Correction to "Spatial and temporal distributions of U.S. winds and wind power at 80 m derived from measurements"

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INDEX TERMS: 0345 Atmospheric Composition and Structure: Pollution—urban and regional (0305); 3399 Meteorology and Atmospheric Dynamics: General or miscellaneous; 9350 Information Related to Geographic Region: North America; 9900 Corrections; *KEYWORDS:* U.S. wind power, least squares, global warming, air pollution, energy, wind speed

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[1] In the paper "Spatial and temporal distributions of U.S. winds and wind power at 80 m derived from measurements" by C. L. Archer and M. Z. Jacobson (*Journal of Geophysical Research*, *108*(D9), 4289, doi:10.1029/2002JD002076, 2003), three errors in the methodology introduced have been identified. In addition, since publication of the article, data from an additional 179 stations have become available. The errors found have little effect on the main conclusions of the paper but result in slight modifications of some figures and tables. Below, the corrections and updates are described.

[2] The first error was in the equation for the amplitude A of the ρ function, given in paragraph 26. The correct formula is

$$A = \alpha \frac{\rho_{12} - \rho_{00}}{2},$$

where the dividing factor 2 was omitted in the original article. Note that this error was simply a typo and it did not have any effect on the results.

[3] The second error was in the equation for the estimate of $\bar{\rho}$, given in paragraph 26 too. The correct formula is

$$\bar{\rho} = \beta \frac{\rho_{00} + \rho_{12}}{2},$$

where $\beta = 0.95$. Note that β, the correction factor, was instead at the denominator in the original article. This error caused an average overestimate of $\sim$10% in the mean wind speed at the 10 selected stations for which the hourly analysis was performed.

[4] Third, a programming bug was fixed that sometimes caused spurious discontinuities in the V80 trend at 0000 and 1200 UTC.

[5] These errors and the addition of 179 stations to the data affected only conclusion 1, which should now state the following: "In the year 2000, mean-annual wind speeds at 80 m may have exceeded 6.9 m/s at approximately 22% of the measurement stations in the United States, implying that over one fifth of the country is suitable for providing electric power from wind at a direct cost equal to that of a new natural gas or coal power plant." However, Tables 3–5 and Figures 3–6 and 10–12 were affected in part by the changes. The corrected versions are reported here.

0148-0227/04/2004JD005099$09.00

Table 3. U.S. States With the Highest Number of Stations in Classes ≥3 at 80 m, With Emphasis on the Number of Offshore/Coastal Sites

State	Total Number of Stations	Number of Class ≥3 Stations	Percent of Class ≥3 Stations	Number of Coastal/Offshore Stations	Number of Coastal/Offshore Class ≥3 Stations	Percent of Coastal/Offshore Class ≥3 Stations	Percent of Class ≥3 Stations That Are Coastal/Offshore
Alaska	144	37	25.7	78	30	38.5	81.1
Texas	87	31	35.6	10	9	90.0	29.0
Kansas	29	21	72.4	0	0	0.0	0.0
Nebraska	30	23	76.7	0	0	0.0	0.0
Minnesota	73	20	27.4	0	0	0.0	0.0
Oklahoma	24	19	79.2	0	0	0.0	0.0
Iowa	47	17	36.2	0	0	0.0	0.0
South Dakota	22	12	54.5	0	0	0.0	0.0
Florida	66	7	10.6	39	5	12.8	71.4
California	110	7	6.4	40	1	2.5	14.3
New York	37	7	18.9	8	5	62.5	71.4
North Dakota	12	8	66.7	0	0	0.0	0.0
Ohio	30	8	26.7	0	0	0.0	0.0
North Carolina	38	8	21.1	11	7	63.6	87.5
Virginia	41	6	14.6	7	2	28.6	33.3
Missouri	20	6	30.0	0	0	0.0	0.0
Louisiana	29	6	20.7	7	4	57.1	66.7
New Jersey	12	5	41.7	4	2	50.0	40.0
Massachusetts	21	5	23.8	11	4	36.4	80.0
Connecticut	8	3	37.5	3	3	100.0	100.0
Washington	41	3	7.3	12	2	16.7	66.7
Maryland	11	3	27.3	6	2	33.3	66.7
Delaware	3	1	33.3	1	1	100.0	100.0
Rhode Island	5	2	40.0	4	2	50.0	100.0
Hawaii	20	1	5.0	19	1	5.3	100.0
Alabama	22	1	4.5	2	1	50.0	100.0
South Carolina	18	1	5.6	4	1	25.0	100.0
Pacific Islands	8	6	75.0	8	6	75.0	100.0
Buoys	51	44	86.3	51	44	86.3	100.0
Other states	534	33	6.2	18	2	11.1	6.1
Total United States	1593	351	22.0	343	134	39.1	38.2

Table 4. Number (and Percent With Respect to Each Region) of U.S. Stations Falling Into Each Wind Power Class at 80 m[a]

