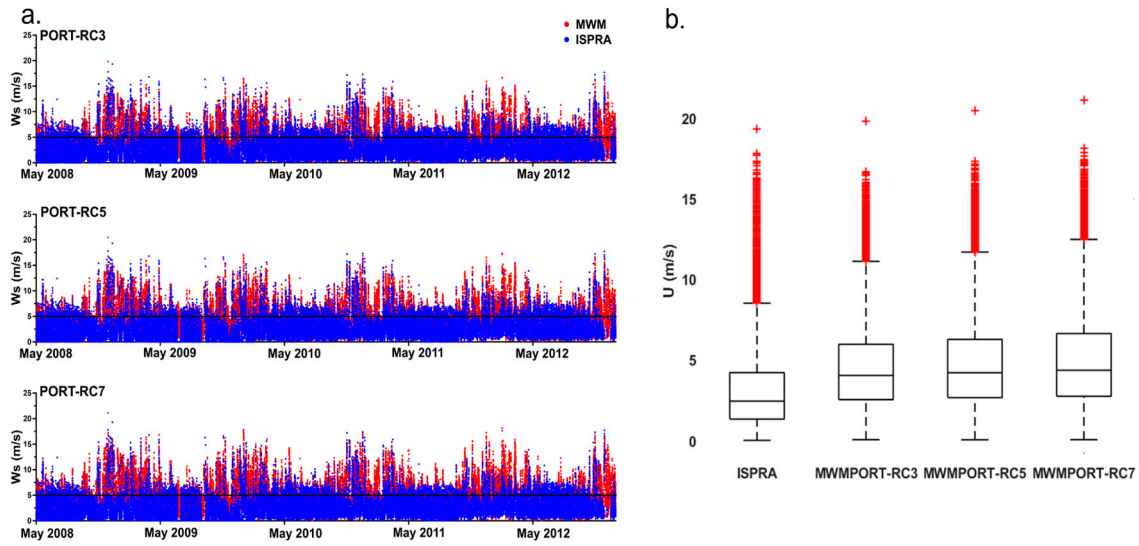


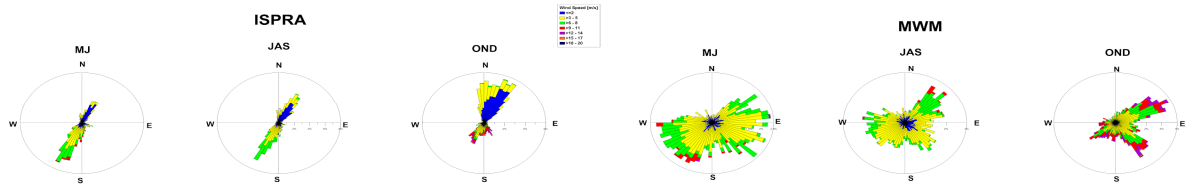
## Supplementary Materials

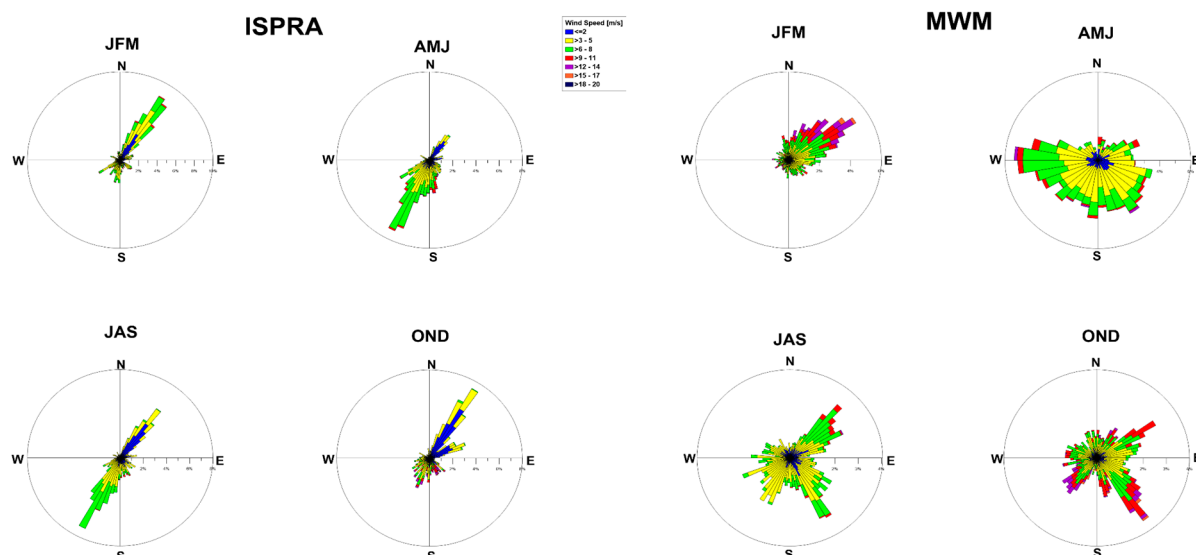


**Figure S1.** (a). Temporal series of wind speed from May 2008 to December 2012 of ISPRA (blue) and DHI model at RC3, RC5, RC7 of PORT site (red); the black line represents the wind speed threshold (5 m/s). (b). Box plots of the dataset; the outliers are identified by red crosses.

**Table S1.** Statistical metrics (correlation coefficient (CC), root mean square error (RMSE) and Hanna–Heinold index (HH)) of wind speed between the MWM model and ISPRA, seasonal comparison (2008–2009–2012). Year 2010 is shown in the text, see Table 3.

