

**ESMAPBD BDFE2**  
**Data Report WINDCUBEv2 S/N WLS7-598**  
**at the site Feni,**  
**Chittagong District, Bangladesh**  
**for the period from**  
**2019-08-01 to 2019-08-31**

**2019-10-02**


**Summary report: SG17010KB31**

# ESMAPBD BDFE2

## Data Report WINDCUBEv2 S/N WLS7-598

### at the site Feni, Chittagong District, Bangladesh

Summary report: SG17010KB31

<b>Location or measuring site:</b>	E 91.358190, N 22.800290, Feni, Chittagong District / Bangladesh		
<b>Client:</b>	<b>Suntrace GmbH</b>	Große Elbstraße 145c D-22767 Hamburg	
	On behalf of <b>Worldbank Group</b>	1818 H Street, NW Washington, DC 20433	
<b>Contractor:</b>	windtest grevenbroich gmbh Frimmersdorfer Str. 73a <b>D-41517 Grevenbroich</b>		
<b>Date of order:</b>	2017-09-12	<b>Contract number:</b>	17 0091 09
<b>Auditor:</b>	<b>Editor:</b>		

Dipl.-Umweltwiss. Eva-Maria Schmitt  
Head of Group site assessment

Dipl.-Ing. Florian Schmidt  
Project manager site assessment

Grevenbroich, 2019-10-02

This summary may only be copied in extracts with the written consent of windtest grevenbroich gmbh.  
It comprises 14 pages in total, incl. appendices.



## CONTENTS

<b>1</b>	<b>Introduction.....</b>	<b>4</b>
<b>2</b>	<b>Measurement statistics .....</b>	<b>4</b>
<b>3</b>	<b>Time series.....</b>	<b>5</b>
<b>4</b>	<b>Daily profile.....</b>	<b>6</b>
<b>5</b>	<b>Wind direction distribution .....</b>	<b>7</b>
<b>6</b>	<b>Natural turbulence .....</b>	<b>7</b>
<b>7</b>	<b>Wind profile.....</b>	<b>8</b>
<b>8</b>	<b>Station Log.....</b>	<b>9</b>
<b>9</b>	<b>Appendix .....</b>	<b>13</b>
9.1	Processing .....	13



## 1 Introduction

windtest grevenbroich gmbh (wtg) was instructed by Suntrace GmbH to evaluate the data of the LiDAR wind measurement system at the location Feni. This report only contains the data measured by the LiDAR device ranging from 2019-08-01 until 2019-08-31 at the present site. In parallel an environmental measurement including a small meteorological mast (10 m) is being performed by the customer. The results of these measurements can be taken from a separate report provided by the customer.

## 2 Measurement statistics

Table 1: Mean measurement values during the evaluation period

Mean Values	Wind speed [m/s]	Wind speed max [m/s]	Wind speed min [m/s]	Wind direction [°]	Weibull A [m/s]	Weibull k [ ]	Availability [%]
40 m	5,22	26,09	0,26	172,5	5,75	1,819	96,8
60 m	5,84	19,51	0,15	174,4	6,38	1,805	94,7
80 m	6,09	18,44	0,26	175,8	6,68	1,850	93,2
100 m	6,25	19,66	0,22	176,9	6,88	1,898	91,8
110 m	6,31	20,41	0,17	177,5	6,95	1,917	90,7
120 m	6,37	19,84	0,17	178,2	6,99	1,916	89,5
130 m	6,42	19,66	0,24	178,8	7,04	1,948	88,6
140 m	6,47	20,07	0,20	179,6	7,11	1,960	87,9
150 m	6,49	20,51	0,17	180,5	7,16	1,985	87,4
160 m	6,55	21,38	0,16	181,2	7,21	1,983	86,5
180 m	6,67	22,20	0,26	182,6	7,36	2,041	83,9
200 m	6,75	22,22	0,29	183,7	7,48	2,068	81,7

