ECMWF COPERNICUS REPORT

Copernicus Climate Change Service

# Common Data Model for in situ observations

## C3S311a Lot 2: Global Land and Marine Observations Database

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# Executive Summary

This document defines the initial version of the Common Data Model (CDM) developed within the Copernicus Climate Change Service (C3S) Access to Global Land and Marine Observations Database (C3S 311a Lot 2) service. This has been developed in consultation across the four C3S 311a (Collection and Processing of In Situ Observations) Lots and ECMWF.

Tab separated versions of the code tables defining the data model can be found at:

`https://github.com/glamod/common_data_model/tree/master/tables/`

| Version | Release date | Release notes |
|---|---|---|
| 1 | 31/08/2017 | Initial version of the common data model |
| 1.01 | 31/08/2017 | 'sub_region' table updated |

# Contents

# List of Tables

# 1 Introduction

## 1.1 Purpose of this document

This document defines the initial version of the Common Data Model (CDM)[1] developed within the Copernicus Climate Change Service (C3S) Access to Global Land and Marine Observations Database (C3S 311a Lot 2) service. This has been developed in consultation across the four C3S 311a (Collection and Processing of In Situ Observations) Lots and with ECMWF.

## 1.2 Scope

The defined common data model is intended for use with in situ land and marine observations. Instantaneous (or point) observations and temporal statistics (e.g. daily and monthly min / max temperatures, accumulation of precipitation etc.) are supported through the use of a significance qualifier. Similarly, column average data are supported through the reporting of the observed variable alongside its value. Profile data is supported through reporting the z-coordinate for each observed value.

Whilst initially intended for use with observations of Essential Climate Variables (ECVs; e.g. GCOS, 2016) the data model is not restricted to the ECVs. As noted above, and following the ECMWF Observations DataBase (ODB) type data model, the observed variable is reported alongside the observed value.

Comprehensive metadata is supported through the use of configuration tables, recording information on:

- Source level metadata: e.g. original source of data, source data centre, citation information etc.
- Station level metadata: e.g. location, operating institute, parameters reported etc.
- Profile level metadata: Additional information for profile data, e.g. unwinder type, type of balloon or expendable bathythermograph (XBT) etc.
- Sensor level metadata: e.g. calibration history and status, sensor type / serial number etc.

Comprehensive quality control and uncertainty information can be recorded using linked Entity-Attribute-Value (EAV) tables.

[1] As noted in the ITT: A common data model is different from a file format, which defines how information is encoded in a file. The purpose of a data model is to provide a well-defined data structure that can be used to represent data records from a variety of sources, in such a way that the information contained in those records can be unambiguously accessed using a common set of tools. Development of a common data model for observations involves specification of data attributes and their symbolic names, including, for example, identifiers for different instruments, observed parameters, geolocation and timing, etc. A governance structure is required to manage such specifications, ensure consistency with standards where they exist, and to ensure a controlled evolution of the data model.

### 1.3 Structure of this document

Section 2 of this document provides background information on the data model and existing relevant data models and standards. Section 3 proposes a governance mechanism for the CDM in recognition that the data model will change and evolve as the requirements of the users and the C3S Climate Data Store develop. Section 4 describes the core components and tables of the data model. The appendix includes the individual table definitions and preliminary versions of the code tables. The code tables listed are provisional and will be expanded as the service develops.

## 2 Background and existing standards

### 2.1 Observational sources and requirements of the data model

Across the C3S 311a service (Collection and Processing of In Situ Observations) access will be provided to observations from surface terrestrial and marine environments and upper air data in a common data model. The observations included range from point observations made from moving platforms to daily and monthly statistics at fixed locations. The parameters reported include, inter alia: air temperature; humidity; wind speed; pressure; cloud cover information; present weather. The statistics include, inter alia: daily min, max and mean air temperature; accumulated precipitation over 3 or 24 hours; mean wind speed over the preceding 10 minutes. The full range of parameters and statistics to be reported will evolve as the service is developed. As new parameters are recovered from newly digitised sources and the reprocessed climate archives the list of parameters will need to expand.

Both surface level (terrestrial and marine) and upper air data will be initially included in the service. The surface level data include observations made at standard and non-standard heights. The upper air data will include multiple observations, starting at the surface and at increasing heights through the atmosphere, often as a function of pressure or geopotential height. Columnar averages will be included. As a result the data model needs to include the flexibility to record the height and the units used for reporting the height of measurement with every observation. Similarly, some reporting stations, and hence observations, will move in the horizontal plane, and the horizontal coordinates need to be reported with each observation. To avoid ambiguity, the coordinate reference system (CRS) should be provided with each location reported.

The period covered by Lot 2 of the service ranges from $\sim$1850 to present. Over this period there have been many changes to the instruments and practices used to record the various parameters. The choice of instruments and practices will influence the quality of the observations and a change in instrumentation, or location, may introduce inhomogeneities into the record. To mitigate this risk comprehensive observational metadata are required. Similarly, information on adjustments and conversions applied to the data need to be recorded. The full range of observational practices and instruments used is not currently known and developed data model will need to be extendable to accommodate new metadata as required.

The observations to be included will be sourced from a variety of existing datasets, such as the International Comprehensive Ocean and Atmosphere Data Set (ICOADS; e.g. Freeman et al., 2017), and newly

digitised sources. In defining the data model the provenance and lineage of the data sources need to be preserved. Similarly, usage rights and citation information need to be preserved and provided to users alongside the observational data. This is a common requirement across all Lots within the service.

In order to meet the above requirements a data model based on the ECMWF Observations DataBase (ODB) model has been developed, with the use of linked tables providing information on the observational and provenance metadata. The ODB type model allows for extension to new parameters through the use of a parameterized observation list (see next section). The linked tables will define a core set of parameters under 4 different categories (station, source, profile and sensor), flexibility will be provided through the specification of optional elements and associated decode tables.

## 2.2 ECMWF Observations DataBase (ODB)

The data model developed and used in the ECMWF Observations DataBase (ODB) software allows the representation of environmental data from many sources, including in situ observations and weather reports, satellite data and model output. As noted in Hersbach et al. (2015), in the ODB implementation a distinction is made between weather reports and observations and this same distinction is made within the CDM and this document. A weather report, such as a ship weather report or a radiosonde ascent, may contain multiple observations of one or more parameters. In the case of a ship weather report observations of the air temperature and humidity, sea level pressure, sea surface temperature, wind speed and direction are typically made and recorded in a single report. In the case of a radiosonde report observations of the temperature will be made at a range of levels from the surface to the burst point of the balloon. To enable flexibility and scalability with the ODB data model the different elements making up a weather report are split into header elements, recording information common across a weather report, and observational (or body) elements specific to a single observation.

In the original version of ODB, e.g. Saarinen (2004), these elements were split between a header table, containing the header elements, and a linked body table containing the observations or body elements. Within the body table the name of the parameter being observed, or its numerical code, is recorded in one column and the observed value within a second column. Other columns, recording information such as QC results, are permissible. This data model allows the efficient expansion of the data model to new variables, without the need to change the underlying structure, by the addition of the new variable to the enumerated list defining the reportable variables. Within the latest version of ODB (ODB-2; e.g. Hersbach et al., 2015) the header and body tables have been combined into a single flat table, with the header rows repeated, to enable efficient archival within the ECMWF MARS system. A simplified schematic of the ODB-2 structure is shown in Table 1.

Within the CDM defined in this document we have opted for the original ODB type data model, with the reports split into header and observational records stored within separate tables. These are described fully within Section 3 of this document. When these tables are stored in a relational database, or similar structure, performing a join on the tables should result in ODB-2 compatible records.

Table 1: Simplified example of records in ODB type data model, with observations from reports 1 and 2 spanning multiple records. For simplicity, the z coordinate has been omitted but profile data would be represented with each layer / height as a separate record

| header information | | | | | observation information | | |
|---|---|---|---|---|---|---|---|
| **record id** | **report id** | **obs id** | **date** | **location** | **parameter** | **value** | **units** |
| 1 | 1 | 1 | 2012-01-01 12:00+0.0 | POINT(-40 40) | air temperature | 300.0 | K |
| 2 | 1 | 2 | 2012-01-01 12:00+0.0 | POINT(-40 40) | sea level pressure | 1013.0 | hPa |
| 3 | 2 | 3 | 2012-01-01 18:00+0.0 | POINT(-40.1 40.2) | air temperature | 300.3 | K |
| 4 | 2 | 4 | 2012-01-01 18:00+0.0 | POINT(-40.1 40.2) | sea level pressure | 1013.2 | hPa |

End of table

## 2.3 BUFR and WIGOS Metadata Standard

There has been a large body of work and significant effort invested in defining data models and parameterising the data and metadata for encoding the data into those data models. Within the scope of the CDM and the C3S 311a service, the WMO Binary Universal Form for the Representation of meteorological data (BUFR) (WMO, 2015a) and the WMO Integrated Observing System Metadata Standard (WMDS) (WMO, 2015b) are key background material.

The BUFR format (WMO 2015a) is a flexible and efficient table driven format for reporting weather observations on the WMO Global Telecommunications System (GTS) in binary. The tables defined as part of the BUFR format include many of the parameters that will be included in the CDM. For example, Common code table C6 (WMO 2015a) includes all the measurement units reportable in BUFR (and other WMO codes). Similarly, code tables are defined for reporting instrument types and methods, station types etc. Where possible, these code tables have been referenced and used in preference to defining new code tables. BUFR tables from Version 27 of Master Table 0 have been used in this version of this document.

In recognition of the increasing importance of observational metadata the WMDS is currently under development and phased implementation (WMO, 2015b). The WMDS extends the ISO19115 metadata standard, with additional mandatory elements describing both the station level and discovery metadata as well as specific information on the instrumentation used and processing steps. As part of the process simplified versions of BUFR and other tables have been included in the standard. As with BUFR these tables have been referenced, where appropriate, in preference to defining new code tables.

# 3 Governance of the Common Data Model

A working group will be set up to manage the governance of the common data model. This group will operate remotely via email and regular teleconferences. Proposals to add new entries to the code tables or make changes to the structure of the common data model shall be made via email to email address:

c3s_311a_CDM_governance@surfacetemperatures.org.

Emails to this address will be distributed to all members of the working group.

During the initial development stage of the service proposals sent to the above email address will be assessed monthly, with discussion via email and teleconference as required. Accepted changes will be implemented at the beginning of the following month or with at least 2 weeks notice. These changes will be published both via the service website and via a subscription email list:

c3s_311a_CDM_notifications@surfacetemperatures.org.

The working group will be self nominating and initially contain at least one member from each Lot to act as a primary point of contact for that Lot and to represent their requirements on the working group. The working group will also contain a representative from ECMWF, or a nominated representative from another organisation, to represent the needs of the wider C3S community. Additional members from the different Lots will be welcomed. In the case of disagreement over proposed changes each Lot will have one vote irrespective of the number of members in the working group. In the case of a hung vote ECMWF, or their representative, will have the deciding vote.

# 4 Common Data Model

As noted above, the CDM is based on the original ODB data model, with meteorological reports split into header and observational records stored in separate tables, header_table and observations_table respectively. In support of these two primary tables, four auxiliary tables have been defined to enable the comprehensive reporting of metadata at different levels:

- Source level metadata (*source_configuration* table). This level contains detailed information on the source dataset, including: information on the product; whether any processing has been applied; the original data centre the data were sourced from; citation information; the data licence for the product; how to cite the data source etc.
- Station level metadata (*station_configuration* table). This level contains detailed information on the station reporting the data including: station operator; the type of station; station / AWS model type; location; operating territory; reporting frequency etc.

- Profile level metadata (*profile_configuration* table). This level contains detailed metadata for atmospheric and oceanic profiles, including: profile type; type of launcher; direction of profile; balloon / XBT type etc.
- Instrument (or sensor) level metadata (*sensor_configuration* table). This level contains detailed information on the sensor used to make a particular observation, including: calibration status; sampling strategy; observing method; sensor housing and ventilation; instrument model and serial number etc.

These tables are defined in the following section and contain elements that are mandatory across all report types. Additional optional elements are provided through Entity-Attribute-Value based tables linked to the configuration tables. Two additional tables have been defined to include the reporting of comprehensive uncertainty estimates and quality control flags. A simplified schematic of the 12 tables forming the core of the CDM is shown in Figure 1 - a more complete schematic can be found at `https://github.com/glamod/common_data_model/blob/master/cdm_full.pdf`.

Within the tables in the following sections the following syntax has been used:

- numeric Any numeric value (integer or floating point).
- int An integer value.
- varchar A variable length character string.
- timestamp A timestamp with time zone, e.g. "2017-07-01 00:00:0.0+00".
- [] An array of the indicated type.
- * An optional element.
- (pk) The indicated elements marked as (pk) within a table form the unique ID for the record.

Unless indicated otherwise all elements listed are mandatory but may be encoded as missing (e.g NA, NULL or format specific equivalent) if not available. Optional elements are indicated by *. Whilst arrays have been indicated for the elements containing multiple values this does not preclude other implementations. Within the table definitions references to external tables are indicated in the external_table column. These references are composed of two parts separated by a colon (:). The first part indicates the table, the second the element within the table. For example, station_configuration:primary_id indicates a reference to the primary_id element in the station_configuration table.

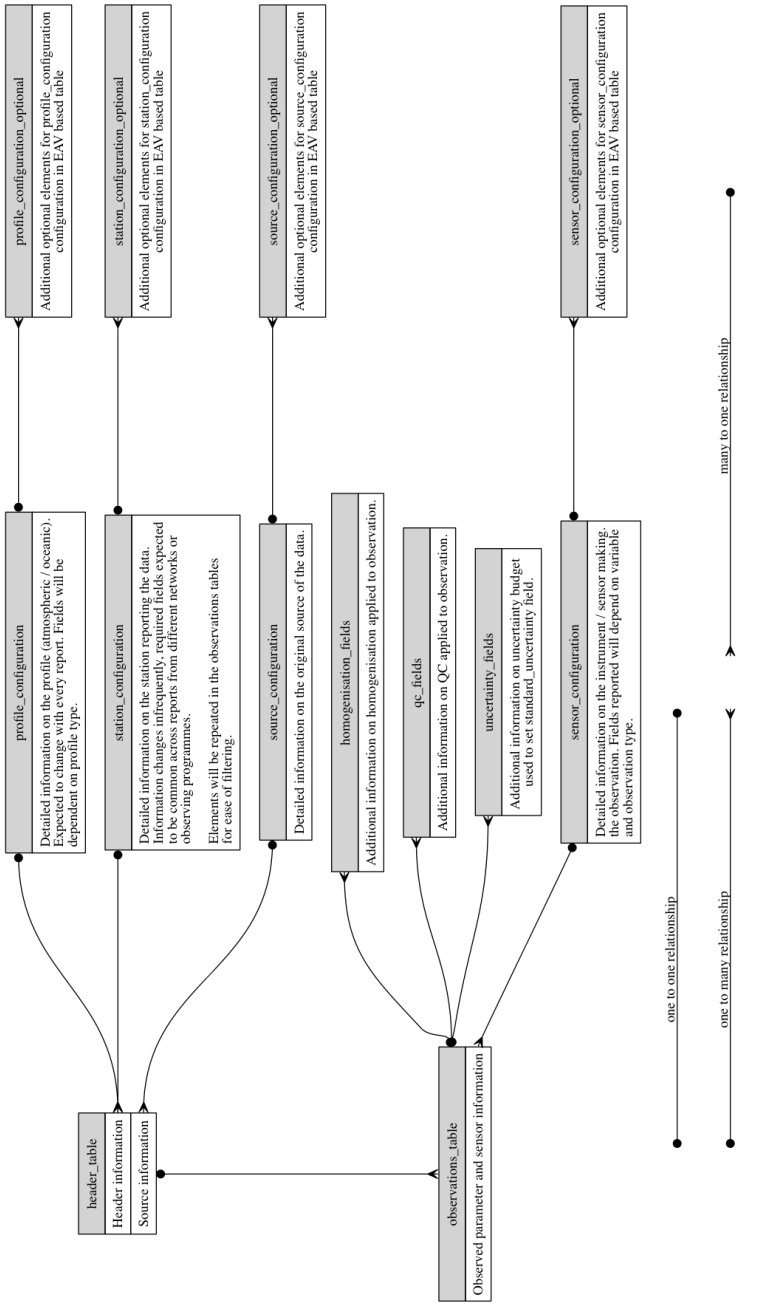


Figure 1: Simplified schematic showing overview of common data model

## 4.1 Header table

Table 2: header_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| report_id | varchar (pk) | | Unique ID for report (unique ID given by combination of report_id and observation_id) |
| region | int | region:region | Region (WMO region / Ocean basin) |
| sub_region | int | sub_region:sub_region | Country / regional sea |
| application_area | int[] | application_area:application_area | WMO application area(s) |
| observing_programme | int[] | observing_programme:observing_programme | Observing programme, e.g. VOS |
| report_type | int | report_type:type | e.g. SYNOP, TEMP, CLIMAT, etc |
| station_name | varchar | | e.g. GRUAN station name, ship name, site name etc |
| station_type | int | station_type:type | Type of station, e.g. land station, sea station etc |
| platform_type | int | platform_type:type | Structure upon which sensor is mounted, e.g. ship, drifting buoy, tower etc |
| platform_sub_type | int | platform_sub_type:sub_type | Sub-type for platform, e.g. 3m discuss buoy |
| primary_station_id | varchar | station_configuration:primary_id | Primary station identifier, e.g. WIGOS ID |
| station_record_number | int | station_configuration:record_number | Together with primary_station_id this forms a link to the station configuration table. |
| primary_station_id_scheme | int | id_scheme:scheme | Scheme used for station ID |
| longitude | numeric | | Longitude of station, -180.0 to 180.0 (or other as defined by station_crs) |
| latitude | numeric | | Latitude of station, -90 to 90 (or other as defined by station_crs) |
| location_accuracy | numeric | | Accuracy to which station location recorded (radius in km) |
| location_method | int | location_method:method | Method by which location determined |

Continued on next page

Table 2 header_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| location_quality | int | location_quality:quality | Quality flag for station location |
| crs | int | crs:crs | Coordinate reference scheme for station location |
| station_speed | numeric | | Station speed over ground if mobile (m/s) |
| station_course | numeric | | Station course over ground if mobile (degree true) |
| station_heading | numeric | | Station heading if mobile |
| height_of_station_above_local_ground | numeric | | Height of station above local ground (m) |
| height_of_station_above_sea_level | numeric | | Height of station above mean sea level (m), negative values for below sea level. |
| height_of_station_above_sea_level_accuracy | numeric | | Accuracy to which height of station known (m) |
| sea_level_datum | int | sea_level_datum:datum | Datum used for sea level |
| report_meaning_of_time_stamp | int | meaning_of_time_stamp:meaning | Report time - beginning, middle or end of reporting period |
| report_timestamp | timestamp with time-zone | | e.g. 1991-01-01 12:00:0.0+0 |
| report_duration | int | | Report duration (s), e.g. 86400 = daily obs, 3600 hourly etc |
| report_time_accuracy | numeric | | Precision to which time was recorded (s) |
| report_time_quality | int | time_quality:quality | Quality flag for report_timestamp |
| report_time_reference | int | time_reference:reference | Reference Time (e.g. referenced to time server, atomic clock, radio clock etc) |
| profile_id | varchar | profile_configuration:profile_id | Information on profile (atmospheric / oceanographic) configuration. Set to Record ID for profile data or missing (NULL) otherwise. |
| events_at_station | int[]* | events_at_station:event | e.g. ship hove to, crop burning etc. |
| report_quality | int | quality_flag:flag | Overall quality of report |

Continued on next page

Table 2 header_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| duplicate_status | int | duplicate_status:status | E.g. no duplicates, best duplicate, duplicate, not checked. |
| duplicates | varchar[]* | header_table:report_id | Array of report_id's for duplicates |
| record_timestamp | timestamp with time-zone | | Timestamp of revision for this record |
| history | varchar | | Sequence of processing steps. Free text with timestamp 1 : history 1; timestamp 2 : history 2 etc. |
| processing_level | int | report_processing_level:level | Level of processing applied to this report |
| processing_codes | int[]* | report_processing_codes:code | Processing applied to this report |
| source_id | varchar | source_configuration:source_id | Original source of data, link to external table |
| source_record_id | varchar | | Record ID in source data, e.g. ID of event from GRUAN meta database |

End of table

## 4.2 Observations table

Table 3: observations_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| observation_id | varchar (pk) | | unique ID for observation |
| report_id | varchar | header_table:report_id | Link to header information |
| data_policy_licence | int | data_policy_licence:policy | WMOessential, WMOadditional, WMOother |
| date_time | timestamp with time-zone | | timestamp for observation |
| date_time_meaning | int | meaning_of_time_stamp:meaning | beginning, middle, end |
| observation_duration | int | | Duration/period over which observation was made (s) |

