



# Guidelines for inventory metadata standards and formats

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Date: 23/01/2019

Ref: C3S\_DC3S311a\_Lot1.2.1\_2018\_Guidelines for inventory  
metadata\_v1.docx

Official ref. number service contract:  
2018/C3S\_3S311a\_Lot1\_FCIÊNCIAS.ID/SC1

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## 1. Introduction

This document presents the first revised guidelines issued by C3S\_311a\_Lot1 to be used in writing and formatting metadata inventories for Land surface, Upper-Air and Marine worldwide in-situ data, resulting from past, present and future Data Rescue Activities and Global Observation Databases. The metadata inventories form the database for the C3S Rescue Data Registry Service.



## 2. Scope

The metadata base built according to the guidelines issued in this document is being stored in the C3S Data Rescue Registry Service, which can be accessed through the C3S Data Rescue Service Portal (<https://data-rescue.copernicus-climate.eu/>). The inventories containing the metadata have public access, and are extensively searchable, with traceable information about observations and the observations location being plottable in a geographical map. Inventories standards were agreed with the developers of the Common Data Model (C3S\_311a\_Lot2).

These guidelines are being used by the Registry management to construct the inventories and also apply to users who want to upload the metadata associated with their rescued data. Users who want to upload metadata will have to register on the C3S Data Rescue Service portal and their upload process will be monitored. Submitted metadata that does not follow the standards and formats described in these guidelines may be converted by management into the required standards and formats, pending required user support.

The metadata standards follow the WIGOS (2015) standards, adapted to the needs of the Registry Service and users, as the service needs to be an appealing and widely used tool, not only to the data rescue community, but also to the public at large. The concept of ECV (GCOS 2016) has also been taken in to account in the guidelines, although the inventories will contain variables that are not yet included in the most recent definition of ECV. These extra variables result from historical rescued data, containing observations that many times are irregular in both time and place, and sometimes include variables that are not presently recorded any more.

When choosing the Inventories metadata information, the process of historical Data Rescue was particularly taken in account. It is possible to represent original metadata units, location coordinates, local observation times, location names and other original information contained in the documents from which the data is recovered. The original information is converted to present and standardized units/coordinates/times/names and represented in the inventories. Metadata changes that may lead to long term observation series inhomogeneities are also represented, as well as conversion, and correction coefficients that have been applied to rescued data. Of special importance is the indication of the sources, data owners contacts, as well as data suppliers' and links to websites containing the data and metadata. The stage of data recovery is indicated in the inventories, not only to avoid duplication of rescue efforts, but also to inform data users of the actual or forthcoming data availability.



The participation of C3S\_311a\_Lot 1 in the Common Data Model (CDM) discussions led to the inclusion of more appropriate data rescue information elements in the CDM (such as metadata surface pressure). Conversely, as the C3S Data Rescue Registry may include in the future the inventories of global databases such as the land and marine databases to be built in C3S\_311a\_Lot2, the CDM construction also influenced the inclusion of metadata information in the C3S\_311a\_Lot1 inventories (metadata standardization and synchronization). The intention is to be able to exchange metadata with the C3S\_311a\_Lot2 using the same nomenclature, standards and formats, without loss of information. This is a process that will be fine-tuned during the implementation of the C3S\_311a services.

The concept of the C3S Data Rescue Registry Service builds on the EC funded FP7 research project ERA-CLIM2 (Brönnimann et al, 2017) and its Global Registry Portal, presently available at <http://eraclim-global-registry.fc.ul.pt>. Following the inventories upload methodology in this project, the C3S\_311a\_Lot1 metadata inventories can be written in Excel (CSV) format.

The guidelines for Land surface inventories are described in section 2. Section 3 contains the guidelines for upper air data inventories, both for fixed platforms (3.1) and moving platforms (3.2). In section 4 are the guidelines for writing marine data inventories for observations taken by each specific marine vessel journey and the ICOADS (Freeman et al. 2017) inventory format issued by C3S\_311a\_Lot2 that is also to be uploaded by the C3S\_311a\_Lot1 Registry. Section 5 lists the observed variables (including ECVs) and abbreviations, chosen by C3S\_311a\_Lot1 and the CDM (C3S\_311a\_Lot2 - see Thorne, 2017a) for which metadata information will be collected in the inventories. In section 6 some indications about the update procedures of the guidelines are given, taking in account users and management feedback.



### 3. Land Surface Inventories

The land surface inventories (available at <https://data-rescue.copernicus-climate.eu/lso>) also take into account the MEDARE metadata inventories format and content (<http://www.omm.urv.cat/MEDARE/index.html>). The inventories have a table format where each row corresponds to one station's observation data series, with associated metadata as complete as possible. If there is a change in the station's metadata (usually but not exclusively location), another row is added. Columns correspond to metadata type as shown in the Header of Table 1. The format presented in Table 1 considers metadata for one station and one variable per row, and is the format for uploading Land surface inventories to the Registry.

The column "Project Title" is the same that appears in the I-DARE inventories (for Data Rescue Projects) available at <https://data-rescue.copernicus-climate.eu/projects>. This characteristic links the Registry inventories to the I-DARE ones, which makes it possible to perform an automatic search for the metadata inventories associated with each Data Rescue Project in the C3S Data Rescue Service Portal.

