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Hesselø OffshoreWind Farm

Site Wind Conditions Assessment

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Hesselø Site Wind Conditions Assessment

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Executive Summary

EMD International A/S has been tasked by Energinet to conduct a Site Wind Conditions Assessment for Hesselø offshore wind farm.

The site wind condition assessment is an early assessment after 8 months of onsite measurements in the Hesselø wind farm zone and has as aim to produce early site wind condition parameters according to IEC 61400-1 [1] and IEC 61400-3-1 [2]. In addition, IEC 61400-15-1 CD [3] is refferenced.

The report include a presentation and analysis of onsite data from the FLS-200 buoy as well as secondary measurements surrounding the site and sourced for this purpose. A wind model created for the site through long-term correction of 7 months of onsite LIDAR data with 22 years of EMD-WRF mesoscale data (labelled “Primary Wind Model”).

The Primary Wind Model is backed up by to alternative models, presented as “Calibrated Mesoscale Data Model” and “Translated Læsø Data Model”. The two alternative models are in good agreement with the Primary Model on mean wind speed for the site, but up to 3% in disagreement on expected production output. The difference may be caused by the very short and seaonally biased local measurement period.

Due to seasonal bias and short measurement period, many of the site condition parameters are supported or replaced by data from the GASP [4] dataset, surrounding measurements or model calculations. It is expected that several of these parameters may fully rely on local measurements when the measurement campaign is complete.

All calculations are done in WindPRO 3.5, developed and sold by EMD International A/S.

The site condition parameters are summarized in Table 1.

The datasets produced by this study are available in a data package prepared for Energinet.

Table 1. Summary table of Site Wind Condition parameters at the Hesselø Floating LIDAR System buoy. All values refer to 140m height above sea level (ASL).

Parameter	Value
Mean wind speed	9.64 m/s
Weibull distribution, A parameter (scale)	10.89
Weibull distribution, k parameter (shape)	2.22
Normal wind profile power law exponent	0.088
Turbulence intensity mean value (TI_{μ}) at a 10-min average wind speed of 15m/s*	6.0%
Turbulence intensity standard deviation (TI_{σ}) at a 10-min average wind speed of 15m/s*	1.7%
Turbulence intensity 90% quantile at a 10-min average wind speed of 15m/s*	8.2%
Mean air density	1.23 kg/m^3
Mean air temperature	8.3 °C
50-year extreme wind speed	40.5 m/s
1-year extreme wind speed	22.8 m/s
Wind shear for extreme wind speed extrapolation	0.095
Characteristic turbulence intensity at 50-year extreme wind speed	12.9%
Air density for extreme wind	1.23 kg/m^3

* Turbulence values at other wind speeds can be found in appendix G.

Recommendations

EMD recommends updating this site parameter assessment at the conclusion of the measurement campaign.

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1 Introduction

EMD International A/S has been tasked by Energinet to provide a site wind condition assessment for the Hesselø Offshore Windfarm.

The objectives of the site wind condition assessment were described by the Scope of Services Site Wind Conditions Assessment [5] provided by Energinet and includes the following:

A site wind condition assessment adequate for a preliminary site-suitability analysis for the Wind Turbine Generator (WTG) and Rotor Nacelle Assembly as well as input in early-stage integrated load analyses of the support structure and turbines.

The parameters for the wind condition assessment are listed in Table 2 and are defined according to IEC61400-1 [1], IEC 61400-3-1 [2] and IEC 61400-15-1 CD [3].

Table 2. Site wind conditions parameter list.

Site parameters at 140m MSL	
Normal conditions parameters	**Extreme conditions parameters**
Mean wind speed	Extreme Turbulence Model (ETM) at hub height
Omni-directional Weibull wind speed distribution parameters	Wind profile for extreme wind speed extrapolation with elevation
Wind profile for wind speed extrapolation with elevation	Wind profile for integrated load analysis
Wind profile for Integrated Load Analysis, Normal Wind Profile (NWP)	Turbulence intensity
Normal Turbulence Model (NTM)	Mean air density
Mean air density	Maximum 10-minute mean wind speed for a 50-year EWM
Mean air temperature	

The site wind condition parameter list is populated through a wind condition and resource assessment based on onsite LIDAR data and mesoscale WRF data. This model supported by a selection of ground stations located within meaningful distance of the Hesselø wind farm zone.

Beside the present report, measurement data as well as WRF and long-term corrected datasets are provided in the form of time series text files.

2 Site Description

2.1 Location

The Hesselø Offshore Wind Farm (OWF) is located in the central part of Kattegat, between Northern Sjælland, the island of Anholt, the Djursland peninsula and the Swedish region of Halland (Figure 1).

The Hesselø OWF zone is defined through the boundary nodes listed in Table 3.

Closest distance to land from the OWF zone is listed in Table 4, making landfall at least 20 km from the OWF zone.

The neighboring Anholt Offshore Wind Farm is located 27 km to the north-west.

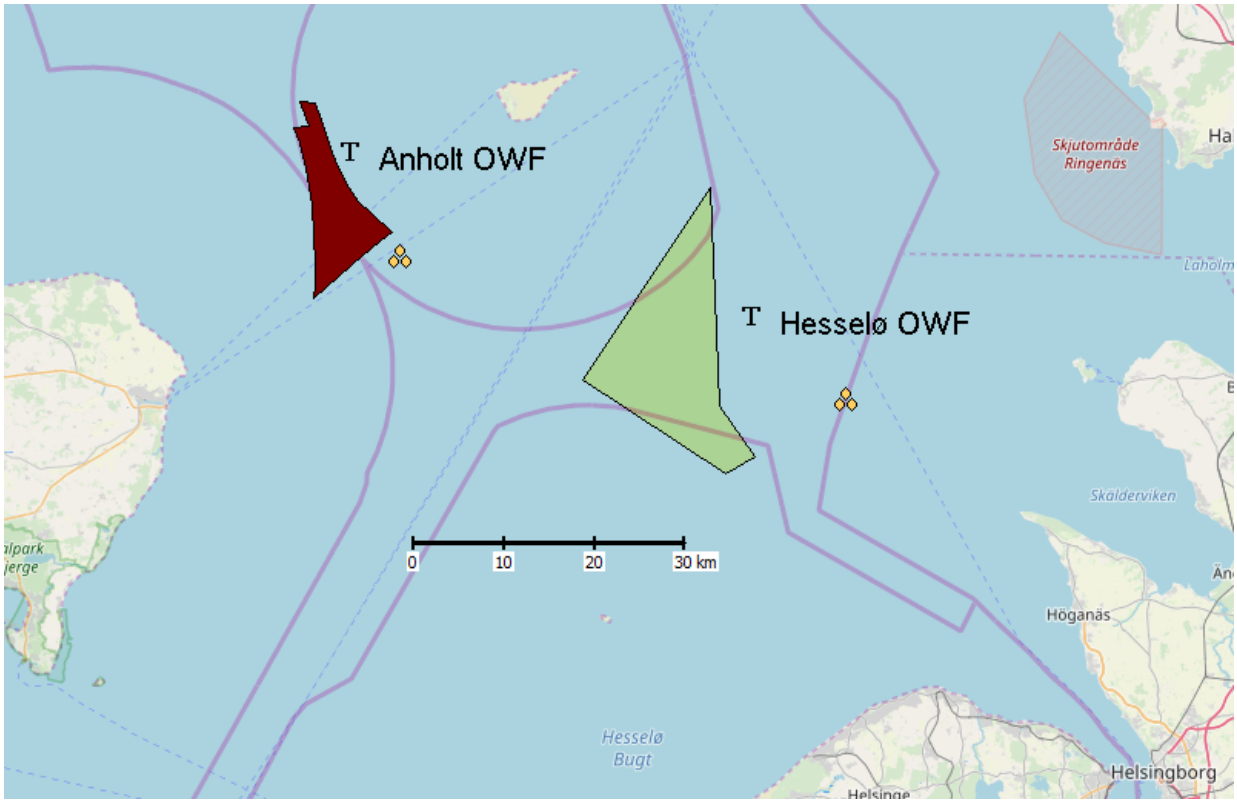

Figure 1. Regional map with location of the Hesselø OWF (OpenStreetMap).

Table 3. Hesselø OWF zone boundary nodes (UTM WGS84, zone 32)

Node	Easting	Northing
OWF 1	680432	6247210
OWF 2	664326	6256982
OWF 3	675002	6274479
OWF 4	677459	6278553
OWF 5	679510	6254602
OWF 6	683606	6249199

Table 4. Distance to landfall in each direction.

Nearest landfall	Distance
Anholt	20 km
Kullen, Sweden	29 km
Rågeleje, Sjælland	30 km
Fornæs, Djursland	43 km
Hesselø	20 km

2.2 Terrain description

The wind farm is located in open water with sufficient distance to any shoreline that direct effect of these is negligible and only represented in the variation in mesoscale climate across the site. For this reason, no microscale terrain assessment has been conducted.

3 Wind Data

3.1 Wind data overview

A host of wind data measurements was considered for the wind condition and resource analysis. Each source is listed in Table 5-7 and considered in the following.

The onsite Floating LIDAR System (FLS), commisioned by Energinet is the primary source of information. Data from an older mast commisionend by Energinet near Læsø was used as a secondary source to verify the wind climate. Ground station data sourced from the Danish Meteorological Institute (DMI) and the Swedish Meteorological Institute (SMHI) are primarily used to verify the long term variation in wind climate.

Please note that, for DMI and SMHI stations, the information in Table 5 only relates to the latest (and most relevant) measurement period.

The DMI observations have been retrieved via:
https://confluence.govcloud.dk/display/FDAPI/Meteorological+Observation

The SMHI data have been retrieved via the SMHI Open Data API about Meteorological Observations:
https://opendata.smhi.se/apidocs/metobs/index.html

The measurement locations are plotted on a map in Figure 2.

Table 5. Measurement stations considered in the study.

Name	Type	Measurement height [m]	Measurement period
Hesselø FLS	LiDAR	**40 - 240**	02/2021 to 10/2021
Læsø	Met-Mast	15, 30, 45, 62	04/1999 to 12/2003
Anholt	Climate Met-Mast	10	05/1993 to 11/2021
Gniben	Climate Met-Mast	10	01/1961 to 11/2021
Nakkehoved Fyr	Climate Met-Mast	10	09/1986 to 11/2021
Väderö	Climate Met-Mast	2	08/1995 to 08/2021
Halmstad Flygplats	Climate Met-Mast	2	/

Table 6. Location of external wind measurements (geographic coordinates, datum WGS84)

Name	Longitude	Latitude	Z [m]	Height above ground (sea) [m]	Provider (Code#)
Læsø	11.1232	57.0842	0.0	62.0	Energinet
Anholt	11.5098	56.7169	2.3	12.3	DMI (#06079)
Gniben	11.2787	56.0083	14.4	24.4	DMI (#06069)
Nakkehoved	12.3424	56.1193	37.2	47.2	DMI (#06068)
Väderö	12.5430	56.4505	8.3	10.3	SMHI (#62260)
Halmstad- Flygplats	12.8167	56.6833	19.8	21.8	SMHI (#62410)

Table 7. Coverage of wind measurement

Name	Availability period(s) [start date- end date]	Recovery	Time interval
LIDAR	28/02/2021-28/10/2021	91.4% (140 m)	10 min
Læsø	24/04/1999-09/12/2003*	93.2%	10 min
Anholt	01/01/1961-01/11/1965	99.4%	3 and 4 hours
	01/10/1967 -05/04/1980	92.2%	4 hours
	20/05/1993-28/09/1999	97.8%	1 hour
	01/10/1999-10/11/2021*	98.4%	10 min
Gniben	01/01/1961-17/03/1985	77.8%	3 hours
	18/03/1985-31/07/2002	91.6%	1 hour
	28/08/2002-10/11/2021*	98.5%	10 min
Nakkehoved	15/01/1982-28/10/1983	81.2%	3 hours
	02/09/1986-29/09/1999	90,7%	1 hour
	18/01/2007-10/11/2021*	98.9%	10 min
Väderö	01/01/1961-30/06/1965	100%	6 hours
	01/08/1995-01/11/2021*	95.6%	1hour
Halmstad Flygplats	01/02/1945-30/06/1978	> 95%	various
	23/04/2021 – 01/08/2021	99.7%	1 hour

* data truncated to a full number of years further in the analysis.

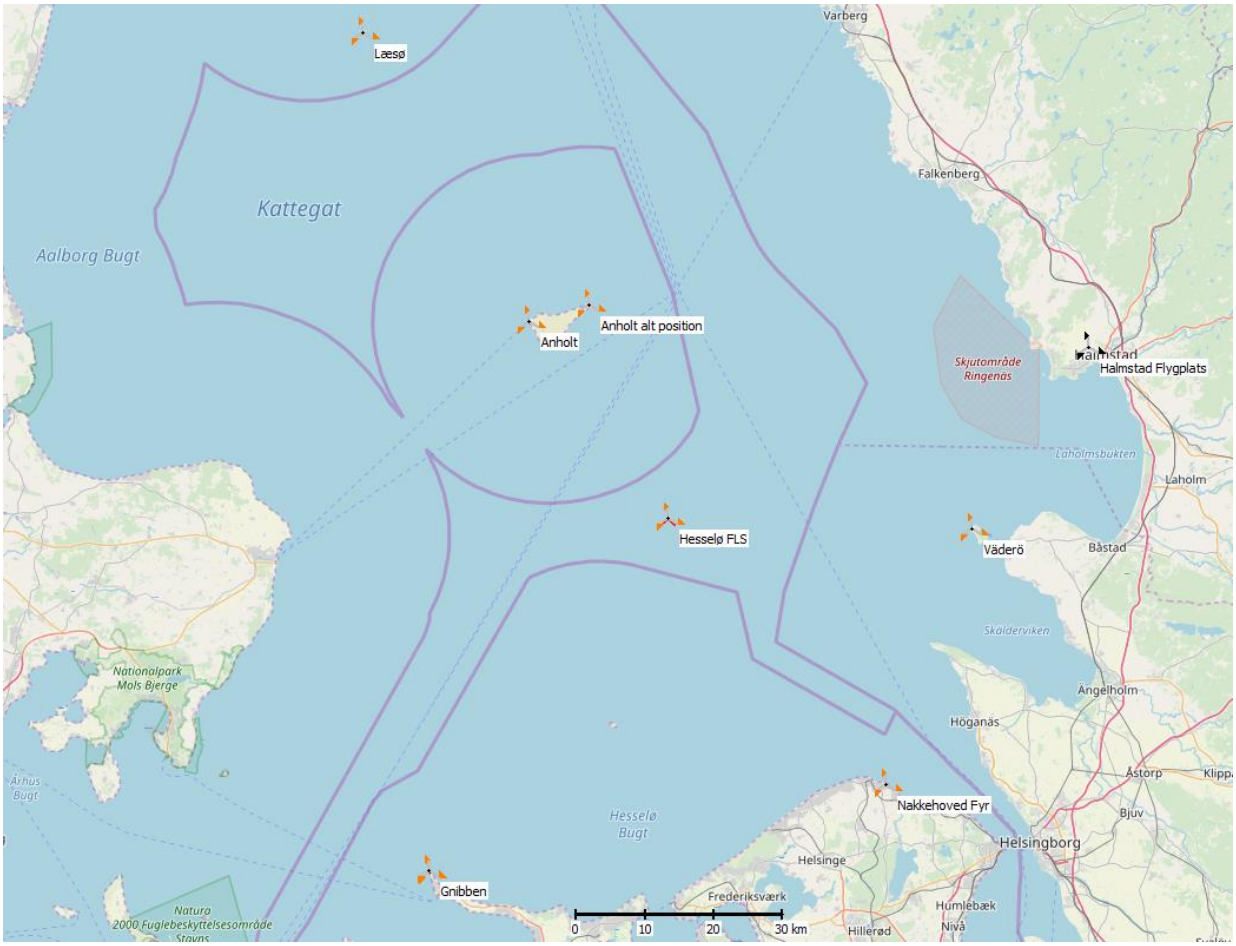

Figure 2. Location of considered measurement stations.

3.2 LIDAR measurements

3.2.1 Measurement Campaign

Energinet has commissioned a floating LIDAR measurement campaign on site, operated by EOLOS Floating LIDAR Solutions. The buoy is labelled FLS200-E01 and the campaign was commenced on 28/02/2021 and is ongoing.

EMD has received documentation as listed in Table 8.

EMD has received measurement data both as daily and monthly batches covering the period 28/02/2021 to 28/10/2021. Total measurement period is 8 months.

Table 8. List of documentation received on the FLS.

Title	Source	Date	Content	Reference
Installation Report	**Eolos**	**04/03/2021**	**Installation report**	[6]
As Installed – Hesselø	Eolos	28/01/2021	Technical specification of buoy and instruments	[7]
FLS Wind Measurement Features	Eolos	01/02/2021	Description of wind measurement instruments	[8]
Hessleø Measurement Plan	Eolos	29/09/2021	Description of data collection and processing.	[9]
Hesselø FLS200 E01 Compass Comparison	Eolos	13/07/2021	Comparison study of the three mounted direction sensors	[10]
Independent analysis and reporting of ZX LiDARs performance verification executed by Zephir Ltd. At Pershore test site, including IEC comliant validation analysis	DNV-GL	29/01/2019	LIDAR verification report	[11]
Assessment of EOLOS FLS-200 E01 Floating LiDAR PRE-Deployment Verification at the TNO Lichteiland Goeree Offshore Test Site, NL	Multiversum	03/09/2021	Pre-deployment verification document	[12]

3.2.2 Buoy position

The buoy position is reported by Eolos as listed in Table 9.

The drift of the buoy is reported as maximum 97 m and for all practical purposes the buoy can be considered stationary.

Table 9. List of wind speed measurement equipment and location.

FLS200-E01	UTM WGS84, z32	Geographical coordinates
Eastings	674664	11°50'6.24"E
Northings	6261349	56°27'51.12N
Elevation ASL [m]	0	0

3.2.3 Instrumentation

The instrumentation on the Eolos FLS200-E01 is described in documents [7] and [8]. In the following, only instruments relevant for the site wind conditions are described.

LIDAR

The LIDAR mounted on the Eolos FLS200-E01 is a ZX300M LIDAR from ZXLiDARs Ltd.

This LIDAR model is classified by DNV-GL [13].

A similar model, but not the same instrument was verified at the Pershore, UK, test site by DNV-GL [11].

The specific instrument deployed on the Eolos FLS200-E01 was verified by Multiversum at the TNO Lichteiland Goeree Offshore Test Site, NL [12].

The information from the classification and the verification was used to assess the measurement uncertainty of the LIDAR. The verification test as well to verify and adjust the wind directions sensor (see section 3.2.6).

The LiDAR window is located 1.6m above sea level. This should be compensated for when interpreting the measurement results together with an 0.4 m offset built into the tidal correction of the data processing by Eolos. This means a 2 m offset between the measurement height reported and the real heights. This results in measurement heights according to Figure 3 from the Eolos Measurement Plan [9].

Floating LIDAR Measurement heights	
Level	**Configured LIDAR height + offset (m)**
10	238+2 = 240 *
9	198+2 =200
8	178+2 = 180
7	158+2 = 160
6	138+2 =140
5	118+2 = 120
4	98+2 = 100
3	68+2 = 70
2	38+2 = 40 (ZX reference height)
1	10+2 = 12

Figure 3. LIDAR measurement heights. Reported heights must be added 2 m to obtain the real height [9].

Meteo stations

The Eolos FLS200-E01 is equipped with two additional meteorological stations. These are a Vaisala WXT536 package and the second is a Aimar 200WX package.

Both are capable of measuring standard parameters: Wind speed, wind direction, air pressure, temperature, humidity and rainfall. Specifications are described by [8].

The mounting of the instruments is 3.25 m above the waterline, however as they are not used for shear or wind model analysis, they are by EMD assigned a generic height of 10m.

In the datafiles provided by Eolos only one sensor signal for each parameter is reported and it is not clear which of the stations provide the input. Hence, the two weather stations are considered as a single unit called METEO by Eolos.

3.2.4 Operation history

The measurement campaign officially started on 28/02/2021.

A communication problem was detected, resulting I two corrective operations.

On 19/03/2021 corrective maintenance was done on the buoy [14].

On 14-17/07-2021 the buoy was moved to port for maintenance and replacement of control box [15].

Based on the maintenance report and communication between Energinet and EOLOS the data collected remotely was as a result of the above suffering data loss, while a more complete dataset was collected locally on the buoy.

Daily files suffer from this corruption, but EOLOS has provided monthly data files with recovered local data.

The period 14-17/07/2021 remain a gap in the dataset.

3.2.5 Eolos Post-processing of Data

Eolos has provided some information on the post-processing of the LIDAR data [9].

Wind direction data are corrected for the yaw of the buoy and the homodyne behavior of the LIDAR. This is the 180-degree ambiguity in the LIDAR measurements. The METEO data are used for this correction.

No motion correction is applied. Eolos states that this is a valid approach.

Eolos corrects for tidal variations. It is understood that this makes the measurements comparable with a fixed structure, such as a mast or a wind turbine, but it also means that the actual measurement height above sea level is variable, within the range of tidal variations. The tidal correction includes an 0.4m offset to convert the 1.6 m window height to 2 m (see section 3.2.3).

Data are filtered if buoy location is outside maximum drift radius + 20m (97 + 20 = 117 m)

Data are filtered if the LIDAR returns invalid values, such as N/A, 9998 or 9999, representing poor quality data.

Data are filtered if out of wind speed (V < 0 m/s or V > 50 m/s) or wind direction (Dir < 0° or Dir > 360°) range.

Eolos has applied a quality control algorithm to the raw measurement data and defines four states:

0 – System not available

1 – System available & post-processed data passing quality checks

2 – System available but data filtered for not passing quality checks

3 – System available & postprocessed data are passing quality checks for wind speed but not direction

These states are labeled “Code” in the datasets from Eolos

The LIDAR’s own error signals (N/A, 9998 and 9999) are captured by the Eolos state 2.

State 0 and state 3 are not present in the datasets received from Eolos.

EMD has included filtered values in the raw data set, but disabled data records with “Code” set to 2 in the filtered dataset.

3.2.6 EMD Filtering of LIDAR Data

EMD has considered the daily files but find the dataset incomplete and inconsistent. The reason for this is unclear but may be related to the reported problem with the logger [15]. Instead monthly files are considered. These are of considerably better quality.

EMD has imported these into WindPRO using the interpretation filter presented in appendix A.

WIND DIRECTION

Eolos reports [9] that the wind direction sensor used in the datafiles is that of the ZX LIDAR (as reported in the data files). In a comparison with EMD-WRF data an average offset of -7.5 degrees is noted (section 5.1.3). In the validation study Multiversum finds good agreement between reference station direction

and the buoy main compass, but a -6.5 degree offset to the ZX LIDAR wind direction measurements. As these two offsets are in agreement, EMD has applied a 6.5 degree offset on the LIDAR wind direction measurements.

DATA QUALITY FILTERING

EMD has used the code setting 2 (section 3.2.5) to filter the data. This has effectively removed the inherent ZX error settings (n/a, 9998 and 9999).

EMD has reviewed the dataset, but no further data needed to be removed.

In the filtered dataset produced by EMD all data highlighted as faulty are set as “disabled” so these records are ignored but not removed from the dataset.

No filtering has been done on the METEO data. They are provided as is.

3.2.7 Recovery Rate and Data Substitution

The LIDAR dataset suffers data loss as a result of above filtering. In order to recover some of this loss a data substitution procedure was done.

The recovery rate on the LIDAR is higher at lower heights than at taller heights. The substitution procedure transfers lower height measurements upwards in the profile with a shear transfer function.

The shear matrix transformation method is described in detail in the WindPRO manual, section 12.3.3.6 [16]).

For each height repaired the height one or two levels below was used as source. A shear matrix was built using the heights immediately above and below the repaired heigth, including the source height. The binning for the matrix consists of 12 diurnal bins and 12 directional bins. No seasonal binning was used in order to increase the count of data records in each bin. Only data concurrent at all selected heights feed into the shear matrix. The shear value in each bin is calculated based on a Weibull derived mean wind speed for each selected height.

An example of a shear matrix (140m) is shown in Table 10.

The synthesized data replaces gaps and disabled data in the recorded dataset (wind speed and direction). The TI (Turbulence Intensity) signal is not repaired, but a turbulence measure can be reconstructed from the standard deviation of wind speed by assuming constant standard deviation of wind speed with height and the repaired wind speed.

Table 11 lists the properties of each repair procedure.

Table 10. Example of shear matrix, here for 140 m height. Values are shear exponent α.

Hour	N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW
00-02	0.12	0.09	0.12	0.09	0.13	0.19	0.13	0.12	0.08	0.05	0.07	0.00
02-04	0.01	0.04	0.12	0.07	0.05	0.22	0.08	0.08	0.13	0.07	0.04	0.03
04-06	0.00	0.06	0.06	0.09	0.21	0.08	0.09	0.05	0.10	0.06	0.04	0.05
06-08	0.18	0.12	0.18	0.02	0.06	0.03	-0.01	0.05	0.04	0.07	0.07	0.11
08-10	0.15	0.14	0.13	0.05	-0.04	0.08	0.07	0.06	0.11	0.06	0.05	0.07
10-12	0.10	0.06	0.08	0.00	0.11	0.05	0.05	0.01	0.04	0.04	0.03	0.10
12-14	0.01	0.07	0.05	0.09	0.12	0.14	0.13	0.06	0.09	0.08	0.05	0.10
14-16	-0.08	-0.04	0.21	-0.05	0.15	0.15	0.09	0.07	0.11	0.12	0.08	0.11
16-18	0.04	-0.04	0.02	0.03	0.18	0.14	0.13	0.16	0.12	0.10	0.04	0.14
18-20	0.07	-0.07	-0.08	0.01	0.07	0.10	0.11	0.14	0.10	0.07	0.08	0.03
20-22	0.12	-0.09	0.07	0.11	0.09	0.04	0.15	0.08	0.15	0.07	0.06	0.13
22-24	0.14	0.14	0.05	0.06	0.12	0.14	0.09	0.09	0.12	0.07	0.04	0.08
All	0.07	0.05	0.09	0.06	0.08	0.11	0.08	0.09	0.11	0.07	0.05	0.07

Table 11. Data substitution

Repaired height [m]	100	120	140	160	180	200	240
Source height, m	70	100	100	120	140	160	180
Shear matrix heights, m	70, 100, 120	100, 120, 140	100, 120, 140	120, 140, 160	140, 160, 180	160, 180, 200	180, 200, 240
Recovery rate before repair	94.3%	92.2%	91.4%	90.6%	88.5%	86.1%	84.5%
Recovery rate after repair	96.0%	96.2%	96.3%	96.4%	96.4%	96.5%	96.6%
Share of repaired data	1.8%	4.2%	5.1%	6.0%	8.2%	10.8%	12.5%

3.2.8 Wind Speed

Wind speed on the LIDAR measurements is calculated as arithmetic mean wind speed and through a Weibull fit as Weibull derived mean wind speed. The Weibull fitting is done in WindPRO using an energy conservation condition. Note that Weibull fitting is uncertain due to the short measurement period.

The following table summarizes the resulting wind speeds before and after data substitution.

Table 12. Weibull parameters of the wind data used (no data substitution done below 100 m ASL).

Height [m]	Periods [months]	Arithmetic mean wind speeds, before data substitution [m/s]	Arithmetic mean wind speeds after data substitution [m/s]	Weibull mean [m/s]	Weibull – A parameter	Weibull – k parameter
12	8	6.99				
40	8	7.75				
70	8	8.18				
100	8	8.43	8.42	8.49	9.59	2.120
120	8	8.54	8.54	8.61	9.72	2.103
140	8	8.64	8.63	8.70	9.82	2.081
160	8	8.72	8.72	8.77	9.90	2.059
180	8	8.81	8.78	8.84	9.98	2.054
200	8	8.89	8.83	8.89	10.03	2.047
240	8	9.00	8.92	8.97	10.12	2.014

Details on the directional wind speed and Weibull distribution can be found in appendix B.

3.2.9 Wind Direction

The wind direction distribution for the 8 months of measurements is presented in Figure 4. There is a rotation of the wind direction distribution clockwise going up in the profile, but from 100 m and up the rotation is minimal.

The direction distribution for each height can be found in appendix B.

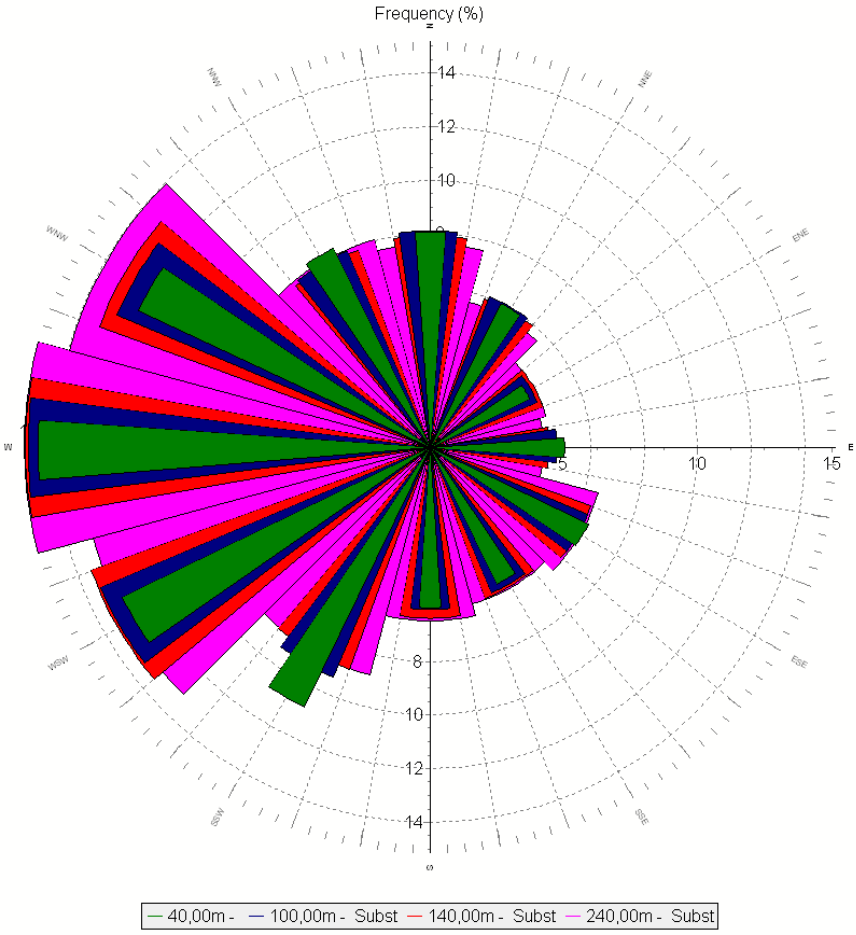

Figure 4. Directional distribution at selected heights of LIDAR measurements.

3.2.10 Diurnal Variations

There is a minor variation in wind speed across the day with higher wind speed in the evening and lower wind speed at daytime.

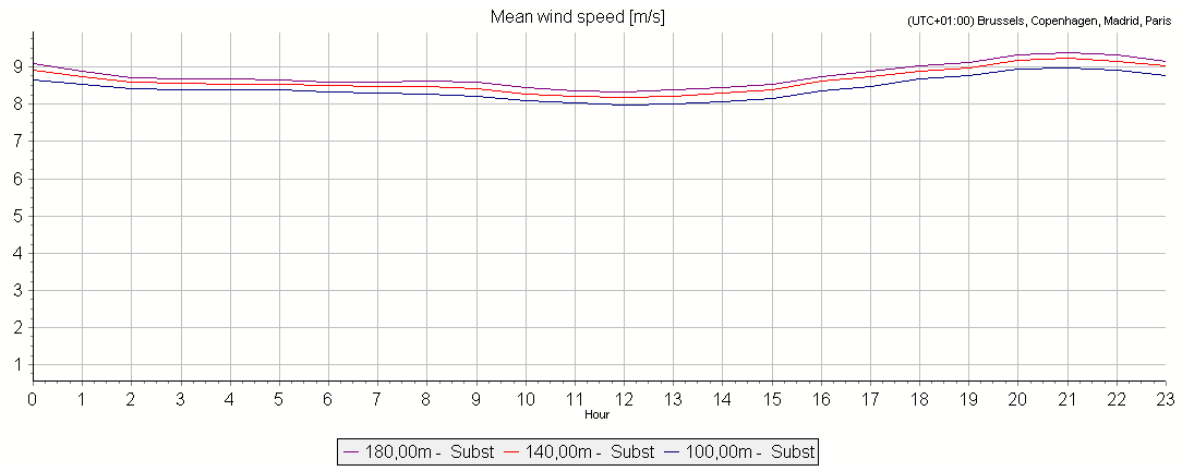

Figure 5. Diurnal wind speed variation.

3.2.11 Seasonal Variations

As only 8 months of data are available it is not meaningful to discuss seasonal variations on the LIDAR data.

3.2.12 Measurement uncertainty

A measurement verification of the FLS200-E01 mounted LIDAR from Multiversum [12] was provided. In this study the Key Performance Indicators (KPI) according to the OWA Roadmap [17] are tested and the verification uncertainty calculated according the the method suggested by the CT/OWA LiDAR Uncertainty Standard Review [18].

The test site was at the TNO Lichtland Goeree Offshore Test Site, The Netherlands.

All KPI's were succesful.

The verification uncertainty from the verification report is included in appendix C.

Classification uncertainty, giving the maximum expected uncertainty are obtained from the ZX300 classification document [13] as 1.41% (average at 130 and 135 m height). The classification table is included in appendix C.

The uncertainty from data repair is found by assuming a 20% uncertainty on the wind speed change from source to detination height. With a 2.5% wind speed difference (from 100 to 140 m), this results in an uncertainty of 0.5% on wind speed of the synthesized data. At 140 m the synthesized data contribute 5.1% of the dataset, resulting in a total 0.025% uncertainty on the wind speed at this height.

The verification and classification uncertainty is combined together with a small contribution from the data repair to a combined uncertainty on the LIDAR measurements at 2.62%.

3.3 Læsø Measurements

3.3.1 Measurement campaign

Wind data from an offshore measurement mast has been provided by Energinet. The met mast was setup in Kattegat sea about 17 km south of the island of Læsø. The distance to Danish and Swedish coast is about 45 km and 66 km.

The available measurements are:

- wind speed at 62, 58, 45, 45, 30, 30, 15, 15 m as 10-minute values (mean, min, max and standard deviation)
- wind direction at 60, 58, 43 and 28 m as 10-minute values (mean, min, max and standard deviation)
- absolute temperature at 55 and 13 m, as 10 minutes values (mean, min, max, standard deviation)

The available data covers a period of 4 years and 8 months from 24/04/1999 until 09/12/2003. However, the wind speed data from the anemometer at 58 m ends on 18/04/2000. This data is therefore not considered further on in the analysis.

EMD has not received any calibration reports nor installation report describing the type of sensors and the detials of the mounting (boom orientation, length, distance to lightning finial). It has thus not been possible to check if the installation has been conducted according to the IEC standards [19]. The only information available comes from the csv files itself, from which the setup of the mast has been deducted and is presented in Table 13.

Table 13. Mounting of sensors on the on-site met mast

Height AGL [m]	Channel Name	Description	Mounting and Orientation	Horizontal boom	Vertical boom
62	CUP62M	Cup Anemomter Unknown type	0°, Assumed Top	Unknown	Unknown
58	CUP58M	Cup Anemomter Unknown type	0°	Unknown	Unknown
45	CUP45SV	Cup Anemomter Unknown type	45°	Unknown	Unknown
45	CUP45NO	Cup Anemomter Unknown type	225°	Unknown	Unknown
30	CUP30SV	Cup Anemomter Unknown type	45°	Unknown	Unknown

Height AGL [m]	Channel Name	Description	Mounting and Orientation	Horizontal boom	Vertical boom
30	CUP30NO	Cup Anemomter Unknown type	225°	Unknown	Unknown
15	CUP15SV	Cup Anemomter Unknown type	45°	Unknown	Unknown
15	CUP15NO	Cup Anemomter Unknown type	225°	Unknown	Unknown
60	DIR60SV	Wind vane Unknown type	0°	Unknown	Unknown
58	DIR28SV	Wind vane Unknown type	0°	Unknown	Unknown
43	DIR43SV	Wind vane Unknown type	45°	Unknown	Unknown
28	DIR28SV	Wind vane Unknown type	45°	Unknown	Unknown
55	TEMPA55NO	Temperature sensor, absolute	45°	Unknown	Unknown
13	TEMPA13NO	Temperature sensor, absolute	45°	Unknown	Unknown

3.3.2 Raw data verification and data treatment

EMD has obtained access to the data as csv files. Therefore, the conversion of the raw data could not be verified.

A discrepancy between the documented boom direction (from the file) and the observed direction can be noticed on the wind speed difference graph between anemometers at same height. For example the booms for the 45 m anemometers seem to be orientated at 10 degrees (instead of 45) and 210 degrees (instead of 225), as seen on Figure 6. No wind veer has been applied to the data since it correlates well with other wind direction data sources.

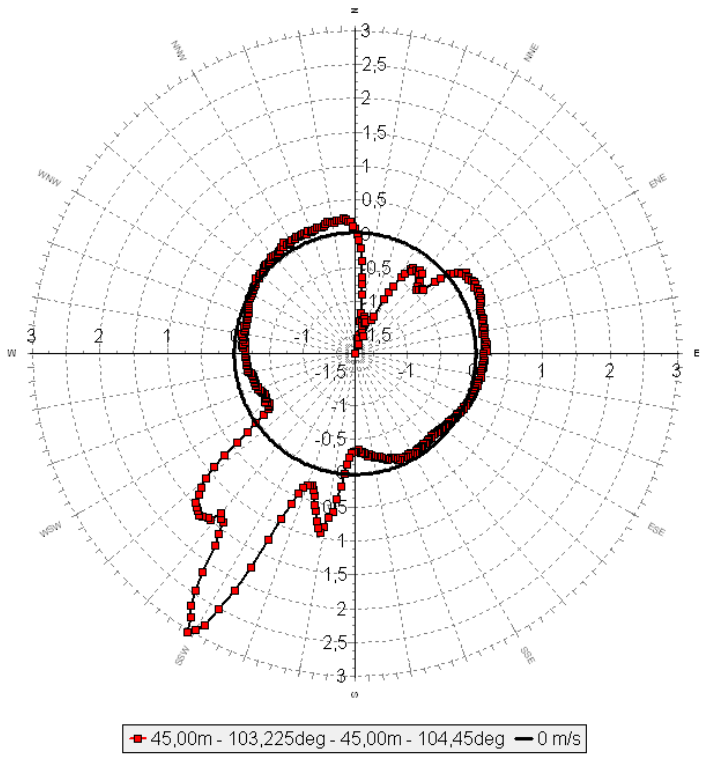

Figure 6. Wind speed difference between 45 m SV and 45 m NE, binned by direction at Læsø

The data at 45, 30 and 10 m have been merged to remove the tower shadowing, based on the obsvered distortions.

From Figure 6, it can also be observed that not only the shadowing of the mast creates a difference larger than 0. It could be due to the vicinity of the wind vane.

In general, the data quality is good. The correlation of the wind directions data and wind speed data at different heights correlates as expected. The data has been filtered for faulty equipment and failures.

4 full years have been selected from 01/07/1999-01/07/2003. The data from the 62 m anemometer is the primary data from the Læsø met mast considered in the study. The recovery rate of the data for this period (94.7%) complies with the minimum requirements of MEASNET [20]. The following major gaps (consecutive days with missing or erroneous data) in the wind data (wind speed at 62 m and wind direction at 58 m) can be noted:

- 35 days from 12/01/2000
- 25 days from 04/01/2002, gap concerning all channels
- 3 days from 01/11/2002

Table 14. Treatment of the primary wind data source from Læsø met mast.

Phase of treatment	Height [m]	Start	End	Period [Months]	Arithmetic mean wind speeds [m/s]	Recovery rate [%]
Raw	62	24/04/1999	09/12/2003	56	8.36	97.6
Filtered	62	24/04/1999	09/12/2003	56	8.85	93.2
Trimmed	62	01/07/1999	01/07/2003	48	8.94	94.7

3.3.3 Data analysis

WIND SPEED

The following table summarizes the resulting wind speeds. Table 15. Wind speed data at Læsø, 4 years (1999-2003)

Mast	Arithmetic mean wind speeds [m/s]	Max wind speed [m/s]	Weibull mean [m/s]	Weibull – A parameter	Weibull – k parameter
62 m	8.80	28.39	8.94	10.09	2.36
45 m	8.45	27.59	8.57	9.67	2.35
30 m	8.14	26.94	8.25	9.31	2.31
15 m	7.50	24.7	7.58	8.56	2.22

WIND DIRECTION

The frequency and energy distribution for the meteorological at Læsø indicate sector west and south-south-west as the expected dominant wind directions.

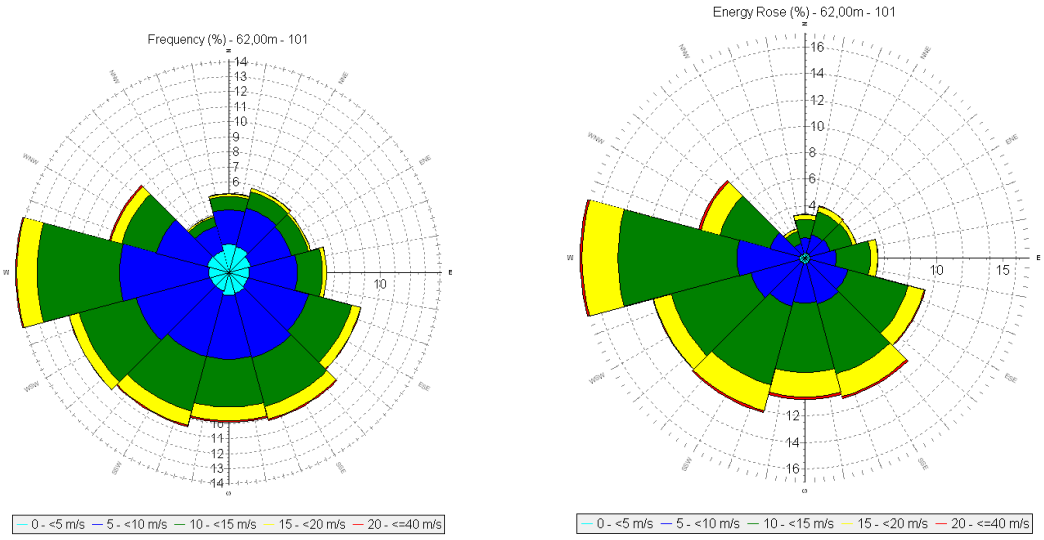

Figure 7. Wind direction frequency (on the left) and energy (on the right) distribution, Læsø 4 years, at 62 m ASL (07/1999-07/2003)

TURBULENCE INTENSITY

The turbulence intensity calculated from the mean wind speed and its standard deviation is presented in Figure 8. At 62 m, the mean turbulence intensity is 7% as expected on an offshore site. As observed on Figure 9, the turbulence is higher from north, possibilbly due to island of Læsø (though mounting of the interument is also a possibility).

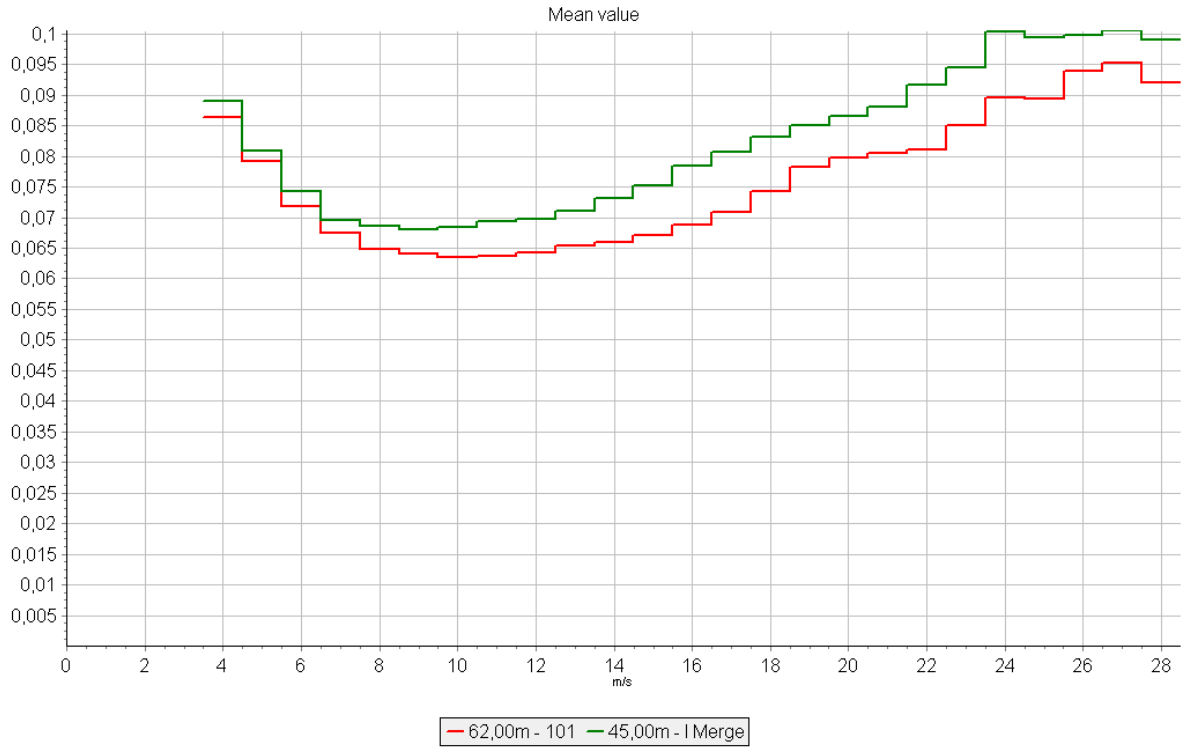

Figure 8. Turbulence intensity measured at Læsø mast (4 years) at 62 and 45 m per wind speed bin

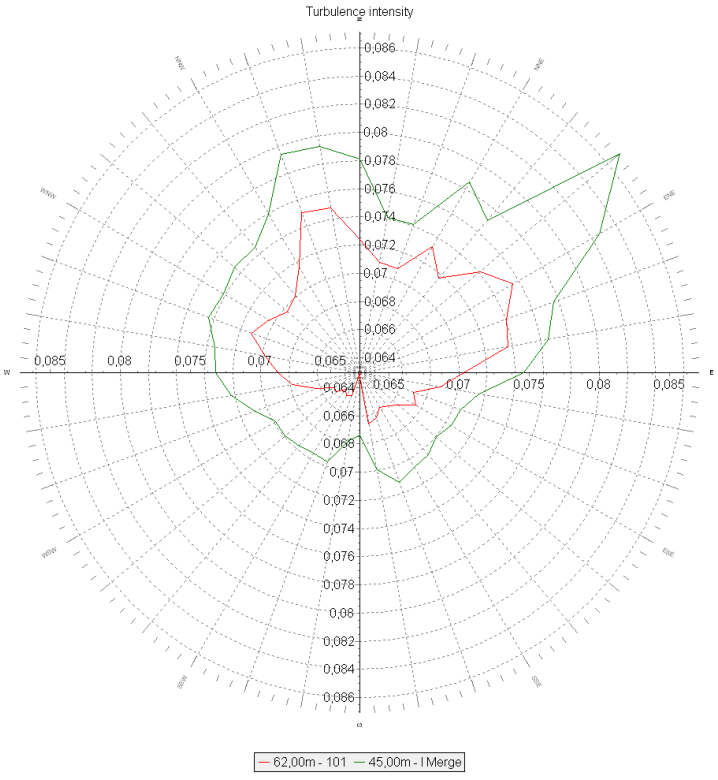

Figure 9. Turbulence intensity measured at Læsø mast (4 years) at 62 and 45 m per wind direction (36 sectors)

DAILY VARIATIONS

The wind speed is lowest at midday and highest during the night. The daily variations of turbulence intensity are minimal as expected on an offshore site.