Continued on next page

Table 3 observations_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| longitude | numeric | | Longitude of the observed value, -180 to 180 (or other as defined by CRS). This may or may not be the same as the report location. |
| latitude | numeric | | Latitude of the observed value, -90 to 90 (or other as defined by CRS) |
| crs | int | crs:crs | Coordinate reference scheme use to encode location |
| z_coordinate | numeric | | z coordinate of observation |
| z_coordinate_type | int | z_coordinate_type:type | Type of z coordinate |
| observation_height_above_station_surface | numeric | | Height of sensor above local ground or sea surface. Positive values for above surface (e.g. sondes), negative for below (e.g. xbt). For visual observations, height of the visual observing platform. |
| observed_variable | int | observed_variable:variable | The variable being observed / measured |
| secondary_variable | int | secondary_variable:variable | Secondary variable required to understand observation, e.g. chemical constituent. Set to NA / missing if not applicable. |
| observation_value | numeric | | The observed value |
| value_significance | int | observation_value_significance:significance | e.g. min, max, mean, sum |
| secondary_value | int | secondary_variable:value | value for the secondary variable. Set to NA or missing if not applicable. |
| units | int | units:units | Units for the observed variable |
| code_table | int | observation_code_table:code_table | Encode / decode table for variable (if encoded) |
| conversion_flag | int | conversion_flag:flag | Flag indicating whether original, converted or both values are available. |

Continued on next page

Table 3 observations_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| location_method | int | location_method:method | Method of determining location, |
| location_precision | numeric | | Precision to which location is reported (radius km) |
| z_coordinate_method | int | z_coordinate_method:method | Method of determining z coordinate |
| bbox_min_longitude | numeric | | Bounding box for observation, valid range given by CRS |
| bbox_max_longitude | numeric | | Bounding box for observation, valid range given by CRS |
| bbox_min_latitude | numeric | | Bounding box for observation, valid range given by CRS |
| bbox_max_latitude | numeric | | Bounding box for observation, valid range given by CRS |
| spatial_representativeness | int | spatial_representativeness:representativeness | Spatial representativeness of observation |
| quality_flag | int | quality_flag:flag | Quality flag for observation |
| qc_passed | int | | Number of quality control checks passed (see qc_table for more information) |
| qc_failed | int | | Number of quality control checks failed (see qc_table for more information) |
| numerical_precision | int | | Reporting precision of observation in units given by 'units' variable. Equivalent to BUFR scale factor |
| standard_uncertainty | numeric | | Standard uncertainty in reported value |
| method_of_estimating_standard_uncertainty | int | method_of_estimating_uncertainty:method | Method of estimating the standard uncertainty |
| sensor_id | varchar | sensor_configuration:sensor_id | Link to sensor_configuration table. |
| sensor_automation_status | int | automation_status:automation | Automated, manual, mixed or visual observation |
| exposure_of_sensor | int | instrument_exposure_quality:exposure | Whether the exposure of the instrument will impact on the quality of the measurement |
| original_precision | int | | Original reporting precision in units given by 'original_units' |

Continued on next page

Table 3 observations_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| original_units | int | units:units | Original units |
| original_value | numeric | | Original value as reported or recorded in log book. |
| conversion_method | int | conversion_method:method | Link to table describing conversion process |
| processing_code | int[]* | processing_code:code | e.g. TRC (temperature radiation corrections) etc. Encoded in table. |
| processing_level | int | processing_level:level | Level of processing applied to observation. |
| adjustment_id | int | adjustment:adjustment_id | Total adjustment applied to observation reported in observation value (observation_value = original + adjustment) |
| traceability | int | traceability:traceability | Whether observation can be traced to international standards. |
| advanced_qc | int | data_present:flag | Flag indicating whether advanced qc data are available |
| advanced_uncertainty | int | data_present:flag | Flag indicating whether advanced uncertainty estimates are available |
| advanced_homogenisation | int | data_present:flag | Flag indicating whether advanced homogenisation information is available |

End of table

## 4.3 Station configuration

Table 4: station_configuration definition

| element_name | type | external_table | description |
|---|---|---|---|
| primary_id | varchar (pk) | | Primary (e.g. WMO) ID for station |
| primary_id_scheme | int | id_scheme:scheme | Scheme used for primary ID |
| record_number | int (pk) | | Record number for this station entry |
| secondary_id | varchar[]* | | Secondary (e.g. local) ID for station |

Continued on next page

Table 4 station_configuration (cont.)

| element_name | type | external_table | description |
|---|---|---|---|
| secondary_id_scheme | int[]* | id_scheme:scheme | Scheme used for secondary ID |
| station_name | varchar | | Name of station (e.g. Tateno) |
| station_abbreviation | varchar | | Abbreviation of station name (e.g. TAT) |
| alternative_name | varchar[]* | | Alternative name for station |
| station_crs | int | crs:crs | coordinate reference system used to report stations location |
| longitude | numeric | | Report position for station if stationary or NULL if mobile. If more than one estimate record best here and additional values using optional fields. |
| latitude | numeric | | Report position for station if stationary or NULL if mobile |
| local_gravity | numeric | | Local gravity at station location (units ms-2) |
| start_date | timestamp | | Date that the station first started reporting in this configuration |
| end_date | timestamp | | Last data the station reported in this configuration |
| station_type | int | station_type:type | Type of reporting station |
| platform_type | int | platform_type:type | Generic type of observing platform |
| platform_sub_type | int | platform_sub_type:sub_type | Specific type of observing platform |
| operating_institute | int | organisation:organisation_id | Institute operating the station (e.g. National Oceanography Centre) |
| operating_territory | int | sub_region:sub_region | Sub-region where station is located or country of registry for mobile station |
| city | varchar | | Nearest city / town to station location |
| contact | varchar[] | contact:contact_id | Contact for station |
| role | int[] | role:role | Role of contact |

Continued on next page

Table 4 station_configuration (cont.)

| element_name | type | external_table | description |
|---|---|---|---|
| observing_frequency | int | observing_frequency:frequency | Typical frequency of observations for this station (reports per day). If irregular use reporting_time. |
| reporting_time | int[] | | Reporting hour(s) if non-standard / irregular hours used |
| telecommunication_method | int[] | communication_method:method | Method used to report observations |
| station_automation | int | automation_status:automation | Whether station is automated, manual or mixed |
| measuring_system_model | varchar[] | | Station / AWS model type |
| measuring_system_id | varchar[] | | ID or serial number of measuring system |
| observed_variables | int[] | observed_variable:variable | array indicating which variables are observed by this station |
| comment | varchar | | Any other comments / footnotes |
| optional_data | int | data_present:flag | Flag indicating availability of additional data |

End of table

Table 5: station_configuration_optional definition

| element_name | kind | external_table | description |
|---|---|---|---|
| station_primary_id | varchar | station_configuration:primary_id | Link to station for which this entry corresponds |
| record_number | int | station_configuration:record_number | Link to station for which this entry corresponds |
| kind | int | kind:kind | Enumerated data type (numeric, int, etc) |
| field | varchar | station_configuration_fields:field_id | Field that this entry corresponds to |
| value | | | Kind inherited from field |
| comments | varchar | | Any additional comments. |

End of table

## 4.4 Profile configuration

Table 6: profile_configuration definition

| element_name | kind | external_table | description |
|---|---|---|---|
| profile_id | varchar (pk) | | Unique ID for this profile entry |
| profile_type | int | profile_type:type | Type of profile (e.g. atmospheric or oceanic) |
| standard_time | int | standard_time:time | e.g. Standard / scheduled time for launch or report, e.g. 00, 06, 12, 18 UTC |
| actual_time | timestamp | | Actual report / launch time |
| profile_number | numeric | | e.g. Balloon Number |
| comments | varchar | | Any additional comments / footnotes |
| optional_data | int | data_present:flag | Flag indicating whether there is additional metadata available |

End of table

Table 7: profile_configuration_optional definition

| element_name | kind | external_table | description |
|---|---|---|---|
| profile_id | varchar | profile_configuration:profile_id | Link to profile for which this entry corresponds |
| kind | int | kind:kind | Enumerated data type (numeric, int, etc) |
| field | varchar | profile_configuration_fields:field_id | Field that this entry corresponds to |
| value | | | Kind inherited from field |
| comments | varchar | | Any additional comments. |

End of table

## 4.5 Source configuration

Table 8: source_configuration definition

| element_name | type | external_table | description |
|---|---|---|---|
| source_id | varchar (pk) | | Unique record ID for dataset |
| product_id | varchar | | ID for product |

Continued on next page

Table 8 source_configuration (cont.)

| element_name | type | external_table | description |
|---|---|---|---|
| product_name | varchar | | Name of source, e.g. International Comprehensive Ocean Atmosphere Data Set, RS92 GRUAN Data Product |
| product_code | varchar | | Abbreviations / product code, e.g. ICOADS, RS92-GDP |
| product_version | varchar | | Version number for dataset, e.g. Release 3.0.0 |
| product_level | int | product_level:level | Level of product |
| product_uri | varchar | | URI for product, either to original source or to CDS |
| description | varchar | | Description of dataset / comments |
| product_references | varchar[] | | References describing the dataset |
| product_citation | varchar[] | | Citation to use when using this product |
| product_status | int | product_status:status | Status of product, draft, pre-release, release |
| source_format | int | source_format:format | Original format for data |
| source_format_version | varchar | | Version of original data format |
| source_file | varchar | | Filename for data from source |
| source_file_checksum | varchar | | Checksum of source datafile |
| data_centre | int | organisation:organisation_id | Data centre from which data sourced |
| data_centre_url | varchar | | URL for data centre |
| data_policy_licence | int | data_policy_licence:policy | Data policy / licence |
| contact | varchar[] | contact:contact_id | contact for data source with role specified by role element |
| contact_role | int[] | role:role | role of contact |
| history | varchar | | History of source |
| comments | varchar | | Additional comments / footnotes |
| timestamp | timestamp with timezone | | Date record created / created |

Continued on next page

Table 8 source_configuration (cont.)

| element_name | type | external_table | description |
|---|---|---|---|
| maintenance_and_update_frequency | int | update_frequency:frequency | Frequency with which modifications and deletions are made to the data after it is first produced |
| optional_data | int | data_present:flag | Flag indicating availability of additional data |

End of table

Table 9: source_configuration_optional definition

| element_name | kind | external_table | description |
|---|---|---|---|
| source_id | varchar (fk) | source_configuration:source_id | Link to source for which this entry corresponds |
| kind | int | kind:kind | Enumerated data type (numeric, int, etc) |
| field | varchar | source_configuration_fields:field_id | Field that this entry corresponds to |
| value | | | Kind inherited from field |
| comments | varchar | | Any additional comments. |

End of table

## 4.6 Sensor configuration

Table 10: sensor_configuration definition

| element_name | type | external_table | description |
|---|---|---|---|
| sensor_id | varchar (pk) | | Unique ID for this instrument |
| observing_method | int | observing_method:method | Method (instrumental, estimated / visual, computed) by which observation made |
| sampling_strategy | int | sampling_strategy:strategy | Sampling strategy used by instrument |
| calibration_status | int | calibration_status:status | Whether the sensor is in / out of calibration |
| calibration_date | timestamp | | Date of last calibration |
| comments | varchar | | additional comments for sensor not reportable elsewhere |
| date_start | timestamp | | start date for period of validity assoiciated with this entry |

Continued on next page

Table 10 sensor_configuration (cont.)

| element_name | type | external_table | description |
|---|---|---|---|
| date_end | timestamp | | end date for period of validity assoiciated with this entry |
| optional_data | int | data_present:flag | Flag indicating if additional data available |

End of table

Table 11: sensor_configuration_optional definition

| element_name | kind | external_table | description |
|---|---|---|---|
| sensor_id | varchar (fk) | sensor_configuration:sensor_id | Link to sensor for which this entry corresponds |
| kind | int | kind:kind | Enumerated data type (numeric, int, etc) |
| field | varchar | sensor_configuration_fields:field_id | Field that this entry corresponds to |
| value | | | Kind inherited from field |
| comments | varchar | | Any additional comments. |

End of table

## 4.7 Quality control flags

A single QC flag is provided in the observations table for the observed value. Additional flags can be provided using the qc_table and by setting the advanced_qc flag to true in the observations_table.

Table 12: qc_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| report_id | varchar | header_table:report_id | Link to report this entry is for |
| observation_id | varchar | observations_table:observation_id | Link to observation this entry is for. Set to NULL / NA if entry for report level QC |
| qc_method | int | qc_method:method | Link to table describing QC method used to set this flag |
| qc_flag | int | quality_flag:flag | E.g. 0 = good, 1 = inconsistent etc |

End of table

## 4.8 Uncertainty budget

A single standard uncertainty value is provided for each observed value in the observations table. Additional values can be provided using the uncertainty_table and by setting the advanced_uncertainty to true in the observations_table.

Table 13: uncertainty_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| observation_id | varchar | observations_table :observation_id | Link to observation this entry is for |
| uncertainty_type | varchar | | Text description of the type of uncertainty described by this entry |
| uncertainty_method | int | uncertainty_method:method | Method used to estimate this uncertainty |
| uncertainty_value | numeric | | Expected error standard deviation due to specified uncerainty source |
| uncertainty_units | int | units:units | The units used to report the uncertainty. This may be different to the reporting units (e.g. %) |

End of table

## 4.9 Homogenisation data

Table 14: homogenisation_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| observation_id | varchar | observations_table :observation_id | Link to observation this entry is for |
| homogenisation_method | int | homogenisation_method:method | Method used to homogenise data |
| homogenisation_ adjustment | numeric | | Value applied to homogenise data (homogenised_value = original (+-/*) homogenisation_adjustment) |
| homogenisation _operator | int | homogenisation_operator:operator | Operator (+-/*) used to apply adjustment |

Continued on next page

Table 14 homogenisation_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| homogenisation_order | int | | Order in which the adjustments are applied. Set to NA or missing if not applicable |

End of table

# 5 References

Freeman E., S. D. Woodruff, S. J. Worley, S. J. Lubker, E. C. Kent, W. E. Angel, D. I. Berry , P. Brohan, R. Eastman, L. Gates, W. Gloeden, Z. Ji, J. Lawrimore, N. A. Rayner, G. Rosenhagen, S. R. Smith, 2017: ICOADS Release 3.0: A Major Update to the Historical Marine Climate Record, International Journal of Climatology, 37, 2211 - 2232. doi:10.1002/joc.4775

GCOS, 2016: The Global Observing System for Climate: Implementation Needs. GCOS-200 / GOOS-214, WMO, Geneva, 342pp.

Hersbach, H., P. Poli and D. Dee, 2015: The observation feedback archive for ICOADS and ISPD datasets. ERA Report Series No. 18, ECMWF, Reading, UK,
31pp.

Saarinen, S., 2004: ODB User guide (draft 1st edition), ECMWF, Reading, UK, 289pp.

WMO, 2015a: Manual On Codes (WMO-No 306), Volume I.2, Part B - Binary Codes, WMO, Geneva.

WMO, 2015b: Manual on the WMO Integrated Global Observing System: Annex VIII to the Technical Regulations (WMO-No 1160), WMO, Geneva.

# 6 Appendix

## 6.1 Table definitions

### 6.1.1 Data tables

Table 15: adjustment definition

| element_name | kind | external_table | description |
|---|---|---|---|
| adjustment_id | varchar (pk) | | unique ID for adjustment record |
| observation_id | varchar | observations_table :observation_id | link to observation that this entry is for |
| value | numeric | | adjustment value |
| reference | varchar | | reference describing adjustment |

End of table

Table 16: contact definition

| element_name | kind | external_table | description |
|---|---|---|---|
| contact_id | varchar (pk) | | primary key |
| title | varchar | | Title of contact (e.g. Mr, Mrs, Dr. etc) |
| name | varchar | | Name of contact |
| organisation | varchar | organisation:organisation_id | Link to organisation that contact is associated with |
| telephone | varchar | | telephone number for contacr |
| email | varchar | | email address for contact |
| url | varchar | | website for contact |

End of table

Table 17: header_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| report_id | varchar (pk) | | Unique ID for report (unique ID given by combination of report_id and observation_id) |
| region | int | region:region | Region (WMO region / Ocean basin) |
| sub_region | int | sub_region:sub_region | Country / regional sea |

Continued on next page

Table 17 header_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| application_area | int[] | application_area:application_area | WMO application area(s) |
| observing_programme | int[] | observing_programme:observing_programme | Observing programme, e.g. VOS |
| report_type | int | report_type:type | e.g. SYNOP, TEMP, CLIMAT, etc |
| station_name | varchar | | e.g. GRUAN station name, ship name, site name etc |
| station_type | int | station_type:type | Type of station, e.g. land station, sea station etc |
| platform_type | int | platform_type:type | Structure upon which sensor is mounted, e.g. ship, drifting buoy, tower etc |
| platform_sub_type | int | platform_sub_type:sub_type | Sub-type for platform, e.g. 3m discuss buoy |
| primary_station_id | varchar | station_configuration:primary_id | Primary station identifier, e.g. WIGOS ID |
| station_record_number | int | station_configuration:record_number | Together with primary_station_id this forms a link to the station configuration table. |
| primary_station_id_scheme | int | id_scheme:scheme | Scheme used for station ID |
| longitude | numeric | | Longitude of station, -180.0 to 180.0 (or other as defined by station_crs) |
| latitude | numeric | | Latitude of station, -90 to 90 (or other as defined by station_crs) |
| location_accuracy | numeric | | Accuracy to which station location recorded (radius in km) |
| location_method | int | location_method:method | Method by which location determined |
| location_quality | int | location_quality:quality | Quality flag for station location |
| crs | int | crs:crs | Coordinate reference scheme for station location |
| station_speed | numeric | | Station speed over ground if mobile (m/s) |
| station_course | numeric | | Station course over ground if mobile (degree true) |
| station_heading | numeric | | Station heading if mobile |

Continued on next page

Table 17 header_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| height_of_station_above_local_ground | numeric | | Height of station above local ground (m) |
| height_of_station_above_sea_level | numeric | | Height of station above mean sea level (m), negative values for below sea level. |
| height_of_station_above_sea_level_accuracy | numeric | | Accuracy to which height of station known (m) |
| sea_level_datum | int | sea_level_datum:datum | Datum used for sea level |
| report_meaning_of_time_stamp | int | meaning_of_time_stamp:meaning | Report time - beginning, middle or end of reporting period |
| report_timestamp | timestamp with time-zone | | e.g. 1991-01-01 12:00:0.0+0 |
| report_duration | int | | Report duration (s), e.g. 86400 = daily obs, 3600 hourly etc |
| report_time_accuracy | numeric | | Precision to which time was recorded (s) |
| report_time_quality | int | time_quality:quality | Quality flag for report_timestamp |
| report_time_reference | int | time_reference:reference | Reference Time (e.g. referenced to time server, atomic clock, radio clock etc) |
| profile_id | varchar | profile_configuration:profile_id | Information on profile (atmospheric / oceanographic) configuration. Set to Record ID for profile data or missing (NULL) otherwise. |
| events_at_station | int[]* | events_at_station:event | e.g. ship hove to, crop burning etc. |
| report_quality | int | quality_flag:flag | Overall quality of report |
| duplicate_status | int | duplicate_status:status | E.g. no duplicates, best duplicate, duplicate, not checked. |
| duplicates | varchar[]* | header_table:report_id | Array of report_id's for duplicates |
| record_timestamp | timestamp with time-zone | | Timestamp of revision for this record |

Continued on next page

Table 17 header_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| history | varchar | | Sequence of processing steps. Free text with timestamp 1 : history 1; timestamp 2 : history 2 etc. |
| processing_level | int | report_processing_level:level | Level of processing applied to this report |
| processing_codes | int[]* | report_processing_codes:code | Processing applied to this report |
| source_id | varchar | source_configuration:source_id | Original source of data, link to external table |
| source_record_id | varchar | | Record ID in source data, e.g. ID of event from GRUAN meta database |

End of table

Table 18: homogenisation_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| observation_id | varchar | observations_table:observation_id | Link to observation this entry is for |
| homogenisation_method | int | homogenisation_method:method | Method used to homogenise data |
| homogenisation_adjustment | numeric | | Value applied to homogenise data (homogenised_value = original (+-/*) homogenisation_adjustment) |
| homogenisation_operator | int | homogenisation_operator:operator | Operator (+-/*) used to apply adjustment |
| homogenisation_order | int | | Order in which the adjustments are applied. Set to NA or missing if not applicable |

End of table

Table 19: observations_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| observation_id | varchar (pk) | | unique ID for observation |
| report_id | varchar | header_table:report_id | Link to header information |

Continued on next page

Table 19 observations_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| data_policy_licence | int | data_policy_licence:policy | WMOessential, WMOadditional, WMOother |
| date_time | timestamp with time-zone | | timestamp for observation |
| date_time_meaning | int | meaning_of_time_stamp:meaning | beginning, middle, end |
| observation_duration | int | | Duration/period over which observation was made (s) |
| longitude | numeric | | Longitude of the observed value, -180 to 180 (or other as defined by CRS). This may or may not be the same as the report location. |
| latitude | numeric | | Latitude of the observed value, -90 to 90 (or other as defined by CRS) |
| crs | int | crs:crs | Coordinate reference scheme use to encode location |
| z_coordinate | numeric | | z coordinate of observation |
| z_coordinate_type | int | z_coordinate_type:type | Type of z coordinate |
| observation_height_above_station_surface | numeric | | Height of sensor above local ground or sea surface. Positive values for above surface (e.g. sondes), negative for below (e.g. xbt). For visual observations, height of the visual observing platform. |
| observed_variable | int | observed_variable:variable | The variable being observed / measured |
| secondary_variable | int | secondary_variable:variable | Secondary variable required to understand observation, e.g. chemical constituent. Set to NA / missing if not applicable. |
| observation_value | numeric | | The observed value |
| value_significance | int | observation_value_significance:significance | e.g. min, max, mean, sum |

