Supplementary materials for

Determining the ideal length of wind speed series for wind speed distribution and resource assessment

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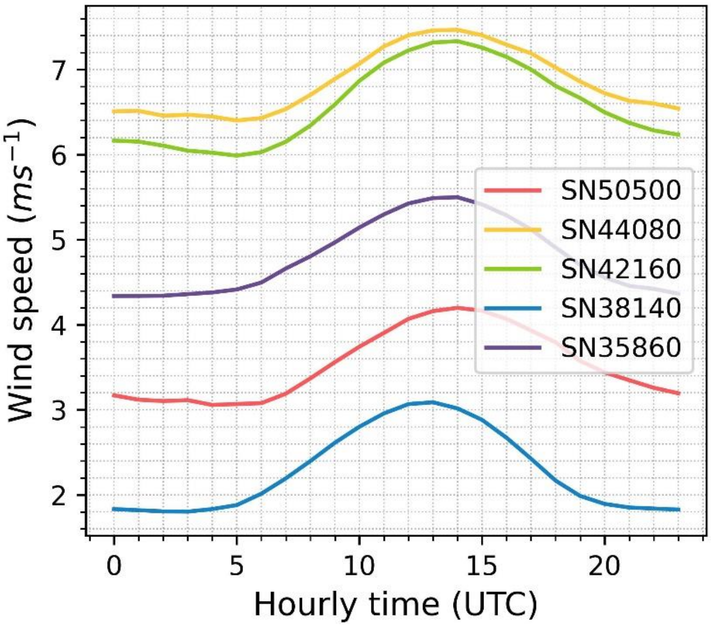

Figure S1 Mean wind speed at each time point across five stations, based on 16 years of hourly observations at each station.

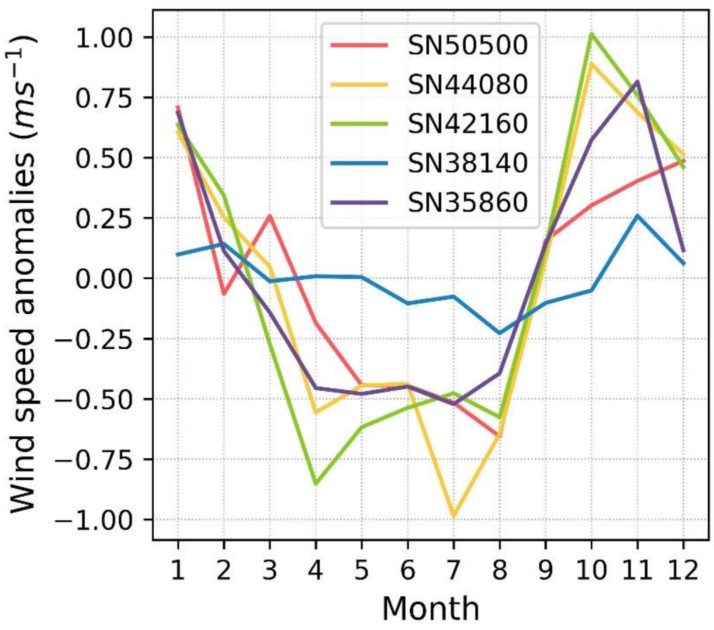

Figure S2 Mean wind speed anomalies (calculated as the mean monthly wind speed minus the annual mean wind speed) for each of the 12 months across five stations, based on 16 years of hourly observations at each station.

