1	0.49	0.53	0.54	0.46	0.56	0.49	0.53	0.37	0.55	0.44	0.59	0.47	0.57	0.41	0.5
A8Z				1	0.58	0.42	0.62	0.46	0.49	0.57	0.57	0.57	0.52	0.52	0.55	0.61	0.49	0.6
A9					1	0.48	0.57	0.53	0.46	0.54	0.47	0.56	0.45	0.54	0.5	0.51	0.44	0.56
AQ						1	0.43	0.5	0.47	0.45	0.26	0.45	0.39	0.56	0.37	0.45	0.35	0.42
AZ							1	0.52	0.52	0.61	0.52	0.61	0.51	0.53	0.56	0.53	0.44	0.67
A7								1	0.46	0.51	0.34	0.53	0.41	0.56	0.47	0.46	0.37	0.48
A6P									1	0.61	0.42	0.5	0.49	0.57	0.55	0.51	0.49	0.61
AJ3										1	0.49	0.67	0.54	0.59	0.72	0.53	0.63	0.71
AP7											1	0.45	0.5	0.37	0.49	0.51	0.44	0.54
AQV												1	0.5	0.58	0.63	0.55	0.52	0.66
ARF													1	0.52	0.54	0.59	0.46	0.58
AW6														1	0.54	0.59	0.49	0.58
AWF															1	0.49	0.64	0.73
AY9N																1	0.5	0.54
AY93																	1	0.63
AYG																		1

Table S5: Concentration Similarity Indices for the hourly averaged $PM_{2.5}$ measured by Clarity Node-S devices in the Dungarvan AQS network for May 2023.

	A3	**A4**	**A8H**	**A8Z**	**A9**	**AQ**	**AZ**	**A7**	**A6P**	**AJ3**	**AP7**	**AQV**	**ARF**	**AW6**	**AWF**	**AY9N**	**AY93**	**AYG**
A3	1	0.85	0.9	0.83	0.84	0.89	0.87	0.88	0.9	0.88	0.8	0.9	0.81	0.88	0.82	0.81	0.86	0.86
A4		1	0.84	0.82	0.87	0.8	0.82	0.89	0.82	0.87	0.81	0.85	0.75	0.81	0.81	0.79	0.79	0.81
A8H			1	0.83	0.84	0.86	0.83	0.87	0.88	0.86	0.79	0.86	0.75	0.82	0.79	0.8	0.85	0.83
A8Z				1	0.87	0.84	0.91	0.85	0.85	0.87	0.89	0.88	0.78	0.76	0.82	0.82	0.82	0.9
A9					1	0.79	0.86	0.89	0.84	0.91	0.85	0.88	0.78	0.81	0.89	0.85	0.78	0.84
AQ						1	0.82	0.83	0.84	0.83	0.76	0.87	0.74	0.8	0.73	0.77	0.83	0.84
AZ							1	0.82	0.88	0.9	0.83	0.93	0.84	0.84	0.86	0.8	0.81	0.94
A7								1	0.86	0.88	0.83	0.86	0.77	0.86	0.82	0.8	0.82	0.82
A6P									1	0.92	0.84	0.93	0.84	0.9	0.9	0.87	0.86	0.93
AJ3										1	0.86	0.93	0.85	0.89	0.94	0.91	0.84	0.94
AP7											1	0.82	0.81	0.72	0.87	0.79	0.8	0.82
AQV												1	0.84	0.89	0.9	0.86	0.84	0.94
ARF													1	0.77	0.84	0.72	0.76	0.87
AW6														1	0.83	0.76	0.81	0.84
AWF															1	0.91	0.76	0.92
AY9N																1	0.77	0.88
AY93																	1	0.83
AYG																		1

Table S6: Concentration Similarity Indices for hourly averaged $PM_{2.5}$ measured by PurpleAir devices in the Cork City AQS network for January 2021.

