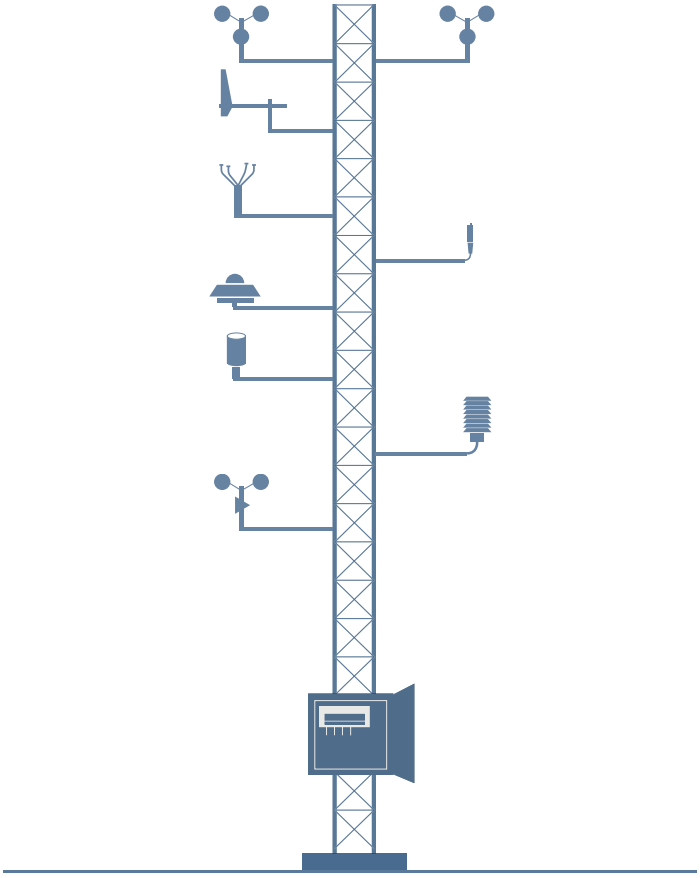
Ammonit

AmmonitOR - Ammonit Online Report



www.ammonit.com

measuring wind and solar power

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Note
All measurement data and plots shown in this manual refer to the test installation of Ammonit in Berlin (Ammonit field tests; Dachmast) and dummy data (Power curve measurement; Power curve logger) and are no reference for real assessment projects.

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Chapter 1

Introduction

AmmonitOR (Ammonit Online Report) is a system developed by Ammonit to collect, manage, monitor and archive measurement data from Ammonit (`http://www.ammonit.com`) data loggers. With AmmonitOR you can easily display your measurement data in plots and schedules. You can create customised status reports and export measurement data.

AmmonitOR follows the MEASNET Site Assessment Guideline, particularly in the field of assessing data integrity and data quality as well as filtering. Refer to 8.1 Assessment of Data Integrity and 8.2.1 Data Quality Assessment and Filtering of the MEASNET Site Assessment Guideline (`http://www.measnet.com/wp-content/uploads/2012/04/Measnet_SiteAssessment_V1-0.pdf`).

The system is available 24/7 and can also be accessed using mobile devices, e.g., tablet PCs or smartphones.

Users have to be registered to access the monitoring system. AmmonitOR (hosted by Ammonit) is free of charge. AmmonitOR can be installed on the customer's Linux™ server (with costs). Contact Ammonit for further details. Benefit from the following AmmonitOR features:

- Global data access around-the-clock (24/7)
- Data quality check using customised filters for sensors, such as ice effects, temperature, humidity, air pressure performance or the measuring system
- Automatic alert emails (based on customised filter conditions), which inform about technical problems, such as faulty measurement data or power supply
- Display of measurement data in diagrams, e.g., histograms, correlation profiles, long term comparison profiles
- Connection log displays online connections of Meteo-40 data loggers, e.g., to monitor connection problems
- Data export in selectable file format, e.g., Microsoft XLS, CSV, HTML
- Generation of PDF reports incl. project details, measurement data and plots for archiving and monitoring purposes
- Long-term data storage of up to three years on a dedicated Ammonit server or on a server of your choice
- Access control: specification of access rights for users, e.g., Admin, User, Guest

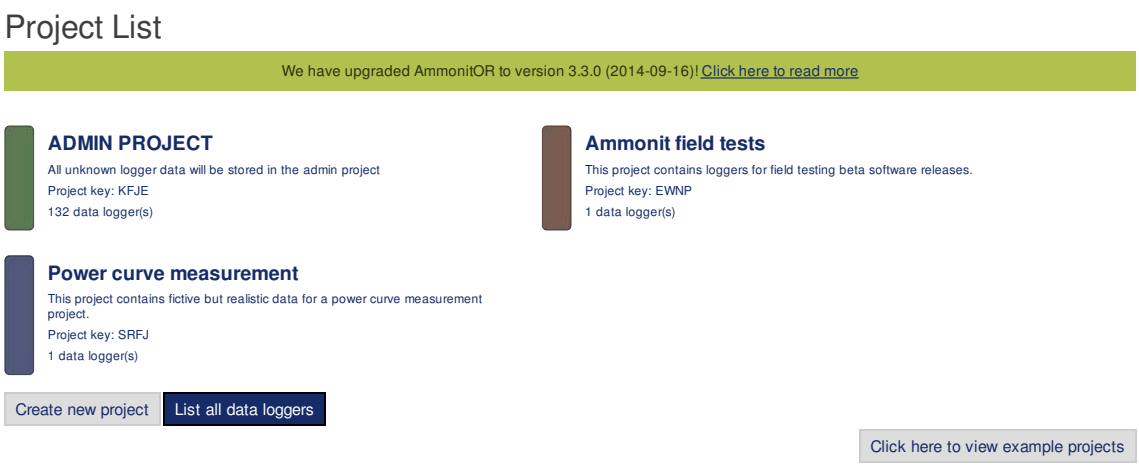


Figure 1.1: AmmonitOR Project List

Chapter 2

Getting started

2.1 Quick guide

Accessing AmmonitOR Go to https://or.ammonit.com (`https://or.ammonit.com`) and enter your login details. If you do not have an account yet, *Sign up* to AmmonitOR.

Different user rights are available, see Section 2.2 and Chapter 3.

Creating new projects In order to create a new project, click oni *Create new project*, enter a project name and press *Submit* (see also Section 8.1.2).

A project includes all details of the measurement campaign: data logger(s), sensors, measurement data, system information.

Uploading data to the project There are three different methods to upload data to a project:

- Uploading data files via SCP connection from Meteo-40 data loggers using the *Project key* (see Section 8.1.2.1) displayed in the AmmonitOR project.
- Emailing data files from Meteo-32 data loggers.
- Uploading data files manually from Meteo-40 and Meteo-32 data loggers via the Archiving → Import data menu.

Monitoring the measurement system AmmonitOR provides various overviews for a quick system check:

- Data calendar displaying state of completeness; click on *Completeness* in the *Monitoring* menu.
- Connection log displaying data logger tunnel connections; click on *Connections* in the *Monitoring logger* menu.
- Selection of evaluation plots displaying measurement data over the last 7 days; click on *Week's review* in the *Monitoring* menu.
- PDF reports summarizing system data on a weekly or monthly basis; click on *Reports* in the *Documentation* menu.
- Table of averages displaying hourly average values of a measurand over a month; click on *Statistics* in the *Data inspection* menu.

For a more detailed data check, generate plots for selectable measurands via the *Plots* in the *Data inspection* menu.

Implementing filters for data plausibility checks AmmonitOR offers various filter options to detect measurement errors or emerging problems. Set filter condition in the Settings → Filters menu.

Exporting data In order to analyse measurement data in other programs, data can be exported into various formats via the Archiving → Export data menu.

2.2 Log in

In order to work with AmmonitOR, you have to log in your account. Go to https://or.ammonit.com (`https://or.ammonit.com`) and enter your email address and password.

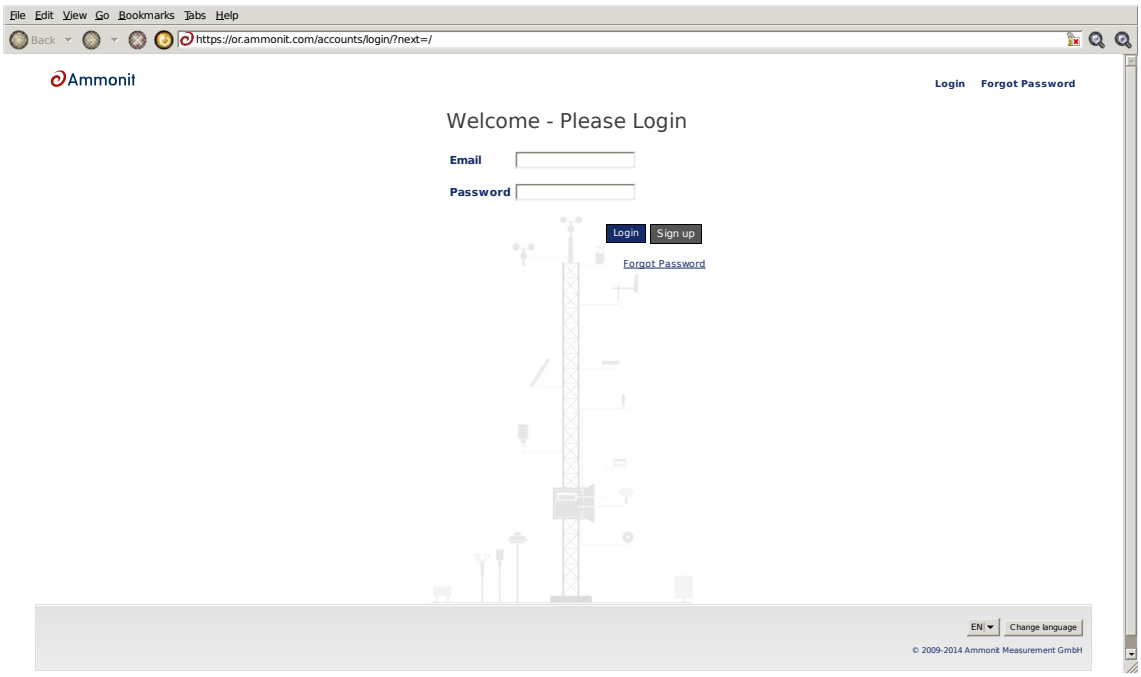


Figure 2.1: Log in to AmmonitOR

If you do not have an account yet, create your account by clicking on *Sign up*. Enter your email address and click on *Register*.

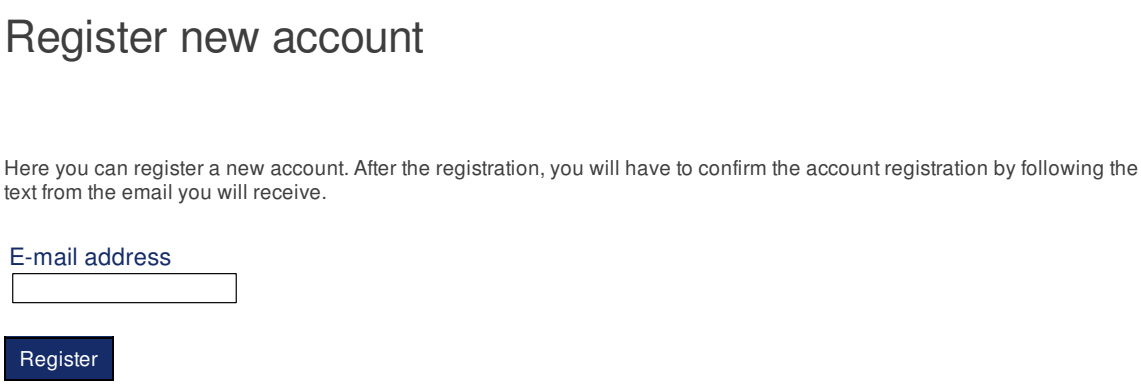


Figure 2.2: Register for AmmonitOR

Your account request has to be confirmed. To complete the registration, you will receive an email with an activation link. Open the link and fill in the form.

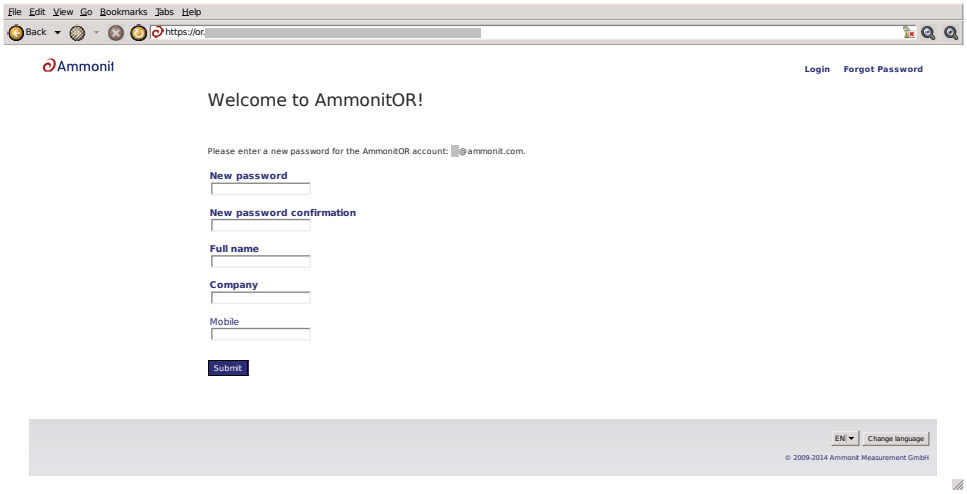


Figure 2.3: Set up your AmmonitOR account

If an account has been successfully created, all AmmonitOR projects can be accessed, for which the registered user has access rights (see also Section 3.1).

One active account is sufficient to manage all AmmonitOR projects, for which the user has access rights.

Note
If the password is lost, click on *Forgot password* to create a new password. AmmonitOR sends an email to the registered user with instructions to create a new password for the account.

Important
To work properly with AmmonitOR, Cookies and JavaScript have to be activated in your browser. Make sure that your browser is up-to-date to avoid problems when displaying any plots.

Note
If you use an AmmonitOR installation on your server, ask your administrator to create a new account.

2.3 Menu structure and page layout

The AmmonitOR website is structured in content and navigation areas (see Figure 2.4).

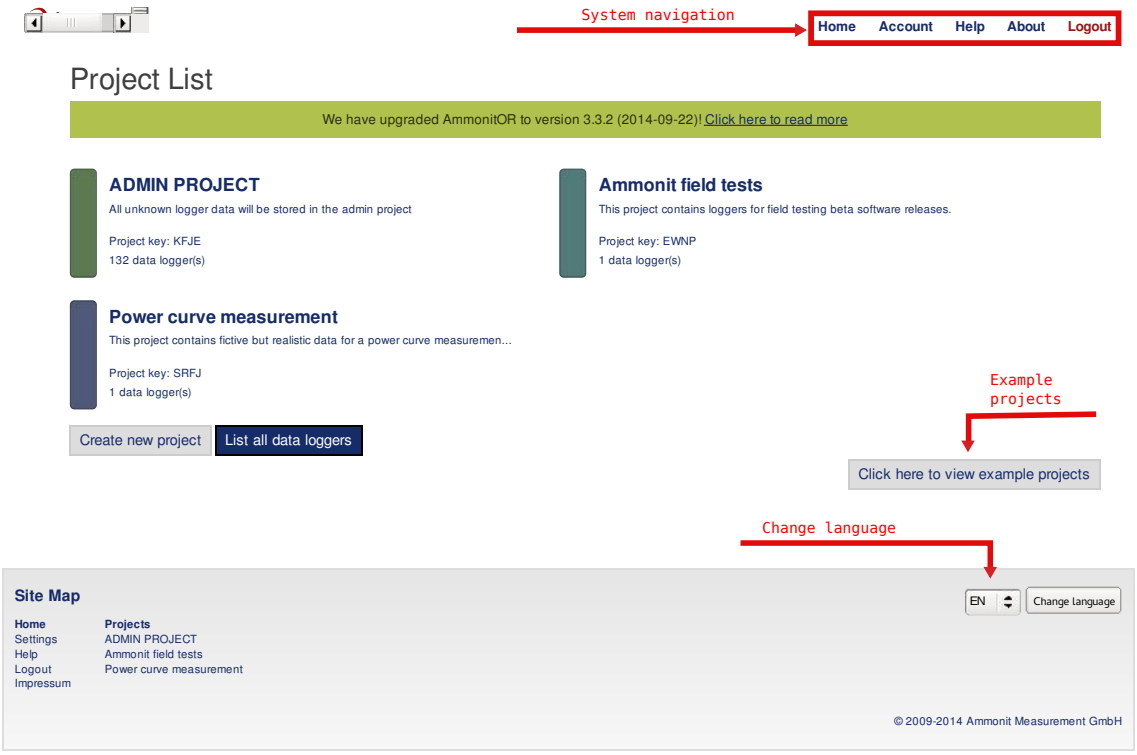


Figure 2.4: Page layout

System navigation

- Home: Jump to *Project list*; click on the Ammonit logo to go to the start page (*Project list*).
- Account: Modification of user details and password.
- Help: Open AmmonitOR help in new browser tab or window.
- About: System information, e.g., version.
- Logout: Close the session.
- Support: If any support case occurs, click on support and fill in the form to provide necessary details to the Ammonit support team. Select the relevant checkboxes to give the Ammonit support team access rights to your project and to send further details about your browser software and operating system.

Website hierarchy (breadcrumb trail) Indicates the current position in AmmonitOR. Click on a hierarchy to open it.

Site map navigation Shows the system navigation and links to all projects the logged-in user has access rights for.

Language changer Users can switch between an English and French web interface of AmmonitOR.

Chapter 3

User management

3.1 User accounts

The login details of a registered user are valid for all projects, to which the user has access rights. There are no project-dependent logins.

AmmonitOR offers an integrated user rights management system. Five user roles with different permissions are available: Admin, User, Configurator, Viewer and Guest.

User Role	Permission
Admin	Full permission for accessing, entering and changing entries.
User	Full read and write access, except for user management.
Configurator	Full read and write access as *User*, but cannot manage users and cannot download data.
Viewer	Full read rights: Viewer can see and download all. Modifications and changes are not allowed.
Guest	Limited read rights: can see plots and summaries, but is not allowed to download data.

Table 3.1: User Roles in AmmonitOR

The number of users within a project is displayed on the project overview page (see also Section 8.1.1). Click on *Edit* to manage user rights (Only available for users with Admin rights): invite new users, change user roles or remove project users.

Only users with `Admin` rights are allowed to manage user roles.

All project users are sorted by their email address in ascending order.

Project Users

Invite a new user to My First Project

Email

Invite

Existing users

Here are roles each user can have:

	admin	write	read	download
Admin *Full permissions.*	✓	✓	✓	✓
User *Can change configuration and download data, but cannot manage users.*		✓	✓	✓
Configurator *Can change configuration, but cannot manage users and cannot download data.*		✓	✓	
Viewer *Can see and download data, but cannot make changes.*			✓	✓
Guest *Can see plots and summaries, but cannot download data.*			✓	

User	Company	Email	Permissions
		admin@ammonit.com	Admin
		user@ammonit.com	User
		viewer@ammonit.com	Viewer

Update

Figure 3.1: User management

Important
The logged-in user cannot modify its own rights.

After creating a new project the user automatically becomes the project owner with Admin right.

3.2 Adding users

Users with `Admin` rights can invite other users by clicking on the *Edit* button next to the *Users* headline on the project overview page. Enter the email address of the user and click *Invite*. AmmonitOR adds the new user with `Viewer` rights to the user list. The user role can be changed in the combobox in the list of existing users. Press *Update* to apply the new user role.

If the new user does not have an AmmonitOR account yet, AmmonitOR sends a welcome message to set up the account. The user has to click on a link in the email (see Figure 3.2) and follow the instructions to set name and password for the account. The created password is valid for all projects, to which the user will be invited. Additionally, the new user receives an email with the invitation to the specific project (see Figure 3.3). By clicking on the link in the invitation email, the AmmonitOR login page opens in the browser and the user can login with the created login details.

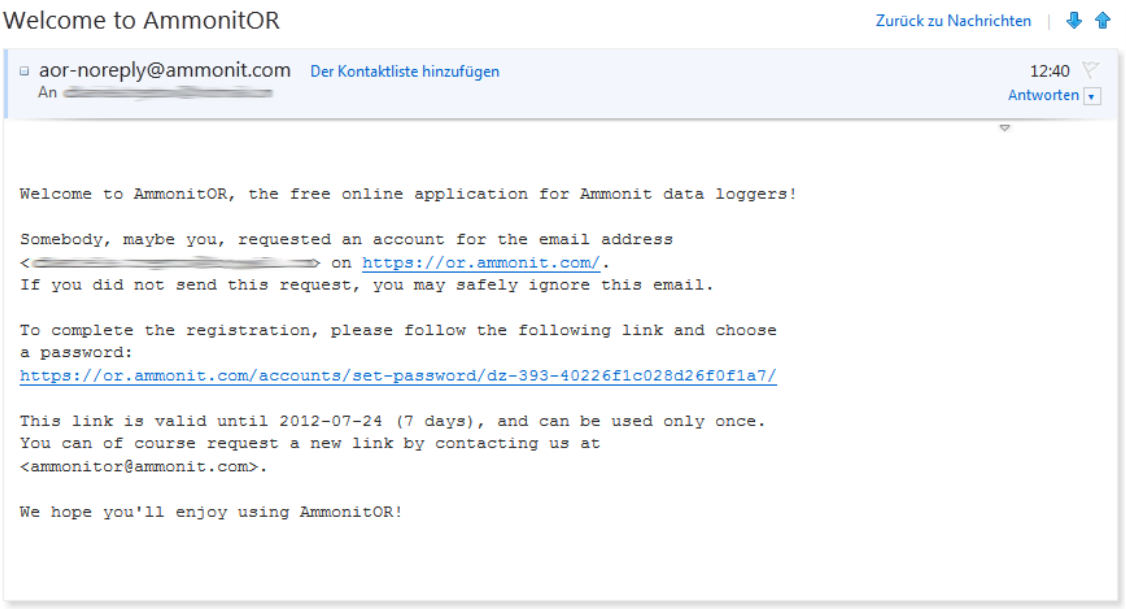


Figure 3.2: Welcome message

If the invited user has already an AmmonitOR account, the user receives an email with the invitation to the project (see Figure 3.3). The user accesses the project with its email address and password, which he / she uses for other AmmonitOR projects, too.

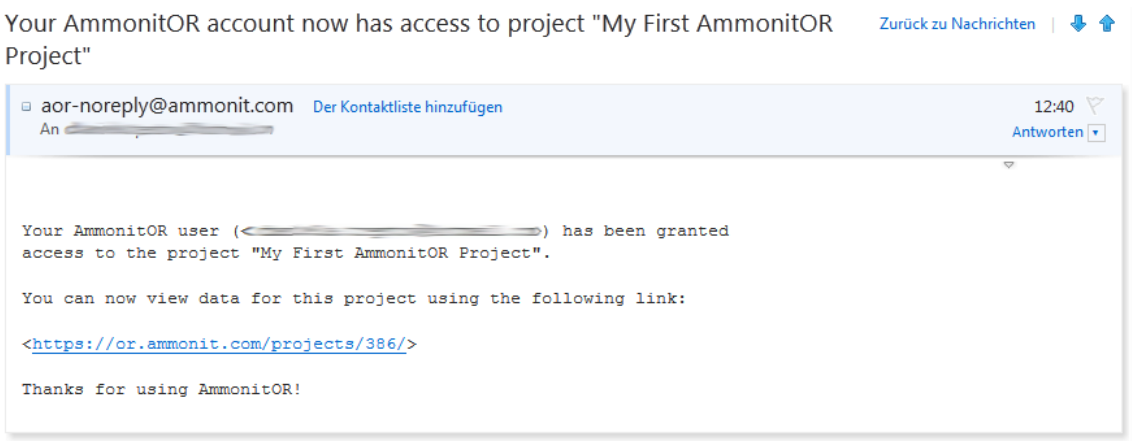


Figure 3.3: Invitation to a project

Note
If users, who already have an AmmonitOR account, are invited to a new AmmonitOR project, they can log in with their existing password. In order to set a new password, click on *Forgot password*.

3.3 Excluding users from a project

If a user should be excluded or removed from the project, select `Remove` in the permission combobox. After clicking on *Update* the user is deleted from the project users list.

Chapter 4

Monitoring

The *Monitoring* section provides the control about current status of your projects and data loggers. AmmonitOR shows an overview about your project related data loggers, measurement data for the last seven days, a completness overview and a connection overview.

4.1 Data Loggers

A list of all data loggers implemented in your projects can be found by clicking on *List all data loggers* in the project overview list. AmmonitOR displays for each data logger a box with data logger serial number, name and type. Additionally, 24h averages of temperature and wind speed as well as 24h minimum internal voltage of the data logger are shown. Put your mouse pointer on the value to display the corresponding sensor for temperature and wind speed. For each data logger, AmmonitOR displays total completeness and when the last data has been imported.

Click on the data logger, to view details of the data logger, e.g., related project and active sensors. For further details see Section 8.2.

Note
If a data logger is used in more than one project, it will be displayed multiply.

For listing data loggers related to a project, select a project and go to the Monitoring → Data loggers menu. AmmonitOR shows only the data loggers related to this particular project. As mentioned above, AmmonitOR indicates additional details for the data logger, i.e., total completeness and minimum internal voltage.

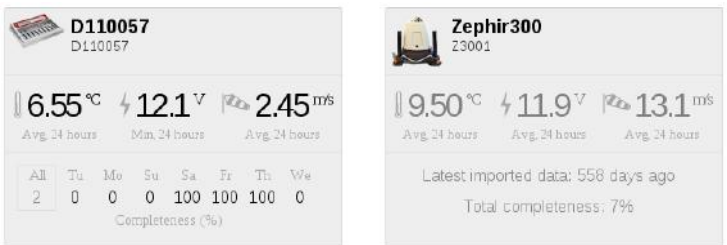


Figure 4.1: List of project related data loggers

The data loggers are sorted by serial number in ascending order.

See also Section 8.2.

4.2 Week's Review

For a quick system check, AmmonitOR provides an overview about all evaluations and system parameters over the last 7 days. To check the system performance, go to the Monitoring → Week's review menu and select a data logger.

AmmonitOR displays all evaluations, which are listed in the evaluation list (see Section 8.2.5 or click on *List all evaluations* on the data logger overview page).

Important
AmmonitOR displays the values for the last 7 days. Beginning with the current date - not the date of the last import!

Click on *Details* to see the xy plot and make further adjustments. See also Section 5.1.1.5.

4.3 Completeness Calendar

AmmonitOR displays for each data logger a *Calendar*, which can be accessed via the Monitoring → Completeness menu. The *Calendar* displays the data completeness for each day.

The *Calendar* is structured in months and days; one row per month.

Figure 4.2: Data calendar

Depending on the number of entries for a day, AmmonitOR colours the cell background (see Table 4.1).

Data completeness for the data logger is shown below the *Calendar*. The completeness value refers to the whole period covered by the calendar.

If more than one data logger has been assigned to the project, you can switch between the calendars of the data loggers using the dropdown list above the calendar. There are two table view options: percent or number of entries.

Display percent This table view shows all entries as percentage value from the expected number of entries, e.g., 50 if 72 entries of expected 144 are counted.

Display number of entries This table views displays the exact number of entries for each day.

Colour	Percentage	Number of Entries	Comment
Green	100%	144	Total data completeness for the day.
Yellow	99.9 ... 95%	136 ... 143	A few entries are missing or faulty.
Orange	90 ... 94.9%	129 ... 135	Critical number of entries.
Red	0 ... 89.9%	0 ... 128	Not enough entries for a relevant measurement according to MEASNET.
Violet	>100%	>144	If data has been uploaded twice caused by an error, AmmonitOR has more data available than expected for the day. An alert message is displayed on AmmonitOR. The issue can be solved by archiving data files. To do so, click on the link in the alert message and deactivate the file(s) in the Archiving → Data logger files menu. The selected data file is archived - not deleted! If necessary, the data file can be reimported. For further details see Section 7.1.

Table 4.1: Data Calendar Colours

Click on a day to review the daily measurements. AmmonitOR shows a data table with all data for the selected day. To customize the data table see Section 5.3.

4.4 Connections

On this page the tunnel connections of Meteo-40 data loggers can be monitored. AmmonitOR displays the connections for the last 30 days. For each tunnel connection, AmmonitOR displays a violet-coloured box within the calendar. User can easily see, when the connection started and how long the data logger has been online. All SCP uploads are marked with a orange line in the overview. Place the mouse pointer in the graphic to see further details of the connection.

For reviewing the online connections of a Meteo-40 data logger, the checkbox *Send Logbook data* has to be selected in the Communication → AmmonitOR menu of the Meteo-40 web interface. The checkbox is active by default.

The connections should correspond to the periods and actions configured in the schedule in the Meteo-40 web interface.

AmmonitOR displays the online periods in violet; SCP connections in orange.

The connection times can be displayed as graphic or text.

In order to view connections older than 30 days, click on *earlier connections*. AmmonitOR moves 30 days back and displays this period. Via *later connections* you can move to later periods. If there is no current connection, you can show the latest connection by clicking on *go to latest connection.*

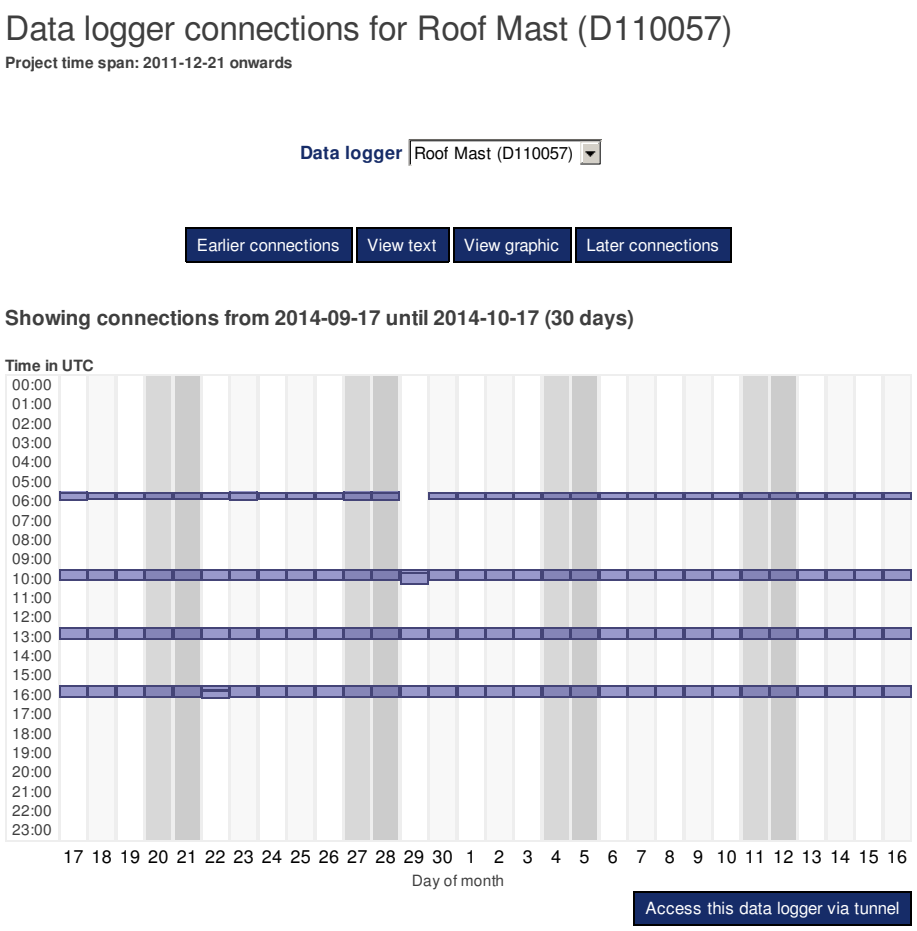


Figure 4.3: Connection overview

If the displayed data logger is scheduled to be online, you can access the data logger via tunnel by clicking on *Access this data data logger via tunnel*.

Holding the mouse pointer on the button, the URL of the data logger is displayed.

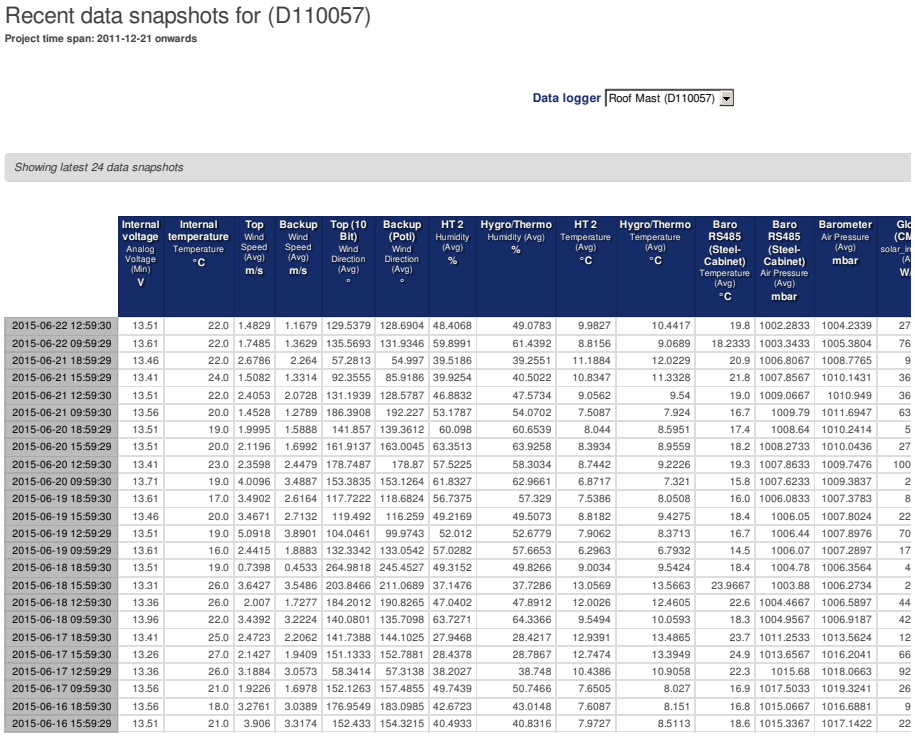
Note

Tunnel connections of Meteo-40 data loggers can be monitored without uploading measurement data to AmmonitOR. To do so, the connection between data logger and AmmonitOR has to be configured in the Meteo-40 web interface in the Communication → AmmonitOR menu. Select the AmmonitOR server and enter your *Project key* in the relevant fields. Deselect the checkbox *Send CSV files* (active by default). The checkbox *Send Logbook data* (active by default) has to be selected to provide tunnel information to AmmonitOR. Save the configuration.
Thus no measurement data is sent to AmmonitOR - only communication information.

4.5 Data snapshots

The data snapshot page shows the last 24 data snapshots, who are sent by Meteo-40 data logger. Therefore the Meteo-40 data logger has to be configured to send the snapshots to AmmonitOR. A data snapshot is a data set e.g. of 10 minute average values of each channel. The difference to normal data transmission is, that data snapshot is always sent when the data logger connects to the internet. Keep that in mind when you configure the Meteo-40 schedule. It is helpfull to know the actual condition of the measurement system in addition to the normal daily data transmission.

For configuring a Meteo-40 data logger, the checkbox *Send data scnapshot* has to be selected in the Communication → AmmonitOR menu of the Meteo-40 web interface. The checkbox is disabled by default.



Recent data snapshots for (D110057)

Project time span: 2011-12-21 onwards

Data logger Roof Mast (D110057)

Showing latest 24 data snapshots

	Internal voltage Analog Voltage (Min) V	Internal temperature Temperature °C	Top Wind Speed (Avg) m/s	Backup Wind Speed (Avg) m/s	Top (10 Bit) Wind Direction (Avg) °	Backup (Poti) Wind Direction (Avg) °	HT 2 Humidity (Avg) %	Hygro/Thermo Humidity (Avg) %	HT 2 Temperature (Avg) °C	Hygro/Thermo Temperature (Avg) °C	Baro RS485 (Steel-Cabinet) Temperature (Avg) °C	Baro RS485 (Steel-Cabinet) Air Pressure (Avg) mbar	Barometer Air Pressure (Avg) mbar	Gl (CM solar_in (A W
2015-06-22 12:59:30	13.51	22.0	1.4829	1.1679	129.5379	128.6904	48.4068	49.0783	9.9827	10.4417	19.8	1002.2833	1004.2339	27
2015-06-22 09:59:29	13.61	22.0	1.7485	1.3629	135.5693	131.9346	59.8991	61.4392	8.8156	9.0689	18.2333	1003.3433	1005.3804	76
2015-06-21 18:59:29	13.46	22.0	2.6786	2.264	57.2813	54.997	39.5186	39.2551	11.1884	12.0229	20.9	1006.8067	1008.7765	9
2015-06-21 15:59:29	13.41	24.0	1.5082	1.3314	92.3555	85.9186	39.9254	40.5022	10.8347	11.3328	21.8	1007.8567	1010.1431	36
2015-06-21 12:59:30	13.51	22.0	2.4053	2.0728	131.1939	128.5787	46.8832	47.5734	9.0562	9.54	19.0	1009.0667	1010.949	36
2015-06-21 09:59:30	13.56	20.0	1.4528	1.2789	186.3908	192.227	53.1787	54.0702	7.5087	7.924	16.7	1009.79	1011.6947	63
2015-06-20 18:59:29	13.51	19.0	1.9995	1.5888	141.857	139.3612	60.098	60.6539	8.044	8.5951	17.4	1008.64	1010.2414	5
2015-06-20 15:59:29	13.51	20.0	2.1196	1.6992	161.9137	163.0045	63.3513	63.9258	8.3934	8.9559	18.2	1008.2733	1010.0436	27
2015-06-20 12:59:30	13.41	23.0	2.3598	2.4479	178.7487	178.87	57.5225	58.3034	8.7442	9.2226	19.3	1007.8633	1009.7476	100
2015-06-20 09:59:30	13.71	19.0	4.0096	3.4887	153.3835	153.1264	61.8327	62.9661	6.8717	7.321	15.8	1007.6233	1009.3837	2
2015-06-19 18:59:30	13.61	17.0	3.4902	2.6164	117.7222	118.6824	56.7375	57.329	7.5386	8.0508	16.0	1006.0833	1007.3783	8
2015-06-19 15:59:30	13.46	20.0	3.4671	2.7132	119.492	116.259	49.2169	49.5073	8.8182	9.4275	18.4	1006.05	1007.8024	22
2015-06-19 12:59:29	13.51	19.0	5.0918	3.8901	104.0461	99.9743	52.012	52.6779	7.9062	8.3713	16.7	1006.44	1007.8976	70
2015-06-19 09:59:29	13.61	16.0	2.4415	1.8883	132.3342	133.0542	57.0282	57.6653	6.2963	6.7932	14.5	1006.07	1007.2897	17
2015-06-18 18:59:30	13.51	19.0	0.7398	0.4533	264.9818	245.4527	49.3152	49.8266	9.0034	9.5424	18.4	1004.78	1006.3564	4
2015-06-18 15:59:30	13.31	26.0	3.6427	3.5486	203.8466	211.0689	37.1476	37.7286	13.0569	13.5663	23.9667	1003.88	1006.2734	2
2015-06-18 12:59:30	13.36	26.0	2.007	1.7277	184.2012	190.8265	47.0402	47.8912	12.0026	12.4605	22.6	1004.4667	1006.5897	44
2015-06-18 09:59:30	13.96	22.0	3.4392	3.2224	140.0801	135.7098	63.7271	64.3366	9.5494	10.0593	18.3	1004.9567	1006.9187	42
2015-06-17 18:59:30	13.41	25.0	2.4723	2.2062	141.7388	144.1025	27.9468	28.4217	12.9391	13.4865	23.7	1011.2533	1013.5624	12
2015-06-17 15:59:30	13.26	27.0	2.1427	1.9409	151.1333	152.7881	28.4378	28.7867	12.7474	13.3949	24.9	1013.6567	1016.2041	66
2015-06-17 12:59:29	13.36	26.0	3.1884	3.0573	58.3414	57.3138	38.2027	38.748	10.4386	10.9058	22.3	1015.68	1018.0663	92
2015-06-17 09:59:30	13.56	21.0	1.9226	1.6978	152.1263	157.4855	49.7439	50.7466	7.6505	8.027	16.9	1017.5033	1019.3241	26
2015-06-16 18:59:30	13.56	18.0	3.2761	3.0389	176.9549	183.0985	42.6723	43.0148	7.6087	8.151	16.8	1015.0667	1016.6881	9
2015-06-16 15:59:29	13.51	21.0	3.906	3.3174	152.433	154.3215	40.4933	40.8316	7.9727	8.5113	18.6	1015.3367	1017.1422	22

Figure 4.4: Data snapshots in AmmonitOR

4.6 Timeline

The timeline is a monitoring tool, where all important events are listed in an interactive time frame. You can scroll monthwise and daywise. If events are triggered in measurement system they will be displayed. Click the event icon and detail information of will occur.

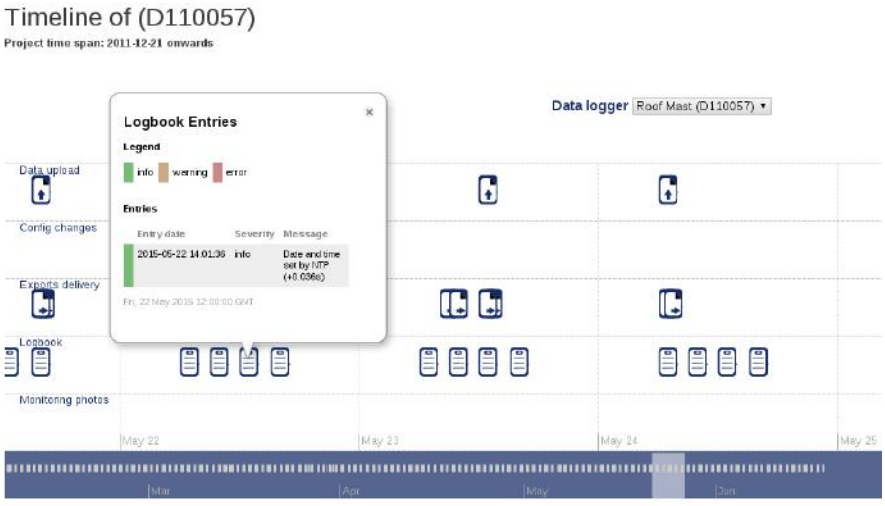


Figure 4.5: Timeline in AmmonitOR

Chapter 5

Data Inspection

In this section you are able to view the measurement data, plot it and view hourly averages.

5.1 Plots

Use AmmonitOR to quickly generate plots with measurement data over a defined period. Typical diagrams can be created for wind and solar resource assessment campaigns as well as for power curve measurement projects, e.g., correlation plots, xy plots or energy yield calculations. Information boxes describe, what is displayed in the diagram and how the values are calculated.

AmmonitOR offers various options to customise the plots, e.g., choose the time range, which should be displayed or the sensors, which should be correlated. In this chapter we list all plots, which are currently available in AmmonitOR. Further plots will be added in the future in order to meet your requirements to effectively monitor your projects.

All plots can be exported to PDF format. Thus diagrams can easily be printed and archived.

AmmonitOR lists plots for five different applications. Each plot is marked with its unique icon:

Figure 5.1: Overview selectable plots

Time variation Select plots, which display the behaviour of measurements over a certain time period - marked with light-blue icons

- Daily profile
- Monthly profile
- Overlay graph
- Sunshine hours
- XY plot

Distribution Select plots, which show the frequency distribution of measurement values - marked with turquoise icons

- Calms analysis
- Energy yield
- Evaluation type avaliability
- Histogram
- Speed direction bar
- Speed direction dots
- Wind direction

- Wind speed

Comparison Select plots, which correlate measurements of sensors of the same type to identify measurement errors - marked with orange icons

- Correlation plot
- Long term comparison profile
- Shadow zone plot
- Simple height profile

Turbulence analysis Typical plots to display turbulence intensity - marked with yellow icons

- Turbulence intensity
- Turbulence intensity polar

Power curve measurement Typical plots for power curve measurement - special power curve measurement devices necessary, e.g., power meter - marked with dark-blue icons

- Energy yield
- Estimated energy yield
- Power curve
- Wind Power Density

In order to show only relevant plots for solar or wind, select one of the radio buttons on top of the page.

5.1.1 Time variation plots

This section lists all plots, which show the behaviour of measurement values over a certain time period.

5.1.1.1 Daily profile

The daily profile indicates the daily behaviour of an evaluation for a specified period. Thus the differences between day and night can be analysed. Each sensor is displayed in a graph.

AmmonitOR considers all hourly average values of a sensors over a certain period. For every hour of the day the average value is calculated and displayed in the diagram. Each sensor is represented in a graph, e.g., different temperature sensors.

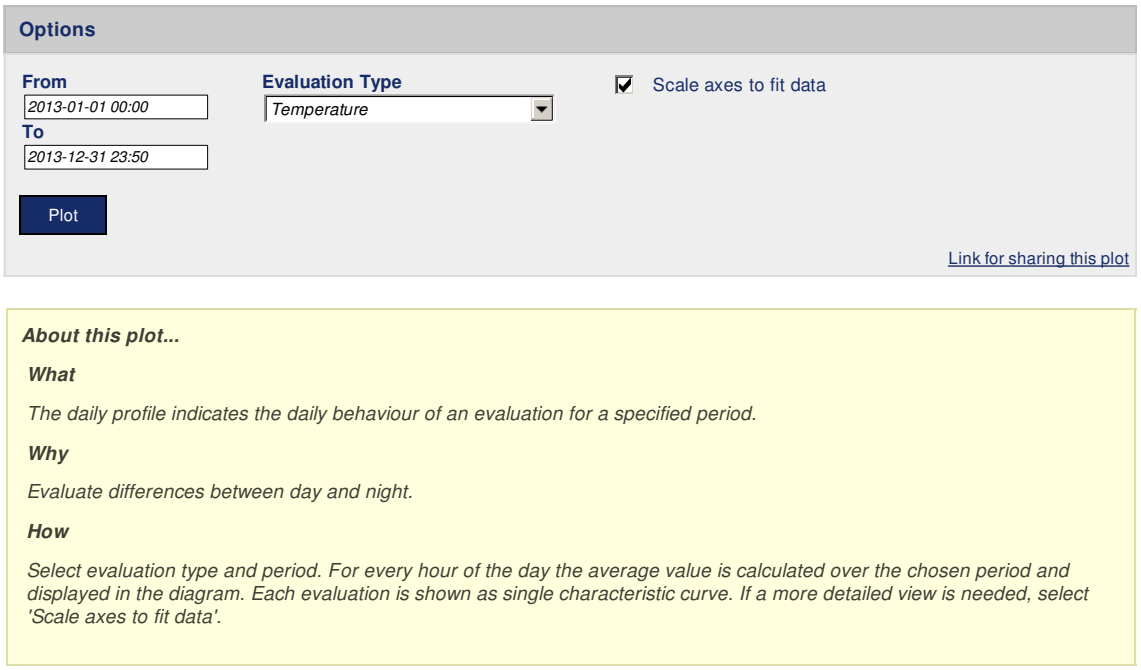
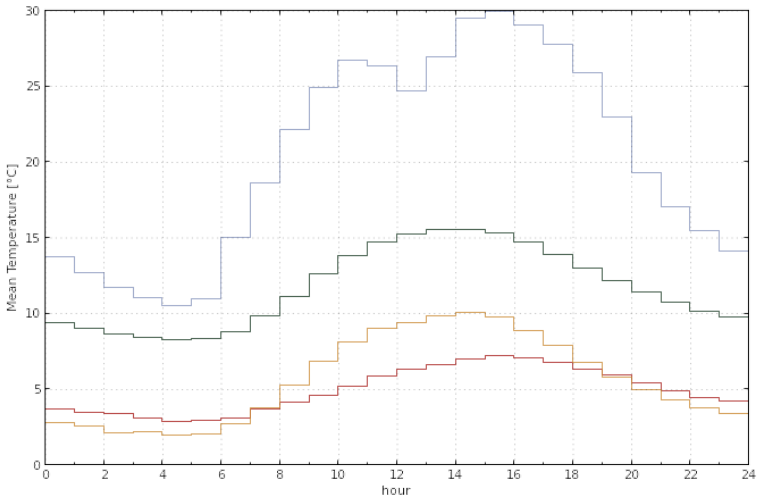


Figure 5.2: Options: Daily profile of the temperature

Go to the Data inspection → Plots menu and select in section *Time variation* the *Daily profile*. Select a data logger from the project and enter the period, which should be displayed in the diagram. Choose an *Evaluation type* from the dropdown list and click on *Plot* to display the daily profile. Select *Scale axis to fit data* to get a more detailed view.



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	HT 2	Hygro/Thermo	Baro RS485 (Steel-Cabinet)	Steel Cabinet
hour	Avg [°C]	Avg [°C]	Avg [°C]	Avg [°C]
0h - 1h	13.73	3.688	9.352	2.806
1h - 2h	12.66	3.487	9.011	2.571
2h - 3h	11.67	3.403	8.645	2.115
3h - 4h	11.03	3.039	8.425	2.163
4h - 5h	10.52	2.832	8.286	1.956
5h - 6h	10.97	2.915	8.301	2.029
6h - 7h	15.02	3.070	8.788	2.670
7h - 8h	18.62	3.655	9.792	3.747
8h - 9h	22.12	4.142	11.13	5.277
9h - 10h	24.87	4.544	12.57	6.850
10h - 11h	26.68	5.184	13.83	8.089
11h - 12h	26.29	5.841	14.67	8.977
12h - 13h	24.68	6.299	15.21	9.338
13h - 14h	26.94	6.608	15.50	9.804
14h - 15h	29.48	7.002	15.53	10.06
15h - 16h	29.93	7.188	15.30	9.745
16h - 17h	29.05	7.024	14.68	8.886
17h - 18h	27.74	6.721	13.85	7.850
18h - 19h	25.86	6.292	12.94	6.774
19h - 20h	22.93	5.899	12.15	5.788
20h - 21h	19.26	5.392	11.41	4.941
21h - 22h	17.02	4.887	10.71	4.296
22h - 23h	15.48	4.459	10.13	3.783
23h - 24h	14.07	4.171	9.733	3.412

Figure 5.3: Example: Daily profile of the temperature

A data table can be displayed by clicking on *Show data table*. In the data table AmmonitOR lists for all sensors the hourly average values. To hide the data table, click on *Hide data table*.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.1.2 Monthly profile

The monthly profile emphasises on the seasonal impacts on the evaluation by following trends in a curve. Sensor defects can be detected.

