

Gravina Access Project
Wind Climatology Technical Memorandum



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Prepared for:



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The objective of this climatology project is to provide joint probability wind speed and direction tables, an annual extreme value distribution with return periods, and monthly and annual wind statistics for the Ketchikan, Alaska area.

Data Sources

Hourly records of wind speed, wind direction and air temperature were purchased and analyzed for Ketchikan Airport. The data comes from the National Climatic Data Center (NCDC) in Ashville, NC. The source file is TD-9956, DATSAV3. Hourly data for the Ketchikan Airport is available for the years 1973 to 1998. Wind speeds are assumed to be the 1-minute average taken on the hour from 1973 to 9/1996. In December of 1996 the data collection was automated. The station is currently an ASOS (Automated Surface Observing System) station operated by the FAA. The ASOS standard for wind speed measurements is the 2-minute average taken during the 2 minutes before the hour. The ratio of the 1-minute average to the 2-minute average is 1.06. This correction has been applied to the data subsequent to 9/1996. The automated anemometer is currently at 83', however the average elevation over the years of the data set appears to be 76'.

Statistics

The hourly record has been sorted to produce joint probability tables for wind speed and direction on a monthly and annual basis. The marginal cumulative probability distribution of wind speed is plotted on Weibull Type II probability paper with a variable k- parameter to produce a least squares straight line fit to the cumulative distribution. Interpolations for statistical levels of 50th, 75th, 90th, 95th and 99th percentile are easily determined.

Results

A subset of the complete wind speed time series for the years 1990 to 1998 is plotted in Fig. 1. Fig. 2 shows a scatter plot giving the relationship of the observed 1-minute average wind speed to the simultaneously reported gust wind speed. The ratio of the gust wind speed to the 1-minute average is approximately 1.52. This ratio is higher than the standard presented in the US Army Corps of Engineers Shore Protection Manual. The ratio assumed for most locations is 1.242. This indicates that Ketchikan has higher gust wind speeds in relationship to the average wind speeds than is expected at other locations.

The annualized joint probability table for wind speed and direction for all the data years is shown in Fig. 3. The annual extreme value distribution is plotted in Fig. 4. The annual cumulative distribution is shown in Fig. 5. The Weibull plots of the cumulative probability of wind speed by month are shown in Figs. 6 - 17. The monthly wind speed statistics are given in Table I.

The statistical and return wind speeds appear to be less than expected at this location. This is often the case when long time series wind speed measurements and professional observations are analysed. The apparent bias that high winds are common can be attributed to; local geographic and architectural effects, the tendency of individuals to remember only to most severe cases and to the relationship between averaged wind speeds and gust wind speeds. Applying a multiplier of 1.52 to the return period and statistical level wind speeds changes ones perception of the severity

of the conditions. The following table gives the annual statistics and return period winds for both the one minute average and gust wind speed. The 95th percentile wind gust is 25.8 knots (29.7mph). The five year return period wind gust is 76 knots (87.5 mph).

Ketchikan Airport Wind Statistics	1-minute average (knots)	Gust wind speed (knots)	Gust wind speed (mph)
100 year return	74	113	130
50 year return	68	103	119
10 year return	56	85	98
5 year return	50	76	87
99 th percentile	23	35	40
95 th percentile	17	26	30
90 th percentile	15	23	26
75 th percentile	11	17	19
50 th percentile	8	12	14