	CCC1	**CCC2**	**CCC3**	**CCC4**	**CCC5**	**CCC7**	**CCC8**	**CCC9**	**CCC11**	**CCC12**	**MTU**	**UCC**
CCC1	1	0.55	0.63	0.52	0.72	0.61	0.6	0.42	0.7	0.54	0.55	0.59
CCC2		1	0.54	0.58	0.63	0.48	0.59	0.56	0.69	0.6	0.4	0.59
CCC3			1	0.48	0.58	0.67	0.65	0.35	0.67	0.49	0.63	0.56
CCC4				1	0.59	0.45	0.51	0.54	0.6	0.58	0.42	0.5
CCC5					1	0.54	0.62	0.65	0.7	0.6	0.4	0.66
CCC7						1	0.54	0.33	0.59	0.42	0.6	0.46
CCC8							1	0.65	0.66	0.57	0.4	0.75
CCC9								1	0.5	0.57	0.18	0.7
CCC11									1	0.59	0.46	0.65
CCC12										1	0.33	0.55
MTU											1	0.31
UCC												1

Table S7: Concentration Similarity Indices for hourly averaged $PM_{2.5}$ measured by PurpleAir devices in the Cork City AQS network for May 2021.

	CCC1	**CCC2**	**CCC3**	**CCC4**	**CCC5**	**CCC7**	**CCC8**	**CCC9**	**CCC11**	**CCC12**	**MTU**	**UCC**
CCC1	1	0.58	0.7	0.51	0.63	0.63	0.58	0.45	0.5	0.39	0.74	0.58
CCC2		1	0.91	0.94	0.93	0.92	0.94	0.89	0.95	0.91	0.81	0.95
CCC3			1	0.85	0.93	0.95	0.92	0.84	0.88	0.79	0.9	0.92
CCC4				1	0.91	0.86	0.9	0.94	0.93	0.91	0.74	0.92
CCC5					1	0.92	0.9	0.83	0.94	0.83	0.86	0.96
CCC7						1	0.93	0.86	0.9	0.8	0.86	0.91
CCC8							1	0.89	0.92	0.84	0.79	0.9
CCC9								1	0.92	0.91	0.63	0.91
CCC11									1	0.91	0.75	0.96
CCC12										1	0.6	0.87
MTU											1	0.79
UCC												1

Figure S1: Map of Dungarvan with Clarity Node-S sensor locations and labels. (Map obtained from Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community)