**Table 1. Metadata information for Land Surface Observations included in the inventories.**

Column (Header)	Designation	Type	Definition
Type of inventory (ID)*		Text	Land surface (01)
Unique_metadata_record_ID*		Integer	Type of Inventory ID followed by inventory entry number (e.g. 010000046)
Project Title		Text	Common Project Title to I-DARE database, acts as a connection between Registry and I-DARE Portal (This one could contain a link to the I-Dare Project Title)
Collection_name*		Text	Name of the data collection (E.g. ERA-CLIM2)
WMO ID		Integer	Station WMO number in the GCOS (current or original number)
Network1_name		Text	National or regional network name 1 <sup>st</sup> level
Network1_ID		Integer or text	Station number in Network1
Network2_name		Text	National or regional network name 2 <sup>nd</sup> level





Network2_ID	Integer or text	Station number in Network2
WMO Region *	Text	Africa (1); Asia (2); South America (3); North, Central America and the Caribbean (4); South West Pacific (5); Europe (6), Antarctica (7)
Country/Region	Text	Station location's current country or autonomous region.
Original Country/Region	Text	Country or autonomous region at the time of observations
City/Town/Village	Text	Stations location at local level (current)
Original City/Town/Village	Text	Stations location at local level - old name (at time of observations)
Station Name*	Text	Name of station at time of observations
Current Station Name	Text	Current name of station if still active
Platform	Text	Classical manual, AWS, synoptic network, local network, resulting from historical observations campaign, other
Latitude_degN	Float	Latitude from $-90^{\circ}$ to $90^{\circ}$ (precision at least $0.001^{\circ}$ )
Longitude_degE	Float	Longitude from $-180^{\circ}$ to $180^{\circ}$ , Greenwich at $0^{\circ}$ (precision at least $0.001^{\circ}$ )
Altitude_masl	Float	Altitude in meters above sea level (precision at least 0.1m)
Original Latitude Units*	Text	Latitude in original units
Original Longitude Units*	Text	Longitude in original units
Original Altitude Units*	text	Altitude in original units
Local Gravity	Text	Recorded local gravity with units at time of observations
Original Location/Relocation	text	Indicate whether the series was observed at the first station location or is a relocation
Start Station Year/Month/Day	Date	Date when station started originally observing the variable
End Station Year/Month/Day	Date	Date when station stopped completely to observe the variable
Start Record Year/Month/Day	Date	Starting date of the variable



Day*		series
End Record Year/Month/Day*	Date	End date of the variable series
Time Resolution*	Text	Frequency of data (ranging from annual to sub-daily), or non-periodic. E.g. subdaily - 3 times per day.
Observation Times	Text	Times of observations in local or UTC time
Time Reference Meridian, or other	Text	Indicate the reference meridian for time of observations. E.g. Greenwich 0° longitude (UTC), 120°E longitude
Estimated Station Days	Integer	Number of days with observations (discounting gaps)
Time Gaps	Text	List of time gaps from years to days. E.g. 1920-1922, 1910/01/01-1912/01/14
Variable name*	Text	Indicate the name of the observed variable according to table 6
Units*	Text	Variable IS units
Original Units*	Text	Variable's original units (if they were not converted)
Variable Instrument	Text	Indicate the measuring instrument, or whether it's a visual observation, values obtained by calculating Tables, computation or other
Corrections/Conversions	Text	Gravity correction, Pressure reduced to 0°C, conversion coefficients, other
Observation Changes	Text	Change in instruments, observing procedures, hours, calculation tables, standards, events at the station. E.g. change in barometer on 1993/12/13.
Type of Access *	Text	Indicate if data is Public/Partially public (WMO resolution 40)/Restricted or other
Data Owner*	Text	Institution, DARE initiative or person owning the data
Data Owner	Text, hyperlink	Link to data owner website and



Link/Contact*		e-mail contact
Source*	Text	Source Name containing the data (Publication name, Logbook name, other)
Type of Initial Source*	Text	Indicate in what type of source the data is contained (Handwritten, printed, charts, microfiche, maps, microfilms or other)
Source Link (Images)	Hyperlink	Link to data bank storing the imaged data and/or metadata
Data Provider	Text	Name of data provider (which can be different from the data owner). E.g. ISPD, ISTI, ECA&D
Data Provider (Link/contact)	Text, hyperlink	Link to data and metadata provider website and email contact
Data series in published databank citation	Hyperlink	Insert Databank Publication DOI if the digitized data has been published
State of Data Rescue*	Text	Stage of Data Rescue (Hardcopy, Imaged, Digitised in original format and/or units, reformatted and/or converted to IS units, Quality controlled, merged into Global Databanks, Homogenised)
Comments	Text	
Project Status	Text	Indicate if the Data Rescue has been completed, is active, suspended or other

\* Mandatory Elements

The Mandatory Elements indicated in Table 1 are those considered essential to have a minimum of useful metadata information on the data series. However, it is possible to include some entries in the inventories which don't possess the full mandatory elements. These include data collections that have been discovered but don't have for instance the exact location (Latitude, Longitude, Altitude) determined, but only the stations name and country. Information that is not available can be entered as NA.

The metadata information contained in the C3S\_311a\_Lot2 Land surface inventories has a correspondence with the information in Table 1 and these inventories will be formatted and uploaded to the Registry. In this way, superposition of tasks between C3S\_311a\_Lot1 and C3S\_311a\_Lot 2 will be



minimal in writing inventories. In the same way, entries in the Registry resulting from DARE projects will be passed on to C3S\_311a\_Lot 2, maximizing the compatibility between both inventories formats and contents.

It is recommended that the CDM should assimilate the `unique_metadata_record_ID` attributed by the C3S Data Rescue Registry, to link these C3S\_311a\_Lot1 and C3S\_311a\_Lot 2 products in a robust way.