		Wind Power Class at 80 m							
		1	2	3	4	5	6	7	≥3
Region	Total Number	V < 5.9 m/s	5.9 ≤ V < 6.9 m/s	6.9 ≤ V < 7.5 m/s	7.5 ≤ V < 8.1 m/s	8.1 ≤ V < 8.6 m/s	8.6 ≤ V < 9.4 m/s	V ≥ 9.4 m/s	V ≥ 6.9 m/s
Northwest	140	118 (84.3)	14 (10.0)	4 (2.9)	1 (0.7)	1 (0.7)	1 (0.7)	1 (0.7)	8 (5.7)
North-Central	180	45 (25.0)	55 (30.6)	38 (21.1)	30 (16.7)	11 (6.1)	1 (0.6)	0 (0.0)	80 (44.4)
Great Lakes	161	89 (55.3)	53 (32.9)	13 (8.1)	3 (1.9)	2 (1.2)	1 (0.6)	0 (0.0)	19 (11.8)
Northeast	146	79 (54.1)	39 (26.7)	14 (9.6)	8 (5.5)	3 (2.1)	2 (1.4)	1 (0.7)	28 (19.2)
East-Central	128	95 (74.2)	15 (11.7)	11 (8.6)	3 (2.3)	1 (0.8)	0 (0.0)	3 (2.3)	18 (14.1)
Southeast	155	124 (80.0)	22 (14.2)	3 (1.9)	0 (0.0)	3 (1.9)	3 (1.9)	0 (0.0)	9 (5.8)
South-Central	213	82 (38.5)	47 (22.1)	28 (13.1)	25 (11.7)	17 (8.0)	8 (3.8)	6 (2.8)	84 (39.4)
Southern Rockies	112	87 (77.7)	16 (14.3)	1 (0.9)	7 (6.3)	0 (0.0)	1 (0.9)	0 (0.0)	9 (8.0)
Southwest	131	115 (87.8)	9 (6.9)	3 (2.3)	3 (2.3)	1 (0.8)	0 (0.0)	0 (0.0)	7 (5.3)
Alaska	144	88 (61.1)	19 (13.2)	8 (5.6)	8 (5.6)	6 (4.2)	12 (8.3)	3 (2.1)	37 (25.7)
Hawaii	20	14 (70.0)	5 (25.0)	0 (0.0)	0 (0.0)	1 (5.0)	0 (0.0)	0 (0.0)	1 (5.0)
Pacific Islands and others	12	3 (25.0)	3 (25.0)	1 (8.3)	2 (16.7)	1 (8.3)	2 (16.7)	0 (0.0)	6 (50.0)
Buoys	51	4 (7.8)	2 (3.9)	3 (5.9)	4 (7.8)	2 (3.9)	11 (21.6)	25 (49.0)	45 (88.2)
United States (all)	1593	943 (59.2)	299 (18.8)	127 (8.0)	94 (5.9)	49 (3.1)	42 (2.6)	39 (2.4)	351 (22.0)

[a]Number of stations is given, with percent with respect to each region in parentheses. Stations are grouped into 11 regions as follows: Northwest: Idaho, Montana, Oregon, Washington, Wyoming. North-Central: Nebraska, Iowa, Minnesota, North Dakota, South Dakota. Great Lakes: Illinois, Indiana, Michigan, Ohio, Wisconsin. Northeast: Connecticut, Massachusetts, Rhode Island, Maine, New Hampshire, Vermont, New Jersey, New York, Pennsylvania. East-Central: Delaware, Kentucky, Maryland, North Carolina, Tennessee, Virginia, West Virginia. Southeast: Alabama, Florida, Georgia, Mississippi, South Carolina. South-Central: Arkansas, Kansas, Louisiana, Missouri, Oklahoma, Texas. Southern Rocky: Arizona, Colorado, New Mexico, Utah. Southwest: California, Nevada.

Table 5. List of Selected Stations[a]

Station ID	State	Annual Mean Speed, m/s	Annual Wind Standard Deviation, m/s	Wind Power Class	Annual Mean Wind Power, W/m^2	Annual Power Standard Deviation, W/m^2
AMA	TX	8.8	4.5	6	819	1847
CAO	NM	8.8	5.5	6	1054	2761
CDB	AK	10.7	6.6	7	1847	4317
CSM	OK	9.3	4.6	6	893	1393
DDC	KS	8.7	4.8	6	845	2090
GCK	KS	8.6	4.8	6	851	2574
GDP	TX	14.2	8.8	7	4306	9661
HBR	OK	9.3	4.8	6	924	1458
RSL	KS	8.9	4.7	6	859	1707
SDB	CA	10.9	6.3	7	1794	4752

[a]Wind speed and power data are calculated at 80 m.

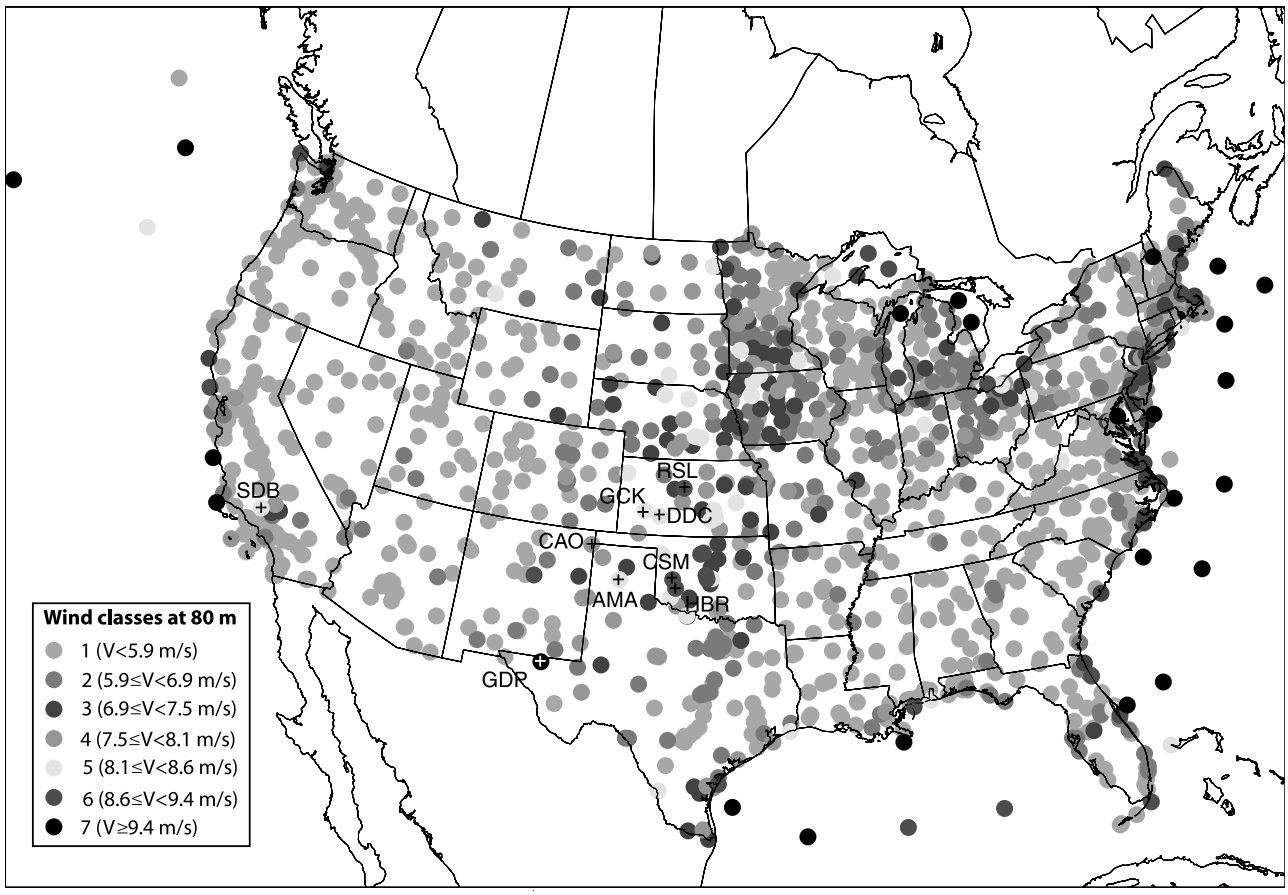


Figure 3. Map of wind speed extrapolated to 80 m and averaged over all days of the year 2000 for the continental United States. The stations selected for additional statistics are marked with a plus sign. The map gives speeds only at locations where at least 20 valid measurements were taken. See color version of this figure at back of this issue.