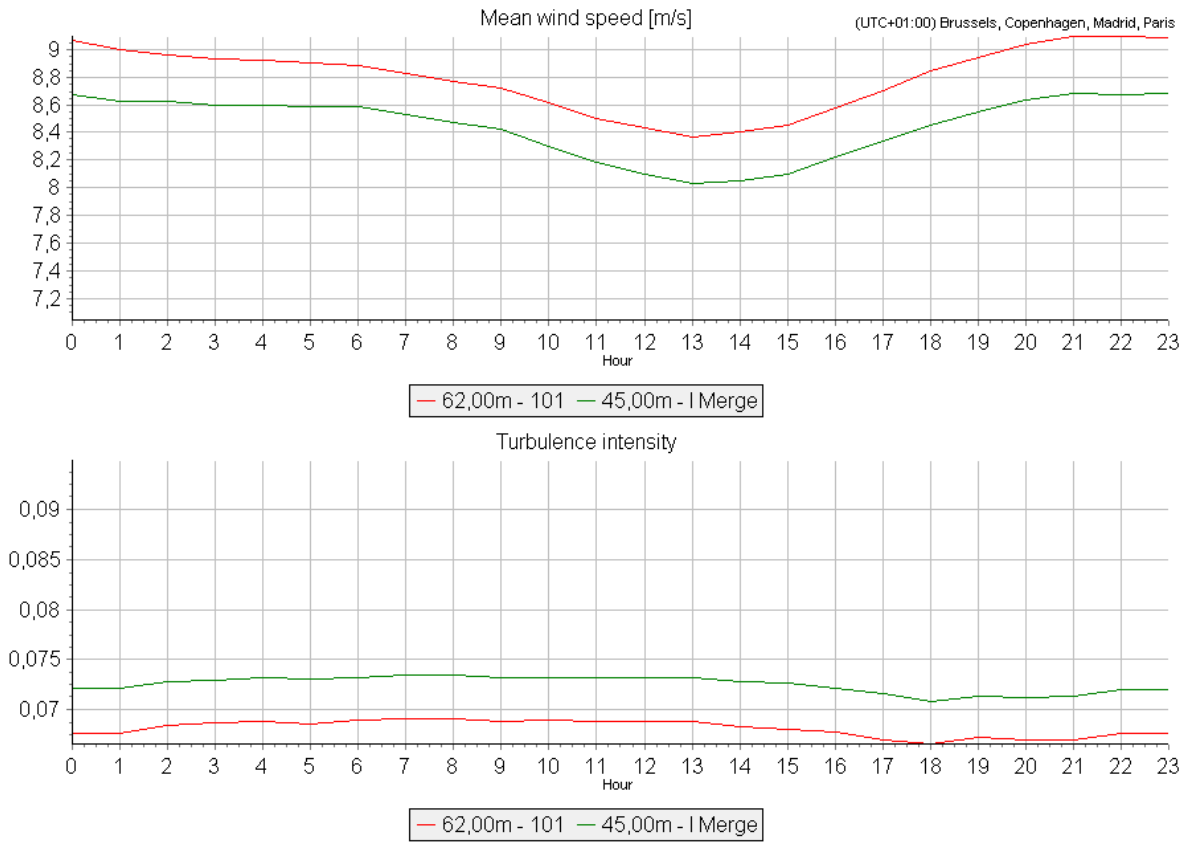

Figure 10. Daily variation of wind speed and turbulence intensity measured at Læsø met mast (62 and 45 m, 4 years)

SEASONAL VARIATIONS

The monthly wind speed variations point to highest wind speeds during the late autumn and winter.

From the seasonal analysis of the wind direction (Figure 12), it can be seen that only during summer (May-August) there is a dominant wind energy sector from west. The remaining months have rather balanced wind roses.

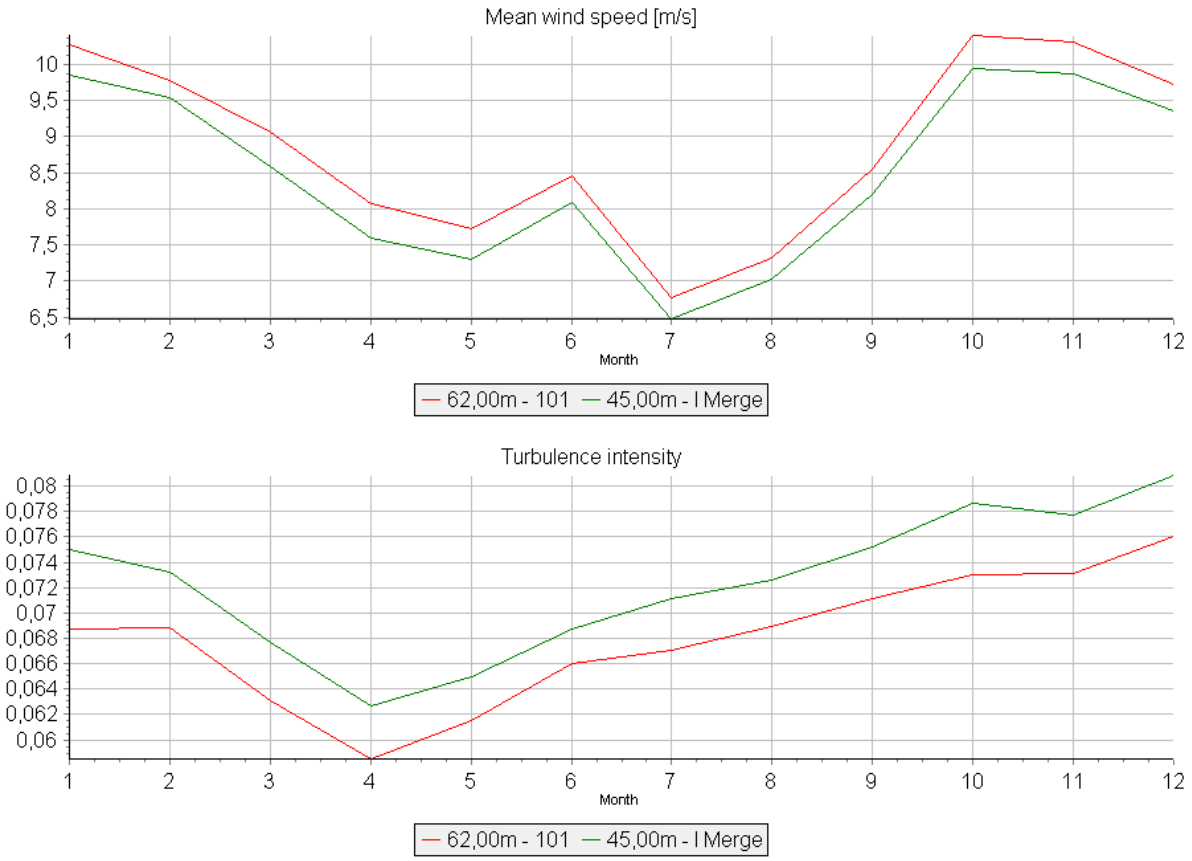

Figure 11. Monthly variation of wind speed and turbulence intensity measured at Læsø met mast (62 and 45 m, 4 years)

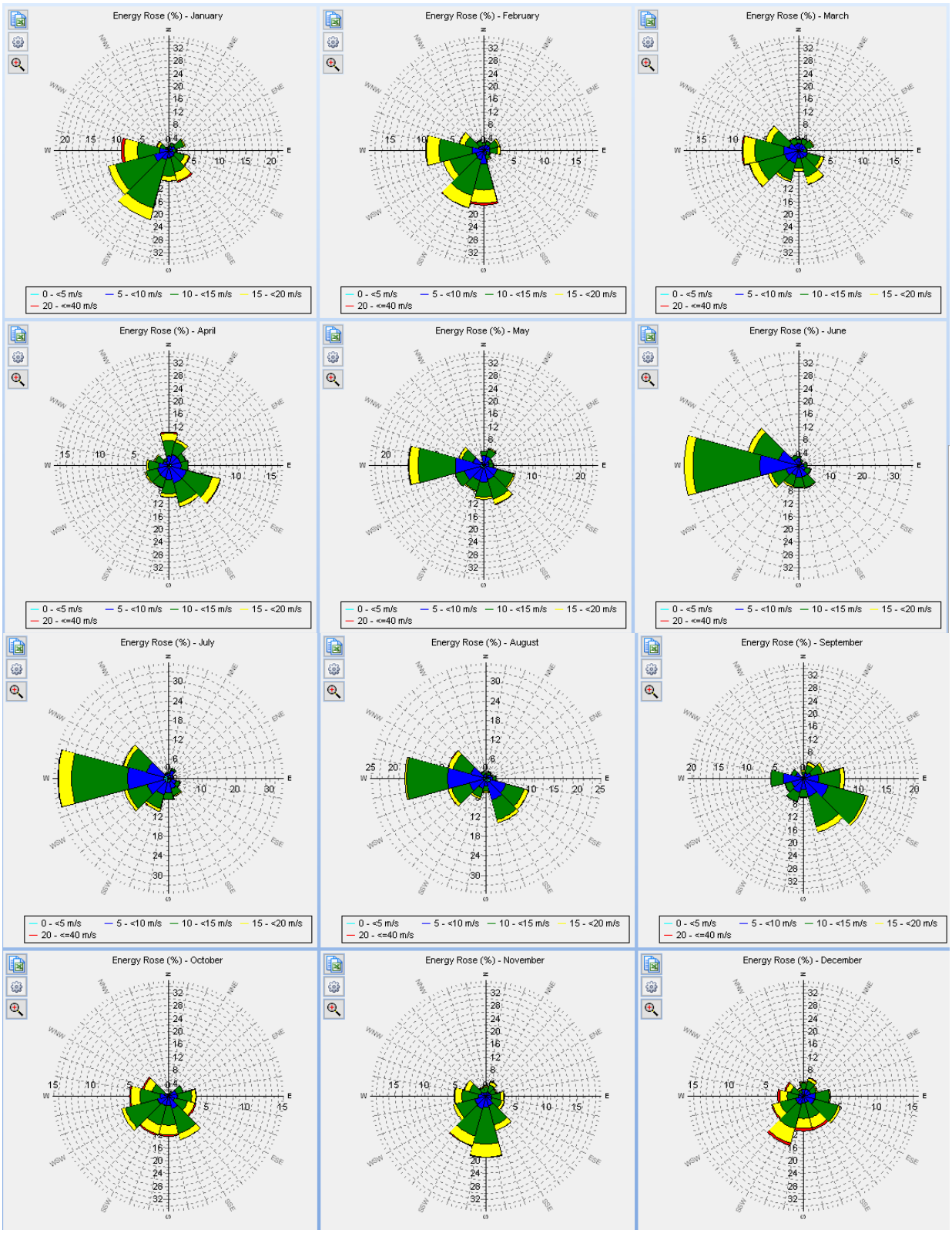

Figure 12. Monthly wind energy roses at Læsø met mast (62 m, 4 years) presented for winter, spring, summer and autumn months

TEMPERATURE

Over the 4 years of measurements at Læsø (55 m), the mean temperature was 9.5 degrees with a minimum and maximum of respectively -11.11 and 26.2.

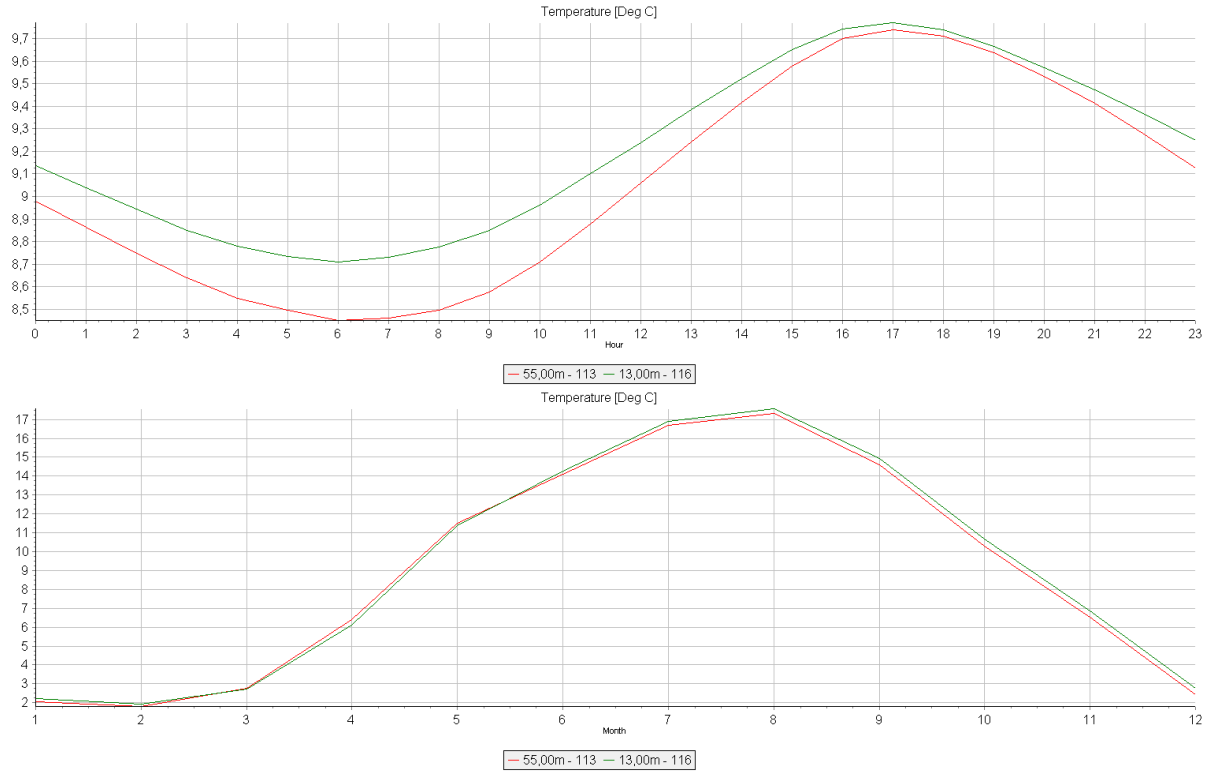

Figure 13. Diurnal and monthly variation of absolute temperature at Læsø mast (55 m & 13 m, 4 years).

3.4 Anholt Measurements

3.4.1 Measurement campaign

The observations made at Anholt come from a meteorological mast from DMI (#06079). Wind speed and direction measurements are recorded at 10 m AGL. Temperature data is measured at 2 m AGL.

The observations have been conducted from several locations during the measurement period [20] as shown on Figure 14. The first location is close to the Anholt lighthouse on the eastern side of the island. The observations from this first period start in 1961 until 1965. The time interval is 3 hours and then 4 hours from mid-1964 until October 1965.

The measurement location has then been moved to the town of Anholt at 2 positions between 1965 and 1980. The data covers the period between 1967 and 1980, with time interval of 4 hours. The coordinates available [20] for these different positions cannot be validated from the Orthophoto map.

The last and current location is at the harbor of Anholt (Table 6). Photomontages made from Google Street View confirm the position of the measurements mast on the northern part of the harbor. The mast is located about 17-25 m from the pier, at an altitude of 2.3 m ASL. The mast does not seem obstructed by local obstacles in the main wind direction. However, effects can be expected from a building about 50 m south-east of the mast. The setup of the anemometer on the mast is unknown, which prevents the assessment of possible distortion from the mast. The data from this location can be divided in two periods with different time intervals: between 01/05/1993 until 28/09/1999 with hourly data and between 29/09/1999- 10/11/2021 with 10 min data. The data is 10 min averaged.

Figure 14. Four positions of Anholt met mast (DMI #06079, [20]) over time[1]: An1 (01/01/1965-01/11/1965), An2 (01/11/1965-25/11/1976), An3 (25/11/1976-06/04/1980) and An4 (06/04/1980-today) (source: windPRO European Satellite Imagery).

Temperature data is available at 2 m above the terrain as hourly average measurements. No turbulence data are available.

3.4.2 Raw data verification and data treatment

In general, the data quality is good. The data have been filtered for faulty equipment and failures due to weather conditions.

To ensure the consistency of data in terms of location and time resolution, only the data from the last period of measurements is kept for this analysis. Out of this period extending from 29/09/1999 until 10/11/2021, 22 full years have been selected: 01/11/1999 – 31/10/2021. The recovery rate of the wind

[1] Note that the period provided for a given position may not exactly coincide to data coverage as described in Table 7 (because of missing data for example).

data for this period is very good with 98.4%. The following gaps (consecutive days with missing or erroneous data) in the wind data can be noted:

- 5 days in 09/2000
- 3 and 4 days in 07/2001
- 7 days in 10/2006
- 14 days in 04/2013
- 1 months between 04/05/2013 and 03/06/2013

The reasons for missing data is unknown.

The recovery rate of the temperature data is also good with 95.5%.

3.4.3 Data analysis

WIND SPEED

The following table summarizes the resulting wind speeds.

Table 16. Wind speed data at Anholt, 22 years (1999-2021)

Mast	Arithmetic mean wind speeds [m/s]	Max wind speed [m/s]	Weibull mean [m/s]	Weibull - A parameter	Weibull - k parameter
Anholt, 10 m	7.22	30.30	7.32	8.26	2.13

WIND DIRECTION

The frequency and energy distribution for the meteorological at Anholt indicate sector west and south-south-west as the expected dominant wind directions.

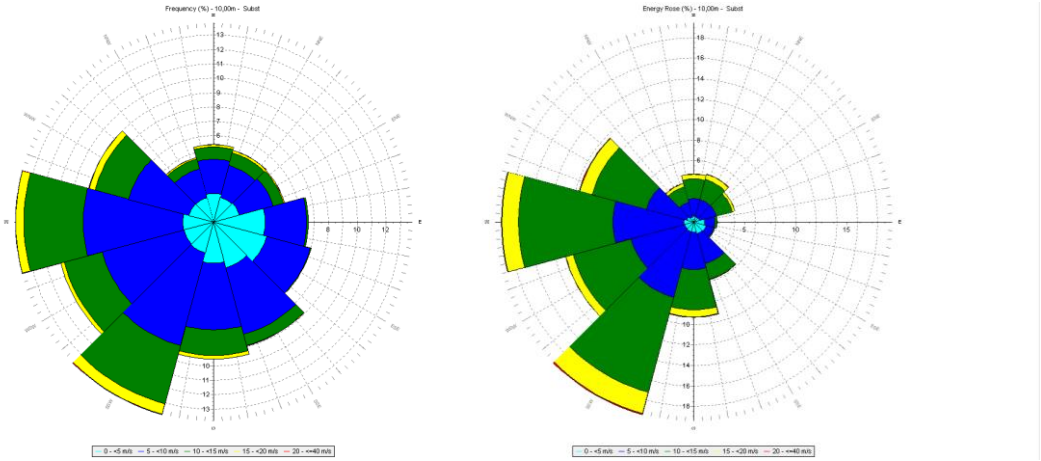

Figure 15. Wind direction frequency (on the left) and energy (on the right) distribution, Anholt 22 years (11/1999-11/2021)

TEMPERATURE

The results of the temperature data is summarized in Table 17.

Table 17. Temperature data measured at Anholt, 22 years (1999-2021), 2 m AGL

Mast	Mean Temperature [°C]	Minimum Temperature [°C]	Maximum Temperature [°C]
Anholt	9.6	-11.1	30.5

3.5 Gniben Measurements

3.5.1 Measurement campaign

The observations made at Gniben come from a meteorological mast from DMI (#06169). Wind speed and direction measurements are recorded at 10 m AGL. Temperature data is measured at 2 m AGL.

The DMI met mast of Gniben is located on Sjællands Odde peninsula. At this outermost point, the peninsula is only 200 m wide, so the location of the met mast is well exposed to the open sea. However, the site is elevated from the sea level by 14 m at the position of the mast.

Observations at Gnibben have been conducted in different periods, characterized by different time interval and locations, as provided by [20]. The locations are shown on Figure 16.

The three different periods are listed in Table 7, each one with a different time resolution. During the first period (01/01/1961-17/03/1985) the met mast has been moved 4 times according to the coordinates provided by [20]. The last and current position of the met mast has is valid for the two last periods 18/03/1985-31/07/2002 and 28/08/2002-10/11/2021 with a time resolution of respectively 1h and 10 min. In the surrounding of the met mast, one can notice a large (about 6 m wide) and tall (about 60 m high) lattice tower, 23 m in south-soutwest direction. Flow distrosion from this object can be

expected on the measurements, however with a minimum impact as it does not concern any primary wind directions. Buildings east of the met mast are less than the measurement height and far enough to avoid noticeable flow. Steep slopes 80 m upwind in the western direction may affect the flow and hence the quality of the measurements. The setup of the anemometer on the mast is unknown, which prevents the assessment of possible distortion from the mast.

Figure 16. Four positions of Gniben met mast (DMI #06069, [20]) over time[2]: Gn1 (01/01/1961-01/08/1974), Gn2 (01/08/1974-01/04/1979), Gn3 (01/04/1979-15/02/1983) and Gn4 (15/02/1983-today) (source: Google maps).

The averaging time of the data is 10 min. For hourly data, it is assumed that the data is also the average of the last 10 minutes data. Temperature data is available as hourly average measurements. No turbulence data are available.

3.5.2 Raw data verification and data treatment

In general, the data quality is good. The data have been filtered for faulty equipment and failures due to weather conditions.

To ensure the consistency of data in terms of location and time resolution, only the data from the last period of measurements is kept for this analysis. Out of this period extending from 28/08/2002 until 10/11/2021, 19 full years of 10 minutes values have been selected: 01/11/2002– 31/10/2021. The

[2]Note that the period provided for a given position may not exactly coincide to data coverage as described in Table 7 (because of missing data for example).

recovery rate of the wind data for this period is very good with 98.5%. The following gaps (consecutive days with missing or erroneous data) in the wind data can be noted:

- 6 days in 08/2009
- 2 and 7 days in 04/2011
- 23 days between 05/2011 and 06/2011
- About 1 month between 12/2012 and 01/2013

The reasons for missing data is unknown.

The recovery rate of the temperature data is also good with 97.7%.

3.5.3 Data analysis

WIND SPEED

The following table summarizes the resulting wind speeds.

Table 18. Wind speed data at Gniben, 19 years (2002-2021)

Mast	Arithmetic mean wind speeds [m/s]	Max wind speed [m/s]	Weibull mean [m/s]	Weibull - A parameter	Weibull - k parameter
Gniben, 10 m	7.04	35.9	7.14	8.06	2.04

The wind speed measurements of 35.9 m/s occurred at Gniben on 29/11/2015 at 20:30. The storm is also visible on the data from Anholt and Nakkehoved Fyr, but to a less extend, especially at Nakkehoved Fyr. The wind speed measurements from Nakkehoved fyr are in general much lower than at Gniben and Anholt, due to the high roughness surrounding the mast. The maximum recorded at Anholt on the same event is 28.6 m/s which is still significantly lower than at Gniben. During this event, the wind direction was 290 degrees. The different in wind speed between Anholt and Gniben can be explained by the configuration of the sites: the measurement mast of Gniben is located on the top of a steep hill and therefore subject to a lot of speed up in the wind direction observed on this date; the measurement mast at Anholt is close to sea level, with no significant speed ups. It can also be observed that the peak events at Gnibben are associated with dip events at Anholt, indicating a very localized storm event.

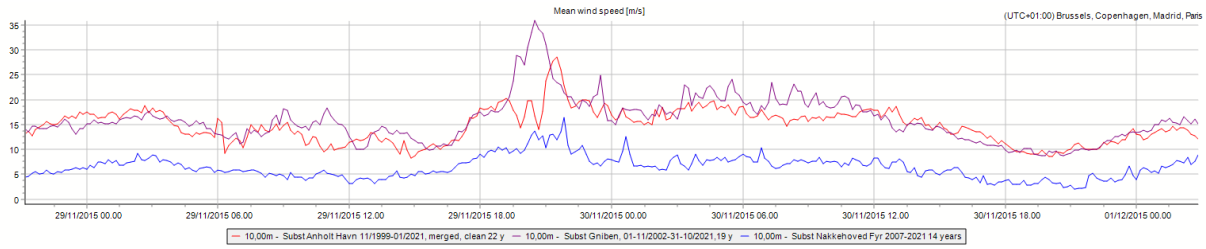

Figure 17. Maximum wind speed event at Gniben compared to measurements at other stations.

WIND DIRECTION

The frequency and energy distribution for the meteorological at Gniben indicate sector west and west-west-south as the expected dominant wind directions, both in term of frequency and energy (Figure 15).

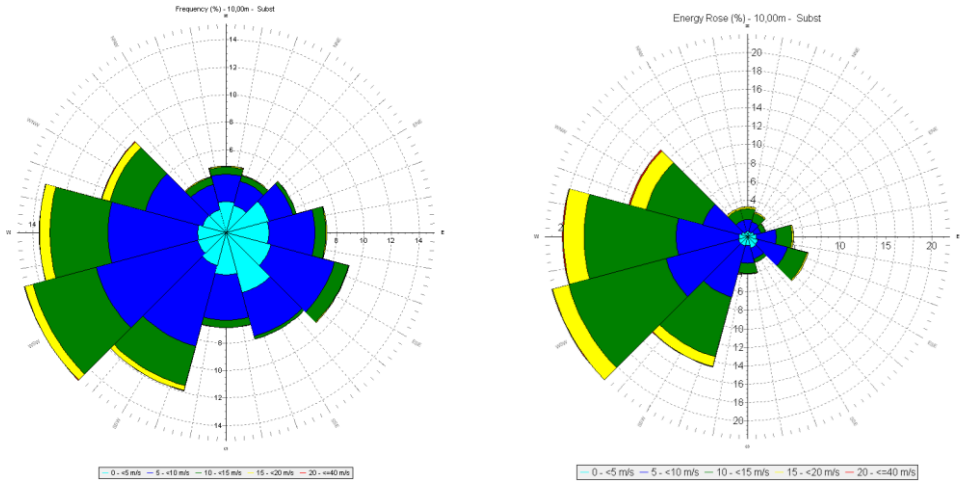

Figure 18. Wind direction frequency (on the left) and energy (on the right) distribution, Gniben 19 years (11/2002-11/2021)

TEMPERATURE

The results of the temperature data is summarized in Table 19.

Table 19. Temperature data measured at Gniben 19 years (11/2002-11/2021), 2 m AGL

Mast	Mean Temperature [°C]	Minimum Temperature [°C]	Maximum Temperature [°C]
Gniben	9.5	-9.4	28.7

3.6 Nakkehoved Measurements

3.6.1 Measurement campaign

The observations made at Nakkehoved comes from a meteorological mast from DMI (#06168). Wind speed and direction measurements are recorded at 10 m AGL. Temperature data is measured at 2 m AGL.

The met mast of Nakkehoved is located on the northern coast of Sjælland, about 100 m from the shore. The surroundings are characterized by high roughness terrain with forest and cities (Gilleleje and Munkerup). The vicinity of trees (5-10 m tall) just next to the mast compromises the quality of the measurements due to the turbulences and displacement of the wind flow created by the canopy. The altitude of the mast os 36.4 m ASL.

Observations at Nakkehoved have been conducted with different time intervals. Two very similar and close sets of coordinates are available [20]. The actual position ("Na2" on Figure 19) which is valid for the 10 mintutes interval data sets can be verified from the Danish Orthophoto Mosaic (source: Geodatastyrelsen). The setup of the anemometer on the mast is unknown, which prevents the assessment of possible distortion from the mast.

Figure 19. Two positions of Nakkehoved met mast (DMI #06068, [20]) over time[3]: An1 (15/01/1982-18/01/2001 and Na2 (18/01/2001-today) (source: KMS Ortofoto forår).

The averaging time of the data is 10 min. For hourly data, it is assumed that the data is also the average of the last 10 minutes data. Temperature data is available at 2 m above the terrain as hourly average measurements. No turbulence data are available.

[3] Note that the period provided for a given position may not exactly coincide to data coverage as described in Table 7 (because of missing data for example).

3.6.2 Raw data verification and data treatment

In general, the data quality is good. The data have been filtered for erroneous data usually due to faulty equipment and failures due to weather conditions.

Only the data from the last period of measurements with 10 minutes values is kept for this analysis. 14 full years have been selected from 01/11/2007-31/10/2021. The recovery rate of the data for this period is very good with 98.9%. The following gaps (consecutive days with missing or erroneous data) in the wind data can be noted:

- 27 days in 03/2014
- 17 days between 07/2021 and 08/2021

The reasons for missing data is unknown.

The recovery rate of the temperature data is also good with 98.1%.

3.6.3 Data analysis

The following table summarizes the resulting wind speeds.

Table 20. Wind speed data at Nakkehoved, 14 years (2007-2021)

Mast	Arithmetic mean wind speeds [m/s]	Max wind speed [m/s]	Weibull mean [m/s]	Weibull - A parameter	Weibull - k parameter
Nakkehoved, 10 m	4.05	26.50	4.01	4.47	1.56

WIND DIRECTION

The frequency and energy distribution for the meteorological data at Nakkehoved are different. The frequency rose indicates mainly primary wind sectors from South and South-southwest due to the presence of trees in all other sectors. The energy rose shows that the main energy sectors are west-northwest and north-northwest. South and South-southwest sectors are indeed characterized with low wind speeds due to high roughness.

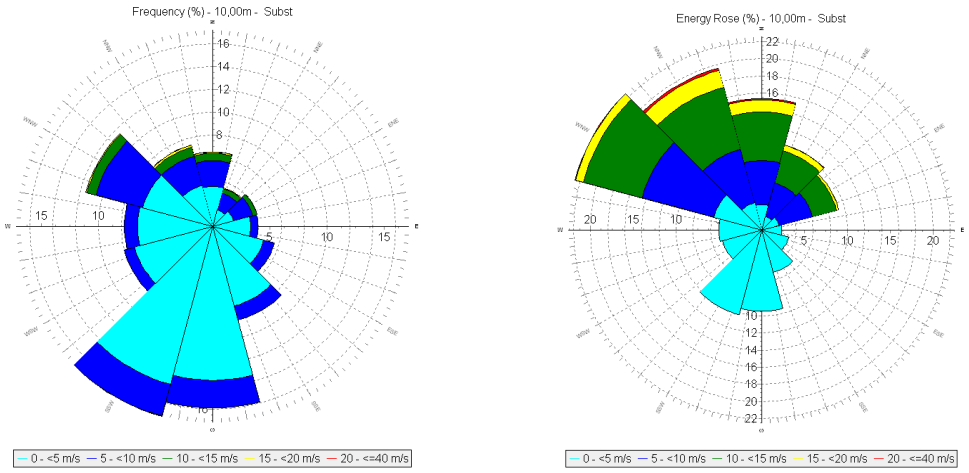

Figure 20. Wind direction frequency (on the left) and energy (on the right) distribution, Nakkehoved 14 years (11/2007-11/2021)

TEMPERATUR

The results of the temperature data is summarized in Table 21.

Table 21. Temperature data measured at Nakkehoved 14 years (11/2007-11/2021), 2 m AGL

Mast	Mean Temperature [°C]	Minimum Temperature [°C]	Maximum Temperature [°C]
Nakkehoved	9.1	-11.6	32.6

3.7 Väderö Measurements

3.7.1 Measurement campaign

The observations made at Väderö come from a meteorological mast operated by SMHI (#62260). The met mast is located on the northwest part of the island of Hallands-Väderö in Sweden. Wind speed, wind direction and temperature data are measured at 2 m AGL.

Observations at Väderö have been conducted during two different periods at different locations [21]. The first period consists of about 4.5 years (between 1961 and 1965), 540 m from the west coast of the island. The time resolution is 6 hours. Due to the short period, its age and the coarse time resolution, this first part of the data set is excluded from the analysis. The second period starts in 1995 (still ongoing), with an hourly time resolution. The wind data is available as 10-minute averages delivered every hour. The temperature data are instantaneous values, also available as hourly data. The position is in the vicinity of the lighthouse, about 140 m from the west coast and at an elevation of 8.3 m ASL. The lighthouse and its dwelling are located about 25 - 32 m in the western direction. Flow distortion

from these obstacles can affect the quality of measurements made at 2 m AGL. The landscape is open but with low vegetation to the east. No turbulence data are available.

Figure 21. Two positions of Hallands-Väderö met mast (SMHI #62260, [21]) over time[4]: Va1 (01/02/1945-30/04/1969 and Va2 (01/05/1969-today) (source: Google maps).

3.7.2 Raw data verification and data treatment

In general, the data quality is good. No filtering of erroneous data has been necessary. The data seems already filtered.

26 full years have been selected from 01/08/1995-01/08/2021. The recovery rate of the data for this period is good with 95.6%. The following gaps (consecutive days with missing or erroneous data) in the wind data can be noted:

- 26 days from 22/11/1995
- 12 days from 16/02/1996
- 14 days from 24/08/1997
- 7 days from 22/05/1998

[4] Note that the period provided for a given position may not exactly coincide to data coverage as described in Table 7 (because of missing data for example).

- 10 days from 22/05/1999
- 4 days from 01/07/2000
- 34 days from 09/04/2002
- 3 and 4 and 3 days gaps from 03/10/2003, 09/10/2003 and 17/10/2003
- 10 days from 24/10/2003
- 7 days from 17/03/2004
- 43 days from 09/01/2205
- 8 and 4 days from 10/03/2005 and 25/03/2005
- 9 days from16/07/2005
- 59 days from 28/11/2011
- 20 days from 06/03/2018
- 40 days from 27/03/2020
- 22 days from 09/07/2021

In general the reasons for missing data is unknown. The longer gaps corresponds to winter months and can therefore be caused by icing.

The recovery rate of the temperature data is also good at 95.6%.

3.7.3 Data analysis

WIND SPEED

The following table summarizes the resulting wind speeds.

Table 22. Wind speed data at Väderö, 26 years (1995-2021)

Mast	Arithmetic mean wind speeds [m/s]	Max wind speed [m/s]	Weibull mean [m/s]	Weibull - A parameter	Weibull - k parameter
Väderö, 2 m	5.73	23.06	5.77	6.50	1.86

WIND DIRECTION

The frequency and energy distribution for the meteorological at Väderö indicate sector south-south-west and west as the expected dominant ones.

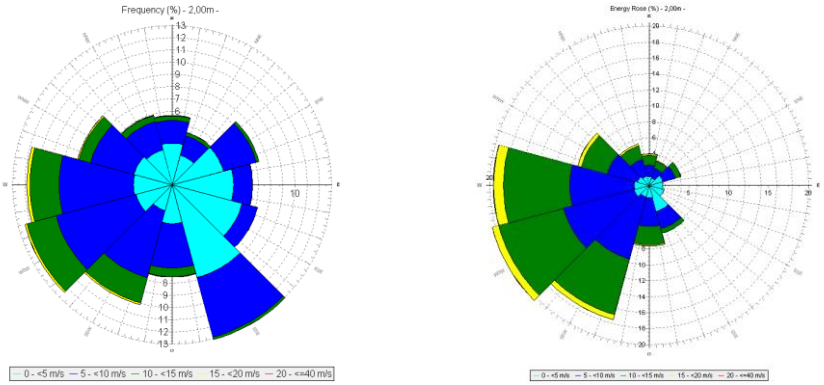

Figure 22. Wind direction frequency (on the left) and energy (on the right) distribution, Väderö 26 years (2005-2021)

TEMPERATURE

The results of the temperature data is summarized in Table 23.

Table 23. Temperature data measured at Väderö, 26 years (1995-2021), 2 m AGL

Mast	Mean Temperature [°C]	Minimum Temperature [°C]	Maximum Temperature [°C]
Väderö	8.8	-12.3	23.1

3.8 Halmstad Flygplats Measurements

3.8.1 Measurement campaign

The observations made at Halmstad flygplats come from a meteorological mast operated by SMHI (#62410). The met mast has been located close to the airport of Halmstad, in Sweden and moved recently (2020) within the airport grounds, approximatively 6.4 km to the coast westwards and 2.4 km to the coast southwards.

Wind speed, wind direction and temperature data are measured at 2 m AGL.

The observations have been made from 4 different positions and at different time intervals. The three first positions covering data from 1945 until 1978 are within a radius of 10 m in a clearing surrounded by trees. It is unclear whether the mast was really moved some meters or if it is an error in the logging of the coordinates. The position “Ha1” on Figure 23 stands for the three first positions. For the data coming from this location, the time interval of data varies a number of time:

- between 1945 and 1948, the data is available every 6 hours,
- between 1949 and 1955 every 4 hours,
- between 1955 and 1962 every hour but only 19 times a day (missing data for the time stamp of 23:00, 00:00, 02:00 03:00 and 05:00)
- between 1962 and 1978, every hour.

The second and current location ("Ha2" on Figure 23), is close to the runaway of the airport, in a much more open environment. The data recording at this location starts in 2021. So no data between 1978 and 2021 is available.

Figure 23. Two positions of Halmstad Flygplats met mast (SMHI #62260, [21]) over time[5]: Ha1 (01/02/1945-30/04/1969) and Ha2 (01/01/2000-today) (source: windPRO European Satellite Imagery).

3.8.2 Data analysis

The wind data available from Halmstad flygplats are not deemed useful for the purpose of the current study. The data is indeed not consistent in location or time interval for a recent enough period. Moreover the location of the met mast is in-land and exposed to high roughness and therefore not representative of an offshore site.

No data analysis are therefore conducted for this met station.

[5] Note that the period provided for a given position may not exactly coincide to data coverage as described in Table 7 (because of missing data for example).

4 Mesoscale data

Mesoscale data have been obtained for the dual purpose of long-term correcting the onsite measurements and calculating a wind speed gradient across the wind farm zone.

The period length is limited by the data availability and has afterwards, through a consistency analysis, been curtailed to an appropriate length.

4.1 Mesoscale Reference Data Overview

Different mesoscale and re-analysis products have been used as long-term data sources:

- 22 years of EMD-WRF On-Demand [22], high resolution mesoscale data have been obtained. The mesoscale model developed by EMD (http://www.emd.dk) has been run for the location of the Hesselø FLS. ERA5 data from ECMWF (http://www.ecmwf.int) has been used as the global boundary data set. The temporal resolution is hourly. Additionally, 5 years of data has been obtained from the northern, southern and western corners of the wind farm zone as well as at the Læsø mast location. The latest available data are from 01/10/2021.
- 30 years and 9 months of ERA5 [23] data, hourly data at a height of 100 m AGL have been obtained. ERA5 is a climate reanalysis dataset developed through the Copernicus Climate Change Service (C3S) and processed/delivered by ECMWF. The location is the closest available data node to the Hesselø FLS.
- 30 years and 5 months of MERRA2 (Modern Era-Retrospective Analysis for Research and Applications 2) [24] data have been obtained. The MERRA2 data have been sourced from NASA (National Aeronautics and Space Administration). MERRA2 uses the GEOS-5 Atmospheric Data Assimilation System (ADAS) integrating a variety of observing systems with numerical models to produce a temporally and spatially consistent synthesis of observations and analyses. The model grid is 0.5° latitude and 0.625° longitude. The location is the closest available data node to the Hesselø FLS.

The location of the mesoscale reference data is presented in Figure 24 and Table 24. All data are extracted through WindPRO.

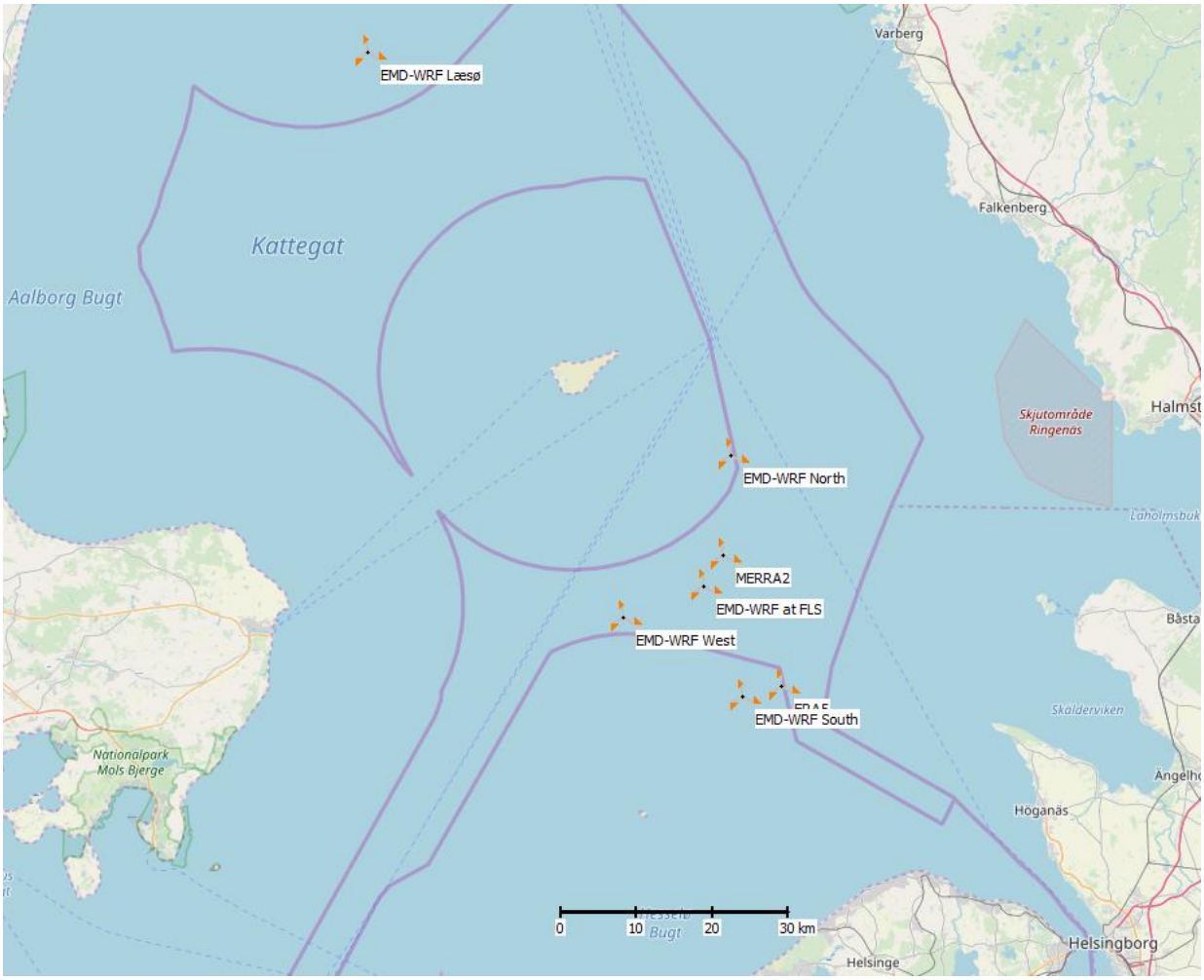

Figure 24. Location of mesoscale reference data.

Table 24. Mesoscale data position and period length.

	EMD-WRF at FLS	EMD-WRF North	EMD-WRF South	EMD-WRF West	EMD-WRF Læsø	ERA5	MERRA2
Position/Node	11.835°E 56.464°N	11.892°E 56.617°N	11.918°E 56.335°N	11.664°E 56.428°N	11.123°E 57.084°N	12.000°E 56.347°N	11.875°E 56.500°N
Start (data used)	01/10/1999	01/10/2016	01/10/2016	01/10/2016	01/02/1999	01/01/1991	01/01/1991
Stop (data used)	01/10/2021	01/10/2021	01/10/2021	01/10/2021	01/02/2004	01/10/2021	01/06/2021

4.2 Global Atlas of Siting Parameters (GASP)

The Global Atlas of Siting Parameters provides a description of the challenging atmospheric conditions required for assessment of site-specific conditions for a wind turbine according to the IEC 61400-1 design standard [1]. The following parameters are provided by the GASP datasets in a resolution of 250m and at three different heights of 50m, 100m, and 150m.

- Wind direction distribution.
- Wind speed probability density distribution.
- Wind shear.
- Flow inclination.
- Air density.
- Terrain complexity.
- Extreme wind speed.
- Turbulence intensity as function of windspeed.

These parameters provide valuable information for planning the placement of wind farms and the choice of turbine to be used, which affect directly the cost of wind energy.

Below is a short description of the parameters. For more details please refer to [4].

Wind speed probability density distribution:

The wind speed probability density is assumed Weibull distributed, and the Weibull shape (k) and scale (A) parameters are provided for each direction.

Wind shear:

The wind shear is modelled according to the wind shear power law and the average power law exponent (α) is provided for each direction.

Flow inclination:

The average flow inclination (φ) is provided for each direction based on the surrounding topography in accordance with the IEC 61400-1 standard.

Air density:

The average air density (ρ) is provided along with an air density applicable for higher (extreme) wind speeds.

Terrain complexity:

The terrain complexity is assessed based on the surrounding topography and the turbulence structure correction parameter is provided.

Extreme wind speed:

The site-specific extreme wind speed is assumed Gumbel distributed. The extreme wind speeds with a 1-year and 50-year return periods are provided.

Turbulence:

To provide turbulence as function of wind speed it is parameterized according to the “Normal turbulence model” (NTM), which assumes a linear relationship between the characteristic turbulence and wind speed. GASP provides the slope (A) and offset (B) parameters of the turbulence for each direction.

5 Long-term Wind Climate

5.1 Long-term Correction of Floating LIDAR System (FLS) Measurements

The long term correction of measured LIDAR data is in the following considered the primary model and reported as the result of the study.

5.1.1 Long-term Consistency

The consistency of historical wind reference data is of vital importance when determining the long-term variation of wind speed. EMD has conducted consistency checks on the data sets in order to ensure that these would be suitable for use. These checks aim to identify trends and to establish a suitable baseline period.