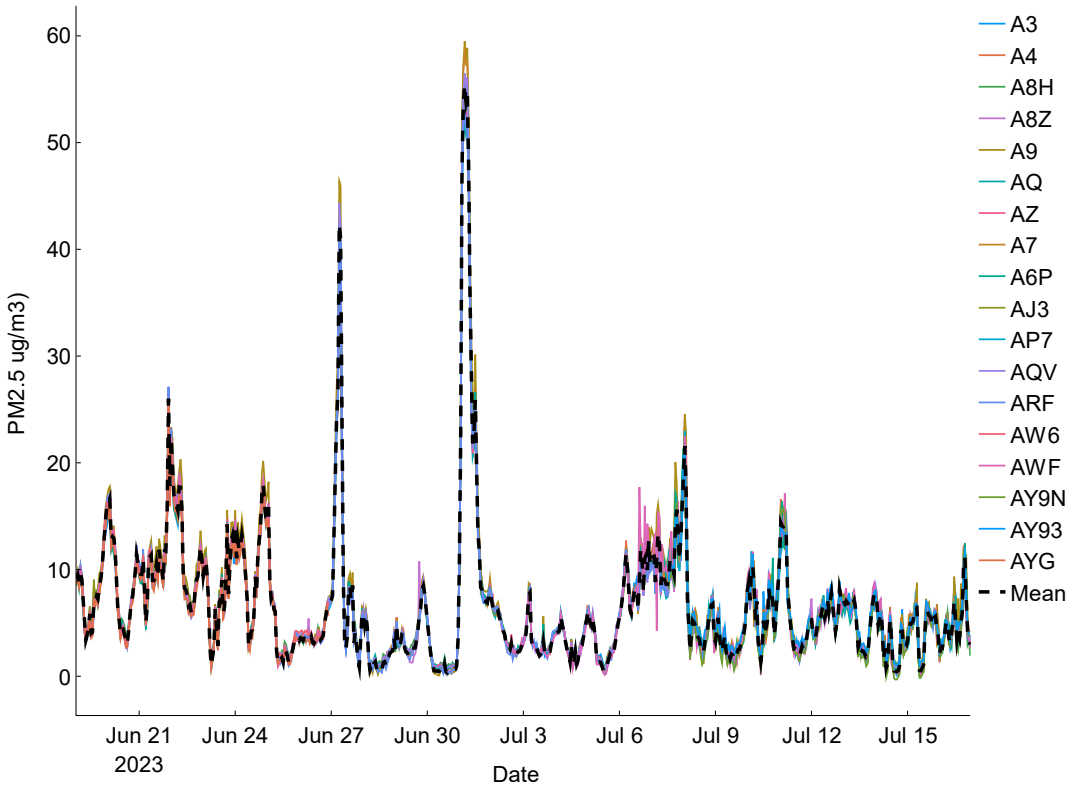

Figure S2: Hourly averaged $PM_{2.5}$ from co-located and harmonised Clarity Node-S devices including the mean $PM_{2.5}$ data series used for the harmonisation (19 June 2023–18 July 2023).

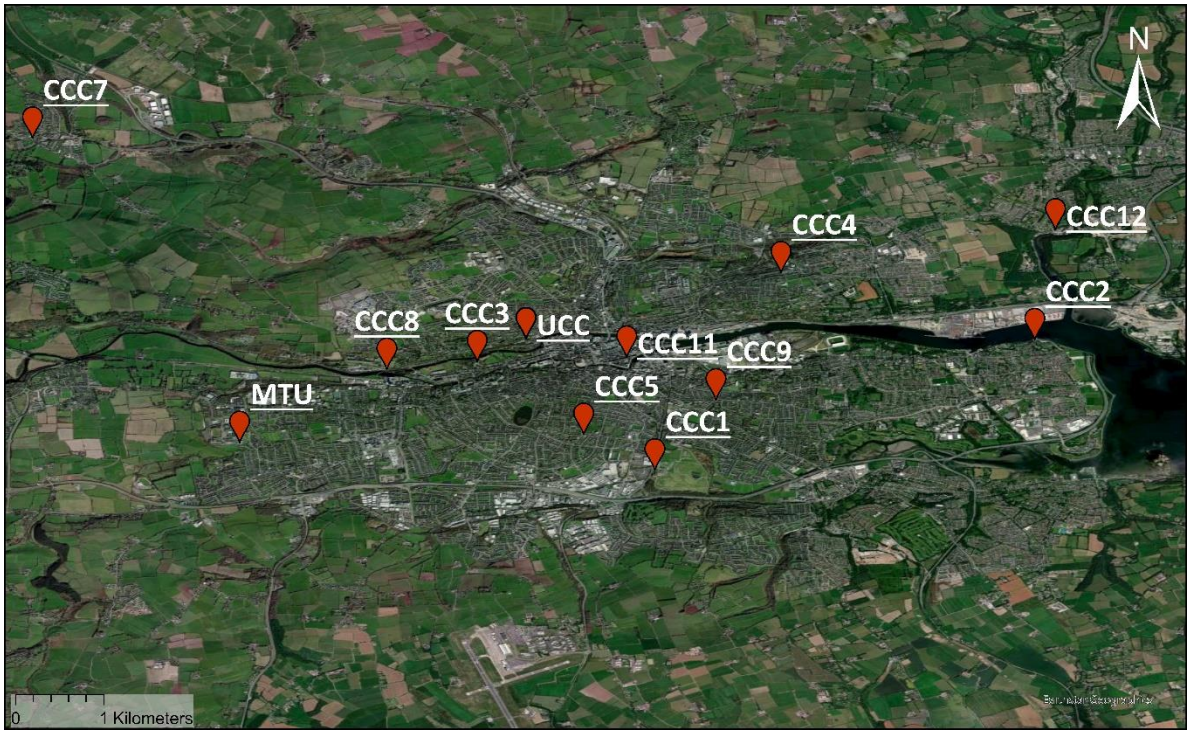

Figure S3: Map of Cork city with PurpleAir PA-II-SD sensor locations and labels. (Map obtained from Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community)