Continued on next page

Table 19 observations_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| secondary_value | int | secondary_variable:value | value for the secondary variable. Set to NA or missing if not applicable. |
| units | int | units:units | Units for the observed variable |
| code_table | int | observation_code_table:code_table | Encode / decode table for variable (if encoded) |
| conversion_flag | int | conversion_flag:flag | Flag indicating whether original, converted or both values are available. |
| location_method | int | location_method:method | Method of determining location, |
| location_precision | numeric | | Precision to which location is reported (radius km) |
| z_coordinate_method | int | z_coordinate_method:method | Method of determining z coordinate |
| bbox_min_longitude | numeric | | Bounding box for observation, valid range given by CRS |
| bbox_max_longitude | numeric | | Bounding box for observation, valid range given by CRS |
| bbox_min_latitude | numeric | | Bounding box for observation, valid range given by CRS |
| bbox_max_latitude | numeric | | Bounding box for observation, valid range given by CRS |
| spatial_representativeness | int | spatial_representativeness:representativeness | Spatial representativeness of observation |
| quality_flag | int | quality_flag:flag | Quality flag for observation |
| qc_passed | int | | Number of quality control checks passed (see qc_table for more information) |
| qc_failed | int | | Number of quality control checks failed (see qc_table for more information) |
| numerical_precision | int | | Reporting precision of observation in units given by 'units' variable. Equivalent to BUFR scale factor |
| standard_uncertainty | numeric | | Standard uncertainty in reported value |

Continued on next page

Table 19 observations_table (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| method_of_estimating_standard_uncertainty | int | method_of_estimating_uncertainty:method | Method of estimating the standard uncertainty |
| sensor_id | varchar | sensor_configuration:sensor_id | Link to sensor_configuration table. |
| sensor_automation_status | int | automation_status:automation | Automated, manual, mixed or visual observation |
| exposure_of_sensor | int | instrument_exposure_quality:exposure | Whether the exposure of the instrument will impact on the quality of the measurement |
| original_precision | int | | Original reporting precision in units given by 'original_units' |
| original_units | int | units:units | Original units |
| original_value | numeric | | Original value as reported or recorded in log book. |
| conversion_method | int | conversion_method:method | Link to table describing conversion process |
| processing_code | int[]* | processing_code:code | e.g. TRC (temperature radiation corrections) etc. Encoded in table. |
| processing_level | int | processing_level:level | Level of processing applied to observation. |
| adjustment_id | int | adjustment:adjustment_id | Total adjustment applied to observation reported in observation value (observation_value = original + adjustment) |
| traceability | int | traceability:traceability | Whether observation can be traced to international standards. |
| advanced_qc | int | data_present:flag | Flag indicating whether advanced qc data are available |
| advanced_uncertainty | int | data_present:flag | Flag indicating whether advanced uncertainty estimates are available |
| advanced_homogenisation | int | data_present:flag | Flag indicating whether advanced homogenisation information is available |

End of table

Table 20: organisation definition

| element_name | kind | external_table | description |
|---|---|---|---|
| organisation_id | varchar (pk) | | unique ID for organisation |
| parent_organisation | varchar | organisation:organisation_id | Link to parent organisation (or NA/NULL or none) |
| name | varchar | | Name of organisation |
| abbreviation | varchar | | Abbreviated name (or NA/NULL) |
| address | varchar | | Road / building name |
| city | varchar | | City |
| admin_area | varchar | | County or admin region |
| region | int | region:region | WMO Region |
| country | int | sub_region:sub_region | Country |
| postal_code | varchar | | Postal / zip code |
| telephone | varchar | | Primary telephone number of organisation |
| url | varchar | | Link to organisation website |
| email | varchar | | Primary email contact for website |

End of table

Table 21: profile_configuration definition

| element_name | kind | external_table | description |
|---|---|---|---|
| profile_id | varchar (pk) | | Unique ID for this profile entry |
| profile_type | int | profile_type:type | Type of profile (e.g. atmospheric or oceanic) |
| standard_time | int | standard_time:time | e.g. Standard / scheduled time for launch or report, e.g. 00, 06, 12, 18 UTC |
| actual_time | timestamp | | Actual report / launch time |
| profile_number | numeric | | e.g. Balloon Number |
| comments | varchar | | Any additional comments / footnotes |
| optional_data | int | data_present:flag | Flag indicating whether there is additional metadata available |

End of table

Table 22: profile_configuration_optional definition

| element_name | kind | external_table | description |
|---|---|---|---|
| profile_id | varchar | profile_configuration:profile_id | Link to profile for which this entry corresponds |
| kind | int | kind:kind | Enumerated data type (numeric, int, etc) |
| field | varchar | profile_configuration_fields:field_id | Field that this entry corresponds to |
| value | | | Kind inherited from field |
| comments | varchar | | Any additional comments. |

End of table

Table 23: qc_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| report_id | varchar | header_table:report_id | Link to report this entry is for |
| observation_id | varchar | observations_table:observation_id | Link to observation this entry is for. Set to NULL / NA if entry for report level QC |
| qc_method | int | qc_method:method | Link to table describing QC method used to set this flag |
| qc_flag | int | quality_flag:flag | E.g. 0 = good, 1 = inconsistent etc |

End of table

Table 24: sensor_configuration definition

| element_name | type | external_table | description |
|---|---|---|---|
| sensor_id | varchar (pk) | | Unique ID for this instrument |
| observing_method | int | observing_method:method | Method (instrumental, estimated / visual, computed) by which observation made |
| sampling_strategy | int | sampling_strategy:strategy | Sampling strategy used by instrument |
| calibration_status | int | calibration_status:status | Whether the sensor is in / out of calibration |
| calibration_date | timestamp | | Date of last calibration |
| comments | varchar | | additional comments for sensor not reportable elsewhere |

Continued on next page

Table 24 sensor_configuration (cont.)

| element_name | type | external_table | description |
|---|---|---|---|
| date_start | timestamp | | start date for period of validity assoiciated with this entry |
| date_end | timestamp | | end date for period of validity assoiciated with this entry |
| optional_data | int | data_present:flag | Flag indicating if additional data available |

End of table

Table 25: sensor_configuration_optional definition

| element_name | kind | external_table | description |
|---|---|---|---|
| sensor_id | varchar (fk) | sensor_configuration:sensor_id | Link to sensor for which this entry corresponds |
| kind | int | kind:kind | Enumerated data type (numeric, int, etc) |
| field | varchar | sensor_configuration_fields:field_id | Field that this entry corresponds to |
| value | | | Kind inherited from field |
| comments | varchar | | Any additional comments. |

End of table

Table 26: source_configuration definition

| element_name | type | external_table | description |
|---|---|---|---|
| source_id | varchar (pk) | | Unique record ID for dataset |
| product_id | varchar | | ID for product |
| product_name | varchar | | Name of source, e.g. International Comprehensive Ocean Atmosphere Data Set, RS92 GRUAN Data Product |
| product_code | varchar | | Abbreviations / product code, e.g. ICOADS, RS92-GDP |
| product_version | varchar | | Version number for dataset, e.g. Release 3.0.0 |
| product_level | int | product_level:level | Level of product |
| product_uri | varchar | | URI for product, either to original source or to CDS |
| description | varchar | | Description of dataset / comments |

Continued on next page

Table 26 source_configuration (cont.)

| element_name | type | external_table | description |
|---|---|---|---|
| product_references | varchar[] | | References describing the dataset |
| product_citation | varchar[] | | Citation to use when using this product |
| product_status | int | product_status:status | Status of product, draft, pre-release, release |
| source_format | int | source_format:format | Original format for data |
| source_format_version | varchar | | Version of original data format |
| source_file | varchar | | Filename for data from source |
| source_file_checksum | varchar | | Checksum of source datafile |
| data_centre | int | organisation:organisation_id | Data centre from which data sourced |
| data_centre_url | varchar | | URL for data centre |
| data_policy_licence | int | data_policy_licence:policy | Data policy / licence |
| contact | varchar[] | contact:contact_id | contact for data source with role specified by role element |
| contact_role | int[] | role:role | role of contact |
| history | varchar | | History of source |
| comments | varchar | | Additional comments / footnotes |
| timestamp | timestamp with time-zone | | Date record created / created |
| maintenance_and_update_frequency | int | update_frequency:frequency | Frequency with which modifications and deletions are made to the data after it is first produced |
| optional_data | int | data_present:flag | Flag indicating availability of additional data |

End of table

Table 27: source_configuration_optional definition

| element_name | kind | external_table | description |
|---|---|---|---|
| source_id | varchar (fk) | source_configuration:source_id | Link to source for which this entry corresponds |
| kind | int | kind:kind | Enumerated data type (numeric, int, etc) |

Continued on next page

Table 27 source_configuration_optional (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| field | varchar | source_configuration_fields:field_id | Field that this entry corresponds to |
| value | | | Kind inherited from field |
| comments | varchar | | Any additional comments. |

End of table

Table 28: station_configuration definition

| element_name | type | external_table | description |
|---|---|---|---|
| primary_id | varchar (pk) | | Primary (e.g. WMO) ID for station |
| primary_id_scheme | int | id_scheme:scheme | Scheme used for primary ID |
| record_number | int (pk) | | Record number for this station entry |
| secondary_id | varchar[]* | | Secondary (e.g. local) ID for station |
| secondary_id_scheme | int[]* | id_scheme:scheme | Scheme used for secondary ID |
| station_name | varchar | | Name of station (e.g. Tateno) |
| station_abbreviation | varchar | | Abbreviation of station name (e.g. TAT) |
| alternative_name | varchar[]* | | Alternative name for station |
| station_crs | int | crs:crs | coordinate reference system used to report stations location |
| longitude | numeric | | Report position for station if stationary or NULL if mobile. If more than one estimate record best here and additional values using optional fields. |
| latitude | numeric | | Report position for station if stationary or NULL if mobile |
| local_gravity | numeric | | Local gravity at station location (units ms-2) |
| start_date | timestamp | | Date that the station first started reporting in this configuration |
| end_date | timestamp | | Last data the station reported in this configuration |
| station_type | int | station_type:type | Type of reporting station |

Continued on next page

Table 28 station_configuration (cont.)

| element_name | type | external_table | description |
|---|---|---|---|
| platform_type | int | platform_type:type | Generic type of observing platform |
| platform_sub_type | int | platform_sub_type:sub_type | Specific type of observing platform |
| operating_institute | int | organisation:organisation_id | Institute operating the station (e.g. National Oceanography Centre) |
| operating_territory | int | sub_region:sub_region | Sub-region where station is located or country of registry for mobile station |
| city | varchar | | Nearest city / town to station location |
| contact | varchar[] | contact:contact_id | Contact for station |
| role | int[] | role:role | Role of contact |
| observing_frequency | int | observing_frequency:frequency | Typical frequency of observations for this station (reports per day). If irregular use reporting_time. |
| reporting_time | int[] | | Reporting hour(s) if non-standard / irregular hours used |
| telecommunication_method | int[] | communication_method:method | Method used to report observations |
| station_automation | int | automation_status:automation | Whether station is automated, manual or mixed |
| measuring_system_model | varchar[] | | Station / AWS model type |
| measuring_system_id | varchar[] | | ID or serial number of measuring system |
| observed_variables | int[] | observed_variable:variable | array indicating which variables are observed by this station |
| comment | varchar | | Any other comments / footnotes |
| optional_data | int | data_present:flag | Flag indicating availability of additional data |

End of table

Table 29: station_configuration_optional definition

| element_name | kind | external_table | description |
|---|---|---|---|
| station_primary_id | varchar | station_configuration:primary_id | Link to station for which this entry corresponds |
| record_number | int | station_configuration:record_number | Link to station for which this entry corresponds |
| kind | int | kind:kind | Enumerated data type (numeric, int, etc) |
| field | varchar | station_configuration_fields:field_id | Field that this entry corresponds to |
| value | | | Kind inherited from field |
| comments | varchar | | Any additional comments. |

End of table

Table 30: uncertainty_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| observation_id | varchar | observations_table:observation_id | Link to observation this entry is for |
| uncertainty_type | varchar | | Text description of the type of uncertainty described by this entry |
| uncertainty_method | int | uncertainty_method:method | Method used to estimate this uncertainty |
| uncertainty_value | numeric | | Expected error standard deviation due to specified uncerainty source |
| uncertainty_units | int | units:units | The units used to report the uncertainty. This may be different to the reporting units (e.g. %) |

End of table

### 6.1.2 Code tables

Table 31: application_area definition (WIGOS 2-01)

| element_name | kind | external_table | description |
|---|---|---|---|
| application_area | int(pk) | | Unique ID for code entry |
| description | varchar | | Description of application area |

End of table

Table 32: automation_status definition

| element_name | kind | external_table | description |
|---|---|---|---|
| automation | int(pk) | | Unique ID for entry |
| description | varchar | | description of automation status (e.g. automatic observations, manual observation etc) |

End of table

Table 33: calibration_status definition (WIGOS 5-08)

| element_name | kind | external_table | description |
|---|---|---|---|
| status | int(pk) | | unique ID for entry |
| description | varchar | | Description of calibration status (e.g. No changes - in calibration etc) |

End of table

Table 34: communication_method definition (Various sources (WMO47, WIGOS, BUFR))

| elemet_name | kind | external_table | description |
|---|---|---|---|
| method | int(pk) | | Primary key / unique ID for entry |
| description | varchar | | Decoded value / text description of communication method |

End of table

Table 35: conversion_flag definition

| element_name | kind | external_table | description |
|---|---|---|---|
| flag | int(pk) | | primary key |
| description | varchar | | Description of whether the original value has been converted or decoded and is stored in the observed variable element |

End of table

Table 36: conversion_method definition

| element_name | kind | external_table | description |
|---|---|---|---|
| method | int(pk) | | unique ID for entry |
| description | varchar | | text description of conversion method |
| implementation | varchar | | details of implementation |
| reference | varchar | | reference / doi of document giving more details on conversion method |

End of table

Table 37: crs definition (BUFR 0 01 150)

| element_name | kind | external_table | description |
|---|---|---|---|
| crs | int(pk) | | primary key |
| description | varchar | | Decoded value / description of coordinate reference system |

End of table

Table 38: data_policy_licence definition (WIGOS 9-02)

| element_name | kind | external_table | description |
|---|---|---|---|
| policy | int (pk) | | Primary key for table |
| name | varchar | | short name of data policy |
| description | varchar | | Description of data licence, usage rights and restrictions |

End of table

Table 39: data_present definition

| element_name | kind | external_table | description |
|---|---|---|---|
| flag | int(pk) | | Primary key for table |
| description | varchar | | Decoded value indicating presence of additional data |

End of table

Table 40: duplicate_status definition (Simplified version of duplicate status flags from IMMA (ICOADS))

| element_name | kind | external_table | description |
|---|---|---|---|
| status | int(pk) | | Primary key for table |
| description | varchar | | Decoded value / description of duplicate status (e.g. unique, best duplicate etc) |

End of table

Table 41: events_at_station definition (WIGOS 4-04)

| element_name | kind | external_table | description |
|---|---|---|---|
| event | int(pk) | | primary key for table |
| description | varchar | | Decoded value / description of events at the time of report / observation |

End of table

Table 42: homogenisation_method definition

| element_name | kind | external_table | description |
|---|---|---|---|
| method | int (pk) | | Primary key for table |
| description | varchar | | Description of method |
| reference | varchar | | DOI or reference for method |

End of table

Table 43: homogenisation_operator definition

| element_name | kind | external_table | description |
|---|---|---|---|
| operator | int (pk) | | Primary key for table |

Continued on next page

Table 43 homogenisation_operator (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| symbol | varchar | | symbol representation of operator, e.g. + |
| description | varchar | | text representation of operator, e.g. add |

End of table

Table 44: id_scheme definition

| element_name | kind | external_table | description |
|---|---|---|---|
| scheme | int(pk) | | Primary key for table |
| description | varchar | | Decoded value / description of ID scheme used to report the station ID |

End of table

Table 45: instrument_exposure_quality definition (WIGOS 5-15)

| element_name | kind | external_table | description |
|---|---|---|---|
| exposure | int(pk) | | primary key for table |
| description | varchar | | decoded value / description of instrument exposure quality |

End of table

Table 46: kind definition

| element_name | kind | external_table | description |
|---|---|---|---|
| kind | int(pk) | | primary key |
| description | varchar | | kind of data (int, numeric etc) |

End of table

Table 47: location_method definition (based on WIGOS 11-01 and BUFR 0 02 148)

| element_name | kind | external_table | description |
|---|---|---|---|
| method | int(pk) | | primary key for table |

Continued on next page

Table 47 location_method (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| description | varchar | | decoded value / description of method by which the station location has been determined |

End of table

Table 48: location_quality definition

| element_name | kind | external_table | description |
|---|---|---|---|
| quality | int (pk) | | primary key for table |
| description | varchar | | decoded value / description of the quality of the location this indicator is for |

End of table

Table 49: meaning_of_time_stamp definition (Based on simplified version of WIGOS 11-03)

| element_name | kind | external_table | description |
|---|---|---|---|
| meaning | int(pk) | | primary key |
| name | varchar | | abbreviation / simple name for meaning of time stamp |
| description | varchar | | definition of meaning of time stamp |

End of table

Table 50: method_of_estimating_uncertainty definition

| element_name | kind | external_table | description |
|---|---|---|---|
| method | int(pk) | | primary key for table |
| description | varchar | | decoded value / description of how the uncertainty has been determined |
| reference | varchar | | Reference or DOI describing method |

End of table

Table 51: observation_code_table definition

| element_name | kind | external_table | description |
|---|---|---|---|
| code_table | int (pk) | | Primary key for table |
| code_table_scheme | varchar | | External scheme used for code table (e.g. BUFR) |
| code_table_id | varchar | | ID used to identify table within scheme (e.g. F XX YYY for BUFR tables) |
| code_table_name | varchar | | Name of code table |
| value | int | | coded value |
| description | varchar | | decoded value / meaning of decoded value |

End of table

Table 52: observation_value_significance definition (based on BUFR 0 08 023)

| element_name | kind | external_table | description |
|---|---|---|---|
| significance | int (pk) | | Primary key for table |
| description | varchar | | decoded value / description of indicated significance (e.g. min over specified period) |

End of table

Table 53: observed_variable definition

| element_name | kind | external_table | description |
|---|---|---|---|
| variable | int(pk) | | primary key for table |
| parameter_group | varchar | | parameter group (e.g. temperature, pressure) that this variable belongs to |
| domain | varchar | | Observation domain (atmospheric, oceanic etc) that this variable is typically reported for |
| sub_domain | varchar | | Sub-domain (e.g. upper air, surface etc) |
| name | varchar | | common name for variable |
| units | varchar | | ASCII abbreviation of units |

Continued on next page

Table 53 observed_variable (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| description | varchar | | Description / definition of variable |

End of table

Table 54: observing_frequency definition (WMO47 - 0602)

| element_name | kind | external_table | description |
|---|---|---|---|
| frequency | int(pk) | | primary key for table |
| description | varchar | | decoded value / description of reporting frequency (e.g. once per day) |

End of table

Table 55: observing_method definition

| element_name | kind | external_table | description |
|---|---|---|---|
| method | int (pk) | | primary key for table |
| description | varchar | | decoded value indicating method of observing (e.g. measured, estimating or computed) |

End of table

Table 56: observing_programme definition (WIGOS 2-02)

| element_name | kind | external_table | description |
|---|---|---|---|
| observing_programme | int(pk) | | primary key for table |
| abbreviation | varchar | | Commonly used abbreviation for observing programme (e.g. VOS) |
| description | varchar | | Description or name of obsserving programme (e.g. Voluntary Observing Ships) |
| sponsor | varchar | | primary sponsor of observing programme (e.g. JCOMM) |

End of table

Table 57: platform_sub_type definition (based on WMO47, ICOADS, BUFR 0 02 149)

| element_name | kind | external_table | description |
|---|---|---|---|
| sub_type | int (pk) | | primary key for table |
| platform_type | int | platform_type:type | platform type to which this sub-type belongs |
| abbreviation | varchar | | abbreviation used to indicate this platform sub-type |
| description | varchar | | description of observing platform sub-type (e.g. Container ship) |

End of table

Table 58: platform_type definition (IMMA (ICOADS) and BUFR 0 03 001 (0 - 31))

| element_name | kind | external_table | description |
|---|---|---|---|
| type | int (pk) | | primary key for table |
| description | varchar | | Description of class of observing platform |

End of table

Table 59: processing_code definition

| element_name | kind | external_table | description |
|---|---|---|---|
| code | int (pk) | | primary key for table |
| abbreviation | varchar | | abbreviation for processing code |
| description | varchar | | description / meaning of processing code |

End of table

Table 60: processing_level definition (WIGOS 7-06)

| element_name | kind | external_table | description |
|---|---|---|---|
| level | int (pk) | | primary key for table |
| name | varchar | | Name commonly used to indicate level of processing |
| description | varchar | | Description of processing level |

End of table

Table 61: product_level definition

| element_name | kind | external_table | description |
|---|---|---|---|
| level | int (pk) | | primary key for table |
| description | varchar | | Meaning of product level |