Analysis of the EMD-WRF dataset using the Mann-Kendall trend test [25] indicated that a common 20 year may be trended (test value 0.12). EMD recommend, based on experience, a Mann-Kendall test value above 0.4 to avoid trends in the data set. Through analysis of the similar ERA5 dataset with longer availability, an acceptable Mann-Kendall test value is achieved if the period is reduced to 15 years (0.66) or increased to 30 years (0.42).

A comparison is made with MERRA2 data in Figure 25. Both datasets are normalized as windiness indices with baseline of either being the period January 2003 to December 2020. There is a qualitative difference between the two with MERRA2 being less trended and more stable across the period.

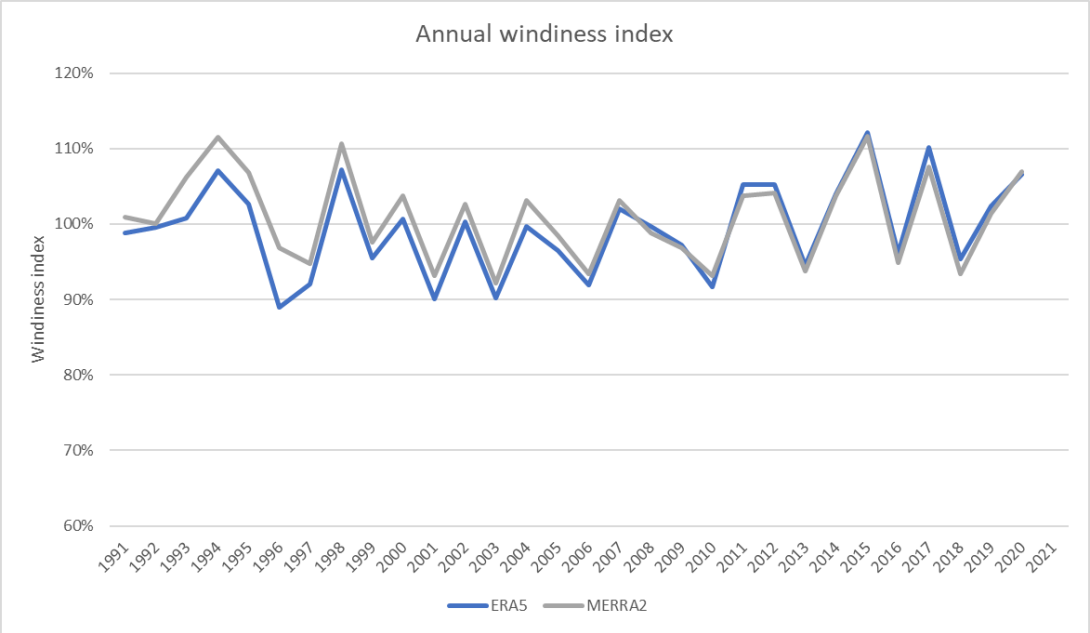

Figure 25. Annual windiness index for ERA5 and MERRA2 near the FLS.

Similar plots are made with four of the external ground stations described in section 3. It is clear that Nakkehoved is very trended and unsuited to verify the trend at Hesselø. The Anholt data have similar problems. There are here three distinct periods: Until 1999, from 1999 to 2012 and after 2012 with larges offsets between each which could mean the mast may have been moved or significantly changed. In any case, it cannot be used to verify the trend at Hesselø. Data from Gniben and Väderö are of higher quality, consistency-wise, and while not giving a perfect match, go a long way to confirm the pattern seen in the ERA5 data. This is consistent with general experience of the North-Atlantic Oscillation [26] where very long period lengths are frequently observed.

Figure 26. Annual windiness indices for Väderö, Nakkehoved, Gniben and Anholt.

Based on this analysis, the ERA5 pattern is confirmed despite the difference to MERRA2.

It is also clear that an untrended period from 2006 to 2021 will merely be the top of the cycle and not representative of the long-term climate. Instead, the 30-year period from 1991 to 2021 is preferred.

EMD-WRF data are not available for this entire period. Instead, it is found that the period 01/10/1999 to 01/10/2021 produce exactly the same wind speed as the period 01/10/1991 to 01/10/2021 (9.28 m/s at 100m) and this 22-year period can therefore be used as proxy for the 30-year reference period.

This is found through long-term adjusting EMD-WRF data to 30-year ERA5 with the Local Scaling method in WindPRO resulting in an insignificant scale and offset and the same wind speed with two decimals as of the 22-year period.

The reference dataset is therefore 22 years of EMD-WRF data at the Hesselø FLS covering the period 01/10/1999 to 01/10/2021. The dataset is available in the data package.

5.1.2 Wind Speed and Energy Correlation

The concurrent period of LIDAR data and EMD-WRF data is 7 months (28/02/2021 to 01/10/2021).

The correlation of the wind speed between LIDAR measurements at the FLS and EMD-WRF data is high.

Correlation coefficient, r, is calculated for each data point without averaging.

The wind energy dataset is calculated by scaling the wind speed to expected wind speed on site, applying a power curve to the scaled time series and dividing with the average production. This is a measure of what a turbine would produce in a given period relative to average. Correlation is calculated on monthly averages and represent the seasonal variation in production output. Please note that with a concurrent period of 7 months, this results in only 7 points for correlation. These however make excellent correlation with the EMD-WRF data.

Table 25. Correlation for reference (150 m) against LIDAR data at 140 m.

	EMD-WRF
Correlation, r [%] Wind Speed, hourly	92.7
Correlation, r [%] Wind Energy, monthly	98.5

5.1.3 Wind Direction Correlation

While correlating very well on direction, it was noted that the EMD-WRF data was 7.5° offset from the raw LIDAR data. As the verification report by Multiversum [12] noted an offset of 6.5° to the reference station and main compass on the buoy, the LIDAR wind direction was offset accordingly (section 3.2.6) leaving a 1° offset compared to EMD-WRF data.

There is a good match of wind direction roses between the LIDAR (140m) and EMD-WRF (150m) concurrent data (Figure 27).

The 7 months of concurrent data does not represent a long-term representative directional distribution and it must be expected that a long-term correction of data will significantly change observed directional distribution (Figure 27).

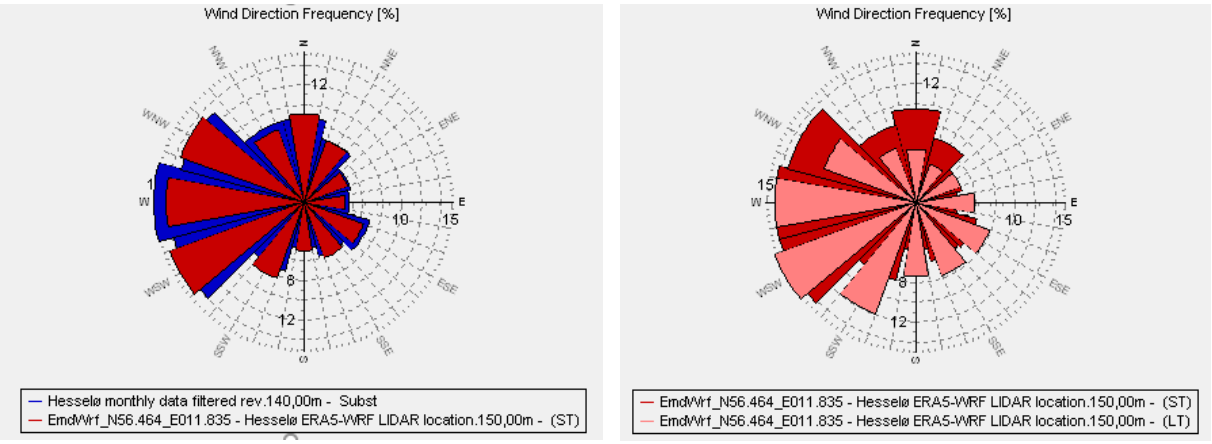

Figure 27. Left: Wind direction roses for the concurrent period of LIDAR (blue) and EMD-WRF (red) data. Right: Wind direction roses for EMD-WRF data. Deep red represents the entire long-term period, light red represents the period concurrent with LIDAR measurements.

5.1.4 Long term correction and validation

EMD has several long-term correction methodologies at disposal. A full description of these can be found in the WindPRO reference document on Measure-Correlate-Predict (MCP) methods [27].

To avoid seasonal bias, EMD recommends performing long term correction using concurrent data covering an integer number of years. In the present case only 7 months of concurrent data is available, and the risk of seasonal bias is considerable. The long-term wind climate calculated through long-term correction of measured data must therefore be considered tentative, to be updated when a full year of measurements is available.

The relevant windPRO methodologies that will correct for the wind direction are linear regression, neural network and the matrix method.

The performance of each method is tested through a 24-hour slicing test. In this, the transfer function is trained of every second day of the data set and used to predict a period consisting of every other day. The metric for comparison is the Mean Bias Error on production output, which is comparable to the difference in turbine production in percentage between using measured or predicted data. The result of this test is presented in Table 26. The matrix method produces the smallest error (0.18% under-prediction of production) and also give satisfying results in predicting the direction distribution and Weibull distribution shape.

Table 26. Prediction test using a 24-hour slicing method. The parameter presented is over-prediction in percent. (140 m data).

Reference	Linear regression	Neural Network	Matrix
24-hour slicing test, % production	0.68	-1.36	-0.18

The long-term correction has been performed using a wind speed/direction matrix. The windPRO Matrix MCP Method is described by developing a relationship matrix for the wind speed bins and direction bins between the wind data at the reference and a concurrent period of wind data from the local site and applying this relationship matrix to all the long-term wind data to determine the estimated site data wind climate. This method corrects for changes in both wind speed and direction. The artificially generated time series for 100 m to 160 m height represents the long-term wind climate and is presented in the following.

5.1.5 Wind Speed

The long-term and seasonally corrected wind speeds for the Hesselø FLS are summarized in the following table. A detailed breakdown of the Weibull parameters can be found in appendix D.

Table 27. Weibull parameters of the long-term wind data used.

Mast	Height [m]	Period [y]	Arithmetic mean wind speeds [m/s]	Weibull mean [m/s]	Weibull - A parameter	Weibull - k parameter
Hesselø FLS	100	22	9.24	9.37	10.58	2.258
Hesselø FLS	120	22	9.39	9.52	10.75	2.227
Hesselø FLS	140	22	9.50	9.64	10.89	2.221
Hesselø FLS	160	22	9.60	9.75	11.00	2.203

5.1.6 Wind Direction

The long-term frequency and energy distribution for the long-term corrected Hesselø FLS at 140 m ASL indicate a main wind direction from southwest to west.

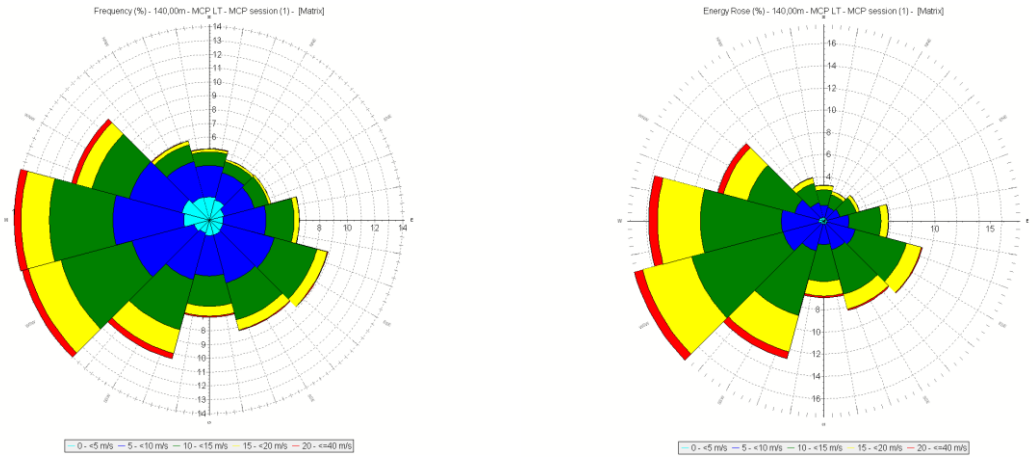

Figure 28. Left: wind direction distribution of long term corrected LIDAR data at 140 m. Right: Energy distribution of long term corrected LIDAR data at 140 m. Both are divided in wind speed intervals.

5.1.7 Diurnal Variations

The diurnal long-term wind speed is compared to the observed diurnal wind speed in Figure 29. The variation is similar but adjusted to higher wind speed for the long-term dataset.

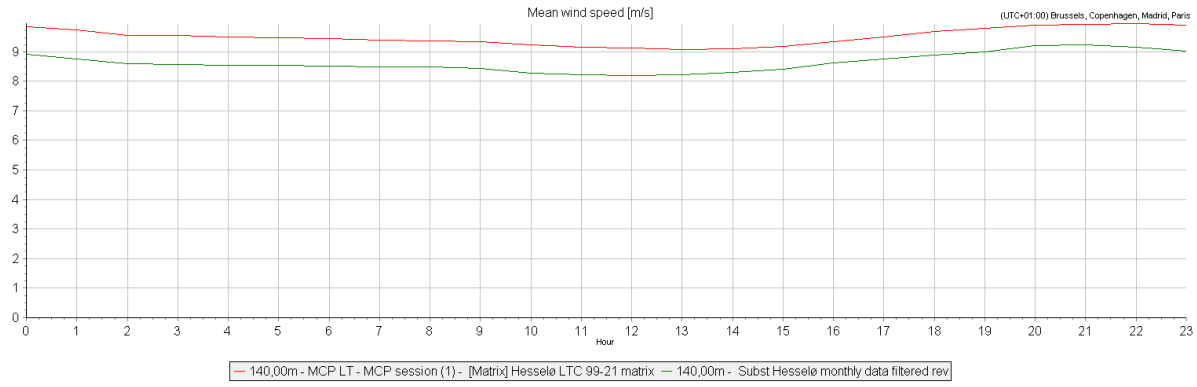

Figure 29. Diurnal wind speed, long-term corrected (red) and observed (green).

5.1.8 Seasonal Variations

The long-term seasonal variation in wind speed at 140 m is presented in Figure 30. With the expected low wind speed months in the summer period, the measured period is heavily seasonal biased.

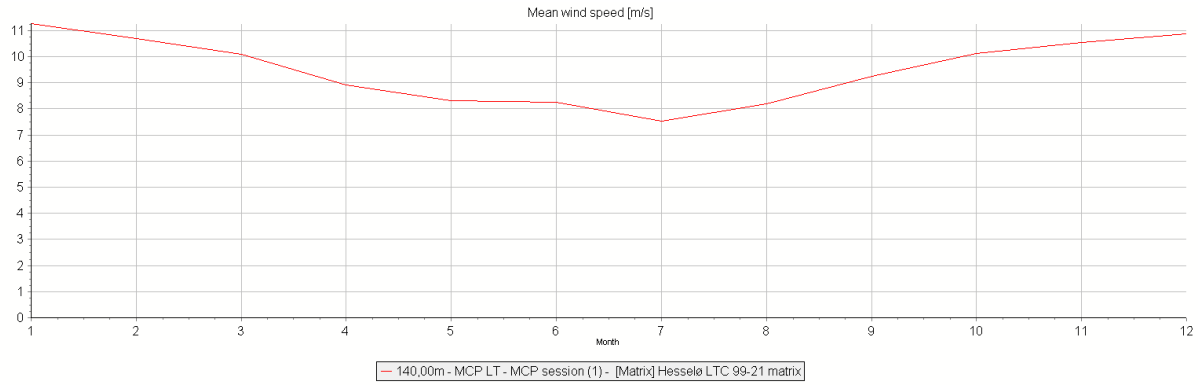

Figure 30. Seasonal variation of long-term corrected dataset at 140 m.

5.2 Alternative Wind Models

To support the wind resource assesment for the Hesselø FLS, two alternative models have been prepared. While the above described long-term correction of measured LIDAR data remain the primary, the two alternative models can be used to validate the model and help in the assessment of the uncertainty of the model. The ground stations at Anholt, Gniben, Nakkehoved and Väderö are all considered unsuitable as sources for a wind model, as all of them are measuring a very low height, at considerable distance from the Hesselø FLS and situated on land with different exposure to terrain and thermal stability.

5.2.1 Calibrated Mesoscale Data Model

The principle of the calibrated mesoscale model is through a simple scale and offset to adapt mesoscale data to that of a ground station. This could be either actual measurements or operating assets. The assumption is that mesoscale data is already representative for the site in terms of direction distribution as well as wind speed variation meaning that the only adjustment required in order to create a virtual mesurement mast is a simple scale and offset on the wind speed.

In this form the methodology has a long history in Denmark, Germany and southern Sweden where it is used instead of performing onsite measurements.

Onshore, the mesoscale data are adapted to microscale terrain through a downscaling procedure before calibration with local assets. This is not necessary offshore where the terrain is uniform and well described by the WRF model.

The main criteria for applying the calibrated mesoscale data model is that a solid correlation exist between the mesoscale data and the ground assets. This has been satisfied in section 5.1.2 and 5.1.3.

In a first step, the EMD-WRF data are shear interpolated from 150 to 140 m based on a shear matrix as described in section 3.7. This shear matrix is based on EMD-WRF data at 100 m and 150 m.

The scale and offset is derived through a simple linear regression with concurrent LIDAR data. As in the case of normal MCP the scale factor should be derived from a concurrent period covering an integer number of years. Deriving it based on only a half year of data will seasonally bias the result.

The linear fit is presented in Figure 31. Based on 4747 samples the scale factor is 0.9670 and the offset is 0.222.

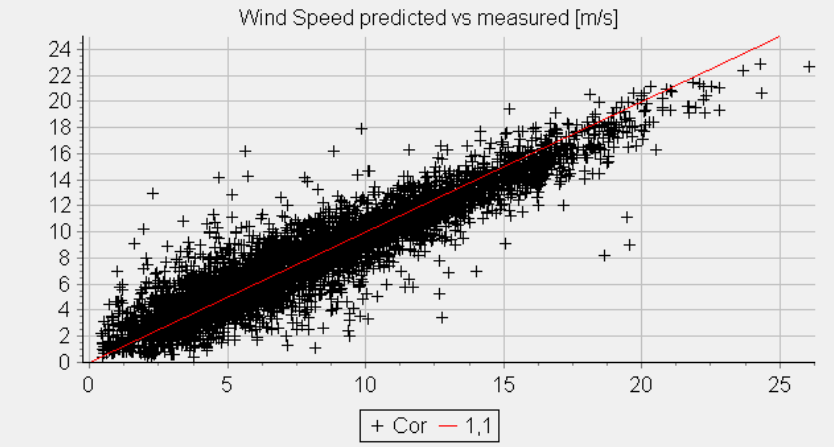

Figure 31. Linear fit of EMD-WRF 140 m to FLS 140 m data.

The scale and offset is applied to 22 years of EMD-WRF 140 m data. The resulting wind speed is 9.52 m/s.

The Calibrated Mesoscale Data Model time series is provided in the data package and a summary of the data can be found in appendix E.

5.2.2 Læsø Derived Long-term Wind Climate

The Læsø measurement mast, described in section 3.3, is located 80 km to the northwest of the Hesselø FLS, but is located in similar terrain with 45 km to landfall in western direction, 66 km to landfall on the east and 16 km to the island of Læsø to the north. With four years of measurements of good quality, it provides a good assessment of the wind conditions in that part of Kattegat.

To translate these measurements to 140 m at Hesselø, three steps are required.

TRANSLATION OF MEASUREMENTS FROM LÆSØ LOCATION TO HESSELØ FLS LOCATION

The method used to translate data from Læsø to Hesselø FLS is the relative difference on the mesoscale data. Given the distance of 80 km this translation is not trivial, but is based on the assumption that the difference between the two sites can be fully described by the difference in the mesoscale data.

An EMD-WRF dataset was extracted for the Læsø location (section 4.1). The correlation between Læsø and EMD-WRF is very high, both on wind speed, monthly energy content and directional distribution (Figure 32 and Table 28) and the EMD-WRF data can there be said to capture the wind dynamics very well at Læsø.

Table 28. Correlation between the Læsø measurements at 62m and EMD-WRF (Læsø) at 50 m.

Correlation r [%]	EMD-WRF
Wind Speed, hourly	93.5
Wind Energy, monthly	99.0

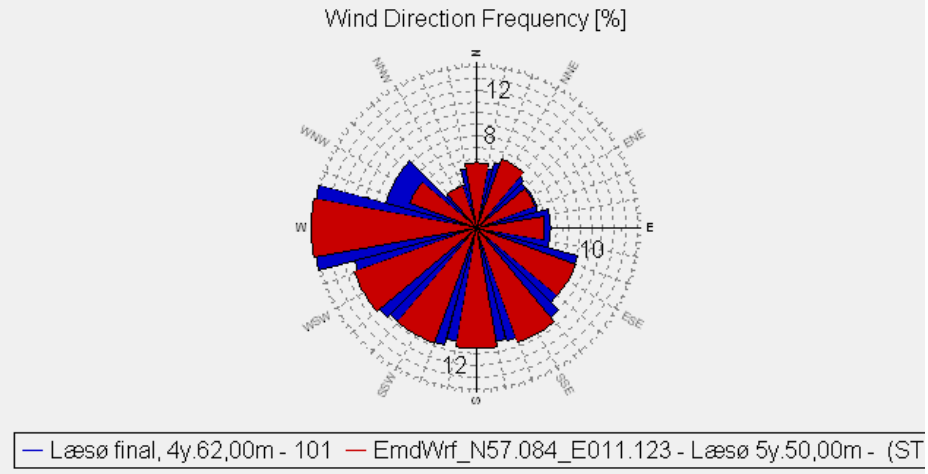

Figure 32. Directional distributions for Læsø mast (blue) and EMD-WRF (Læsø) (red) for concurrent period (4 years).

Comparing the wind direction distribution between EMD-WRF data at Læsø and EMD-WRF data at Hesselø FLS a difference in directional distribution and particularly energy distribution is noted (Figure 33). A translation function is therefore required to both translate the directions and the energy content in each direction.

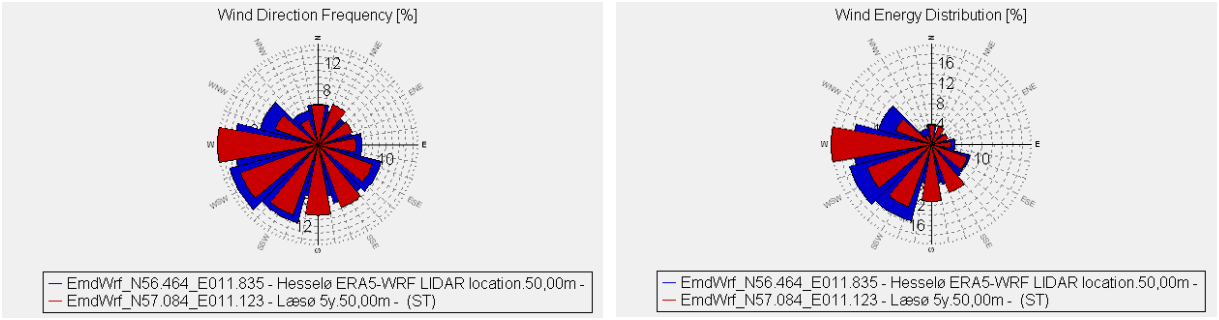

Figure 33. Left: directional distribution between EMD-WRF at Læsø (red) and EMD-WRF at Hesselø FLS (blue). Right: Energy rose of same two datasets.

A translation function is created using linear regression with a translation function for for every 1° direction, used data in a +/-15° window, giving a scale and offset on wind speed as well as an offset on wind direction.

This translation function is then applied to the four year of Læsø data, creating a 4 year dataset at Hesselø FLS.

SHEAR EXTRAPOLATION

The translated data are at 62 m ASL and need to be translated to 140 m ASL. The obvious way to do this is through a shear extrapolation. This, however, is not trivial. A shear extrapolation from 62 m to 140 m is far outside the 2/3 ratio set by the MEASNET guideline ([28]). There are of course a measured shear at the Hesselø FLS from the LIDAR profile, but when considering the seasonal shear on the EMD-WRF data we note a seasonal bias on the observed shear as these cover mainly summer months. The alternative is to use a shear based on long term corrected observations. This solves the seasonality issue but due to imperfect long term correction and the inherrent random scatter in the matrix MCP function there is a lot of noise in the directional and diurnal shear values. The most robust shear extrapolation was found to be a shear matrix based on long term corrected data at Hesselø FLS from 100 m to 160m, using only seasonal binning (Table 29).

Table 29. Shear by season, based on long term corrected measurements at Hesselø FLS 100 m to 160 m.

Direction /hour	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sep-Oct	Nov-Dec
All	0.11	0.11	0.08	0.06	0.06	0.09

LONG TERM CORRECTION OF TRANSLATED LÆSØ DATA

The four years of translated Læsø data need to be long term corrected to the same 22 year baseline as used for the LIDAR data on the Hesselø FLS.

The correlation between the translated Læsø data and the EMD-WRF at Hesselø is less good than for the local measurements, but considering the translations they have been subjected to, this is to be expected. Both on wind speed, monthly energy content and directional distribution the correlation is sufficiently good to perform a long term correction.

Table 30. Correlation between translated and shear extrapolated Læsø data and EMD-WRF (Hesselø FLS).

Correlation r [%]	EMD-WRF
Wind Speed, hourly	87.4
Wind Energy, monthly	96.0

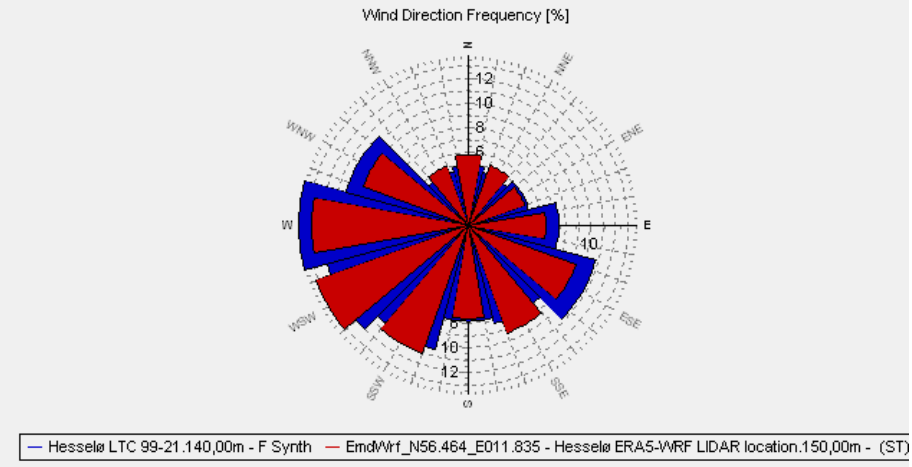

Figure 34. Directional distribution of translated Læsø data at 140 m (blue) and EMD-WRF (Hesselø FLS) (red), concurrent period.

Long term correction to 22 years is tested with the three methods described in section 5.1.4. The 24-hour slicing test is applied. The prediction error is typically 1% on production. Linear regression has the smallest error, but as the directional prediction with this method was poor, the matrix method with a small negative bias is preferred.

Table 31. 24-hour slicing test using three different MCP techniques. The mean bias error is in % production output.

Reference	Linear regression	Neural Network	Matrix
24-hour slicing test, % production	0.72	-1.1	-0.87

The mean wind speed through the three steps can be followed in Table 32. The wind distribution and Weibull fit can be found in detail in appendix F.

Table 32. Mean wind speed through the translation stages, Læsø data.

Stage	Arithmetic mean wind speed [m/s]
4 years of measured mean wind speed, Læsø , 62 m ASL	8.80
4 years, translated to Hesselø FLS position, 62 m ASL	8.68
4 years, shear extrapolated to 140 m ASL	9.31
22 year, LTC at Hesselø FLS, 140 m ASL	9.50

5.2.3 Comparison with alternative results

The wind resource at Hesselø FLS was assessed through long term correction of measured LIDAR data. This remains the primary model for the site.

Two alternative models were tested, using the calibrated mesocale data method and by translating Læsø measurements to the site.

The results of these tests are summed up in Table 33

While the mean wind speed align perfectly, the production output deviated up to 2.9%. This production output is found by appying the power curve of a very large wind turbine (12 MW) with a typical shape power curve to the time series produced by each model. The reason for this difference may be found in the different wind speed probability functions as shown in Figure 35. The measured LIDAR data has a flat “top” that fits poorly to a Weibull distribution. In this region of Europe it is common that with a long enough measument period the data will align well with a Weibull distribution and it is possible that through continued measuring the probability function will allign with the alternative methods and they thus indicate an upside in the scale of 2-3 % production.

While the directional distributions are qualitative similar, they are not identical and indicate the uncertainty on the long term direction distribution (Figure 36).

Table 33. Comparison of model results. Production is relative to the primary wind model and obtained by applying a generic power curve to the resulting time series.

Reference	Primary wind model	Calibrated mesoscale model	Translated Læsø data model
Aritmetic mean wind speed, m/s	9.50	9.52	9.50
Production relative to primary model		+2.1%	+2.9%

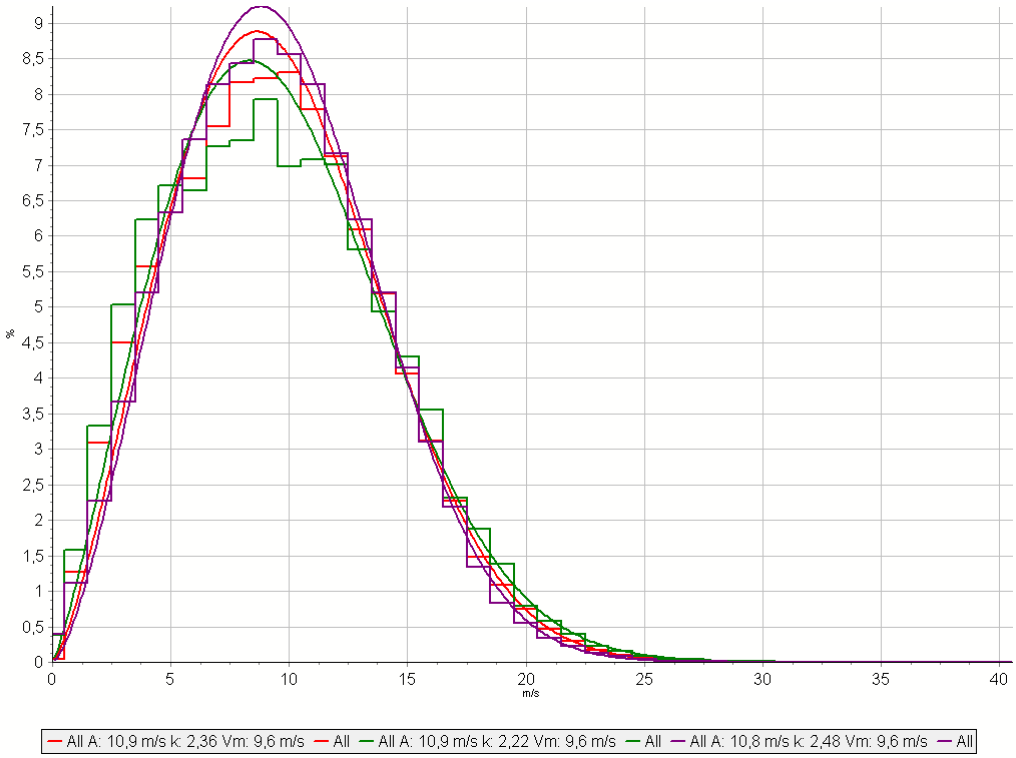

Figure 35. Wind speed probability function for the three datasets. Primary model (green) has a poor fit to a Weibull distribution compared to the calibrated mesoscale model (red) and the translated Læsø data (purple).

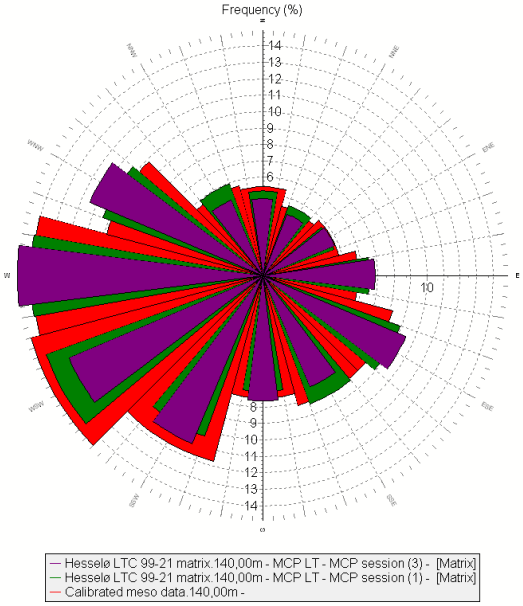

Figure 36. Directional distribution of the three long term wind models. Green: Primary model, red: Calibrated mesoscale model, purple: Translated Læsø data.

5.3 Uncertainty on Long-Term Wind Climate

MEASUREMENT UNCERTAINTY

Uncertainty on measurements was discussed in section 3.2.12. The components are summarized in Table 34.

Table 34. Measurement uncertainty.

Contributor	Reference	Source	Uncertainty 1 std dev ws
Classification	[13]	Classification report	1.4%
Verification	[12]	Verification report	2.2%
Data patching		Estimated	0.03%
Total			**2.6%**

LONG-TERM CORRECTION UNCERTAINTY.

The long term correction uncertainty consists of components with very low uncertainty (correlation, reference consistency, reference period length) and one component with very high uncertainty, which is the very short and seasonally biased local data period length. This is therefore the dominant uncertainty with very minor contributions from other components.

Based on [26], the combined long term correction uncertainty of a very short (half year) measurement period with high correlation as well as consistent and long reference data is 5% independently of the methodology used.

The long term correction changes the wind speed form 7 months to 22 years by 10%. In this context a high uncertainty is expected.

As presented in section 5.1.4 the performance test on the MCP methods is very good and in section 5.2.3, the wind speed is predicted very well across different models, yet the distribution of wind speed may be off, leading to a production difference across methods of up to 3%, the reason likely being the very short measurement period. A long term correction uncertainty on wind speed of 5%, given a sensitivity on wind speed to production of approximately 1 (making the 3% production difference translate to a 3% wind speed difference), we therefore consider a reasonable value.

VERY LONG-TERM UNCERTAINTY

The future climate is the potential difference in wind speed of the next 20 years from the past period considered in the wind study. Northern Europe is subject to long wave oscillations meaning that a 20-year operation period can be quite different from the very long-term average. As suggested by [24], we estimate that for the wind speed regime in question this uncertainty is 1.5 % on wind speed.

YEAR-TO-YEAR VARIABILITY

Based on the annual variation on the EMD-WRF data the annual variability is 4.2%. Over a 20 year lifetime this uncertainty is reduced to 0.94%.

TOTAL UNCERTAINTY

The uncertainty components are combined to a total wind speed uncertainty. A total is given for a 1 and a 20 year period.

Table 35. Combined uncertainty on long term wind data. Uncertainty given as one standard deviation.

Wind data uncertainty	1 year	20 years
Measurement unc.	2.6%	2.6%
Long-term correction unc.	5.0%	5.0%
Very long term unc.	1.5%	1.5%
Annual variability	4.2%	0.9%
Total	**7.2%**	**5.9%**

6 Flow Modelling

6.1 Methodology

A wind resource model has been made for the Hesselø offshore wind farm zone. The model is based on the primary wind model (long term corrected LIDAR data) and describe the horizontal change across the site.

This is achieved by creating a virtual met mast in each corner of the wind farm with long-term data at the same heights as at the Hesselø FLS (100, 120, 140 and 160 m).

Each virtual mast is a copy of the long term corrected data at the Hesselø FLS, scaled with the relative difference between the Hesselø FLS location and each corner location.

A five year EMD-WRF dataset (01/10/2016 to 01/10/2021) was extracted for each corner node. The scale factor is the relative difference in wind speed in each of 12 direction sectors. This set of 12 scale factors is then applied to the timeseries of the copy of the long term corrected LIDAR data. The scale factors can be found in Table 36.

The three resulting 22 year datasets for each corner node can be found in the data package.

Table 36. Directional scale factors derived from comparing concurrent period of EMD-WRF data at Hesselø FLS and EMD-WRF data at each corner node. 100 m scale factors are used to scale 100 and 120 m data, 150 m scale factors are used to scale 140 and 160 m data.

Sector	North 100 m	North 150 m	South 100 m	South 150 m	West 100 m	West 150 m
N	0.999	1.001	1.009	1.008	0.987	0.991
NNE	0.979	0.979	1.014	1.012	1.023	1.022
ENE	0.966	0.970	1.008	1.012	1.009	1.010
E	1.007	1.009	0.981	0.982	1.007	1.006
ESE	0.973	0.972	0.989	0.994	1.002	1.002
SSE	1.015	1.012	0.961	0.964	0.992	0.991
S	1.014	1.009	0.974	0.981	1.018	1.017
SSW	1.003	1.003	0.968	0.970	1.016	1.016
WSW	0.973	0.972	1.017	1.016	0.996	0.996
W	1.022	1.021	0.992	0.994	0.984	0.986
WNW	0.987	0.989	0.988	0.987	1.003	1.003

6.2 Wind Resource Map

Based in the corner node virtual mast datasets, a wind resource map is calculated.

The wind resource map is calculated for each of the four measurement heights (100, 120, 140 and 160 m) through inverse linear interpolation, where each grid cell is a distance weighted average of the three corner nodes plus the original primary model dataset at the Hesselø FLS. The grid resolution is 200 m.

Please note that the wind speed in the wind resource map is Weibull derived mean wind speed and therefore different from the arithmetic mean wind speed of the time series.

The wind resource map as .rsf file is included in the data package.

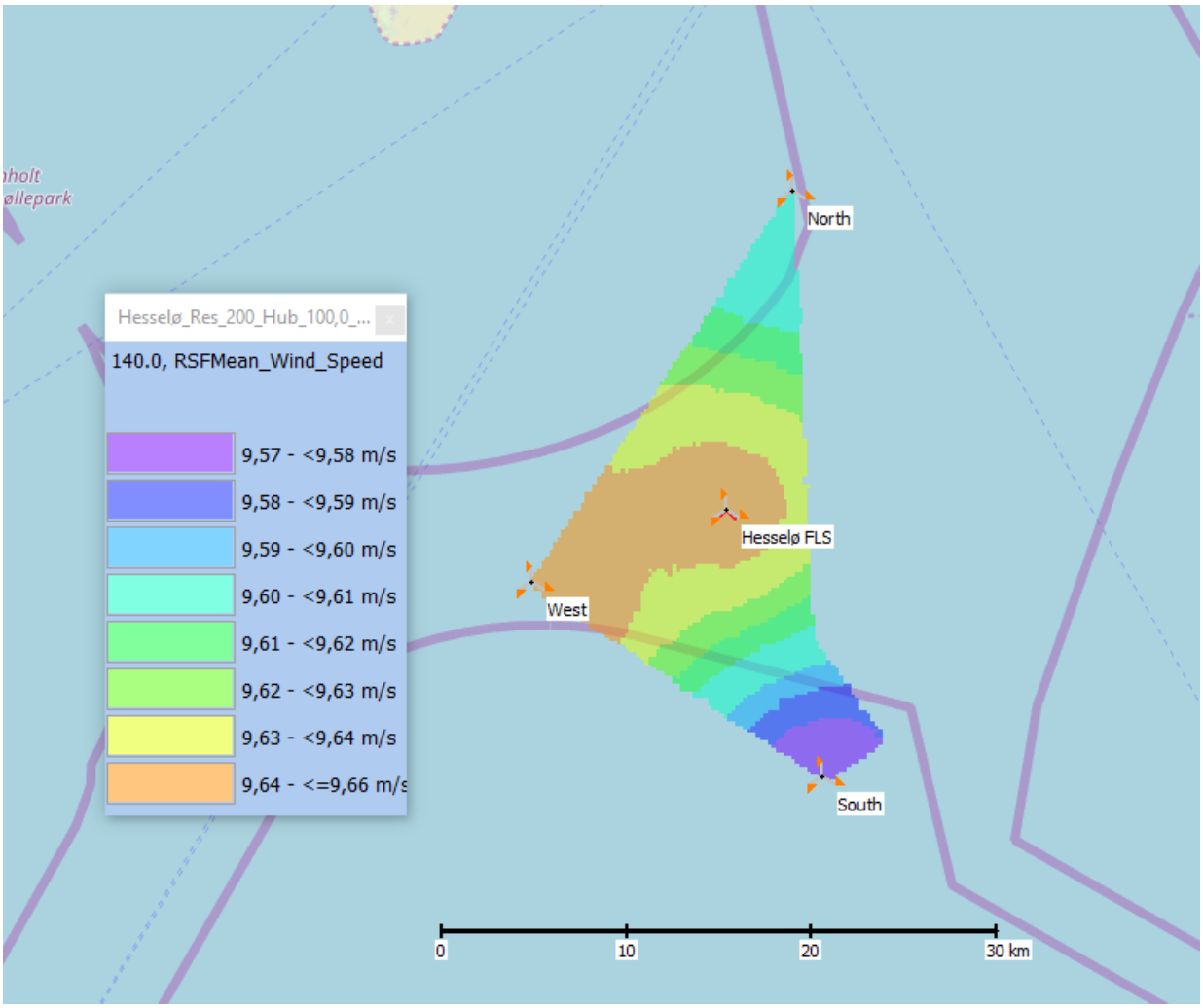

Figure 37. Wind resource map for Hesselø offshore wind farm zone. Wind speeds are Weibull derived mean wind speeds.

7 Siting Parameters

This chapter outlines the requested siting parameters for assessment of structural integrity of wind turbines in accordance with the relevant design standards: IEC 61400-1 Ed. 4 [1], IEC 61400-3-1 Ed. 1 [2], IEC 61400-15-1 CD [3], DS 472 Ed 2. [29], and EN1991-1-4 including the Danish Annex DK NA EN1991-1-4 [30] [31].

For siting parameters that require turbine specific information the following has been assumed.

Table 37. Turbine specific information used for siting parameters.

Turbine specification	Value
Hub height	140 m
Rotor diameter	200 m
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Wind turbine class	II

7.1 Normal Wind Conditions

Normal wind conditions have been derived in accordance with IEC 61400-3-1 Ed. 1 [2], IEC 61400-1 Ed. 4 [1] and IEC 61400-15-1 CD [3]. Due to the limited data avialable, all parameters except for the wind speed distribution have been estimated as omnidirectional characteristic values. This is in line with the IEC 61400-3-1 which allows omnidirectional values to be considered for offshore sites that are far away from the coast where the environment generally exhibits little directional variation.

Due to the site location being offshore the terrain is classified as “not complex” (terrain complexity factor is 1.0) and the wind flow is assumed without any inclination (flow inclination 0°).

7.1.1 Wind Speed Distribution

The 10-min mean wind speed probability distribution at hub height is modelled by a Weibull distribution for each direction, respectively [1]. The distributions are estimated based on long term corrected data from the LIDAR. Note that this data is 1hr averaging periods but according to IEC 61400-3-1 the long-term probabiltiy distribution of mean wind speed may be assumed to be independent of averaging periods between 10min and 3hr. The results are summarized in the table below. Details can be found in Appendix D. Due to a relatively poor Weibull fit because of the very short measurement period, an alternative Weibull distribution is also suggested based on the Translated Læsø Data (appendix F).

Table 38. Weibull distribution parameters based on long-term corrected LIDAR data at 140 m ASL (Primary model).

Sector	A parameter [-]	k parameter [-]	Frequency [%]	Mean wind speed [m/s]
Mean	10.89	2.22	100.00	9.64
0-N	8.23	1.88	5.17	7.30
1-NNE	8.09	1.90	4.56	7.18
2-ENE	8.91	2.26	4.62	7.89
3-E	10.02	2.60	6.52	8.90
4-ESE	10.89	2.71	8.89	9.69
5-SSE	10.76	2.53	8.30	9.55
6-S	10.71	2.30	7.04	9.49
7-SSW	12.59	2.53	10.40	11.17
8-WSW	12.65	2.67	14.05	11.25
9-W	11.85	2.28	14.16	10.49
10-WNW	10.79	1.95	10.36	9.57
11-NNW	8.64	1.97	5.94	7.66

7.1.2 Normal Wind Profile (NWP)

The site-specific normal wind profile is characterised by the mean wind shear power law coefficient (α_c). According to IEC 61400-1 Ed. 4 [1] the site-specific omnidirectional characteristic wind shear should be evaluated as the energy weighted average of the sectorwise values.

The long term corrected LiDAR measurements was used to calculate the characteristic shear. Two values are offered: A power law coefficient based on heights 100m, 120m, 140m, and 160m, the expected hub height range and, secondly, the shear across to expected rotor range, based on 40m, 140m and 240m height data. These have been long term corrected along the same line as the primary heights and the results are summarised in the table below. No further analysis of the athmospheric stability conditions at the site has been conducted.

Table 39. Site specific omnidirectional wind shear exponent.

Method	Wind shear power law exponent [-]
Hub height range (100m to 160m)	0.086
Rotor range (40m to 240m)	0.088

7.1.3 Normal Turbulence Model (NTM)

The normal turbulence model in the IEC 61400-1 [1] is defined by a linear relationship between the characteristic 90% quantile of turbulence ($\sigma_{c,90}$) and wind speed. For offshore sites, this is not fully appropriate due to the Charnock effect which adds a second order effect to the turbulence increase with wind speed [2]. A special purpose offshore model is therefore considered where the turbulence mean value (σ_μ) is modelled as a second order function of wind speed, and the turbulence standard deviation (σ_σ) is modelled as a linear function of wind speed. The models are outlined by the equations below:

$$\sigma_\mu(U) = A_{\sigma_\mu} + B_{\sigma_\mu}U + C_{\sigma_\mu}U^2$$

$$\sigma_\sigma(U) = A_{\sigma_\sigma} + B_{\sigma_\sigma}U$$

The characteristic turbulence required for structural design can be calculated by combining the two models as [1]:

$$\sigma_{c,90}(U) = \sigma_\mu(U) + 1.28\sigma_\sigma(U)$$

Generally, the models and safety factors recommended by the IEC 61400-1 and IEC 61400-3-1 have been callibrated towards turbulence measured by cup anemometers, which cannot be compared to LIDAR measurements without a correction model. The turbulence model parameters for the current site are, therefore, quantified by combining the information provided by the LIDAR measurements with two offshore cup anemometer measurement campaigns: one located near Læsø (provided by Energinet) and another which is also located relatively close to site. The latter measurement campaign is taken from EMD's database and cannot be further disclosed.

A three-step approach is considered to derive the representative characteristic turbulence at the site. First the LIDAR is used in a relative analysis to establish a model that can extrapolate turbulence with height. Then, the data from both masts (Læsø + undisclosed mast) is used to fit the turbulence model parameters (A, B, and C) which are then extrapolated vertically to hub height with the model established in step 1. Finally, the parameters derived at the mast positions are interpolated spatially to the exact site location by using inverse distance weighting.