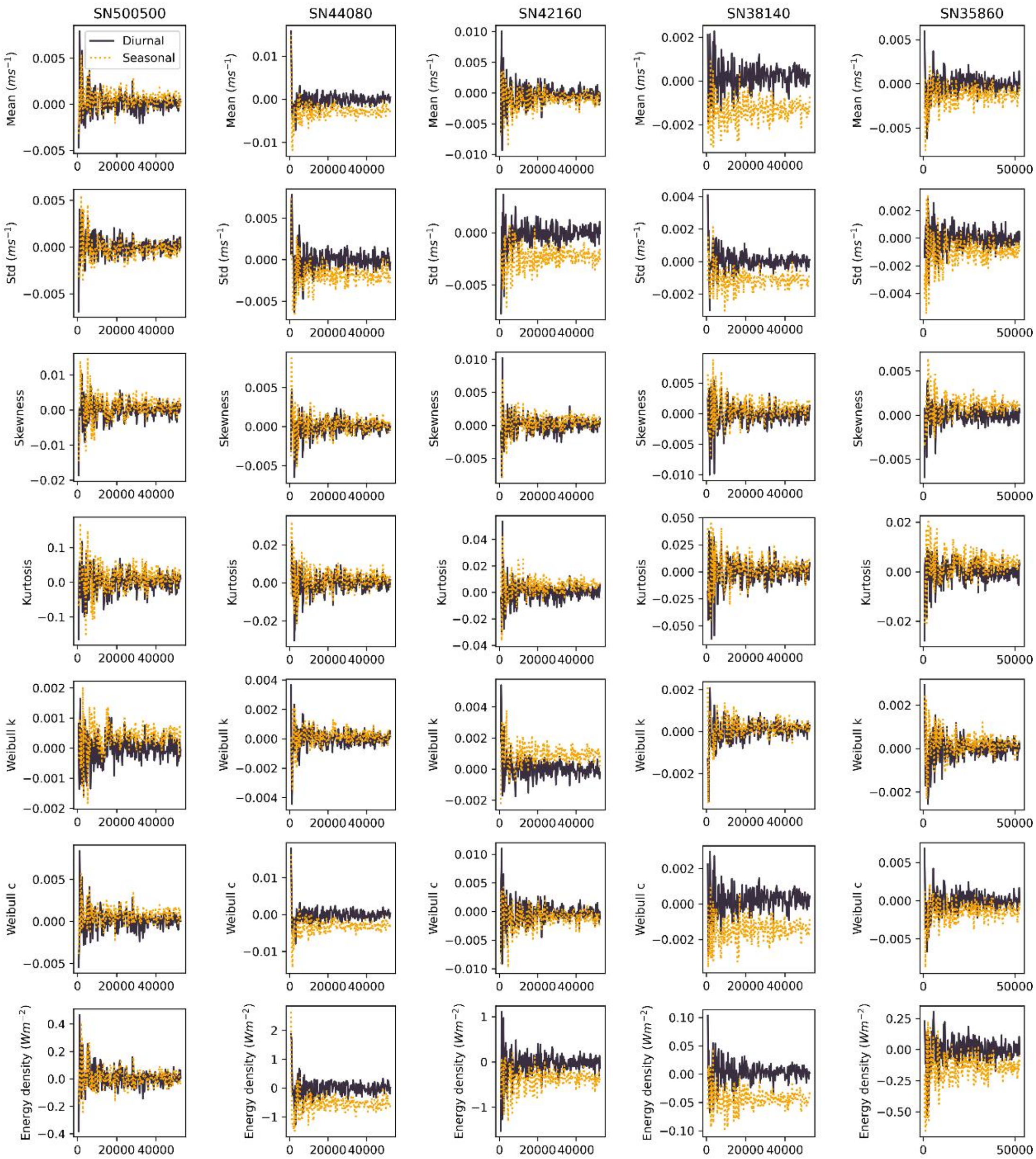

Figure S3 Differences in the 90% confidence intervals derived from in-situ observations between random sampling and diurnal-cycle-retained sampling (represented by black lines), and between random sampling and seasonality-retained sampling (represented by orange lines).

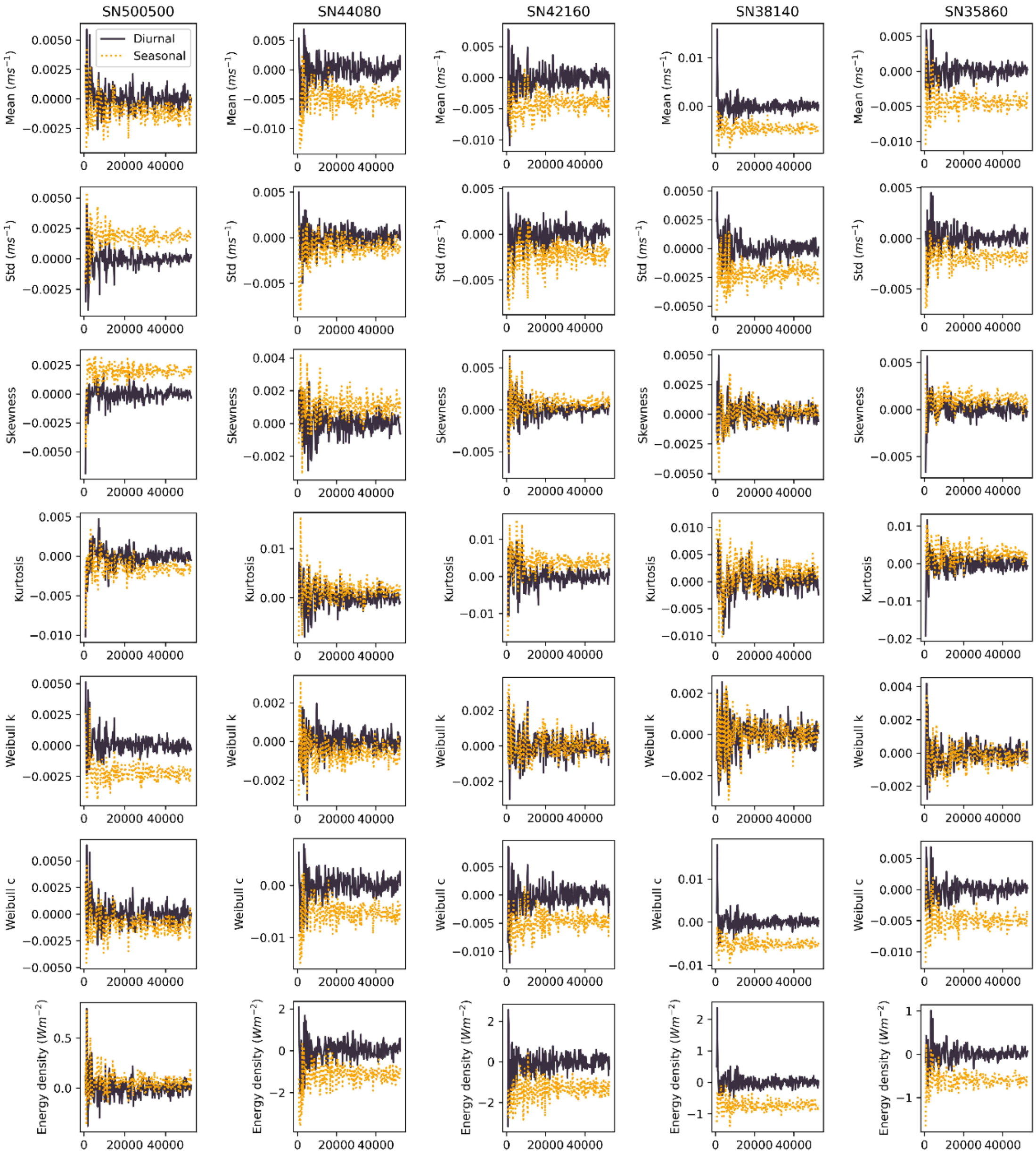

Figure S4 Same as Figure S3, but for ERA5 100-meter dataset.

