Estimates of the Number of Large Amplitude Gusts

J. V. Ramsdell

March 1978

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AMPLITUDE GUSTS

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March 1978

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SUMMARY

The purpose of this report is to present preliminary estimates of the number of occurrences of large amplitude gusts for use in the design of wind energy conversion systems. Existing turbulence information has been combined with an assumed wind speed distribution to arrive at the estimates.

The number of large amplitude gusts per year is treated as a function of the annual mean wind speed and terrain roughness. This treatment is based upon the assumptions that the atmosphere has neutral stability during high winds and that the gustiness is induced by flow over surface roughness elements. Large gusts during thunderstorms and other severe weather phenomena are not treated.

The results of the study are presented in tabular form as a function of gust amplitude and hourly average wind speed. Tables of estimates are given for terrain varying in roughness from open water to high mountains, and for annual mean wind speeds between 4 and 12 ms^{-1} . Positive and negative gusts are treated separately.

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INTRODUCTION

Consideration of gustiness of the wind is important in the design of structures exposed to the wind. The purpose of this report is to provide preliminary information for estimating the number of gusts exceeding a given amplitude during the life of a structure. In particular it is provided for use in the design of wind energy conversion systems (WECS). The estimated number of large amplitude gusts in a typical year is a function of terrain roughness and annual mean wind speed as well as hourly mean wind speed and gust amplitude. Positive and negative gusts are treated separately.

The analysis leading to the estimates parallels work done to describe gusts experienced by low flying aircraft (250 to 750 ft above ground) in the U.S. Air Force's LO-LOCAT research program⁽¹⁻³⁾. It combines analysis of turbulence collected downwind of the central business district in Seattle, WA and at the Seattle-Tacoma International Airport⁽⁴⁾ with turbulence information reported for other locations. The estimates presented are strictly applicable to gustiness resulting from mechanically induced turbulence. Gustiness during thunderstorms and other severe weather phenomena is outside the scope of this study.

The estimated numbers of large amplitude gusts presented in the tables in Appendix A are preliminary in two respects. They are based, to a large degree, on the Seattle turbulence data which may not be representative of turbulence in typical sites selected for installation of wind energy conversion systems. And, the form of presentation of the estimates has been developed following limited interaction with wind energy conversion system designers.

Publication of these preliminary estimates is designed to initiate an interaction between meteorologists and wind system designers. Meteorologists need to know which gust amplitudes are important in design and the frequency of occurrence at which they become important. They also need to know how information on gust amplitudes should be presented to be of maximum value to designers. Comments and suggestions along these lines will play an important role in determining the form revisions to this report will take.

WIND DESCRIPTION

Although the concept of gusts is generally understood in an intuitive way, formal definition of several concepts facilitates a quantitative understanding necessary to correctly interpret the results presented. We will concern ourselves with wind speed, but the definition can be extended to the full velocity vector without significant alteration. Throughout this report wind specifically refers to the wind at a height above ground of interest. For horizontal axis WECS this height is assumed to be hub height, and for vertical axis WECS the height is assumed to be mid-rotor height.

Under most atmospheric conditions, if we observe the wind for a suitably long period we can define a mean speed, $\bar{U}$, according to

$$\bar{U} = \frac{1}{T} \int_0^T U(t) dt \quad (1)$$

where $U(t)$ is the instantaneous speed and T is the averaging period. We can then define a gust as the departure of the instantaneous wind speed from the mean, i.e.,

$$u(t) = U(t) - \bar{U} \quad (2)$$

where $u(t)$ is the amplitude of the gust at t . The end of one gust and the beginning of the next are defined by $u(t) = 0$; both positive and negative gusts are possible. Finally we define a measure of gustiness, σ_u , by

$$\sigma_u = \left[\frac{1}{T} \int_0^T u^2(t) dt \right]^{1/2} . \quad (3)$$

To obtain a more precise definition of T required in Equations (1) and (3) it is necessary to consider the accuracy desired and problems associated with long T . Following the logic of Wyngaard⁽⁵⁾, the average wind speed can be estimated to an accuracy of about 1% in a 15 minute observation period. However, more than an hour is required to estimate σ_u to the same accuracy. Thus accuracy considerations lead to measurement for periods as long as possible. The problem associated with long measurement periods is that U and σ_u may become a function of time. In particular, they may change as a result of the earth's diurnal heating cycle. As a result of these considerations, the choice of T in the range of 30 to 60 minutes is most realistic.

During the relatively high wind speeds of interest in wind energy conversion the atmospheric stability is approximately neutral. Under these conditions it is reasonable to assume that our measure of gustiness, σ_u , is a function of wind speed and surface roughness. This assumption is supported by data, although the scatter is large and it is difficult to quantify the relationship between σ_u and surface roughness. SethuRaman, et. al.⁽⁶⁾ present data that indicate

$$\sigma_u = .09 \bar{U} \quad (4)$$

for air flow over water in neutral atmospheric conditions, and MacCready, et. al.⁽⁷⁾ show turbulence increasing more than four-

fold from flat desert terrain to high mountains. Finally, Counihan⁽⁸⁾ formally suggests a relationship of the form

$$\sigma_u = k\bar{U} \quad , \quad (5)$$

where k is a function of surface roughness, based on a review of turbulence data published through 1972. The proportionality constant k is also known as the intensity of turbulence.

Turbulence literature shows a tendency of k to decrease as height above ground and mean wind speed increase. However, for our present purposes we can neglect this variation and adopt Equation (5) assuming a constant k . In addition we assume the relationship between k and terrain given in Table 1.

Table 1. Relationship between the turbulence intensity and terrain types

<u>Terrain Type</u>	<u>k</u>
Smooth/Open Water	.10
Flat/Gently Rolling	.15
Hilly	.20
Low Mountains	.25
High Mountains	.30

In the foregoing discussion, we have assumed neutral atmospheric stability and mechanically generated turbulence. While these are the typical conditions of interest in wind energy conversion, there are other conditions that may be important in WECS design. They include extreme low level atmospheric stability, mountain lee-waves, thunderstorms, and dust devils. The results presented here do not apply to these conditions.

GUST AMPLITUDE EXCEEDANCE ESTIMATES

Having completed basic definitions, we now address the central problem under consideration, i.e., estimation of the number of times a structure will experience gusts of a given amplitude in some specified period of time. If we were in a position to wait an extended period of time for our estimates we would perform the following experiment. We would place an anemometer at the location of the proposed structure and record the wind speed continuously. At the end of the period we would divide the record into 1 hour segments and compute $\bar{U}$ and σ_u for each segment. We would then go back through the records and count the number of gusts and the number of times gust amplitudes exceeded some value of interest, Δu . We would then look for relationship between $N(\Delta u)$, the number of gusts with amplitudes exceeding Δu ; N_o , the total number of gusts, $\bar{U}$, and σ_u . This relationship would then be combined with information on the long term distribution of $\bar{U}$ to provide the desired estimates.

Not having the luxury of an extended period to make observations at each potential site for installation of wind energy conversion systems, we proceed in an identical manner with available data.

The analysis of the LO-LOCAT turbulence data⁽¹⁻³⁾ in general supports a relationship of the form

$$N(\Delta u) = N_o \sum_{i=1}^n P_i e^{-a_i x} \quad (6)$$

for the number of gusts exceeding Δu during a flight, where P_i is the fraction of the time that turbulence category i is encountered, a_i is related to the probability distribution of $u(t)$, and x is $\Delta u / \sigma_u$. The mean wind speed does not enter $N(\Delta u)$ explicitly because steady-state aircraft loads are related to

the mean airspeed of the aircraft rather than the speed of the wind relative to the ground. There is, however, a relationship between $\bar{U}$ and a_i .

The steady-state loads on wind energy conversion systems are a function of mean wind speed. Therefore, it is necessary to identify both mean wind speed and gust amplitude in exceedance estimates. Thus, $N(\Delta u, \bar{U})$ is taken as the number of gusts per unit time with amplitudes exceeding Δu when the mean wind speed is $\bar{U}$.

An analysis of gust amplitude data from Seattle, WA was used to evaluate the relationship between gust amplitudes, turbulence and the mean wind speed during half-hour periods. The wind measurements were made at heights between 12.7 and 95.4 m above ground. Mean wind speeds during the measurement periods ranged between 1 and 14 ms^{-1} . The measurements are described in detail in Reference 4.

When the gust data from Seattle were analyzed, it was determined that N_0 was independent of mean wind speed, and had a mean value of about 1150 hr^{-1} . Figure 1 shows that the number of positive gusts per kilometer of air passage is proportional to the inverse of the mean wind speed. The actual value of N_0 is a function of measurement system dimensions and would be lower for larger measurement systems. In addition it may be a function of the terrain roughness.

It was further determined that for the Seattle data the relationship between $N(\Delta u, \bar{U})$, N_0 and $\Delta u/\sigma_u$ was described by an exponential of the form:

$$N(\Delta u, \bar{U})/N_0 = \exp(-ax^b) \quad (7)$$

where x is $\Delta u/\sigma_u$. Figure 2 shows the relationships for both positive and negative gusts assuming $N_0 = 1150 \text{ hr}^{-1}$. The data points shown represent average values of $N(\Delta u, \bar{U})$ for small ranges of $\Delta u/\sigma_u$.

Figure 1. Relationship between the number of positive gusts and wind speed.