**Time Series Record of Measured Wind Speed
Ketchikan Airport - Anemometer Elevation varies abt. 76'**

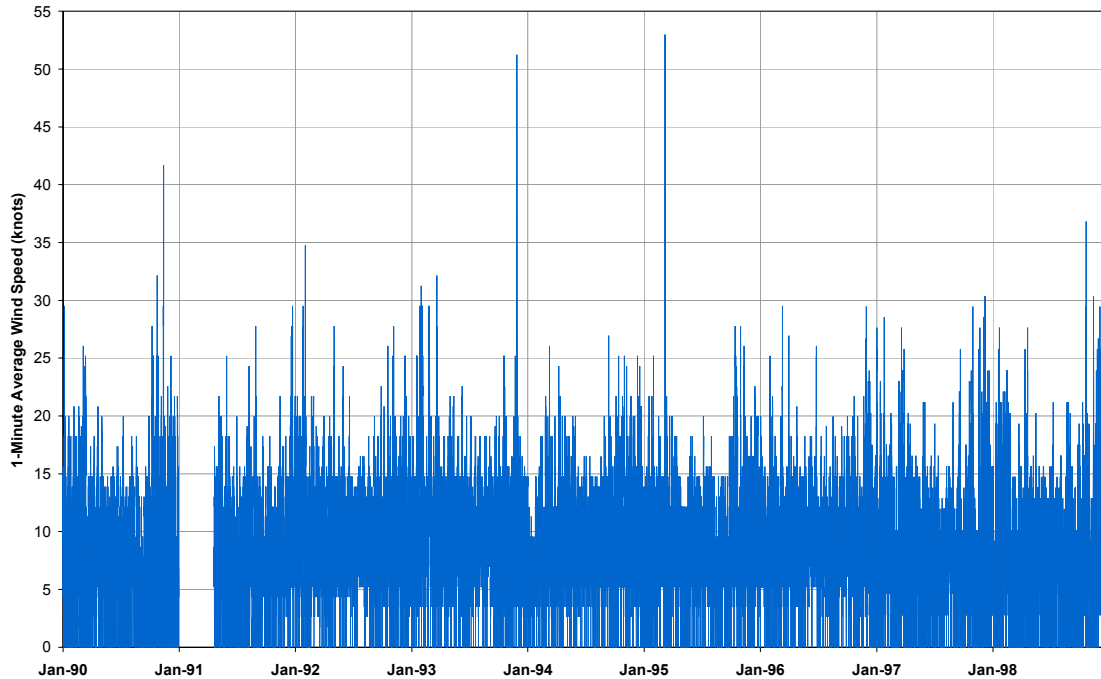


Figure 1

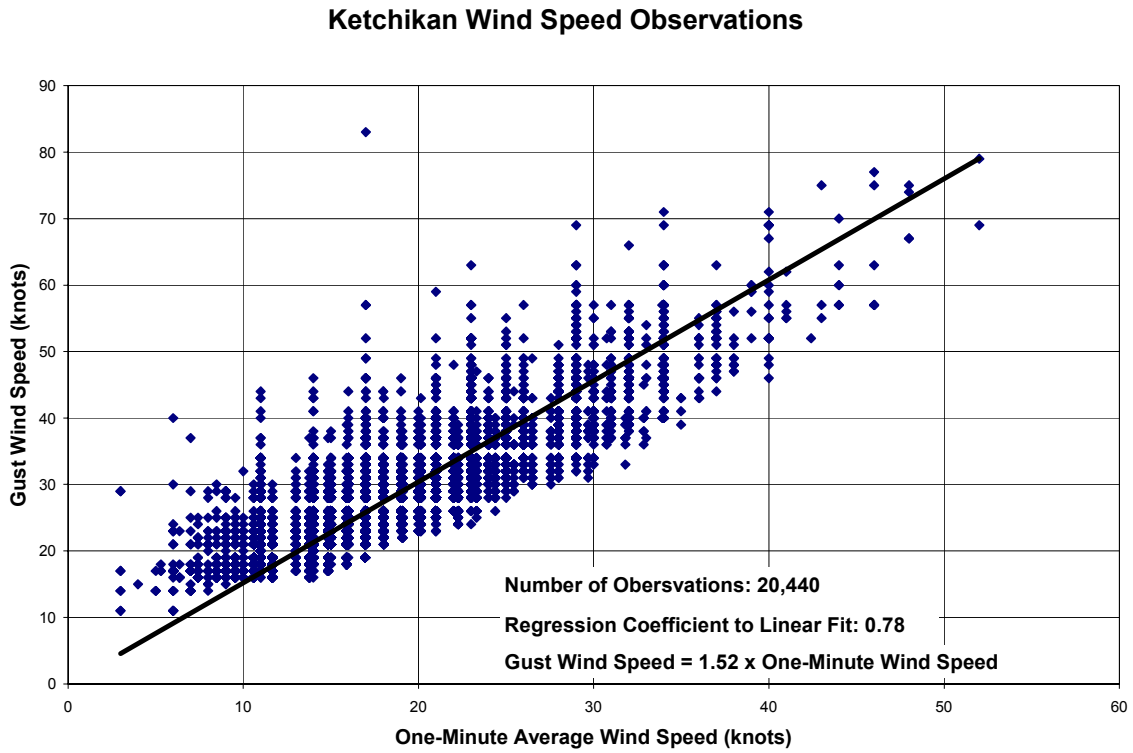


Figure 2

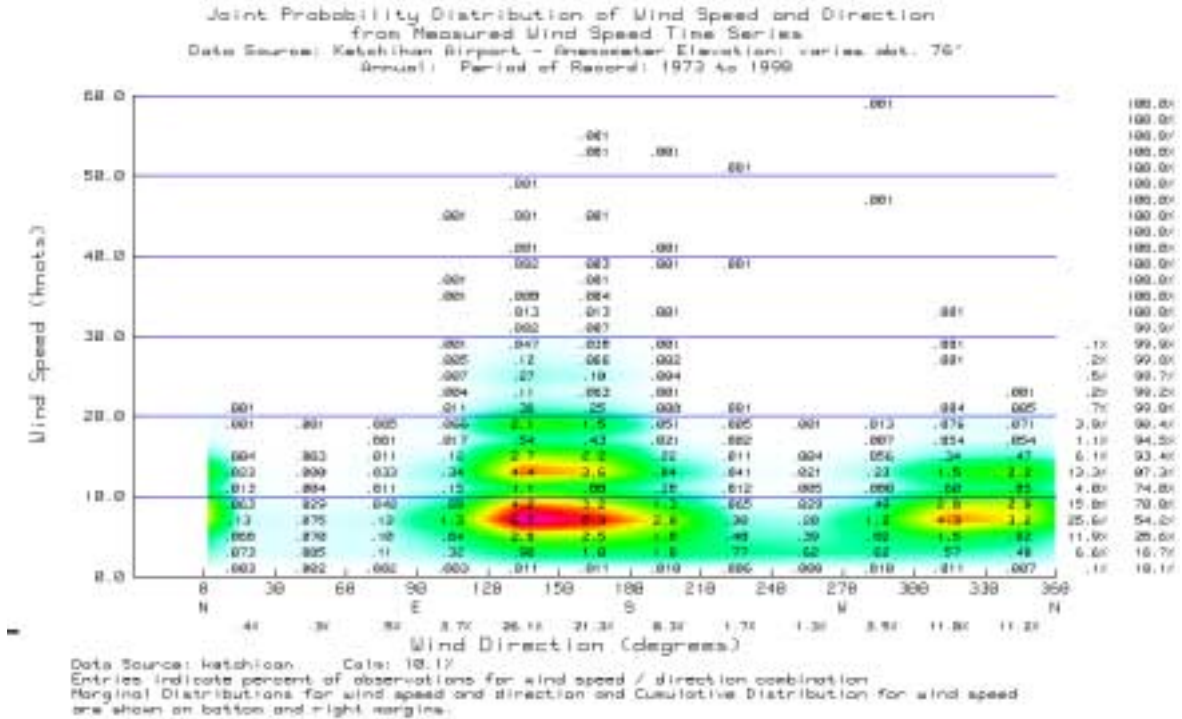


Figure 3

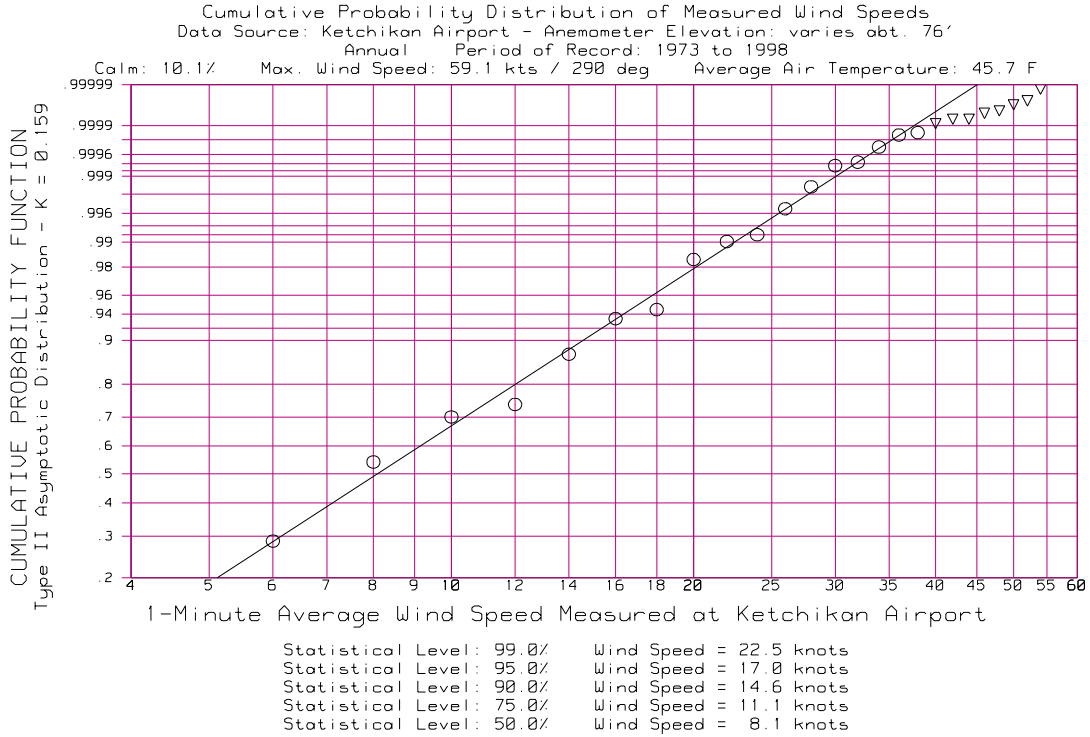


Figure 4

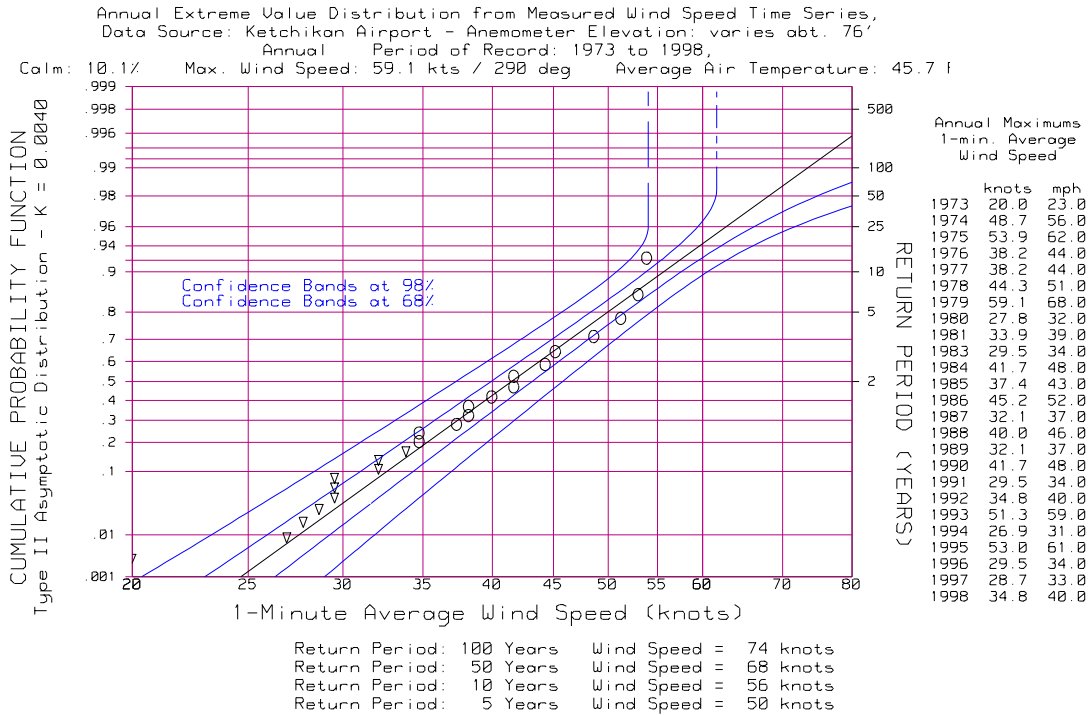


Figure 5

Table I

Statistical Level:	99 th Percentile	95 th Percentile	90 th Percentile	75 th Percentile	50 th Percentile
January					
Wind Speed (kts):	23.7	18.4	15.8	12.0	8.2
February					
Wind Speed (kts):	24.3	18.7	16.1	12.2	8.6
March					
Wind Speed (kts):	23.0	17.1	14.6	11.2	8.3
April					
Wind Speed (kts):	21.4	17.0	14.9	11.7	8.6
May					
Wind Speed (kts):	20.1	15.8	13.9	11.0	8.3
June					
Wind Speed (kts):	18.6	14.3	12.5	10.1	8.1
July					
Wind Speed (kts):	17.3	13.9	12.3	10.0	7.8
August					
Wind Speed (kts):	18.2	14.4	12.6	10.1	7.8
September					
Wind Speed (kts):	20.5	15.1	13.0	10.1	7.8
October					
Wind Speed (kts):	23.8	18.2	15.6	11.8	8.3
November					
Wind Speed (kts):	25.8	18.6	15.6	11.5	8.1
December					
Wind Speed (kts):	23.6	18.2	15.6	11.8	8.2
Annual					
Wind Speed (kts):	22.5	17.0	14.6	11.1	8.1

