

# WIND STUDY FOR THE CONSTRUCTION OF THE NEW INTERNATIONAL AIRPORT IN ARGYLE



NOVEMBER 2007

**PRELIMINARY TECHNICAL REPORT, ON THE WIND PATTERN BEHAVIOUR IN THE ÁREA PROPOSED FOR THE CONSTRUCTION OF THE INTERNATIONAL AIRPORT IN ARGYLE, SAINT VINCENT FROM THE 11/05/07 TO THE 31/08/07.**

**Introduction:**

The following preliminary report contains the study of the wind pattern and its zonal variation, generated by dynamic meteorological factors with incidence in the flow of the air, from the 11th May to the 31st August, 2007, reflecting in its contents a series of registered observations in digital format presented simultaneously every minute by three (3) remote weather stations located at three different points (Head 020°, Head 200° and the Central Station at IADC's office), very close to the projected centre line of the runway for the new International Airport in the Argyle region.

The atmosphere is a fluid that is rarely at rest. Due to the irregular distribution of temperature, the air masses move in all the directions. This phenomenon is known as the wind and to define it from a physical point of view, it is the speed of air particles; consequently it is a vector that is defined by its direction and intensity. The direction is expressed in sexagesimal degrees, that is to say, according to a graduated circle of 360°, describing from where the wind comes. In the maneuvers of takeoff and landing, the wind direction is referenced to the Magnetic north. The intensity is expressed in miles/hours, that is to say, in knots, meters/second or in kilometers/hour.

**General Objective:**

To determine, by studying the hourly weather observations of the wind pattern, the diversity or the predominant vector of the wind flow for the construction of the Argyle International Airport.

**Presentation of the results for Head 020°:**

Within the period from the 11<sup>th</sup> of May to the 31<sup>st</sup> of August, 2007, 115.743 pieces of wind data was collected, taken in intervals of one minute from the remote weather station located at the 020° head, between the coordinates 13° 08' 28" north latitude and 61° 09' 20" west longitude at a height of 86 meters above sea level.

The information presented relates to a population of 100% of the information collected and distributed in this preliminary wind study report between 16 wind rose directions. The following distribution can be seen in table N° 01:

Direction	Radial	Symbol	%
North	350°, 360°, 010°	N	0,330042
North/Northeast	020°, 030°	NNE	2,201429
<b>Northeast</b>	<b>040°, 050°</b>	<b>NE</b>	<b>10,45074</b>
<b>East/Northeast</b>	<b>060°, 070°</b>	<b>ENE</b>	<b>54,08102</b>
<b>East</b>	<b>080°, 090°, 100°</b>	<b>E</b>	<b>25,93418</b>
East/Southeast	110°, 120°	ESE	3,78943
Southeast	130° y 140°	SE	0,892495
South/Southeast	150°, 160°	SSE	0,406072
South	170°, 180°, 190°	S	0,753393
South/Southwest	200°, 210°	SSW	0,542581
Southwest	220°, 230°	SW	0,298074
West/Southwest	240°, 250°	WSW	0,11491
West	260°, 270°, 280°	W	0,091582
West/Northwest	290°, 300°	WNW	0,048383
Northwest	310°, 320°	NW	0,032831
North/Northwest	330°, 340°	NNW	0,032831

**Table N° 01** Head 020° from the 11<sup>th</sup> May to 31<sup>st</sup> August, 2007

#### **Brief Synopsis of the data:**

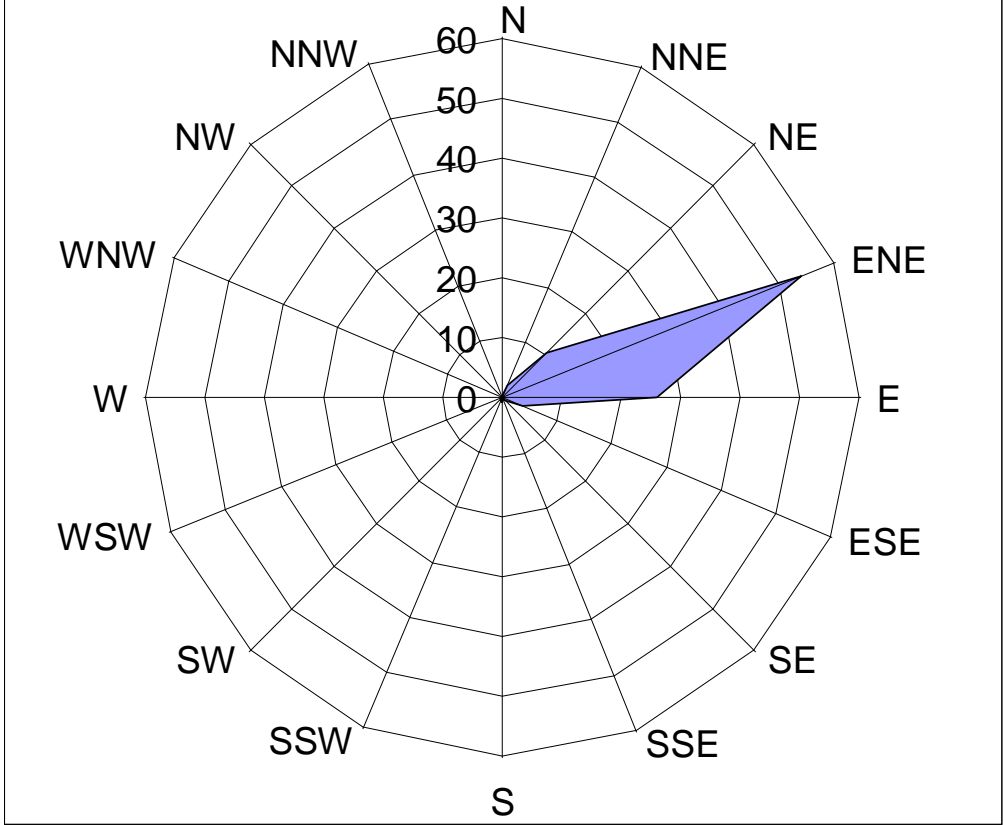
This summary of the wind study in the Argyle region corresponds to 113 days of observations at the 020° Head. The three (03) directions that stand out most at the said observation point are highlighted in bold letters. The most predominant component is that of the East/Northeast (**ENE**) with a percentage of 54.08%, followed by that of the East (**E**) with 25.93% and the wind flow from the Northeast (**NE**) with 10.45%. Summing up these three (03) close or consecutive wind directions, you get 90.47%, showing clearly the predominant wind flow within the first quadrant of the wind rose. The other wind components are distributed among the remaining thirteen (13) radials of the wind rose with percentages oscillating between 3,789% and 0,032%, which doesn't represent any significant change on the dominant flow, as shown in Graph N° 01.

In terms of the wind intensity in this period, a maximum of 39 Kts was attained at the beginning of august, caused by the passing of tropical storms in the region of the Lesser Antilles and the same way the mean speed in the period evaluated was 13.9 Kts, as shown in the Graphs 02a, 2b, 2c, 2d, 2e, 2f, 2g, 2h corresponding to the months of May, June, July and August, 2007.

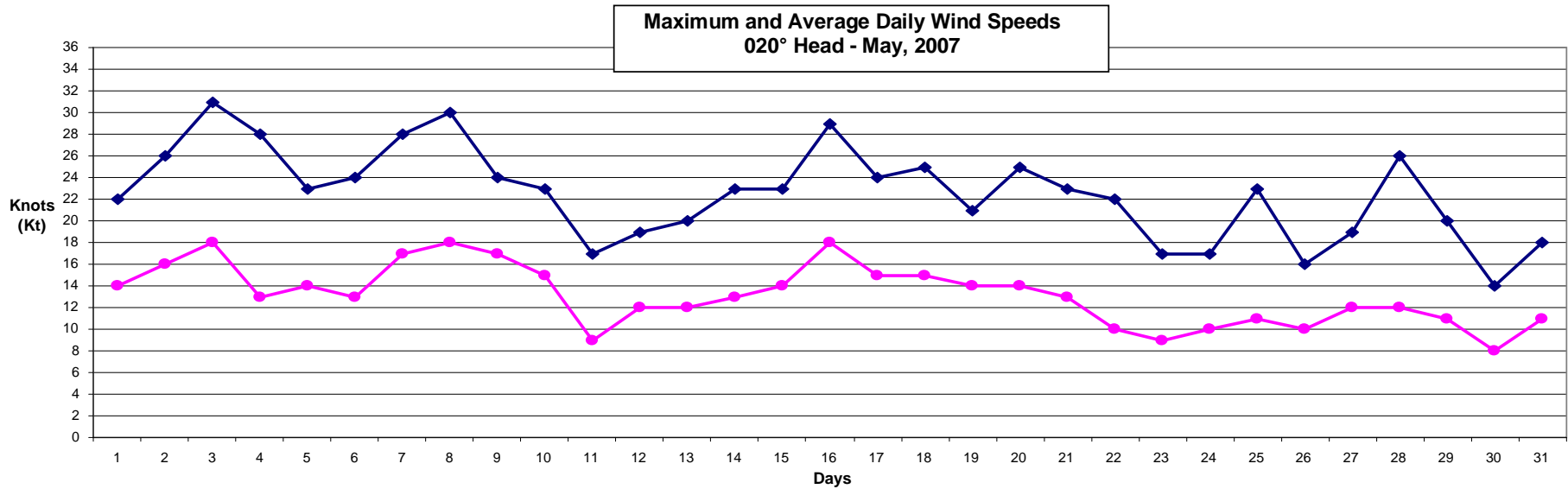
Maximum Absolute Speed: **39.0 Kts.**

Average Speed (average of the daily extreme values): **13.9 Kts**

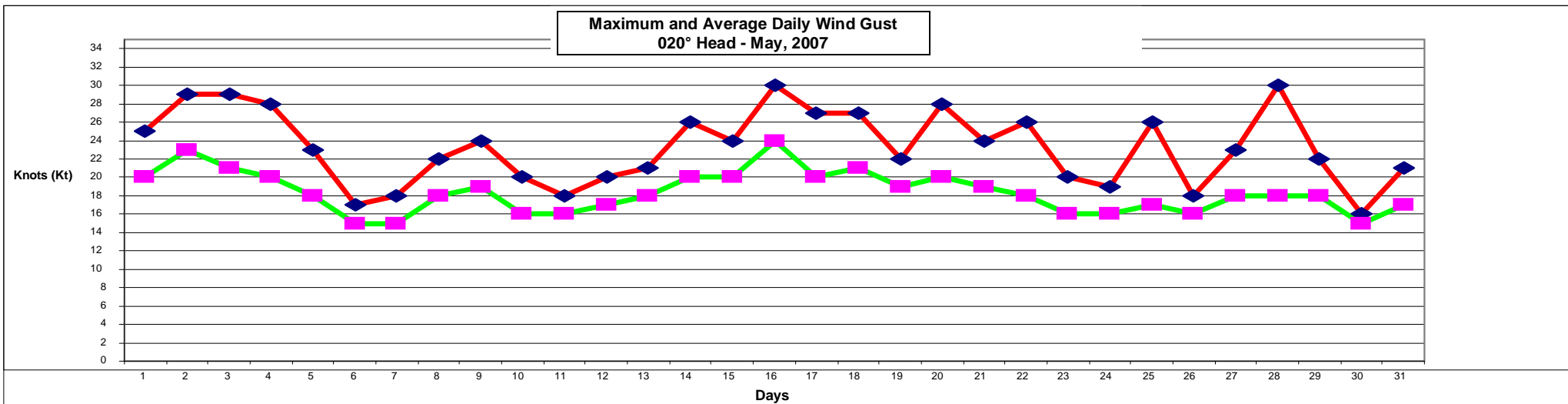
**FREQUENCY (%) WIND ROSE**  
**LOCATION ARGYLE AT THE 020° HEAD**  
11<sup>th</sup> MAY TO 31<sup>st</sup> AUGUST 07. 2007