ISPRA vs MWM Wind Speed	RC3			RC5			RC7		
	CC	RMSE (m/s)	HH	CC	RMSE (m/s)	HH	CC	RMSE (m/s)	HH
<b>2008 Trimester</b>									
Winter (JFM)	-	-	-	-	-	-	-	-	-
Spring (AMJ)	-	-	-	-	-	-	-	-	-
Summer (LAS)	0.46	2.01	0.62	0.43	2.2	0.66	0.39	2.3	0.7
Autumn (OND)	0.64	3.5	0.73	0.63	3.7	0.76	0.62	3.9	0.8
<b>2009 Trimester</b>									
Winter (JFM)	0.51	3.9	0.75	0.5	4.2	0.78	0.48	4.5	0.82
Spring (AMJ)	0.51	2.6	0.75	0.49	2.8	0.79	0.49	2.9	0.83
Summer (LAS)	0.54	2.2	0.74	0.52	2.4	0.77	0.5	2.5	0.81
Autumn (OND)	0.52	3.8	0.73	0.5	4.1	0.77	0.49	4.3	0.81
<b>2012 Trimester</b>									
Winter (JFM)	0.51	3.2	0.75	0.49	3.4	0.78	0.48	3.7	0.82
Spring (AMJ)	0.51	2.3	0.75	0.49	2.5	0.79	0.47	2.7	0.83
Summer (LAS)	0.53	2.2	0.74	0.52	2.3	0.78	0.5	2.5	0.82
Autumn (OND)	0.52	2.9	0.73	0.5	3.1	0.77	0.49	3.4	0.81





**Figure S4.** The left panel shows the seasonal wind direction for the year 2012 at the ISPRA weather station. Right panel shows the seasonal wind direction for the year 2012 in the MWM model at PORT-RC3.

**Table S2.** Statistical metrics of comparisons among HF PORT site, ISPRA weather station and MWM model wind directions with wind speed  $U > 5$  m/s at RC5 for the years 2008, 2009 and 2012. Year 2010 is shown in the text, see Table 5.

2008	RC5					
Events	HF vs ISPRA			HF vs MWM		
	qcc	$\theta$ (°)	RMSE (°)	qcc	$\theta$ (°)	RMSE (°)
May_19_22						
Jul_22_24	0.71	38.45	58.7	-0.78	21.5	59.66
Sep_13_16	0.86	-13.69	33.98	0.54	-19.37	0.45
Oct_3_5	0.81	14.89	54.48	0.81	-5.28	58.78
Oct_30_31	0.59	-33.21	42.39	0.59	-47.53	55.67
Nov_21_25	0.66	-18.36	49.95	0.69	-37.89	55.87
Nov_28_30	0.82	-38.98	43.29	0.86	-52.88	55.67
Dec_1_2	0.59	-34.36	49.95	0.42	-44.16	59.18
Dec_4_8	0.69	-38.85	49.66	0.77	-60.26	65.38
Dec_12_13	-0.9	-1.04	5.37	-0.94	-153.81	0
Dec_15_17						
	0.37	-22.61	26.16	0.51	-25.26	31.7
2009	RC5					
Jan_1_3	0.09	-12.55	40.47	0.64	-39.39	66.7
Jan_14_15						
Mar_23_26	0.79	-22.36	46.78	0.64	-71.46	83.91
Apr_29_30	0.52	10.18	44.52	0.32	-20.53	46.65
Jun_2_3	-	-	-	-	-	-
Oct_12_13	-	-	-	-	-	-
Nov_3_5	0.82	-27.62	37.88	0.29	-72.4	71.68
Nov_8_9	0.84	-21.99	35.92	0.66	-43.37	53.09

Nov_27_28	0.46	-35.94	44.66	0.47	-72.93	72.08
Dec_1_4	0.91	-16.99	24.93	0.63	-37.23	41.09
Dec_6_9	0.59	-48.72	50.57	0.63	-84.64	84.83
Dec_22_23	0.26	-31.22	36.89	0.51	-54.88	57.87
Dec_27_29	0.32	-54.98	56.2	0.23	-90.15	90.77
<b>2012 RC5</b>						
Jan_4_8	-	-	-	0.75	-20.92	30.24
Feb_18_19	-0.2	-47.29	51.23	-0.23	-59.57	61.98
Apr_7_9	0.58	-46.35	69.08	-0.28	-34.93	61.2
Apr_11_12	0.18	-55.49	57.07	-0.38	-88.46	76.51
Apr_14_16	0.84	-3.61	33.98	0.93	-18.75	31.01
Apr_18_21	0.76	-18.81	51.9	0.74	-42.73	53.23
May_7_9	-0.5	-1.39	68.77	0.6	-39.98	56.16
May_21_24	0.19	-18.97	66.06	0.58	-36.01	63.94
Sep_4_6	0.23	-21.43	27.94	0.63	-33.34	38.1
Oct_1_3	0.1	21.28	42.25	0.6	9.41	39.53
Oct_9_10	-0.1	-37.06	39.22	0.77	-61.63	63.93
Oct_15_16	0.88	-18.58	35.02	0.79	-37.95	47.14
Oct_27_29	0.48	-50.22	53.91	0.12	-59.86	65.33
Nov_28_30	0.8	-12.33	42.96	0.78	-11.03	45.68
Dec_27_29	-0.6	-71.28	70.39	-0.25	-14.68	62