Table 2: Availability during the evaluation period

Availability per day [%]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
40 m	100	99	94	91	96	90	97	92	84	99	99	96	96	99	94	99	97	100	99	97	100	88	100	97	99	100	100	99	100	100	100
60 m	100	98	86	88	94	88	93	77	74	97	99	95	93	99	94	98	93	98	99	97	100	83	100	97	99	100	100	99	100	99	99
80 m	99	99	80	90	94	85	83	67	72	98	97	94	91	97	96	97	91	96	97	96	100	83	100	96	98	100	100	99	100	99	99
100 m	99	99	81	87	93	83	77	60	69	96	95	94	88	97	96	92	89	94	95	94	100	83	100	95	97	100	100	99	100	99	97
110 m	99	98	80	89	92	83	74	52	69	96	94	94	83	96	95	85	88	91	93	94	99	81	100	95	96	100	100	99	100	99	97
120 m	98	98	81	88	90	80	71	49	69	94	92	93	81	92	95	83	85	89	91	94	98	81	100	94	93	100	100	99	100	99	97
130 m	98	97	78	87	88	80	65	47	72	94	91	92	76	92	94	82	85	88	92	94	94	80	100	95	90	100	100	99	100	99	97
140 m	98	97	78	86	86	80	63	44	72	96	90	92	74	91	92	80	85	88	90	94	92	80	99	94	91	100	100	99	100	99	96
150 m	98	97	78	85	81	79	60	42	74	95	90	92	72	89	92	81	85	88	88	94	92	79	99	94	90	100	100	99	100	99	95
160 m	98	97	77	82	76	78	56	42	77	95	91	91	69	90	90	81	83	88	86	94	92	78	98	94	89	100	100	99	100	99	93
180 m	98	95	76	84	63	65	54	37	76	94	90	76	70	88	87	85	75	88	85	94	91	76	98	89	89	100	99	99	100	99	83
200 m	98	93	76	81	50	53	52	38	76	94	89	66	72	84	86	84	67	88	85	94	91	78	97	83	89	99	96	99	100	98	79