End of table

Table 62: product_status definition

| element_name | kind | external_table | description |
|---|---|---|---|
| status | int(pk) | | primary key for table |
| abbreviation | varchar | | abbreviation used to indicate product status |
| description | varchar | | Meaning of product status |

End of table

Table 63: profile_configuration_codes definition

| element_name | kind | external_table | description |
|---|---|---|---|
| field_id | varchar (pk) | profile_configuration_fields:field_id | Link to field code is for |
| field_name | varchar | | Name of field |
| code_value | int (pk) | | Coded value. Together with field_id forms primary key |
| abbreviation | varchar | | Abbreviation used for coded value |
| description | varchar | | Decoded value / meaning of code |
| start_date | timestamp | | Start of validity period for indicated code |
| end_date | timestamp | | End of validity period for indicated code |

End of table

Table 64: profile_configuration_fields definition

| element_name | kind | external_table | description |
|---|---|---|---|
| field_id | varchar (pk) | | primary key |
| field_name | varchar | | Name of field described by this entry |

Continued on next page

Table 64 profile_configuration_fields (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| type | int | kind:kind | The variable type used to store information on the indicated field |
| description | varchar | | Description of the indicated field |

End of table

Table 65: profile_type definition

| element_name | kind | external_table | description |
|---|---|---|---|
| type | int (pk) | | primary key for table |
| description | varchar | | type of profile measurements (atmospheric, oceanographic etc) |

End of table

Table 66: qc_method definition

| element_name | kind | external_table | description |
|---|---|---|---|
| method | int (pk) | | Primary key for table |
| description | varchar | | Description of method |
| reference | varchar | | DOI or reference for method |

End of table

Table 67: quality_flag definition (BUFR 0 33 020)

| element_name | kind | external_table | description |
|---|---|---|---|
| flag | int (pk) | | primary key for table |
| description | varchar | | meaning of quality flag |

End of table

Table 68: region definition (WIGOS 3-01)

| element_name | kind | external_table | description |
|---|---|---|---|
| region | int(pk) | | primary key for table |
| WMO_region | int | | WMO region that this corresponds to |
| desription | varchar | | Definition of region |

Continued on next page

Table 68 region (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|

End of table

Table 69: report_processing_codes definition

| element_name | kind | external_table | description |
|---|---|---|---|
| code | int (pk) | | primary key for table |
| abbreviation | varchar | | abbreviation used to indicate processing code |
| description | varchar | | definition of processing code |

End of table

Table 70: report_processing_level definition

| element_name | kind | external_table | description |
|---|---|---|---|
| level | int(pk) | | primary key for table |
| abbreviation | varchar | | abbreviation used to indicate processing level |
| description | varchar | | definition of processing level |

End of table

Table 71: report_type definition

| element_name | kind | external_table | description |
|---|---|---|---|
| type | int(pk) | | primary key for table |
| abbreviation | varchar | | abbreviation used to indicate report type (e.g. SHIP) |
| description | varchar | | description of report type, e.g. routine weather report made by ship |

End of table

Table 72: role definition (ISOTC211/19115 CIRoleCode)

| element_name | kind | external_table | description |
|---|---|---|---|
| role | int(pk) | | primary key for table |
| description | varchar | | definition of role |

End of table

Table 73: sampling_strategy definition (WIGOS 6-03)

| element_name | kind | external_table | description |
|---|---|---|---|
| strategy | int (pk) | | primary key for table |
| name | varchar | | name or abbreviation used to indicate sampling strategy |
| description | varchar | | definition of sampling strategy |

End of table

Table 74: sea_level_datum definition (BUFR 0 01 151)

| element_name | kind | external_table | description |
|---|---|---|---|
| datum | int(pk) | | primary key for table |
| description | varchar | | Long name of sea level dataum |

End of table

Table 75: secondary_variable definition

| element_name | kind | external_table | description |
|---|---|---|---|
| variable | int(pk) | | part of primary key - indicator for secondary variable name |
| variable_name | varchar | | name / description of secondary variable |
| value | int(pk) | | coded value for secondary variable |
| symbol | varchar | | abbreviation or symbol used to represent decoded value, e.g. chemical symbol for atmospheric constituent |
| description | varchar | | Name or description of decoded value |

End of table

Table 76: sensor_configuration_codes definition

| element_name | kind | external_table | description |
|---|---|---|---|
| field_id | varchar (pk) | sensor_configuration_fields:field_id | Link to field code is for |
| field_name | varchar | | Name of field |

Continued on next page

Table 76 sensor_configuration_codes (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| parameter | varchar | | Which parameter this entry is valid for |
| code_value | int (pk) | | Coded value. Together with field_id forms primary key |
| abbreviation | varchar | | Abbreviation used for coded value |
| description | varchar | | Decoded value / meaning of code |

End of table

Table 77: sensor_configuration_fields definition

| element_name | kind | external_table | description |
|---|---|---|---|
| field_id | varchar (pk) | | primary key |
| field_name | varchar | | Name of field described by this entry |
| parameter | varchar | | Which parameter this entry if relevant for |
| type | int | kind:kind | The variable type used to store information on the indicated field |
| description | varchar | | Description of the indicated field |

End of table

Table 78: source_configuration_codes definition

| element_name | kind | external_table | description |
|---|---|---|---|
| field_id | varchar (pk) | source_configuration_fields:field_id | Link to field code is for |
| field_name | varchar | | Name of field |
| code_value | int (pk) | | Coded value. Together with field_id forms primary key |
| abbreviation | varchar | | Abbreviation used for coded value |
| description | varchar | | Decoded value / meaning of code |

End of table

Table 79: source_configuration_fields definition

| element_name | kind | external_table | description |
|---|---|---|---|
| field_id | varchar (pk) | | primary key |
| field_name | varchar | | Name of field described by this entry |
| type | int | kind:kind | The variable type used to store information on the indicated field |
| description | varchar | | Description of the indicated field |

End of table

Table 80: source_format definition

| element_name | kind | external_table | description |
|---|---|---|---|
| format | int(pk) | | primary key for table |
| description | varchar | | description of data format, e.g. NetCDF |

End of table

Table 81: spatial_representativeness definition (WIGOS 1-05)

| element_name | kind | external_table | description |
|---|---|---|---|
| representativeness | int (pk) | | primary key for table. coded value |
| description | varchar | | meaning / definition of decoded value |

End of table

Table 82: standard_time definition

| element_name | kind | external_table | description |
|---|---|---|---|
| time | int(pk) | | primary key for table, encoded value |
| description | varchar | | decoded observing time, e.g. 12 UTC |

End of table

Table 83: station_configuration_codes definition

| element_name | kind | external_table | description |
|---|---|---|---|
| field_id | varchar (pk) | station_configuration_fields:field_id | Link to field code is for |
| field_name | varchar | | Name of field |
| code_value | int (pk) | | Coded value. Together with field_id forms primary key |
| abbreviation | varchar | | Abbreviation used for coded value |
| description | varchar | | Decoded value / meaning of code |

End of table

Table 84: station_configuration_fields definition

| element_name | kind | external_table | description |
|---|---|---|---|
| field_id | varchar (pk) | | primary key |
| field_name | varchar | | Name of field described by this entry |
| type | int | kind:kind | The variable type used to store information on the indicated field |
| description | varchar | | Description of the indicated field |

End of table

Table 85: station_type definition (WIGOS 3-04)

| element_name | kind | external_table | description |
|---|---|---|---|
| type | int (pk) | | primary key for table, coded value |
| description | varchar | | decoded station type |

End of table

Table 86: sub_region definition

| element_name | kind | external_table | description |
|---|---|---|---|
| sub_region | int(pk) | | primary key |
| type | varchar | | tpye of sub region, e.g. country, regional sea etc |

Continued on next page

Table 86 sub_region (cont.)

| element_name | kind | external_table | description |
|---|---|---|---|
| code | varchar | | abbreviation or character code |
| name | varchar | | decoded value |

End of table

Table 87: time_quality definition

| element_name | kind | external_table | description |
|---|---|---|---|
| quality | int(pk) | | primary key, coded value |
| description | varchar | | decoded value expressing quality of time / date information |

End of table

Table 88: time_reference definition (WIGOS: 7-10)

| element_name | kind | external_table | description |
|---|---|---|---|
| reference | int(pk) | | primary key, coded value |
| description | varchar | | decoded base time to which times referenced |

End of table

Table 89: traceability definition (WIGOS 8-05)

| element_name | kind | external_table | description |
|---|---|---|---|
| traceability | int(pk) | | primary key, coded value |
| description | varchar | | definition of traceability of measurement |

End of table

Table 90: uncertainty_method definition

| element_name | kind | external_table | description |
|---|---|---|---|
| method | int (pk) | | Primary key for table |
| description | varchar | | Description of method |
| reference | varchar | | DOI or reference for method |

End of table

Table 91: units definition

| element_name | kind | external_table | description |
|---|---|---|---|
| units | int(pk) | | primary key |
| name | varchar | | name of units |
| abbreviation | varchar | | conventional abbreviation in ASCII |
| base_units | varchar | | definition in base units |

End of table

Table 92: update_frequency definition

| element_name | kind | external_table | description |
|---|---|---|---|
| frequency | int (pk) | | primary key |
| description | varchar | | Description of update frequency |

End of table

Table 93: z_coordinate_method definition

| element_name | kind | external_table | description |
|---|---|---|---|
| method | int (pk) | | primary key, coded value |
| description | varchar | | description of method used to determine z location |

End of table

Table 94: z_coordinate_type definition

| element_name | kind | external_table | description |
|---|---|---|---|
| type | int(pk) | | primary key, coded value |
| description | varchar | | description of units / type of z coordinate |

End of table

## 6.2 Code tables

Table 95: application_area codes

| application_area | description |
|---|---|
| 1 | Global numerical weather prediction (GNWP) |
| 2 | High-resolution numerical weather prediction (HRNWP) |
| 3 | Nowcasting and very short range forecasting (NVSRF) |
| 4 | Seasonal and inter-annual forecasting (SIAF) |
| 5 | General weather forecasting |
| 6 | Aeronautical meteorology |
| 7 | Ocean applications |
| 8 | Agricultural meteorology |
| 9 | Hydrology |
| 10 | Climate monitoring (as undertaken through the Global Climate Observing System, GCOS) |
| 11 | Climate applications |
| 12 | Space weather |
| 13 | Cryosphere applications |
| 14 | Energy sector |
| 15 | Transportation sector |
| 16 | Health sector |
| 17 | Terrestrial ecology |
| 18 | Operational air quality forecasting |
| 19 | Atmospheric composition forecasting |
| 20 | Atmospheric composition monitoring and analysis |
| 21 | Large urban complexes |

End of table

Table 96: automation_status codes

| automation | description |
|---|---|
| 0 | Automatic observation. |
| 1 | Automatic, always supplemented by manual input. |
| 2 | Automatic, occasionally supplemented by manual input. |

Continued on next page

Table 96 automation_status (cont.)

| automation | description |
|---|---|
| 3 | Automatic, supplemented by manual observations. |
| 4 | Manual observation. |
| 5 | Unknown. |
| 6 | Visual observation. |

End of table

Table 97: calibration_status codes

| status | description |
|---|---|
| 0 | No changes - in calibration. |
| 1 | No changes - out of calibration. |
| 2 | No changes - calibration unknown. |
| 3 | Recalibrated - in calibration. |

End of table

Table 98: communication_method codes

| method | description |
|---|---|
| 0 | Cellular (unspecified) |
| 1 | Meteosat DCP |
| 2 | Iridium (unspecified) |
| 3 | GOES DCP |
| 4 | VSAT (unspecified) |
| 5 | Landline telephone |
| 6 | Radio modem |
| 7 | E-mail (unspecified) |
| 8 | Voice (ship). The observation is sent to a NMS through the telephone network. The communication may use Inmarsat, Iridium, Vsat, VHF |
| 9 | Email (ship). The observation is sent to a NMS through an email. The WMO message is attached to this email. The satellite communication provider may be Inmarsat, Iridium, Vsat |

Continued on next page

Table 98 communication_method (cont.)

| method | description |
|---|---|
| 10 | Web (ship). The observation is sent through the Web (example: TurboWeb). The satellite communication provider may be Inmarsat, Iridium, Vsat |
| 11 | Inmarsat-C (FM13, SAC41). Standard procedure used to report observations (FM13 messages) from conventional VOS for many years. Collect call system: the NMS which receives the observations pays the communication costs |
| 12 | Inmarsat-C (FM13, other SAC). FM13 messages are sent to a dedicated SAC (other than SAC41) established at one, or more LES. In general, communications are paid by the country who recruited the ship |
| 13 | Inmarsat-C (EUHC). Text messages containing compressed data (E-SURFMAR format) are sent ashore through Inmarsat-C to a dedicated SAC and LES. Communications are paid by the country who recruited the ship |
| 14 | Inmarsat-C (SEAS). SEAS binary messages sent through Inmarsat-C Data Mode to a dedicated SAC and LES. Communications are paid by NOAA/NWS |
| 15 | Automated Identification System (direct or through satellite) |
| 16 | Argos system |
| 17 | Cellular (Dial-up). Dial-up communication using terrestrial wireless networks (GSM, GPRS) |
| 18 | Cellular (SMS). SMS sent through terrestrial wireless networks (GSM, GPRS) |
| 19 | Globalstar communication system |
| 20 | GMS (DCP). Data Collecting Platform of Geostationary Meteorological Satellites |
| 21 | Iridium (SBD). Short Burst Data service of Iridium communication system |
| 22 | Iridium (Email). Email sent through Iridium (e.g. Easymail) |
| 23 | Iridium (Dial-up). Dial-up communication using Iridium |

Continued on next page

Table 98 communication_method (cont.)

| method | description |
|---|---|
| 24 | Inmarsat-C (Data Mode). Data Mode service of Inmarsat-C used by S-AWS. See above for SEAS which also uses this service for conventional VOS |
| 25 | Inmarsat-C (Email). Email sent through Inmarsat-C |
| 26 | Orbcomm communication system |
| 27 | Vsat (Email). Email sent through Vsat |
| 28 | Vsat (Dial-up). Dial-up communication using Vsat |
| 29 | Delayed Mode only |
| 30 | Other (specify in footnote). |

End of table

Table 99: conversion_flag codes

| flag | description |
|---|---|
| 0 | Both original (non SI) and converted (SI) values available, see conversion_method for details. |
| 1 | Only original value in non-SI units available, no conversion has been performed. See original_value field. |
| 2 | Original value in SI units available, no conversion required. |
| 3 | Value coded - see code_table for details. |

End of table

Table 100: conversion_method codes

| method | description | implementation | reference |
|---|---|---|---|
| TBD | TBD | TBD | TBD |

End of table

Table 101: crs codes

| crs | description |
|---|---|
| 0 | WGS84 |

Continued on next page

Table 101 crs (cont.)

| crs | description |
|---|---|
| 1 | ETRS89 |
| 2 | NAD83 |
| 3 | DHDN |
| 4 | Ellipsoidal datum using International Reference Meridian maintained by the International Earth Rotation and Reference System Services (IERS) |

End of table

Table 102: data_policy_licence codes

| policy | name | description |
|---|---|---|
| 0 | Open | Data in public domain and freely available (no cost and unrestricted). |
| 1 | WMO essential | WMO Essential Data: free and unrestricted international exchange of basic data and products. |
| 2 | WMO additional | WMO Additional Data: free and unrestricted access to data and products exchanged under the auspices of WMO to the research and education communities for non-commercial activities. A more precise definition of the data policy may be additionally supplied within the metadata. In all cases it shall be the responsibility of the data consumer to ensure that they understand the data policy specified by the data provider – which may necessitate dialogue with the data publisher for confirmation of terms and conditions. |

Continued on next page

Table 102 data_policy_licence (cont.)

| policy | name | description |
|---|---|---|
| 3 | WMO other | Data identified for global distribution via WMO infrastructure (GTS / WIS) that is not covered by WMO Resolution 25 neither WMO Resolution 40 e.g. aviation OPMET data. Data marked with “WMOOther” data policy shall be treated like “WMOAdditional” where a more precise definition of the data policy may be additionally supplied within the metadata. In all cases it shall be the responsibility of the data consumer to ensure that they understand the data policy specified by the data provider – which may necessitate dialogue with the data publisher for confirmation of terms and conditions. |

End of table

Table 103: data_present codes

| flag | description |
|---|---|
| 0 | Indicated data is not available |
| 1 | Indicated data available |

End of table

Table 104: duplicate_status codes

| status | description |
|---|---|
| 0 | Unique observation, no known duplicates |
| 1 | Best duplicate |
| 2 | Duplicate |
| 3 | Worst duplicate |
| 4 | Unchecked |

End of table

Table 105: events_at_station codes

| event | description |
|---|---|
| 1 | Grass-cutting |
| 2 | Snow clearing |

Continued on next page

Table 105 events_at_station (cont.)

| event | description |
|---|---|
| 3 | Tree removal |
| 4 | Construction activity |
| 5 | Road work |
| 6 | Biomass burning |
| 7 | Dust storm |
| 8 | Storm damage |
| 9 | Wind storm |
| 10 | Flood |
| 11 | Fire |
| 12 | Earthquake |
| 13 | Land slide |
| 14 | Storm surge or tsunami |
| 15 | Lightning |
| 16 | Vandalism |

End of table

Table 106: homogenisation_method codes

| method | description | reference |
|---|---|---|
| TBD | TBD | TBD |

End of table

Table 107: homogenisation_operator codes

| operator | symbol | description |
|---|---|---|
| TBD | TBD | TBD |

End of table

Table 108: id_scheme codes

| scheme | description |
|---|---|
| 0 | WIGOS ID |
| 1 | GRUAN ID |
| 2 | IMO Number |
| 3 | National ID |
| 4 | WMO buoy / station number |
| 5 | Ship / platform callsign |
| 6 | Generic ID (e.g. SHIP, PLAT etc) |

Continued on next page

Table 108 id_scheme (cont.)

| scheme | description |
|---|---|
| 7 | Station name |
| 8 | ICOADS other |
| 9 | ICOADS unknown |
| 10 | ICOADS composite |
| 11 | Oceangraphic platform / cruise number |
| 12 | Other buoy number (e.g. Argo) |

End of table

Table 109: instrument_exposure_quality codes

| exposure | description |
|---|---|
| 1 | Class 1 - Exposure of instrument allows reference level measurements |
| 2 | Class 2 - Exposure of instrument has small or infrequent influence on measurement |
| 3 | Class 3 - Exposure of instrument leads to increased uncertainty or occasional invalid measurements |
| 4 | Class 4 - Exposure of instruemnt leads to high uncertainty or regular invalid measurements |
| 5 | Class 5 - Exposure of instrument leads to invalid measurements |

End of table

Table 110: kind codes

| kind | description |
|---|---|
| 0 | int |
| 1 | numeric |
| 2 | varchar |
| 3 | timestamp with timezone |

End of table

Table 111: location_method codes

| method | description |
|---|---|
| 0 | Argos |
| 1 | ARGOS DOPPLER |

Continued on next page

Table 111 location_method (cont.)

| method | description |
|---|---|
| 2 | ARGOS Kalman |
| 3 | Argos-3 |
| 4 | Argos-4 |
| 5 | From map |
| 6 | GALILEO |
| 7 | GOES DCP |
| 8 | GPS |
| 9 | INMARSAT |
| 10 | Iridium |
| 11 | Iridium and GPS |
| 12 | IRIDIUM DOPPLER |
| 13 | LORAN |
| 14 | Meteosat DCP |
| 15 | Orbcomm |
| 16 | Surveyed |

End of table

Table 112: location_quality codes

| quality | description |
|---|---|
| 0 | Good - location consistent with other reports from this station |
| 1 | Doubtful |
| 2 | Bad - Track check failed |
| 3 | Unchecked |

End of table

Table 113: meaning_of_time_stamp codes

| meaning | name | description |
|---|---|---|
| 1 | beginning | Date / time specified indicates the start of the period over which the observation was made. |
| 2 | end | Date / time specified indicates the end of the period over which the observation was made. |
| 3 | middle | Date / time specified indicates the middle of the period over which the observation was made. |

End of table

Table 114: method_of_estimating_uncertainty codes

| method | description | reference |
|---|---|---|
| TBD | TBD | TBD |

End of table

Table 115: observation_code_table codes

| code_table | code_table_scheme | code_table_id | code_table_name | value | description |
|---|---|---|---|---|---|
| 0 | BUFR | 0 20 003 | Present weather | NA | See BUFR 0 20 003 |
| 1 | BUFR | 0 20 004 | Past weather | NA | See BUFR 0 20 004 |
| 2 | BUFR | 0 10 063 | Characteristics of pressure tendancy | NA | See BUFR 0 10 063 |

End of table

Table 116: observation_value_significance codes

| significance | description |
|---|---|
| 0 | Maximum value over indicated period |
| 1 | Minimum value over indicated period |
| 2 | Mean value over indicated period |
| 3 | Median value over indicated period |
| 4 | Modal value over indicated period |
| 5 | Mean absolute error over indicated period |
| 6 | Best estimate of standard deviation (N-1) of observed parameter over indicated period |
| 7 | Standard deviation (N) of observed parameter over indicated period |
| 8 | Harmonic mean of observed parameter over indicated period |
| 9 | Root mean square vector error of observed parameter over indicated period |
| 10 | root mean square of observed parameter over indicated period |
| 11 | Vector mean of observed parameter over indicated period |
| 12 | Instantaneous value of observed parameter |
| 13 | Accumulation over specified period |
| 14 | Not applicable |

