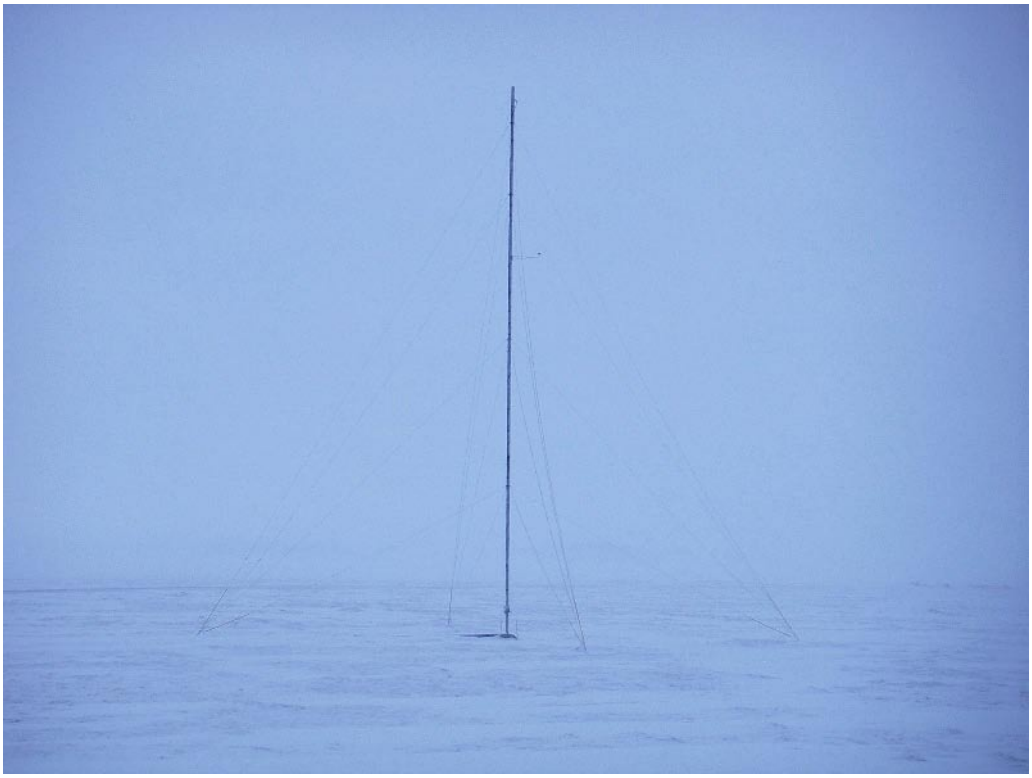
# Kaktovik Wind Resource Report

*Report by: Douglas Vaught, P.E., V3 Energy LLC, Eagle River, Alaska*
*Date of Report: August 26, 2010*



Kaktovik met tower; D. Vaught photo

## Contents

## Summary Information

With reference to two nearby Automated Weather Observing System (AWOS) sources (Barter Island Airport and Barter Island DEW), the wind resource in Kaktovik is outstanding (Class 5 to 6), but verification with the met tower was fraught with difficulty, namely a lost data card, significant data loss due to icing, and loss of both 30 meter level anemometers in early January due to ice and wind damage that were not replaced until early March. Given the anemometer problems, met tower data as collected is not useful for calculating mean wind speed, but inserting synthesized data to the data set yields a wind resource prediction in-line with the AWOS data sources. Other parameters, including turbulence, wind shear, and directionality of winds, indicate a desirable wind resource for wind power development.

### *Met tower data synopsis*

| | |
|---|---|
| Data dates | June 26, 2009 to July 19, 2010 (13 months) |
| Wind power class | Presumed 5 (excellent) (from AWOS and synthesized data) |
| Power density mean, 30 m | 479 W/m$^2$ (synthesized data) |
| Wind speed mean, 30 m | 6.49 m/s (synthesized data) |
| Max 10-min wind speed average | 29.3 m/s |
| Maximum wind gust | 35.2 m/s (Feb 2010) |
| Weibull distribution | k = 1.82, c = 7.18 m/s (measured data) |
| Roughness class | 0.68 (lawn grass) |
| IEC 61400-1, 3$^{rd}$ ed. classification | Class III-c (lowest defined and most common) |
| Turbulence intensity, mean | 0.076 (at 15 m/s) |
| Calm wind frequency | 24% (<3.5 m/s) |

### *Community profile*

| | |
|---|---|
| Current Population: | 286 (2009 DCCED Certified Population) |
| Incorporation Type: | 2nd Class City |
| Borough Located In: | North Slope Borough |
| Taxes: | Sales: None, Property: 18.5 mills (Borough), Special: None |
| Coastal Management District: | North Slope Borough |

## Test Site Location

Met tower was located 650 meters (2100 ft) south of the village boundary near the village sewage treatment plant. This site is not considered ideal for wind power development as a more likely site is immediately west of the powerplant on the west-central edge of the village. But, the flat and

featureless topography of Kaktovik ensures the met tower data is useable anywhere in the village environs.

## *Site information*

| | |
|---|---|
| Site number | 0224 |
| Latitude/longitude | N 70° 07.065’ W 143° 36.342’, WGS 84 |
| Site elevation | 2 meters |
| Datalogger type | NRG Symphonie, 10 minute time step |
| Tower type | NRG 34-meter tall tower, 152 mm diameter, erected to 30 m |
| Anchor type | 1.5 m screw-in |

## *Google Earth image*


## *Tower Sensor Information*

| Channel | Sensor type | Height | Multiplier | Offset | Orientation |
|---|---|---|---|---|---|
| 1 | NRG #40 anemometer | 30 m (A) | 0.760 | 0.43 | 181° T |
| 2 | NRG #40 anemometer | 30 m (B) | 0.754 | 0.43 | 271° T |
| 3 | NRG #40 anemometer | 20 m | 0.758 | 0.38 | 272° T |
| 7 | NRG #200P wind vane | 29 m | 0.351 | 357 | 357° T |
| 9 | NRG #110S Temp C | 3 m | 0.136 | -86.383 | N |
| 10 | RH-5 relative humidity | 2 m | 0.098 | 0 | S |
| 12 | Voltmeter | 2 m | 0.021 | 0 | n/a |

## Photographs

Missing 30 m anemometers, Feb 2010; D. Vaught photo

Alternate wind site behind powerplant; D. Vaught photo

## Data recovery

Data recovery to date in Kaktovik was poor, with only 62 to 71 percent data return from the anemometers and wind vane with all of the missing data representing the winter months. This was due to several problems. First was loss of a data card and hence all data from Oct. 2 to Nov. 13. Then, beginning in early December, a number of apparent icing events rendered the anemometers and wind vane inoperable for much of the month. In early January, the two 30 meter level (channels 1 and 2) anemometers broke off the tower, apparently as a result of icing loads and high winds, and were not replaced until March 3. Throughout winter and spring, frequent and severe icing events resulted in significant data loss to the anemometers and wind vane. Note also much data loss from the relative humidity sensor occurred as well. The RH sensor lost function due to loss of battery power with loss of daylight (for recharge via the PV panels) and for unknown reasons, sensor function did not return with return of sunlight in spring.