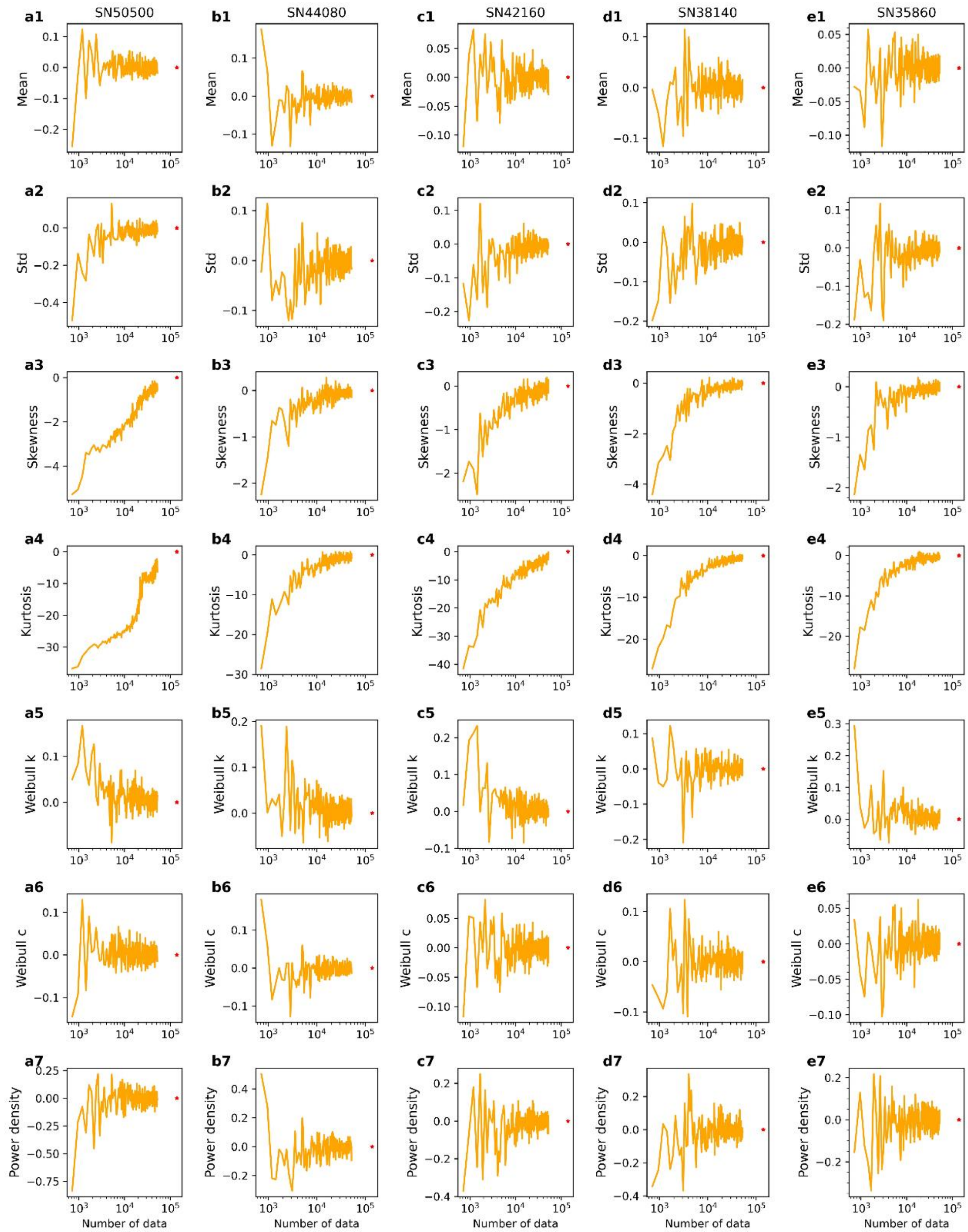

Figure S5 Relative percentage error of the median for each resampling group compared to the total time series value from in-situ weather observations.