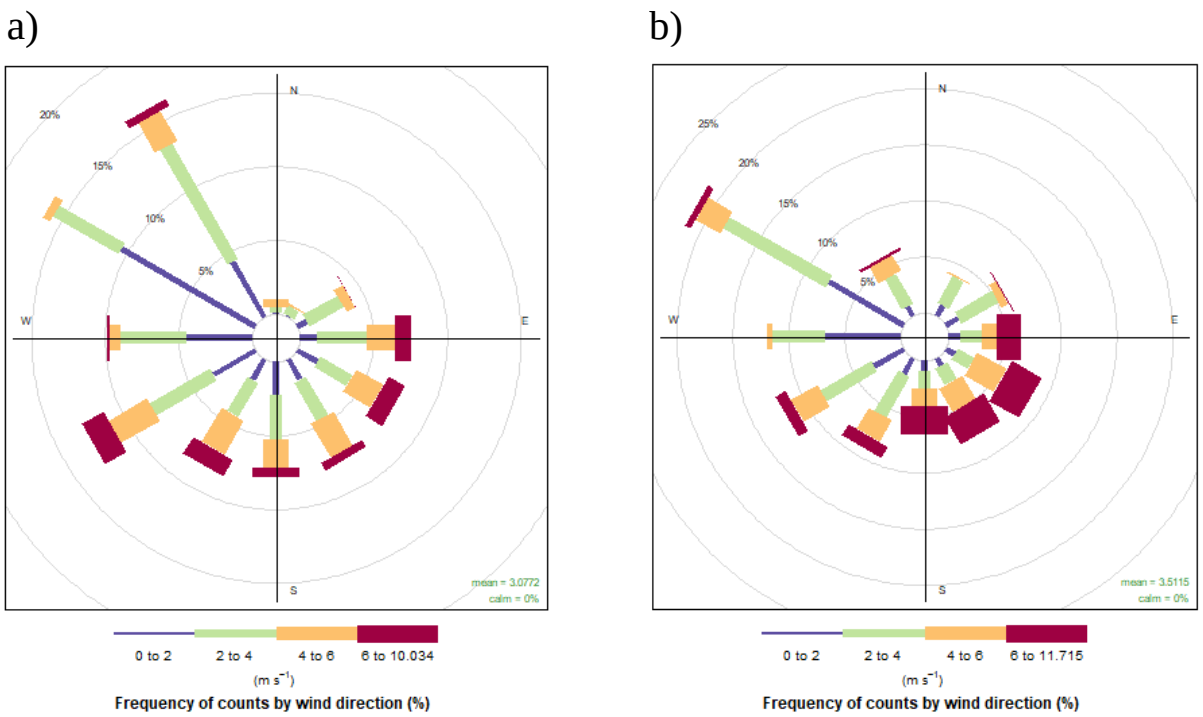

Figure S4: Wind rose plots for devices a) AP7 and b) AY93 in the Dungarvan sensor network (January 2023 - May 2023).