### *Data recovery summary table*

| Label | Units | Height | Possible Records | Valid Records | Recovery Rate (%) |
|---|---|---|---|---|---|
| Speed 30 A | m/s | 30 m | 55,878 | 35,600 | 63.7 |
| Speed 30 B | m/s | 30 m | 55,878 | 34,822 | 62.3 |
| Speed 20 | m/s | 20 m | 55,878 | 39,748 | 71.1 |
| Direction 29 | ° | 29 m | 55,878 | 36,612 | 65.5 |
| Temperature | °C | | 55,878 | 48,823 | 87.4 |
| RH-5 Humidity %RH | %RH | | 55,878 | 14,196 | 25.4 |
| iPack Voltmeter | volts | | 55,878 | 49,800 | 89.1 |

### *Anemometer data recovery*

| Year | Month | Possible Records | 30 m A Valid Records | 30 m A Recovery Rate (%) | 30 m B Valid Records | 30 m B Recovery Rate (%) | 20 m Valid Records | 20 m Recovery Rate (%) |
|---|---|---|---|---|---|---|---|---|
| 2009 | Jun | 720 | 720 | 100.0 | 720 | 100.0 | 720 | 100.0 |
| 2009 | Jul | 4,464 | 4,464 | 100.0 | 4,464 | 100.0 | 4,464 | 100.0 |
| 2009 | Aug | 4,464 | 4,464 | 100.0 | 4,464 | 100.0 | 4,464 | 100.0 |
| 2009 | Sep | 4,320 | 4,197 | 97.2 | 4,320 | 100.0 | 4,320 | 100.0 |
| 2009 | Oct | 4,464 | 228 | 5.1 | 228 | 5.1 | 228 | 5.1 |
| 2009 | Nov | 4,320 | 1,748 | 40.5 | 1,750 | 40.5 | 1,751 | 40.5 |
| 2009 | Dec | 4,464 | 1,033 | 23.1 | 750 | 16.8 | 750 | 16.8 |
| 2010 | Jan | 4,464 | 42 | 0.9 | 0 | 0.0 | 408 | 9.1 |
| 2010 | Feb | 4,032 | 0 | 0.0 | 0 | 0.0 | 3,971 | 98.5 |
| 2010 | Mar | 4,464 | 3,966 | 88.8 | 3,794 | 85.0 | 3,972 | 89.0 |
| 2010 | Apr | 4,320 | 3,602 | 83.4 | 3,213 | 74.4 | 3,483 | 80.6 |
| 2010 | May | 4,464 | 4,336 | 97.1 | 4,319 | 96.8 | 4,357 | 97.6 |
| 2010 | Jun | 4,320 | 4,202 | 97.3 | 4,202 | 97.3 | 4,262 | 98.7 |
| 2010 | Jul | 2,598 | 2,598 | 100.0 | 2,598 | 100.0 | 2,598 | 100.0 |
| All data | | 55,878 | 35,600 | 63.7 | 34,822 | 62.3 | 39,748 | 71.1 |

## Wind Speed

Wind data collected from the met tower, from the perspective of both mean wind speed and mean power density, indicates an excellent wind resource when sufficiently manipulated. The extremely cold arctic temperatures of Kaktovik contributed to the high wind power density. It is problematic, however, analyzing wind data with significant concentrated data loss, such as occurred in Kaktovik with the missing data card, broken 30 meter anemometers, and many icing events. To correct this problem, synthetic data was inserted in the data gaps to create a more realistic wind speed data profile. To be sure, long segments of synthetic data introduce uncertainty to the data set, but missing data does as well. To overcome this uncertainty, improved data collection with heated sensors would be necessary. But, considering the wind data collected and noting that two long-term airport AWOS data sources confirm a robust wind resource in Kaktovik, continuing a wind study with heated sensors is not absolutely necessary.

### *Anemometer data summary*

| Variable | Original data set Speed 30 A | Original data set Speed 30 B | Original data set Speed 20 | Synthesized data set Speed 30 A | Synthesized data set Speed 30 B | Synthesized data set Speed 20 |
|---|---|---|---|---|---|---|
| Measurement height (m) | 30 | 30 | 20 | 30 | 30 | 20 |
| MMM wind speed (m/s) | 6.59 | 5.95 | 6.59 | 6.49 | 6.39 | 6.14 |
| Max 10-min avg wind speed (m/s) | 26.4 | 26.2 | 29.3 | 30.7 | 30.7 | 29.3 |
| Max gust wind speed (m/s) | 32.7 | 30.2 | 35.2 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Weibull k | 1.82 | 1.82 | 1.68 | 1.63 | 1.63 | 1.62 |
| Weibull c (m/s) | 7.18 | 6.97 | 6.94 | 7.26 | 7.14 | 6.87 |
| MMM power density (W/m²) | 478 | 382 | 641 | 479 | 459 | 409 |
| MMM energy content (kWh/m²/yr) | 4,184 | 3,350 | 5,613 | 4,199 | 4,025 | 3,586 |
| Energy pattern factor | 2.16 | 2.15 | 2.49 | 2.55 | 2.57 | 2.58 |
| Frequency of calms (%) | 24.7 | 25.8 | 27.4 | 27.3 | 27.8 | 29.8 |
| 1-hr autocorrelation coefficient | 0.952 | 0.950 | 0.958 | 0.957 | 0.956 | 0.957 |
| Diurnal pattern strength | 0.012 | 0.013 | 0.006 | 0.027 | 0.028 | 0.030 |
| Hour of peak wind speed | 23 | 21 | 1 | 4 | 5 | 4 |

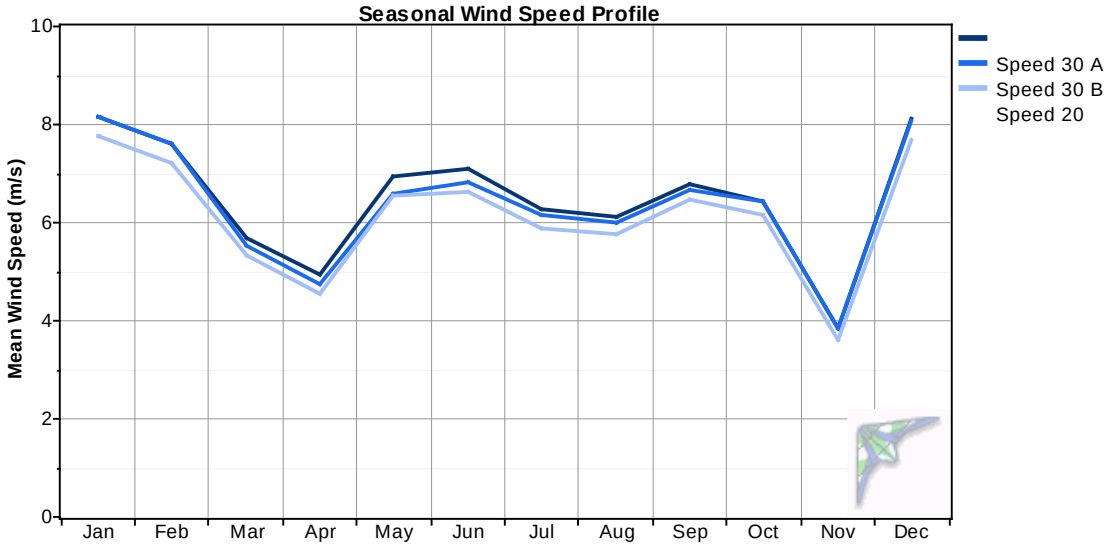
## Time Series

Time series calculations indicate high wind speed averages throughout the year, even during the summer months. Because the 30 meter anemometers were inoperable (broken off the met tower) for an extended period of time, the data summary graph below is presented with 20 meter anemometer data which is more complete in original form.