Figure 2. Number of gusts per hour (positive and negative) exceeding a given amplitude.

The values of a and b determined for these data using linear regression techniques are given in Table 2. The differences between the values for positive and negative gusts are statistically significant. As a result they are treated separately throughout this report.

Table 2. Exceedance parameters for
Seattle turbulence data

	a	b
Positive Gusts	1.03	1.43
Negative Gusts	1.16	1.53

The results presented in Equation (7) and Table 2 are specific to the Seattle data, and their application to other locations is open to question. However, in order to provide preliminary estimates of the number of occurrences of large amplitude gusts, we will use these results in conjunction with the results of turbulence research at other locations.

At this point estimation of the number of large amplitude gusts requires the specification of hourly mean wind speed and a qualitative knowledge of the terrain in the area of interest. The remaining task is specification of the frequency of occurrence of each wind speed. Doran, et. al.⁽⁹⁾ discuss wind speed probability distributions and conclude that for wind energy applications a Rayleigh distribution is an acceptable approximation. One advantage of the Rayleigh distribution is that it is completely determined when the annual mean wind speed is specified.

Using this distribution, the number of hours per year that the wind speed is between c_1 and c_2 is given by

$$F(c_1 \leq U \leq c_2) = 8766 \left\{ \exp \left[-\frac{\pi}{4} \left(\frac{c_1}{\bar{V}} \right)^2 \right] - \exp \left[-\frac{\pi}{4} \left(\frac{c_2}{\bar{V}} \right)^2 \right] \right\} \quad (8)$$

where $\bar{V}$ is the annual mean speed.

Cliff⁽¹⁰⁾ presents comparisons of the observed wind speed frequency distributions at 16 locations with the appropriate Rayleigh approximations. These comparisons show that the Rayleigh distribution tends to underestimate the frequency of moderate wind speeds and overestimate the frequency of high wind speeds. However, the differences noted do not significantly affect the utility of the Rayleigh distribution for planning and design studies.

Therefore, we end up with an estimate of the number of gusts per year exceeding Δu of the form

$$N(\Delta u, \bar{U}) = 1150 F(c_1 \leq \bar{U} \leq c_2) \exp(-a x^b) . \quad (9)$$

The number of gusts of amplitude Δu when the hourly mean speed is $\bar{U}$ experienced during the service life of the wind system can be found by simply multiplying $N(\Delta u, \bar{U})$ from Equation (9) by the expected life in years.

RESULTS

Equations (5), (7), (8) and (9) form a set that can be used to estimate the number of large amplitude gusts at a site if the annual mean wind speed and terrain classification are known. These computations have been carried out for each of five terrain classifications and for annual mean wind speeds between 4 and 12 ms^{-1} (9 and 27 mph). The results of the computations are presented in Appendix A for gust amplitudes between -10 and +12 ms^{-1} (-22 and +27 mph) and hourly average wind speeds between 2 and 30 ms^{-1} (4.5 and 67 mph).

Table 3 shows an example of the computational results for a typical location which might be considered for a WECS installation. In the table, values of $N(\Delta u, \bar{U})$ are given as a function of Δu and $\bar{U}$. In reality, $\bar{U}$ is the center of a 2 ms^{-1} range, i.e., 10 ms^{-1} represents the range 9 to 11 ms^{-1} . It should also be remembered that $N(\Delta u, \bar{U})$ is the number of gusts exceeding Δu . Values of $N(\Delta u, \bar{U})$ less than 0.1 yr^{-1} are not included in Table 3 or in the tables in Appendix A.

The variation of gust estimates with terrain classification and annual mean wind speed is shown in Tables 4 through 6. Table 4 is for an hourly average speed near the low end of a typical WECS operating range, and Tables 5 and 6 are for average wind speeds near the high speed end. In each table the gust amplitude examined is approximately half of the average speed. In general, Tables 4 through 6 show that the estimated number of gusts of a given amplitude becomes less sensitive to changes in annual mean wind speed or terrain classification as the wind speed and terrain roughness increase.

Table 4 shows that the number of gusts of a given amplitude reaches a maximum as the annual mean wind speed increases, and then decreases with further increases in mean speed. The rate of increase is rapid at low speeds and is generally more rapid than the decrease at high speeds. This behavior follows from the shape of the frequency distribution of hourly average speeds and the change of the distribution with changes in annual mean speeds. As expected, the number of gusts of a given amplitude also increases with increasing terrain roughness. This increase results from the decrease in the ratio $\Delta u/\sigma_u$ as σ_u becomes a larger proportion of $\bar{U}$.

Tables 5 and 6 show the increase in number of gusts with increasing annual mean speed, but they do not show the maximum. The hourly average speeds considered in these tables are sufficiently high that the maximums occur at annual mean speeds above 12 ms^{-1} .

Table 3. Estimated number of large amplitude gusts
for a location in hilly terrain with a
6 ms⁻¹ annual mean wind speed.

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					1.89+00	6.12+01					
4				2.57+00	2.10+04	5.29+04	8.32+01				
6			2.51+00	1.47+03	1.85+05	2.77+05	7.42+03	8.11+01	4.40-01		
8		1.83+00	2.49+02	1.50+04	3.35+05	4.16+05	3.77+04	1.89+03	5.93+01	1.26+00	
10	1.06+00	5.70+01	1.86+03	3.42+04	3.11+05	3.54+05	6.17+04	6.98+03	5.63+02	3.42+01	1.61+00
12	1.41+01	2.88+02	4.02+03	3.63+04	1.92+05	2.09+05	5.43+04	1.01+04	1.45+03	1.68+02	1.59+01
14	4.82+01	5.21+02	4.17+03	2.36+04	8.83+04	9.32+04	3.16+04	8.22+03	1.73+03	3.06+02	4.62+01
16	6.93+01	4.82+02	2.62+03	1.08+04	3.16+04	3.27+04	1.34+04	4.40+03	1.21+03	2.90+02	6.07+01
18	5.46+01	2.75+02	1.13+03	3.69+03	9.03+03	9.26+03	4.35+03	1.70+03	5.72+02	1.70+02	4.54+01
20	2.72+01	1.08+02	3.59+02	9.80+02	2.10+03	2.13+03	1.11+03	4.96+02	1.94+02	6.85+01	2.20+01
22	9.37+00	3.08+01	8.70+01	2.07+02	4.00+02	4.04+02	2.29+02	1.13+02	5.00+01	2.01+01	7.46+00
24	2.36+00	6.67+00	1.66+01	3.54+01	6.29+01	6.34+01	3.84+01	2.06+01	9.99+00	4.47+00	1.86+00
26	4.49-01	1.13+00	2.52+00	4.93+00	8.21+00	8.24+00	5.27+00	3.02+00	1.59+00	7.74-01	3.55-01
28		1.51-01	3.10-01	5.65-01	8.90-01	8.91-01	5.96-01	3.61-01	2.02-01	1.06-01	
30											

Table 4. Estimated number of occurrences per year of gusts exceeding 4 ms^{-1} (9 mph) when the hourly average wind speed is between 7 and 9 ms^{-1} (16 and 20 mph).

<u>Terrain</u>	<u>ANNUAL MEAN WIND SPEED</u>				
	4	6	8	10	12
Open Water	2.5+01	5.9+01	6.1+01	5.2+01	4.2+01
Flat Land	2.2+03	5.4+03	5.6+03	4.8+03	3.8+03
Hilly	1.6+04	3.8+04	3.9+04	3.3+04	2.7+04
Low Mts.	4.4+04	1.1+05	1.1+05	9.4+04	7.6+04
High Mts.	8.4+04	2.0+05	2.1+05	1.8+05	1.4+05

Table 5. Estimated number of occurrences per year of gust exceeding 8 ms^{-1} (18 mph) when the hourly average wind speed is between 15 and 17 ms^{-1} (34 and 38 mph).

<u>Terrain</u>	<u>ANNUAL MEAN WIND SPEED</u>				
	4	6	8	10	12
Open Water	*	1.9+00	1.2+01	2.3+01	3.0+01
Flat Land	4.8-01	1.7+02	1.1+03	2.1+03	2.7+03
Hilly	3.3+00	1.2+03	7.5+03	1.5+04	1.9+04
Low Mts.	9.5+00	3.4+03	2.1+04	4.2+04	5.4+04
High Mts.	1.8+01	6.5+03	4.0+04	7.9+04	1.0+05

*less than 0.1

Table 6. Estimated number of occurrences per year of gusts exceeding 12 ms^{-1} (27 mph) when the hourly average wind speed is between 23 and 25 ms^{-1} (51 and 56 mph).

Terrain	ANNUAL MEAN WIND SPEED				
	4	6	8	10	12
Open Water	*	*	3.6-01	2.8+00	7.8+00
Flat Land	*	2.7-01	3.3+01	2.6+02	7.2+02
Hilly	*	1.9+00	2.3+02	1.8+03	5.0+03
Low Mts.	*	5.3+00	6.5+02	5.2+03	1.4+04
High Mts.	*	1.0+01	1.2+03	9.7+03	2.7+04

*less than 0.1

The number of gusts of a given amplitude is directly related to N_0 assumed in for use in Equation (5). The value 1150 hr^{-1} assumed earlier leads to an upper limit of 10^7 positive and negative gusts per year. Further, this limit should be approached as Δu becomes small and σ_u becomes large, if the wind speed dependence is eliminated, i.e.,

$$\lim_{\Delta u/\sigma_u \rightarrow 0} \sum_{\bar{U}} N(\Delta u, \bar{U}) = 10^7 \quad (10)$$

A check of the estimates for $\Delta u = 2 \text{ ms}^{-1}$ in Table A-25 ($\Delta u/\sigma_u = 0.56$) shows the summation in Equation (9) to be about 5.4×10^6 .