### 3 Time series

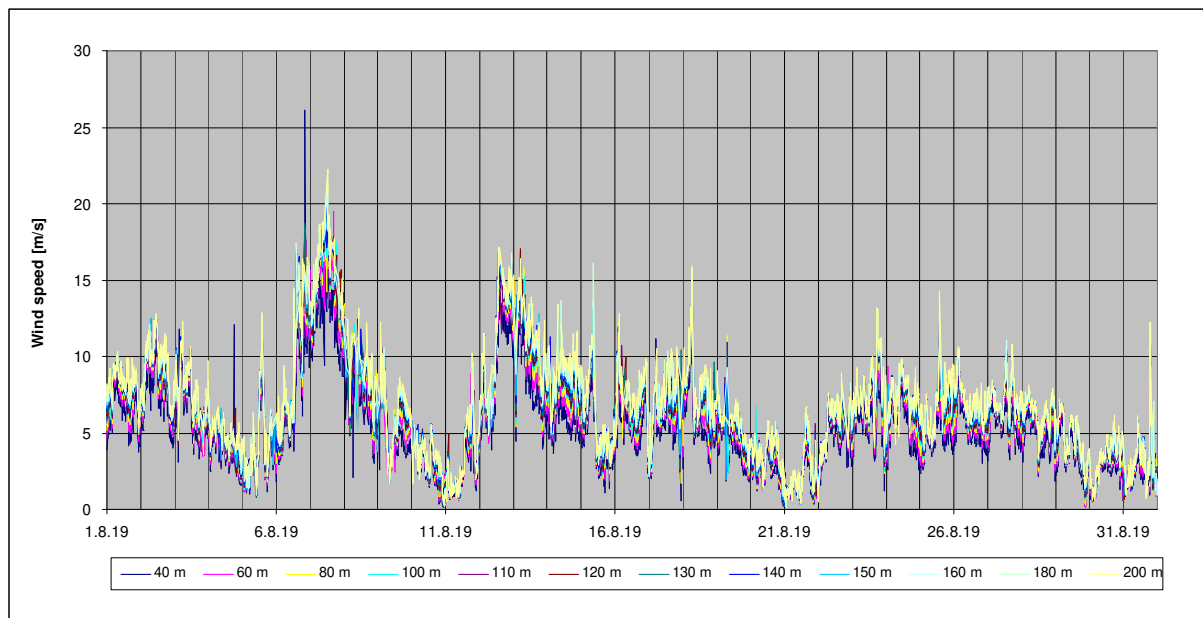


Figure 1: Time series of wind speed during the evaluation period

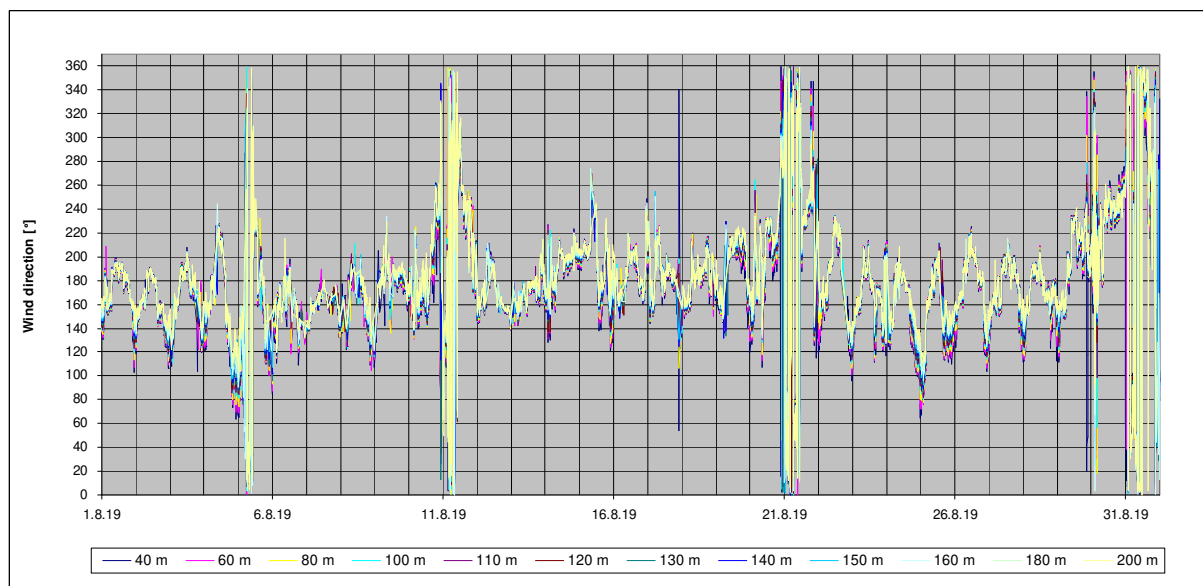


Figure 2: Time series of wind direction during the evaluation period



## 4 Daily profile

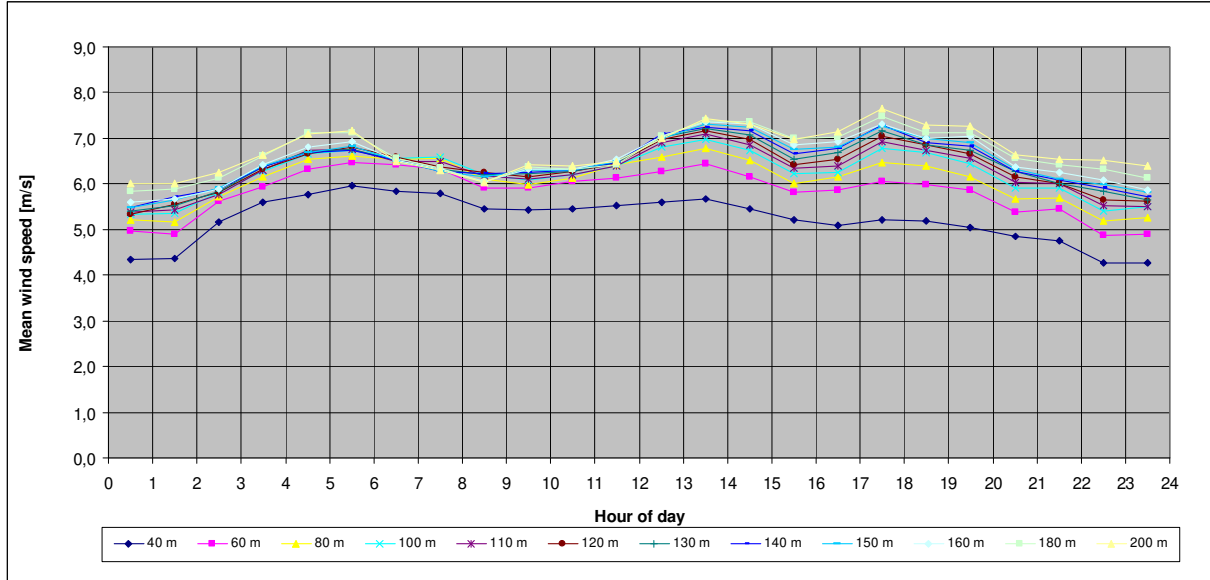


Figure 3: Daily profile of wind speed during the evaluation period

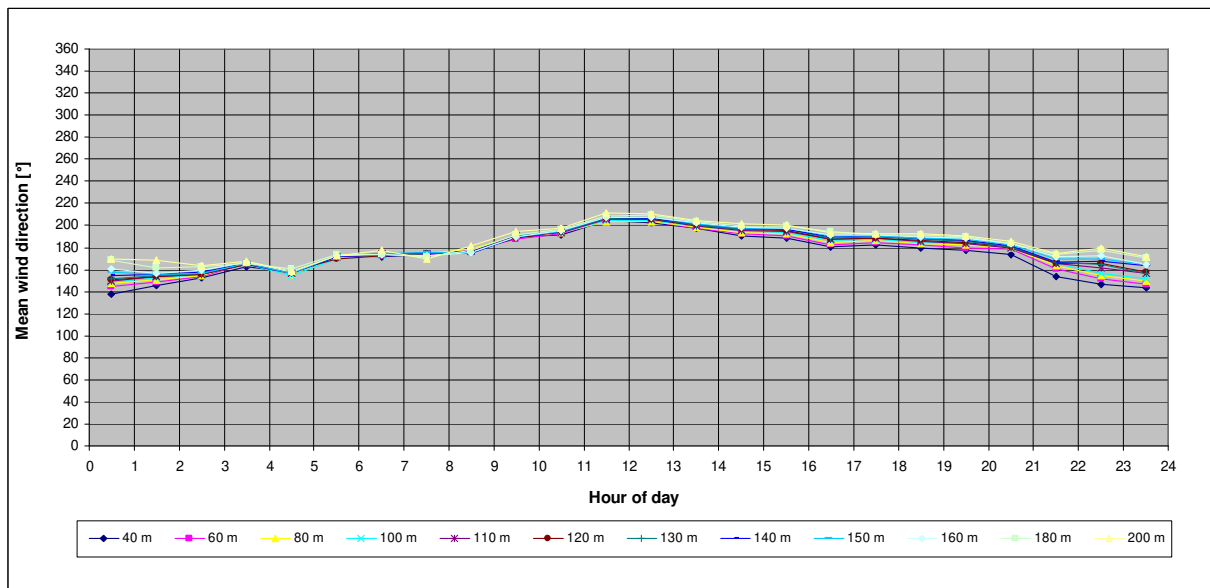


Figure 4: Daily profile of wind direction during the evaluation period



## 5 Wind direction distribution

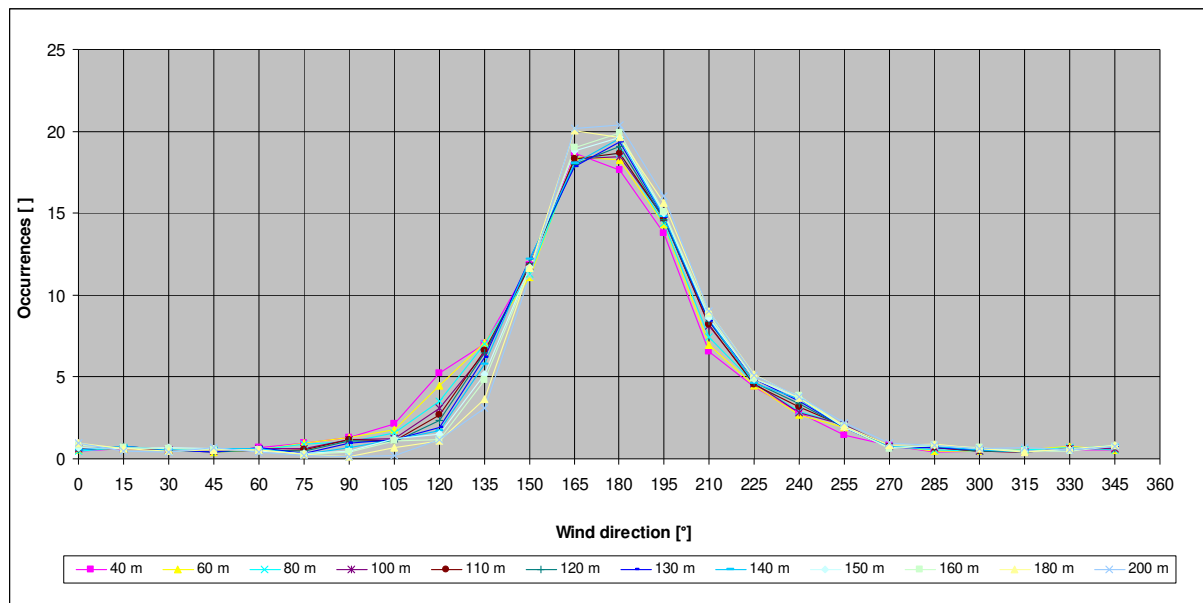


Figure 5: Frequency distribution of wind direction during the evaluation period

## 6 Natural turbulence

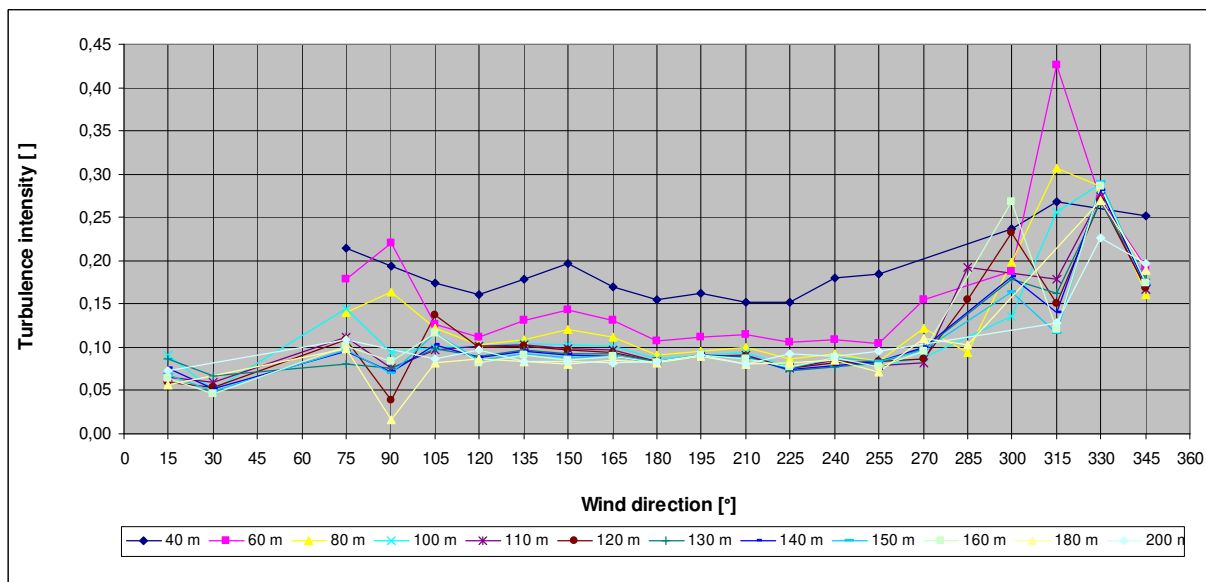


Figure 6: Directional mean turbulence during the evaluation period