At a later stage, the C3S Data Rescue Registry Portal will also show the Land surface inventories in a more condensed format, containing all variables and all data rescue stages per row (similar to the ERA-CLIM2 Global Registry format). This format will be obtained through the transformation of the main inventories information using appropriate software.



## 4. Upper Air Inventories

The Upper Air inventories are presented for fixed platforms (subsection 4.1) and moving platforms (subsection 4.2)

### 1.1 Fixed Platforms

In the same way as the land surface inventories, the Upper Air fixed platform Metadata Inventories (available at <https://data-rescue.copernicus-climate.eu/uao>) should contain the information presented in Table 2:

**Table 2. Metadata information for Upper air Observations in fixed platforms**

Column Designation	Type	Definition
Type of inventory (ID)*	Text	Upper air fixed platform (11)
Unique_metadata_record_ID*	Integer	Type of Inventory ID followed by inventory entry number (e.g. 110000135)
Collection_name*	Text	Name of the data collection (e.g. ERA-CLIM2)
Project Title	Text	Common Project Title to I-DARE database, acts as a connection between Registry and I-DARE Portal
WMO ID	Integer	Station WMO number in the GCOS (current or original number)
Network1_name	Text	National or regional network name 1 <sup>st</sup> level
Network1_ID	Integer or text	Station number in Network1
Network2_name	Text	National or regional network name 2 <sup>st</sup> level
Network2_ID	Integer or text	Station number in Network2
WMO Region*	Text	Africa (1); Asia (2); South America (3); North, Central America and the Caribbean (4); South West Pacific (5); Europe (6), Antarctica (7)
Country/Region*	Text	Stations location current country or autonomous region.
Original Country/Region	Text	Country or autonomous region



		at the time of observations
City/Town/Village	Text	Stations location at local level (current and/or old place)
Original City/Town/Village	Text	Stations location at local level - old name (at time of observations)
Station Name*	Text	Name of station at time of observations
Current Station Name	Text	Current name of station if still active
Platform*	Text	Pilot balloon, radiosonde, kite, other
Latitude_degN	Float	Latitude from $-90^{\circ}$ to $90^{\circ}$ (precision at least $0.001^{\circ}$ )
Longitude_degE	Float	Longitude from $-180^{\circ}$ to $180^{\circ}$ , Greenwich at $0^{\circ}$ (precision at least $0.001^{\circ}$ )
Altitude_masl	Float	Altitude in meters above sea level (precision at least 0.1m)
Original Latitude Units*	Text	Latitude in original units
Original Longitude Units*	Text	Longitude in original units
Original Altitude Units*	Text	Altitude in original units
Local Gravity	Text	Recorded local gravity with units at time of observations
Original Location/Relocation	Text	Indicate whether the series was observed at the first station location or is a relocation
Start Station Year/Month/Day	Date	Date when station started originally observing the variable
End Station Year/Month/Day	Date	Date when station stopped completely to observe the variable
Start Record Year/Month/Day*	Date	Starting date of the variable series
End Record Year/Month/Day*	Date	End date of the variable series
Time Resolution*	Text	Frequency of data (ranging from annual to sub-daily), or non-periodic e.g. 3 times per day.
Observation Times	Text	Times of observations in local or UTC time
Time Reference Meridian, or other	Text	Indicate the reference meridian for time of observations e.g. Greenwich $0^{\circ}$ longitude (UTC),



		120°E longitude
Estimated Station Days	Integer	Number of days with observations (discounting gaps)
Time Gaps	Text	List of time gaps from years to days. E.g. 1920-1922, 1910/01/01-1912/01/14
Vertical coordinate*	Text	Indicate vertical coordinate e.g. pressure, height or other
Significant Levels Y/N	Text	Indicate whether the series contains significant level and/or tropopause observations
Variable name*	Text	Indicate the name of the observed variable according to Table 6
Units*	Text	Variable units
Original Units*	Text	Variable's original units (if they were not converted)
Variable Instrument	Text	Indicate the measuring instrument, or whether it's a visual observation, values obtained by calculating Tables, computation or other
Corrections/Conversions	Text	Gravity correction, Pressure reduced to 0°C, conversion coefficients or other
Observation Changes	Text	Change in instruments, observing procedures, hours, calculation tables, standards, events at the station e.g. change in type of pilot balloon.
Type of Access (Public/Restricted)*	Text	Indicate if data is Public/Partially public (WMO resolution 40)/Restricted, other
Data Owner*	Text	Institution, DARE initiative or person owning the data
Data Link/Contact* Owner	Text, hyperlink	Link to data owner website and e-mail contact
Source*	Text	Source Name containing the data (Publication, Logbook name or other)
Type of Initial Source *	Text	Indicate in what type of source the data is contained (Handwritten, printed, charts, microfiche, maps, microfilms or other)



Source Link (Images)	Hyperlink	Link to data bank storing the imaged data and/or metadata
Data Provider	Text	Name of data provider (which can be different from the data owner). E.g. CHUAN, IGRA
Data Provider (Link/contact)	Text, hyperlink	Link to data provider website and email contact
Data series in published databank citation	Hyperlink	Insert Databank Publication DOI if the digitized data has been published
State of Data Rescue*	Text	Stage of Data Rescue (Hardcopy, Imaged, Digitised in original format and/or units, reformatted and/or converted to IS units, Quality controlled, merged into Global Databanks (Lot2 or other), Homogenised)
Comments	Text	
Project Status	Text	Indicate if the Data Rescue has been completed, is active, suspended or other

\* Mandatory Elements

As in the Land surface inventories case, the upper air fixed platform inventories will be shown online in a more condensed format, with all variables and all data rescue stages per row.

