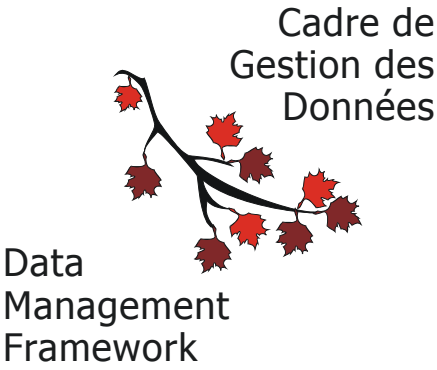


Surface Weather Observation XML (SW-OB-XML)

-Client User Guide-

August 11, 2016
Version 7.1

Table of Contents

1. Document Information[1]

1.1 History

Author	Date	Ver.	Remarks
Thinesh Sornalingam	June 7, 2012	1.0d	Initial draft
AbdulAziz Raouf	June 8, 2012	1.1d	Added in Section 4 Datasets
Thinesh Sornalingam	June 11, 2012	1.2d	Added units of measures and conversions
Dale Boudreau	June 13, 2012	1.3d	1st overall edit of whole document
Dale Boudreau	June 19, 2012	1.4d	2nd overall edit of whole document
Dale Boudreau	June 20, 2012	1.5d	Changed max_vis to vis for RA XML sample and mapping table
Dale Boudreau	June 21, 2012	1.6d	Minor tweaks to data set mapping tables. Dropped vis_code and horizontal_visibility code table
Dale Boudreau	June 25, 2012	1.7d	NC-AWOS: cld_cvr_# becomes sum_cld_cvr_#, added 'sum' to Appendix 6.2
Dale Boudreau	June 26, 2012	1.8d	Updated RA XML example (Sect. 4.3)
Dale Boudreau	June 28, 2012	1.9d	Changed references to External XML and E-ML to "SW-OB-XML" or "SWOB". Added details (table) on incoming code source meanings in section 3.2.3.
Abdulaziz Raouf	June 29,2012	1.9d	Updated NCHWOS dataset table to include full list of elements present section 5.5
Dale Boudreau	July 9, 2012	2.0d	Changed rpt_typ to stn_typ for NC-AWOS (code table 002196).
Dale Boudreau	July 10, 2012	2.1d	Added clg_hgt to WinIDE and RA mapping tables.
Dale Boudreau	July 24, 2012	2.2d	Edited XML structure example. New RA sample. Section 4.2 part D added info in "MSNG". Changed avg_vis_mt50-60 to just vis for NC-AWOS.
Dale Boudreau	July 27, 2012	2.3d	Removed ceiling height (clg_hgt) from RA dataset
Dale Boudreau	July 30, 2012	2.4d	For NC-HWOS dataset, added prsnt_wx_# and changed cld_amt_code to cld_amt_code_#. Also did global search from std_code_source and replaced with std_code_src.
Tahreem Ali	July 30, 2012	2.5d	Removed indexed temperatures for CA (air_temp_#, min_air_temp_pst1hr_#, max_air_temp_pst1hr_#) and duplicate row for pcpn_amt_pst1hr
Abdulaziz Raouf	July 30, 2012	2.6d	Changed label name and description for NCAWOS element wnd_dir_10m_mt50-60_max_spd to wnd_dir_10m_pst1hr_max_spd
Dale Boudreau	August 9, 2012	2.7d	Added std code 88 to report_type code table (from

[1] For more details on additions and changes to the actual SWOB-ML product, please refer to the Release Notes cited in Section 1.3

			incoming of 126 from BUFR58 descriptor 001196). Added icao_stn_id to WinIDE and RA.
Dale Boudreau	August 29, 2012	2.8d	Added word "snow" to descriptions of codes 83, 84 for present_weather code table.
Dale Boudreau	August 31, 2012	3.0	Final Version
Dale Boudreau	October 25, 2012	3.2	Updated description for codes 46, 47 in table total_cloud_amount
Dale Boudreau	December 21, 2012	4.0	Multiple changes made for the DMS 2.3.12.1 release deployed on Data Depot January 15, 2013. Changes are as follows (see Release Notes for more detail): WinIDE tot_cld_amt – changed units from 1/10 to % tot_cld_opcty – changed units from 1/10 to % CA Added the following elements: • avg_cum_pcpn_gag_wt_fltrd_55-60 • snow_dpth_# • logr_panl_temp • max_batry_volt_pst1hr • min_batry_volt_pst1hr • hdr_fwd_pwr • hdr_refltd_pwr • hdr_suply_volt • hdr_oscil_drft
Dale Boudreau	February 14, 2013	5.0	Multiple changes made for the DMS 2.4.0 release deployed on Data Depot early March, 2013. Changes are as follows (see Release Notes for more detail): RA Element cld_amt_code_# wasn't being reported for clear sky because of a change to the decoded code value from 'CLR BLO 100' to 'CLR BLO'. The code substitution XML was updated to accommodate this code change and resolve this issue. Added the following elements: • max_air_temp_pst6hrs • min_air_temp_pst6hrs • max_air_temp_pst24hrs • min_air_temp_pst24hrs CA Added the following elements: • pcpn_amt_pst3hrs • pcpn_amt_pst6hrs • pcpn_amt_pst24hrs • max_air_temp_pst6hrs • min_air_temp_pst6hrs • max_air_temp_pst24hrs

			• min_air_temp_pst24hrs 'air_temp_#' added User Guide table 5.7 as well as an explanation of how it may appear 'snw_dpth_#' added User Guide table 5.7 as well as an explanation of how it may appear <u>NC-AWOS</u> Added element cld_amt_code_# Fixed label name for the following elements by appending an 's' at the end (i.e. hr to hrs): • pcpn_amt_pst3hr • pcpn_amt_pst6hr • pcpn_amt_pst24hr • max_air_temp_pst6hr • min_air_temp_pst6hr • max_air_temp_pst24hr • min_air_temp_pst24hr Changed 'wmo_id' to 'wmo_synop_id', and changed 'max_10m_wnd_gst_ spd_mt50-60' to 'max_wnd_gst_spd_10m_mt50-60 <u>NC-HWOS</u> Added elements: • cor • pcpn_amt_pst6hrs <u>WinIDE</u> Changed 'wmo_id' to 'wmo_synop_id'
Dale Boudreau	February 28, 2013	5.1	Modified code descriptions for obscuring_phenomena (table 6.5.2) codes 28 and 34 to deal with specific meanings for NC-HWOS.
Dale Boudreau	March 18, 2013	5.2	DMS Release 2.4.1: Added the new element max_vis_pst1hr to CA dataset. More modifications to code descriptions for obscuring_phenomena (table 6.5.2) codes 5, 15, 29, and 46 to deal with specific meanings for NC-HWOS.
Dale Boudreau	May 7, 2013	5.3	DMS Release 2.4.2: Added cld_amt_code_# to the NC-AWOS table (Sect. 5.6)
Dale Boudreau	July 15, 2013	6.0	DMS Release 2.4.2: Added NC-AWOS to "station_type" code table (6.5.8) as code 12, and added codes 17, 18. Removed "product_status" code table from the appendix as it was not referenced by any SWOB elements in any of the networks. New codes (86-98) added to bottom of "report_type" code table (6.5.6). Updated code descriptions in tables 6.5.7, 6.5.8, and 6.5.10. element additions/modifications to the various networks: <u>WinIDE</u>

			Added the following element: • clg_hgt NC-HWOS Added 3 additional identification elements: • clim_id • msc_id • rtp_typ Learned that the following elements have an incorrect label since they should be for a 24 hour period. Therefore changed the labels of the following elements to reflect that this is a 24 hour peak wind speed, not a 1-hour peak as the SWOB label originally indicated: Changed • max_pk_wnd_spd_10m_pst1hr to **max_pk_wnd_spd_10m_pst24hrs** • wnd_dir_10m_pst1hr_pk_spd to **wnd_dir_10m_pst24hrs_pk_spd** NC-AWOS Added the following identification element: • rtp_typ CA Removed duplicated element rows from Table 5.7. Added the following element: • avg_wnd_spd_pcpn_gag_mt58-60
Dale Boudreau	August 13, 2014	6.1	CA Added additional elements: • avg_globl_solr_radn_pst1hr • tot_globl_solr_radn_pst1hr • avg_wnd_spd_pcpn_gag_mt50-60 • data_avail (future release) Removed the following element: • stn_id (last 4 digits of wmo_synop_id) • avg_wnd_spd_pcpn_gag_mt58-60 NC-AWOS Added element stn_elev Removed the following elements (always missing): • pcpn_amt_pst3hrs • pcpn_amt_pst24hrs GENERAL • Removed duplicate element rows from Table 5.7 • Added code table for wind_gust_squall_indicator • Changed descriptions for codes 13, 10 in station_type code table

Tahreem Ali / Dale Boudreau	March 24, 2014	7.0	<u>Added the following new datasets:</u> • PanAM – MSC & Partner (CA messages) • PanAM – MSC & Partner (Compact messages) • PanAM – MSC & Partner (ATMOS messages) <u>Updated the following code tables:</u> • station_type • report_type • present_weather <u>Added the following code table:</u> • buoy_type <u>Reflected data changes:</u> • removed T-12 from SWOBs • removed pcpn_amt_pst3hrs and pcpn_amt_pst24hrs from NC-AWOS SWOBs (not observed) • Changed precision of Pressure elements to 1 decimal place • Changed precision of snow depth elements to 0 decimal places • Changed precision of all temperature elements to 1 decimal place • Changed precision of relative humidity to 0 decimal places • Changed precision of all precipitation/rainfall elements to 1 decimal place <u>Many editorial changes:</u> • Many minor editorial changes • Added text to sections 2.1, 2.3, 4.4, 5.1, 5.2.1, • Added new sections: 5.2.3, 5.2.4, • Modified Qa flag descriptions in section 4.5 • Added new data set descriptions and element tables (sections 5.9 – 5.22 • Added additional glossary items • Added additional short label descriptions • Added additional units and conversions
Dale Boudreau	September 15, 2015	7.1	Added new units to section 6.3
Tahreem Ali	August 11, 2016	7.1	<u>Added the following new datasets:</u> • DND AWOS • DND HWOS <u>Updated short labels for the following datasets:</u> • CA

			Removed PanAm datasets except for CA-Compact Updated taxonomy sections to account for new datasets (DND) Updated Qa section to remove the qa summary = 20 rule Updated sections to account for new labels (pstXmts) Added section on multiple sensors

1.2 Filename & Location

Approved (public) Version:
http://dd.weatheroffice.gc.ca/observations/doc/SWOB-ML_Product_User_Guide_v7.1_e.pdf

Current Draft (internal version):
http://ecollab.ncr.int.ec.gc.ca/org/1275692/wem/MS_lib/DMS_SW-OB-ML_Product_User_Guide_v7.1_INTERNAL_e_Final.doc

1.3 Referenced Documents

Document	Author	Version
DMF External Met-ML Specification http://ecollab.ncr.int.ec.gc.ca/org/1275692/wem/MS_lib/DMFExternalMet-MLspecification.doc	Dale Boudreau, Thinesh Sornalingam, Abdulaziz Raouf	1.1
Taxonomy Documentation	Ioanne Carlo Bugash	0.4.1d

2. Introduction

2.1 Overview

The creation of a product for surface weather observations has been undertaken by the Data Management Initiative (DMI) project to provide the Metrological Service of Canada (MSC) and external clients with a concise, user-friendly, easy to read product containing typical hourly surface weather data from MSC and partner atmospheric monitoring networks.

These products will be generated by applications within the Data Management System (DMS). The DMS is collection of a real-time data acquisition, decoding, standardization, quality assessment (Qa) and product generation components for observation, forecast, and warning data. It is to become MSC's primary disseminator of meteorological data to internal and external clients.

There are multiple phases or processing stages within DMS that incoming raw data passes through. Each phase has an associated XML output. In the raw phase, the incoming messages are in their original form (e.g. ASCII, BUFR, etc.). Then they are converted into a "parsed" product (typically an XML). In the parsed phase, the data has not yet been standardized or fully "decoded". The parsed phase prepares the data to be decoded. The parsed phase is optional in the sense that not all data must pass through it. In some cases, the data proceeds straight to the decode phase from the raw phase. In the decode phase, the data is standardized (i.e. mapped to a standard classification, element definition, and name). The data emerges as a decoded XML product following the completion of its passage through the decode phase. The decoded XML is a standards-based format, which is then put through any number of enhanced, quality assessment and/or product generation (PG) phases to add further value and meet client requirements. The Surface Weather Observation XML product (SW-OB-XML) is the result of the PG phase. The SW-OB-XML is in a basic XML format patterned after the DMS internal Met-ML format. The SW-OB-XML will be referred to by the condensed acronym 'SWOB' hereafter in this document. The diagram at the end of section 2.1 captures this flow for selected networks.

As opposed to the more comprehensive DMS decoded Met-ML products, the SWOB is a simplified XML product that focuses on core elemental data without the clutter and complexity of auxiliary content such as non-critical metadata, and detailed Qa results. To the extent possible, this information has been captured in a short element label and an optional qualifier to indicate a summary of any Qa.

Although the SWOB XML is intended for machine-to machine data transmission, the format and clarity of this self-descriptive format is easily human-readable without any specific training or knowledge of markup languages. However, for clients needing to interact with and display data over long intervals or comparing observations from multiple stations geospatially, the use tools such as XML parsers, graphical displays and GIS is advisable.

There are many different streams of the SWOB product, each containing data from the following networks (a short reference name is to the right of the arrow):

1. Legacy MSC & Partner Manned aviation weather stations using the WinIDE or MIDS interface → **WinIDE**
2. DND HWOS → **DND HWOS**
3. Legacy MSC & Partner AWOS aviation weather stations → **RA**
4. DND AWOS → **DND AWOS**

5. Nav Canada HWOS aviation weather stations → **NC-HWOS**
6. Nav Canada AWOS aviation weather stations → **NC-AWOS**
7. MSC & Partner public surface weather stations using Campbell Scientific data loggers → **CA**
   7.1. Minutely data sets supporting the **PanAm Games**:
   - MSC Compact stations → **COMPACT-minutely**

Each dataset product can be uniquely identified via its URI (will be discussed in more detail in Section 4.4).

During the production of a SWOB, the following tasks are carried out:

- Incoming DMS element packages are assigned an abbreviated label
- Unit conversion from incoming units to standard units, and if necessary, rounded to a given precision to trim insignificant digits resulting from some unit conversions.
- If the incoming element is a numeric code or a text value from a list of controlled vocabulary (so in effect a code), then code substitution is performed to map to a DMS standard code.
- An optional quality assessment (Qa) summary flag (using incoming 'native' and DMS quality assessments whenever available) may be attached to applicable elements.

2.2 Purpose and Scope

One of the main purposes of the SW-OB-XML is to offer a replacement for much of the content traditionally found in the legacy SA (surface analysis) product still being used within MSC, although officially it was to have been retired years ago. Although the SWOB will not capture all of the SA's content, it will include the most sought-after hourly surface weather observation elements and any elements pertaining to longer time frames. Some of the more subtle and obscure elements contained in the SA will be excluded from the initial offering of the SWOB. Clients requiring specific aviation, synoptic, or marine data may be better served acquiring the METAR or SYNOP products. Meanwhile, additional elements not present in SA will also be available in the SWOB.

As mentioned above, there are many streams of the SWOB product, each pertaining to a specific network. Each product will be accessible via its own URI within the DMS, or possibly a file system containing the XML files referenced using a filename (e.g. CMC's DataDepot).

The observation elements included in the majority of SWOBs are from these basic observation groups, although some data sets have other groups such as radiation, wave, etc:

- present weather
- sky condition
- visibility
- pressure
- wind
- temperature

- humidity
- precipitation

The format of this product is XML. It will be generated operationally by MSC's Data Management System (DMS) at CMC in Montreal. It will be produced in real-time from the incoming raw data of each dataset. It will be encoded in a standards based XML, which conforms to global meteorological observation conventions (discussed in detail in Section 4).

In addition to the elemental data from the groups indicated above, the SWOB may also contain optional quality assessment (Qa) information in the form of a summary quality flag attached to each element, whenever available. This flag's value is computed by considering any incoming Qa performed on the element at the source (so-called "Native QC"), any Qa conducted in-house by the DMS, or a combination of the two. The absence of a Qa summary flag on an element in the SWOB indicates the quality is unknown.

The SWOB is a very condensed and convenient product of hourly observational data, as opposed to the fuller and more comprehensive decoded XMLs being generated by DMS for the listed datasets. Those clients requiring full element definitions, full quality assessments, etc., should gain access to the DMS decoded, or decoded_enchanced, products of each dataset.

2.3 Intended Audience

Any clients interested in hourly surface weather data will find the External XML product attractive due to its content, simplicity and compactness. Most clients currently using the legacy SA format should also find this product a suitable replacement given it has the majority of the elements in a clear format and may have additional content which could never be encoded using the SA format. Clients who would like quick and easy access to MSC data from the DMS, will also generally benefit from the SW-OB-XML product, especially given that data viewing and access tools are under development in the DMF.

This version of the User Guide is intended for **internal users** within Environment Canada, as some data sets described herein are not available on the publicly accessible CMC DD (DataDepot) site, but rather only on the DDi (internal). The non-public SWOBs are either third party data sets that have as part of their data sharing agreements restrictions on data usage or distribution, or are Beta data sets that have not completed user acceptance testing.

3. Data Standardization

3.1 Standardization of incoming data by the DMS

The DMS decodes and processes data from many networks. The same element may have a variety of different names across the input data sets. For example, air temperature may be called dry-bulb temperature, temperature, temp, ambient temperature, etc. The DMS standardizes elements names so they may be more easily inter-compared, quality assessed, and extracted. Furthermore, the elements may have optional qualifiers assigned to them to covey important metadata. Below is an example of how a particular wind speed from MSC networks is elementalized by the DMS and stored in XML format:

```
- <element group="wind" name="wind_speed" orig-name="011012" uom="m/s" value="0.0">
    <qualifier group="element" name="statistical_significance" uom="unitless" value="average" />
    <qualifier group="element" name="time_displacement" uom="min" value="-2" />
    <qualifier group="element" name="time_duration" uom="min" value="2" />
    <qualifier group="element" name="vertical_displacement" uom="m" value="10" />
  </element>
```

The above "standard element package" would be applied consistently across the networks and look as the example above for cases where the incoming element is an average wind speed over the last 2 minutes of the hour and a height of 10 metres.

To avoid conversion and rounding errors, all incoming codes and units are left as-is. Such operations are typically reserved for product generators, datamarts or display tools, just as the data leaves the DMS for client use.

3.2 Standardization for the SWOB

The SWOB product generator needs to ingest data from many networks to make one product where the element names, units and code tables are consistent. To make the SWOB as concise as possible and remove any remaining element description variations in the DMS decoded output, a "short label" was devised to encapsulate all the critical element-defining metadata into one phrase. Furthermore, all the various unit and code variations for identical elements across the networks were handled by converting to DMS "standard units" and "standard codes".