Go to the Data inspection → Plots menu and select in section *Time variation* the *Monthly profile* to generate a monthly profile plot. Select a data logger and determine the time period, which should be considered for the plot. Choose an *Evaluator type*, e.g., wind speed or temperature. Select an *Average calculation method*:

- Average for each month
- Average for each hour
- Moving average (based on hourly averages) - a moving average window has to be selected: month, 2 weeks, week

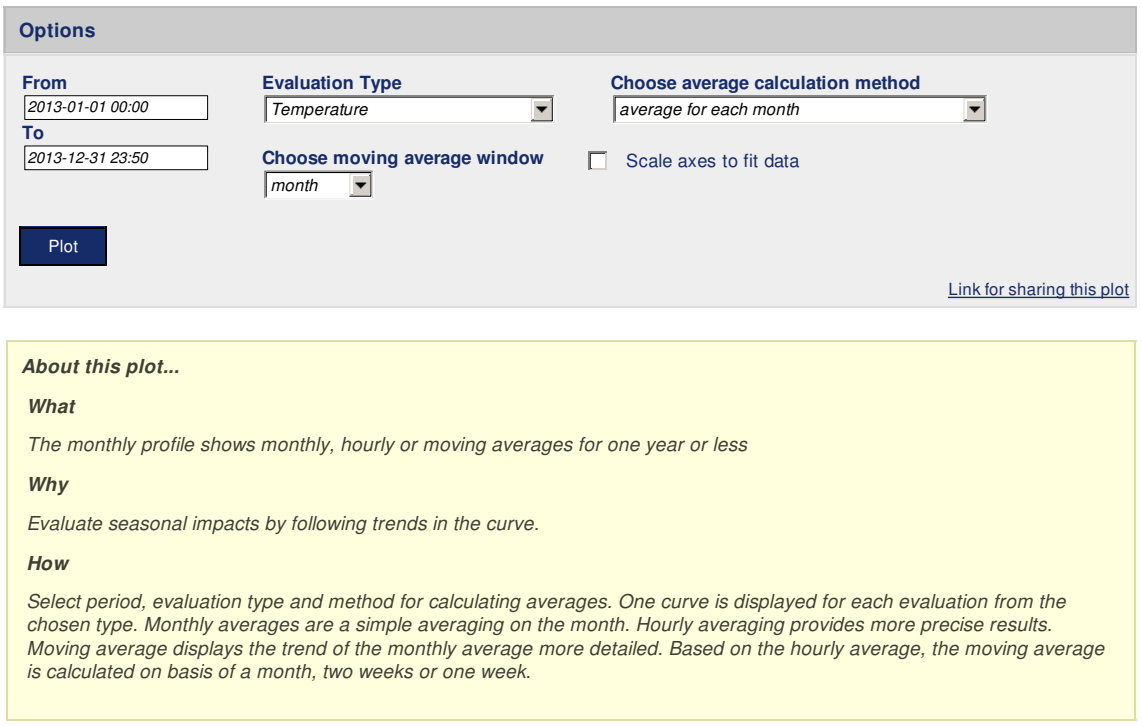
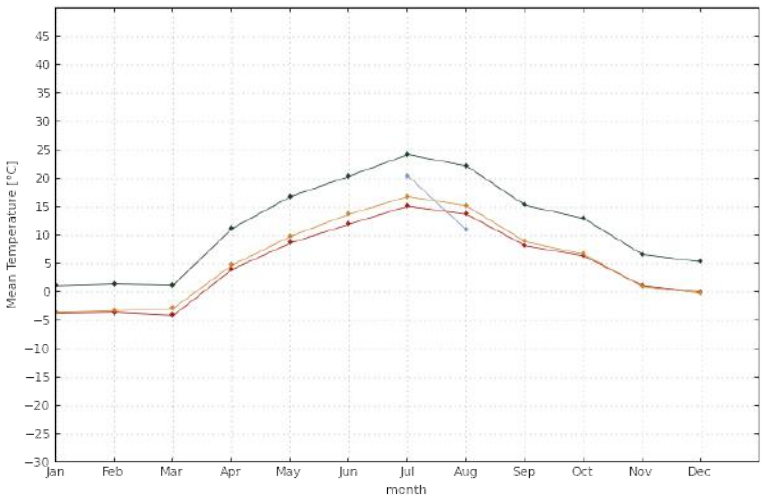


Figure 5.4: Options for Monthly Profile

Monthly average Indicates the seasonal differences of the evaluations, based on average values of each month.



month	HT 2 Avg [°C]	Hygro/Thermo Avg [°C]	Baro RS485 (Steel-Cabinet) Avg [°C]	Steel Cabinet Avg [°C]
2013 Jan		-3.697	1.156	-3.558
2013 Feb		-3.530	1.479	-3.247
2013 Mar		-4.069	1.290	-2.811
2013 Apr		4.028	11.22	4.760
2013 May		8.705	16.87	9.860
2013 Jun		12.00	20.44	13.76
2013 Jul	20.49	15.19	24.29	16.89
2013 Aug	10.96	13.74	22.23	15.23
2013 Sep		8.234	15.35	8.942
2013 Oct		6.413	12.99	6.702
2013 Nov		1.176	6.692	1.028
2013 Dec		0.086	5.357	-0.152

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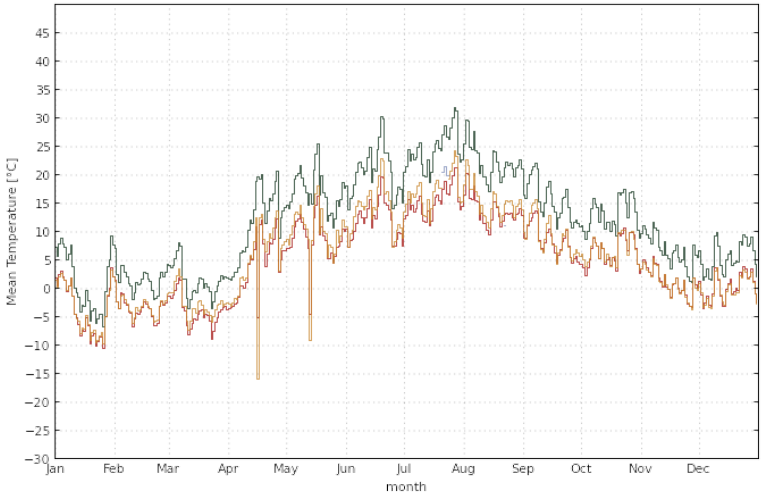
Figure 5.5: Example: Monthly profile of temperature based on monthly averages

Note
If a sensors has had a defect, you can see a deviation in the graph compared to other sensors for the same evaluation as shown in Figure 5.5.

Hourly average Displays the seasonal differences of the evaluations more detailed, based on hourly average values.



date	HT 2 Avg [°C]	Hygro/Thermo Avg [°C]	Baro RS485 (Steel-Cabinet) Avg [°C]	Steel Cabinet Avg [°C]
2013-01-01 00:00:00		1.723	7.194	1.356
2013-01-02 00:00:00		0.487	5.655	0.040
2013-01-03 00:00:00		2.321	7.815	1.911
2013-01-04 00:00:00		3.032	8.715	2.653
2013-01-05 00:00:00		1.990	7.790	1.881
2013-01-06 00:00:00		1.494	7.186	1.364
2013-01-07 00:00:00		-0.674	4.963	-0.398
2013-01-08 00:00:00		0.473	5.929	0.341
2013-01-09 00:00:00		1.847	7.645	1.787
2013-01-10 00:00:00		-1.380	3.791	-1.484

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Figure 5.6: Example: Monthly profile of temperature based on hourly averages

Note
If a sensors has had a defect, you can see a deviation in the graph compared to other sensors for the same evaluation as shown in Figure 5.6.

Moving average Displays the trend of the monthly average more detailed. Based on hourly averages, AmmonitOR calculates the moving average on a monthly, 2-weekly or weekly basis for each sensor. Select the basis for the moving average graph from the *Choose moving average window* dropdown list.

$$\alpha'_i = e^{-\frac{1}{2}\cdot w\cdot i^2} \qquad \text{with} \qquad w = 1\ldots w_n \qquad i \in [-m, +m]$$

$$\alpha_i = \frac{1}{\beta}\cdot\alpha'_i \qquad \text{with} \qquad \beta = \sum_{i=-m}^{+m}\alpha'_i$$

$$\overline{x}_t = \sum_{i=-m}^{+m} x_{t+i}\cdot\alpha_i$$

Equation 5.1: Calculation of moving average (x(t))

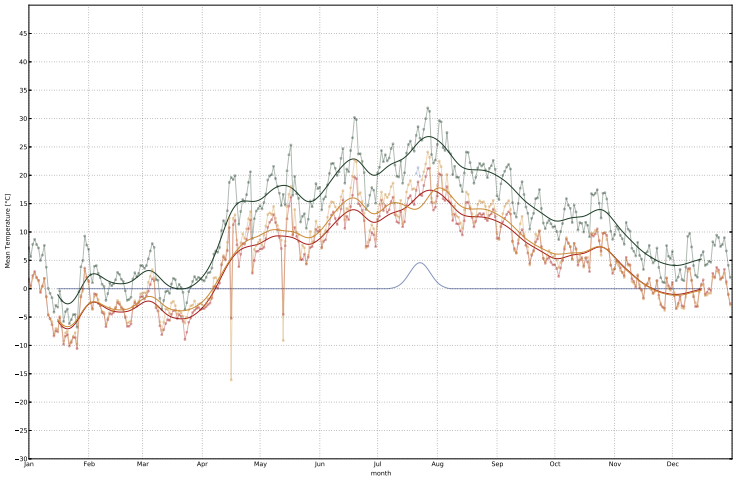


Figure 5.7: Example: Moving average of temperature based on monthly averages

Note
If a sensors has had a defect, you can see a deviation in the graph compared to other sensors for the same evaluation as shown in Figure 5.7.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.1.3 Overlay graph

The periodical overlay graph completes the xy plot (see Section 5.1.1.5). Using this diagram, periodical occurrences can be monitored and the trend of an evaluation can be analysed.

Ammonit displays for each day (x-axis) a coloured graph (see key next to the diagram) - all graphs are shown in one diagram. The trend of the evaluation can be monitored. Unexpected deviations can indicate measurement errors or defective sensors.

Go to the Data inspection → Plots menu and select in section *Time variation* the *Overlay graph*. Select a data logger from the dropdown list and specify the period, which should be displayed. Choose an evaluation and select a statistic, e.g., average.

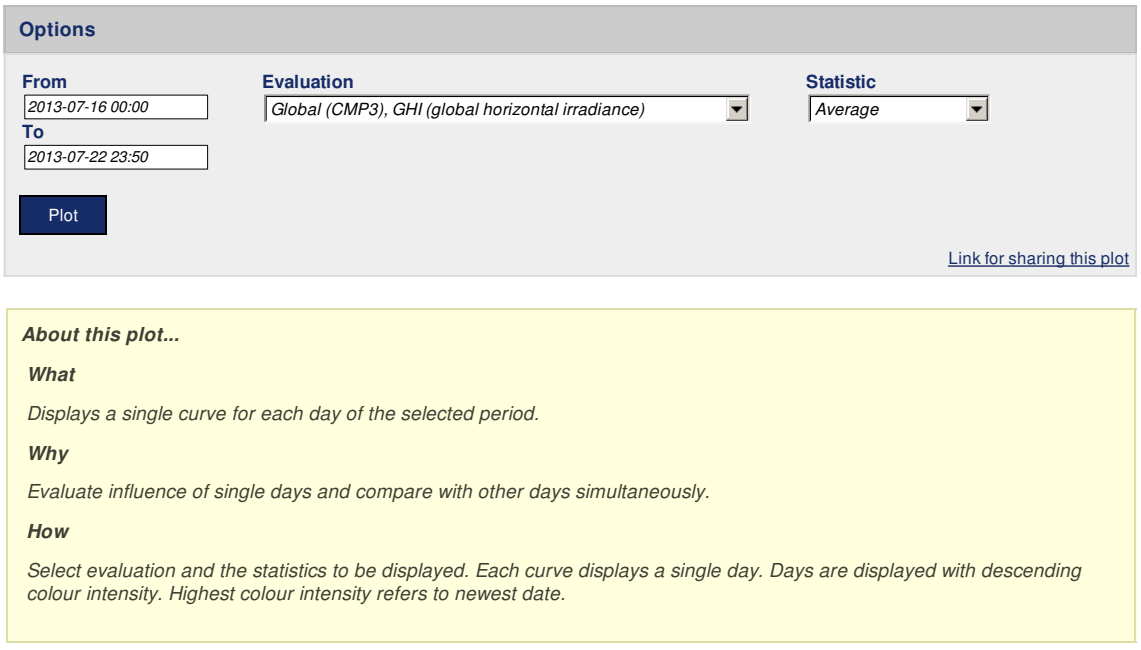
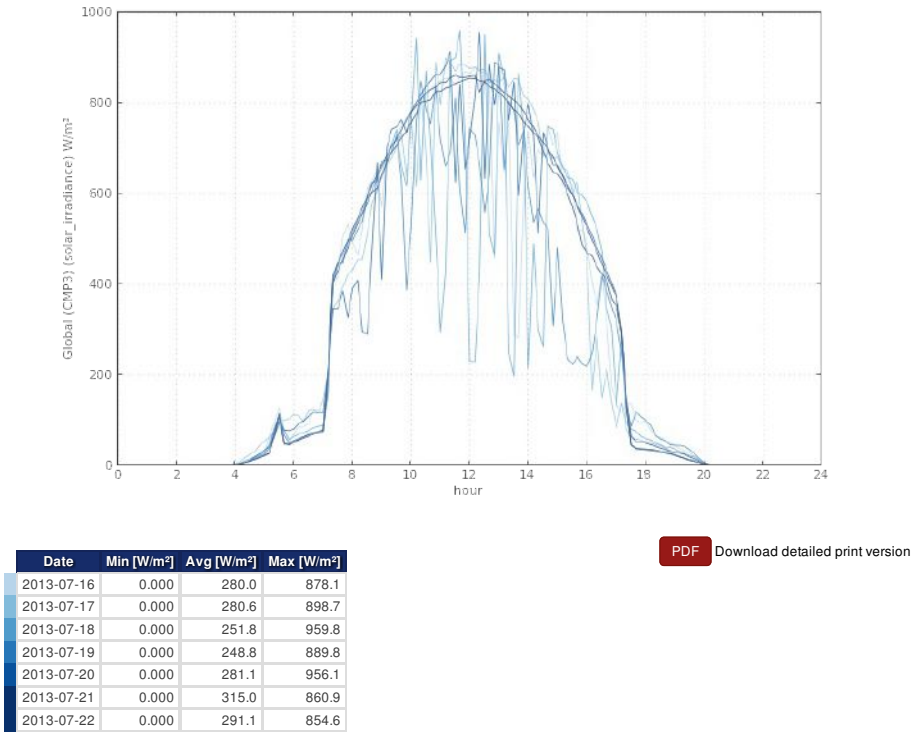


Figure 5.8: Options for the overlay graph

Click on *Plot* to display the diagram.



Date	Min [W/m²]	Avg [W/m²]	Max [W/m²]
2013-07-16	0.000	280.0	878.1
2013-07-17	0.000	280.6	898.7
2013-07-18	0.000	251.8	959.8
2013-07-19	0.000	248.8	889.8
2013-07-20	0.000	281.1	956.1
2013-07-21	0.000	315.0	860.9
2013-07-22	0.000	291.1	854.6

Figure 5.9: Example: Global horizontal irrediance for a specified period in an overlay graph

Below the plot a data table is shown. If the data table has more than 10 rows, the table is hidden. Click on *Show data table* to display the table, on *Hide data table* to hide the table.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.1.4 Sunshine hours

The plot displays the daily sunshine hours in a bar chart. According to WMO the sun is shining at 120 W/². Sunshine duration sensors measure the sun status. The sun status can also be calculated by Ammonit Meteo-40 data loggers from measurement data gathered by a pyranometer. AmmonitOR does not calculate the sun status from pyranometer measurement data.

Go to the Data inspection → Plots menu and select in section *Time variation* the *Sunshine hour* plot. Select a data logger from the project and determine the period, which should be considered. Choose an *Evaluation* and click on *Plot*.

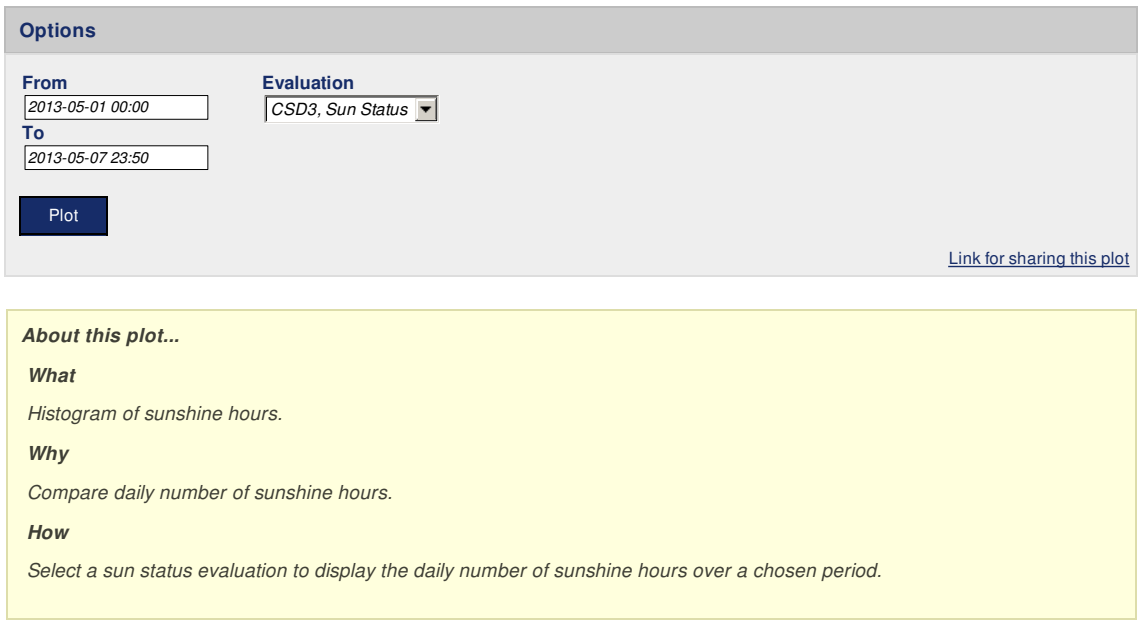
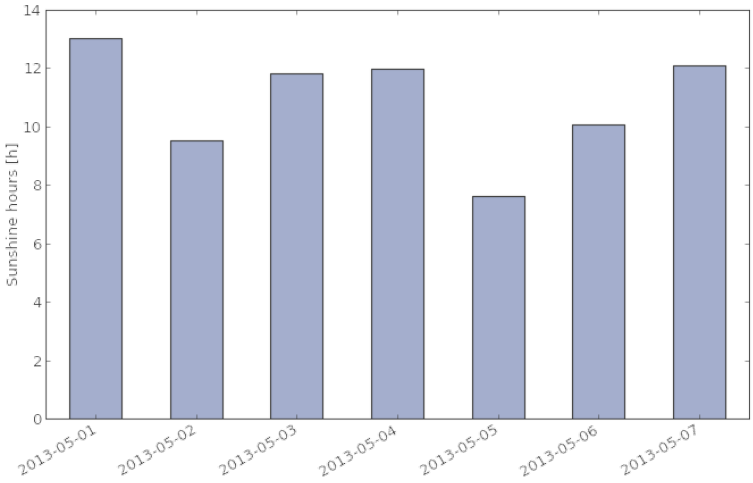


Figure 5.10: Options for sunshine hours plot



Date	Sunshine hours [h]
2013-05-01	13.02
2013-05-02	9.510
2013-05-03	11.83
2013-05-04	11.98
2013-05-05	7.603
2013-05-06	10.07
2013-05-07	12.10

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Figure 5.11: Example: Sunshine hours for a determined period

AmmonitOR shows the daily number of sunshine hours in a data table. If more than 10 days are listed, click on *Show data table* to display the table, on *Hide data table* to make the table hidden.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.1.5 XY plot

Use the xy plot to monitor the behaviour of different evaluations over a determined time. One ore more sensors can be displayed in the plot.

Go to the Data inspection → Plots menu and select in section *Time variation* the *XY plot*. Select a data logger from the project and determine the period. Choose the *Evaluators*, which should be monitored. If more than one sensor should be displayed, hold the CTRL key and use the left-mouse click to select additional sensors. Select a *Statistic* and click on *Plot* to display the diagram.

For comparability all plots of the same evaluation show a common scale. In order to view more details in the plot, the axes can be scaled to fit by activating on the *Scale axes to fit data* checkbox.

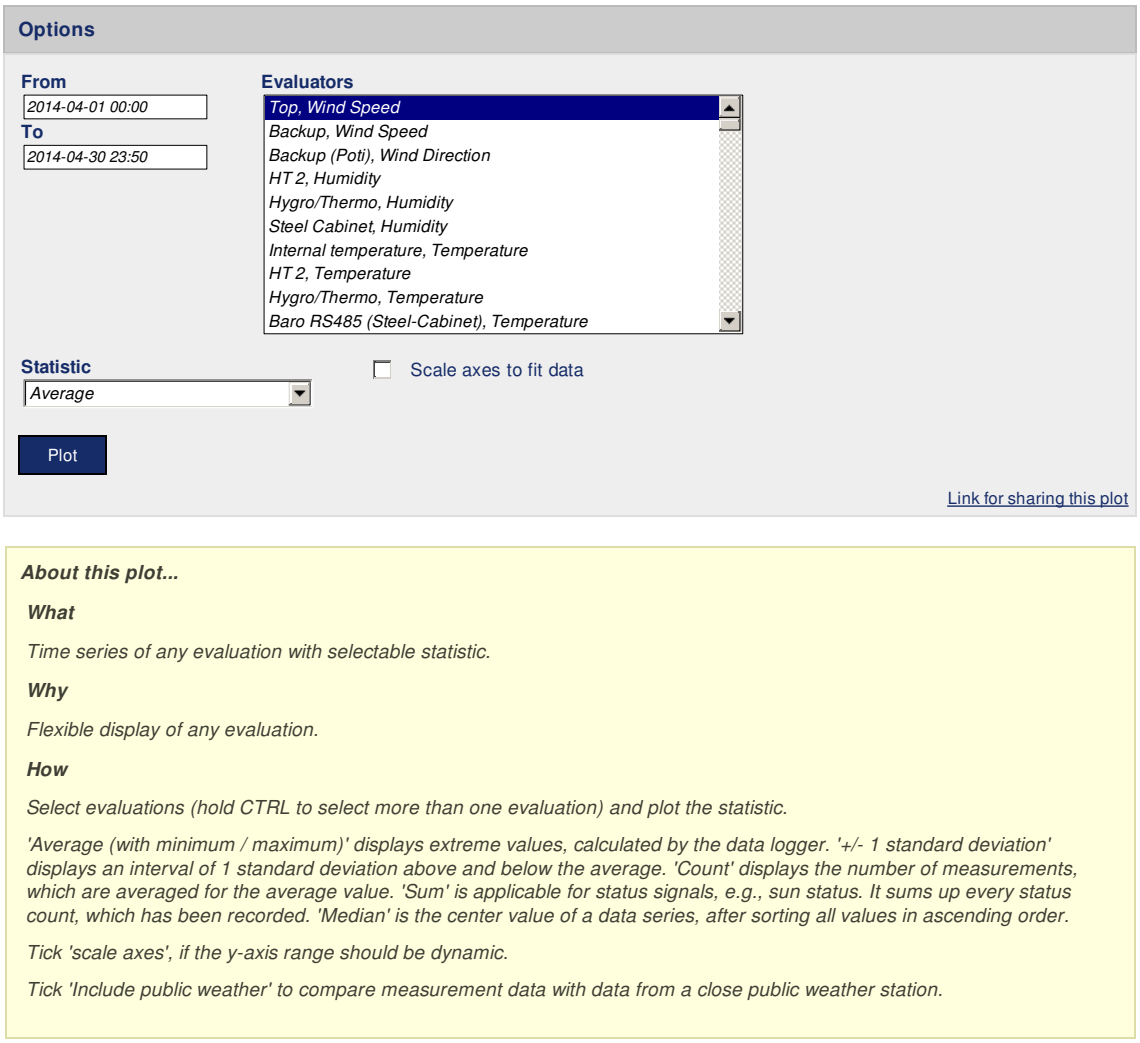


Figure 5.12: Options for XY plot

AmmonitOR displays the plot with the evaluation on the y-axis (e.g., temperature and humidity) and time on the x-axis.

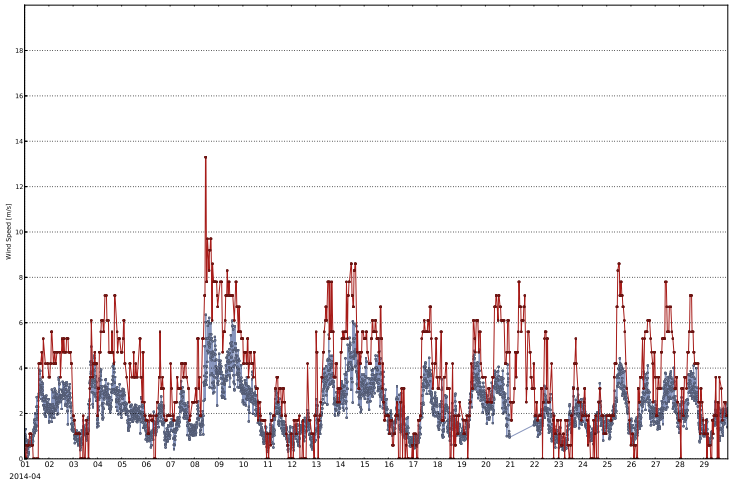


Figure 5.13: Example: Temperature for a determined period in XY plot

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.2 Distribution

This section lists all plots, which display a frequency distribution of measurement values.

5.1.2.1 Calms analysis

Use this analysis to inspect calm durations on site for defined wind speed limits.

Go to the Data inspection → Plots menu and select in section *Distribution* the *Calms analysis* plot. Select a data logger, if more than one data logger is related to the project. Set lower and upper calm limit.

The lower calm limit indicates the wind speed, at which your wind turbine does not produce energy (not enough wind). The upper calm limit indicates the critical wind speed, at which your wind turbine might stop producing wind energy due to very high wind speed.

Set start and end of the period, which should be analysed. By default AmmonitOR displays 1 hour bins for the calm duration. If required, choose another bin for calm duration.

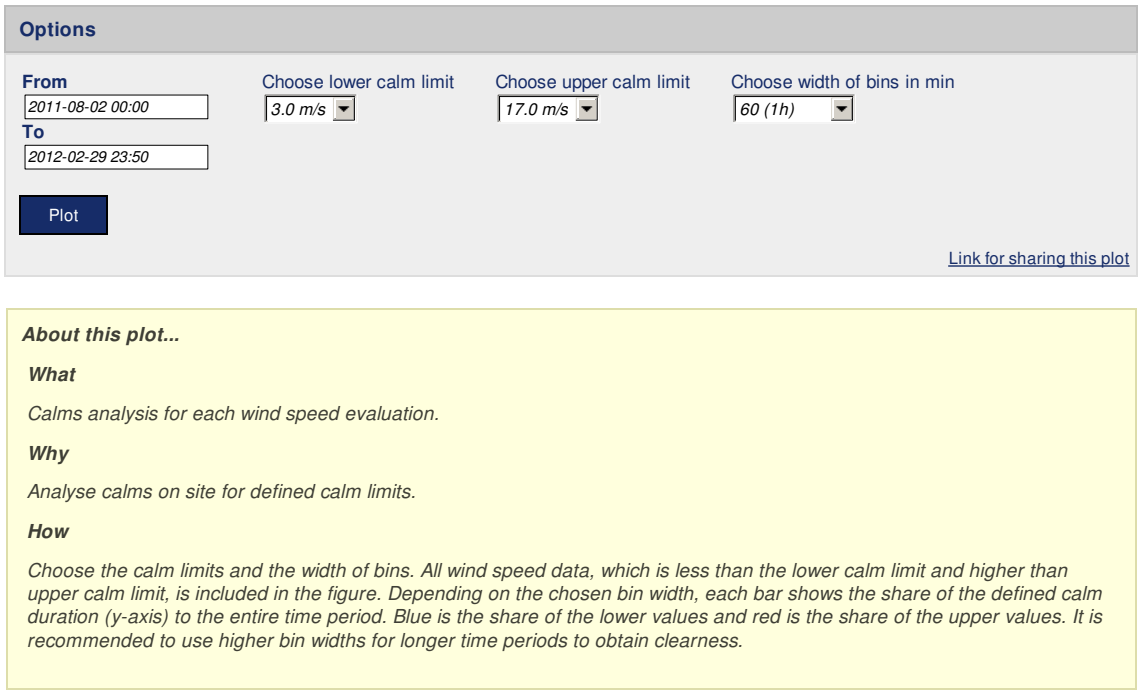
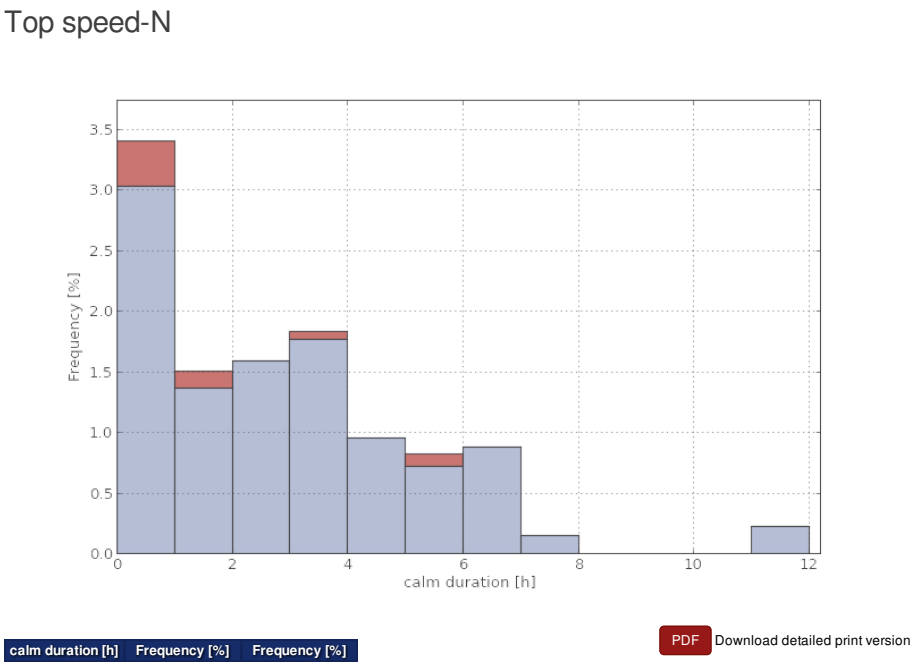


Figure 5.14: Selectable options for calms analysis

Click on *Plot* to display the frequency distribution for each wind speed sensor, connected to the selected data logger.



calm duration [h]	Frequency [%] Lower calm limit	Frequency [%] Upper calm limit
0.00 - 1.00	3.034	0.367
1.00 - 2.00	1.370	0.141
2.00 - 3.00	1.592	0.000
3.00 - 4.00	1.766	0.066
4.00 - 5.00	0.957	0.000
5.00 - 6.00	0.724	0.102
6.00 - 7.00	0.881	0.000
7.00 - 8.00	0.147	0.000
11.00 - 12.00	0.226	0.000
Total	10.70	0.675

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Figure 5.15: Example for calms analysis plot

Frequencies lower calm limit are displayed in blue color; frequencies upper calm limit are displayed in red color.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.2.2 Energy yield

Use this plot to display the energy yield of your wind turbine over a defined period.

The energy yield is calculated as follows:

$$E_i = N_i \cdot P_i$$

Equation 5.2: Calculation of Energy Yield

Where N_i refers to the number of hours in bin i and P_i is the averaged power in bin i.

Go to the Data inspection → Plots menu and select in section *Distribution* the *Energy yield* plot. Select a data logger from your project, if more than one data logger is related to the project. Select a *Wind speed sensor*, the *Power curve* of your turbine and choose start and end of the period, which should be displayed. Click on *Plot* to show the energy yield plot.

If no *Power curve* has been defined, go to the Settings → Wind turbines menu and add a turbine.

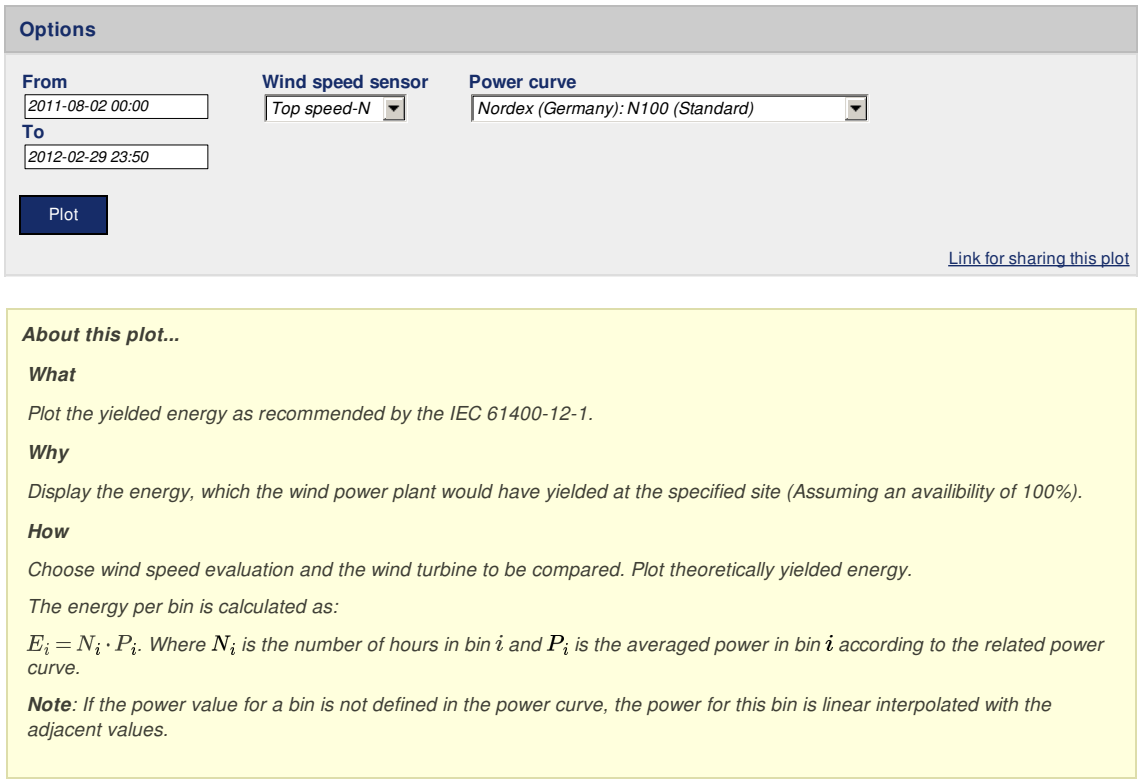
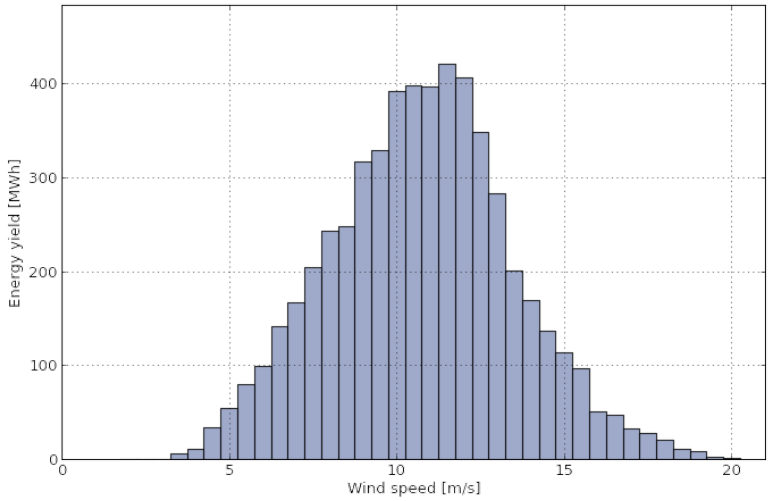


Figure 5.16: Selectable option for the energy yield plot

The energy yield of your turbine is displayed in a bar chart with 0.5 m/s wind speed bins.



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Wind speed bin range [m/s]	Mean Wind speed	Energy yield [MWh]
1.75 - 2.25	2.018	0.000
2.25 - 2.75	2.510	0.000
2.75 - 3.25	3.008	0.000
3.25 - 3.75	3.501	5.713
3.75 - 4.25	4.000	11.47
4.25 - 4.75	4.499	33.74
4.75 - 5.25	5.003	54.44
5.25 - 5.75	5.503	79.38
5.75 - 6.25	6.004	99.42
6.25 - 6.75	6.501	141.4
6.75 - 7.25	6.996	166.7
7.25 - 7.75	7.498	205.0
7.75 - 8.25	7.993	243.0
8.25 - 8.75	8.505	247.6
8.75 - 9.25	8.993	316.8
9.25 - 9.75	9.494	329.2
9.75 - 10.25	9.997	391.7
10.25 - 10.75	10.50	398.4
10.75 - 11.25	11.00	396.3
11.25 - 11.75	11.50	420.6
11.75 - 12.25	11.99	406.0
12.25 - 12.75	12.49	347.9
12.75 - 13.25	12.99	283.3
13.25 - 13.75	13.49	200.8
13.75 - 14.25	13.99	168.8
14.25 - 14.75	14.48	137.1
14.75 - 15.25	14.99	113.3
15.25 - 15.75	15.48	96.25
15.75 - 16.25	15.98	51.25
16.25 - 16.75	16.51	47.08
16.75 - 17.25	16.98	32.50
17.25 - 17.75	17.46	27.50
17.75 - 18.25	17.99	20.83
18.25 - 18.75	18.46	11.25
18.75 - 19.25	18.96	7.917
19.25 - 19.75	19.46	2.917
19.75 - 20.25	20.00	0.833
		Σ 5496.38

Figure 5.17: Example for the energy yield plot

Below the plot, a data table is displayed, listing all wind speed bins, the energy yield of your turbine as well as the total energy yield for the selected period.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.2.3 Evaluation type avaliability

The evaluation type avaliability plot displays in graphical form the values of data avaliability per evaluation.

The data avaliability is a percentage value of the imported data with valid values. If the complete data in a data file for a given period is there, the result is 100%. Every missing value, None or NaN results in decrease of data avaliability. This value is crucial for remote sensors.

Go to the Data inspection → Plots menu and select in section *Distribution* the *Evaluation type avaliability* plot. Select a data logger from your project, if more than one data logger is related to the project. Select a *Evaluation type* and choose start and end of the period, which should be displayed. Click on *Plot* to show the evaluation type avaliability.

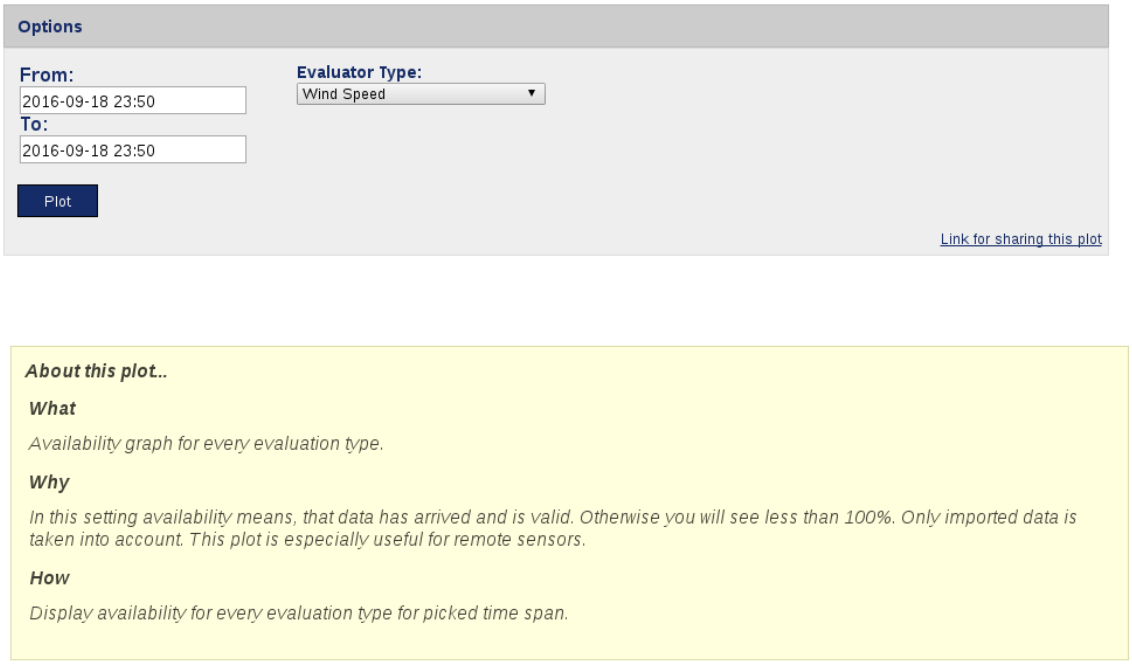
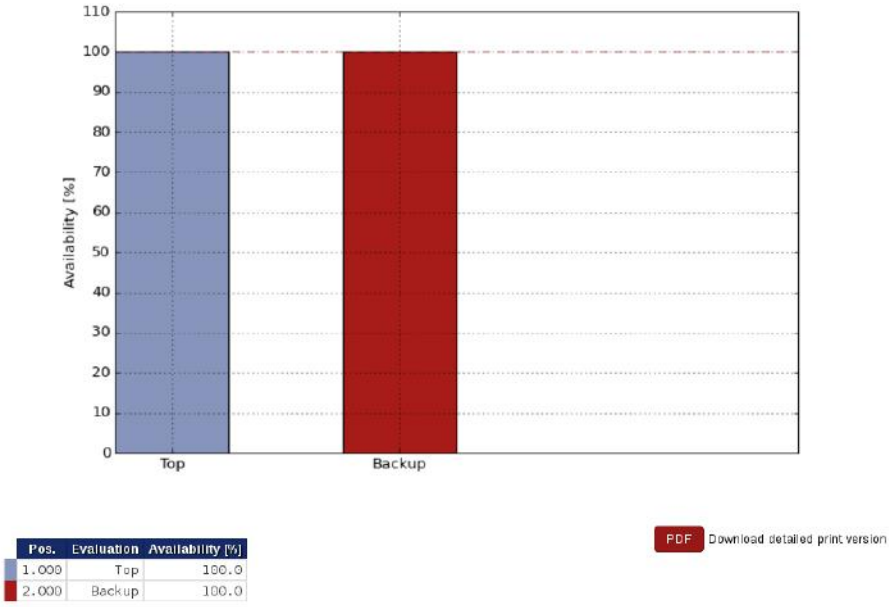


Figure 5.18: Selectable option for the evaluation type avaliability plot



Pos.	Evaluation	Availability [%]
1.000	Top	100.0
2.000	Backup	100.0

Figure 5.19: Example for the evaluation type avaliability plot

Below the plot, a data table is displayed, listing all evaluations for a chosen type, with the value of their avaliability.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.2.4 Histogram

In the *Histogram* all available evaluations can be displayed to analyse the frequency distribution in selectable bins.

to to the Data inspection → Plots menu and select in section *Distribution* the *Histogram* plot. Select a data logger from the dropdown list and set the time period, which should be displayed. Choose *Evaluation*, *Statistic* and *Bin width*.

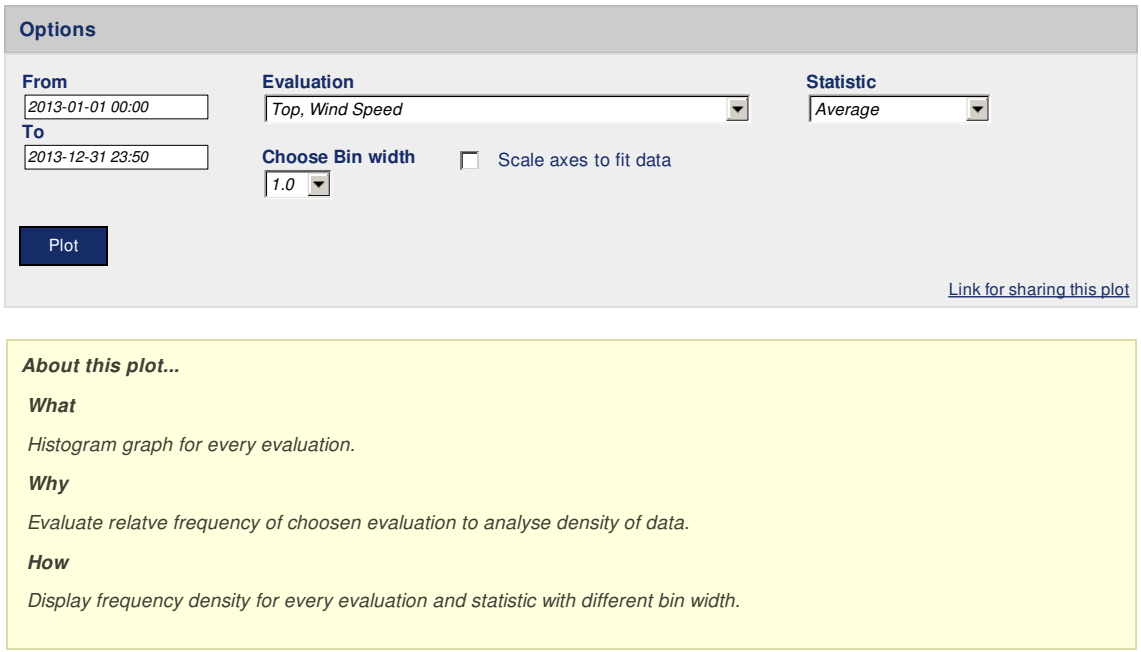
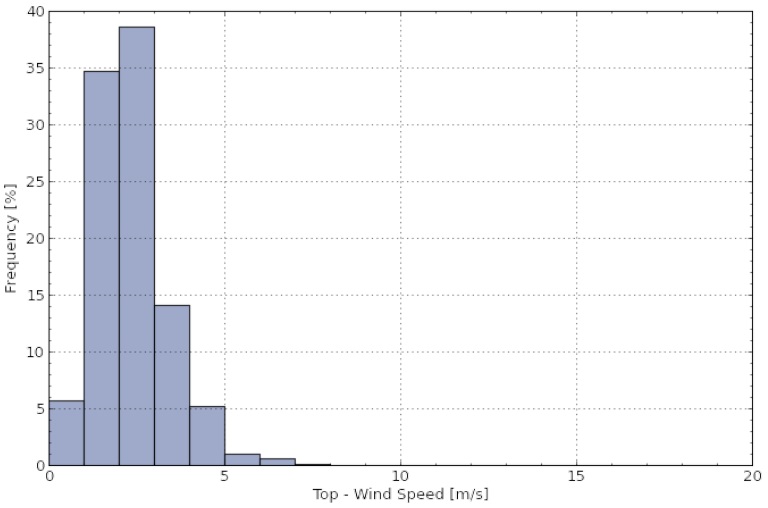


Figure 5.20: Options for histogram

Via *Plot* AmmonitOR calculates the chart.



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Top - Wind Speed [m/s]	Frequency [%]
0.0 - 1.0	5.691
1.0 - 2.0	34.69
2.0 - 3.0	38.56
3.0 - 4.0	14.14
4.0 - 5.0	5.221
5.0 - 6.0	0.963
6.0 - 7.0	0.627
7.0 - 8.0	0.112
8.0 - 9.0	0.000
9.0 - 10.0	0.000
10.0 - 11.0	0.000
11.0 - 12.0	0.000
12.0 - 13.0	0.000
13.0 - 14.0	0.000
14.0 - 15.0	0.000
15.0 - 16.0	0.000
16.0 - 17.0	0.000
17.0 - 18.0	0.000
18.0 - 19.0	0.000

Figure 5.21: Example: Histogram of wind speed for a determined period

Click on *Show data table* to display the table, on *Hide data table* to hide the table.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.2.5 Speed direction bars

The plot with speed direction bars displays the frequency scale of wind speed and wind direction in a wind rose diagram using coloured bars, which indicate different wind speed bins.

Go to the Data inspection → Plots menu and select in section *Distribution* the *Speed direction bar* plot. Select a data logger and define a period, which should be considered. Choose an evaluation pair and determine the number of sectors in the wind rose diagram.

If no *Speed/direction pair* has been defined, an information box is shown. Click on *Add new evaluation pair* and select a wind speed and a wind direction sensor to calculate the evaluation.

Evaluation pairs can also be defined in the Settings → Data logger menu. See Section 8.2.2 for further details.

By default *Normed* is active to display the values in percentage. If the *Normed* checkbox is ticked off, AmmonitOR shows the frequency; how often a wind speed value of a defined scope has been measured in a wind direction sector according to the selected chart options as numbers.

Select *Table with weibull data* to see additional weibull data in the data table. AmmonitOR displays a table referring to the chosen sectors. Wind speed average, weibull's a and weibull's k as well as the frequency of every sector are calculated and displayed. *Table with weibull data* is not selected by default.

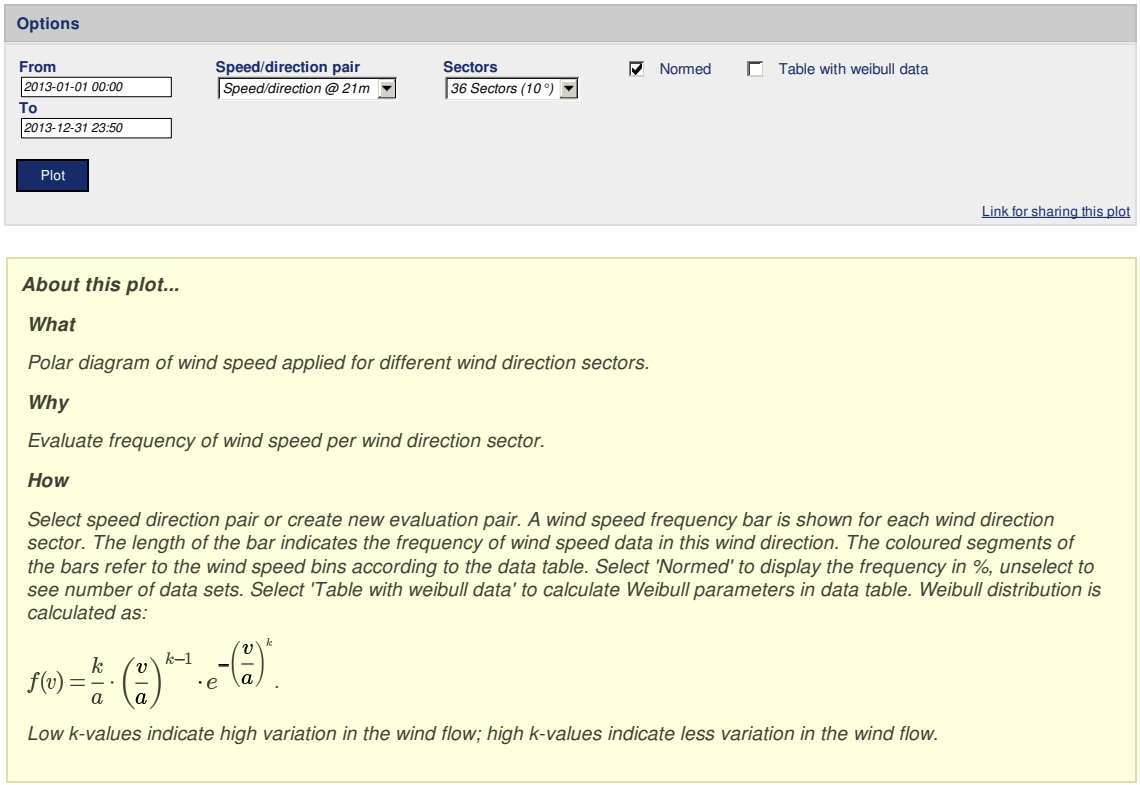
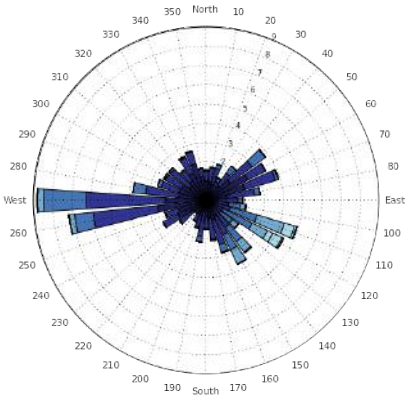


Figure 5.22: Options for speed direction bars diagram

Click on *Plot* to create the diagram.