## 1.2 Moving Platforms

Developing the ERA-CLIM2 inventories, the Upper Air moving platform Metadata Inventories (available at <https://data-rescue.copernicus-climate.eu/mp-ua0>) should contain the following information:

**Table 3. Metadata information for Upper air moving platforms**

Column Designation	Type	Definition
Type of inventory (ID)*	Text	Upper air moving platform (12)
Unique_metadata_record_ID*	Integer	Type of Inventory ID followed by inventory entry number (e.g. 120000060)
Project Title	Text	Common Project Title to I-DARE database, acts as a connection between Registry and I-DARE Portal
Country*	Text	Country where the documents





		are archived
Archive*	Text	Institution and location holding the archive's documents
Archive Reference*	Text	Documents ID in the archives
Document Title*	Text	Publication or Data Collection's name
Document archive contact*	Hyperlink/text	Archive website and/or e-mail
Document Type	Text	Indicate if it's a manuscript, printed or other type of document
Document Description	Text	Description of the type of document (flight bulletins, ship's logbooks or other)
Start Date*	Date	Initial year/month/day of the recording
End Date*	Date	Final year/month/day of the recording
Region	Text	Regions where the vehicle took observations
Document Imaged*	Text	Yes or No if the documents have been imaged
Document Keyed*	Text	Yes or No if the documents have been digitized
Keyed Data Processed/QC*	Text	Yes or No if the digitized data have been processed/ QCed
Data Available*	Text	Yes or No if the digitized data is available for use
Data provider	Text	Name of digitized data provider
Data provider contact	Hyperlink/text	Website and/or e-mail of digitized data provider
Imaged data/metadata link	Hyperlink	Indicate Link for data/metadata images if available
Platform Type*	Text	Ship, Aircraft, Mobile Pilot balloon or other.
Vehicle's Name or designation*	Text	
Frequency of Meteorological Observation	Text	Daily, sub-daily or actual frequency i.e. four-hourly
Estimated station days	Integer	Number of days with observations
Vertical coordinate*	Text	Altitude or pressure
Variable*	Text	Indicate the name of the observed variable according to



		table 6
Units*	Text	Variable units
Original Units*	Text	Variable's original units (if they were not converted)
Comments	Text	
Project Status	Text	Indicate if the Data Rescue has been completed, is active, suspended or other

\*Mandatory Elements

As in the upper air fixed platform inventories case, the upper air moving platform inventories will be shown online in a more condensed format, containing all variables and all data rescue stages per row.



## 5. Marine Inventories

Developing the ERA-CLIM2 inventories, the type chosen to display data rescued marine metadata includes all observed variables in one row for each ship voyage with observations.

The Marine metadata inventories (available at <https://data-rescue.copernicus-climate.eu/marine>) should contain the following information:

**Table 4. Metadata information for marine inventories**

Column Designation	Type	Definition
Type of inventory (ID)	Text	Marine (02)
Unique_metadata_record_ID*	Integer	Type of Inventory ID followed by inventory entry number (e.g. 020000160)
Project Title	Text	Common Project Title to I-DARE database, acts as a connection between Registry and I-DARE Portal
Country*	Text	Country where the documents are archived
Archive*	Text	Institution and location holding the archive's documents
Archive Reference	Text	Documents ID in the archives
Document Title*	Text	Publication or Data Collection's name
Document archive contact	Hyperlink/text	Archive website and/or e-mail
Document Type	Text	Indicate if it's a manuscript, printed or other type of document
Document Description	Text	Description of the type of document (Logbook, language, pages with observations, synoptic charts, thermographs or other)
Start Date	Date	Initial year/month/day of the recording
End Date	Date	Final year/month/day of the recording



Document Imaged	text	Yes or No if the documents have been imaged
Document Keyed	text	Yes or No if the documents have been digitized
Keyed Data Processed/QC	text	Yes or No if the digitized data have been processed/ QCed
Data Available	text	Yes or No if the digitized data is available for use
Data provider	text	Name of digitized data provider
Data provider contact	Hyperlink/text	Website and/or e-mail of digitized data provider
Imaged data/metadata link	Hyperlink	Indicate Link for data/metadata images if available
Platform Type	Text	Ship, Lightship buoy, drifting buoy etc.
Ship Name	Text	
Ship Type	Text	sailing ship, barque steamship motor vessel, research vessel, frigate, cruiser aircraft carrier or other.
Owner or Port of Registry	Text	Platform owner name or Port of Registry
Gross Tonnage	Integer	Platform weight in gross tonnage
Builder's Measure	Integer	Builder's Measure of Tonnage
Dimensions (Length, Breadth, Draught)	Text	Platform's dimensions
Vessel Movements	Text	Ports and places visited by the platform (with dates)
Frequency of Meteorological Observation	Text	Daily, sub-daily or actual frequency i.e. four-hourly
Time of Meteorological Observation	Text	local time or UTC
Atmospheric Pressure Units	Text	Inches, French inches, millimeters, millibars or other.
Atmospheric Pressure Type of Instrument	Text	Type of barometer (Mercury, Aneroid or other), barograph
Atmospheric Pressure Instrument Make and	Text	Make and number of barometer, barograph or