STEP 1: VERTICAL EXTRAPOLATION MODEL

The LIDAR measurements are used to establish a model that can extrapolate turbulence from the mast heights, both between 50 m and 100 m, to the turbine hub height of 140 m. For each LiDAR measurement height (from 40 m to 240 m) the average wind speed (U_{avg}) and turbulence intensity[6] (TI_{avg}) has been calculated based on all available data.

[6] Taken from the turbulence intensity signal in the Lidar measurements.

These two values are then combined to a synthesized average turbulence as:

$$\sigma_{avg}(h) = U_{avg}(h) \cdot TI_{avg}(h)$$

The results of this analysis are outlined below. Some uncertainty in this translation may arise from the change in measurement volume of the LIDAR with height. It is not clear how well that is considered in the LIDAR turbulence intensity signal.

Table 40. Results of turbulence analysis on LIDAR.

Height [m]	U_{avg} [m/s]	TI_{avg} [%]	σ_{avg} [m/s]	$\sigma_{avg}/\sigma_{avg,140m}$ [-]
40	7.72	9.0	0.693	0.984
70	8.18	8.5	0.694	0.985
100	8.44	8.3	0.698	0.990
120	8.54	8.2	0.700	0.993
140	8.65	8.1	0.705	1.000
160	8.76	8.1	0.713	1.012
180	8.85	8.2	0.722	1.024
200	8.91	8.2	0.730	1.035
240	9.05	8.4	0.756	1.073

The relevant heights for turbulence exptrapolation are in the range of 50 m to 140 m. In this range it is appropriate to assume that the standard deviation is constant with height, hence, no extrapolation is required. This is in line with the proposal in IEC 61400-15-1 CD [3] that the wind speed standard deviation may be kept constant while wind speed is extrapolated upwards to hub height.

STEP 2: MODEL PARAMETER ESTIMATION

With the extrapolation model established the measurements at both masts are used to quantify the turbulence model parameters at their respective locations. The results of this analysis are shown below which also clearly justify a second order fit to the mean turbulence rather than a linear fit:

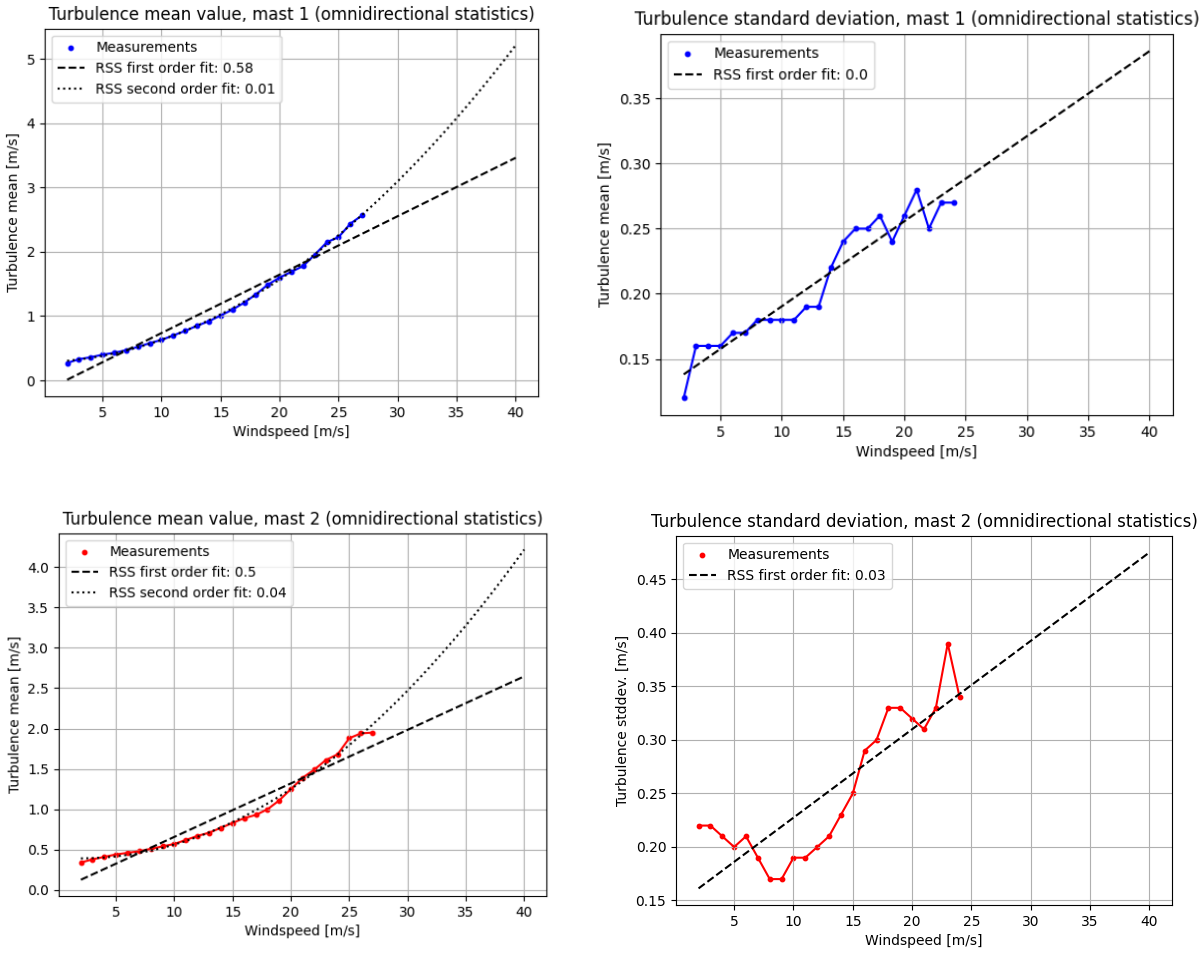

Figure 38. Turbulence model fit on data from external masts (mast 1: Læsø and mast 2: undisclosed).

STEP 3: SPATIAL INTERPOLATION

With turbulence models established at both masts positions the parameters at the site are finally derived by inverse distance weighting using a power parameter of 0.5. The results are summarized in the table below.

Table 41. Turbulence model parameters at the Hesselø FLS location (140 m).

Turbulence model parameters at the site	Turbulence mean value	Turbulence standard deviation	Turbulence characteristic value
A	0.3622	0.1383	0.5392
B	-0.0052	0.0077	0.0047
C	0.0027		0.0027

The figure below shows the characteristic turbulence at the two masts along with the inverse distance weighted (IDW) model recommended at the site (see Appendix G for tabulated values).

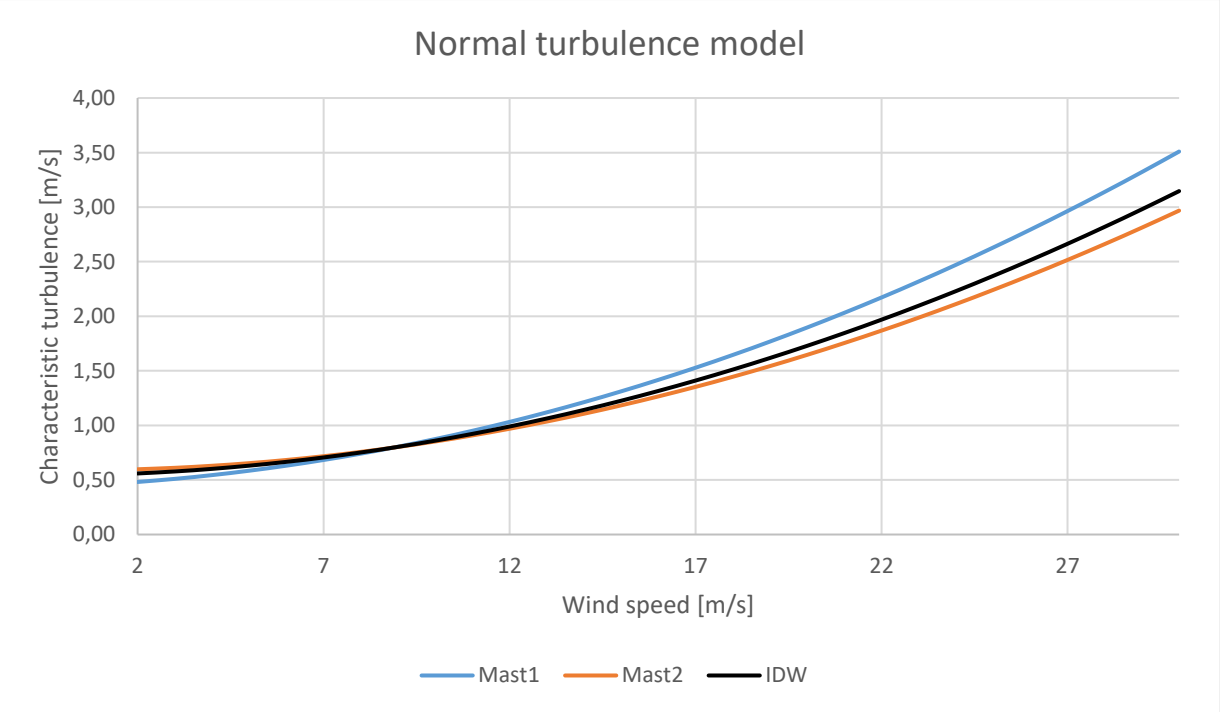

Figure 39. Characteristic turbulence at the two masts along with the inverse distance weighted (IDW) model recommended at the site.

7.1.4 Air Density

Air density during normal wind conditions is characterised by its average value at hub height which is estimated based on the recent Global Atlas og Siting Parameters (GASP). GASP is the outcome of an EUDP sponsored project by DTU and EMD [4] where site parameters such as air density are defined for the heights 50m, 100m and 150m. The air density at hub height (140m) is estimated by interpolation. Alternatively, based on the calculated temperature at 100 m in section 7.1.5, the air density can be calculated to 1.235 kg/m^3.

Air density average value (140m)	**1.23kg/m^3**

7.1.5 Air Temperature

Air temperature has been measured on the Hesselø FLS buoy, but only for 8 month. The average temperature measured during the 8 months was 12.6°C. The temperature has been long-term corrected with EMD-WRF data from the FLS location to 8.9°C at the buoy. These temperatures conform with temperatures at surrounding meteorological stations (Table 43).

The EMD-WRF timeseries has been calibrated to represent the lidar posistion at 100m height using an offset of -0.4°C (difference between WMD-WRF and measurements), which is then further adjusted to hub height (140m) using a temperature gradient of -6.5K/km [32]. The resulting timeseries has then been used to estimate how many hours the temperature is outside the normal and extreme temperature ranges defined in the IEC 61400-3-1 as -10°C to 30°C and -15°C to 40°C, respectively. The results are summarized in Table 42. The probability of temperatures falling outside the defined ranges is assessed by Gaussian distributions fitted to either the 10% highest or lowest tempreatures [16].

Table 42. Temperature assessment at the Hesselø FLS location (140m).

Check	Tmin [°C]	Tmax [°C]	hours < Tmin [h/year]	hours > Tmax [h/year]	Total hours outside range [h/year]
Normal range	-10.0	30.0	6.264	0.169	6.433
Extreme range	-15.0	40.0	0.096	0.000	0.096
Mean air temperature				8.3°C	
Standard deviation air temperature				6.7°C	
Maximum temperature				28.4°C	
Minimum temperature				-11.3°C	

Table 43. Temperature measurements from surrounding stations

Station	Temperature, [°C]	Station	Temperature [°C]
Læsø (55m)	9.5	EMD-WRF (100m)	8.4
Anholt (10m)	9.6	EMD-WRF (2m)	9.3
Gniben (10m)	9.5	FL200-E01 (2m, 8 months)	12.6
Nakkehoved (10m)	9.1	FL200-E01 (2m, long term)	8.9
Väderö (2m)	8.8		

7.2 Extreme Wind Conditions

7.2.1 Extreme Wind Speed Model (EWM)

The site-specific extreme wind speed model is characterized by the extreme wind speed with a 50-year return period [1], which for offshore conditions is supplemented by the extreme wind speed with a 1-year return period [2].

Typically, more data is required to reliably estimate extreme events than what is currently available to this project. The site-specific extreme wind speeds have therefore been estimated using the approach recommended by the Eurocode for wind loads on structures EN1991-1-4 [30] including its Danish Annex DK NA EN1991-1-4 [31] as well as the Danish Standard DS 472 [29].

EN1991-1-4 [30] defines a fundamental value of the basic wind speed ($v_{b,0}$) which corresponds to a 50-year extreme wind speed at 10 m height, independent of direction and time of year and with with a standard surface rougness of $z_{0,II} = 0.05m$. Inland in Denmark (expect for the West coast) this basic wind speed is set to 24 m/s [31], and in [33] it is specified that this value also covers the inner seas of Denmark where the current site is located. A first estimate of the 50-year extreme wind speed at hub height is calcualted by extrapolating this basis wind speed using the method described in EN 1991-1-4 [30]. This resulted in a 50-year extreme wind speed og 40.7m/s.

To verify and improve this result, and at the same time also add the 1-year extreme wind speed, a WEng model has been set up. It is noted that atmospheric conditions are assumed neutral in WEng which matches high wind speed conditions [34]. The analysis was performed through Site Compliance in windPRO as shown below:

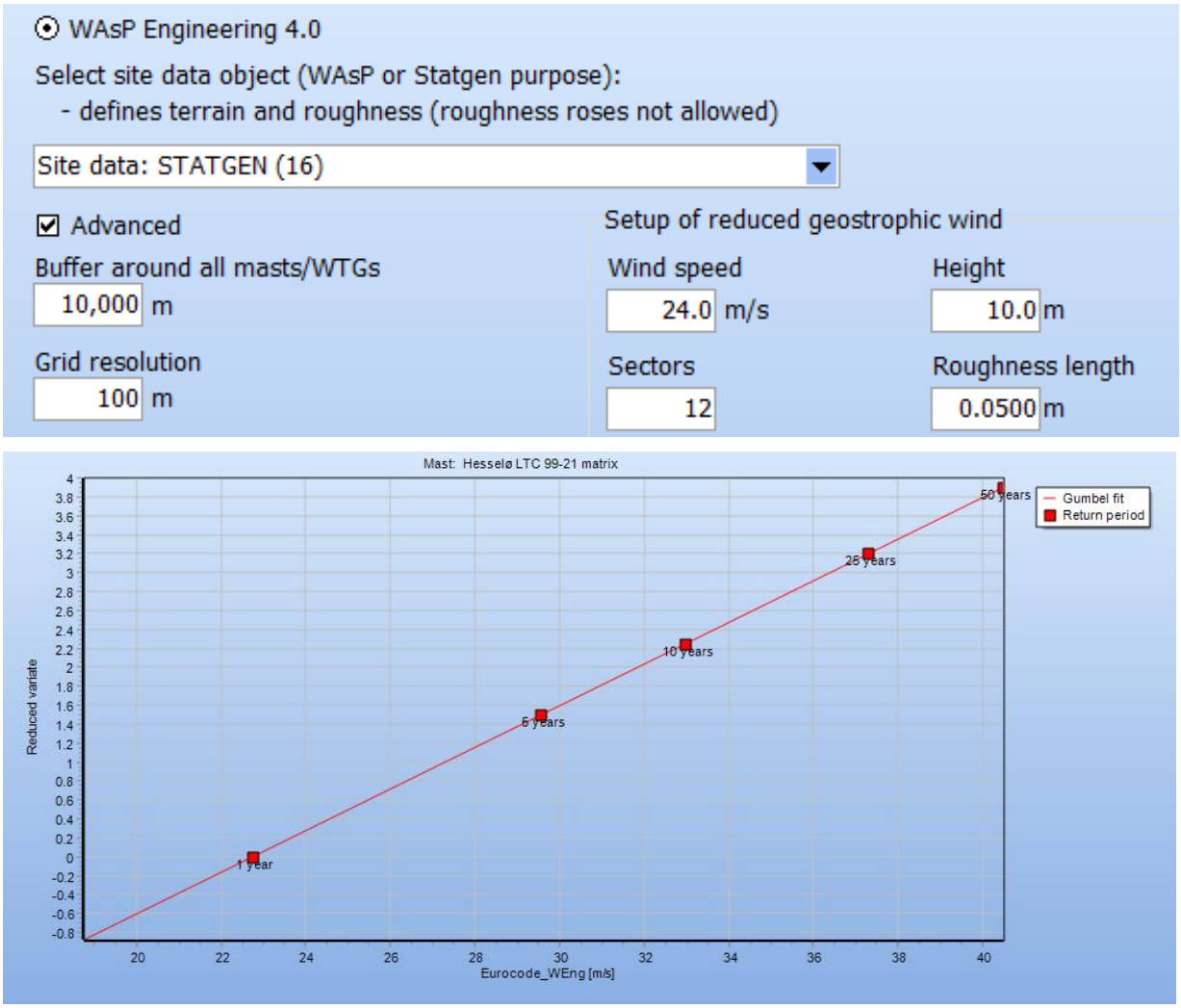

Figure 40. WAsP Engineering settings and output from modelling in windPRO, Site Compliance.

The resulting 1-year and 50-year extreme wind speeds are summarized in the table below:

Table 44. Extreme wind speed results (140m).

Time horizon	Extreme wind speed [m/s]
1-year	22.8
50-year	40.5

7.2.2 Wind Profile for Extreme Wind Speed Extrapolation

The site-specific wind profile associated with extreme wind speed events has been estimated based on the provided LIDAR data, and then further investigated by a WEng analysis. First, concurrent LIDAR measurements from all heights between 40 m and 240 m have been considered to estimate a timeseries

of wind shear power law exponent values. The plot below shows the exponents associated with only the highest percentile of wind speeds at hub height:

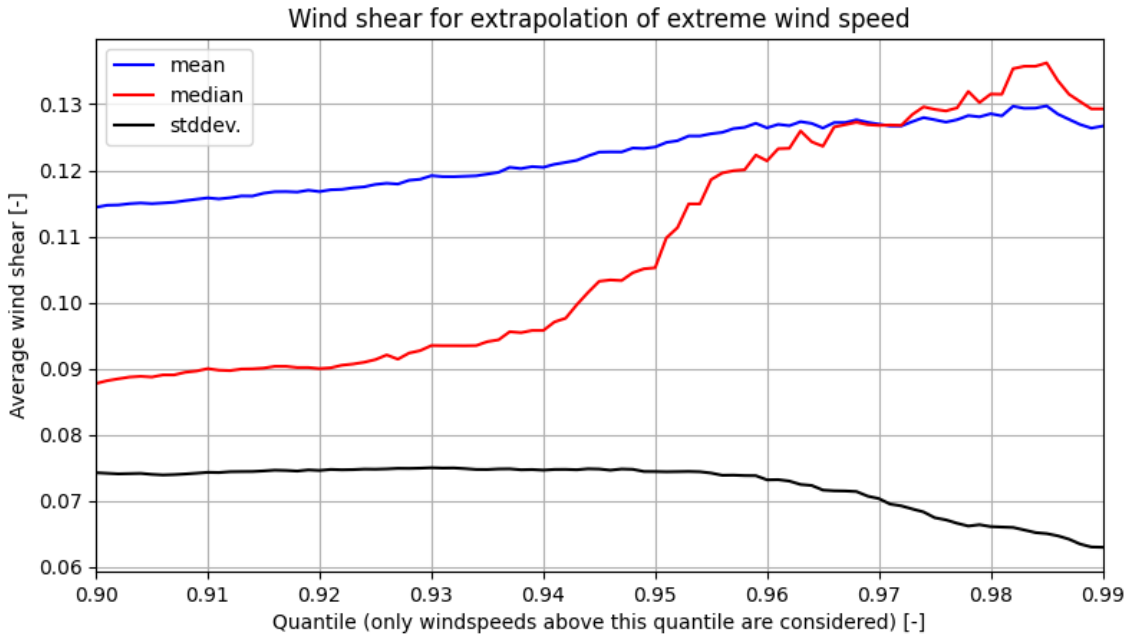

Figure 41. Wind shear extrapolation of extreme wind speed at Hesselø FLS.

Initially, the wind shear mean value and median are not coinciding and the standard deviation (stddev.) is relatively high. In combination, this indicates that multiple atmospheric stability conditions are present at the considered wind speeds. As the wind speed percentile increases above ~0.96 the mean and median begin to coincide and converge. This suggests that the atmospheric stability becomes uniform and normally distributed. The converged value is most likely associated with neutral atmospheric stability conditions which prevail during extreme wind speed [34]. The associated wind shear is approximately 0.12-0.13, but it has to be noted that the 99th percentile of recorded wind speeds is only ~20m/s. Consequently, it may not be fully appropriate to use the shear value for extreme wind speeds in the range of 35-50 m/s.

To further investigate the wind profile at extreme wind speeds a WEng analysis has been made, which implicitly assumes neutral atmospheric conditions. An extreme wind analysis has been made similar to previously in section 7.2.1, but in addition to extracting the 50-year wind speed at hub height it has also been extracted at hub height +/- one rotor radius as summarized below.

Table 45. Extreme wind speed calculated at +/- one rotor radius.

Height [m]	50-year extreme windspeed [m/s]
40	35.85
140	40.48
240	42.47

By fitting a straight line to the extreme wind profile in a double logarithmic plot, the wind shear value will appear as the slope:

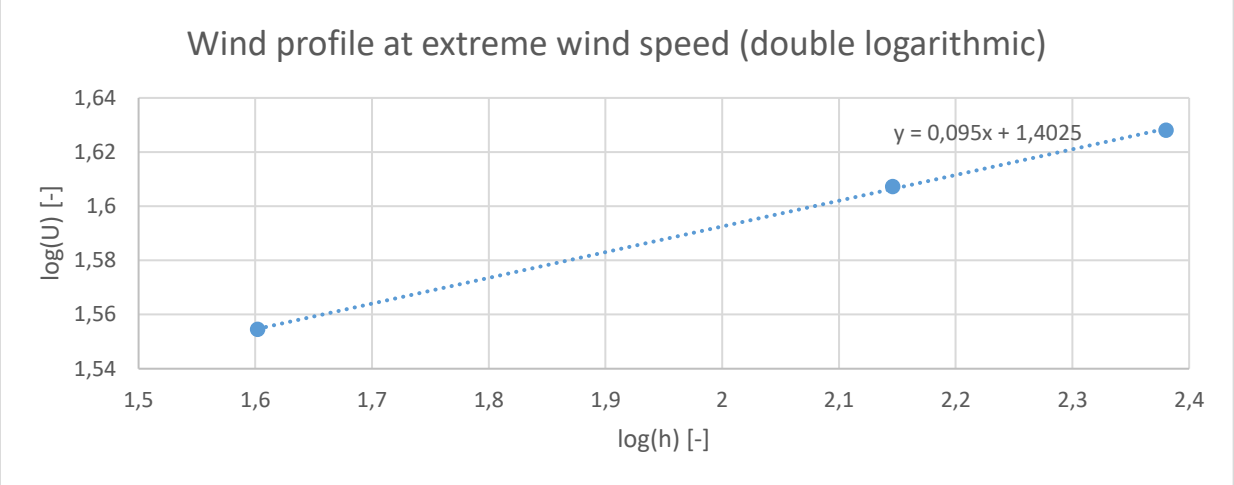

Figure 42. Fitted shear to extreme wind speed at three heights ASL.

The wind shear found through WEng associated to the extreme wind speed as the site is 0.095 which is the value recommended for extreme wind speed extrapolation.

Wind shear for extreme wind speed extrapolation	**0.095**

To improve confidence in the result from WEng it is checked that the surface roughness (z_0) that it has assumed for the calculation correspond to rough sea. By plotting the wind profile in a semi-logarithmic plot the offset is equal to $\log(z_0)$:

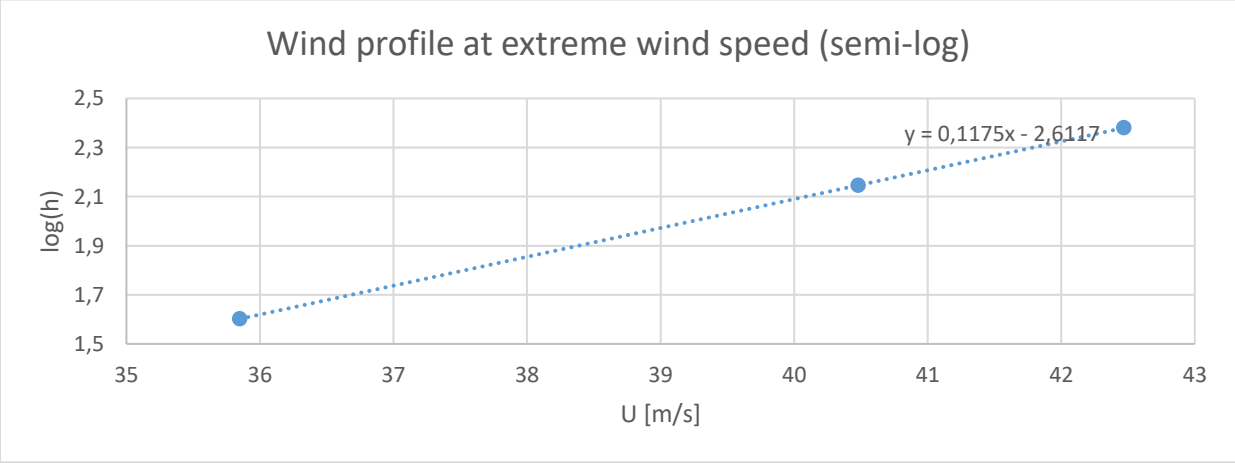

Figure 43. Fit on extreme wind speed to obtain roughness length at high wind speeds.

The corresponding surface roughness used inside Weng is therefore:

$$e^{(-2.6117)} = 0.073$$

which seems appropriate for the sea state at high wind speed events.

7.2.3 Extreme Wind Shear (EWS)

To estimate the site-specific extreme wind shear it is reccomended to use equations (27) and (28) in section 6.3.3.7 of the IEC 61400-1 [1] with site-specific values for the ambient turbulence standard deviation together with the site-specific wind shear exponent.

7.2.4 Turbulence at Extreme Wind speed

In addition to the extreme turbulence model the IEC 61400-3-1 [2] requires that the site-specific turbulence for extreme wind speed is defined. Using the turbulence model defined in section 7.1.3 the turbulence is estimated at relevant extreme wind speeds as shown below:

Table 46. Turbulence at extreme wind speed.

WTG Class	50-year windspeed (@hub height) [m/s]	50-year windspeed (10m height) [m/s]*	Turbulence intensity mean [%]	Turbulence intensity stddev. [%]	Turbulence intensity characteristic [%]
I	50.0	37.94	13.9	1.0	15.3
II	42.5	32.25	12.0	1.1	13.4
III	37.5	28.45	10.7	1.1	12.2
Site	40.5	30.72	11.5	1.1	12.9

*The 10 m values for the IEC classes are calculated using a wind shear derived from the site-specific 10 m and 240 m extreme wind speed.

It is generally accepted that there is a limiting condition for wave development, such that, for a given wind speed, the significant wave height and peak wavelengths stop growing. In effect, this means that the sea surface rougness will eventually saturate as the wind speed becomes very extreme, and the Charnock effect (second order effect) ceases. In [34] and [35] it was reported that the 10 m windspeed required for saturation of the surface roughness is in the range 33-40 m/s at a height of 10 m above sea level. However, these findings corresponded to virtually infinite fetch for wave development, and it is therefore expected that the wind speed required for saturation at the current site (where the fetch is rather limited) will be lower than the reported range of 33-40 m/s. It is therefore expected to be conservative to only use the second order turbulence model to extrapolate the turbulence as it most likely overestimates the Charnock effect. However, a closer calibration of the turbulence model that accounts for saturation of the sea roughness is not currently justified without additional data.

7.2.5 Extreme Turbulence Model (ETM)

The site-specific extreme turbulence model as function of wind speed (σ_{ETM}) is assessed using the peak factor method described in the IEC 61400-1 footnote 32 [1]:

$$\sigma_{ETM}(V_{hub}) = \sigma_{mean}(V_{hub}) + k_p(V_{hub}) \cdot \sigma_{stddev}(V_{hub}),$$

$$k_p = 0.01\left(\frac{V_{ave}}{(m/s)} - 21\right)\left(\frac{V_{hub}}{(m/s)} - 5\right) + 5$$

Omnidirectional values are used for the mean wind speed (V_{ave}) as well as the mean and standard deviation of turbulence. The extreme turbulence values are plotted below:

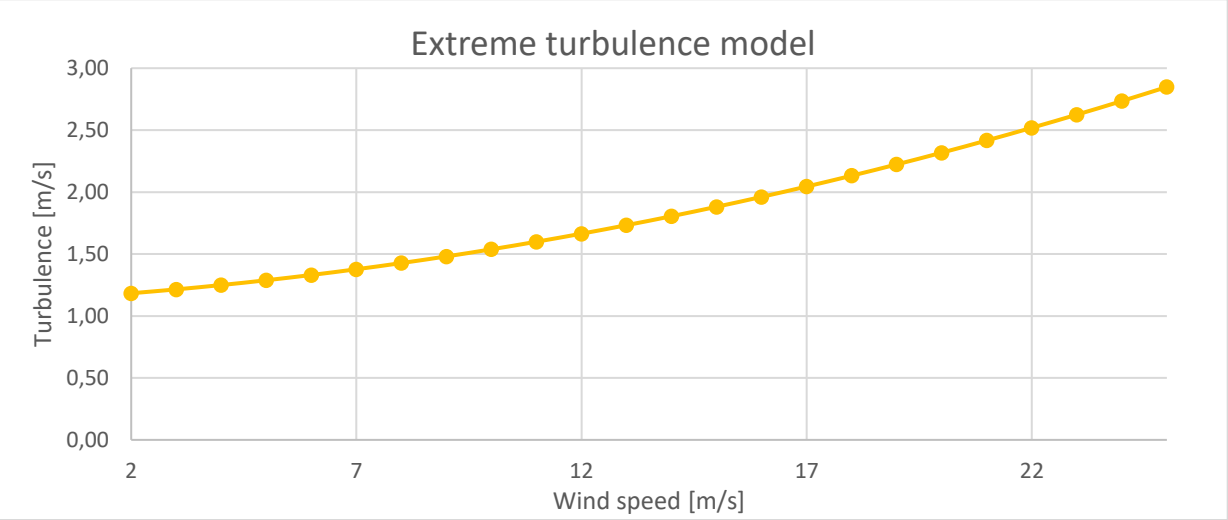

Figure 44. Extreme turbulence model.

7.2.6 Air Density for Extreme Wind

The air density for extreme wind conditions is taken from GASP [4]. Alternatively, the air density for extreme conditions can be found based on average temperature at high wind speed events. This is calculated as 1.24 kg/m^3.

Air density for extreme wind speeds (140m)	**1.23 kg/m^3**

7.3 Summary Table of Siting Parameters

The requested omnidirectional siting parameters are summarized in the table below.

Table 47. Summary table of siting parameters (140m).

Parameter	Value
Mean wind speed	9.64 m/s
Weibull distribution, A parameter (scale)	10.89
Weibull distribution, k parameter (shape)	2.22
Normal wind profile power law exponent	0.088
Turbulence intensity mean value (TI_{μ}) at a 10-min average wind speed of 15m/s*	6.0%
Turbulence intensity standard deviation (TI_{σ}) at a 10-min average wind speed of 15m/s*	1.7%
Turbulence intensity 90% quantile at a 10-min average wind speed of 15m/s*	8.2%
Mean air density	1.23 kg/m^3
Mean air temperature	8.3 °C
50-year extreme wind speed	40.5 m/s
1-year extreme wind speed	22.8 m/s
Wind shear for extreme wind speed extrapolation	0.095
Characteristic turbulence intensity at 50-year extreme wind speed	12.9%
Air density for extreme wind	1.23 kg/m^3

*Turbulence values ar other wind speeds can be found in appendix G.

8 Data Package

EMD has submitted datasets in support of this study. These are as far as it is possible provided in accessible formats

8.1 Raw Buoy Data

The raw data from FLS-200 at Hesselø are provided as presented to EMD. These are the monthly data conforming to the description in this report.

The files are labelled:

- EOLOS_20210228_0000_20210327_2350_10minCompassZX_Code.dat
- EOLOS_20210228_0000_20210427_2350_10minCompassZX_Code.dat
- EOLOS_20210228_0000_20210527_2350_10minCompassZX_Code.dat
- EOLOS_20210228_0000_20210627_2350_10minCompassZX_Code.dat
- EOLOS_20210228_0000_20210727_2350_10minCompassZX_Code.dat
- EOLOS_20210228_0000_20210827_2350_10minCompassZX_Code.dat
- EOLOS_20210228_0000_20210927_2350_10minCompassZX_Code.dat
- EOLOS_20210228_0000_20211027_2350_10minCompassZX_Code.dat

For convenience, the raw data file are combined in a single text file. The text file can be imported directly into WindPRO, but as an open format, it is generally accessible.

- FLS-200 raw data combined.txt

8.2 Filtered and Repaired LIDAR Data

A dataset for the filtered and repaired dataset is provided. The filter and repair process is described in section 3.2. The text file can be imported directly into WindPRO, but as an open format, it is generally accessible.

- FLS-200 data filtered and repaired.txt

The text file include measurements at all heights. Measurements on the buoy (METEO) are for practical reasons set at 10m. The dataset is organized in columns, starting with data for 12 m ASL, then proceeding with data for the next height. Data for a given height with SampleStatus flagged as “1” is disabled by EMD.

The content of the columns is explained in Table 48.

Table 48. Column explanation for data time series.

Column label	Description
TimeStamp	Date and time, dd/mm/yyyy hh.mm
MeanWindSpeedUID_xx,xm	Mean wind speed at height xx.x m, m/s
DirectionUID_xx,xm	Wind direction at height xx.x m, m/s
TurbIntUID_xx,xm	Turbulence intensity at height xx.x m
MaxWindspeedUID_xx,xm	Maximum wind speed at height xx.x m, m/s
MinWindspeedUID_xx,xm	Minimum wind speed at height xx.x m, m/s
WindSpeedVerticalUID_xx,xm	Vertical wind speed at height xx.x m, m/s
StdDevWindspeedUID_xx,xm	Standard deviation of wind speed at height xx.x m, m/s
OtherUID_xx,xm	Info flag at height xx.x m
CNRSNRUID_xx,xm	Code at height xx.x m (EOLOS data quality indicator)
Comment_xx,xm	Comments for height xx.x m (not used)
TimeStampStatus_12,0m	Internal setting for WindPRO
SampleStatus_12,0m	Status flag on entire sample: 0: OK, 1: disabled, 2: below limit, 4: above limit, 8: duplicate, 16: null value, 32: missing, 128: other error
DataStatus_yyyy_xx,xm	Status flag for parameter yyyy flagged at height xx.x m. Settings as for Sample Status.
DataStatus…..	Datastatus for other parameters.

8.3 EMD-WRF Dataset

The EMD-WRF datasets used in this study are included in the data package.

A text file export with selected parameters are included for the location of the Hesselø FLS

- EMD-WRF at Hesselø FLS.txt

The data columns are described in Table 49.

All EMD-WRF datasets are included as WindPRO Meteo objects in an Object export file

- EMD-WRF object export file.wpobjects

The object export file can be imported into WindPRO 3.5 by right-clicking in the Object list and select Import -> Import from windPRO object import file. The object export file includes more parameters than presented in the text file.

Table 49. Column explanation for EMD-WRF data time series.

Column label	Description
TimeStamp	Date and time, dd/mm/yyyy hh.mm
MeanWindSpeedUID_xx,xm	Mean wind speed at height xx.x m, m/s
DirectionUID_xx,xm	Wind direction at height xx.x m, m/s
TurbIntUID_xx,xm	Turbulence intensity at height xx.x m
TemperatureUID_100,0m	Temperature at height xx.x m
Comment_xx,xm	Comments for height xx.x m (not used)
TimeStampStatus_12,0m	Internal setting for WindPRO
SampleStatus_12,0m	Status flag on entire sample: 0: OK, 1: disabled, 2: below limit, 4: above limit, 8: duplicate, 16: null value, 32: missing, 128: other error
DataStatus_yyyy_xx,xm	Status flag for parameter yyyy flagged at height xx.x m. Settings as for Sample Status.
DataStatus…..	Datastatus for other parameters.

8.4 Long-term Corrected LIDAR data for 100, 120, 140 and 160 m

The long-term corrected time series at Hesselø FLS at 100, 120, 140 and 160 m ASL (the primary model) are included in the data package.

- Long term corrected Hesselø FLS data Primary Model.txt

Parameters included are wind speed and wind direction. Data format follows the format described above. The text file can be imported directly into WindPRO, but as an open format, it is generally accessible.

Long term time series are calculated for the corner nodes in the Hesselø wind farm zone.

- Primary model North.txt
- Primary model South.txt
- Primary model West.txt

8.5 Alternative calibrated Mesoscale Data

The alternative model described as Calibrated Mesoscale Scale is provided as a time series only for 140 m ASL

- Calibrated Mesoscale Data.txt

Parameters include wind speed, wind direction and temperature. Data format follows the format described above. The text file can be imported directly into WindPRO, but as an open format, it is generally accessible.

8.6 Alternative Læsø Adapted Data.

The alternative model described as Translated Læsø Data is provided as a timeseries only for 140 m ASL.

- Translated Læsø Data.txt

Parameters include wind speed, wind direction. Data format follows the format described above. The text file can be imported directly into WindPRO, but as an open format, it is generally accessible.

9 References

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Appendix A. Raw data import filter, FLS200-E01

Column	Header	First data	Channel	Type	Sub type	Unit	Height	Name	Converted
1	timestamp	28/02/2021 00.00		Time stamp	Date&Time	d-m-y h:m			28/02/2021 01.00
2	lidar_lidar10m_Z10_HorizWS	6,379		Wind speed	Mean	m/s	12	lidar_lidar10m_Z10_HorizWS_Mean	6,38 m/s
3	lidar_lidar10m_Z10_StdDevWS	0,262		Wind speed	StdDev	m/s	12	lidar_lidar10m_Z10_StdDevWS_StdDev	0,26 m/s
4	lidar_lidar10m_Z10_MaxWS	6,982		Wind speed	Max	m/s	12	lidar_lidar10m_Z10_MaxWS_Max	6,98 m/s
5	lidar_lidar10m_Z10_MinWs	5,824		Wind speed	Min	m/s	12	lidar_lidar10m_Z10_MinWs_Min	5,82 m/s
6	lidar_lidar10m_WD_alg_03	266,262		Wind direction	Mean	Degrees	12	lidar_lidar10m_WD_alg_03_Mean	266,3 Degrees
7	lidar_lidar10m_Z10_VertWs	0,074		Wind speed vertical	Mean	m/s	12	lidar_lidar10m_Z10_VertWs_Mean	0,07 m/s
8	lidar_lidar10m_Z10_InfoFlag	4		Other			12	lidar_lidar10m_Z10_InfoFlag	4
9	lidar_lidar10m_Z10_StatFlag	0		Ignore					
10	lidar_lidar10m_Z10_Packets	38		Ignore					
11	lidar_lidar10m_Z10_TurbInt	0,051		Turbulence intensity	Mean		12	lidar_lidar10m_Z10_TurbInt_Mean	0,051
12	lidar_lidar10m_code	1		Ignore					
13	lidar_lidar38m_Z10_HorizWS	8,964		Wind speed	Mean	m/s	40	lidar_lidar38m_Z10_HorizWS_Mean	8,96 m/s
14	lidar_lidar38m_Z10_StdDevWS	0,265		Wind speed	StdDev	m/s	40	lidar_lidar38m_Z10_StdDevWS_StdDev	0,27 m/s
15	lidar_lidar38m_Z10_MaxWS	9,53		Wind speed	Max	m/s	40	lidar_lidar38m_Z10_MaxWS_Max	9,53 m/s
16	lidar_lidar38m_Z10_MinWs	8,416		Wind speed	Min	m/s	40	lidar_lidar38m_Z10_MinWs_Min	8,42 m/s
17	lidar_lidar38m_WD_alg_03	272,082		Wind direction	Mean	Degrees	40	lidar_lidar38m_WD_alg_03_Mean	272,1 Degrees
18	lidar_lidar38m_Z10_VertWs	0,013		Wind speed vertical	Mean	m/s	40	lidar_lidar38m_Z10_VertWs_Mean	0,01 m/s
19	lidar_lidar38m_Z10_InfoFlag	4		Other			40	lidar_lidar38m_Z10_InfoFlag	4
20	lidar_lidar38m_Z10_StatFlag	0		Ignore					
21	lidar_lidar38m_Z10_Packets	38		Ignore					
22	lidar_lidar38m_Z10_TurbInt	0,041		Turbulence intensity	Mean		40	lidar_lidar38m_Z10_TurbInt_Mean	0,041
23	lidar_lidar38m_code	1		CNR/SNR	Mean	dB	40	lidar_lidar38m_code_Mean	1,0 dB
24	lidar_lidar68m_Z10_HorizWS	11,043		Wind speed	Mean	m/s	70	lidar_lidar68m_Z10_HorizWS_Mean	11,04 m/s
25	lidar_lidar68m_Z10_StdDevWS	0,275		Wind speed	StdDev	m/s	70	lidar_lidar68m_Z10_StdDevWS_StdDev	0,28 m/s
26	lidar_lidar68m_Z10_MaxWS	11,571		Wind speed	Max	m/s	70	lidar_lidar68m_Z10_MaxWS_Max	11,57 m/s
27	lidar_lidar68m_Z10_MinWs	10,565		Wind speed	Min	m/s	70	lidar_lidar68m_Z10_MinWs_Min	10,57 m/s
28	lidar_lidar68m_WD_alg_03	279,112		Wind direction	Mean	Degrees	70	lidar_lidar68m_WD_alg_03_Mean	279,1 Degrees
29	lidar_lidar68m_Z10_VertWs	0,049		Wind speed vertical	Mean	m/s	70	lidar_lidar68m_Z10_VertWs_Mean	0,05 m/s
30	lidar_lidar68m_Z10_InfoFlag	4		Other			70	lidar_lidar68m_Z10_InfoFlag	4
31	lidar_lidar68m_Z10_StatFlag	0		Ignore					
32	lidar_lidar68m_Z10_Packets	38		Ignore					
33	lidar_lidar68m_Z10_TurbInt	0,037		Turbulence intensity	Mean		70	lidar_lidar68m_Z10_TurbInt_Mean	0,037
34	lidar_lidar68m_code	1		CNR/SNR	Mean	dB	70	lidar_lidar68m_code_Mean	1,0 dB
35	lidar_lidar98m_Z10_HorizWS	11,554		Wind speed	Mean	m/s	100	lidar_lidar98m_Z10_HorizWS_Mean	11,55 m/s
36	lidar_lidar98m_Z10_StdDevWS	0,284		Wind speed	StdDev	m/s	100	lidar_lidar98m_Z10_StdDevWS_StdDev	0,28 m/s
37	lidar_lidar98m_Z10_MaxWS	11,999		Wind speed	Max	m/s	100	lidar_lidar98m_Z10_MaxWS_Max	12,00 m/s
38	lidar_lidar98m_Z10_MinWs	10,807		Wind speed	Min	m/s	100	lidar_lidar98m_Z10_MinWs_Min	10,81 m/s
39	lidar_lidar98m_WD_alg_03	284,337		Wind direction	Mean	Degrees	100	lidar_lidar98m_WD_alg_03_Mean	284,3 Degrees
40	lidar_lidar98m_Z10_VertWs	0,123		Wind speed vertical	Mean	m/s	100	lidar_lidar98m_Z10_VertWs_Mean	0,12 m/s
41	lidar_lidar98m_Z10_InfoFlag	4		Other			100	lidar_lidar98m_Z10_InfoFlag	4
42	lidar_lidar98m_Z10_StatFlag	0		Ignore					
43	lidar_lidar98m_Z10_Packets	38		Ignore					
44	lidar_lidar98m_Z10_TurbInt	0,039		Turbulence intensity	Mean		100	lidar_lidar98m_Z10_TurbInt_Mean	0,039
45	lidar_lidar98m_code	1		CNR/SNR	Mean	dB	100	lidar_lidar98m_code_Mean	1,0 dB
46	lidar_lidar118m_Z10_HorizWS	11,83		Wind speed	Mean	m/s	120	lidar_lidar118m_Z10_HorizWS_Mean	11,83 m/s
47	lidar_lidar118m_Z10_StdDevWS	0,282		Wind speed	StdDev	m/s	120	lidar_lidar118m_Z10_StdDevWS_StdDev	0,28 m/s
48	lidar_lidar118m_Z10_MaxWS	12,405		Wind speed	Max	m/s	120	lidar_lidar118m_Z10_MaxWS_Max	12,41 m/s
49	lidar_lidar118m_Z10_MinWs	11,288		Wind speed	Min	m/s	120	lidar_lidar118m_Z10_MinWs_Min	11,29 m/s
50	lidar_lidar118m_WD_alg_03	286,412		Wind direction	Mean	Degrees	120	lidar_lidar118m_WD_alg_03_Mean	286,4 Degrees
51	lidar_lidar118m_Z10_VertWs	0,085		Wind speed vertical	Mean	m/s	120	lidar_lidar118m_Z10_VertWs_Mean	0,09 m/s
52	lidar_lidar118m_Z10_InfoFlag	4		Other			120	lidar_lidar118m_Z10_InfoFlag	4
53	lidar_lidar118m_Z10_StatFlag	0		Ignore					
54	lidar_lidar118m_Z10_Packets	38		Ignore					
55	lidar_lidar118m_Z10_TurbInt	0,04		Turbulence intensity	Mean		120	lidar_lidar118m_Z10_TurbInt_Mean	0,04
56	lidar_lidar118m_code	1		CNR/SNR	Mean	dB	120	lidar_lidar118m_code_Mean	1,0 dB
57	lidar_lidar138m_Z10_HorizWS	12,243		Wind speed	Mean	m/s	140	lidar_lidar138m_Z10_HorizWS_Mean	12,24 m/s
58	lidar_lidar138m_Z10_StdDevWS	0,298		Wind speed	StdDev	m/s	140	lidar_lidar138m_Z10_StdDevWS_StdDev	0,30 m/s
59	lidar_lidar138m_Z10_MaxWS	12,895		Wind speed	Max	m/s	140	lidar_lidar138m_Z10_MaxWS_Max	12,90 m/s
60	lidar_lidar138m_Z10_MinWs	11,558		Wind speed	Min	m/s	140	lidar_lidar138m_Z10_MinWs_Min	11,56 m/s
61	lidar_lidar138m_WD_alg_03	289,275		Wind direction	Mean	Degrees	140	lidar_lidar138m_WD_alg_03_Mean	289,3 Degrees
62	lidar_lidar138m_Z10_VertWs	0,094		Wind speed vertical	Mean	m/s	140	lidar_lidar138m_Z10_VertWs_Mean	0,09 m/s
63	lidar_lidar138m_Z10_InfoFlag	4		Other			140	lidar_lidar138m_Z10_InfoFlag	4
64	lidar_lidar138m_Z10_StatFlag	0		Ignore					
65	lidar_lidar138m_Z10_Packets	37		Ignore					
66	lidar_lidar138m_Z10_TurbInt	0,042		Turbulence intensity	Mean		140	lidar_lidar138m_Z10_TurbInt_Mean	0,042
67	lidar_lidar138m_code	1		CNR/SNR	Mean	dB	140	lidar_lidar138m_code_Mean	1,0 dB
68	lidar_lidar158m_Z10_HorizWS	12,67		Wind speed	Mean	m/s	160	lidar_lidar158m_Z10_HorizWS_Mean	12,67 m/s
69	lidar_lidar158m_Z10_StdDevWS	0,344		Wind speed	StdDev	m/s	160	lidar_lidar158m_Z10_StdDevWS_StdDev	0,34 m/s
70	lidar_lidar158m_Z10_MaxWS	13,377		Wind speed	Max	m/s	160	lidar_lidar158m_Z10_MaxWS_Max	13,38 m/s