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Speed [m/s]	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230
0 - 1	0.134	0.157	0.134	0.112	0.179	0.202	0.269	0.224	0.134	0.045	0.045	0.022	0.045	0.090	0.045	0.090	0.112	0.179	0.067	0.157	0.090	0.067	0.067	0.179
1 - 2	0.874	0.807	0.762	0.426	0.762	1.322	2.129	1.860	0.986	0.493	0.224	0.291	0.246	0.403	0.314	0.851	0.941	0.762	0.807	0.448	0.672	0.672	0.381	0.695
2 - 3	0.493	0.739	0.829	0.560	0.807	1.412	1.008	1.658	1.412	1.120	0.896	0.986	0.650	0.448	1.344	1.031	1.344	1.098	0.583	1.300	0.672	0.448	0.381	0.851
3 - 4	0.067	0.022	0.224	0.202	0.448	0.851	0.022	0.157	0.269	0.224	0.627	1.434	1.703	0.739	0.941	0.896	0.403	0.067	0.022	0.246	0.067	0.022	0.000	0.022
4 - 5	0.000	0.000	0.000	0.000	0.000	0.022	0.000	0.000	0.000	0.022	0.246	1.479	0.896	0.381	0.672	0.807	0.045	0.000	0.000	0.022	0.000	0.000	0.000	0.000
5 - 6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.560	0.314	0.000	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 - 7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.112	0.515	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7 - 8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.090	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8 - 9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9 - 10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10 - 11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11 - 12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12 - 13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13 - 14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14 - 15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Figure 5.23: Example: Wind speed and wind direction for a determined period

The plot shows a wind rose with coloured bars, which indicate how often a wind speed has been measured for a wind direction sector. The colours indicate the value in m/s. Refer to the data table below the plot for the wind speed bin related to the colour shown in the wind rose.

Click on *Show data table* to display the table, on *Hide data table* to hide the table.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.2.6 Speed direction dots

The speed direction dots diagram displays the frequency scale of wind speed and wind direction data for a determined period in a wind rose diagram.

Go to the Data inspection → Plots menu and select in section *Distribution* the *Speed direction dots* plot. Select a data logger and define a period, for which should be displayed. Choose an evaluation pair and determine the number of sectors in the wind rose diagram.

If no *Speed/direction pair* has been defined, an information box is shown. Click on *Add new evaluation pair* and select a wind speed and a wind direction sensor to calculate the evaluation.

Evaluation pairs can also be defined in the Settings → Data logger menu. See Section 8.2.2 for further details.

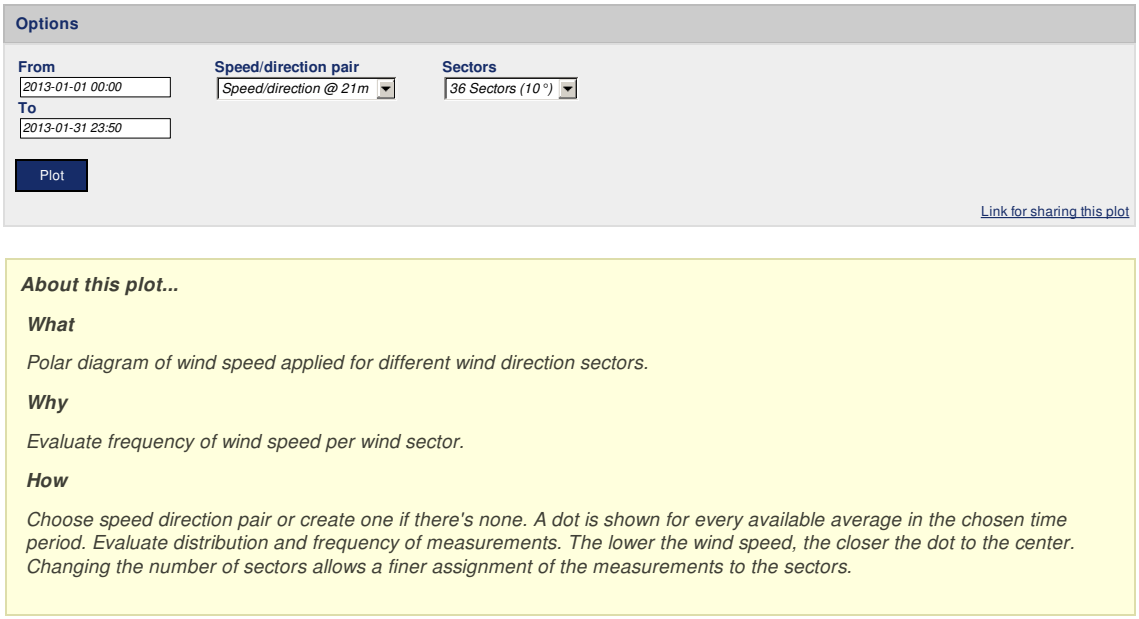
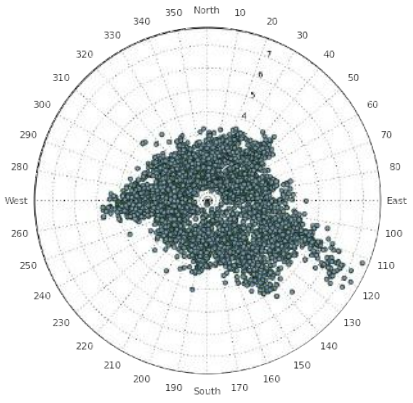


Figure 5.24: Options for speed direction dots diagram

Click on *Plot* to create the speed direction dots diagram.



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Speed [m/s]	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	2
0 - 1	0.134	0.157	0.134	0.112	0.179	0.202	0.269	0.224	0.134	0.045	0.045	0.022	0.045	0.090	0.045	0.090	0.112	0.179	0.067	0.157	0.090	0.067	0.067	0.179	0.1
1 - 2	0.874	0.807	0.762	0.426	0.762	1.322	2.129	1.860	0.986	0.493	0.224	0.291	0.246	0.403	0.314	0.851	0.941	0.762	0.807	0.448	0.672	0.672	0.381	0.695	1.1
2 - 3	0.493	0.739	0.829	0.560	0.807	1.412	1.008	1.658	1.412	1.120	0.896	0.986	0.650	0.448	1.344	1.031	1.344	1.098	0.583	1.300	0.672	0.448	0.381	0.851	0.8
3 - 4	0.067	0.022	0.224	0.202	0.448	0.851	0.022	0.157	0.269	0.224	0.627	1.434	1.703	0.739	0.941	0.896	0.403	0.067	0.022	0.246	0.067	0.022	0.000	0.022	0.0
4 - 5	0.000	0.000	0.000	0.000	0.000	0.022	0.000	0.000	0.000	0.022	0.246	1.479	0.896	0.381	0.672	0.807	0.045	0.000	0.000	0.022	0.000	0.000	0.000	0.000	0.0
5 - 6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.560	0.314	0.000	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
6 - 7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.112	0.515	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
7 - 8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.090	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
8 - 9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
9 - 10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
10 - 11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
11 - 12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
12 - 13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
13 - 14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0
14 - 15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0

Figure 5.25: Example: Wind speed and wind direction for a determined period

The measurement values are displayed in a wind rose. The higher the wind speed the farther away are the dots from the center of the wind rose diagram. The wind speed is indicated on a scale (0m/s is in the center of the wind rose diagram).

AmmonitOR lists the frequency of measurement values in percentage; how often a wind speed value of a defined scope has been measured in a wind direction sector according to the selected chart options. Click on *Show data table* to display the table, on *Hide data table* to hide the table.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.2.7 Wind direction

The wind direction plot displays the frequency scale of wind directions in a wind rose diagram. AmmonitOR displays for each wind direction sensor a separate wind rose diagram.

Go to the Data inspection → Plots menu and select in section *Distribution* the *Wind direction* plot. Select a data logger from the project and determine the period, which should be monitored. Choose the number of sectors for the wind rose diagram.

By default *Normed* is active and the frequency is displayed in percentage. If you deselect the *Normed* checkbox, the frequency of measurement data is displayed.

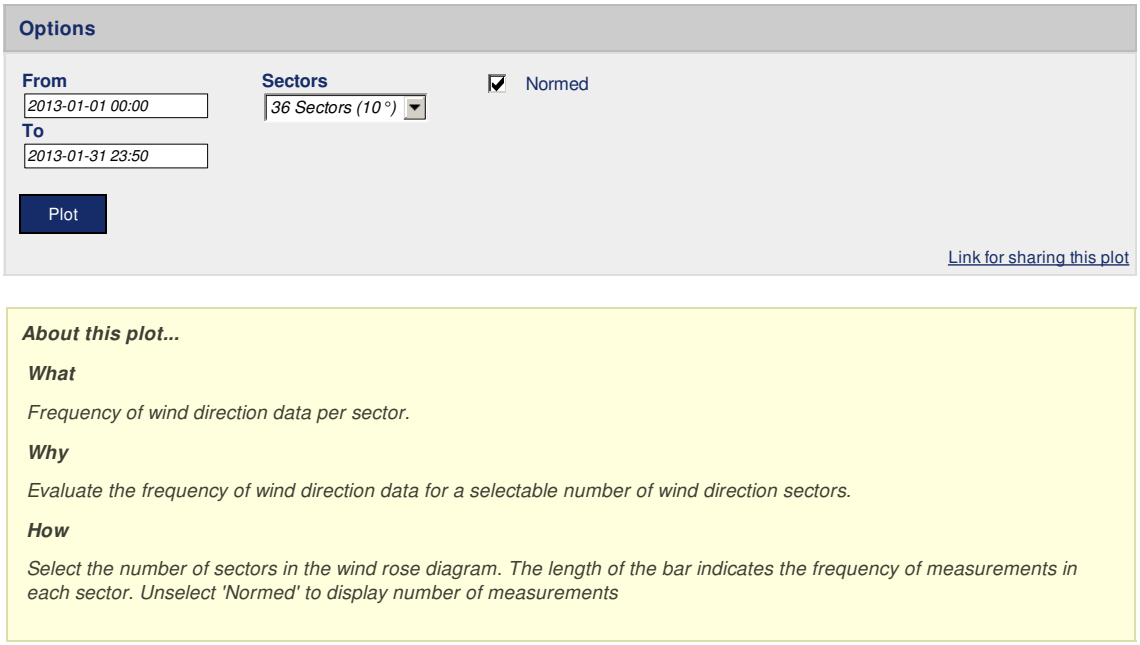
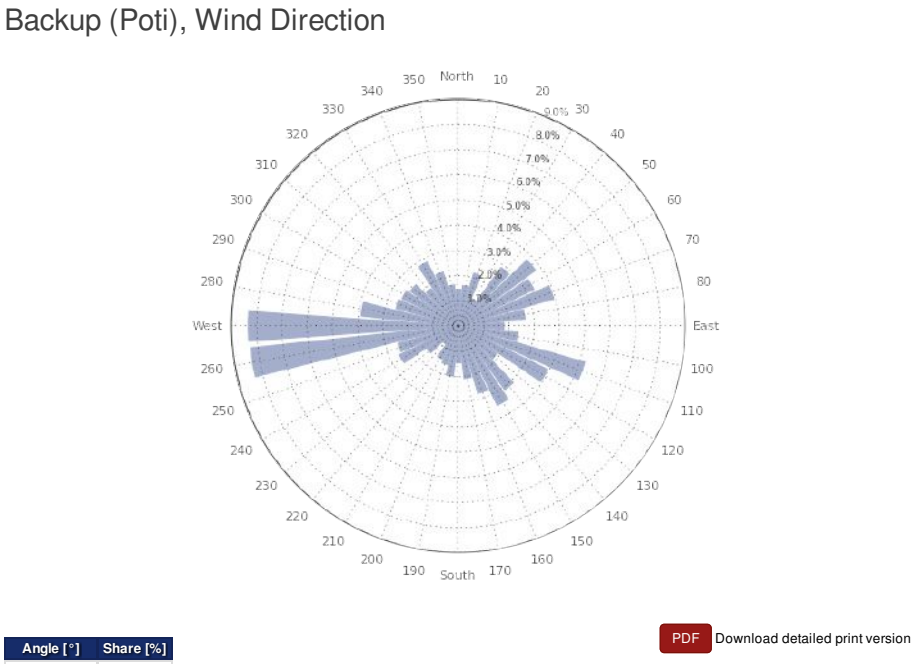


Figure 5.26: Options for wind rose diagram

Click on *Plot* to generate the wind rose diagram(s).



Angle [°]	Share [%]
-5.0 - 5.0	1.456
5.0 - 15.0	1.613
15.0 - 25.0	2.173
25.0 - 35.0	1.210
35.0 - 45.0	2.868
45.0 - 55.0	3.764
55.0 - 65.0	3.316
65.0 - 75.0	3.921
75.0 - 85.0	2.644
85.0 - 95.0	1.793

Figure 5.27: Example: Wind rose for a determined period

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.2.8 Wind speed

AmmonitOR displays the frequency scale of all installed wind speed sensors in histograms. Weibull parameters can be displayed. The distribution of measurement values are calculated in 0.5 m/s bins.

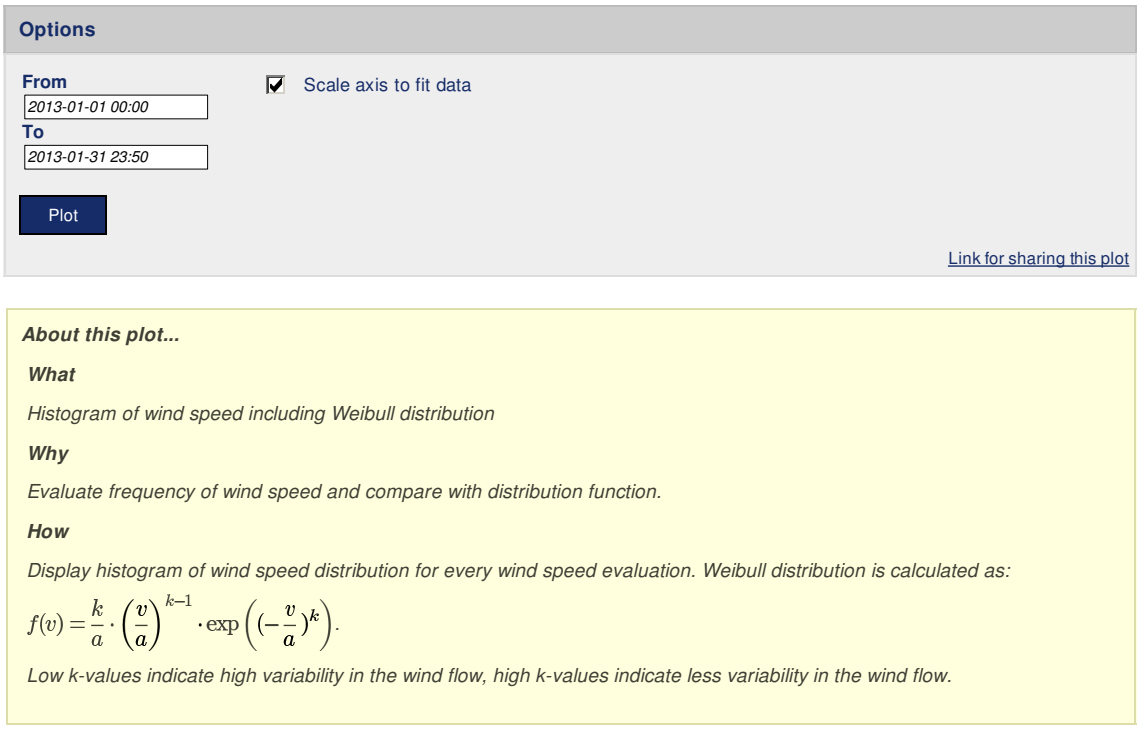
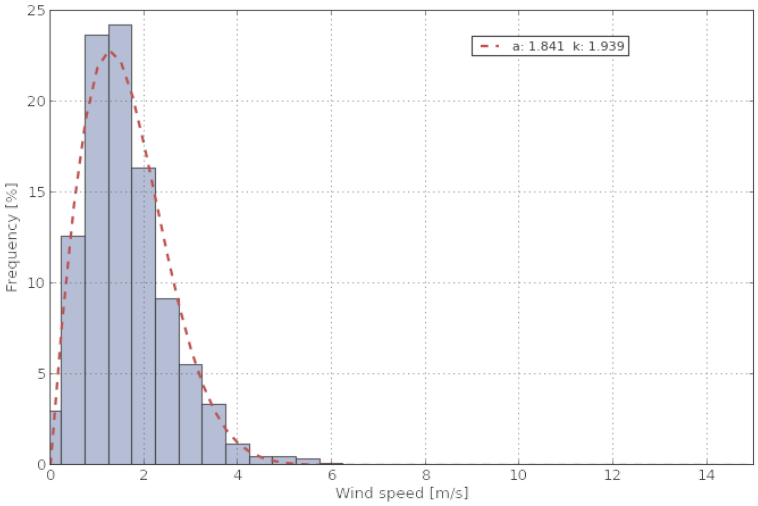


Figure 5.28: Options for wind speed histogram

Go to the Data inspection → Plots menu and select in section *Distribution* the *Wind speed* plot. Select a data logger from the project and determine the period, which should be monitored. Click on *Plot* to display for each wind speed sensor a histogram with Weibull curve and Weibull parameters.

Backup



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Speed [m/s]	Frequency [%]
0.0 - 0.5	2.958
0.5 - 1.0	12.59
1.0 - 1.5	23.62
1.5 - 2.0	24.20

Figure 5.29: Histogram of wind speed

Weibull parameters are calculated using the Modified Maximum Likelihood Estimation algorithm.

$$\frac{\sum_{i=1}^{n} v_i^k \log v_i P(v_i)}{\sum_{i=1}^{n} v_i^k P(v_i)} - \frac{1}{k} = \sum_{i=1}^{n} \log v_i P(v_i)$$

Equation 5.3: Calculation of weibull shape parameter

$$\hat{a} = \left[\sum_{i=1}^{n} v_i^{\hat{k}} P(v_i) \right]^{1/\hat{k}}$$

Equation 5.4: Calculation of weibull scale parameter

The first equation (shape parameter) is estimated using iterative processes with a precision of ±0.0001, the scale parameter is derived from the estimated shape parameter using the second equation.

For each wind speed sensor, AmmonitOR lists the frequency for all 0.5 m/s bins in a data table below the histograms. Click on *Show data table* to display the table, on *Hide data table* to hide the data table.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.3 Comparison

This section lists all plots, which correlate or compare measurement values.

5.1.3.1 Correlation plot

The correlation plot is used to compare measurement values (evaluations) of the same sensor type, e.g., anemometers. Thus measurement errors or defective sensors can easily be detected.

One sensor is used as reference. AmmonitOR automatically selects the sensor with the greatest installation height as reference, it indicated. The reference sensor is shown on x-axis; other sensors on the y-axis. For example: top anemometer on x-axis and backup anemometer on y-axis. All measurement values are displayed in a data cluster - optimally on a diagonal.

AmmonitOR calculates a regression line for each correlation, which is displayed in the plot. Thus the trend of the measurement values can be monitored.

The regression line is calculated as follows:

$$y(x) = \tilde{a} \cdot x + \tilde{b}$$

$$\tilde{a} = \frac{\overline{xy} - \overline{x} \cdot \overline{y}}{\overline{x}^2 - (\overline{x})^2}$$

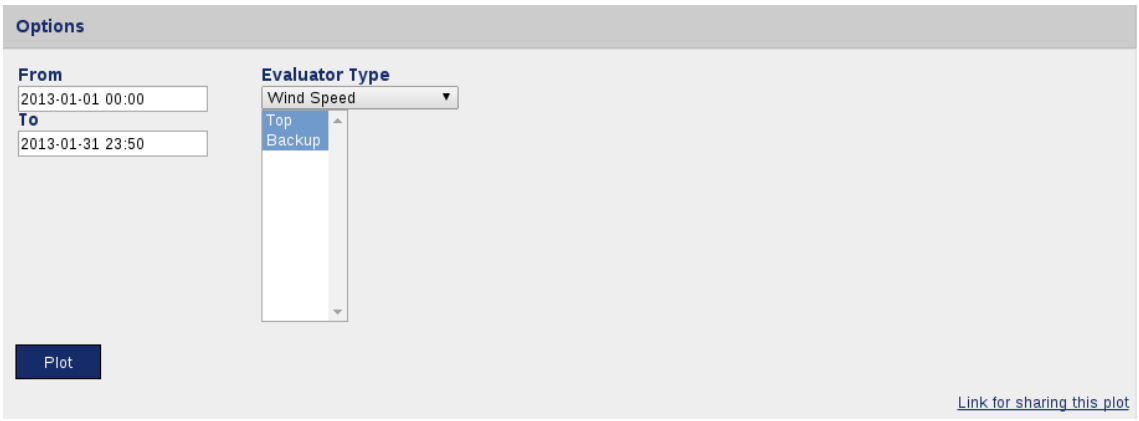
$$\tilde{b} = \overline{y} - \tilde{a} \cdot \overline{x}$$

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \overline{y})^2}}$$

$$R^2 := r_{xy}^2$$

Equation 5.5: Calculation of regression line and coefficient of determination R²

Go to the Data inspection → Plots menu and select in section *Comparison* the *Correlation plot*. Select a data logger and define the period, which should be considered for the plot. Choose an *Evaluation type* from the dropdown list. AmmonitOR automatically includes all sensors of the evaluation type in the plot. Deselect sensors, which should not be displayed in the correlation profile by using the CTRL key. Click on *Plot* to display the correlation profile.



About this plot...

What

The correlation plot is used to compare measurement values (evaluations) of the same sensor type.

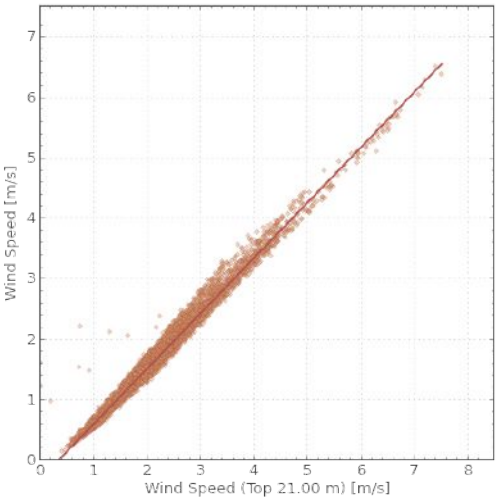
Why

Measurement errors or defective sensors can be detected.

How

The highest sensor is automatically selected as reference sensor (x-axis). It is correlated to the other sensors of the same type (y-axis).The calculated linear regression follows $y = m \cdot x + b$ *(compare solid line and data table). If slope* $m < 1$*, the values for the reference sensor are higher than the average. If* $m > 1$*, the values of the compared sensor are higher than the average. The coefficient of determination* R^2 *indicates the linear correlation.* $R^2 = 1$ *indicates optimal correlation;* $R^2 = 0$ *no linear correlation.*

Figure 5.30: Selectable options for correlation profile



Evaluation	Height [m]	Orientation [°]	R²	m	b
Top	21.00				
Backup	20.00		0.981	0.915	-0.293

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Figure 5.31: Correlation profile for wind direction

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

The explanation next to the diagram (see Figure 5.31) indicates, which regression line corresponds to the correlated sensor. The coefficient of determination R^2 indicates the linear correlation. $R^2 = 1$ means optimal correlation; $R^2 = 0$ indicates no linear correlation.

Important
Depending on the installation height of the correlated sensors, the gradient angle of the regression line is different. This is because of atmospheric layers. It affects all height-dependent sensors, e.g., anemometers, temperature sensors and air pressure sensors.

5.1.3.2 Long term comparison profile

The long term comparison profile is used to monitor and detect wear on the top anemometer based on the correlation with the backup anemometer. For a determined period measurement values of the top anemometer are correlated with measurement values of the backup anemometer.

Go to the Data inspection → Plots menu and select in section *Comparison* the *Long term comparison profile*. Select primary and backup wind speed evaluations, which should be correlated. Select a wind direction evaluation.

Wind speed data can be filtered to monitor only a typical wind speed range. Additionally, wind speed data related to a determined wind direction sector can be considered. To do so, select the filter for wind speed and / or wind direction.

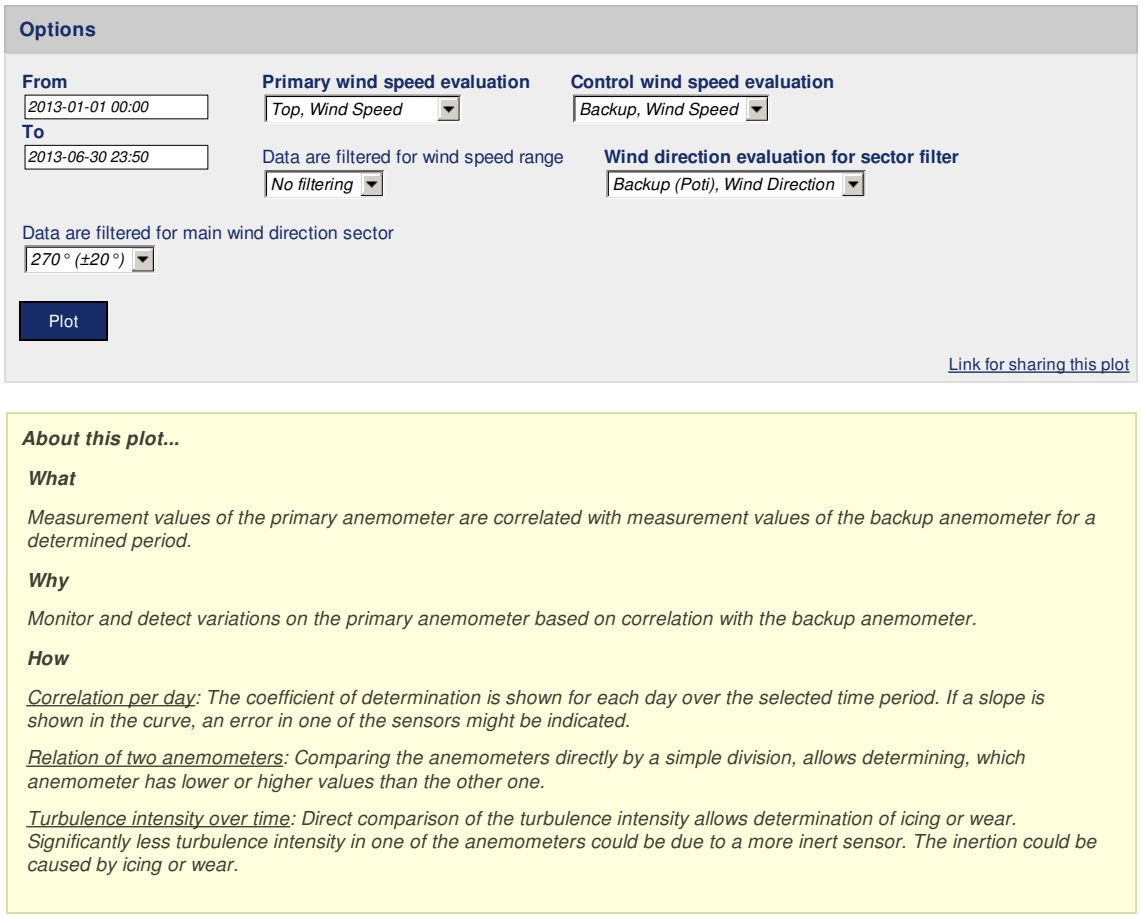


Figure 5.32: Options for long term comparison profile

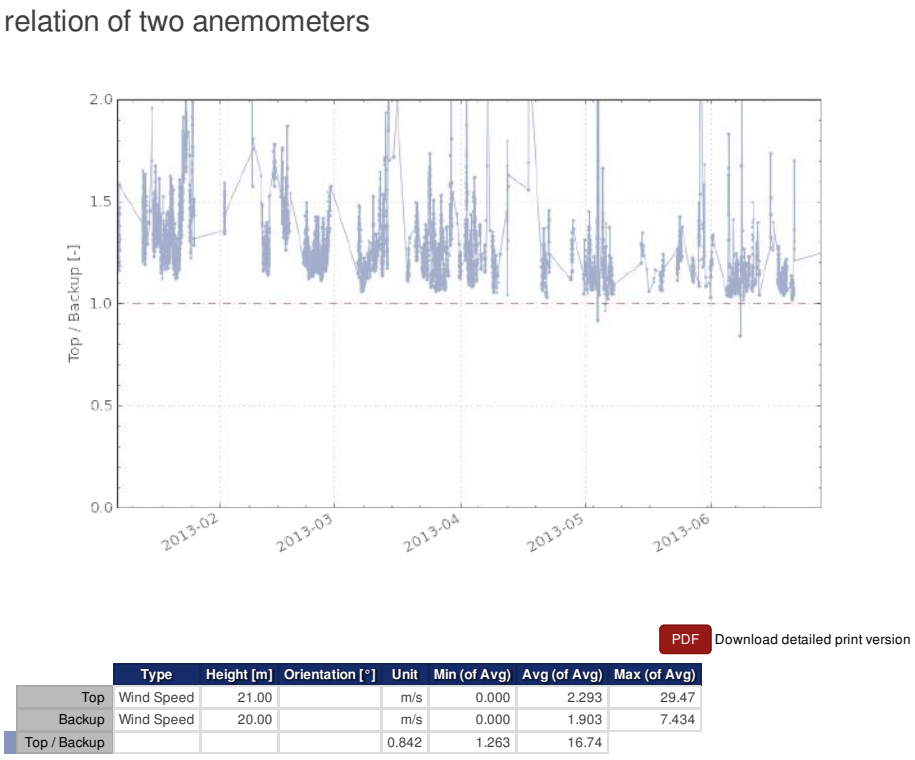
AmmonitOR displays three plots: correlation per day, relation of the chosen anemometers and turbulence intensity over time.

Correlation per day AmmonitOR displays the correlation of the selected wind speed sensors per day. The behaviour of the R^2 can be monitored for the determined period. Optimal correlation would be R^2 close to 1.

Figure 5.33: Correlation of selected anemometers per day

Relation of chosen anemometers The division result of the selected top and backup anemometers is displayed in a curve. If the top anemometer is slower than the backup anemometer, the displayed curve is below the optimal value 1. This plot indicates the defective anemometer.

In a table the total minimum, average and maximum measurement values of the selected anemometers are displayed (based on the calculated averages), as well as the values for the displayed curve.



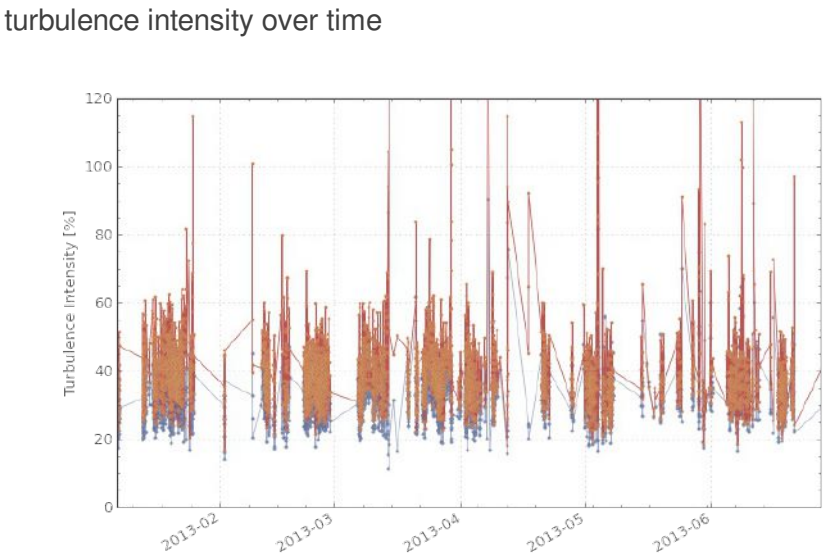
	Type	Height [m]	Orientation [°]	Unit	Min (of Avg)	Avg (of Avg)	Max (of Avg)
Top	Wind Speed	21.00		m/s	0.000	2.293	29.47
Backup	Wind Speed	20.00		m/s	0.000	1.903	7.434
Top / Backup				0.842	1.263	16.74	

Figure 5.34: Relation of selected anemometers

Turbulence intensity over time AmmonitOR displays the turbulence intensity of both anemometers in a plot. If the turbulence intensity of one anemometer is much higher than the other, a defective anemometer can be the reason.

The turbulence intensity is the proportion of standard deviation and average of the 10min statistics over a certain period. The value is given in percentage.

A table shows the minimum, average and maximum value of the turbulence intensity of the selected anemometers.



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Turbulence intensity	Height [m]	Orientation [°]	Unit	Min (of Avg)	Avg (of Avg)	Max (of Avg)
Top	21.00		%	11.81	33.24	120.3
Backup	20.00		%	16.85	39.37	257.1
Top / Backup			0.102	0.857	1.291	

Figure 5.35: Turbulence intensity for selected anemometers

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.3.3 Shadow zone plot

Generate this plot to display shadow zones caused by the mast or lightning protection. AmmonitOR shows the wind direction by calculating the quotient [q] of two anemometers. The generated chart shows a bulge in the direction of the mast, lightning protection or obstacle.

The shadow zone is calculated as follows:

$$q = \frac{\text{Anemometer1}}{\text{Anemometer2}}$$

Equation 5.6: Calculation of shadow zone

Go to the Data inspection → Plots menu and select in section *Comparison* the *Shadow zone plot*. Select a data logger and determine the period, which should be displayed. Choose wind speed sensors and a wind vane. The numerator should be the top anemometer and the divisor the backup anemometer. However, it is possible to compare other anemometers installed on different heights - according to literature the height difference should not exceed 5m.

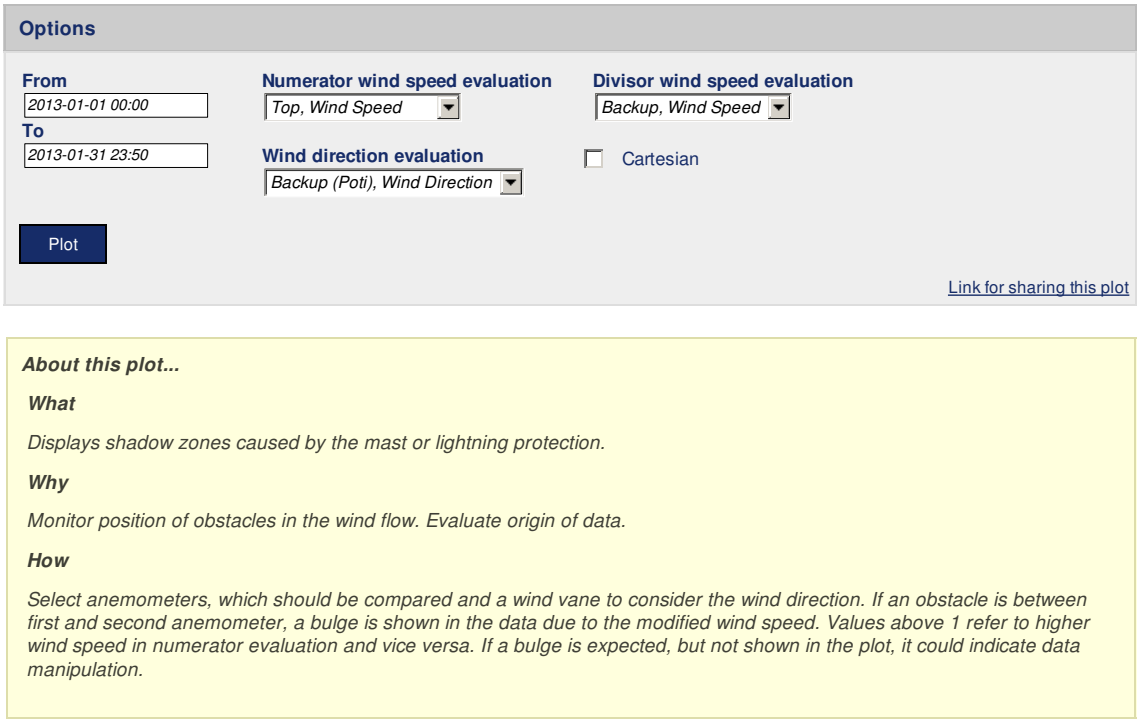


Figure 5.36: Options for shadow zone plot

Click on *Plot* to create the shadow zone diagram.

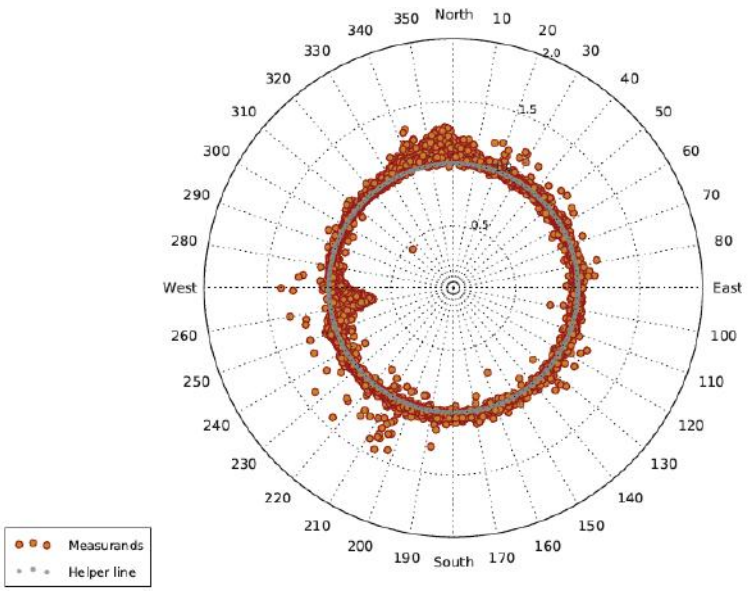


Figure 5.37: Example: Shadow zone plot

In order to show the shadow zone plot in a cartesian chart, select *Cartesian*.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.3.4 Simple height profile

The simple height profile is used to compare evaluations in different installation heights. AmmonitOR displays the average values including standard deviation of an evaluation for a determined period.

Go to the Data inspection → Plots menu and select in section *Comparison* the *Simple height profile*. Select a data logger and determine the period, which should be displayed. Choose an *Evaluation type*, for which all installed sensors are shown in the plot.

Click on *Plot* to display the diagram.

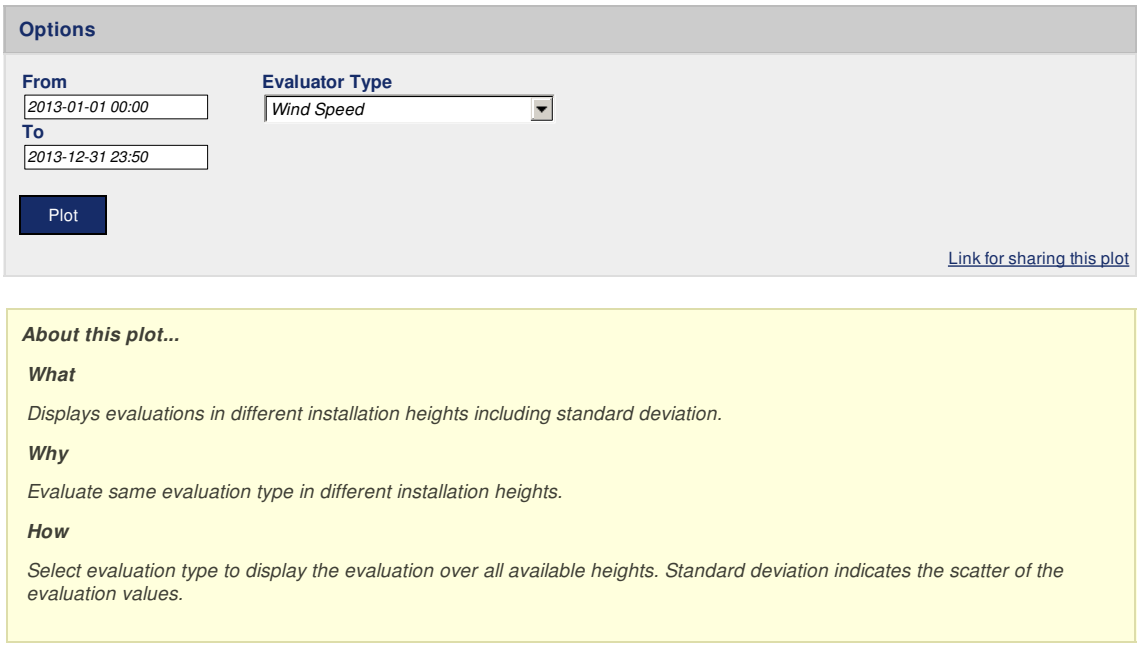
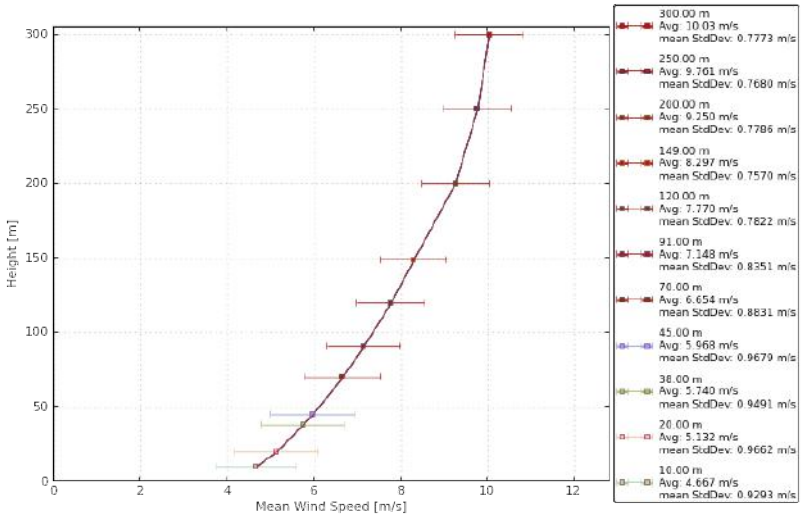


Figure 5.38: Options: Simple height profile

For example: If the simple height profile for wind speed should be displayed, AmmonitOR shows for each installed anemometer a graph.



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Evaluation	Height [m]	Avg [m/s]	± mean StdDev [m/s]
Horizontal Wind Speed @ 300m	300.0	10.03	0.777
Horizontal Wind Speed @ 250m	250.0	9.761	0.768
Horizontal Wind Speed @ 200m	200.0	9.250	0.779
Horizontal Wind Speed @ 149m	149.0	8.297	0.757
Horizontal Wind Speed @ 120m	120.0	7.770	0.782
Horizontal Wind Speed @ 91m	91.00	7.148	0.835
Horizontal Wind Speed @ 70m	70.00	6.654	0.883
Horizontal Wind Speed @ 45m	45.00	5.968	0.968
Horizontal Wind Speed @ 38m	38.00	5.740	0.949
Horizontal Wind Speed @ 20m	20.00	5.132	0.966
Horizontal Wind Speed @ 10m	10.00	4.667	0.929

Figure 5.39: Example: Simple height profile for wind speed

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.4 Turbulence analysis

This section lists typical plots relevant for turbulence analysis.

5.1.4.1 Turbulence intensity

Turbulence intensity is crucial for the wind turbine design, especially to calculate the wind load on the rotor blades and on the tower. It does not necessarily have an impact on the energy yield.

Horizontal and vertical wind speed data is necessary to calculate the turbulence intensity. It is recommended installing a propeller anemometer to measure the vertical wind speed in addition to cup anemometers (horizontal wind speed). Ultrasonic anemometers can also be installed, which measure horizontal and vertical wind speed as well as wind direction.

The average turbulence intensity (I_v) is given in % (percentage). The turbulence intensity is the proportion of standard deviation (σ) and average (v) of the 10min-statistics for a certain period.

$$I_v = \frac{\sigma_v}{\overline{v}} = [\%]$$

Equation 5.7: Calculation of the turbulence intensity (Iv)

$$I_c = \overline{I}_v + \sigma_{\overline{I_v}} = [\%]$$

Equation 5.8: Calculation of the characteristical turbulence intensity (Ic)

$$I_{NTM} = \frac{I_{ref} \cdot (0.75 \cdot v_{hub} + 5,6)}{v_{hub}} = [\%]$$

Class A: $I_{ref} = 0.16$ Class B: $I_{ref} = 0,14$ Class C: $I_{ref} = 0.12$

Equation 5.9: Calculation of the Normal Turbulence Model (NTM) of IEC61400-1

Go to the Data inspection → Plots menu and select in section *Turbulence analysis* the *Turbulence intensity* plot. Select a data logger from the project and determine the period, which should be monitored. Choose a wind speed evaluation. If more than one wind speed evaluation should be displayed, hold the CTRL key and use the left-mouse click to choose further evaluations. Click on *Plot* to display the chart.

By selecting the checkbox *Turbulence intensity profile for IEC's normal turbulence model*, curves of the normal turbulence model are displayed in the diagram, see Figure 5.43.

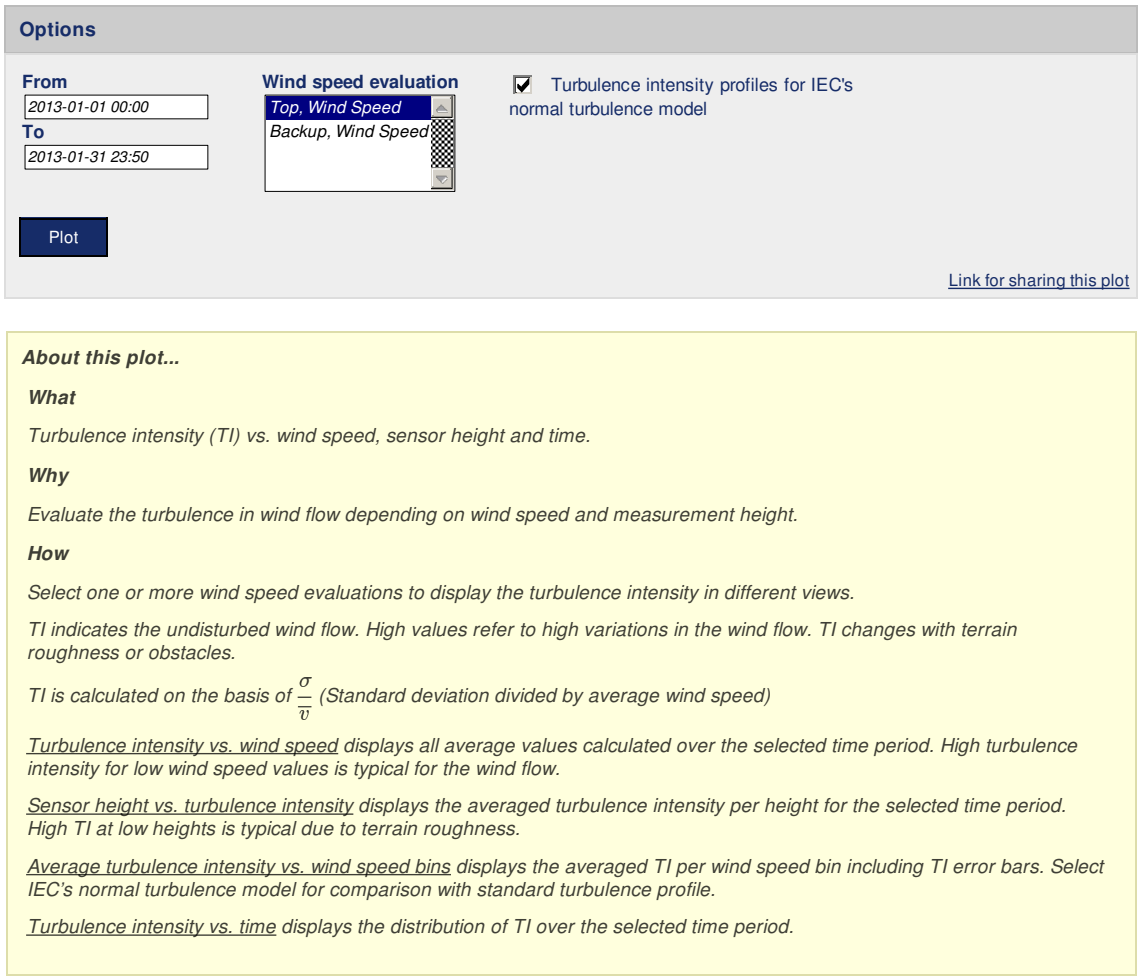


Figure 5.40: Options for turbulence intensity plots

AmmonitOR generates four plots to monitor turbulence intensity.

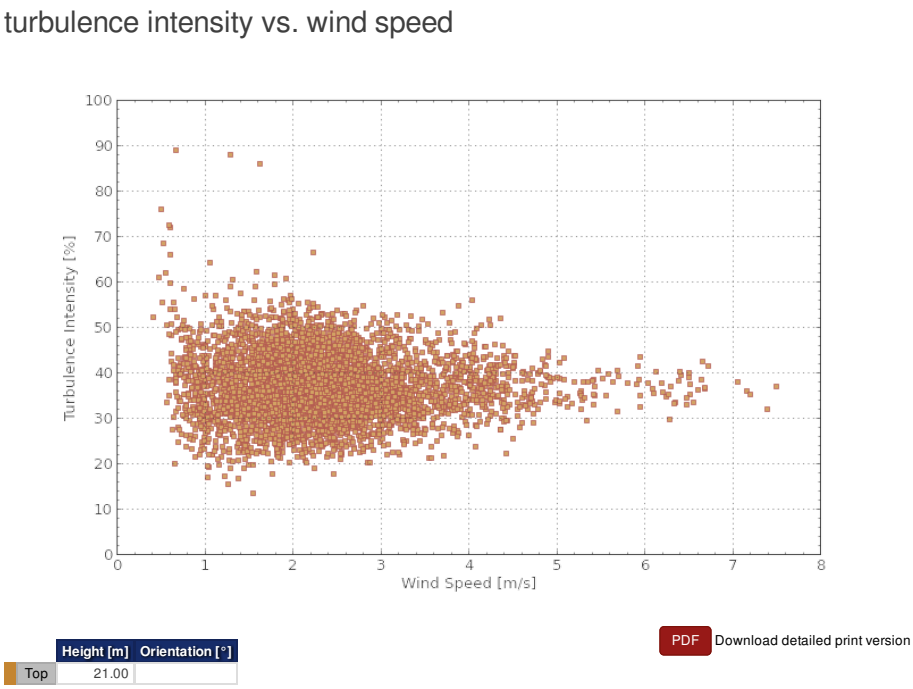


Figure 5.41: Example: Turbulence intensity frequency scale

Figure 5.41 displays the frequency scale of the turbulence intensity on the wind speed.