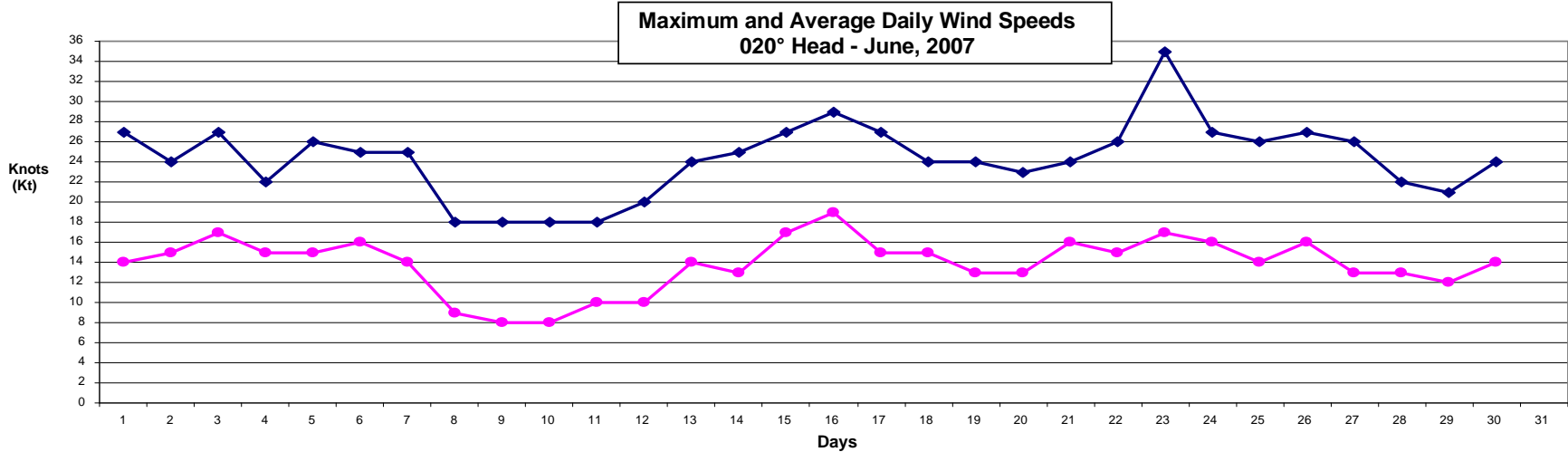
**Graph N° 01** Wind Rose  
Head 020° from 11<sup>th</sup> May to 31<sup>st</sup> August, 2007



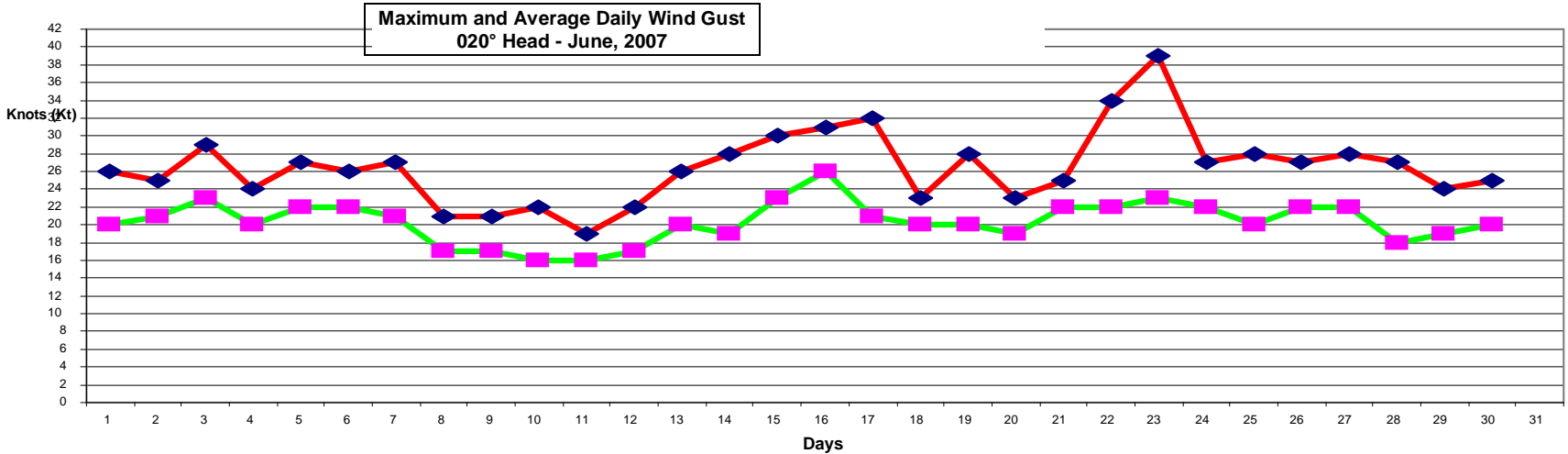
**Graph N° 02a** Chart showing Maximum and Average Wind Speeds for the month of May, 2007



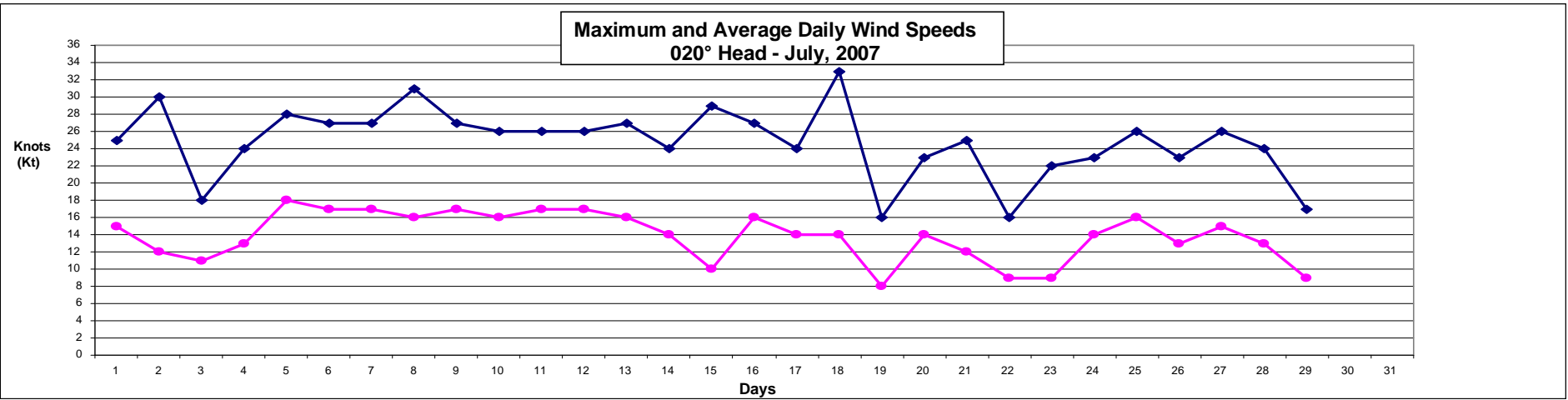
**Graph N° 02b** Chart showing Maximum and Average Wind Gusts for the month of May, 2007



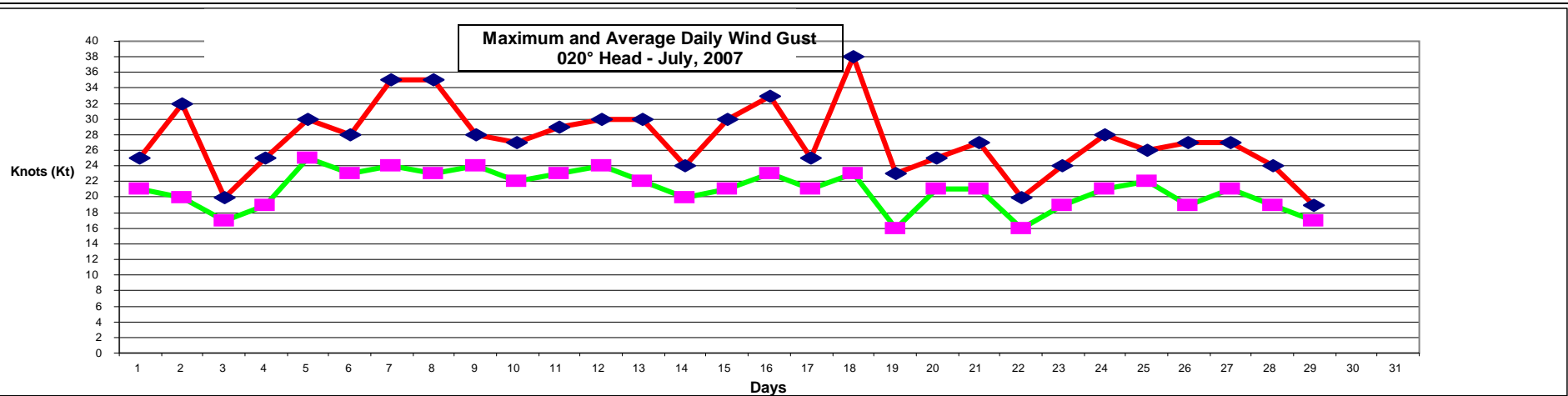
**Graph N° 02c** Chart showing Maximum and Average Wind Speeds for the month of June, 2007