Column	Header	First data	Channel	Type	Sub type	Unit	Height	Name	Converted
71	lidar_lidar158m_Z10_MinWs	11,7		Wind speed	Min	m/s	160	lidar_lidar158m_Z10_MinWs_Min	11,70 m/s
72	lidar_lidar158m_WD_alg_03	291,632		Wind direction	Mean	Degrees	160	lidar_lidar158m_WD_alg_03_Mean	291,6 Degrees
73	lidar_lidar158m_Z10_VertWs	0,146		Wind speed vertical	Mean	m/s	160	lidar_lidar158m_Z10_VertWs_Mean	0,15 m/s
74	lidar_lidar158m_Z10_InfoFlag	4		Other			160	lidar_lidar158m_Z10_InfoFlag	4
75	lidar_lidar158m_Z10_StatFlag	0		Ignore					
76	lidar_lidar158m_Z10_Packets	38		Ignore					
77	lidar_lidar158m_Z10_TurbInt	0,047		Turbulence intensity	Mean		160	lidar_lidar158m_Z10_TurbInt_Mean	0,047
78	lidar_lidar158m_code	1		CNR/SNR	Mean	dB	160	lidar_lidar158m_code_Mean	1,0 dB
79	lidar_lidar178m_Z10_HorizWS	13,371		Wind speed	Mean	m/s	180	lidar_lidar178m_Z10_HorizWS_Mean	13,37 m/s
80	lidar_lidar178m_Z10_StdDevWS	0,278		Wind speed	StdDev	m/s	180	lidar_lidar178m_Z10_StdDevWS_StdDe	0,28 m/s
81	lidar_lidar178m_Z10_MaxWS	14,146		Wind speed	Max	m/s	180	lidar_lidar178m_Z10_MaxWS_Max	14,15 m/s
82	lidar_lidar178m_Z10_MinWs	12,647		Wind speed	Min	m/s	180	lidar_lidar178m_Z10_MinWs_Min	12,65 m/s
83	lidar_lidar178m_WD_alg_03	294,369		Wind direction	Mean	Degrees	180	lidar_lidar178m_WD_alg_03_Mean	294,4 Degrees
84	lidar_lidar178m_Z10_VertWs	0,163		Wind speed vertical	Mean	m/s	180	lidar_lidar178m_Z10_VertWs_Mean	0,16 m/s
85	lidar_lidar178m_Z10_InfoFlag	4		Other			180	lidar_lidar178m_Z10_InfoFlag	4
86	lidar_lidar178m_Z10_StatFlag	0		Ignore					
87	lidar_lidar178m_Z10_Packets	38		Ignore					
88	lidar_lidar178m_Z10_TurbInt	0,04		Turbulence intensity	Mean		180	lidar_lidar178m_Z10_TurbInt_Mean	0,04
89	lidar_lidar178m_code	1		CNR/SNR	Mean	dB	180	lidar_lidar178m_code_Mean	1,0 dB
90	lidar_lidar198m_Z10_HorizWS	13,984		Wind speed	Mean	m/s	200	lidar_lidar198m_Z10_HorizWS_Mean	13,98 m/s
91	lidar_lidar198m_Z10_StdDevWS	0,325		Wind speed	StdDev	m/s	200	lidar_lidar198m_Z10_StdDevWS_StdDe	0,33 m/s
92	lidar_lidar198m_Z10_MaxWS	14,66		Wind speed	Max	m/s	200	lidar_lidar198m_Z10_MaxWS_Max	14,66 m/s
93	lidar_lidar198m_Z10_MinWs	13,558		Wind speed	Min	m/s	200	lidar_lidar198m_Z10_MinWs_Min	13,56 m/s
94	lidar_lidar198m_WD_alg_03	295,396		Wind direction	Mean	Degrees	200	lidar_lidar198m_WD_alg_03_Mean	295,4 Degrees
95	lidar_lidar198m_Z10_VertWs	0,216		Wind speed vertical	Mean	m/s	200	lidar_lidar198m_Z10_VertWs_Mean	0,22 m/s
96	lidar_lidar198m_Z10_InfoFlag	4		Other			200	lidar_lidar198m_Z10_InfoFlag	4
97	lidar_lidar198m_Z10_StatFlag	0		Ignore					
98	lidar_lidar198m_Z10_Packets	24		Ignore					
99	lidar_lidar198m_Z10_TurbInt	0,045		Turbulence intensity	Mean		200	lidar_lidar198m_Z10_TurbInt_Mean	0,045
100	lidar_lidar198m_code	1		CNR/SNR	Mean	dB	200	lidar_lidar198m_code_Mean	1,0 dB
101	lidar_lidar238m_Z10_HorizWS	9999		Wind speed	Mean	m/s	240	lidar_lidar238m_Z10_HorizonWS_Mean	9.999,00 m/s
102	lidar_lidar238m_Z10_StdDevWS	9999		Wind speed	StdDev	m/s	240	lidar_lidar238m_Z10_StdDevWS_StdDe	9.999,00 m/s
103	lidar_lidar238m_Z10_MaxWS	9999		Wind speed	Max	m/s	240	lidar_lidar238m_Z10_MaxWS_Max	9.999,00 m/s
104	lidar_lidar238m_Z10_MinWs	9999		Wind speed	Min	m/s	240	lidar_lidar238m_Z10_MinWs_Min	9.999,00 m/s
105	lidar_lidar238m_WD_alg_03	9999		Wind direction	Mean	Degrees	240	lidar_lidar238m_WD_alg_03_Mean	9.999,0 Degrees
106	lidar_lidar238m_Z10_VertWs	9999		Wind speed vertical	Mean	m/s	240	lidar_lidar238m_Z10_VertWs_Mean	9.999,00 m/s
107	lidar_lidar238m_Z10_InfoFlag	4		Other			240	lidar_lidar238m_Z10_InfoFlag	4
108	lidar_lidar238m_Z10_StatFlag	0		Ignore					
109	lidar_lidar238m_Z10_Packets	0		Ignore					
110	lidar_lidar238m_Z10_TurbInt	9999		Turbulence intensity	Mean		240	lidar_lidar238m_Z10_TurbInt_Mean	9.999,00
111	lidar_lidar238m_code	2		CNR/SNR	Mean	dB	240	lidar_lidar238m_code_Mean	2,0 dB
112	meteo_Sn_min	3,2		Ignore					
113	meteo_Sm_avg	5,463	Met	Wind speed	Mean	m/s	10	Met_meteo_Sm_avg_Mean	5,46 m/s
114	meteo_Sx_max	6,9		Ignore					
115	meteo_Dir_bear	260,839	Met	Wind direction	Mean	Degrees	10	Met_meteo_Dir_bear_Mean	260,8 Degrees
116	meteo_Ta_avg	2,702	Met	Temperature	Mean	Deg C	10	Met_meteo_Ta_avg_Mean	2,7 Deg C
117	meteo_Ua_avg	100	Met	Relative humidity	Mean	%	10	Met_meteo_Ua_avg_Mean	100,00%
118	meteo_Pa_avg	1033,23	Met	Pressure	Mean	hPa	10	Met_meteo_Pa_avg_Mean	1.033,2 hPa
119	meteo_Rc	0		Precipitation	Mean	mm/h	10	meteo_Rc_Mean	0,0 mm/h
120	meteo_SlrW_Avg	999		Solar irradiation (direc	Mean	W/m²	0	meteo_SlrW_Avg_Mean	999,0 W/m²
121	AHRS_AHRSroll_Max	2,815		Ignore					
122	AHRS_AHRSroll_Min	-5,938		Ignore					
123	AHRS_AHRSpitch_Max	5,442		Ignore					
124	AHRS_AHRSpitch_Min	-4,555		Ignore					
125	AHRS_AHRSyaw_Max	3,197		Ignore					
126	AHRS_AHRSyaw_Min	-4,576		Ignore					
127	buoy_status_CR6S_batt_Avg	NaN	Met	Battery	Mean	V	10	Met_buoy_status_CR6S_batt_Avg_Mean	
128	buoy_status_GPSlat	56,4642		Ignore					

Appendix B. Hesselø FLS200-E01 filtered and repaired dataset

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Calculated:
11/01/2022 09.19

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Frequency distribution (TAB file data)

240,00m - Subst

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			8,92	7,69	7,64	7,17	6,67	8,74	9,11	9,06	9,47	9,79	9,81	9,81	7,82
0		0,49	15	1	2	2	0	1	3	2	1	2	0	0	1
1	0,50	1,49	622	91	43	63	56	33	39	28	42	60	46	41	80
2	1,50	2,49	1149	129	80	96	85	78	102	69	82	109	102	95	122
3	2,50	3,49	2075	164	136	122	148	152	129	176	117	189	266	283	193
4	3,50	4,49	2733	220	217	104	130	135	215	178	198	425	353	328	230
5	4,50	5,49	2737	219	194	113	105	159	187	199	177	341	379	416	248
6	5,50	6,49	2730	226	152	186	150	224	124	210	223	295	334	355	251
7	6,50	7,49	2464	186	169	163	170	212	126	121	216	225	321	305	250
8	7,50	8,49	2694	266	161	108	188	197	114	156	263	293	261	407	280
9	8,50	9,49	2527	228	142	106	139	137	82	158	294	295	357	380	209
10	9,50	10,49	2361	216	117	117	90	92	119	165	278	267	405	315	180
11	10,50	11,49	2062	173	103	121	60	122	120	132	237	282	339	209	164
12	11,50	12,49	1895	141	120	105	42	149	100	104	163	244	364	203	160
13	12,50	13,49	1782	132	94	63	39	147	121	82	104	285	392	222	101
14	13,50	14,49	1344	59	72	19	17	86	120	60	99	223	367	159	63
15	14,50	15,49	1135	59	42	9	7	74	55	76	105	204	284	178	42
16	15,50	16,49	871	35	20	6	2	64	50	49	96	182	187	150	30
17	16,50	17,49	747	12	22	4	3	44	80	28	93	106	151	174	30
18	17,50	18,49	522	2	2	0	0	44	53	18	66	102	59	159	17
19	18,50	19,49	428	2	2	0	0	27	31	20	29	123	45	122	27
20	19,50	20,49	265	1	0	0	0	7	25	57	19	61	30	52	13
21	20,50	21,49	192	2	0	0	0	0	18	48	11	50	20	29	14
22	21,50	22,49	103	0	0	0	0	0	15	21	10	10	23	22	2
23	22,50	23,49	46	0	0	0	0	0	0	18	2	5	7	14	0
24	23,50	24,49	79	0	0	0	0	0	7	10	17	8	6	31	0
25	24,50	25,49	58	0	0	0	0	0	0	1	13	6	7	31	0
26	25,50	26,49	22	0	0	0	0	0	0	0	3	1	2	16	0
27	26,50	27,49	5	0	0	0	0	0	0	0	0	0	1	4	0
28	27,50	28,49	1	0	0	0	0	0	0	0	0	0	1	0	0
29	28,50	29,49	0	0	0	0	0	0	0	0	0	0	0	0	0
30	29,50	30,49	0	0	0	0	0	0	0	0	0	0	0	0	0
31	30,50	31,49	0	0	0	0	0	0	0	0	0	0	0	0	0
32	31,50	32,49	0	0	0	0	0	0	0	0	0	0	0	0	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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Calculated:
11/01/2022 09.19

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Frequency distribution (TAB file data)

200,00m - Subst

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			8,83	7,72	7,55	7,07	6,64	8,61	9,10	8,96	9,36	9,74	9,79	9,46	7,77
0		0,49	8	0	1	0	0	0	3	1	0	1	0	1	1
1	0,50	1,49	662	76	51	70	68	41	44	27	43	71	50	41	80
2	1,50	2,49	1221	138	78	110	78	80	111	79	85	111	103	112	136
3	2,50	3,49	2096	171	159	111	138	141	145	159	134	218	256	299	165
4	3,50	4,49	2628	210	220	97	125	130	192	146	197	419	356	334	202
5	4,50	5,49	2772	235	183	134	109	158	190	189	180	338	401	398	257
6	5,50	6,49	2767	231	165	173	145	258	119	210	231	286	331	346	272
7	6,50	7,49	2551	188	148	189	159	221	132	137	209	255	328	332	253
8	7,50	8,49	2623	279	176	114	172	197	89	162	270	258	249	382	275
9	8,50	9,49	2569	234	146	81	145	127	110	160	289	298	378	383	218
10	9,50	10,49	2407	220	117	118	101	92	117	187	292	274	409	298	182
11	10,50	11,49	2079	170	112	121	62	142	115	144	215	297	333	192	176
12	11,50	12,49	1880	151	138	102	36	132	100	106	155	262	341	209	148
13	12,50	13,49	1724	117	94	57	33	143	117	93	106	278	366	219	101
14	13,50	14,49	1384	70	60	24	11	83	119	68	92	254	388	153	62
15	14,50	15,49	1083	55	35	6	8	84	49	75	89	219	271	162	30
16	15,50	16,49	888	37	20	8	2	68	58	34	99	188	185	161	28
17	16,50	17,49	745	20	17	3	2	55	87	25	103	139	120	151	23
18	17,50	18,49	475	2	3	0	2	24	34	19	57	114	36	164	20
19	18,50	19,49	404	2	0	0	0	17	33	41	30	98	48	112	23
20	19,50	20,49	265	2	0	0	0	2	39	43	18	74	31	41	15
21	20,50	21,49	156	0	0	0	0	0	30	23	12	22	30	31	8
22	21,50	22,49	98	0	0	0	0	0	4	22	3	7	36	25	1
23	22,50	23,49	80	0	0	0	0	0	5	11	25	5	23	11	0
24	23,50	24,49	39	0	0	0	0	0	2	3	15	3	12	4	0
25	24,50	25,49	13	0	0	0	0	0	0	1	2	1	4	5	0
26	25,50	26,49	8	0	0	0	0	0	0	0	0	0	3	5	0
27	26,50	27,49	2	0	0	0	0	0	0	0	0	0	0	2	0
28	27,50	28,49	0	0	0	0	0	0	0	0	0	0	0	0	0
29	28,50	29,49	0	0	0	0	0	0	0	0	0	0	0	0	0
30	29,50	30,49	0	0	0	0	0	0	0	0	0	0	0	0	0
31	30,50	31,49	0	0	0	0	0	0	0	0	0	0	0	0	0
32	31,50	32,49	0	0	0	0	0	0	0	0	0	0	0	0	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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Calculated:
11/01/2022 09.19

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Frequency distribution (TAB file data)

180,00m - Subst

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			8,78	7,66	7,55	7,01	6,67	8,50	9,10	8,82	9,36	9,69	9,72	9,38	7,79
0		0,49	9	2	2	0	0	0	0	2	0	0	0	2	1
1	0,50	1,49	664	77	55	70	64	54	35	32	43	63	63	38	70
2	1,50	2,49	1216	146	66	112	82	77	112	77	73	116	106	125	124
3	2,50	3,49	2142	187	169	118	149	137	154	152	148	230	246	295	157
4	3,50	4,49	2592	200	229	86	114	136	197	134	189	412	358	336	201
5	4,50	5,49	2812	243	174	143	110	144	195	195	185	353	401	400	269
6	5,50	6,49	2835	227	176	172	157	286	122	215	224	292	327	366	271
7	6,50	7,49	2550	180	146	194	172	210	126	140	215	263	319	330	255
8	7,50	8,49	2569	271	182	107	145	186	88	168	277	241	258	376	270
9	8,50	9,49	2607	245	156	88	157	111	117	158	293	294	402	371	215
10	9,50	10,49	2412	222	113	111	107	108	127	199	266	286	403	290	180
11	10,50	11,49	2048	167	101	104	60	136	97	151	218	304	342	190	178
12	11,50	12,49	1900	144	143	107	36	140	99	101	165	249	350	220	146
13	12,50	13,49	1685	115	93	71	41	117	130	90	100	252	373	207	96
14	13,50	14,49	1419	79	69	18	9	86	100	79	104	259	388	161	67
15	14,50	15,49	1064	44	31	7	10	96	64	63	71	230	264	157	27
16	15,50	16,49	904	42	26	5	2	70	66	33	101	175	190	167	27
17	16,50	17,49	684	18	19	0	3	47	81	23	100	148	81	140	24
18	17,50	18,49	462	2	1	0	1	14	25	18	60	122	35	162	22
19	18,50	19,49	435	1	0	0	0	16	46	51	37	103	50	109	22
20	19,50	20,49	265	2	0	0	0	1	41	25	18	75	35	55	13
21	20,50	21,49	142	0	0	0	0	0	21	25	7	11	45	25	8
22	21,50	22,49	93	0	0	0	0	0	3	14	15	10	36	15	0
23	22,50	23,49	61	0	0	0	0	0	8	6	26	2	12	7	0
24	23,50	24,49	18	0	0	0	0	0	0	3	7	1	4	3	0
25	24,50	25,49	13	0	0	0	0	0	0	1	0	0	6	6	0
26	25,50	26,49	6	0	0	0	0	0	0	0	0	0	1	5	0
27	26,50	27,49	2	0	0	0	0	0	0	0	0	0	1	1	0
28	27,50	28,49	0	0	0	0	0	0	0	0	0	0	0	0	0
29	28,50	29,49	0	0	0	0	0	0	0	0	0	0	0	0	0
30	29,50	30,49	0	0	0	0	0	0	0	0	0	0	0	0	0
31	30,50	31,49	0	0	0	0	0	0	0	0	0	0	0	0	0
32	31,50	32,49	0	0	0	0	0	0	0	0	0	0	0	0	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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11/01/2022 09.19

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Frequency distribution (TAB file data)

160,00m - Subst

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			8,72	7,64	7,44	6,96	6,69	8,44	9,08	8,71	9,29	9,68	9,64	9,33	7,72
0		0,49	8	2	1	1	0	0	0	2	0	0	1	0	1
1	0,50	1,49	662	78	59	67	70	48	37	34	41	61	59	38	70
2	1,50	2,49	1253	153	72	117	89	82	110	81	80	114	117	119	119
3	2,50	3,49	2130	183	169	111	162	125	152	149	145	239	245	288	162
4	3,50	4,49	2588	204	225	92	107	142	185	126	205	407	351	343	201
5	4,50	5,49	2890	245	191	160	109	147	196	204	191	347	408	405	287
6	5,50	6,49	2836	230	175	173	155	290	120	212	219	293	338	361	270
7	6,50	7,49	2570	180	159	193	182	204	122	164	219	255	299	323	270
8	7,50	8,49	2590	278	176	101	144	173	101	165	275	254	262	394	267
9	8,50	9,49	2650	253	161	93	168	104	127	160	314	278	423	355	214
10	9,50	10,49	2368	217	110	109	107	118	113	206	266	288	394	262	178
11	10,50	11,49	2034	166	93	99	65	130	96	142	214	314	337	199	179
12	11,50	12,49	1902	130	151	87	44	141	115	114	148	251	358	229	134
13	12,50	13,49	1655	123	88	73	41	109	125	78	104	240	378	196	100
14	13,50	14,49	1421	71	72	28	9	87	88	88	101	271	381	163	62
15	14,50	15,49	1038	42	26	6	13	93	76	56	68	222	251	160	25
16	15,50	16,49	904	47	15	6	4	74	74	33	103	184	180	160	24
17	16,50	17,49	660	19	17	0	4	41	62	27	98	155	63	152	22
18	17,50	18,49	491	3	0	0	0	13	28	30	54	123	45	169	26
19	18,50	19,49	417	2	0	0	0	10	48	40	32	122	51	93	19
20	19,50	20,49	250	0	0	0	0	0	46	22	22	58	49	40	13
21	20,50	21,49	122	0	0	0	0	0	13	18	14	5	43	24	5
22	21,50	22,49	74	0	0	0	0	0	4	11	22	3	23	11	0
23	22,50	23,49	44	0	0	0	0	0	5	4	21	0	7	7	0
24	23,50	24,49	12	0	0	0	0	0	1	2	2	0	3	4	0
25	24,50	25,49	9	0	0	0	0	0	0	0	0	0	5	4	0
26	25,50	26,49	5	0	0	0	0	0	0	0	0	0	1	4	0
27	26,50	27,49	1	0	0	0	0	0	0	0	0	0	0	1	0
28	27,50	28,49	0	0	0	0	0	0	0	0	0	0	0	0	0
29	28,50	29,49	0	0	0	0	0	0	0	0	0	0	0	0	0
30	29,50	30,49	0	0	0	0	0	0	0	0	0	0	0	0	0
31	30,50	31,49	0	0	0	0	0	0	0	0	0	0	0	0	0
32	31,50	32,49	0	0	0	0	0	0	0	0	0	0	0	0	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

Project:
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Calculated:
11/01/2022 09.19

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Frequency distribution (TAB file data)

140,00m - Subst

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			8,63	7,53	7,41	6,80	6,75	8,37	9,09	8,55	9,19	9,60	9,53	9,25	7,70
0		0,49	12	3	1	2	1	0	0	2	0	0	0	1	2
1	0,50	1,49	657	87	51	60	70	43	40	42	42	59	61	41	61
2	1,50	2,49	1280	173	73	116	89	77	111	77	81	126	121	111	125
3	2,50	3,49	2095	190	169	124	145	138	129	144	145	233	245	276	157
4	3,50	4,49	2619	203	228	109	108	149	171	128	207	422	364	335	195
5	4,50	5,49	2946	242	218	144	110	159	196	216	194	345	417	412	293
6	5,50	6,49	2855	210	169	182	169	290	125	202	226	304	357	358	263
7	6,50	7,49	2607	192	166	196	200	187	116	169	224	252	301	319	285
8	7,50	8,49	2631	292	181	102	136	173	109	166	280	267	285	380	260
9	8,50	9,49	2654	254	150	95	169	115	131	160	314	274	408	367	217
10	9,50	10,49	2411	224	119	101	103	126	113	209	275	316	382	263	180
11	10,50	11,49	2014	174	93	102	77	134	88	141	195	287	344	192	187
12	11,50	12,49	1955	128	158	94	47	151	120	121	142	279	358	234	123
13	12,50	13,49	1597	110	86	62	37	78	125	74	120	231	392	178	104
14	13,50	14,49	1378	76	71	13	13	98	89	73	99	253	369	171	53
15	14,50	15,49	1004	33	24	1	10	101	87	39	71	223	238	150	27
16	15,50	16,49	909	50	20	4	5	73	77	31	103	220	154	150	22
17	16,50	17,49	618	17	10	0	4	31	41	32	84	149	56	168	26
18	17,50	18,49	502	2	0	0	0	16	45	37	47	111	56	162	26
19	18,50	19,49	405	1	0	0	0	3	53	28	39	136	56	73	16
20	19,50	20,49	212	0	0	0	0	0	28	31	19	29	61	32	12
21	20,50	21,49	86	0	0	0	0	0	6	8	18	5	29	17	3
22	21,50	22,49	62	0	0	0	0	0	8	7	28	0	14	5	0
23	22,50	23,49	27	0	0	0	0	0	2	5	8	0	6	6	0
24	23,50	24,49	7	0	0	0	0	0	0	0	0	0	2	5	0
25	24,50	25,49	8	0	0	0	0	0	0	0	0	0	3	5	0
26	25,50	26,49	5	0	0	0	0	0	0	0	0	0	2	3	0
27	26,50	27,49	0	0	0	0	0	0	0	0	0	0	0	0	0
28	27,50	28,49	0	0	0	0	0	0	0	0	0	0	0	0	0
29	28,50	29,49	0	0	0	0	0	0	0	0	0	0	0	0	0
30	29,50	30,49	0	0	0	0	0	0	0	0	0	0	0	0	0
31	30,50	31,49	0	0	0	0	0	0	0	0	0	0	0	0	0
32	31,50	32,49	0	0	0	0	0	0	0	0	0	0	0	0	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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Calculated:
11/01/2022 09.19

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Frequency distribution (TAB file data)

120,00m - Subst

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			8,54	7,47	7,37	6,66	6,78	8,27	9,02	8,44	9,12	9,46	9,40	9,17	7,61
0		0,49	8	3	0	0	0	1	0	0	1	0	2	0	1
1	0,50	1,49	664	80	56	66	58	42	42	44	46	65	54	45	66
2	1,50	2,49	1295	173	61	114	96	78	109	79	84	118	131	120	132
3	2,50	3,49	2078	203	171	121	135	145	116	132	149	256	240	255	155
4	3,50	4,49	2660	195	238	114	127	147	179	125	206	418	370	337	204
5	4,50	5,49	3002	254	234	143	122	158	193	206	201	359	416	427	289
6	5,50	6,49	2882	215	163	187	184	274	133	216	231	300	366	336	277
7	6,50	7,49	2649	200	153	187	208	184	115	174	230	260	312	329	297
8	7,50	8,49	2708	302	199	112	145	178	125	163	285	274	295	371	259
9	8,50	9,49	2635	256	140	102	156	118	124	168	315	273	421	348	214
10	9,50	10,49	2407	231	111	90	101	125	102	213	289	320	373	271	181
11	10,50	11,49	2044	184	125	92	84	133	105	156	194	269	331	192	179
12	11,50	12,49	1978	120	145	100	44	150	138	102	156	268	375	241	139
13	12,50	13,49	1566	97	91	42	35	81	102	92	136	246	373	175	96
14	13,50	14,49	1320	66	67	4	18	107	97	53	84	256	371	151	46
15	14,50	15,49	996	30	18	2	14	90	86	42	83	233	221	156	21
16	15,50	16,49	861	58	21	3	6	59	73	34	106	194	127	153	27
17	16,50	17,49	610	13	3	0	3	27	42	34	69	167	58	167	27
18	17,50	18,49	498	1	0	0	0	13	54	30	54	119	61	144	22
19	18,50	19,49	360	0	0	0	0	0	50	27	35	101	65	67	15
20	19,50	20,49	137	0	0	0	0	0	14	17	21	9	39	26	11
21	20,50	21,49	80	0	0	0	0	0	5	11	26	2	23	12	1
22	21,50	22,49	47	0	0	0	0	0	7	3	18	0	11	8	0
23	22,50	23,49	12	0	0	0	0	0	0	1	1	0	3	7	0
24	23,50	24,49	8	0	0	0	0	0	0	0	0	0	4	4	0
25	24,50	25,49	5	0	0	0	0	0	0	0	0	0	1	4	0
26	25,50	26,49	5	0	0	0	0	0	0	0	0	0	2	3	0
27	26,50	27,49	0	0	0	0	0	0	0	0	0	0	0	0	0
28	27,50	28,49	0	0	0	0	0	0	0	0	0	0	0	0	0
29	28,50	29,49	0	0	0	0	0	0	0	0	0	0	0	0	0
30	29,50	30,49	0	0	0	0	0	0	0	0	0	0	0	0	0
31	30,50	31,49	0	0	0	0	0	0	0	0	0	0	0	0	0
32	31,50	32,49	0	0	0	0	0	0	0	0	0	0	0	0	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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Calculated:
11/01/2022 09.19

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Frequency distribution (TAB file data)

100,00m - Subst

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			8,42	7,44	7,25	6,41	6,85	8,16	8,94	8,29	8,96	9,30	9,29	9,08	7,48
0		0,49	11	2	1	1	0	2	0	1	1	0	0	1	2
1	0,50	1,49	665	81	62	71	51	45	32	38	47	59	49	54	76
2	1,50	2,49	1260	152	69	118	78	82	110	67	98	129	127	104	126
3	2,50	3,49	2132	216	153	133	157	158	120	127	158	250	251	254	155
4	3,50	4,49	2713	196	256	116	132	142	175	115	219	417	389	329	227
5	4,50	5,49	3055	260	254	148	132	164	186	207	210	385	408	418	283
6	5,50	6,49	2907	211	157	192	199	278	138	214	231	306	369	326	286
7	6,50	7,49	2725	246	160	178	214	187	113	170	239	258	340	334	286
8	7,50	8,49	2775	307	196	111	148	177	111	164	321	274	296	381	289
9	8,50	9,49	2669	252	145	102	162	114	143	188	312	294	414	329	214
10	9,50	10,49	2344	230	105	81	93	124	93	195	281	311	370	269	192
11	10,50	11,49	2114	189	158	89	81	163	109	157	214	241	347	215	151
12	11,50	12,49	1917	130	137	78	51	140	133	84	172	282	368	209	133
13	12,50	13,49	1549	86	83	32	32	91	103	89	142	243	376	173	99
14	13,50	14,49	1253	55	53	1	26	111	96	43	80	260	335	158	35
15	14,50	15,49	980	36	22	0	19	85	81	29	92	230	219	147	20
16	15,50	16,49	815	53	13	4	8	50	69	39	79	195	124	152	29
17	16,50	17,49	632	9	1	0	1	25	58	27	88	171	63	162	27
18	17,50	18,49	468	1	0	0	0	5	47	29	46	131	62	130	17
19	18,50	19,49	247	0	0	0	0	0	34	24	34	35	53	54	13
20	19,50	20,49	109	0	0	0	0	0	10	15	16	3	36	20	9
21	20,50	21,49	75	0	0	0	0	0	10	3	29	1	19	12	1
22	21,50	22,49	20	0	0	0	0	0	0	0	6	0	6	8	0
23	22,50	23,49	7	0	0	0	0	0	0	0	0	0	2	5	0
24	23,50	24,49	8	0	0	0	0	0	0	0	0	0	3	5	0
25	24,50	25,49	6	0	0	0	0	0	0	0	0	0	3	3	0
26	25,50	26,49	2	0	0	0	0	0	0	0	0	0	1	1	0
27	26,50	27,49	0	0	0	0	0	0	0	0	0	0	0	0	0
28	27,50	28,49	0	0	0	0	0	0	0	0	0	0	0	0	0
29	28,50	29,49	0	0	0	0	0	0	0	0	0	0	0	0	0
30	29,50	30,49	0	0	0	0	0	0	0	0	0	0	0	0	0
31	30,50	31,49	0	0	0	0	0	0	0	0	0	0	0	0	0
32	31,50	32,49	0	0	0	0	0	0	0	0	0	0	0	0	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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Calculated:
11/01/2022 09.19

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Frequency distribution (TAB file data)

70,00m -

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			8,18	7,27	6,92	6,21	6,81	7,99	8,76	8,00	8,73	8,77	9,12	8,94	7,27
0		0,49	6	3	1	0	1	0	0	0	0	1	0	0	0
1	0,50	1,49	660	95	68	61	45	27	35	40	49	57	51	44	88
2	1,50	2,49	1282	142	75	119	79	95	100	65	105	145	120	102	135
3	2,50	3,49	2142	177	190	133	148	146	134	127	182	230	267	262	146
4	3,50	4,49	2796	241	260	136	129	154	163	115	208	424	404	317	245
5	4,50	5,49	3217	256	258	156	170	201	176	233	238	429	389	416	295
6	5,50	6,49	3022	234	171	194	226	267	141	205	256	316	377	306	329
7	6,50	7,49	2867	280	161	169	213	184	98	166	258	288	354	376	320
8	7,50	8,49	2818	295	204	108	165	160	141	166	345	292	288	365	289
9	8,50	9,49	2727	252	129	100	149	127	134	204	349	318	412	323	230
10	9,50	10,49	2329	244	122	78	97	150	86	198	280	279	365	266	164
11	10,50	11,49	2163	181	161	83	69	171	126	147	246	257	363	204	155
12	11,50	12,49	1896	116	129	68	63	140	137	85	172	295	372	198	121
13	12,50	13,49	1521	74	48	8	41	118	105	62	130	319	383	160	73
14	13,50	14,49	1136	39	27	0	25	96	106	38	96	216	317	146	30
15	14,50	15,49	920	43	25	1	13	57	76	33	97	211	196	136	32
16	15,50	16,49	774	39	7	3	4	33	78	21	120	171	114	156	28
17	16,50	17,49	418	2	0	0	1	9	39	25	54	66	62	140	20
18	17,50	18,49	339	0	0	0	0	1	41	33	26	50	55	118	15
19	18,50	19,49	151	0	0	0	0	0	17	13	18	8	38	42	15
20	19,50	20,49	74	0	0	0	0	0	4	4	31	1	18	13	3
21	20,50	21,49	33	0	0	0	0	0	0	0	8	0	15	10	0
22	21,50	22,49	11	0	0	0	0	0	0	0	0	0	2	9	0
23	22,50	23,49	5	0	0	0	0	0	0	0	0	0	1	4	0
24	23,50	24,49	10	0	0	0	0	0	0	0	0	0	4	6	0
25	24,50	25,49	3	0	0	0	0	0	0	0	0	0	2	1	0
26	25,50	26,49	1	0	0	0	0	0	0	0	0	0	0	1	0
27	26,50	27,49	0	0	0	0	0	0	0	0	0	0	0	0	0
28	27,50	28,49	0	0	0	0	0	0	0	0	0	0	0	0	0
29	28,50	29,49	0	0	0	0	0	0	0	0	0	0	0	0	0
30	29,50	30,49	0	0	0	0	0	0	0	0	0	0	0	0	0
31	30,50	31,49	0	0	0	0	0	0	0	0	0	0	0	0	0
32	31,50	32,49	0	0	0	0	0	0	0	0	0	0	0	0	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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Calculated:
11/01/2022 09.19

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Frequency distribution (TAB file data)

40,00m -

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			7,72	6,94	6,41	5,80	6,46	7,68	8,15	7,64	8,10	8,06	8,73	8,57	6,94
0		0,49	2	0	0	0	0	0	0	1	0	0	1	0	0
1	0,50	1,49	646	79	64	58	44	23	25	40	57	58	69	39	90
2	1,50	2,49	1377	144	89	128	88	105	117	59	108	152	130	124	133
3	2,50	3,49	2359	206	201	154	138	151	133	154	199	291	278	291	163
4	3,50	4,49	3076	233	280	154	161	179	168	137	273	453	435	338	265
5	4,50	5,49	3554	311	288	157	228	233	177	224	347	423	417	408	341
6	5,50	6,49	3336	254	200	219	246	254	147	216	295	354	414	353	384
7	6,50	7,49	2936	299	176	133	224	157	134	175	346	300	306	367	319
8	7,50	8,49	2904	285	177	107	142	156	135	182	431	344	304	345	296
9	8,50	9,49	2685	275	129	93	157	170	145	223	335	293	406	278	181
10	9,50	10,49	2410	222	129	79	67	208	127	195	302	271	364	269	177
11	10,50	11,49	2200	158	117	63	72	210	140	152	264	371	349	167	137
12	11,50	12,49	1701	86	65	29	53	152	106	74	166	319	363	198	90
13	12,50	13,49	1234	39	39	0	24	71	101	47	131	233	370	121	58
14	13,50	14,49	1017	31	21	1	16	61	87	18	153	153	298	152	26
15	14,50	15,49	704	43	14	2	7	39	72	21	79	100	155	138	34
16	15,50	16,49	450	14	0	1	3	14	36	22	25	74	81	158	22
17	16,50	17,49	348	1	0	0	0	1	28	29	23	50	47	152	17
18	17,50	18,49	182	0	0	0	0	0	14	17	21	15	41	59	15
19	18,50	19,49	86	0	0	0	0	0	1	7	26	0	25	21	6
20	19,50	20,49	33	0	0	0	0	0	0	0	7	1	16	9	0
21	20,50	21,49	12	0	0	0	0	0	0	0	0	0	2	10	0
22	21,50	22,49	8	0	0	0	0	0	0	0	0	0	4	4	0
23	22,50	23,49	8	0	0	0	0	0	0	0	0	0	3	5	0
24	23,50	24,49	2	0	0	0	0	0	0	0	0	0	1	1	0
25	24,50	25,49	1	0	0	0	0	0	0	0	0	0	0	1	0
26	25,50	26,49	0	0	0	0	0	0	0	0	0	0	0	0	0
27	26,50	27,49	0	0	0	0	0	0	0	0	0	0	0	0	0
28	27,50	28,49	0	0	0	0	0	0	0	0	0	0	0	0	0
29	28,50	29,49	0	0	0	0	0	0	0	0	0	0	0	0	0
30	29,50	30,49	0	0	0	0	0	0	0	0	0	0	0	0	0
31	30,50	31,49	0	0	0	0	0	0	0	0	0	0	0	0	0
32	31,50	32,49	0	0	0	0	0	0	0	0	0	0	0	0	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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Calculated:
11/01/2022 09.19

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Frequency distribution (TAB file data)

12,00m -

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			6,95	6,20	5,84	5,22	5,86	6,84	7,15	6,75	7,20	7,18	8,01	7,90	6,24
0		0,49	1	0	0	0	0	0	0	0	1	0	0	0	0
1	0,50	1,49	786	96	67	71	45	34	33	47	67	74	84	64	104
2	1,50	2,49	1665	176	107	138	115	128	120	102	118	191	150	150	170
3	2,50	3,49	2862	254	260	185	179	187	121	164	259	330	359	330	234
4	3,50	4,49	3588	262	301	186	248	225	225	161	327	475	489	366	323
5	4,50	5,49	3990	359	283	217	230	221	188	291	398	463	472	431	437
6	5,50	6,49	3525	316	197	155	279	247	175	255	415	350	415	338	383
7	6,50	7,49	3220	360	173	145	201	204	192	226	412	356	275	361	315
8	7,50	8,49	3111	246	156	112	152	262	158	248	440	368	381	343	245
9	8,50	9,49	2700	262	100	56	110	246	113	209	364	350	415	296	179
10	9,50	10,49	2201	146	117	52	80	193	114	157	264	377	372	199	130
11	10,50	11,49	1692	67	80	41	44	84	107	71	203	291	403	202	99
12	11,50	12,49	1224	35	40	1	34	60	102	19	156	136	430	146	65
13	12,50	13,49	892	29	20	0	15	60	78	8	69	117	300	159	37
14	13,50	14,49	653	43	12	3	4	24	40	25	36	100	154	188	24
15	14,50	15,49	428	7	1	0	0	13	28	26	31	58	56	184	24
16	15,50	16,49	262	0	0	0	0	1	18	21	24	29	48	99	22
17	16,50	17,49	100	0	0	0	0	0	1	13	30	3	26	23	4
18	17,50	18,49	34	0	0	0	0	0	0	0	2	1	14	17	0
19	18,50	19,49	16	0	0	0	0	0	0	0	0	0	7	9	0
20	19,50	20,49	8	0	0	0	0	0	0	0	0	0	2	6	0
21	20,50	21,49	5	0	0	0	0	0	0	0	0	0	4	1	0
22	21,50	22,49	1	0	0	0	0	0	0	0	0	0	1	0	0
23	22,50	23,49	0	0	0	0	0	0	0	0	0	0	0	0	0
24	23,50	24,49	0	0	0	0	0	0	0	0	0	0	0	0	0
25	24,50	25,49	0	0	0	0	0	0	0	0	0	0	0	0	0
26	25,50	26,49	0	0	0	0	0	0	0	0	0	0	0	0	0
27	26,50	27,49	0	0	0	0	0	0	0	0	0	0	0	0	0
28	27,50	28,49	0	0	0	0	0	0	0	0	0	0	0	0	0
29	28,50	29,49	0	0	0	0	0	0	0	0	0	0	0	0	0
30	29,50	30,49	0	0	0	0	0	0	0	0	0	0	0	0	0
31	30,50	31,49	0	0	0	0	0	0	0	0	0	0	0	0	0
32	31,50	32,49	0	0	0	0	0	0	0	0	0	0	0	0	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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11/01/2022 09.19

Meteo data report - Mean turbulence

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Mean turbulence

240,00m - Subst

Bin	Start	End	Mean	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			0,08	0,08	0,08	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,08
0		0,49													
1	0,50	1,49	0,06	0,08	0,06	0,06	0,05			0,08	0,05				0,06
2	1,50	2,49	0,06	0,07	0,07	0,05	0,05	0,08	0,10	0,05	0,06			0,04	0,07
3	2,50	3,49	0,06	0,06	0,06	0,07	0,06	0,07	0,06	0,06	0,06	0,06	0,05	0,06	0,06
4	3,50	4,49	0,09	0,08	0,08	0,08	0,08	0,08	0,09	0,09	0,08	0,09	0,09	0,10	0,09
5	4,50	5,49	0,09	0,08	0,09	0,09	0,08	0,08	0,09	0,09	0,10	0,09	0,10	0,10	0,09
6	5,50	6,49	0,08	0,08	0,08	0,08	0,08	0,07	0,08	0,08	0,08	0,09	0,09	0,08	0,08
7	6,50	7,49	0,08	0,08	0,07	0,08	0,09	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,08
8	7,50	8,49	0,08	0,08	0,08	0,09	0,08	0,08	0,07	0,08	0,08	0,08	0,08	0,08	0,07
9	8,50	9,49	0,08	0,07	0,07	0,09	0,08	0,08	0,07	0,08	0,08	0,08	0,08	0,08	0,07
10	9,50	10,49	0,08	0,08	0,08	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,08
11	10,50	11,49	0,08	0,07	0,08	0,07	0,07	0,07	0,07	0,08	0,08	0,07	0,08	0,08	0,08
12	11,50	12,49	0,08	0,07	0,07	0,08	0,08	0,07	0,06	0,07	0,07	0,07	0,08	0,08	0,08
13	12,50	13,49	0,08	0,07	0,07	0,07	0,07	0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,09
14	13,50	14,49	0,08	0,07	0,07	0,07	0,09	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,09
15	14,50	15,49	0,08	0,07	0,07	0,09	0,10	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,09
16	15,50	16,49	0,08	0,08	0,08	0,09	0,11	0,08	0,07	0,07	0,07	0,07	0,08	0,08	0,09
17	16,50	17,49	0,08	0,09	0,08	0,09	0,09	0,07	0,07	0,08	0,07	0,07	0,08	0,08	0,09
18	17,50	18,49	0,08	0,07	0,08			0,07	0,07	0,08	0,07	0,07	0,09	0,08	0,08
19	18,50	19,49	0,08	0,07	0,09			0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08
20	19,50	20,49	0,08	0,07				0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,09
21	20,50	21,49	0,08	0,07					0,07	0,07	0,07	0,07	0,09	0,08	0,09
22	21,50	22,49	0,08						0,07	0,07	0,08	0,08	0,08	0,09	0,08
23	22,50	23,49	0,08							0,07	0,08	0,08	0,09	0,09	
24	23,50	24,49	0,08						0,08	0,08	0,08	0,08	0,09	0,09	
25	24,50	25,49	0,08							0,09	0,08	0,08	0,09	0,09	
26	25,50	26,49	0,09								0,08	0,07	0,09	0,09	
27	26,50	27,49	0,09										0,10	0,09	
28	27,50	28,49	0,10										0,10		
29	28,50	29,49													
30	29,50	30,49													
31	30,50	31,49													
32	31,50	32,49													
33	32,50	33,49													
34	33,50	34,49													
35	34,50	35,49													
36	35,50	36,49													
37	36,50	37,49													
38	37,50	38,49													
39	38,50	39,49													
40	39,50	40,49													
41	40,50														

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Calculated:
11/01/2022 09.19

Meteo data report - Mean turbulence

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Mean turbulence

200,00m - Subst

Bin	Start	End	Mean	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,07	0,08	0,08	0,08
0		0,49													
1	0,50	1,49	0,07	0,06	0,06								0,12		
2	1,50	2,49	0,06	0,07	0,07	0,05	0,05	0,09	0,09	0,07	0,06		0,06	0,04	0,07
3	2,50	3,49	0,06	0,07	0,06	0,05	0,06	0,07	0,06	0,05	0,06	0,06	0,06	0,07	0,06
4	3,50	4,49	0,09	0,08	0,08	0,08	0,08	0,08	0,08	0,09	0,08	0,08	0,09	0,10	0,09
5	4,50	5,49	0,09	0,08	0,08	0,09	0,08	0,08	0,08	0,08	0,09	0,09	0,09	0,10	0,09
6	5,50	6,49	0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,09	0,08	0,08
7	6,50	7,49	0,08	0,07	0,07	0,08	0,09	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,08
8	7,50	8,49	0,08	0,07	0,07	0,09	0,08	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,07
9	8,50	9,49	0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,07	0,08	0,08	0,07
10	9,50	10,49	0,08	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08
11	10,50	11,49	0,07	0,07	0,07	0,07	0,08	0,07	0,07	0,07	0,08	0,07	0,08	0,08	0,07
12	11,50	12,49	0,07	0,07	0,07	0,08	0,08	0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,07
13	12,50	13,49	0,07	0,07	0,07	0,07	0,07	0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,08
14	13,50	14,49	0,07	0,07	0,07	0,07	0,10	0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,08
15	14,50	15,49	0,07	0,07	0,07	0,08	0,10	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,09
16	15,50	16,49	0,08	0,08	0,07	0,09	0,11	0,07	0,07	0,06	0,07	0,07	0,08	0,08	0,09
17	16,50	17,49	0,07	0,08	0,08	0,09	0,10	0,07	0,06	0,08	0,06	0,07	0,08	0,08	0,08
18	17,50	18,49	0,08	0,06	0,09		0,09	0,07	0,07	0,07	0,07	0,07	0,09	0,08	0,09
19	18,50	19,49	0,07	0,06				0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,08
20	19,50	20,49	0,07	0,07				0,05	0,07	0,07	0,07	0,07	0,08	0,08	0,09
21	20,50	21,49	0,08						0,07	0,07	0,08	0,07	0,08	0,09	0,09
22	21,50	22,49	0,08						0,07	0,07	0,08	0,08	0,08	0,09	0,09
23	22,50	23,49	0,08						0,08	0,07	0,08	0,08	0,08	0,09	
24	23,50	24,49	0,08						0,08	0,08	0,08	0,08	0,08	0,10	
25	24,50	25,49	0,09							0,09	0,08	0,08	0,09	0,09	
26	25,50	26,49	0,09										0,09	0,09	
27	26,50	27,49	0,11											0,11	
28	27,50	28,49													
29	28,50	29,49													
30	29,50	30,49													
31	30,50	31,49													
32	31,50	32,49													
33	32,50	33,49													
34	33,50	34,49													
35	34,50	35,49													
36	35,50	36,49													
37	36,50	37,49													
38	37,50	38,49													
39	38,50	39,49													
40	39,50	40,49													
41	40,50														