If the value of N_0 in Equation (5) were to be changed by a factor of 2, all estimates in Tables 3 through 6 and A-1 through A-25 would be changed by a factor of 2. This factor of 2 change is small in comparison with many of the differences in the estimates in Tables 4 through 6 as a result of changing terrain classification by a single category. In addition at low annual mean wind speeds a change of 2 ms^{-1} can produce

changes in the estimates which are larger than those from a factor of 2 change in N_0 .

CONCLUSIONS

The estimated number of occurrences of large amplitude gusts presented in Tables 3 through 6 and Tables A-1 through A-25 are preliminary estimates based on detailed analysis of a limited amount of data. The analysis is supported by conclusions drawn from other studies of atmospheric turbulence. An attempt has been made to present realistic estimates of the number of occurrences of these gusts. However in some instances assumptions have been made which may tend to result in overestimates of the gust occurrences, and in other cases assumptions were made out of necessity. In these cases the resulting biases are unknown.

Assumptions that may tend to bias the estimates toward high values include the assumptions that: $N_0 = 1150 \text{ hr}^{-1}$, k is constant, and that hourly average wind speeds have a Rayleigh distribution.

Assumptions that have an unknown effect on the estimates include both the form of Equation (7) and the values of its numerical coefficients. In comparison with a Gaussian representation, Equation (7) produces the larger estimates, but the Gaussian distribution may underestimate the frequency of large gusts⁽¹¹⁾.

Following evaluation of the estimates presented in this report by design engineers, revisions, if warranted, should include analysis of additional turbulence data to improve the assumptions listed above.

If it becomes necessary to estimate the number of large amplitude gusts at a specific site, the estimates can be improved by utilizing available data rather than assumptions

or by making more detailed assumptions. In particular, terrain roughness (and intensity of turbulence) can be treated as a function of wind direction.

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*Available from the National Technical Information Service, Springfield, VA 22161.

Appendix A
GUST EXCEEDANCE TABLES

GUST EXCEEDANCE TABLES

The tables presented in this appendix contain estimates of $N(\Delta u, \bar{U})$, the number of times per year that gust amplitudes will exceed Δu when the hourly mean wind speed is $\bar{U}$. These estimates were computed using

$$N(\Delta u, \bar{U}) = 1150 F(c_1 \leq \bar{U} \leq c_2) \exp(-ax^b), \quad (A1)$$

$$F(c_1 \leq \bar{U} \leq c_2) = 8766 \left\{ \exp \left[-\frac{\pi}{4} \left(\frac{c_1}{\bar{V}} \right)^2 \right] - \exp \left[-\frac{\pi}{4} \left(\frac{c_2}{\bar{V}} \right)^2 \right] \right\}, \quad (A2)$$

and

$$x = \Delta u / \sigma_u = \Delta u / (k\bar{U}) \quad (A3)$$

where: c_1 and c_2 define a range for hourly wind speeds, $\bar{V}$ is the annual mean speed; and σ_u is a measure of the gustiness. The values of a , b and k are given in Tables 1 and 2 of the text. Wind speeds used in Equations A1 through A3 are for wind energy conversion system hub height.

To find the proper estimate for a particular application, first select the Table that corresponds to the terrain and annual mean wind speed of interest. For example, Table A-6 might be selected if gusts in the Kansas plains were of interest and the annual average wind speed was found to be about 4 ms^{-1} (8.9 mph). The table shows that gusts of 2 ms^{-1} or larger during periods when the average wind speed is 10 ms^{-1} are estimated to occur about 3.4×10^4 times per year. Note that $3.39 + 04$ in table is read as 3.39×10^4 . During a 30 year life time it is estimated that a wind energy conversion system would be subjected to about 10^6 gusts of this magnitude.

The tables do not provide any information on the rate at which the wind speed increases or the duration of gusts.

TABLE A-1

TERRAIN: Smooth

ANNUAL MEAN WIND SPEED: 4 ms^{-1}

HOURLY AVERAGE SPEED (ms^{-1})	GUST AMPLITUDE (ms^{-1})				
	-4	-2	2	4	6
2					
4		3.71+00	1.20+02		
6		1.26+03	6.37+03	3.78-01	
8	7.58-01	6.20+03	1.56+04	2.46+01	
10	9.25+00	5.54+03	1.00+04	9.14+01	2.61-01
12	1.48+01	1.87+03	2.79+03	7.49+01	8.19-01
14	6.88+00	3.13+02	4.18+02	2.29+01	6.11-01
16	1.33+00	2.97+01	3.69+01	3.34+00	1.67-01
18	1.27-01	1.71+00	2.01+00	2.65-01	

TABLE A-2

TERRAIN: Smooth

ANNUAL MEAN WIND SPEED: 6 ms^{-1}

HOURLY AVERAGE SPEED (ms^{-1})	GUST AMPLITUDE (ms^{-1})								
	-8	-6	-4	-2	2	4	6	8	10
2									
4				2.57+00	8.32+01				
6				1.47+03	7.42+03	4.40-01			
8			1.83+00	1.50+04	3.77+04	5.93+01			
10			5.70+01	3.42+04	6.17+04	5.63+02	1.61+00		
12		4.92-01	2.88+02	3.63+04	5.43+04	1.45+03	1.59+01		
14		3.40+00	5.21+02	2.36+04	3.16+04	1.73+03	4.62+01	7.01-01	
16		8.00+00	4.82+02	1.08+04	1.34+04	1.21+03	6.07+01	1.91+00	
18	1.49-01	9.00+00	2.75+02	3.69+03	4.35+03	5.72+02	4.54+01	2.44+00	
20	1.80-01	5.87+00	1.08+02	9.80+02	1.11+03	1.94+02	2.20+01	1.78+00	1.08-01
22	1.23-01	2.49+00	3.08+01	2.07+02	2.29+02	5.00+01	7.46+00	8.29-01	
24		7.40-01	6.67+00	3.54+01	3.84+01	9.99+00	1.86+00	2.68-01	
26		1.61-01	1.13+00	4.93+00	5.27+00	1.59+00	3.55-01		
28			1.51-01	5.65-01	5.96-01	2.02-01			

TABLE A-3

TERRAIN: Smooth

ANNUAL MEAN WIND SPEED: 8 ms^{-1}

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2											
4					1.69+00	5.48+01					
6					1.17+03	5.90+03	3.49-01				
8				1.89+00	1.54+04	3.89+04	6.11+01				
10				8.23+01	4.94+04	8.90+04	8.13+02	2.32+00			
12			1.07+00	6.27+02	7.89+04	1.18+05	3.17+03	3.46+01	1.88-01		
14			1.20+01	1.84+03	8.36+04	1.12+05	6.12+03	1.63+02	2.48+00		
16		3.65-01	4.95+01	2.98+03	6.68+04	8.30+04	7.52+03	3.76+02	1.18+01	2.50-01	
18		1.75+00	1.05+02	3.22+03	4.31+04	5.08+04	6.68+03	5.31+02	2.85+01	1.10+00	
20		4.27+00	1.40+02	2.56+03	2.33+04	2.65+04	4.62+03	5.23+02	4.22+01	2.56+00	1.21-01
22	2.03-01	6.38+00	1.30+02	1.60+03	1.08+04	1.20+04	2.60+03	3.89+02	4.32+01	3.74+00	2.60-01
24	3.20-01	6.53+00	9.10+01	3.21+02	4.35+03	4.73+03	1.23+03	2.29+02	3.29+01	3.80+00	3.60-01
26	3.41-01	4.91+00	5.05+01	3.53+02	1.55+03	1.65+03	4.97+02	1.11+02	1.97+01	2.86+00	3.50-01
28	2.65-01	2.87+00	2.29+01	1.30+02	4.86+02	5.13+02	1.74+02	4.52+01	9.53+00	1.68+00	2.54-01
30	1.58-01	1.34+00	8.73+00	4.16+01	1.36+02	1.42+02	5.34+01	1.57+01	3.84+00	7.97-01	1.44-01