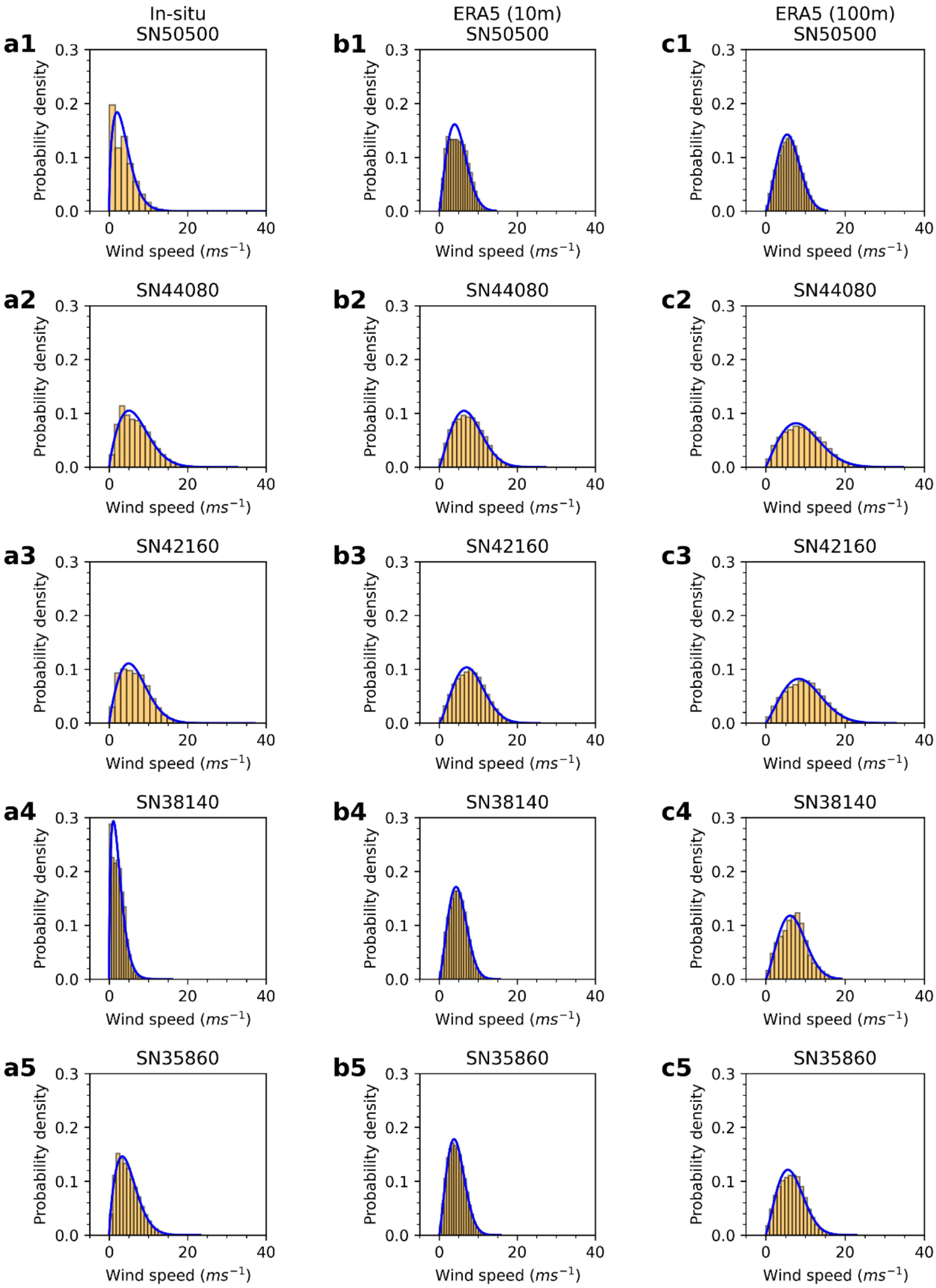

Figure S6 Wind speed distribution at five stations from both in-situ weather measurements and ERA5 reanalysis data (10m and 100m).

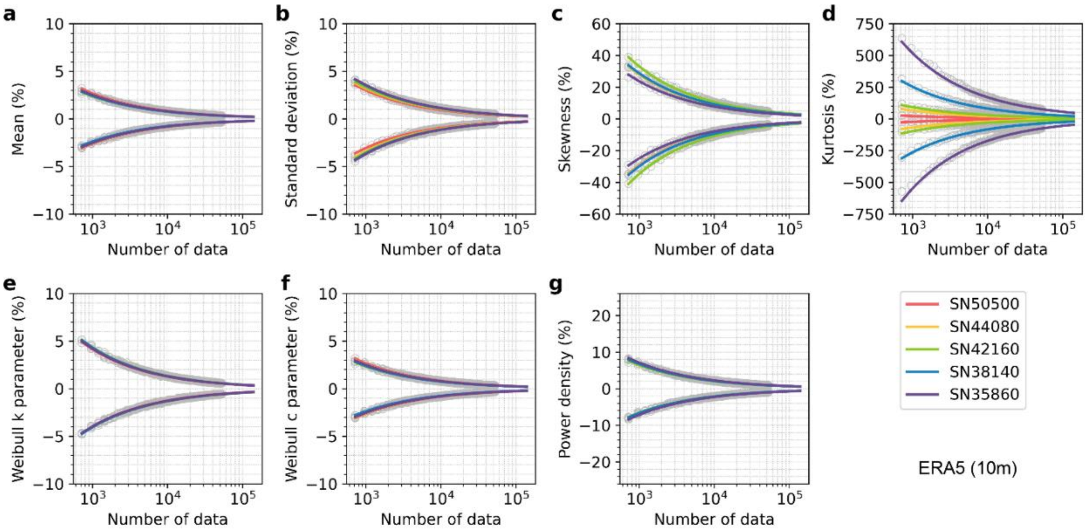

Figure S7 90% confidence intervals for the percent error in the mean, standard deviation, skewness, kurtosis, Weibull k and c parameters, and energy density, based on ERA5 10-meter dataset ranging from n = 720 (30 days) to n = 140,160 (16 years) across five stations. The fits to get the required data density are shown in Table S5.