### *20 m data summary*

| | | Original data | | | Synthesized data | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Month | Mean (m/s) | Max 10-min (m/s) | Max gust (m/s) | Mean (m/s) | Std. Dev. (m/s) | Weibull k | Weibull c (m/s) |
| 2009 | Jun | 5.73 | 11.7 | 14.0 | 5.73 | 2.20 | 2.87 | 6.45 |
| 2009 | Jul | 6.26 | 12.7 | 14.8 | 6.26 | 2.77 | 2.42 | 7.05 |
| 2009 | Aug | 5.78 | 14.7 | 18.6 | 5.78 | 2.63 | 2.33 | 6.51 |
| 2009 | Sep | 6.47 | 18.0 | 22.4 | 6.47 | 3.90 | 1.74 | 7.28 |
| 2009 | Oct | 2.68 | 7.4 | 8.3 | 6.14 | 3.65 | 1.72 | 6.88 |
| 2009 | Nov | 4.66 | 14.9 | 17.1 | 3.63 | 2.69 | 1.44 | 4.02 |
| 2009 | Dec | 8.07 | 24.8 | 29.5 | 7.68 | 5.11 | 1.57 | 8.58 |
| 2010 | Jan | 14.58 | 24.7 | 28.8 | 7.77 | 4.99 | 1.62 | 8.69 |
| 2010 | Feb | 7.29 | 29.3 | 35.2 | 7.23 | 5.33 | 1.41 | 7.96 |
| 2010 | Mar | 5.42 | 16.7 | 18.9 | 5.32 | 2.87 | 1.91 | 5.99 |
| 2010 | Apr | 4.80 | 17.1 | 20.1 | 4.54 | 2.82 | 1.71 | 5.11 |
| 2010 | May | 6.68 | 19.1 | 22.7 | 6.56 | 3.93 | 1.70 | 7.36 |
| 2010 | Jun | 6.85 | 19.5 | 23.5 | 6.79 | 4.13 | 1.72 | 7.64 |
| 2010 | Jul | 5.24 | 13.6 | 17.4 | 5.24 | 2.63 | 2.10 | 5.91 |
| MMM annual | | 6.59 | 29.3 | 35.2 | 6.13 | 3.95 | 1.62 | 6.86 |

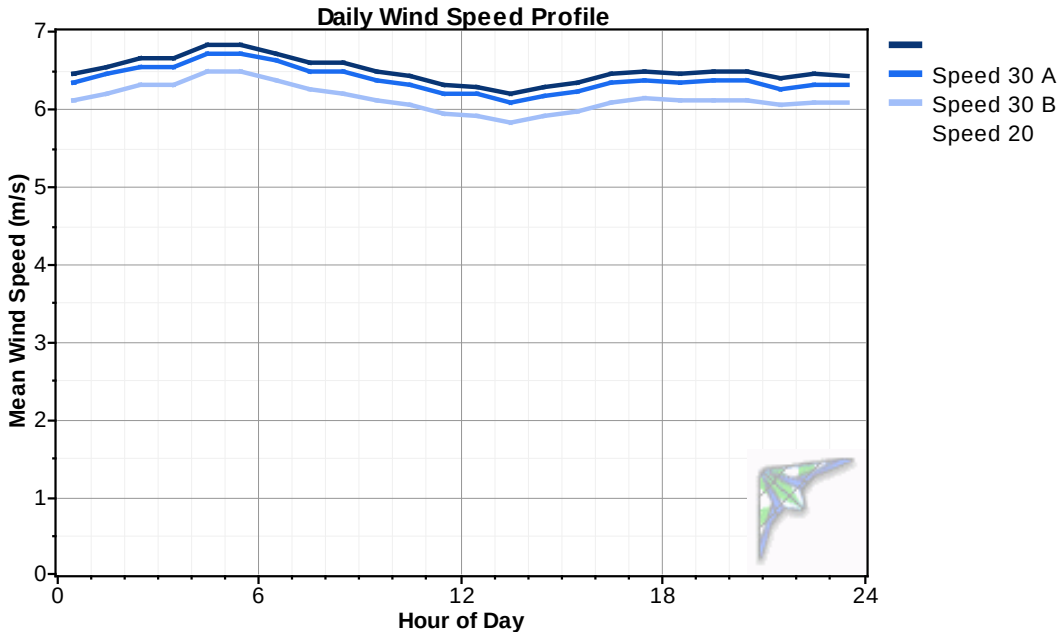
### *Time series graph, synthesized data*



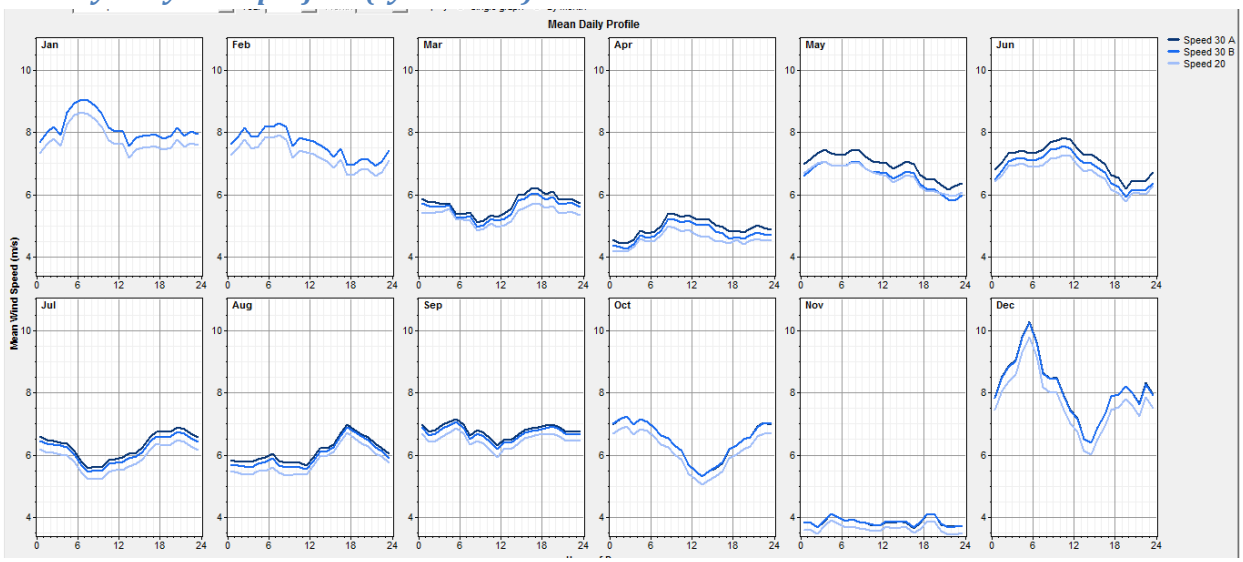

## Daily Wind Profile

The daily wind profile indicates a minor variation of wind speeds throughout the day, with lowest wind speeds during the morning hours and highest wind speeds during late afternoon and early evening hours. This perspective changes somewhat when considering monthly views of daily profiles as more variation is observed.