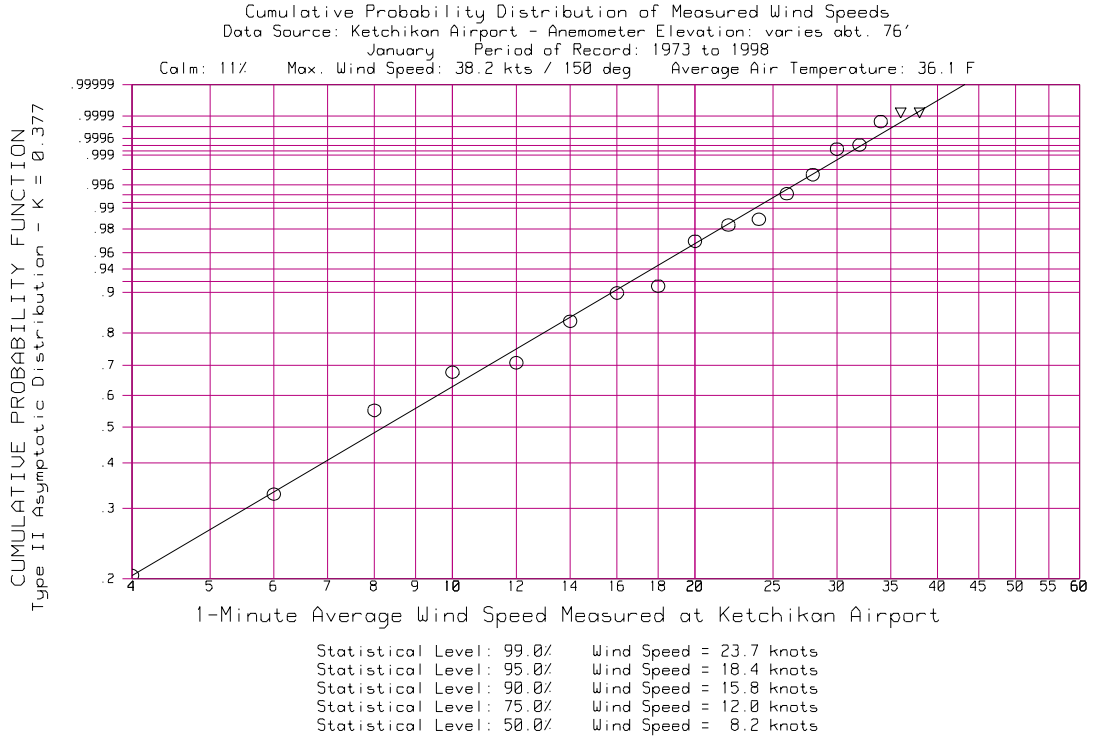


Figure 6

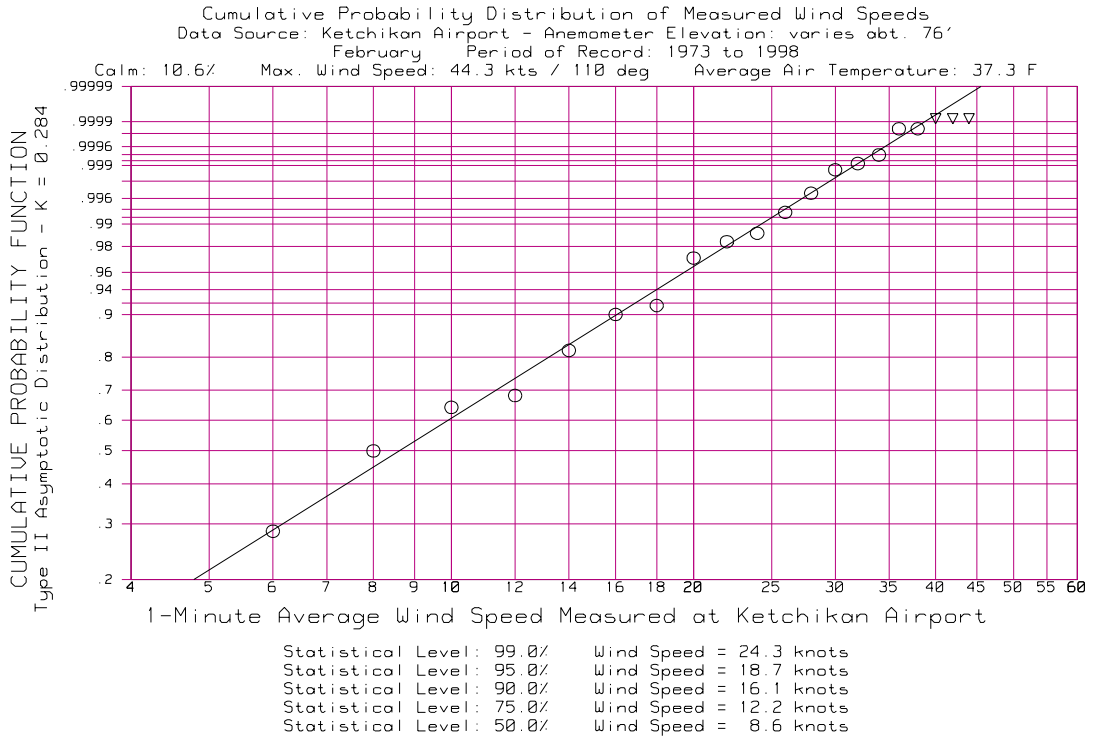


Figure 7

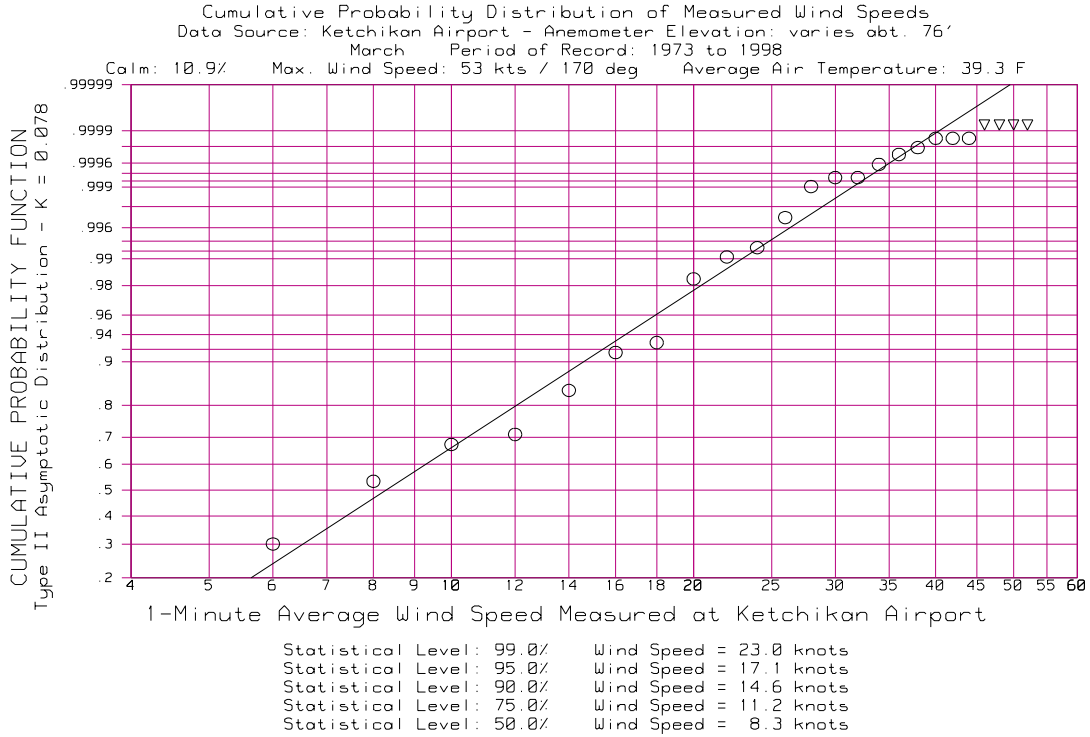