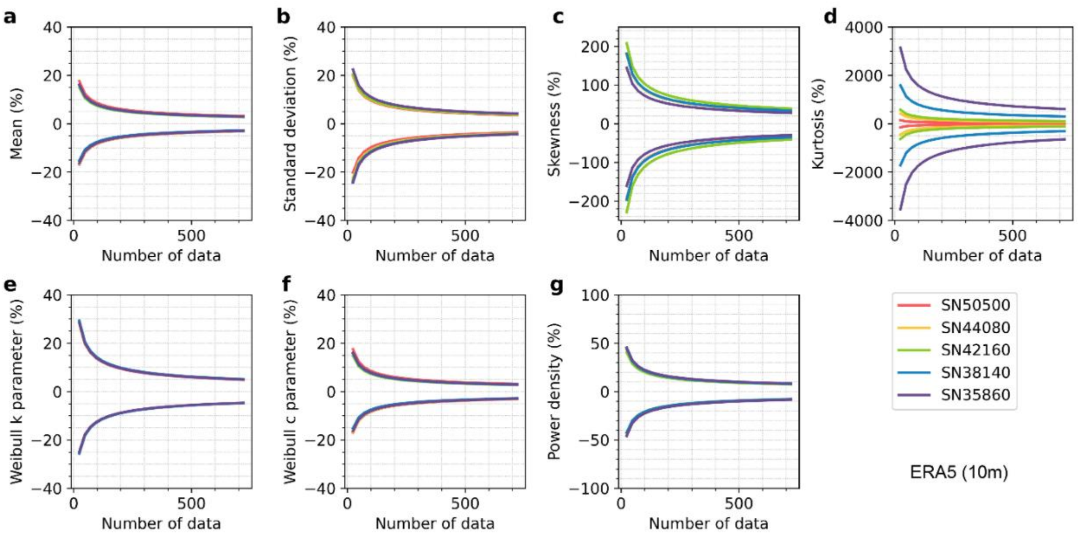

Figure S8 90% confidence intervals for the percent error in the mean, standard deviation, skewness, kurtosis, Weibull k and c parameters, and energy density, based on ERA5 10-meter dataset ranging from n = 24 (1 day) to n = 720 (30 days) across five stations. The fits to get the required data density are shown in Table S5.

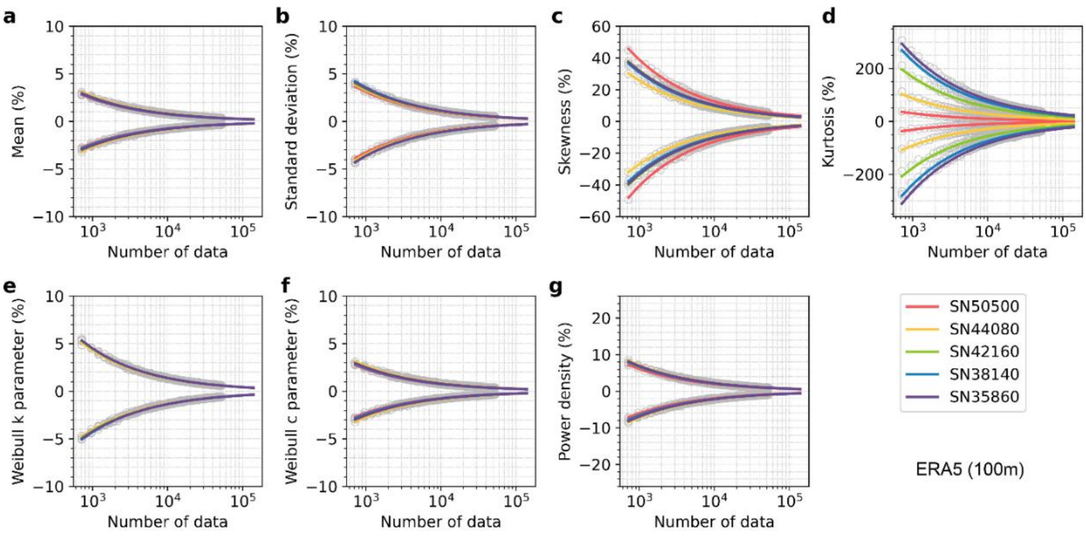

Figure S9 Same as Figure S7, but for ERA5 100-meter dataset. The fits to get the required data density are shown in Table S6.

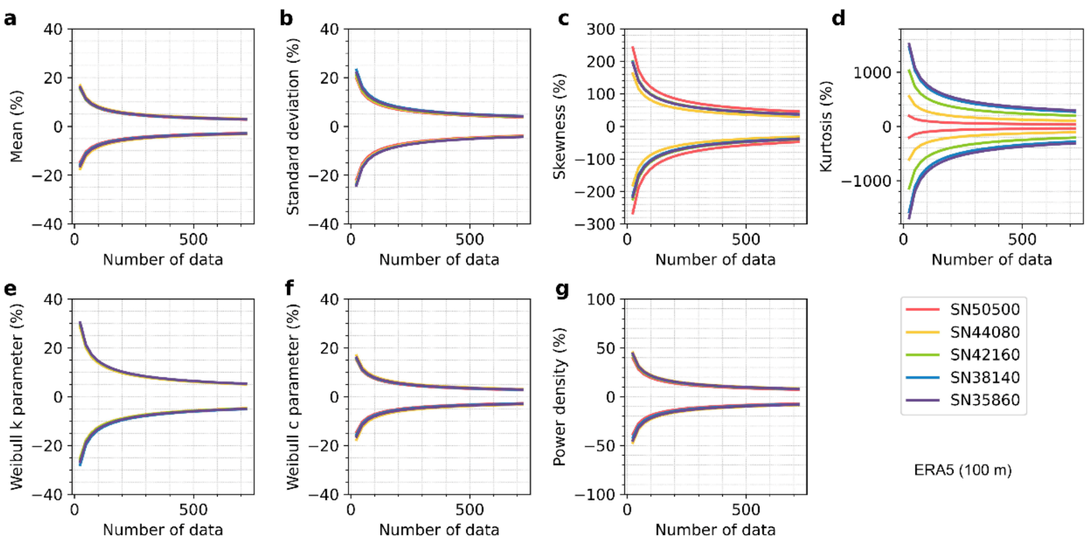

Figure S10 Same as Figure S8, but for ERA5 100-meter dataset. The fits to get the required data density are shown in Table S6.

Table S1. The selected years (Yr.) and the observation times (Obs. Tim.) for each station used in this study.