### *Annual daily wind profile (synth. data)*

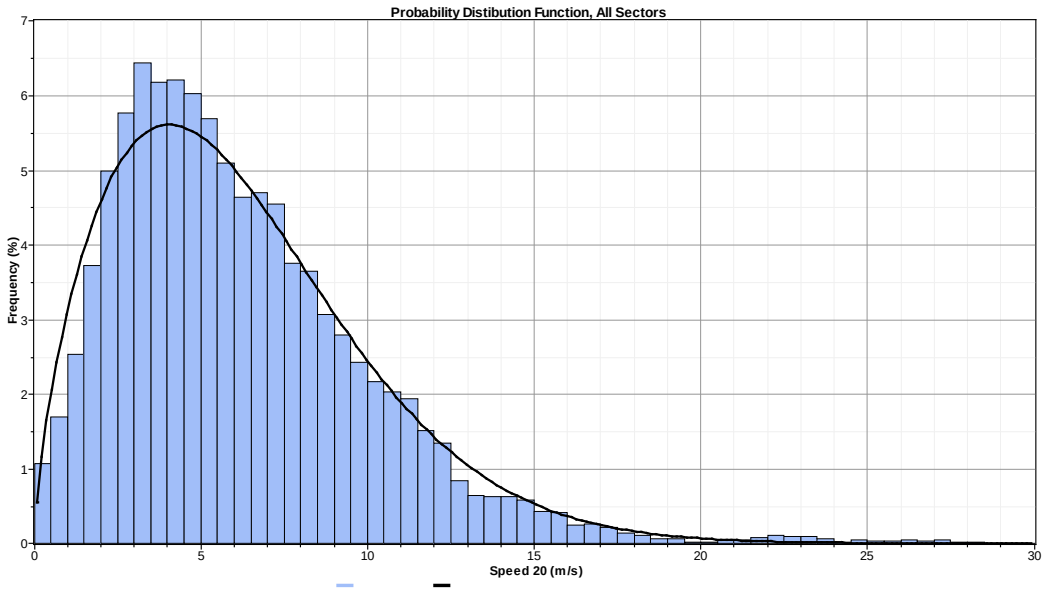


### *Monthly daily wind profiles (synth. data)*




## Probability Distribution Function

The probability distribution function (or histogram) of wind speed is a useful statistical tool to describe a site with "normal" a wind range of wind speeds (normal is defined as the Raleigh distribution with a Weibull k of 2.0). Given the data recovery problems in Kaktovik the probability distribution function should be considered suspect in accuracy, both with original data and with synthesized data.

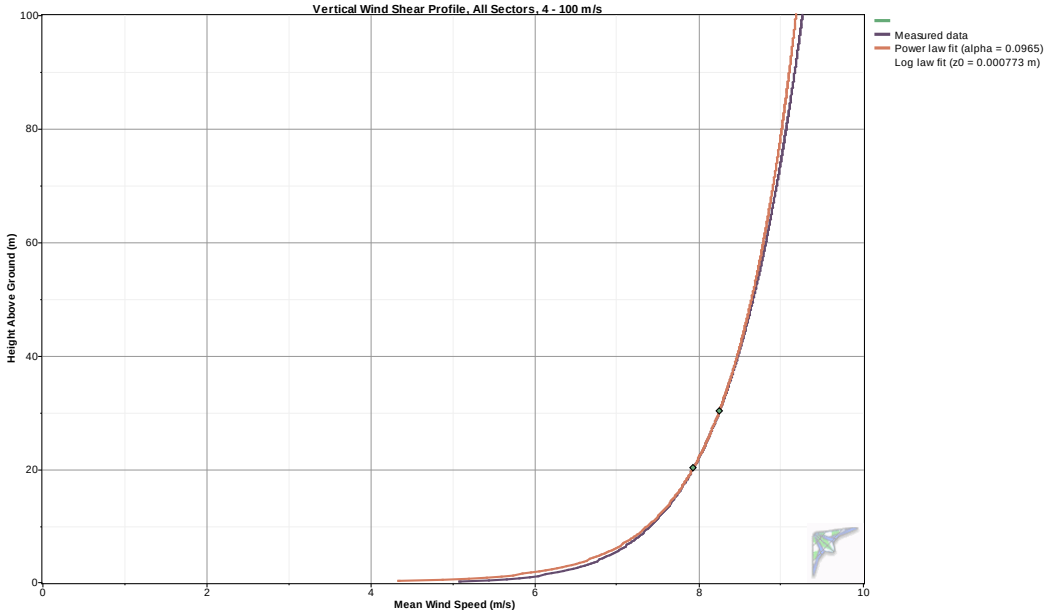



## Wind Shear and Roughness

A wind shear power law exponent of 0.097 indicates very low wind shear at the site; hence turbine construction at a low hub height is possibly a desirable option, although note again that data recovery problems impact the accuracy of this calculation. Related to wind shear, a calculated surface roughness

of 0.0059 meters (indicating the height above ground level where wind velocity would be zero) indicates very smooth terrain (roughness description: lawn grass) surrounding the met tower, especially toward the primary wind direction of northeast, location of a large lagoon (with a frozen surface most of the year).

### *Vertical wind shear profile (synth. data), wind speed > 4 m/s*




### *Wind shear by direction sector table (synth. data), wind speed > 4 m/s*

| Direction Sector | Time Steps | Mean Wind Speed (m/s) Speed 30 B | Speed 20 | Best-Fit Power Law Exp | Surface Roughness (m) |
|---|---|---|---|---|---|
| 348.75° - 11.25° | 557 | 7.53 | 7.11 | 0.142 | 0.0212 |
| 11.25° - 33.75° | 1,324 | 6.38 | 6.03 | 0.141 | 0.0199 |
| 33.75° - 56.25° | 8,212 | 7.91 | 7.71 | 0.063 | 0.0000 |
| 56.25° - 78.75° | 7,959 | 9.02 | 8.91 | 0.030 | 0.0000 |
| 78.75° - 101.25° | 1,619 | 8.33 | 7.94 | 0.116 | 0.0045 |
| 101.25° - 123.75° | 1,065 | 9.11 | 8.70 | 0.114 | 0.0038 |
| 123.75° - 146.25° | 849 | 8.43 | 8.03 | 0.122 | 0.0065 |
| 146.25° - 168.75° | 492 | 9.02 | 8.60 | 0.118 | 0.0051 |
| 168.75° - 191.25° | 543 | 7.77 | 7.32 | 0.149 | 0.0298 |
| 191.25° - 213.75° | 857 | 7.05 | 6.61 | 0.159 | 0.0456 |
| 213.75° - 236.25° | 3,310 | 8.64 | 8.13 | 0.149 | 0.0296 |
| 236.25° - 258.75° | 4,683 | 9.06 | 8.58 | 0.133 | 0.0134 |
| 258.75° - 281.25° | 2,287 | 8.27 | 7.88 | 0.119 | 0.0055 |
| 281.25° - 303.75° | 1,584 | 8.37 | 7.97 | 0.120 | 0.0057 |
| 303.75° - 326.25° | 634 | 8.22 | 7.86 | 0.112 | 0.0031 |
| 326.25° - 348.75° | 517 | 7.38 | 7.08 | 0.103 | 0.0015 |

## Extreme Winds

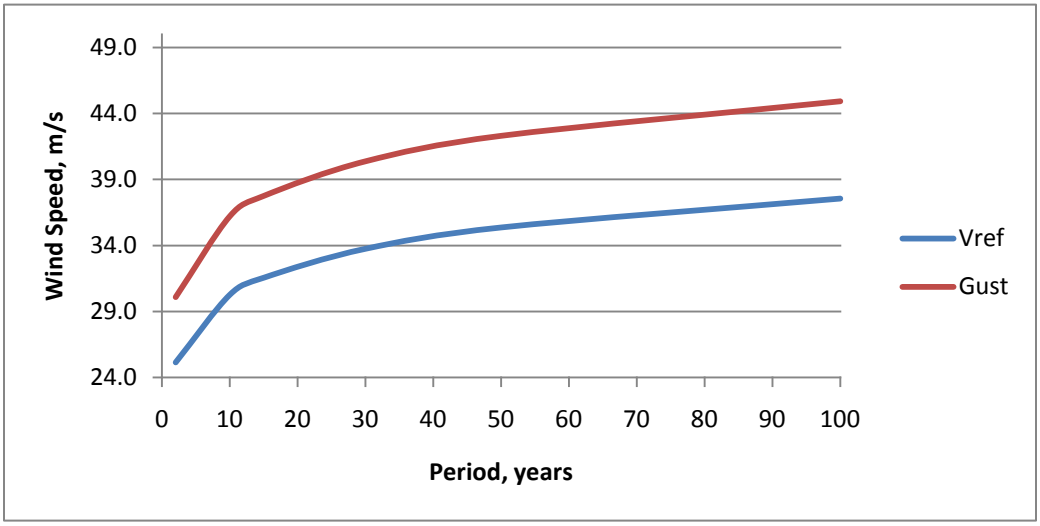
Although thirteen months of data is minimal for calculation of extreme wind probability, use of a modified Gumbel distribution analysis, based on monthly maximum winds vice annual maximum winds, yields reasonably good results. Caution should be exercised though in that one month of data – October 2009 – had to be removed due to the lost data card and data recovery in general was problematic in Kaktovik. That said, extreme wind analysis indicates a desirable situation in Kaktovik: moderately high mean wind speed combined with relatively low (probable) extreme wind speeds. This may be explained by particular climactic aspects of Kaktovik which because of its extreme northerly latitude, is not exposed to Gulf of Alaska storm winds which tend to significantly increase the long-term probability of damaging winds.