number		other
Correction of Atmospheric Pressure	Text	State if pressure has been corrected (yes, no) or if it contains 1 or more records (uncorrected and true, corrected)
Adjunct Thermometer Temperature	Text	State if records contain adjunct thermometer temperature values (yes, no)
Adjunct Thermometer Temperature Units	Text	Centigrade, Fahrenheit, Celsius or other
Atmospheric Pressure Instrument Exposure	Text	Location in the platform where the pressure instrument was put (with height above sea level)
Barometric Tendency	text	Yes or No if the documents contain barometric tendency
Air Temperature Units	Text	Centigrade, Fahrenheit, Celsius or other.
Type of air temperature instrument	Text	Type of Thermograph, thermometer or other
Air Temperature Instrument Make and number	Text	Make and number of thermograph, thermometer or other
Air Temperature instrument exposure	Text	Location in the platform where the temperature instrument was put (indicated if screened/not screened)
Humidity (wet & dry bulb thermometers) Type of Instrument	Text	Psychrometer, Hygrometer or other
Humidity Instrument Make and number	Text	Make and number of Psychrometer, Hygrometer or other
Humidity Instrument exposure	Text	Location in the platform where the humidity instrument was put
Dew Point temperature	text	Yes or No if the documents contain dew point temperature
Wind Direction	Text	Indicate if wind direction is True or Magnetic
Wind Force Units	Text	Descriptive, Beaufort, Norwegian Scale, mph m/sec



		or other
Height of Anemometer	Float	Elevation above sea level of wind force observation
Visibility	text	Yes or No if the documents contain visibility observations
Weather	Text	Weather description type (Beaufort notation, descriptive or other)
Clouds	text	Yes or No if the documents contain (type and/or cover) cloud observations
Upper air observations	Text, Hyperlink	Aircraft, pilot balloon radiosonde, other. Include link to respective metadata upper air inventories if these are registered
Frequency of Oceanographic Observations	Text	Daily, sub-daily or actual frequency i.e. four-hourly
Time of Oceanographic Observation	Text	Indicate if observations are done at local time or UTC/GMT
Sea Temperature Observation method	Text	canvas bucket, wooden bucket ERI, hull sensor
Sea temperature type of instrument	Text	Indicate type of instrument used
Sea temperature instrument make and number	Text	Indicate make and number
Sea surface temperature	text	Yes or No if the documents contain SST observations
Sub-surface temperature	text	Yes or No if the documents contain sub-surface temperature
Sea temperature units	Text	Indicate Units of Sea temperature (Celsius, Fahrenheit or other)
Specific Gravity/Density	text	Yes or No if the documents contain specific gravity/density
Scale used for measuring Waves	Text	E.g. Direction, period and height; Sea state and direction
Method used for calculating Current	text	E.g. Floating object with timing device to determine



		Velocity of current (distance, time, direction)
Sea Ice	Text	Indicate which sea ice variables are observed
Icebergs	Text	Indicate if icebergs are observed and/or number and size of icebergs is recorded
Observations of Aurora	Text	Indicate if aurora observations are included and/or number of auroras recorded
Weather reports or warnings	Text	Yes or no if the document indicates Weather reports or warnings
Notes (Severe Weather Events)	Text	Description of severe weather events, with dates and extreme values
Notes (Other Observations)	Text	Description of auroras, magnetic disturbances, biological observations (e.g. whales) or other
Comments	Text	
Project Status	Text	Indicate if the Data Rescue has been completed, is active, suspended or other

\*Mandatory Elements (The number of Mandatory elements has been reduced in relation to the previous Guidelines version)

The C3S Data Rescue Registry will also upload separately and display the ICOADS 3.0 (Freeman et al. 2017) inventory produced by C3S 311a\_Lot2 (Thorne, 2017b) and presented in table 5, with the explicit information contained in the entries: Sid (Source ID) and dck (Deck). For more details on the ICOADS inventory see Thorne, 2017b.

**Table 5. ICOADS inventory from Thorne (2017b)**

<b>Element</b>	<b>Description</b>	<b>Comments</b>
Ver	Inventory version	1
Sid	ICOADS SID	see Smith et al. (2016)
sid_text	Text expansion of sid code	see Smith et al. (2016)
Dck	ICOADS DCK	see Smith et al. (2016)



<b>Element</b>	<b>Description</b>	<b>Comments</b>
dck_text	Text expansion of dck code	see Smith et al. (2016)
lon_min	minimum longitude ( $x_1$ )	-180 to 180
lon_max	maximum longitude ( $x_2$ )	-180 to 180
lat_min	minimum latitude ( $y_1$ )	-90 to 90
lat_max	maximum latitude ( $y_2$ )	-90 to 90
Bbox	co-ordinates of bounding box (lat-lon): rectangle, line or point.	POLYGON(( $x_1 y_1, x_2 y_2, x_3 y_3, x_4 y_4, x_1 y_1$ ))
date_min	earliest date and time	YYYY-MM-DD HH:MM:SS
date_max	latest date and time	YYYY-MM-DD HH:MM:SS
num_at	count of air temperature observations	
num_wbt	count of humidity observations (wet bulb temperature)	
num_dpt	count of humidity observations (dewpoint temperature)	
num_rh	count of humidity observations (relative humidity)	
num_ws	count of wind speed observations	
num_d	count of wind direction observations	
num_slp	count of surface pressure observations	
num_sst	count of sea surface temperature observations	
num_n	count of total cloud cover observations	
num_wh	count of significant wave height observations	
num_ww	count of present weather code observations	
num_obs	total observation count	
num_rej	number flagged for exclusion	
inv_date	date of creation or updating of inventory element	
Subset	Which subset of data has been inventoried ('total', 'final', 'reject')	





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<b>Element</b>	<b>Description</b>	<b>Comments</b>
p_statuses	processing status within C3S311a Lot 2	'inventoried'



## 6. Variables included in the Inventories

The list of observed variables (Table 6) to be included in the C3S Data Rescue Registry was compiled in part from the WMO/OSCAR variables inventory (<https://www.wmo-sat.info/oscar/variables>). Other variables not mentioned in this source were considered necessary for representation in the inventories. The list is very large and only some of variables are frequently rescued from historical documents. This list has been shared and synchronised with the List of observed parameters contained in the revised CDM. Table 6 was updated with 12 additional variables (positioned at the end of the table) since the previous version of these Guidelines.