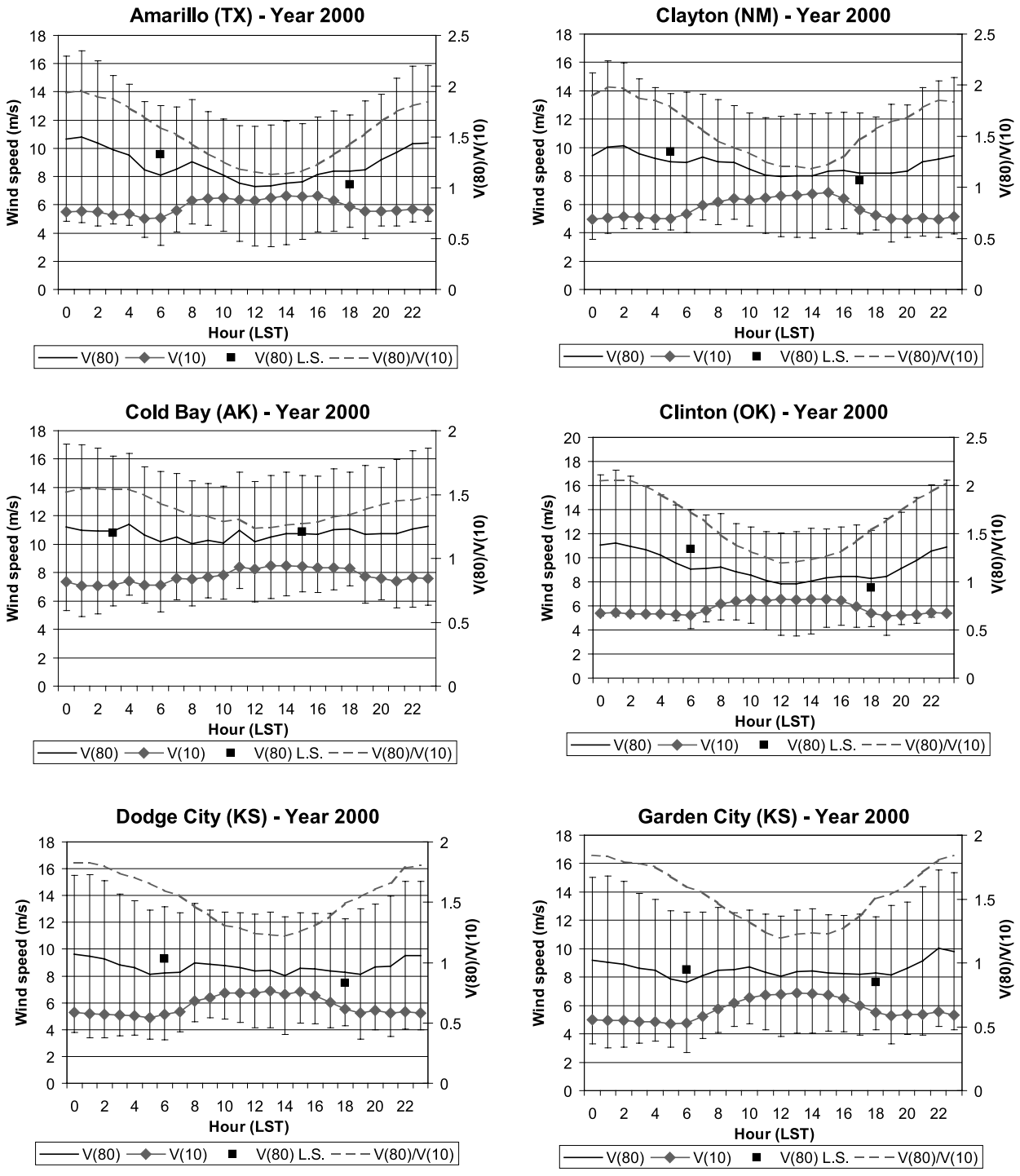


Figure 4. Mean and standard deviation of wind speed extrapolated to 80 m at the 10 selected sites, averaged over all days of the year 2000 for each hour of the day. The 10-m mean wind speed and the ratio of 80-m over 10-m mean wind speeds are also shown.