3.2.1 Element Short Labels:

Critical element-defining metadata such as data type, element name, statistical significance, time period displacement, time period duration, height/depth, index, etc., have been used to devise a "short label" for each DMS element package. For example, the element package shown in Section 3.1 would have the short label of "**avg_wnd_spd_10m_mt58-60**" or "**avg_wnd_spd_10m_pst2mts**". For the element name portion of the short label, the name as it appears in the original DMS decoded element has been abbreviated using the abbreviation glossary in Appendix 6.2. The length of these labels has been kept to a minimum and special characters and spaces have been avoided so that the labels may also be used as column names in database tables and meet the most stringent of requirements.

3.2.2 Units:

All element packages have a standard element assigned by the DMS based on the data class (e.g. velocity, temperature, azimuth, pressure, etc.), although some variations exist for certain elements within a class. For example, most pressure-related elements will have a DMS standard unit of hPa, but in the case of altimeter, the standard unit is inHg since it is used by a specific client community and in practically all cases measured and used in that unit. Examples of typical standard units for some classes are:

- precipitation amount = mm
- wind speed = km/h
- pressure = hPa
- visibility = km
- height = m
- temperature = °C

The conversion to DMS standard units is only done at the last possible moment, typically when data leaves the DMS via product generators, like the one that creates the SWOB, or during the population of custom datamarts and display tools where client requirements need to be satisfied. The DMS standard units will meet the majority of client needs, but inevitably some clients will have different preferences and will need to do some conversions. To assist in this, Appendix 6.4 has a list of unit conversions so clients can see what was used to convert incoming units to DMS standard units for a given element, or to apply client-side conversions. The data set tables in Section 5 show the incoming uom (unit of measure) and the standard units they were converted to. As well, the rounding precision is given where the value represents the number of digits after the decimal (e.g. 2 would represent 0.01). A value of 0 represents integer values. The intent is to remove insignificant digits as a result of a unit conversion. To avoid giving the appearance of extra precision that was not intended, the following rules were applied:

- In the element mappings the following convention is used to represent precision:

  0 = whole number
  1 = one decimal digit = 0.1
  2 = two decimal digits = 0.01
  3 = three decimal digit = 0.001
  …

- Mathematical rounding precision only applies to numerical values and for elements a precision is indicated in the Precision column (see Section 5). For instance if the decoded value = 5.67 and the Rounding Precision is 1, then the SWOB value = 5.7. If on the other hand the decoded value has a lower precision than what is specified for that element in the mappings, then preserve the decoded value as-is. For example, if a decoded value or unit conversion = 5, Precision = 1 (i.e. 0.1), then SWOB value = 5.

The following page has some examples of rounding to a specified precision:

Decoded Value	Rounding Precision	External Element Value
12.3	0 (to the nearest whole number)	12
23.3	2 (two decimal digits)	23.3 (decoded value precision is less than requested precision, so preserve decoded value as-is)
45.12346666666	6 (six decimal digits)	45.123467
23.549	1 (one decimal digit)	23.5 (given the requested precision is 1 decimal digit, one needs to look at the digit immediately following it for rounding (4). As a general rule: if precision = x, then always look at x * 10^{-1} to carry out rounding)
17.6	0	18

3.2.3 Codes:

As with units, the incoming code values are preserved as-is after DMS decoding, with the code table source and type (i.e. name) cited. Prior to the creation of the SWOB, incoming code tables are left in their original form. The source of these tables can be any of the following:

Incoming code-src	Description	Documentation Source	Sample **code-source** and code-type
wmo_bufr	A WMO code table for data encoded in BUFR format	WMO Pub. No. 306 =- Manual on Codes Part B – Binary Codes: http://www.wmo.int/pages/prog/www/WMOCodes/WMO306_vI2/VolumeI.2.html	**wmo_bufr** 020003
local_bufr	A local Canadian code table for MSC data encoded in BUFR format. Defined by CMC	CMC: ftp://depot.cmc.ec.gc.ca/ftp/cmoi/bufr/english/tabloc_bufr_e	**local_bufr** 020197
wmo_tac	A WMO code table for data encoded in Traditional Alphanumeric Code forms (TAC) such as SYNOP	WMO Pub. No. 306 =- Manual on Codes Part A – Alphanumeric Codes http://www.wmo.int/pages/prog/www/WMOCodes/WMO306_vI1/VolumeI.1.html	**wmo_tac** 000500
local_tac	A local code table defind by the DMS for incoming data encoded in Traditional Alphanumeric Code forms (TAC)	DMS code tables and encode/decode specification documents	**local_tac** 008197
Various sources	A local code table defind by the DMS for incoming data encoded in ASCII formats. The code source may be the name of the network, product, message, etc.	DMS code tables and encode/decode specification documents	**ra** present_weather **rwin** essPrecipSituation **metar** visibility

However, a "standard" code table is also associated with each of these incoming code tables for a given element. The master list of code tables that the DMS maintains has cross referenced similar code tables for a given entity to a DMS standard table, which is in effect a superset of all the similar code tables for that entity. This allows for products or clients to use one standard code value for an element to map to their preferred codes, expressions or interpretation rather than having to map too many different tables for a given element across multiple networks. For example, present weather is reported by many networks, but most use different code tables or even text strings (note, in the DMS text strings that are controlled vocabulary are also treated as if they were codes).

Example 1. Present weather arriving to the DMS in different code tables for each network is mapped to a code value in a single DMS standard code table. Below are *some* examples:

Network	Observation	Incoming code-src	Incoming code-type	Incoming value	SWOB code-src	SWOB code-type	Std code value
WinIDE	**Manned** Observation: Light rain (not freezing, continuous)	local_bufr	020210	11	std_code_src	present_weather	**65**
NC-HWOS	**Manned** Observation: Light rain (not freezing, continuous)	wmo_bufr	020019	-RA	std_code_src	present_weather	**65**
RA	**Automated** Station Observation: Light rain	ra	present_weather	R-	std_code_src	present_weather	**364**
RWIN	**Automated** Station Observation: Light rain	rwin	WMO4680	61	std_code_src	present_weather	**364**

Example 2. Cloud type and obscuring phenomena arriving to the DMS in a different code tables for each network is mapped to a code value in a single DMS standard code table. Below are *some* examples:

Network	Observation	Incoming code-src	Incoming code-type	Incoming value	SWOB code-src	SWOB code-type	Std code value
WinIDE	Altocumulus	local_bufr	020197	0	std_code_src	obscuring_phenomena	**0**
NC-HWOS	Altocumulus	wmo_bufr	020012	3	std_code_src	obscuring_phenomena	**0**
ASCII SYNOP FM-12	Altocumulus	wmo_tac	000500	3	std_code_src	obscuring_phenomena	**0**

To see the meaning of the standard code table vales for coded SWOB elements, please refer to Appendix 6.5. With this information clients can map the SWOB standard code values to their preferred expression or code using a single mapping table, rather than one for each network.

4. SW-OB-XML Format and Structure

4.1 Overview

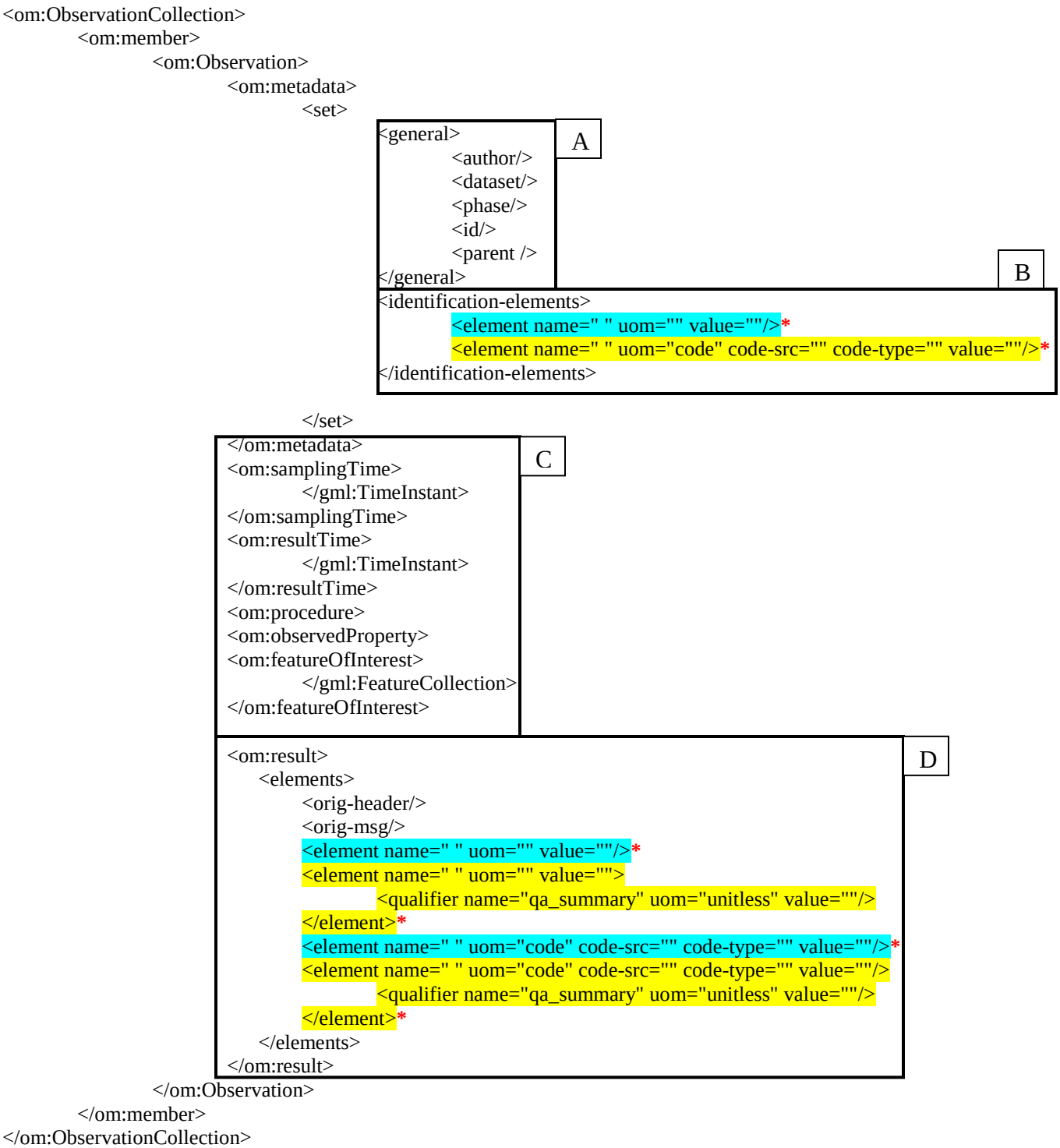
As with all DMS decoded XML products, the SWOB conforms to global standards such as OGC's Observation and Measurement schema and GML. Being compliant with such standards enhances the interoperability of the format and also offers a common look and feel among similar products.

The two standards employed in the SWOB are the following:

Open Geospatial Consortium's Observations and Measurements Encoding Standard (O&M) defines an abstract model and an XML schema encoding for observations and it provides support for common sampling strategies. O&M also provides a general framework for systems that deal in technical measurements in science and engineering. This is one of the OGC Sensor Web Enablement (SWE) suite of standards.
Additional information of O&M can be obtained from here:
http://www.opengeospatial.org/standards/om

Open Geospatial Consortium's Geography Markup Language Encoding Standard (GML) The Geography Markup Language (GML) is an XML grammar for expressing geographical features. GML serves as a modeling language for geographic systems as well as an open interchange format for geographic transactions on the Internet. As with most XML based grammars, there are two parts to the grammar – the schema that describes the document and the instance document that contains the actual data.
A GML document is described using a GML Schema. This allows users and developers to describe generic geographic data sets that contain points, lines and polygons.
Additional information of GML can be obtained from here:
http://www.opengeospatial.org/standards/gml

4.2 Structural Organization of SWOB



***Note: zero to many lines in this format can be present**

Section A:

This section provides metadata around the DMS component that produces this XML.

- <author> is the component's name
- <dataset> contains the full taxonomy of this dataset (discussed below in detail)
- <phase> the DMS phase at which point this XML was generated
- <id> is the full URI (uniform resource indicator) of this instance of the XML
- <parent> is the full URI of the input file that led to the generation of this XML instance. In the case of a product generator, which produces the SWOB, the input is either the decoded or decoded_enchanced XML.

Section B:

This section of the SWOB contains metadata elements about the observation. For instance, one could find the time of observation, the reporting station identifier (e.g. MSC ID, ICAO ID, WMO Synoptic ID, etc), the station's latitude, longitude and elevation, correction level of the observation, etc. The elements in this section are of the form <element name=" " uom="" value=""/>, where

- *name* is an abbreviated label (less than 30 characters) assigned to each element definition
- *uom* is the unit of measure
- *value* is the value of the element.

In the case when *uom*="code", then two additional attributes will be included, these are:

- *code-src* is the authoritative source of which this code table originates
- *code-type* is the type or name of a given code table available for a given source

The resulting element would look like this:
<element name="" uom="code" code-src="" code-type="" value=""/>. Such elements contain coded values.
There can be any number of identification elements for a given observation, depending on the dataset.

Section C:

This section contains additional metadata about the observation.

- <om:samplingTime> is the full date time of this observation encoded within a GML element
- <om:resultTime> is the full date-time when the DMS product generator produced this instance of the SWOB encoded within a GML element
- <om:featureOfInterest> is the latitude and longitude of the station that reported this observation encoded within a GML element.

Section D:

This section of the SWOB is the body of the observation, where one would expect to find the observational elements. Fundamentally an element is a single unit of observation. For instance, air temperature, relative humidity, wind speed, wind direction, visibility, etc. are all examples of a singular observed phenomenon, which is encoded as an element in the SWOB. Elements in this section are of the form:
<element name=" " uom="" value=""/> where

- *name* is an abbreviated label (less than 30 characters) assigned to each element definition
- *uom* is the unit of measure
- *value* is the value of the element

In the case when *uom*="code", then two additional attributes will be included, these are:

- *code-src* is the authoritative source of which this code table originates
- *code-type* is the type or name of a given code table available for a given source

The resulting element would look like this:
<element name="" uom="code" code-src="" code-type="" value=""/>. Such elements contain coded integer or values or a text value from a list of controlled vocabulary (so in effect a code). The incoming element that is encoded here, comes in with a native code source and type (an example for a present weather code source and type may be: wmo_bufr, 020003, respectively). During the production of the SWOB, a "standard code value" is substituted for the incoming codes. The exact code substitutions used for each dataset of the SWOB product will be discussed in Section 5 of this document.

For elements which are reported in the raw observation that have an empty or illegal value, the value/code will be designated as MSNG to denote "missing".

Finally, if Qa information is available for the element, then a qualifier will be tagged onto the element to provide an over-all summary of the quality assessments. In this case, the element will look like this:

```
<element name=" " uom="" value="">
        <qualifier name="qa_summary" uom="unitless" value=""/>
</element>
```

or

```
<element name=" " uom="code" code-src="" code-type="" value=""/>
        <qualifier name="qa_summary" uom="unitless" value=""/>
</element>
```

See Section 4.5 for details on the creation of the Qa qualifier and the meaning of the code value (i.e. Qa flags).

4.3 Sample SWOB

Here is a full sample output of a SWOB instance for the RA (MSC AWOS) dataset:

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<om:ObservationCollection xmlns:om="http://www.opengis.net/om/1.0"
    xmlns="http://dms.ec.gc.ca/schema/point-observation/2.0"
    xmlns:gml="http://www.opengis.net/gml" xmlns:xlink="http://www.w3.org/1999/xlink"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
     <om:member>
        <om:Observation>
            <om:metadata>
                <set>
                    <general>
                        <author name="MSC-DMS-PG-External-XML" version="1.0" />
                         <dataset name="msc/observation/atmospheric/surface_weather/ra-1.0-ascii"
                         />
                         <phase name="product_swob-xml-2.0" />
                         <id xlink:href="/data/msc/observation/atmospheric/surface_weather/ra-1.0-
                          ascii/product_swob-xml-2.0/201207181400/7018573/yoy/orig" />
                        <parent xlink:href="/data/msc/observation/atmospheric/surface_weather/ra-
                         1.0-ascii/decoded_enhanced-xml-2.0/201207181400/7018573/yoy/orig" />
                    </general>
                    <identification-elements>
                            <element name="tc_id" uom="unitless" value="YOY" />
                            <element name="stn_nam" uom="unitless" value="VAL CARTIER" />
                            <element name="msc_id" uom="unitless" value="7018573" />
                            <element name="clim_id" uom="unitless" value="7018573" />
                            <element name="wmo_synop_id" uom="unitless" value="71716" />
                            <element code-src="std_code_src" code-type="report_type" name="rpt_typ"
                              uom="code" value="0" />
                            <element name="date_tm" uom="datetime" value="2012-07-18T14:00:00.000Z" />
                            <element code-src="std_code_src" code-type="station_type" name="stn_typ"
                              uom="code" value="4" />
                            <element name="lat" uom="°" value="46.9" />
                            <element name="long" uom="°" value="71.5" />
                            <element name="stn_elev" uom="m" value="167.6" />
                    </identification-elements>
                </set>
        </om:metadata>
      <om:samplingTime>
            <gml:TimeInstant>
                <gml:timePosition>2012-07-18T14:00:00.000Z</gml:timePosition>
            </gml:TimeInstant>
      <om:samplingTime>
      <om:resultTime>
            <gml:TimeInstant>
                <gml:timePosition>2012-07-18T14:01:04.657Z</gml:timePosition>
            </gml:TimeInstant>
        </om:resultTime>
      <om:procedure xlink:href="/data/msc/metadata/station/surface_weather/jicc-1.0-binary/decoded-
        xml-1.0/201207181143/yoy" />
      <om:observedProperty gml:remoteSchema="/schema/point-observation/2.0.xsd" />
    <om:featureOfInterest>
                <gml:FeatureCollection>
```

```
                    <gml:location>
                        <gml:Point>
                            <gml:pos>46.9 71.5</gml:pos>
                        </gml:Point>
                    </gml:location>
                </gml:FeatureCollection>
</om:featureOfInterest>
<om:result>
                <elements>
                    <element code-src="std_code_src" code-type="total_cloud_amount"
                      name="cld_amt_code_1" uom="code" value="2">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="cld_bas_hgt_1" uom="m" value="1500">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element code-src="std_code_src" code-type="total_cloud_amount"
                      name="cld_amt_code_2" uom="code" value="2">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="cld_bas_hgt_2" uom="m" value="1800">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="vis" uom="km" value="14.484">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element code-src="std_code_src" code-type="present_weather" name="prsnt_wx"
                      uom="code" value="409">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="altmetr_setng" uom="inHg" value="29.77">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="air_temp" uom="°C" value="21.2">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="dwpt_temp" uom="°C" value="11.3">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="avg_wnd_dir_10m_mt58-60" uom="°" value="281">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="avg_wnd_spd_10m_mt58-60" uom="km/h" value="13">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="max_wnd_gst_spd_10m_mt50-60" uom="km/h" value="31.5">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="sum_cld_cvr_1" uom="%" value="0">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="sum_cld_cvr_2" uom="%" value="0">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="min_vis_mt50-60" uom="km" value="14.484">
                        <qualifier name="qa_summary" uom="unitless" value="100" />
                    </element>
                    <element name="max_vis_mt50-60" uom="km" value="14.484">
```