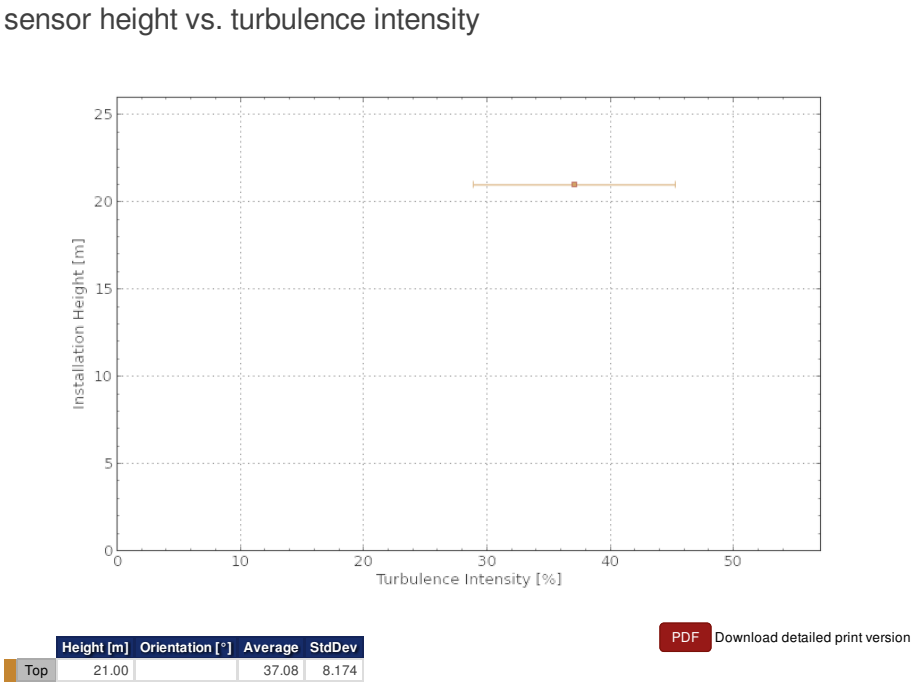


Figure 5.42: Example: Turbulence intensity vs. installation height

Figure 5.42 displays the turbulence intensity of the selected wind speed sensor on the different installation heights.

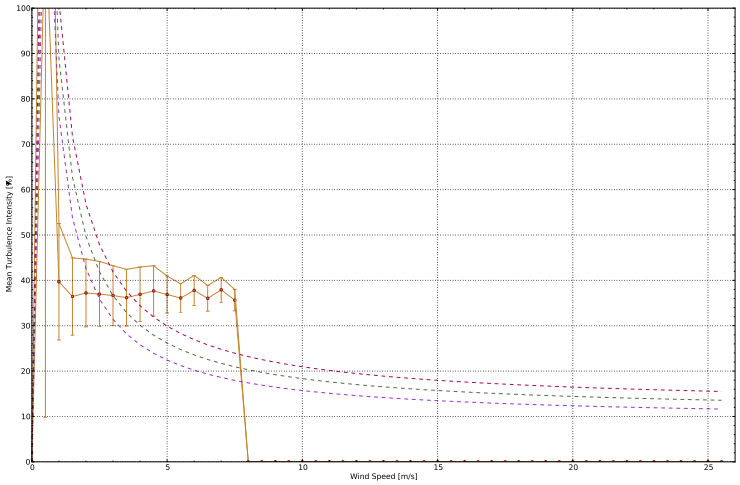


Figure 5.43: Example: Mean and characteristic turbulence intensity

Figure 5.43 displays the mean and characteristic turbulence intensity of the selected sensor.

AmmonitOR lists for each wind speed bin average and standard deviation of the wind speed. Click on *Show data table* to review the data, on *Hide data table* to hide the data table.

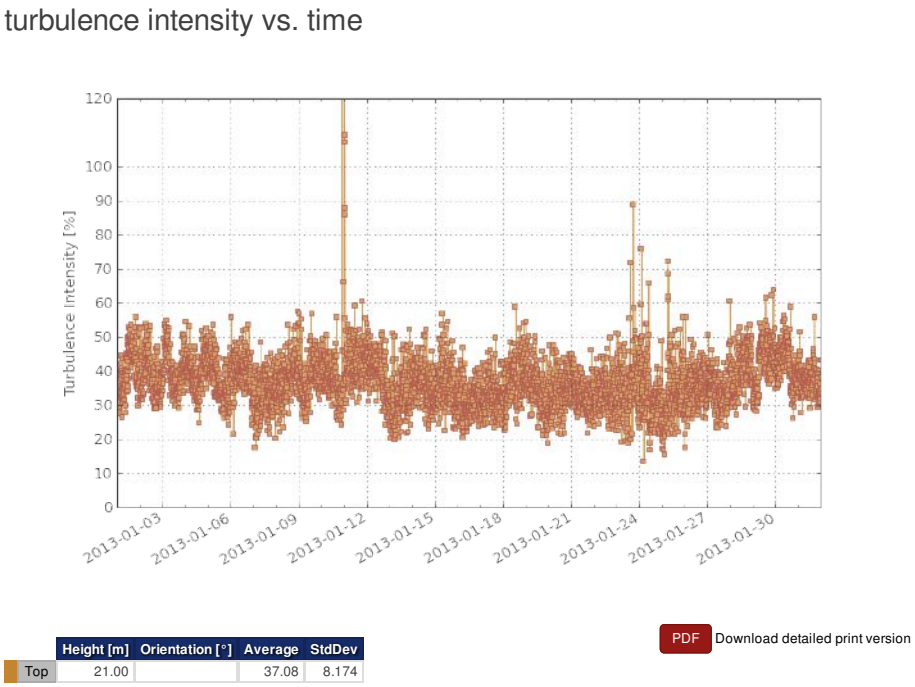


Figure 5.44: Example: Turbulence intensity trend

Figure 5.44 displays the trend of the turbulence intensity for the selected period.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.4.2 Turbulence intensity polar

The turbulence intensity polar displays the frequency scale of the turbulence intensity in a wind rose plot.

Go to the Data inspection → Plots menu and select in section *Turbulence analysis* the *Turbulence intensity polar* plot. Select a data logger from the project and determine the period, which should be monitored. Choose a wind speed and a wind direction evaluation from the list. Click on *Plot* to display the wind rose diagram.

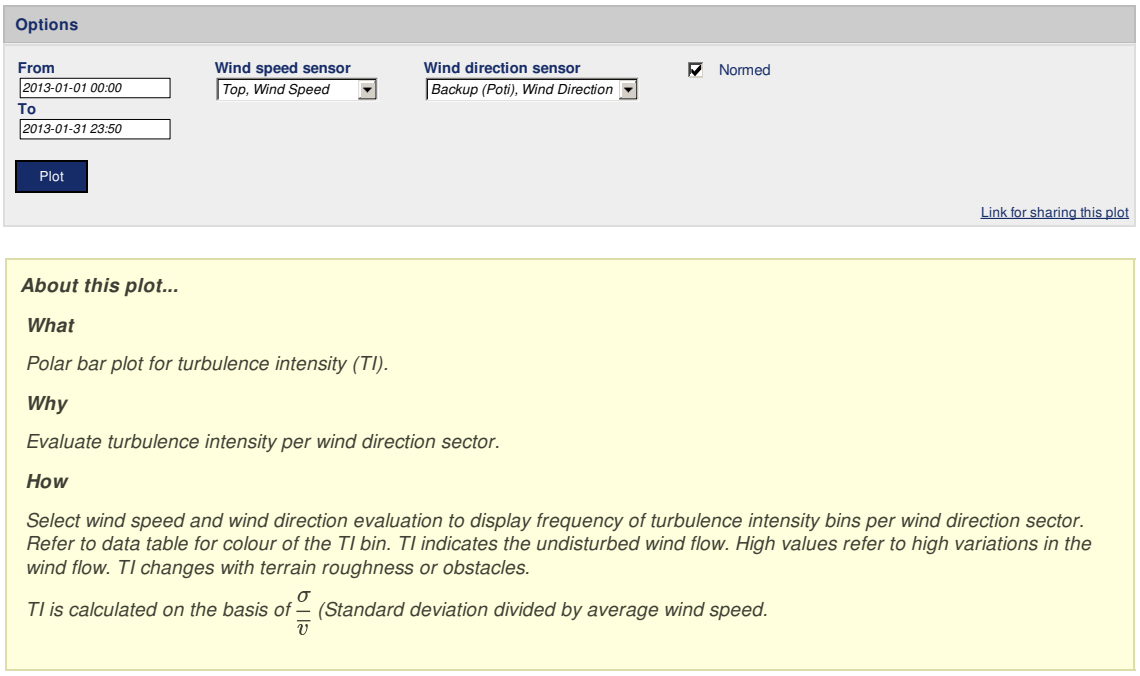
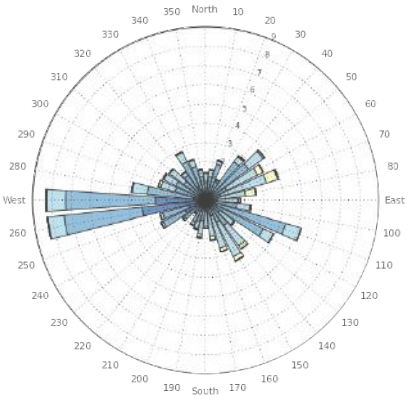


Figure 5.45: Options for turbulence intensity polar

By default *Normed* is active and the frequency of measurement values is displayed in percentage. If you deselect the *Normed* checkbox, AmmonitOR displays the frequency of the measurement values in numbers.



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TI [%]	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230
00 - 10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10 - 20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022
20 - 30	0.134	0.224	0.448	0.359	0.516	0.314	0.090	0.112	0.022	0.000	0.045	0.336	0.157	0.022	0.000	0.000	0.022	0.000	0.022	0.090	0.090	0.381	0.359	0.403
30 - 40	0.807	0.986	1.502	0.740	1.973	2.421	1.098	0.672	0.359	0.538	1.569	3.968	3.161	0.874	1.592	1.255	0.829	0.717	0.538	0.986	1.054	0.874	0.448	0.964
40 - 50	0.448	0.381	0.179	0.090	0.314	0.941	1.793	2.488	1.681	1.143	0.695	0.852	0.605	0.897	1.323	1.995	1.726	1.166	0.785	0.695	0.359	0.179	0.022	0.112
50 - 60	0.045	0.022	0.045	0.022	0.067	0.090	0.314	0.605	0.538	0.112	0.067	0.000	0.000	0.067	0.202	0.224	0.202	0.202	0.112	0.134	0.045	0.000	0.000	0.000
60 - 70	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.045	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.000	0.000	0.000	0.022	0.000	0.022	0.022	0.000
70 - 80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022
80 - 90	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.022	0.000	0.000	0.000
90 - 100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.022	0.000	0.022	0.000

Figure 5.46: Example: Turbulence intensity polar

The turbulence intensity in the different wind direction sectors is highlighted according to a colour scale. The colours are indicated in the data table below the diagram. AmmonitOR lists for each wind direction sector (10°) the frequency of turbulence intensity in 10% bins.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.5 Power curve measurement

This section lists a number of plots relevant for power curve measurement applications. In order to display the plots in this section, `Speed/power` pairs and power measuring units, e.g., power meters, are required.

5.1.5.1 Energy yield

Use this plot to display the calculated energy yield of your wind turbine over a defined period. Additionally, a reference wind turbine can be added to the plot to compare the energy yield of your turbine with the energy yield of the reference turbine.

The energy yield is calculated as follows:

$$E_i = N_i \cdot P_i$$

Equation 5.10: Calculation of Energy Yield

Where N_i refers to the number of hours in bin i and P_i is the averaged power in bin i.

Go to the Data inspection → Plots menu and select in section *Power curve measurement* the *Energy yield* plot. Select a data logger from your project, if more than one data logger are related to the project. Select a *Speed/power pair* and choose start and end of the period, which should be displayed. Optionally, a *Power curve* can be included in the plot - select one from the dropdown list. Click on *Plot* to show the energy yield plot.

If no *Speed/power pair* has been defined, a red-colored information box is displayed. Click on *Add new evaluation pair* and select a wind speed sensor and a power measuring unit (power meter) to calculate the evaluation for the energy yield. It is possible to create more than on *Speed/power pair*.

Evaluation pairs can also be defined in the Settings → Data logger menu. See Section 8.2.2 for further details.

If no *Power curve* has been defined, go to the Settings → Wind turbine menu and add a wind turbine.

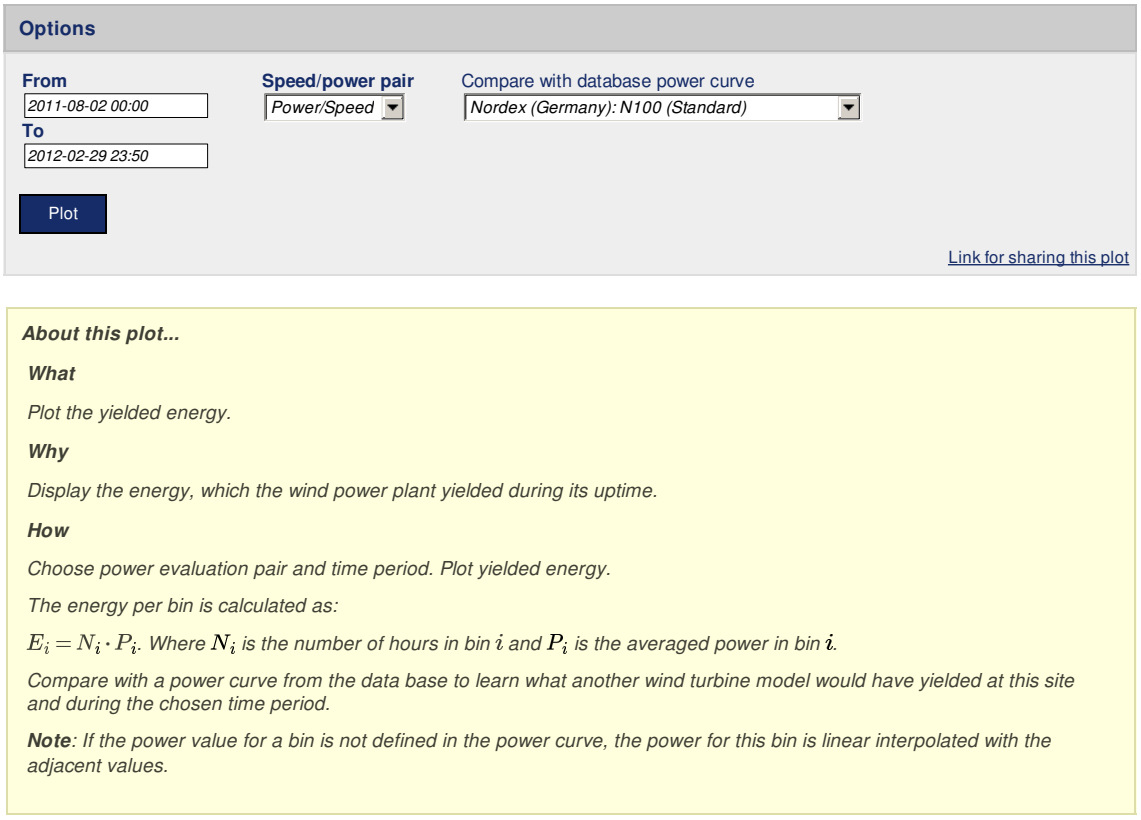
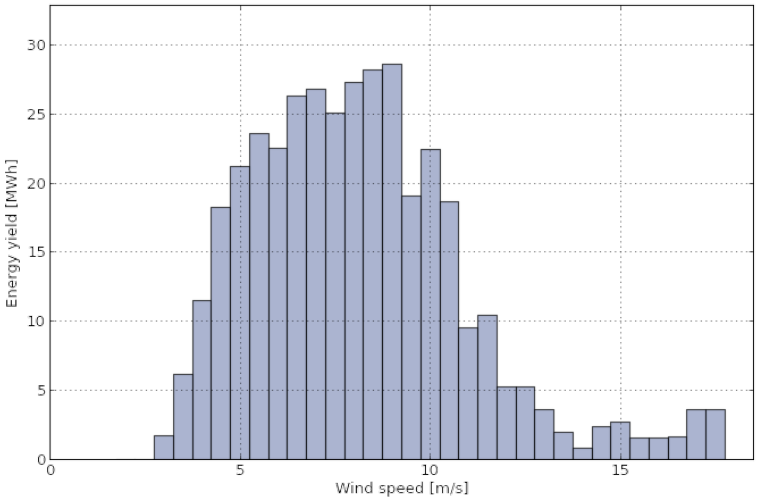


Figure 5.47: Selectable option for the energy yield plot

The energy yield of your turbine is displayed in blue bars. If selected, the energy yield of the reference wind turbine is displayed in red bars.



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Wind speed bin range [m/s]	Mean Wind speed	Energy yield [MWh]
1.75 - 2.25	2.014	0.000
2.25 - 2.75	2.524	0.000
2.75 - 3.25	3.017	1.715
3.25 - 3.75	3.492	6.165
3.75 - 4.25	4.002	11.49
4.25 - 4.75	4.494	18.20

Figure 5.48: Example for the energy yield plot

Below the plot, a data table can be displayed by clicking on *Show data table*. AmmonitOR lists for all wind speed bins the energy yield of your turbine as well as the total enery yield for the selected period. Additionally, AmmonitOR lists the mean wind speed per wind speed bin. If a wind turbine has been selected for comparison reasons, the table list all values of the turbine in a separate column.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.5.2 Estimated energy yield

In order to estimate the energy yield according to IEC 61400-12-1 a number of measurement values have to be collected. Use this plot to predict the annual energy yield based on wind speed and power curve data for a specified time period.

By setting the *Operational range* of the turbine, the extrapolated energy yield per wind speed bin is displayed in the plot. The measurement data is extrapolated to display the maximum achieveable energy yield per wind speed bin. According to IEC 61400-12-1 a number of measurement values have to be available to confirm the calculation. Areas with missing measurement values are highlighted in the plot.

Additionally, a reference turbine can be included in the plot to compare its data with your turbine.

According to IEC 61400-12-1 the energy yield forecast is calculated as follows:

$$EP = N_h \sum_{i=0}^{N} [F(v_i) - F(v_{i-1})] \cdot \left(\frac{P_{i-1} - P_i}{2} \right)$$

Equation 5.11: Calculation of Energy Yield Forecast acc. to IEC 61400-12-1

Where N_h represents the number of hours in the chosen time period, F_v is the Rayleigh probability distribution, v_i is the averaged wind speed per bin i and P_i is the averaged power per bin i.

The Rayleigh distribution is calculated as follows:

$$F(v) = 1 - e^{-\frac{\pi}{4}\left(\frac{v}{v_{avg}}\right)^2}$$

Equation 5.12: Calculation of Rayleigh distribution

Where v_{avg} is the mean wind speed the energy yield is predicted for (4−11 m/s).

Go to the Data inspection → Plots menu and select in section *Power curve measurement* the *Estimated energy yield plot*. Select a data logger from the dropdown list and choose a *Speed/power pair*. Set start and end of the period, which should be displayed. Enter the *Operational range* of your turbine with cut-in and cut out. Use a hyphen (-) to separate the values, e.g., 3-20.

If no *Speed/power pair* has been defined, a red-colored information box is displayed. Click on *Add new evaluation pair* and select a wind speed sensor and a power measuring unit (power meter) to calculate the evaluation for the energy yield. It is possible to create more than on *Speed/power pair*.

Evaluation pairs can also be defined in the Settings → Data logger menu. See Section 8.2.2 for further details.

If a reference turbine should be included in the plot, choose a turbine from the list under *Compare with database power curve*. The selected reference turbine will be displayed with red-colored bars in the plot. If no reference turbine has been defined, go to the Settings → Wind turbines menu and add the required turbine data.

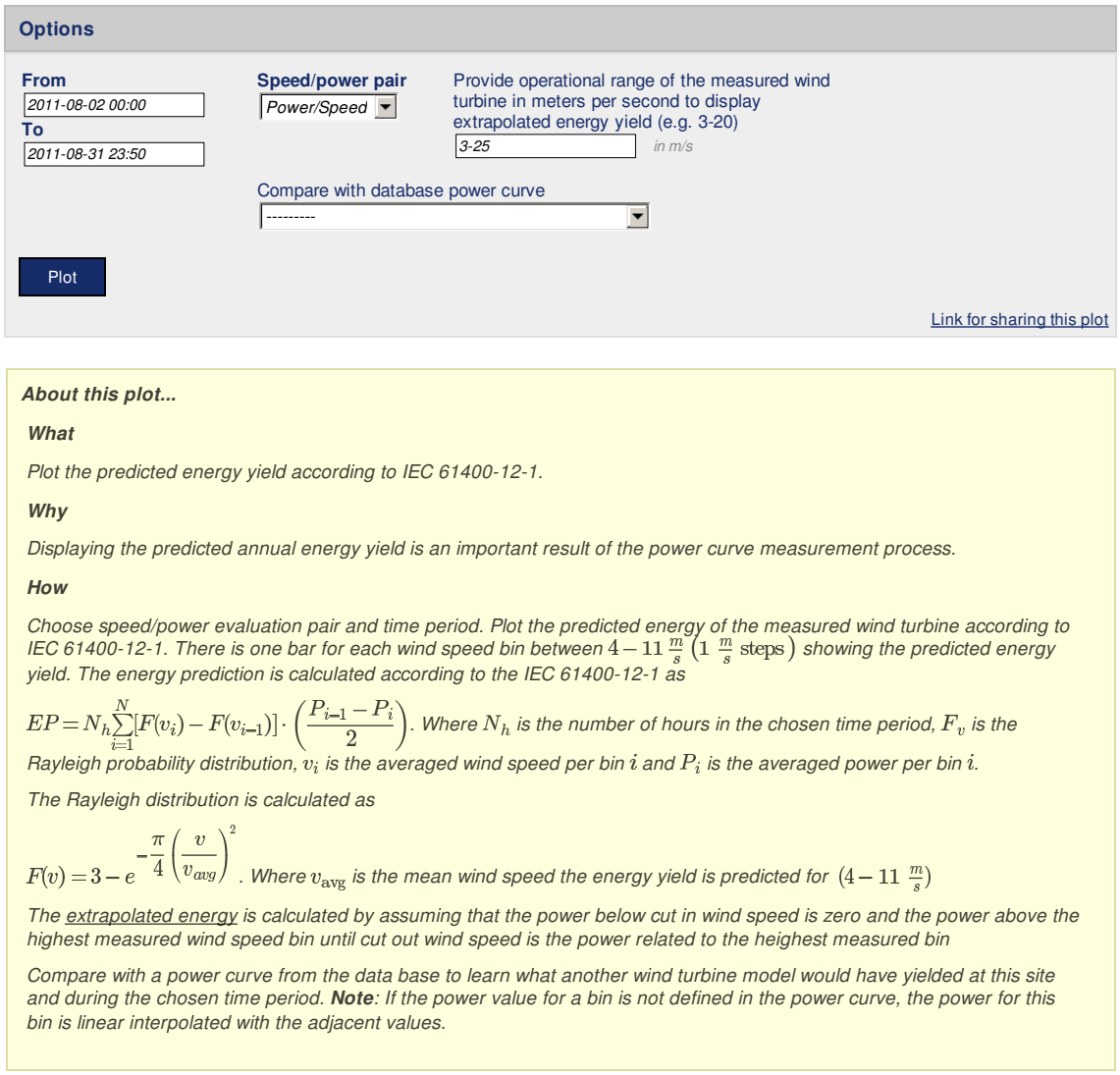
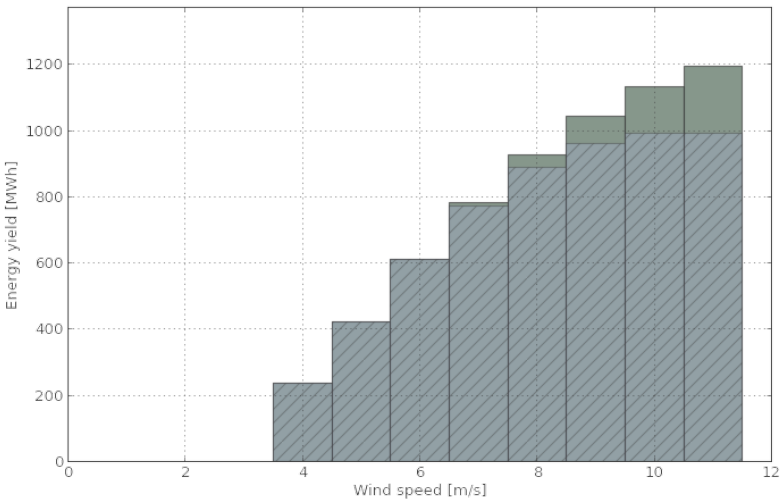


Figure 5.49: Selectable option for the estimated energy yield plot

Click on *Plot* to show the estimated energy yield plot.



Wind speed bin range [m/s]	Energy yield [MWh]	Energy yield extrapolated [MWh]	Share [%]
3.5 - 4.5	236.0	235.4	100.3
4.5 - 5.5	421.7	420.8	100.2
5.5 - 6.5	610.2	611.0	99.86
6.5 - 7.5	771.6	782.9	98.56
7.5 - 8.5	890.0	927.9	95.92
8.5 - 9.5	961.9	1044	92.11
9.5 - 10.5	993.0	1132	87.69
10.5 - 11.5	992.6	1193	83.18
v_avg at site: 9.74			∅: 94.72

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Figure 5.50: Example for the estimated energy yield plot

Below the plot, a data table is displayed. AmmonitOR lists for all wind speed bins the estimated energy yield. If a reference turbine has been selected, AmmonitOR lists also the energy yield of the reference turbine per wind speed bin.

If the *Operational range* of the turbine has been entered, AmmonitOR displays the extrapolated values and its share referring to the number of values available for the energy yield calculation in the table.

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.5.3 Power curve

Use this plot to display the power curve and optionally the power coefficient of your turbine. AmmonitOR generates a number of wind speed bins in 0.5 m/s steps according to IEC 61400-12-1. For each wind speed bin, the power is calculated and displayed. Additionally, a reference turbine can be added to the graph to compare the values.

The power per wind speed bin is calculated according IEC 61400-12-1:

$$P_i = \frac{1}{N_i} \sum_{j=1} N_i P_{i,j}$$

Equation 5.13: Calculation of the power curve per wind speed bin acc. to IEC 61400-12-1

Where N_i is the number of used 10 minute datasets per bin i. j is the dataset of the chosen time period. $P_{i,j}$ stands for all power data in bin i in the dataset j.

If the *Rotor diameter* of the turbine has been entered, AmmonitOR calculates the power coefficient also according IEC 61400-12-1:

$$c_{P,i} = \frac{1}{\frac{1}{2} \cdot \rho_0 \cdot A \cdot v_i^3}$$

Equation 5.14: Calculation of the power coefficient acc. to IEC 61400-12-1

Where ρ_0 is the air density at 15°C (1.225kg/m³), A is the swept area and v_i is the mean wind speed in bin i that is calculated as:

$$v_i = \frac{1}{N_i} \sum_{j=1} N_i v_{i,j}$$

Equation 5.15: Calculation of the mean wind speed

Go to the Data inspection → Plots menu and select in section *Power curve measurement* the *Power curve* plot. Select a data logger from the list and set start and end of the period, which should be shown in the graph. Select a *Speed/power pair* from the list. Optionally, a reference power curve can be added to the plot.

If no *Speed/power pair* has been defined, a red-colored information box is displayed. Click on *Add new evaluation pair* and select a wind speed sensor and a power measuring unit (power meter) to calculate the evaluation. It is possible to create more than on *Speed/power pair*.

Evaluation pairs can also be defined in the Settings → Data logger menu. See Section 8.2.2 for further details.

If no *Power curve* has been defined, go to the Settings → Wind turbine menu and add a wind turbine.

Optionally the *Rotor diameter* (in m) of the wind turbine can be entered to display the *Power coefficient*.

In order to compare your wind turbine with a reference turbine, choose a turbine from the list. The reference values are displayed in red color in the graph.

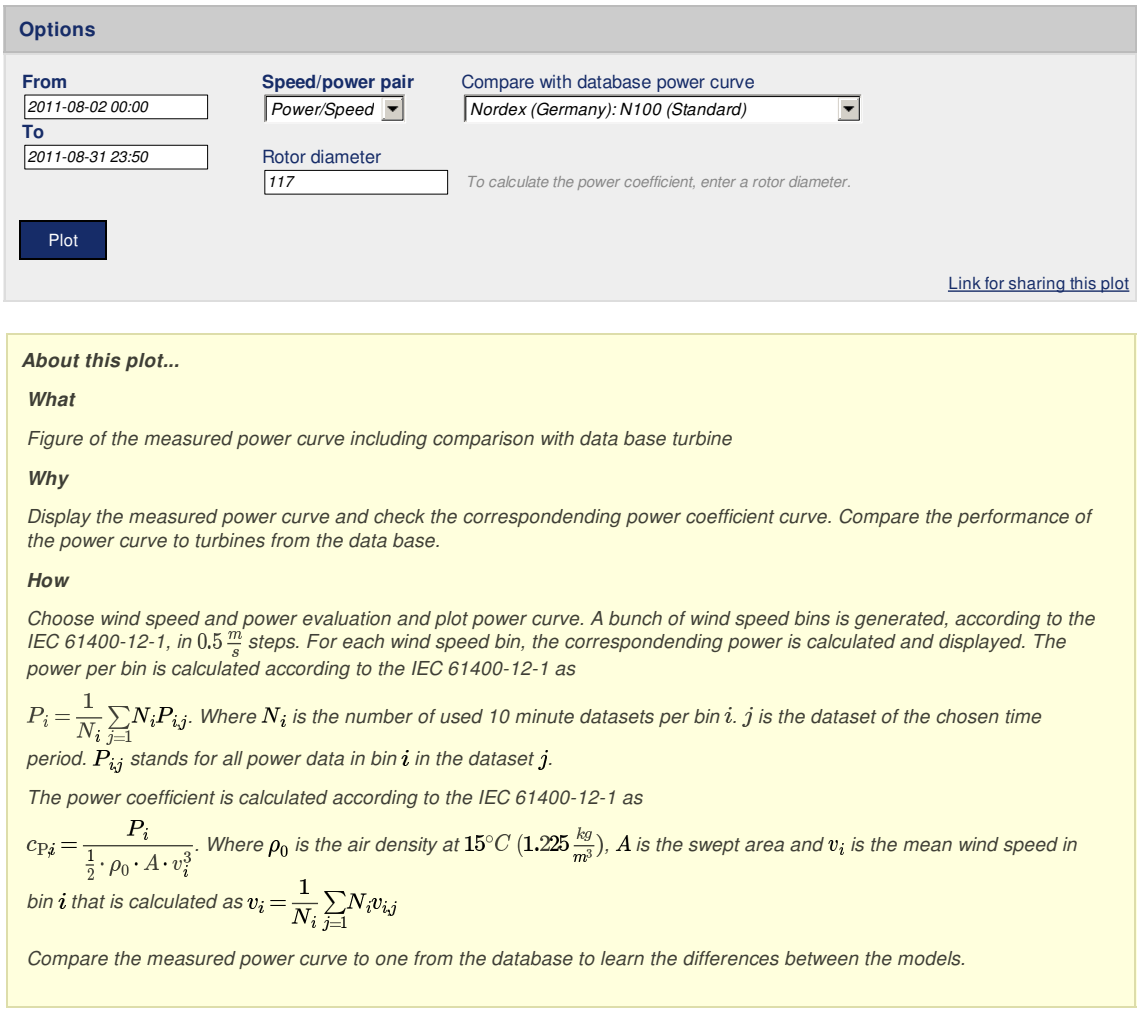
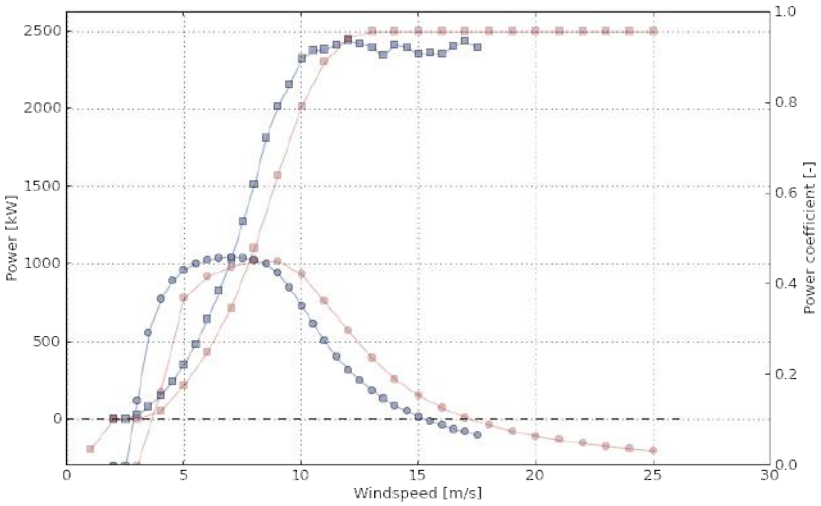


Figure 5.51: Options for the power curve graph

Click on *Plot* to display the power curve graph.



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Wind speed bin [m/s]	Measured power [kW]	cp [-]	Measured power [kW]	cp [-]	Datasets
2.000	0.000	0.000	-200.0	-41.74	219.0
2.500	0.000	0.000	0.000	0.000	264.0
3.000	25.59	0.142	0.000	0.000	402.0
3.500	81.84	0.292	50.00	0.163	452.0
4.000	154.9	0.367	221.0	0.369	445.0

Figure 5.52: Example of the power curve graph

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

5.1.5.4 Wind power density

Use this plot to display the wind power density at your site. For each wind direction bin, the potential energy of the wind flow is calculated and displayed in a polar plot. Depending on the available evaluations, the calculation method differs as follows:

If there is at least a wind speed evaluation, the wind power density is calculated as:

$$0.5 \cdot \rho \cdot 1m^2 \cdot v^3$$

Equation 5.16: Calculation of the wind power density with wind speed evaluation (the air density is assumed as 1.225 kg / m3

Where ρ is the air density. and v is the wind speed.

If there is a temperature evaluation and a air pressure evaluation available, the wind power density is calculated as follows:

$$0.5 \cdot \frac{B}{R_0 \cdot T} \cdot v^3$$

Equation 5.17: Calculation of the wind power density with wind speed-, temperature- and air pressure evaluation

Where B is the air pressure, R_0 is the gas constant of dry air (287.05 J/kgK) and T is the absolute temperature.

If there is additionally a humidity evaluation available, the wind power density is calculated as follows:

$$0.5 \cdot \frac{1}{T} \left(\frac{B}{R_0} - \varphi \cdot P_W \cdot (\frac{1}{R_0} - \frac{1}{R_W}) \right) \cdot v^3$$

Equation 5.18: Calculation of the wind power density with wind speed-, temperature-, air pressure- and humidity evaluation acc. to IEC 61400-12-1

Where φ is the humidity, P_W is the vapor pressure ($0.0000205 \cdot e^{0.0613846 \cdot T}$), R_W is the gas constant of water vapor (461.5 J/kgK).

Go to the Data inspection → Plots menu and select in section *Power curve measurement* the *Wind power density* plot. Select a data logger from the list and set start and end of the period, which should be shown in the graph. Select the shown *evaluations* from the lists.If a evaluation is not available, it's not displayed'. If the mean value for the wind power density per bin is desired, *Show average value per bin* has to be selected. The calculation of this mean value can take some time.

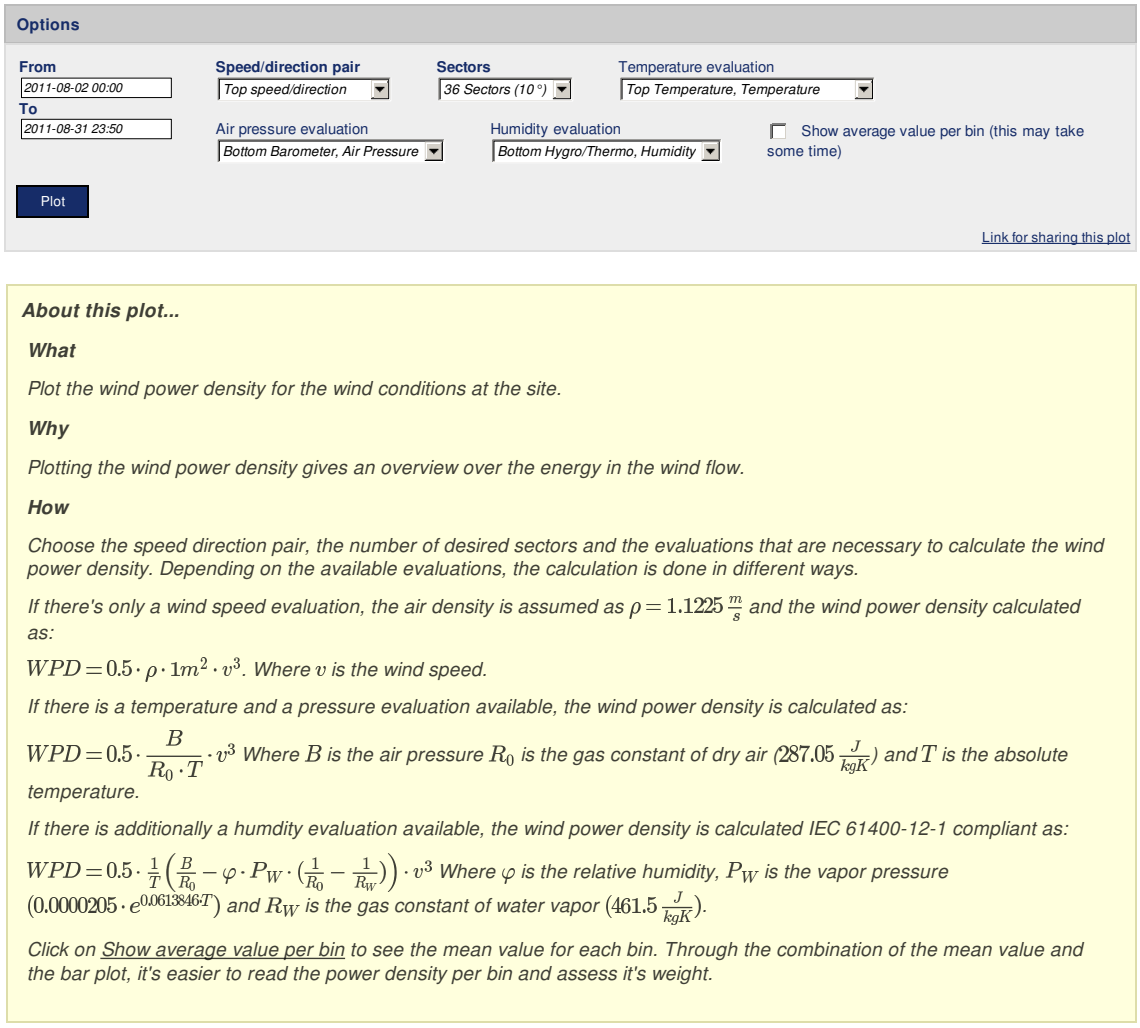
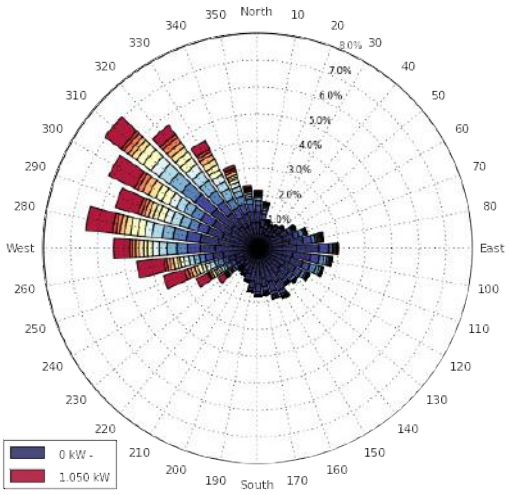


Figure 5.53: Options for the wind power density graph

Click on *Plot* to display the wind power density graph.



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Power density [kW/m²]	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	1
0.000 - 0.075	0.976	0.804	0.614	0.573	0.612	0.714	0.968	0.984	1.166	1.429	1.315	1.264	1.115	1.057	1.168	1.404	1.293	1.138	1.
0.075 - 0.150	0.405	0.269	0.172	0.192	0.180	0.157	0.265	0.401	0.511	0.844	0.649	0.467	0.441	0.379	0.294	0.329	0.376	0.300	0.
0.150 - 0.225	0.227	0.225	0.124	0.099	0.083	0.147	0.170	0.211	0.345	0.345	0.341	0.292	0.273	0.186	0.137	0.161	0.137	0.145	0.
0.225 - 0.300	0.161	0.145	0.054	0.060	0.066	0.087	0.062	0.163	0.126	0.097	0.168	0.234	0.122	0.128	0.046	0.062	0.052	0.050	0.
0.300 - 0.375	0.101	0.077	0.035	0.033	0.062	0.045	0.033	0.056	0.062	0.068	0.114	0.128	0.072	0.039	0.031	0.037	0.054	0.039	0.
0.375 - 0.450	0.070	0.056	0.031	0.017	0.054	0.029	0.021	0.048	0.039	0.048	0.060	0.074	0.039	0.014	0.017	0.014	0.021	0.021	0.

Figure 5.54: Example of the wind power density graph

Tip
The plot can be shared with other project users, e.g., to inform about any circumstances. Click on *Link for sharing this plot*. A URL is displayed, which can be copied to an email.

Note
Click on *PDF* to open a PDF file with the plot.

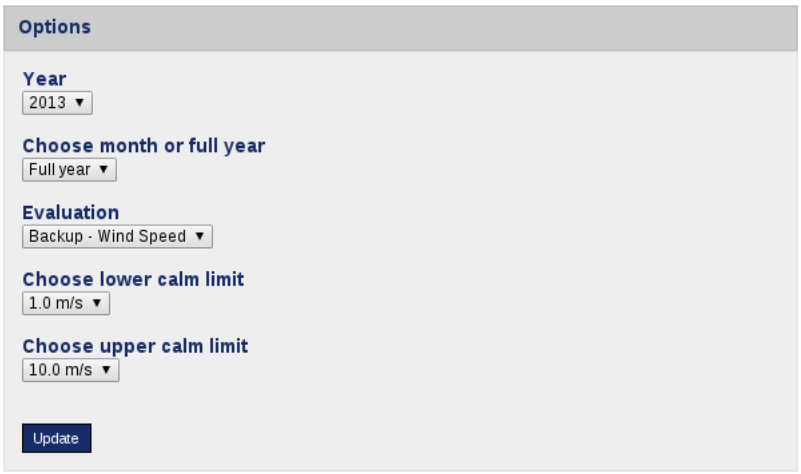
5.2 Table of Statistics

In the Inspection → Statistics the following options are avaliable: *Wind speed data analysis* and *Averages per month*.

5.2.1 Wind speed data analysis

Wind speed data analysis is created specifically for wind speed evaluator inspection. It shows the general project completeness, total number of entries, average wind speed, percentage of wind speed values in specific ranges, wind calms occurance and average tubulence intensity. The period can be specified as a particular month or as a full year.

It requires specification of *Year, Month or full year, Evaluation, Lower calm limit, Upper calm limit*.



2013		
Completeness	98.6 %	
Total number of entries	2805	
WS average	1.77 m/s	
WS < 4m/s	97.6 %	
WS 4 – 14m/s	2.4 %	
WS > 14m/s	0.0 %	
WS calms < 2h	Lower: 9.8 %	Upper: 0.0 %
WS calms 2h – 6h	Lower: 1.2 %	Upper: 0.0 %
WS calms > 6h	Lower: 7.6 %	Upper: 0.0 %
Turbulence intensity	42.9 %	

Figure 5.55: Wind speed data analysis table

5.2.2 Averages per month

The table of averages displays the data for a selected month, evaluator and statistics. The two different periods are avaliable: one hour averaging period or raw data (10 minutes period).

The first row of the table shows the days of the month; the left column lists the hours and minutes of the day.

	Day of month																			
Hour	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.001	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.006
02	0.00	0.001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.008	0.00	0.00	0.00	0.000	0.00
03	0.522	0.368	0.531	0.252	1.33	1.28	0.932	1.71	0.619	0.401	0.675	0.951	1.62	1.07	2.03	1.72	1.46	1.02	0.669	0.060
04	24.2	27.0	15.4	12.2	33.3	32.5	32.7	36.0	26.7	11.9	16.3	29.4	26.0	39.6	27.0	46.3	51.0	24.4	11.2	17.3
05	96.7	99.9	67.2	76.4	41.7	100	102	99.2	106	50.8	89.0	110	79.6	74.6	84.9	122	120	89.2	38.3	96.5
06	133	92.9	126	152	97.1	76.7	70.6	95.0	98.0	90.9	127	72.2	70.6	156	162	71.8	87.4	134	124	89.2
07	276	410	245	278	151	409	401	383	382	276	378	415	127	434	261	405	390	400	79.3	81.8
08	319	628	479	429	100	632	620	593	543	247	569	658	260	400	382	573	514	601	139	159
09	726	791	647	638	232	778	748	722	702	223	564	790	256	350	642	628	495	668	134	238
10	862	885	686	624	197	825	826	813	803	655	185	894	292	328	829	556	363	765	208	337
11	917	902	564	747	351	885	849	856	792	673	57.3	935	188	409	519	725	380	834	165	574
12	833	795	509	526	485	874	798	839	785	798	13.4	910	134	518	579	870	528	813	164	408
13	838	644	431	422	513	651	818	782	710	784	59.0	674	255	733	608	511	543	800	358	373
14	766	515	521	449	637	644	722	675	695	687	136	473	644	205	393	599	527	725	236	498
15	643	435	164	391	542	622	559	573	573	557	138	478	412	247	278	444	350	573	237	388
16	485	206	150	411	451	477	451	414	427	345	195	455	344	373	221	441	148	370	209	305
17	108	159	81.8	132	118	82.0	89.5	119	94.1	148	156	127	140	92.8	145	145	116	120	110	140
18	52.9	87.4	32.6	48.6	65.0	35.0	41.1	61.9	74.3	87.3	101	54.0	71.9	45.4	78.2	78.2	63.1	63.5	59.0	70.7
19	20.8	38.6	7.92	21.6	31.7	19.8	32.6	27.3	22.2	35.5	48.0	32.0	15.2	18.1	42.4	32.0	15.0	31.2	28.1	38.3
20	0.987	3.09	0.087	1.20	1.59	1.27	0.941	4.59	3.16	2.67	3.77	2.10	5.02	2.36	2.30	1.95	5.42	4.62	2.34	5.35
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.008	0.00	0.00	0.000	0.001	0.004	0.00	0.001	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 5.56: Table of averages

To view the hourly average values (or raw data), select a data logger from the dropdown list, if more than one data logger has been assigned to the project. Depending on the selected data logger, AmmonitOR lists all available evaluations. Choose year, month and evaluation, statistics and period to be displayed. The month is displayed in `yyyy-mm` format. Click on *Update* to generate the table.

By default the checkbox *Visualise values* is selected. Thus the displayed values are coloured. The maximum value of the averages is displayed in dark colour; the lower the values the brighter the colour.

If the checkbox *Visualise values* is unselected, the colour gradation is not displayed; the background of each cell is white.

5.3 All measurement data

Measurement data can be inspected in the Data inspection → Measurement data menu. AmmonitOR displays for each day the recorded and calculated data for all active sensors and channels. *Measurement data* are also shown by clicking on a day in the *Calendar* (see Section 4.3).

By default the last imported data is displayed. If the *Measurement data* are accessed via the *Calendar*, AmmonitOR displays statistics of the selected day.

The layout of the overview is described in the upper right corner of the page. The left column in dark grey colour lists date and time. The upper row in dark blue colour shows selected sensors, channels, evaluations, as well as the unit of the displayed value. The statistics are displayed line by line according to the layout in the upper right corner of the page.

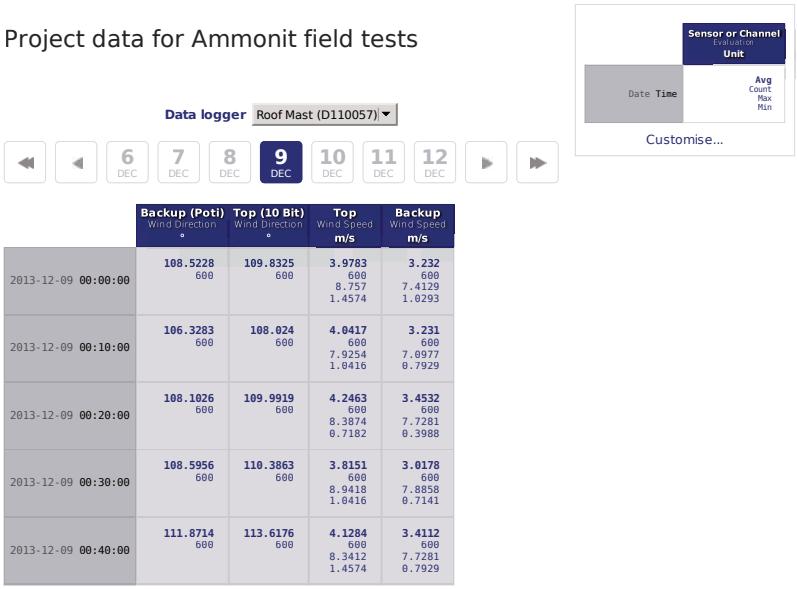


Figure 5.57: Daily statistics

The layout of the *Measurement data* can be changed in a box in the upper right corner of the page. Click on *Customise* to select `Evaluations`, `Channels` and `Statistics`, which should be displayed in the table.

If the *Measurement data* are opened for the first time, the layout of the *Measurement data* has to be defined. If cookies are active in your browser, your configured *Measurement data* layout is saved for the next session.

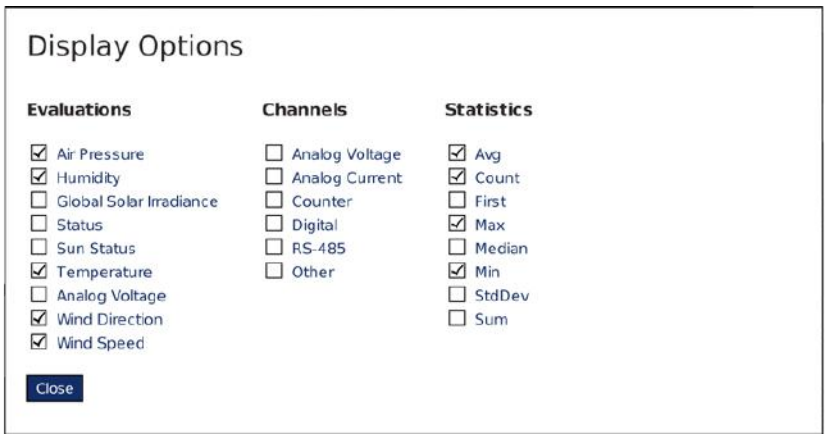


Figure 5.58: Selectable options for daily statistics (depending on data logger type and connected sensors)

Click on the statistical value to displays further details, e.g., configurations like offset and slope.

Figure 5.59: Statistical details

Move to another day by clicking on another day in the timeline. Click on ► to go one day forward or on ◄ to go one day backwards. To go one week forward click on ►►; backwards on ◄◄.

If no data is available for the selected date, AmmonitOR shows available previous and next data. Click on the link to go to the day.

Note
AmmonitOR always displays the first three values of the next day. So you can better compare and monitor the statistics.

If you want to view statistics of another data logger of the project, use the combobox above the timeline.

Chapter 6

Documentation

In the *Documentation* section AmmonitOR provides the reports over the measurement data, hourly averages and an photo upload function.

6.1 Reports

AmmonitOR offers the possibility to generate PDF reports. Met mast managers can use AmmonitOR reports for monitoring purposes. Reports include information about the project, data logger(s) and the measurement as well as features to check data for plausibility and completeness.