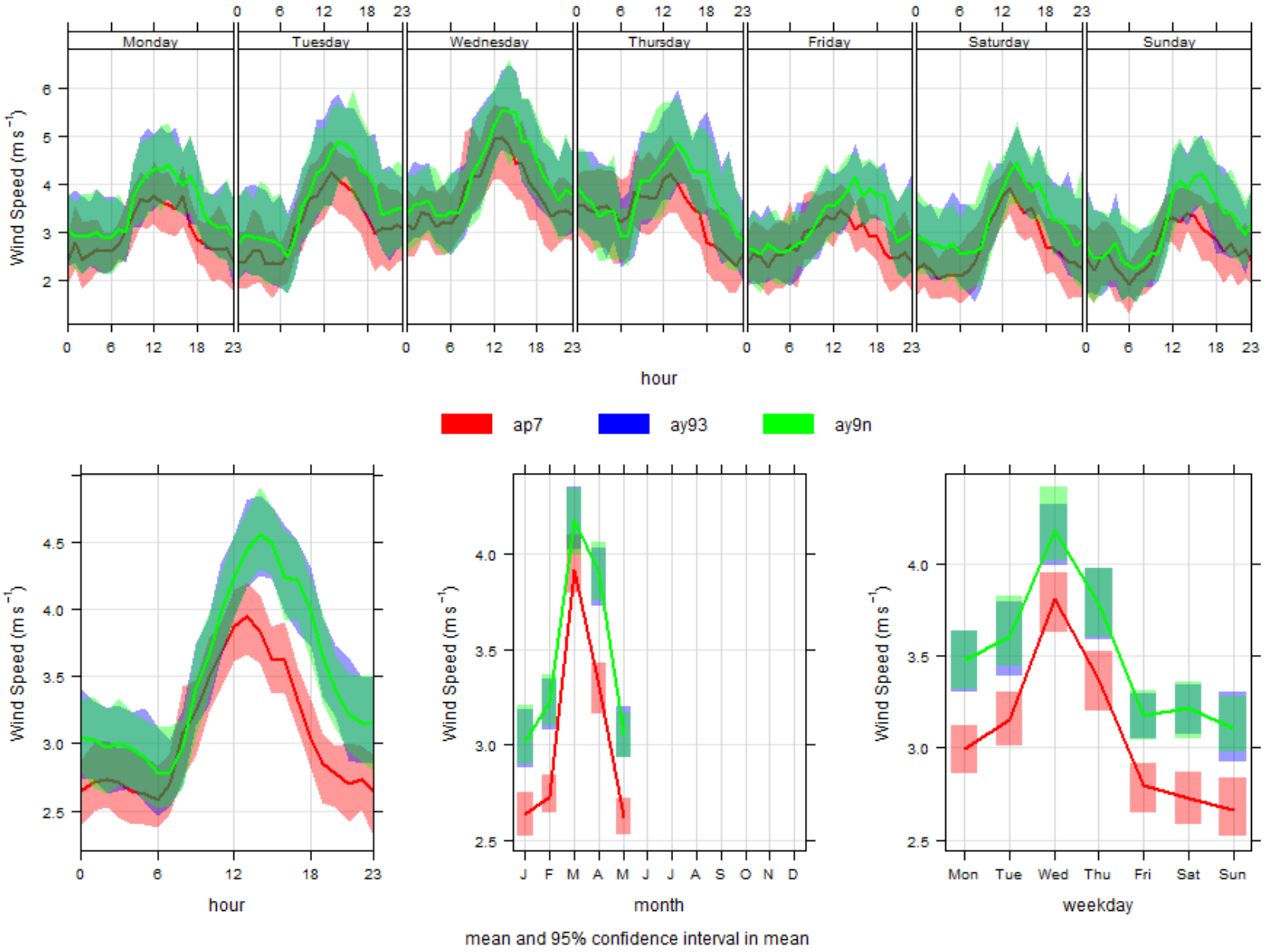

Figure S5: Temporal variation (hour of day - day of week variation, mean diurnal variation, monthly variation, and day of the week variation) in the wind speed recorded by devices AP7, AY93, and AY9N for the January 2023 - May 2023 measurement period.