End of table

Table 117: observed_variable codes

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 0 | aerosols | | | aerosol absorption optical depth | Dimensionless | Vertical column integral of spectral aerosol absorption coefficient: AAOD = exp(-K. Dz) where K is the absorption coefficient [km-1] and Dz the vertical path [km] |
| 1 | aerosols | | | aerosol column burden | g m-2 | 2D field of the column burden of condensed particles in the atmosphere |
| 2 | aerosols | | | aerosol dust concentration | g kg-1 | 3-D field of concentration of dust or sand in the atmosphere |
| 3 | aerosols | | | aerosol effective radius | micro m | 3D field of mean aerosol particle size, defined as the ratio of the third and second moments of the number size distribution of aerosol particles. Requested in the troposphere (assumed height: 12 km) and as columnar average. |
| 4 | aerosols | | | aerosol extinction coefficient | m-1 | 3D field of spectral volumetric extinction cross-section of aerosol particles. |
| 5 | aerosols | | | aerosol mass mixing ratio | g kg-1 | 3D field of the mass mixing ratio of condensed particles in the atmosphere |
| 6 | aerosols | | | aerosol optical depth | Dimensionless | The AOD is the effective depth of the aerosol column from the viewpoint of radiation propagation: Vertical column integral of spectral aerosol extinction coefficient AOD = exp(-K. Dz) where K is the extinction coefficient [km-1 ] and Dz the vertical path [km] |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 7 | aerosols | | | aerosol species mole fraction | moles per mole of dry air | 3D field of the mole fraction of condensed-phase chemical species (e.g., sulfate, nitrate, ammonium, elemental carbon, organic carbon), in the atmosphere |
| 8 | aerosols | | | aerosol species total column burden | moles m-2 | 2D field of the total column burden concentration of condensed-phase chemical species (e.g., sulfate, nitrate, ammonium, elemental carbon, organic carbon), in the atmosphere |
| 9 | aerosols | | | aerosol type | coded | Selection, out of a pre-defined set of aerosol classes, that best fits an input data set (observed or modeled). The pre-defined set of aerosol classes includes specification of the particle composition, mixing state, complex refractive index, and shape as a function of particle size. The definition of aerosol type includes specification of all the classes as well as the algorithm used to choose the best fit to the input data. |
| 10 | aerosols | | | aerosol volcanic ash | g kg-1 | 3D field of mass mixing ratio of volcanic ash |
| 11 | aerosols | | | total column aerosol volcanic ash | g m-2 | Field of total column mass of volcanic ash |
| 12 | aerosols | | | air conductivity | km | TBD |
| 13 | albedo | | | blue ice and snow albedo | percent | TBD |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 14 | albedo | | | blue ice bidirectional reflectance | sr-1 | TBD |
| 15 | albedo | | | clean glacier ice albedo | percent | TBD |
| 16 | albedo | | | dirty glacier ice albedo | percent | TBD |
| 17 | albedo | | | earth surface albedo | percent | Hemispherically integrated reflectance of the Earth surface in the range 0.4 - 0.7 micro-m |
| 18 | albedo | | | snow bidirectional reflectance | sr-1 | TBD |
| 19 | cloud | atmospheric | upper-air | cloud base height | m | cloud base height (hb) |
| 20 | cloud | atmospheric | upper-air | cloud base lowest height | coded | Height above surface of the base of the lowest cloud seen (coded 0-9) |
| 21 | cloud | atmospheric | upper-air | cloud cover | Okta or percent | 3D field of fraction of sky filled by clouds. |
| 22 | cloud | atmospheric | upper-air | cloud genus | Coded | Genus of cloud (0 - Cirrus to 9 - Cumulo-Nimbus) |
| 23 | cloud | atmospheric | upper-air | cloud genus base height | Coded or m | Height of base of cloud whose genus is c |
| 24 | cloud | atmospheric | upper-air | high cloud type | coded | type of high clouds (ch) |
| 25 | cloud | atmospheric | upper-air | low cloud type | coded | type of low clouds (cl) |
| 26 | cloud | atmospheric | upper-air | lowest cloud amout | Okta | low or (if low clouds don't exist) middle cloud amount |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 27 | cloud | atmospheric | upper-air | middle cloud type | coded | type of middle clouds (cm) |
| 28 | cloud | atmospheric | upper-air | total cloud amount | Okta | total amount of clouds |
| 29 | evaporation | atmospheric | | evaporation | mm | TBD |
| 30 | evaporation | atmospheric | | evaporation | kg m-2 s-1 | TBD |
| 31 | evaporation | atmospheric | | potential evapotran-spiration | mm day-1 | Quantity of water evaporated from the soil and plants when the ground is at its natural moisture content. |
| 32 | evaporation | atmospheric | | real evapo-transpiration | mm day-1 | TBD |
| 33 | humidity | atmospheric | | absolute hu-midity | g m-3 | TBD |
| 34 | humidity | atmospheric | surface; upper-air | 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. Dew point temperature is the temperature at which a parcel of air reaches saturation upon being cooled at constant pressure and specific humidity. |
| 36 | humidity | atmospheric | surface; upper-air | dew point temperature | K | Dew point temperature is the temper-ature at which a parcel of air reaches saturation upon being cooled at constant pressure and specific humidity. |
| 37 | humidity | atmospheric | surface; upper-air | ice bulb tem-perature | K | TBD |
| 38 | humidity | atmospheric | surface; upper-air | relative hu-midity | percent | TBD |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 39 | humidity | atmospheric | surface; upper-air | specific humidity | g kg-1 | specific means per unit mass. Specific humidity is the mass fraction of water vapor in (moist) air. |
| 40 | humidity | atmospheric | | water vapour pressure | hPa | TBD |
| 41 | humidity | atmospheric | surface; upper-air | wet bulb temperature | K | TBD |
| 43 | ice | | | ice thickness | m | Thickness of the ice sheet. It is related to sea-ice elevation and ice density |
| 44 | precipitation | atmospheric | | accumulated precipitation | mm | accumulated precipitation over specified period |
| 45 | precipitation | atmospheric | | fresh snow | mm | TBD |
| 46 | precipitation | atmospheric | | hydrometeor type | Code table | 3D field of the predominant form of condensed water in a volume of free atmosphere, including liquid cloud, rain, ice crystals, snow, graupel and hail. (This variable replaces "precipitation type"). |
| 47 | precipitation | atmospheric | | precipitation | g m-2 s-1 | Precipitation (liquid or solid) |
| 48 | precipitation | atmospheric | | precipitation instensity liquid | mm h-1 | Precipitation intensity at surface (liquid or solid) |
| 49 | precipitation | atmospheric | | precipitation intensity solid | mm h-1 | Precipitation intensity at surface (solid) |
| 50 | precipitation | atmospheric | | precipitation type | coded | Liquid, snow, hail, fog |
| 51 | precipitation | atmospheric | | rainy days | Days | TBD |
| 52 | precipitation | atmospheric | | snow cover | percent | Fraction of a given area which is covered by snow |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 53 | precipitation | atmospheric | | snow depth | cm | Vertical distance from the snow surface to the underlying surface (ground, glacier ice or sea ice). |
| 54 | precipitation | atmospheric | | snow status | coded | Wet or dry |
| 55 | precipitation | atmospheric | | snow water equivalent | mm | Surface snow amount |
| 56 | pressure | atmospheric | surface | adjunct temperature barometer | K | temperature of the adjunct thermometer to the barometer to reduce pressure to 0 degC |
| 57 | pressure | atmospheric | surface | air pressure | Pa | pressure of air column at specified height |
| 58 | pressure | atmospheric | surface | 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. |
| 59 | pressure | atmospheric | surface | pressure tendency | Pa | pressure tendency |
| 60 | pressure | atmospheric | surface | pressure tendency characteristics | coded | characteristic of pressure tendency (used in synoptic maps) |
| 61 | radiation | atmospheric | | diffuse radiation | W m-2 | TBD |
| 62 | radiation | atmospheric | | downward longwave irradiance at earth surface | W m-2 | Flux density of radiation emitted by the gases, aerosols and clouds of the atmosphere to the Earth's surface |
| 63 | radiation | atmospheric | | downward shortwave irradiance at earth surface | W m-2 | Flux density of the solar radiation at the Earth surface |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 64 | radiation | atmospheric | | downward shortwave irradiance at toa | W m-2 | Flux density of the solar radiation at the top of the atmosphere |
| 65 | radiation | atmospheric | | earth surface shortwave bidirectional reflectance | percent | Reflectance of the Earth surface as a function of the viewing angle and the illumination angle in the range 0.4-0.7 micro m . The distribution of this variable is represented by the Bidirectional Reflectance Distribution Function (BRDF) |
| 66 | radiation | atmospheric | | fraction of absorbed par | percent | Fraction of PAR absorbed by vegetation (land or marine) for photosynthesis processes (generally around the 'red' ) |
| 67 | radiation | atmospheric | | global radiation | W m-2 | TBD |
| 68 | radiation | atmospheric | | longwave earth surface emissivity | percent | TBD |
| 69 | radiation | atmospheric | | longwave radiation | W m-2 | TBD |
| 70 | radiation | atmospheric | | meteorological optical range | m | Meteorological optical range at surface |
| 71 | radiation | atmospheric | | photosynthetically active radiation | W m-2 | Flux of downwelling photons of wavelength 0.4-0.7 micro m |
| 72 | radiation | atmospheric | | shortwave cloud reflectance | percent | Reflectance of the solar radiation from clouds |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 73 | radiation | atmospheric | | shortwave radiation | W m-2 | TBD |
| 74 | radiation | atmospheric | | solar gamma ray flux | W m-2 | Radiative flux integrated over the gamma-ray domain. |
| 75 | radiation | atmospheric | | solar UV flux | W m-2 | Integrated UV flux over the solar disk. |
| 76 | radiation | atmospheric | | solar VIS flux | W m-2 | Integrated VIS flux over the solar disk |
| 77 | radiation | atmospheric | | solar X ray flux | W m-2 | Integrated X-ray flux over the solar disk |
| 78 | radiation | atmospheric | | sunshine duration | h | TBD |
| 79 | radiation | atmospheric | | upward long-wave irradi-ance at Earth surface | W m-2 | Flux density of terrestrial radiation emitted by the Earth surface |
| 80 | radiation | atmospheric | | upward long-wave irradi-ance at TOA | W m-2 | Flux density of terrestrial radiation emitted by the Earth surface and the gases, aerosols and clouds ot the atmosphere at the top of the atmosphere |
| 81 | radiation | atmospheric | | upward shortwave irradiance at TOA | W m-2 | Flux density of solar radiation, reflected by the Earth surface and atmosphere, emitted to space at the top of the atmosphere |
| 82 | radiation | atmospheric | | upward spec-tral radiance at TOA | W m-2 nm-1 sr-1 | Upward radiant power measured at the top of the atmosphere per area unit, per solid angle, and per wavelength interval. Spectral range 0.2-200 micro m. |
| 83 | salinity | oceanic | surface; sub-surface | salinity | psu | ocean salinity (PSU) |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 85 | temperature | atmospheric | surface; upper-air | air temperature | K | Air temperature is the bulk temperature of the air, not the surface (skin) temperature. |
| 86 | temperature | atmospheric | | daily maximum air temperature | K | TBD |
| 87 | temperature | atmospheric | | daily maximum air temperature with direct sun exposure | K | TBD |
| 88 | temperature | atmospheric | | daily maximum grass temperature | K | Grass maximum thermometer is 5 cm above ground |
| 89 | temperature | atmospheric | | daily minimum air temperature | K | TBD |
| 90 | temperature | atmospheric | | daily minimum air temperature with direct sun exposure | K | TBD |
| 91 | temperature | atmospheric | | daily minimum grass temperature | K | Grass minimum thermometer is 5 cm above ground |
| 92 | temperature | atmospheric | | days with ground frost | Days | TBD |
| 93 | temperature | atmospheric | | snow temperature | K | TBD |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 94 | temperature | atmospheric | | soil temperature | K | Lot 1 is using Ts - WMO abbrev. |
| 95 | temperature | oceanic | surface; subsurface | water temperature | K | Water (sea, river, lake) temperature at depth indicated |
| 96 | visibility | atmospheric | surface | horizontal visibility in air | m | The visibility is the distance at which something can be seen. |
| 97 | weather | | | lightning detection | deg (lat, lon) and UTC | Detection of the time and location (latitude, longitude) of lightning events. Accuracy expressed in terms of Hit Rate and False Alarm Rate, which requires predetermination of a specific distance and time tolerance . |
| 98 | weather | | | lightning duration | s | TBD |
| 99 | weather | | | lightning horizontal distance | Km | TBD |
| 100 | weather | atmospheric | surface | past weather 1 | coded | past weather 1 - most extreme phomenon (w) |
| 101 | weather | atmospheric | surface | past weather 2 | coded | past weather 2 - most frequent phomenon (used in synoptic maps) |
| 102 | weather | atmospheric | surface | present weather | coded | present weather (ww) |
| 103 | weather | | | Total lightning density | Dimensionless | Total number of detected flashes in the corresponding time interval and the space unit. The space unit (grid box) should be equal to the horizontal resolution and the accumulation time to the observing cycle |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 104 | wind | atmospheric | surface; upper-air | eastward wind speed | m s-1 | 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.) |
| 105 | wind | atmospheric | surface; upper-air | northward wind speed | m s-1 | Northward indicates a vector component which is positive when directed northward (negative southward). 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.) |
| 106 | wind | atmospheric | surface; upper-air | wind from direction | degree | direction from which the wind is blowing Lot 1 uses dd - WMO abbrev. |
| 107 | wind | atmospheric | surface; upper-air | wind speed | m s-1 | 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. Lot 1 uses ff - WMO abbrev. |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 108 | wind | atmospheric | surface | wind speed of gust | m s-1 | 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. A gust is a sudden brief period of high wind speed. In an observed timeseries of wind speed, the gust wind speed can be indicated by a cell methods of maximum for the time-interval. In an atmospheric model which has a parametrised calculation of gustiness, the gust wind speed may be separately diagnosed from the wind speed. Lot 1 uses fx - WMO abbrev. |
| 109 | wind | atmospheric | | wind speed max | m s-1 | Maximum observed wind speed over specified period Lot 1 uses fm - WMO abbrev. |
| 110 | | | | turbulence | J m-3 | TBD |
| 110 | | | | turbulence | J m-3 | TBD |
| 111 | | | | precipitable water column | kg m-2 | TBD |
| 112 | | | | tropopause height | m | TBD |
| 113 | | | | tropopause temperature | K | TBD |
| 114 | | | | tropopause pressure | Pa | TBD |

Continued on next page

Table 117 observed_variable (cont.)

| variable | parameter_group | domain | sub_domain | name | units | description |
|---|---|---|---|---|---|---|
| 115 | | | | tropopause potential temperature | K | TBD |
| 116 | | | | frost point temperature | K | TBD |

End of table

Table 118: observing_frequency codes

| frequency | description |
|---|---|
| 0 | One observation per day (24 hour intervals). |
| 1 | Two observations per day (12 hour intervals). |
| 2 | Four observations per day (6 hour intervals). |
| 3 | Eight observations per day (3 hour intervals). |
| 4 | Hourly observations. |
| 5 | Irregular observations. |

End of table

Table 119: observing_method codes

| method | description |
|---|---|
| 0 | Measured |
| 1 | Estimated |
| 2 | Computed |

End of table

Table 120: observing_programme codes

| observing_programme | abbreviation | description | sponsor |
|---|---|---|---|
| 1 | AMDAR | Global Aircraft Meteorological DAta Relay | WMO/GOS |
| 2 | EPA | Environmental Protection Agency | NA |
| 3 | EUMETNET | Grouping of European National Meteorological Services | WMO/GOS |
| 4 | WMO/GAW | World Meteorological Organization/Global Atmospheric Watch | NA |
| 5 | GCOS | Global Climate Observing System | NA |
| 6 | GCW | Global Cryosphere Watch | NA |

Continued on next page

Table 120 observing_programme (cont.)

| observing_programme | abbreviation | description | sponsor |
|---|---|---|---|
| 7 | GOOS | Global Ocean Observing System | NA |
| 8 | IPA | International Permafrost Association | NA |
| 9 | JCOMM | Joint Technical Commission for Oceanography and Marine Meteorology | WMO/GOS |
| 10 | WMO/GOS | World Meteorological Organization/Global Observing System | NA |
| 11 | GTOS | Global Terrestrial Observing System | NA |
| 12 | IAGOS | In-service Aircraft for a Global Observing System | NA |
| 13 | WHYCOS | World Hydrological Cycle Observing System | NA |
| 14 | WMO/CLW | World Meteorological Office/Climate and Water Department | NA |
| 15 | ADNET | Asian dust and aerosol lidar observation network | GALION ; WMO/GAW |
| 16 | Aeronet | AErosol RObotic NETwork | NASA? |
| 17 | ANTON | Antarctic Observing Network | WMO/GOS |
| 18 | ASAP | Automated Shipboard Aerological Program | WMO/GOS |
| 19 | BSRN | Baseline Surface Radiation Network | WMO/GAW & GCOS |

Continued on next page

Table 120 observing_programme (cont.)

| observing_programme | abbreviation | description | sponsor |
|---|---|---|---|
| 20 | CASTNET | Clean Air Status and Trends Network | (National - USA) |
| 21 | CIS-LiNet | Lidar network for monitoring atmosphere over CIS regions | GALION ; WMO/GAW |
| 22 | CLN | CREST Lidar Network | GALION ; WMO/GAW |
| 23 | DART | Deep-ocean Assessment and Reporting of Tsunamis | NOAA Centre for Tsunamis Research |
| 24 | E-AMDAR | European - Aircraft Meteorological DAta Relay | EUMETNET ; WMO/GOS |
| 25 | E-ASAP | European - Automated Shipboard Aerological Program | EUMETNET ; WMO/GOS |
| 26 | E-GVAP | European - GNSS water vapour programme | EUMETNET ; WMO/GOS |
| 27 | E-PROFILE | European - wind profiles from radar | EUMETNET ; WMO/GOS |
| 28 | E-SURFMAR | European - Surface Marine Operational Service | EUMETNET ; WMO/GOS |
| 29 | EARLINET | European Aerosol Research Lidar Network | GALION ; WMO/GAW |
| 30 | GALION | GAW Aerosol Lidar Observation Network | WMO/GAW |
| 31 | GAW-PFR | GAW-Precision Filter Radiometers | WMO/GAW |
| 32 | German AOD Network | German Aerosol Optical Depth Network | WMO/GAW |

Continued on next page

Table 120 observing_programme (cont.)

| observing_programme | abbreviation | description | sponsor |
|---|---|---|---|
| 33 | GLOSS | Global Sea Level Observing System | JCOMM ; WMO/GOS |
| 34 | GRUAN | GCOS Reference Upper Air Network | GCOS |
| 35 | GSN | GCOS Surface Network | GCOS |
| 36 | GTN-G | Global Terrestrial Network - Glaciers | GCOS |
| 37 | GTN-H | Global Terrestrial Network - Hydrology | WMO/CLW ; GCOS ; GTOS |
| 38 | GTN-P | Global Terrestrial Network - Permafrost | IPA ; GCOS ; GTOS |
| 39 | GUAN | GCOS Upper Air Network | GCOS |
| 40 | IAGOS-MOZAIC | Measurement of Ozone and Water Vapour on Airbus in-service Aircraft | IAGOS |
| 41 | LALINET | Latin America Lidar Network | GALION; WMO/GAW |
| 42 | MPLNET | Micro Pulse Lidar Network | GALION; WMO/GAW |
| 43 | NDACC | Network for the Detection of Atmospheric Composition Change | GALION; WMO/GAW |
| 44 | OPERA | European Weather Radar Project | EUMETNET; (WMO/GOS) |
| 45 | PIRATA | Prediction and Research Moored Array in the Atlantic | GOOS; WMO/GOS |
| 46 | PolarAOD | Polar Aerosol Optical Depth Measurement Network Project | WMO/GAW |

Continued on next page

Table 120 observing_programme (cont.)

| observing_programme | abbreviation | description | sponsor |
|---|---|---|---|
| 47 | RAMA | Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction | NOAA |
| 48 | RBCN | Regional Basic Climatological Network | WMO/GOS |
| 49 | RBON | Regional Basic Observing Network | WMO/GOS |
| 50 | RBSN | Regional Basic Synoptic Network | WMO/GOS |
| 51 | TAO | Tropical Atmosphere and Ocean Array | NOAA; GCOS |
| 52 | SKYNET | Aerosol -cloud-radiation interaction in the atmosphere project | WMO/GAW |
| 53 | SibRad | NA | WMO/GAW |
| 54 | SOOP | Ship of Opportunity | JCOMM ; WMO/GOS |
| 55 | U.S. IOOS | United States Integrated Ocean Observing System | (National - USA) |
| 56 | VOS | Voluntary Observing Fleet | JCOMM ; WMO/GOS |
| 57 | VOSCLIM | Voluntary Observing Fleet (VOS) Climate Project | JCOMM ; WMO/GOS |
| 58 | WRAP | Worldwide Recurring ASAP Project | JCOMM ; WMO/GOS |