```
                    <qualifier name="qa_summary" uom="unitless" value="100" />
                </element>
                <element name="stn_pres" uom="hPa" value="988.3">
                    <qualifier name="qa_summary" uom="unitless" value="100" />
                </element>
                <element name="min_air_temp_pst1hr" uom="°C" value="20.5">
                    <qualifier name="qa_summary" uom="unitless" value="100" />
                </element>
                <element name="max_air_temp_pst1hr" uom="°C" value="21.9">
                    <qualifier name="qa_summary" uom="unitless" value="100" />
                </element>
                <element name="avg_wnd_dir_10m_mt50-60" uom="°" value="270">
                    <qualifier name="qa_summary" uom="unitless" value="100" />
                </element>
                <element name="avg_wnd_spd_10m_mt50-60" uom="km/h" value="16.7">
                    <qualifier name="qa_summary" uom="unitless" value="100" />
                </element>
                <element name="wnd_dir_10m_pst1hr_pk_spd" uom="°" value="270">
                    <qualifier name="qa_summary" uom="unitless" value="100" />
                </element>
                <element name="max_pk_wnd_spd_10m_pst1hr" uom="km/h" value="31.5">
                    <qualifier name="qa_summary" uom="unitless" value="100" />
                </element>
                <element name="pcpn_gag_wt_fltrd" uom="kg/m²" value="410.5">
                    <qualifier name="qa_summary" uom="unitless" value="100" />
                </element>
                <element name="pcpn_amt_pst1hr" uom="mm" value="0.0">
                    <qualifier name="qa_summary" uom="unitless" value="100" />
                </element>
                <element name="rel_hum" uom="%" value="53" />
                <element code-src="std_code_src" code-type="tendency_characteristic"
                  name="pres_tend_char_pst3hrs" uom="code" value="1" />
                <element name="pres_tend_amt_pst1hr" uom="hPa" value="0.2" />
                <element name="pres_tend_amt_pst3hrs" uom="hPa" value="1.5" />
                <element name="pcpn_amt_pst3hrs" uom="mm" value="0.5" />
                <element name="pcpn_amt_pst6hrs" uom="mm" value="0.5" />
                <element name="pcpn_amt_pst24hrs" uom="mm" value="8.5" />
                <element name="pcpn_snc_last_syno_hr" uom="mm" value="0.5" />
                <element name="mslp" uom="hPa" value="1008.2" />
            </elements>
        </om:result>
    </om:Observation>
  </om:member>
</om:ObservationCollection>
```

4.4 Taxonomy and URI

Each dataset is classified using taxonomy. Each instance of a SWOB is uniquely identified via its URI. One can access each dataset's SWOB instances using the assigned URI in the DMS notification web application (permissions dependent).

Taxonomies are of the form:

/organization/category/type/network/dataset-version-format/phase-format-version/(<parameters>*)

Please refer to the Taxonomy Documentation referenced in Section 1.3 for more information about the taxonomy structure and meaning of the various tokens.

The chart below indicates the taxonomy for each dataset:

Incoming Dataset	SWOB Taxonomy
Legacy MSC & Partner **Manned** aviation weather stations using the **WinIDE** or MIDS interface (BUFR messages under header 'ISAx41')	/msc/observation/atmospheric/aviation/manned-1.0-binary/product_swob-xml-2.0
Legacy MSC & Partner AWOS aviation weather stations ('**RA**' ASCII messages)	/msc/observation/atmospheric/surface_weather/ra-1.0-ASCII/product_swob-xml-2.0
DND **AWOS** (BUFR messages under header 'ISAx64')	/dnd/observation/atmospheric/surface_weather/awos-1.0-binary/product_generic_swob-xml-2.0
Nav Canada **AWOS** aviation weather stations (BUFR messages under header 'ISAx61')	/nav_canada/observation/atmospheric/surface_weather/awos-2.0-binary/product_swob-xml-2.0
DND **HWOS** (BUFR messages under header 'ISAx67')	/dnd/observation/atmospheric/surface_weather/hwos-1.0-binary/product_generic_swob-xml-2.0
Nav Canada **HWOS** aviation weather stations (BUFR messages under header 'ISAx62')	/nav_canada/observation/atmospheric/surface_weather/hwos-1.0-binary/product_swob-xml-2.0
MSC & Partner public surface weather network stations using Campbell Scientific data loggers ('**CA**' ASCII messages)	/msc/observation/atmospheric/surface_weather/ca-1.0-ascii/product_swob-xml-2.0 New feed: /msc/observation/atmospheric/surface_weather/ca-1.1-ascii/product_generic_swob-xml-2.0
• MSC weather stations using Campbell Scientific data loggers	/msc/observation/atmospheric/surface_weather/ca-1.2-ascii/product_swob-xml-2.0

transmitting minutely in support of the 2015 PanAm Games (‘**COMPACT-minutely**’ CA ASCII messages sent to the DMS)	

To each of the taxonomies listed above, the following parameters may be appended:

/<datetime>/<MSC Id>/<secondary station identifier>/<revision level>/<content frequency>

- <datetime> is the full date-time string when the observation was reported by the station in the format YYYYMMDDHHMM
- <MSC Id> is the official MSC station identifier (for MSC stations this is the climate identifier used by the National Climate Archive to guarantee uniqueness). For Partner networks, the MSC identifier may be a copy of the secondary identifier unless a Climate identifier can be assigned.
- <secondary station identifier> is an additional station identifier attached to the URI. It varies depending on the dataset and is typically the identifier most commonly used by a particular network’s operators. For example:
    - NC-AWOS: ICAO station identifier
    - NC-HWOS: ICAO station identifier
    - CA: TC identifier
    - RA: TC identifier
    - WinIDE: TC identifier
- <revision level> is the correction/revision level of the observation. If the observation is the original message “orig” will be used. If there are corrections or revisions, an indicator will be used (e.g. CCA, CCB, CCC, etc.).
- <content frequency> is used for networks that issue multiple observations for a given time with different data content. The frequency of a particular observation is also indicated (in minutes). The value of this parameter is in the format content_frequency, where the content types are data, diag (diagnostic data) and supp (supplementary program data), and the message frequency is in minutes (e.g. **data_60** would be an observation containing hourly data intended for official products; **supp_1** would be an observation from a supplementary program such as solar radiation transmitted every minute).

The chart below indicates the URI for selected dataset examples:

Dataset	URI	Example
MSC & Partner Manned (WinIDE/MIDS - ISAx41 BUFR)	/msc/observation/atmospheric/aviation/manned-1.0-binary/product_swob-xml-2.0/<datetime>/<MSC Id>/<secondary station identifier>/<revision level>	/msc/observation/atmospheric/surface_weather/winide-1.0-binary/product_swob-xml-2.0/201206081400/2403500/yrb/orig
MSC & Partner AWOS (RA messages)	/msc/observation/atmospheric/surface_weather/ra-1.0-ASCII/product_swob-xml-2.0/<datetime>/<MSC Id>/<secondary station identifier>/<revision level>	/msc/observation/atmospheric/surface_weather/ra-1.0-ASCII/product_swob-xml-2.0/201206081408/6106398/ywa/orig
Nav Canada HWOS (ISAx62 BUFR)	/nav_canada/observation/atmospheric/surface_weather/awos-2.0-binary/product_swob-xml-2.0/<datetime>/<MSC Id>/<secondary station identifier>/<revision level>	/nav_canada/observation/atmospheric/surface_weather/hwos-1.0-binary/product_swob-xml-2.0/201206081405/3034479/cyxh/orig
Nav Canada AWOS (ISAx61 BUFR)	/nav_canada/observation/atmospheric/surface_weather/hwos-1.0-binary/product_swob-xml-2.0/<datetime>/<MSC Id>/<secondary station identifier>/<revision level>	/nav_canada/observation/atmospheric/surface_weather/awos-2.0-binary/product_swob-xml-2.0/201206081405/5062835/cybq/orig
MSC & Partner surface weather network (Campbell Sci. CA messages	/msc/observation/atmospheric/surface_weather/ca-1.0-ASCII/product_swob-xml-2.0/<datetime>/<MSC Id>/<secondary station identifier>/<revision level>	/msc/observation/atmospheric/surface_weather/ca-1.0-ASCII/product_swob-xml-2.0/201206081400/8305500/xmp/orig

4.5 Quality Assessment Flag

The SWOB will contain a quality assessment (Qa) summary flag as a qualifier attached to an element whenever possible. In the SWOB it will appear as such:

```
<element name=" " uom="" value="">
        <qualifier name="qa_summary" uom="unitless" value=""/>
</element>
or
<element name=" " uom="code" code-src="" code-type="" value=""/>
        <qualifier name="qa_summary" uom="unitless" value=""/>
</element>
```

The possibility of this flag being attached to an element is dependent on the following scenarios:

1. There will be no qa_summary flag if there are no incoming "Native QC" flags on the element **and** there was no in-house DMS quality assessment done on the element.
2. There will be no qa_summary flag if the incoming "Native QC" attached to the element has no flags raised **and** there is no in-house DMS quality assessment done on the element
3. A qa_summary flag will be generated and attached to the element, if it arrived from the source with one or more Native QC flags indicating a problem **and/or** if a quality assessment was carried out by DMS on the element.

In scenario 2, an algorithm will be used to arrive at a single qa_summary value considering the availability of both the native and DMS quality assessments on the element.

Below is the algorithm used to generate the value for the qa_summary qualifier:

Prior to executing the algorithm, all incoming Native QC values are converted to DMS standard Qa flag values (so that they can be easily compared to the DMS Qa flag value) using the following scheme:

-10 = Suppressed
-1 = Missing
0 = Error
10 = Doubtful
15 = Suspect/Warning
20 = Inconsistent
100 = Acceptable/Passed

Qa Flag Definitions:

Suppressed – the data provider has indicated that the data value is not to be used or published due to instrumentation or environmental issues which have compromised the data.

Missing – the "value" of an element is null, blank/space, "MSNG" (from the decoder), a code representing missing, or could not be derived.

Error – The value is physically impossible, beyond the capability of the sensor to detect, or identified as incorrect.

Doubtful – The value is physically possible but is statistically improbable: at or exceeding expected extreme values.

Suspect/Warning – the data provider has indicated that the data may be unreliable or is outside of nominal limits.

Inconsistent – The value is inconsistent when it departs significantly from an expected physical relationship with an independently measured, associated variable. It is not possible to determine if either the value or the associated variable is in error.

Acceptable/Passed – The value passed all applicable quality assessment test(s) or has been verified as acceptable.

The final qa_summary flag values are generated as follows:

- The final qa_summary flag in the SWOB is the lowest value between the converted Native QC flag (if exists) and the real-time DMS Qa flag:
  e.g.
  if Native QC flag variable = 0 and DMS Qa flag=10, then SWOB qa_summary = 0
  if Native QC flag variable = -10 and DMS Qa flag=0, then SWOB qa_summary = -10
  if Native QC flag variable = 10 and DMS Qa flag=100, then SWOB qa_summary = 10
  if Native QC flag variable = 100 and DMS Qa flag=100, then SWOB qa_summary = 100
  if Native QC flag variable = 100 and DMS Qa flag = 0, then SWOB qa_summary = 0
  if Native QC flag variable = -10 and DMS Qa flag = 0, then SWOB qa_summary = -10
  if Native QC flag variable = 15 and DMS Qa flag = 10, then SWOB qa_summary = 10
  if Native QC flag variable = 100 and DMS Qa was not performed, then no qa_summary in SWOB
  if no incoming Native QC flags and DMS Qa was not performed, then no qa_summary in SWOB

- If an element does not have a qa_summary qualifier, it means that there was no **direct** quality assessment performed on it within the DMS, and that if Native QC was present, no flags were raised. Note however, that although derived elements may not have a Qa flag, it is likely that some or all of the input elements had Native QC and/or DMS Qa and these flags were considered when determining whether or not to derive the element.

5. Datasets

5.1 Overview

This section will outline where the incoming data comes from, how it is mapped to short labels, the description of the elements, and which elements have gone through unit conversion. The sections are broken down by dataset:

1. Legacy MSC & Partner Manned aviation weather stations using the WinIDE or MIDS interface
2. DND HWOS aviation weather stations
3. Legacy MSC & Partner AWOS aviation weather stations
4. DND AWOS aviation weather stations
5. Nav Canada HWOS aviation weather stations
6. Nav Canada AWOS aviation weather stations
7. MSC & Partner public surface weather network stations using Campbell Scientific data loggers which transmit official hourly observations

MSC & Partner networks supporting the 2015 PanAm Games:

9. Minutely MSC & Partner surface weather network – COMPACT

As mentioned in Section 2.1, the SWOB product generator feeds off six different datasets and creates a standardized product from each. The product is generated off of XMLs from the decoded data phase in real-time and focuses on hourly weather data elements in the categories of: present weather, sky condition, visibility, pressure, wind, temperature, humidity, and precipitation. Some datasets also provide basic climate and daily data. It is important to note that the data differs between networks as not all network stations report the same weather information, and for a given station the content can vary hour-to-hour.

The tables in the sub-sections below provide a superset of the weather elements that could potentially be in a given SWOB. They describe the meaning of the short label and identify the incoming units and codes. As well, the standard units and code tables required for the SWOB are indicated, along with the precision values are rounded to in the event of a unit conversion. The value in the Precision column represents the number of digits after the decimal (e.g. 2 would represent 0.01). A value of 0 represents integer values. Descriptions of the unit of measure's (uom) expression and meaning can be found in Appendix 6.3, while Appendix 6.4 provides unit conversions. Descriptions of the meaning of codes in the standard code tables can be found in Appendix 6.5.

5.2 Data Element Terminology

5.2.1 Wind

The various types of wind measurements can cause confusion given the large number of variations. In particular, the use of the terms 'wind **gust** speed', '**maximum** wind speed', and '**peak** wind speed'

need to be defined as these terms are sometimes used interchangeably yet the data are processed quite differently.

- **Maximum Wind Speed** (e.g. max_wnd_spd_10m_mt50-60 or max_wnd_spd_20m_pst10mts): This is the highest instantaneous wind speed no matter what the value (e.g. could be 0) over the interval indicated (e.g. could be over the past hour, or minutes 50 to 60 as in this example);
- **Maximum Wind Gust Speed** (or just wind gust; e.g. max_wnd_**gst**_spd_10m_mt50-60 or max_wnd_gst_spd_10m_pst10mts): This element is derived from the 10 minute maximum wind speed element described above. The rules follow the ManObs definition and it is only reportable if the max wind speed over the last 10 minutes of the hour is ≥15 knots AND the max speed exceeds the 2-minute mean wind speed by ≥5 knots (note the 10-minute mean is used for climate stations such as the CA data set).
- **Peak Wind Speed** (e.g. max_**pk**_wnd_spd_10m_pst1hr): This element is derived from the maximum wind speed over the past hour. The rules follow the ManObs definition and it is only reportable if the max wind speed over the past hour is ≥17 knots. Depending on the network, the time of the peak and the wind direction at the time of the peak may also be reported. The peak direction element would be wnd_dir_10m_pst1hr_pk_spd.

Given how critical the height of the anemometer is to the measurement and use of wind speed data, the height of the instrument is typically included in the SWOB short label (e.g. avg_wnd_spd_**10m**_pst10mts). For the operational MSC surface weather networks, as well as partner data (e.g. Nav Canada, DND), the standardized anemometer heights are generally 10 m as per WMO and ICAO guidelines. However, in the case of the MSC "Compact" stations supporting the 2015 PanAm Games Mesonet, the height of the anemometer can vary from station-to-station. The nominal height of the anemometer for a Compact station situated on the ground is approximately 2.5 m above the pedestal base, however, some stations are located on rooftops or other structures, so the wind speed height can vary significantly. To keep the SWOB short label consistent for wind elements across all the networks the label was not modified on a station-to-station basis to account for anemometer heights that depart from the standard. Clients needing information specific to the Compact stations will need to access the station information metadata maintained by the Data Management System.

5.2.2 Cloud Amount/Cover

Sky condition, in terms of cloud amount and cloud cover, is complicated by the fact it's handled differently across the networks that observe it. Human observations are capable of reporting a total cloud amount because the human can assess the whole celestial dome, whereas the instrumentation currently deployed at automatic stations cannot. As for cloud amount/cover reported for individual cloud layers, the observation from a manual station is non-cumulative and pertains to each layer, while the measurement from an automatic station is a summation so each layer incorporates the amount of the layer below. Finally, there are variations in the way cloud amount (also known as cloud cover) is reported across the networks. Some networks send codes that represent the sky condition as strings such as SCT (scattered), BKN (broken), OVC (overcast), etc. Other networks observe in eighths (octas) or tenths. For this reason is may be difficult to translate the standard code from all networks to a single scheme without compromises being made.

Sky Coverage	Legacy MSC AWOS	MSC Manned (WinIDE/MIDS)	NC-AWOS	NC-HWOS	METAR Product

String based on cloud layer opacity or coverage/amount	Sky Coverage derived from summation cloud cover (amount) as estimated by a ceilometer	Sky Coverage derived from observing cloud layer opacity in tenths	Sky Coverage derived from summation cloud amount as estimated by a ceilometer.	Sky Coverage derived from cloud layer amounts in Octas	Sky Coverage derived from the various observing systems based on observing Cloud layer amounts in Octas (NC-AWOS, NC-HWOS) or mapped from tenths (WinIDE)
CLR/SKC (clear-no cloud or obscuring phenomena)	0% (results in the code of 'CLR BLO 100' meaning clear below 10,000 ft)	0/10th (CLR)	0/8th (SKC)	0/8th (SKC)	0/8th (SKC)
FEW	n/a	1/10 – 3/10th	1/8 – 2/8th	1/8 – 2/8th	1/8 – 2/8th
SCT (scattered)	≤ 49%	4/10 – 5/10th	3/8 – 4/8th	3/8 – 4/8th	3/8 – 4/8th
BKN (broken)	50 – 89%	6/10 – 9/10th	5/8 – 7/8th	5/8 – 7/8th	5/8 – 7/8th
OVC (overcast)	≥ 90%	10/10th	8/8th	8/8th	8/8th
-X (partially obscured by surface-based layer)	< 90% (80% in multi-parameter) Note: will not come out on any METAR because you can see through it	1/10th – <10/10th surface-based layer	n/a	n/a	n/a
X (totally obscured by surface based layer)	≥ 90%, otherwise 100%	10/10th surface-based layer	n/a	n/a	n/a

Precipitation and Rainfall

Within the DMS there is a clear distinction between "precipitation", which implies a measurement of all forms of liquid and frozen precipitation, and "rainfall", which is just the liquid state. The designation of a measurement as either precipitation or rainfall is determined by the instrument is use. For MSC data, official precipitation elements will come from an all-weather sensor capable of operating year round. Examples of such instrumentation are weighing-type gauges (e.g. GEONOR and PLUVIO), Piezo electric strike plates, and Doppler sensors. For rainfall and rate of rainfall measurements, the most commonly used sensor is a tipping bucket rain gauge (TBRG) like the TB3 used by the MSC. For MSC data, an exception to the precipitation rule is granted when a station only has a TBRG. In such cases the rainfall measurement may be used in derived precipitation elements as long as certain criteria are met (e.g. dew point temperature is > +1°C, or the air temp is > 4.5°C).

For third party, where we have less detail on instrumentation, it may not be possible to distinguish between precipitation and rainfall or validate that what they call "precipitation" is indeed from an all-weather instrument. Also for the case of the Nav Canada and some stations in other third party datasets (e.g. GRCA, TRCA) we know that a heated TBRG may be employed to report precipitation, which can compromise the accuracy of measuring both liquid and frozen precipitation.

5.2.3 Station elevation

Station elevation is a critical parameter used for the computation of mean sea level pressure (MSLP). For networks that have the barometer relatively close to the ground, an initial station pressure correction may not be done for the difference in height between the level of the barometer and the ground surface (where the elevation is normally referenced) before the final reduction to sea level for the computation of MSLP. The automated Public Surface Weather network (i.e. Campbell stations issuing CA messages) and legacy AWOS sites (RA messages) are examples of such networks. For these networks the station elevation is actually referenced from the height of the barometer to

compensate for not doing a pressure correction down to ground surface. At these stations the barometer is approximately 1.5 m to 2.5 m above the ground surface.

Station elevation is a critical parameter used for the computation of mean sea level pressure (MSLP). For networks that have the barometer relatively close to the ground, an initial station pressure correction may not be done for the difference in height between the level of the barometer and the ground surface (where the elevation is normally referenced) before the final reduction to sea level for the computation of MSLP. The automated Public Surface Weather network (i.e. Campbell stations issuing CA messages) and legacy AWOS sites (RA messages) are examples of such networks. For these networks the station elevation is actually referenced from the height of the barometer to compensate for not doing a pressure correction down to ground surface. At these stations the barometer is approximately 1.5 m to 2.5 m above the ground surface.

5.2.4 Multiplicities

Some elements within the DMS are repeated due to more than one instance of occurrence or more than one observation being made. For these elements, the element name is followed by "_#". For example, air temperature in the CA dataset can be observed up to three times if three sensors are available. In this case, three air temperature measurements are sent to the DMS which are used to achieve an "official" air temperature. A SWOB output would show the official as well as the three sensor values. For example:

```
<element name="air_temp" uom="°C" value="21.2">
        <qualifier name="qa_summary" uom="unitless" value="100" />
</element>
<element name="air_temp_1" uom="°C" value="21.2">
<element name="air_temp_2" uom="°C" value="MSNG">
<element name="air_temp_3" uom="°C" value="MSNG">
```

Some other elements that can have more than one sensor include:

- Wind – 2 sensors
- Snow – 3 sensors
- Precipitation gauge weight – up to 3 sensors

Furthermore, cloud elements in the NC AWOS/NC HWOS dataset can have multiple instances being reported, one for each cloud layer. A SWOB output for this would look like the following:

```
<element code-src="std_code_src" code-type="total_cloud_amount"
  name="cld_amt_code_1" uom="code" value="1">
        <qualifier name="qa_summary" uom="unitless" value="100" />
</element>
<element name="cld_bas_hgt_1" uom="m" value="900.0">
        <qualifier name="qa_summary" uom="unitless" value="100" />
</element>
<element code-src="std_code_src" code-type="total_cloud_amount"
  name="cld_amt_code_2" uom="code" value="2">
        <qualifier name="qa_summary" uom="unitless" value="100" />
</element>
<element name="cld_bas_hgt_2" uom="m" value="1140.0">
        <qualifier name="qa_summary" uom="unitless" value="100" />
</element>
```

Elements with more than one instance of occurence include:

- Cloud elements (height, type, cover, amount) – up to 6 instances
- Present weather – up to 8 instances
- Recent weather – up to 3 instances

In the following sections, datasets that can contain multiplicities will have an additional column of "Maximum Multiplicity" identifying the maximum number of times that element can be repeated.

5.3 Legacy MSC & Partner Manned (WinIDE/MIDS)

The WinIDE and MIDS legacy applications are interfaces that DND and Nav Canada weather observers use to enter their weather observations. The observing program is in support of aviation and most stations are located at airports. Observers are expected to input observed conditions in accordance with the Manual of Surface Observations (MANOBS). The output is a BUFR (Binary Universal Form of Representation) message, which is not human readable. These stations are in the process of being converted to NC-HWOS stations. All the incoming elements, units and values that come from within the actual BUFR are mapped to their desired elements, units, values and qualifiers by the DMS and stored in XML format. These elements are then mapped to the short labels shown in the table below.

Label Name	Description	Standard Units	Standard Code Source	Standard Code Type	Precision	Maximum Multiplicity (_#)
tc_id	TC identifier	unitless				
long	longitude	°			6	
lat	latitude	°			6	
stn_elev	station height	m			3	
stn_typ	station type	code	std_code_src	station_type		
rpt_typ	report type	code	std_code_src	report_type		
clim_id	climate identifier	unitless				
date_tm	date and time	datetime				
wmo_synop_id	WMO synoptic identifier	unitless				
icao_stn_id	ICAO station identifier	unitless				
stn_nam	station name	unitless				
msc_id	MSC identifier	unitless				
cor	correction	unitless				
tot_cld_opcty	total cloud opacity	%			0	
tot_cld_amt	total cloud amount	%			0	
cld_bas_hgt_#	cloud height for individual layers indexed by layer	m			0	8
cld_cvr_#	cloud cover/amount (non-cumulative) indexed by layer	code	std_code_src	sky_condition		8
cld_typ_#	cloud type obscuring phenomena indexed by layer	code	std_code_src	obscuring_phenomena		8
cld_opcty_#	cloud opacity indexed by layer	%			0	8
clg_typ	ceiling type	code	std_code_src	ceiling_type		

clg_hgt	ceiling height	m			0	
vis	horizontal visibility	km			3	
prsnt_wx_#	present weather indexed	code	std_code_src	present_weather		8
stn_pres	station pressure	hPa			1	
mslp	mean sea level pressure	hPa			1	
air_temp	air temperature	°C			1	
dwpt_temp	dew point temperature	°C			1	
avg_wnd_dir_10m_mt58-60	2-min vectoral average 10m wind direction min58-60	°			0	
avg_wnd_spd_10m_mt58-60	2-min average 10m wind speed min58-60	km/h			1	
wnd_gst_char_10m_mt50-60	10-min wind gust character min50-60	code	std_code_src	wind_gust_squall_indicator		
max_wnd_gst_spd_10m_mt50-60	10-min maximum 10m wind gust speed min50-60	km/h			1	
altmetr_setng	altimeter setting	inHg			2	
pres_tend_char_pst3hrs	past 3-hour trend pressure tendency characteristic	code	std_code_src	tendency_characteristic		
pres_tend_amt_pst3hrs	past 3-hour differential pressure change amt	hPa			1	
rel_hum	relative humidity	%			0	
rmk	remark	unitless				

5.4 DND HWOS

DND HWOS is the name given to the DND staffed observations that are sent to MSC using a BUFR (Binary Universal Form of Representation) message. The BUFR message contains multiple fields that are not observed or reported by DND, and thus are either not included in the SWOB output or will always have a value of MSNG. The observers are expected to observe and input weather conditions in accordance with the Manual of Surface Observations (MANOBS). Observations are scheduled to be reported on an hourly basis at the top of the hour, along with 'Special' reports when warranted.

Label Name	Description	Standard Units	Standard Code Source	Standard Code Type	Precision	Maximum Multiplicity (_#)
wmo_synop_id	WMO Identifier	unitless				
data_pvdr	data provider	unitless				
data_attrib_not	data attribution notice	unitless				
stn_nam	station name	unitless				
date_tm	official report date and time	datetime				
lat	latitude	°			6	
long	longitude	°			6	
stn_elev	station elevation	m			3	
icao_stn_id	ICAO station identifier	unitless				
clim_id	climate identifier	unitless				
msc_id	MSC identifier	unitless				
rpt_typ	report type	code	std_code_src	report_type		
stn_typ	station type	code	std_code_src	station_type		

cor	correction level	unitless				
stn_pres	station pressure	hPa			1	
mslp	Mean sea level pressure	hPa			1	
pres_tend_amt_pst3hrs	past 3-hour differential pressure tendency amount	hPa			1	
pres_tend_char_pst3hrs	past 3-hour trend of pressure tendency characteristic	code	std_code_src	tendency_characteristic		
altmetr_setng	altimeter settings	inHg			2	
air_temp	air temperature	°C			1	
dwpt_temp	dew point temperature	°C			1	
rel_hum	relative humidity	%			0	
vis	prevailing horizontal visibility	km			3	
vert_vis	vertical visibility (in meters)	m			3	
prsnt_wx_#	present weather	code	std_code_src	present_weather		5
recnt_wx_#	recent weather	code	std_code_src	present_weather		3
cld_amt_code_#	non-cumulative cloud amount coded (oktas) indexed by layer	code	std_code_src	total_cloud_amount		5
cld_bas_hgt_#	cloud base height	m			0	5
cld_typ_#	cloud type	code	std_code_src	obscuring_phenomena		5
avg_wnd_dir_10m_pst2mts (**WinIDE:** avg_wnd_dir_10m_mt58-60)	past 2-minute average 10m wind direction	°			0	
avg_wnd_spd_10m_pst2mts (**WinIDE:** avg_wnd_spd_10m_mt58-60)	past 2-minute average 10m wind speed	km/h			1	
max_wnd_gst_spd_10m_pst10mts (**WinIDE:** max_wnd_gst_spd_10m_mt50-60)	past 10-minute max 10 m wind gust speed	km/h			1	
rmk	remark	unitless				

Not Reported:

Label Name	Description	Standard Units	Standard Code Source	Standard Code Type	Precision	Maximum Multiplicity (_#)
max_air_temp_pst1hr	past 1-hour maximum air temperature	°C			1	
min_air_temp_pst1hr	past 1-hour minimum air temperature	°C			1	
max_air_temp_pst6hrs	past 6-hour maximum air temperature	°C			1	
min_air_temp_pst6hrs	past 6-hour minimum air temperature	°C			1	
max_air_temp_pst24hrs	past 24-hour maximum air temperature	°C			1	
min_air_temp_pst24hrs	past 24-hour minimum air temperature	°C			1	
max_vis	maximum horizontal visibility	km			3	

min_vis	minimum horizontal visibility	km			3	
tot_cld_amt	total cloud amount	%			0	
avg_wnd_dir_10m_pst10mts (**WinIDE:** avg_wnd_dir_10m_mt50-60)	past 10-minute average 10m wind direction	°			0	
avg_wnd_spd_10m_pst10mts (**WinIDE:** avg_wnd_spd_10m_mt50-60)	past 10-minute average 10m wind speed	km/h			1	
wnd_dir_10m_pst24hrs_pk_spd	wind direction associated with the past 24-hour peak wind speed at 10 m	°			0	
max_pk_wnd_spd_10m_pst24hrs	past 24-hour maximum peak 2-minute mean 10m wind speed	km/h			1	
rnfl_snc_last_syno_hr	rainfall since last synoptic hour (TBRG)	mm			1	
pcpn_amt_pst6hrs	past 6-hour accumulated precipitation gauge amount	mm			1	
pcpn_amt_pst24hrs	past 24-hour accumulated precipitation gauge amount	mm			1	
snw_dpth	snow depth	cm			0	

5.5 MSC & Partner AWOS (RA messages)

RA is the bulletin header for MSC AWOS aviation weather observation reports. AWOS stations are connected via modem and voice-grade circuits to a regional host computer. These AWOS stations respond to a poll from the host and transmit their data. In response to a poll, AWOS transmits its most recent observation. These outputs are the assessment of weather conditions at a particular place and particular time. They are transmitted hourly, or whenever there is significant weather change, in which case a "Special" report (SP) is issued.

Sample Incoming Message:

```
RACN00 CWAO 040100
ZVV SA 031100 AUTO 41SCT/9.+/P-/M/-24.2/-28.2/29307G18/004//2/9+ 9+/9897/-
249-241/29007G030340365/Z/1245-0/
*
CL03/VC04/PB07/TC08/WC09/RE18/
*
3*83018701/4*8301/7*8301/9*9301/18*7101/
E83-03 E87-03/E83-04/E83-07/E93-09/E71-18/=
```

All the incoming elements, units and values that come from within the actual RA are mapped to their desired elements, units, values and qualifiers by the DMS and stored in XML format. These elements are then mapped to the short labels shown in the table below.

Label Name	Description	Standard Units	Standard Code Source	Standard Code Type	Precision	Maximum Multiplicity (_#)

tc_id	TC identifier	unitless				
rpt_typ	report type	code	std_code_src	report_type		
date_tm	actual observation date-time	datetime				
wmo_synop_id	WMO synop identifier	unitless				
stn_nam	station name	unitless				
icao_stn_id	ICAO station identifier	unitless				
clim_id	climate identifier	unitless				
msc_id	MSC identifier	unitless				
stn_typ	station type	code	std_code_src	station_type		
lat	latitude	°			6	
long	longitude	°			6	
stn_elev	station elevation	m			3	
clg_typ_#	ceiling type indexed by layer	code	std_code_src	ceiling_type		1
cld_amt_code_#	cumulative cloud amount coded indexed by layer	code	std_code_src	total_cloud_amount		6
cld_bas_hgt_#	cloud height indexed by layer	m			0	6
sum_cld_cvr_#	summation cloud cover indexed by layer	%			0	6
min_vis_mt50-60	10-min minimum horizontal visibility min50-60	km			3	
max_vis_mt50-60	10-min maximum horizontal visibility min50-60	km			3	
vis	horizontal visibility	km			3	
prsnt_wx	present weather	code	std_code_src	present_weather		
air_temp	air temperature	°C			1	
dwpt_temp	dew point temperature	°C			1	
min_air_temp_pst 1hr	past 1-hour min air temperature min00-60	°C			1	
max_air_temp_pst 1hr	past 1-hour max air temperature min00-60	°C			1	
max_air_temp_pst 6hrs	maximum air temperature over the past 6 hours	°C			1	
min_air_temp_pst 6hrs	minimum air temperature over the past 6 hours	°C			1	
max_air_temp_pst 24hrs	maximum air temperature over the past 24 hours	°C			1	
min_air_temp_pst 24hrs	minimum air temperature over the past 24 hours	°C			1	
avg_wnd_dir_10m _mt58-60	2-min vectoral average 10m wind direction at min58-60	°			0	
avg_wnd_spd_10 m_mt58-60	2-min average 10m wind speed at min58-60	km/h			1	
max_wnd_gst_spd _10m_mt50-60	10-min max 10m wind gust speed at min50-60	km/h			1	
avg_wnd_dir_10m _mt50-60	10-min vectoral average 10m wind direction min50-60	°			0	
avg_wnd_spd_10 m_mt50-60	10-min average 10m wind speed min50-60	km/h			1	
wnd_dir_10m_pst1 hr_pk_spd	past 1-hour peak 10m wind speed direction min00-60	°			0	

max_pk_wnd_spd_10m_pst1hr	past 1-hour peak 10m wind speed min00-60	km/h			1	
pcpn_gag_wt_fltrd	gauge weight filtered	kg/m²			1	
pcpn_amt_pst1hr	1-hour precipitation amount min00-60	mm			1	
altmetr_setng	altimeter setting	inHg			2	
stn_pres	station pressure	hPa			1	
mslp	mean sea level pressure	hPa			1	
pres_tend_char_pst3hrs	past 3-hour trend pressure tendency characteristic	code	std_code_src	tendency_characteristic		
pres_tend_amt_pst3hrs	past 3-hour differential pressure tendency amount	hPa			1	
pres_tend_amt_pst1hr	past 1-hour differential pressure tendency amount	hPa			1	
rel_hum	derived relative humidity	%			0	
pcpn_amt_pst3hrs	derived past 3-hour accumulated precipitation amount	mm			1	
pcpn_amt_pst6hrs	derived past 6-hour accumulated precipitation amount	mm			1	
pcpn_amt_pst24hrs	derived past 24-hour accumulated precipitation amount	mm			1	
pcpn_snc_last_syno_hr	precipitation since last synoptic hour	mm			1	

5.6 DND AWOS

The DND AWOS is a new generation Automatic Weather Observing System maintained and managed by the Department of National Defence (DND). These AWOS stations are a direct replacement of legacy MSC AWOS stations throughout the country, and are deployed in support of DND operations. Raw observations are collected by DND for processing before sending to MSC using a BUFR (Binary Universal Form of Representation) message. The BUFR message contains multiple fields that are not observed or reported by DND, and thus are either not included in the SWOB output or will always have a value of MSNG. The observations are scheduled to be taken hourly at top of the hour, and whenever there is significant weather change, in which case a 'Special' report is issued.

Label Name	Description	Standard Units	Standard Code Source	Standard Code Type	Precision	Maximum Multiplicity (_#)
clim_id	climate identifier	unitless				
msc_id	msc identifier	unitless				
wmo_synop_id	WMO synoptic identifier	unitless				
data_pvdr	data provider	unitless				
data_attrib_not	data attribution notice	unitless				
stn_nam	station name	unitless				
stn_typ	station type	code	std_code_src	station_type		
rpt_typ	report type	code	std_code_src	report_type		
date_tm	date	datetime				
lat	latitude	°			6	
long	longitude	°			6	

stn_elev	station elevation	m			3	
icao_stn_id	icao station identifier	unitless				
stn_pres	station pressure	hPa			1	
mslp	mean sea level pressure	hPa			1	
pres_tend_amt_pst3hrs	past 3-hour differential tendency amount	hPa			1	
pres_tend_char_pst3hrs	past 3-hour trend pressure tendency characteristic	code	std_code_src	tendency_characteristic		
altmetr_setng	altimeter setting	inHg			2	
air_temp	air temperature	°C			1	
dwpt_temp	dew point temperature	°C			1	
rel_hum	relative humidity	%			0	
max_air_temp_pst24hrs	past 24-hour maximum air temperature	°C			1	
min_air_temp_pst24hrs	past 24-hour minimum air temperature	°C			1	
avg_vis_pst10mts (**RA:** vis)	past 10-min average horizontal visibility	km			3	
max_vis_pst10mts (**RA:** max_vis_mt50-60)	past 10-min maximum horizontal visibility	km			3	
min_vis_pst10mts (**RA:** min_vis_mt50-60)	past 10-min minimum 2.83m horizontal visibility	km			3	
cld_bas_hgt_#	cloud height	m			0	6
cld_amt_code_#	Cumulative cloud amount coded (oktas) indexed by layer	code	std_code_src	total_cloud_amount		6
cld_lyr_amt_rptg_mtd	cloud layer amount reporting method	code	std_code_src	cloud_amount_reporting_method		
vert_vis	vertical visibility	m			3	
prsnt_wx_#	present weather indexed	code	std_code_src	present_weather		8
avg_wnd_dir_10m_pst10mts (**RA:** avg_wnd_dir_10m_mt50-60)	past 10-min average 10m wind direction	°			0	
avg_wnd_spd_10m_pst10mts (**RA:** avg_wnd_spd_10m_mt50-60)	past 10-min average 10m wind speed	km/h			1	
avg_wnd_dir_10m_pst2mts (**RA:** avg_wnd_dir_10m_mt58-60)	past 2-min average 10m wind direction	°			0	
avg_wnd_spd_10m_pst2mts (**RA:** avg_wnd_spd_10m_mt58-60)	past 2-min average 10m wind speed	km/h			1	
max_wnd_gst_spd_10m_pst10mts (**RA:** max_wnd_gst_spd_10m_mt50-60)	past 10-min maximum 10m wind gust speed	km/h			1	
max_pk_wnd_spd_10m_pst1hr	past 1-hour instantaneous 10m peak wind speed	km/h			1	
wnd_dir_10m_pst1hr_pk_spd	past 1-hour instantaneous 10m peak wind direction	°			0	
wnd_dir_10m_pst1	past 1-hour maximum 10m	°			0	

hr_max_spd	wind speed direction					
max_wnd_spd_10m_pst1hr	past 1-hour maximum 10m wind speed	km/h			1	

Not Reported:

Label Name	Description	Standard Units	Standard Code Source	Standard Code Type	Precision	Maximum Multiplicity (_#)
pcpn_amt_pst1hr	past 1-hour accumulated precipitation gauge amount	mm			1	
pcpn_amt_pst6hrs	past 6-hour accumulated precipitation gauge amount	mm			2	
vpr_pres	vapour pressure	hPa			1	
wetblb_temp	wet bulb temperature	°C			1	
max_air_temp_pst1hr	past 1-hour maximum air temperature	°C			1	
min_air_temp_pst1hr	past 1-hour minimum air temperature	°C			1	
max_air_temp_pst6hrs	past 6-hour maximum air temperature	°C			1	
min_air_temp_pst6hrs	past 6-hour minimum air temperature	°C			1	

5.7 Nav Canada HWOS

NC-HWOS is the common name given to observation data transmitted by NAV CANADA's (NC) new software interface for manned observations. NC-HWOS is a direct replacement of WinIDE/MIDS. The observing program is in support of aviation and most stations are located at airports. Observers are expected to input weather conditions in accordance with the Manual of Surface Observations (MANOBS). The output is a BUFR (Binary Universal Form of Representation) message, which is not human readable. All the incoming elements, units and values that come from within the actual BUFR are mapped to their desired elements, units, values and qualifiers by the DMS and stored in XML format. These elements are then mapped to the short labels shown below.

Label Name	Description	Standard Units	Standard Code Source	Standard Code Type	Precision	Maximum Multiplicity (_#)
wmo_synop_id	WMO Identifier	unitless				
data_pvdr	data provider	unitless				
data_attrib_not	data attribution notice	unitless				
stn_nam	station name	unitless				
date_tm	official report date and time	datetime				
lat	latitude	°			6	
long	longitude	°			6	
stn_elev	station elevation	m			3	
icao_stn_id	ICAO station identifier	unitless				
clim_id	climate identifier	unitless				
msc_id	MSC identifier	unitless				

rpt_typ	report type	code	std_code_src	report_type		
stn_typ	station type	code	std_code_src	station_type		
cor	correction level	unitless				
stn_pres	station pressure	hPa			1	
mslp	Mean sea level pressure	hPa			1	
pres_tend_amt_pst3hrs	past 3-hour differential pressure tendency amount	hPa			1	
pres_tend_char_pst3hrs	past 3-hour trend of pressure tendency characteristic	code	std_code_src	tendency_characteristic		
altmetr_setng	altimeter settings	inHg			2	
air_temp	2 m air temperature	°C			1	
dwpt_temp	2 m dew point Temperature	°C			1	
rel_hum	2 m relative humidity	%			0	
max_air_temp_pst1hr	past 1-hour max 2 m Air Temperature	°C			1	
min_air_temp_pst1hr	past 1-hour min 2 m air temperature	°C			1	
max_air_temp_pst6hrs	past 6-hour max 2 m Air Temperature	°C			1	
min_air_temp_pst6hrs	past 6-hour min 2 m air temperature	°C			1	
max_air_temp_pst24hrs	past 24-hour max 2 m air temperature	°C			1	
min_air_temp_pst24hrs	past 24-hour min 2 m air temperature	°C			1	
vis	prevailing horizontal visibility	km			3	
max_vis	maximum horizontal visibility	km			3	
min_vis	minimum horizontal visibility	km			3	
vert_vis	vertical visibility (in meters)	m			3	
prsnt_wx_#	present weather	code	std_code_src	present_weather		5
recnt_wx_#	recent weather	code	std_code_src	present_weather		3
tot_cld_amt	total cloud amount	%			0	
cld_amt_code_#	non-cumulative cloud amount coded (oktas) indexed by layer	code	std_code_src	total_cloud_amount		5
cld_bas_hgt_#	cloud base height	m			0	5
cld_typ_#	cloud type	code	std_code_src	obscuring_phenomena		5
avg_wnd_dir_10m_mt50-60	10-minute average 10m wind direction min50-60	°			0	
avg_wnd_spd_10m_mt50-60	10-minute average 10m wind speed min50-60	km/h			1	
avg_wnd_dir_10m_mt58-60	2-minute average 10m wind direction min58-60	°			0	
avg_wnd_spd_10m_mt58-60	2-minute average 10m wind speed min58-60	km/h			1	
max_wnd_gst_spd_10m_mt50-60	10-minute max 10 m wind gust speed min50-60	km/h			1	
wnd_dir_10m_pst24hrs_pk_spd	wind direction associated with the past 24-hour peak wind speed at 10 m	°			0	
max_pk_wnd_spd_10m_pst24hrs	past 24-hour maximum peak 2-minute mean 10m wind speed	km/h			1	

rnfl_snc_last_synoc_hr	rainfall since last synoptic hour (TBRG)	mm			1	
pcpn_amt_pst6hrs	past 6-hour accumulated 1.5 m precipitation gauge amount	mm			1	
pcpn_amt_pst24hrs	past 24-hour accumulated 1.5 m precipitation gauge amount	mm			1	
snw_dpth	snow depth	cm			0	
rmk	remark	unitless				

5.8 Nav Canada AWOS

NC-AWOS is the common name given to observation data gathered by NAV CANADA's (NC) new automated weather observation system (AWOS). The observing program is in support of aviation and most stations are located at airports. NC-AWOS is a new generation system intended to replace the MSC's legacy AWOS. It is encoded in a defined BUFR template created by NC and EC. Although a replacement of the legacy AWOS, NC-AWOS is not a direct data replacement. There are data content gains, losses and differences in comparison to the MSC legacy AWOS system. The output is a BUFR (Binary Universal Form of Representation) message, which is not human readable. All the incoming elements, units and values that come from within the actual BUFR are mapped to their desired elements, units, values and qualifiers by the DMS and stored in XML format. These elements are then mapped to the short labels shown in the table below.

Label Name	Description	Standard Units	Standard Code Source	Standard Code Type	Precision	Maximum Multiplicity (_#)
clim_id	climate identifier	unitless				
msc_id	msc identifier	unitless				
wmo_synop_id	WMO synoptic identifier	unitless				
data_pvdr	data provider	unitless				
data_attrib_not	data attribution notice	unitless				
stn_nam	station name	unitless				
stn_typ	station type	code	std_code_src	station_type		
rpt_typ	report type	code	std_code_src	report_type		
date_tm	date	datetime				
lat	latitude	°			6	
long	longitude	°			6	
stn_elev	station elevation	m			3	
icao_stn_id	icao station identifier	unitless				
stn_pres	station pressure	hPa			1	
mslp	mean sea level pressure	hPa			1	
pres_tend_amt_pst3hrs	past 3-hour differential tendency amount	hPa			1	
pres_tend_char_pst3hrs	past 3-hour trend pressure tendency characteristic	code	std_code_src	tendency_characteristic		
altmetr_setng	altimeter setting	inHg			2	
air_temp	2m air temperature	°C			1	
dwpt_temp	2m dew point temperature	°C			1	

rel_hum	2m relative humidity	%			0	
max_air_temp_pst 1hr	past 1-hour maximum 2m air temperature	°C			1	
min_air_temp_pst 1hr	past 1-hour minimum 2m air temperature	°C			1	
max_air_temp_pst 6hrs	past 6-hour maximum 2m air temperature	°C			1	
min_air_temp_pst 6hrs	past 6-hour minimum 2m air temperature	°C			1	
max_air_temp_pst 24hrs	past 24-hour maximum 2m air temperature	°C			1	
min_air_temp_pst 24hrs	past 24-hour minimum 2m air temperature	°C			1	
vis	horizontal visibility computed from 10-min average 2.83m horizontal visibility min50-60.	km			3	
max_vis_mt50-60	10-min maximum 2.83m horizontal visibility min50-60	km			3	
min_vis_mt50-60	10-min minimum 2.83m horizontal visibility min50-60	km			3	
cld_bas_hgt_#	cloud height	m			0	6
cld_amt_code_#	Cumulative cloud amount coded (oktas) indexed by layer	code	std_code_src	total_cloud_amount		6
vert_vis	vertical visibility	m			3	
prsnt_wx_#	present weather indexed	code	std_code_src	present_weather		8
avg_wnd_dir_10m_mt50-60	10-min average 10m wind direction min50-60	°			0	
avg_wnd_spd_10m_mt50-60	10-min average 10m wind speed min50-60	km/h			1	
avg_wnd_dir_10m_mt58-60	2-min average 10m wind direction min58-60	°			0	
avg_wnd_spd_10m_mt58-60	2-min average 10m wind speed min58-60	km/h			1	
max_wnd_gst_spd_10m_mt50-60	10-min maximum 10m wind gust speed min50-60	km/h			1	
max_pk_wnd_spd_10m_pst1hr	past 1-hour instantaneous 10m peak wind speed min00-60	km/h			1	
wnd_dir_10m_pst1hr_pk_spd	past 1-hour instantaneous 10m peak wind direction min00-60	°			0	
wnd_dir_10m_pst1hr_max_spd	past 1-hour maximum 10m wind speed direction min00-60	°			0	
max_wnd_spd_10m_pst1hr	past 1-hour maximum 10m wind speed min00-60	km/h			1	
pcpn_amt_pst1hr	past 1-hour accumulated 1.5 m precipitation gauge amount	mm			1	
pcpn_amt_pst6hrs	past 6-hour accumulated 1.5 m precipitation gauge amount	mm			2	

5.9 MSC & Partner surface weather network (Campbell Sci. CA messages)

The primary focus of the Public Surface Weather network is to support weather forecasting and climate monitoring. Observations are reported hourly, typically from data logger output tables 11 or 160. Campbell Scientific data loggers are the data acquisition system used in this network to obtain data from sensors, as well as process, store, and transmit the data. The data loggers encode the observations and transmit via the Datalogger Retrieval System on a one-observation to one-file basis. The file is transmitted to the Canadian Meteorological Centre (CMC) under the bulletin header CA. CMC then makes the file available to the rest of EC. The raw files are paired with a configuration file from JICC, which has information on element position, name and unit, to decode the CVS file format.

Sample of CA bulletin:

Table 160

CACN00 CWAO 121300

XQA

160,2010,132,1300,1583,100,152,-15.84,85.4,3.774,3.77,142.4,2.584,5.639,1203,128.9,5.375,0,4.15,4.13,135.9,5.661,4.801,4.946,-16.38,86.6,4.524,4.465,134,9.26,-15.83,-17.14,-12.95,12.32,1079,213.1,0,0.076,0.112,0.112, 0.158,-10.14,-10.09,162,15

The resulting decoded elements are mapped to their desired element names, units, values and qualifiers by the DMS and stored in XML format. These elements are then mapped to the short labels shown below.

Label Name	Description	Standard Units	Standard Code Source	Standard Code Type	Precision	Maximum Multiplicity (_#_	Precision
wmo_synop_id	wmo identifier	unitless					
stn_nam	station name	unitless					
tc_id	TC identifier	unitless					
clim_id	climate identifier	unitless					
msc_id	MSC identifier	unitless					
stn_elev	station elevation	m			3		3
lat	latitude	°			6		6
long	longitude	°			6		6
date_tm	date and time	datetime					
data_pvdr	data provider	unitless					
data_avail	data availability	%			0		0
logr_panl_temp	datalogger panel temperature	°C			1		1
max_batry_volt_pst1hr	past 1-hour maximum battery voltage	V			2		2
min_batry_volt_pst1hr	past 1-hour minimum battery voltage	V			2		2
hdr_fwd_pwr	HDR (High Data Rate) transmitter forward	W			2		2

	power						
hdr_refltd_pwr	HDR (High Data Rate) transmitter reflected power	W			2		2
hdr_suply_volt	HDR (High Data Rate) transmitter supply voltage	V			2		2
hdr_oscil_drft	HDR (High Data Rate) transmitter oscillator drift	Hz			2		2
avg_uvb_indx_pst 1hr	5-minute average UVB index in past 1-hour	unitless					
rel_hum	relative humidity min59-60	%			0		0
max_rel_hum_pst 1hr	past 1-hour maximum relative humidity min00-60	%			0		0
min_rel_hum_pst 1hr	past 1-hour minimum relative humidity min00-60	%			0		0
avg_rel_hum_pst 1hr	past 1-hour average relative humidity min00-60	%			0		0
rnfl_amt_pst1hr	past 1-hour rainfall amount (TBRG)	mm			1		1
avg_cum_pcpn_g ag_wt_fltrd_pst5m ts (**previously**: avg_ avg_cum_pcpn_g ag_wt_fltrd_55-60)	5-minute cumulative precipitation gauge weight (filtered) min55-60	kg/m²			1		1
avg_cum_pcpn_g ag_wt_fltrd_pst5m ts_#	5-minute cumulative precipitation gauge weight (filtered) min55-60 (indexed)	kg/m²			1	3	1
pcpn_amt_pst1hr	past 1-hour precipitation amount min00-60	mm			1		1