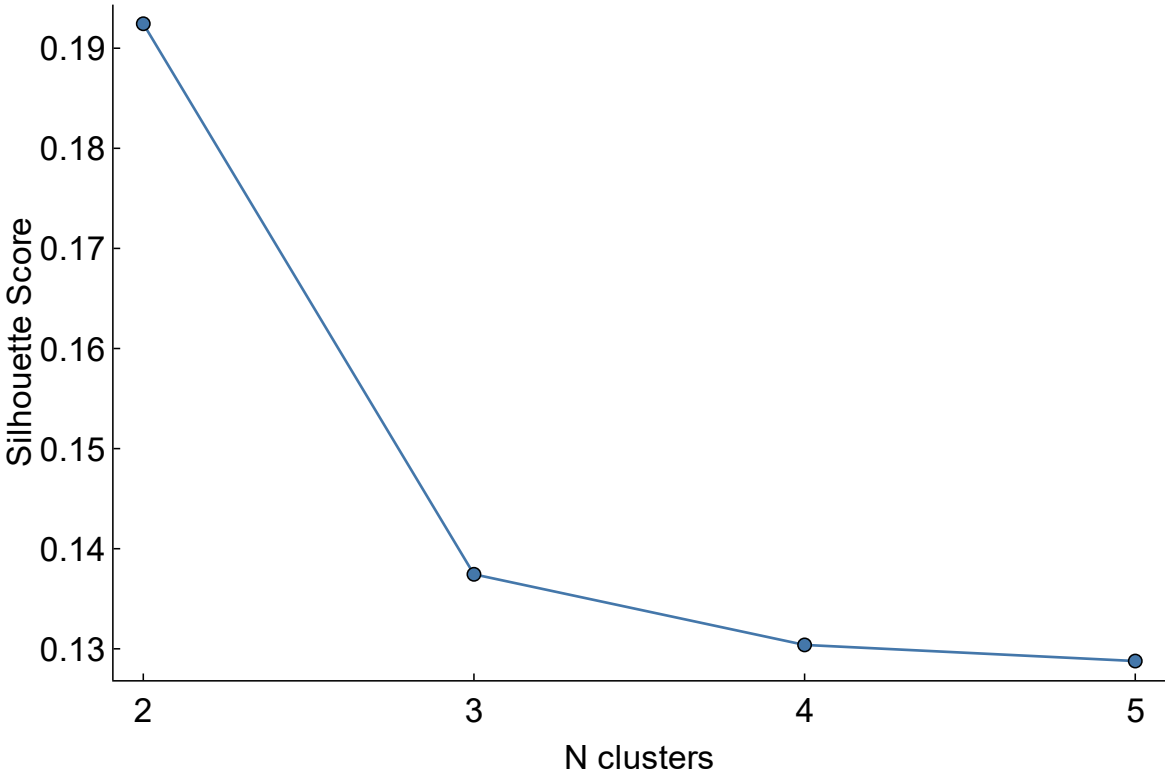

Figure S6: Silhouette scores for Hierarchical clustering on the Dungarvan sensor network CSI results.

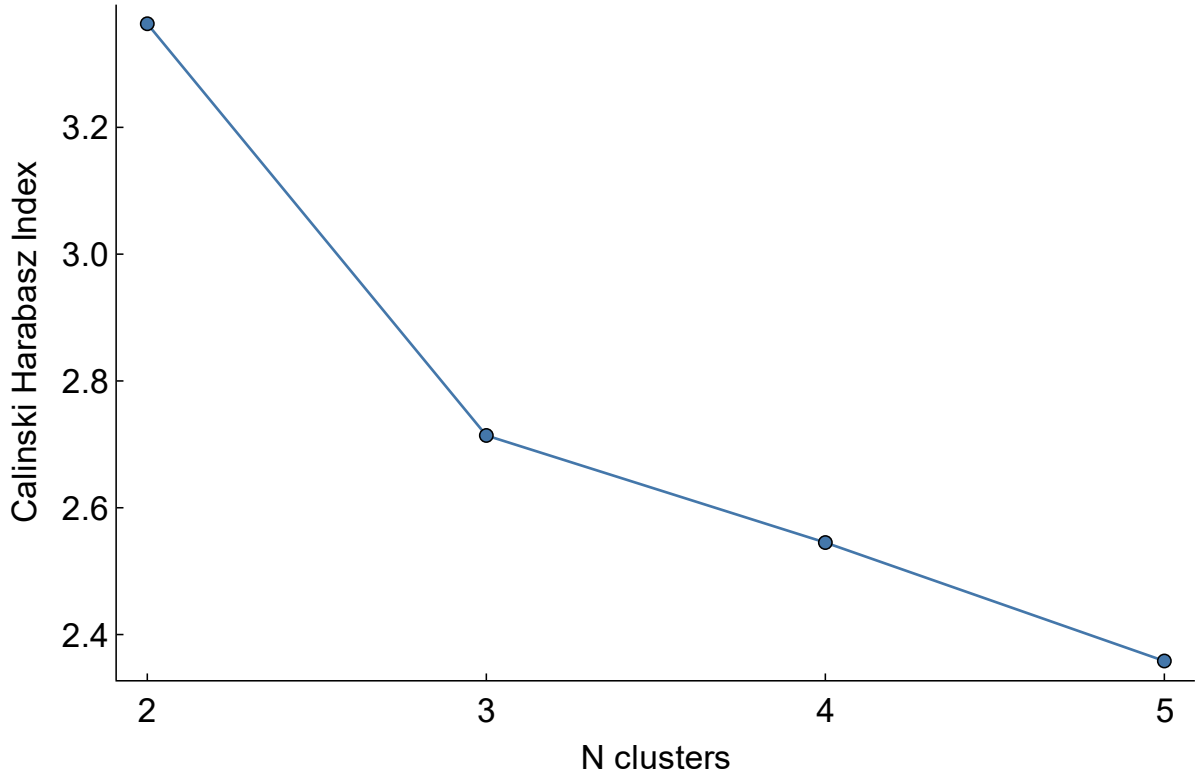

Figure S7: Calinski-Harabasz Indices for FCM clustering on the Dungarvan sensor network CSI results.