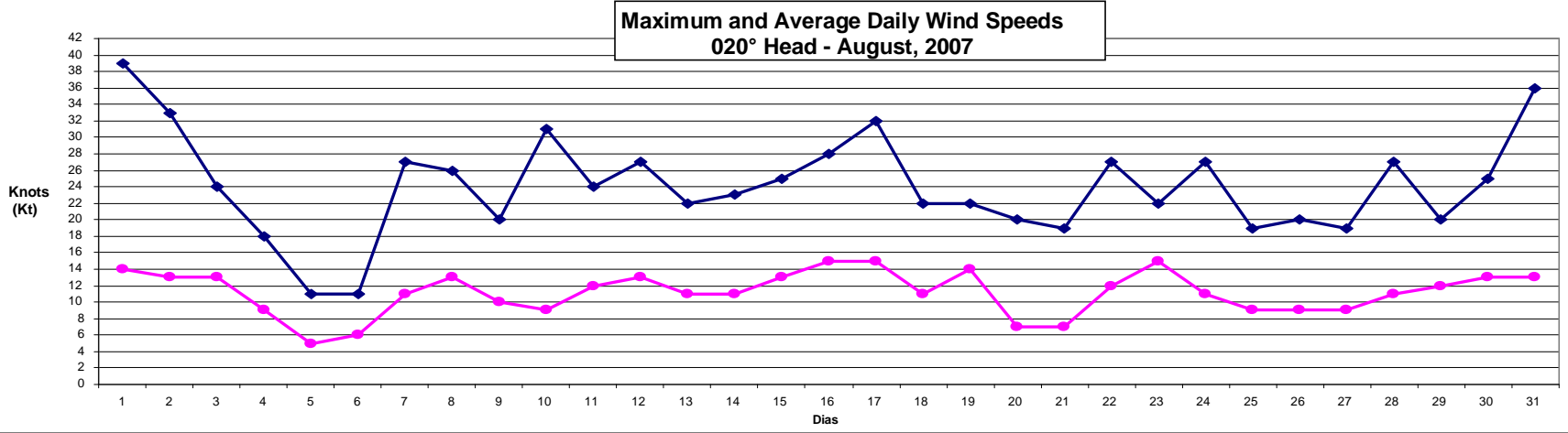
**Graph N° 02d** Chart showing Maximum and Average Wind Gusts for the month of June, 2007



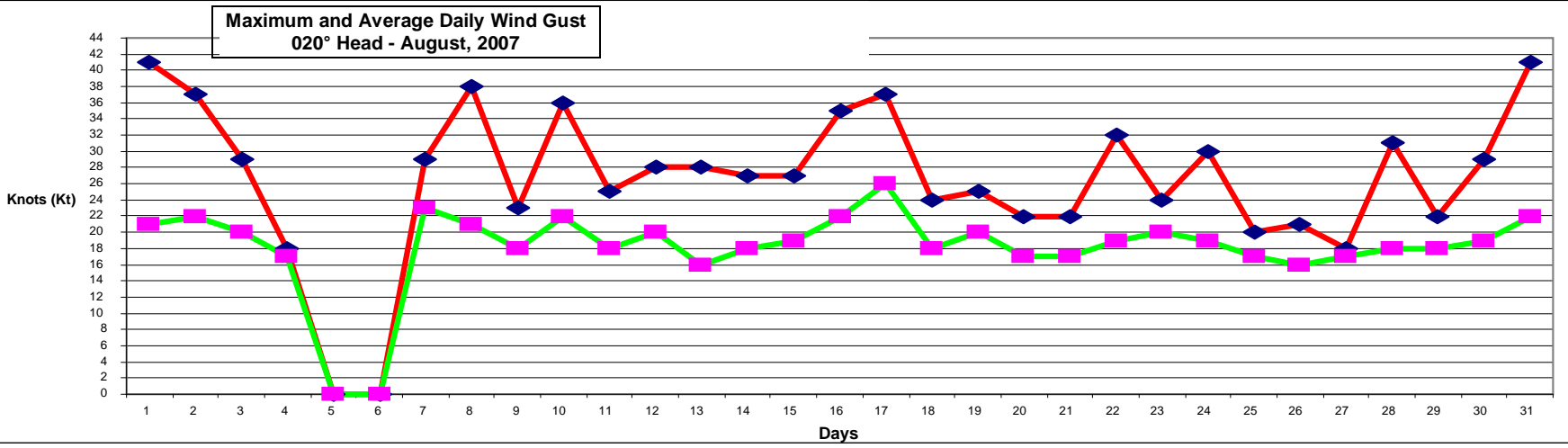
**Graph N° 02e** Chart showing Maximum and Average Wind Speeds for the month of July, 2007



**Graph N° 02f** Chart showing Maximum and Average Wind Gusts for the month of July, 2007



**Graph N° 02g** Chart showing Maximum and Average Wind Speeds for the month of August, 2007



**Graph N° 02h** Chart showing Maximum and Average Wind Gusts for the month of August, 2007

### Presentation of the results from the 200°Head:

The 200° Head is located between the coordinates 13° 10' 28" north latitude and 61° 08' 68" west longitude. A quantity of 158,452 observations of the wind pattern was registered between the 11th of May and the 31st of August, 2007. They were taken sequentially in one minute intervals by a remote weather station and detailed as percentages of the total in the following Table N° 02.

Direction	Radial	Symbol	%
North	350°,360°, 010°	N	2,070659
North/Northeast	020°, 030°	NNE	3,120819
Northeast	040°,050°	NE	5,082296
<b>East/Northeast</b>	<b>060°,070°</b>	<b>ENE</b>	<b>23,07386</b>
<b>East</b>	<b>080°, 090°, 100°</b>	<b>E</b>	<b>55,81185</b>
<b>East/Southeast</b>	<b>110°,120°</b>	<b>ESE</b>	<b>5,782824</b>
Southeast	130° y 140°	SE	1,724813
South/Southeast	150°, 160°	SSE	0,853886
South	170°, 180°, 190°	S	0,908161
South/Southwest	200°, 210°	SSW	0,368566
Southwest	220°, 230°	SW	0,343953
West/Southwest	240°,250°	WSW	0,123697
West	260°, 270°,280°	W	0,124328
West/Northwest	290°,300°	WNW	0,114861
Northwest	310°, 320°	NW	0,239189
North/Northwest	330°, 340°	NNW	0,256229

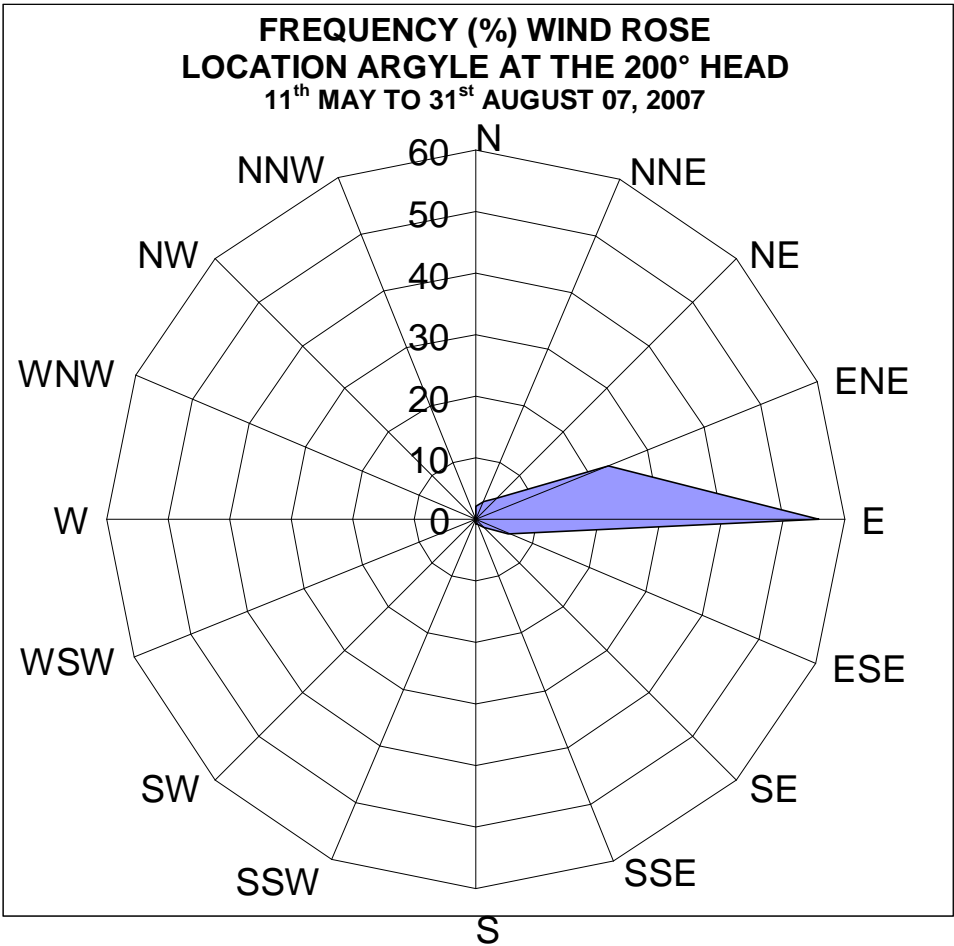
**Table N° 02:** Head 200° from 11<sup>th</sup> May to 31<sup>st</sup> August, 2007

### Brief Synopsis of the Data:

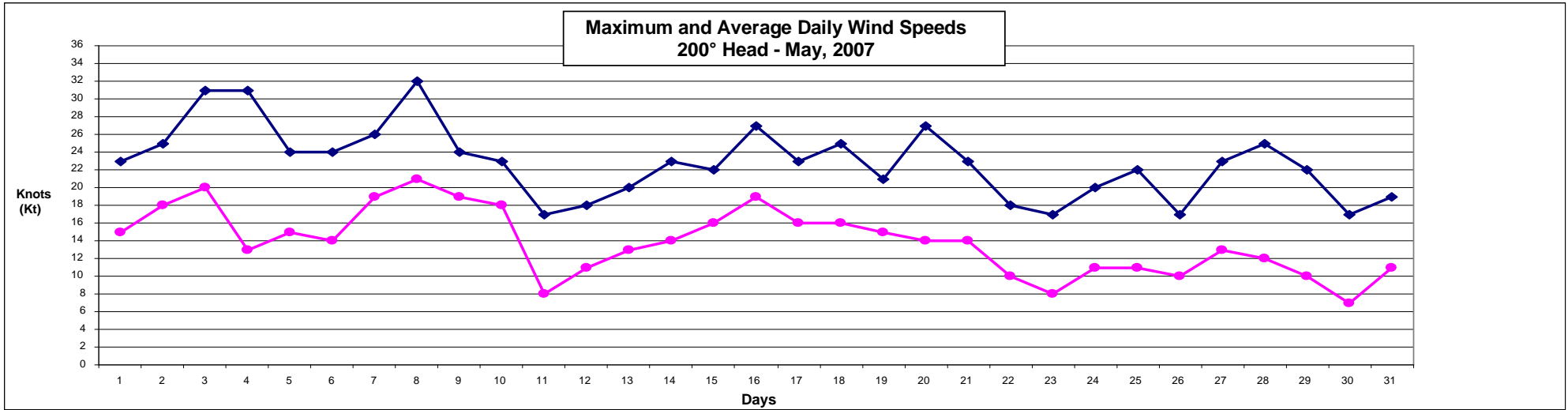
The following observation point at the 200° Head presents a predominant wind flow direction from the East (**E**) recording 55.81%. As a second predominant wind flow component at the said location, the flow from the East/Northeast (**ENE**) has 23.07% and third is the wind flow from the East/Southeast (**ESE**) with 5.78%. These three components of the wind flow give a sum of 84.67%, as shown in Table N° 02.