pcpn_amt_pst1hr _#	past 1-hour precipitation amount min00-60 (indexed)	mm			1	2	1
pcpn_amt_pst3 hrs	past 3-hour precipitation amount	mm			1		1
pcpn_amt_pst24 hrs	past 24-hour precipitation amount	mm			1		1
pcpn_snc_last_sy no_hr	precipitation since last synoptic hour	mm			1		1
air_temp	1-min average air temperature min59-60	°C			1		1
air_temp_#	1-min average air temperature min59-60 (indexed).	°C			1	3	1
avg_air_temp_pst 1hr	past 1-hour average air temperature min00-60	°C			1		1
avg_air_temp_pst 1hr_#	past 1-hour average air temperature min00-60 (indexed)	°C			1	3	1
max_air_temp_ps t1hr	past 1-hour maximum air temperature min00-60	°C			1		1
max_air_temp_ps t1hr_#	past 1-hour maximum air temperature min00-60 (indexed)	°C			1	3	1
min_air_temp_pst 1hr	past 1-hour minimum air temperature min00-60	°C			1		1
min_air_temp_pst 1hr_#	past 1-hour minimum air temperature min00-60 (indexed)	°C			1	3	1
max_air_temp_ps	past 6-hour maximum	°C			1		1

t6hrs	(1-minute average) hourly air temperature						
min_air_temp_pst 6hrs	past 6-hour minimum (1-minute average) hourly air temperature	°C			1		1
max_air_temp_ps t24hrs	past 24-hour maximum (1-minute average) hourly air temperature	°C			1		1
min_air_temp_pst 24hrs	past 24-hour minimum (1-minute average) hourly air temperature	°C			1		1
dwpt_temp	dew point temperature (top of the hour)	°C			1		1
wetblb_temp	wet bulb temperature (top of hour)	°C			1		1
avg_wetblb_temp _pst24hrs	past 24-hour average (1-minute average) wetbulb temperature	°C			1		1
avg_wnd_spd_pc pn_gag_pst10mts (**previously**: avg_wnd_spd_pc pn_gag_mt50-60)	10-minute average wind speed at the height of the precipitation gauge (approx. 2 m in most cases)	km/h			1		1
avg_wnd_spd_10 m_pst10mts (**previously**: avg_wnd_spd_10 m_mt50-60)	10-minute average 10 m wind speed min50-60	km/h			1		1
avg_wnd_spd_10 m_pst10mts_#	10-minute average 10 m wind speed min50-60 (indexed)	km/h			1	2	1
avg_wnd_dir_10m _pst10mts (**previously**: avg_wnd_dir_10m _mt50-60)	10-minute vector average 10 m wind direction min50-60	°			0		0
avg_wnd_dir_10m _pst10mts_#	10-minute vector average 10 m wind direction min50-60 (indexed)	°			0	2	0
avg_wnd_spd_10 m_pst2mts (**previously**: avg_wnd_spd_10 m_mt58-60)	2-minute average 10 m wind speed min58-60	km/h			1		1
avg_wnd_spd_10 m_pst2mts _#	2-minute average 10 m wind speed min58-60 (indexed)	km/h			1	2	1
avg_wnd_dir_10m _pst2mts (**previously**: avg_wnd_dir_10m _mt58-60)	2-minute vector average 10 m wind direction min58-60	°			0		0
avg_wnd_dir_10m _pst2mts_#	2-minute vector average 10 m wind direction min58-60 (indexed)	°			0	2	0
avg_wnd_spd_10 m_pst1hr	past 1-hour average 10 m wind speed min00-60	km/h			1		1
avg_wnd_spd_10 m_pst1hr_#	past 1-hour average 10 m wind speed min00-60 (indexed)	km/h			1	2	1
avg_wnd_dir_10m _pst1hr	past 1-hour vector average 10 m wind direction min00-60	°			0		0
avg_wnd_dir_10m _pst1hr_#	past 1-hour vector average 10 m wind direction min00-60 (indexed)	°			0	2	0
max_wnd_spd_10	10-minute max 10 m	km/h			1		1

m_pst10mts (**previously**: max_wnd_spd_10m_mt50-60)	wind speed min50-60						
max_wnd_spd_10m_pst10mts_#	10-minute max 10 m wind speed min50-60 (indexed)	km/h			1	2	1
wnd_dir_10m_pst10mts_max_spd (**previously**: wnd_dir_10m_mt50-60_max_spd)	Instantaneous 10 m wind direction for max 10-minute wind speed min50-60	°			0		0
wnd_dir_10m_pst10mts_max_spd_#	Instantaneous 10 m wind direction for max 10-minute wind speed min50-60 (indexed)	°			0	2	0
max_wnd_spd_10m_pst1hr	1-hour max 10 m wind speed min00-60	km/h			1		1
max_wnd_spd_10m_pst1hr_#	1-hour max 10 m wind speed min00-60 (indexed)	km/h			1	2	1
wnd_dir_10m_pst1hr_max_spd	Instantaneous 10 m wind direction for max hourly wind speed min00-60	°			0		0
wnd_dir_10m_pst1hr_max_spd_#	Instantaneous 10 m wind direction for max hourly wind speed min00-60 (indexed)	°			0	2	0
max_wnd_spd_pst1hr_tm	Time of max hourly 10 m wind speed min00-60	hhmm			1		1
max_wnd_spd_pst1hr_tm_#	Time of max hourly 10 m wind speed min00-60 (indexed)	hhmm			1	2	1
max_wnd_gst_spd_10m_pst10mts (**previously**: max_wnd_gst_spd_10m_mt50-60)	10-min max 10m wind gust speed min50-60	km/h			1		1
wnd_dir_10m_pst1hr_pk_spd	past 1-hour peak instant wind direction at 10m min00-60	°			0		0
max_pk_wnd_spd_10m_pst1hr	past 1-hour peak instantaneous wind speed at 10 m min00-60	km/h			1		1
max_pk_wnd_tm_pst1hr	past 1-hour peak instantaneous wind speed time	datetime					
pk_wnd_rmk	derived peak wind remark	unitless					
stn_pres	station pressure (top of hour)	hPa			1		1
mslp	mean sea level pressure (top of the hour)	hPa			1		1
pres_tend_amt_pst3hrs	past 3-hour differential pressure tendency amount	hPa			1		1
pres_tend_char_pst3hrs	past 3-hour differential pressure tendency characteristic	code	std_code_src	tendency_characteristic			
avg_snw_dpth_pst5mts (**previously**: snw_dpth)	5-min average snow depth min55-60	cm			0		0
avg_snw_dpth_pst5mts_# (**previously**: snw_dpth_#)	5-min average snow depth min55-60 (indexed). Only present if an official value from the three input snow	cm			0	3	0

	depths could not be determined.						
avg_snw_dpth_pst1hr	past 1-hour average snow depth min00-60	cm			0		0
max_vis_pst1hr	past 1-hour maximum horizontal visibility min00-60	km			3		3
avg_globl_solr_radn_pst1hr	past 1-hour average global solar radition (RF1) min00-60	W/m^2			1		1
tot_globl_solr_radn_pst1hr	past 1-hour total global solar radition (RF1) min00-60	kJ/m^2			1		1

5.10 PanAm – Minutely MSC & Partner surface weather network - COMPACT

A temporary MSC mesonet installed to support the 2015 PanAm Games. Atmospheric weather data are collected and output on a minutely basis. The stations are self-contained on a single portable platform that allows for the stations to be easily moved and deployed when and where needed. Most stations are deployed at ground level at or near venues, but some are on structures or rooftops (see wind note in section 5.2.1). Campbell Scientific data loggers are the data acquisition system used in this network to obtain data from sensors, as well as process, store, and transmit the data. The data loggers encode the observations and transmit via the Datalogger Retrieval System on a one-observation to one-file basis. The raw files are paired with a configuration file from JICC (using Table 63), which has information on element position, names and units, to decode the CVS file format. The minutely observed values are then used to derive additional minutely, hourly and daily elements. These are then mapped to the short labels below.

Label Name	Description	Standard Units	Standard Code Source	Standard Code Type	Precision
wmo_synop_id	wmo identifier	unitless			
stn_nam	station name	unitless			
tc_id	TC identifier	unitless			
clim_id	climate identifier	unitless			
msc_id	MSC identifier	unitless			
stn_elev	station elevation	m			3
lat	latitude	°			6
long	longitude	°			6
date_tm	date and time	datetime			
data_avail_pst1hr	data availability	%			0
data_avail_pst1mt	data availability	%			0
min_batry_volt_pst1mt	past 1-minute minimum battery voltage	V			2
min_batry_volt_pst1hr	past 1-hour minimum battery voltage	V			2
max_batry_volt_pst1mt	past 1-minute maximum battery voltage	V			2

max_batry_volt_pst1hr	past 1-hour maximum battery voltage	V			2
logr_panl_temp	datalogger panel temperature	°C			1
avg_air_temp_pst1mt	1-min average air temperature	°C			1
max_air_temp_pst1mt	1-min maximum air temperature	°C			1
min_air_temp_pst1mt	1-min minimum air temperature	°C			1
avg_rel_hum_pst1mt	1-minute average relative humidity	%			0
max_rel_hum_pst1mt	1-minute maximum relative humidity	%			0
min_rel_hum_pst1mt	1-minute minimum relative humidity	%			0
avg_dwpt_temp_pst1mt	1-minute average dew point temperature	°C			1
max_dwpt_temp_pst1mt	1-minute maximum dew point temperature	°C			1
min_dwpt_temp_pst1mt	1-minute minimum dew point temperature	°C			1
avg_wetblb_temp_pst1mt	1-minute average wet bulb temperature	°C			1
max_wetblb_temp_pst1mt	1-minute maximum wet bulb temperature	°C			1
min_wetblb_temp_pst1mt	1-minute minimum wet bulb temperature	°C			1
avg_temp_blck_glob_pst1mt	1-minute average black globe temperature	°C			1
max_temp_blck_glob_pst1mt	1-minute maximum black globe temperature	°C			1
min_temp_blck_glob_pst1mt	1-minute minimum black globe temperature	°C			1
avg_wetblb_temp_blck_glob_pst1mt	1-minute average wetbulb black globe temperature	°C			1
max_wetblb_temp_blck_glob_pst1mt	1-minute maximum wetbulb black globe temperature	°C			1
min_wetblb_temp_blck_glob_pst1mt	1-minute minimum wetbulb black globe temperature	°C			1
avg_stn_pres_pst1mt	1-minute average station pressure	hPa			1
rnfl_amt_pst1mt	past 1-hour rainfall amount (TBRG)	mm			1
avg_wnd_spd_10m_pst1mt	1-minute average wind speed	km/h			1
avg_wnd_dir_10m_pst1mt	1-minute vector average wind direction	°			0
max_wnd_spd_10m_pst1mt	1-minute maximum wind speed	km/h			1
wnd_dir_10m_pst1mt_max_spd	1-minute vector average wind direction	°			0
max_wnd_spd_10m_pst10mts	10-minute maximum wind speed	km/h			1
wnd_dir_10m_pst10mts_max_spd	1-minute vector average wind direction	°			0
max_wnd_spd_10m_pst1hr	1-hour maximum wind speed	km/h			1
wnd_dir_10m_pst1hr_max_spd	1-hr vector average wind direction	°			0
max_wnd_spd_10m_pst1hr_tm	1-hour maximum wind speed	hhmm			1
avg_wnd_spd_10m_pst1hr	past 1-hour average wind speed	km/h			1
avg_wnd_dir_10m_pst1hr	past 1-hour vector average wind direction	°			0
avg_wnd_spd_10m_pst10mts	past 10-minute average wind speed	km/h			1
avg_wnd_dir_10m_pst10mts	past 10-minute vector average wind direction	°			0

avg_wnd_spd_10m_pst2mts	past 2-minute average wind speed	km/h			1
avg_wnd_dir_10m_pst2mts	past 2-minute vector average wind direction	°			0
pres_tend_amt_pst3hrs	past 3-hour differential pressure tendency amount	hPa			1
pres_tend_char_pst3hrs	past 3-hour differential pressure tendency characteristic	code	std_code_src	tendency_characteristic	
avg_mslp_pst1mt	past 1-minute average mean sea level pressure	hPa			1
avg_dwpt_temp_pst1hr	1-hour average dew point temperature	°C			1
max_rel_hum_pst1hr	1-hour maximum relative humidity	%			0
min_rel_hum_pst1hr	1-hour minimum relative humidity	%			0
avg_air_temp_pst1hr	past 1-hour average air temperature	°C			1
max_air_temp_pst1hr	past 1-hour maximum air temperature	°C			1
min_air_temp_pst1hr	past 1-hour minimum air temperature	°C			1
max_air_temp_pst6hrs	past 6-hour maximum (1-minute average) hourly air temperature	°C			1
min_air_temp_pst6hrs	past 6-hour minimum (1-minute average) hourly air temperature	°C			1
max_air_temp_pst24hrs	past 24-hour maximum (1-minute average) hourly air temperature	°C			1
min_air_temp_pst24hrs	past 24-hour minimum (1-minute average) hourly air temperature	°C			1
avg_rel_hum_pst1hr	past 1-hour average relative humidity	%			0
avg_temp_blck_glob_pst1hr	Past 1-hour average black globe temperature	°C			1
rnfl_amt_pst1hr	past 1-hour rainfall amount (TBRG)	mm			1
pcpn_amt_pst1hr	past 1-hour precipitation amount	mm			1
pcpn_amt_pst3hrs	past 3-hour precipitation amount	mm			1
pcpn_amt_pst6hrs	past 6-hour precipitation amount	mm			1
pcpn_amt_pst24hrs	past 24-hour precipitation amount	mm			1
pcpn_amt_pst1mt	past 1-minute precipitation amount	mm			1
pcpn_amt_pst10mts	past 10-minute precipitation amount	mm			1
pcpn_typ_pst1mt	past 1-minute precipitation amount	code	std_code_src	present_weather	1
pcpn_amt_snc_top_of_hr	precipitation amount since top of the hour	mm			1
max_wnd_gst_spd_10m_pst10mts	10-min max wind gust speed	km/h			1
wnd_dir_10m_pst1hr_pk_spd	past 1-hour peak instantaneous wind direction	°			0
max_pk_wnd_spd_10m_pst1hr	past 1-hour peak instantaneous wind speed	km/h			1

6. Appendices

6.1 Glossary

Term	Abbreviation For:	Definition
ASCII	American Standard Code for Information Interexchange	a code for representing data as numbers, with each character assigned a number from 0 to 127
ATMOS	Automated Transportable Meteorological Observing System	automatic surface weather stations (using Campbell data loggers) operated by EC's Science and Technology Branch
AWOS	Automated Weather Observing Station	weather stations that use automated sensors to report weather observations
BDQ	Base de Données Qualifiées	decoding and Qa/Qc software used in Quebec Region
BUFR	Binary Universal Format for Representation	a binary WMO code form used to transmit numerical or quantitative data
CA	Campbell	an ASCII CVS file containing data recoded by a Campbell Scientific data logger
CMC	Canadian Meteorological Centre	provides forecast guidance to national and regional prediction centres
COMPACT		automatic compact surface weather stations (using Campbell data loggers) operated by the MSC. Temporarily deployed in support of the 2015 PanAm Games
CSV	Comma, Space, Value	a file format where data values are delimited by a comma or space
DMF	Data Management Framework	new framework data management policies, procedures, processes and standards that are being implement to manage MSC's environmental monitoring data
DMI	Data Management Initiative	an initiative used to lead the development, implementation and enhancement of a data management framework and systems that provides clients with an authoritative source of MSC and related external data of known quality
DMS	Data Management System	a real-time data acquisition, standardization, quality assessment and product generation software of observation, forecast, and warning data
DND	Department of National Defense	Department of National Defense
EC	Environment Canada	the department of the Government of Canada responsible for coordinating environmental policies and programs, providing weather forecasts and detailed meteorological information as well as preserving and enhancing the natural environment and renewable resources
GML	Geography Markup Language	the XML grammar defined by the Open Geospatial Consortium (OGC) to express geographical features; serves as a modeling language for geographic systems as well as an open interchange format for geographic transactions on the Internet.
HWOS	Human Weather Observation Stations	weather stations that require an observer to report weather conditions
ICAO	International Civil Aviation Organization	a specialized agency of the United Nations that codifies the principles and techniques of international air navigation and fosters the planning and

		development of international air transport to ensure safe and orderly growth
ISAx41		telecommunications circuit header used to transmit BUFR data collected from manned stations
ISAx61		telecommunications circuit header used to transmit BUFR data collected from Nav Canada automated stations
ISAx62		telecommunications circuit header used to transmit BUFR data collected from Nav Canada manned stations
LWIS	Limited Weather Information System	a more basic automated weather system (AWOS), capable of measuring only wind, altimeter setting, temperature and dew point temperature
JICC	Java Interactive CodeCon	a software interface for entering and maintaining automatic station configuration data and used to decode their raw messages
MANOBS	Manual for Surface Weather Observation	a manual that prescribes the standard procedures of the Meteorological Service of Canada for observing, recording and reporting weather conditions
METAR	Meteorological Aviation Report	an ASCII format for routine surface weather observation for aviation purposes, reported on-the-hour;
MIDS		a legacy interface for entering weather observations at aviation stations
MSC	Meteorological Services of Canada	a Branch of Environment Canada, which provides public meteorological information, weather forecasts and warnings of severe weather and also monitors and conducts research on climate, atmospheric science, air quality, water quantities, ice and other environmental issues
MSLP	Mean Sea Level Pressure	station pressure reduced to the level of mean sea level
NativeQC	Native Quality Control	Incoming information and flags indicating data quality or quality control performed at source
NC	Nav Canada (National Aviation Canada)	private corporation that provides aviation data and weather briefings
O&M	Observations and Measurements international standard	defines standard models and XML schema for encoding observations and meteorological data from a sensor, both archived and real-time. O&M is one of the core standards in the OGC Sensor Web Enablement (SWE) suite.
OGC	Open Geospatial Consortium	an international industry consortium of companies, government agencies and universities participating in a consensus process to develop publicly available interface standards
PG	Product Generator	software that generates products (e.g. SYNOP, METAR, SWOB)
Qa	Quality Assessment	an evaluation where data are subjected to quality check routines used to assess and characterize the quality of data
QC	Quality Control	measures taken to correct or control bad data
RA		bulletin header for MSC's legacy AWOS weather observation reports
RCS	Reference Climate Station	an enhanced automatic surface weather observing station operated by the MSC
SA	Surface Analysis	decommissioned ASCII format used for surface

		weather observation
SP	Special	special aviation weather report issued off the top of the hour when there is significant change in weather
SWE	Sensor Web Enablement	an OGC initiative that enables all types of Web and/or Internet-accessible sensors, instruments, and imaging devices to be accessible and, where applicable, controllable via the Web
SW-OB-XML	Surface Weather Observation XML	an XML product containing surface weather and climate observations from MSC, partner and 3rd party monitoring networks. It is simplified XML product that focuses on core weather data without the clutter and complexity of auxiliary metadata
SWOB	Surface Weather Observation	a condensed reference to the SW-OB-XML product
SYNOP	Synoptic	weather observations reported at least four times a day at 0000 UTC, 0600 UTC, 1200 UTC and 1800 UTC
Taxonomy		structure for classifying content (a unique dataset) according to a predetermined information domain; assists in organizing and describing information
TBRG	Tipping Bucket Rain Gauge	a tipping bucket rain gauge is used to measure liquid precipitation (rainfall) or rate of rainfall