## 7 Wind profile

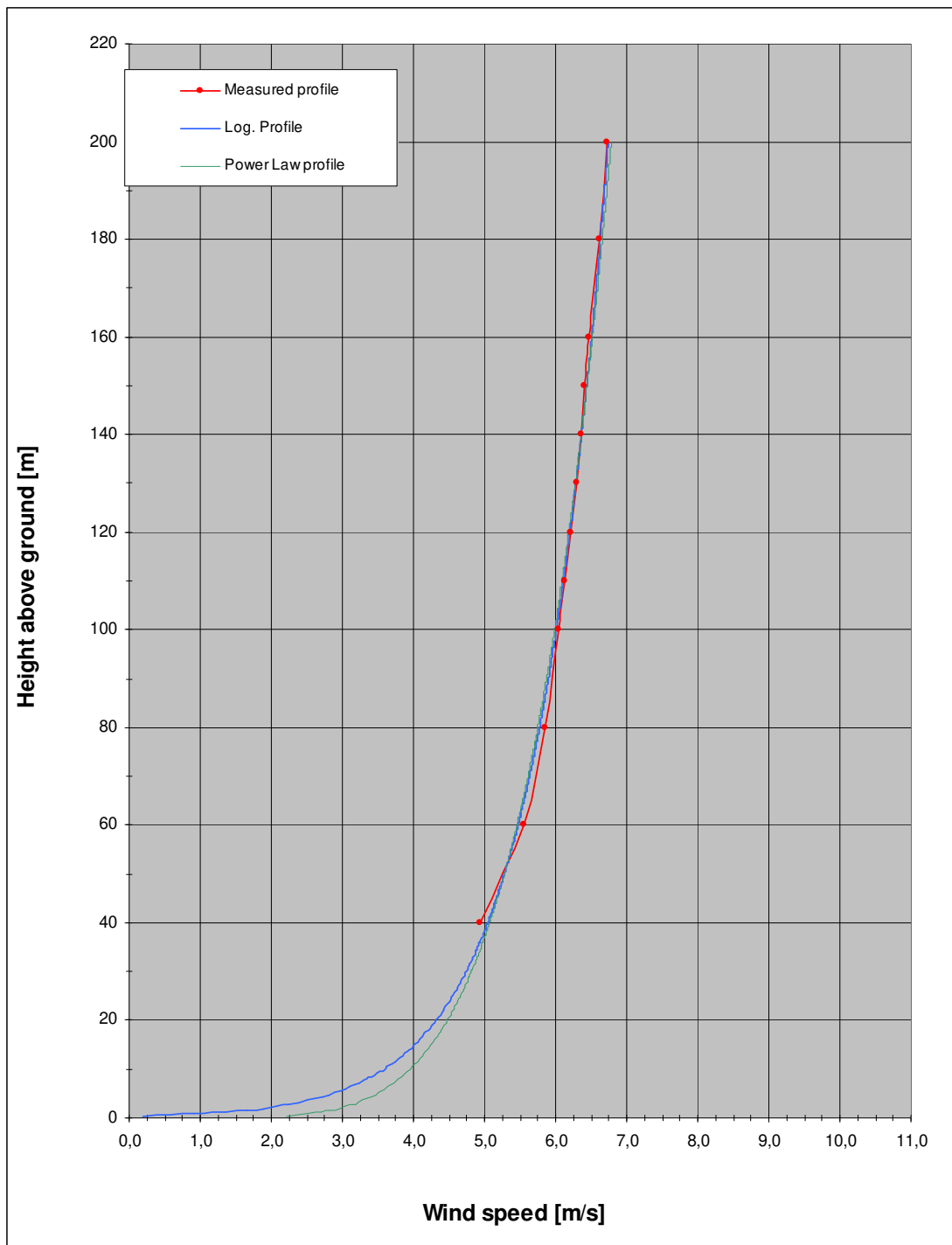


Figure 7: Wind profile during the evaluation period





## 8 Station Log

Date	Note	Issues
2017-06-04	Installation of LiDAR (Florian Schmidt, wtg) Connection to utility grid due to charger problems with 24 V	frequent restarts
2017-06-15	Manufacturer recommends to turn off LiDAR due to frequent restarts	frequent restarts
2017-06-16	LiDAR disconnected from Grid (Najmul Hossain, EQMS)	LiDAR disconnected
2017-07-27	Installation of DC-AC converter to supply LiDAR (Najmul Hossain, EQMS) LiDAR connected to power supply Performance check via remote connection (Florian Schmidt, wtg)	-
2017-07-28	Performance check via remote connection (Florian Schmidt, wtg)	-
2017-07-31	Data and performance check (Florian Schmidt, wtg) No connection to LiDAR	According to sent data, most likely no present LiDAR issues