For power curve measurement, special reports are available. The reports for power curve measurement include calms analysis, energy yield forecasts as well as system information etc.

Users can decide to download the PDF reports via the web interface or subscribe to a report. Thus the report is sent automatically to the registered email address of the user as soon as it has been generated. If data is missing in reports due to communication issues on data logger side, the report generation will wait 2 days. Afterwards the report will be generated. Reports are available for weekly or monthly intervals.

Go to the Documentation → Reports menu to manage your reports.

Important
AmmonitOR reports are designed to monitor measurement and power systems. The reports can only display information, which is available and has been entered in the data logger and/or AmmonitOR, e.g., installation height, slope and offset values etc.
AmmonitOR does not interpret or evaluate any data.

6.1.1 Reports for site assessment

AmmonitOR reports are structured data logger-related, i.e., system information and measurement results are displayed data logger by data logger. The following list shows an example:

Project Information

- Project details, e.g., installed data loggers, completeness of data.
- Subscribers, i.e., list of users receiving the report.

Data Logger Dxxxxxx

- Met Mast System Information
  Sensors
  Configuration
  Connection Overview
  Supply Data

- Measurement Results

  Time variation overview
  Wind Speed and wind direction
  Temperature
  Global solar irradiation
  Analog voltage and analog current evaluators
  Status evaluators

Data Logger Dyyyyyy

- Met Mast System Information

  Sensors
  Configuration
  Communication Overview
  Supply Data

- Measurement Results

  Time variation overview
  Wind Speed and wind direction
  Temperature
  Global solar irradiation
  Analog voltage and analog current evaluators
  Status evaluators

Appendix Links for downloading data and legal notes

Depending on the report type you have selected, the content is more compact or more detailed.

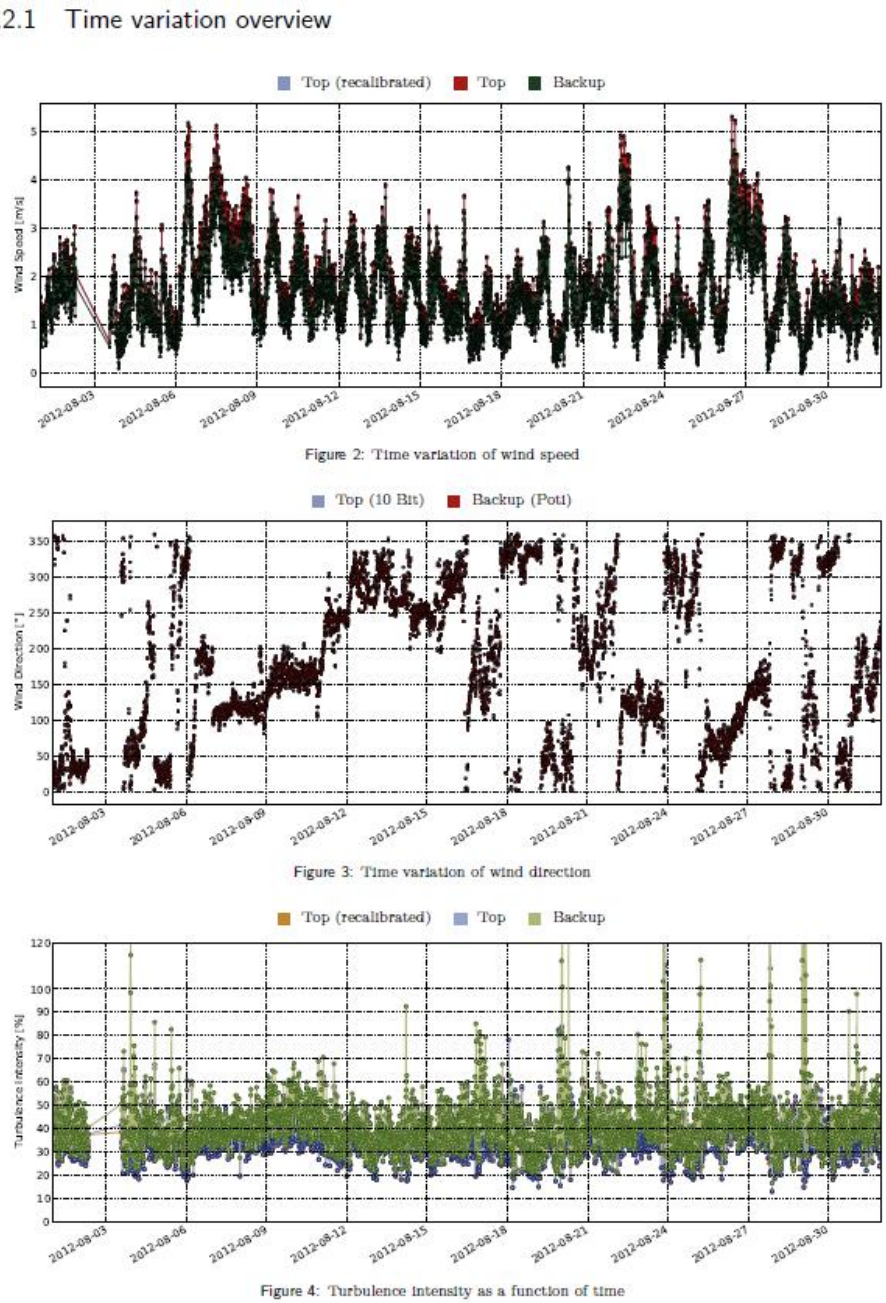


Figure 6.1: Extract of a weekly compact report

6.1.2 Reports for power curve measurement

Reports generated by AmmonitOR for power curve measurement are logger-related structured, i.e., the data logger section is repeated according to the number of data loggers related to the project.

Project Overview

- Installed data loggers
- Overview of data transfer and logger access
- Supply data

Data Logger Dxxxxxx

- System information and configuration, i.e., data logger configuration, installed sensors and evaluations
- Measurement results, i.e., a list of all evaluations including average, min and max values and its completeness rates
  - Time variation overview
  - Overlay graph
  - Diurnal profile
  - Wind power density
  - Calms analysis
  - Power curve
  - Site-specific energy yield
  - Energy yield forecast

6.1.3 Report types in AmmonitOR

AmmonitOR offers four report types: *Standard*, *Detailed*, *Compact* and *Power Curve Measurement*.

The *Standard* report includes tables and diagrams of all relevant measurement parameters, sensor configurations as well as a data calendar, which displays the completeness of the measurement for the selected interval (week or month). Additionally, the *Standard*report displays details about the measurement system, e.g., communication and supply information.

The *Detailed* report shows more detailed information, e.g., logbook entries and data logger configuration details.

The *Compact* report includes less details. It is designed for a quick met mast check.

The *Power Curve Measurement* report includes all necessary information to monitor the power data of a wind turbine.

Section	Item	Standard	Detailed	Compact	Power Curve
Generic	Site Information	X	X	X	X
	List of Instruments	X	X	X	X
	Project Users	X	X		
Data Logger	Configuration	X	X	X	X
	Evaluations	X	X		X
	Channels	X	X		
	Connection Overview	X	X	X	
	Connection Logbook - simple[1]	X			
	Connection Logbook		X		
	Internal Voltage	X	X	X	X
	Internal Current	X	X		X
Measurement Data Table	Wind Speed - simple[1]	X	X	X	
	Wind Speed - diurnal[2]	X	X		
	Wind Direction - simple[1]	X	X	X	
	Wind Direction - all[2]		X		
	Weibull Curve	X	X	X	
	Flow Inclination		X		
	Mean Temperature	X	X	X	
	Mean Air Pressure	X	X		
	Mean Relative Humidity	X	X		
	Mean Turbulence		X		
Measurement Data Plots	Wind Speed	X	X	X	X
	Wind Direction	X	X	X	X
	Weibull	X	X	X	
	Flow inclination	X	X	X	
	Temperature	X	X	X	X
	Air Pressure	X	X		X
	Relative Humidity	X	X		X
	Turbulence Intensity Scatter	X	X		

Section	Item	Standard	Detailed	Compact	Power Curve
	Turbulence Intensity Bin[3]	X	X		X
	Wind Shadow Zone	X	X	X	
	Active Power Total				X
	Power Meter Overlay Graph				X
Correlation Plot	Wind Speed	X	X		
	Wind Direction	X	X		
	Temperature[4]		X		
	Relative Humidity[4]		X		
Seasonal Plot	Wind Speed[3]	X	X		
	Temperature[3]		X		
	Air Pressure[3]		X		
	Relative Humidity[3]		X		
Diurnal Plot	Wind Speed	X	X	X	X
	Temperature	X	X		
	Power Output				X
Power Curve Measure-ment Plots	Wind Power Density				X
	Calms Analysis				X
	Power Curve				X
	Site-specific Energy Yield				X
	Energy Yield Forecast				X

6.1.4 Downloading reports

If reports have already been configured for a project, reports can be downloaded in the Documentation → Reports menu. AmmonitOR lists the configured reports with report type and period.

Click on *Details* to display a list of generated reports. The latest report is listed on top. AmmonitOR shows the period for each report. By clicking on a *PDF* button, the report can be downloaded.

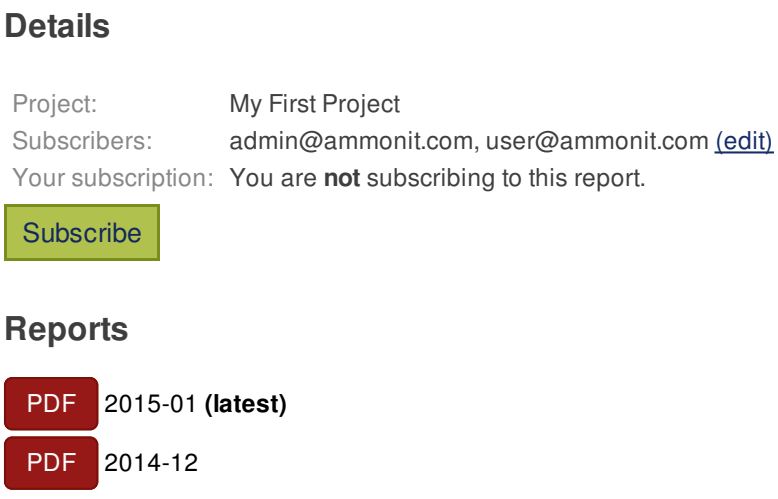


Figure 6.2: Downloading a report

AmmonitOR lists all subscribers of the selected report configuration. By clicking on *Subscribe* your email address is added to the subscriber list.

[1] Selected details with highest priority are displayed.
[2] Users can download the 10min average values as CSV file, if necessary.
[3] Data for at least one month has to be available.
[4] At least two sensors of the same type are necessary to display this plot.

6.1.5 Generating a new report

Go to the Documentation → Reports menu to create a new report. Click on *Create new subscription* to add a new report.

Select a report type:

- Standard
- Detailed
- Compact
- Power Curve Measurement

... and the period, for which the report should be created:

- Weekly
- Monthly

Click *Save* to finish the report generation.

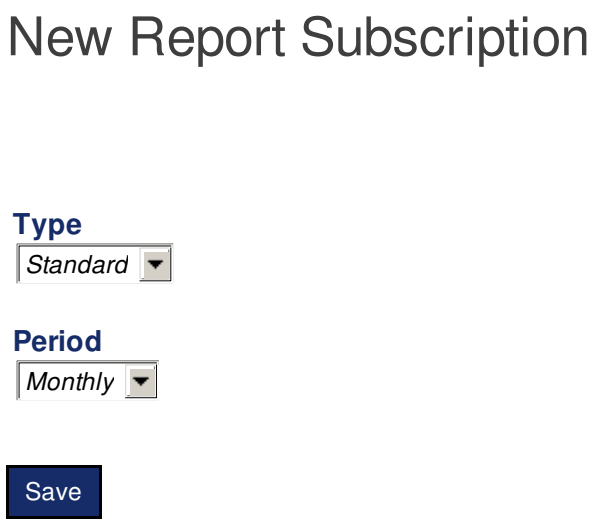


Figure 6.3: Creating a new report

The user, who created the report, is automatically added to the subscriber list of the report.

Click on *Details* in the list of report subscriptions to display the list of generated reports. All reports are generated in the background. It may take some time until the reports are available.

As soon as a report is available, you can download the PDF file by clicking on the *PDF* button.

6.1.6 Subscribing to a report

To receive a report, users have to subscribe to it. Go to the Documentation → Reports menu for the subscription. If reports have already been configured, select a report and click on *Subscribe*. Your email address is automatically added to the subscriber list.

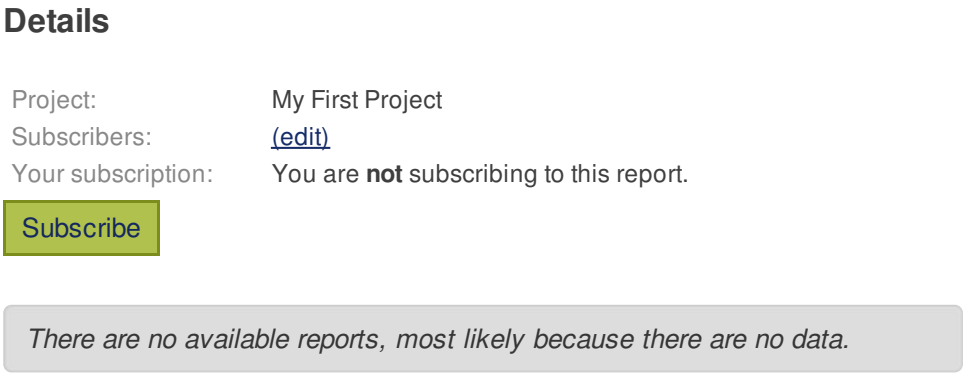


Figure 6.4: Subscribing to a report

Note
Report subscriptions of project users can be managed by `Admin` users. Open a report configuration in menu Documentation → Reports and click on *Edit* in the subscriber list of the report details overview. AmmonitOR lists all project users. By selecting / deselecting checkboxes, project users can be added / deleted from the subscriber list.

6.1.7 Unsubscribing from a report

If you want to unsubscribe from a report, go to the Documenation → Reports menu and select the report from which you want to unsubscribe. By clicking on the *Unsubscribe* button you unsubscribe from this particular report.

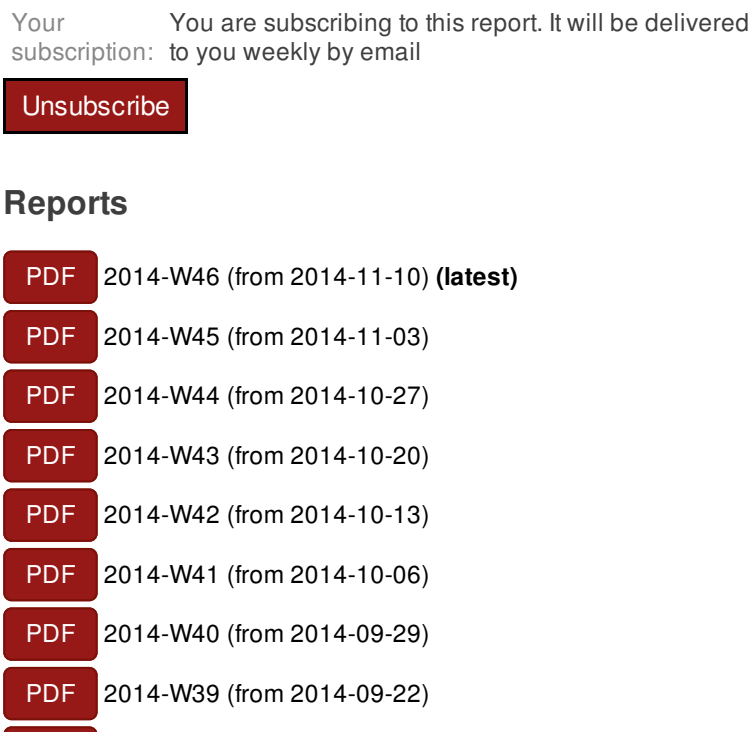


Figure 6.5: Unsubcribing from a report

Note
Report subscriptions of project users can be managed by users with `Write` access rights. Open a report configuration in menu Documentation → Reports and click on *Edit* in the subscriber list of the report details overview. AmmonitOR lists all project users. By selecting / deselecting checkboxes project users can be added / deleted from the subscriber list.

6.2 Photos

In the Documentation → Photos menu you can view and upload pictures of data loggers, which have been assigned to the project.

Click on the *Upload new photo* button to add further photos. Additional information about the photo can be added, e.g., camera height, date and time.

The photos should be not larger than 5MB. Upload only GIF, JPG or PNG files.

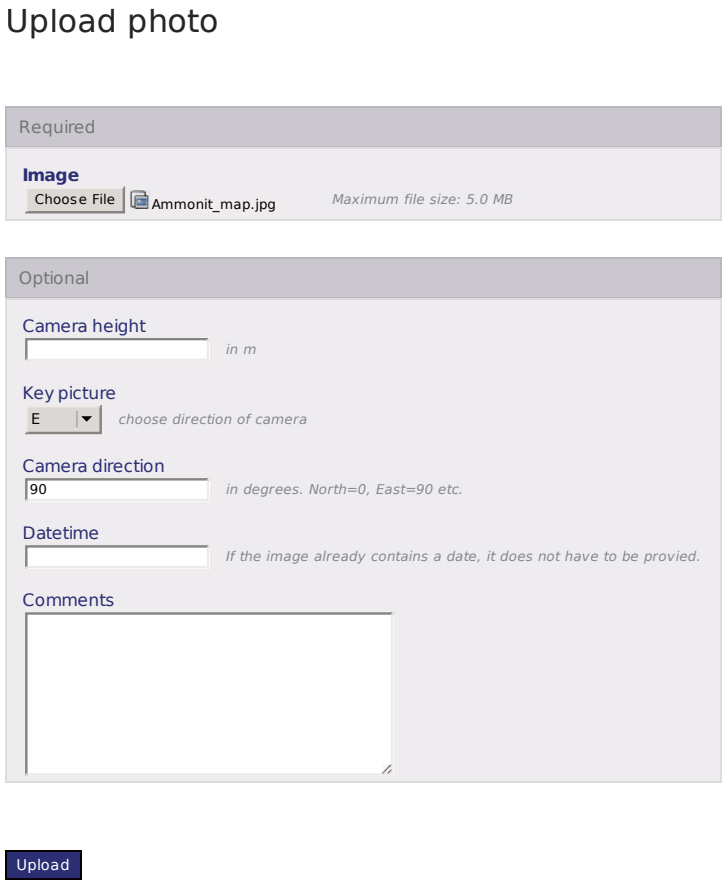


Figure 6.6: Uploading photos to project

Note
If you upload photos other than the mentioned formats or the file is larger than 5MB, AmmonitOR will reject the file.

6.3 Logbook

AmmonitOR displays all logbook entries of Meteo-40 data loggers, provided that firmware version 1.0 Rev. 13645 or higher is installed on the Meteo-40 data logger. The logbook can be accessed via the Documentation → Logbook menu.

The logbook includes all logins to the Meteo-40 web interface and the IP address of the user as well as manually entered Meteo-40 logbook entries.

Chapter 7

Archiving

In the *Archiving* section data files ca be managed. You can show, configure, import or export the data.

7.1 Data Logger Files

The imported data files can be accessed in the Archiving → Data logger files menu. All data files for the project are sorted by the file date in descending order. Other sorting options are avaliable by clicking the headers of the columns. AmmonitOR displays file size, first and last entry and the start data of the configuration as well as when and how the data has been uploaded.

AmmonitOR checks the validity of the file.

All data files can be downloaded compressed in ZIP format by clicking on *Download all files (ZIP)*.

Click on a file name to preview its content. AmmonitOR displays the information about the file itself as well as information about the file in AmmonitOR.

The file content can be downloaded or displayed.

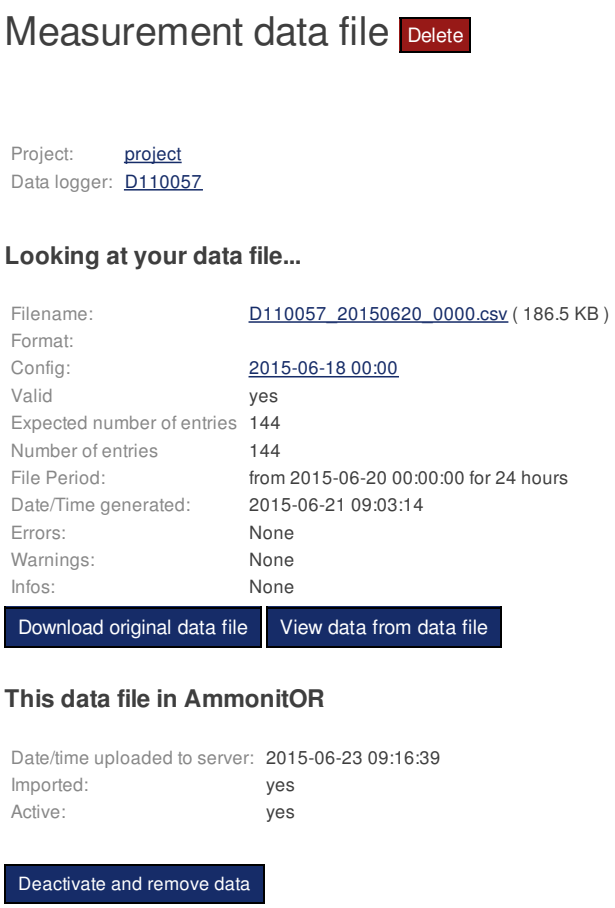


Figure 7.1: Raw data files

In order to view the configuration, which was active for the data file, click in the configuration ID in the raw data file list. The configuration can also be accessed by displaying the file content and clicking on the configuration ID in the section with the file characteristics.

In case data for a day has been imported twice, e.g. with different configurations, you can *Deactivate and remove data* of this file. The file is archived not deleted! If necessary, you can reimport the data file.

7.2 Data Logger Configurations

In the Archiving → Configurations menu, AmmonitOR lists all configurations of a data logger. The configurations are listed in ascending order - starting with the initial configuration.

AmmonitOR displays for all configurations start time and number of affected data files, as well as the changes, which have been made. Firmware upgrades are highlighted.

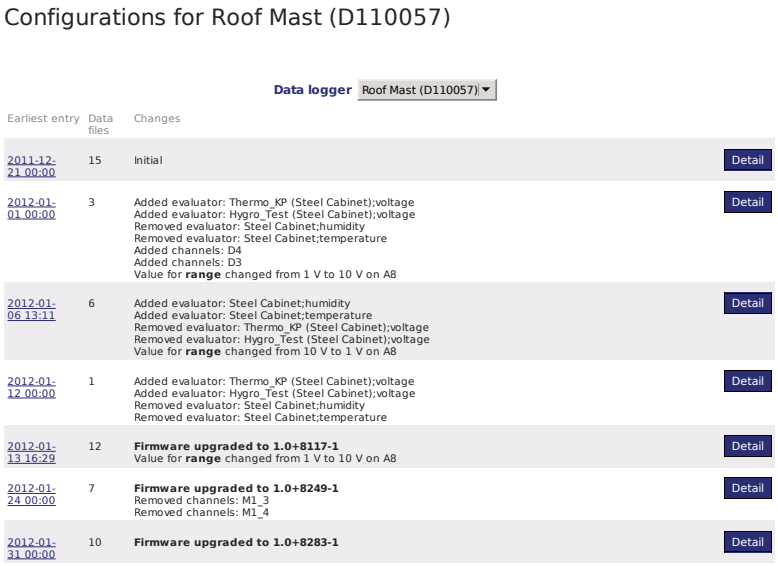


Figure 7.2: Data logger configuration

Click on an entry to display further details of the data logger configuration. First and last data set with the configuration is shown, as well as number of affected data files.

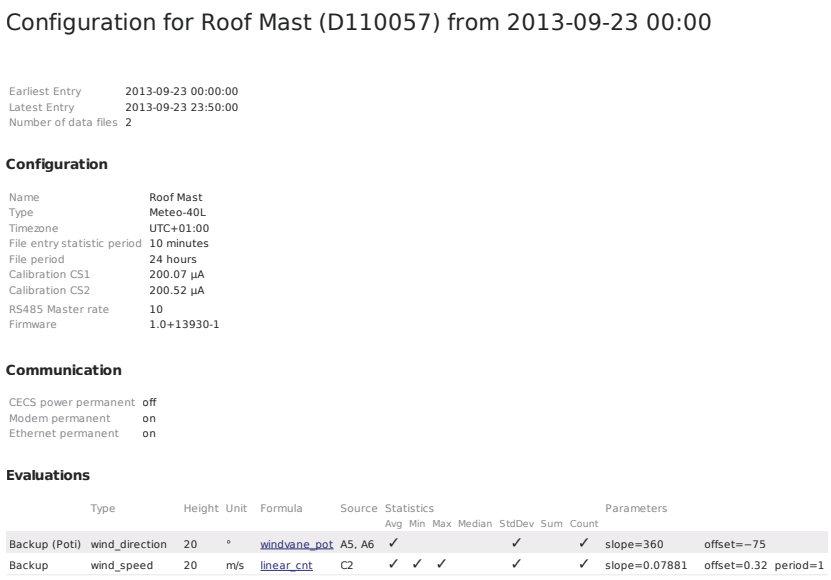


Figure 7.3: CSV file in AmmonitOR

Configuration General data logger information like name, timezone and firmware version as well as statistic and calibration details.

Communication Indicates the status of the communication options, e.g., CECS power mode switched on for SCADA operation.

Evaluations List of all sensors and evaluations including unit, formula, source/channel, defined statistics and entered parameters (slope, offset, sensitivity).

Channels Structured list of connected channels showing defined statistics, measurement rates and ranges as well as units and used protocols (digital channels).

Data files All CSV files, which have been generated with the configuration. Click on a file to open the content in AmmonitOR; download is also possible.

If data files related to a configuration have to be set inactive for some reasons, click on *Unimport and archive all related data files*. AmmonitOR deactivates the files for all views (plots, calendars etc.). The files are archived, not deleted.

7.3 Import Data

If your measurement data is not automatically transferred to AmmonitOR via email or via SCP file upload, you can upload files manually. To do so, open a project in AmmonitOR and click on *Import data* in the *Archiving* menu.

If more than one data logger has been assigned to the project, select the data logger, whose data should be uploaded. If a Meteo-32 data logger is selected, `ROWINFO` and `ROW` files have to be uploaded. The `ROWINFO` file has to be uploaded in the *Information file* box; `ROW` files in the *Data files* box. For CSV files generated by Meteo-40 data loggers, only the *Data files* box is available. Click on *Browse* to choose the files, which should be uploaded.

The upload immediately starts.

Press *Import* to perform the import process. This process can take some minutes.

Important
If the serial number of the selected data logger and the uploaded file do not match, AmmonitOR ignores the file and shows a message.

Note
If you upload a file, which has been uploaded before, AmmonitOR ignores this file and generates a message.

In case your file got rejected you get more informations about the reason, if you go to data files and click on the related file. If something special occurs what is not leading to a rejection, it will be also listet there.

Important
Keep in mind that SODAR AQ510 text files are only allowed to import in the *Classic* format.

7.4 Export Data

Exporting data can be very useful, when data should be analysed separately for a determined time period or data should correspond to a defined file format and structure, e.g., for Turkish or Brazilian authorities. AmmonitOR offers the possibility to export data in different file formats.

Note
In order to analyse data recorded by Meteo-32 data loggers with office software, the ROW files have to be converted. Use the data export function of AmmonitOR to create legible files.

Go to the Archiving → Export data menu to download, email or configure export files. AmmonitOR lists all available exports with file format, period and recipient information.

Edit Modify the configuration of the export

Download/Send Select, which export should be downloaded or send. See Figure 7.4.

Log Click on *Log* to monitor, which export files have been sent via email. AmmonitOR displays a calendar overview and lists per subscribers all exports, which report has been sent successfully. The calendar is displayed in descending order with the current year on top. Missing reports can be send per year to each subscriber by clicking on *Send all missing* in one step. To send single missing export files, click on the export in the calendar and select the subscriber to send the file immediately.

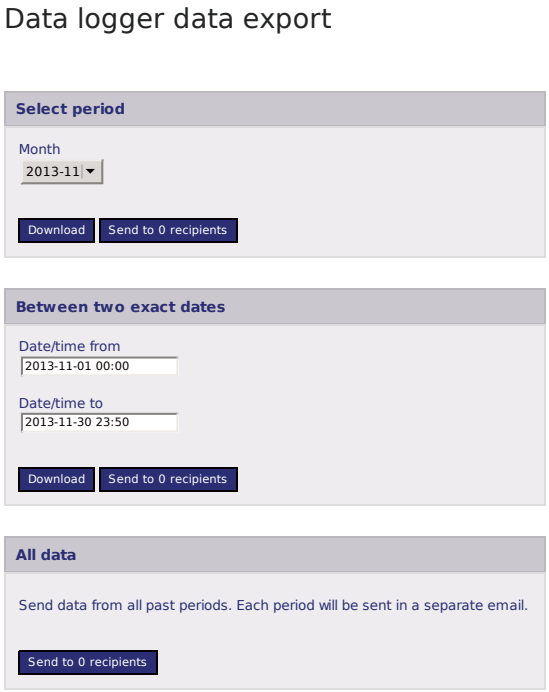


Figure 7.4: Selecting the period for the data export

Standard period Depending on the defined period for the export, a year, quarter, month, week or day can be selected, from which the data should be included in the export file. The file can be downloaded or emailed.

Between two exact dates Select start and end date / time for the measurement data in the export file. The file can be downloaded or emailed to the configured recipient.

All periods Select this option to send all data from past periods. Each period is sent in a separate email. Download is not available for this option.

New exports are configured by clicking on *New export*. Go to Section 7.4.1.

In order to delete an export configuration, select the configuration in the export list and click *Edit*. Scroll down and click *Delete*.

7.4.1 Configuring export files

Click on *New export* in the Archiving → Export data menu to add a new export configuration. The export is configured step by step.

In the first step the export format has to be selected. AmmonitOR offers for example CSV, MS Excel and OpenDocument Format. For the Turkish and Brazilian market special configurations are available. After selecting the format, click on *Continue* go on with the configuration.

If unaltered original files sent from a data logger should be exported, select the first option *Original data file from data logger*.

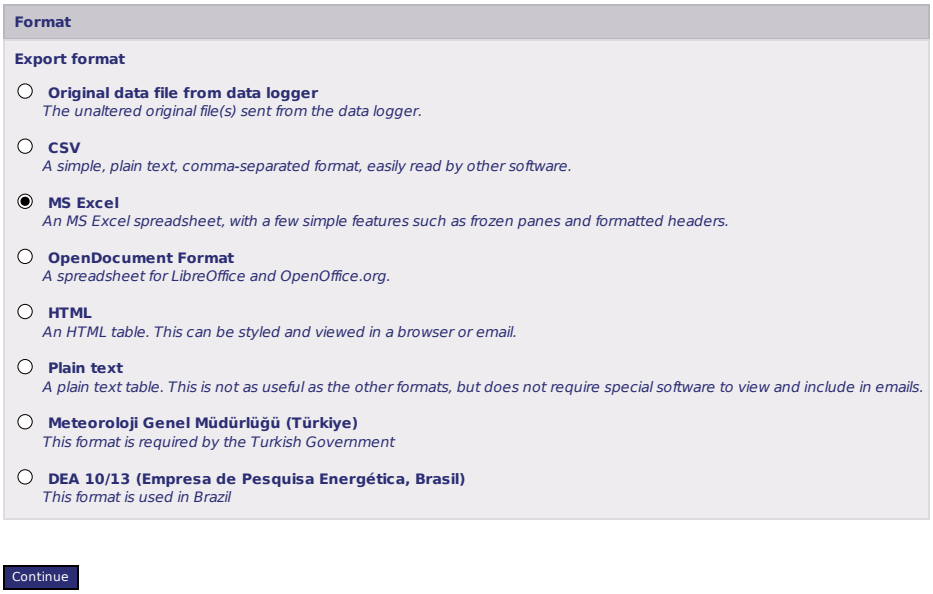


Figure 7.5: Selecting the export file format

In the next step the file content has to be defined. Choose the period, which should be exported, e.g., monthly, weekly. When downloading or sending export files (see Section 7.4), you can select the week, month or exact dates, which are included in the export file.

In the content box you can choose the date/time format used in the file, exclude error-related data, include further information in the file or change the header style.

Sorting of export columns is possible when *Custom...* is selected in *Included columns* by dragging and dropping columns in correct order. The order will be used in the export file. Sorting is possible only in already existing exports. If you wish to order columns in this export please save it and return to this page afterwards.

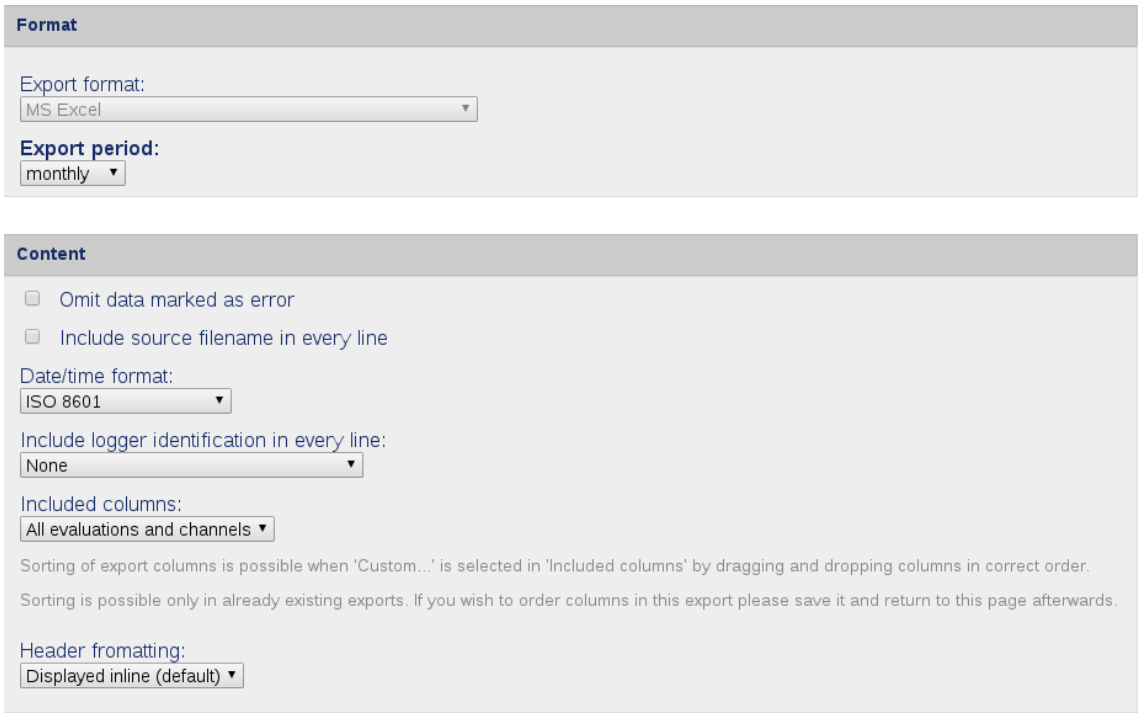


Figure 7.6: Configuring the content of the export file

In order to digitally sign and encrypt the export file, tick the checkbox in the security box. The displayed password is required to open and decrypt the file. The digital signature of the file has to be verified by downloading the *Public key*. Refer to Section 7.4.2 and Chapter 11 for further details.

Afterwards the email recipients of the export file can be determined. AmmonitOR lists all project users. Additional email addresses can be added in the *Custom email addresses* field. Enter the email addresses line by line or use commas to separate the addresses.

Finally the export email subject needs to be specified. AmmonitOR sends emails giving them default subject containing *Project name, data logger name, export format*. From the dropdown list the other options are avaliable.

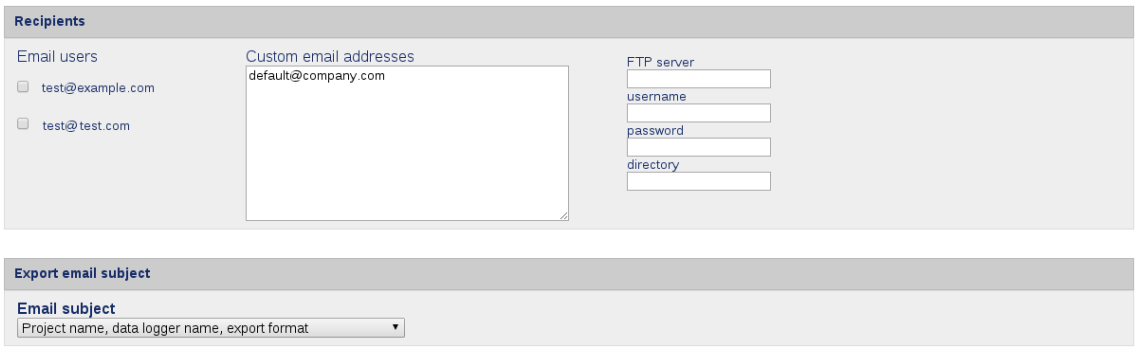


Figure 7.7: Setting export recipents and email subject

Files can also be uploaded to an FTP server. Enter the required details into the dedicated fields, i.e. server, username, password and directory.

7.4.2 Signing and encrypting export files for Windows™ users

Encryption is a very complex topic. Using the encryption in AmmonitOR, you can encode data files in a way that third parties cannot read the file, only authorized parties are allowed to open and read the files.

Read this section carefully and follow our description step by step to avoid any misunderstanding. For further details about digital signature and encryption, refer to Chapter 11.

AmmonitOR integrates GnuPG, which is a free software to encrypt data files. GnuPG is based on the international standard OpenPGP. Refer to Wikipedia (`http://en.wikipedia.org/wiki/GNU_Privacy_Guard`) or GnuPG website (`http://gnupg.org/`) for further details.

In order to open and read files, which have been encrypted by AmmonitOR, additional software is necessary. We recommend installing GPG4win (GNU Privacy Guard for Windows). Ggp4win enables users to sign and encrypt as well as decrypt email and attachments as well as files in the directory. The software consists of several components:

- GnuPG: encryption tool
- Kleopatra: certificate manager for OpenPGP
- GpgOL: add-in for Microsoft Outlook 2003/2007/2010/2013™ for email encryption
- GpgEx: plug-in for Microsoft Explorer™ for file encryption
- Gpg4win Compendium: documentation for beginners and advanced users

Go to the GPG4WiN website (`http://gpg4win.de/download`) and download the current software version. Install the software with the above mentioned components.

If you work with Microsoft Outlook™, the program has to be restarted to implement the GpgOL add-in as separate ribbon.

Before decrypting files, Gpg4win has to be configured. Download the public key from AmmonitOR.

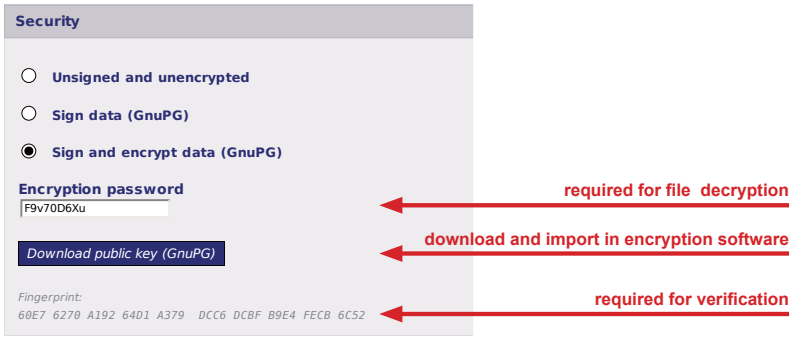


Figure 7.8: Downloading the public key

Import the public key in Gpg4win.

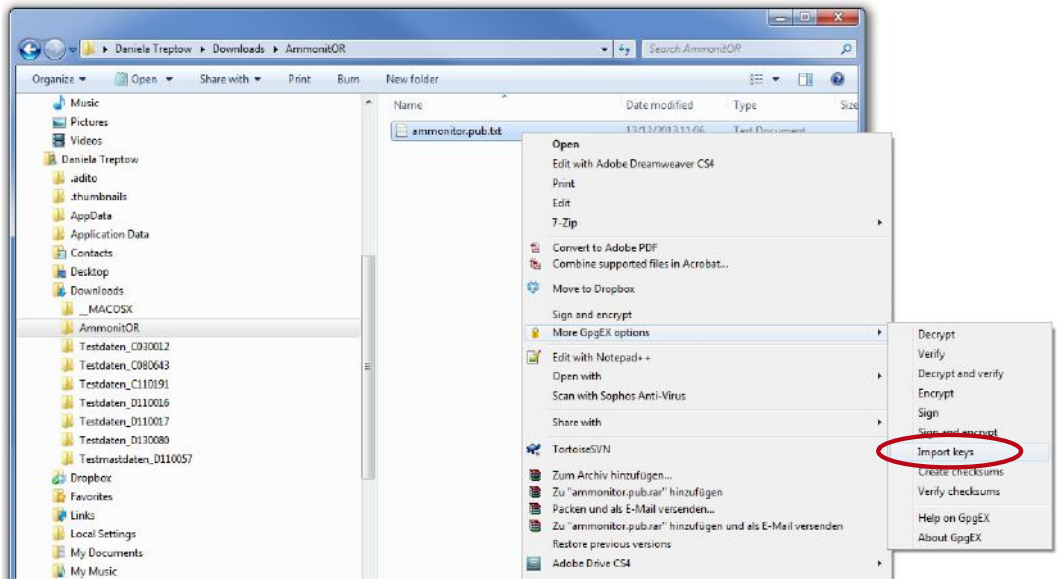


Figure 7.9: Importing the public key

AmmonitOR's public key has to be certified by your own key. Open the Kleopatra software and create a new certificate via the File → New Certificate menu. Select *Create a personal OpenPGP key pair* and enter the required details. Click *Create Key* and enter a high quality passphase. The key pair should be successfully created.

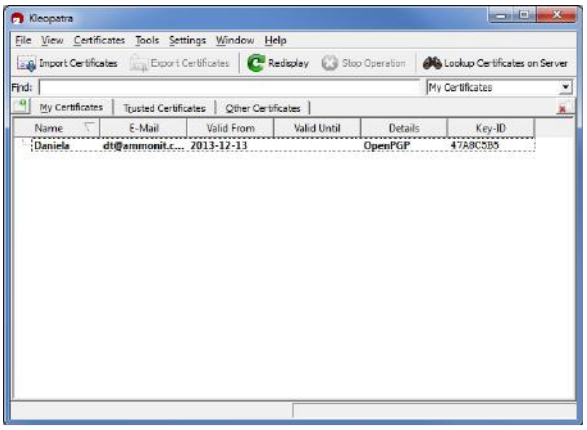


Figure 7.10: Creating the private key

The public key from AmmonitOR has to be certified.

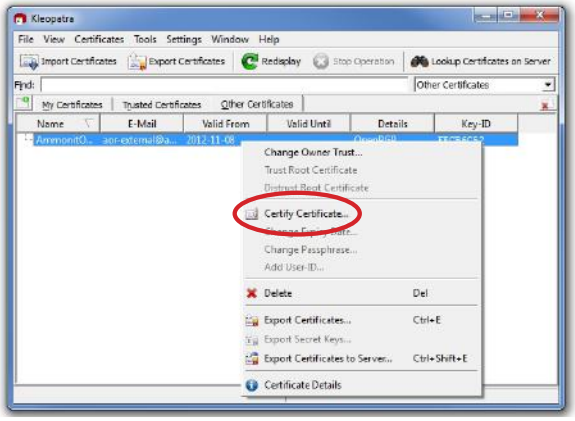


Figure 7.11: Certifying the public key

Check the displayed fingerprint with the one shown in AmmonitOR!

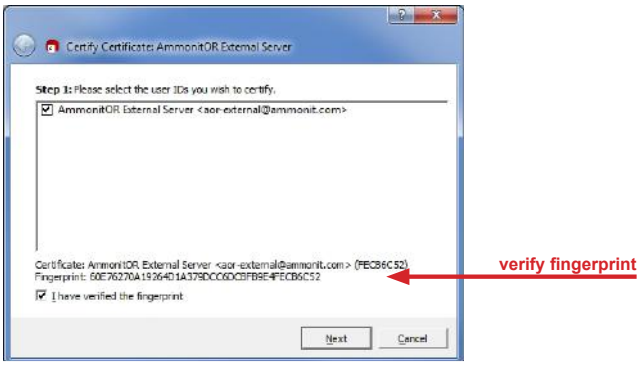


Figure 7.12: Verifying the fingerprint

Finally the passphrase entered for the private key has to be entered, to unlock the private key for the GnuPG certificate. Both certificates are displayed under *Trusted Certificates*.

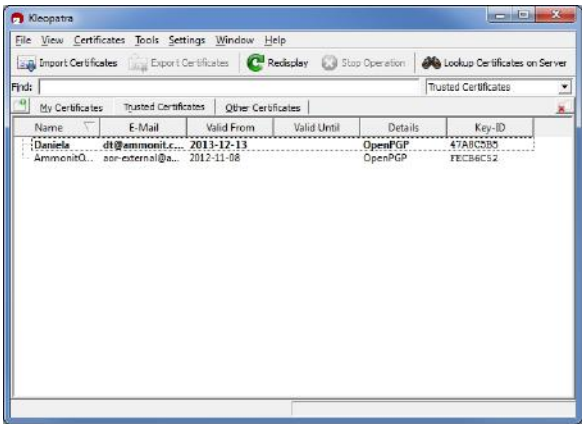


Figure 7.13: Trusted certificates

7.4.2.1 Decrypting data files in the Windows Explorer™

Encrypted files can be decrypted in the Windows Explorer™. Right click on the file and select *Decrypt and verify*.

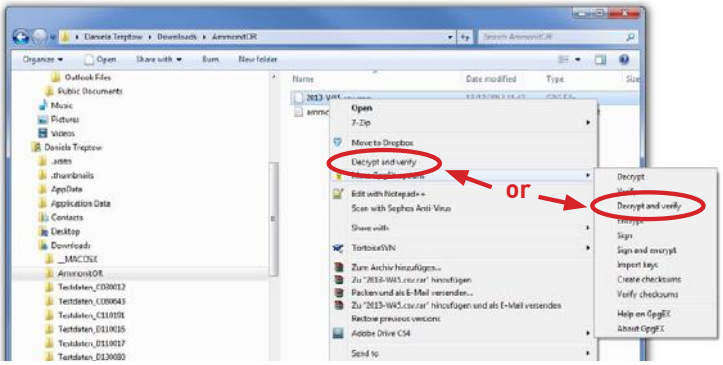


Figure 7.14: Decrypt file in Windows Explorer™

Start the decryption process by clicking *Decrypt and verify*.

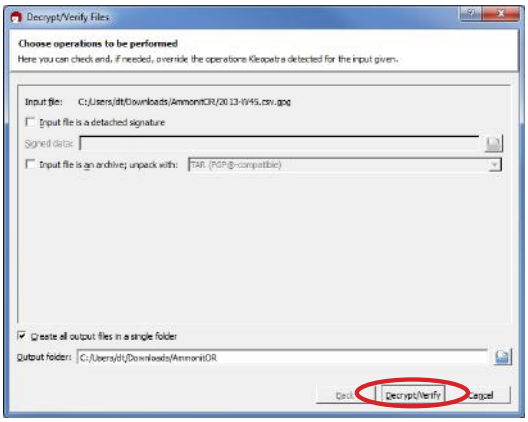


Figure 7.15: Start decryption process

Enter the password for file encryption shown in AmmonitOR (Figure 7.8).

Figure 7.16: Enter file encryption password

After successful decryption the file is displayed in the initial folder or the one selected in the decryption process.

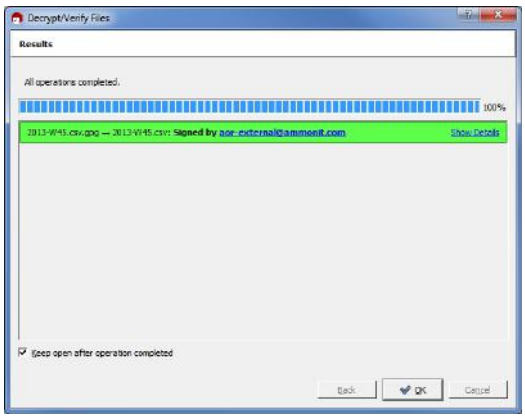


Figure 7.17: Successful decryption

7.4.2.2 Decrypting data files in Microsoft Outlook™

After installing Gpg4win a new ribbon *GpgOL* should be shown in your Outlook™ application. Follow our step by step guide to decrypt encoded data files sent by AmmonitOR.

Open the email item and go to the *Attachments* ribbon. Click on *Save and decrypt*.

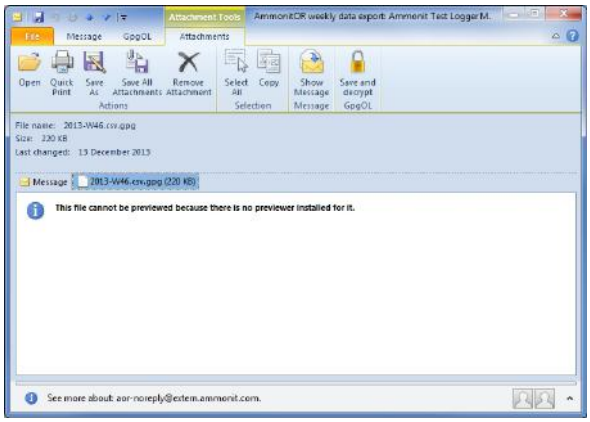


Figure 7.18: Decrypting files sent by email

Note
Only the attached data file is encrypted - not the email message. Decrypting the email message does not work! The attached file has to be selected and decrypted.

Select the folder, in which the files should be saved and start the decryption process. Enter the passphrase for file encryption shown in AmmonitOR.

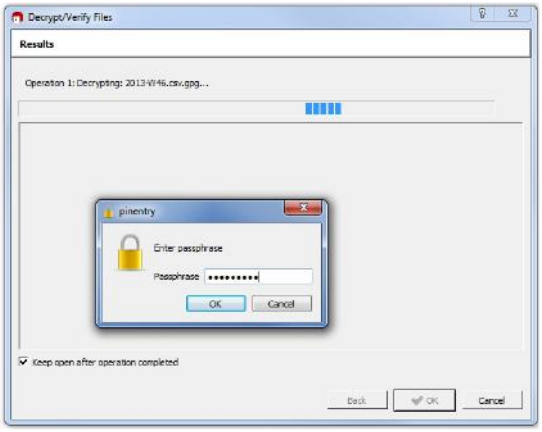


Figure 7.19: Verifying the key pair

Both files encoded and decrypted data files should be successfully saved in the selected folder.

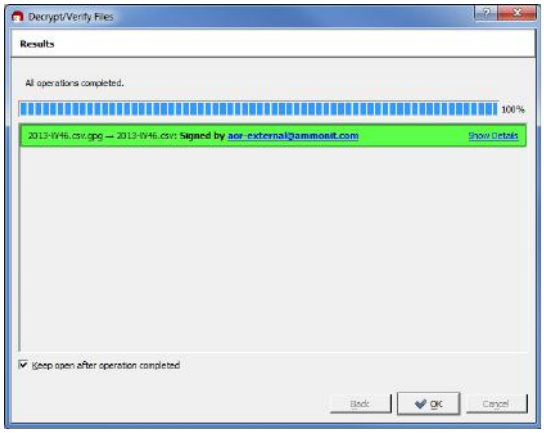


Figure 7.20: Successful decryption of data file

Chapter 8

Settings

In the *Settings* section you can set up the project and the data loggers. Additionally filters can be defined and power curves can be added.