End of table

Table 121: platform_sub_type codes

| sub_type | platform_type | abbreviation | description |
|---|---|---|---|
| 0 | 2 | BA | Barge |
| 1 | 2 | BC | Bulk Carrier |

Continued on next page

Table 121 platform_sub_type (cont.)

| sub_type | platform_type | abbreviation | description |
|---|---|---|---|
| 2 | 2 | CA | Cable ship |
| 3 | 2 | CG | Coast Guard Ship |
| 4 | 2 | CS | Container Ship |
| 5 | 2 | DR | Dredger |
| 6 | 2 | FE | Passenger ferries |
| 7 | 2 | FP | Floating production and storage units |
| 8 | 2 | FV | Other Fishing Vessel |
| 9 | 2 | GC | General Cargo |
| 10 | 2 | GT | Gas Tanker |
| 11 | 2 | IC | Icebreaking vessel |
| 12 | 2 | IF | Inshore Fishing Vessel |
| 13 | 2 | LC | Livestock carrier |
| 14 | 2 | LT | Liquid Tanker |
| 15 | 2 | LV | Light Vessel |
| 16 | 2 | MI | Mobile installation including mobile offshore drill ships, jack-up rigs and semi-submersibles |
| 17 | 2 | MS | Military Ship |
| 18 | 2 | OT | Other |
| 19 | 2 | MW | Ocean Weather Ship |
| 20 | 2 | PI | Pipe layer |
| 21 | 2 | PS | Passenger ships and cruise liners |
| 22 | 2 | RF | Ro/Ro Ferry |
| 23 | 2 | RR | Ro/Ro Cargo |
| 24 | 2 | RS | Refrigerated cargo ships including banana ships |
| 25 | 2 | RV | Research Vessel |
| 26 | 2 | SA | Large sailing vessels |
| 27 | 2 | SV | Support Vessel |
| 28 | 2 | TR | Trawler |
| 29 | 2 | TU | Tug |
| 30 | 2 | VC | Vehicle carriers |
| 31 | 2 | YA | Yacht / Pleasure Craft |
| 32 | 2 | BA | Barges, including crane barges and tank barges. |
| 33 | 2 | BC | Bulk Carriers, including Ore/Bulk/Oil (OBO) carriers and Ore/Oil carriers. |
| 34 | 2 | CA | Cable ships. |
| 35 | 2 | CG | Coastguard cutters, patrol ships and launches. |

Continued on next page

Table 121 platform_sub_type (cont.)

| sub_type | platform_type | abbreviation | description |
|---|---|---|---|
| 36 | 2 | CS | Container ships, including open and closed container ships and refrigerated container ships. |
| 37 | 2 | DR | Dredgers including bucket, hopper, grab and suction dredgers. |
| 38 | 2 | FE | Passenger ferries (carrying passengers only). |
| 39 | 2 | FP | Floating Production and Storage Units. |
| 40 | 2 | FV | Fishing Vessels including purse seiners, long liners etc., but excluding trawlers. |
| 41 | 2 | GC | General Cargo ships with one or more holds. |
| 42 | 2 | GT | Liquefied gas carriers/tankers including LNG and LPG carriers. |
| 43 | 2 | IC | Icebreaking vessels (dedicated vessel). If the vessel fits in another category and is ice strengthened |
| 44 | 2 | LC | Livestock Carrier (dedicated ship for the carriage of livestock). |
| 45 | 2 | LT | Liquid tankers including oil product tankers, chemical tankers and crude oil tankers (including VLCC's and ULCC's). |
| 46 | 2 | LV | Light vessels. |
| 47 | 2 | MI | Mobile installations, including mobile offshore drill ships, jack-up rigs, semi-submersibles. |
| 48 | 2 | MS | Military ships. |
| 49 | 2 | OW | Ocean Weather Ships (dedicated weather ship). |
| 50 | 2 | PI | Pipe Layers. |
| 51 | 2 | PS | Passenger ships and Cruise liners. |
| 52 | 2 | RF | Ro Ro ferries (carrying passengers and laden vehicles). |
| 53 | 2 | RR | Ro Ro cargo ships for carriage of road and/or rail vehicles and cargo, including containerised cargo. |
| 54 | 2 | RS | Refrigerated cargo ships including banana ships. |
| 55 | 2 | RV | Research Vessels, including oceanographic, meteorological and hydrographic research ships and seismographic research ships. |

Continued on next page

Table 121 platform_sub_type (cont.)

| sub_type | platform_type | abbreviation | description |
|---|---|---|---|
| 56 | 2 | SA | Large sailing vessels, including sail training vessels. |
| 57 | 2 | SV | Support vessels including offshore support vessels, offshore supply vessels, stand-by vessels, pipe carriers, anchor handling vessels, buoy tenders (including coastguard vessels engaged solely on buoy tending duties), diving support vessels, etc. |
| 58 | 2 | TR | Trawler fishing vessels. |
| 59 | 2 | TU | Tugs, including fire-fighting tugs, salvage tugs, pusher tugs, pilot vessels, tenders etc. |
| 60 | 2 | VC | Vehicle Carriers: dedicated multi deck ships for the carriage of new unladen road vehicles. |
| 61 | 2 | YA | Yachts and pleasure craft. |
| 62 | 2 | OT | Other (specify in footnote). |
| 63 | 0 | | Synoptic network |
| 64 | 7 | | Local Network |
| 65 | 2 | | Ocean Weather Ship (on station) |
| 66 | 2 | | Ocean Weather Ship (off station) |
| 67 | 43 | | Other |
| 68 | 43 | | Coastal-Marine Automated Network (C-MAN) (NDBC operated) |
| 69 | 5 | | Unspecified drifting buoy |
| 70 | 5 | | Standard Lagrangian drifter (Global Drifter Programme) |
| 71 | 5 | | Standard FGGE type drifting buoy (non-Lagrangian meteorological drifting buoy) |
| 72 | 5 | | Wind measuring FGGE type drifting buoy (non-Lagrangian meteorological drifting buoy) |
| 73 | 6 | | Ice drifter |
| 74 | 5 | | SVPG Standard Lagrangian drifter with GPS |
| 75 | 5 | | SVP-HR drifter with high-resolution temperature or thermistor string |
| 76 | 37 | | Unspecified subsurface float |
| 77 | 36 | | SOFAR |
| 78 | 36 | | ALACE |
| 79 | 36 | | MARVOR |
| 80 | 36 | | RAFOS |
| 81 | 36 | | PROVOR |

Continued on next page

Table 121 platform_sub_type (cont.)

| sub_type | platform_type | abbreviation | description |
|---|---|---|---|
| 82 | 36 | | SOLO |
| 83 | 36 | | APEX |
| 84 | 4 | | Unspecified moored buoy |
| 85 | 4 | | Nomad |
| 86 | 4 | | 3-metre discus |
| 87 | 4 | | 10-12-metre discus |
| 88 | 4 | | ODAS 30 series |
| 89 | 4 | | ATLAS (e.g. TAO area) |
| 90 | 4 | | TRITON buoy |
| 91 | 4 | | FLEX mooring (e.g. TIP area) |
| 92 | 4 | | Omnidirectional waverider |
| 93 | 4 | | Directional waverider |
| 94 | 36 | | Subsurface ARGO float |
| 95 | 36 | | PALACE |
| 96 | 36 | | NEMO |
| 97 | 36 | | NINJA |
| 98 | 6 | | Ice buoy/float (POPS or ITP) |
| 99 | 4 | | Mooring oceanographic |
| 100 | 4 | | Mooring meteorological |
| 101 | 4 | | Mooring multidisciplinary (OceanSITES) |
| 102 | 4 | | Mooring tide gauge or tsunami buoy |
| 103 | 6 | | Ice beacon |
| 104 | 6 | | Ice mass balance buoy |

End of table

Table 122: platform_type codes

| type | description |
|---|---|
| 0 | Land station (synoptic network) |
| 1 | Shallow water station (fixed to sea / lake floor) |
| 2 | Ship |
| 3 | Rig / platform |
| 4 | Moored buoy |
| 5 | Drifting buoy (of drifter) |
| 6 | Ice buoy |
| 7 | Land station (local network) |
| 8 | Land vehicle |
| 9 | Autonomous marine vehicle |
| 32 | Ice station |

Continued on next page

Table 122 platform_type (cont.)

| type | description |
|---|---|
| 33 | Lightship |
| 34 | Mechanical / digital / micro bathythermograph (MBT) |
| 35 | Oceanographic station data (bottle and low resolution CTD / XCTD data) |
| 36 | Profiling float |
| 37 | Subsurface float (moving) |
| 38 | Tide gauge |
| 39 | Underwater platform |
| 40 | Undulating oceanographic recorder |
| 41 | Aircraft |
| 42 | Autonomous pinneped bathythermograph |
| 43 | Coastal / Island |
| 44 | Expendable bathythermograph (XBT) |
| 45 | Glider |
| 46 | High-resolution Conductivity-Temperature-Depth (CTD) / Expendable CTD(XCTD) |

End of table

Table 123: processing_code codes

| index | processing_code | abbreviation | description |
|---|---|---|---|
| TBD | TBD | TBD | TBD |

End of table

Table 124: processing_level codes

| level | name | description |
|---|---|---|
| 0 | Unknown | NA |
| 1 | Raw | NA |
| 2 | Level 0 | Analogue/digital electric signals |

Continued on next page

Table 124 processing_level (cont.)

| level | name | description |
|---|---|---|
| 3 | Level I | Level I data (Primary Data): in general, are instrument readings expressed in appropriate physical units, and referred to Earth geographical coordinates. They require conversion to the normal meteorological variables (identified in Part I, Chapter 1). Level I data themselves are in many cases obtained from the processing of electrical signals such as voltages, referred to as raw data. Examples of these data are satellite radiances and water-vapour pressure, positions of constant-level balloons, etc. but not raw telemetry signals. Level I data still require conversion to the meteorological parameters specified in the data requirements. |
| 4 | Level II | Level II Data (Meteorological parameters). They may be obtained directly from many kinds of simple instruments, or derived from Level I data. For example, a sensor cannot measure visibility, which is a Level II quantity; instead, sensors measure the extinction coefficient, which is a Level I quantity. |
| 5 | Level III | Level III (Initial state parameters) are internally consistent data sets, generally in gridpoint form obtained from level II data by applying established initialization procedures. NOTE: Data exchanged internationally are level II or level III data. |
| 6 | Level IV | NA |

End of table

Table 125: product_level codes

| level | description |
|---|---|
| TBD | TBD |

End of table

Table 126: product_status codes

| status | description | extended_description |
|---|---|---|
| TBD | TBD | TBD |

End of table

Table 127: profile_configuration_codes codes

| field_id | field_name | code_value | abbreviation | description | start_date | end_date |
|---|---|---|---|---|---|---|
| 0 | include descent | 0 | NA | Descent excluded | NA | NA |
| 0 | include descent | 1 | NA | Descent included | NA | NA |
| 1 | processing code | 0 | cc | Calibration correction (of humidity sensors) | NA | NA |
| 1 | processing code | 1 | HRC | Humidity radiation correction | NA | NA |
| 1 | processing code | 2 | or | Outlier removal (remove temperature spikes) | NA | NA |
| 1 | processing code | 3 | pGPS | Combination of pressure and GPS | NA | NA |
| 1 | processing code | 4 | TL | Time-lag correction | NA | NA |
| 1 | processing code | 5 | TRC | Temperature radiation correction | NA | NA |
| B002003 | type of measuring equipment used | 0 - 15 | NA | See BUFR table 0 02 003 | NA | NA |

Continued on next page

Table 127 profile_configuration_codes (cont.)

| field_id | field_name | code_value | abbreviation | description | start_date | end_date |
|---|---|---|---|---|---|---|
| B002011 | radiosonde sounding system | 0 - 255 | NA | See BUFR table 0 02 011 | NA | NA |
| B002013 | solar and infrared radiation correction | 0 - 15 | NA | See BUFR table 0 02 013 | NA | NA |
| B002014 | tracking technique | 0 - 127 | NA | See BUFR table 0 02 014 | NA | NA |
| B002015 | radiosonde completeness | 0 - 15 | NA | See BUFR table 0 02 015 | NA | NA |
| B002017 | humidity correction algorithm | 0 - 31 | NA | See BUFR table 0 02 017 | NA | NA |
| B002066 | radiosonde ground receiving system | 0 - 63 | NA | See BUFR table 0 02 066 | NA | NA |
| B002080 | balloon manufacturer | 0 - 63 | NA | See BUFR table 0 02 080 | NA | NA |
| B002081 | balloon type | 0 - 31 | NA | See BUFR table 0 02 081 | NA | NA |
| B002083 | type of balloon shelter | NA | NA | See BUFR table 0 02 083 | NA | NA |
| B002084 | type of gas used in balloon | NA | NA | See BUFR table 0 02 084 | NA | NA |
| B002095 | type of pressure sensor | 0 - 31 | NA | See BUFR table 0 02 095 | NA | NA |

Continued on next page

Table 127 profile_configuration_codes (cont.)

| field_id | field_name | code_value | abbreviation | description | start_date | end_date |
|---|---|---|---|---|---|---|
| B002191 | geopotential height calculation | 0 - 15 | NA | See BUFR table 0 02 191 | NA | NA |
| B003011 | method of depth calculation | 0 - 3 | NA | See BUFR table 0 03 011 | NA | NA |
| B022056 | profile direction | 0 - 3 | NA | See BUFR table 0 22 056 | NA | NA |
| B022067 | instrument type for water temperature salinity profile | 0 - 1023 | NA | See BUFR table 0 22 067 | NA | NA |
| B022068 | water temperature profile recorder type | 0 - 127 | NA | See BUFR table 0 22 068 | NA | NA |
| B022178 | XBT launcher type | 0 - 255 | NA | See BUFR table 0 22 178 | NA | NA |
| B035035 | reason for termination | 0 - 31 | NA | See BUFR table 0 35 035 | NA | NA |

End of table

Table 128: profile_configuration_fields codes

| field_id | field_name | type | description |
|---|---|---|---|
| 0 | include descent | int (fk) | See profile_configuration_codes |
| 1 | processing code | int (fk) | See profile_configuration_codes |
| 2 | unwinder type | varchar | NA |
| 3 | burstpoint altitude | numeric | NA |
| 4 | burstpoint pressure | numeric | NA |
| 5 | filling weight | numeric | NA |
| 6 | gross weight | numeric | NA |
| 7 | payload | numeric | NA |
| 8 | unwinder length | numeric | NA |
| 9 | ascent rate | numeric | Rate of ascent / descent for profile (+ve values indicate ascent, -ve descent)(m/s) |
| B002016 | radiosonde configuration | int (fk) | See profile_configuration_codes |
| B002003 | type of measuring equipment used | int (fk) | See profile_configuration_codes |
| B002011 | radiosonde sounding system | int (fk) | See profile_configuration_codes |
| B002011 | radiosonde type | int (fk) | See profile_configuration_codes |
| B002013 | solar and infrared radiation correction | int (fk) | See profile_configuration_codes |
| B002014 | tracking technique | int (fk) | See profile_configuration_codes |
| B002015 | radiosonde completeness | int (fk) | See profile_configuration_codes |
| B002017 | humidity correction algorithm | int (fk) | See profile_configuration_codes |
| B002066 | radiosonde ground receiving system | int (fk) | See profile_configuration_codes |
| B002080 | balloon manufacturer | int (fk) | See profile_configuration_codes |
| B002081 | balloon type | int (fk) | See profile_configuration_codes |
| B002083 | type of balloon shelter | int (fk) | See profile_configuration_codes |
| B002084 | type of gas used in balloon | int (fk) | See profile_configuration_codes |
| B002095 | type of pressure sensor | int (fk) | See profile_configuration_codes |

Continued on next page

Table 128 profile_configuration_fields (cont.)

| field_id | field_name | type | description |
|---|---|---|---|
| B002191 | geopotential height calculation | int (fk) | See profile_configuration_codes |
| B003011 | method of depth calculation | int (fk) | See profile_configuration_codes |
| B022056 | profile direction | int (fk) | See profile_configuration_codes |
| B022067 | instrument type for water temperature salinity profile | int (fk) | See profile_configuration_codes |
| B022068 | water temperature profile recorder type | int (fk) | See profile_configuration_codes |
| B022178 | XBT launcher type | int (fk) | See profile_configuration_codes |
| B035035 | reason for termination | int (fk) | See profile_configuration_codes |

End of table

Table 129: profile_type codes

| type | description |
|---|---|
| 0 | Atmospheric |
| 1 | Oceanographic |
| 2 | Soil |
| 3 | Snow |

End of table

Table 130: qc_method codes

| method | description | reference |
|---|---|---|
| TBD | TBD | TBD |

End of table

Table 131: quality_flag codes

| flag | description |
|---|---|
| 0 | Good |
| 1 | Inconsistent |
| 2 | Doubtful |
| 3 | Wrong |

Continued on next page

Table 131 quality_flag (cont.)

| flag | description |
|---|---|
| 4 | Not checked |
| 5 | Has been changed |
| 6 | Estimated |
| 7 | Missing value |

End of table

Table 132: region codes

| region | WMO_region | description |
|---|---|---|
| 0 | NA | Reserved |
| 1 | 1 | Africa |
| 2 | 2 | Asia |
| 3 | 3 | South America |
| 4 | 4 | North America, Central America, Caribbean |
| 5 | 5 | South-West Pacific |
| 6 | 6 | Europe |
| 7 | 7 | Antarctica |

End of table

Table 133: report_processing_codes codes

| code | abbreviation | description |
|---|---|---|
| TBD | TBD | TBD |

End of table

Table 134: report_processing_level codes

| level | abbreviation | description |
|---|---|---|
| TBD | TBD | TBD |

End of table

Table 135: report_type codes

| type | abbreviation | description |
|---|---|---|
| TBD | TBD | TBD |

End of table

Table 136: role codes

| role | description |
|---|---|
| TBD | TBD |

End of table

Table 137: sampling_strategy codes

| strategy | name | description |
|---|---|---|
| 1 | Continuous | Sampling is done continuously, but not necessarily at regular time intervals. Sampling is integrating, i.e., none of the medium escapes observations. |
| 2 | Discrete | Sampling is done at regular time intervals for certain sampling periods that are smaller than the time interval. Sampling is not integrating, i.e., parts of the medium escape observation. |
| 3 | Event | Sampling is done at irregular time intervals. |

End of table

Table 138: sea_level_datum codes

| datum | description |
|---|---|
| 0 | Earth Gravitational Model 1996 |
| 1 | Baltic height system 1977 |

End of table

Table 139: secondary_variable codes

| variable | variable_name | value | symbol | description |
|---|---|---|---|---|
| 0 | atmospheric constituent | 0 | BrO | Bromine monoxide |
| 0 | atmospheric constituent | 1 | C10H16 | 3-Carene |
| 0 | atmospheric constituent | 2 | C10H16 | Alpha pinene |
| 0 | atmospheric constituent | 3 | C10H16 | Beta pinene |
| 0 | atmospheric constituent | 4 | C10H16 | Limonene |
| 0 | atmospheric constituent | 5 | C2H2 | Ethyne (Acetylene) |
| 0 | atmospheric constituent | 6 | C2H5OH | Ethanol |
| 0 | atmospheric constituent | 7 | C2H6 | Propene |
| 0 | atmospheric constituent | 8 | C2H6S | Ethanethiol |
| 0 | atmospheric constituent | 9 | C3H6O | Acetone |
| 0 | atmospheric constituent | 10 | C4H10 | Methylpropane |
| 0 | atmospheric constituent | 11 | C4H10 | n-butane |
| 0 | atmospheric constituent | 12 | C5H12 | 2-Methylbutane |
| 0 | atmospheric constituent | 13 | C5H12 | n-Pentane |

Continued on next page

Table 139 secondary_variable (cont.)

| variable | variable_name | value | symbol | description |
|---|---|---|---|---|
| 0 | atmospheric constituent | 14 | C5H8 | Isoprene |
| 0 | atmospheric constituent | 15 | C6H6 | Benzene |
| 0 | atmospheric constituent | 16 | C7H8 | Toluene |
| 0 | atmospheric constituent | 17 | CFC-11 | CFC-11 |
| 0 | atmospheric constituent | 18 | CFC-12 | CFC-12 |
| 0 | atmospheric constituent | 19 | CH3CN | Acetonitrile |
| 0 | atmospheric constituent | 20 | CH3OH | Methanol |
| 0 | atmospheric constituent | 21 | CH4 | Methane |
| 0 | atmospheric constituent | 22 | ClO | Chlorine monoxide |
| 0 | atmospheric constituent | 23 | ClONO2 | Chlorine nitrate |
| 0 | atmospheric constituent | 24 | CO | Carbon monoxide |
| 0 | atmospheric constituent | 25 | CO2 | Carbon dioxide |
| 0 | atmospheric constituent | 26 | COS | Carbonyl sulfide |
| 0 | atmospheric constituent | 27 | H2O | Water vapour |
| 0 | atmospheric constituent | 28 | HCHO | Formaldehyde |

Continued on next page

Table 139 secondary_variable (cont.)