TABLE A-4

TERRAIN: Smooth

ANNUAL MEAN WIND SPEED: 10 ms^{-1}

HOURLY AVERAGE SPEED (ms^{-1})	GUST AMPLITUDE (ms^{-1})											
	-10	-8	-6	-4	-2	2	4	6	8	10	12	
2												
4					1.17+00	3.78+01						
6					8.78+02	4.43+03	2.63-01					
8				1.60+00	1.31+04	3.31+04	5.19+01					
10				8.18+01	4.91+04	8.85+04	8.09+02	2.31+00				
12			1.29+00	7.55+02	9.50+04	1.42+05	3.81+03	4.17+01	2.26-01			
14			1.82+01	2.78+03	1.26+05	1.69+05	9.25+03	2.47+02	3.75+00			
16		7.16-01	9.72+01	5.86+03	1.31+05	1.63+05	1.48+04	7.38+02	2.32+01	4.91-01		
18		4.61+00	2.78+02	8.49+03	1.14+05	1.34+05	1.76+04	1.40+03	7.52+01	2.89+00		
20	2.91-01	1.57+01	5.13+02	9.41+03	8.56+04	9.74+04	1.70+04	1.92+03	1.55+02	9.41+00	4.43-01	
22	1.08+00	3.39+01	6.88+02	8.50+03	5.72+04	6.34+04	1.38+04	2.06+03	2.29+02	1.98+01	1.38+00	
24	2.53+00	5.17+01	7.21+02	6.50+03	3.45+04	3.74+04	9.74+03	1.82+03	2.61+02	3.01+01	2.85+00	
26	4.18+00	6.02+01	6.19+02	4.33+03	1.89+04	2.02+04	6.09+03	1.36+03	2.41+02	3.51+01	4.29+00	
28	5.20+00	5.62+01	4.50+02	2.55+03	9.53+03	1.01+04	3.42+03	8.88+02	1.87+02	3.30+01	4.99+00	
30	5.14+00	4.37+01	2.84+02	1.35+03	4.42+03	4.62+03	1.74+03	5.12+02	1.25+02	2.59+01	4.68+00	

TABLE A-5

TERRAIN: Smooth

ANNUAL MEAN WIND SPEED: 12 ms^{-1}

HOURLY AVERAGE SPEED (ms^{-1})	-10	-8	-6	-4	GUST AMPLITUDE (ms^{-1})			6	8	10	12
					-2	2	4				
2											
4					8.44-01	2.73-01					
6					6.66+02	3.36+03	1.99-01				
8				1.30+00	1.06+04	2.68+04	4.21+01				
10				7.23+01	4.33+04	7.82+04	7.14+02	2.04+00			
12			1.26+00	7.41+02	9.32+04	1.40+05	3.74+03	4.09+01	2.22-01		
14			2.02+01	3.09+03	1.40+05	1.87+05	1.03+04	2.74+02	4.16+00		
16		9.16-01	1.24+02	7.49+03	1.68+05	2.08+05	1.89+04	9.45+02	2.97+01	6.29-01	
18		6.93+00	4.18+02	1.28+04	1.71+05	2.02+05	2.65+04	2.11+03	1.13+02	4.35+00	1.25-01
20	5.24-01	2.83+01	9.25+02	1.70+04	1.54+05	1.76+05	3.06+04	3.47+03	2.80+02	1.70+01	7.99-01
22	2.37+00	7.45+01	1.51+03	1.87+04	1.26+05	1.39+05	3.04+04	4.54+03	5.04+02	4.37+01	3.04+00
24	6.94+00	1.42+02	1.98+03	1.78+04	9.45+04	1.03+05	2.67+04	4.98+03	7.15+02	8.24+01	7.82+00
26	1.45+01	2.09+02	2.15+03	1.50+04	6.58+04	7.03+04	2.12+04	4.73+03	8.38+02	1.22+02	1.49+01
28	2.34+01	2.53+02	2.02+03	1.15+04	4.28+04	4.52+04	1.54+04	3.99+03	8.40+02	1.48+02	2.24-01
30	3.04+01	2.59+02	1.68+03	8.01+03	2.62+04	2.74+04	1.03+04	3.03+03	7.40+02	1.54+02	2.77+01

TABLE A-6

TERRAIN: Flat/Gently Rolling
 ANNUAL MEAN WIND SPEED: 4 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	-10	-8	-6	-4	GUST AMPLITUDE (ms ⁻¹)		4	6	8	10	12
2						6.65-01					
4					2.18+03	1.10+04	6.51-01				
6				2.09+01	3.86+04	8.01+04	3.42+02	3.78-01			
8			7.58-01	4.45+02	5.59+04	8.38+04	2.24+03	2.46+01	1.33-01		
10			9.25+00	8.53+02	2.64+04	3.39+04	2.44+03	9.14+01	2.05+00		
12		2.46-01	1.48+01	4.53+02	6.07+03	7.17+03	9.41+02	7.49+01	4.02+00	1.54-01	
14		2.71-01	6.88+00	1.02+02	7.94+02	8.90+02	1.75+02	2.29+01	2.19+00	1.60-01	
16			1.33+00	1.20+01	6.34+01	6.88+01	1.79+01	3.34+00	4.80-01		
18			1.27-01	7.99-01	3.22+00	3.41+00	1.09+00	2.65-01			
20					1.06-01	1.11-01					
22											
24											
26											
28											
30											

TABLE A-7

TERRAIN: Flat/Gently Rolling
ANNUAL MEAN WIND SPEED: 6 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	-10	-8	-6	-4	GUST AMPLITUDE (ms ⁻¹)		4	6	8	10	12
					-2	2					
2						3.32-01					
4					1.51+03	7.60+03	4.51-01				
6				2.44+01	4.50+04	9.33+04	3.98+02	4.40-01			
8			1.83+00	1.07+03	1.35+05	2.02+05	5.42+03	5.93+01	3.21-01		
10		2.52-01	5.70+01	5.26+03	1.63+05	2.09+05	1.50+04	5.63+02	1.27+01	1.85-01	
12		4.78+00	2.88+02	8.81+03	1.18+05	1.39+05	1.83+04	1.45+03	7.80+01	3.00+00	
14	5.06-01	2.05+01	5.21+02	7.74+03	6.00+04	6.73+04	1.32+04	1.73+03	1.65+02	1.21+01	7.01-01
16	1.69+00	3.46+01	4.82+02	4.35+03	2.31+04	2.50+04	6.51+03	1.21+03	1.74+02	2.01+01	1.91+00
18	2.46+00	3.05+01	2.75+02	1.73+03	6.95+03	7.38+03	2.36+03	5.72+02	1.11+02	1.78+01	2.44+00
20	1.95+00	1.66+01	1.08+02	5.14+02	1.68+03	1.76+03	6.59+02	1.94+02	4.74+01	9.84+00	1.78+00
22	9.61-01	6.11+00	3.08+01	1.19+02	3.30+02	3.41+02	1.45+02	5.00+01	1.46+01	3.70+00	8.29-01
24	3.21-01	1.62+00	6.67+00	2.17+01	5.32+01	5.45+01	2.56+01	9.99+00	3.37+00	1.00+00	2.68-01
26		3.23-01	1.13+00	3.20+00	7.07+00	7.20+00	3.67+00	1.59+00	6.01-01	2.04-01	
28			1.51-01	3.84-01	7.79-01	7.90-01	4.31-01	2.02-01			
30											

TABLE A-8

TERRAIN: Flat/Gently Rolling
 ANNUAL MEAN WIND SPEED: 8 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	-10	-8	-6	-4	GUST AMPLITUDE (ms ⁻¹)		-2	2	4	6	8	10	12
2								1.95-01					
4							9.93+02	5.01+03	2.97-01				
6				1.94+01	3.57+04	7.42+04	3.16+02	3.49-01					
8			1.89+00	1.11+03	1.39+05	2.09+05	5.59+03	6.11+01	3.31-01				
10		3.64-01	8.23+01	7.60+03	2.35+05	3.02+05	2.17+04	8.13+02	1.83+01	2.67-01			
12		1.04+01	6.27+02	1.92+04	2.57+05	3.03+05	3.98+04	3.17+03	1.70+02	6.53+00	1.88-01		
14	1.79+00	7.25+01	1.84+03	2.74+04	2.12+05	2.38+05	4.67+04	6.12+03	5.85+02	4.28+01	2.48+00		
16	1.05+01	2.14+02	2.98+03	2.69+04	1.43+05	1.55+05	4.03+04	7.52+03	1.08+03	1.24+02	1.18+01		
18	2.88+01	3.57+02	3.22+03	2.02+04	8.12+04	8.62+04	2.76+04	6.68+03	1.30+03	2.08+02	2.85+01		
20	4.63+01	3.94+02	2.56+03	1.22+04	3.99+04	4.17+04	1.57+04	4.62+03	1.13+03	2.34+02	4.22+01		
22	5.01+01	3.18+02	1.60+03	6.18+03	1.72+04	1.78+04	7.56+03	2.60+03	7.59+02	1.93+02	4.32+01		
24	3.96+01	2.00+02	8.21+02	2.67+03	6.54+03	6.71+03	3.15+03	1.23+03	4.14+02	1.23+02	3.29+01		
26	2.42+01	1.01+02	3.53+02	1.00+03	2.22+03	2.26+03	1.15+03	4.97+02	1.88+02	6.39+01	1.97+01		
28	1.19+01	4.26+01	1.30+02	3.31+02	6.70+02	6.79+02	3.71+02	1.74+02	7.27+01	2.75+01	9.53+00		
30	4.83+00	1.52+01	4.16+01	9.62+01	1.82+02	1.83+02	1.06+02	5.34+01	2.42+01	1.00+01	3.84+00		