2017-08-08	Data connection restored Data and performance check (Florian Schmidt, wtg)	-
2017-09-05	No connection to LiDAR	According to sent data, most likely no present LiDAR issues
2017-09-09	Data connection restored Data and performance check (Florian Schmidt, wtg)	-
2017-12-04	No connection to LiDAR	According to sent data, most likely no present LiDAR issues
2017-12-05	Data connection restored Data and performance check (Florian Schmidt, wtg)	-
2018-01-02	No connection to LiDAR	According to sent data, most likely no present LiDAR issues
2018-01-03	Data connection restored Data and performance check (Florian Schmidt, wtg)	-
2018-01-30	No connection to LiDAR	According to sent data, most likely no present LiDAR issues
2018-02-06	Data connection restored Data and performance check (Florian Schmidt, wtg)	-
2018-05-01	LiDAR shut down (02:20 - 02:30) LiDAR shut down (04:30 - 06:10)	No power supply / Low solar radiation due to heavy rain
2018-05-04	LiDAR shut down (10:50 - 12:10)	No power supply / Low solar radiation due to heavy rain
2018-05-07	LiDAR shut down (02:10 - 03:20) LiDAR shut down (11:20 - 12:30)	No power supply / Low solar radiation due to heavy rain
2018-05-15	LiDAR shut down (10:30 - 12:40)	No power supply / Low solar radiation due to heavy rain
2018-06-05	LiDAR shut down (10:50 - 12:10)	No power supply / Low solar radiation due to heavy rain
2018-07-11	LiDAR shut down (10:10 - 13:20)	No power supply / Low solar radiation due to cloudy conditions
2018-07-13	LiDAR shut down (09:50 - 13:00)	No power supply / Low solar radiation due to cloudy conditions