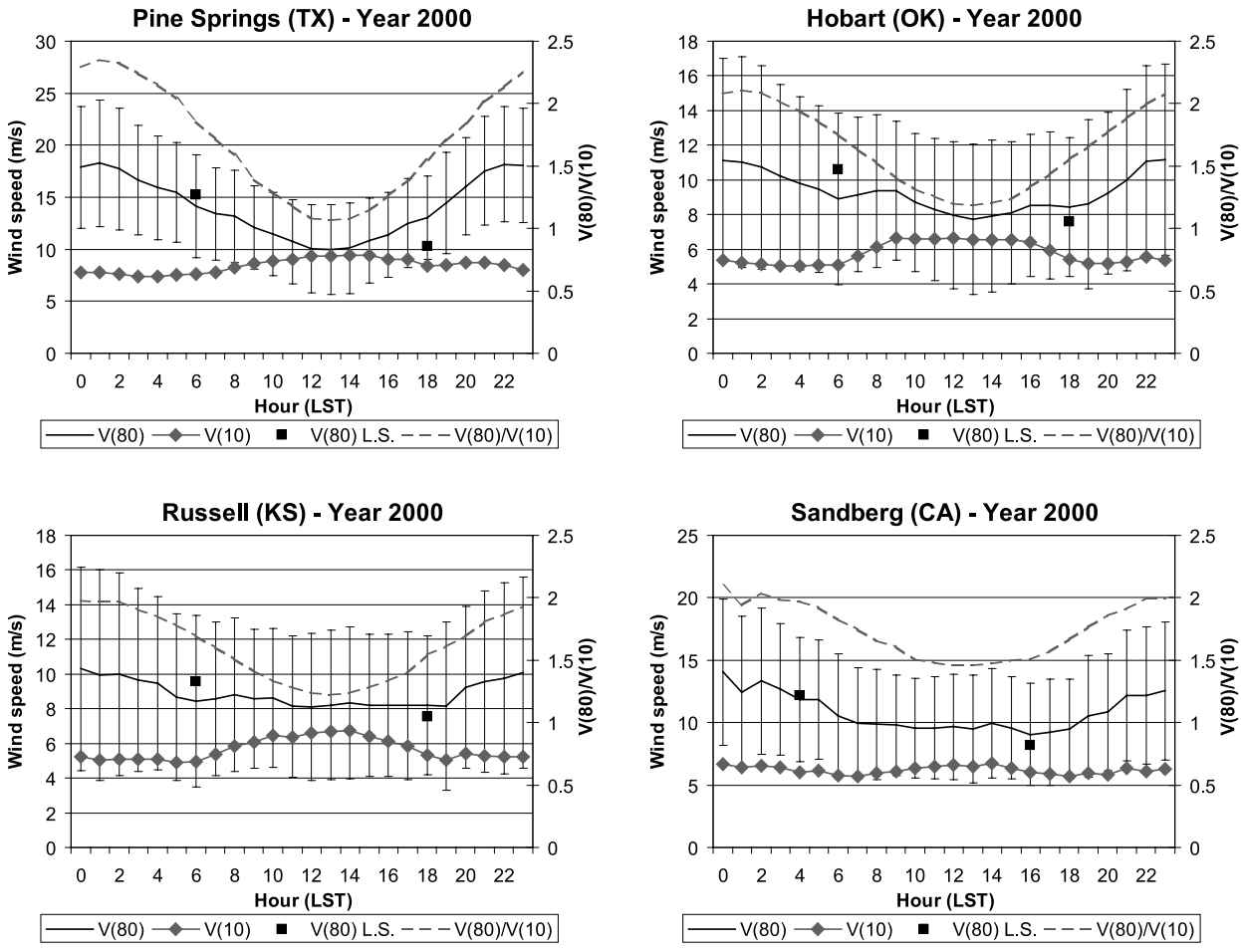


Figure 4. (continued)

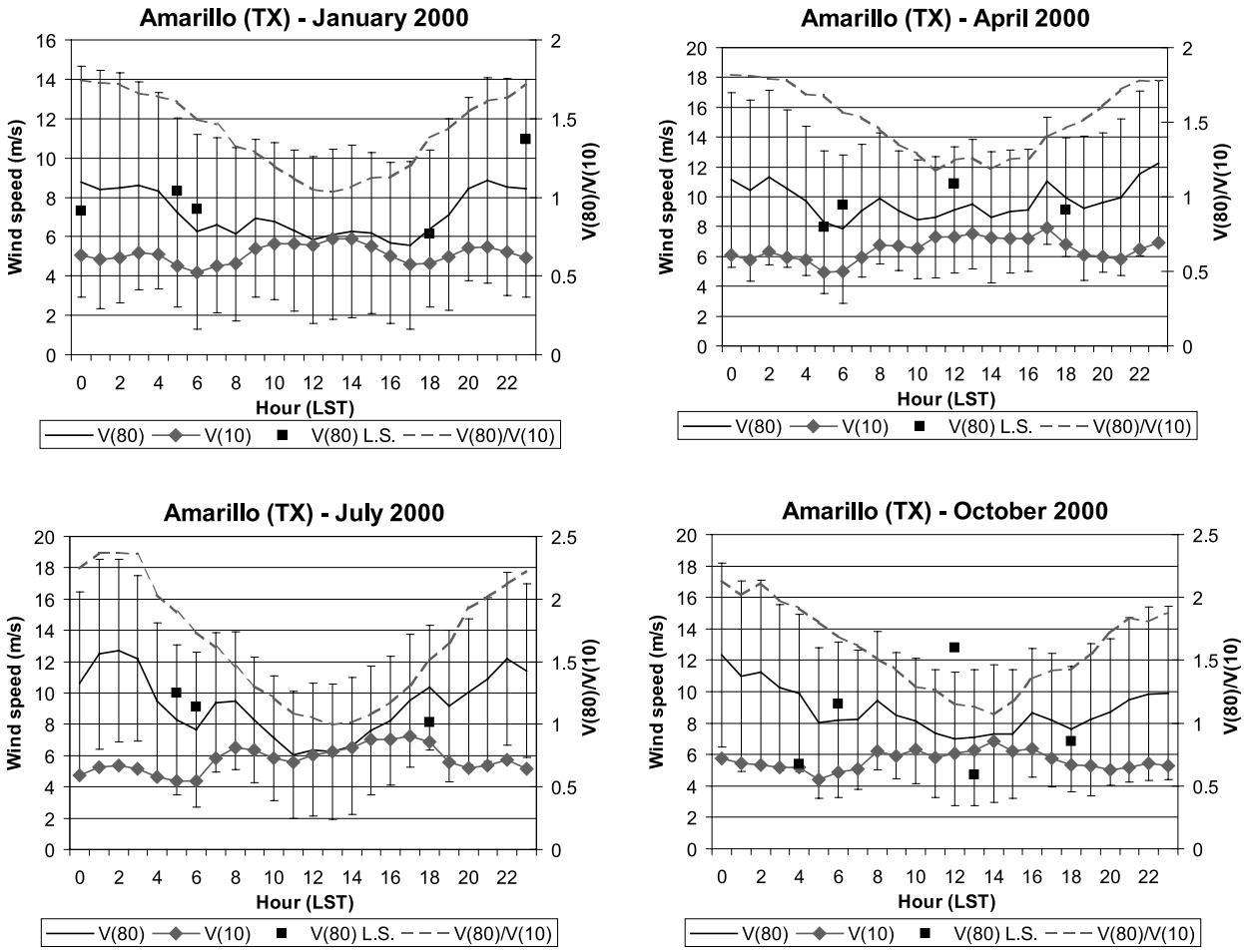


Figure 5. Mean and standard deviation of wind speeds extrapolated to 80 m at Amarillo, Texas (AMA), averaged over all days of each month of the year 2000 for each hour of the day. The 10-m mean wind speed and the ratio of 80-m over 10-m mean wind speeds are also shown.