TC_ID	Transport Canada identifier	unique 3-letter ID's traditionally assigned by Transport Canada aviation weather stations, but also assigned by MSC to public surface weather stations
URI	Uniform Resource Identifier	the path that uniquely identifies an individual instance of a dataset. It is made up of the taxonomy and additional parameters unique to the dataset.
WinIDE	Windows Interactive Data Entry	a software interface that allows data to be recorded at manned aviation weather stations and transmits the data in BUFR format
WMO	World Meteorological Organization	specialized agency of the United Nations for meteorology (weather and climate), operational hydrology and related geophysical sciences
XML	Extensible Markup Language	a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable

6.2 Short Label Abbreviations

The table below shows the full word being abbreviated for the name portion of the SWOB element ‘short label’.

Word/Phrase	abbrev
above	abv
above mean sea level	amsl
accretion	accretn
accumulated	accum
accuracy	acc
acquisition	acq
actual	actl

aerial	aerl
agency	agncy
air	air
aircraft	acft
airframe	arfrm
algorithm	algo
altimeter	altmetr
altitude	altd
amount	amt
and	and
anemometer	anemom
angle	angl
approximated	aprxd
arrangement	arrngmnt
arrival	arrivl
attribution	attrib
automatic/automated	auto
availability	avail
aviation	avtn
awos	aws
aws (automatic weather system)	aws
azimuth	azmth
barometer	baro
base	bas
based	based
battery	batry
bearing	berng
below	blw
black	blck
block	blk
bound	bnd
boundary	bndry
bright	brght
buoy	buoy
bypass	bypas
cable	cabl
calibration	cal
capability	cap
ceiling	clg
ceilometer	ceilmtr
change	chg
characteristic/character	char
checksum	cksum
chosen	chsn
class	class
clear	clr
climate	clim
cloud	cld

code/coded	code
coefficient	coeff
computer	comp
conditions/condition	condn
configuration	config
constant	const
contamination	contamntn
correction	cor
count	cnt
cover	cvr
cumulative	cum
current	crnt
data	data
datalogger	logr
date	date
date-time	datetm
day	dy
decode	decod
degree	deg
density	dnsty
departure	depart
deposit	dpst
depression	deprssn
depth	dpth
derived	der
description	desc
descriptor	dscrptr
designator	dsgntr
destination	dest
detection	dtctn
development	devlmt
deviation	dev
dewpoint	dwpt
diagnostic	diagnstc
diameter	dia
differential	diff
diffuse	dfuse
digit	digit
direct	drect
direction	dir
discrimination	discrmn
displacement	dsplcmt
distance/distant	dis
drift	drft
drifting	drftg
drogue	drog
dummy	dum
duration	dur

east	east
edge	edg
element	elemt
elevation	elev
emittance	emit
end	end
engineering	eng
enroute	enrt
equipment	eqpt
equivalent	equiv
error	err
evaporation	evap
events	evnts
evolution	evoln
extended	extnd
factor	factr
filtered	fltrd
fine	fine
fire	fire
flag/flags	flg
flight	flt
flown	flown
forward	fwd
free	free
frequency	freq
fresh	frsh
friction	fric
fuel	fuel
gauge	gag
Geonor	gnor
geopotential	geoptl
global	globl
globe	glob
GPS (global positioning system)	gps
ground	gnd
group	grp
gust	gst
hailstone	halstn
hardware	hrdwr
hazard	hzrd
header/HDR (high data rate GOES transmitter)	hdr
height	hgt
high	hi
horizontal	hor
hour	hr
hourly	hly
hours	hrs

humidity	hum
hwos (human weather observing system)	hwos
hydrostatic	hydrosttc
icao (international civil aviation organization)	icao
ice	ice
icing	icng
identifier, identify	id
index	indx
indicator	indctr
information	info
infrared	ir
initial	initl
input	inpt
instantaneous	inst
instrument	instr
intensity	intnsty
interface	intrfc
internal	int
irradiance	irrad
isobaric	isobar
issuing	issug
julian day (day of year)	jday
last	last
latitude	lat
layer	lyr
length	len
level	lvl
lightning	ltng
liquid	lqd
local	locl
local standard time	lst
logger	logr
longitude	long
low	lo
lower	lwr
lowest	lwst
magnitude	mag
main	main
maintenance	matnanc
mandatory	mand
manned	mnd
marine	marin
marsden	marsden
maximum	max
mean (average)	avg
mean sea level	msl
mean sea level pressure	mslp
measurement	msrmnt

message	msg
method	mtd
middle	mid
minimum	min
minute	mt
mobile	mbl
model	modl
moisture	moist
motion	mtn
MSC (meteorological service of Canada)	msc
name	nam
national	natl
navigational/navigation	nav
network	ntwk
node	node
north	north
notice	not
number	nbr
obscuration	obscn
obscuring	obscg
observation	obs
occurrence	ocr
octas	octas
office	off
official	ofcl
offset	offset
opacity	opcty
operating	oprating
oscillator	oscil
other	othr
override	ovrd
pan	pan
panel	panl
panic	panic
part	prt
past	pst
peak	pk
period	pd
peripheral	periphl
phase	phas
phenomenon	phenom
plan	plan
point	pt
position	pos
power	pwr
precipitation	pcpn
precision	precisn
present	prsnt

pressure	pres
prevailing	prev
processed	procssd
product	prdct
program	prg
provider	pvdr
province	prov
proximity	prxmty
pyranometer	pyrnmtr
quadrant	quad
qualifier	qlfr
quality	qlty
radiation	radn
rainfall	rnfl
range	rng
rapid	rpd
read/reading	read
recent	recnt
reference	ref
reflected	refltd
refuel	reful
region	regn
relative	rel
relay	relay
release	rls
remark	rmk
removal	remov
report	rpt
reporting	rptg
reset	reset
revised	rev
roll	rol
run	run
runway	rwy
rvr (runway visual range)	rvr
salinity	salnty
satellite	sat
send	snd
sensor	snsr
serial	ser
service	serv
setting	setng
shear	shr
shift	shft
ship	shp
shortwave	shrtwv
shutdown	shtdwn
signal	sgnl

significant/significance/signature	sig
since	snc
situation	situatn
sky	sky
snow	snw
snowfall	snwfl
SOG (snow on ground)	sog
soil	soil
solar	solr
solid	sld
sonde	sonde
space	spce
special	spcl
specification	spec
speed	spd
spray	spry
spread	sprd
square	sq
stage	stg
standard	std
start	start
state	state
station	stn
statistical	statcal
status	stat
stop	stop
storm	strm
strike	strk
string (text string)	strng
subsurface	subsfc
summation	sum
sunshine	sunshn
supplementary	suppl
supply	suply
suppressed	spprssd
surface	sfc
suspect	suspct
swell	swell
synoptic	syno
system	sys
table	tbl
TC (Transport Canada)	tc
technique	techng
temperature	temp
tendency	tend
thickness	thknes
time	tm
top	top

total	tot
towards	twds
track	trk
tracking	trkng
transducer	transdcr
transient	trnsnt
transmission/transmitter	trans
trend	trnd
tropic	tropic
tropopause	tropo
turbulence	turb
type	typ
ultraviolet radiation	uv
ultraviolet A radiation	uva
ultraviolet B radiation	uvb
unfiltered	unfiltrd
unit	unit
unknown	unkn
unprocessed	unprocssd
upper	upr
used	used
UTC (universal coordinated time)	utc
valid	vld
value	val
vapour	vpr
variable/variation	var
vector	vtr
version	ver
vertical	vert
vicinity	vcnity
visibility	vis
voltage	volt
vortex	vrtx
warning	wrng
watchman	wtchmn
water	wtr
weather	wx
weight	wt
wet-bulb	wetblb
wind	wnd
with	w
without	wo
wmo (world metrological organisation)	wmo
year	yr
zone	zn

6.3 Units of Measure

The table below is an inventory of all units of measure used by the DMS.

UNIT CLASS	UNIT NAME	UNIT SYMBOL	UNIT DESCRIPTION
Angle	decadegree(s)	da°	Angle, azimuth or coordinates in tens of a degree
Angle	decidegree(s)	d°	Angle, azimuth or coordinates in tenth of a degree
Angle	decidegree(s)	0.1°	Angle, azimuth or coordinates in tenth of a degree
Angle	minute(s) of arc - (1/60) degree	'	Angle in second(s) of arc - (1/60) degree
Angle	degree(s) - equal to (pi/180)rad	°	Angle in degree(s)degree(s) - unit of angle equal to (pi/180)rad
Angle	decadegrees	10°	Angle in tens of degrees azimuth
Angle	second(s) of arc - (1/60) minute	"	Angle in second(s) of arc - (1/60) minute
Angle	millidegrees	m°	Angle in thousandths of a degree
Area	square kilometre(s)	km²	Area in square kilometre(s)
Area	hectare(s)	ha	Area in hectare(s)
Area	square metre(s)	m²	Area in square metre(s)
Area	acre(s)	acre	Area in acre(s)
Area	square mile(s)	mi²	Area in square mile(s)
Areal_Weight	kilograms per square metre(s)	kg/m²	Areal Weight in kilograms per square metre(s)
Calibration	centimetre(s) per square hertz	cm/Hz²	unit for a calibration coefficient parameter used to convert a weighing precipitation gauge transducer value (from a vibrating wire of a specific length) to precipitation weight per unit area (kg/m^2), which is equivalent to mm)
Calibration	centimetre(s) per hertz	cm/Hz	unit for a calibration coefficient parameter used to convert a weighing precipitation gauge transducer value (from a vibrating wire of a specific length) to precipitation weight per unit area (kg/m²), which is equivalent to mm)
Code	unit is a code value	code	Unit is a code value
Density	microgram(s) per cubic meter	µg/m³	Unit used to measure density
Density	milligram(s) per litre	mg/L	Unit used to measure density/concentration
Density	micrograms(s) per litre	µg/L	Unit used to measure density/concentration
Electrical/Magnetic	Siemens	S	The Siemens (symbol: S) is the SI derived unit of electric conductance and electric admittance
Electrical/Magnetic	milliSiemens	mS	The Siemens (symbol: S) is the SI derived unit of electric conductance and electric admittance
Electrical/Magnetic	milliSiemens per 10 cm	mS/10cm	Unit used to measure rate of electrical conductivity over 10 cm
Electrical/Magnetic	milli-mhos per 10 cm	milli-mhos/10cm	Rate of electrical conductivity in milli-mhos over 10 cm where mhos is a non-SI unit of conductivity which is equivalent to 1 Siemens
Electrical/Magnetic	milliSiemens per 10 cm	mS/dm	Unit used to measure rate of electrical conductivity over 10 cm (i.e. a decimeter)

Electrical/Magnetic	milli-mhos per 10 cm	milli-mhos/dm	Rate of electrical conductivity in milli-mhos over 10 cm (i.e. a decimeter) where mhos is a non-SI unit of conductivity which is equivalent to 1 Siemens
Electrical/Magnetic	milliSiemens per cm	mS/cm	Unit used to measure rate of electrical conductivity over 1 cm
Electrical/Magnetic	volt	V	Electrical/Magnetic in volt(s) - potential difference
Electrical/Magnetic	Relative Fluorescence Unit	RFU	Unit used to measure fluorescence of particles in a fluid
Energy_Flux	kilojoule(s) per square metre	kJ/m²	Energy Flux in kilojoule(s) per square metre
Energy_Flux	joule(s) per square metre	J/m²	Energy Flux in joule(s) per square metre
Energy_Flux	watt(s) per square metre	W/m²	Energy Flux in watt(s) per square metre
Energy_Flux	watt(s)	W	Rate of energy conversion in watt(s), equivalent to one joule per second
Energy_Flux	microvolt-watt per square metre	µVW/m²	calibration coefficient to convert voltage into W/m^2
Energy_Flux	megajoule(s) per square metre	MJ/m²	Energy Flux in megajoule(s) per square metre
Flow/Rate	cubic metre(s) per second	m³/s	Flow/Rate in cubic metre(s) per second
Flow/Rate	litre(s) per minute	L/min	Flow/Rate in litre(s) per minute
Flow/Rate	litre(s) per hour	L/h	Flow/Rate in litre(s) per hour
Flow/Rate	millilitre(s) per second	mL/s	Flow/Rate in millilitre(s) per second
Flow/Rate	millilitre(s) per hour	mL/h	Flow/Rate in millilitre(s) per hour
Flow/Rate	millimetre(s) per hour	mm/h	Flow/Rate in millimetre(s) per hour
Flow/Rate	U.S. gallon(s) per hour	USgal/h	Flow/Rate in U.S. gallon(s) per hour
Flow/Rate	Imperial gallon(s) per hour	gal/h	Flow/Rate in Imperial gallon(s) per hour
Flow/Rate	Imperial gallon(s) per minute	gal/min	Flow/Rate in Imperial gallon(s) per minute
Flow/Rate	Jackson Turbidity Unit	JTU	Unit used to measure turbidity in water
Frequency	hertz(s)	Hz	Unit of frequency defined as the number of cycles per second of a periodic phenomenon
Intensity	unit is particular m per second	m²·³/s	Intensity in particular m per second
Length	tenths of mile(s)	0.1mi	Length in tenths of a mile(s)
Length	tenths of millimetre(s)	0.1mm	Length in tenths of millimetre(s)
Length	nanometre(s)	nm	Length in nanometre(s)
Length	millimetre(s)	mm	Length in millimetre(s)
Length	centimetre(s)	cm	Length in centimetre(s)
Length	half metre(s)	0.5m	Length in half metre(s)
Length	metre(s)	m	Length in metre(s)
Length	hectometre(s)	hm	Length in hectometre(s)
Length	kilometre(s)	km	Length in kilometre(s)
Length	foot or feet	ft	Length in feet
Length	thirties of metres	30m	Length in thirties of metres
Length	hundreds of feet	100ft	Length in hundreds of feet
Length	inch(es)	in	Length in inch(es)
Length	(statute) mile(s)	mi	Length in (statute) mile(s)
Length	nautical mile(s)	n.mi	Length in nautical mile(s)
Length	yard(s)	yd	Length in yard(s)
Length	geopotential metre(s)	gpm	Length in Geopotential metre(s)
Length	tenths of millimeter(s)	mm/10	Length in tenths millimetre(s)
Length	hectometre(s)	100m	Length in hundreds of metres
Length	decimeter(s)	dm	Length in tenths of metres

Mass	kilogram(s)	kg	Mass in kilogram(s)
Mass	gram(s)	g	Mass in gram(s)
Mass	ounce(s)	oz	Mass in ounce(s)
Mass	pound(s)	lb	Mass in pound(s)
Mass	milligram(s)	mg	Mass in milligram(s)
Mass	kilogram per kilogram	kg/kg	Mass in kilogram per kilogram
Percent/Fraction/Index	hundredths part(s) per thousand	0.01ppt	hundredths part(s) per thousand
Percent/Fraction/Index	part(s) per million	ppm	Percent/Fraction/Index in part(s) per million
Percent/Fraction/Index	hundredths of a percent	100%	Percent/Fraction/Index in hundredths of a percent
Percent/Fraction/Index	percent	%	Percent/Fraction/Index in percent
Percent/Fraction/Index	part(s) per billion	ppb	Percent/Fraction/Index in part(s) per billion
Percent/Fraction/Index	eighth(s)	1/8	Percent/Fraction/Index in eighth(s)
Percent/Fraction/Index	tenth(s)	1/10	Percent/Fraction/Index in tenth(s)
Percent/Fraction/Index	part(s) per thousand	ppt	parts per thousands
Pressure/Stress	pounds per square inch	psi	Pressure/Stress in pounds per square inch
Pressure/Stress	atmosphere(s)	atm	Pressure/Stress in atmosphere(s)
Pressure/Stress	hectopascal(s)	hPa	Pressure/Stress in hectopascal(s)
Pressure/Stress	centibar(s)	cbar	Pressure/Stress in centibar(s)
Pressure/Stress	decapascal(s)	daPa	Pressure/Stress in tens of pascals
Pressure/Stress	inches of mercury	inHg	Pressure/Stress in inches of mercury
Pressure/Stress	kilopascal(s)	kPa	Pressure/Stress in kilopascal(s)
Pressure/Stress	pascal(s)	Pa	Pressure/Stress in pascal(s)
Pressure/Stress	millimetres of mercury	mmHg	Pressure/Stress in millimetres of mercury
Pressure/Stress	millibar(s)	mbar	Pressure/Stress in millibar(s)
Signal_Strength	decibel(s) milliwatt	dBm	The expression dBm is used to define signal strength in wires and cables at RF and AF frequencies. The symbol is an abbreviation for "decibels relative to one milliwatt" (dBmW)
Temperature	degree(s) Fahrenheit	°F	Temperature in degree(s) Fahrenheit
Temperature	low precision Kelvin	bufrK	Temperature in Kelvin decoded from MSC CodeCon BUFR (precision of 0.1)
Temperature	Kelvin	K	Temperature in Kelvin
Temperature	decidegree(s) Celsius	d°C	Temperature in tenth of degree(s) Celsius
Temperature	centidegrees Celsius	c°C	hundredths of a degree(s) Celsius
Temperature	degree(s) Celsius	°C	Temperature in degree(s) Celsius
Time/Date	annum (year)	a	Time/Date in annum (year)
Time/Date	month(s)	mo	Time/Date in month(s)
Time/Date	day(s)	d	Time/Date in day(s)
Time/Date	date-time	datetime	Time/Date in full ISO 8601 format YYYY-MM-DD**T**HH:MM:SS.000**Z**
Time/Date	hour(s) and minute(s)	hhmm	Time/Date in hour(s) and minute(s)
Time/Date	hour(s), minute(s) and second(s)	hhmmss	Time/Date in hour(s), minute(s) and second(s)
Time/Date	minute(s)	min	Time/Date in minute(s)
Time/Date	hour(s)	H	Time/Date in hour(s)
Time/Date	day of year	doy	Time/Date in day of year (also referred to as Julian day)
Time/Date	second(s)	S	Time/Date in second(s)
Time/Date	millisecond(s)	ms	Time/Date in millisecond(s)
Time/Date	decisecond(s)	0.1s	Time/Date in tenths of a second
Unitless	unit is not applicable	unitless	Unit is not applicable

Velocity	knot(s)	kn	Velocity in knot(s)- nautical mile(s) per hour
Velocity	mile(s) per hour	mph	Velocity in mile(s) per hour
Velocity	kilometre(s) per hour	km/h	Velocity in kilometre(s) per hour
Velocity	foot or feet per second	ft/s	Velocity in foot or feet per second
Velocity	decimetre(s) per second	dm/s	Velocity in decimetre(s) per second
Velocity	metre(s) per second	m/s	Velocity in metre(s) per second
Velocity	centimetres per second	cm/s	Velocity in centimetres per second
Volume	quart(s)	qt	Volume in quart(s)
Volume	pint(s)	pt	Volume in pint(s)
Volume	fluid ounce(s)	fl.oz	Volume in fluid ounce(s)
Volume	U.S. gallon(s)	USgal	Volume in U.S. gallon(s)
Volume	cubic yard(s)	yd³	Volume in cubic yard(s)
Volume	millilitre(s)	mL	Volume in millilitre(s)
Volume	cubic metre(s)	m³	Volume in cubic metre(s)
Volume	litre(s)	L	Volume in litre(s)
Volume	cubic centimetre(s)	cm³	Volume in cubic centimetre(s)
Volume	Imperial gallon(s)	gal	Volume in Imperial gallon(s)

6.4 Unit Conversions

The table below is an inventory of unit conversions employed in the DMS

ORIGINAL UNIT	MULTIPLIER	OFFSET	TARGET UNIT
0.1mi	0.1609344	0	km
0.1mi	0.1	0	mi
0.1mm	0.1	0	kg/m²
0.1mm	0.1	0	mm
0.1s	0.1	0	s
0.5m	0.5	0	m
1/10	10	0	%
1/8	12.5	0	%
100ft	1	0	30m
100ft	30	0	m
10°	10	0	°
30m	30	0	m
J/m²	0.001	0	kJ/m²
K	1	-273.15	°C
MJ/m²	1000	0	kJ/m²
MJ/m²	1000000	0	J/m²
Pa	0.1	0	daPa
Pa	0.01	0	hPa
Pa	0.001	0	kPa
Pa	0.0002953	0	inHg
bufrK	1	-273.2	°C
cbar	10	0	hPa
cm	10	0	mm
cm	0.01	0	m
daPa	10	0	Pa
daPa	0.1	0	hPa

da°	10	0	°
dm	0.1	0	m
dm/s	0.36	0	km/h
ds	0.1	0	s
d°	0.1	0	°
d°C	0.1	273.15	K
d°C	0.1	0	°C
ft	0.3048	0	m
ft	0.0003048	0	km
h	60	0	min
hPa	100	0	Pa
hPa	10	0	daPa
hPa	1	0	mbar
hPa	0.1	0	kPa
hPa	0.02952998	0	inHg
hm	100	0	m
in	2.54	0	cm
in	25.4	0	mm
inHg	33.86389	0	hPa
inHg	3386.389	0	Pa
kPa	10	0	mbar
kPa	0.2952998	0	inHg
kPa	10	0	hPa
kg/m²	1	0	mm
km	1000	0	m
km	0.62137119	0	mi
km	0.539957	0	n.mi
km/h	0.539957	0	kn
km/h	0.277778	0	m/s
km/h	0.62137119	0	mph
kn	1.150779	0	mph
kn	1.852	0	km/h
kn	0.514444	0	m/s
m	0.033333	0	100ft
m	0.03333333	0	30m
m	2	0	0.5m
m	100	0	cm
m	3.2808399	0	ft
m	0.01	0	hm
m	0.001	0	km
m	0.000621371	0	mi
m	1000	0	mm
m/s	3.6	0	km/h
m/s	1.94384	0	kn
mbar	0.02952998	0	inHg
mbar	1	0	hPa
mbar	0.1	0	kPa
mbar	100	0	Pa
mbar	10	0	daPa
mi	1.609344	0	km
mi	0.868976	0	n.mi

mi	1609.344	0	m
milli-mhos/10cm	1	0	mS/10cm
milli-mhos/10cm	1	0	mS/dm
mS/cm	10	0	mS/dm
mS/dm	0.1	0	mS/cm
ms	0.000016667	0	min
s	0.016666667	0	min
min	0.016666667	0	h
mm	10	0	0.1mm
mm	1	0	kg/m²
mm	0.001	0	m
mm/10	0.1	0	mm
mph	1.609344	0	km/h
mph	0.44704	0	m/s
m°	0.001	0	°
n.mi	1.852	0	km
n.mi	1.150779	0	mi
n.mi	1852	0	m
s	10	0	0.1s
°	0.1	0	da°
°	10	0	d°
°	10	0	0.1°
°C	1	273.15	K
°C	1.8	32	°F
°C	10	0	d°C
°F	0.55556	-17.77778	°C

6.5 Standard Code Tables

The tables below provide descriptions of the standard code values for a given code type (i.e. table name)

6.5.1 buoy_type

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	buoy_type	0	Unspecified drifting buoy