Figure 8

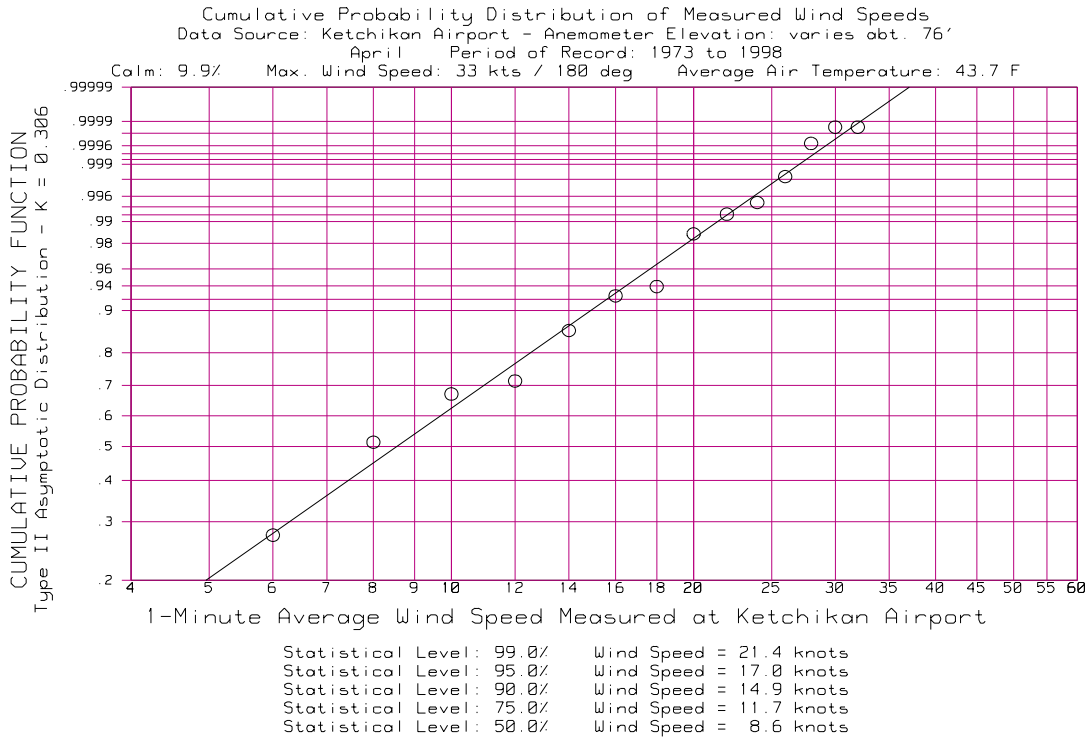


Figure 9

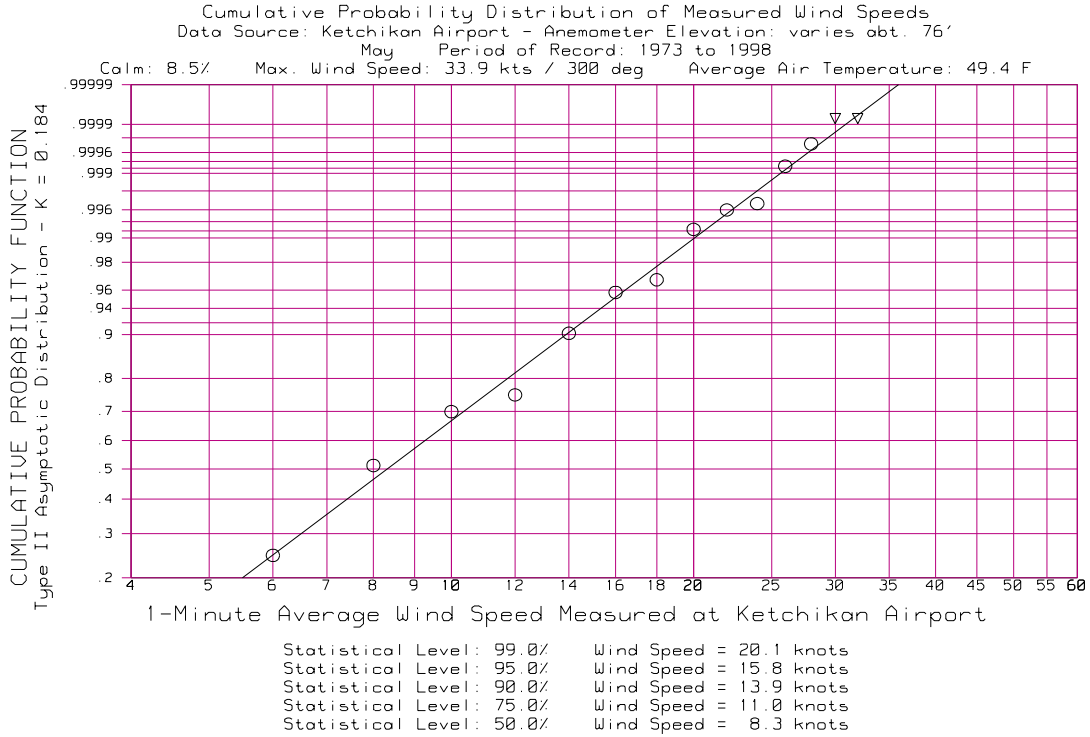