SN38140		SN35860		SN42160		SN44080		SN50500	
Yr.	Obs. Tim.	Yr.	Obs. Tim.	Yr.	Obs. Tim.	Yr.	Obs. Tim.	Yr.	Obs. Tim.
1996	8784	2001	8760	1998	8714	1995	8692	1974	8760
1998	8714	2002	8757	2000	8724	1996	8747	1975	8744
2002	8782	2003	8725	2001	8754	1997	8722	1976	8784
2003	8782	2004	8764	2002	8760	1998	8716	1977	8740
2004	8772	2008	8756	2004	8718	1999	8753	1978	8756
2009	8759	2009	8759	2008	8782	2000	8783	1979	8760
2010	8758	2010	8710	2009	8760	2001	8722	1980	8781
2011	8756	2014	8740	2010	8760	2002	8756	1981	8760
2012	8753	2015	8724	2011	8760	2003	8718	1982	8759
2014	8749	2016	8784	2012	8783	2004	8784	1983	8736
2015	8747	2017	8759	2013	8680	2006	8725	1984	8782
2017	8721	2018	8759	2016	8763	2009	8757	1985	8751
2018	8719	2019	8759	2018	8685	2010	8760	1986	8750
2019	8706	2020	8783	2020	8748	2011	8636	1987	8753
2020	8685	2021	8760	2022	8750	2012	8648	1988	8775
2021	8678	2022	8711	2023	8728	2013	8689	1990	8740

Table S2. Root mean squared error (RMSE) values derived from in-situ observations, comparing random sampling with diurnal cycle-retained sampling (Diurnal) and seasonality-retained sampling (Seasonal).

In-situ observations		SN50500	SN44080	SN42160	SN38140	SN35860	Average
Mean	Diurnal	0.0023	0.0026	0.0025	0.0013	0.0018	0.0021
	Seasonal	0.0023	0.004	0.0025	0.0016	0.0022	0.0025
Std. dev	Diurnal	0.0016	0.0019	0.0018	0.001	0.0013	0.0015
	Seasonal	0.0021	0.0027	0.0028	0.0014	0.0017	0.0021
Skewness	Diurnal	0.0083	0.002	0.0024	0.0029	0.0018	0.0035
	Seasonal	0.0075	0.0022	0.0025	0.0032	0.0022	0.0035
Kurtosis	Diurnal	0.1229	0.0106	0.0193	0.021	0.0084	0.0364
	Seasonal	0.1138	0.0113	0.0233	0.023	0.0084	0.0360
Shape k	Diurnal	0.0007	0.0009	0.001	0.0008	0.0008	0.0008
	Seasonal	0.0009	0.0008	0.0014	0.0008	0.0008	0.0009
Scale c	Diurnal	0.0025	0.0029	0.0028	0.0016	0.0021	0.0024
	Seasonal	0.0024	0.0045	0.0029	0.0018	0.0025	0.0028
Power density	Diurnal	0.1396	0.4855	0.3858	0.0292	0.1589	0.2398
	Seasonal	0.1687	0.7466	0.5161	0.0498	0.2311	0.3425

Table S3. Same as Table S2, but for ERA5 100-meter dataset.

ERA5 100-meter		SN50500	SN44080	SN42160	SN38140	SN35860	Average
Mean	Diurnal	0.0016	0.0027	0.0029	0.0023	0.0019	0.0023
	Seasonal	0.0105	0.0057	0.0051	0.005	0.005	0.0063
Std. dev	Diurnal	0.0011	0.0019	0.0018	0.0014	0.0013	0.0015
	Seasonal	0.0028	0.0022	0.0031	0.0024	0.0022	0.0025
Skewness	Diurnal	0.0012	0.0013	0.0015	0.0014	0.0015	0.0014
	Seasonal	0.0025	0.0016	0.0017	0.0015	0.0018	0.0018
Kurtosis	Diurnal	0.0021	0.003	0.004	0.0037	0.0044	0.0034
	Seasonal	0.0029	0.0038	0.0056	0.0044	0.0052	0.0044
Shape k	Diurnal	0.0012	0.0011	0.0012	0.0013	0.0011	0.0012
	Seasonal	0.0033	0.0012	0.0011	0.0013	0.0011	0.0016
Scale c	Diurnal	0.0018	0.0031	0.0032	0.0025	0.0022	0.0026
	Seasonal	0.0116	0.0064	0.0058	0.0056	0.0055	0.0070
Power density	Diurnal	0.1552	0.7918	0.8559	0.31	0.2731	0.4772
	Seasonal	0.8931	1.4477	1.6094	0.7847	0.6521	1.0774

Table S4. Equations relating percent error (*Y*) within 90% confidence intervals to number of data points (*n*), using data ranging from *n* = 720 to 52,560. P denotes the positive error bar, and N represents the negative error bar.