Industry standard reference of extreme wind is the 50 year, 10-minute average probable wind speed, referred to as $V_{ref}$. For Wainwright, this calculates to 35.4 m/s, below the threshold of International Electrotechnical Commission (IEC) 61400-1, 3rd edition criteria (of 37.5 m/s) for a Class III site. Note that Class III extreme wind classification is the lowest defined and all wind turbines are designed for this wind regime.

### *Extreme wind sped probability table*

| | $V_{ref}$ | Gust | IEC 61400-1, 3rd ed. | |
|---|---|---|---|---|
| Period (years) | (m/s) | (m/s) | Class | $V_{ref}$, m/s |
| 2 | 25.1 | 30.1 | I | 50.0 |
| 10 | 30.3 | 36.2 | II | 42.5 |
| 15 | 31.6 | 37.8 | III | 37.5 |
| 30 | 33.7 | 40.4 | S | designer-specified |
| 50 | 35.4 | 42.3 | | |
| 100 | 37.5 | 44.9 | | |
| average gust factor: | 1.20 | | | |

### *Extreme wind speed probability graph*



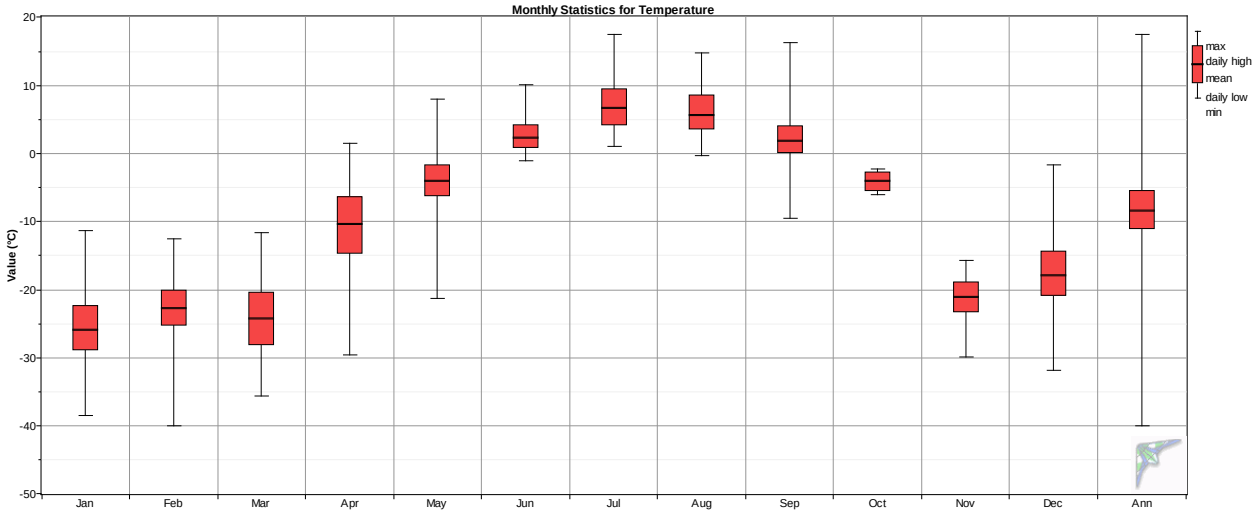
# Temperature and Density

Kaktovik experiences cool summers and very cold winters. The result is high air density. Calculated air density exceeds standard air density for a sea level elevation (1.225 Kg/m$^3$) by over eight percent. This is advantageous in wind power operations as wind turbines produce more power at low temperatures (high air density) than at standard temperature and density.

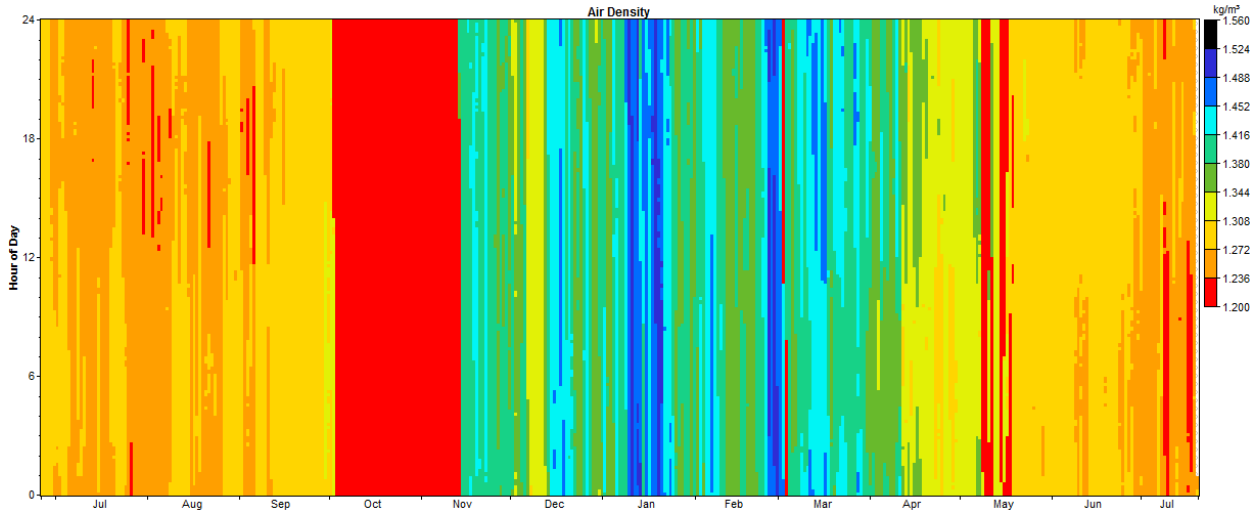
## *Temperature and density table*

| | Temperature | | | Air Density | | |
|---|---|---|---|---|---|---|
| Month | Mean (°C) | Min (°C) | Max (°C) | Mean (kg/m³) | Min (kg/m³) | Max (kg/m³) |
| Jan | -25.8 | -38.6 | -11.4 | 1.427 | 1.348 | 1.504 |
| Feb | -22.7 | -40.1 | -12.6 | 1.410 | 1.354 | 1.513 |
| Mar | -24.2 | -35.7 | -11.7 | 1.412 | 1.224 | 1.485 |
| Apr | -10.3 | -29.7 | 1.5 | 1.343 | 1.284 | 1.449 |
| May | -4.0 | -21.4 | 8.0 | 1.294 | 1.224 | 1.401 |
| Jun | 2.4 | -1.1 | 10.0 | 1.280 | 1.246 | 1.296 |
| Jul | 6.7 | 1.0 | 17.4 | 1.261 | 1.214 | 1.287 |
| Aug | 5.7 | -0.4 | 14.7 | 1.265 | 1.225 | 1.293 |
| Sep | 1.9 | -9.5 | 16.3 | 1.283 | 1.219 | 1.338 |
| Oct | -4.0 | -6.1 | -2.4 | 1.229 | 1.224 | 1.321 |
| Nov | -21.1 | -30.0 | -15.8 | 1.325 | 1.224 | 1.451 |
| Dec | -17.9 | -31.9 | -1.7 | 1.383 | 1.299 | 1.462 |
| Annual | -9.4 | -40.1 | 17.4 | 1.325 | 1.214 | 1.513 |