Figure 10

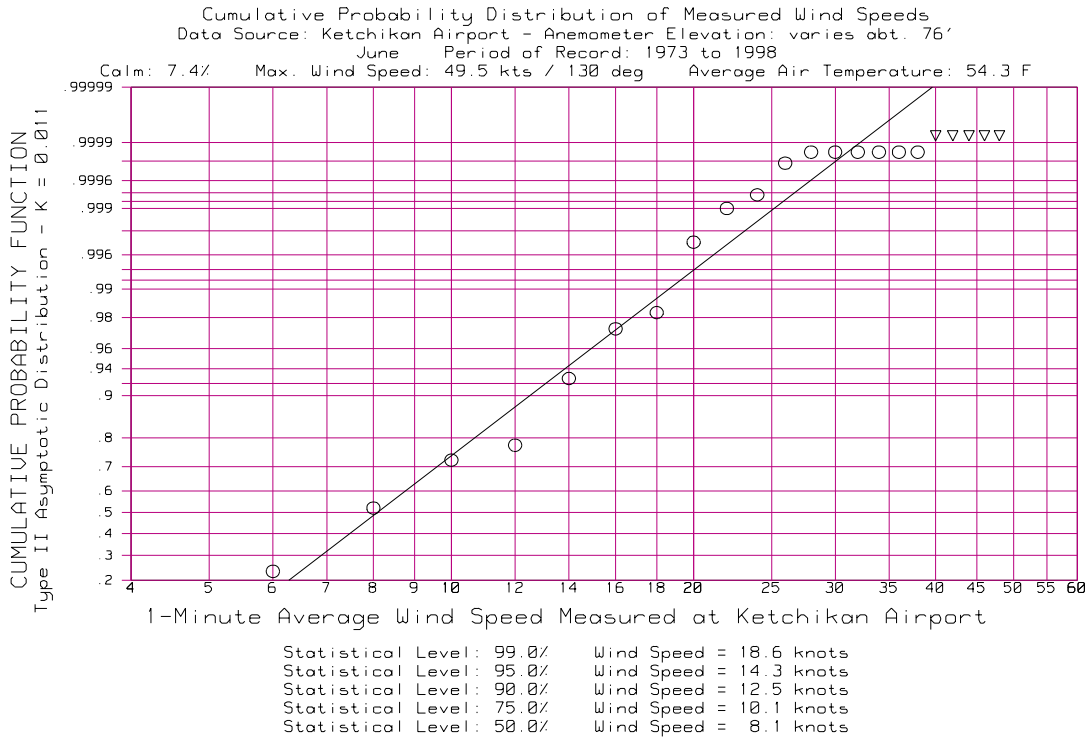


Figure 11

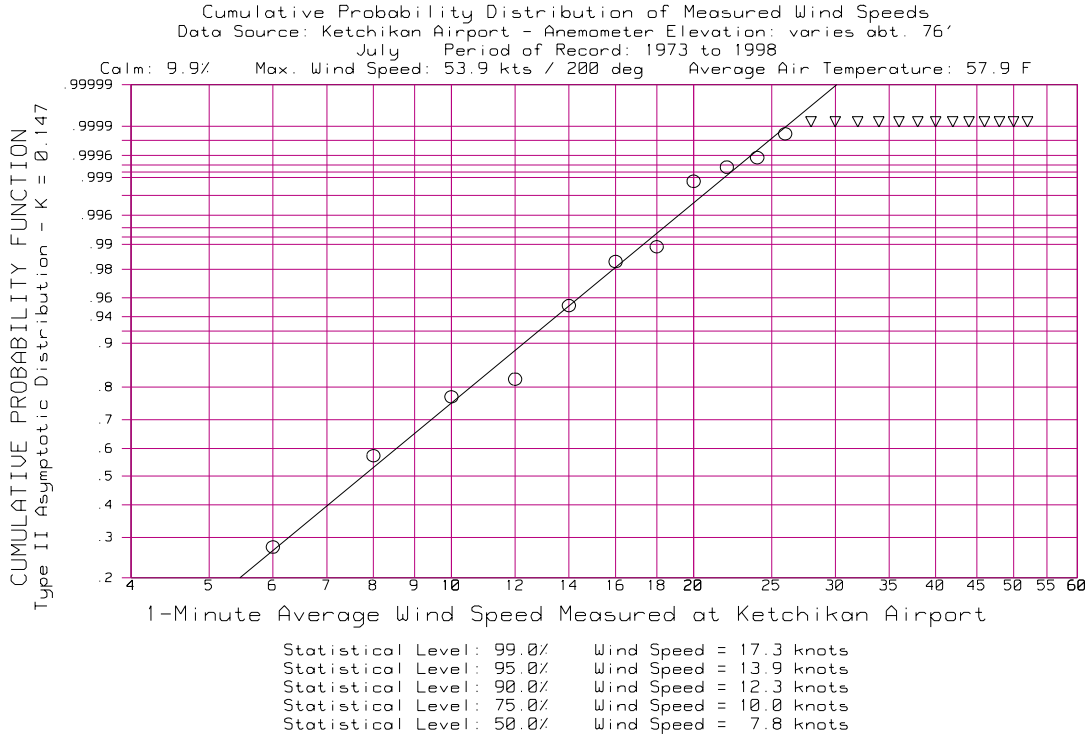


Figure 12