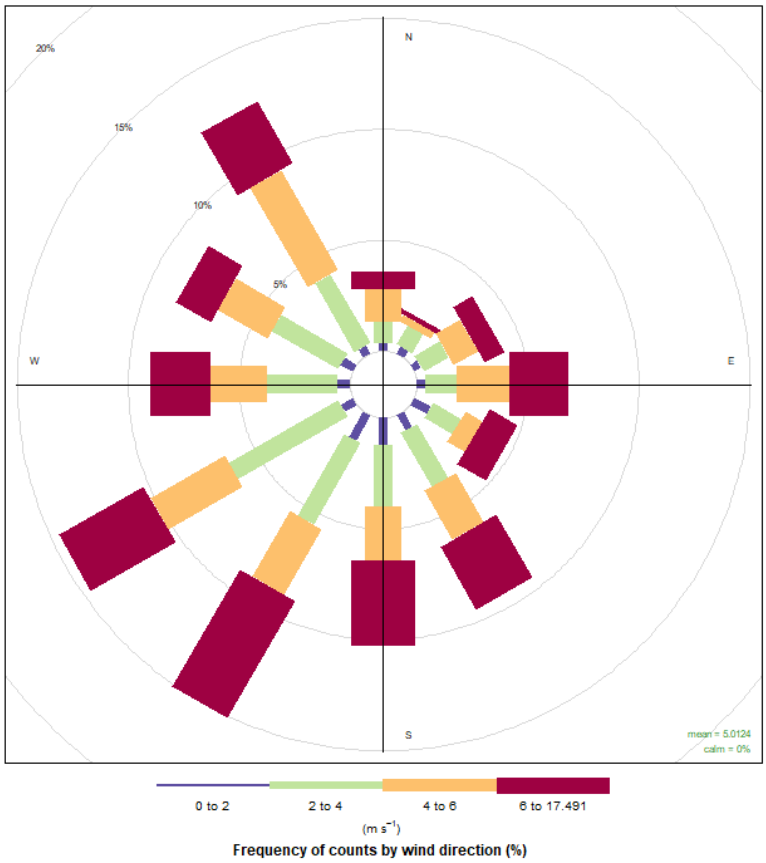

Figure S8: Wind rose plot for Cork Airport (January to May 2021 and September to December 2021).