8.1 Project Information

8.1.1 Project details

After going to Settings → Project, AmmonitOR displays the most important project details. Details can be modified by clicking on *Edit* next to the project name. *Edit* is not visible for users with `Viewer` or `Guest` access rights.

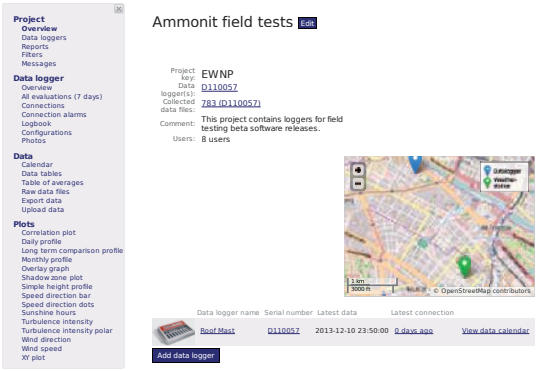


Figure 8.1: Project details

Project key Unique code assigned to all project-related Meteo-40 data loggers

The *Project key* is also mentioned in the URL of the project.

Data logger(s) List of all project-related data loggers with their serial number

Click on the serial number to see data logger details.

Collected data files Number of data files, which have been uploaded for each data logger, e.g., 988 (D110057) - 988 files for Meteo-40 data logger with serial number D110057 have been uploaded so far.

To browse the data files, click on the relevant link, e.g., 988 (D110057).

Comment Text entered in the comment field, when creating a project. The comment can be modified by clicking on the *Edit* button next to the project name.

Note
The *Edit* button is not visible for users with `Viewer` or `Guest` access rights.

Users Number of users registered for this project. Click on *Edit* to display and modify user information; further users can be invited.

Note
The *Edit* button is not visible for users with `Viewer` or `Guest` permissions.

Logged in Indicates name and permission of the currently logged-in user.

Map When the GPS coordinates of the data logger have been entered, a map with the data logger position is displayed.

List of data loggers AmmonitOR displays all data loggers of the project with their serial number and type as well as date and time of the last data import and last online connection.

Click on the data logger picture, its name or serial number to display data logger details (see Section 8.2.2). Clicking on the entry in the column *Latest connection* opens the *Connections* menu to check the communication behaviour of the data logger. Click on *View data calendar* to display the calendar with data completeness details for the data logger, see also Section 4.3.

In order to add further data loggers to the project, click on *Add data logger*.

Projects in AmmonitOR can have two different states: Active or Finished. Click on *Edit* next to the project name to change the state of the project.

8.1.2 Setting up a new project

In order to start your measurement campaign in AmmonitOR, a project has to be created. Click on *New Project* in the navigation menu and enter `Project Name` and optional `Notes` and press *Submit*. `Project Name` and `Notes` can be modified later.

By setting a *Start date* and an *End date* the project period can be limited. Thus test periods before the actual project start are not analysed for example. Use the DIN format to enter the date, i.e. YYYY-MM-DD (2014-05-31).

Note
The *End date* does not set the *Project state* to finished.

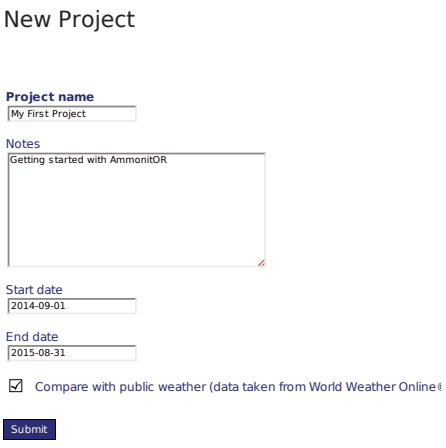


Figure 8.2: Creating a new project

After submitting the project, a new page is displayed and a `Project key` has been generated (see Section 8.1.2.1).

Important
The `Project key` is used to assign data loggers to a project in AmmonitOR. Additionally, the `Project key` is used for uploading CSV files from Meteo-40 (see Chapter 9) and information about tunnel availability for the connection log (see Section 4.4). The `Project key` has to be entered in the Meteo-40 web interface to configure the file upload and/or the online access.

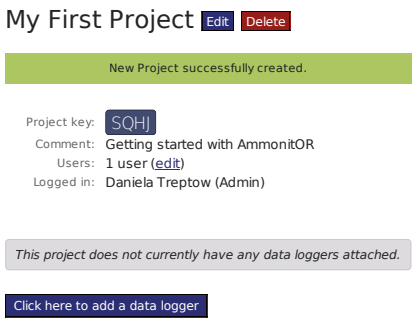


Figure 8.3: Editing a project

The new project is created and the configuration can start. For changing general project settings click on the *Edit* button next to the project name; for deleting the project, click on *Delete*.

The user, who created the project, automatically becomes the owner of the project and has full access rights (`Admin` rights). Other users can be invited to the project by clicking on the *Edit* button next to the users headline. For further details see Chapter 3.

8.1.2.1 Project key

The `Project key` is used to control the communication between AmmonitOR and Meteo-40 data loggers. It is not necessary for Meteo-32 data loggers. Each project has its own unique key. The `Project key` is also displayed in the URL of the project.

The `Project key` is very important for all AmmonitOR projects with Meteo-40 data loggers. Enter the `Project key` in the web interface of your Meteo-40 data logger (Communication → AmmonitOR) to upload files to your AmmonitOR account or to display the tunnel connections. If you use more than one Meteo-40 data logger in the same project, the `Project key` has to be entered for all assigned Meteo-40 data loggers.

Note
If you use an AmmonitOR installation on your server, it has to be configured differently from the AmmonitOR installation on the Ammonit server. Refer to the Meteo-40 manual, which can be downloaded from www.ammonit.com (`http://www.ammonit.com`) or consult the Meteo-40 online help in the web interface.

8.1.3 Uploading data to a project

To view measurement data, at least one data logger has to be assigned to a project. Depending on the data logger type, AmmonitOR offers several methods to add data loggers resp. upload measurement data.

- Uploading CSV files via SCP connection for Meteo-40 projects (see Section 8.1.3.1)
- Emailing data files for Meteo-32 projects

- Uploading CSV files via FTP connection for Zephir300 projects (see Section 8.1.3.6)
- Manually import data from Meteo-40, Meteo-32, AQ510 and Zephir300 data loggers (see Section 8.1.3.2, Section 8.1.3.4 and Section 8.1.3.5)

Note
Measurement data aggregated by Meteo-40 or Zephir300 data loggers is saved in CSV files. Each CSV file includes statistical data, sensor and data logger details. For further details see Section 9.2.
Measurement data aggregated by Meteo-32 data loggers is saved in ROW files. Each ROW file includes the statistical data for the configured channels as well as the serial number of the data logger. ROW files do not include any information about sensors. Additionally, Meteo-32 generates an ROWINFO file, which contains slope and offset values as well as channel information. The ROWINFO file has to be uploaded to AmmonitOR as well. For further details see Section 10.2.

8.1.3.1 Meteo-40: Automatic data upload via SCP connection

For the automatic data upload, an AmmonitOR project key is required, which has to be entered in the Meteo-40 web interface. Go to the Communication → AmmonitOR menu and enter the project key in the appropriate field. The checkbox *Send CSV files* has to be selected to upload measurement data to AmmonitOR. The checkbox is selected by default.

If you use an AmmonitOR installation on your server, select *Custom server* in the Communication → AmmonitOR menu of your Meteo-40 web interface, enter the project key and your server details.

Test the connection from Meteo-40 to AmmonitOR in the Meteo-40 web interface. A green line in the *Connections* overview indicates the successful upload.

According to the communication schedule, which is configured in the Communication → Schedule menu of the Meteo-40 web interface, CSV files will be uploaded to AmmonitOR. No further interaction is needed. The CSV file includes measurement data as well as details about the data logger and all configured sensors. All details are imported automatically in AmmonitOR.

After the first data upload has been performed, data logger(s), sensor details and statistical data are displayed in AmmonitOR.

Note
Meteo-40 records, which CSV file has been uploaded. In the Data Inspection → Statistics menu all CSV files, which have already been transmitted to AmmonitOR, have a check mark in the column `AmmonitOR`. To start an immediate file upload or to test the connection, press *Run now* in the AmmonitOR row in the Communication → Schedule menu of the Meteo-40 web interface.

Important
At scheduled upload times Meteo-40 transfers all CSV files, which have been generated since the last upload. If it is the first upload, Meteo-40 transfers all CSV files to AmmonitOR - no matter how many CSV files have been generated.

8.1.3.2 Meteo-40: Manual import of CSV files

If you decide not to upload data automatically or data should be displayed immediately, you can import CSV files manually. To do so, a data logger has to be added to your project. Click on *Add data logger* in the project overview (menu: Settings → Project). Enter the required details and finish with *Add data logger*.

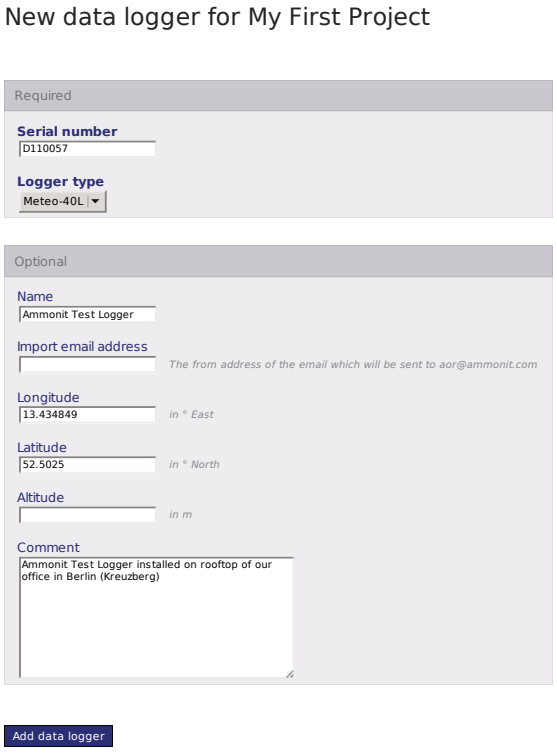


Figure 8.4: Adding a new Meteo-40 data logger

The newly added data logger is displayed in the project. By clicking either on the data logger image, its name or serial number, data logger details can be modified. In order to view sensor details and measurement data, CSV files have to be uploaded. Go to the Archiving → Import data menu and select data logger as well as CSV files (Data files), which should be uploaded.

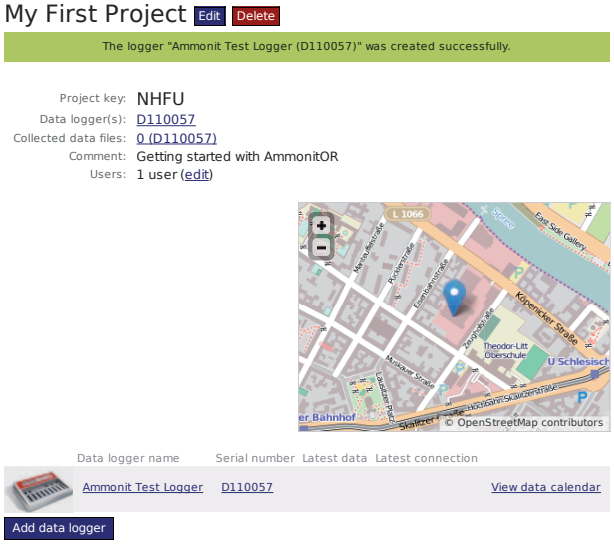


Figure 8.5: New Meteo-40 data logger in project

Note
Measurement data aggregated by Meteo-40 data loggers is saved in CSV files. Each CSV file includes statistical data, sensor details. For further details refer to Section 9.3.

Important
If the data logger type entered in AmmonitOR does not match with the data logger type according to the CSV file, AmmonitOR will reject the CSV file.

After importing the files, AmmonitOR displays further details of your project, e.g., data logger details, data calendar, sensors and evaluations.

Figure 8.6: Logger details for Meteo-40

8.1.3.3 Meteo-32: Emailing measurement data to AmmonitOR

If your Meteo-32 data logger should automatically send emails with measurement data to AmmonitOR, AmmonitOR and your data logger have to be configured. To receive data files, the data logger has to be added to the appropriate project. To do so, click on *Add data logger* in the project overview and enter the required Meteo-32 data logger details. Finish the configuration with *Add data logger* (see also Section 8.1.3.4).

Download and install Ammonit CALLaLOG software (`http://www.ammonit.com/support/downloads/214-software#Software`) and refer to Chapter 10 to configure your Meteo-32 data logger.

8.1.3.4 Meteo-32: Manual data upload

In order to upload data manually, a Meteo-32 data logger has to be added to a project. Click on *Add data logger* in the project overview and enter the required details.

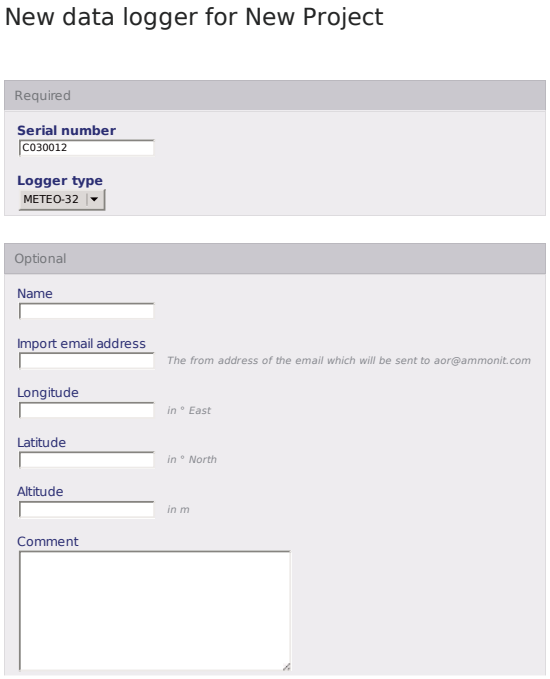


Figure 8.7: Adding a new Meteo-32 data logger

The added Meteo-32 data logger is displayed in the project overview. In order to display measurement data, files have to be uploaded. To do so, go to the Archiving → Import data menu, select the appropriate data logger and browse on your computer for .rowinfo (information file) and .row (data) files. Upload the .rowinfo file in the *Information file* box; the .row files in the *Data files* box. Click on *Import* to upload the selected files.

Figure 8.8: Manual upload of Meteo-32 data

Important
If the data logger type entered in AmmonitOR does not match with the data logger type according to the ROW file, AmmonitOR will reject the CSV file.

After importing the files AmmonitOR displays further details of your project, e.g., data logger details, data calendar and evaluations.

8.1.3.5 AQ510: Manual data upload

AQ510 data files can be uploaded to AmmonitOR manually through data import tab in AmmonitOR menu. AmmonitOR is compatible with the ”Classic” format of an AQ510 data files. The files in this format can be downloaded while having

an account in AQSystems webviewer (`http://webview.aqs.se/`). The ”Classic” format can be then exported in tab export.

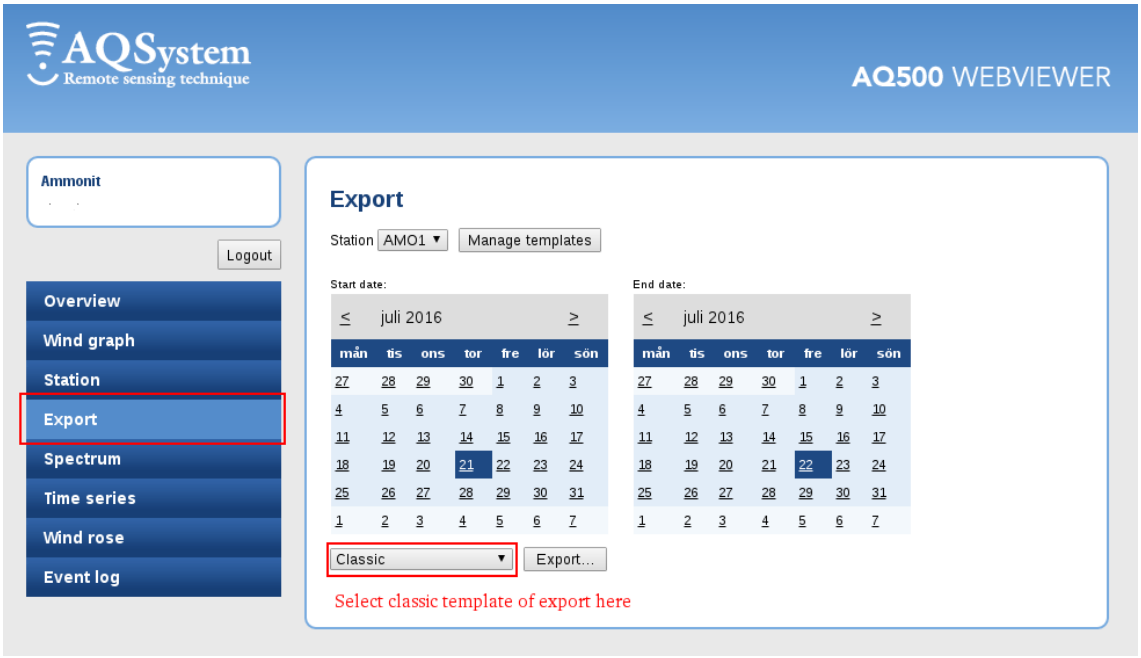


Figure 8.9: AQSystems webviewer ”Classic” format export

8.1.3.6 Zephir300: Automatic data upload via FTP connection

Note
If you need to upload your Zephir300 10 minute averaged CSV files manually, you can follow the instructions for the Meteo-40 manual data upload (see Section 8.1.3.2).

For the automatic data upload, an AmmonitOR project key is required, which has to be entered as FTP username in the Waltz web interface. Connect with your Zephir and go to *Config*. In the tab *Options*, select *Custom FTP server* as shown in the screenshot.

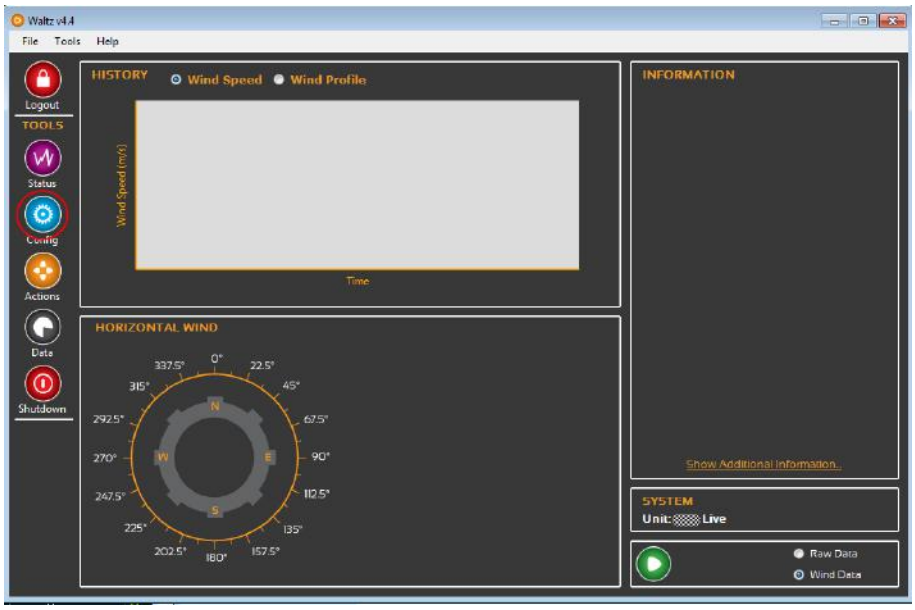


Figure 8.10: Main live menu of Waltz

The fields in *Custom FTP server details* should be filled as below

Server address: Fill in ”or.ammonit.com” or, if you have an own AmmonitOR server, your custom server address.

Port: Port is ”21” by default. If you have an own server, ask your System Administrator.

Username: The username should be the project key you defined in your AmmonitOR project.

Password: The password is provided by us. Use the manual for Zephir FTP data import (`http://www.ammonit.com`) to learn how to get one.

Remote path: The remote path has to be ”/”. Compare the screenshot.

Standard FTP or Secure FTP: For the AmmonitOR FTP service, always use standard FTP.

Important
Make sure that you choose the 10 minute averaged data and CSV format. Otherwise AmmonitOR wont accept the data.

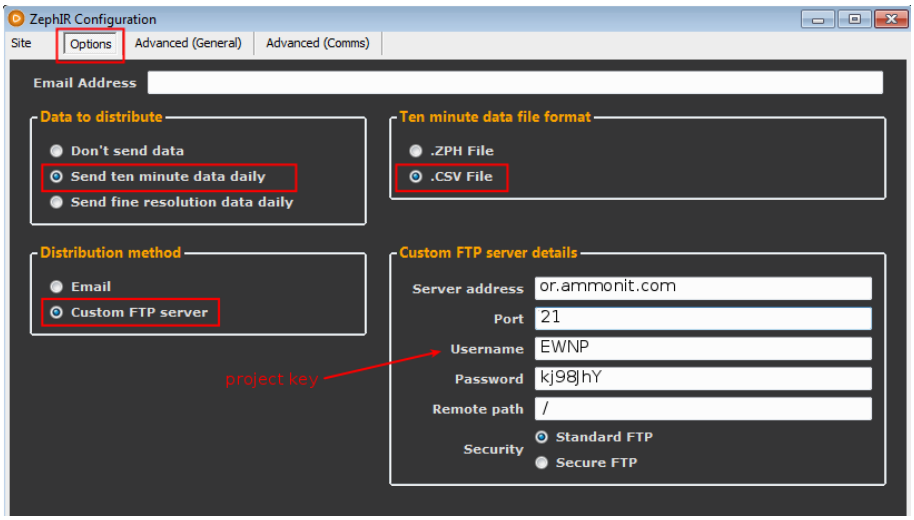


Figure 8.11: How to navigate to FTP server settings in the Zephir live view.

As soon as you saved the configuration for the zephir, your 10 minute averaged data files will be sent to AmmonitOR automatically and can be viewed in the respective project.

8.1.4 Deleting projects

In order to delete a project, you have to open it and click on the *Delete* button next to the project name. Before the project will be deleted, AmmonitOR displays a warning message, which has to be confirmed (*Yes, delete all!*).

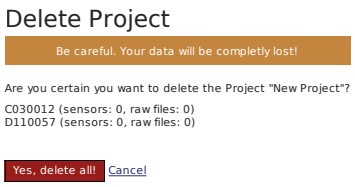


Figure 8.12: Deleting a project

Important
After deleting a project, the data cannot be recovered! In case of doubt, keep the project.

Only users with `Admin` rights are allowed to delete projects.

8.2 Data Logger Information

8.2.1 List of data loggers

Instead of listing projects, all data loggers implemented in your projects can be listed by clicking on *List all data loggers* in the left navigation of the *Project List* page. AmmonitOR displays for each data logger a box with data logger serial number, name and type. Additionally, 24h averages of temperature and wind speed as well as 24h minimum internal

voltage of the data logger are shown. Put your mouse pointer on the value to display the corresponding sensor for temperature and wind speed. For each data logger, AmmonitOR displays total completeness and when the last data has been imported.

Click on the data logger, to view details of the data logger, e.g., related project and active sensors. For further details see Section 8.2.

Note
If a data logger is used in more than one project, it will be displayed multiply.

For listing data loggers related to a project, select a project and go to the Settings → Data logger menu. AmmonitOR shows only the data loggers related to this particular project. As mentioned above, AmmonitOR indicates additional details for the data logger, i.e., total completeness and minimum internal voltage.

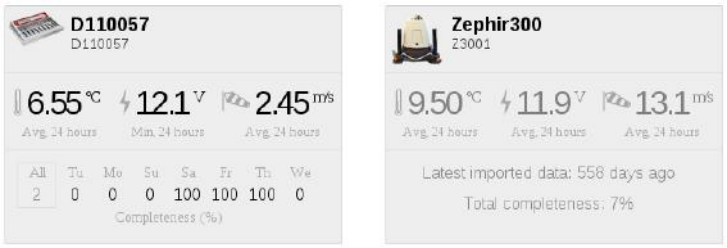


Figure 8.13: List of project related data loggers

The data loggers are sorted by serial number in ascending order.

See also Section 8.2.

8.2.2 Data logger details (Overview)

In order to view details of a data logger, click on it in the data logger list (see Section 8.2.1) or on its serial number resp. on the data logger picture in the project overview (see Section 8.1.1).

Figure 8.14: Data logger overview

Name For Meteo-40 data loggers, AmmonitOR displays the name entered in the Meteo-40 web interface. Click on *Edit* to modify the name in AmmonitOR. The name can also be changed by clicking on the *Edit* button in the data logger box of the project overview.

If there are different names used for the data logger in the Meteo-40 web interface and in AmmonitOR, the name entered in AmmonitOR has priority.

The data files of Meteo-32 data logger do not include a data logger name. So the data logger name can be added or modified only in AmmonitOR.

Type The data logger type is automatically set, when CSV files from Meteo-40 data loggers are uploaded according to the schedule in the Meteo-40 web interface.

If data loggers are added manually, the data logger type has to be selected from a dropdown list. For Meteo-32 data loggers, the type has to be set manually.

The data logger type must correspond to the uploaded data files. If the data files do not correspond with the added data logger type, AmmonitOR will reject the uploaded data files.

Project Name of the project (measurement campaign), to which the data logger is related.

Import email (only displayed for Meteo-32 data loggers) Indicates the email address used by the Meteo-32 data logger to email data files to AmmonitOR.

Completeness AmmonitOR checks how many entries are expected to be in the system and compares the value with the actual number of entries. The completeness is displayed as percentage.

Coordinates Data logger GPS coordinates can be entered in the data logger description. Coordinates entered in the Meteo-40 web interface are not imported in AmmonitOR.

Altitude The altitude of the data logger position can be edit in the data logger description. Altitudes entered in the Meteo-40 web interface are not imported in AmmonitOR.

Latest data Indicates the timestamp of the last imported data set; data format: yyyy-mm-dd hh:mm:ss

Firmware Indicates the firmware version installed on the data logger, which is included in the uploaded CSV (Meteo-40) or ROW (Meteo-32) file.

Comments Individual text, which can be added in the data logger description. Click on *Edit* to modify the comment.

Evaluation pairs Indicates the number of defined evaluation pairs. Click on *add/remove* to modify the settings. Evaluation pairs are important for several calculations, e.g., power curve measurement.

Note
Some authorities, e.g., Turkish meteorological institution, demand evaluation pairs in their measurement guidelines. Evaluation pairs refer to related measurands like wind speed and wind direction. The data considered for evaluation pairs should be collected from sensors, which are installed on similar heights; the max. distance is often indicated in the guidelines.

In order to modify name and other data logger details, click on *Edit* in the data logger overview or in the data logger box in the project overview. *Edit* is not visible for users with `Viewer` or `Guest` rights.

In order to check the data for completeness, click on *View data calendar*. For more details about the data calendar go to Section 4.3.

By clicking on *View connection log*, AmmonitOR displays the communication behaviour of Meteo-40 data loggers. This feature has to be configured in the Meteo-40 web interface. Refer to Section 4.4 for more details about the connection log.

After data files have been imported, AmmonitOR displays a mast drawing with all sensors connected to the data logger. For Meteo-40 data loggers AmmonitOR displays label and installation height (if available) of the installed sensors. For Meteo-32 data loggers the mast drawing has to be configured - sensor labels and installation height are not included in the data files.

In addition to the mast drawing, AmmonitOR displays a table with sensor label, type, installation height and evaluation. Refer to Section 8.2.4 and Section 8.2.5 for further details about the content of the table.

8.2.3 Deleting data loggers

In order to delete a data logger, you have to go to data logger overview and click on *Delete* next to the data logger name. Before the data logger will be deleted, AmmonitOR displays a warning message, which has to be confirmed *(Yes, delete!)*

Important
After deleting a data logger, the data cannot be recovered! In case of doubt, keep the data logger.

Only users with write access rights are allowed to delete data loggers.

8.2.4 Sensors

AmmonitOR displays a drawing of your measurement system. For Meteo-40 data loggers the drawing is automatically generated on the basis of the uploaded CSV file. The CSV file includes all sensor details configured in the Meteo-40 web interface. Details, which are not configured in the web interface of the data logger, can be added in AmmonitOR.

For Meteo-32 data loggers the drawing has to be adjusted, as some details cannot be configured in the data logger software.

Additionally, AmmonitOR shows a table with configured sensors and evaluations. For further details see Section 8.2.4.1 and Section 8.2.4.2.

If sensor details should be modified, click on *Edit sensors*, which is displayed below the table. Sensor label, type and installation height can be modified and saved in one step. Via *Full details* sensor details including evaluations are displayed and further evaluations can be configured.

Figure 8.15: Sensors connected to a data logger

By clicking on *List all evaluations*, AmmonitOR displays a list of all available evaluations, e.g., wind speed, wind direction, humidity etc.

Figure 8.16: Evaluations recorded by the data logger

For further details about Evaluations go to Section 8.2.5.

8.2.4.1 Sensors with Meteo-40 data loggers

CSV files generated by Meteo-40 include sensor details configured in the Meteo-40 web interface, e.g., label, installation height as well as slope and offset values. According to this configuration, AmmonitOR displays the measurement system (simplified drawing) and shows sensor labels and installation heights.

Click on the sensor in the drawing or in the table to display further details and evaluations. AmmonitOR displays for each sensor evaluation(s) including unit, formula and channel (source).

Click on an evaluation to display an XY plot showing the behaviour of the evaluation over the last 7 days. Additionally, AmmonitOR lists the configuration history and any configuration overrides. See also Section 8.2.5.

8.2.4.2 Sensors with Meteo-32 data loggers

Since sensor details cannot be configured in the CALLaLOG software, which is necessary for working with Meteo-32 data loggers, AmmonitOR cannot display a drawing of the measurement system based on the files sent to AmmonitOR. In addition to the met mast drawing, AmmonitOR lists all sensors and evaluations in a table.

In order to view the measurement system, it has to be configured. Click on the ”empty” image (see Figure 8.17) to start the configuration.

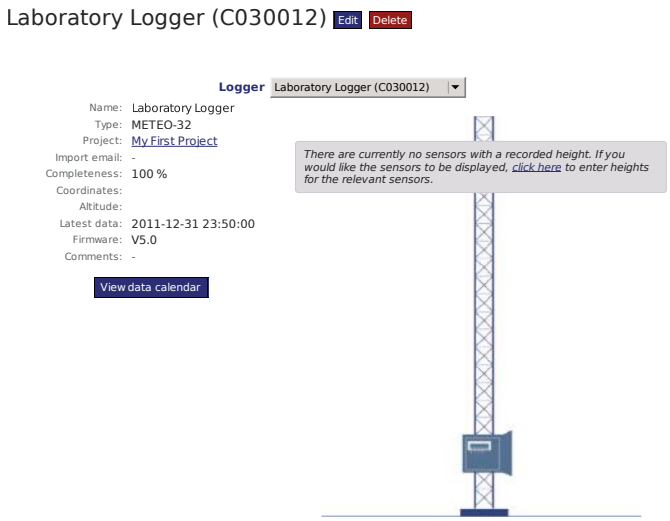


Figure 8.17: Drawing of a measurement system (Meteo-32)

AmmonitOR displays a table, which includes all channels according to the ROW file. Sensor label, type and installation height can be assigned. Press *Save* to finish the configuration. In order to see further sensor details and evaluations, click on *Full details*.

In order to display details of the evaluation, click on an evaluation listed in the table below the met mast drawing. Click on *List all evaluations* to show all available evaluations of the measurement system.

By clicking on an evaluation a XY plot is displayed, which shows the behaviour of the evaluation over the last 7 days. Additionally, AmmonitOR lists the configuration history and any configuration overrides. See also Section 8.2.5.

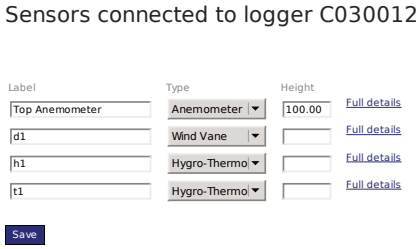


Figure 8.18: Configuring a measurement system (Meteo-32)

Tip
We recommend configuring all sensors in your Meteo-32 measurement project.

8.2.5 Evaluations

On the data logger details page a table is shown, which lists all sensors and visible evaluations. Click on an evaluation to display type, sensor and formula of the calculation as well as unit of the evaluation. If configured, also the installation height of the sensor is indicated.

If evaluator detail page is opened an XY plot is displayed, which shows the measurand behaviour of the last 7 days. In order to view another time period, click on *Edit*. AmmonitOR also calculates the `Average` of the measured values for the selected period.

While being in data logger details page, if *List all evaluations* is clicked, AmmonitOR displays a table with both visible and hidden (or deactivated) evaluations (see Section 8.2.5.1). Click on the evaluations to display any details. In order to reactivate a hidden or deactivated evaluation, click on *Active* checkbox and *Save* at the bottom of a page.

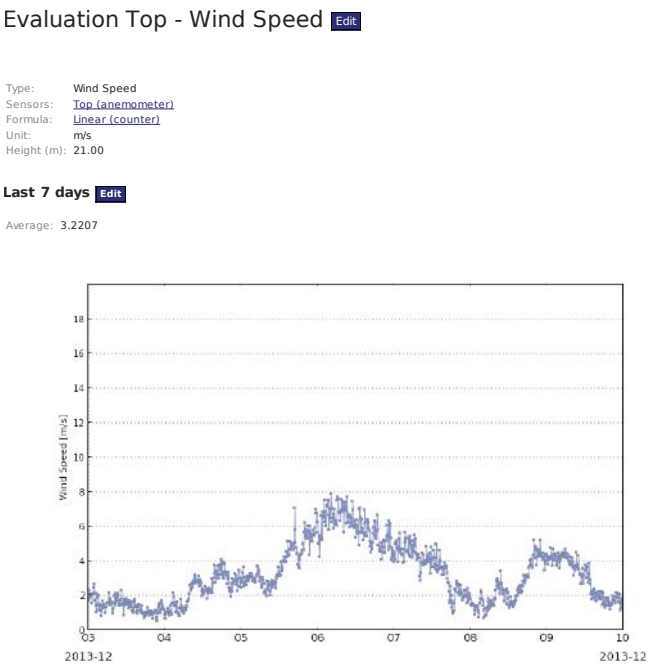


Figure 8.19: Example: Wind speed evaluation with plot

In the *Logger configuration history* all configuration changes are listed and the period, for which the configuration has been valid. In order to view the configuration parameters, click on the *Configuration ID* in the first column. See Section 8.2.5.3 for modifying the configuration.

8.2.5.1 Editing evaluations

If an evaluation is not necessary for any reason, the evaluation can be made invisible by clicking the *Active* and *Save* at the bottom of the evaluation list. Hidden or invisible evaluations can be reactivated in the same manner, see Section 8.2.5

Evaluations can be edit by clicking on the *Edit* button displayed in the headline in the evaluation overview page. Label and type of the evaluation can be modified. Here also the evaluation visibility options can be changed.

8.2.5.2 Adding evaluations

In some cases it is required to add further evaluations to a project, e.g., air density. To do so, click on the sensor, which is required to calculate the evaluation.

Click on *Add new evaluation* to configure the evaluation. The new evaluation will be listed in the evaluation list.

8.2.5.3 Modifying the configuration

If measurement data has to be recalculated, e.g., due to sensor replacement, slope and offset values can be modified. To do so, select an evaluation and go to *AmmonitOR configuration overrides*. Click on *New configuration override* to create a new evaluation.

Reason Enter the reason for the configuration override, e.g., replacement of a sensor.

Period Only valid for evaluations, whose sensors are connected to counter channels, i.e. wind speed, precipitation. Indicates the period of time covered by the measurement.

For example: Wind speed is calculated by counting the number of cycles (rotations or tics) per second. `1` has to be entered in the field *Period*.

Sensitivity Only valid for solar irradiation sensors. Enter the sensitivity value given for the new sensor (acc. to calibration protocol).

Offset Enter the offset value, given for the new sensor.

Slope Enter the slope value of the new sensor

Optionally, you can decide with period should be recalculated. You can choose to recalculate the whole measurement, a defined period, all data before a date or all data after a date.

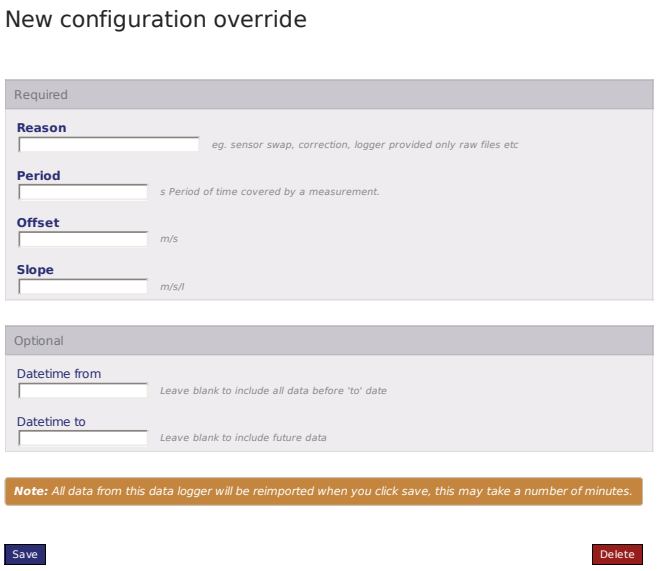


Figure 8.20: Overriding a sensor configuration (Anemometer)

Important
A modified configuration in AmmonitOR does not affect the data logger configuration or the generation of data files. The configuration is only valid for data in AmmonitOR. Configurations can be modified multiply or deleted. In both cases the data is reimported and newly calculated according to the entered period.

New AmmonitOR configurations are listed under the *Logger configuration history*. Configurations can be modified via the *Edit* button. If further recalculations should be added, click on *New configuration override*.

8.3 Wind Turbine Information

For different power curve analysis, it can be important to compare your turbine data with other turbines. Use this menu to enter wind turbine data as well as power curve information and power coefficient for comparison reasons. Note that

the *Rotor diameter* is required for power coefficient curve. Once entered wind turbines, can be used by the editing user in different projects. Other users do not have access to the wind turbine.

Go to the Settings → Wind turbine information menu to view or edit turbine data. If any data has been entered, AmmonitOR lists the provided turbine information as well as the plot(s) with the turbine power curve.

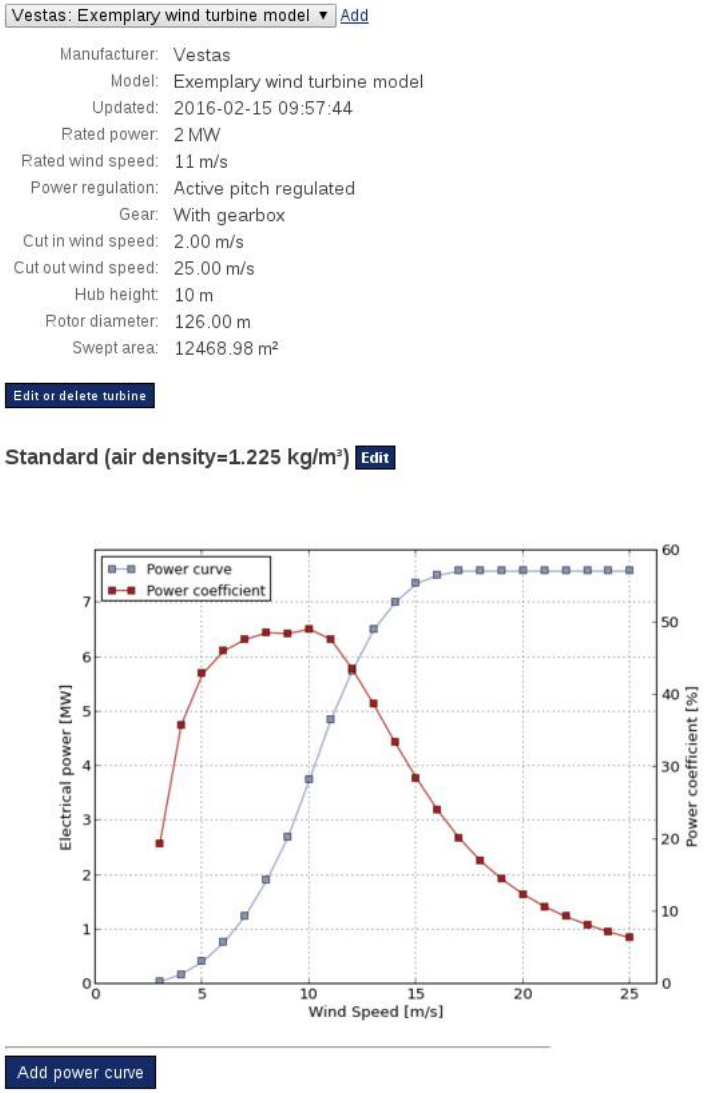


Figure 8.21: Wind turbine data in toolbox

In order to modify turbine data, click on *Edit turbine properties*; for modifying power curve and power coefficient data, click on *Edit* next to the air density information. It is possible to enter more than one power curve for a turbine, e.g., if air density varies.

If no turbine data has been provided, click on *Add turbine* to enter the information. By clicking on *Add power curve* the characteristical data for the power curve can be entered. For each wind turbine more than one power curve can be provided.

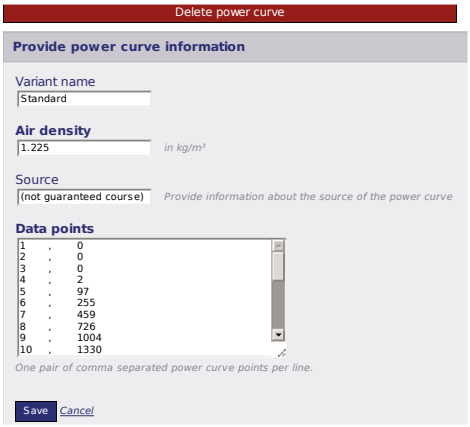


Figure 8.22: Editing a power curve in the toolbox

8.4 Connection alarms

AmmonitOR provides an alarm function in case the data logger does not connect for a defined time period or reconnects after a while of no communication.

Click on *Add new connection alarm* to define a new alarm. Select either *Alert immediately on every new connection* if you want an email as soon as the data logger connects to AmmonitOR or *Alert when a connection has been missing for...* if you want to get an email as soon as the logger did not send data for a specific time period. Choose type of connection to get alerted if only connection of a specific type dit not occur. Finally select the recipients of the alarm and save.

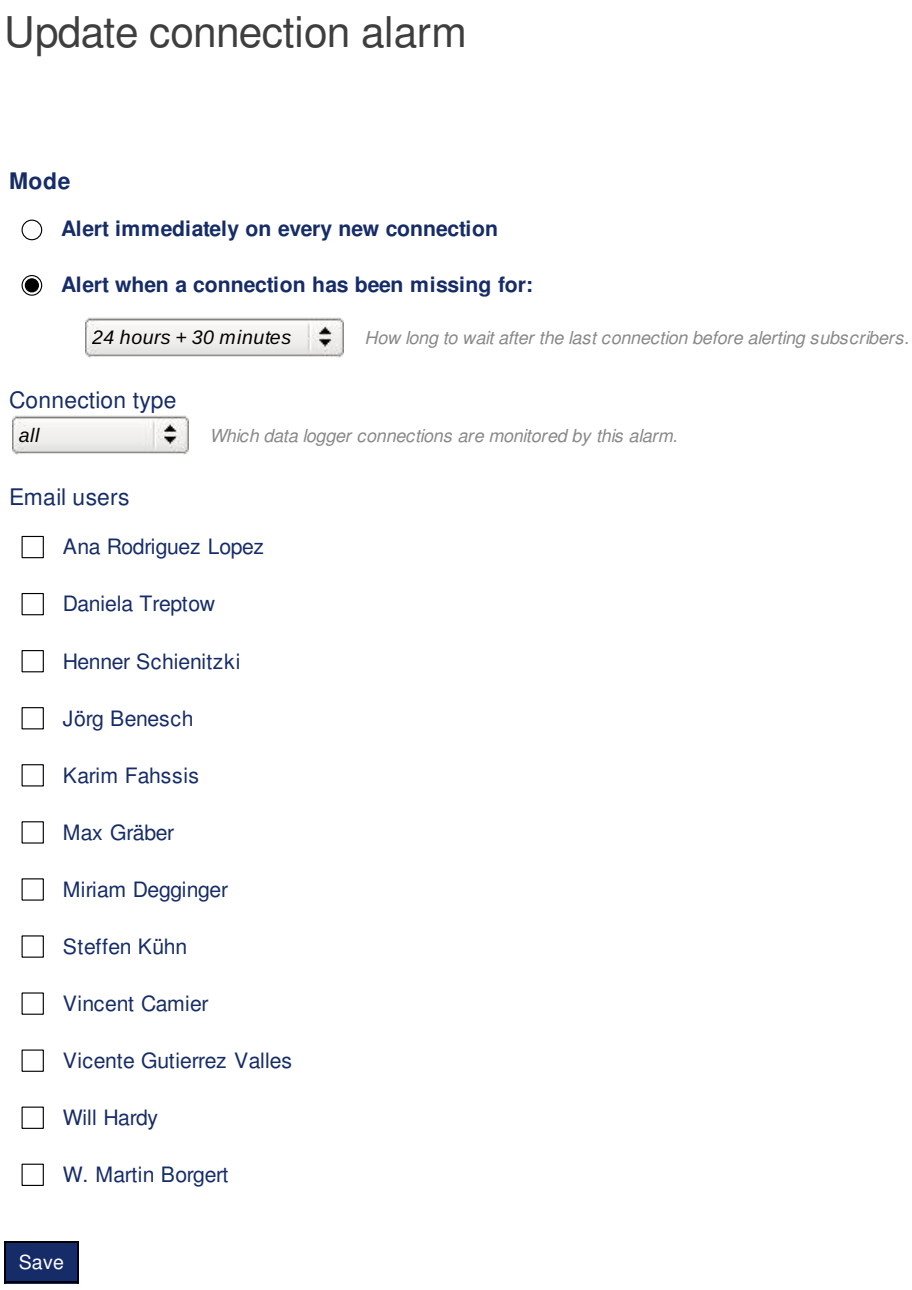


Figure 8.23: Create a new connection alarm

When alarms have been created, it can be seen in the connection alarm overview.

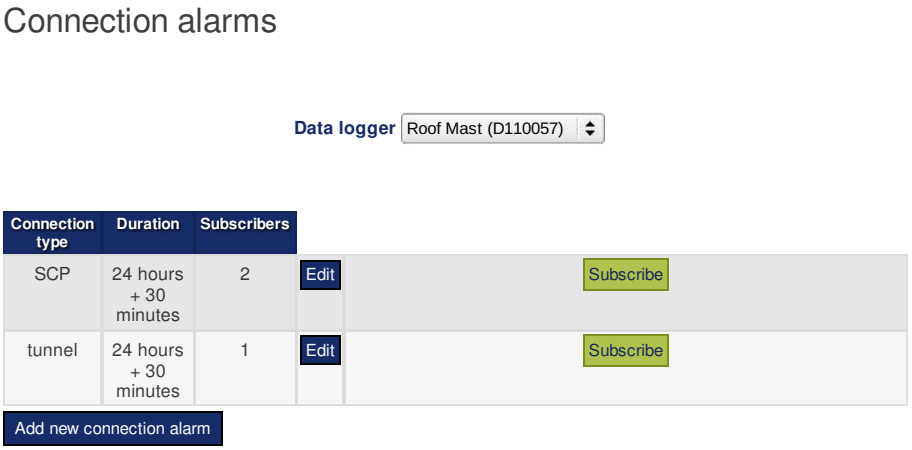


Figure 8.24: Alarm overview

8.5 Filters

In order to check measurement data for plausibility, filters can be implemented. In doing so, AmmonitOR alerts when any filter triggers. Filters can be configured for measurement and system data, e.g. temperature and internal voltage. For example: AmmonitOR can send an alert email when the voltage of the battery is lower than a defined value. Or measurement data can be highlighted when the temperature is lower than 4 degrees; icing could be a problem.

AmmonitOR offers different filters and every type has a special function. Filters can be created and managed in menu Settings → Filters. If filters have been created, AmmonitOR displays the filters in an overview - separated by filter type: *Range filters*, *Sequence filters*, *Comparison filters* and *Direction comparison filters*. AmmonitOR lists which filter is active, filter conditions, and what happens when the filter condition applies.

In order to modify, activate or deactivate filters, click on *Details*. To create new filters for a category, click on *Create a new ... filter*.

Range filters

Active	Evaluations	Min. value	Max. value	Message	Alert type	New status	
yes	Top (10 Bit) - wind direction, Backup (Poti) - wind direction	0	360	impossible wind direction	archive and email	Error	Details
yes	Barometer - air pressure, Baro RS485 (Steel-Cabinet) - air pressure	870	1085	impossible air pressure	archive and email	Suspicious	Details
yes	Internal temperature - temperature, Hygro/Thermo - temperature, Baro RS485 (Steel-Cabinet) - temperature, Steel Cabinet - temperature	-40	80	exceptional temperature	archive and email	Suspicious	Details
yes	Hygro/Thermo - humidity, Steel Cabinet - humidity	0	100	Humidity can not be greater than 100%	archive and email	Error	Details
no	Hygro/Thermo - humidity	0	4	humidity testing email	archive and email	Suspicious	Details
yes	Hygro/Thermo - humidity, Steel Cabinet - humidity, Internal temperature - temperature, Hygro/Thermo - temperature, Steel Cabinet - temperature, Barometer - air pressure, Internal voltage - voltage, Internal current - current, Status_8k2 - status, Status_8k2 of S6 - status, Status of S6 - status	600	600	Measurements missing	archive and email	not set	Details
yes	Top - wind speed, Backup - wind speed		30	Test Filter Very High Wind Speed! Unfortunately, your mast flew away...	only archive	Error	Details
yes	Internal voltage - voltage	11.4000		Batterie voltage is low	archive and email	Suspicious	Details

Sequence filters

Active	Evaluations	Threshold	Message	Alert type	New status	
yes	Top - wind speed, Backup - wind speed	36	Anemometer possibly frozen.	archive and email	Suspicious	Details

Comparison filters

Active	Project	Evaluation 1	Comparison type	Evaluation 2	Evaluation 2 factor	Evaluation 2 offset	Message	Alert type	New status	
yes	Ammonit field tests	Top - wind speed	>	Backup - wind speed	6.0000	0.000000	fault	only archive	Suspicious	Details

Direction comparison filters

Active	Evaluation 1	Evaluation 2	Maximum offset	Message	Alert type	New status	
yes	Top (10 Bit) - wind direction	Backup (Poti) - wind direction	90	Wind directions greatly differ	archive and email	Suspicious	Details

Figure 8.25: Overview filters

Tip
AmmonitOR offers a set of default filters for range and sequence filters, which can be uses as examples. Click on *Create set of default ... filters* to see and edit the filter conditions.

8.5.1 Range filters

By using the range filters, measurement values, which are out of the normal / expected range, can be detected.