| variable | variable_name | value | symbol | description |
|---|---|---|---|---|
| 0 | atmospheric constituent | 29 | HCHO | Formaldehyde (Total Column) |
| 0 | atmospheric constituent | 30 | HCl | Hydrogen chloride |
| 0 | atmospheric constituent | 31 | HDO | ??? |
| 0 | atmospheric constituent | 32 | HNO3 | Nitric acid |
| 0 | atmospheric constituent | 33 | N2O | Nitrous oxide |
| 0 | atmospheric constituent | 34 | N2O5 | Dinitrogen pentoxide |
| 0 | atmospheric constituent | 35 | NO | Nitrogen monoxide |
| 0 | atmospheric constituent | 36 | NO2 | Nitrogen dioxide |
| 0 | atmospheric constituent | 37 | NO2 | Nitrogen dioxide (Total column) |
| 0 | atmospheric constituent | 38 | O3 | Ozone |
| 0 | atmospheric constituent | 39 | O3 | Ozone (Total column) |
| 0 | atmospheric constituent | 40 | OH | ??? |
| 0 | atmospheric constituent | 41 | PAN | ??? |
| 0 | atmospheric constituent | 42 | PSC occurrence | ??? |
| 0 | atmospheric constituent | 43 | SF6 | Sulphur hexaflouride |

Continued on next page

Table 139 secondary_variable (cont.)

| variable | variable_name | value | symbol | description |
|---|---|---|---|---|
| 0 | atmospheric constituent | 44 | SO2 | Sulphur dioxide |
| 0 | atmospheric constituent | 45 | SO2 | Sulphur dioxide (Total column) |

End of table

Table 140: sensor_configuration_codes codes

| field_id | field_name | parameter | code_value | abbreviation | description |
|---|---|---|---|---|---|
| B002033 | sensor type - salinity | salinity | 0 - 7 | | See BUFR table 0 02 033 |
| B002038 | sensor type - water temperature | water temperature | 0 - 15 | | See BUFR table 0 02 038 |
| B002038 | sensor type - water temperature | water temperature | 16 | | Bait tanks thermometer. |
| B002038 | sensor type - water temperature | water temperature | 17 | | electronic sensor |
| B002038 | sensor type - water temperature | water temperature | 18 | | Iimplied bucket [note: applicable to early ICOADS data] |
| B002038 | sensor type - water temperature | water temperature | 19 | | Radiation thermometer. |
| B002038 | sensor type - water temperature | water temperature | 20 | | Through Hull sensor. |
| B002038 | sensor type - water temperature | water temperature | 21 | | Trailing thermistor |
| B002038 | sensor type - water temperature | water temperature | 22 | | unknown or non-bucket |
| B002051 | sensor type - extremes | air temperature | 0 - 15 | | See BUFR table 0 02 051 |

Continued on next page

Table 140 sensor_configuration_codes (cont.)

| field_id | field_name | parameter | code_value | abbreviation | description |
|---|---|---|---|---|---|
| B002096 | sensor type - air temperature | air temperature | 0 | | See BUFR table 0 02 096 |
| B002097 | sensor type - humidity | humidity | 0 - 31 | | See BUFR table 0 02 097 |
| B002169 | sensor type - wind speed | wind speed | 0 - 15 | | See BUFR table 0 02 169 |
| B002169 | sensor type - wind speed | wind speed | 16 | | Anemograph. |
| B002169 | sensor type - wind speed | wind speed | 17 | | Anemometer - type unspecified |
| B002169 | sensor type - wind speed | wind speed | 18 | | Beaufort force |
| B002169 | sensor type - wind speed | wind speed | 19 | | Cup anemometer and wind vane (combined unit). |
| B002169 | sensor type - wind speed | wind speed | 20 | | Cup anemometer and wind vane (separate instruments). |
| B002169 | sensor type - wind speed | wind speed | 21 | | Handheld anemometer. |
| B002169 | sensor type - wind speed | wind speed | 22 | | Other (specify in footnote). |
| B002169 | sensor type - wind speed | wind speed | 23 | | Propeller vane. |
| B002185 | sensor type - evaporation | evaporation | 0 - 15 | | See BUFR table 0 02 185 |
| B003003 | sensor housing - type | all | 0 - 15 | | See BUFR table 0 03 003 |
| B003004 | sensor housing - radiation shielding | all | 0 - 15 | | See BUFR table 0 03 004 |

Continued on next page

Table 140 sensor_configuration_codes (cont.)

| field_id | field_name | parameter | code_value | abbreviation | description |
|---|---|---|---|---|---|
| B003008 | sensor housing - ventilation | all | 0 - 7 | | See BUFR table 0 03 008 |
| B003020 | sensor housing - material | all | 0 - 7 | | See BUFR table 0 03 020 |
| B003021 | sensor housing - heating | all | 0 - 4 | | See BUFR table 0 03 021 |
| B003022 | sensor owner | all | 0 - 7 | | See BUFR table 0 03 022 |
| B003023 | sensor housing - configuration | all | 0 - 7 | | See BUFR table 0 03 023 |
| BARG | sensor type - barograph | pressure trend | 0 | | Open Scale barograph with 1 day clock. |
| BARG | sensor type - barograph | pressure trend | 1 | | Open Scale barograph with 2 day clock. |
| BARG | sensor type - barograph | pressure trend | 2 | | Open Scale barograph with 3 day clock. |
| BARG | sensor type - barograph | pressure trend | 3 | | Open Scale barograph with 4 day clock. |
| BARG | sensor type - barograph | pressure trend | 4 | | Open Scale barograph with 5 day clock. |
| BARG | sensor type - barograph | pressure trend | 5 | | Open Scale barograph with 6 day clock. |
| BARG | sensor type - barograph | pressure trend | 6 | | Open Scale barograph with 7 day clock. |
| BARG | sensor type - barograph | pressure trend | 7 | | Open Scale barograph with 8 day clock. |
| BARG | sensor type - barograph | pressure trend | 8 | | Open Scale barograph with 9 day clock. |
| BARG | sensor type - barograph | pressure trend | 9 | | Open Scale barograph. |

Continued on next page

Table 140 sensor_configuration_codes (cont.)

| field_id | field_name | parameter | code_value | abbreviation | description |
|---|---|---|---|---|---|
| BARG | sensor type - barograph | pressure trend | 10 | | Other (specify in footnote). |
| BARG | sensor type - barograph | pressure trend | 11 | | Small Scale barograph. |
| BARG | sensor type - barograph | pressure trend | 12 | | Tendency obtained from an electronic digital barometer. |
| BARM | sensor type - barometer | pressure | 0 | | Aneroid barometer (issued by the PMO or a NMS). |
| BARM | sensor type - barometer | pressure | 1 | | Digital aneroid barometer (aka Precision Aneroid Barometer). |
| BARM | sensor type - barometer | pressure | 2 | | Electronic digital barometer (consisting of one or more pressure transducers). |
| BARM | sensor type - barometer | pressure | 3 | | Mercury barometer. |
| BARM | sensor type - barometer | pressure | 4 | | Other |
| BARM | sensor type - barometer | pressure | 5 | | Ship's aneroid barometer. |
| IBS | ice bulb status | humidity | 0 | | Ice bulb |
| IBS | ice bulb status | humidity | 1 | | Wet bulb |
| MANU | manufacturer | all | 0 | | Vaisala |
| SLOC | sensor location - ship | all | 0 | | Aft mast. |
| SLOC | sensor location - ship | all | 1 | | Bridge wing |
| SLOC | sensor location - ship | all | 2 | | Foremast yardarm |
| SLOC | sensor location - ship | all | 3 | | Foremast. |

Continued on next page

Table 140 sensor_configuration_codes (cont.)

| field_id | field_name | parameter | code_value | abbreviation | description |
|---|---|---|---|---|---|
| SLOC | sensor location - ship | all | 4 | | Handheld. |
| SLOC | sensor location - ship | all | 5 | | Main deck |
| SLOC | sensor location - ship | all | 6 | | Mainmast yardarm |
| SLOC | sensor location - ship | all | 7 | | Mainmast. |
| SLOC | sensor location - ship | all | 8 | | Mast on wheelhouse top yardarm |
| SLOC | sensor location - ship | all | 9 | | Mast on wheelhouse top. |
| SLOC | sensor location - ship | all | 10 | | Meteorological mast. |
| SLOC | sensor location - ship | all | 11 | | Not fitted. |
| SLOC | sensor location - ship | all | 12 | | Other |
| SLOC | sensor location - ship | all | 13 | | Pressurised wheelhouse (closed and not vented to the outside). |
| SLOC | sensor location - ship | all | 14 | | Wheelhouse |
| SLOC | sensor location - ship | all | 15 | | Wheelhouse, not pressurised (vented to the outside). |
| SRR | sensor type - precipitation | precipitation | NA | | Place holder |
| SSIDE | sensor side - ship | all | 0 | | Center |
| SSIDE | sensor side - ship | all | 1 | | Port |

Continued on next page

Table 140 sensor_configuration_codes (cont.)

| field_id | field_name | parameter | code_value | abbreviation | description |
|---|---|---|---|---|---|
| SSIDE | sensor side - ship | all | 2 | | Starboard |
| SSIDE | sensor side - ship | all | 3 | | Windward side |
| SWV | sensor type - waves | waves | 0 | | buoy |
| SWV | sensor type - waves | waves | 1 | | other |
| SWV | sensor type - waves | waves | 2 | | shipborne wave recorder |
| SWW | sensor type - present weather | present weather | 0 | | Automatic, included (using WMO Codes 4677 and 4561) |
| SWW | sensor type - present weather | present weather | 1 | | Automatic, included (using WMO codes 4680 amd 4531) |
| SWW | sensor type - present weather | present weather | 2 | | Automatic, omitted (no observation, data not available) |
| SWW | sensor type - present weather | present weather | 3 | | Automatic, omitted (no significant phenomenon to report) |
| SWW | sensor type - present weather | present weather | 4 | | Manned, included |
| SWW | sensor type - present weather | present weather | 5 | | Manned, omitted (no observation, data not available) |

Continued on next page

Table 140 sensor_configuration_codes (cont.)

| field_id | field_name | parameter | code_value | abbreviation | description |
|---|---|---|---|---|---|
| SWW | sensor type - present weather | present weather | 6 | | Manned, omitted (no significant phenomenon to report) |
| TSONDE | teleme-try_sonde | sonde | TBD | | TBD |
| STREAT | sample treat-ment | all | TBD | | TBD |
| SPROC | sample pro-cedure | all | TBD | | TBD |
| QCPROC | quality control procedure | all | TBD | | TBD |
| CALMETH | Calibration method | all | TBD | | TBD |

End of table

Table 141: sensor_configuration_fields codes

| field_id | field_name | parameter | type | description |
|---|---|---|---|---|
| SACC | sensor accuracy | all | numeric | Reported accuracy (trueness) of sensor in units of measurement. |
| SPRE | sensor precision | all | numeric | Reported precision (repeatability) of sensor in units of measurement |
| B002033 | sensor type - salinity | salinity | int (fk) | NA |
| B002038 | sensor type - water temperature | water temperature | int (fk) | NA |
| B002051 | sensor type - extremes | air temperature | int (fk) | NA |
| B002096 | sensor type - air temperature | air temperature | int (fk) | NA |
| B002097 | sensor type - humidity | humidity | int (fk) | NA |
| B002169 | sensor type - wind speed | wind speed | int (fk) | NA |
| B002185 | sensor type - evaporation | evaporation | int (fk) | NA |
| B003003 | sensor housing - type | all | int (fk) | NA |
| B003004 | sensor housing - radiation shielding | all | int (fk) | NA |
| B003008 | sensor housing - ventilation | all | int (fk) | NA |
| B003020 | sensor housing - material | all | int (fk) | NA |
| B003021 | sensor housing - heating | all | int (fk) | NA |
| B003022 | sensor owner | all | int (fk) | NA |

Continued on next page

Table 141 sensor_configuration_fields (cont.)

| field_id | field_name | parameter | type | description |
|---|---|---|---|---|
| B003023 | sensor housing - configuration | all | int (fk) | NA |
| BARG | sensor type - barograph | pressure trend | int (fk) | NA |
| BARM | sensor type - barometer | pressure | int (fk) | NA |
| CALINT | calibration interval | all | numeric | Maximum number of months recommended between calibrations. |
| CALMETH | calibration method | all | int (fk) | Method used to calibrate instrument |
| CALREF | calibration reference | all | varchar | Reference instrument (make, model and serial number) used to perform calibtation |
| CALDEV | calibration chamber | all | varchar | Calibration chamber (or device) used to perform the calibration |
| CALPRTY | calibration party | all | varchar | Who performed the calibration |
| CALRES | calibration result | all | varchar | Result of the calibration |
| CALCERT | calibration certificate | all | varchar | Certificate number of calibration certificate |
| FREQ | sampling frequency | all | numeric | time period (s) between successive measurements from sensor |
| IBS | ice bulb status | humidity | int (fk) | NA |
| LDCL | sensor location - distance from center line | wind speed | numeric | NA |
| LDFB | sensor location - distance from bow | wind speed | numeric | NA |
| LHAD | sensor location - height above deck | wind speed | numeric | NA |
| MANU | manufacturer | all | int (fk) | NA |
| QCPROC | quality control procedure | all | int (fk) | Procedure used to quality control the observation and set quality flag |

Continued on next page

Table 141 sensor_configuration_fields (cont.)

| field_id | field_name | parameter | type | description |
|---|---|---|---|---|
| SERIAL | serial number | all | varchar | NA |
| SHVR | sensor housing - ventilation rate | all | numeric | NA |
| SLOC | sensor location - ship | all | int (fk) | NA |
| SMAX | sensor range - max | all | numeric | Maximum observable value with sensor in reported units of measurement |
| SMIN | sensor range - min | all | numeric | Minimum observable value with sensor in reported units of measurement |
| SMOD | sensor model | all | varchar | NA |
| SOFT | software_version | all | varchar | NA |
| SPROC | sampling procedure | all | int (fk) | how the sample was obtained |
| SRES | sensor resolution | all | numeric | NA |
| SRESP | sensor response time | all | numeric | Time (s) for sensor to chnage from previous state to current state |
| SRR | sensor type - precipitation | precipitation | int (fk) | NA |
| SSIDE | sensor side - ship | all | int (fk) | NA |
| STAB | sensor stability | all | numeric | Reported stability of sensor in reported units of measurement per year. |
| SWV | sensor type - waves | waves | int (fk) | NA |
| SWW | sensor type - present weather | present weather | int (fk) | NA |
| STREAT | sample treatment | all | int (fk) | treatment of the sample prior to analysis |
| TSONDE | telemetry_sonde | sonde | int (fk) | NA |
| WGHT | weight | sonde | numeric | NA |
| STIME | sample times | all | timestamp | time of the samples used to calculate statistics |
| INSTDATE | installation date | all | timestamp | Date when sensor was installed |

Continued on next page

Table 141 sensor_configuration_fields (cont.)

| field_id | field_name | parameter | type | description |
|---|---|---|---|---|
| MNTDATE | maintenance date | all | timestamp | Date when maintenance performed (use MTNCE to summarise activites undertaken) |
| MNTMETH | maintenance | all | varchar | Summary of maintenance performed |
| MNTPRTY | maintenance party | all | varchar | Who performed the maintenance |
| MNTINT | maintenance interval | all | numeric | Maximum number of months recommended between maintenance activities |

End of table

Table 142: source_configuration_codes codes

| field_id | field_name | code_value | abbreviation | description |
|---|---|---|---|---|
| 0 | delayed mode format | 0 | IMMT version just prior to version number being included | NA |
| 0 | delayed mode format | 1 | IMMT-1 (in effect from 2 Nov. 1994) | NA |
| 0 | delayed mode format | 2 | IMMT-2 (in effect from Jan. 2003) | NA |
| 0 | delayed mode format | 3 | IMMT-3 (in effect from Jan. 2007) | NA |
| 0 | delayed mode format | 4 | IMMT-4 (in effect from Jan. 2011) | NA |
| 0 | delayed mode format | 5 | IMMT-5 (in effect from June 2012) | NA |
| 1 | metadata source | 0 | COAPS | NA |
| 1 | metadata source | 1 | WMO Publication 47 | NA |
| 2 | metadata source format | 1 | Output from digitisation project, semi-colon delimited format (1955) | NA |
| 2 | metadata source format | 2 | Output from digitisation project, semi-colon delimited format (1956) | NA |
| 2 | metadata source format | 3 | Output from digitisation project, semi-colon delimited format (1957 - 1967) | NA |

Continued on next page

Table 142 source_configuration_codes (cont.)

| field_id | field_name | code_value | abbreviation | description |
|---|---|---|---|---|
| 2 | metadata source format | 4 | Output from digitisation project, semi-colon delimited format (1968 - 1969) | NA |
| 2 | metadata source format | 5 | Fixed format (1970 - 1004) | NA |
| 2 | metadata source format | 6 | Semi-colon delimited format (1995 - 2001) | NA |
| 2 | metadata source format | 7 | Semi-colon delimited format (2002 - 2007 q1) | NA |
| 2 | metadata source format | 8 | Semi-colon delimited format (2007 - 2008) | NA |
| 2 | metadata source format | 9 | Semi-colon delimited format (2009 - 2014) | NA |
| 3 | observation source type | 0 | unknown | NA |
| 3 | observation source type | 1 | delayed mode - logbook (paper) | NA |
| 3 | observation source type | 2 | real time - national telecommunication channels | NA |
| 3 | observation source type | 3 | delayed mode - national publications | NA |
| 3 | observation source type | 4 | delayed mode - logbook (electronic) | NA |

Continued on next page

Table 142 source_configuration_codes (cont.)

| field_id | field_name | code_value | abbreviation | description |
|---|---|---|---|---|
| 3 | observation source type | 5 | real time - global telecommunication system (GTS) | NA |
| 3 | observation source type | 6 | delayed mode - International publications | NA |
| 4 | real time format | 0 | previous to FM24-V | NA |
| 4 | real time format | 1 | FM 24-V | NA |
| 4 | real time format | 2 | FM 24-VI Ext. | NA |
| 4 | real time format | 3 | FM 13-VII | NA |
| 4 | real time format | 4 | FM 13-VIII | NA |
| 4 | real time format | 5 | FM 13-VIII Ext. | NA |
| 4 | real time format | 6 | FM 12-IX | NA |
| 4 | real time format | 7 | FM 13-IX Ext. | NA |
| 4 | real time format | 8 | FM 13-X | NA |
| 4 | real time format | 9 | FM 13-XI | NA |
| 4 | real time format | 10 | FM 13-XII Ext. | NA |
| 4 | real time format | 11 | FM 13-XIII | NA |
| 4 | real time format | 12 | FM 13-XIV Ext. | NA |
| 5 | source format | 0 | IMMA - Version 0 | NA |
| 5 | source format | 1 | IMMA - Version 1 | NA |
| 6 | icoads source deck | NA | See ICOADS Source Deck | NA |
| 7 | icoads source id | NA | See ICOADS Source ID | NA |
| 8 | product level | 2 | Data read from original data file | NA |
| 9 | product status | 1 | Data approved | Data exist, read from chache, PTU + altitude columns available, all GC25 tests ok, all uncertainties as expected |

End of table

Table 143: source_configuration_fields codes

| field_id | field_name | kind | description |
|---|---|---|---|
| 0 | delayed mode format | int (fk) | NA |
| 1 | metadata source | int (fk) | NA |
| 2 | metadata source format | int (fk) | NA |
| 3 | observation source type | int (fk) | NA |
| 4 | real time format | int (fk) | NA |
| 5 | source format | int (fk) | NA |
| 6 | source deck | int (fk) | NA |
| 7 | source id | int (fk) | NA |
| 10 | product original time resolution | numeric | NA |

End of table

Table 144: source_format codes

| format | description |
|---|---|
| 0 | ASCII (comma seperated values) |

End of table

Table 145: spatial_representativeness codes

| representativeness | description |
|---|---|
| 0 | Nil reason - None of the codes in the table is applicable in the context of the observed quantity or unknown, or not available information. |
| 1 | Microscale - An area or volume less than 100 m horizontal extent (for example, evaporation) |
| 2 | Toposcale, local scale - An area or volume of 100 m to 3 km horizontal extent (for example, air pollution, tornadoes) |
| 3 | Mesoscale - An area or volume of 3 km to 100 km horizontal extent (for example, thunderstorms, sea and mountain breezes) |

Continued on next page

Table 145 spatial_representativeness (cont.)

| representativeness | description |
|---|---|
| 4 | Large scale- An area or volume of 100 km to 3000 km horizontal extent (for example, fronts, various cyclones, cloud clusters) |
| 5 | Planetary scale - An area or volume of more than 3000 km horizontal extent (for example, long upper tropospheric waves) |
| 6 | Drainage area - An area (also known as 'catchment') having a common outlet for its surface runoff, in km2 |

End of table

Table 146: standard_time codes

| time | description |
|---|---|
| 0 | 00 UTC |
| 1 | 06 UTC |
| 2 | 12 UTC |
| 3 | 18 UTC |