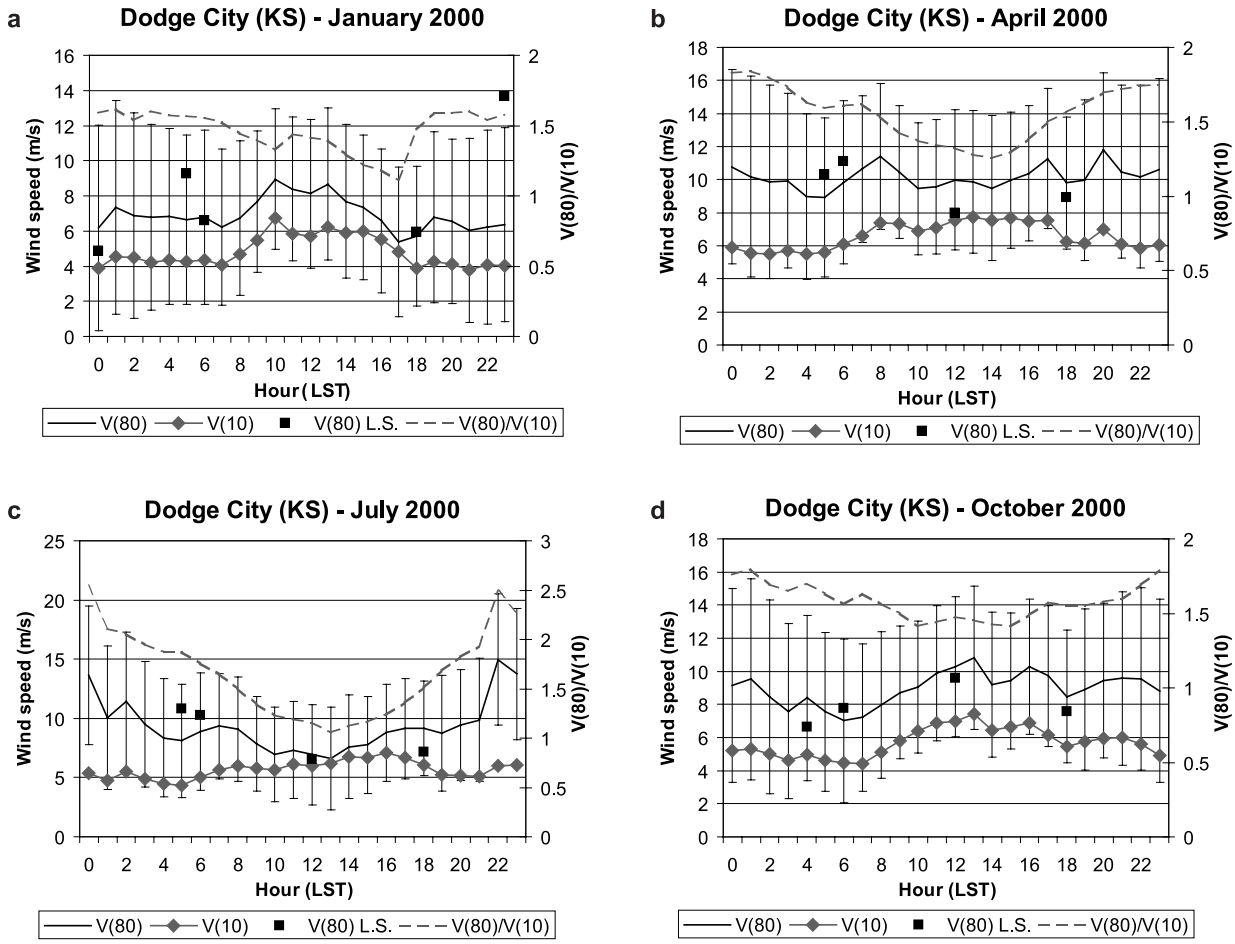


Figure 6. (a–d) Same as Figure 5 but for Dodge City, Kansas (DDC).