Date	Note	Issues
2018-07-15	LiDAR shut down (10:40 - 13:20)	No power supply / Low solar radiation due to cloudy conditions
2018-08-02	LiDAR shut down (10:40 - 10:50)	No power supply / Low solar radiation due to cloudy conditions
2018-08-06	LiDAR shut down (12:50 - 14:10)	No power supply / Low solar radiation due to cloudy conditions
2018-09-11	LiDAR shut down (11:20 - 12:40)	No power supply / Low solar radiation due to cloudy conditions
2018-09-16	LiDAR shut down (10:10 - 12:20)	No power supply / Low solar radiation due to cloudy conditions
2018-09-29	LiDAR shut down (9:50 - 10:20)	No power supply / Low solar radiation due to cloudy conditions
2018-10-25	No connection to LiDAR	According to sent data, most likely no present LiDAR issues
2018-10-26	Data connection restored Data and performance check (Florian Schmidt, wtg)	-
2018-11-01	Wiper nozzle is blocked Station keeper is manually cleaning the window with a special cleaning cloth until repair	Low data availability
2018-11-21	No connection to LiDAR	According to sent data, most likely no present LiDAR issues
2018-11-26	Data connection restored Data and performance check (Florian Schmidt, wtg)	-
2018-12-21	No connection to LiDAR	According to sent data, most likely no present LiDAR issues
2018-12-22	Data connection restored Data and performance check (Florian Schmidt, wtg)	-
2019-01-28	No connection to LiDAR	According to sent data, most likely no present LiDAR issues
2019-01-28	LiDAR shut down (0:00 - 24:00)	No power supply / Low solar radiation due to cloudy conditions
2019-01-29	LiDAR shut down (17:50 - 18:40)	No power supply / Low solar radiation due to cloudy conditions
2019-02-05	Data connection restored Data and performance check (Florian Schmidt, wtg)	-
2019-02-27	LiDAR shut down (3:10 - 5:10)	No power supply / Low solar radiation due to cloudy conditions
2019-03-09	LiDAR shut down (10:20 - 12:20)	No power supply / Low solar radiation due to cloudy conditions



Date	Note	Issues
2019-04-10	LiDAR shut down (3:50 - 5:30)	No power supply / Low solar radiation due to cloudy conditions
2019-05-04	LiDAR shut down (1:30 - 4:00)	No power supply / Low solar radiation due to cloudy conditions
2019-05-04	LiDAR shut down (10:50 - 12:40)	No power supply / Low solar radiation due to cloudy conditions
2019-06-14	No connection to LiDAR	According to sent data, most likely no present LiDAR issues
2019-06-16	Data connection restored Data and performance check (Florian Schmidt, wtg)	
2019-07-17	No connection to LiDAR	Power supply problem (likely due to over / under voltage) caused the LiDAR PC to shut down.
2019-07-22	Local partner contacted to double check the GSM connection - Sim card is charged and should be running	
2019-07-23	Basic checklist for LiDAR sent to station keeper	
2019-07-24	Reset of LiDAR (incl. modem) by station keeper and visual check of functionality of all major components. - Power supply is running and batteries are charging - 230V converter is turned on and working - The LiDAR is turned on and the measurement LED is indicating an active measurement	
2019-08-12	Data connection restored Data and performance check (Florian Schmidt, wtg) - Data from 2019-07-17 until 2019-07-24 is missing	Cause unknown
2019-08-13	Data connection restored Data and performance check (Florian Schmidt, wtg)	
2019-08-14	No connection to LiDAR	-
2019-08-19	LiDAR shut down (04:10 - 04:40)	No power supply / Low solar radiation due to cloudy conditions (No GSM Connection)
2019-08-20	LiDAR shut down (20:50 - 21:50))	No power supply / Low solar radiation due to cloudy conditions (No GSM Connection)

