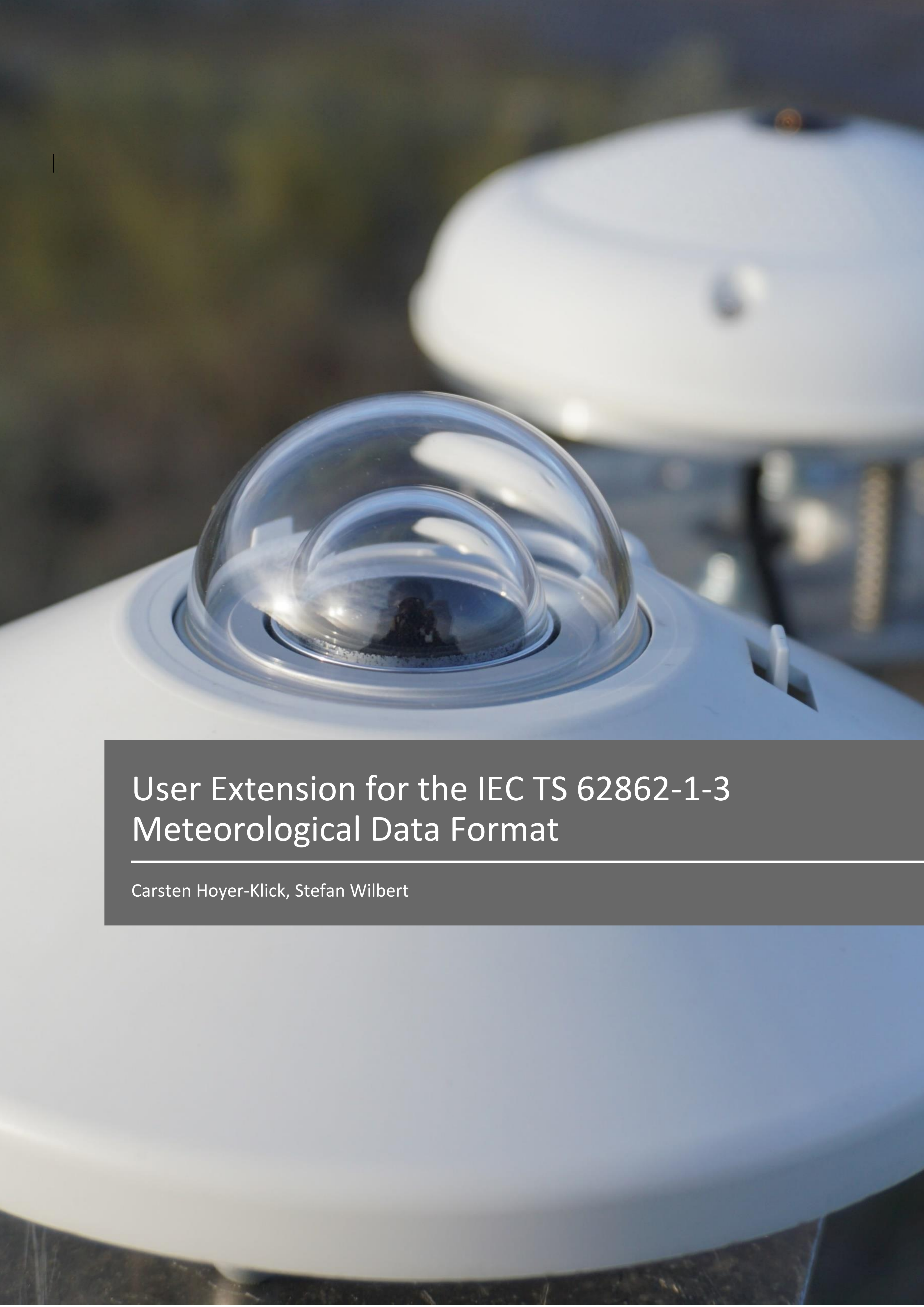

User Extension for the IEC TS 62862-1-3 Meteorological Data Format

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Characteristics of document

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Scope

The scope of this report is to create a user defined extension of the IEC TS 62862-1-3 data format based on experiences by using the data format within the SOLREV project and other applications that allows its application for PV. This ASCII based data format is convenient for the transfer and storage of small data sets, for example meteorological data from a single site and a limited number of years. For cases with larger data sets binary formats are more convenient. The netCDF format is recommended for such purposes by the authors. The present document also addresses these binary formats as also there a convenient and agreed upon vocabulary is required. Our work is connected to the Open Energy Ontology [Booshehri et al. 2021] (https://openenergy-platform.org/ontology/) and the standardization of parameter names and keywords can be applied to both text and binary formats

The original ASCII format can be found at IEC at https://webstore.iec.ch/publication/32167. The format offers two fields for user extensions:

- `#user_defined_fields yes`
- `#user_defined_fields_reference URL`

To use this user extension, the following lines should be added to the data file:

- `#user_defined_fields yes`
- `#user_defined_fields_reference https://doi.org/10.5281/zenodo.10001580`

This document describes the user defined fields, which can be referenced in the second line.

User Extensions

With this document we propose a number of user extensions.

The first block in table 1 is related to the FAIR data discussion. FAIR stands for "Finable, Accessible, Interoperable and Reusable" data in scientific research [Wilkinson et al. 2016].

The property "Findable" is usually realized by creating metadata about the data which is registered to a searchable metadata catalog. The enhancements proposed here add a number of fields which can be used to create a metadata set for such a catalog. The list is inspired by the Helmholtz Kernel information profile from the Helmholtz Metadata Collaboration [Curdt 2022].