One can conclude that the three (03) wind flow components mentioned earlier specifically determines the dominance of the flow from the East. The other thirteen (13) components of the wind rose having percentages oscillating between 0.12% and 5.08 %, will not affect the final evaluation of the results, as can be seen demonstrated in Graph N° 03.

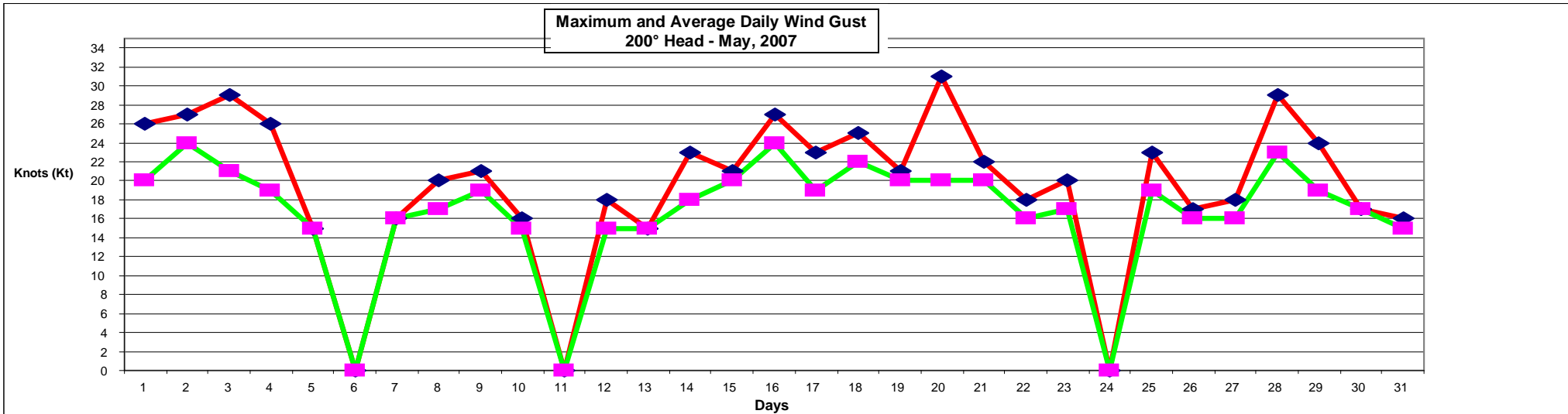
The maximum absolute wind speed registered was **40.0 Kts**, with an average wind speed of **13.3 Kts**. Following, you can see the maximum and average wind speed intensities according to Graphs N°; 4a, 4b, 4c, 4d, 4e, 4f, 4g y 4h.



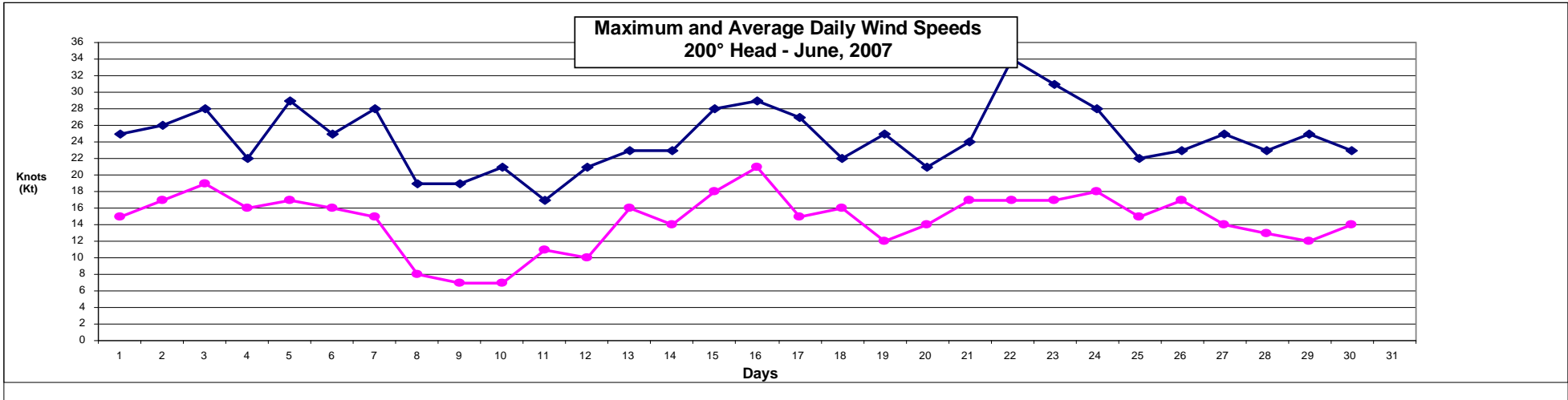
**Graph N° 03** Wind Rose  
 200° Head from the 11<sup>th</sup> May to 31<sup>st</sup> August, 2007



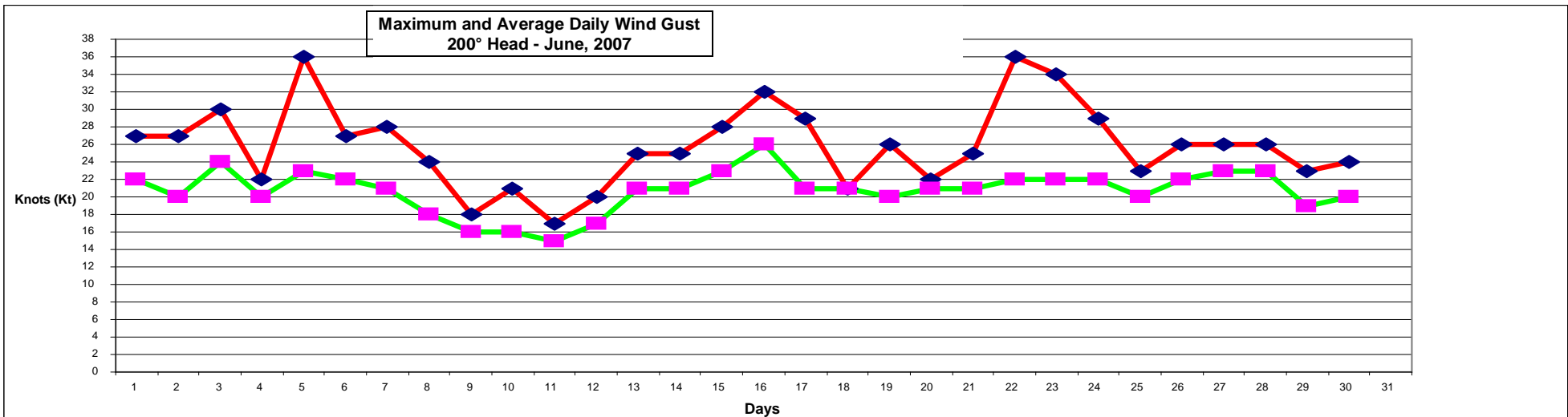
**Graph N° 04<sup>a</sup>** Chart showing Maximum and Average Wind Speeds for the month of May, 2007



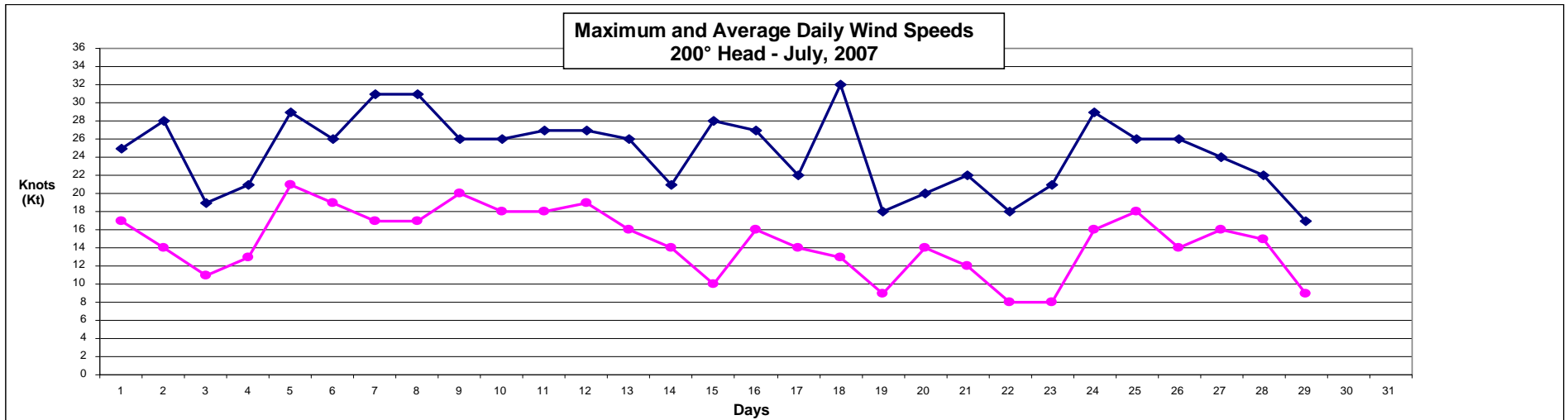
**Graph N° 04<sup>b</sup>** Chart showing Maximum and Average Wind Gusts for the month of May, 2007