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Calculated:
11/01/2022 09.19

Meteo data report - Mean turbulence

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Mean turbulence

180,00m - Subst

Bin	Start	End	Mean	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08
0		0,49													
1	0,50	1,49	0,05		0,04	0,06									
2	1,50	2,49	0,06	0,05	0,08	0,06	0,05	0,07	0,08				0,06	0,04	0,07
3	2,50	3,49	0,06	0,06	0,07	0,06	0,06	0,08	0,07	0,07	0,06	0,07	0,06	0,06	0,06
4	3,50	4,49	0,09	0,08	0,08	0,08	0,08	0,08	0,09	0,08	0,09	0,08	0,09	0,10	0,09
5	4,50	5,49	0,09	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,09	0,09	0,09	0,10	0,09
6	5,50	6,49	0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,09	0,08	0,08
7	6,50	7,49	0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,07
8	7,50	8,49	0,08	0,07	0,07	0,08	0,08	0,07	0,06	0,08	0,08	0,08	0,08	0,08	0,07
9	8,50	9,49	0,07	0,07	0,07	0,08	0,08	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,07
10	9,50	10,49	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08
11	10,50	11,49	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,07
12	11,50	12,49	0,07	0,07	0,07	0,07	0,08	0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,07
13	12,50	13,49	0,07	0,07	0,06	0,07	0,07	0,06	0,07	0,06	0,07	0,07	0,08	0,08	0,08
14	13,50	14,49	0,07	0,07	0,07	0,07	0,09	0,06	0,06	0,07	0,07	0,06	0,08	0,08	0,08
15	14,50	15,49	0,07	0,07	0,07	0,08	0,11	0,07	0,07	0,06	0,07	0,07	0,08	0,08	0,09
16	15,50	16,49	0,07	0,08	0,07	0,09	0,10	0,07	0,06	0,07	0,07	0,07	0,08	0,08	0,09
17	16,50	17,49	0,07	0,08	0,08		0,09	0,07	0,06	0,08	0,06	0,07	0,08	0,08	0,09
18	17,50	18,49	0,08	0,06	0,09		0,08	0,07	0,06	0,07	0,07	0,07	0,09	0,08	0,08
19	18,50	19,49	0,07	0,06				0,06	0,06	0,07	0,06	0,07	0,07	0,08	0,08
20	19,50	20,49	0,07	0,07				0,06	0,07	0,08	0,07	0,07	0,08	0,09	0,09
21	20,50	21,49	0,08						0,07	0,07	0,07	0,08	0,08	0,09	0,10
22	21,50	22,49	0,08						0,08	0,07	0,08	0,08	0,08	0,09	
23	22,50	23,49	0,08						0,08	0,07	0,08	0,08	0,08	0,08	
24	23,50	24,49	0,08							0,08	0,08	0,09	0,07	0,09	
25	24,50	25,49	0,09							0,08			0,08	0,10	
26	25,50	26,49	0,09										0,09	0,09	
27	26,50	27,49	0,08										0,08	0,09	
28	27,50	28,49													
29	28,50	29,49													
30	29,50	30,49													
31	30,50	31,49													
32	31,50	32,49													
33	32,50	33,49													
34	33,50	34,49													
35	34,50	35,49													
36	35,50	36,49													
37	36,50	37,49													
38	37,50	38,49													
39	38,50	39,49													
40	39,50	40,49													
41	40,50														

Project:
Hesselø

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Thomas Sørensen / ts@emd.dk
Calculated:
11/01/2022 09.19

Meteo data report - Mean turbulence

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Mean turbulence

160,00m - Subst

Bin	Start	End	Mean	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08
0		0,49													
1	0,50	1,49	0,07			0,07									
2	1,50	2,49	0,07	0,04	0,04	0,05	0,06		0,11				0,35	0,07	0,06
3	2,50	3,49	0,07	0,06	0,07	0,06	0,06	0,07	0,07	0,07	0,06	0,06	0,06	0,08	0,05
4	3,50	4,49	0,09	0,08	0,08	0,08	0,08	0,08	0,09	0,08	0,09	0,08	0,09	0,09	0,08
5	4,50	5,49	0,09	0,07	0,08	0,08	0,08	0,09	0,08	0,08	0,09	0,09	0,09	0,10	0,09
6	5,50	6,49	0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,09	0,08	0,08
7	6,50	7,49	0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,07
8	7,50	8,49	0,07	0,07	0,07	0,08	0,08	0,08	0,07	0,08	0,08	0,07	0,08	0,08	0,07
9	8,50	9,49	0,07	0,07	0,07	0,08	0,08	0,07	0,06	0,07	0,07	0,07	0,08	0,08	0,07
10	9,50	10,49	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,07
11	10,50	11,49	0,07	0,07	0,07	0,07	0,08	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,07
12	11,50	12,49	0,07	0,07	0,07	0,07	0,08	0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,07
13	12,50	13,49	0,07	0,07	0,06	0,07	0,07	0,06	0,07	0,06	0,07	0,07	0,08	0,08	0,08
14	13,50	14,49	0,07	0,07	0,07	0,07	0,09	0,06	0,06	0,06	0,06	0,06	0,08	0,08	0,08
15	14,50	15,49	0,07	0,07	0,07	0,08	0,10	0,07	0,06	0,06	0,07	0,06	0,08	0,08	0,09
16	15,50	16,49	0,07	0,08	0,08	0,09	0,10	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,09
17	16,50	17,49	0,07	0,07	0,08		0,10	0,07	0,06	0,07	0,06	0,07	0,08	0,08	0,09
18	17,50	18,49	0,07	0,06				0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,08
19	18,50	19,49	0,07	0,06				0,06	0,06	0,07	0,07	0,07	0,08	0,09	0,08
20	19,50	20,49	0,07						0,07	0,07	0,07	0,06	0,08	0,08	0,10
21	20,50	21,49	0,08						0,07	0,07	0,08	0,08	0,07	0,09	0,09
22	21,50	22,49	0,08						0,07	0,07	0,08	0,08	0,08	0,10	
23	22,50	23,49	0,08						0,08	0,08	0,08		0,08	0,09	
24	23,50	24,49	0,08						0,08	0,08	0,08		0,08	0,09	
25	24,50	25,49	0,09										0,09	0,10	
26	25,50	26,49	0,10										0,09	0,10	
27	26,50	27,49	0,11											0,11	
28	27,50	28,49													
29	28,50	29,49													
30	29,50	30,49													
31	30,50	31,49													
32	31,50	32,49													
33	32,50	33,49													
34	33,50	34,49													
35	34,50	35,49													
36	35,50	36,49													
37	36,50	37,49													
38	37,50	38,49													
39	38,50	39,49													
40	39,50	40,49													
41	40,50														

Project:
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Calculated:
11/01/2022 09.19

Meteo data report - Mean turbulence

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Mean turbulence

140,00m - Subst

Bin	Start	End	Mean	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08
0		0,49													
1	0,50	1,49	0,05			0,05									
2	1,50	2,49	0,07	0,04	0,06	0,05	0,06						0,35		0,07
3	2,50	3,49	0,06	0,06	0,05	0,07	0,06	0,08	0,05		0,05	0,06	0,06	0,05	0,05
4	3,50	4,49	0,08	0,07	0,08	0,08	0,07	0,09	0,09	0,08	0,09	0,08	0,09	0,09	0,08
5	4,50	5,49	0,08	0,07	0,08	0,08	0,08	0,08	0,08	0,08	0,09	0,09	0,09	0,10	0,09
6	5,50	6,49	0,08	0,07	0,07	0,08	0,07	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,08
7	6,50	7,49	0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,07
8	7,50	8,49	0,07	0,07	0,07	0,08	0,08	0,08	0,06	0,08	0,08	0,07	0,08	0,08	0,07
9	8,50	9,49	0,07	0,07	0,07	0,07	0,08	0,07	0,06	0,07	0,07	0,07	0,08	0,08	0,07
10	9,50	10,49	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,07
11	10,50	11,49	0,07	0,07	0,07	0,07	0,08	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,07
12	11,50	12,49	0,07	0,07	0,07	0,07	0,07	0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,08
13	12,50	13,49	0,07	0,07	0,07	0,07	0,07	0,06	0,07	0,06	0,06	0,07	0,08	0,08	0,08
14	13,50	14,49	0,07	0,07	0,07	0,07	0,08	0,06	0,06	0,06	0,07	0,06	0,08	0,08	0,08
15	14,50	15,49	0,07	0,08	0,08	0,08	0,09	0,07	0,06	0,06	0,07	0,06	0,08	0,08	0,09
16	15,50	16,49	0,07	0,08	0,08	0,09	0,11	0,07	0,06	0,07	0,07	0,06	0,08	0,08	0,09
17	16,50	17,49	0,07	0,07	0,07		0,10	0,07	0,06	0,07	0,06	0,07	0,09	0,08	0,09
18	17,50	18,49	0,07	0,05				0,06	0,06	0,07	0,07	0,07	0,07	0,08	0,08
19	18,50	19,49	0,07	0,07				0,05	0,07	0,08	0,06	0,07	0,08	0,09	0,09
20	19,50	20,49	0,08						0,07	0,07	0,07	0,06	0,08	0,09	0,10
21	20,50	21,49	0,08						0,07	0,07	0,08	0,09	0,08	0,09	0,09
22	21,50	22,49	0,08						0,08	0,07	0,08		0,08	0,09	
23	22,50	23,49	0,08						0,08	0,07	0,08		0,08	0,09	
24	23,50	24,49	0,10										0,09	0,10	
25	24,50	25,49	0,10										0,10	0,10	
26	25,50	26,49	0,09										0,09	0,10	
27	26,50	27,49													
28	27,50	28,49													
29	28,50	29,49													
30	29,50	30,49													
31	30,50	31,49													
32	31,50	32,49													
33	32,50	33,49													
34	33,50	34,49													
35	34,50	35,49													
36	35,50	36,49													
37	36,50	37,49													
38	37,50	38,49													
39	38,50	39,49													
40	39,50	40,49													
41	40,50														

Project:
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Thomas Sørensen / ts@emd.dk
Calculated:
11/01/2022 09.19

Meteo data report - Mean turbulence

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Mean turbulence

120,00m - Subst

Bin	Start	End	Mean	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			0,08	0,07	0,07	0,07	0,08	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08
0		0,49													
1	0,50	1,49													
2	1,50	2,49	0,05				0,05								
3	2,50	3,49	0,07	0,05	0,05	0,07	0,09	0,07			0,06	0,06	0,14	0,04	0,06
4	3,50	4,49	0,08	0,07	0,08	0,08	0,08	0,09	0,08	0,08	0,09	0,08	0,09	0,09	0,08
5	4,50	5,49	0,08	0,07	0,08	0,08	0,07	0,08	0,07	0,08	0,09	0,08	0,09	0,10	0,08
6	5,50	6,49	0,08	0,07	0,08	0,07	0,07	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,08
7	6,50	7,49	0,07	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,07
8	7,50	8,49	0,07	0,07	0,07	0,07	0,08	0,08	0,06	0,08	0,07	0,07	0,08	0,07	0,07
9	8,50	9,49	0,07	0,07	0,07	0,07	0,08	0,07	0,06	0,07	0,07	0,07	0,08	0,08	0,07
10	9,50	10,49	0,07	0,07	0,07	0,08	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,07
11	10,50	11,49	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,07
12	11,50	12,49	0,07	0,07	0,07	0,07	0,07	0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,07
13	12,50	13,49	0,07	0,07	0,07	0,06	0,07	0,06	0,06	0,06	0,06	0,07	0,08	0,08	0,08
14	13,50	14,49	0,07	0,07	0,07	0,06	0,07	0,06	0,06	0,06	0,07	0,06	0,08	0,08	0,08
15	14,50	15,49	0,07	0,07	0,08	0,08	0,09	0,07	0,07	0,06	0,07	0,06	0,08	0,08	0,09
16	15,50	16,49	0,07	0,08	0,09	0,09	0,09	0,07	0,06	0,07	0,07	0,06	0,09	0,08	0,09
17	16,50	17,49	0,07	0,07	0,07		0,09	0,07	0,06	0,07	0,07	0,07	0,08	0,08	0,09
18	17,50	18,49	0,07	0,07				0,06	0,06	0,08	0,06	0,07	0,08	0,09	0,08
19	18,50	19,49	0,07						0,07	0,08	0,07	0,07	0,08	0,08	0,10
20	19,50	20,49	0,08						0,07	0,08	0,08	0,06	0,08	0,09	0,10
21	20,50	21,49	0,08						0,08	0,07	0,08	0,09	0,08	0,09	0,08
22	21,50	22,49	0,08						0,08	0,08	0,08		0,08	0,09	
23	22,50	23,49	0,09							0,07	0,09		0,08	0,09	
24	23,50	24,49	0,10										0,09	0,10	
25	24,50	25,49	0,10										0,10	0,10	
26	25,50	26,49	0,10										0,10	0,10	
27	26,50	27,49													
28	27,50	28,49													
29	28,50	29,49													
30	29,50	30,49													
31	30,50	31,49													
32	31,50	32,49													
33	32,50	33,49													
34	33,50	34,49													
35	34,50	35,49													
36	35,50	36,49													
37	36,50	37,49													
38	37,50	38,49													
39	38,50	39,49													
40	39,50	40,49													
41	40,50														

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Calculated:
11/01/2022 09.19

Meteo data report - Mean turbulence

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Mean turbulence

100,00m - Subst

Bin	Start	End	Mean	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08
0		0,49													
1	0,50	1,49													
2	1,50	2,49													
3	2,50	3,49	0,09	0,05	0,05	0,06	0,06				0,05	0,35	0,20		0,06
4	3,50	4,49	0,09	0,07	0,08	0,09	0,07	0,09	0,08	0,09	0,09	0,09	0,10	0,09	0,08
5	4,50	5,49	0,08	0,07	0,07	0,08	0,07	0,08	0,08	0,08	0,09	0,09	0,09	0,10	0,09
6	5,50	6,49	0,08	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,08
7	6,50	7,49	0,07	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,07	0,08	0,08	0,07
8	7,50	8,49	0,07	0,07	0,07	0,07	0,08	0,07	0,07	0,08	0,07	0,07	0,08	0,08	0,07
9	8,50	9,49	0,07	0,07	0,07	0,08	0,08	0,08	0,06	0,07	0,07	0,07	0,08	0,08	0,07
10	9,50	10,49	0,07	0,07	0,07	0,08	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,07
11	10,50	11,49	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,07
12	11,50	12,49	0,07	0,07	0,07	0,07	0,07	0,06	0,06	0,07	0,07	0,07	0,08	0,08	0,08
13	12,50	13,49	0,07	0,07	0,07	0,06	0,07	0,06	0,07	0,06	0,07	0,07	0,08	0,08	0,08
14	13,50	14,49	0,07	0,07	0,07	0,07	0,08	0,06	0,07	0,06	0,07	0,06	0,08	0,08	0,09
15	14,50	15,49	0,07	0,08	0,09		0,09	0,07	0,06	0,07	0,07	0,06	0,09	0,08	0,09
16	15,50	16,49	0,07	0,08	0,09	0,09	0,10	0,07	0,06	0,07	0,07	0,07	0,08	0,08	0,09
17	16,50	17,49	0,07	0,06	0,09		0,09	0,07	0,06	0,08	0,06	0,07	0,07	0,09	0,09
18	17,50	18,49	0,08	0,06				0,06	0,07	0,08	0,07	0,07	0,08	0,09	0,09
19	18,50	19,49	0,08						0,07	0,08	0,08	0,08	0,08	0,09	0,10
20	19,50	20,49	0,08						0,08	0,08	0,08	0,09	0,08	0,09	0,10
21	20,50	21,49	0,09						0,08	0,08	0,08	0,09	0,09	0,10	0,09
22	21,50	22,49	0,09								0,08		0,08	0,09	
23	22,50	23,49	0,10										0,11	0,10	
24	23,50	24,49	0,11										0,10	0,11	
25	24,50	25,49	0,10										0,10	0,10	
26	25,50	26,49	0,10										0,10	0,09	
27	26,50	27,49													
28	27,50	28,49													
29	28,50	29,49													
30	29,50	30,49													
31	30,50	31,49													
32	31,50	32,49													
33	32,50	33,49													
34	33,50	34,49													
35	34,50	35,49													
36	35,50	36,49													
37	36,50	37,49													
38	37,50	38,49													
39	38,50	39,49													
40	39,50	40,49													
41	40,50														

Project:
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Calculated:
11/01/2022 09.19

Meteo data report - Mean turbulence

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Mean turbulence

70,00m -

Bin	Start	End	Mean	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			0,08	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,07	0,09	0,08	0,08
0		0,49													
1	0,50	1,49													
2	1,50	2,49													
3	2,50	3,49													
4	3,50	4,49	0,09	0,07	0,08	0,08	0,08	0,09	0,08	0,10	0,09	0,09	0,10	0,10	0,09
5	4,50	5,49	0,08	0,07	0,07	0,08	0,07	0,07	0,08	0,08	0,09	0,08	0,09	0,09	0,08
6	5,50	6,49	0,08	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,09	0,08	0,08
7	6,50	7,49	0,07	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,07
8	7,50	8,49	0,08	0,07	0,07	0,08	0,08	0,08	0,07	0,07	0,08	0,07	0,08	0,08	0,08
9	8,50	9,49	0,07	0,07	0,07	0,08	0,08	0,07	0,07	0,08	0,07	0,07	0,08	0,08	0,07
10	9,50	10,49	0,08	0,07	0,07	0,08	0,07	0,07	0,07	0,07	0,08	0,08	0,08	0,08	0,08
11	10,50	11,49	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08
12	11,50	12,49	0,08	0,07	0,07	0,08	0,08	0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,08
13	12,50	13,49	0,08	0,07	0,08	0,07	0,08	0,07	0,06	0,07	0,07	0,06	0,09	0,08	0,09
14	13,50	14,49	0,08	0,07	0,08		0,10	0,07	0,06	0,06	0,07	0,07	0,09	0,09	0,10
15	14,50	15,49	0,08	0,08	0,09	0,09	0,10	0,08	0,06	0,07	0,07	0,07	0,09	0,09	0,09
16	15,50	16,49	0,08	0,08	0,09	0,08	0,09	0,08	0,06	0,08	0,07	0,07	0,08	0,09	0,09
17	16,50	17,49	0,08	0,08			0,09	0,08	0,07	0,08	0,07	0,08	0,08	0,09	0,10
18	17,50	18,49	0,09					0,11	0,08	0,09	0,08	0,09	0,09	0,09	0,09
19	18,50	19,49	0,09						0,09	0,09	0,09	0,09	0,09	0,10	0,11
20	19,50	20,49	0,09						0,08	0,09	0,09	0,10	0,09	0,09	0,09
21	20,50	21,49	0,09								0,09		0,09	0,10	
22	21,50	22,49	0,09										0,10	0,09	
23	22,50	23,49	0,11										0,12	0,10	
24	23,50	24,49	0,10										0,10	0,11	
25	24,50	25,49	0,10										0,10	0,11	
26	25,50	26,49	0,09											0,09	
27	26,50	27,49													
28	27,50	28,49													
29	28,50	29,49													
30	29,50	30,49													
31	30,50	31,49													
32	31,50	32,49													
33	32,50	33,49													
34	33,50	34,49													
35	34,50	35,49													
36	35,50	36,49													
37	36,50	37,49													
38	37,50	38,49													
39	38,50	39,49													
40	39,50	40,49													
41	40,50														

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Calculated:
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Meteo data report - Mean turbulence

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Mean turbulence

40,00m -

Bin	Start	End	Mean	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			0,08	0,08	0,08	0,08	0,08	0,08	0,07	0,08	0,08	0,08	0,09	0,09	0,08
0		0,49													
1	0,50	1,49													
2	1,50	2,49													
3	2,50	3,49													
4	3,50	4,49	0,09	0,08	0,08	0,08	0,07	0,08	0,09	0,09	0,09	0,09	0,10	0,10	0,09
5	4,50	5,49	0,08	0,07	0,07	0,08	0,07	0,07	0,08	0,08	0,09	0,09	0,10	0,10	0,08
6	5,50	6,49	0,08	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08	0,08	0,09	0,08	0,08
7	6,50	7,49	0,08	0,08	0,07	0,09	0,08	0,08	0,07	0,08	0,08	0,08	0,08	0,08	0,08
8	7,50	8,49	0,08	0,08	0,08	0,09	0,08	0,08	0,07	0,08	0,08	0,08	0,08	0,08	0,08
9	8,50	9,49	0,08	0,08	0,07	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,09	0,09	0,08
10	9,50	10,49	0,08	0,08	0,08	0,07	0,09	0,08	0,07	0,08	0,08	0,08	0,09	0,09	0,08
11	10,50	11,49	0,08	0,08	0,08	0,08	0,08	0,07	0,07	0,08	0,08	0,08	0,09	0,09	0,09
12	11,50	12,49	0,08	0,08	0,09	0,09	0,08	0,07	0,07	0,08	0,08	0,08	0,09	0,09	0,09
13	12,50	13,49	0,08	0,09	0,09		0,10	0,08	0,07	0,07	0,08	0,08	0,09	0,09	0,10
14	13,50	14,49	0,09	0,08	0,09	0,08	0,11	0,09	0,07	0,07	0,07	0,08	0,09	0,10	0,10
15	14,50	15,49	0,09	0,10	0,10	0,09	0,10	0,09	0,08	0,09	0,08	0,09	0,10	0,10	0,10
16	15,50	16,49	0,10	0,09		0,11	0,10	0,09	0,08	0,09	0,09	0,10	0,10	0,10	0,10
17	16,50	17,49	0,10	0,09				0,10	0,09	0,10	0,10	0,10	0,10	0,10	0,11
18	17,50	18,49	0,10						0,09	0,10	0,10	0,10	0,10	0,10	0,11
19	18,50	19,49	0,10						0,11	0,09	0,10		0,10	0,10	0,11
20	19,50	20,49	0,10								0,09	0,11	0,11	0,10	
21	20,50	21,49	0,10										0,11	0,10	
22	21,50	22,49	0,11										0,11	0,11	
23	22,50	23,49	0,12										0,12	0,13	
24	23,50	24,49	0,11										0,10	0,12	
25	24,50	25,49	0,10											0,10	
26	25,50	26,49													
27	26,50	27,49													
28	27,50	28,49													
29	28,50	29,49													
30	29,50	30,49													
31	30,50	31,49													
32	31,50	32,49													
33	32,50	33,49													
34	33,50	34,49													
35	34,50	35,49													
36	35,50	36,49													
37	36,50	37,49													
38	37,50	38,49													
39	38,50	39,49													
40	39,50	40,49													
41	40,50														

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Calculated:
11/01/2022 09.19

Meteo data report - Mean turbulence

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)

Mean turbulence

12,00m -

Bin	Start	End	Mean	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			0,10	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,10	0,10	0,10	0,10
0		0,49													
1	0,50	1,49													
2	1,50	2,49													
3	2,50	3,49													
4	3,50	4,49	0,10	0,09	0,09	0,09	0,08	0,08	0,09	0,09	0,09	0,10	0,11	0,11	0,10
5	4,50	5,49	0,09	0,09	0,09	0,09	0,08	0,09	0,09	0,09	0,10	0,10	0,10	0,10	0,09
6	5,50	6,49	0,09	0,09	0,08	0,09	0,09	0,08	0,08	0,09	0,08	0,09	0,10	0,10	0,09
7	6,50	7,49	0,09	0,09	0,09	0,10	0,10	0,09	0,09	0,09	0,09	0,09	0,10	0,09	0,09
8	7,50	8,49	0,10	0,10	0,09	0,10	0,10	0,08	0,09	0,10	0,09	0,09	0,10	0,10	0,10
9	8,50	9,49	0,10	0,10	0,10	0,10	0,10	0,09	0,09	0,10	0,10	0,10	0,10	0,10	0,10
10	9,50	10,49	0,10	0,10	0,10	0,10	0,10	0,10	0,09	0,10	0,10	0,10	0,10	0,10	0,10
11	10,50	11,49	0,10	0,10	0,10	0,10	0,11	0,10	0,10	0,10	0,10	0,10	0,11	0,11	0,11
12	11,50	12,49	0,11	0,11	0,10	0,10	0,11	0,10	0,10	0,10	0,10	0,10	0,11	0,11	0,11
13	12,50	13,49	0,11	0,11	0,11		0,13	0,11	0,10	0,12	0,10	0,11	0,11	0,11	0,12
14	13,50	14,49	0,11	0,11	0,11	0,11	0,12	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,12
15	14,50	15,49	0,12	0,10	0,10			0,11	0,12	0,11	0,12	0,12	0,12	0,12	0,12
16	15,50	16,49	0,12					0,12	0,12	0,12	0,12	0,11	0,12	0,12	0,12
17	16,50	17,49	0,12						0,13	0,11	0,13	0,12	0,12	0,11	0,12
18	17,50	18,49	0,12								0,11	0,11	0,12	0,12	
19	18,50	19,49	0,12										0,12	0,12	
20	19,50	20,49	0,14										0,12	0,14	
21	20,50	21,49	0,13										0,13	0,13	
22	21,50	22,49	0,10										0,10		
23	22,50	23,49													
24	23,50	24,49													
25	24,50	25,49													
26	25,50	26,49													
27	26,50	27,49													
28	27,50	28,49													
29	28,50	29,49													
30	29,50	30,49													
31	30,50	31,49													
32	31,50	32,49													
33	32,50	33,49													
34	33,50	34,49													
35	34,50	35,49													
36	35,50	36,49													
37	36,50	37,49													
38	37,50	38,49													
39	38,50	39,49													
40	39,50	40,49													
41	40,50														

Project:
Hesselø

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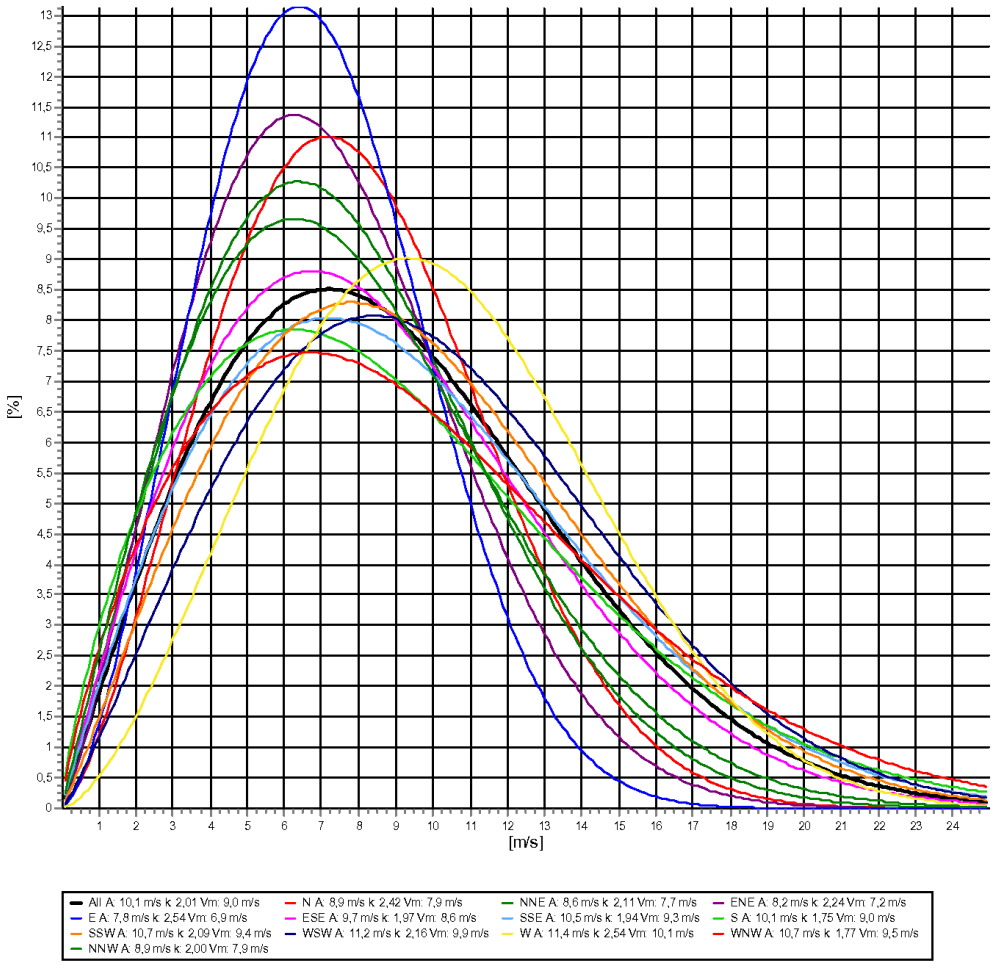
Calculated:
11/01/2022 09.19

Meteo data report - Weibull data overview

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)
Height: **240,00m** - **Subst**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,93	2,419	7,62	7,92
1-NNE	8,65	2,108	5,61	7,66
2-ENE	8,15	2,235	4,48	7,22
3-E	7,78	2,541	4,25	6,91
4-ESE	9,66	1,973	6,49	8,56
5-SSE	10,46	1,938	6,05	9,28
6-S	10,11	1,754	6,49	9,01
7-SSW	10,65	2,089	8,79	9,44
8-WSW	11,21	2,162	13,05	9,92
9-W	11,36	2,544	15,18	10,08
10-WNW	10,69	1,774	13,96	9,52
11-NNW	8,86	1,997	8,04	7,85
Mean	**10,12**	**2,014**	**100,00**	**8,97**



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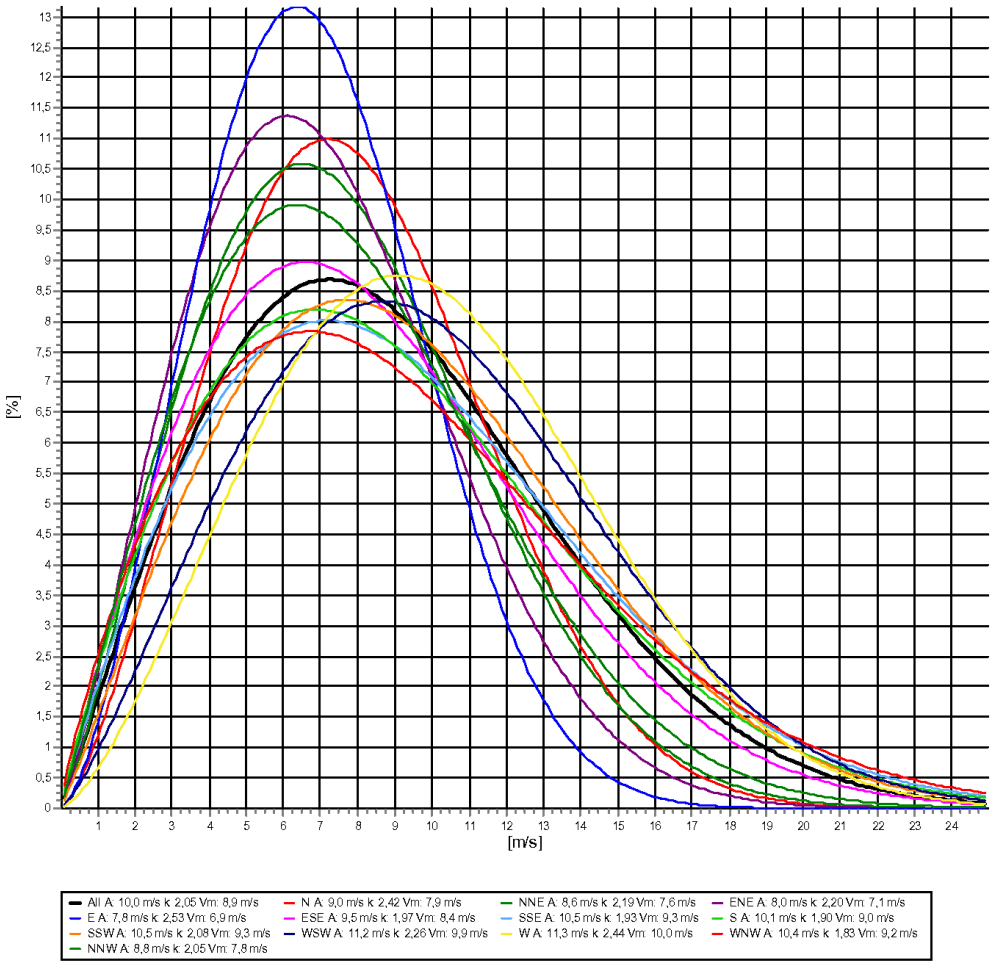
Calculated:
11/01/2022 09.19

Meteo data report - Weibull data overview

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)
Height: **200,00m** - **Subst**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,96	2,421	7,76	7,94
1-NNE	8,62	2,186	5,72	7,63
2-ENE	8,04	2,195	4,51	7,12
3-E	7,75	2,535	4,15	6,88
4-ESE	9,46	1,965	6,53	8,38
5-SSE	10,47	1,932	6,08	9,29
6-S	10,14	1,900	6,44	8,99
7-SSW	10,55	2,081	8,78	9,34
8-WSW	11,22	2,258	13,35	9,93
9-W	11,31	2,437	15,13	10,03
10-WNW	10,36	1,826	13,60	9,21
11-NNW	8,81	2,053	7,96	7,80
Mean	**10,03**	**2,047**	**100,00**	**8,89**



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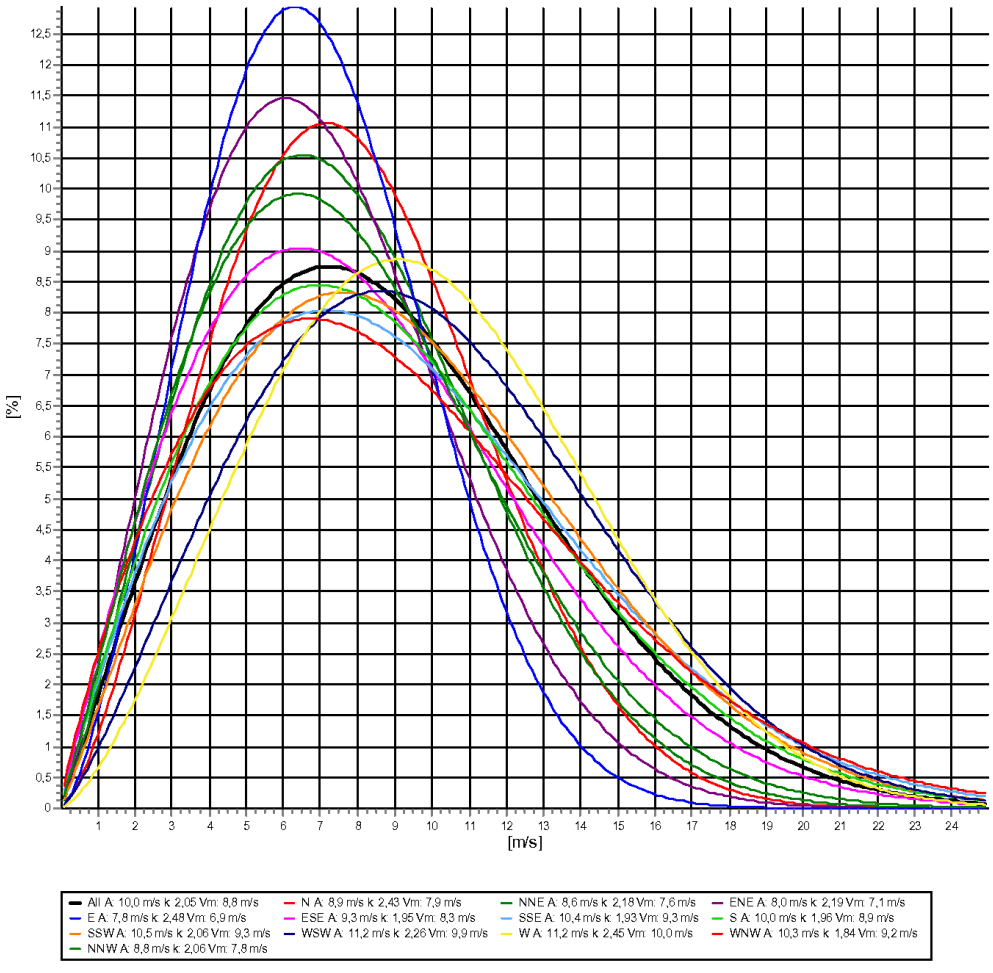
Calculated:
11/01/2022 09.19

Meteo data report - Weibull data overview

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)
Height: **180,00m** - **Subst**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,92	2,426	7,78	7,91
1-NNE	8,63	2,182	5,80	7,65
2-ENE	7,98	2,194	4,50	7,06
3-E	7,76	2,482	4,22	6,88
4-ESE	9,32	1,949	6,46	8,27
5-SSE	10,45	1,935	6,11	9,26
6-S	10,02	1,960	6,41	8,89
7-SSW	10,50	2,057	8,75	9,30
8-WSW	11,17	2,256	13,36	9,90
9-W	11,23	2,453	15,16	9,96
10-WNW	10,30	1,836	13,56	9,15
11-NNW	8,81	2,058	7,86	7,81
Mean	**9,98**	**2,054**	**100,00**	**8,84**



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Calculated:
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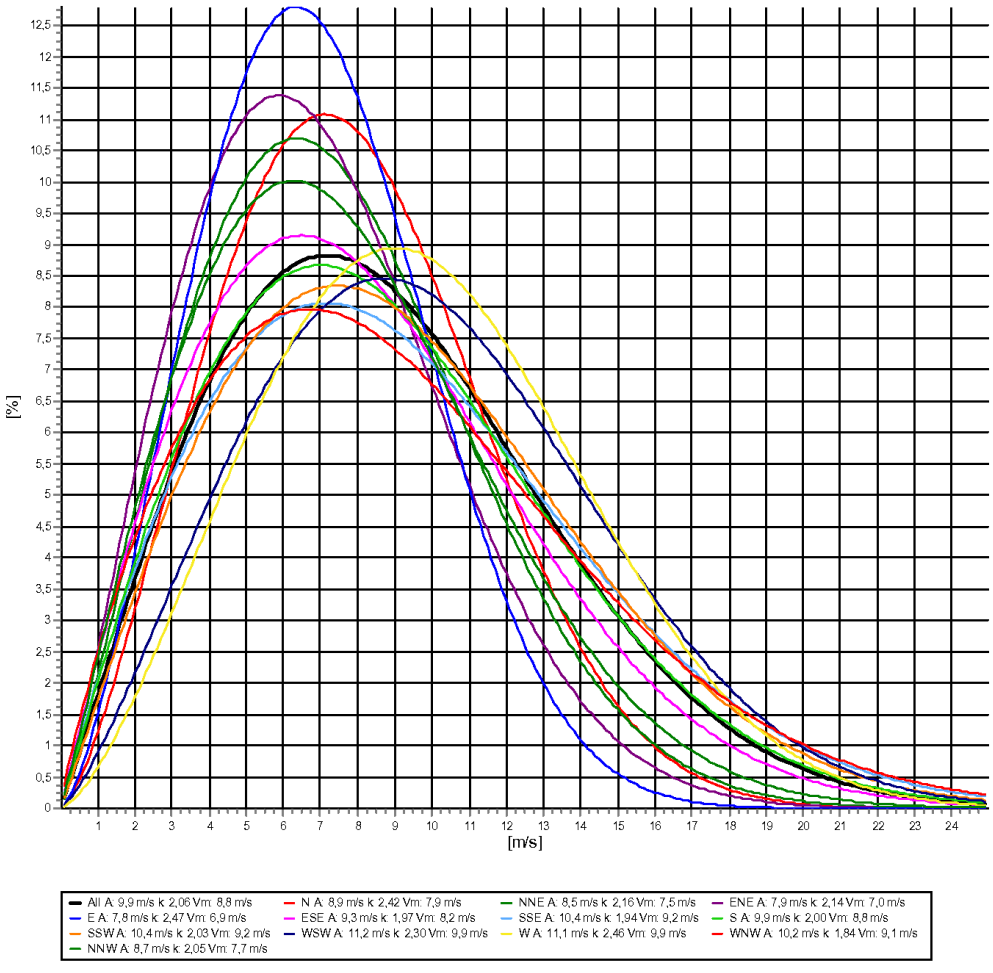
Meteo data report - Weibull data overview

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)
Height: **160,00m** - **Subst**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,89	2,420	7,82	7,88
1-NNE	8,46	2,162	5,84	7,49
2-ENE	7,89	2,139	4,51	6,99
3-E	7,82	2,473	4,39	6,94
4-ESE	9,28	1,970	6,35	8,23
5-SSE	10,40	1,935	6,09	9,23
6-S	9,89	1,998	6,46	8,76
7-SSW	10,39	2,034	8,81	9,21
8-WSW	11,18	2,297	13,35	9,90
9-W	11,13	2,459	15,10	9,88
10-WNW	10,23	1,843	13,41	9,09
11-NNW	8,69	2,048	7,88	7,70
Mean	**9,90**	**2,059**	**100,00**	**8,77**



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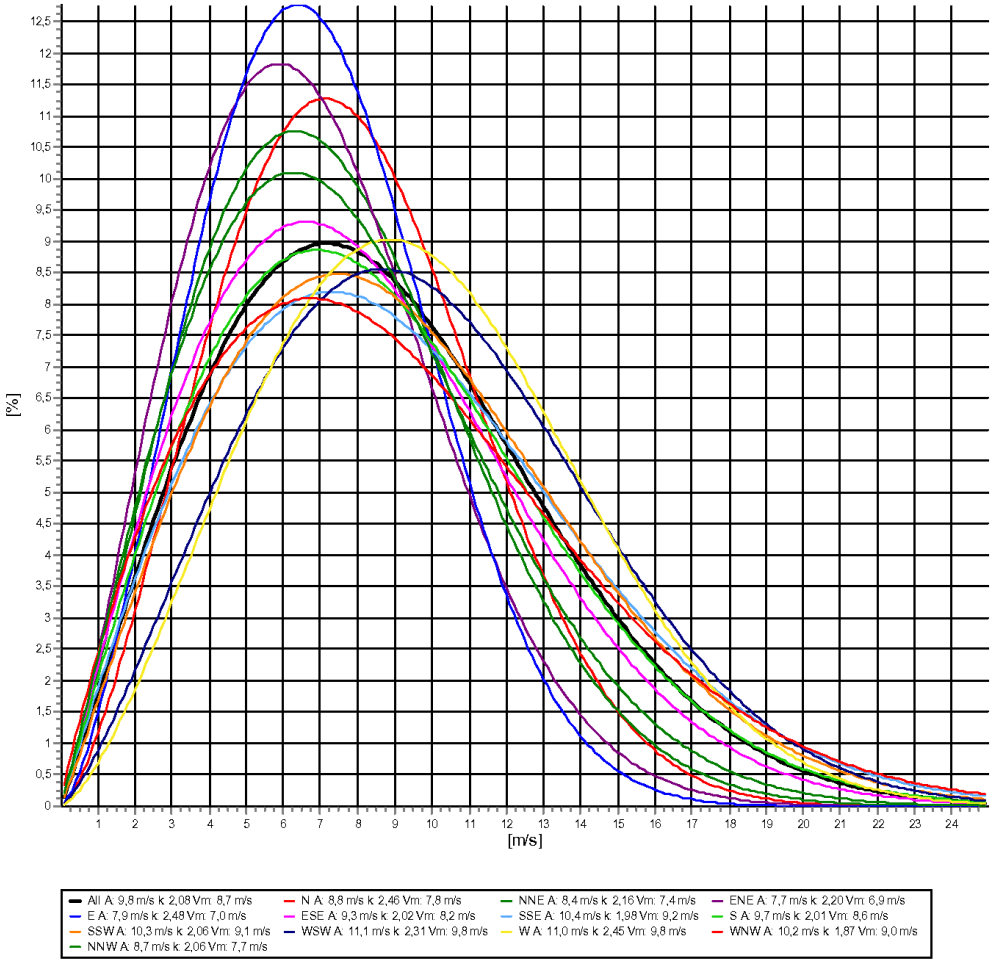
Calculated:
11/01/2022 09.19

Meteo data report - Weibull data overview

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)
Height: **140,00m** - **Subst**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,83	2,455	7,93	7,83
1-NNE	8,40	2,160	5,92	7,44
2-ENE	7,74	2,201	4,49	6,86
3-E	7,85	2,479	4,45	6,97
4-ESE	9,27	2,018	6,38	8,21
5-SSE	10,41	1,984	5,99	9,23
6-S	9,71	2,012	6,38	8,61
7-SSW	10,31	2,058	8,82	9,13
8-WSW	11,09	2,310	13,47	9,83
9-W	10,99	2,447	15,14	9,75
10-WNW	10,16	1,867	13,15	9,02
11-NNW	8,66	2,062	7,86	7,67
Mean	**9,82**	**2,081**	**100,00**	**8,70**



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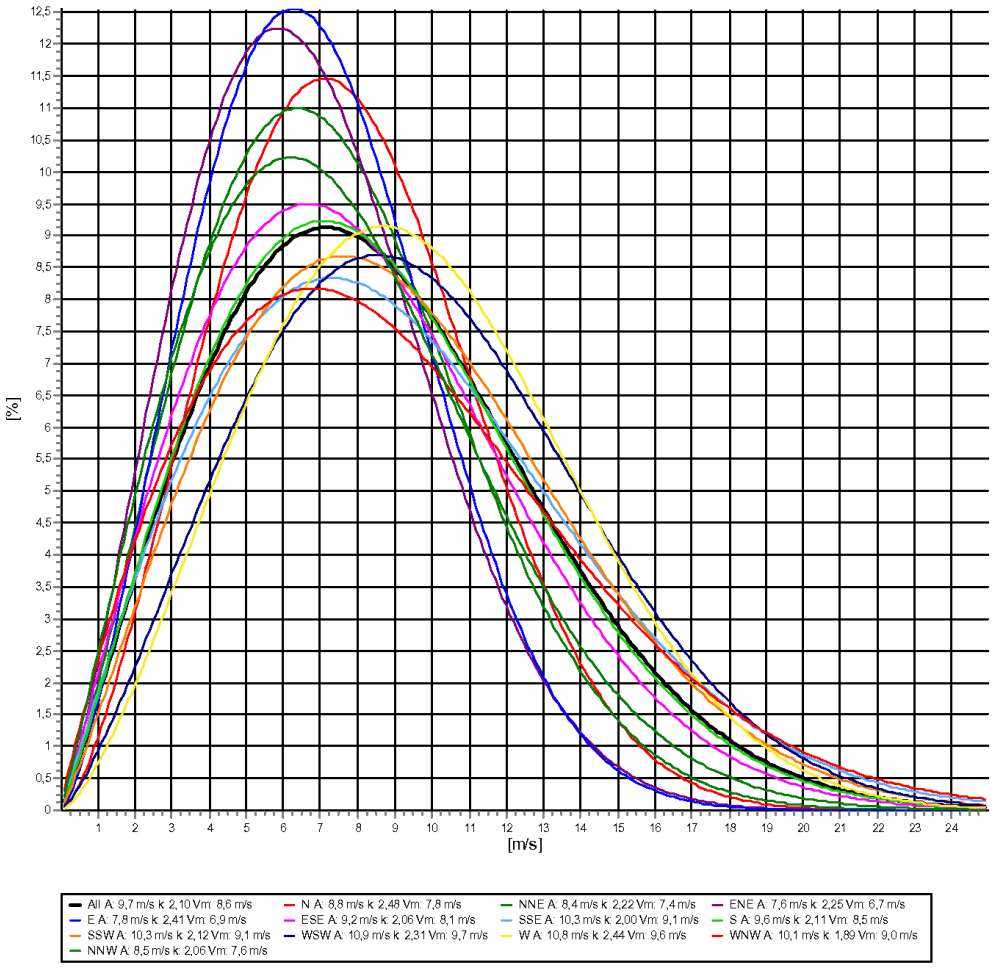
Meteo data report - Weibull data overview