**Table 6. List of variables and abbreviations to be used in the Data Rescue Registry inventories.**

Variable group	domain	Abbreviation	Variable name	units	description / notes
aerosols		aaod	aerosol_absorption_optical_depth	Dimensionless	
aerosols		acb	aerosol_column_burden	g/m <sup>2</sup>	
aerosols		adc	aerosol_dust_concentration	g.kg <sup>-1</sup>	
aerosols		aer	aerosol_effective_radius	µm	
aerosols		aec	aerosol_extinction_coefficient	m <sup>-1</sup>	
aerosols		ammr	aerosol_mass_mixing_ratio	g/Kg	
aerosols		aod	aerosol_optical_depth	Dimensionless	
aerosols		asmf	aerosol_species_mole_fraction	moles/mole of dry air	
aerosols		astcb	aerosol_species_total_column_burden	moles/m <sup>2</sup>	
aerosols		at	aerosol_type	Classes	
aerosols		ava	aerosol_volcanic_ash	g/kg	
aerosols		avat	total_column_aerosol_volcanic_ash	g/m <sup>2</sup>	
aerosols		ac	air_conductivity	Km	



albedo		bsa	blue_ice_and_snow_albedo	%	
albedo		bir	blue_ice_bidirectional_reflectance	sr <sup>-1</sup>	
albedo		cga	clean_glacier_ice_albedo	%	
albedo		dga	dirty_glacier_ice_albedo	%	
albedo		esa	earth_surface_albedo	%	
albedo		sbr	snow_bidirectional_reflectance	sr <sup>-1</sup>	
cloud	atmospheric upper air	hb	cloud_base_height	m/100	cloud base height
cloud	atmospheric upper air	h	cloud_base_lowest_height	Coded	Height above surface of the base of the lowest cloud seen (coded 0-9)
cloud	atmospheric upper air	n	cloud_cover	Okta or %	
cloud	atmospheric upper air	c	cloud_genus	Coded	Genus of cloud (0 - Cirrus ... 9 - Cumulo-Nimbus)
cloud	atmospheric upper air	hs	cloud_genus_base_height	Coded or m/10	Height of base of cloud whose genus is c
cloud	atmospheric upper air	ch	high_cloud_type	Coded	type of high clouds
cloud	atmospheric upper air	cl	low_cloud_type	Coded	type of low clouds
cloud	atmospheric upper air	nh	lowest_cloud_amount	Okta	low or (if low clouds don't exist) middle cloud amount
cloud	atmospheric upper air	cm	middle_cloud_type	Coded	type of middle clouds
composition	atmospheric		BrO	%	
composition	atmospheric		C10H16 (3-Carene)	%	
composition	atmospheric		C10H16 (alfapinene)	%	
composition	atmospheric		C10H16 (betapinene)	%	
composition	atmospheric		C10H16 (Limonene)	%	
composition	atmospheric		C2H2	mol/mol	
composition	atmospheric		C2H5OH	%	



composition	atmospheric				
composition	atmospheric		C2H6	mol/mol	
composition	atmospheric		C2H6S	%	
composition	atmospheric		C3H6O	%	
composition	atmospheric		C4H10 (Methylpropane)	%	
composition	atmospheric		C4H10 (n-butane)	%	
composition	atmospheric		C5H12 (2-Methylbutane)	%	
composition	atmospheric		C5H12 (n-Pentane)	%	
composition	atmospheric		C5H8	%	
composition	atmospheric		C6H6	%	
composition	atmospheric		C7H8	%	
composition	atmospheric		CFC-11	mol/mol	
composition	atmospheric		CFC-12	mol/mol	
composition	atmospheric		CH3CN	%	
composition	atmospheric		CH3OH	%	
composition	atmospheric		CH4	mol/mol	
composition	atmospheric		ClO	mol/mol	
composition	atmospheric		ClONO2	mol/mol	
composition	atmospheric		CO	mol/mol	
composition	atmospheric		CO2	mol/mol	
composition	atmospheric		COS	mol/mol	
composition	atmospheric		H2O	mol/mol	
composition	atmospheric		HCHO	mol/mol layers	
composition	atmospheric		HCHO (Total Column)	1.3X10 <sup>15</sup> molecules / cm <sup>-2</sup>	



composition	atmospheric		HCl	mol/mol	
composition	atmospheric		HDO	mol/mol	
composition	atmospheric		HNO3	mol/mol	
composition	atmospheric		N2O	mol/mol	
composition	atmospheric		N2O5	mol/mol	
composition	atmospheric		NO	mol/mol	
composition	atmospheric		NO2	mol/mol	
composition	atmospheric		NO2 (Total column)	1.3X10 <sup>15</sup> molecules / cm <sup>-2</sup>	
composition	atmospheric		O3	mol/mol	
composition	atmospheric		O3 (Total column)	DU (Dobson Unit)	
composition	atmospheric		OH	molecules per cm <sup>3</sup>	
composition	atmospheric		PAN	mol/mol	
composition	atmospheric		PSC occurrence	HR, FAR	
composition	atmospheric		SF6	mol/mol	
composition	atmospheric		SO2	mol/mol	
composition	atmospheric		SO2 (Total column)	1.3X10 <sup>15</sup> molecules / cm <sup>-2</sup>	
evaporation	atmospheric surface	eee	evaporation	mm	
evaporation	atmospheric surface	ev	evaporation	kg/(m <sup>2</sup> s)	
evaporation	atmospheric surface	pev	potential_evapotranspiration	mm/day	
evaporation	atmospheric surface	rev	real_evapotranspiration	mm/day	
humidity	atmospheric surface	ah	absolute_humidity	g/m <sup>3</sup>	