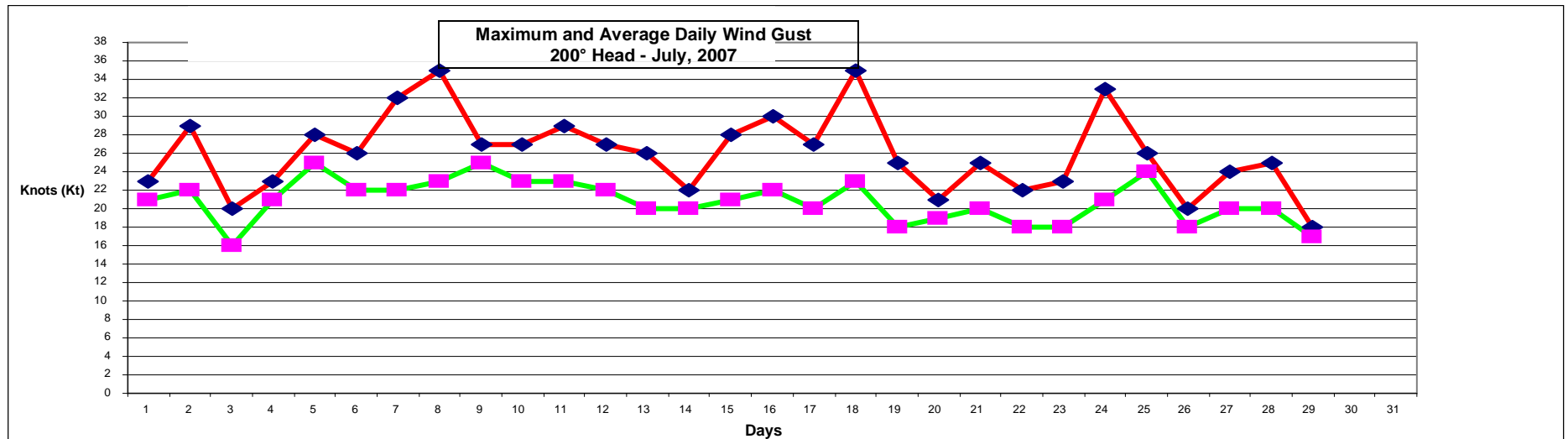
**Graph N° 04c** Chart showing Maximum and Average Wind Speeds for the month of June, 2007



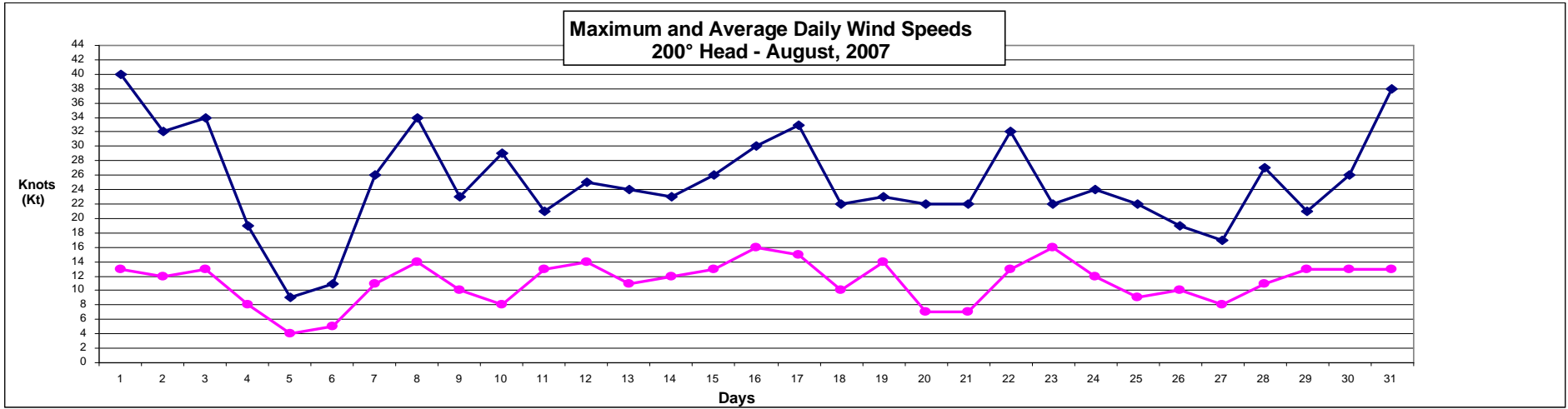
**Graph N° 04d** Chart showing Maximum and Average Wind Gusts for the month of June, 2007



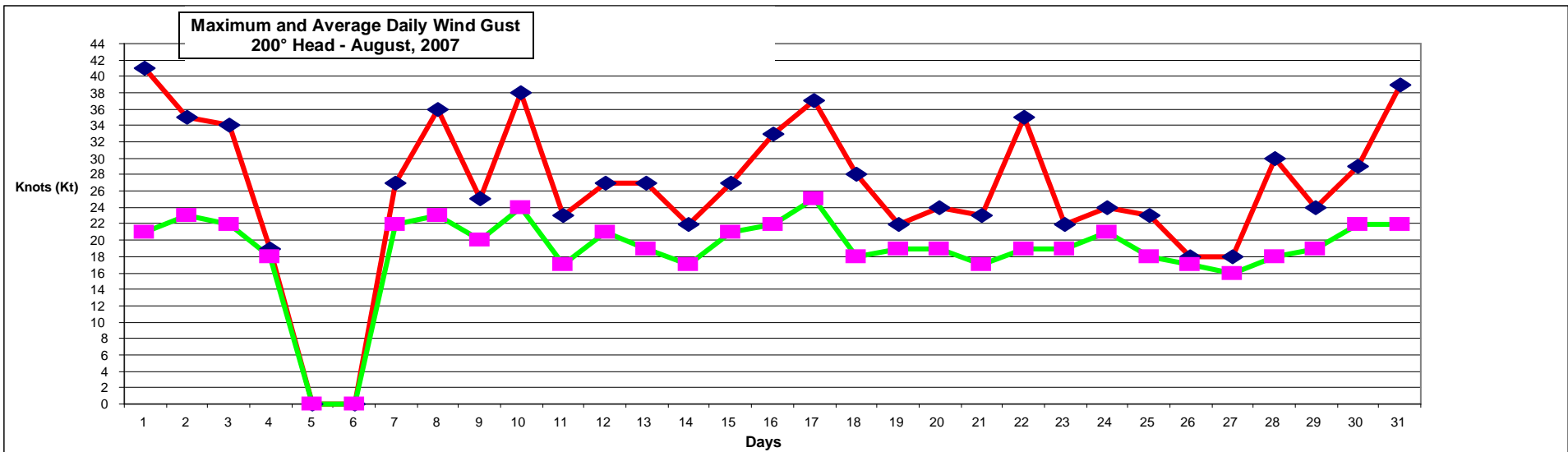
**Graph N° 04e** Chart showing Maximum and Average Wind Speeds for the month of July, 2007



**Graph N° 04f** Chart showing Maximum and Average Wind Gusts for the month of July, 2007



**Graph N° 04g** Chart showing Maximum and Average Wind Speeds for the month of August, 2007



**Graph N° 04h** Chart showing Maximum and Average Wind Gusts for the month of August, 2007

### Presentation of the results for the Central Station at IADC's Office:

Following, presented in Table N° 03, is the information corresponding to the sixteen (16) different wind directions recorded at the Central Station at IADC's office. It is located between the coordinates 13° 09' 97" North latitude and 61° 08' 64" West longitude at 16 meters above sea level and contributed 158,451 pieces of wind data. The following variation in the wind can be noted:

Direction	Radial	Symbol	%
North	350°,360°, 010°	N	2,346467
North/Northeast	020°, 030°	NNE	2,903106
<b>Northeast</b>	<b>040°,050°</b>	<b>NE</b>	<b>7,946936</b>
<b>East/Northeast</b>	<b>060°,070°</b>	<b>ENE</b>	<b>41,77758</b>
<b>East</b>	<b>080°, 090°, 100°</b>	<b>E</b>	<b>34,01872</b>
East/Southeast	110°,120°	ESE	4,985768
Southeast	130° y 140°	SE	2,383071
South/Southeast	150°, 160°	SSE	0,622906
South	170°, 180°, 190°	S	0,83559
South/Southwest	200°, 210°	SSW	0,19312
Southwest	220°, 230°	SW	0,169137
West/Southwest	240°,250°	WSW	0,100346
West	260°, 270°,280°	W	0,132533
West/Northwest	290°,300°	WNW	0,182391
Northwest	310°, 320°	NW	0,386239
North/Northwest	330°, 340°	NNW	1,016087

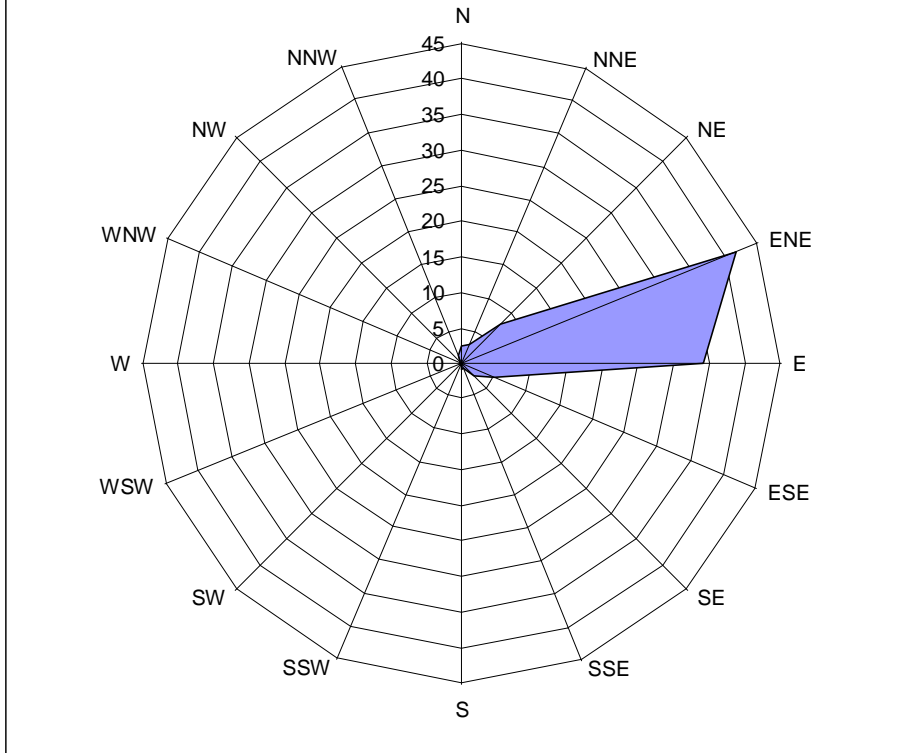
**Table N° 03;** Central Station, IADC, from 11<sup>th</sup> May to 31<sup>st</sup> August, 2007