TABLE A-9

TERRAIN: Flat/Gently Rolling
ANNUAL MEAN WIND SPEED: 10 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	-10	-8	-6	-4	GUST AMPLITUDE (ms ⁻¹)		4	6	8	10	12
2						1.27-01					
4					6.85+02	3.46+03	2.05-01				
6				1.46+01	2.69+04	5.58+04	2.38+02	2.63-01			
8			1.60+00	9.41+02	1.18+05	1.77+05	4.75+03	5.19+01	2.82-01		
10		3.61-01	8.18+01	7.55+03	2.34+05	3.00+05	2.16+04	8.09+02	1.82+01	2.66-01	
12	1.15-01	1.25+01	7.55+02	2.31+04	3.09+05	3.65+05	4.80+04	3.81+03	2.05+02	7.87+00	2.26-01
14	2.70+00	1.09+02	2.78+03	4.14+04	3.21+05	3.60+05	7.06+04	9.25+03	8.84+02	6.47+01	3.75+00
16	2.06+01	4.20+02	5.86+03	5.28+04	2.80+05	3.04+05	7.91+04	1.48+04	2.12+03	2.44+02	2.32+01
18	7.60+01	9.41+02	8.49+03	5.32+04	2.14+05	2.28+05	7.29+04	1.76+04	3.42+03	5.50+02	7.52+01
20	1.70+02	1.45+03	9.41+03	4.49+04	1.47+05	1.53+05	5.76+04	1.70+04	4.14+03	8.60+02	1.55+02
22	2.65+02	1.69+03	8.50+03	3.28+04	9.11+04	9.42+04	4.01+04	1.38+04	4.03+03	1.02+03	2.29+02
24	3.13+02	1.58+03	6.50+03	2.12+04	5.18+04	5.31+04	2.50+04	9.74+03	3.28+03	9.77+02	2.61+02
26	2.96+02	1.24+03	4.33+03	1.23+04	2.71+04	2.77+04	1.41+04	6.09+03	2.31+03	7.83+02	2.41+02
28	2.33+02	8.37+02	2.55+03	6.49+03	1.31+04	1.33+04	7.27+03	3.42+03	1.43+03	5.40+02	1.87+02
30	1.57+02	4.96+02	1.35+03	3.13+03	5.91+03	5.97+03	3.45+03	1.74+03	7.87+02	3.26+02	1.25+02

TABLE A-10

TERRAIN: Flat/Gently Rolling
ANNUAL MEAN WIND SPEED: 12 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2											
4					4.95+02	2.50+03	1.48-01				
6				1.11+01	2.04+04	4.23+04	1.80+02	1.99-01			
8			1.30+00	7.63+02	9.60+04	1.44+05	3.85+03	4.21+01	2.28-01		
10		3.19-01	7.23+01	6.67+03	2.06+05	2.65+05	1.91+04	7.14+02	1.61+01	2.35-01	
12	1.13-01	1.23+01	7.41+02	2.27+04	3.03+05	3.58+05	4.70+04	3.74+03	2.01+02	7.72+00	2.22-01
14	3.00+00	1.21+02	3.09+03	4.59+04	3.56+05	3.99+05	7.83+04	1.03+04	9.81+02	7.18+01	4.16+00
16	2.63+01	5.37+02	7.49+03	6.76+04	3.59+05	3.89+05	1.01+05	1.89+04	2.71+03	3.13+02	2.97+01
18	1.14+02	1.42+03	1.28+04	8.01+04	3.22+05	3.42+05	1.10+05	2.65+04	5.14+03	8.28+02	1.13+02
20	3.07+02	2.61+03	1.70+04	8.09+04	2.64+05	2.76+05	1.04+05	3.06+04	7.46+03	1.55+03	2.80+02
22	5.84+02	3.72+03	1.87+04	7.21+04	2.01+05	2.07+05	8.82+04	3.04+04	8.86+03	2.25+03	5.04+02
24	8.58+02	4.33+03	1.78+04	5.80+04	1.42+05	1.46+05	6.84+04	2.67+04	8.99+03	2.68+03	7.15+02
26	1.03+03	4.31+03	1.50+04	4.27+04	9.43+04	9.61+04	4.90+04	2.12+04	8.02+03	2.72+03	8.38+02
28	1.05+03	3.76+03	1.15+04	2.91+04	5.91+04	5.99+04	3.27+04	1.54+04	6.41+03	2.42+03	8.40+02
30	9.31+02	2.94+03	8.01+03	1.85+04	3.50+04	3.53+04	2.04+04	1.03+04	4.66+03	1.93+03	7.40+02

TABLE A-11

TERRAIN: Hilly

ANNUAL MEAN WIND SPEED: 4 ms^{-1}

HOURLY AVERAGE SPEED (ms^{-1})	GUST AMPLITUDE (ms^{-1})										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					3.79+00	1.23+02					
4				3.71+00	3.04+04	7.65+04	1.20+02				
6			2.15+00	1.26+03	1.59+05	2.38+05	6.37+03	6.97+01	3.78-01		
8		7.58-01	1.03+02	6.20+03	1.39+05	1.72+05	1.56+04	7.82+02	2.46+01	5.20-01	
10	1.71-01	9.25+00	3.02+02	5.54+03	5.04+04	5.73+04	1.00+04	1.13+03	9.14+01	5.54+00	2.61-01
12	7.27-01	1.48+01	2.07+02	1.87+03	9.89+03	1.07+04	2.79+03	5.21+02	7.49+01	8.62+00	8.19-01
14	6.37-01	6.88+00	5.51+01	3.13+02	1.17+03	1.23+03	4.18+02	1.09+02	2.29+01	4.04+00	6.11-01
16	1.91-01	1.33+00	7.22+00	2.97+01	8.68+01	9.00+01	3.69+01	1.21+01	3.34+00	7.97-01	1.67-01
18		1.27-01	5.24-01	1.71+00	4.18+00	4.28+00	2.01+00	7.85-01	2.65-01		
20					1.32-01	1.34-01					
22											
24											
26											
28											
30											

TABLE A-12

TERRAIN: Hilly

ANNUAL MEAN WIND SPEED: 6 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	-10	-8	-6	-4	GUST AMPLITUDE (ms ⁻¹)		4	6	8	10	12
2					1.89+00	6.12+01					
4				2.57+00	2.10+04	5.29+04	8.32+01				
6			2.51+00	1.47+03	1.85+05	2.77+05	7.42+03	8.11+01	4.40-01		
8		1.83+00	2.49+02	1.50+04	3.35+05	4.16+05	3.77+04	1.89+03	5.93+01	1.26+00	
10	1.06+00	5.70+01	1.86+03	3.42+04	3.11+05	3.54+05	6.17+04	6.98+03	5.63+02	3.42+01	1.61+00
12	1.41+01	2.88+02	4.02+03	3.63+04	1.92+05	2.09+05	5.43+04	1.01+04	1.45+03	1.68+02	1.59+01
14	4.82+01	5.21+02	4.17+03	2.36+04	8.83+04	9.32+04	3.16+04	8.22+03	1.73+03	3.06+02	4.62+01
16	6.93+01	4.82+02	2.62+03	1.08+04	3.16+04	3.27+04	1.34+04	4.40+03	1.21+03	2.90+02	6.07+01
18	5.46+01	2.75+02	1.13+03	3.69+03	9.03+03	9.26+03	4.35+03	1.70+03	5.72+02	1.70+02	4.54+01
20	2.72+01	1.08+02	3.59+02	9.80+02	2.10+03	2.13+03	1.11+03	4.96+02	1.94+02	6.85+01	2.20+01
22	9.37+00	3.08+01	8.70+01	2.07+02	4.00+02	4.04+02	2.29+02	1.13+02	5.00+01	2.01+01	7.46+00
24	2.36+00	6.67+00	1.66+01	3.54+01	6.29+01	6.34+01	3.84+01	2.06+01	9.99+00	4.47+00	1.86+00
26	4.49-01	1.13+00	2.52+00	4.93+00	8.21+00	8.24+00	5.27+00	3.02+00	1.59+00	7.74-01	3.55-01
28		1.51-01	3.10-01	5.65-01	8.90-01	8.91-01	5.96-01	3.61-01	2.02-01	1.06-01	
30											

TABLE A-13

TERRAIN: Hilly

ANNUAL MEAN WIND SPEED: 8 ms^{-1}

HOURLY AVERAGE SPEED (ms^{-1})	GUST AMPLITUDE (ms^{-1})										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					1.11+00	3.59+01					
4				1.69+00	1.39+04	3.49+04	5.48+01				
6			1.99+00	1.17+03	1.47+05	2.20+05	5.90+03	6.45+01	3.49-01		
8		1.89+00	2.56+02	1.54+04	3.46+05	4.30+05	3.89+04	1.95+03	6.11+01	1.30+00	
10	1.52+00	8.23+01	2.69+03	4.94+04	4.49+05	5.10+05	8.90+04	1.01+04	8.13+02	4.93+01	2.32+00
12	3.07+01	6.27+02	8.75+03	7.89+04	4.19+05	4.54+05	1.18+05	2.20+04	3.17+03	3.65+02	3.46+01
14	1.70+02	1.84+03	1.47+04	8.36+04	3.12+05	3.29+05	1.12+05	2.91+04	6.12+03	1.08+03	1.63+02
16	4.29+02	2.98+03	1.62+04	6.68+04	1.95+05	2.03+05	8.30+04	2.72+04	7.52+03	1.79+03	3.76+02
18	6.38+02	3.22+03	1.32+04	4.31+04	1.05+05	1.08+05	5.08+04	1.98+04	6.68+03	1.99+03	5.31+02
20	6.46+02	2.56+03	8.53+03	2.33+04	4.99+04	5.07+04	2.65+04	1.18+04	4.62+03	1.63+03	5.23+02
22	4.88+02	1.60+03	4.53+03	1.08+04	2.08+04	2.11+04	1.20+04	5.89+03	2.60+03	1.05+03	3.89+02
24	2.90+02	8.21+02	2.04+03	4.35+03	7.74+03	7.80+03	4.73+03	2.53+03	1.23+03	5.51+02	2.29+02
26	1.41+02	3.53+02	7.90+02	1.55+03	2.57+03	2.58+03	1.65+03	9.46+02	4.97+02	2.43+02	1.11+02
28	5.73+01	1.30+02	2.67+02	4.86+02	7.66+02	7.67+02	5.13+02	3.11+02	1.74+02	9.14+01	4.52+01
30	1.99+01	4.16+01	7.93+01	1.36+02	2.05+02	2.05+02	1.42+02	9.03+01	5.34+01	2.98+01	1.57+01