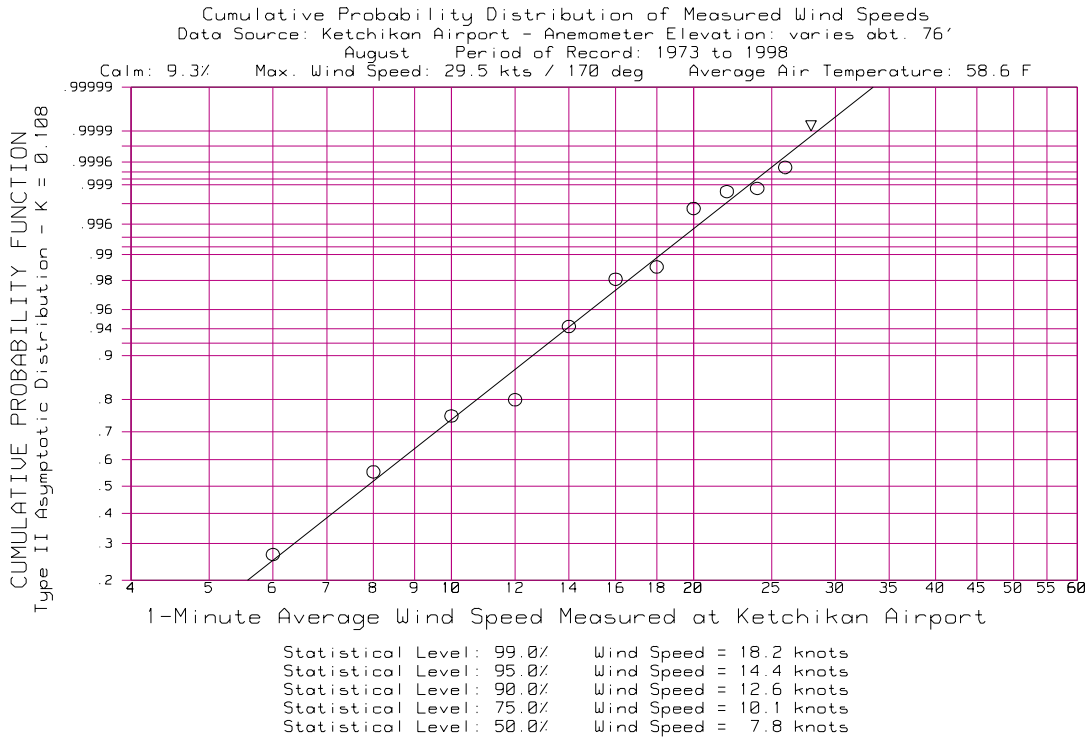


Figure 13

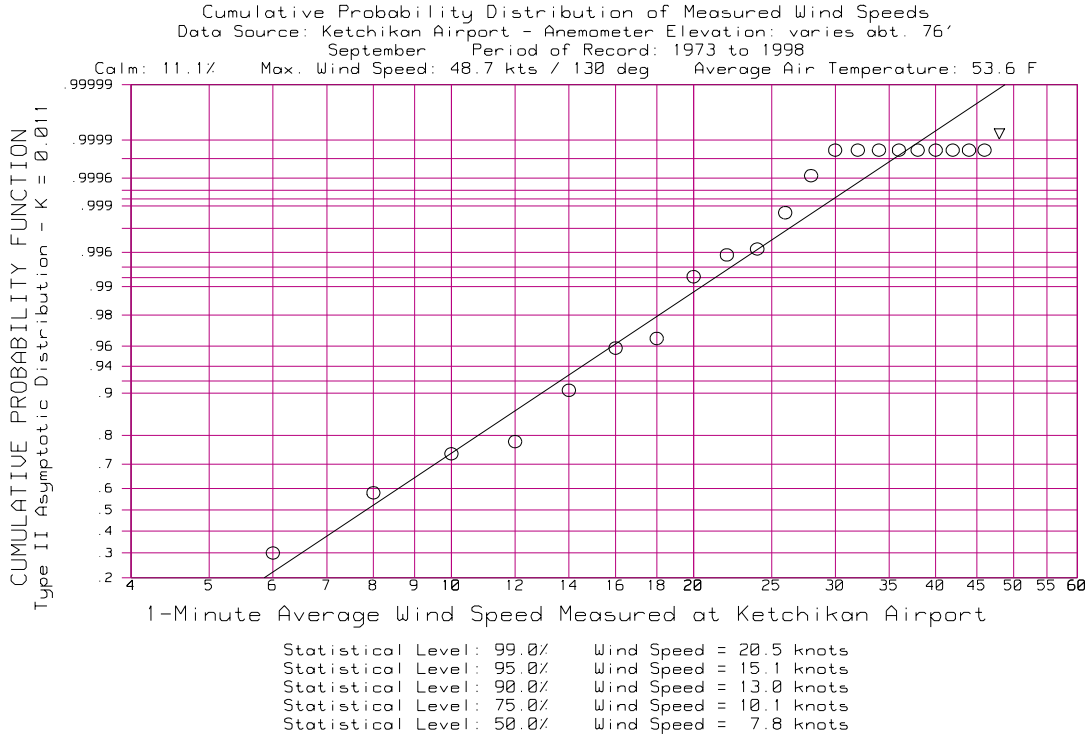


Figure 14

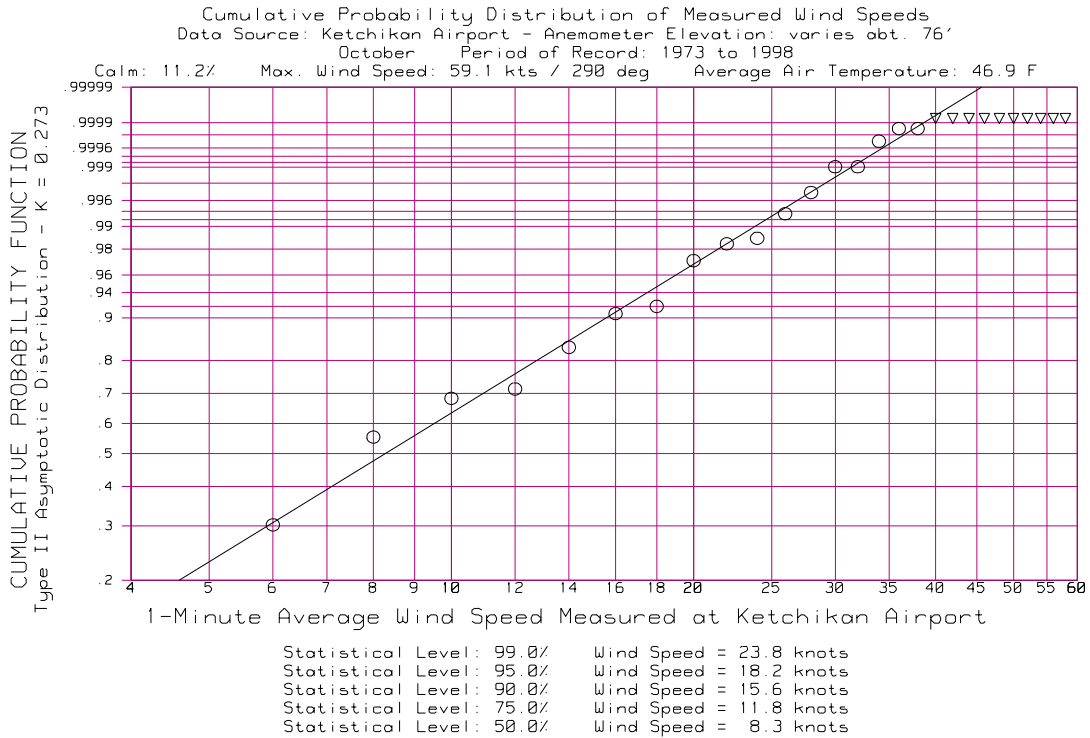