### Brief Synopsis of the Data:

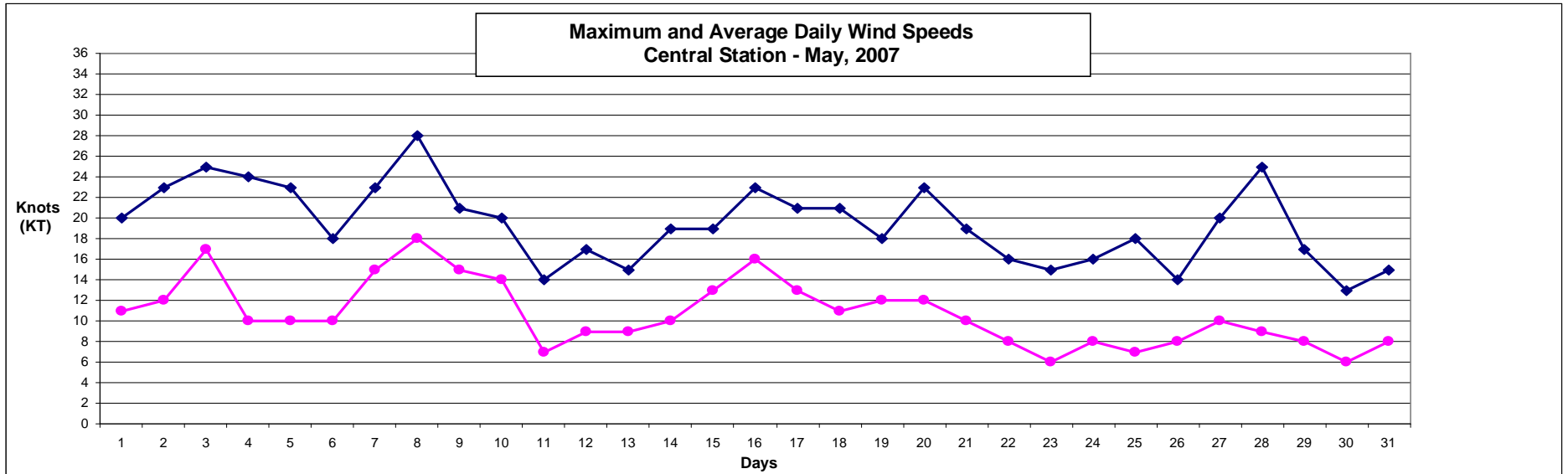
The study and analysis of the wind at the Central Station close to IADC's office, corresponds to a total of 158,451 pieces of wind data, product of one hundred and thirteen (113) days of observations. The results obtained are presented in Table N° 03. The three most outstanding wind directions are presented in bold letters. The East/Northeast component (**ENE**) leads with of 41.78%, followed by the flow from the East (**E**) with 34.02% and the Northeast flow (**NE**) with 7.95%. Summing these three wind directions we get 83.75%. On the other hand, the remaining thirteen (13) radials of the wind rose share the remaining 16.25% distributed between 0.10% and 4.99%, that which doesn't modify the dominant tendency of the flow from the East/Northeast direction, as can be seen in Graph N° 05.

The wind intensity in the period evaluated maintained an absolute maximum of 37 Kts and an average of 10.6 Kts. The following are a series of Graphs representing the maximum and average wind intensities at the central station, namely, Graphs N° 06a, 6b, 6c, 6d, 6e, 6f, 6g and 6h. However, it is important to highlight that the maximum wind gust experienced was 41 Kts, influenced by the successive passing of tropical disturbances over the Lesser Antilles.

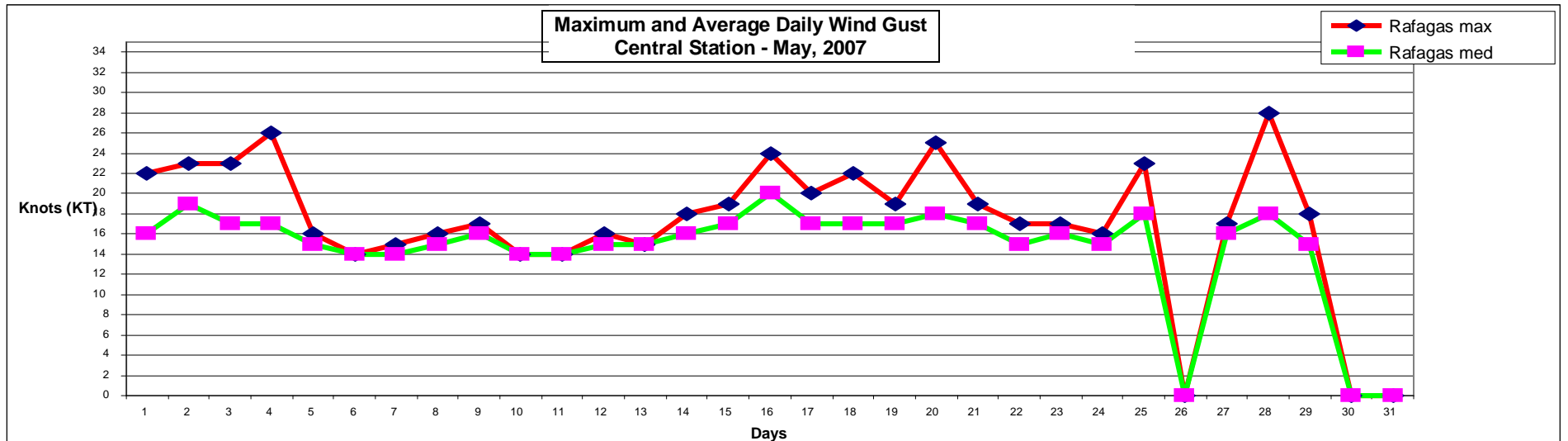
**FREQUENCY (%) WIND ROSE  
LOCATION ARGYLE AT CENTRAL STATION  
11<sup>th</sup> MAY TO 31<sup>st</sup> AUGUST 07, 2007**



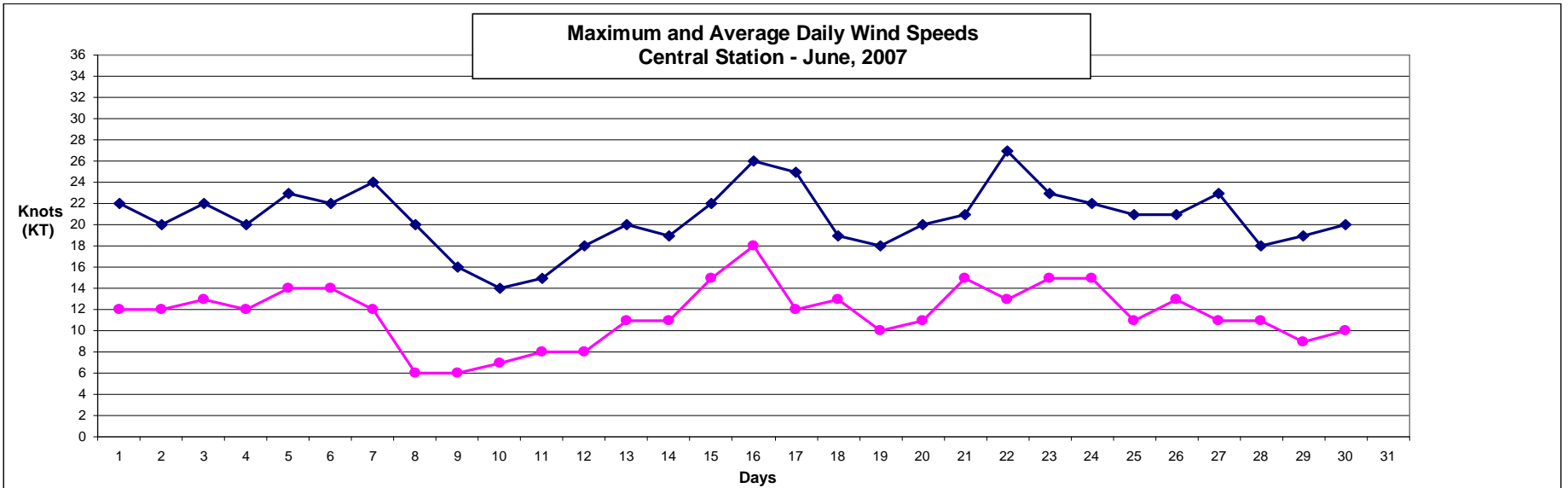
**Graph N° 05** Wind Rose  
Central Station at IADC's Office from the 11<sup>th</sup> May to 31<sup>st</sup> August, 2007



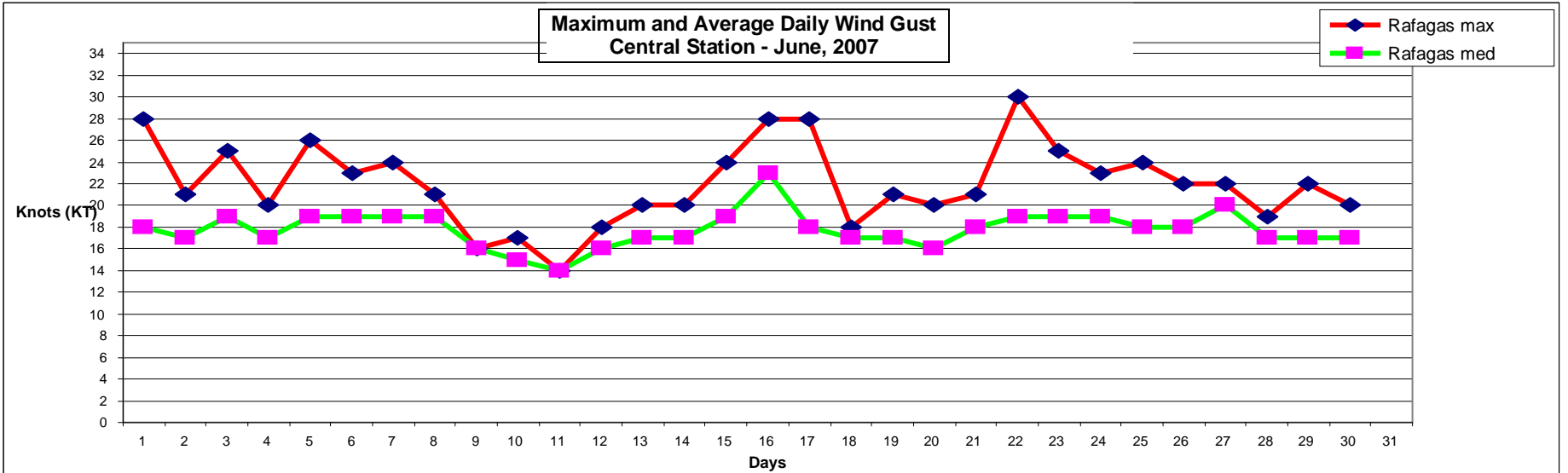
**Graph N° 06<sup>a</sup>** Chart showing Maximum and Average Wind Speeds for the month of May, 2007