## Monthly temperature boxplot



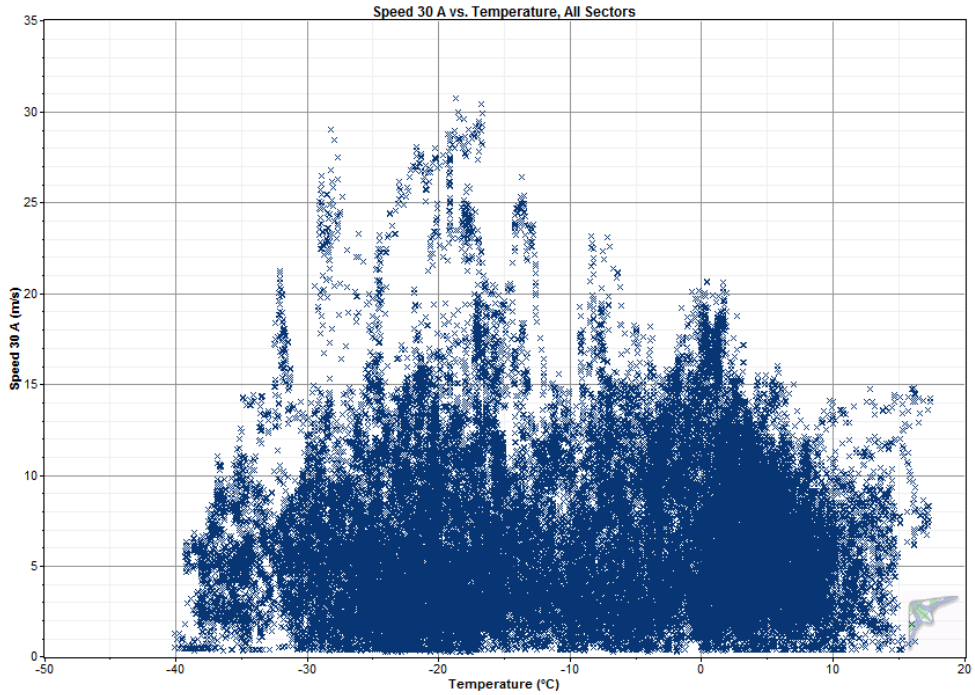
### *Air density DMap*




## Wind Speed Scatterplot

The wind speed versus temperature scatterplot below indicates that a substantial percentage of wind in Kaktovik coincides with very cold temperatures, as one would expect give the location on the Arctic Ocean coast. Temperatures have fallen below -40°C, the minimum operating temperature of arctic-capable wind turbines presently operating in Alaska, but only a few times during the measurement period.

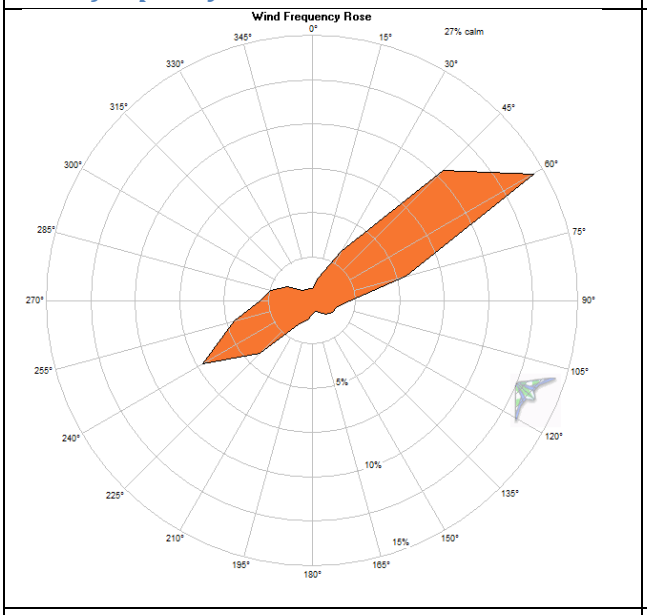
### *Wind speed versus temperature scatterplot (synth. data)*



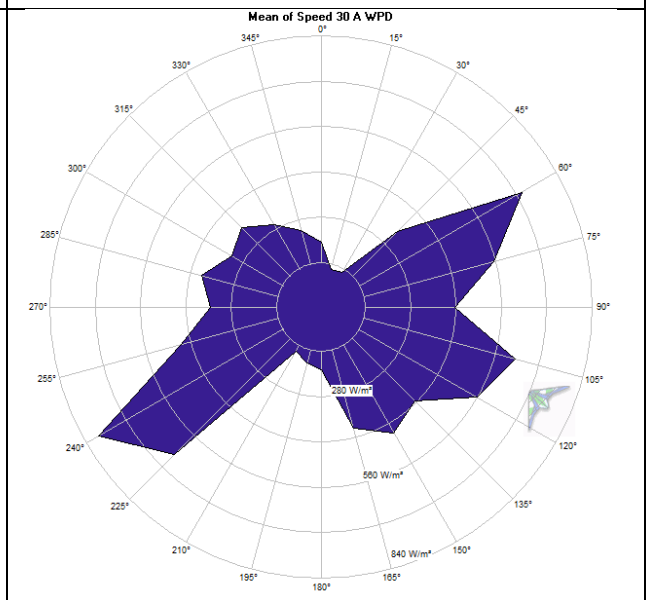
## Wind direction

Wind frequency rose data indicates highly directional winds from the northeast and southwest. Power density rose data (representing the power in the wind) indicates power winds are very strongly directional, from 060°T and directly opposite, from 240°T. Calm frequency (percent of time that winds at 30 meter level are less than 3.5 m/s) was 27 percent during the met tower test period, but this statistic may be suspect due to the large amount of data loss.