Parameters	SN50500	SN44080	SN42160	SN38140	SN35860
Mean (P)	Y=exp[-0.507ln(n)+4.888]	Y=exp[-0.503ln(n)+4.579]	Y=exp[-0.497ln(n)+4.497]	Y=exp[-0.496ln(n)+4.724]	Y=exp[-0.494ln(n)+4.536]
Mean (N)	Y=-exp[-0.511ln(n)+4.929]	Y=-exp[-0.494ln(n)+4.491]	Y=-exp[-0.498ln(n)+4.504]	Y=-exp[-0.500ln(n)+4.758]	Y=-exp[-0.501ln(n)+4.601]
Std. dev (P)	Y=exp[-0.497ln(n)+5.045]	Y=exp[-0.503ln(n)+4.579]	Y=exp[-0.486ln(n)+4.692]	Y=exp[-0.497ln(n)+4.971]	Y=exp[-0.489ln(n)+4.748]
Std. dev (N)	Y=-exp[-0.509ln(n)+5.169]	Y=-exp[-0.494ln(n)+4.491]	Y=-exp[-0.500ln(n)+4.838]	Y=-exp[-0.503ln(n)+5.033]	Y=-exp[-0.504ln(n)+4.904]
Skewness (P)	Y=exp[-0.452ln(n)+6.610]	Y=exp[-0.495ln(n)+6.434]	Y=exp[-0.483ln(n)+6.523]	Y=exp[-0.482ln(n)+6.579]	Y=exp[-0.488ln(n)+6.254]
Skewness (N)	Y=-exp[-0.471ln(n)+6.807]	Y=-exp[-0.502ln(n)+6.522]	Y=-exp[-0.496ln(n)+6.665]	Y=-exp[-0.506ln(n)+6.825]	Y=-exp[-0.509ln(n)+6.475]
Kurtosis (P)	Y=exp[-0.436ln(n)+8.521]	Y=exp[-0.493ln(n)+8.449]	Y=exp[-0.474ln(n)+8.746]	Y=exp[-0.469ln(n)+7.971]	Y=exp[-0.488ln(n)+8.273]
Kurtosis (N)	Y=-exp[-0.451ln(n)+8.673]	Y=-exp[-0.500ln(n)+8.540]	Y=-exp[-0.485ln(n)+8.869]	Y=-exp[-0.496ln(n)+8.254]	Y=-exp[-0.507ln(n)+8.472]
Weibull k (P)	Y=exp[-0.508ln(n)+4.902]	Y=exp[-0.503ln(n)+4.845]	Y=exp[-0.503ln(n)+4.907]	Y=exp[-0.509ln(n)+4.994]	Y=exp[-0.51ln(n)+4.919]
Weibull k (N)	Y=-exp[-0.491ln(n)+4.721]	Y=-exp[-0.493ln(n)+4.731]	Y=-exp[-0.484ln(n)+4.696]	Y=-exp[-0.501ln(n)+4.906]	Y=-exp[-0.493ln(n)+4.735]
Weibull c (P)	Y=exp[-0.507ln(n)+4.864]	Y=exp[-0.503ln(n)+4.580]	Y=exp[-0.496ln(n)+4.494]	Y=exp[-0.497ln(n)+4.782]	Y=exp[-0.494ln(n)+4.55]
Weibull c (N)	Y=-exp[-0.512ln(n)+4.906]	Y=-exp[-0.495ln(n)+4.505]	Y=-exp[-0.498ln(n)+4.506]	Y=-exp[-0.501ln(n)+4.824]	Y=-exp[-0.501ln(n)+4.619]
Power density (P)	Y=exp[-0.508ln(n)+6.011]	Y=exp[-0.505ln(n)+5.689]	Y=exp[-0.495ln(n)+5.547]	Y=exp[-0.500ln(n)+5.854]	Y=exp[-0.493ln(n)+5.614]
Power density (N)	Y=-exp[-0.509ln(n)+6.014]	Y=-exp[-0.492ln(n)+5.560]	Y=-exp[-0.497ln(n)+5.566]	Y=-exp[-0.497ln(n)+5.813]	Y=-exp[-0.5ln(n)+5.674]

Table S5. Equations for the ERA5 10-meter dataset relate percent error (*Y*) within 90% confidence intervals to the number of data points (*n*), for values of *n* between 720 and 52,560. P represents the positive error bar and N represents the negative error bar.

Parameters	SN50500	SN44080	SN42160	SN38140	SN35860
Mean (P)	Y=exp[-0.505ln(n)+4.47]	Y=exp[-0.496ln(n)+4.356]	Y=exp[-0.494ln(n)+4.275]	Y=exp[-0.504ln(n)+4.368]	Y=exp[-0.498ln(n)+4.365]
Mean (N)	Y=-exp[-0.499ln(n)+4.413]	Y=-exp[-0.501ln(n)+4.404]	Y=-exp[-0.498ln(n)+4.316]	Y=-exp[-0.498ln(n)+4.304]	Y=-exp[-0.5ln(n)+4.38]
Std. dev (P)	Y=exp[-0.504ln(n)+4.576]	Y=exp[-0.488ln(n)+4.535]	Y=exp[-0.489ln(n)+4.568]	Y=exp[-0.497ln(n)+4.688]	Y=exp[-0.493ln(n)+4.671]
Std. dev (N)	Y=-exp[-0.506ln(n)+4.61]	Y=-exp[-0.506ln(n)+4.711]	Y=-exp[-0.507ln(n)+4.754]	Y=-exp[-0.505ln(n)+4.775]	Y=-exp[-0.506ln(n)+4.802]
Skewness (P)	Y=exp[-0.497ln(n)+6.767]	Y=exp[-0.494ln(n)+6.749]	Y=exp[-0.492ln(n)+6.901]	Y=exp[-0.493ln(n)+6.766]	Y=exp[-0.484ln(n)+6.511]
Skewness (N)	Y=-exp[-0.508ln(n)+6.875]	Y=-exp[-0.508ln(n)+6.891]	Y=-exp[-0.505ln(n)+7.038]	Y=-exp[-0.505ln(n)+6.887]	Y=-exp[-0.5ln(n)+6.67]
Kurtosis (P)	Y=exp[-0.499ln(n)+6.546]	Y=exp[-0.497ln(n)+7.613]	Y=exp[-0.489ln(n)+7.91]	Y=exp[-0.492ln(n)+8.935]	Y=exp[-0.483ln(n)+9.587]
Kurtosis (N)	Y=-exp[-0.504ln(n)+6.598]	Y=-exp[-0.507ln(n)+7.717]	Y=-exp[-0.502ln(n)+8.044]	Y=-exp[-0.503ln(n)+9.046]	Y=-exp[-0.5ln(n)+9.762]
Weibull k (P)	Y=exp[-0.512ln(n)+4.962]	Y=exp[-0.506ln(n)+4.943]	Y=exp[-0.508ln(n)+4.979]	Y=exp[-0.514ln(n)+5.011]	Y=exp[-0.512ln(n)+4.973]
Weibull k (N)	Y=-exp[-0.502ln(n)+4.839]	Y=-exp[-0.489ln(n)+4.767]	Y=-exp[-0.488ln(n)+4.771]	Y=-exp[-0.494ln(n)+4.808]	Y=-exp[-0.493ln(n)+4.779]
Weibull c (P)	Y=exp[-0.504ln(n)+4.463]	Y=exp[-0.495ln(n)+4.348]	Y=exp[-0.494ln(n)+4.261]	Y=exp[-0.504ln(n)+4.353]	Y=exp[-0.498ln(n)+4.36]
Weibull c (N)	Y=-exp[-0.5ln(n)+4.419]	Y=-exp[-0.502ln(n)+4.41]	Y=-exp[-0.499ln(n)+4.313]	Y=-exp[-0.498ln(n)+4.301]	Y=-exp[-0.5ln(n)+4.378]
Power density (P)	Y=exp[-0.506ln(n)+5.416]	Y=exp[-0.495ln(n)+5.329]	Y=exp[-0.493ln(n)+5.266]	Y=exp[-0.503ln(n)+5.384]	Y=exp[-0.497ln(n)+5.398]
Power density (N)	Y=-exp[-0.498ln(n)+5.332]	Y=-exp[-0.502ln(n)+5.393]	Y=-exp[-0.5ln(n)+5.33]	Y=-exp[-0.497ln(n)+5.326]	Y=-exp[-0.499ln(n)+5.413]