humidity	atmospheric	dep_dew	dew_point_depression	K	Dew point depression is also called dew point deficit. It is the amount by which the air temperature exceeds its dew point temperature.
humidity	atmospheric surface; upper air	td	dew_point_temperature	C	
humidity	atmospheric	t_dew	dew_point_temperature	K	Dew point temperature is the temperature at which a parcel of air reaches saturation with respect to liquid water upon being cooled at constant pressure and specific humidity.
humidity	atmospheric surface; upper air	ibt	ice_bulb_temperature	K	
humidity	atmospheric surface; upper air	rh	relative_humidity	%	
humidity	atmospheric surface; upper air	q	specific_humidity	(Kg/kg)	Specific means per unit mass. Specific humidity is the mass fraction of water vapor in (moist) air.
humidity	atmospheric surface; upper air	e	water_vapour_pressure	hPa	
humidity	atmospheric surface; upper air	tb	wet_bulb_temperature	C	
humidity	atmospheric surface; upper air	t_wet	wet_bulb_temperature	K	
ice		ddd	ice_thickness	m	



precipitation	atmospheric surface	rr	accumulated_precipitation	mm	accumulated precipitation over specified period
precipitation	atmospheric surface	fs	fresh_snow	mm	
precipitation	atmospheric surface	ht	hydrometeor_type	Code table	
precipitation	atmospheric surface	rrls	precipitation	kg/(m <sup>2</sup> s) or mm	Precipitation (liquid or solid)
precipitation	atmospheric surface	rril	precipitation_intensity_liquid	mm/h	Precipitation intensity at surface (liquid or solid)
precipitation	atmospheric surface	rris	precipitation_intensity_solid	mm/h	Precipitation intensity at surface (solid)
precipitation	atmospheric surface	rrt	precipitation_type	coded	Liquid, snow, hail, fog
precipitation	atmospheric surface	nr	rainy_days	Days	
precipitation	atmospheric surface	sc	snow_cover	%	
precipitation	atmospheric surface	sd	snow_depth	cm	
precipitation	atmospheric surface	sst	snow_status	coded	Wet   dry
precipitation	atmospheric surface	sw	snow_water_equivalent	mm	Surface snow amount
pressure	atmospheric surface	atb	adjunct_temperature_barometer	C	temperature of the adjunct thermometer to the barometer to reduce pressure to 0°C
pressure	atmospheric surface	p	air_pressure	Pa	
pressure	atmospheric	mslp	air_pressure_at_sea_level	Pa	sea_level means mean sea level, which is close to the geoid in sea areas. Air pressure at sea level is the quantity often abbreviated as MSLP or PMSL.
pressure	atmospheric surface	ppp	pressure_tendency	Pa	pressure tendency



pressure	atmospheric surface	a	pressure_tendency_characteristic	coded	characteristic of pressure tendency (used in synoptic maps)
radiation	atmospheric	dr	diffuse_radiation	W m <sup>-2</sup>	
radiation	atmospheric	dlwie	downward_longwave_irradiance_at_earth_surface	W m <sup>-2</sup>	
radiation	atmospheric	dswie	downward_shortwave_irradiance_at_earth_surface	W m <sup>-2</sup>	
radiation	atmospheric	dswit	downward_shortwave_irradiance_at_toa	W m <sup>-2</sup>	
radiation	atmospheric	eswr	earth_surface_shortwave_bidirectional_reflectance	%	
radiation	atmospheric	fapar	fraction_of_absorbed_par	%	FAPAR
radiation	atmospheric	gr	global_radiation	W m <sup>-2</sup>	
radiation	atmospheric	lwe	longwave_earth_surface_emissivity	%	
radiation	atmospheric	lr	longwave_radiation	W m <sup>-2</sup>	
radiation	atmospheric	mor	meteorological_optical_range	m	Meteorological optical range at surface
radiation	atmospheric	par	photosynthetically_active_radiation	W m <sup>-2</sup>	
radiation	atmospheric	swcr	shortwave_cloud_reflectance	%	
radiation	atmospheric	sr	shortwave_radiation	W m <sup>-2</sup>	
radiation	atmospheric	sgf	solar_gamma_ray_flux	W m <sup>-2</sup>	
radiation	atmospheric	suf	solar_UV_flux	W m <sup>-2</sup>	
radiation	atmospheric	svf	solar_VIS_flux	W m <sup>-2</sup>	
radiation	atmospheric	sxf	solar_X_ray_flux	W m <sup>-2</sup>	
radiation	atmospheric surface	ss	sunshine_duration	Hours	
radiation	atmospheric	ulwie	upward_longwave_irradiance_at_earth_surface	W m <sup>-2</sup>	
radiation	atmospheric	ulwit	upward_longwave_irradiance_at_TOA	W m <sup>-2</sup>	
radiation	atmospheric	uswit	upward_shortwave_irradiance_at_TOA	W m <sup>-2</sup>	