TABLE A-14

TERRAIN: Hilly

ANNUAL MEAN WIND SPEED: 10 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					7.24-01	2.34+01					
4				1.17+00	9.55+03	2.41+04	3.78+01				
6			1.50+00	8.78+02	1.11+05	1.66+05	4.43+03	4.85+01	2.63-01		
8		1.60+00	2.18+02	1.31+04	2.94+05	3.65+05	3.31+04	1.65+03	5.19+01	1.10+00	
10	1.51+00	8.18+01	2.67+03	4.91+04	4.46+05	5.07+05	8.85+04	1.00+04	8.09+02	4.90+01	2.31+00
12	3.70+01	7.55+02	1.05+04	9.50+04	5.04+05	5.47+05	1.42+05	2.66+04	3.81+03	4.39+02	4.17+01
14	2.57+02	2.78+03	2.23+04	1.26+05	4.71+05	4.98+05	1.69+05	4.39+04	9.25+03	1.63+03	2.47+02
16	8.42+02	5.86+03	3.19+04	1.31+05	3.83+05	3.98+05	1.63+05	5.35+04	1.48+04	3.52+03	7.38+02
18	1.68+03	8.49+03	3.49+04	1.14+05	2.78+05	2.85+05	1.34+05	5.23+04	1.76+04	5.25+03	1.40+03
20	2.38+03	9.41+03	3.14+04	8.56+04	1.83+05	1.86+05	9.74+04	4.33+04	1.70+04	5.99+03	1.92+03
22	2.59+03	8.50+03	2.40+04	5.72+04	1.10+05	1.12+05	6.34+04	3.12+04	1.38+04	5.56+03	2.06+03
24	2.30+03	6.50+03	1.61+04	3.45+04	6.13+04	6.18+04	3.74+04	2.00+04	9.74+03	4.36+03	1.82+03
26	1.72+03	4.33+03	9.68+03	1.89+04	3.15+04	3.16+04	2.02+04	1.16+04	6.09+03	2.97+03	1.36+03
28	1.12+03	2.55+03	5.24+03	9.53+03	1.50+04	1.50+04	1.01+04	6.10+03	3.42+03	1.79+03	8.88+02
30	6.46+02	1.35+03	2.58+03	4.42+03	6.66+03	6.66+03	4.62+03	2.94+03	1.74+03	9.68+02	5.12+02

TABLE A-15

TERRAIN: Hilly

ANNUAL MEAN WIND SPEED: 12 ms^{-1}

HOURLY AVERAGE SPEED (ms^{-1})	GUST AMPLITUDE (ms^{-1})										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					5.08-01	1.65+01					
4				8.44-01	6.90+03	1.74+04	2.73+01				
6			1.14+00	6.66+02	8.38+04	1.26+05	3.36+03	3.68+01	1.99-01		
8		1.30+00	1.77+02	1.06+04	2.38+05	2.96+05	2.68+04	1.34+03	4.21+01	8.92-01	
10	1.34+00	7.23+01	2.36+03	4.33+04	3.94+05	4.48+05	7.82+04	8.85+03	7.14+02	4.33+01	2.04+00
12	3.63+01	7.41+02	1.03+04	9.32+04	4.94+05	5.36+05	1.40+05	2.60+04	3.74+03	4.31+02	4.09+01
14	2.86+02	3.09+03	2.47+04	1.40+05	5.23+05	5.52+05	1.87+05	4.87+04	1.03+04	1.81+03	2.74+02
16	1.08+03	7.49+03	4.08+04	1.68+05	4.91+05	5.09+05	2.08+05	6.84+04	1.89+04	4.50+03	9.45+02
18	2.53+03	1.28+04	5.26+04	1.71+05	4.19+05	4.29+05	2.02+05	7.87+04	2.65+04	7.90+03	2.11+03
20	4.28+03	1.70+04	5.65+04	1.54+05	3.30+05	3.36+05	1.76+05	7.81+04	3.06+04	1.08+04	3.47+03
22	5.70+03	1.87+04	5.29+04	1.26+05	2.43+05	2.46+05	1.39+05	6.88+04	3.04+04	1.22+04	4.54+03
24	6.29+03	1.78+04	4.42+04	9.45+04	1.68+05	1.69+05	1.03+05	5.49+04	2.67+04	1.19+04	4.98+03
26	5.99+03	1.50+04	3.36+04	6.58+04	1.09+05	1.10+05	7.03+04	4.03+04	2.12+04	1.03+04	4.73+03
28	5.05+03	1.15+04	2.35+04	4.28+04	6.75+04	6.76+04	4.52+04	2.74+04	1.54+04	8.05+03	3.99+03
30	3.83+03	8.01+03	1.53+04	2.62+04	3.94+04	3.94+04	2.74+04	1.74+04	1.03+04	5.73+03	3.03+03

TABLE A-16

TERRAIN: Low Mountains

ANNUAL MEAN WIND SPEED: 4 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					2.05+02	2.02+03					
4				2.01+02	1.20+05	2.17+05	1.98+03	5.66+00			
6		5.14-01	1.16+02	1.07+04	3.32+05	4.27+05	3.07+04	1.15+03	2.58+01	3.78-01	
8	7.58-01	4.10+01	1.34+03	2.46+04	2.23+05	2.54+05	4.43+04	5.02+03	4.05+02	2.46+01	1.16+00
10	9.25+00	1.57+02	1.87+03	1.47+04	7.06+04	7.60+04	2.13+04	4.38+03	7.02+02	9.14+01	9.91+00
12	1.48+01	1.26+02	8.19+02	3.91+03	1.28+04	1.33+04	5.01+03	1.48+03	3.60+02	7.49+01	1.35+01
14	6.88+00	3.73+01	1.63+02	5.60+02	1.43+03	1.47+03	6.68+02	2.51+02	8.08+01	2.29+01	5.79+00
16	1.33+00	5.25+00	1.75+01	4.77+01	1.02+02	1.04+02	5.43+01	2.42+01	9.47+00	3.34+00	1.07+00
18	1.27-01	4.02-01	1.10+00	2.54+00	4.79+00	4.84+00	2.79+00	1.41+00	6.39-01	2.65-01	1.01-01
20					1.48-01	1.49-01					
22											
24											
26											
28											
30											

TABLE A-17

TERRAIN: Low Mountains

ANNUAL MEAN WIND SPEED: 6 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					1.02+02	1.01+03					
4				1.39+02	8.32+04	1.50+05	1.37+03	3.92+00			
6		5.98-01	1.35+02	1.25+04	3.87+05	4.97+05	3.57+04	1.34+03	3.01+01	4.40-01	
8	1.83+00	9.89+01	3.23+03	5.93+04	5.39+05	6.13+05	1.07+05	1.21+04	9.78+02	5.93+01	2.79+00
10	5.70+01	9.69+02	1.15+04	9.09+04	4.35+05	4.69+05	1.32+05	2.70+04	4.33+03	5.63+02	6.11+01
12	2.88+02	2.45+03	1.59+04	7.59+04	2.48+05	2.59+05	9.75+04	2.87+04	7.01+03	1.45+03	2.62+02
14	5.21+02	2.82+03	1.24+04	4.24+04	1.08+05	1.11+05	5.06+04	1.90+04	6.11+03	1.73+03	4.38+02
16	4.82+02	1.91+03	6.36+03	1.74+04	3.72+04	3.78+04	1.97+04	8.78+03	3.44+03	1.21+03	3.90+02
18	2.75+02	8.69+02	2.37+03	5.48+03	1.04+04	1.05+04	6.04+03	3.04+03	1.38+03	5.72+02	2.19+02
20	1.08+02	2.86+02	6.73+02	1.37+03	2.36+03	2.37+03	1.48+03	8.20+02	4.15+02	1.94+02	8.51+01
22	3.08+01	7.16+01	1.50+02	2.77+02	4.42+02	4.43+02	2.93+02	1.75+02	9.69+01	5.00+01	2.43+01
24	6.67+00	1.40+01	2.66+01	4.57+01	6.87+01	6.87+01	4.77+01	3.03+01	1.79+01	9.99+00	5.29+00
26	1.13+00	2.17+00	3.84+00	6.18+00	8.87+00	8.85+00	6.40+00	4.27+00	2.67+00	1.59+00	8.98-01
28	1.51-01	2.71-01	4.51-01	6.91-01	9.54-01	9.51-01	7.10-01	4.93-01	3.23-01	2.02-01	1.21-01
30											