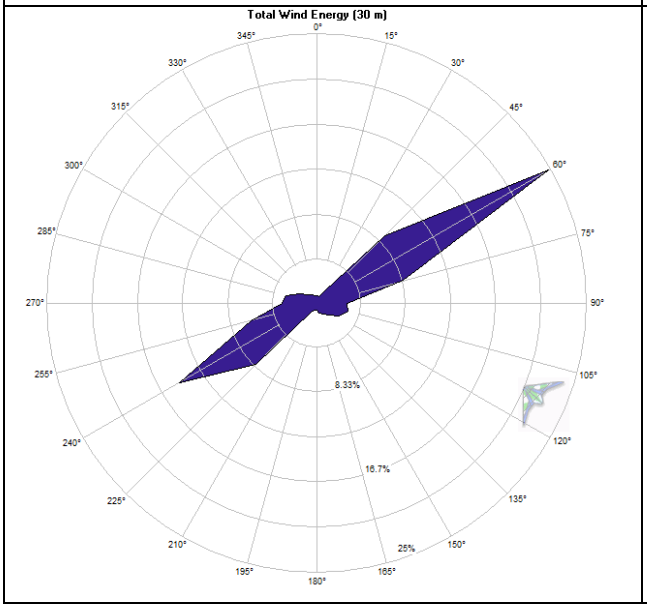
### *Wind frequency rose*



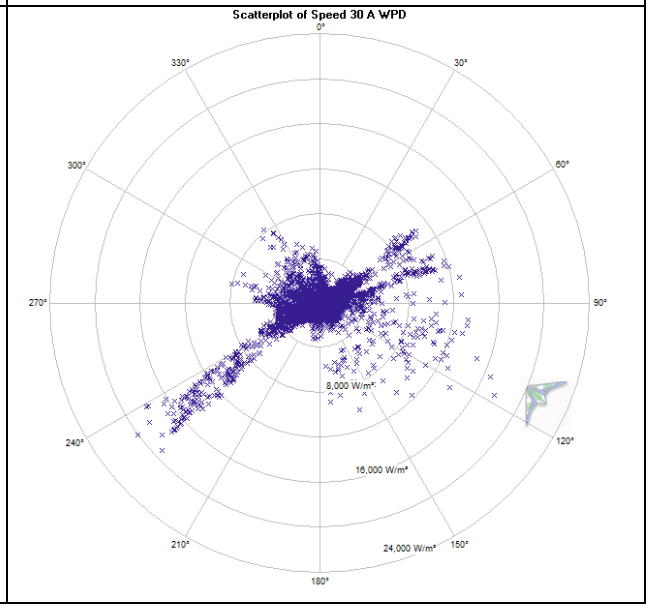

### *Mean value rose*



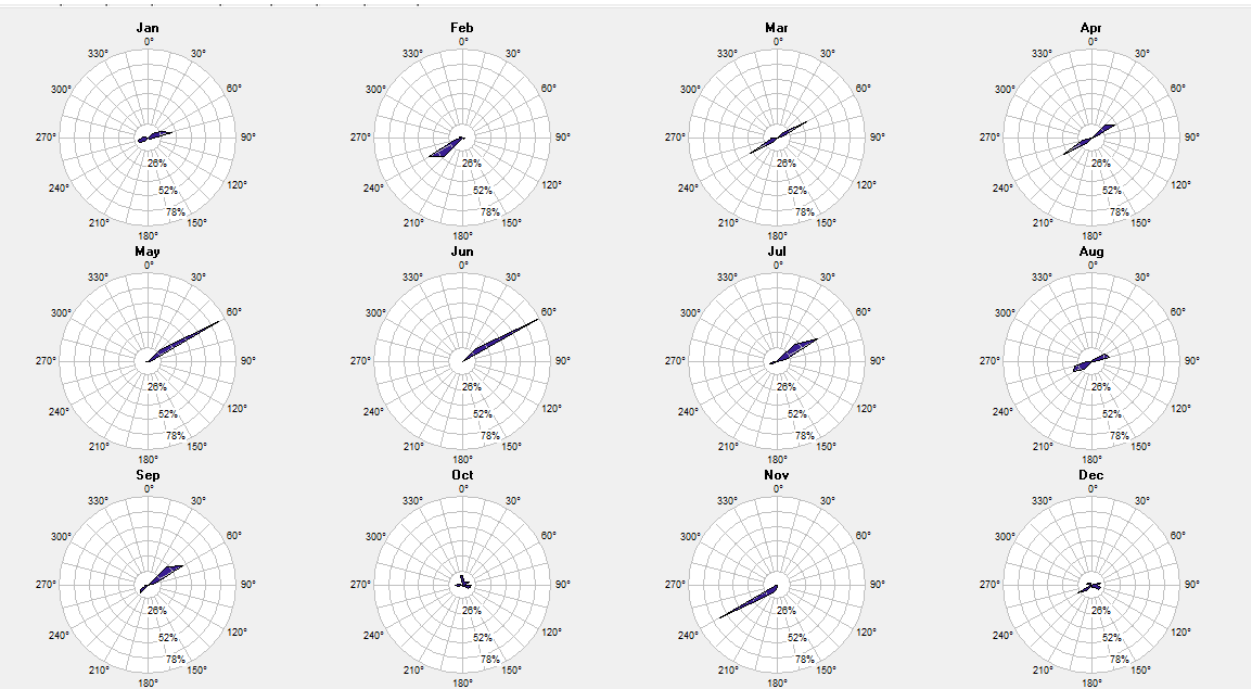

### *Total energy rose*




### *Scatterplot rose*



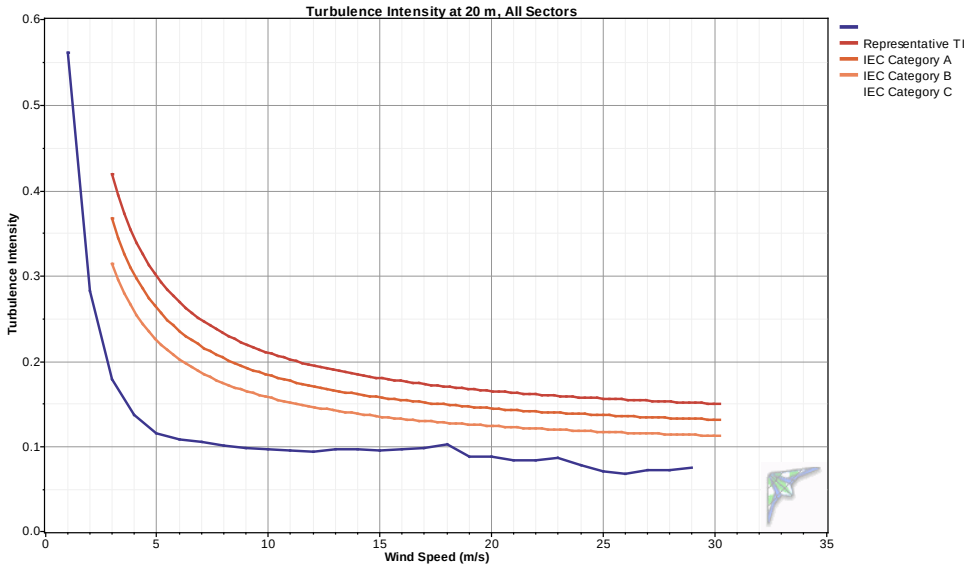
### *Wind density roses by month*



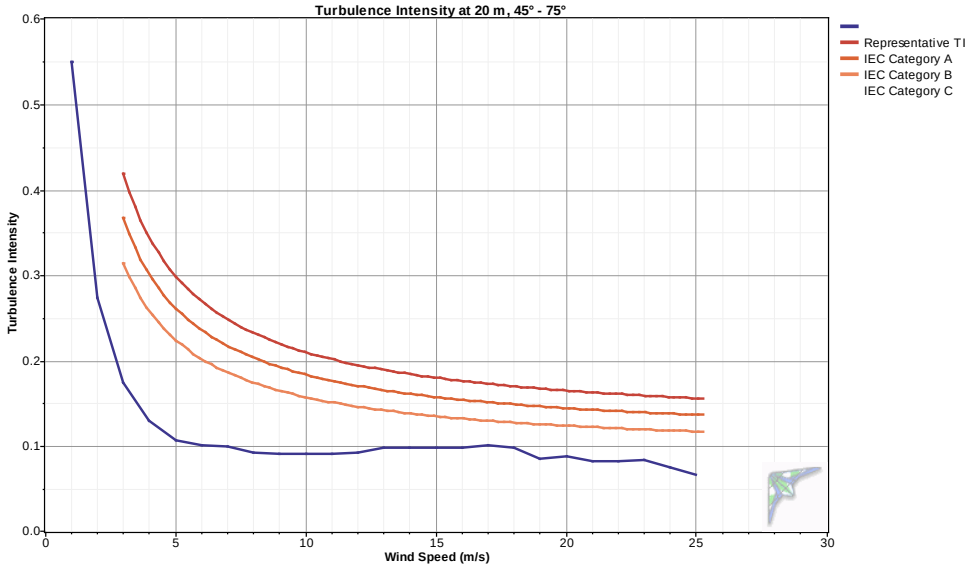

## Turbulence

Turbulence intensity at the Kaktovik test site is well within acceptable standards with an IEC 61400-1, 3rd edition (2005) classification of turbulence category C, which is the lowest defined. Mean turbulence intensity at 15 m/s is 0.076 (at 20 meters).