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)
Height: **120,00m** - **Subst**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,76	2,480	8,00	7,77
1-NNE	8,38	2,217	5,96	7,42
2-ENE	7,60	2,252	4,41	6,73
3-E	7,82	2,412	4,58	6,93
4-ESE	9,19	2,056	6,30	8,15
5-SSE	10,30	2,003	6,00	9,13
6-S	9,62	2,105	6,33	8,52
7-SSW	10,28	2,122	9,01	9,11
8-WSW	10,91	2,308	13,45	9,67
9-W	10,82	2,436	15,05	9,59
10-WNW	10,12	1,888	12,98	8,98
11-NNW	8,55	2,057	7,93	7,57
Mean	**9,72**	**2,103**	**100,00**	**8,61**



Project:
Hesselø

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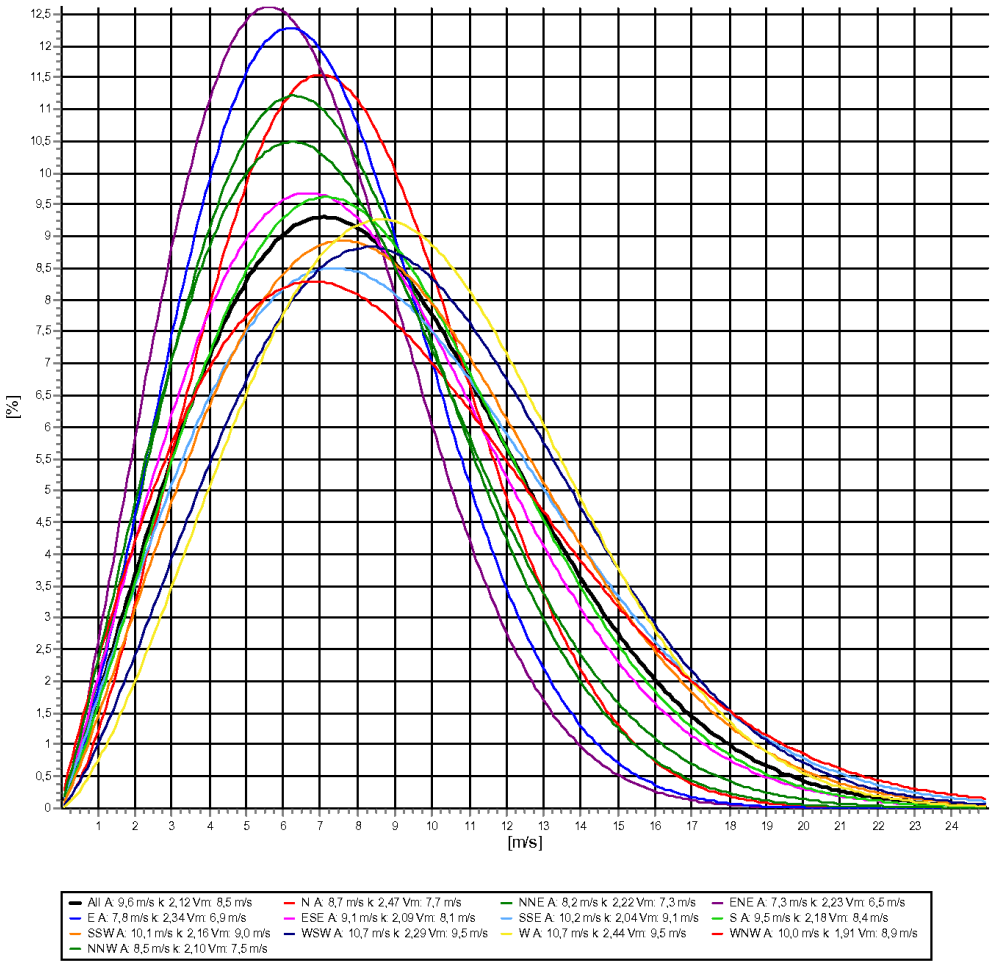
Thomas Sørensen / ts@emd.dk
Calculated:
11/01/2022 09.19

Meteo data report - Weibull data overview

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)
Height: **100,00m** - **Subst**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,66	2,467	8,11	7,68
1-NNE	8,24	2,224	6,05	7,29
2-ENE	7,33	2,229	4,35	6,49
3-E	7,82	2,342	4,73	6,93
4-ESE	9,11	2,088	6,41	8,07
5-SSE	10,24	2,044	5,89	9,07
6-S	9,46	2,181	6,05	8,38
7-SSW	10,13	2,162	9,31	8,97
8-WSW	10,69	2,291	13,37	9,47
9-W	10,69	2,441	15,03	9,48
10-WNW	10,03	1,906	12,71	8,90
11-NNW	8,46	2,104	7,98	7,49
Mean	**9,59**	**2,120**	**100,00**	**8,49**



Project:
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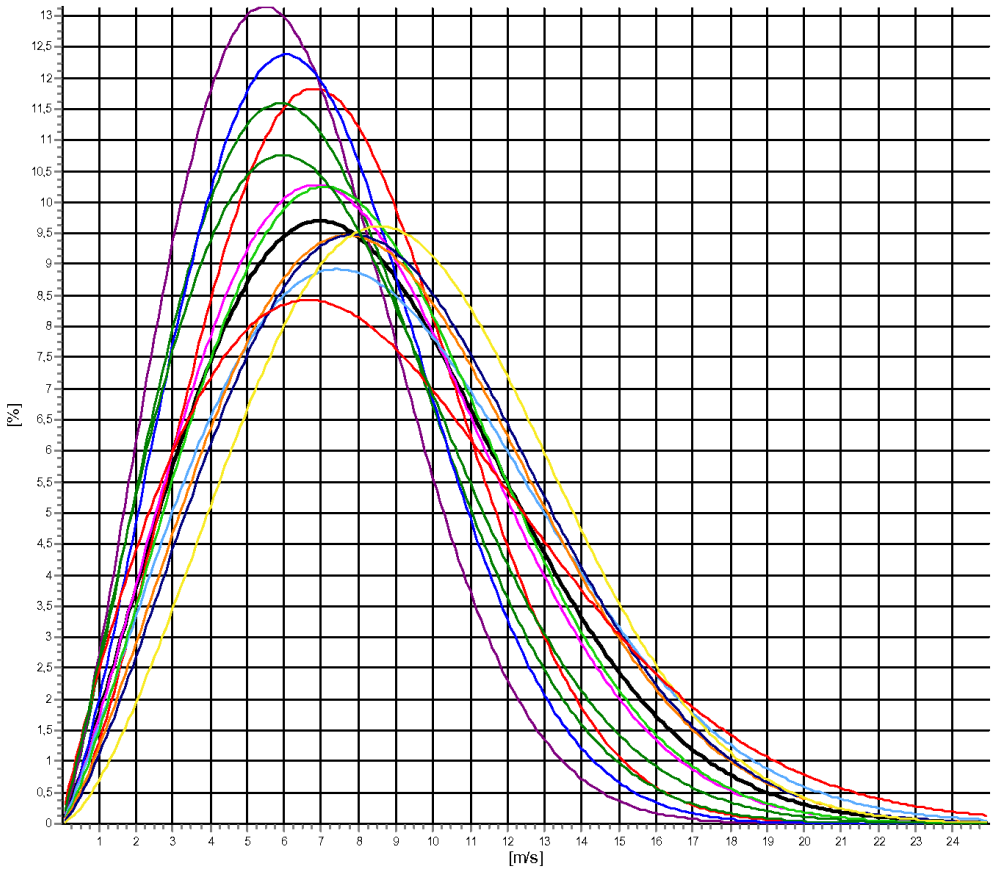
Calculated:
11/01/2022 09.19

Meteo data report - Weibull data overview

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)
Height: **70,00m** -

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,42	2,455	8,14	7,47
1-NNE	7,82	2,168	6,11	6,93
2-ENE	7,09	2,252	4,25	6,28
3-E	7,71	2,323	4,92	6,83
4-ESE	8,96	2,216	6,41	7,94
5-SSE	10,02	2,128	5,81	8,88
6-S	9,14	2,269	5,94	8,10
7-SSW	9,92	2,276	9,81	8,78
8-WSW	10,04	2,317	13,12	8,90
9-W	10,51	2,501	14,91	9,32
10-WNW	9,84	1,895	12,37	8,73
11-NNW	8,18	2,076	8,20	7,24
Mean	**9,30**	**2,151**	**100,00**	**8,23**



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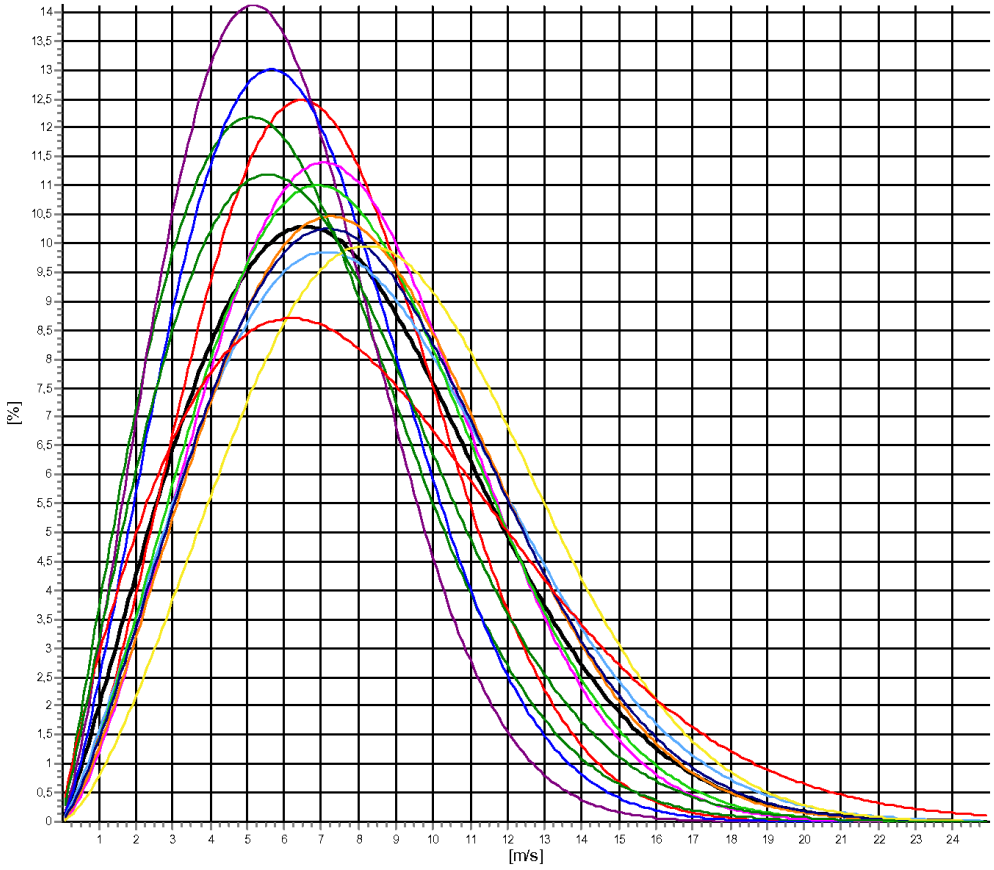
Calculated:
11/01/2022 09.19

Meteo data report - Weibull data overview

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)
Height: **40,00m** -

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	7,99	2,461	8,06	7,09
1-NNE	7,11	2,032	5,98	6,30
2-ENE	6,64	2,274	4,14	5,88
3-E	7,25	2,288	5,02	6,42
4-ESE	8,74	2,455	6,56	7,75
5-SSE	9,34	2,215	5,69	8,28
6-S	8,74	2,350	5,99	7,75
7-SSW	9,18	2,347	10,78	8,14
8-WSW	9,20	2,290	12,79	8,15
9-W	10,10	2,488	14,66	8,96
10-WNW	9,39	1,851	12,05	8,34
11-NNW	7,74	2,033	8,28	6,86
Mean	**8,77**	**2,154**	**100,00**	**7,76**



Project:
Hesselø

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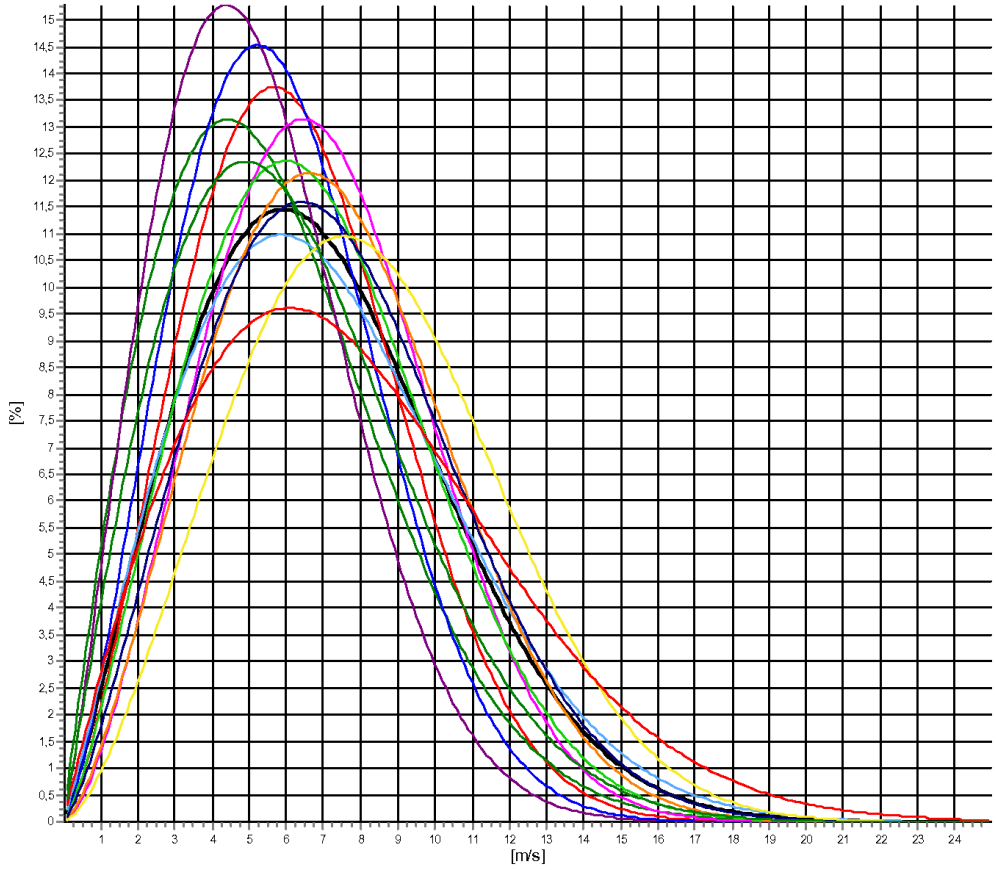
Calculated:
11/01/2022 09.19

Meteo data report - Weibull data overview

Mast: Hesselø monthly data filtered rev; Hesselø FLS; Complete period **Period:** Full period: 28/02/2021 - 28/10/2021 (8,0 months)
Height: **12,00m** -

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	7,10	2,394	8,06	6,29
1-NNE	6,40	1,941	5,81	5,68
2-ENE	5,87	2,139	4,13	5,20
3-E	6,62	2,348	5,27	5,86
4-ESE	7,83	2,559	6,64	6,95
5-SSE	8,03	2,083	5,50	7,11
6-S	7,66	2,301	6,20	6,78
7-SSW	8,19	2,450	10,97	7,26
8-WSW	8,19	2,310	12,34	7,26
9-W	9,25	2,510	14,73	8,21
10-WNW	8,78	1,952	11,87	7,79
11-NNW	6,93	1,995	8,48	6,15
Mean	**7,88**	**2,158**	**100,00**	**6,98**



Appendix C. FLS200-E01 verification and classification uncertainty

Verification uncertainty on four selected heights ASL from the verification report by Multiversum [12]

		FLS verification @ 90 m	FLS verification @ 115 m	FLS verification @ 140 m	FLS verification @ 165 m
BIN WS from [m/s]	BIN WS to [m/s]	V_{FLS} Uncertainty [%]	V_{FLS} Uncertainty [%]	V_{FLS} Uncertainty [%]	V_{FLS} Uncertainty [%]
3,75	4,25	2,60%	2,59%	3,08%	2,92%
4,25	4,75	2,40%	2,63%	2,48%	2,43%
4,75	5,25	2,57%	2,40%	2,40%	2,51%
5,25	5,75	2,37%	2,33%	2,29%	2,48%
5,75	6,25	2,18%	2,11%	2,26%	2,67%
6,25	6,75	2,31%	2,12%	2,06%	2,08%
6,75	7,25	2,44%	2,55%	2,22%	2,06%
7,25	7,75	2,17%	2,15%	2,36%	2,43%
7,75	8,25	2,00%	2,04%	2,19%	2,00%
8,25	8,75	2,04%	2,15%	2,06%	2,03%
8,75	9,25	2,19%	2,03%	2,07%	2,19%
9,25	9,75	1,97%	1,92%	2,00%	2,02%
9,75	10,25	2,11%	1,96%	1,95%	1,89%
10,25	10,75	2,07%	2,11%	1,91%	1,88%
10,75	11,25	1,88%	1,87%	2,02%	1,93%
11,25	11,75	2,20%	1,96%	1,98%	2,09%
11,75	12,25	2,12%	2,05%	2,01%	2,04%
12,25	12,75	2,19%	2,07%	1,97%	1,96%
12,75	13,25	2,07%	1,91%	1,99%	1,82%
13,25	13,75	1,96%	1,85%	1,88%	1,82%
13,75	14,25	1,97%	1,95%	1,97%	1,88%
14,25	14,75	2,02%	1,99%	1,84%	1,84%
14,75	15,25	1,93%	1,86%	1,93%	1,90%
15,25	15,75	2,21%	1,88%	1,96%	1,94%
15,75	16,25	2,08%	1,96%	2,04%	2,01%

Type specific classification uncertainty from classification report for ZX300 by DNV-GL [13]

ZX300 Type Class Table											
EVs / Heights	Max influence (m x Range)								Preliminary accuracy	Type specific class	Standard uncertainty
	Temperature Gradient	Air Temperature	Turbulence Intensity	Wind Veer	Wind Shear	Air Density	Rain	Flow inclination angle			
[m]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
135	-1.85	-1.81	0.46	0.60	-2.48	*	-0.59	0.71	3.78	2.67	1.54
130	-2.03	-1.34	0.62	0.57	-1.14	*	-0.60	1.17	3.11	2.20	1.27
125	-1.80	-1.37	0.70	0.59	-1.20	*	-0.96	1.07	3.07	2.17	1.25
120	-1.91	-1.13	0.78	0.58	-0.61	*	-0.92	0.96	2.83	2.00	1.16
115	-1.97	-0.90	0.87	0.57	-0.02	*	-0.87	0.86	2.70	1.91	1.10
110	-2.03	-0.66	0.95	0.57	0.57	*	-0.82	0.76	2.71	1.92	1.11
105	-2.09	-0.42	1.04	0.56	1.16	*	-0.77	0.65	2.88	2.04	1.18
100	-1.52	2.50	1.71	0.00	1.02	-0.45	-0.01	0.55	3.61	2.55	1.47
95	-1.18	1.96	1.47	0.12	1.17	-0.33	0.20	0.22	2.99	2.12	1.22
90	-0.82	1.42	1.43	0.23	1.31	-0.20	0.23	-0.11	2.57	1.81	1.05
85	-0.46	0.91	1.40	0.34	1.52	-0.07	0.25	-0.66	2.43	1.72	0.99
80	-0.10	0.57	1.50	0.47	1.68	0.05	0.28	-0.63	2.47	1.75	1.01
75	0.11	0.61	1.61	0.60	2.23	0.18	0.30	-0.59	2.96	2.10	1.21
70	0.14	1.11	1.33	0.72	2.79	0.31	0.28	-0.56	3.43	2.43	1.40
65	0.23	1.35	1.09	0.89	2.36	0.75	0.26	-0.52	3.21	2.27	1.31
60	0.23	1.77	0.86	1.04	2.05	1.13	0.24	-0.49	3.28	2.32	1.34
55	0.25	2.07	0.71	0.45	1.91	1.51	0.23	*	3.32	2.34	1.35
50	0.28	1.03	0.52	0.61	1.60	1.89	0.28	*	2.83	2.00	1.15
45	0.32	0.41	0.39	0.77	1.29	2.27	0.31	*	2.82	2.00	1.15
40	0.16	-0.22	0.27	0.93	0.99	2.66	0.35	*	3.03	2.14	1.24
35	0.10	-0.61	0.41	0.45	0.13	0.48	0.38	*	1.07	0.75	0.44
30	0.03	-0.76	0.53	0.34	-0.44	-0.41	0.41	*	1.23	0.87	0.50
25	0.02	-0.78	0.67	0.29	-1.01	-1.30	0.45	*	2.01	1.42	0.82
20	0.00	-0.71	0.82	0.23	-1.58	-2.18	0.48	*	2.95	2.09	1.21

* EV was not assessed in the height

Appendix D. Hesselø FLS200-E01 Long-term Corrected Dataset

Project: Description:
Hesselø

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Niels Jernes Vej 10
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+45 9635 4444
Thomas Sørensen / ts@emd.dk
Calculated:
12/01/2022 09.40

Meteo data report - Monthly wind speeds

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

Monthly wind speeds

160,00m - MCP LT - MCP session (8) - [Matrix]

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
January		12,82	9,07	12,89	11,83	9,86	13,61	9,20	14,84	14,40	9,85	9,32	10,40	11,36	10,02	13,50	12,75	10,97	10,00	10,67
February		12,45	10,73	14,26	7,04	9,79	10,87	8,59	11,00	13,57	8,69	8,59	12,34	11,50	7,92	12,46	11,03	10,53	11,09	9,41
March		10,66	8,31	11,40	9,08	10,71	8,97	8,57	11,23	11,67	9,88	9,59	11,29	11,55	9,74	10,98	10,66	7,79	10,49	9,04
April		8,43	8,45	7,56	9,98	8,71	8,33	9,09	9,53	7,29	8,18	9,66	9,06	8,73	9,70	8,80	10,31	9,07	10,21	9,91
May		8,04	8,40	8,87	8,46	9,41	7,68	9,49	8,05	5,65	8,66	8,12	9,41	8,74	8,84	7,10	10,07	7,70	8,74	7,45
June		9,28	7,63	9,47	9,58	9,11	8,48	7,45	6,78	8,98	8,14	7,45	8,03	9,00	8,46	6,59	9,08	7,77	10,80	7,83
July		6,57	6,76	8,32	6,97	7,19	7,13	5,75	9,37	6,69	8,13	7,69	7,60	7,75	7,68	7,01	9,18	7,73	8,50	6,37
August		8,04	9,09	7,57	7,49	8,00	7,86	6,21	9,03	9,01	9,37	8,45	8,66	7,14	7,71	9,41	9,01	9,65	8,63	8,64
September		9,89	8,09	7,39	8,74	10,11	8,62	10,36	11,06	8,17	10,27	9,75	10,45	11,47	7,67	8,34	9,41	7,97	8,18	11,13
October	10,83	10,11	11,56	9,93	8,61	10,79	9,45	9,32	7,43	11,65	10,10	9,82	11,29	9,82	10,98	11,10	9,37	10,58	12,33	11,34
November	10,24	10,53	11,35	9,29	10,08	10,52	10,46	12,34	10,78	11,34	12,84	10,55	9,85	10,53	10,01	10,10	11,56	11,66	10,54	9,28
December	12,19	9,35	9,11	9,46	12,00	11,13	10,72	12,71	9,81	8,31	8,67	8,80	13,42	10,81	13,29	11,27	13,97	11,55	12,28	10,92
mean, all data	11,10	9,67	9,03	9,68	9,17	9,61	9,34	9,09	9,90	9,72	9,40	8,98	10,14	9,86	9,35	9,71	10,53	9,41	10,14	9,33
mean of months	11,09	9,68	9,05	9,70	9,16	9,61	9,35	9,09	9,91	9,73	9,40	8,98	10,15	9,87	9,34	9,72	10,53	9,41	10,15	9,33

Monthly wind speeds

160,00m - MCP LT - MCP session (8) - [Matrix]

Month	2019	2020	2021	Mean	Mean of month
January	10,81	13,13	9,28	11,39	11,39
February	11,72	13,60	10,57	10,82	10,81
March	11,90	10,46	10,24	10,19	10,19
April	8,65	9,67	9,02	9,02	9,02
May	9,07	8,87	7,46	8,38	8,38
June	8,88	7,44	7,16	8,34	8,34
July	8,20	10,04	7,33	7,63	7,63
August	7,98	6,68	8,89	8,30	8,30
September	10,70	9,20	7,77	9,31	9,31
October	9,29	9,84	13,03	10,25	10,37
November	9,18	11,17		10,65	10,65
December	11,70	10,37		10,99	10,99
mean, all data	9,83	10,03	8,62	9,61	
mean of months	9,84	10,04	9,07		9,62

Monthly wind speeds

140,00m - MCP LT - MCP session (1) - [Matrix]

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
January		12,81	9,03	12,80	11,79	9,73	13,32	9,13	14,71	14,26	9,82	9,07	10,34	11,15	9,95	13,28	12,68	10,92	9,83	10,51
February		12,37	10,47	14,06	6,95	9,67	10,79	8,41	10,76	13,20	8,57	8,48	12,24	11,21	7,91	12,36	10,95	10,54	11,04	9,36
March		10,58	8,33	11,28	8,98	10,49	8,92	8,39	11,17	11,43	9,87	9,57	11,09	11,51	9,62	10,86	10,65	7,64	10,41	8,95
April		8,33	8,39	7,50	9,86	8,64	8,42	9,01	9,32	7,25	8,04	9,49	8,86	8,69	9,53	8,84	10,01	8,96	10,16	9,86
May		7,87	8,23	8,71	8,44	9,29	7,67	9,36	8,18	5,77	8,50	8,00	9,36	8,84	8,60	7,02	10,00	7,52	8,66	7,38
June		9,22	7,44	9,48	9,47	8,90	8,37	7,45	6,77	8,95	8,11	7,34	7,96	8,79	8,39	6,71	8,90	7,60	10,75	7,66
July		6,65	6,61	8,24	6,81	7,18	6,98	5,72	9,19	6,54	7,94	7,67	7,45	7,73	7,70	7,03	8,90	7,63	8,35	6,45
August		7,88	8,92	7,53	7,46	7,95	7,85	6,15	8,78	8,92	9,30	8,25	8,64	7,05	7,53	9,41	8,86	9,45	8,52	8,40
September		9,65	8,21	7,47	8,72	10,10	8,41	10,25	11,01	8,01	10,13	9,64	10,42	11,40	7,59	8,30	9,44	7,83	8,06	11,05
October	10,80	10,01	11,44	9,78	8,55	10,76	9,36	9,27	7,56	11,56	10,07	9,70	11,11	9,63	10,75	10,96	9,18	10,41	12,06	11,26
November	10,08	10,27	11,18	9,24	9,95	10,50	10,31	12,23	10,62	11,33	12,65	10,46	9,69	10,50	9,93	10,07	11,50	11,41	10,50	9,20
December	12,17	9,35	9,01	9,34	11,93	10,91	10,53	12,55	9,64	8,25	8,52	8,77	13,27	10,75	13,26	11,12	13,80	11,64	12,14	10,74
mean, all data	11,03	9,57	8,93	9,60	9,09	9,51	9,24	8,99	9,80	9,61	9,29	8,87	10,03	9,76	9,25	9,65	10,41	9,29	10,03	9,23
mean of months	11,02	9,58	8,94	9,62	9,08	9,51	9,24	8,99	9,81	9,62	9,29	8,87	10,04	9,77	9,23	9,66	10,41	9,30	10,04	9,24

Monthly wind speeds

140,00m - MCP LT - MCP session (1) - [Matrix]

Month	2019	2020	2021	Mean	Mean of month
January	10,73	12,94	9,07	11,27	11,27
February	11,64	13,45	10,53	10,69	10,68
March	11,81	10,26	10,11	10,09	10,09
April	8,51	9,65	8,97	8,92	8,92
May	9,14	8,85	7,30	8,30	8,30
June	8,67	7,34	7,11	8,24	8,24
July	8,09	9,93	7,18	7,54	7,54
August	7,78	6,57	8,89	8,19	8,19
September	10,59	9,18	7,76	9,24	9,24
October	8,99	9,71	15,39	10,13	10,36
November	9,05	11,03		10,53	10,53
December	11,60	10,22		10,89	10,89

To be continued on next page...

Project: Description:
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Calculated:
12/01/2022 09.40

Meteo data report - Monthly wind speeds

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

...continued from previous page

Month	2019	2020	2021	Mean	Mean of month
mean, all data	9,71	9,92	8,53	9,50	
mean of months	9,72	9,93	9,23		9,52

Monthly wind speeds

120,00m - MCP LT - MCP session (7) - [Matrix]

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
January		12,54	8,97	12,19	11,40	9,84	13,20	9,06	14,44	13,94	9,66	9,20	9,98	11,05	9,72	13,26	12,40	10,89	9,53	10,34
February		11,99	10,19	13,65	6,88	9,46	10,76	8,25	10,88	12,98	8,53	8,34	12,07	10,92	7,65	12,08	10,74	10,19	10,83	9,48
March		10,39	8,19	11,00	8,87	10,29	8,72	8,39	10,88	11,28	9,49	9,10	10,57	11,04	9,46	10,48	10,21	7,44	10,01	8,89
April		8,17	8,40	7,39	9,64	8,48	8,23	8,79	9,23	7,07	7,78	9,40	8,81	8,50	9,38	8,72	9,85	8,96	9,97	9,77
May		7,91	8,13	8,56	8,23	9,25	7,46	9,14	8,02	5,58	8,47	7,94	9,11	8,54	8,69	6,82	9,78	7,56	8,52	7,10
June		9,09	7,43	9,22	9,28	8,79	8,26	7,22	6,85	8,86	8,11	7,21	7,87	8,72	8,35	6,57	8,87	7,67	10,41	7,77
July		6,55	6,86	8,25	6,71	7,05	7,01	5,75	9,16	6,60	7,97	7,63	7,49	7,72	7,45	7,01	8,87	7,65	8,23	6,33
August		7,93	8,94	7,38	7,39	7,94	7,82	6,19	8,88	8,88	9,21	8,22	8,55	7,00	7,73	9,52	8,74	9,51	8,46	8,35
September		9,75	8,07	7,34	8,66	10,00	8,42	9,90	10,92	8,10	10,14	9,60	10,38	11,36	7,47	8,13	9,41	7,80	8,10	11,16
October	10,86	9,90	11,42	9,73	8,71	10,73	9,36	9,27	7,28	11,58	10,04	9,77	11,25	9,63	10,68	11,05	9,23	10,62	11,95	11,16
November	9,85	10,44	11,20	9,06	9,74	10,34	10,42	12,06	10,56	11,24	12,38	10,47	9,74	10,36	9,89	10,16	11,49	11,38	10,44	9,02
December	11,99	9,19	8,89	9,33	11,81	10,69	10,34	12,42	9,43	8,25	8,53	8,74	13,19	10,55	13,06	11,08	13,51	11,25	11,98	10,61
mean, all data	10,91	9,48	8,88	9,40	8,96	9,40	9,16	8,87	9,70	9,52	9,19	8,80	9,91	9,61	9,14	9,57	10,26	9,24	9,86	9,16
mean of months	10,90	9,49	8,89	9,43	8,94	9,41	9,17	8,87	9,71	9,53	9,19	8,80	9,92	9,62	9,13	9,57	10,26	9,24	9,87	9,16

Monthly wind speeds

120,00m - MCP LT - MCP session (7) - [Matrix]

Month	2019	2020	2021	Mean	Mean of month
January	10,50	12,59	9,04	11,08	11,08
February	11,16	13,31	10,39	10,50	10,49
March	11,41	10,07	9,84	9,82	9,82
April	8,34	9,36	8,90	8,78	8,78
May	9,03	8,66	7,25	8,17	8,17
June	8,47	7,32	7,18	8,16	8,16
July	8,07	9,91	7,19	7,52	7,52
August	7,82	6,65	8,83	8,18	8,18
September	10,62	8,98	7,69	9,18	9,18
October	8,99	9,74	17,84	10,13	10,47
November	9,06	11,02		10,47	10,47
December	11,56	10,13		10,75	10,75
mean, all data	9,58	9,80	8,47	9,40	
mean of months	9,59	9,81	9,42		9,42

Monthly wind speeds

100,00m - MCP LT - MCP session (6) - [Matrix]

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
January		12,34	8,81	12,05	11,07	9,60	12,85	8,89	14,19	13,51	9,50	9,04	9,69	10,79	9,51	13,05	12,24	10,48	9,54	10,05
February		11,73	10,13	13,34	6,83	9,32	10,60	8,15	10,60	12,66	8,40	8,22	11,90	10,73	7,64	11,89	10,55	9,93	10,60	9,19
March		10,22	8,13	10,84	8,76	10,08	8,44	8,20	10,82	10,97	9,42	8,93	10,39	10,80	9,37	10,27	10,05	7,44	9,88	8,73
April		8,06	8,19	7,35	9,55	8,27	8,18	8,68	8,88	6,94	7,87	9,17	8,55	8,43	9,35	8,48	9,63	8,82	9,76	9,58
May		7,80	7,94	8,35	8,09	8,98	7,43	9,03	7,92	5,54	8,19	7,95	9,12	8,40	8,51	6,77	9,73	7,40	8,38	6,93
June		8,98	7,36	9,07	9,21	8,73	8,21	7,20	6,72	8,67	8,08	7,17	7,61	8,55	8,24	6,52	8,84	7,55	10,34	7,67
July		6,53	6,61	8,02	6,58	7,07	7,05	5,69	9,02	6,53	7,83	7,53	7,37	7,60	7,46	6,88	8,77	7,55	8,18	6,20
August		7,83	8,84	7,36	7,33	7,79	7,68	6,00	8,81	8,70	9,14	8,04	8,34	6,88	7,37	9,40	8,56	9,34	8,33	8,35
September		9,55	7,95	7,36	8,51	9,89	8,27	9,74	10,66	7,93	9,93	9,46	10,24	11,22	7,48	8,02	9,16	7,71	7,95	10,98
October	10,67	9,78	11,03	9,61	8,44	10,42	9,15	9,14	7,31	11,39	9,86	9,63	10,96	9,53	10,55	10,68	9,06	10,28	11,72	11,00
November	9,67	10,28	10,98	8,99	9,50	10,18	10,15	11,93	10,41	11,14	12,20	10,29	9,50	10,10	9,75	9,94	11,13	11,26	10,14	9,03
December	11,75	9,12	8,82	9,22	11,59	10,48	10,19	12,14	9,27	8,06	8,50	8,54	12,99	10,42	12,81	10,79	13,37	11,10	11,70	10,47
mean, all data	10,71	9,34	8,72	9,27	8,80	9,23	9,01	8,73	9,55	9,32	9,08	8,66	9,71	9,45	9,02	9,38	10,09	9,07	9,70	9,01
mean of months	10,70	9,35	8,73	9,30	8,79	9,23	9,02	8,73	9,55	9,34	9,08	8,66	9,72	9,45	9,00	9,39	10,09	9,07	9,71	9,02

Monthly wind speeds

100,00m - MCP LT - MCP session (6) - [Matrix]

Month	2019	2020	2021	Mean	Mean of month
January	10,34	12,29	8,95	10,85	10,85
February	10,88	13,03	10,12	10,30	10,29
March	11,33	9,88	9,58	9,66	9,66
April	8,18	9,32	8,82	8,64	8,64
May	8,86	8,68	7,24	8,06	8,06
June	8,37	7,27	7,08	8,07	8,07
July	7,96	9,84	7,29	7,43	7,43

To be continued on next page...

Project: Description:
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Calculated:
12/01/2022 09.40

Meteo data report - Monthly wind speeds

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

...continued from previous page

Month	2019	2020	2021	Mean	Mean of month
August	7,70	6,54	8,77	8,05	8,05
September	10,26	8,79	7,51	9,03	9,03
October	8,75	9,57	14,96	9,93	10,15
November	9,07	10,89		10,30	10,30
December	11,23	9,96		10,57	10,57
mean, all data	9,40	9,66	8,36	9,24	
mean of months	9,41	9,67	9,03		9,26

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Calculated:
12/01/2022 09.40

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

Frequency distribution (TAB file data)

160,00m - MCP LT - MCP session (8) - [Matrix]

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			9,60	7,35	7,26	7,84	8,77	9,56	9,45	9,53	10,98	10,91	10,53	9,87	7,67
0		0,49	765	78	104	117	80	49	5	65	30	52	84	13	88
1	0,50	1,49	3139	361	180	365	307	233	251	183	184	276	323	205	271
2	1,50	2,49	6146	567	430	478	475	393	509	486	421	630	661	505	591
3	2,50	3,49	9618	835	910	521	600	608	569	535	907	1269	1035	1138	691
4	3,50	4,49	11927	819	885	689	597	902	903	835	1119	1586	1378	1296	918
5	4,50	5,49	12683	969	828	747	666	1143	1061	946	1092	1360	1494	1261	1116
6	5,50	6,49	13006	925	771	807	983	1400	954	958	874	1244	1470	1387	1233
7	6,50	7,49	13266	1000	721	661	1062	1436	953	901	907	1339	1506	1584	1196
8	7,50	8,49	14040	829	645	583	1108	1107	1326	1007	1319	1412	1876	1611	1217
9	8,50	9,49	15057	723	541	506	1152	1186	1709	1221	1350	1763	2492	1566	848
10	9,50	10,49	13436	662	377	642	1028	1491	1272	778	1081	1531	2354	1416	804
11	10,50	11,49	13466	574	599	795	1108	1697	1109	1005	1329	1753	1900	939	658
12	11,50	12,49	12943	409	419	791	1017	1059	1340	1419	1000	1733	1962	1299	495
13	12,50	13,49	12162	363	392	556	803	977	1022	889	1660	2159	1980	986	375
14	13,50	14,49	9581	249	233	337	522	890	874	929	1318	1873	1399	690	267
15	14,50	15,49	8359	148	150	128	371	753	794	614	1108	1883	1355	854	201
16	15,50	16,49	6530	126	118	107	279	847	530	245	997	1295	1112	717	157
17	16,50	17,49	4962	90	49	54	134	456	324	213	864	1150	742	718	168
18	17,50	18,49	3611	59	30	16	101	244	129	166	579	819	807	597	64
19	18,50	19,49	2867	42	18	17	54	189	182	116	485	670	605	455	34
20	19,50	20,49	1962	25	10	3	15	59	62	88	434	546	480	213	27
21	20,50	21,49	1064	13	4	1	12	17	28	71	258	288	223	133	16
22	21,50	22,49	825	10	2	3	2	8	17	60	233	175	188	114	13
23	22,50	23,49	548	3	2	2	1	7	2	42	121	122	139	93	14
24	23,50	24,49	376	2	2	0	1	3	1	32	49	81	105	88	12
25	24,50	25,49	194	1	0	0	0	0	0	19	38	32	50	45	9
26	25,50	26,49	106	0	0	0	0	0	0	15	16	17	35	19	4
27	26,50	27,49	85	3	0	0	0	0	0	7	3	14	39	14	5
28	27,50	28,49	51	0	0	0	0	0	0	8	8	5	20	9	1
29	28,50	29,49	28	0	0	0	0	0	0	7	1	2	10	7	1
30	29,50	30,49	21	0	0	0	0	0	0	2	4	2	5	7	1
31	30,50	31,49	18	0	0	0	0	0	0	0	3	1	13	1	0
32	31,50	32,49	10	0	0	0	0	0	0	1	1	0	4	4	0
33	32,50	33,49	2	0	0	0	0	0	0	1	0	0	0	1	0
34	33,50	34,49	4	0	0	0	0	0	0	0	0	1	2	1	0
35	34,50	35,49	3	0	0	0	0	0	0	1	2	0	0	0	0
36	35,50	36,49	1	0	0	0	0	0	0	0	0	1	0	0	0
37	36,50	37,49	2	0	0	0	0	0	0	0	0	1	0	0	1
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

Project: Description:
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Calculated:
12/01/2022 09.40

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

Frequency distribution (TAB file data)

140,00m - MCP LT - MCP session (1) - [Matrix]

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			9,50	7,24	7,19	7,70	8,73	9,47	9,45	9,34	10,87	10,83	10,43	9,67	7,69
0		0,49	739	76	114	95	77	48	9	67	34	40	73	43	63
1	0,50	1,49	3037	420	212	330	274	198	236	157	189	261	283	212	265
2	1,50	2,49	6411	625	468	508	513	385	511	481	432	700	652	552	584
3	2,50	3,49	9719	832	931	610	549	644	517	590	901	1394	1018	1119	614
4	3,50	4,49	12008	912	1013	694	576	842	909	750	1118	1554	1413	1343	884
5	4,50	5,49	12939	967	826	794	718	1151	1155	962	1030	1276	1534	1332	1194
6	5,50	6,49	12813	910	738	757	1033	1433	834	949	1013	1216	1364	1333	1233
7	6,50	7,49	14009	926	774	667	1129	1371	1171	1049	906	1442	1689	1654	1231
8	7,50	8,49	14171	779	618	594	1191	1281	1376	973	1353	1390	1853	1615	1148
9	8,50	9,49	15273	770	579	559	1138	1189	1582	1253	1431	1725	2446	1625	976
10	9,50	10,49	13458	648	391	640	1066	1649	1229	729	1125	1502	2218	1415	846
11	10,50	11,49	13642	605	649	799	1061	1585	1073	1177	1260	1818	1957	1071	587
12	11,50	12,49	13508	388	490	804	1067	1164	1579	1336	1233	1875	1942	1130	500
13	12,50	13,49	11208	348	392	469	705	858	750	747	1651	2105	1828	999	356
14	13,50	14,49	9523	231	218	264	495	917	992	914	1372	1782	1365	708	265
15	14,50	15,49	8295	153	156	155	448	929	868	476	1031	1778	1270	809	222
16	15,50	16,49	6847	155	110	84	240	729	588	209	1172	1523	1105	785	147
17	16,50	17,49	4454	72	50	43	133	383	210	195	726	952	830	716	144
18	17,50	18,49	3607	49	30	25	83	225	153	141	547	922	769	600	63
19	18,50	19,49	2667	45	18	8	52	120	144	104	512	722	627	279	36
20	19,50	20,49	1514	25	2	3	16	31	60	79	358	448	316	143	33
21	20,50	21,49	1108	15	5	2	5	13	32	82	258	270	265	142	19
22	21,50	22,49	753	6	4	2	1	5	26	41	209	181	157	97	24
23	22,50	23,49	441	2	1	2	2	4	3	35	92	84	113	92	11
24	23,50	24,49	293	2	0	0	0	0	2	31	47	67	64	77	3
25	24,50	25,49	154	1	0	0	0	0	1	12	28	30	46	32	4
26	25,50	26,49	95	2	0	0	0	0	0	12	10	16	34	18	3
27	26,50	27,49	72	0	0	0	0	0	0	6	6	12	39	8	1
28	27,50	28,49	34	0	0	0	0	0	0	7	6	1	12	8	0
29	28,50	29,49	29	1	0	0	0	0	0	4	4	2	10	6	2
30	29,50	30,49	21	1	0	0	0	0	0	4	1	2	11	2	0
31	30,50	31,49	9	1	0	0	0	0	0	1	0	0	4	2	1
32	31,50	32,49	6	0	0	0	0	0	0	0	0	0	2	4	0
33	32,50	33,49	2	0	0	0	0	0	0	0	1	0	1	0	0
34	33,50	34,49	2	0	0	0	0	0	0	0	0	1	0	1	0
35	34,50	35,49	1	0	0	0	0	0	0	0	1	0	0	0	0
36	35,50	36,49	1	0	0	0	0	0	0	0	0	1	0	0	0
37	36,50	37,49	1	0	0	0	0	0	0	1	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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Calculated:
12/01/2022 09.40

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

Frequency distribution (TAB file data)

120,00m - MCP LT - MCP session (7) - [Matrix]