Table S6. Same as Table S2, but for ERA5 100-meter dataset.

Parameters	SN50500	SN44080	SN42160	SN38140	SN35860
Mean (P)	Y=exp[-0.5ln(n)+4.315]	Y=exp[-0.497ln(n)+4.402]	Y=exp[-0.494ln(n)+4.305]	Y=exp[-0.502ln(n)+4.357]	Y=exp[-0.498ln(n)+4.361]
Mean (N)	Y=-exp[-0.495ln(n)+4.254]	Y=-exp[-0.503ln(n)+4.458]	Y=-exp[-0.498ln(n)+4.354]	Y=-exp[-0.5ln(n)+4.335]	Y=-exp[-0.501ln(n)+4.383]
Std. dev (P)	Y=exp[-0.492ln(n)+4.533]	Y=exp[-0.489ln(n)+4.559]	Y=exp[-0.489ln(n)+4.593]	Y=exp[-0.501ln(n)+4.731]	Y=exp[-0.493ln(n)+4.656]
Std. dev (N)	Y=-exp[-0.506ln(n)+4.685]	Y=-exp[-0.506ln(n)+4.739]	Y=-exp[-0.507ln(n)+4.783]	Y=-exp[-0.503ln(n)+4.76]	Y=-exp[-0.508ln(n)+4.803]
Skewness (P)	Y=exp[-0.49ln(n)+7.047]	Y=exp[-0.494ln(n)+6.659]	Y=exp[-0.49ln(n)+6.854]	Y=exp[-0.497ln(n)+6.868]	Y=exp[-0.486ln(n)+6.817]
Skewness (N)	Y=-exp[-0.504ln(n)+7.187]	Y=-exp[-0.509ln(n)+6.815]	Y=-exp[-0.505ln(n)+7.015]	Y=-exp[-0.505ln(n)+6.958]	Y=-exp[-0.501ln(n)+6.972]
Kurtosis (P)	Y=exp[-0.495ln(n)+6.837]	Y=exp[-0.494ln(n)+7.888]	Y=exp[-0.486ln(n)+8.482]	Y=exp[-0.496ln(n)+8.86]	Y=exp[-0.483ln(n)+8.858]
Kurtosis (N)	Y=-exp[-0.504ln(n)+6.93]	Y=-exp[-0.508ln(n)+8.03]	Y=-exp[-0.501ln(n)+8.633]	Y=-exp[-0.506ln(n)+8.974]	Y=-exp[-0.498ln(n)+9.015]
Weibull k (P)	Y=exp[-0.511ln(n)+5.007]	Y=exp[-0.506ln(n)+4.955]	Y=exp[-0.507ln(n)+5.002]	Y=exp[-0.511ln(n)+5.037]	Y=exp[-0.512ln(n)+5.041]
Weibull k (N)	Y=-exp[-0.489ln(n)+4.776]	Y=-exp[-0.489ln(n)+4.78]	Y=exp[-0.493ln(n)+4.298]	Y=-exp[-0.502ln(n)+4.924]	Y=-exp[-0.493ln(n)+4.849]
Weibull c (P)	Y=exp[-0.5ln(n)+4.293]	Y=exp[-0.496ln(n)+4.404]	Y=-exp[-0.499ln(n)+4.358]	Y=exp[-0.502ln(n)+4.347]	Y=exp[-0.497ln(n)+4.352]
Weibull c (N)	Y=-exp[-0.495ln(n)+4.249]	Y=-exp[-0.503ln(n)+4.468]	Y=exp[-0.493ln(n)+5.305]	Y=-exp[-0.5ln(n)+4.333]	Y=-exp[-0.501ln(n)+4.387]
Power density (P)	Y=exp[-0.499ln(n)+5.256]	Y=exp[-0.496ln(n)+5.385]	Y=-exp[-0.501ln(n)+5.382]	Y=exp[-0.502ln(n)+5.376]	Y=exp[-0.496ln(n)+5.362]
Power density (N)	Y=-exp[-0.496ln(n)+5.225]	Y=-exp[-0.503ln(n)+5.451]	Y=exp[-0.494ln(n)+4.305]	Y=-exp[-0.496ln(n)+5.312]	Y=-exp[-0.501ln(n)+5.396]