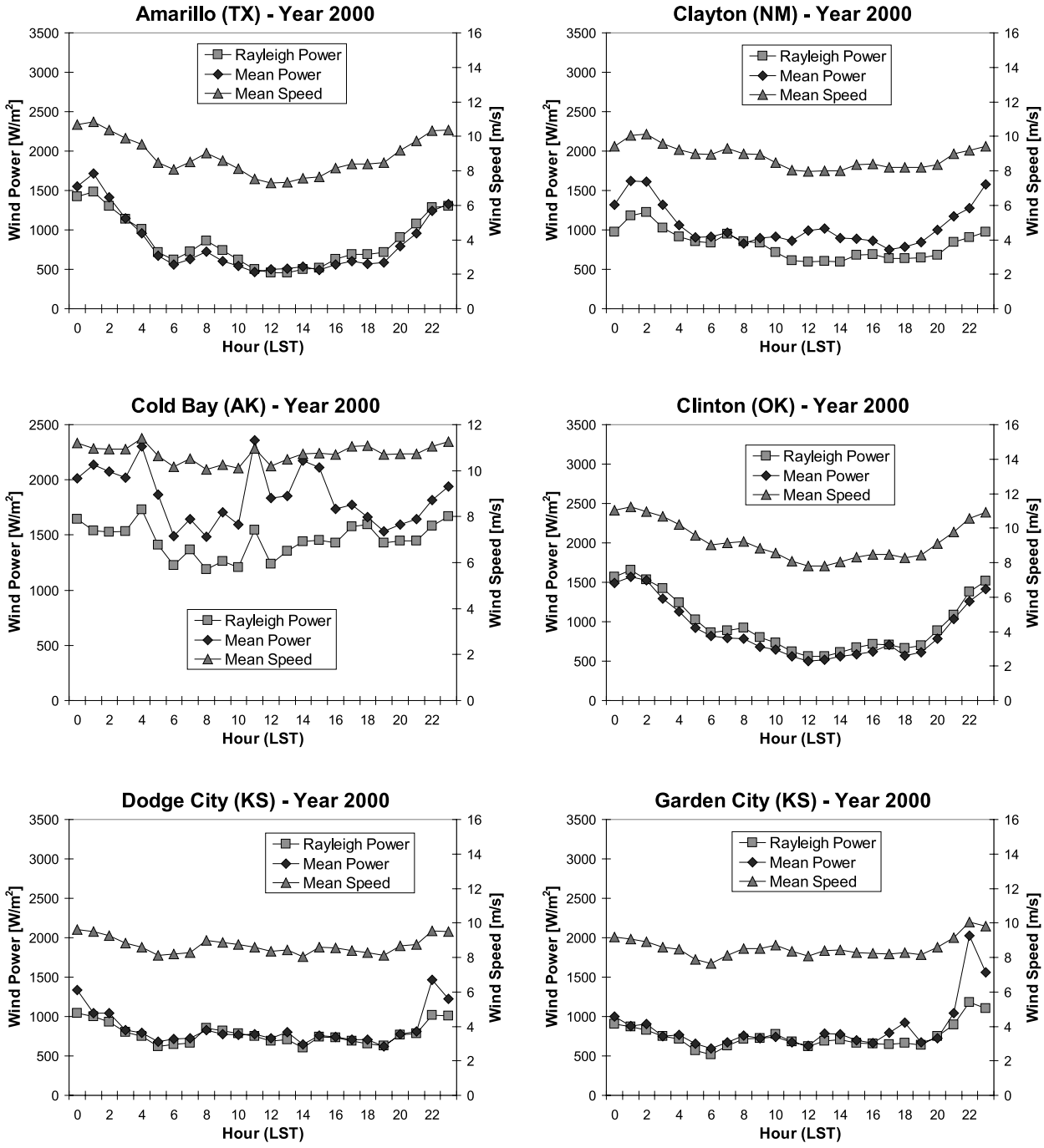


Figure 10. Calculated power (diamonds), Rayleigh power (squares), and mean wind speed (triangles) extrapolated to 80 m, averaged over all days of the year 2000 for each hour of the day at the 10 selected sites.

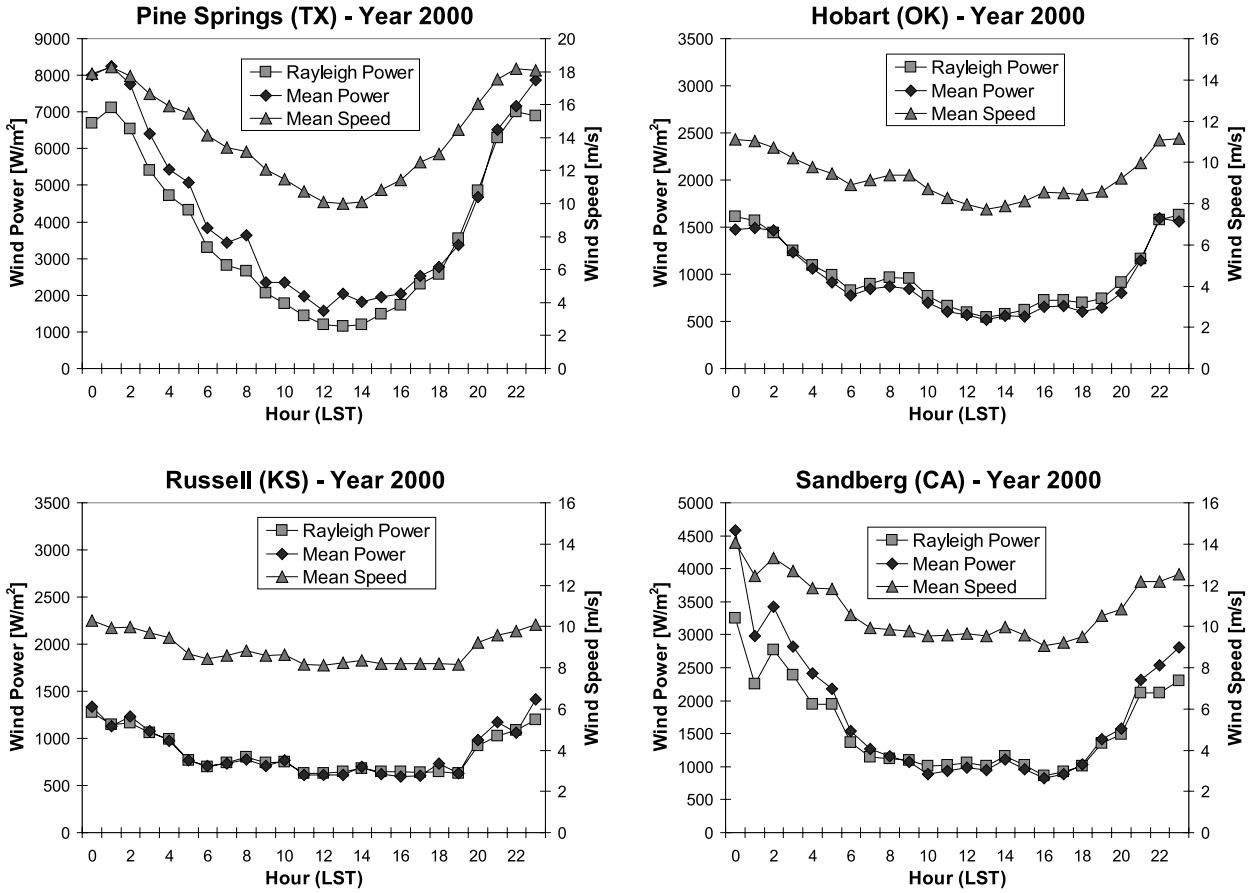


Figure 10. (continued)