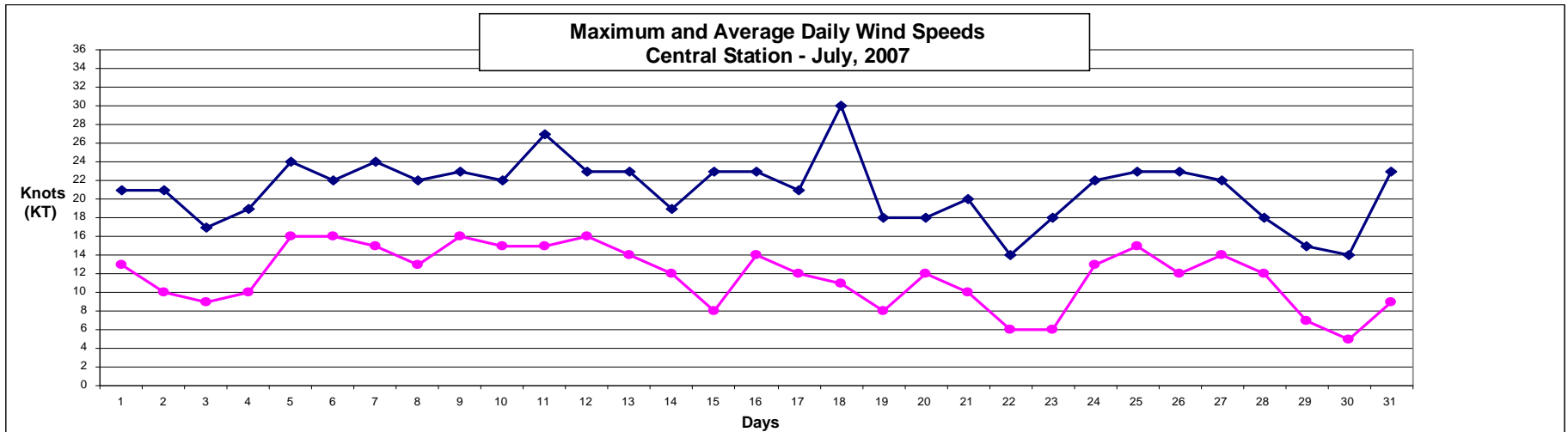
**Graph N° 06<sup>b</sup>** Chart showing Maximum and Average Wind Gusts for the month of May



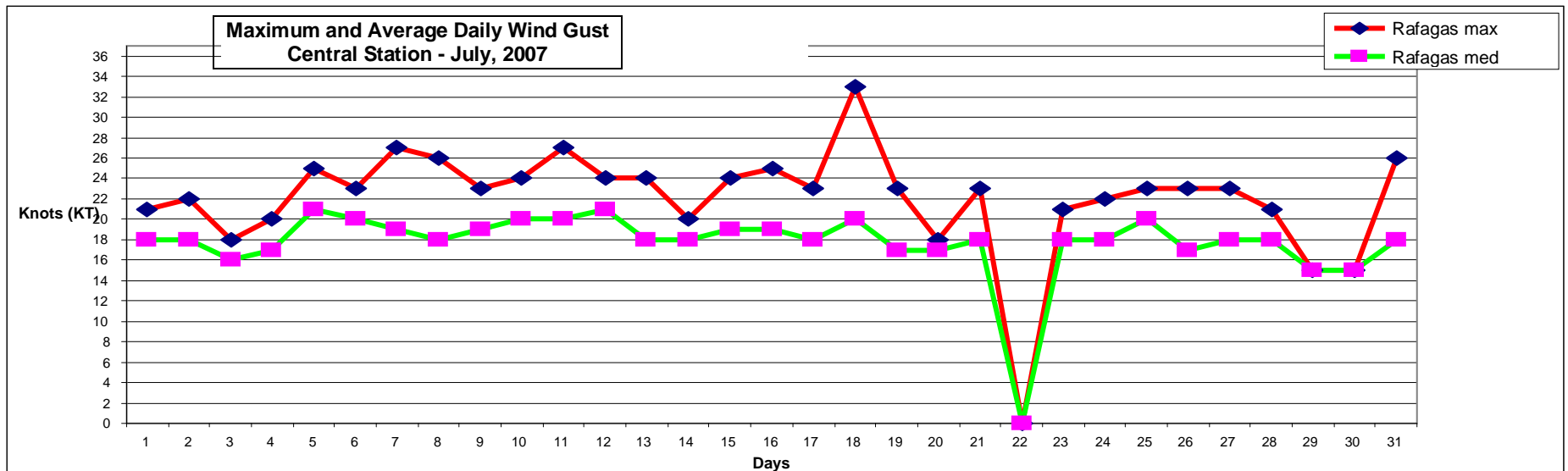
**Graph N° 06c** Chart showing Maximum and Average Wind Speeds for the month of June, 2007



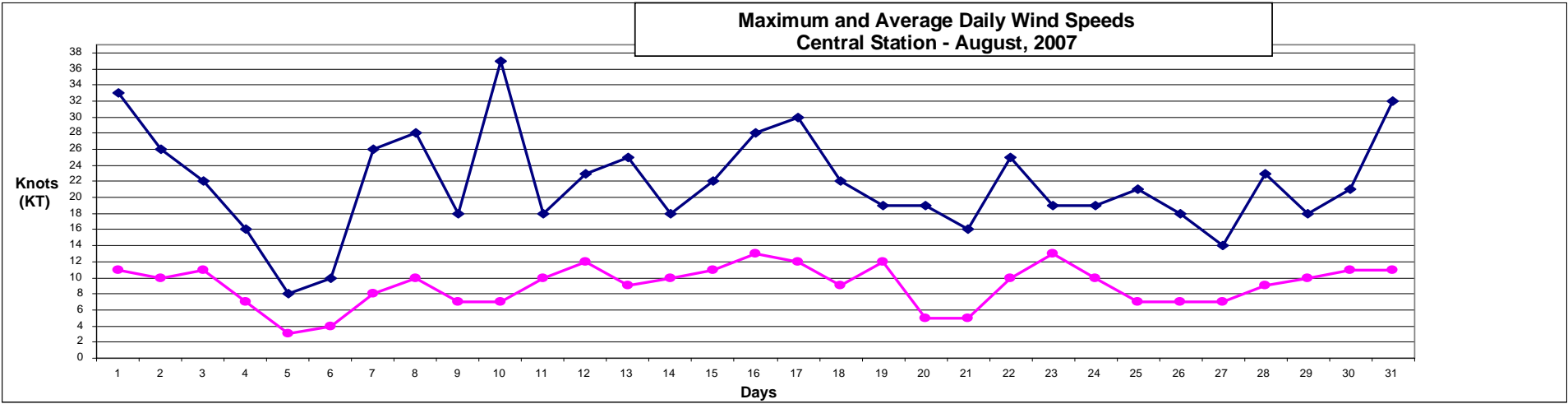
**Graph N° 06d** Chart showing Maximum and Average Wind Gusts for the month of June



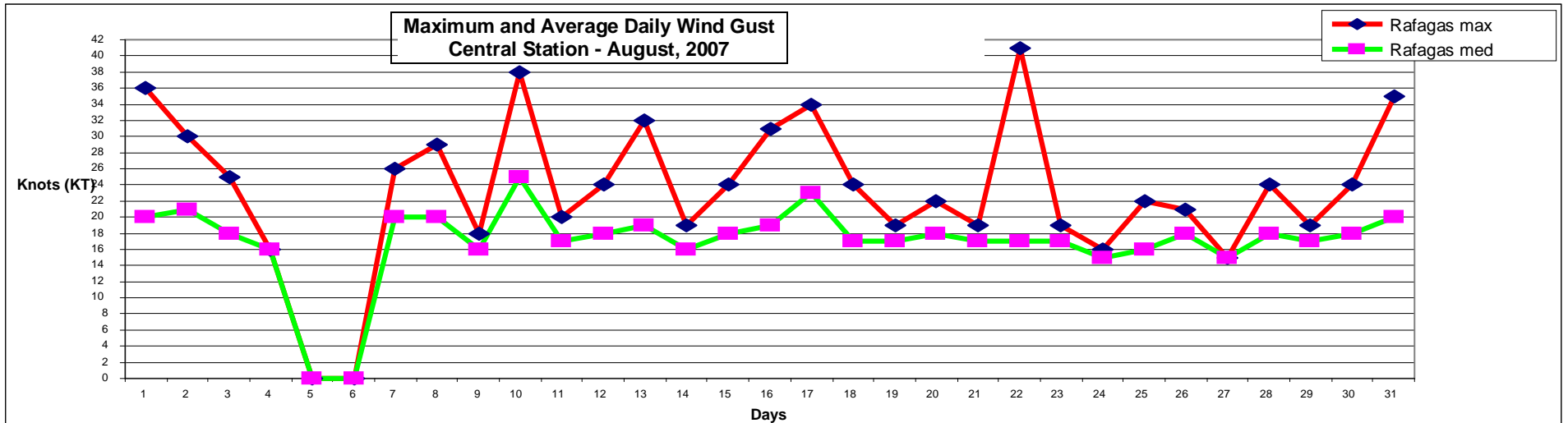
**Graph N° 06e** Chart showing Maximum and Average Wind Speeds for the month of July, 2007