Figure 15

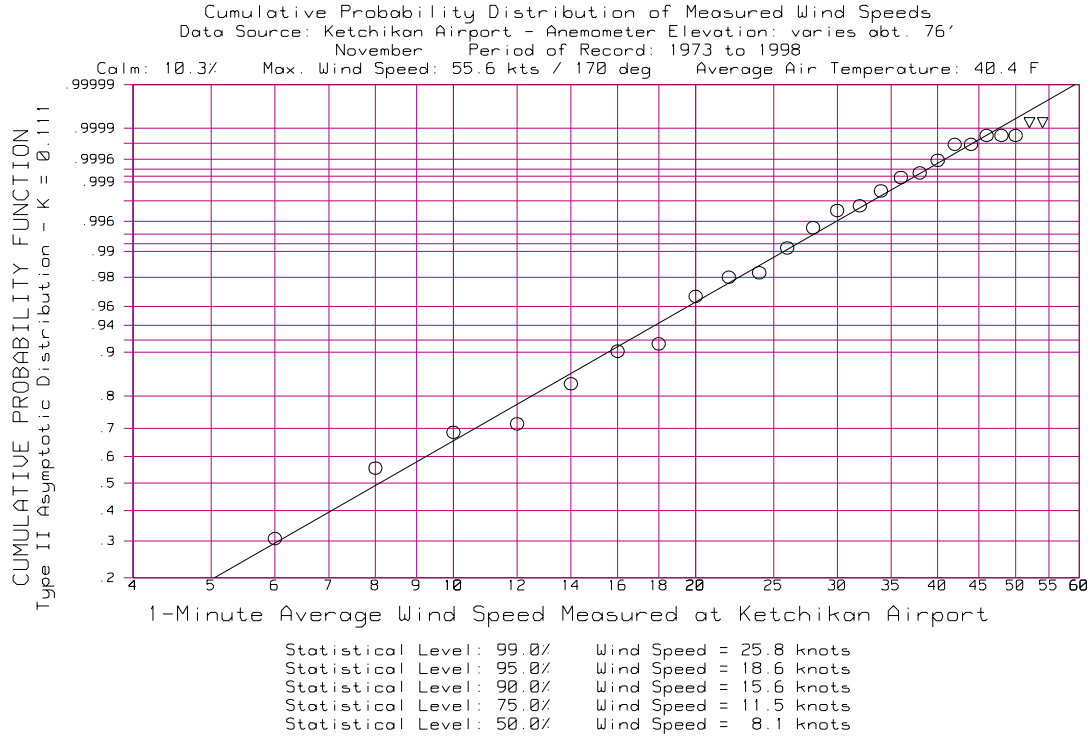


Figure 16

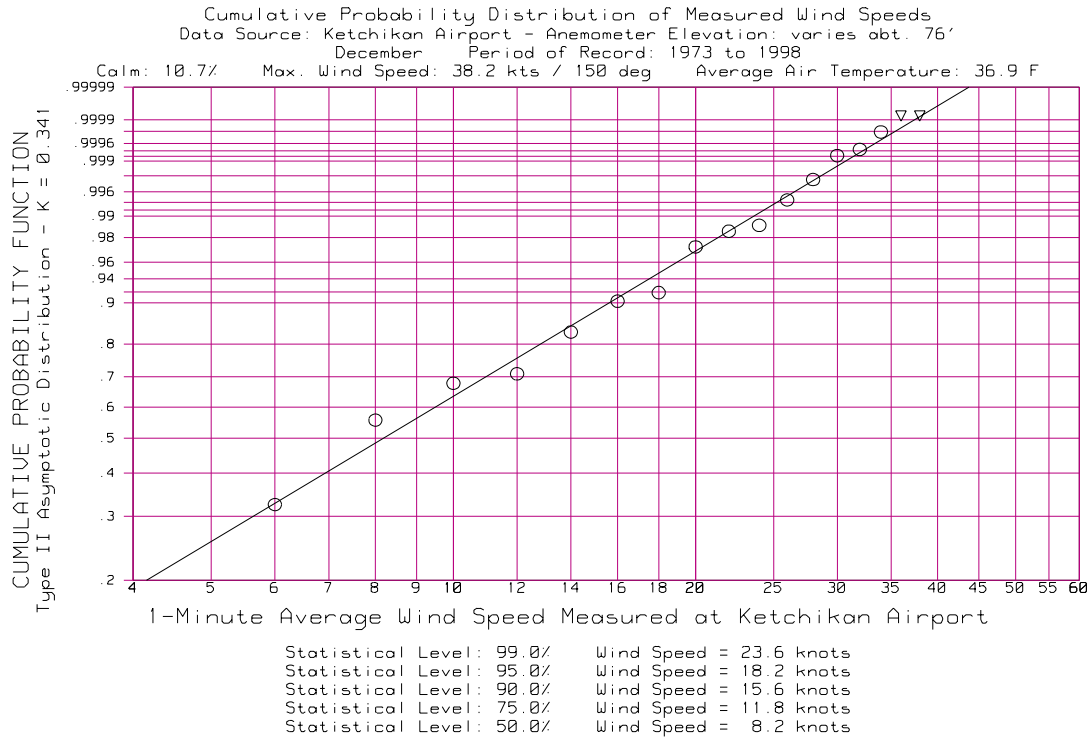


Figure 17