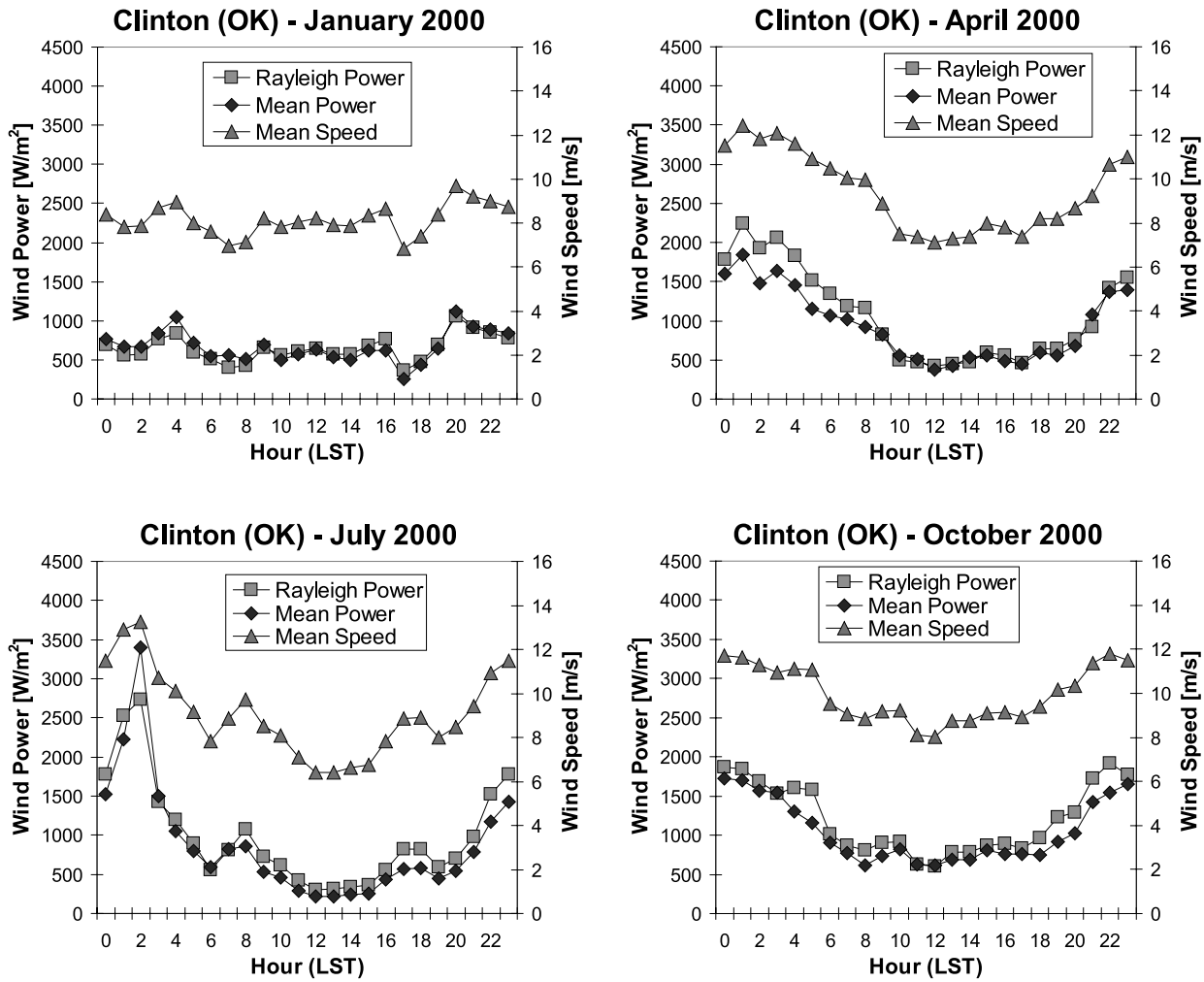


Figure 11. Calculated power (diamonds), Rayleigh power (squares), and mean wind speed (triangles) extrapolated to 80 m, averaged over all days of each month of the year 2000 for each hour of the day at Clinton, Oklahoma (CSM).