"Accessible" is usually realized by placing the data into a repository which is accessible through standard internet protocols. This data does not need to be open, it can also be restricted by an authorization procedure (e.g. a login and a password or encryption).

"Interoperable" means that the data can be used by different actors and different software. Ideally this is done by interoperable data structures which are machine readable, as it often done with JSON or XML. The defined and standardized data format guarantees some kind of interoperability.

"Reusability" is often associated with the license of the data. User rights have explicitly to be granted to the user. Without a license standard intellectual property rights apply which usually grant nearly no rights to reuse the data. Create Commons or open data base licenses are good choices to make data available for the reuse of the data. Care needs to be taken with noncommercial licenses, as e.g. research institute which earn their income by funded research projects count as commercial entities within this respect.

Table 2 shows some relations of how already existing fields can be mapped to a FAIR data metadata profile.

Table 3 gives some additional fields which help to describe the measurement site. These correspond to table 3 in the IEC data format description. Such parameters might be yearly averages of parameters which can also be included as time series (e.g. albedo, see also table 4).

Table 4 adds some additional information for the channel descriptions on the height of the measurement device above ground and it includes a key of an ontology, which is referenced in the #ontology key. This table corresponds to table 7 in the IEC data format description.

Table 5 provides some additional data field definitions which can be used to annotate measured data as channel.sign. This table corresponds to table 8 in the IEC data format description.

Table 1 FAIR enhancement

Field name	Data type	Unit	complexity level	mandatory / optional	Example	Description
#date.created	string		1	m	#date.created 2022-10-01T12:45	Timestamp of first creation of this dataset
#date.lastmodfied	string		1	m	#date.lastmodified 2022-11-02T13:05	Timestamp of last modification, should correspond to last #history entry
#license.name	string		1	m	#license.name CC-BY-4.0	Name of the license which is used for the dataset. The name should correspond to license names at dalicc.net (e.g. CC-BY-4.0 - https://api.dalicc.net/web/license/CC-BY-4.0)
#license.url	string		1	m	#license.url https://creativecommons.org/licenses/by/4.0/	Link to the license used for the dataset
#version	string		1	m	#version 1.1 #version 2022-11-02T13-05	Version number of the data set, numbered versions or using timestamps is recommended (see example).
#hasMetadata	string		1	o	#hasMetadata https://energy.databus.dbpedia.org/user/group/artifact/version/	Link to metadata of this dataset in a metadata catalog
#wasDerivedFrom	string		1	o	#wasDerivedFrom https://energy.databus.dbpedia.org/user/group/artifact/version	If the data set was derived from a different data set, e.g. through temporal aggregation, Persistent identifier (a uniform resource identifier) of the source data.
#wasRevisionOf	string		1	o	#wasRevisionOf https://energy.databus.dbpedia.org/user/group/artifact/version	If previous versions of the data set are available, PID of the previous version can be referenced
#ontology	string		1	o	#ontology https://openenergy-platform.org/ontology/oeo	Ontology used for channel definitions

Table 2: Mapping of FAIR meta data to existing data fields

ID of the Helmholtz Kernel Information Profile Field name	Existing field in the data format
Contact	#IPR.contact
wasGeneratedBy	#IPR.source.name

Table 3: Location fields

Field name	Data type	Unit	complexity level	mandatory / optional	Example	Description
#location.avg_albedo	float	Unitless	1	o	#location.avg_albedo 0.2	Average albedo of the measurement site
#location.avg_soiling_loss	float	%	1	o	#location.soiling_loss 1.2	Average soiling loss [0..100] in percent compared to freshly cleaned state.
#location.avg_soiling_loss_rate	float	%/d	1	o	#location.soiling_loss_rate 0.1	Average daily change of soiling loss [0..100]

Table 4: Key words for the channel description

Field name	Data type	Unit	complexity level	mandatory / optional	Example	Description
#channel.*sign*.height_above_ground	float	m	1	o	#channel.wind.height_above_ground 10	Location of the instrument above ground
#channel.sign.ontologykey	string		1	o	#channel.dni.ontologykey OEO00010392	Ontology key containing the definition of the parameter in the channel
#channel.sign.ontologyname	string		1	o	#channel.dni.ontologyname direct normal solar irradiance	Name of the concept in the ontology to be human readable.

Table 5: Meteorological file format. Variables, note that the given units are mandatory

Sign	Data type	Unit	Description
POA	float	W/m^2	Plane of array irradiance
RPOA	float	W/m^2	Rear plane-of-array irradiance (irradiance on the backside of a PV module)
POA_PVmatched	float	W/m^2	PV-matched POA, e.g. POA as measured by a PV reference cell
RPOA_PVmatched	float	W/m^2	PV-matched RPOA, e.g. RPOA as measured by a PV reference cell
module_temperature	float	degrC	Module temperature in °C
Single_axis_tilt_angle	float	Degrees	Tilt angle of a single axis tracer
Dual_axis_tracker_primary_angle_error	float	Degrees	Error of the primary angle of a dual axis tracker
Dual_axis_tracker_secondary_angle_error	float	Degrees	Error of the secondary angle of a dual axis tracker
Soiling_loss	Float	%	Relative reduction of solar power due to soiling compared to freshly cleaned state
Soiling_loss_rate	Float	%/d	Change of soiling loss per day
Soiling loss	float	Unitless	Ratio of solar power with soiling to expected power without soiling and otherwise equivalent conditions
Albedo	float	Unitless	Ground albedo
White sky albedo	float	Unitless	White sky ground albedo
Black sky albedo	float	Unitless	Black sky ground albedo

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