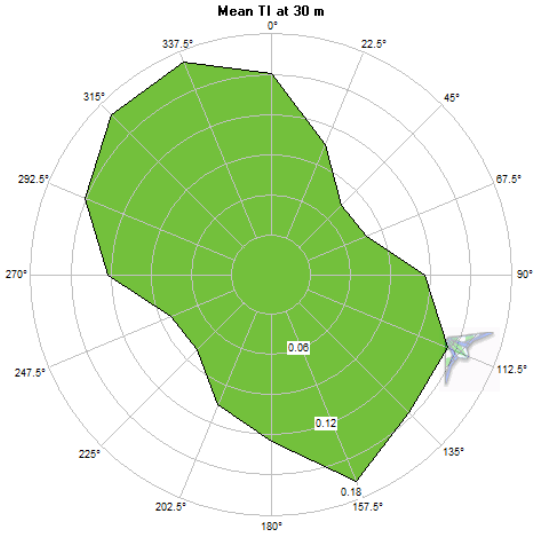
### *Turbulence intensity, all wind sectors*



## *Turbulence intensity, NE to ENE wind sector*




## *Turbulence intensity by direction*




## *Turbulence table (20 m anemometer)*

| Bin Midpoint (m/s) | Bin Endpoints Lower (m/s) | Upper (m/s) | Records in Bin | Mean TI | Std. Deviation of TI | Representative TI | Peak TI |
|---|---|---|---|---|---|---|---|
| 1 | 0.5 | 1.5 | 1,676 | 0.363 | 0.155 | 0.561 | 1.111 |
| 2 | 1.5 | 2.5 | 3,458 | 0.174 | 0.084 | 0.282 | 1.250 |
| 3 | 2.5 | 3.5 | 4,851 | 0.115 | 0.049 | 0.178 | 0.515 |
| 4 | 3.5 | 4.5 | 4,924 | 0.090 | 0.037 | 0.137 | 0.400 |
| 5 | 4.5 | 5.5 | 4,654 | 0.076 | 0.031 | 0.116 | 0.378 |
| 6 | 5.5 | 6.5 | 3,863 | 0.073 | 0.027 | 0.108 | 0.309 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 6.5 | 7.5 | 3,671 | 0.074 | 0.024 | 0.105 | 0.269 |
| 8 | 7.5 | 8.5 | 2,936 | 0.073 | 0.021 | 0.101 | 0.320 |
| 9 | 8.5 | 9.5 | 2,328 | 0.073 | 0.019 | 0.098 | 0.326 |
| 10 | 9.5 | 10.5 | 1,826 | 0.074 | 0.017 | 0.096 | 0.231 |
| 11 | 10.5 | 11.5 | 1,579 | 0.074 | 0.016 | 0.094 | 0.159 |
| 12 | 11.5 | 12.5 | 1,134 | 0.074 | 0.015 | 0.094 | 0.183 |
| 13 | 12.5 | 13.5 | 587 | 0.076 | 0.016 | 0.097 | 0.154 |
| 14 | 13.5 | 14.5 | 499 | 0.077 | 0.015 | 0.096 | 0.152 |
| 15 | 14.5 | 15.5 | 404 | 0.076 | 0.014 | 0.095 | 0.166 |
| 16 | 15.5 | 16.5 | 261 | 0.080 | 0.013 | 0.097 | 0.123 |
| 17 | 16.5 | 17.5 | 189 | 0.080 | 0.014 | 0.098 | 0.145 |
| 18 | 17.5 | 18.5 | 95 | 0.080 | 0.017 | 0.102 | 0.183 |
| 19 | 18.5 | 19.5 | 46 | 0.075 | 0.011 | 0.088 | 0.104 |
| 20 | 19.5 | 20.5 | 15 | 0.076 | 0.009 | 0.088 | 0.097 |
| 21 | 20.5 | 21.5 | 40 | 0.074 | 0.008 | 0.084 | 0.086 |
| 22 | 21.5 | 22.5 | 74 | 0.072 | 0.010 | 0.084 | 0.096 |
| 23 | 22.5 | 23.5 | 73 | 0.074 | 0.010 | 0.087 | 0.100 |
| 24 | 23.5 | 24.5 | 34 | 0.068 | 0.007 | 0.078 | 0.085 |
| 25 | 24.5 | 25.5 | 28 | 0.062 | 0.007 | 0.071 | 0.080 |
| 26 | 25.5 | 26.5 | 33 | 0.060 | 0.007 | 0.068 | 0.073 |
| 27 | 26.5 | 27.5 | 29 | 0.063 | 0.008 | 0.072 | 0.089 |
| 28 | 27.5 | 28.5 | 13 | 0.064 | 0.006 | 0.072 | 0.076 |
| 29 | 28.5 | 29.5 | 4 | 0.067 | 0.006 | 0.074 | 0.072 |
| 30 | 29.5 | 30.5 | 0 | | | | |

## Airport AWOS Data

In 2005, Alaska Energy Authority (AEA) personnel analyzed the wind resource at all Automated Weather Observing Station (AWOS) and Automated Surface Observing System (ASOS) sites in Alaska. At most stations, AWOS/ASOS data has been collected for twenty-five or more years. Barter Island DEW Station (ICAO station identifier: PABA) data has been collected by an AWOS since 1973. AWOS data summarized below is through 2004.

The AEA report documents data from AWOS sensor, which is 8 meters above ground level. To compare this data to the met tower lower sensor height of 20, the AWOS data was adjusted using an exponent extrapolation function with a power law exponent value of 0.097, the measured shear value at the met tower site. Comparing to the met tower 20 meter anemometer (both the collected data set and the synthesized data set), one can see that average wind speeds recorded by the met tower are approximately that predicted by the Barter Island DEW Station AWOS data. By itself, the AWOS data indicates a Class 6 wind resource, hence confirming the wind resource measured at the met tower site, data recovery problems aside.

### *DEW Station/met tower data comparison*

| | Barter Island DEW | | Met Tower, 20m anem. | |
|---|---|---|---|---|
| | AWOS, 8 m sensor (m/s) | Data adj. to 20 m (m/s) | Collected data (m/s) | Synthesized data (m/s) |
| Jan | 6.8 | 7.43 | 14.58 | 7.77 |
| Feb | 5.9 | 6.45 | 7.29 | 7.23 |
| Mar | 5.7 | 6.23 | 5.42 | 5.32 |
| Apr | 5.2 | 5.68 | 4.80 | 4.54 |
| May | 6.0 | 6.56 | 6.68 | 6.56 |
| Jun | 5.2 | 5.68 | 6.69 | 6.64 |
| Jul | 5.3 | 5.79 | 5.88 | 5.88 |
| Aug | 5.2 | 5.68 | 5.78 | 5.78 |
| Sep | 5.8 | 6.34 | 6.47 | 6.47 |
| Oct | 7.0 | 7.65 | 2.68 | 6.14 |
| Nov | 6.9 | 7.54 | 4.66 | 3.63 |
| Dec | 6.2 | 6.78 | 8.07 | 7.68 |
| Annual | 5.9 | 6.48 | 6.59 | 6.14 |