TABLE A-18

TERRAIN: Low Mountains

ANNUAL MEAN WIND SPEED: 8 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					6.00+01	5.92+02					
4				9.15+01	5.49+04	9.90+04	9.05+02	2.59+00			
6		4.75-01	1.08+02	9.94+03	3.08+05	3.95+05	2.84+04	1.06+03	2.39+01	3.49-01	
8	1.89+00	1.02+02	3.33+03	6.12+04	5.56+05	6.33+05	1.10+05	1.25+04	1.01+03	6.11+01	2.88+00
10	8.23+01	1.40+03	1.66+04	1.31+05	6.29+05	6.77+05	1.90+05	3.90+04	6.25+03	8.13+02	8.82+01
12	6.27+02	5.34+03	3.47+04	1.65+05	5.40+05	5.65+05	2.12+05	6.25+04	1.52+04	3.17+03	5.71+02
14	1.84+03	9.98+03	4.37+04	1.50+05	3.82+05	3.92+05	1.79+05	6.71+04	2.16+04	6.12+03	1.55+03
16	2.98+03	1.18+04	3.94+04	1.07+05	2.30+05	2.34+05	1.22+05	5.44+04	2.13+04	7.52+03	2.41+03
18	3.22+03	1.02+04	2.77+04	6.41+04	1.21+05	1.22+05	7.06+04	3.56+04	1.61+04	6.68+03	2.56+03
20	2.56+03	6.81+03	1.60+04	3.26+04	5.60+04	5.63+04	3.51+04	1.95+04	9.86+03	4.62+03	2.02+03
22	1.60+03	3.73+03	7.80+03	1.44+04	2.30+04	2.31+04	1.53+04	9.14+03	5.05+03	2.60+03	1.27+03
24	8.21+02	1.72+03	3.28+03	5.62+03	8.46+03	8.46+03	5.87+03	3.73+03	2.21+03	1.23+03	6.51+02
26	3.53+02	6.79+02	1.20+03	1.94+03	2.78+03	2.78+03	2.01+03	1.34+03	8.37+02	4.97+02	2.82+02
28	1.30+02	2.33+02	3.88+02	5.94+02	8.21+02	8.18+02	6.11+02	4.24+02	2.78+02	1.74+02	1.04+02
30	4.16+01	7.03+01	1.11+02	1.63+02	2.18+02	2.17+02	1.67+02	1.20+02	8.17+01	5.34+01	3.36+01

TABLE A-19

TERRAIN: Low Mountains

ANNUAL MEAN WIND SPEED: 10 ms^{-1}

HOURLY AVERAGE SPEED (ms^{-1})	GUST AMPLITUDE (ms^{-1})										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					3.91+01	3.87+02					
4				6.31+01	3.78+04	6.82+04	6.23+02	1.78+00			
6		3.58-01	8.09+01	7.47+03	2.31+05	2.97+05	2.13+04	8.00+02	1.80+01	2.63-01	
8	1.60+00	8.67+01	2.83+03	5.20+04	4.73+05	5.38+05	9.38+04	1.06+04	8.57+02	5.19+01	2.45+00
10	8.18+01	1.39+03	1.65+04	1.30+05	6.25+05	6.73+05	1.89+05	3.87+04	6.21+03	8.09+02	8.77+01
12	7.55+02	6.43+03	4.17+04	1.99+05	6.51+05	6.80+05	2.55+05	7.53+04	1.84+04	3.81+03	6.88+02
14	2.78+03	1.51+04	6.60+04	2.26+05	5.77+05	5.93+05	2.70+05	1.01+05	3.26+04	9.25+03	2.34+03
16	5.86+03	2.32+04	7.73+04	2.11+05	4.52+05	4.59+05	2.40+05	1.07+05	4.19+04	1.48+04	4.74+03
18	8.49+03	2.68+04	7.31+04	1.69+05	3.19+05	3.22+05	1.86+05	9.39+04	4.26+04	1.76+04	6.75+03
20	9.41+03	2.50+04	5.88+04	1.20+05	2.06+05	2.07+05	1.29+05	7.16+04	3.62+04	1.70+04	7.43+03
22	8.50+03	1.98+04	4.14+04	7.66+04	1.22+05	1.22+05	8.11+04	4.85+04	2.68+04	1.38+04	6.71+03
24	6.50+03	1.36+04	2.60+04	4.45+04	6.70+04	6.70+04	4.65+04	2.95+04	1.75+04	9.74+03	5.15+03
26	4.33+03	8.32+03	1.47+04	2.37+04	3.41+04	3.40+04	2.46+04	1.64+04	1.03+04	6.09+03	3.45+03
28	2.55+03	4.58+03	7.62+03	1.17+04	1.61+04	1.60+04	1.20+04	8.32+03	5.46+03	3.42+03	2.05+03
30	1.35+03	2.29+03	3.62+03	5.30+03	7.09+03	7.06+03	5.42+03	3.89+03	2.66+03	1.74+03	1.09+03

TABLE A-20

TERRAIN: Low Mountains

ANNUAL MEAN WIND SPEED: 12 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					2.75+01	2.71+02					
4				4.56+01	2.74+04	4.93+04	4.51+02	1.29+00			
6		2.71-01	6.14+01	5.67+03	1.75+05	2.25+05	1.62+04	6.07+02	1.36+01	1.99-01	
8	1.30+00	7.03+01	2.30+03	4.21+04	3.83+05	4.36+05	7.60+04	8.61+03	6.95+02	4.21+01	1.99+00
10	7.23+01	1.23+03	1.46+04	1.15+05	5.52+05	5.94+05	1.67+05	3.42+04	5.48+03	7.14+02	7.74+01
12	7.41+02	6.30+03	4.09+04	1.95+05	6.38+05	6.67+05	2.50+05	7.38+04	1.80+04	3.74+03	6.75+02
14	3.09+03	1.67+04	7.32+04	2.51+05	6.40+05	6.58+05	3.00+05	1.12+05	3.62+04	1.03+04	2.60+03
16	7.49+03	2.97+04	9.89+04	2.70+05	5.78+05	5.88+05	3.07+05	1.37+05	5.36+04	1.89+04	6.06+03
18	1.28+04	4.03+04	1.10+05	2.54+05	4.80+05	4.85+05	2.80+05	1.41+05	6.40+04	2.65+04	1.02+04
20	1.70+04	4.51+04	1.06+05	2.16+05	3.71+05	3.73+05	2.33+05	1.29+05	6.53+04	3.06+04	1.34+04
22	1.87+04	4.35+04	9.10+04	1.69+05	2.69+05	2.69+05	1.78+05	1.07+05	5.89+04	3.04+04	1.48+04
24	1.78+04	3.73+04	7.11+04	1.22+05	1.84+05	1.83+05	1.27+05	8.09+04	4.79+04	2.67+04	1.41+04
26	1.50+04	2.89+04	5.12+04	8.25+04	1.18+05	1.18+05	8.54+04	5.69+04	3.56+04	2.12+04	1.20+04
28	1.15+04	2.06+04	3.42+04	5.24+04	7.23+04	7.21+04	5.38+04	3.74+04	2.45+04	1.54+04	9.21+03
30	8.01+03	1.35+04	2.14+04	3.14+04	4.20+04	4.18+04	3.21+04	2.31+04	1.57+04	1.03+04	6.47+03

TABLE A-21

TERRAIN: High Mountains

ANNUAL MEAN WIND SPEED: 4 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					2.22+03	1.12+04	6.65-01				
4			3.71+00	2.18+03	2.74+05	4.10+05	1.10+04	1.20+02	6.51-01		
6	1.92-01	2.09+01	1.26+03	3.86+04	5.17+05	6.10+05	8.01+04	6.37+03	3.42+02	1.31+01	3.78-01
8	2.18+01	4.45+02	6.20+03	5.59+04	2.97+05	3.22+05	8.38+04	1.56+04	2.24+03	2.59+02	2.46+01
10	1.00+02	8.53+02	5.54+03	2.64+04	8.64+04	9.03+04	3.39+04	1.00+04	2.44+03	5.06+02	9.14+01
12	8.99+01	4.53+02	1.87+03	6.07+03	1.49+04	1.52+04	7.17+03	2.79+03	9.41+02	2.80+02	7.49+01
14	2.85+01	1.02+02	3.13+02	7.94+02	1.61+03	1.63+03	8.90+02	4.18+02	1.75+02	6.60+01	2.29+01
16	4.22+00	1.20+01	2.97+01	6.34+01	1.13+02	1.14+02	6.88+01	3.69+01	1.79+01	8.02+00	3.34+00
18	3.35-01	7.99-01	1.71+00	3.22+00	5.20+00	5.21+00	3.41+00	3.01+00	1.09+00	5.55-01	2.65-01
20				1.06-01	1.59-01	1.59-01	1.11-01				
22											
24											
26											
28											
30											