radiation	atmospheric	usrt	upward_spectral_radiance_at_TOA	$W\ m^{-2}\ nm^{-1}\ sr^{-1}$	
salinity	oceanic	sal	salinity	Psu	ocean salinity (PSU)
temperature	atmospheric surface, upper air	ta	air_temperature	C	
temperature	atmospheric surface, upper air	t_air	air_temperature	K	Air temperature is the bulk temperature of the air, not the surface (skin) temperature.
temperature	atmospheric surface	Tx	daily_maximum_air_temperature	C	
temperature	atmospheric surface	Txs	daily_maximum_air_temperature_with_direct_sun_exposure	C	
temperature	atmospheric surface	TGs	daily_maximum_grass_temperature	C	Grass maximum thermometer is 5 cm above ground
temperature	atmospheric surface	Tn	daily_minimum_air_temperature	C	
temperature	atmospheric surface	Tns	daily_minimum_air_temperature_with_direct_sun_exposure	C	
temperature	atmospheric surface	TGn	daily_minimum_grass_temperature	C	Grass minimum thermometer is 5 cm above ground
temperature	atmospheric surface	days_frost	days_with_ground_frost	Days	
temperature	atmospheric surface	t_snow	snow_temperature	C	
temperature	atmospheric sub-surface	Ts	soil_temperature	C	
temperature	oceanic	t_water	water_temperature	K	Water (sea, river, lake) temperature at depth indicated, includes SST
visibility	atmospheric surface	vv	horizontal_visibility_in_air	m	The visibility is the distance at which something can be seen.
weather		ld	lightning_detection	deg (lat, lon) and UTC	
weather		ls	lightning_duration	s	



weather		lhd	lightning_horizontal_distance	Km	
weather	atmospheric surface	w1	past_weather_1	coded	past weather 1 - most extreme phenomenon
weather	atmospheric surface	w2	past_weather_2	coded	past weather 2 - most frequent phenomenon (used in synoptic maps)
weather	atmospheric surface	ww	present_weather	coded	present weather
weather		tld	Total lightning density	Dimensionless	
wind	atmospheric surface, upper air	u	eastward_wind_speed	m s <sup>-1</sup>	Eastward indicates a vector component which is positive when directed eastward (negative westward). Wind is defined as a two-dimensional (horizontal) air velocity vector, with no vertical component. (Vertical motion in the atmosphere has the standard name upward_air_velocity.)
wind	atmospheric surface, upper air	v	northward_wind_speed	m s <sup>-1</sup>	Northward indicates a vector component which is positive when directed northward (negative southward).
wind	atmospheric surface, upper air	dd	wind_from_direction	degree	direction from which the wind is blowing
wind	atmospheric surface, upper air	w	wind_speed	m s <sup>-1</sup>	Speed is the magnitude of velocity. Wind is defined as a two-dimensional (horizontal) air velocity vector,



					with no vertical component. (Vertical motion in the atmosphere has the standard name upward_air_velocity .) The wind speed is the magnitude of the wind velocity.
wind	atmospheric surface	fx	wind_speed_of_gust	m s <sup>-1</sup>	A gust is a sudden brief period of high wind speed.
wind	atmospheric surface	fm	wind_speed_max	m s <sup>-1</sup>	Maximum observed wind speed over specified period.
		turb	turbulence	J/m <sup>3</sup>	
precipitation	Atmospheric surface	pwc	Precipitable_water_column	kg m <sup>-2</sup>	
pressure	Upper Air	TropH	Tropopause_height	m	
Temperature	Upper Air	TropT	Tropopause_temperature	K	
Pressure	Upper Air	TropP	Tropopause_pressure	Pa	
Temperature	Upper Air	TropP T	Tropopause_potential temperature	K	
Temperature	Atmospheric surface	FrostT	Frost_point_temperature	K	
pressure	Atmospheric surface; upper air	gph	Geopotential_height	m	height of a standard or significant pressure level in meters
pressure	Atmospheric surface; upper air	gdm	Geopotential_height_deca meters	decameters	height of a standard or significant pressure level in decimeters
Temperature	Atmospheric surface; upper air	temp_ vertgr ad	Vertical_gradient_ of_temperature	K/m	vertical variation of temperature
Temperature	Atmospheric surface; upper air	ptemp_ vertgr ad	Vertical_gradient_of_poten tial_temperature	K/m	vertical variation of potential temperature
Temperature	Atmospheric surface; upper air	ept	Equivalent_potential_temp erature	K	temperature a parcel of air would reach if all the water vapor in the parcel were to condense,



					releasing its latent heat, and the parcel was brought adiabatically to a standard reference pressure, usually 1000 hPa
wind	Atmospheric surface; upper air	rs_vert speed	Vertical_speed_of_radiosonde	m s-1	vertical speed of radiosonde ascent



## 7. Guidelines updating procedure

There will be a new update of the guidelines by the end of December 2019. Revision of the guidelines will certainly take into account Registry users feedback, monitoring of its adequacy by management and discussions among C3S\_311a\_Lot1 groups and other C3S\_311a services. Once the Data Rescue projects populating the C3S Data Rescue Activities Portal (and I-DARE portal) start sending or registering their metadata inventories in the Data Rescue Registry, issues might arise that can lead to the necessity to update the guidelines.

The information contained in the inventories can easily be expanded due to its simple structure, both by including more metadata elements and more variables. Also, other types of inventories can be created that suit the service supplied by C3S\_311a\_Lot 1 in a better way.

These Guidelines will be available in the C3S Data Rescue Service Portal <https://data-rescue.copernicus-climate.eu/>.



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