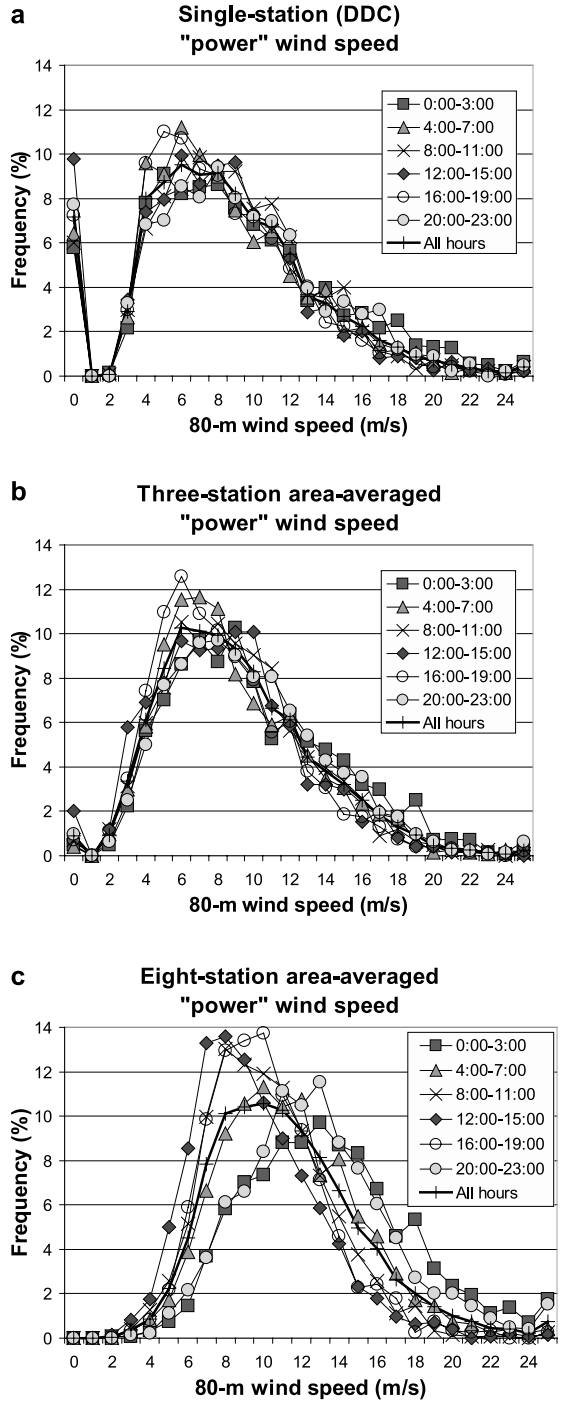
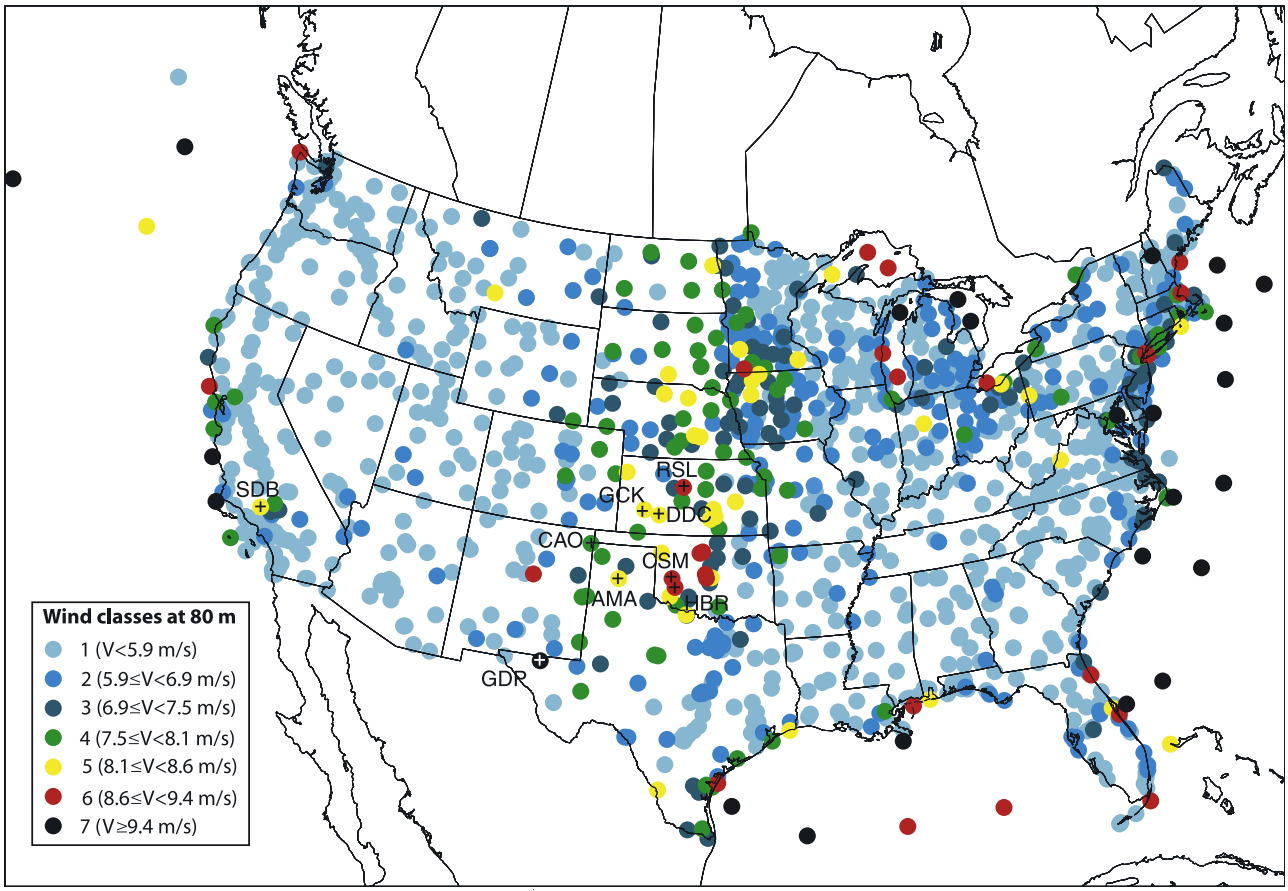


Figure 12. Power wind speed distribution, divided into six 4-hour blocks, for (a) one station, (b) three stations, and (c) eight stations. See color version of this figure at back of this issue.



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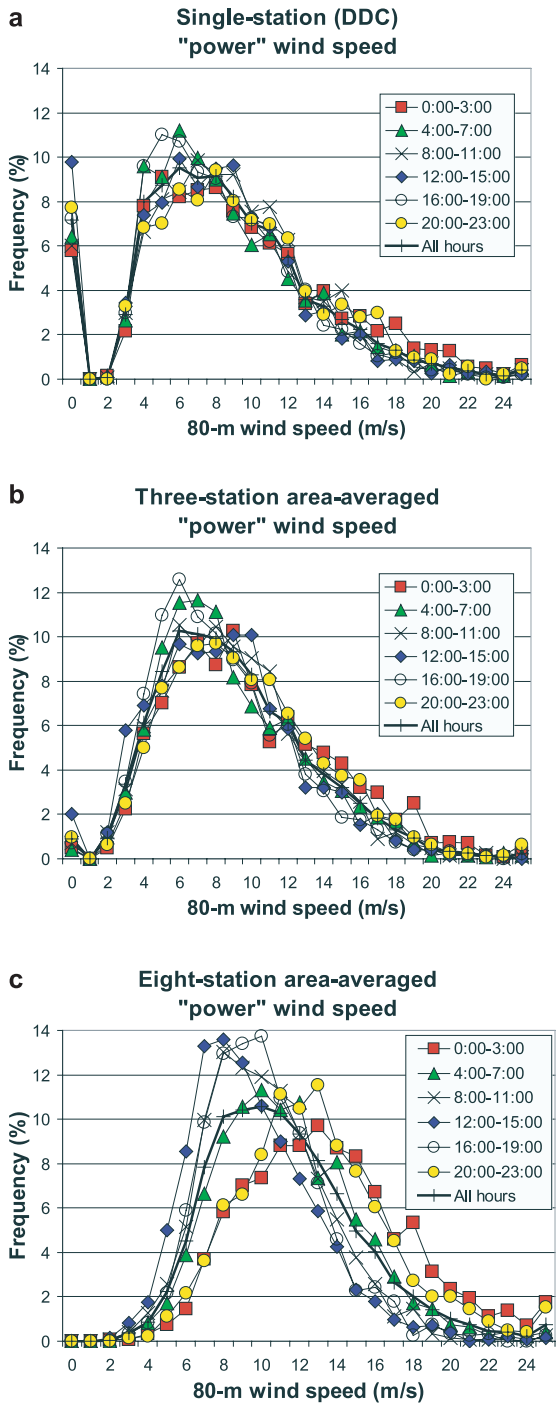

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