Note: Weekly and other frequently performed checks as well as data backup will not be listed in the station log.



We hereby affirm that the evaluation was performed in accordance with the latest state of the art, impartially and to the best of our knowledge and belief.

Grevenbroich. 2019-10-02

---

Dipl.-Ing. Florian Schmidt  
Project Manager



## 9 Appendix

### 9.1 Processing

<b>Version</b>	<b>Date</b>	<b>Content</b>
SG17010B1	2017-04-25	Verification of the remote sensing device type Leosphere WINDCUBE v2 S/N WLS7-598 performed at the verification station Grevenbroich
SG17010B2	2017-06-22	Installation of the Remote Sensing Device Type Leosphere WINDCUBE v2 S/N WLS7-598 at the site Feni
SG17010KB1	2017-08-31	ESMAPBD BDFE2 Cumulative Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni
SG17010KB2	2017-09-11	ESMAPBD BDFE2 Cumulative Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni
SG17010KB3	2017-10-06	ESMAPBD BDFE2 Cumulative Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni
SG17010KB4	2017-11-08	ESMAPBD BDFE2 Cumulative Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni
SG17010KB5	2017-12-18	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2017-11-01 to 2017-11-30
SG17010KB6	2018-01-17	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2017-12-01 to 2017-12-31
SG17010KB7	2018-03-02	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-01-01 to 2018-01-31
SG17010KB8	2018-03-02	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-02-01 to 2018-02-30
SG17010KB9	2018-04-13	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2017-06-01 to 2017-06-30
SG17010KB10	2018-04-13	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2017-07-01 to 2017-07-31
SG17010KB11	2018-04-13	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-03-01 to 2018-03-31
SG17010KB12	2018-05-24	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2017-08-01 to 2017-08-31
SG17010KB13	2018-05-24	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2017-09-01 to 2017-09-30
SG17010KB14	2018-05-24	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2017-10-01 to 2017-09-31
SG17010KB15	2018-05-24	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-04-01 to 2018-04-30
SG17010KB16	2018-06-06	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-05-01 to 2018-05-31
SG17010KB17	2018-07-03	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-06-01 to 2018-06-30
SG17010KB18	2018-08-10	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-07-01 to 2018-07-30
SG17010KB19	2018-09-03	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-08-01 to 2018-08-31



<b>Version</b>	<b>Date</b>	<b>Content</b>
SG17010KB20	2018-10-01	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-09-01 to 2018-09-30
SG17010KB21	2018-11-02	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-10-01 to 2018-10-31
SG17010KB22	2018-12-03	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-11-01 to 2018-11-30
SG17010KB23	2019-01-08	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2018-12-01 to 2018-12-31
SG17010KB24	2019-02-19	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2019-01-01 to 2019-01-31
SG17010KB25	2019-03-26	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2019-02-01 to 2019-02-28
SG17010KB26	2019-04-01	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2019-03-01 to 2019-03-31
SG17010KB27	2019-05-13	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2019-04-01 to 2019-04-30
SG17010KB28	2019-06-07	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2019-05-01 to 2019-05-31
SG17010KB29	2019-07-01	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2019-06-01 to 2019-06-30
SG17010KB30	2019-08-12	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2019-07-01 to 2019-07-31
SG17010KB31	2019-10-02	ESMAPBD BDFE2 Data Report WINDCUBEv2 S/N WLS7-598 at the site Feni for the period 2019-08-01 to 2019-08-31

<b>Copy to</b>	<b>Copy no.</b>
Customer	1
Project folder	2

**Copy no.:**