**Graph N° 06f** Chart showing Maximum and Average Wind Gusts for the month of July



**Graph N° 06g** Chart showing Maximum and Average Wind Speeds for the month of August, 2007



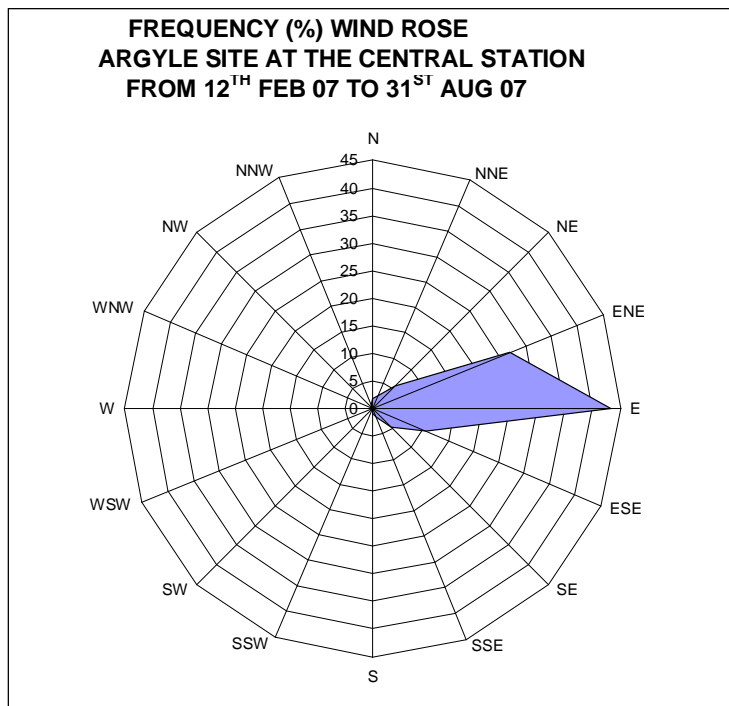
**Graph N° 06h** Chart showing Maximum and Average Wind Gusts for the month of August

## Wind Intensity Frequency Chart taken from the 1st of May to the 31 of August, 2007 at the Central Station at IADC's Office.

The present frequency table corresponds to the evaluation of 2,877 hourly data of the wind intensity and classified in intensities expressed in knots (Kts) from the 1<sup>st</sup> of May to 31<sup>st</sup> of August with the purpose of knowing the magnitude of incidences of the wind speed corresponding to the 16 directions of the wind rose.

The wind intensity in a general evaluation, maintains a range of incidence from the 0.5 kts to the 27 kts with a percentage of 99.97%. Nevertheless, the Northeast (**NE**), East/Northeast (**ENE**) and the East (**E**) directions maintain an accumulation of wind speeds from the 2.8 Kts to 21.6 Kts, which corresponds to 2,348 data and representing a percentage of 81.61% of the study population. It is possible to define, according to this frequency chart, that the most consequent intensities come from the east component, covering the scales from 5.5 Kts to 16.6 Kts. This info was accumulated in one hundred thirteen (113) days and amounts to 1,228 data with a percentage of 42.68%, as can you can see in Chart N° 05.

Following is the Graph of the wind rose of the Central Station from the 12<sup>th</sup> of February to the 31<sup>st</sup> of August 2007 with the purpose of visualizing the wind component corresponding to two hundred (201) days of digital observation, as is shown in Graph N° 07, and its percentages in table N° 04, where you can see the three (03) significant directions in colors. The component from the East (**E**) presents a 43.23%, second in predominance is the wind of the East/Northeast (**ENE**) with 26.98% and third is the wind flow from the East/Southeast (**ESE**) with 10.57%. The remaining thirteen (13) directions of the wind rose range from a percentage of 5.82% to 0.08% without any variation in terms of the percentage data registered.



**Graph N° 07** Wind Rose  
Central Station IADC from 12<sup>th</sup> Feb 2007 to 31<sup>st</sup> Aug 2007

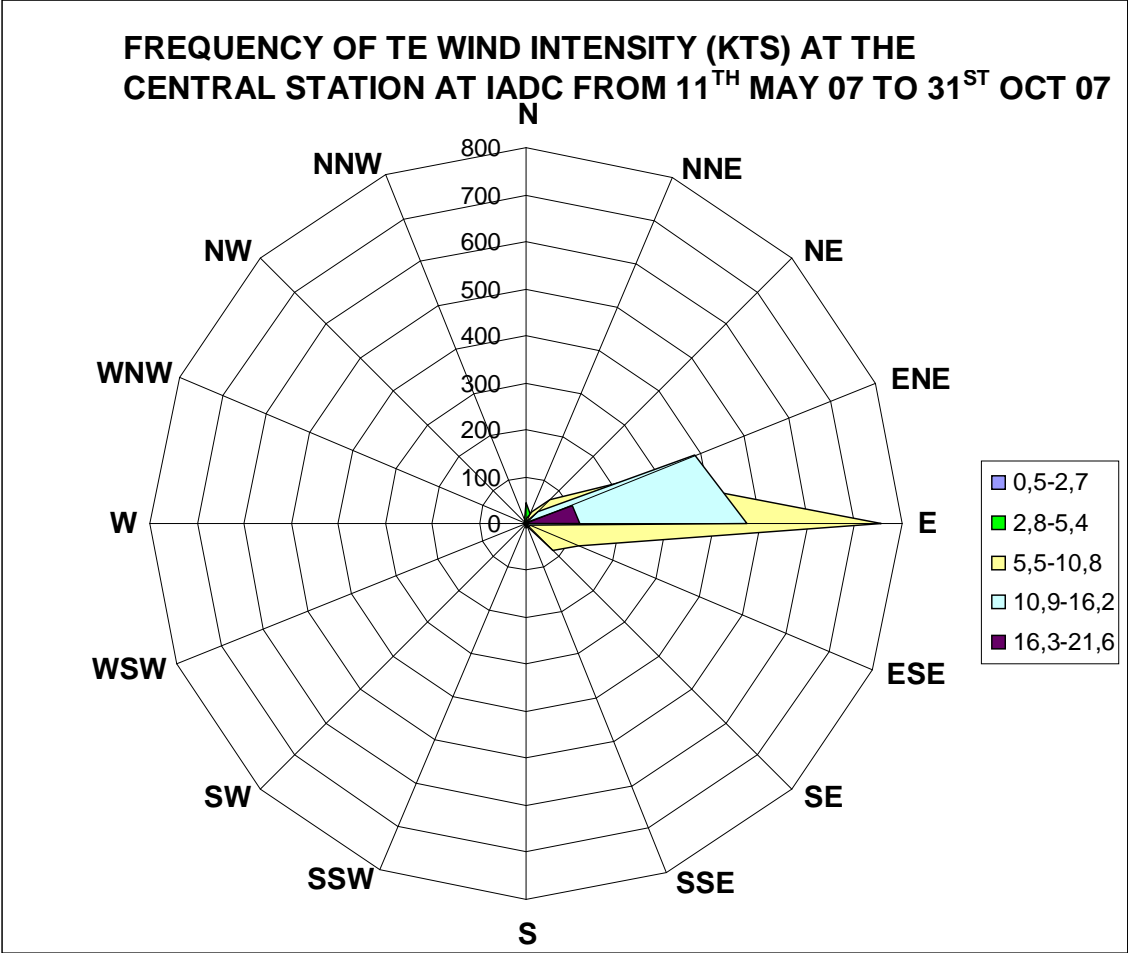
<b>Direction</b>	<b>Radial</b>	<b>Symbol</b>	<b>%</b>
North	350°,360°, 010°	N	1,806424
North/Northeast	020°, 030°	NNE	2,429195
Northeast	040°,050°	NE	5,825075
<b>East/Northeast</b>	<b>060°,070°</b>	<b>ENE</b>	<b>26,98242</b>
<b>East</b>	<b>080°, 090°, 100°</b>	<b>E</b>	<b>43,2311</b>
<b>East/Southeast</b>	<b>110°,120°</b>	<b>ESE</b>	<b>10,57094</b>
Southeast	130° y 140°	SE	4,842918
South/Southeast	150°, 160°	SSE	1,841589
South	170°, 180°, 190°	S	0,946289
South/Southwest	200°, 210°	SSW	0,164572
Southwest	220°, 230°	SW	0,125539
West/Southwest	240°,250°	WSW	0,079473
West	260°, 270°,280°	W	0,114989
West/Northwest	290°,300°	WNW	0,13222
Northwest	310°, 320°	NW	0,253891
North/Northwest	330°, 340°	NNW	0,653365

**Table N° 04:** Central Station IADC from 12<sup>th</sup> Feb 07 to 31<sup>st</sup> Aug 07

CHART OF THE WIND FREQUENCY OF THE CENTRAL STATION AT IADC 11<sup>TH</sup> MAY TO 31<sup>ST</sup> OCT, 2007

		WIND INTENSITY IN KTS (KNOTS)										
		0,5-2,7	2,8-5,4	5,5-10,8	10,9-16,2	16,3-21,6	21,2-27,0	27,1-32,4	32,5-37,8	>37,9	SUMA	TOTAL %
<b>Calm</b>												
<b>N</b>		16	44	9							69	2,398332
<b>NNE</b>		3	22	28	3	1					57	1,98123
<b>NE</b>		3	29	73	37	4					146	5,074731
<b>ENE</b>		3	24	262	388	105	2				784	27,25061
<b>E</b>		6	83	757	471	115	4		1		1437	49,94786
<b>ESE</b>		2	45	122	10						179	6,221759
<b>SE</b>		1	27	80	9	2					119	4,136253
<b>SSE</b>			5	6	2						13	0,45186
<b>S</b>		2	7	11	5	1					26	0,903719
<b>SSW</b>		1	1		1	2					5	0,173792
<b>SW</b>		2	3		2						7	0,243309
<b>WSW</b>		2		1	1						4	0,139034
<b>W</b>		1	1								2	0,069517
<b>WNW</b>		1	1								2	0,069517
<b>NW</b>		1	6	1							8	0,278067
<b>NNW</b>		7	11	1							19	0,66041
<b>SUMA</b>		51	309	1351	929	230	6			1	2877	100

**FREQUENCY OF TE WIND INTENSITY (KTS) AT THE CENTRAL STATION AT IADC FROM 11<sup>TH</sup> MAY 07 TO 31<sup>ST</sup> OCT 07**



**Graph** Wind Intensity at the Central Station IADC from the 1<sup>st</sup> May 07 to the 31<sup>st</sup> Oct 07

MT1. (AV) Diógenes Enrique Carrillo Tirado  
Specialist in Aeronautical Meteorology

MSc. Leonardo Pérez Pérez  
Coordinator of the Commission  
Argyle International Airport