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			9,39	7,29	7,20	7,63	8,61	9,48	9,39	9,16	10,82	10,66	10,22	9,49	7,52
0		0,49	608	72	76	80	41	17	37	45	56	34	51	33	66
1	0,50	1,49	3168	361	183	322	242	190	325	176	214	309	316	231	299
2	1,50	2,49	6596	702	457	585	524	473	448	491	518	640	705	515	538
3	2,50	3,49	9381	821	874	561	574	674	523	509	928	1216	1029	949	723
4	3,50	4,49	12226	856	957	736	631	764	890	853	1013	1566	1427	1575	958
5	4,50	5,49	13312	983	917	851	781	1427	1108	968	1032	1282	1550	1272	1141
6	5,50	6,49	13328	857	793	1001	1053	1244	978	969	1138	1300	1532	1286	1177
7	6,50	7,49	14063	1027	728	706	1142	1320	979	1113	1020	1415	1809	1585	1219
8	7,50	8,49	14439	786	684	601	1123	1382	1676	863	1282	1559	1870	1595	1018
9	8,50	9,49	15474	762	504	683	1372	1399	1481	1087	1512	1808	2387	1691	788
10	9,50	10,49	14176	895	518	597	972	1504	1173	886	1166	1795	2327	1492	851
11	10,50	11,49	13949	532	527	769	1046	1625	1379	1325	1310	1846	2032	1011	547
12	11,50	12,49	12721	387	471	667	894	1112	1347	1031	1352	2084	1763	1145	468
13	12,50	13,49	10961	352	379	384	695	928	1017	892	1516	1675	1644	1080	399
14	13,50	14,49	9080	236	228	188	448	1109	857	689	1127	1750	1535	685	228
15	14,50	15,49	8822	200	166	166	355	934	950	456	1423	1882	1332	783	175
16	15,50	16,49	6250	123	95	111	256	683	427	233	1053	1624	850	617	178
17	16,50	17,49	4212	60	43	68	143	361	216	175	708	837	916	578	107
18	17,50	18,49	3903	48	24	48	93	202	161	134	929	940	806	442	76
19	18,50	19,49	2414	41	11	32	48	117	113	95	514	645	460	292	46
20	19,50	20,49	1284	26	0	14	28	62	62	55	285	280	272	176	24
21	20,50	21,49	976	8	2	11	3	22	42	62	264	191	216	141	14
22	21,50	22,49	636	5	7	4	2	11	23	49	147	109	159	108	12
23	22,50	23,49	358	7	0	7	0	7	9	19	65	70	98	71	5
24	23,50	24,49	190	0	0	6	1	2	5	12	34	39	58	31	2
25	24,50	25,49	131	3	0	1	1	0	2	13	26	26	38	19	2
26	25,50	26,49	89	0	0	0	0	0	1	8	17	17	30	15	1
27	26,50	27,49	41	0	0	0	0	0	0	7	2	5	19	8	0
28	27,50	28,49	26	0	0	1	0	0	0	5	2	3	12	3	0
29	28,50	29,49	21	0	0	1	0	0	0	2	5	1	7	5	0
30	29,50	30,49	14	0	0	0	0	0	0	1	2	2	6	3	0
31	30,50	31,49	7	0	0	0	0	0	0	0	0	0	3	4	0
32	31,50	32,49	3	0	0	0	0	0	0	0	0	0	2	1	0
33	32,50	33,49	1	0	0	0	0	0	0	0	0	1	0	0	0
34	33,50	34,49	2	0	0	0	0	0	0	0	1	0	1	0	0
35	34,50	35,49	1	0	0	0	0	0	0	0	0	0	1	0	0
36	35,50	36,49	1	0	0	0	0	0	0	0	0	1	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

Project: Description:
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Calculated:
12/01/2022 09.40

Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

Frequency distribution (TAB file data)

100,00m - MCP LT - MCP session (6) - [Matrix]

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			9,23	7,32	7,11	7,38	8,53	9,34	9,18	9,13	10,66	10,36	10,12	9,33	7,36
0		0,49	635	46	91	76	37	9	56	52	47	42	46	47	86
1	0,50	1,49	3374	378	205	394	250	135	344	235	224	288	322	232	367
2	1,50	2,49	6259	599	467	557	468	472	371	431	538	664	680	524	488
3	2,50	3,49	9694	834	884	712	659	605	577	511	930	1303	1008	987	684
4	3,50	4,49	12127	875	991	709	631	946	840	705	990	1637	1424	1447	932
5	4,50	5,49	14026	1028	970	894	886	1468	1130	1006	1066	1370	1615	1353	1240
6	5,50	6,49	13768	898	814	964	1079	1190	1127	1077	1174	1418	1517	1287	1223
7	6,50	7,49	14246	1053	757	704	1186	1418	897	1011	1020	1500	1870	1540	1290
8	7,50	8,49	14844	728	647	701	1165	1413	1811	941	1327	1606	1860	1550	1095
9	8,50	9,49	15337	865	537	614	1295	1427	1230	1084	1443	1746	2409	1849	838
10	9,50	10,49	15107	846	657	649	1096	1725	1196	967	1464	1829	2283	1505	890
11	10,50	11,49	13483	496	518	754	1034	1610	1468	1041	1282	1852	1923	987	518
12	11,50	12,49	13176	379	469	623	968	1130	1303	1181	1661	2084	1940	1003	435
13	12,50	13,49	10664	371	364	288	627	1052	885	897	1423	1665	1686	1039	367
14	13,50	14,49	9676	259	208	193	442	1107	990	678	1521	1855	1555	677	191
15	14,50	15,49	8129	203	161	134	315	826	759	439	1193	1828	1323	787	161
16	15,50	16,49	5478	104	80	112	257	595	327	239	850	1307	875	569	163
17	16,50	17,49	4828	60	34	58	154	299	204	201	1100	1216	859	563	80
18	17,50	18,49	3161	63	17	38	86	162	127	130	668	683	695	430	62
19	18,50	19,49	1729	38	11	21	37	91	80	73	390	325	403	219	41
20	19,50	20,49	1239	20	1	6	23	42	59	78	324	252	264	156	14
21	20,50	21,49	796	8	4	9	7	15	27	48	194	145	201	124	14
22	21,50	22,49	414	4	5	8	1	7	6	26	84	72	125	71	5
23	22,50	23,49	264	7	0	7	2	7	5	21	43	56	71	38	7
24	23,50	24,49	161	4	0	2	0	0	0	8	33	30	48	31	5
25	24,50	25,49	96	1	1	2	0	0	0	8	14	14	34	21	1
26	25,50	26,49	59	2	0	0	0	0	0	5	10	10	21	10	1
27	26,50	27,49	33	0	0	0	0	0	0	1	0	8	16	8	0
28	27,50	28,49	21	0	0	1	0	0	0	1	4	1	10	4	0
29	28,50	29,49	15	1	0	0	0	0	0	0	3	2	5	4	0
30	29,50	30,49	8	0	0	0	0	0	0	1	0	0	6	1	0
31	30,50	31,49	6	0	0	0	0	0	0	0	0	0	3	3	0
32	31,50	32,49	8	0	0	1	0	0	0	1	0	0	3	3	0
33	32,50	33,49	1	0	0	0	0	0	0	1	0	0	0	0	0
34	33,50	34,49	1	0	0	0	0	0	0	0	1	0	0	0	0
35	34,50	35,49	1	0	0	0	0	0	0	0	0	1	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

Project: Description:
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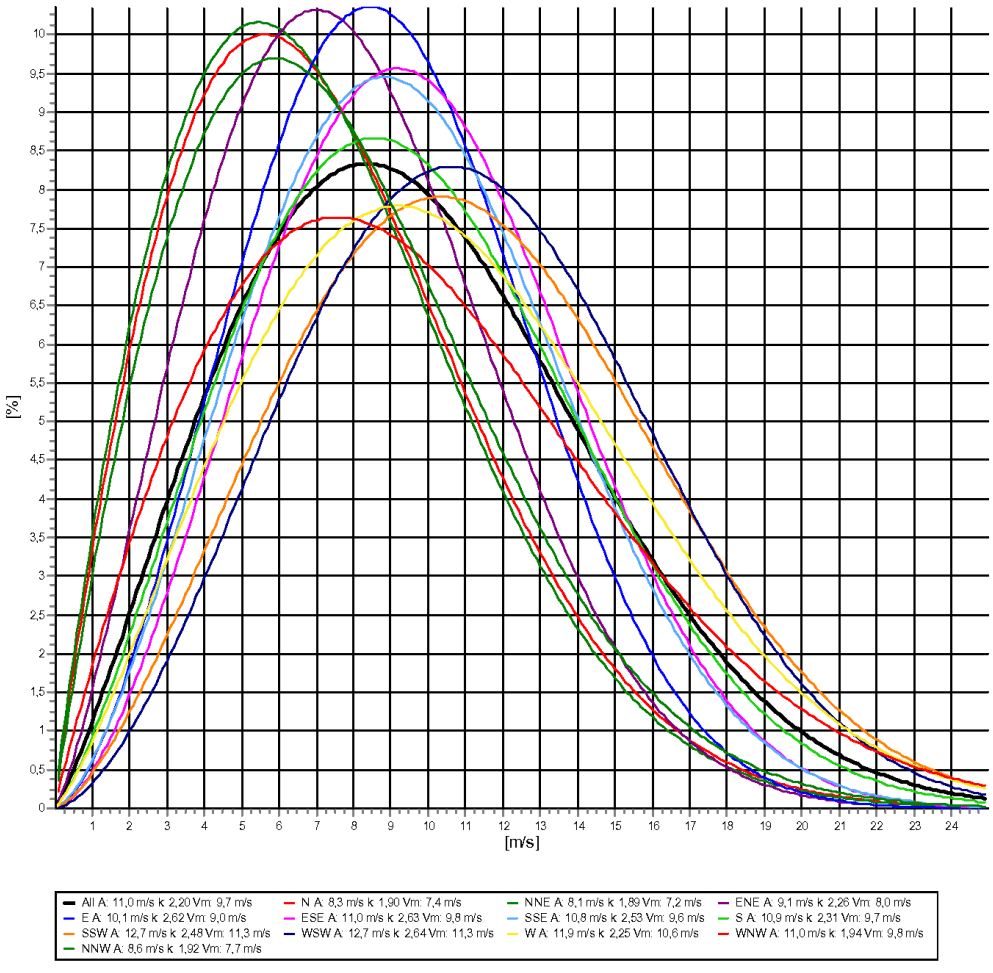
Meteo data report - Weibull data overview

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)
Height: **160,00m - MCP LT - MCP session (8) - [Matrix]**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,31	1,905	5,13	7,37
1-NNE	8,14	1,889	4,37	7,23
2-ENE	9,06	2,265	4,63	8,03
3-E	10,13	2,624	6,47	9,00
4-ESE	11,01	2,634	8,89	9,78
5-SSE	10,77	2,527	8,26	9,56
6-S	10,95	2,307	7,19	9,70
7-SSW	12,71	2,485	10,26	11,27
8-WSW	12,72	2,640	14,04	11,31
9-W	11,95	2,247	14,44	10,58
10-WNW	11,01	1,940	10,36	9,76
11-NNW	8,63	1,924	5,96	7,66
Mean	**11,00**	**2,203**	**100,00**	**9,75**



Project: Description:
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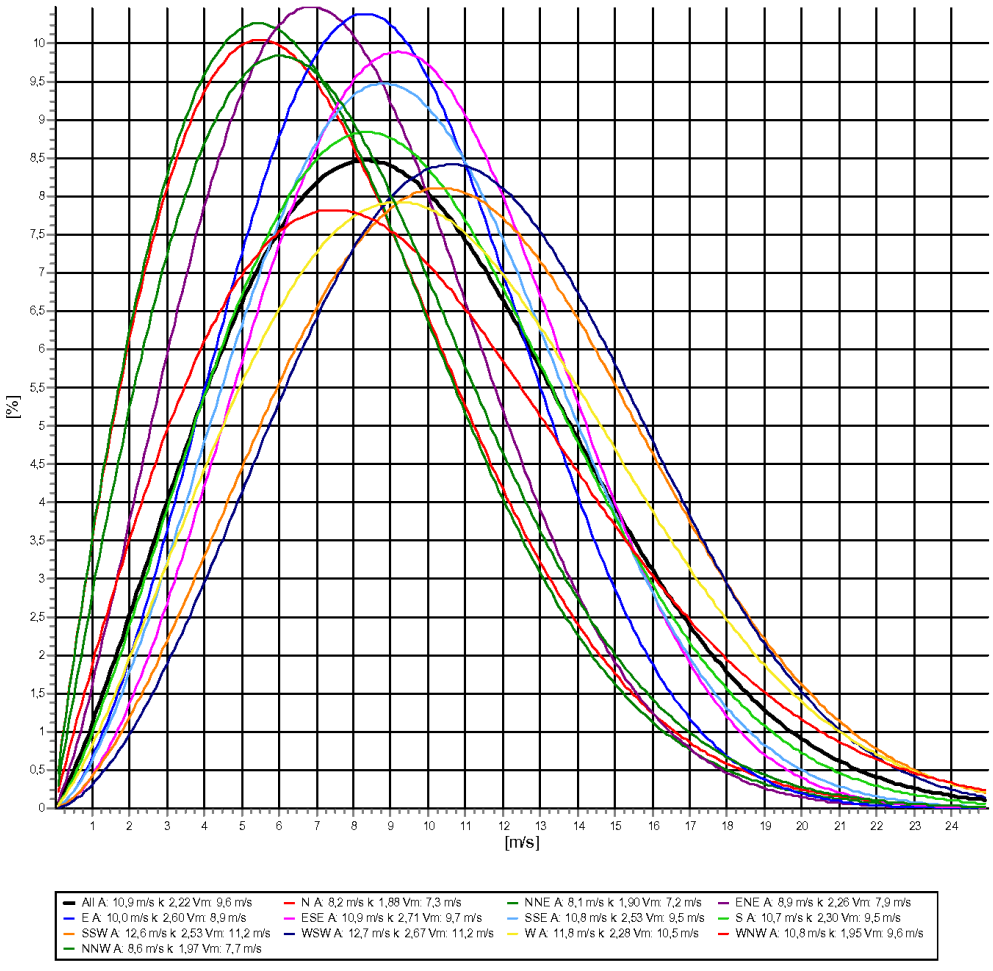
Meteo data report - Weibull data overview

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)
Height: **140,00m - MCP LT - MCP session (1) - [Matrix]**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,23	1,883	5,17	7,30
1-NNE	8,09	1,899	4,56	7,18
2-ENE	8,91	2,258	4,62	7,89
3-E	10,02	2,595	6,52	8,90
4-ESE	10,89	2,707	8,89	9,69
5-SSE	10,76	2,529	8,30	9,55
6-S	10,71	2,300	7,04	9,49
7-SSW	12,59	2,533	10,40	11,17
8-WSW	12,65	2,669	14,05	11,25
9-W	11,85	2,276	14,16	10,49
10-WNW	10,79	1,952	10,36	9,56
11-NNW	8,64	1,970	5,94	7,66
Mean	**10,89**	**2,221**	**100,00**	**9,64**



Project: Description:
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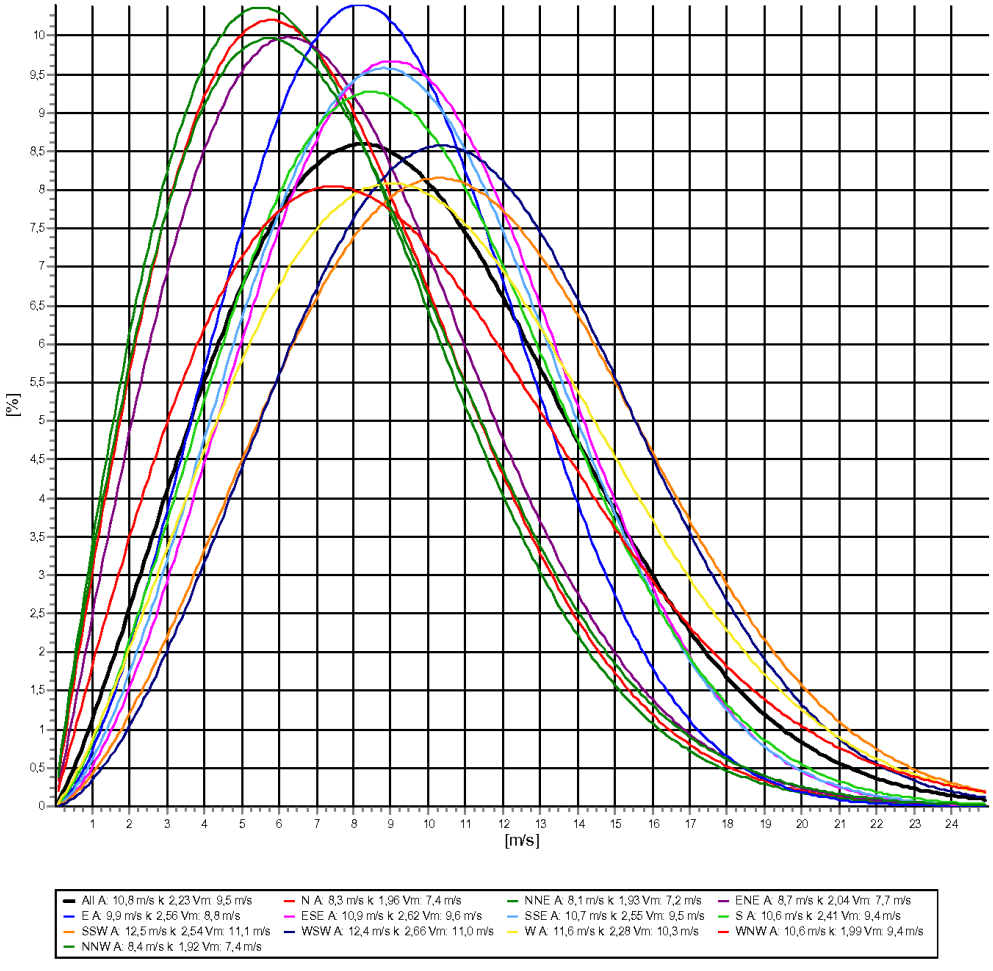
Meteo data report - Weibull data overview

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)
Height: **120,00m - MCP LT - MCP session (7) - [Matrix]**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,31	1,965	5,26	7,37
1-NNE	8,08	1,928	4,48	7,16
2-ENE	8,70	2,038	4,77	7,71
3-E	9,91	2,565	6,46	8,80
4-ESE	10,85	2,623	9,11	9,64
5-SSE	10,71	2,552	8,41	9,51
6-S	10,58	2,408	6,86	9,38
7-SSW	12,53	2,537	10,71	11,12
8-WSW	12,37	2,656	13,97	10,99
9-W	11,61	2,275	14,14	10,29
10-WNW	10,61	1,985	10,08	9,40
11-NNW	8,39	1,922	5,74	7,44
Mean	**10,75**	**2,227**	**100,00**	**9,52**



Project: Description:
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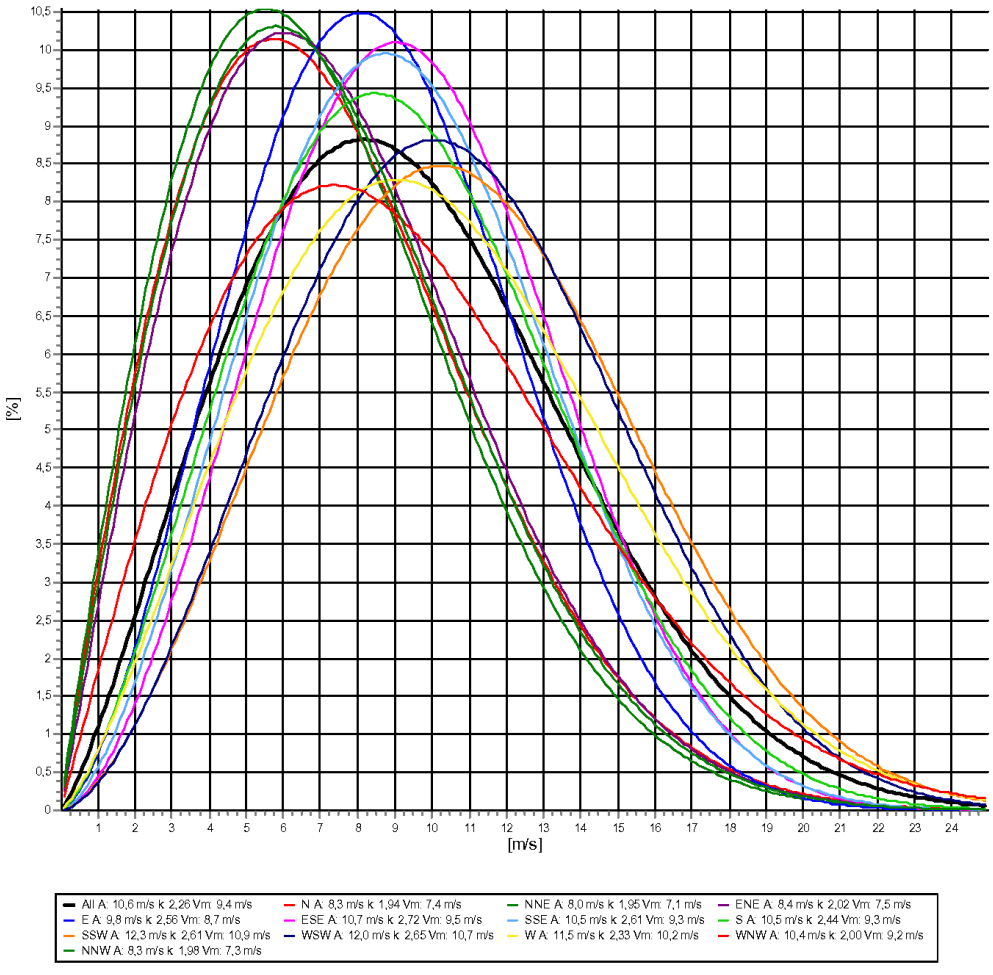
Meteo data report - Weibull data overview

Mast: Hesselø LTC 99-21 matrix; Long-term corrected data at Hesselø FLS **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)
Height: **100,00m - MCP LT - MCP session (6) - [Matrix]**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,30	1,942	5,27	7,36
1-NNE	7,99	1,945	4,61	7,09
2-ENE	8,44	2,020	4,79	7,48
3-E	9,80	2,557	6,59	8,70
4-ESE	10,71	2,717	9,20	9,52
5-SSE	10,51	2,610	8,20	9,33
6-S	10,51	2,441	6,79	9,32
7-SSW	12,33	2,608	10,90	10,95
8-WSW	12,02	2,654	13,90	10,68
9-W	11,52	2,328	14,05	10,21
10-WNW	10,43	1,998	9,89	9,24
11-NNW	8,27	1,982	5,81	7,33
Mean	**10,58**	**2,258**	**100,00**	**9,37**



Appendix E. Alternative Model: Calibrated Mesoscale Dataset (140 m)

Project:
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Meteo data report - Monthly wind speeds

Mast: Calibrated meso data; Calibrated Mesoscale Data Model (140 m) **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

Monthly wind speeds

140,00m -

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
January		12,71	9,08	12,69	11,62	9,77	13,27	9,16	14,60	14,32	9,68	9,19	10,39	11,21	9,98	13,31	12,55	10,95	9,98	10,49
February		12,29	10,57	14,05	7,08	9,75	10,94	8,38	10,84	13,27	8,61	8,43	12,26	11,23	7,86	12,58	11,08	10,52	11,06	9,39
March		10,54	8,43	11,28	9,08	10,58	8,87	8,39	11,21	11,50	9,83	9,41	11,02	11,32	9,73	10,80	10,51	7,68	10,32	9,02
April		8,34	8,42	7,57	9,94	8,63	8,42	9,01	9,20	7,25	8,07	9,51	8,92	8,76	9,61	8,92	10,04	8,98	10,05	9,90
May		7,99	8,20	8,76	8,37	9,26	7,62	9,41	8,20	5,62	8,53	8,06	9,42	8,73	8,74	7,04	10,00	7,70	8,68	7,43
June		9,06	7,67	9,35	9,41	8,94	8,47	7,42	6,77	8,85	8,20	7,36	7,87	8,84	8,47	6,56	8,99	7,73	10,63	7,68
July		6,53	6,57	8,29	6,89	7,21	7,06	5,76	9,17	6,71	8,03	7,78	7,67	7,72	7,66	7,09	8,88	7,63	8,35	6,42
August		7,98	8,99	7,60	7,44	7,93	7,84	6,12	8,98	8,98	9,29	8,30	8,62	7,04	7,68	9,42	8,85	9,53	8,52	8,51
September		9,84	8,27	7,55	8,67	10,07	8,58	10,20	10,97	8,09	10,14	9,65	10,49	11,28	7,48	8,30	9,49	7,93	8,05	11,08
October	10,84	10,09	11,47	9,79	8,64	10,81	9,46	9,34	7,52	11,56	10,06	9,87	11,13	9,72	10,91	11,14	9,20	10,40	12,09	11,34
November	10,02	10,49	11,30	9,28	9,94	10,41	10,45	12,31	10,78	11,31	12,65	10,42	9,76	10,45	10,00	10,11	11,47	11,50	10,39	9,30
December	12,09	9,34	9,07	9,34	12,00	10,86	10,52	12,56	9,62	8,19	8,67	8,77	13,26	10,78	13,38	11,02	13,76	11,56	12,12	10,78
mean, all data	11,00	9,59	8,99	9,61	9,10	9,52	9,28	9,00	9,82	9,63	9,31	8,90	10,06	9,75	9,31	9,68	10,40	9,34	10,02	9,28
mean of months	10,98	9,60	9,00	9,63	9,09	9,52	9,29	9,01	9,82	9,64	9,31	8,90	10,07	9,76	9,29	9,69	10,40	9,34	10,02	9,28

Monthly wind speeds

140,00m -

Month	2019	2020	2021	Mean	Mean of month
January	10,77	12,84	9,09	11,26	11,26
February	11,61	13,44	10,60	10,73	10,72
March	11,78	10,39	10,19	10,09	10,09
April	8,49	9,59	9,04	8,94	8,94
May	9,07	8,79	7,43	8,32	8,32
June	8,72	7,38	7,14	8,25	8,25
July	8,04	9,97	7,26	7,58	7,58
August	7,90	6,60	8,81	8,22	8,22
September	10,52	9,08	7,71	9,25	9,25
October	9,16	9,81	15,48	10,20	10,43
November	9,12	11,07		10,57	10,57
December	11,67	10,28		10,89	10,89
mean, all data	9,73	9,93	8,57	9,53	
mean of months	9,74	9,94	9,27		9,54

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Calculated:
12/01/2022 10.03

Meteo data report - Frequency distribution (TAB file data)

Mast: Calibrated meso data; Calibrated Mesoscale Data Model (140 m) **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

Frequency distribution (TAB file data)

140,00m -

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			9,52	7,68	7,25	7,83	8,48	9,43	9,44	9,38	10,74	10,82	10,39	9,67	7,63
0		0,49	77	8	4	5	5	2	7	9	7	8	9	6	7
1	0,50	1,49	2461	207	183	208	208	194	207	205	186	194	211	227	231
2	1,50	2,49	5958	523	499	414	477	448	448	482	492	556	542	490	587
3	2,50	3,49	8673	783	641	606	604	575	646	626	831	878	892	781	810
4	3,50	4,49	10732	920	794	702	709	724	811	844	1032	1138	1007	1053	998
5	4,50	5,49	12212	978	910	837	783	955	890	908	1127	1256	1288	1203	1077
6	5,50	6,49	13138	1018	863	833	785	1055	1000	989	1188	1477	1450	1420	1060
7	6,50	7,49	14557	1033	791	887	945	1272	1105	1102	1374	1672	1770	1507	1099
8	7,50	8,49	15750	953	813	861	1062	1295	1391	1143	1597	1894	2195	1548	998
9	8,50	9,49	15863	926	699	721	1022	1409	1365	1165	1658	1960	2392	1632	914
10	9,50	10,49	16029	764	564	811	1129	1408	1463	1169	1628	2204	2482	1614	793
11	10,50	11,49	15014	664	505	767	935	1378	1354	1108	1617	2206	2456	1416	608
12	11,50	12,49	13736	513	397	563	765	1307	1258	1129	1593	2405	2116	1212	478
13	12,50	13,49	11748	354	293	375	630	1106	1140	937	1477	2117	1928	1037	354
14	13,50	14,49	10009	213	212	248	504	921	869	755	1496	1985	1649	866	291
15	14,50	15,49	7842	159	104	161	277	663	674	527	1229	1723	1371	765	189
16	15,50	16,49	6007	137	61	108	166	456	494	435	1041	1397	1001	548	163
17	16,50	17,49	4378	102	39	66	83	261	314	282	953	1028	702	447	101
18	17,50	18,49	2863	85	23	23	68	156	146	176	632	664	474	353	63
19	18,50	19,49	2096	49	10	8	21	103	79	140	506	508	362	252	58
20	19,50	20,49	1428	28	2	5	6	33	51	105	368	368	246	176	40
21	20,50	21,49	906	15	1	5	7	14	31	49	243	209	169	148	15
22	21,50	22,49	582	10	6	2	2	5	6	36	140	139	131	92	13
23	22,50	23,49	327	2	0	2	0	4	0	18	70	73	79	67	12
24	23,50	24,49	193	3	0	2	0	0	0	13	29	45	69	29	3
25	24,50	25,49	109	5	0	0	0	0	0	8	14	21	35	24	2
26	25,50	26,49	60	1	0	0	0	0	0	2	9	10	24	14	0
27	26,50	27,49	48	0	0	0	0	0	0	0	8	10	20	10	0
28	27,50	28,49	22	0	0	0	0	0	0	0	2	4	12	4	0
29	28,50	29,49	15	0	0	0	0	0	0	0	2	0	9	4	0
30	29,50	30,49	15	0	0	0	0	0	0	0	1	2	8	4	0
31	30,50	31,49	6	0	0	0	0	0	0	0	0	0	2	4	0
32	31,50	32,49	7	0	0	0	0	0	0	0	0	0	3	4	0
33	32,50	33,49	0	0	0	0	0	0	0	0	0	0	0	0	0
34	33,50	34,49	0	0	0	0	0	0	0	0	0	0	0	0	0
35	34,50	35,49	3	0	0	0	0	0	0	0	1	2	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

Project:
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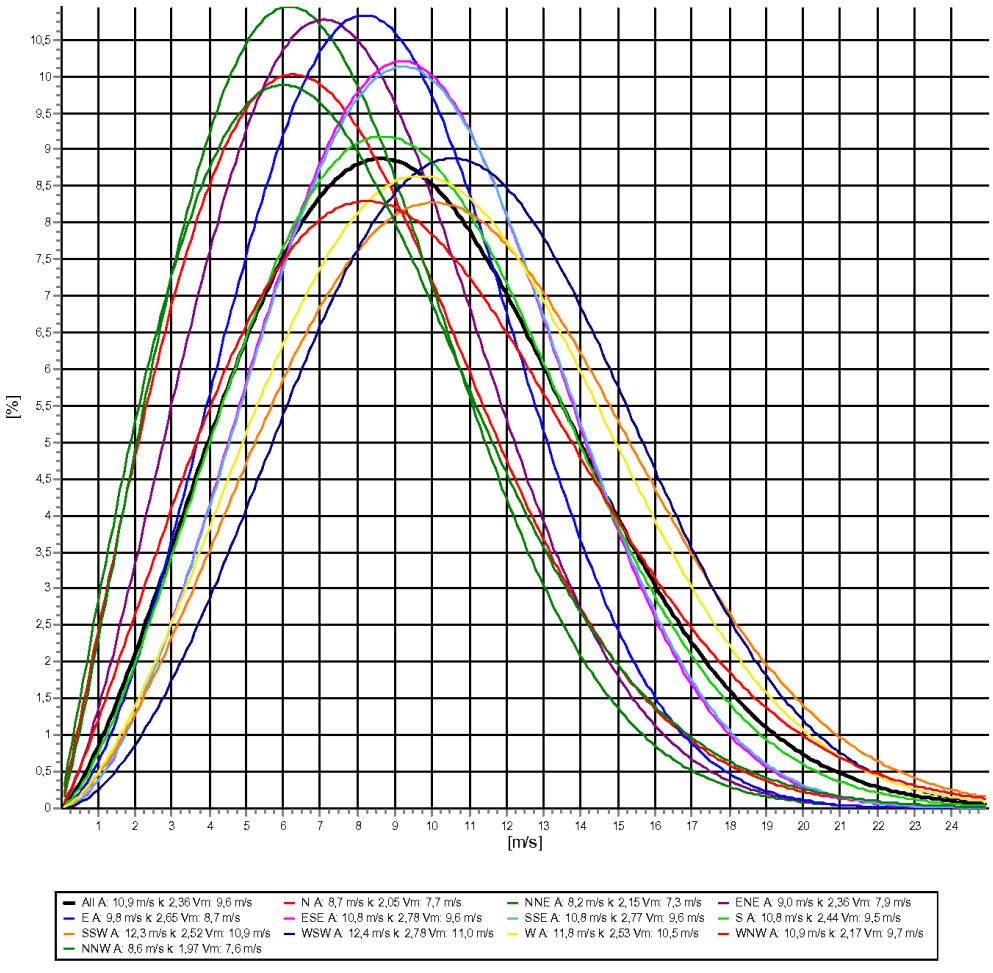
Meteo data report - Weibull data overview

Mast: Calibrated meso data; Calibrated Mesoscale Data Model (140 m) **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)
Height: **140,00m** -

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,69	2,049	5,42	7,70
1-NNE	8,23	2,151	4,36	7,29
2-ENE	8,95	2,357	4,78	7,93
3-E	9,77	2,653	5,80	8,69
4-ESE	10,79	2,779	8,16	9,61
5-SSE	10,84	2,771	8,17	9,65
6-S	10,77	2,436	7,45	9,55
7-SSW	12,28	2,519	11,69	10,90
8-WSW	12,41	2,781	14,60	11,04
9-W	11,80	2,532	14,05	10,48
10-WNW	10,94	2,170	9,83	9,68
11-NNW	8,59	1,968	5,68	7,61
Mean	**10,88**	**2,363**	**100,00**	**9,64**



Appendix F. Alternative Model: Translated Læsø Data

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Meteo data report - Monthly wind speeds

Mast: Hesselø LTC 99-21 matrix; Translated Læsø Data Model **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

Monthly wind speeds

140,00m - MCP LT - MCP session (3) - [Matrix]

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
January		12,32	9,14	12,24	11,03	9,91	12,62	9,26	13,76	13,75	9,57	8,97	10,28	11,02	9,72	12,86	12,16	10,65	9,73	10,31
February		11,78	10,33	13,41	7,41	9,60	10,46	8,55	10,78	12,55	8,52	8,55	11,77	10,97	8,02	12,24	10,87	10,56	10,75	9,27
March		10,46	8,46	10,97	9,18	10,32	8,78	8,48	10,92	11,28	9,68	9,35	10,84	11,13	9,79	10,64	10,38	7,99	10,22	9,08
April		8,44	8,54	7,85	9,84	8,77	8,74	9,15	9,35	7,62	8,31	9,55	9,13	8,89	9,45	8,80	9,94	8,97	10,04	9,95
May		8,27	8,30	8,83	8,68	9,46	8,07	9,37	8,26	6,28	8,59	8,24	9,38	8,89	8,78	7,45	9,88	8,02	8,93	7,62
June		9,24	7,95	9,33	9,47	9,05	8,60	7,72	7,31	8,92	8,34	7,75	8,16	8,78	8,65	7,06	8,97	7,96	10,54	8,08
July		6,92	7,03	8,31	7,26	7,62	7,58	6,31	9,25	7,05	8,08	7,88	7,96	8,07	7,89	7,44	9,01	7,97	8,48	6,92
August		8,47	9,07	7,64	7,62	8,08	8,21	6,55	9,04	8,98	9,25	8,40	8,66	7,46	8,04	9,50	9,08	9,38	8,72	8,65
September		9,75	8,49	7,88	8,94	10,05	8,70	10,07	10,74	8,32	9,98	9,59	10,35	11,14	7,81	8,33	9,63	8,14	8,30	10,83
October	10,57	10,01	11,17	9,90	8,82	10,51	9,50	9,38	7,74	11,16	9,71	9,91	10,82	9,78	10,76	10,93	9,33	10,20	11,73	11,00
November	9,99	10,33	11,14	9,15	9,85	10,24	10,25	11,89	10,61	11,02	12,10	10,20	9,65	10,14	9,70	10,07	11,12	11,12	10,34	9,33
December	11,73	9,45	9,12	9,26	11,51	10,69	10,33	12,13	9,70	8,36	8,66	8,91	12,73	10,61	12,72	10,63	13,09	11,14	11,69	10,45
mean, all data	10,77	9,61	9,05	9,54	9,14	9,53	9,31	9,07	9,78	9,60	9,23	8,94	9,97	9,73	9,29	9,65	10,29	9,34	9,95	9,29
mean of months	10,76	9,62	9,06	9,56	9,13	9,53	9,32	9,07	9,79	9,61	9,23	8,94	9,98	9,74	9,28	9,66	10,29	9,34	9,96	9,29

Monthly wind speeds

140,00m - MCP LT - MCP session (3) - [Matrix]

Month	2019	2020	2021	Mean	Mean of month
January	10,56	12,33	9,07	10,97	10,97
February	11,23	12,82	10,46	10,50	10,50
March	11,58	10,28	9,99	9,99	9,99
April	8,51	9,60	9,09	9,03	9,02
May	9,08	8,88	7,71	8,50	8,50
June	8,84	7,69	7,53	8,45	8,45
July	8,30	9,78	7,54	7,85	7,85
August	8,18	7,07	8,76	8,40	8,40
September	10,33	9,07	8,10	9,30	9,30
October	9,12	9,77	14,57	10,08	10,28
November	9,11	10,66		10,36	10,36
December	11,27	10,07		10,65	10,65
mean, all data	9,67	9,83	8,68	9,51	
mean of months	9,68	9,83	9,28		9,52

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Meteo data report - Frequency distribution (TAB file data)

Mast: Hesselø LTC 99-21 matrix; Translated Læsø Data Model **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)

Frequency distribution (TAB file data)

140,00m - MCP LT - MCP session (3) - [Matrix]

Bin	Start	End	Sum	0-N	1-NNE	2-ENE	3-E	4-ESE	5-SSE	6-S	7-SSW	8-WSW	9-W	10-WNW	11-NNW
Mean			9,50	8,10	7,52	7,83	8,82	9,51	8,96	9,06	10,60	10,17	10,05	10,33	8,69
0		0,49	750	0	3	12	12	33	87	178	144	123	115	42	1
1	0,50	1,49	2151	25	65	126	120	231	282	313	256	233	292	174	34
2	1,50	2,49	4385	167	269	315	365	508	472	498	413	387	435	384	172
3	2,50	3,49	7067	378	560	527	579	735	647	617	565	625	732	687	415
4	3,50	4,49	10023	781	745	776	760	814	767	846	785	1051	1034	951	713
5	4,50	5,49	12217	816	811	875	1062	974	849	989	1100	1537	1339	1165	700
6	5,50	6,49	14184	949	865	877	996	1106	1003	1132	1405	1607	1840	1511	893
7	6,50	7,49	15704	1228	822	803	1194	1574	1161	1146	1413	1541	2085	1573	1164
8	7,50	8,49	16258	1205	756	842	1212	1757	1349	1104	1356	1613	2297	1728	1039
9	8,50	9,49	16914	938	761	932	1361	1591	1330	1191	1450	1865	2603	1865	1027
10	9,50	10,49	16519	644	565	829	1241	1521	1296	1218	1469	2160	2939	1825	812
11	10,50	11,49	15697	498	489	755	1000	1488	997	1134	1691	2200	2880	1944	621
12	11,50	12,49	13806	322	357	675	798	1369	934	997	1685	2319	2427	1463	460
13	12,50	13,49	12029	300	194	304	728	1277	825	822	1549	2010	2265	1344	411
14	13,50	14,49	10041	197	184	218	743	1012	740	744	1487	1635	1759	1089	233
15	14,50	15,49	8006	203	151	108	409	745	566	561	1315	1237	1297	1145	269
16	15,50	16,49	5988	181	100	81	292	527	307	414	1120	914	931	899	222
17	16,50	17,49	4202	110	22	29	191	479	214	321	808	673	519	669	167
18	17,50	18,49	2575	47	15	18	77	219	156	167	487	406	338	526	119
19	18,50	19,49	1591	44	7	6	28	134	96	133	298	167	205	407	66
20	19,50	20,49	1067	7	3	2	8	100	58	71	216	122	175	275	30
21	20,50	21,49	650	6	0	3	4	30	15	49	155	104	108	152	24
22	21,50	22,49	431	1	1	0	0	17	8	23	106	64	65	132	14
23	22,50	23,49	251	1	0	0	0	3	5	14	84	57	40	39	8
24	23,50	24,49	151	4	0	0	0	0	1	6	25	34	37	38	6
25	24,50	25,49	93	0	0	0	0	1	0	5	10	23	24	29	1
26	25,50	26,49	34	0	0	0	0	0	1	1	5	8	10	8	1
27	26,50	27,49	35	0	0	0	0	0	0	5	5	0	12	13	0
28	27,50	28,49	22	0	0	0	0	0	0	2	3	3	6	8	0
29	28,50	29,49	8	0	0	0	0	0	0	0	1	1	4	2	0
30	29,50	30,49	7	0	0	0	0	0	0	0	1	1	4	1	0
31	30,50	31,49	3	0	0	0	0	0	0	0	1	0	2	0	0
32	31,50	32,49	1	0	0	0	0	0	0	0	0	1	0	0	0
33	32,50	33,49	3	0	0	0	0	0	0	0	0	0	2	1	0
34	33,50	34,49	1	0	0	0	0	0	0	0	0	0	1	0	0
35	34,50	35,49	0	0	0	0	0	0	0	0	0	0	0	0	0
36	35,50	36,49	0	0	0	0	0	0	0	0	0	0	0	0	0
37	36,50	37,49	0	0	0	0	0	0	0	0	0	0	0	0	0
38	37,50	38,49	0	0	0	0	0	0	0	0	0	0	0	0	0
39	38,50	39,49	0	0	0	0	0	0	0	0	0	0	0	0	0
40	39,50	40,49	0	0	0	0	0	0	0	0	0	0	0	0	0
41	40,50		0	0	0	0	0	0	0	0	0	0	0	0	0

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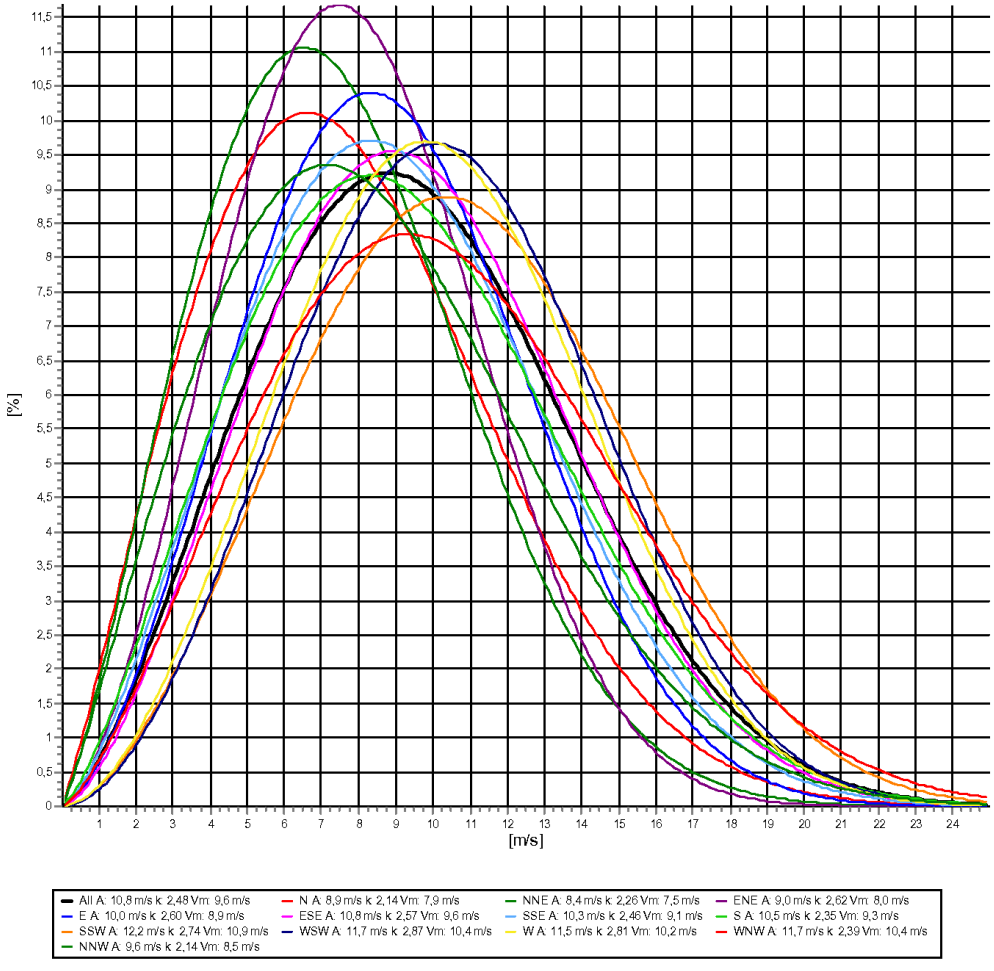
Meteo data report - Weibull data overview

Mast: Hesselø LTC 99-21 matrix; Translated Læsø Data Model **Period:** Full period: 01/10/1999 - 01/10/2021 (264,0 months)
Height: **140,00m - MCP LT - MCP session (3) - [Matrix]**

Weibull data

Sector	A [m/s]	k	f	Mean wind speed [m/s]
0-N	8,88	2,140	4,69	7,86
1-NNE	8,45	2,260	4,02	7,48
2-ENE	8,97	2,621	4,73	7,97
3-E	10,03	2,604	6,83	8,91
4-ESE	10,82	2,574	9,46	9,61
5-SSE	10,27	2,462	7,35	9,11
6-S	10,47	2,353	7,62	9,28
7-SSW	12,23	2,736	11,10	10,88
8-WSW	11,71	2,872	12,82	10,44
9-W	11,46	2,808	14,94	10,21
10-WNW	11,69	2,391	11,45	10,36
11-NNW	9,61	2,141	4,99	8,51
Mean	**10,85**	**2,475**	**100,00**	**9,62**



Appendix G. Normal Turbulence Model (140 m)

Wind speed [m/s]	Turbulence intensity mean value (TI_μ) [%]	Turbulence intensity standard deviation (TI_σ) [%]	Turbulence intensity 90% quantile [%]
3	12.4	5.4	19.3
4	9.6	4.2	15.0
5	8.1	3.5	12.6
6	7.2	3.1	11.1
7	6.6	2.7	10.1
8	6.2	2.5	9.4
9	6.0	2.3	8.9
10	5.8	2.2	8.6
11	5.8	2.0	8.4
12	5.8	1.9	8.2
13	5.8	1.8	8.2
14	5.9	1.8	8.2
15	6.0	1.7	8.2
16	6.1	1.6	8.2
17	6.3	1.6	8.3
18	6.4	1.5	8.4
19	6.6	1.5	8.5
20	6.8	1.5	8.6
21	7.0	1.4	8.8
22	7.2	1.4	8.9
23	7.4	1.4	9.1
24	7.6	1.3	9.3
25	7.8	1.3	9.5

Wind speed [m/s]	TURBULENCE MEAN VALUE (σ_μ) [M/S]	TURBULENCE STANDARD DEVIATION (σ_σ) [M/S]	Turbulence 90% QUANTILE [m/s]
3	0.37	0.16	0.58
4	0.39	0.17	0.60
5	0.40	0.18	0.63
6	0.43	0.18	0.66
7	0.46	0.19	0.70
8	0.50	0.20	0.75
9	0.54	0.21	0.80
10	0.58	0.22	0.86
11	0.64	0.22	0.92
12	0.69	0.23	0.98
13	0.76	0.24	1.06
14	0.83	0.25	1.13
15	0.90	0.25	1.22
16	0.98	0.26	1.31
17	1.07	0.27	1.40
18	1.16	0.28	1.50
19	1.25	0.28	1.60
20	1.36	0.29	1.71
21	1.46	0.30	1.83
22	1.58	0.31	1.95
23	1.69	0.32	2.08
24	1.82	0.32	2.21
25	1.95	0.33	2.34