TABLE A-22

TERRAIN: High Mountains

ANNUAL MEAN WIND SPEED: 6 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					1.11+03	5.60+03	3.32-01				
4			2.57+00	1.51+03	1.90+05	2.84+05	7.60+03	8.32+01	4.51-01		
6	2.24-01	2.44+01	1.47+03	4.50+04	6.02+05	7.10+05	9.33+04	7.42+03	3.98+02	1.53+01	4.40-01
8	5.26+01	1.07+03	1.50+04	1.35+05	7.16+05	7.77+05	2.02+05	3.77+04	5.42+03	6.24+02	5.93+01
10	6.19+02	5.26+03	3.42+04	1.63+05	5.33+05	5.57+05	2.09+05	6.17+04	1.50+04	3.12+03	5.63+02
12	1.75+03	8.81+03	3.63+04	1.18+05	2.89+05	2.96+05	1.39+05	5.43+04	1.83+04	5.45+03	1.45+03
14	2.16+03	7.74+03	2.36+04	6.00+04	1.22+05	1.23+05	6.73+04	3.16+04	1.32+04	4.99+03	1.73+03
16	1.54+03	4.35+03	1.08+04	2.31+04	4.10+04	4.13+04	2.50+04	1.34+04	6.51+03	2.92+03	1.21+03
18	7.24+02	1.73+03	3.69+03	6.95+03	1.12+04	1.13+04	7.38+03	4.35+03	2.36+03	1.20+03	5.72+02
20	2.45+02	5.14+02	9.80+02	1.68+03	2.53+03	2.53+03	1.76+03	1.11+03	6.59+02	3.68+02	1.94+02
22	6.26+01	1.19+02	2.07+02	3.30+02	4.70+02	4.69+02	3.41+02	2.29+02	1.45+02	8.71+01	5.00+01
24	1.24+01	2.17+01	3.54+01	5.32+01	7.24+01	7.22+01	5.45+01	3.84+01	2.56+01	1.63+01	9.99+00
26	1.95+00	3.20+00	4.93+00	7.07+00	9.29+00	9.25+00	7.20+00	5.27+00	3.67+00	2.46+00	1.59+00
28	2.47-01	3.84-01	5.65-01	7.79-01	9.94-01	9.89-01	7.90-01	5.96-01	4.31-01	3.00-01	2.02-01

TABLE A-23

TERRAIN: High Mountains

ANNUAL MEAN WIND SPEED: 8 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	-10	-8	-6	-4	GUST AMPLITUDE (ms ⁻¹)		4	6	8	10	12
					-2	2					
2					6.51+02	3.28+03	1.95-01				
4			1.69+00	9.93+02	1.25+05	1.87+05	5.01+03	5.48+01	2.97-01		
6	1.78-01	1.94+01	1.17+03	3.57+04	4.78+05	5.64+05	7.42+04	5.90+03	3.16+02	1.22+01	3.49-01
8	5.43+01	1.11+03	1.54+04	1.39+05	7.39+05	8.02+05	2.09+05	3.89+04	5.59+03	6.44+02	6.11+01
10	8.93+02	7.60+03	4.94+04	2.35+05	7.69+05	8.04+05	3.02+05	8.90+04	2.17+04	4.51+03	8.13+02
12	3.80+03	1.92+04	7.89+04	2.57+05	6.29+05	6.45+05	3.03+05	1.18+05	3.98+04	1.19+04	3.17+03
14	7.64+03	2.74+04	8.36+04	2.12+05	4.30+05	4.36+05	2.38+05	1.12+05	4.67+04	1.77+04	6.12+03
16	9.51+03	2.69+04	6.68+04	1.43+05	2.54+05	2.56+05	1.55+05	8.30+04	4.03+04	1.81+04	7.52+03
18	8.46+03	2.02+04	4.31+04	8.12+04	1.31+05	1.32+05	8.62+04	5.08+04	2.76+04	1.40+04	6.68+03
20	5.83+03	1.22+04	2.33+04	3.99+04	6.01+04	6.00+04	4.17+04	2.65+04	1.57+04	8.73+03	4.62+03
22	3.26+03	6.18+03	1.08+04	1.72+04	2.45+04	2.44+04	1.78+04	1.20+04	7.56+03	4.54+03	2.60+03
24	1.53+03	2.67+03	4.35+03	6.54+03	8.91+03	8.88+03	6.71+03	4.73+03	3.15+03	2.01+03	1.23+03
26	6.13+02	1.00+03	1.55+03	2.22+03	2.91+03	2.90+03	2.26+03	1.65+03	1.15+03	7.70+02	4.97+02
28	2.13+02	3.31+02	4.86+02	6.70+02	8.55+02	8.51+02	6.79+02	5.13+02	3.71+02	2.58+02	1.74+02
30	6.47+01	9.62+01	1.36+02	1.82+02	2.26+02	2.25+02	1.83+02	1.42+02	1.06+02	7.63+01	5.34+01

TABLE A-24

TERRAIN: High Mountains

ANNUAL MEAN WIND SPEED: 10 ms^{-1}

HOURLY AVERAGE SPEED (ms^{-1})	GUST AMPLITUDE (ms^{-1})										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					4.25+02	2.14+03	1.27-01				
4			1.17+00	6.85+02	8.61+04	1.29+05	3.46+03	3.78+01	2.05-01		
6	1.34-01	1.46+01	8.78+02	2.69+04	3.60+05	4.24+05	5.58+04	4.43+03	2.38+02	9.15+00	2.63-01
8	4.61+01	9.41+02	1.31+04	1.13+05	6.28+05	6.82+05	1.77+05	3.31+04	4.75+03	5.47+02	5.19+01
10	8.88+02	7.55+03	4.91+04	2.34+05	7.64+05	7.99+05	3.00+05	8.85+04	2.16+04	4.48+03	8.09+02
12	4.58+03	2.31+04	9.50+04	3.09+05	7.58+05	7.77+05	3.65+05	1.42+05	4.80+04	1.43+04	3.81+03
14	1.15+04	4.14+04	1.26+05	3.21+05	6.50+05	6.59+05	3.60+05	1.69+05	7.06+04	2.67+04	9.25+03
16	1.87+04	5.28+04	1.31+05	2.80+05	4.98+05	5.02+05	3.04+05	1.63+05	7.91+04	3.54+04	1.48+04
18	2.23+04	5.32+04	1.14+05	2.14+05	3.46+05	3.47+05	2.28+05	1.34+05	7.29+04	3.70+04	1.76+04
20	2.14+04	4.49+04	8.56+04	1.47+05	2.21+05	2.21+05	1.53+05	9.74+04	5.76+04	3.21+04	1.70+04
22	1.73+04	3.28+04	5.72+04	9.11+04	1.30+05	1.29+05	9.42+04	6.34+04	4.01+04	2.41+04	1.38+04
24	1.21+04	2.12+04	3.45+04	5.18+04	7.06+04	7.03+04	5.31+04	3.74+04	2.50+04	1.59+04	9.74+03
26	7.50+03	1.23+04	1.89+04	2.71+04	3.57+04	3.55+04	2.77+04	2.02+04	1.41+04	9.43+03	6.09+03
28	4.17+03	6.49+03	9.53+03	1.31+04	1.68+04	1.67+04	1.33+04	1.01+04	7.27+03	5.07+03	3.42+03
30	2.10+03	3.13+03	4.42+03	5.91+03	7.36+03	7.32+03	5.97+03	4.62+03	3.45+03	2.48+03	1.74+03

TABLE A-25

TERRAIN: High Mountains

ANNUAL MEAN WIND SPEED: 12 ms⁻¹

HOURLY AVERAGE SPEED (ms ⁻¹)	GUST AMPLITUDE (ms ⁻¹)										
	-10	-8	-6	-4	-2	2	4	6	8	10	12
2					2.98+02	1.50+03					
4			8.44-01	4.93+02	6.23+04	9.33+04	2.50+03	2.73+01	1.48-01		
6	1.02-01	1.11+01	6.66+02	2.04+04	2.73+05	3.22+05	4.23+04	3.36+03	1.80+02	6.94+00	1.99-01
8	3.74+01	7.63+02	1.06+04	9.60+04	5.09+05	5.52+05	1.44+05	2.68+04	3.85+03	4.44+02	4.21+01
10	7.84+02	6.67+03	4.33+04	2.06+05	6.75+05	7.06+05	2.65+05	7.82+04	1.91+04	3.96+03	7.14+02
12	4.49+03	2.27+04	9.32+04	3.03+05	7.43+05	7.61+05	3.58+05	1.40+05	4.70+04	1.40+04	3.74+03
14	1.28+04	4.59+04	1.40+05	3.56+05	7.22+05	7.31+05	3.99+05	1.87+05	7.83+04	2.96+04	1.03+04
16	2.39+04	6.76+04	1.68+05	3.59+05	6.38+05	6.42+05	3.89+05	2.08+05	1.01+05	4.53+04	1.89+04
18	3.36+04	8.01+04	1.71+05	3.22+05	5.21+05	5.23+05	3.42+05	2.02+05	1.10+05	5.56+04	2.65+04
20	3.86+04	8.09+04	1.54+05	2.64+05	3.98+05	3.98+05	2.76+05	1.76+05	1.04+05	5.79+04	3.06+04
22	3.81+04	7.21+04	1.26+05	2.01+05	2.86+05	2.85+05	2.07+05	1.39+05	8.82+04	5.30+04	3.04+04
24	3.32+04	5.80+04	9.45+04	1.42+05	1.93+05	1.93+05	1.46+05	1.03+05	6.84+04	4.36+04	2.67+04
26	2.61+04	4.27+04	6.58+04	9.43+04	1.24+05	1.23+05	9.61+04	7.03+04	4.90+04	3.28+04	2.12+04
28	1.88+04	2.91+04	4.28+04	5.91+04	7.54+04	7.50+04	5.99+04	4.52+04	3.27+04	2.28+04	1.54+04
30	1.25+04	1.85+04	2.62+04	3.50+04	4.36+04	4.33+04	3.53+04	2.74+04	2.04+04	1.47+04	1.03+04

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