Range filters

Active	Evaluations	Min. value	Max. value	Message	Alert type	New status	
yes	Top (10 Bit) - Wind Direction, Backup (Poti) - Wind Direction, Wind Vane 10 Bit - Wind Direction, Wind Vane Poti - Wind Direction	0	360	impossible wind direction	archive and email	Error	Details
yes	Barometer - Air Pressure, Baro RS485 (Steel-Cabinet) - Air Pressure	870	1085	impossible air pressure	archive and email	Suspicious	Details
yes	Internal temperature - Temperature, Hygro/Thermo - Temperature, Baro RS485 (Steel-Cabinet) - Temperature, Steel Cabinet - Temperature	-40	80	exceptional temperature	archive and email	Suspicious	Details
yes	Hygro/Thermo - Humidity, Steel Cabinet - Humidity	0	100	Humidity can not be greater than 100%	archive and email	Error	Details
no	Hygro/Thermo - Humidity	0	4	humidity testing email	archive and email	Suspicious	Details
yes	Top - Wind Speed, Backup - Wind Speed		30	Test Filter Very High Wind Speed! Unfortunately, your mast flew away...	only archive	Error	Details
yes	Hygro/Thermo - Humidity, Steel Cabinet - Humidity, Internal temperature - Temperature, Hygro/Thermo - Temperature, Steel Cabinet - Temperature, Barometer - Air Pressure, Internal voltage - Analog Voltage, Internal current - Analog Current, Status_8k2 - Status, Status_8k2 of S6 - Status, Status of S6 - Status	580	600	Measurements missing. The counter didn´t arrive to 600.	archive and email	Suspicious	Details
yes	Internal voltage - Analog Voltage	11.4000		Batterie voltage is low	archive and email	Suspicious	Details
yes	Hygro/Thermo - Humidity, Steel Cabinet - Humidity	0	95	unlikely humidity	only archive	Suspicious	Details
yes	Internal temperature - Temperature, Hygro/Thermo - Temperature, Baro RS485 (Steel-Cabinet) - Temperature, Steel Cabinet - Temperature	-40	80	impossible temperature	only archive	Error	Details

Create set of default range filters

Create a new range filter

Figure 8.26: Range filter

Click on *Create a new range filter* in menu Settings → Filters. Define the range by entering a *Minimum value* and a *Maximum value*. All measurement values fitting into the range are valid. The filter triggers when measurement values are not in the defined range.

After determine the range, at least one sensor has to be selected. AmmonitOR lists all sensors connected to any of the data loggers related to the project. If more than one sensor should be selected, hold the `CTRL` key and use the left-mouse click to choose the sensors which should be monitored. In the *Statistics* field the statistical value has to be selected, which should be monitored, e.g., average, minimum or maximum. If more than one statistical value should be checked, hold the `CTRL` key and use the left-mouse click to select further statistics.

Additionally, it has to be decided, what status the data sequence should obtain, if the defined filter triggers:

Suspicious Highlights the affected measurement values in the data overview in yellow colour.

Error Highlights the affected measurement values in the data overview in red colour.
`Error`-marked values are not considered in plots.

No status Affected data sequence is not highlighted.

Important
If the filter status is `Error`, AmmonitOR will not use the measurement values in a plot (see).

Finally *Alert type* and *Message* have to be determined.

Only archive If a filter triggers, AmmonitOR generates a message, which is displayed in the message list of the project.

Archive and email If a filter triggers, AmmonitOR generates a message, which is displayed in the message list of the project and AmmonitOR sends an email to all project users.

The text entered in the *Message* textbox is used for alert email and archived message.

Click on *Add filter* to activate the filter.

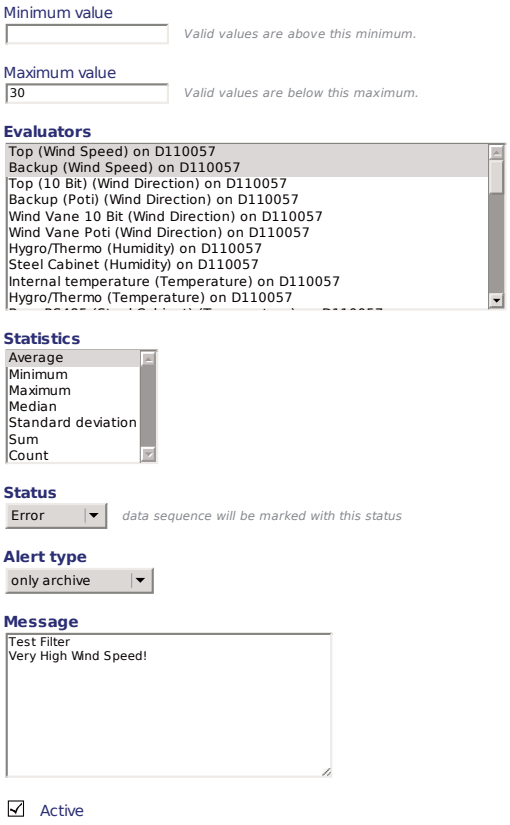


Figure 8.27: Example of a range filter for an anemometer

Tip
AmmonitOR offers a set of default filters for range filters, which can be uses as examples. Click on *Create set of default range filters* to see and edit the filter conditions.

8.5.2 Sequence filters

In order to detect measurement values that do not change over a certain period of time, such as frozen anemometers in icing situations, *Sequence Filters* can be configured. Use these filters to recognize problems with the sensor or missing measurement values.

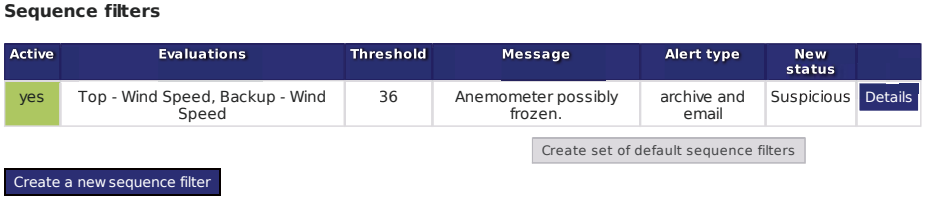


Figure 8.28: Sequence filter

Click on *Create a new sequence filter* in the Settings → Filters menu to configure a new filter.

Threshold Indicates the minimal number of subsequent identical values, which should be considered suspicious.

Evaluations Select the evaluation, which should be monitored. AmmonitOR displays all evaluations with the serial number of the data logger, to which the evaluation pertains.

If more than one evaluation should be monitored, hold the `CTRL` key and use the left-mouse click to highlight the evaluations.

Statistics Choose from a list the statistic which should be considered for the filter.

If more than one statistical value should be checked, hold the `CTRL` key and use the left-mouse click to select the statistics.

Status

- Suspicious: Data sequence is marked in yellow colour in the data overview.
- Error: Data sequence is marked in red colour in the data overview. Errors are considered as measurement errors and are not displayed in plots.

Alert type `only archive`: AmmonitOR lists date and number of matched entries when the filter applied.

`archive and email`: As above. Additionally, AmmonitOR send an email to the project members to inform about the filter.

Message Enter a message which is displayed in the filter overview and in the email text, if the alert type is `archive and email`.

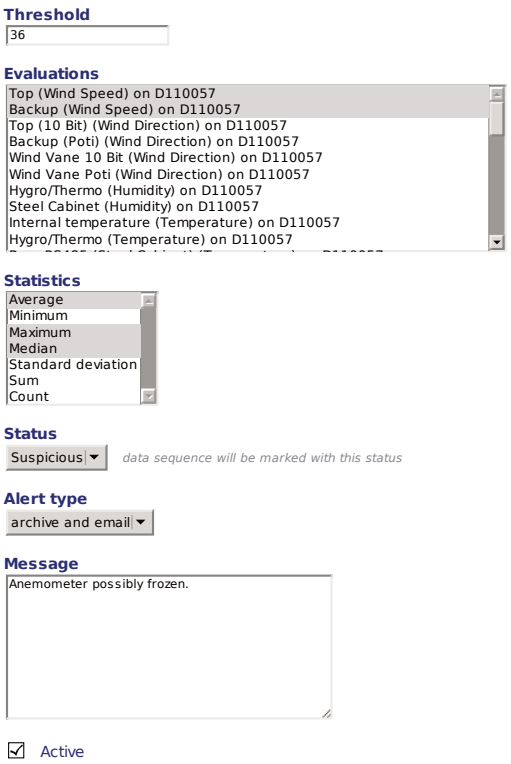


Figure 8.29: Example of a sequence filter

Tip
AmmonitOR offers a set of default filters for sequence filters, which can be uses as examples. Click on *Create set of default sequence filters* to see and edit the filter conditions.

8.5.3 Comparison filters

These filters compare data of two different sensors at the same time.

Comparison filters

Active	Project	Evaluation 1	Comparison type	Evaluation 2	Evaluation 2 factor	Evaluation 2 offset	Message	Alert type	New status	
yes	Ammonit field tests	Top - Wind Speed	>	Backup - Wind Speed	6.0000	0.000000	fault	only archive	Suspicious	Details
yes	Ammonit field tests	Steel Cabinet - Humidity	>	Hygro/Thermo - Temperature	1.0000	0.000000	A	only archive	Suspicious	Details

Create new comparison filter

Figure 8.30: Comparison filter

Parameters for Comparison Filters

Active defines if the filter is active. only active filters will be used to check anything.

Message a text which will be used if the filter triggers and generates a message.

Alert type Possible values are **`no alert`** and **`email`**. **`no alert`** means, that the generated message will be archived, but there won't be send an email or sms. **`email`** means, that the generated message will be archived and an email will be send.

Sensor 1 Sensor 1 for the comparison

Comparison type The type how to compare Sensor 1 with Sensor 2

Sensor 2 Sensor 2 for the comparison

Sensor 2 factor A factor for the value of sensor 2

Measurand status **`Measurand status`** defines the status of the measurands from both sensors after the measurands trigger the filter.

Example 8.1 Simple filter to check difference between two temperatures

The following filter should generate a message and set the measurands status to `suspicious` if the value of Temperature 1 `t1` is greater than 105% of the value of temperature 2 `t2`. The equation for this filter is:

$$t_1 > t_2 \cdot 1.05$$

Equation 8.1: Linear Equation

Active **`True`**

Message **`Value of temperature 1 >> value of temperature 2`**

Sensor 1 **`t1`**

Comparison Type **`>`**

Sensor 2 **`t2`**

Sensor 2 Factor **`1.05`**

Measurand Status **`Suspiciou`**

Example 8.2 Anemometer 1 Windspeed must be lower than Anemometer 2 Windspeed

The following filter should generate a Message and set the measurands status to Suspicious if the value of Anemometer1 (Height: 10 m) is greater than the value of Anemometer 2 (Height: 80 m). The equation for this filter is:

$$s_1 > s_2 \cdot 1.0$$

Equation 8.2: Linear Equation

Active `True`

Message `Value of Anemometer 1 >> value of Anemometer 2`

Sensor 1 `s1`

Comparison Type `>`

Sensor 2 `s2`

Sensor 2 Factor `1.0`

Measurand Status `Suspicious`

8.5.4 Direction comparison filter

The *Direction Comparison Filter* correlates wind direction data of two wind vanes. Click on *Create new direction comparison filter* in the Settings → Filter menu to add a new filter.

Direction comparison filters

Active	Evaluation 1	Evaluation 2	Maximum offset	Message	Alert type	New status	
yes	Top (10 Bit) - Wind Direction	Backup (Poti) - Wind Direction	90	Wind directions greatly differ	archive and email	Suspicious	Details

Create new direction comparison filter

Figure 8.31: Direction comparison filter

Evaluation 1 / Evaluation 2 Select the wind vanes which should be compared.

Maximum offset The entered value indicates the maximum deviation between both evaluations. If the difference between both evaluations is greater than the `Maximum offset` the filter triggers.

Example: If you entered 50 for the offset value and the difference between evaluation 1 and evaluation 2 is 60, the filter triggers. If the difference is 50, the filter does not trigger.

Statistic Select a statistic, which should be monitored.

Status According to the selected status, the data sequence will be marked in the data overview.

- Suspicious: The data sequence is marked yellow in the data overview.
- Error: The data sequence is marked red in the data overview and is not considered in plots.

Alert type `only archive`: AmmonitOR lists date and number of matched entries when the filter applied.

`archive and email`: As above. Additionally, AmmonitOR send an email to the project members to inform about the filter.

Message Enter a comment, which will be displayed in the filter overview and in the email sent, if alert type is `archive and email`.

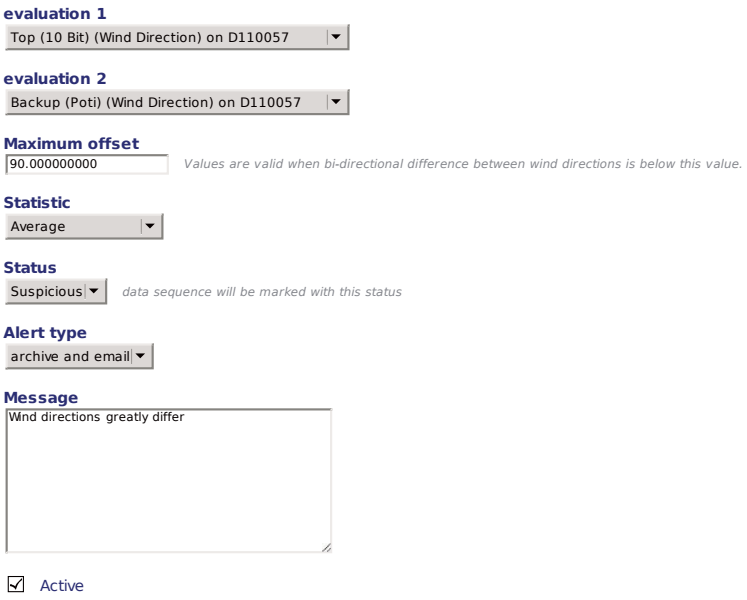


Figure 8.32: Example of a direction comparison filter

8.5.5 Editing filter details

Important
Only users with `Write` access rights are allowed to add, modify or delete filters.

Filter conditions can be edited in the Settings → Filters menu by clicking on *Details* of a listed filter. Click on *Edit* on the filter details page to modify filter conditions.

If a filter should be deactivated or deleted, click on the *Details* button of the selected filter in the overview. In the options section you can *Deactivate* or *Delete this particular filter*.

AmmonitOR lists all matched entries data logger by data logger on the filter details page. It is shown on which day the filter condition triggered and how many entries are affected. By clicking on an entry the measurement data for this day is displayed. Suspicious data is marked yellow; errors are marked red (according to the entered filter condition).

Chapter 9

Ammonit Data Logger Meteo-40

9.1 Preparing Meteo-40 for AmmonitOR

AmmonitOR version 2.0 and higher is compatible with Meteo-40 data loggers. If you use a previous version on your server, perform an upgrade or contact Ammonit.

To display measurement data and/or communication behaviour of Meteo-40 data loggers in AmmonitOR, the data logger and AmmonitOR have to be configured.

If the data logger should be added to an existing AmmonitOR project, note down the *Project key* of the existing project. If the data logger should be included in a new project, set up a new project in AmmonitOR and note down the *Project key*. The *Project key* has to be entered in the Communication → AmmonitOR menu of the Meteo-40 web interface as shown in Figure 9.1. See also Meteo-40 manual, which can be downloaded from the Ammonit website (`http://www.ammonit.com`).

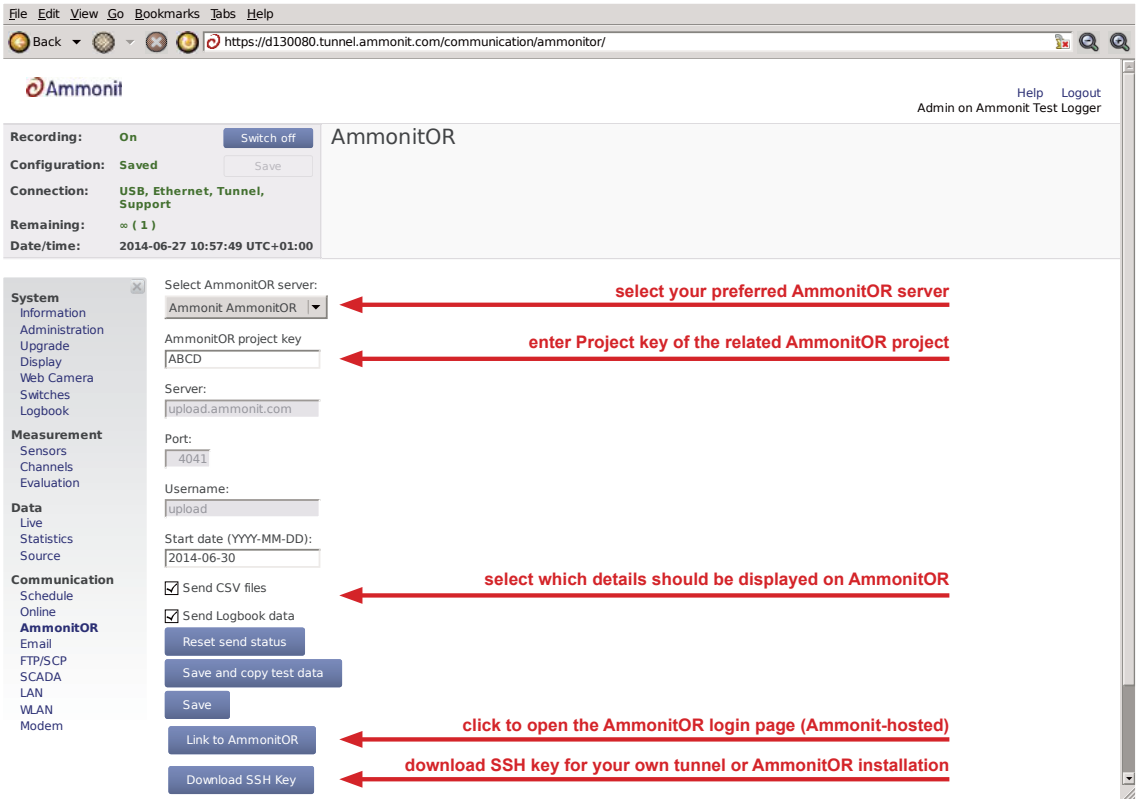


Figure 9.1: Configuring the Meteo-40 web interface

Select your preferred AmmonitOR server: Ammonit-hosted installation or your own AmmonitOR server.

If you use the Ammonit-hosted installation, server details are filled automatically. If you use your own installation, enter the necessary server details. Your local AmmonitOR server has to authenticate each data logger. To do so, see Section 16.3.1.

AmmonitOR project key Enter the *Project key* of your related AmmonitOR project. The *Project key* is displayed in the project overview of your AmmonitOR project. You can connect more than one data logger to an AmmonitOR project. To do so, use the *Project key* for all project-related data loggers.

Decide, which data should be monitored in AmmonitOR:

Both Measurement Data and Communication Behaviour (default) Select both checkboxes *Send CSV files* and *Send Logbook data* to monitor measurement data and communication behaviour of the data logger.

Only Measurement Data Select *Send CSV files* to monitor measurement data, resp. statistic data in AmmonitOR. According to the scheduled upload times, Meteo-40 sends CSV files to AmmonitOR. Deselect *Send Logbook data*.

Only Communication Data Select *Send Logbook data* to monitor the communication behaviour of the data logger. According to the scheduled upload times, Meteo-40 transfers connection details to AmmonitOR - no measurement data is uploaded, when only the checkbox *Send Logbook data* is ticked. *Send CSV files* has to be unticked. The communication behaviour can be monitored in the *Connection Log* (see Section 4.4).

Link to AmmonitOR Click on *Link to AmmonitOR* to enter the AmmonitOR login page or to set up a new AmmonitOR account.

Download SSH Key Applies only, when you use a local AmmonitOR installation (not the Ammonit-hosted installation). Your AmmonitOR server has to authenticate each Meteo-40 data logger. To do so, download the SSH key and see Section 16.3.1 .

9.2 CSV Files

Meteo-40 stores measurement data in standard Comma-Separated Value (CSV) format with appended information in ini file format. The CSV file is documented in RFC 4180 (`http://tools.ietf.org/html/rfc4180`) and well explained, e.g., in Wikipedia (`http://en.wikipedia.org/wiki/Comma-separated_values`). Ini files are described e.g. in Wikipedia (`http://en.wikipedia.org/wiki/INI_file`) as well. CSV files can easily be read by many programs and software tools, as is the ini file format.

Note
In almost all cases, the CSV files created by Meteo-40 are compressed using GNU gzip (`http://www.gzip.org/`) with the typical file extension .gz. gzip compressed files can be uncompressed on all operating systems, see Wikipedia (`http://en.wikipedia.org/wiki/Gzip`) for further details.

9.3 Meteo-40 CSV File Format

The measurement data files of the Meteo-40 use the , (comma) as field separator, ” (double quote) for embedding commas in textual strings and UTF-8 as character set.

The statistics files generated by Meteo-40 data loggers are structured in two parts, the data in standard CSV format and additional information in so-called ini file format. Both parts are separated by one empty line:

9.3.1 Data part (CSV format)

The CSV part starts with a header line. This line is a comma-separated list of the statistics for each active channel and evaluator. The first item of the list is the data/time entry; followed by the evaluator statistics which have the form `Sen`

sor;Evaluation;Statistic (e.g., Anemometer;wind_speed;Avg or WindVane10bit;wind_direction;Count).Thereafter, the channel statistics are displayed in the form Channel;Statistic (e.g., A2;Avg or C1;StdDev).

The statistics can individually be selected per sensor in the Data → Statistics menu.

Currently, Meteo-40 offers the following statistics: Avg, Min, Max, StdDev, Count, Median, and Sum.

According to the configured statistics interval, Meteo-40 calculates the statistics. Each time period is represented in a line of the CSV file. The values are generally decimal numbers, using a point (.) as decimal mark.

Language settings of the data logger do not have an influence on the CSV file. In the first column of the CSV file the datetime for each statistic is given. Date and time are indicated with milliseconds in accordance to ISO-8601, e.g., 2012-05-31 15:50:00.500.

The date and time values are always the local time of the data logger. The timezone is stated in the second part of the file.

9.3.2 Information part (Ini file format)

The information part contains data logger information as well as sensor details like installation height, slope and offset values, as well as unit and sensor name.

The information part is included in every file. It can be found below the statistical data. The overall format of the configuration is the following:

```
[Section 1]
key1=value
key2=value
[Section 2]
key1=value
```

All section names, keys and values are case-sensitive and may contain unicode characters in UTF-8 encoding. While sections and values may contain spaces; keys do not. Each section is unique; each key is unique within its section. Neither the order of sections nor the order of entries within the sections are significant or guaranteed.

- [System]: Serial number and type of the data logger; the name which has been assigned by the user; timezone in the format UTC+xx:xx or UTC-xx:xx; as well as the version of the firmware of the data logger
- [Evaluation] indicates file_interval and stat_interval.
- [Adjustment]: CS1 and CS2 are the calibration values for the current source of Meteo-40. The values are for informational purpose only.
- [Counters]: The measurement_period for counter channels is indicated in seconds, in general 1s. For this time period the number of pulses is counted.
- [Master]: rate of RS485 is given in s, min or h; baudrate for RS485 without unit.
- [Sensor;Evaluator]
  - statistic: List of statistics which are calculated for the sensor, e.g., average, min, max.
  - unit: Unit for the data, e.g., m/s.
  - sensor_label: Name which has been entered by the user in the sensor configuration.
  - sensor_height: Installation height which has been entered by the user in the sensor configuration.
  - sensor_type: Indicates the type of the sensor, e.g., anemometer.
  - sensor_model: The model of the sensor, e.g., Thies First Class Advanced.
  - formula: The type of formula used to convert the electrical values, e.g., linear.
  - formula_params: Parameters which are referenced to in the formula, including related channels and evaluator parameters, e.g., A5 A6 var_offset var_slope. Values of the parameters are displayed in the lines below the formula parameters, e.g., var_offset, var_slope, var_period, var_sensitivity.
- [Channel]
  - statistic: List of statistics which are calculated for the channel/sensor. For each statistic a column is displayed in the upper part of the CSV file.
  - unit: Unit of the calculated data.
  - rate: Configured rate for the channel with unit (not applicable for Master channels).
  - range: Configured range for analog voltage channels (Ax) with unit.
  - protocol: Protocol which is used for digital channels (Dx).

Chapter 10

Ammonit Data Logger Meteo-32

10.1 Preparing Meteo-32 for AmmonitOR

If a Meteo-32 data logger should be part of an AmmonitOR project, the Meteo-32 data logger must have installed firmware version `1.9` or higher. Additionally the data logger has to be configured to send emails to aor@ammonit.com. To do so, start the CALLaLOG software and connect the data logger to your computer.

Note
CALLaLOG can be downloaded from the Ammonit website in the support section: www.ammonit.com (`http://www.ammonit.com`).

Open the GPRS menu and enter the GPRS settings. Figure 10.1 shows an example with settings. The email address (`Copy to`) is important. Emails have to be sent to aor@ammonit.com. The primary email address (`Primary Recipient`) can be used for any other address. Enter the same primary email address in the AmmonitOR import email address field in data logger settings for proper data file identification.

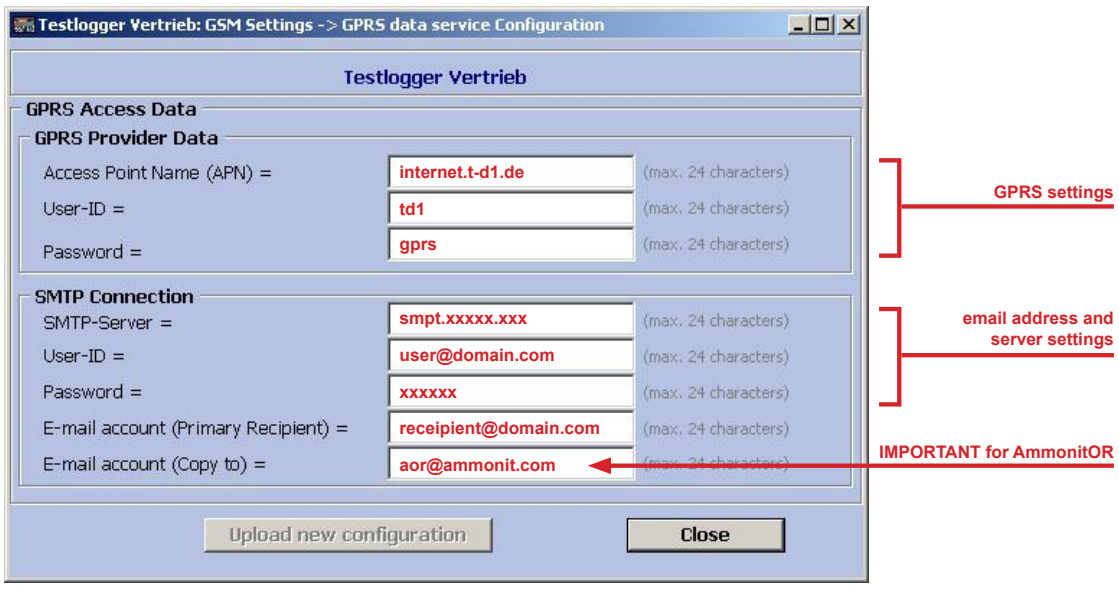


Figure 10.1: GPRS settings

Fill all mandatory fields (serial number, data logger type, name and import email address) in the Ammonit software CALLaLOG to identify the data logger. On the basis of the data sent by Meteo-32, AmmonitOR archives measurement data.

10.2 ROW and ROWINFO files

ROW and ROWINFO files are sent by the Meteo-32 data logger as email attachments. ROW files include measurement data; ROWINFO files contain channel names, as well as slope and offset values.

Both files have the same base name. Date and time formats are similar to ISO-8601 `YYYY_MM_DD_hhmm`. ROW files have the extension `.row`; ROWINFO files have the extension `.rowinfo`.

10.3 Email Subject

The email subject consists of the data logger serial number and its id, e.g., `Ammonit Data Logger C080765 (# 21)`.

10.4 ROWINFO file format

The rowinfo file consists of two lines:

1. The first line is a space separated list of active channels (*three* letter codes). The order is relevant and has to be the order of the activated channels from the `.row` file.
2. The second line indicates slope and offset values for active channels as space separated list of statements. Every statement consists of *two* letter code of the channel and the postfix `_slope` or `_offset`, an equal sign, and the four digit value. The order is not relevant.

10.4.1 Example

`2010_01_21_0000.rowinfo`

1st line:

```
s1a s1x s1s s2a s2x s2s s3a s3x s3s d1a d1s d2a d2s h1a t1a b1a r1a
s4a s4x s4s vxa vxi
```

2nd line:

```
s1_slope=0477 s1_offset=0025 s2_slope=0480 s2_offset=0024
s3_slope=0483 s3_offset=0024 d1_offset=0178 d2_offset=0176
h1_slope=0100 t1_slope=0100 t1_offset=0030 b1_slope=0060
b1_offset=0800 r1_slope=0000 s4_slope=0483 s4_offset=0025
```

(line breaks here for readability only)

10.5 Explanations

1. If more than one field in the first line refer to the same physical channel, such as `s1a` and `s1x`, the slope and offsets are still transmitted only once in the second line.
2. If a channel does not have slope or offset, the respective values are not transmitted.
3. The order in the first line is important, in the second line it is not.

10.6 Row file format

The first line is the header. The other lines are the data, e.g. for 10 minutes values of one day, 144 lines.

The header structure is:

1. starts always with a `T`
2. date and time in the format `MM/DD/YY hh:mm:ss`
3. measurement and aggregation frequencies
4. version string
5. serial number of the data logger, e.g., `C010203`

10.6.1 Example

`2010_01_21_0000.row`

```
      T 01/21/10 00:00:00 1*600 V5.0 C08076543
      78 84 2 77 84 2 67 73 3 283 1 272 2 65 2898 1015 28 47 51 2 119 119
      82 84 2 77 80 2 66 75 3 286 1 283 2 62 2860 983 28 43 57 3 130 129
      74 83 3 77 79 3 65 70 1 273 3 285 1 64 2830 1001 26 45 48 2 123 119
      68 79 2 71 82 2 60 74 3 289 2 275 2 68 2909 982 27 43 48 2 126 126
      ...
```

Here the measurement frequency is 1 second, the store frequency is 600 times the measurement frequency, i.e. 10 minutes. For one complete day, there should be one data line per 10 minutes, i.e. 144 data lines.

Chapter 11

Security

In order to monitor your measurement campaigns, measurement data is securely transmitted to AmmonitOR and can be accessed via encrypted HTTPS connection. To protect data from unauthorized access, AmmonitOR encrypts all communications using the industry standard Open SSH protocol (for further details refer to Wikipedia (`http://en.wikipedia.org/wiki/OpenSSH`)). All browser sessions are encrypted using the SSL (Secure Sockets Layer) protocol. For more information refer to Wikipedia (`http://en.wikipedia.org/wiki/Secure_Socket_Layer`).

Export data files can be encrypted using GnuPG (`http://gnupg.org/`). GnuPG is a free cryptographic software, which uses public-key cryptography. To encrypt files and messages, GnuPG uses asymmetric keypairs (public and private key), which are individually created by GnuPG users. Refer to Wikipedia (`http://en.wikipedia.org/wiki/GNU_Privacy_Guard`) for further details.

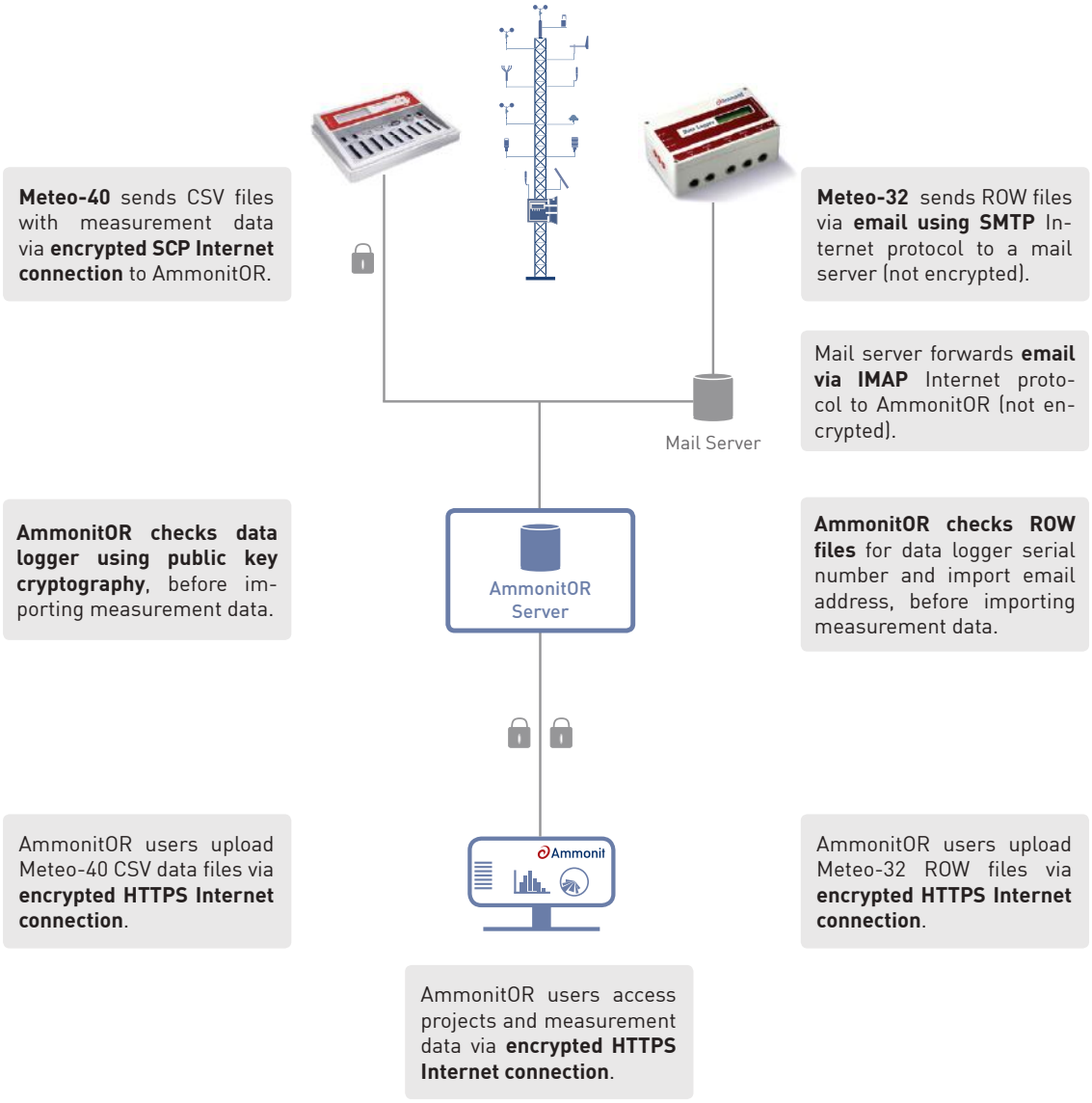


Figure 11.1: Interaction between AmmonitOR and data logger

11.1 Accessing AmmonitOR

Users access AmmonitOR via an encrypted HTTPS internet connection (`https://or.ammonit.com`).

11.2 User management

To view and edit projects in AmmonitOR, users have to be registered. According to the integrated user rights management, AmmonitOR offers several user roles with different permissions. Users can only access projects to which they have been invited to. Refer to Chapter 3 for further details.

User rights are project-related, i.e. that users can have different permission in different projects.

Only users with assigned permissions are allowed to modify project and data logger settings as well as to invite new project users and assign user rights.

11.3 Data transfer between data logger and AmmonitOR

11.3.1 Data transfer between Meteo-40 and AmmonitOR

Meteo-40 uploads CSV files via SCP internet connection to AmmonitOR. The connection is encrypted. Before the data is imported, AmmonitOR checks the data logger using public-key cryptography.

Using the `Project key`, the measurement data is imported to the corresponding project in AmmonitOR.

11.3.2 Data transfer between Meteo-32 and AmmonitOR

The ROW files of Meteo-32 are send via email using SMTP internet protocol to a mail server. The mail server forwards the email using IMAP internet protocol to AmmonitOR. The connection between data logger and AmmonitOR is not encrypted. Before the measurement data is imported, AmmonitOR checks ROW files for serial number and import email address of the data logger.

11.4 Manual upload of data files to AmmonitOR

If you prefer to upload data files manually to your AmmonitOR account, the files are transferred via a secure HTTPS connection. The connection to or.ammonit.com (`https://or.ammonit.com`) is encrypted using high-grade encryption, AES 256 CBC, with SHA1 for message authentication and DHE_RSA as key exchange mechanism. The certificate is verified by Thawte, Inc. The encryption permits unauthorized people from viewing any transmitted information.

For further details about the certificate refer to the information displayed in your browser.

11.5 Encrypted data export

Data export files can be encrypted using GnuPG (`http://gnupg.org/`). Refer to Section 7.4.2 for further details.

Chapter 12

Frequently Asked Questions

12.1 Account settings

Question	Answer
What do I need to work with AmmonitOR?	You need an account to access the online platform. Enter the URL or.ammonit.com (`https://or.ammonit.com`) in your browser software and login with your account details.  **Tip** In order to become familiar with AmmonitOR, open one of the example projects.
How can I register for AmmonitOR?	Click on *Sign up* on the login page of AmmonitOR and enter your email address. You will receive an activation link by email. Follow the link and enter your details in the form, e.g., name, company, password to set up your account.
I need access to one of our projects. How do I do this?	Ask a colleague who has read and write permission for this project to send you an invitation to this particular project. If you already have an AmmonitOR account, you can access the project immediately. If you do not have an AmmonitOR account, the invitation includes instructions how an account can be set up.
If I invite a user to my project, does he/she have access to all of my projects?	In AmmonitOR user rights are project-related. Thus users only have access to projects which they have created or to which they have been invited to.
Is it possible to have an own installation of AmmonitOR on our server?	Yes, you can have a separate installation on your server - independent from the Ammonit server. Please contact us for an offer.

12.2 Data import

Question	Answer
How can I import data to my AmmonitOR account?	Depending on the data logger you use, there are different ways to import data to your AmmonitOR account. • Automatic data upload via SCP connection with Meteo-40 (refer to Section 8.1.3.1) • Manual import of CSV files from Meteo-40 (refer to Section 8.1.3.2) • Emailing data files from Meteo-32 (Section 8.1.3.3) • Manual import of data files from Meteo-32 (Section 8.1.3.4)
What is an import email address?	The import email address is the address configured in the Meteo-32 data logger to send the emails to. This address and the serial number of the Meteo-32 data logger is used to sort the data into your projects.
From which data loggers can I import data files?	AmmonitOR supports Meteo-40 and Meteo-32 data loggers. If you use a separate AmmonitOR installation, you require version 2.0 or higher to be able to include Meteo-40 data loggers. Meteo-32 data loggers require firmware 1.9 or higher to be compatible with AmmonitOR. The firmware can be downloaded from the Ammonit Website (`http://www.ammonit.com`).
Can I upload data to AmmonitOR which has previously been downloaded from a Meteo32 data logger?	Yes, you can manually upload ROW files generated by Meteo-32 data loggers via web interface to AmmonitOR.
How can I send data to AmmonitOR which has previously been downloaded from a Meteo-32 data logger?	You can easily upload data files from your Meteo-32 data logger via web interface to AmmonitOR.

12.3 Data evaluation and monitoring

Question	Answer
Do I have to set slope and offset parameters in AmmonitOR?	No, the parameters are configured in the data logger. Use the sensor helper in the Meteo-40 web interface; CallALog software for Meteo-32. The data files sent or uploaded to AmmonitOR include configured slope and offset values for all sensors. For further details about CSV files generated by Meteo-40 data loggers see Section 9.3; details about ROW and ROWINFO files created by Meteo-32 data loggers can be found in Section 10.2.
Can I modify slope and offset parameters in AmmonitOR?	Yes, you can modify the parameters for each sensor for a determined period. Refer to Section 8.2.5.3 for further details.

12.4 Data loggers and projects

Question	Answer
Can I monitor the online periods of my Meteo-40 data logger?	Yes, AmmonitOR is designed to display the data logger connections - only applicable for Meteo-40 data loggers. In order to monitor the online periods of a data logger, it is not necessary to upload measurement data to AmmonitOR. Both features can be configured independently. For further details refer to Section 4.4.
Is it possible to add further data loggers including old data to an existing project?	Yes, you can easily add new Ammonit data loggers. The data files can be uploaded via the Archiving → Import data menu. Refer to Section 7.3 for further details.

12.5 Data export

Question	Answer
I have activated *Sign and encrypt data* for my data exports. I receive files with .gpg. How can I open these files?	In order to decrypt encoded data files sent by AmmonitOR, you have to install encryption software on your PC. Refer to Section 7.4.2, if you are working with Windows™. Follow the description step by step to avoid any misunderstandings.
I have imported the public-key as described in the manual, but I still cannot open the file, sent by AmmonitOR.	Check the following: • Did you certify the public key from AmmonitOR with your own private key? Both public and private key should be displayed under *Trusted certificates* in the GPG4win software (Kleopatra). • If you decrypt the file in Microsoft Outlook™, open the email item, click on the attached file and open the *Attachments* ribbon. Click on *Save and decrypt*. Clicking on *Decrypt* in the *GpgOL* ribbon does not work, as the email itself is not encrypted, only the data file. Both has to be considered separately.

Chapter 13

Glossary

AGPL
: Affero General Public License, a free software/open source license. See Wikipedia (`http://en.wikipedia.org/wiki/Affero_General_Public_License`).

AmmonitOR
: Ammonit Online Report. Software to manage different measurement projects.

CALLaLOG
: Software for PCs to configure Ammonit data loggers METEO-32 or download measurement data from Ammonit data loggers METEO-32.

GNU
: GNU is a Unix-like computer operating system developed by the GNU Project. See Wikipedia (`http://en.wikipedia.org/wiki/GNU`).

GnuPG
: Also GNU Privacy Guard or GPG is a free crytography software, which uses public-key cryptography to encrypt and decrypt data.

ROM
: Read-Only Memory. A storage medium used in computers. See Wikipedia (`http://en.wikipedia.org/wiki/Read-only_memory`).

Chapter 14

Release Notes

14.1 Release 3.6.5 (2016-11-15)

- Logbook: Interactive search field for logbook content.
- Meteo-40: Gust data files and full config data files are downloadable in data files section.
- Minor bugfixes in data export.
- Improved error messages for data file import.

14.2 Release 3.6.4 (2016-10-27)

- Better detection of overlapping data files. If just one entry is overlapping due to config changes in Meteo-40, both entries will be deleted.
- Data Export: AmmonitOR supports TOA5 Format.
- Config page and plots display Value statistic.
- Access confirmation emails don’t provide any broken links.
- API: Upload type of data files will be sent as well.
- Sending test data to an AmmonitOR project will create the data logger if it does not exist already.
- Import of data files is improved.

14.3 Release 3.6.3 (2016-10-12)

- Import of big number of data files no longer causes creation of duplicate sensors.
- Wind direction evaluations are enabled for usage with monthly profile.
- CSV export provides space as a seperator.
- Data logger widgets show offline sign while data logger is not connected to tunnel.
- Sorting of table columns of project detail view is now possible.
- General bugfixes to configs, file import, calendar views, Zephir sensors compatibility.
- Config list view has a separate table for deactivated configs now.

14.4 Release 3.6.2 (2016-09-22)

- Guest users can no longer view statistics pages.
- Data avaliability plot targeted for remote sensors is introduced.
- General bug fixes to widgets, logbook, exports.
- AmmonitOR zeroes the solar evaluations when negative channel values are present, while overriding the config by user.

14.5 Release 3.6.1 (2016-09-09)

- Rest API is intruduced to AmmonitOR. It is possible to access detail project and data logger informations as well as download data logger files through 3rd party application.
- Data avaliability plot.
- General bug fixes to data export, plots and UI.

14.6 Release 3.6.0 (2016-08-05)

- AmmonitOR runs now under Debian 8.0 (Jessie) system instead of Debian 7.0 (Wheezy).
- Better support of AQS files.
- AQS and Zephir300 configuration take no longer unnecessary file period into account.
- Power curve measurement plots can be again compared with database wind turbines.
- Exports give possibility of setting a custom order of columns using a drag-and-drop.
- Exports give possibility of formatting the files header.
- EPE export allows choosing wind speed evaluations.
- Export cannot be sent beyond current date.
- Export log provides a valid tirgger for sending export.
- Activation and disactivation of evaluations is now more user friendly.
- Measurement data page column order is the same as in CSV data file now.

14.7 Release 3.5.3 (2016-05-10)

- AQS data import’s upload form was not allowing to select files and prevented import.
- Measurement data view displays the year information above the table.
- In several places the data logger firmware was not displayed as latest version.
- Some detailed reports were not generated, because of a bug in turbulence intensity plot.
- Data logger widget shows a more informative message, if the needed evaluation is available.

14.8 Release 3.5.2 (2016-04-26)

- Minor bug fixes in reports generation.
- Added AmmonitOR icon to the right uppper corner of webpage.

14.9 Release 3.5.1 (2016-04-16)

- SODAR AQ510 is supported by AmmonitOR.
- Zephir import with gaps and 10min averages were refused in the past. AmmonitOR is now able to detect gaps.
- Measurement data page had sometimes issues with displaying the correct end date and time of the day.
- All power evaluations (”active_power”) can be grouped as evaluation pair. Before it was only possible for ”active_power Total”.
- Removed obsolete button ”Access data logger via tunnel” for Meteo32 and Remote Sensors in Connections table view.
- Several minor issues in power curve plot, energy yield plot are solved.

14.10 Release 3.4.15 (2016-03-18)

- Performance and stability changes to server.
- Minor problems are solved in energy yield plot and statistic page of average tables.
- Reports are able to display all evaluations again and not only ones, who are listed in config (Temporarily issue since 2016-02).

14.11 Release 3.4.14 (2016-03-04)

- Table of statistics allows different statistic types and average periods.
- Power Curve graph shows additionally the power coefficent curve.
- Several minor bugfixes in reports and plots.
- Project creation page provides some help text.

14.12 Release 3.4.13 (2016-02-29)

- Table of data files is now sortable.
- Histogram plot is able to display negativ ranges as well.
- Fixed a problem with displaying data files in calendar view in right order.
- Reports: Add better handling for large tables with many rows.
- Reports: If data is missing in reports due to communication issues on data logger side, the report generation will wait until 2 days. After the report will be generated.
- Reduced query load for server administration pages.
- Search field on project overview is sensitive for data logger serials and project keys.
- Completeness calendar highlights row and column if mouse hovers over.
- Analysis table for wind speed evaluations is added. It displays average, completeness, calms, entries and turbulence intensity for chosen month or year.
- The email subject of data exports is editable.

14.13 Release 3.4.12 (2015-12-18)

- Week’s Review: Fixed a problem with showing the connections of the current day.
- Connection Log: Added time information to mouse over banner.
- Fixed a problem in Zephir data import.
- XY plot: Percipitation and Sum had no unit.
- Data logger widget: Resolved an issue in the greyout mechanics, when data seems to be old.

14.14 Release 3.4.11 (2015-11-11)

- Added some performance optimisations for logger detail page, configuration list, evaluation list, photos and data export list.
- Added a display option for looking at data files raw content.
- Data file download uses the original filename.
- Fixed data logger delete function.
- Fixed: Connection log was temporarily not available in Google's Chrome.

14.15 Release 3.4.10 (2015-10-23)

- Data files are now organised by month with an index page to jump to a specific month.
- Data files list page has been made faster.
- Data logger name, type and coordinates are taken from the latest configuration file, but it is possible to override them in AmmonitOR. Leave the fields open and AmmonitOR will display the configuration values.
- Configuration list is in reverse order now. The lastest entry is first for better readability.
- Fixed a problem with data file zip download.
- Fixed data logger overview it shows either the from CSV imported values or the latest data snapshot if it is newer.

14.16 Release 3.4.9 (2015-10-10)

- Fixed connection log issues when using Mozilla Firefox.
- Increased maximum data file upload size to 4MB (uncompressed)
- Fixed a problem with zipped EPE exports

14.17 Release 3.4.8 (2015-10-08)

- Larger CSV exports are now possible with a pickup-delivery system.
- Timezone support added to connection log, allowing connections to be shown in local time.
- Data tables now have link to relevant data file.
- Data tables now have units and relevant configuration information.
- Warnings are now clearer on data file detail page.
- Older files from Zephir remote sensors can now be processed.
- Added server administration tool to conveniently restore system from backup.
- Speed and performance improvements on a number of pages.

14.18 Release 3.4.7 (2015-08-17)

- Fixed a problem that arose when configuration overrides were created for solar irradiance evalautions.

14.19 Release 3.4.6 (2015-08-13)

- Missing coordinates are now allowed in Meteo40 data files.
- Data snapshot overview page now handles new/removed evaluations cleanly.
- Improved error message when unrecognised ZPH data files are uploaded (Zephir).

14.20 Release 3.4.5 (2015-08-04)

- Page for creating and updating raw data exports is now working again.

14.21 Release 3.4.4 (2015-07-28)

- Power curve measurement report is now available.

14.22 Release 3.4.3 (2015-07-27)

- Export email of original data file had no attachment.

14.23 Release 3.4.2 (2015-07-23)

- Power curve report is disabled temporarily. In next release the report will be available again.
- Bug fixes in import module.
- Several major and minor bug fixes.

14.24 Release 3.4.1 (2015-07-15)

- Support for Zephir300 devices: Zephir300 CSV data files (10 minute averaged) can be uploaded (ftp or manually) now; Full integration into AmmonitOR.
- New data import experience: Much better feedback about uploaded data files; Improved data upload performance.
- Richer data file overview: More information about data file; Better original data file view; Improved handling of data files (Delete all invalid files with one click).
- New timeline feature: See everything that happens in your AmmonitOR project over time in one view.
- New report period: Bimonthly.
- Week's review: time range is now adjustable (7 days, 14 days, 21 days and 28 days).
- Better experience with evaluation selection in several plots.
- Bug fixes in Wind power density and energy yield plot.
- Bug fix in configuration overwrite. AmmonitOR refused to overwrite values of pyranometer evaluations. As result no values were displayed.
- Several major and minor bug fixes.

14.25 Release 3.3.10 (2015-03-4)

- Confusing presentation of coordinates are resolved.
- Photos have more display options. Coordinates for documentation, gallery for documentation and photo timeline to display monitoring photos send by data logger. The photo timeline will have more display options in future.
- Fixed bugs in plot wind power density and energy yield.

14.26 Release 3.3.9 (2015-02-05)

- Weather station support is disabled, because the external weather api is no longer reliable.
- Boom orientation is added to the sensor desciption and will be displayed when necessarpy.
- Connection log now displays exact start and finish times for uploading connections, in case they take longer than a few seconds. This should be useful for monitoring slow uploads (eg via satellite).
- Data file completeness calendar now repeats its header for every year, useful for long term projects.
- Data file completeness calendar now shows latest entries at the top.
- Bug fix: Solar irradiance formula was not found when adding a new evaluation.

14.27 Release 3.3.8 (2014-12-19)

- Changed MGM summary export format to allow missing air density sensors, and removed temperature height.
- Data export calendar was only displaying attempted deliveries, it now displays whether or not an export was successfully sent.
- Data export filename and email subject are improved with more details about format and period.

14.28 Release 3.3.7 (2014-12-15)

- Extension of MGM export formats with summary file format (S) is added.
- Evaluation completeness analysis is now able to correctly handle overlapping configuration periods.
- Minor bug fixes: Daily and monthly profile plots can now handle doubled evaluations.

14.29 Release 3.3.6 (2014-12-03)

- Turkish MGM data export now allows users to choose which height evaluations are used for the D file. The evaluation with the nearest height is chosen.
- Display configuration on data file page if available (METEO-32 data loggers).