End of table

Table 147: station_configuration_codes codes

| field_id | field_name | code_value | abbreviation | description |
|---|---|---|---|---|
| 0 | AWS Entry and Display Software | | | TBD |
| 1 | AWS Entry and Display Software Version | | | TBD |
| 2 | AWS Model | | | TBD |
| 3 | AWS Model Version | | | TBD |
| 4 | AWS Software | | | TBD |
| 5 | AWS Software version | | | TBD |
| 9 | Drogue type | NA | | See BUFR code table 0 02 034 |
| 11 | Lagrangian drifter drogue status | NA | | See BUFR code table 0 22 060 |
| 11 | LogBook software and version | | | TBD |
| 16 | Other instruments | 0 | BAT | Bathythermometer. |
| 16 | Other instruments | 1 | BT | Bathythermograph (towed). |
| 16 | Other instruments | 2 | FLM | Fluorometer. |
| 16 | Other instruments | 3 | LWR | Long wave radiation. |
| 16 | Other instruments | 4 | MAX | Maximum thermometer. |
| 16 | Other instruments | 5 | MIN | Minimum thermometer. |
| 16 | Other instruments | 6 | NTE | Nitrate sensor. |
| 16 | Other instruments | 7 | NTT | Nutrient sensor. |
| 16 | Other instruments | 8 | P | Pilot balloon equipment. |
| 16 | Other instruments | 9 | CO2 | pCO2 system. |
| 16 | Other instruments | 10 | PLK | Plankton recorder. |
| 16 | Other instruments | 11 | PRS | Photosynthetic radiation sensor. |
| 16 | Other instruments | 12 | PYG | Pyrogeometer. |
| 16 | Other instruments | 13 | R | Radiosonde equipment. |

Continued on next page

Table 147 station_configuration_codes (cont.)

| field_id | field_name | code_value | abbreviation | description |
|---|---|---|---|---|
| 16 | Other instruments | 14 | RG | Rain gauge. |
| 16 | Other instruments | 15 | RSD | Radar storm and meteorological phenomena detection. |
| 16 | Other instruments | 16 | RT | Reversing thermometer. |
| 16 | Other instruments | 17 | SKY | Sky camera. |
| 16 | Other instruments | 18 | SLM | Solarimeter. |
| 16 | Other instruments | 19 | ST | Sea thermograph. |
| 16 | Other instruments | 20 | SWR | Short wave radiation. |
| 16 | Other instruments | 21 | TSD | Temperature/salinity/depth probe. |
| 16 | Other instruments | 22 | TUR | Turbidity sensor. |
| 16 | Other instruments | 23 | W | Radiowind or radarwind equipment. |
| 16 | Other instruments | 24 | WR | Wave Recorder |
| 16 | Other instruments | 25 | XBT | Expendable bathythermograph. |
| 16 | Other instruments | 26 | OT | Other (specify in footnote). |
| 17 | Station status | 1 | | Planned |
| 17 | Station status | 2 | | Pre-operational |
| 17 | Station status | 3 | | Operational / Reporting |
| 17 | Station status | 4 | | Partly reporting |
| 17 | Station status | 5 | | Temporarily suspended |
| 17 | Station status | 6 | | Closed |
| 18 | Type of meteorological reporting ship | 0 | 70 | Auxiliary ship |
| 18 | Type of meteorological reporting ship | 1 | 75 | Auxiliary ship (AWS) |
| 18 | Type of meteorological reporting ship | 2 | 10 | Selected |
| 18 | Type of meteorological reporting ship | 3 | 15 | Selected (AWS) |
| 18 | Type of meteorological reporting ship | 4 | 40 | Supplementary |

Continued on next page

Table 147 station_configuration_codes (cont.)

| field_id | field_name | code_value | abbreviation | description |
|---|---|---|---|---|
| 18 | Type of meteorological reporting ship | 5 | 45 | Supplementary (AWS) |
| 18 | Type of meteorological reporting ship | 6 | 80 | Third party |
| 18 | Type of meteorological reporting ship | 7 | 85 | Third party (AWS) |
| 18 | Type of meteorological reporting ship | 8 | 99 | Unknown |
| 18 | Type of meteorological reporting ship | 9 | 30 | VOSClim - VOS Climate |
| 18 | Type of meteorological reporting ship | 10 | 35 | VOSClim (AWS) - VOS Climate (AWS) |

End of table

Table 148: station_configuration_fields codes

| field_id | field_name | kind | description |
|---|---|---|---|
| 0 | AWS Entry and Display Software | int (fk) | See station_configuration_codes |
| 1 | AWS Entry and Display Software Version | int (fk) | See station_configuration_codes |
| 2 | AWS Model | int (fk) | See station_configuration_codes |
| 3 | AWS Model Version | int (fk) | See station_configuration_codes |
| 4 | AWS Software | int (fk) | See station_configuration_codes |
| 5 | AWS Software version | int (fk) | See station_configuration_codes |
| 6 | Cargo height | numeric | Height of cargo above deck (m) |
| 7 | Distance of bridge from bow | numeric | (m) |
| 8 | Draught | numeric | (m) |
| 9 | Drogue type | int (fk) | See station_configuration_codes |
| 10 | Freeboard | numeric | NA |
| 11 | Lagrangian drifter drogue status | int (fk) | See station_configuration_codes |
| 12 | Length overall of the ship, ignoring bulbous bow | numeric | NA |
| 13 | LogBook software and version | int (fk) | See station_configuration_codes |
| 14 | Maximum operating speed on normal service | numeric | NA |
| 15 | Moulded breadth | numeric | NA |
| 16 | Other instruments | int (fk) | See station_configuration_codes |
| 17 | Station status | int (fk) | See station_configuration_codes |
| 18 | Type of meteorological reporting ship | int (fk) | See station_configuration_codes |
| 19 | Surface cover | int (fk) | See station_configuration_codes |
| 20 | Surface cover scheme | int (fk) | See station_configuration_codes |
| 21 | Topography | int (fk) | See station_configuration_codes |
| 22 | Topography scheme | int (fk) | See station_configuration_codes |

Continued on next page

Table 148 station_configuration_fields (cont.)

| field_id | field_name | kind | description |
|---|---|---|---|
| 23 | Soil type | int (fk) | See station_configuration_codes |
| 24 | Land use | int (fk) | See station_configuration_codes |
| 25 | Alternate longitude | numeric | NA |
| 26 | Alternate latitude | numeric | NA |
| 27 | Distance from road | numeric | Distance from nearest road (in km) |
| 28 | Distance from water body | numeric | Distance from nearest water body (in km) |

End of table

Table 149: station_type codes

| type | description |
|---|---|
| 1 | Land station |
| 2 | Sea station |
| 3 | Aircraft |
| 4 | Satellite |
| 5 | Underwater platform |

End of table

Table 150: sub_region codes

| sub_region | type | code | name |
|---|---|---|---|
| 0 | country | AD | ANDORRA |
| 1 | country | AE | UNITED ARAB EMIRATES |
| 2 | country | AF | AFGHANISTAN |
| 3 | country | AG | ANTIGUA AND BARBUDA |
| 4 | country | AI | ANGUILLA |
| 5 | country | AL | ALBANIA |
| 6 | country | AM | ARMENIA |
| 7 | country | AN | NETHERLANDS ANTILLES |
| 8 | country | AO | ANGOLA |
| 9 | country | AQ | ANTARCTICA |
| 10 | country | AR | ARGENTINA |
| 11 | country | AS | AMERICAN SAMOA |
| 12 | country | AT | AUSTRIA |
| 13 | country | AU | AUSTRALIA |
| 14 | country | AW | ARUBA |
| 15 | country | AX | ALAND ISLANDS |

Continued on next page

Table 150 sub_region (cont.)

| sub_region | type | code | name |
|---|---|---|---|
| 16 | country | AZ | AZERBAIJAN |
| 17 | country | BA | BOSNIA AND HERZEGOVINA |
| 18 | country | BB | BARBADOS |
| 19 | country | BD | BANGLADESH |
| 20 | country | BE | BELGIUM |
| 21 | country | BF | BURKINA FASO |
| 22 | country | BG | BULGARIA |
| 23 | country | BH | BAHRAIN |
| 24 | country | BI | BURUNDI |
| 25 | country | BJ | BENIN |
| 26 | country | BL | SAINT BARTHΔíLEMY |
| 27 | country | BM | BERMUDA |
| 28 | country | BN | BRUNEI DARUSSALAM |
| 29 | country | BO | BOLIVIA |
| 30 | country | BR | BRAZIL |
| 31 | country | BS | BAHAMAS |
| 32 | country | BT | BHUTAN |
| 33 | country | BV | BOUVET ISLAND |
| 34 | country | BW | BOTSWANA |
| 35 | country | BY | BELARUS |
| 36 | country | BZ | BELIZE |
| 37 | country | CA | CANADA |
| 38 | country | CC | COCOS (KEELING) ISLANDS |
| 39 | country | CD | CONGO, THE DEMOCRATIC REPUBLIC OF THE |
| 40 | country | CF | CENTRAL AFRICAN REPUBLIC |
| 41 | country | CG | CONGO |
| 42 | country | CH | SWITZERLAND |
| 43 | country | CI | COTE D'IVOIRE |
| 44 | country | CK | COOK ISLANDS |
| 45 | country | CL | CHILE |
| 46 | country | CM | CAMEROON |
| 47 | country | CN | CHINA |
| 48 | country | CO | COLOMBIA |
| 49 | country | CR | COSTA RICA |
| 50 | country | CU | CUBA |
| 51 | country | CV | CAPE VERDE |
| 52 | country | CX | CHRISTMAS ISLAND |
| 53 | country | CY | CYPRUS |
| 54 | country | CZ | CZECH REPUBLIC |
| 55 | country | DD | GERMAN DEMOCRATIC REPUBLIC |

Continued on next page

Table 150 sub_region (cont.)

| sub_region | type | code | name |
|---|---|---|---|
| 56 | country | DE | GERMANY |
| 57 | country | DJ | DJIBOUTI |
| 58 | country | DK | DENMARK |
| 59 | country | DM | DOMINICA |
| 60 | country | DO | DOMINICAN REPUBLIC |
| 61 | country | DZ | ALGERIA |
| 62 | country | EC | ECUADOR |
| 63 | country | EE | ESTONIA |
| 64 | country | EG | EGYPT |
| 65 | country | EH | WESTERN SAHARA |
| 66 | country | ER | ERITREA |
| 67 | country | ES | SPAIN |
| 68 | country | ET | ETHIOPIA |
| 69 | country | FI | FINLAND |
| 70 | country | FJ | FIJI |
| 71 | country | FK | FALKLAND ISLANDS (MALVINAS) |
| 72 | country | FM | MICRONESIA, FEDERATED STATES OF |
| 73 | country | FO | FAROE ISLANDS |
| 74 | country | FR | FRANCE |
| 75 | country | GA | GABON |
| 76 | country | GB | UNITED KINGDOM |
| 77 | country | GD | GRENADA |
| 78 | country | GE | GEORGIA |
| 79 | country | GF | FRENCH GUIANA |
| 80 | country | GG | GUERNSEY |
| 81 | country | GH | GHANA |
| 82 | country | GI | GIBRALTAR |
| 83 | country | GL | GREENLAND |
| 84 | country | GM | GAMBIA |
| 85 | country | GN | GUINEA |
| 86 | country | GP | GUADELOUPE |
| 87 | country | GQ | EQUATORIAL GUINEA |
| 88 | country | GR | GREECE |
| 89 | country | GS | SOUTH GEORGIA AND THE SOUTH SANDWICH ISLANDS |
| 90 | country | GT | GUATEMALA |
| 91 | country | GU | GUAM |
| 92 | country | GW | GUINEA-BISSAU |
| 93 | country | GY | GUYANA |
| 94 | country | HK | HONG KONG |

Continued on next page

Table 150 sub_region (cont.)

| sub_region | type | code | name |
|---|---|---|---|
| 95 | country | HM | HEARD ISLAND AND MCDONALD ISLANDS |
| 96 | country | HN | HONDURAS |
| 97 | country | HR | CROATIA |
| 98 | country | HT | HAITI |
| 99 | country | HU | HUNGARY |
| 100 | country | ID | INDONESIA |
| 101 | country | IE | IRELAND |
| 102 | country | IL | ISRAEL |
| 103 | country | IM | ISLE OF MAN |
| 104 | country | IN | INDIA |
| 105 | country | IO | BRITISH INDIAN OCEAN TERRITORY |
| 106 | country | IQ | IRAQ |
| 107 | country | IR | IRAN, ISLAMIC REPUBLIC OF |
| 108 | country | IS | ICELAND |
| 109 | country | IT | ITALY |
| 110 | country | JE | JERSEY |
| 111 | country | JM | JAMAICA |
| 112 | country | JO | JORDAN |
| 113 | country | JP | JAPAN |
| 114 | country | KE | KENYA |
| 115 | country | KG | KYRGYZSTAN |
| 116 | country | KH | CAMBODIA |
| 117 | country | KI | KIRIBATI |
| 118 | country | KM | COMOROS |
| 119 | country | KN | SAINT KITTS AND NEVIS |
| 120 | country | KP | KOREA, DEMOCRATIC PEOPLE'S REPUBLIC OF |
| 121 | country | KR | KOREA, REPUBLIC OF |
| 122 | country | KW | KUWAIT |
| 123 | country | KY | CAYMAN ISLANDS |
| 124 | country | KZ | KAZAKHSTAN |
| 125 | country | LA | LAO PEOPLE'S DEMOCRATIC REPUBLIC |
| 126 | country | LB | LEBANON |
| 127 | country | LC | SAINT LUCIA |
| 128 | country | LI | LIECHTENSTEIN |
| 129 | country | LK | SRI LANKA |
| 130 | country | LR | LIBERIA |
| 131 | country | LS | LESOTHO |
| 132 | country | LT | LITHUANIA |
| 133 | country | LU | LUXEMBOURG |
| 134 | country | LV | LATVIA |

Continued on next page

Table 150 sub_region (cont.)

| sub_region | type | code | name |
|---|---|---|---|
| 135 | country | LY | LIBYAN ARAB JAMAHIRIYA |
| 136 | country | MA | MOROCCO |
| 137 | country | MC | MONACO |
| 138 | country | MD | MOLDOVA, REPUBLIC OF |
| 139 | country | ME | MONTENEGRO |
| 140 | country | MF | SAINT MARTIN |
| 141 | country | MG | MADAGASCAR |
| 142 | country | MH | MARSHALL ISLANDS |
| 143 | country | MK | MACEDONIA, THE FORMER YU-GOSLAV REPUBLIC OF |
| 144 | country | ML | MALI |
| 145 | country | MM | MYANMAR |
| 146 | country | MN | MONGOLIA |
| 147 | country | MO | MACAO |
| 148 | country | MP | NORTHERN MARIANA ISLANDS |
| 149 | country | MQ | MARTINIQUE |
| 150 | country | MR | MAURITANIA |
| 151 | country | MS | MONTSERRAT |
| 152 | country | MT | MALTA |
| 153 | country | MU | MAURITIUS |
| 154 | country | MV | MALDIVES |
| 155 | country | MW | MALAWI |
| 156 | country | MX | MEXICO |
| 157 | country | MY | MALAYSIA |
| 158 | country | MZ | MOZAMBIQUE |
| 159 | country | NA | NAMIBIA |
| 160 | country | NC | NEW CALEDONIA |
| 161 | country | NE | NIGER |
| 162 | country | NF | NORFOLK ISLAND |
| 163 | country | NG | NIGERIA |
| 164 | country | NI | NICARAGUA |
| 165 | country | NL | NETHERLANDS |
| 166 | country | NO | NORWAY |
| 167 | country | NP | NEPAL |
| 168 | country | NR | NAURU |
| 169 | country | NU | NIUE |
| 170 | country | NZ | NEW ZEALAND |
| 171 | country | OM | OMAN |
| 172 | country | PA | PANAMA |
| 173 | country | PE | PERU |

Continued on next page

Table 150 sub_region (cont.)

| sub_region | type | code | name |
|---|---|---|---|
| 174 | country | PF | FRENCH POLYNESIA |
| 175 | country | PG | PAPUA NEW GUINEA |
| 176 | country | PH | PHILIPPINES |
| 177 | country | PK | PAKISTAN |
| 178 | country | PL | POLAND |
| 179 | country | PM | SAINT PIERRE AND MIQUELON |
| 180 | country | PN | PITCAIRN |
| 181 | country | PR | PUERTO RICO |
| 182 | country | PS | PALESTINIAN TERRITORY, OCCUPIED |
| 183 | country | PT | PORTUGAL |
| 184 | country | PW | PALAU |
| 185 | country | PY | PARAGUAY |
| 186 | country | QA | QATAR |
| 187 | country | RE | REUNION |
| 188 | country | RO | ROMANIA |
| 189 | country | RS | SERBIA |
| 190 | country | RU | RUSSIAN FEDERATION |
| 191 | country | RW | RWANDA |
| 192 | country | SA | SAUDI ARABIA |
| 193 | country | SB | SOLOMON ISLANDS |
| 194 | country | SC | SEYCHELLES |
| 195 | country | SD | SUDAN |
| 196 | country | SE | SWEDEN |
| 197 | country | SG | SINGAPORE |
| 198 | country | SH | SAINT HELENA |
| 199 | country | SI | SLOVENIA |
| 200 | country | SJ | SVALBARD AND JAN MAYEN |
| 201 | country | SK | SLOVAKIA |
| 202 | country | SL | SIERRA LEONE |
| 203 | country | SM | SAN MARINO |
| 204 | country | SN | SENEGAL |
| 205 | country | SO | SOMALIA |
| 206 | country | SR | SURINAME |
| 207 | country | ST | SAO TOME AND PRINCIPE |
| 208 | country | SU | USSR |
| 209 | country | SV | EL SALVADOR |
| 210 | country | SY | SYRIAN ARAB REPUBLIC |
| 211 | country | SZ | SWAZILAND |
| 212 | country | TC | TURKS AND CAICOS ISLANDS |
| 213 | country | TD | CHAD |

Continued on next page

Table 150 sub_region (cont.)

| sub_region | type | code | name |
|---|---|---|---|
| 214 | country | TF | FRENCH SOUTHERN TERRITORIES |
| 215 | country | TG | TOGO |
| 216 | country | TH | THAILAND |
| 217 | country | TJ | TAJIKISTAN |
| 218 | country | TK | TOKELAU |
| 219 | country | TL | TIMOR-LESTE |
| 220 | country | TM | TURKMENISTAN |
| 221 | country | TN | TUNISIA |
| 222 | country | TO | TONGA |
| 223 | country | TR | TURKEY |
| 224 | country | TT | TRINIDAD AND TOBAGO |
| 225 | country | TV | TUVALU |
| 226 | country | TW | TAIWAN, PROVINCE OF CHINA |
| 227 | country | TZ | TANZANIA, UNITED REPUBLIC OF |
| 228 | country | UA | UKRAINE |
| 229 | country | UG | UGANDA |
| 230 | country | UM | UNITED STATES MINOR OUTLYING ISLANDS |
| 231 | country | US | UNITED STATES |
| 232 | country | UY | URUGUAY |
| 233 | country | UZ | UZBEKISTAN |
| 234 | country | VA | HOLY SEE (VATICAN CITY STATE) |
| 235 | country | VC | SAINT VINCENT AND THE GRENADINES |
| 236 | country | VE | VENEZUELA |
| 237 | country | VG | VIRGIN ISLANDS, BRITISH |
| 238 | country | VI | VIRGIN ISLANDS, U.S. |
| 239 | country | VN | VIET NAM |
| 240 | country | VU | VANUATU |
| 241 | country | WF | WALLIS AND FUTUNA |
| 242 | country | WS | SAMOA |
| 243 | country | YE | YEMEN |
| 244 | country | YT | MAYOTTE |
| 245 | country | YU | YUGOSLAVIA |
| 246 | country | ZA | SOUTH AFRICA |
| 247 | country | ZM | ZAMBIA |
| 248 | country | ZW | ZIMBABWE |
| 249 | country | ZZ | THIRD PARTY SUPPORT SHIPS |
| 250 | country | CW | CURACAO |

End of table

Table 151: time_quality codes

| quality | description |
|---|---|
| 0 | Timestamp valid, time reported to nearest second |
| 1 | Timestamp valid, time reported to nearest minute |
| 2 | Timestamp valid, time reported to nearest hour |
| 3 | Time missing, date valid. Report set to local midday |
| 4 | Day missing |
| 5 | Invalid date / time |

End of table

Table 152: time_reference codes

| reference | description |
|---|---|
| 0 | Unknown |
| 1 | Time server |
| 2 | Radio clock |
| 3 | Manual comparison |

End of table

Table 153: traceability codes

| traceability | description |
|---|---|
| 0 | Unknown |
| 1 | Traceable to international standards |
| 2 | Traceable to other standards |

End of table

Table 154: uncertainty_method codes

| method | description | reference |
|---|---|---|
| TBD | TBD | TBD |

End of table

Table 155: units codes

| units | name | abbreviation | base_units |
|---|---|---|---|
| 1 - 1024 | | | See BUFR Common Code Table C-6 |

End of table

Table 156: update_frequency codes

| frequency | description |
|---|---|
| 0 | Irregular |
| 1 | Daily |
| 2 | Weekly |
| 3 | Monthly |
| 4 | Annual |

End of table

Table 157: z_coordinate_method codes

| method | description |
|---|---|
| 0 | Value from chart |

End of table

Table 158: z_coordinate_type codes

| type | description |
|---|---|
| 0 | height (m) above sea level |

End of table

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