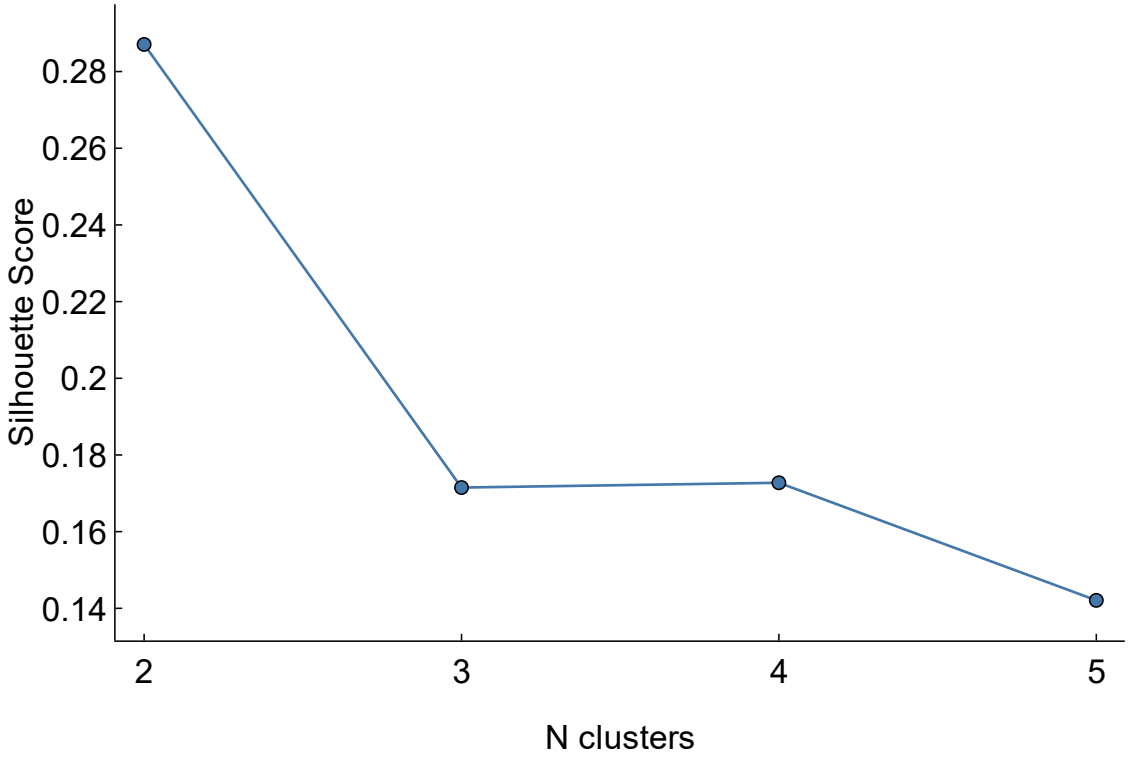

Figure S9: Silhouette scores for Hierarchical clustering on the Cork sensor network CSI results.

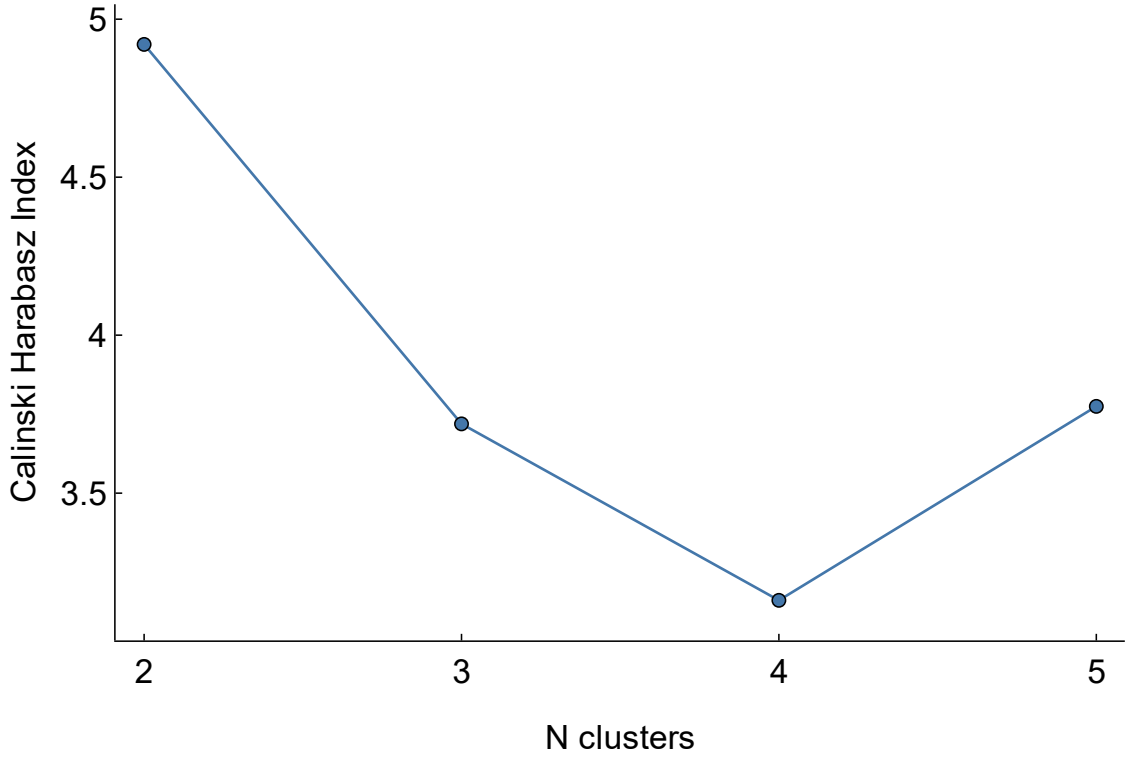

Figure S10: Calinski-Harabasz Indices for FCM clustering on the Cork sensor network CSI results.