14.30 Release 3.3.5 (2014-11-20)

- New regulation for Turkish MGM data export filenames e.g. 120001_20141120_R.txt.
- Improvements in filter for overlapping data files.
- Report changes in standard, detailed, compact. Added information of used wind vane in shadow zone plot. Restored missing plots speed direction bar and speed direction dots. Keep in mind that evaluation pairs a necessary for these plots.
- Minor bug fixes: calm analysis, power curve plot.

14.31 Release 3.3.4 (2014-11-13)

- Periodic data snapshots and monitoring photos can now be uploaded from Meteo-40 dataloggers.
- Project period is more prominent.
- Minor bug fixes: monthly profile, turbulence intensity, wind power density, long term comparison.

14.32 Release 3.3.3 (2014-10-17)

- Status and photo upload via data logger Meteo40 is available. New menu point for photo upload ”data snapshot”.
- Report regeneration is improved. Every single report is selectable for regeneration.
- We fixed a problem concerning to display data completeness.
- Logbook calendar has a legend.
- Example projects get new permissions. Read and download permissions are available.
- Minor bug fix: Shadow zone plot, longer term comparison profile, monthly profile, histogram

14.33 Release 3.3.2 (2014-09-22)

- Minor bug fix: SMTP import server.
- Minor bug fix: Shadow zone plot.

14.34 Release 3.3.1 (2014-09-17)

- Minor bug fixes, increasing processing stability.
- Wind turbine example data are available for plots.

14.35 Release 3.3.0 (2014-09-15)

- Sidebar menu is cleaned up and restructered.
- New plot: Wind power density. Plot wind power density in a polar view.
- Log book feature provides a calendar view for entries.
- Project color can be chosen by user.
- Minor performance improvements.
- AmmonitOR is ready for full configuration file upload of Meteo-40.
- New example project for power curve measurement is added with 13 example turbines. The data of example turbines are available for every project.
- Minor bug fixes in plots energy yield estimated, wind speed, long-term-comparison profile.

14.36 Release 3.2.2 (2014-07-29)

- Major performance improvements.
- New plot selection menu to make it easier to find the plot you need.
- New plot: Histogram. Generic histogram of any evaluation.
- New plot: Energy yield. Compare your measurements to your power curves in the toolbox.
- New plot: Estimated energy yield. Compare your measurements to your power curves in the toolbox.
- New plot: Shadow zone can now be shown on cartesian axes.
- Improved photo documentation, including direction markup and cardinal points view.
- Removed error measurement exclusion from filters for performance reasons, will be replaced with new filter framework in the near future.
- Added ability to sign data exports without encryption.
- Raw data files can now be viewed online in table format.
- Projects now have unique colours to help quickly identify which project is active.
- Numerous smaller bug fixes.

14.37 Release 3.2.1 (2014-06-25)

- General stability improvements and help pages are accessable again.

14.38 Release 3.2.0 (2014-06-18)

- New, more readable URL addresses, old bookmarks should redirect appropriately.
- New toolbox for adding tubine power curve information.
- New calendar view for data export logs.
- New power curve measurement report.
- New plot for calms analysis.
- New plot for power curve.
- New plots for energy yield.
- The wind direction and wind speed plots now support up to 144 sectors (2.5°).

14.39 Release 3.1.20 (2014-04-16)

- New information is provided on each plot: what it represents, why it might be useful and how to read it.
- A ”connection alarm” can be sent for each connection as it arrives, not just for when it is missing.
- New users can create new accounts themselves online, through a link on the login page (”sign up”).

14.40 Release 3.1.19 (2014-03-21)

- The weekly report subscriptions always start on monday for consistency.
- Speed direction bar has new option for showing a table with weibull’s a and k for given sectors.
- Monthly profile plot supports flexible start and end dates.
- You can now view wind direction evaluations in a monthly profile plot.
- Daily profile plot has new option to scale axes for better comparison.
- Stability improvements for report generation, wind speed plot and daily profile plot.

14.41 Release 3.1.18 (2013-12-16)

- Added new permission level. The Configurater can change data handling and management, but cannot download data or change project user permissions.
- Minor but necessary improvements for data export (FTP settings), daily-profile, wind-speed graph and reports.

14.42 Release 3.1.17 (2013-11-22)

- Added a button to view details of a related configuration file.
- Minor but necessary improvements for data export, filters, XY-graph, wind-speed graph and long-term-comparison profile.
- In reports the permissions of project users are inherited.

14.43 Release 3.1.16 (2013-11-15)

- Tunnel connections over 24 hours are displayed correctly in connection log.
- Meteo-40 communication configuration is displayed by configuration detail page.
- General improvements for XY-graph

14.44 Release 3.1.15 (2013-11-13)

- General improvements for XY-graph.
- Minor fixes in UI.

14.45 Release 3.1.14 (2013-11-11)

- Project permission system are refactored. The new permissions are: Admin - Full permissions, User - Can change configuration, but cannot manage users, Viewer - Can see and download data, but cannot make changes, Guest - Can see plots and summaries, but cannot download data.
- Logbook entries of data logger Meteo-40 are automatically uploaded and displayed.
- Option for showing public weather information in XY-graph and map, if data logger has coordinates.
- Fixed problem where Forgot-Password email wasn’t send, if the user forgot to set a valid password during the first week account validation time.
- General improvements for the plots XY-graph and ”Long time comparison”-graph.
- Fixed problem with ”earlier connection” button at connection log page.
- Project data logger overview shows only active evaluations.
- Delete button for incident log was added.
- The documentation was updated.

14.46 Release 3.1.13 (2013-09-02)

- Minor but necessary UI fixes for previous release.

14.47 Release 3.1.12 (2013-08-30)

- Export original data files, with the normal export features (eg grouped by month, zipped, encryption, automatic delivery via email and ftp).
- New evaluation pairs. Allows pairs of evaluations (eg Speed/Direction) to be defined. These are then used for various plots, exports and reports.
- New data logger overview, showing most important details for each data logger to quickly identify any possible issues.
- New plots for long term comparison profile: wind speed relationship and turbulance intensity trend.
- French language now available.
- New, cleaner configuration detail page.
- Clicking on a plot in the All Evaluations (7 days) overview allows the plot's parameters to be edited.
- Successful SCP upload tests from Meteo-40 data loggers are recorded and displayed alongside other data logger connections in the connection log.
- Fixed problem where plots were not visible with Internet Explorer 8 (not officially supported).

14.48 Release 3.1.11 (2013-08-07)

- Speed up for All Evaluations (7-days) page.
- Speed up for individual plots.
- Improved layout for data logger configuration detail page.

14.49 Release 3.1.10 (2013-07-29)

- Wind direction evaluations cannot be recalculated from channels, as they require a vector average. A new evaluation can now be created to add an offset to an existing evluation, calculated by the data logger using vector average.
- Only files with statistic intervals of or greater than 1 minute are accepted.
- Coordinates entered in Meteo-40 data loggers (with latest firmware) are imported.
- Data loggers are listed as a table in the project overview.
- The data logger under the mouse cursor is highlighted in the map in project overview.
- Infrastructure improvements, using new server software for better performance.

14.50 Release 3.1.9 (2013-06-07)

- Simpler configuration for data exports.
- Custom field selection for data export.
- New fields for data exports: data logger serial, project name, data logger name, original data filename.
- Custom date format for data exports.
- New data export format for projects in Brazil: DEA 10/13 (Empresa de Pesquisa Energética, Brasil).

14.51 Release 3.1.8 (2013-05-03)

- New connection alarm feature for all users: Let yourself be notified if no connection has been made from the data logger for a certain time.
- Upgrading weibull parameter estimation to use Modified Maximum Likelihood Estimation, a very accurate method for estimating weibull parameters.
- Added a tool to help find and remove duplicate and overlapping data files.
- Plots can now be downloaded in high resolution PDF format for closer inspection and printing.
- Points in wind direction XY plots are now joined, lines wrap around 360°-0° intelligently.
- A short connection log now appears at the top of the ”All evaluations (7 days)” page.
- Identical reports have been removed and now cannot be accidentally created.
- Days with too many data are now shown clearly as blue in the calendar, use the duplicate/overlapping data file tool to resolve these issues.
- Fixed MS Excel report to format values and dates as data, not text.
- Small changes to data export UI.
- Removed ”undo” option from project deletion, projects are now deleted instantly and permanently.
- Added incident logs for beta testers, to allow certain data to be manually excluded.

14.52 Release 3.1.7 (2013-04-10)

- Improved formatting in MS Excel export, including frozen panes, clearer header and better column widths.
- Connection log now shows weekdays/weekends in background.
- Added a new plot showing a bar chart for visualization of sunshine duration.
- Available reports can be marked for regeneration by admin users.
- New connection alarm feature for beta testers.

14.53 Release 3.1.6 (2013-03-27)

- AmmonitOR-only evaluations are now also included in data export.

14.54 Release 3.1.5 (2013-03-22)

- Added a new page showing plots for all evaluations over the last week.
- Added a new date/time picker to help choose dates in forms.

14.55 Release 3.1.4 (2013-03-14)

- Reports are now automatically delivered by email when available.
- Disallowed two data loggers with the same serial in a single project.
- A warning is displayed for data exports that might not be possible (eg very large MS Excel files).
- More and clearer information on the data export log page.
- The sun status evaluation detail page now shows its sum.
- XY plot can now show sun status sum.
- Email and SCP connections are now more visible on connection log page.
- All months are now available in the table of averages.

14.56 Release 3.1.3 (2013-03-08)

- FTP passwords no longer need to be reentered for data exports.

14.57 Release 3.1.2 (2013-03-05)

- Fixed connections problems for data imports via SCP with Meteo-40.
- Fixed problem with images in documentation.
- Added a predictable channel ordering for data export.

14.58 Release 3.1.1 (2013-03-01)

- Log files for data exports are now available.
- Data file deletion now possible.
- Release notes are now available in the documentation.

14.59 Release 3.1.0 (2013-01-25)

- Software libraries updated.
- Plot enhancements.
- Report enhancements.

14.60 Release 3.0.3 (2012-12-13)

- Fix minor problems.

14.61 Release 3.0.2 (2012-12-04)

- Fix problem with report generation.
- Fixes for different plots.

14.62 Release 3.0.1 (2012-11-20)

- Fix problem with truncated encrypted files.
- Support sun status on analog inputs for METEO-32.
- Fix problem with unavailable export options..

14.63 Release 3.0.0 (2012-11-08)

- Signing and Encryption support with GnuPG.

14.64 Release 2.1.0 (2012-05)

- Graphic display of tunnel connections from your Meteo-40 data logger.
- Online support form, providing the Ammonit support team with sufficient access and information
- Allow a user to unsubscribe from email alerts
- New plot: ”Shadow Zone Plot”
- New plot: ”Turbulence Intensity”
- New plot: ”Daily Profile”
- New plot: ”Monthly Profile”
- New plot: ”Turbulence Intensity Polar”
- New plot: ”Correlation Plot”
- New plot: ”Sunshine Hours Histogram”
- New plot: ”Overlay Graph”

14.65 Release 2.0.0 (2012-01)

- The new Ammonit Data Logger Meteo-40 is supported now!
- The data access should be faster.
- Individual data entries cannot be marked anymore, instead use a filter.
- A series of small usability improvements and bug fixes has been applied.

14.66 Release 1.2.0 (2011-03-30)

- New data upload page, to upload old data directly from the browser.
- New METEO-32 value calculator, to help interpret data sent from a METEO-32 data logger.
- Date based pagination for data page.
- Data can now be exported as a ZIP file of daily CSV files for any given time period.
- Extensive review of data integrity.
- Axes in XY charts are scaled identically for all identical units.
- New list of all data loggers in all projects.
- Series of small usability improvements.

14.67 Release 1.1.2 (2011-01-20)

- New data calendar view for each data logger, to recognise missing data.
- CSV Export now uses your custom slopes and offsets.
- Bug fix: Anemometer channels (s1, s2, s3, s4) previously did not take into account the different unit in the offset. This did not change the values, unless a custom offset was set in AmmonitOR. Old data has been automatically converted and new data will be converted when imported. If a custom offset was used, the data will be corrected, we have informed all affected users directly.
- New page for Frequently Asked Questions in manual.
- Series of small usability improvements.

14.68 Release 1.1.1 (2010-12-02)

- Reports are now include high resolution charts.
- Raw data is now shown in data view.
- Data view popup now shows complete data for a given measurand.
- Messages now link to related data entries.
- extended channels (v1, v2, v3, v4, c1, c2) now have their raw values converted, and units provided. Old data has been automatically converted and new data will be converted when imported.
- Past reports are now also listed.
- Several minor improvements for stability.

14.69 Release 1.1.0 (2010-11-30)

- You can subscribe to monthly data reports in PDF format, sent to your email address.
- All plots can now be downloaded and printed in PDF format.
- Photos for each data logger can be uploaded.
- You can export and download your data as a CSV file.
- The data import is now more flexible (eg using data from CALLaLOG).
- Your data logger data is now stored in its own separate datastore for security and speed.
- Our automatic testing has grown to cover all aspects of AmmonitOR.
- A number of small usability changes have been made (see eg the data entry list!).
- A number of small fixes and tweaks.

Chapter 15

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Version 3, 19 November 2007

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To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively state the exclusion of warranty; and each file should have at least the “copyright” line and a pointer to where the full notice is found.

```
one line to give the program's name and a brief idea of what it does.
Copyright (C) year name of author

This program is free software: you can redistribute it and/or modify
it under the terms of the GNU Affero General Public License as published by
the Free Software Foundation, either version 3 of the License, or
(at your option) any later version.

This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
GNU Affero General Public License for more details.

You should have received a copy of the GNU Affero General Public License
along with this program.  If not, see http://www.gnu.org/licenses/ (http://www.gnu ↩
    .org/licenses/).
```

Also add information on how to contact you by electronic and paper mail.

If your software can interact with users remotely through a computer network, you should also make sure that it provides a way for users to get its source. For example, if your program is a web application, its interface could display a “Source” link that leads users to an archive of the code. There are many ways you could offer source, and different solutions will be better for different programs; see section 13 for the specific requirements.

You should also get your employer (if you work as a programmer) or school, if any, to sign a “copyright disclaimer” for the program, if necessary. For more information on this, and how to apply and follow the GNU AGPL, see http://www.gnu.org/licenses/ (`http://www.gnu.org/licenses/`).

Chapter 16

Administration

This chapter applies only, if you are the administrator of your own AmmonitOR instance.

16.1 Installation Requirements

If you wish to install AmmonitOR on your server, please contact Ammonit and consider the following aspects.

16.1.1 Hardware Requirements

Consider the following hardware requirements for your AmmonitOR installation. Better hardware means more performance while using AmmonitOR. Recommendations are:

- A server known to work with Debian Linux (e.g. Ubuntu servers also work with Debian)
- Quad core CPU ≥ 2.5 GHz
- Compatible with the `amd64` architecture, i.e. Intel or AMD
- ≥ 8 GB RAM
- ≥ 500 GB hard disk space

16.1.2 Requirements for the server administrator

For the administration of an AmmonitOR server, you need to be familiar with the following tasks:

- Debian-Linux server administration (Wheezy)
- SSH (including key based authentication)
- starting/stopping services using upstart
- Nginx, Gunicorn, PostgreSQL, and RabbitMQ configuration and administration

16.1.3 Server Installation

For remote installation of AmmonitOR by Ammonit, you have to provide:

- Operating system: Linux, esp. Debian 7.4 („Wheezy“)
  You can download Debian at `http://cdimage.debian.org/cdimage/release/7.4.0/amd64/`. The installation guide can be found on `http://www.debian.org/releases/stable/installmanual` (several languages available).

- Server must have a public (remote accessible) IP address. A router in between does not cause any problem; the router has to be configured for port forwarding.
- Server must be accessible over SSH (secure shell). SSH server (package: `openssh-server`) must be installed on the Linux server.
- We need either a root account or a user account with full `sudo` permissions. Use strong passwords, e.g., generated by AGP. For even higher security use login over SSH authorized keys.
- If the server is only accessible via VPN, it must support Linux client (e.g. OpenVPN). Any proprietary firewall software can lead to problems and may not be supported by Ammonit.
- Port 443 (or another port of your choice) must be accessible for installation and usage. Optionally also port 80, in addition to port 443.
- Port 2222 (or another port of your choice) must be accessible for continued server maintenance. The port will be used for remote access via SSH. Port 22 is not advised for security reasons or if a custom tunnel server is configured.
- Port 4041 has to be accessable from everywhere. The port is used by Meteo-40 data loggers to upload data to AmmonitOR.
- Ports 22 and 4040 must be accessable from everywhere. These ports are used by Meteo-40 data loggers to setup tunnel connections (only needed, if a custom tunnel server is configured).
- An email account (IMAP) to collect the data files from Ammonit data loggers. AmmonitOR requires the account's password. The account must have enough memory space to archive the emails.
- An email account (SMTP) to send reports, messages, etc. from AmmonitOR.
- Email address of your system administrator.

16.1.4 AmmonitOR Architecture

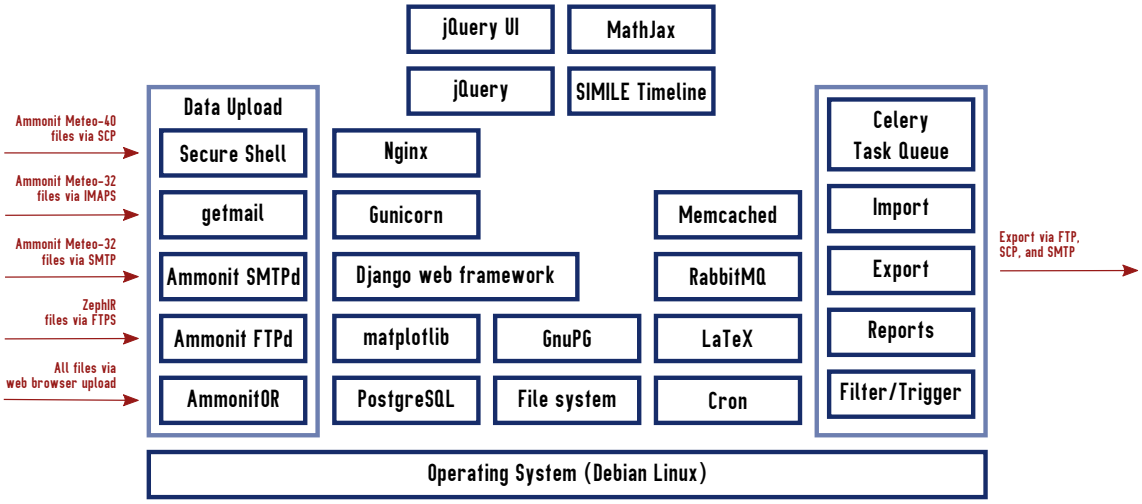

Figure 16.1: AmmonitOR Architecture

16.2 Administration Interface

For maintenance purposes access the administration interface of AmmonitOR. The administration interface is only needed in rare cases. Most configurations can be made in the user interface.

Important
Each change made in the administration menu is final. There are no confirmation prompts!
Make only changes, which are absolutely necessary to reduce mistakes.

To access the administration interface, replace the `Project key` in URL with `admin` (see URL in Figure 16.2). Login is only possible with admin rights. The most important elements of the administration interface are:

- User administration -- *Site users*
- Projects administration -- *Projects*
- Data Logger administration -- *Loggers*

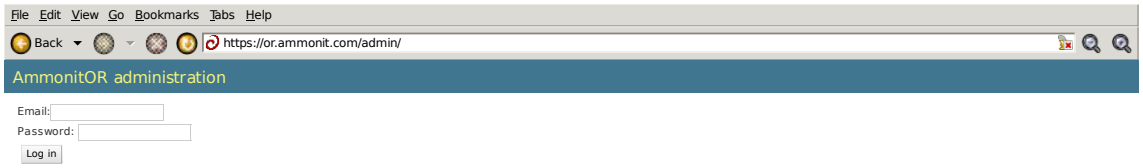

Figure 16.2: Administration Log In page

All administration pages support searching and filtering. The search field is always on the top left. The filtering options are provided on the right side of the list.

In order to edit project settings, the *Action* dropdown menu or the *Add* button can be used. The *Action* dropdown menu is always above the list under the search field. The *Add* button is on the top right. Each list element is editable, e.g., in the project administration. To do so, click on the item, e.g., project name, to display all details and start editing. All displayed fields can be modified. Save the changes by clicking on *Save*.

The history of changes can be displayed by clicking on the button on the top right. To display the project, click on the link button.

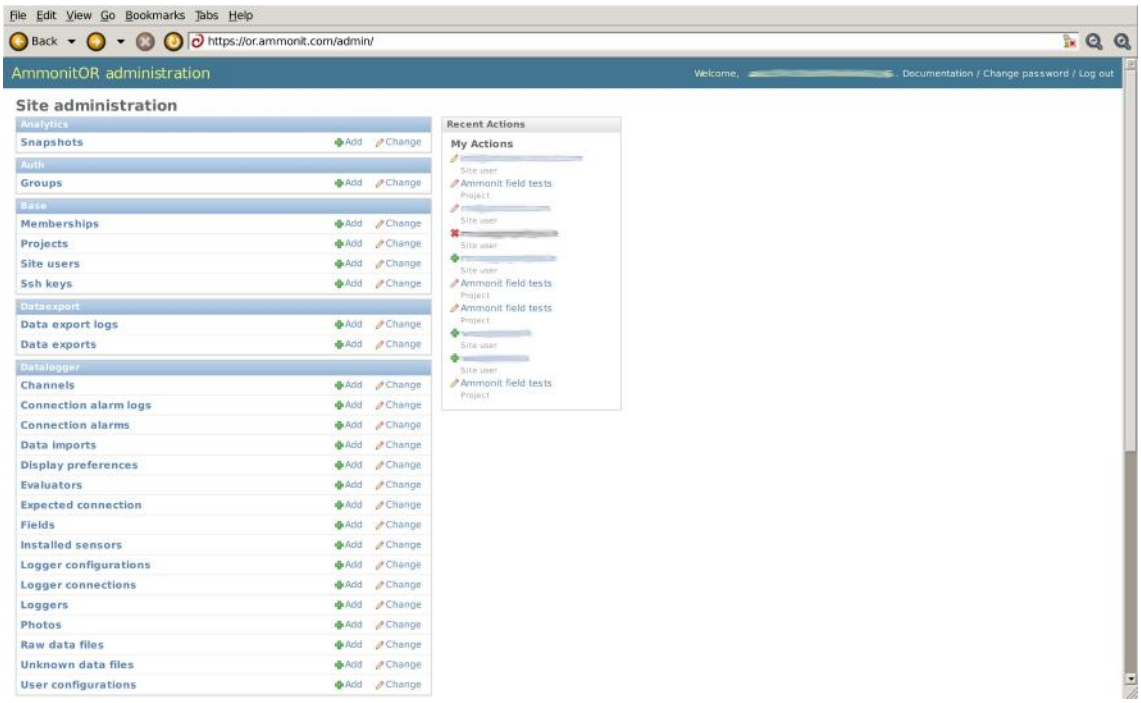

Figure 16.3: Administration home view

16.2.1 User administration

In the user administration *site users* and access rights can be managed. AmmonitOR displays to which projects the user has been invited to and the permissions related to the project. Usernames and passwords can be changed. New users can be added by clicking on *add user* on the top right. Optionally, full name, company and telephone number can be entered.

Users can be selected via the search box on the *site users* page. To perform an action, select an users by activating the checkbox in the first column and choose the action from the dropdown list above the user list. Click on *Go* to perform the selected action.

In the edit mode of a project five attribute fields are available: username, password, personal info, permissions, important dates and project memberships. Additional project memberships per user can be added; three permission types can be selected.

Superuser Administrator of AmmonitOR; system / server and content management (only for experienced users)

Staff status Users working with project data in AmmonitOR (recommended status for site users); not allowed to access the administration interface, only login page.

Alpha tester / beta tester Optional user permissions. `Beta tester` can work with new beta features of AmmonitOR. `Alpha testers` are for internal testing purposes used by Ammonit developers. It is not recommended setting this status to project users.

Important
By deselecting the `active` checkbox on the site user edit page, the selected user can be temporarily locked out from AmmonitOR. This feature can be useful in case of spam attacks.

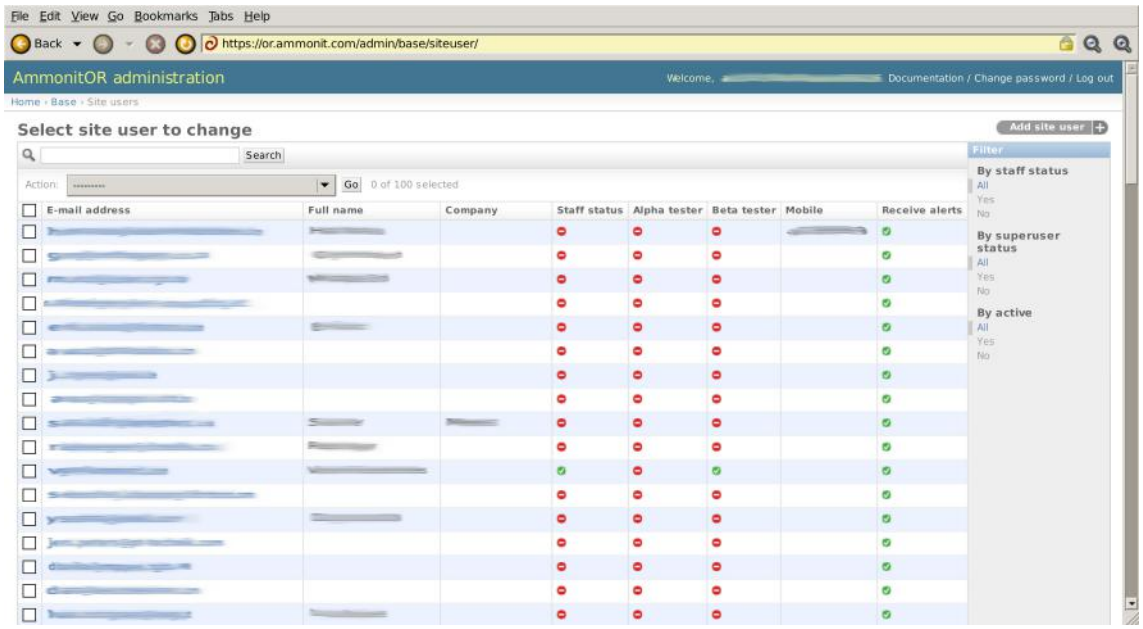

Figure 16.4: Site user administration page

16.2.2 Projects administration

The project administration page provides an overview over all relevant project details: project name, project key, data loggers, project users (members) and available reports.

In order to perform an action, e.g., delete a project or regenerate reports, select one or more projects by activating the checkbox(es) in the first column and choose an action from the dropdown list above. Click on *Go* to perform the action.

Click on *Add project* on the top right of the page to set up further projects. The project edit page displays all project details including user memberships. `Superusers` (see Section 16.2.1) can assign read and write permission to site users. Additionally, users can be added to projects. The *Project state* indicates whether a project is active or finished.

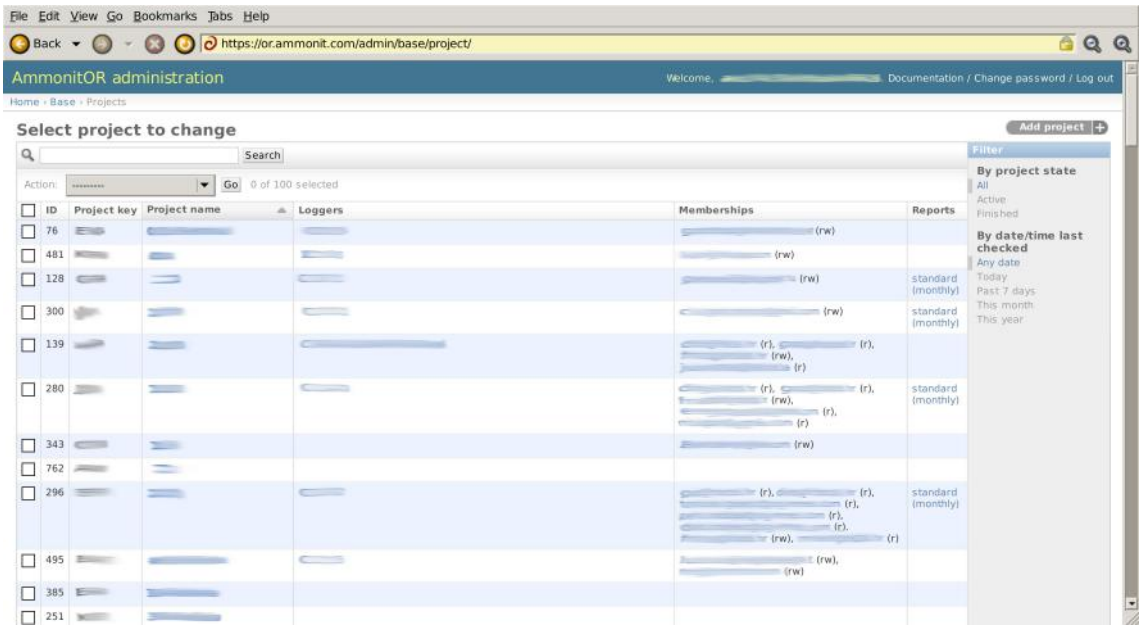

Figure 16.5: Projects administration page

16.2.3 Data logger administration

The data logger administration page lists all available data loggers with serial number, data logger type, name, import email address, firmware version and related projects.

To perform an action, e.g., delete a data logger or reimport missing data files, select one ore more data loggers by activating the checkbox(es) in the first column and choose an action from the dropdown list above. Click on *Go* to perfom the action.

Click on a data logger serial number to edit data logger details. On the data logger edit page AmmonitOR displays all settings of the data logger, e.g., related projects, serial number, name, import email address (Meteo-32), data logger type and firmware version.

Important
Ignore database table names and database model names. Do not edit the fields!

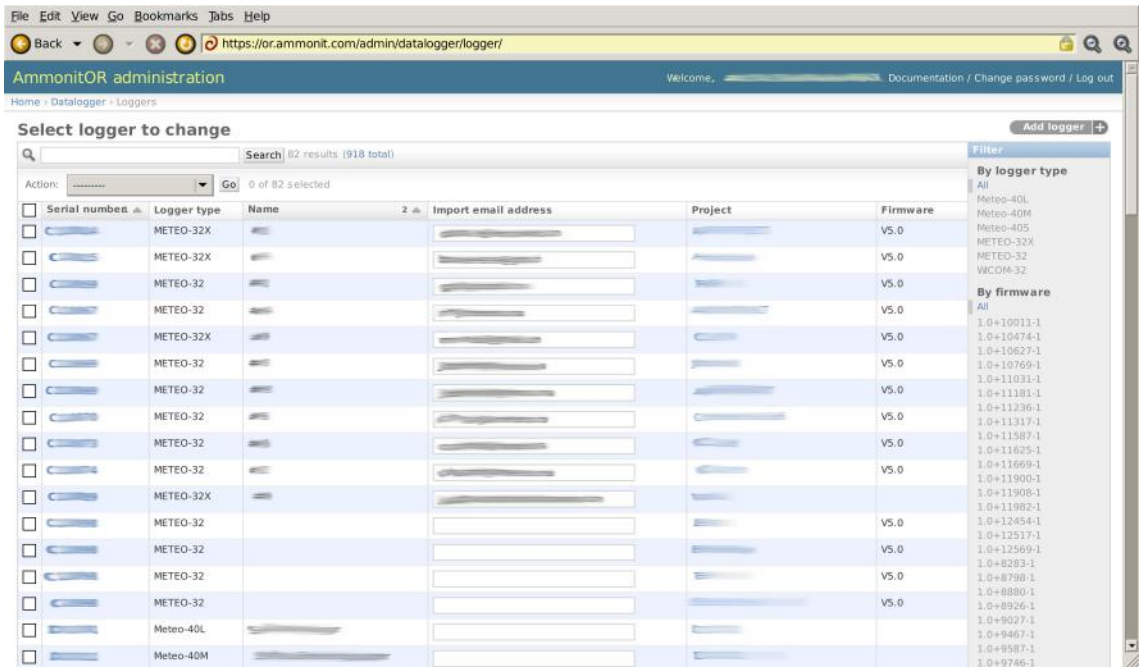

Figure 16.6: Data logger administration page

16.3 Common Tasks

16.3.1 Adding Meteo-40 SSH Keys

To allow Meteo-40 data loggers sending e-mails to AmmonitOR, the SSH key of the data logger has to be added in AmmonitOR. The SSH key can be downloaded in the Communication → AmmonitOR or the Communication → Online menu of the data logger web interface. Add the SSH key in the Base → SSH keys menu of AmmonitOR. Click on *Add ssh key* on the top right of the page.

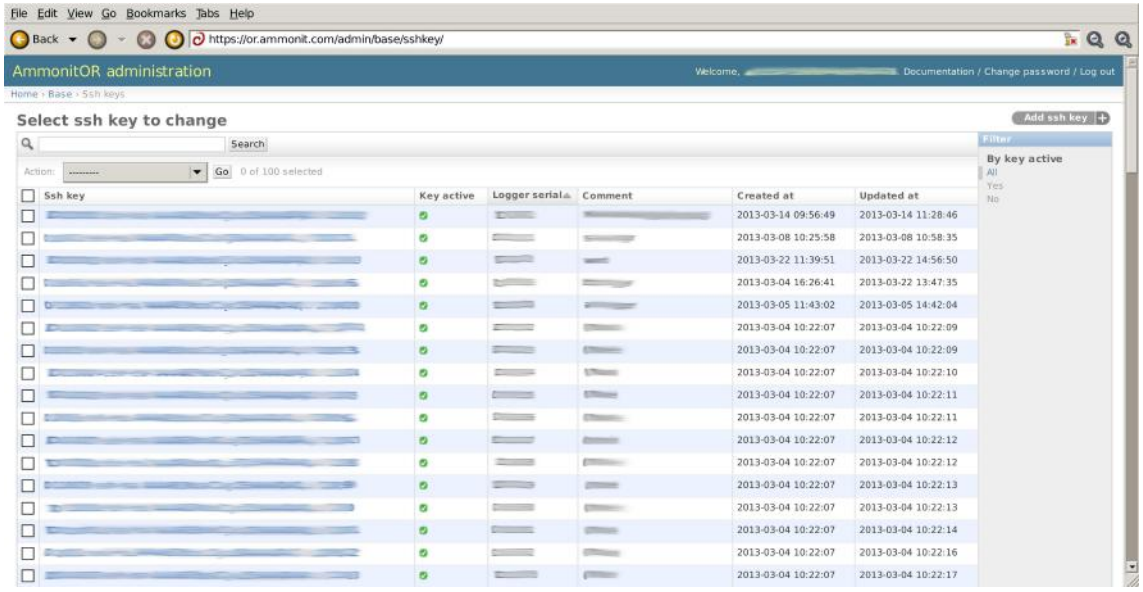

Figure 16.7: SSH key administration page

Copy and past the key into the `Public key` field. Insert the data logger serial number and save the action. This task has to be done once for each data logger.

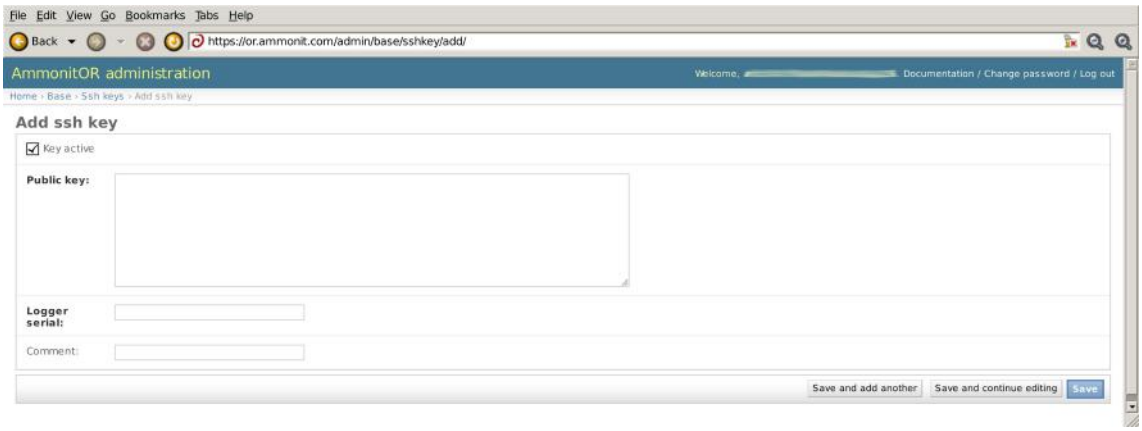

Figure 16.8: Add SSH key for a data logger

16.3.2 Managing raw data files

The raw data file overview page displays a list of raw data files of all available data loggers. AmmonitOR lists all files imported or not yet imported.

Not yet imported raw data files can be imported by choosing the `Reimport data` option from the dropdown list above. Click on *Go* to perform the action. The reimport may take few seconds.

It is not possible to make any changes on the data file edit page. However, the page displays further details about the file, e.g., import method, which is called *Email Message-ID or username*. AmmonitOR displays, which method has been used to import the raw data file, i.e. SCP (Meteo-40), email (Meteo-32) or manual upload. The related configuation file numbers are listed under `Config`. In the `File` field the file name in the database is displayed.

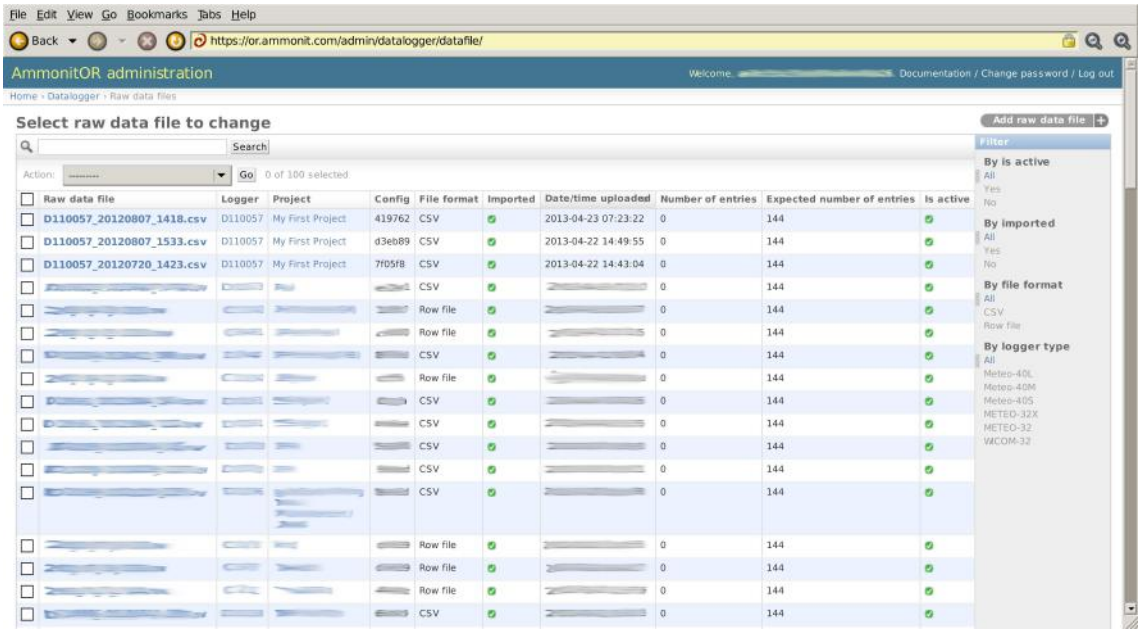

Figure 16.9: Raw data file page

16.4 Connecting custom data loggers with custom AmmonitOR

The following information is required for setting up a proper connection between custom AmmonitOR installation and Ammonit data loggers:

- Properly working custom AmmonitOR instance (https://or.yourdomain.com/)
- Properly working email import for METEO-32 data loggers
- Properly working tunnel access for Meteo-40 data loggers
- Administration rights on AmmonitOR and data logger
- Optional: Properly working custom tunnel server (Tunnel statistics at https://stats.tunnel.yourdomain.com/)

Ammonit Meteo-40 data loggers send data via SCP to the AmmonitOR server. Thus AmmonitOR must authenticate the data logger with its SSH key. The connection is established via a tunnel server. AmmonitOR `Project key` and serial number of the data logger are the references for managing data in the AmmonitOR database. To connect Meteo-40 data loggers with your AmmonitOR installation, some settings have to be made:

- Open the Meteo-40 web interface. Log in as `Admin`.
- Go to the Communication → Online menu and set the option *Ammonit tunnel*. Save the configuration.
- Go to the Communication → AmmonitOR menu and enter the `project key` from of related AmmonitOR project. Save the configuration.

If a custom tunnel server is used, further settings have to be made:

- Open the Meteo-40 web interface. Log in as `Admin`
- Go to the Communication → Online menu and set the option *Custom tunnel*.
- Enter your tunnel login, e.g., logger@Dnnnnnn.tunnel.yourdomain.com
- Empty the field *Tunnel port*, if an entry has been made. Save the configuration.
- Click on *Download SSH Key*. A new page opens and displays the `SSH key` of the data logger. AmmonitOR required this key for authentication. The SSH key has to be added in AmmonitOR under https://or.yourdomain.com/admin/base/sshkey/; see below.
- Go to the Communication → AmmonitOR menu and enter the project key from of data logger related AmmonitOR project. Save the configuration.

The next step is to connect AmmonitOR with the data logger:

- Open the AmmonitOR administration page (https://or.yourdomain.com/admin/). Log in as `Admin`.
- If the data loggers has already been added to a project, perform the following actions (Go to the next bullet point to add a data logger to a project):
  - Go to the Base → Ssh keys menu and click on `Add ssh key` in the upper right corner.
  - Paste the copied SSH key from the data logger in the fiels `Public key`. Enter the serial number of the data logger in the field `Logger serial`. A comment can be added.
  - Click on `Save` in the lower right corner.
- If a data loger has to be added to a project, perform the following actions:
  - Go to your AmmonitOR login page (https/or.yourdomain.com/); not the administration page. Log in as `User`, `Configurator` or `Admin` (read and write access is required).
  - Add the data logger as described in Section 8.1.1 and Section 8.1.3.
  - Add the data logger `SSH key` as described in Section 16.3.1.
  -

If a data logger is online available, it is shown in the `Connection log` (see also Section 4.4) or see additional tunnel tool https://stats.tunnel.yourdomain.com/. The Stats-page lists all tunnel statistics.

16.5 API for 3rd party applications

API (application progarm interface) allows creating a connection between the third party applications and AmmonitOR to exchange data. The third party application can download the raw data files with metadata (additional information) form AmmonitOR projects. The exchange of information is safe and protected with tokens authentication method. The detailed information about its functionality and security is described.

This chapter contains the exemplary requests to demonstrate the functionality of API connection using `curl` - a library for transferring the data. This library is avaliable for a big variety of of platforms (including Windows, Linux and OS X). Using this library and given commands the functionality of API can be demonstrated.

16.5.1 General concept

The general concept behind the connection of third party applications is usage of `http GET` request to connect to particular AmmonitOR addresses (urls) to get data and information. The data is returned as response in JSON format, which can be read by the application. It is simmilar to requesting the standard url, but done internally between AmmonitOR and application.

- At first the application needs to obtain the token for authentication with a `http POST` request to AmmonitOR. This request needs to be supplied with:
  - A valid AmmonitOR username (as `username`)
  - A project key (as `project_key`)
  - The application name (as `app_id`) in the data section of request.

  ```
  curl -X POST -d "username=user@example.com&project_key=EWNP&app_id=ExampleApp" https://or.ammonit.com/api/auth-token/
  ```

  Such information allows AmmonitOR to recognize the application details. AmmonitOR will then check if user has a permission to given project (as well as the download permission) and generate a unique token which will be returned as response to the request (in JSON format). Using this token for authentication for further connections with AmmonitOR, so the token must be saved.
- In the same time AmmonitOR will create an application enquiry in a project. Every new enquiry will display a information message box in the project views. It can also be accessed via project page under 3rd party applications. Any user in a project having both read and download permissions, can then accept the application enquiry or reject it. Only accepted applications can connect to AmmonitOR to get data. The information about the user who acceptted/restricted the application along with the time of this operation is recorded.

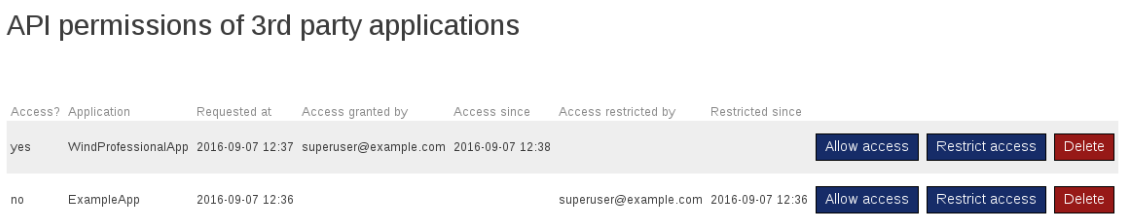

Figure 16.10: User interface to interact with the applications management.

- If user who requested the third party application connection looses the project permissions, the token is withdrawn and the application looses the connection. Similarly when the application gets restricted or deleted in the view by any user, the connection is lost.
- After gaining access, the third party application can request the further urls and data, while making the next `http GET` requests. This time the token recieved by the first connection needs to be passed in the request authorization header (just like in the example below). AmmonitOR only accepts the requests with a proper token and after confirming all user permissions.

  ```
  curl -X GET https://or.ammonit.com/api/requested_url/-H 'Authorization:Token 0eb9392d6b5fe83c35e2a25d7b6c0c1b61f0519f'
  ```

16.5.2 Avaliable responses

AmmonitOR offers a range of responses for third party applications. The user input parameters to the url are:

- *project_key* e.g. EWNP
- *logger_serial* e.g. D110057
- *filename.fileformat* with the name just as `original_filename` parameter. E.g. D110057_20160808_0000.csv

List of avaliable requests/responses:

- **Connect application with AmmonitOR and obtain authentication token**

  ```
  https://or.ammonit.com/api/auth-token/
  {"token":"0eb9392d6b5fe83c35e2a25d7b6c0c1b61f0519f"}
  ```

- **List of data loggers in project with their basic metadata**

  ```
  https://or.ammonit.com/api/{project_key}/loggers-list/
  [{"project":{"key":"EWNP", "name":"Example project"}, "serial":"D110057", "override_n
  ame":"abcdefgh", "series":"meteo-32", "station_number":"1", "override_timezone":"", "
  override_latitude":52.5025, "override_longitude":13.434849, "override_altitude":40, "
  is_active":true}, {"project":{"key":"EWNP", "name":"Example project"}, "serial":"C000
  001", "override_name":"My logger", "series":"meteo-32", "station_number":"2", "overri
  de_timezone":"", "override_latitude":52.5025, "override_longitude":13.434849, "overri
  de_altitude":30, "is_active":true}]
  ```

- **Basic information about particular data logger in project**

  ```
  https://or.ammonit.com/api/{project_key}/{logger_serial}/
  {"project":{"key":"EWNP", "name":"1"}, "serial":"D110057", "override_name":"abcdefgh"
  , "series":"meteo-32", "station_number":"1", "override_timezone":"", "override_latitu
  de":52.5025, "override_longitude":13.434849, "override_altitude":40, "is_active":true}
  ```

- **List of all the data logger files in AmmonitOR**

  ```
  https://or.ammonit.com/api/{project_key}/{logger_serial}/files/
  [{"original_filename":"D110057_20160808_0000.csv", "is_valid":true}, {"original_filen
  ame":"D110057_20160809_0000.csv", "is_valid":true}]
  ```

- **Download of the file content (one file per request only).**

  ```
  https://or.ammonit.com/api/{project_key}/{logger_serial}/files/{filename.fileformat}/

  {"original_filename":"D110057_20160808_0000.csv", "is_valid":true, "file_content":"Date/
  time,V1;wind_speed;Avg,V1;wind_speed;Max,V1;wind_speed;Min,V1;wind_speed;StdDev,V1;win
  d_speed;Count\n2016-08-08 00:00:00,1,2,3,4,5..."}
  ```

If your application requires more data, information, views or simply you would want to ask us questions about connecting your application to AmmonitOR, feel free to contact us. We are opened for providing more options in our API.

16.5.3 API example script

```
#!/usr/bin/python3

import argparse
import json

import requests

HELP_MESSAGE = """
List of avaliable views:\n
* 'permission' - make a enquiry for a new app in AmmonitOR\n
* 'all' - list all AmmonitOR loggers in project\n
* 'logger' - get the logger metadata\n
* 'file' - list all data files for a logger\n
```

```
* 'download' - download data files of given project and data logger\n
"""


def get_options():
    parser = argparse.ArgumentParser(
        formatter_class=argparse.RawTextHelpFormatter)
    parser.add_argument("-a", "--app",
                        help="Provide the application name",
                        default="Ammonit API test client")
    parser.add_argument("-f", "--file",
                        help="Data logger original filename, "
                        "e.g. 'D123456_20160808.csv'")
    parser.add_argument("-l", "--logger",
                        help="Data logger serial, e.g. 'D123456'")
    parser.add_argument("-p", "--project",
                        help="AmmonitOR project key, e.g. 'ABCD'",
                        required=True)
    parser.add_argument("-t", "--token",
                        help="Token to communicate with AmmonitOR, "
                        "coming from requesting the permission view")
    parser.add_argument("-s", "--server-url",
                        help="Server URL to use, e.g. https://or.ammonit.com",
                        default="https://or.ammonit.com")
    parser.add_argument("-u", "--username",
                        help="Valid AmmonitOR user, e.g. bach@example.com",
                        default="superuser@example.com")
    parser.add_argument("-v", "--view",
                        help=HELP_MESSAGE,
                        required=True)
    return parser.parse_args()


def format_output(output):
    return json.dumps(json.loads(output.decode('utf-8')),
                      indent=4, sort_keys=True)


def get_token(options, header):
    url = options.server_url + "/api/auth-token/"
    data = {'username': options.username,
            'project_key': options.project,
            'app_id': options.app}
    r = requests.post(url, data)
    print(format_output(r.content))


def get_logger_list(options, header):
    if options.project:
        url = options.server_url + "/api/%s/loggers-list/" % (options.project)
        r = requests.get(url, headers=header)
        print(format_output(r.content))
    else:
        print("Please provide the project key!")


def get_logger_data(options, header):
    if options.project and options.logger:
        url = options.server_url + "/api/%s/%s/" \
            % (options.project, options.logger)
        r = requests.get(url, headers=header)
        print(format_output(r.content))
```

```
    else:
        print("Please provide the project key and logger serial!")


def get_files(options, header):
    if options.project and options.logger:
        url = options.server_url + "/api/%s/%s/files/" \
            % (options.project, options.logger)
        r = requests.get(url, headers=header)
        print(format_output(r.content))
    else:
        print("Please provide the project key and logger serial!")


def get_download(options, header):
    if options.project and options.logger and options.file:
        url = options.server_url + "/api/%s/%s/files/%s/" \
            % (options.project, options.logger, options.file)
        r = requests.get(url, headers=header)
        print(format_output(r.content))
    else:
        print("Please provide the project key, logger serial, "
              " and name of file to be downloaded!")

requestables = {"permission": get_token,
                "all": get_logger_list,
                "logger": get_logger_data,
                "file": get_files,
                "download": get_download}

if __name__ == '__main__':
    options = get_options()

    header = None

    # We try to get header
    if options.view != "permission":
        if options.token:
            header = {'Authorization': 'Token ' + options.token}
        else:
            print("Please provide the token for authentication!")

    requestables[options.view](options, header)
```

Chapter 17

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