		1	Standard Lagrangian drifter (Global Drifter Programme)
		2	Standard FGGE-type drifting buoy (non-Lagrangian meteorological drifting buoy)
		3	Wind measuring FGGE-type drifting buoy (non-Lagrangian meteorological drifting buoy)
		4	Ice float
		5	Reserved
		6	Reserved
		7	Reserved
		8	Unspecified subsurface float
		9	SOFAR
		10	ALACE

		11	MARVOR
		12	RAFOS
		13	Reserved
		14	Reserved
		15	Reserved
		16	Unspecified moored buoy
		17	6-metre Nomad
		18	3-metre discus
		19	10–12-metre discus
		20	ODAS 30 series
		21	ATLAS (e.g. TAO area)
		22	TRITON
		23	Reserved
		24	Omnidirectional wave rider
		25	Directional wave rider
		26	Subsurface ARGO float
		27	Reserved
		28	Reserved
		29	Reserved
		30	Reserved
		31	Reserved
		32	Reserved
		33	Reserved
		34	Reserved
		35	Reserved
		36	Reserved
		37	Reserved
		38	Reserved
		39	Reserved
		40	Reserved
		41	Reserved
		42	Reserved
		43	Reserved
		44	Reserved
		45	Reserved
		46	Reserved
		47	Reserved
		48	Reserved
		49	Reserved
		50	Reserved
		51	Reserved
		52	Reserved

		53	Reserved
		54	Reserved
		55	Reserved
		56	Reserved
		57	Reserved
		58	Reserved
		59	Reserved
		60	Reserved
		61	Reserved
		62	Reserved
		63	Missing value (// in SYNOP & coded 63 in BUFR)
		64	1.7-metre WatchKeeper

6.5.2 ceiling_type

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	ceiling_type	0	RESERVED
		1	Measured by aircraft
		2	Measured by balloon
		3	Estimated
		4	Delimited by precipitation
		5	Indefinite
		6	Measured
		7	ground-base layer delimited by precipitation
		8	ground-base layer not delimited by precipitation

6.5.3 obscuring_phenomena

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	obscuring_phenomena	0	Altocumulus
		1	Altocumulus castellanus
		2	Altostratus
		3	Cirrocumulus
		4	Cirrostratus
		5	Cirrus. For the Nav Canada NC-HWOS data set this code is used for Cirrus and Sky Clear (SKC).
		6	Cumulonimbus
		7	Cumulus
		8	Cumulus fractus
		9	Stratus fractus
		10	Towering cumulus (aka cumulus congestus)

		11	Nimbo stratus
		12	Stratocumulus
		13	Stratus
		14	Missing
		15	Cloud not visible owing to darkness, fog, duststorm, sandstorm, or other analogous phenomena. For the Nav Canada NC-HWOS data set this means smoke (i.e. FU, equivalent to code 65).
		16	No CH clouds
		17	Cirrus fibratus, sometimes uncinus, not progressively invading the sky
		18	Cirrus spissatus, in patches or entangled sheaves, which usually do not increase and sometimes seem to be the remains of the upper part of a Cumulonimbus; or Cirrus castellanus or floccus
		19	Cirrus spissatus cumulonimbogenitus
		20	Cirrus uncinus or fibratus, or both, progressively invading the sky; they generally thicken as a whole
		21	Cirrus (often in bands) and Cirrostratus, or Cirrostratus alone, progressively invading the sky; they generally thicken as a whole, but the continuous veil does not reach 45 degrees above the horizon
		22	Cirrus (often in bands) and Cirrostratus, or Cirrostratus alone, progressively invading the sky; they generally thicken as a whole; the continuous veil extends more than 45 degrees above the horizon, without the sky being totally covered
		23	Cirrostratus covering the whole sky
		24	Cirrostratus not progressively invading the sky and not entirely covering it
		25	Cirrocumulus alone, or Cirrocumulus predominant among the Ch cloud
		26	CH clouds invisible owing to darkness, fog, blowing dust or sand, or other similar phenomena, or because of a continuous layer of lower clouds
		27	No CL clouds
		28	Cumulus humilis or Cumulus fractus other than of bad weather, or both. For the Nav Canada NC-HWOS data set this means only Cumulus fractus (i.e. equivalent to code 8)
		29	Cumulus mediocris or congestus, Towering cumulus (TCU), with or without Cumulus of species fractus or humilis or Stratocumulus, all having their bases at the same level. For the Nav Canada NC-HWOS data set this means only TCU (i.e. equivalent to code 10).
		30	Cumulonimbus calvus, with or without Cumulus, Stratocumulus or Stratus
		31	Stratocumulus cumulogenitus
		32	Stratocumulus other than Stratocumulus cumulogenitus
		33	Stratus nebulosus or Stratus fractus other than of bad weather
		34	Stratus fractus or Cumulus fractus of bad weather, or both (pannus), usually below Altostratus or Nimbostratus. For the Nav Canada NC-HWOS data set this means only Stratus fractus (i.e. equivalent to code 9)
		35	Cumulus and Stratocumulus other than Stratocumulus cumulogenitus, with bases at different levels
		36	Cumulonimbus capillatus (often with an anvil), with or without Cumulonimbus calvus, Cumulus, Stratocumulus, Stratus or pannus
		37	CL clouds invisible owing to darkness, fog, blowing dust or sand, or other similar phenomena

		38	No CM clouds
		39	Altostratus translucidus
		40	Altostratus opacus or Nimbostratus
		41	Altocumulus translucidus at a single level
		42	Patches (often lenticular) of Altocumulus translucidus, continually changing and occurring at one or more levels
		43	Altocumulus translucidus in bands, or one or more layers of Altocumulus translucidus or opacus, progressively invading the sky; these Altocumulus as a whole clouds generally thicken as a whole
		44	Altocumulus cumulogenitus (or cumulonimbogenitus)
		45	Altocumulus translucidus or opacus in two or more layers, or Altocumulus opacus in a single layer, not progressively invading the sky, or Altocumulus with Altostratus or Nimbostratus
		46	Altocumulus castellanus or floccus. For the Nav Canada NC-HWOS data set this means only Altocumulus castellanus (i.e. equivalent to code 1).
		47	Altocumulus of a chaotic sky, generally at several levels
		48	CM clouds invisible owing to darkness, fog, blowing dust or sand, or other similar phenomena, or because of continuous layer of lower clouds
		49	Reserved
		50	Reserved
		51	Reserved
		52	Reserved
		53	Reserved
		54	Rain
		55	Hail
		56	Ice pellets
		57	Drizzle
		58	Ice crystals
		59	Snow
		60	Blowing snow
		61	Fog
		62	Dust, blowing dust
		63	Haze
		64	Sand, blowing sand
		65	Smoke
		66	Volcanic ash
		67	CH
		68	CM
		69	CL
		70	Reserved
		71	Reserved
		72	Reserved
		73	Reserved
		74	Reserved
		75	Reserved
		76	Reserved

		77	Reserved
		78	Reserved
		79	Reserved
		80	Reserved
		81	Reserved
		82	Reserved
		83	Reserved
		84	Reserved
		85	Reserved

6.5.4 operating_agency

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	operating_agency	0	Australia, Bureau of Meteorology (BOM)
		1	Australia, Joint Australian Facility for Ocean Observing Systems (JAFOOS)
		2	Australia, the Commonwealth Scientific and Industrial Research Organization (CSIRO)
		3	Canada, Marine Environmental Data Service (MEDS)
		4	Canada, Institute of Ocean Sciences (IOS)
		5	Canada, Environment Canada
		6	Canada, Department of National Defence
		7	Canada, Nav Canada
		8	China, The State Oceanic Administration
		9	China, Second Institute of Oceanography, State Oceanic Administration
		10	China, Institute of Ocean Technology
		11	France, Institut de Recherche pour le Développement (IRD)
		12	France, Institut Français de Recherche pour l'Exploitation de la mer (IFREMER)
		13	Germany, Bundesamt fuer Seeschiffahrt und Hydrographie (BSH)
		14	Germany, Institut fuer Meereskunde, Kiel
		15	India, National Institute of Oceanography (NIO)
		16	India, National Institute for Ocean Technology (NIOT)
		17	India, National Centre for Ocean Information Service
		18	Japan, Japan Meteorological Agency (JMA)
		19	Japan, Frontier Observational Research System for Global Change
		20	Japan, Japan Marine Science and Technology Centre (JAMSTEC)
		21	Republic of Korea, Seoul National University
		22	Republic of Korea, Korea Ocean Research and Development Institute (KORDI)
		23	Republic of Korea, Meteorological Research Institute
		24	New Caledonia, Institut de Recherche pour le Développement (IRD)

		25	New Zealand, National Institute of Water and Atmospheric Research (NIWA)
		26	Russian Federation, State Oceanographic Institute of Roshydromet
		27	Russian Federation, Federal Service for Hydrometeorology and Environmental Monitoring
		28	Spain, Instituto Español de Oceanografía
		29	United Kingdom, Hydrographic Office
		30	United Kingdom, Southampton Oceanography Centre (SOC)
		31	USA, NOAA Atlantic Oceanographic and Meteorological Laboratories (AOML)
		32	USA, NOAA Pacific Marine Environmental Laboratories (PMEL)
		33	USA, Scripps Institution of Oceanography (SIO)
		34	USA, Woods Hole Oceanographic Institution (WHOI)
		35	USA, University of Washington
		36	USA, Naval Oceanographic Office

6.5.5 present_weather

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	present_weather	0	Manned Observation: Cloud development not observed or not observable
		1	Manned Observation: Clouds generally dissolving or becoming less developed. (Characteristic change of the state of sky during the past hour)
		2	Manned Observation: State of sky on the whole unchanged. (Characteristic change of the state of sky during the past hour)
		3	Manned Observation: Clouds generally forming or developing. (Characteristic change of the state of sky during the past hour)
		4	Manned Observation: Visibility reduced by smoke, e.g. veldt or forest fires, industrial smoke or volcanic ashes
		5	Manned Observation: Haze
		6	Manned Observation: Widespread dust in suspension in the air, not raised by wind at or near the station at the time of observation
		7	Manned Observation: Dust or sand raised by wind at or near the station at the time of observation, but no well-developed dust whirl(s) or sand whirl(s), and no duststorm or sandstorm seen; or, in the case of sea stations and coastal stations, blowing spray at the station
		8	Manned Observation: Well-developed dust whirl(s) or sand whirl(s) seen at or near the station during the preceding hour or at the time of observation, but no duststorm or sandstorm.
		9	Manned Observation: Duststorm or sandstorm within sight at the time of observation, or at the station during the preceding hour
		10	Manned Observation: Mist
		11	Manned Observation: Shallow fog or ice fog patches at the station, whether on land or sea, not deeper than about 2 metres on land or 10 metres at sea
		12	Manned Observation: Shallow fog or ice fog, more or less continuous, at the station, whether on land or sea, not deeper than about 2 metres on land or 10 metres at sea
		13	Manned Observation: Lightning visible, no thunder heard
		14	Manned Observation: Precipitation within sight, not reaching the ground or the surface of the sea

		15	Manned Observation: Precipitation within sight, reaching the ground or the surface of the sea, but distant, i.e. estimated to be more than 5 km from the station
		16	Manned Observation: Precipitation within sight, reaching the ground or the surface of the sea, near to, but not at the station
		17	Manned Observation: Thunderstorm, but no precipitation at the time of observation
		18	Manned Observation: Squalls (at or within sight of the station during the preceding hour or at the time of observation)
		19	Manned Observation: Funnel cloud(s) [Tornado cloud or water-spout] (at or within sight of the station during the preceding hour or at the time of observation)
		20	Manned Observation: Drizzle (not freezing) or snow grains (not falling as shower(s))
		21	Manned Observation: Rain (not freezing) (not falling as shower(s))
		22	Manned Observation: Snow (not falling as shower(s))
		23	Manned Observation: Rain and snow or ice pellets (not falling as shower(s))
		24	Manned Observation: Freezing drizzle or freezing rain (not falling as shower(s))
		25	Manned Observation: Shower(s) of rain
		26	Manned Observation: Shower(s) of snow, or of rain and snow
		27	Manned Observation: Shower(s) of hail [hail, small hail, snow pellets], or of rain and hail [hail, small hail, snow pellets]
		28	Manned Observation: Fog or ice fog
		29	Manned Observation: Thunderstorm (with or without precipitation)
		30	Manned Observation: Slight or moderate duststorm or sandstorm has decreased during the preceding hour
		31	Manned Observation: Slight or moderate duststorm or sandstorm - no appreciable change during the preceding hour
		32	Manned Observation: Slight or moderate duststorm or sandstorm has begun or has increased during the preceding hour
		33	Manned Observation: Severe duststorm or sandstorm has decreased during the preceding hour
		34	Manned Observation: Severe duststorm or sandstorm - no appreciable change during the preceding hour
		35	Manned Observation: Severe duststorm or sandstorm has begun or has increased during the preceding hour
		36	Manned Observation: Slight or moderate drifting snow - generally low (below eye level)
		37	Manned Observation: Heavy drifting snow - generally low (below eye level)
		38	Manned Observation: Slight or moderate blowing snow - generally high (above eye level)
		39	Manned Observation: Heavy blowing snow - generally high (above eye level)
		40	Manned Observation: Fog or ice fog at a distance at the time of observation, but not at the station during the preceding hour, the fog or ice fog extending to a level above that of the observer
		41	Manned Observation: Fog or ice fog in patches
		42	Manned Observation: Fog or ice fog, sky visible - has become thinner during the preceding hour
		43	Manned Observation: Fog or ice fog, sky invisible - has become thinner during the preceding hour
		44	Manned Observation: Fog or ice fog, sky visible - no appreciable change during the preceding hour

		45	Manned Observation: Fog or ice fog, sky invisible - no appreciable change during the preceding hour
		46	Manned Observation: Fog or ice fog, sky visible - has begun or has become thicker during the preceding hour
		47	Manned Observation: Fog or ice fog, sky invisible - has begun or has become thicker during the preceding hour
		48	Manned Observation: Fog, depositing rime, sky visible
		49	Manned Observation: Fog, depositing rime, sky invisible
		50	Manned Observation: Very light drizzle
		51	Manned Observation: Light drizzle (not freezing, continuous)
		52	Manned Observation: Moderate drizzle (not freezing, continuous)
		53	Manned Observation: Heavy drizzle (not freezing, continuous)
		54	Manned Observation: Light drizzle (not freezing, intermittent)
		55	Manned Observation: Moderate drizzle (not freezing, intermittent)
		56	Manned Observation: Heavy drizzle (not freezing, intermittent)
		57	Manned Observation: Very light freezing drizzle
		58	Manned Observation: Light freezing drizzle
		59	Manned Observation: Moderate freezing drizzle
		60	Manned Observation: Heavy freezing drizzle
		61	Manned Observation: Moderate or heavy freezing drizzle
		62	Manned Observation: Light drizzle and rain
		63	Manned Observation: Moderate or heavy drizzle and rain
		64	Manned Observation: Very light rain
		65	Manned Observation: Light rain (not freezing, continuous)
		66	Manned Observation: Moderate rain (not freezing, continuous)
		67	Manned Observation: Heavy rain (not freezing, continuous)
		68	Manned Observation: Light rain (not freezing, intermittent)
		69	Manned Observation: Moderate rain (not freezing, intermittent)
		70	Manned Observation: Heavy rain (not freezing, intermittent)
		71	Manned Observation: Very light freezing rain
		72	Manned Observation: Light freezing rain
		73	Manned Observation: Moderate freezing rain
		74	Manned Observation: Heavy freezing rain
		75	Manned Observation: Moderate or heavy freezing rain
		76	Manned Observation: Rain or drizzle and snow, slight
		77	Manned Observation: Rain or drizzle and snow, moderate or heavy
		78	Manned Observation: Very light snow
		79	Manned Observation: Light snow (continuous)
		80	Manned Observation: Moderate snow (continuous)
		81	Manned Observation: Heavy snow (continuous)
		82	Manned Observation: Light snow (intermittent)
		83	Manned Observation: Moderate snow (intermittent)
		84	Manned Observation: Heavy snow (intermittent)
		85	Manned Observation: Ice crystals

		86	Manned Observation: Snow grains (with or without fog)
		87	Manned Observation: Very light snow grains
		88	Manned Observation: Light snow grains
		89	Manned Observation: Moderate snow grains
		90	Manned Observation: Heavy snow grains
		91	Manned Observation: Isolated star-like snow crystals (with or without fog)
		92	Manned Observation: Ice pellets
		93	Manned Observation: Very light ice pellets
		94	Manned Observation: Light ice pellets
		95	Manned Observation: Moderate ice pellets
		96	Manned Observation: Heavy ice pellets
		97	Manned Observation: Very light rain showers
		98	Manned Observation: Light rain showers
		99	Manned Observation: Moderate rain showers
		100	Manned Observation: Heavy rain showers
		101	Manned Observation: Moderate or heavy rain showers
		102	Manned Observation: Light showers of rain and snow mixed
		103	Manned Observation: Moderate or heavy showers of rain and snow mixed
		104	Manned Observation: Very light snow showers
		105	Manned Observation: Light snow showers
		106	Manned Observation: Moderate snow showers
		107	Manned Observation: Heavy snow showers
		108	Manned Observation: Moderate or heavy snow showers
		109	Manned Observation: Light showers of snow pellets or small hail, with or without rain or rain and snow mixed
		110	Manned Observation: Moderate or heavy showers of snow pellets or small hail, with or without rain or rain and snow mixed
		111	Manned Observation: Very light hail
		112	Manned Observation: Light showers of hail, with or without rain or rain and snow mixed, not associated with thunder
		113	Manned Observation: Moderate hail
		114	Manned Observation: Heavy hail
		115	Manned Observation: Moderate or heavy showers of hail, with or without rain or rain and snow mixed, not associated with thunder
		116	Manned Observation: Light rain at time of observation - Thunderstorm during the preceding hour but not at time of observation
		117	Manned Observation: Moderate or heavy rain at time of observation - Thunderstorm during the preceding hour but not at time of observation
		118	Manned Observation: Light snow, or rain and snow mixed or hail [hail, small hail, snow pellets] at time of observation - Thunderstorm during the preceding hour but not at time of observation
		119	Manned Observation: Moderate or heavy snow, or rain and snow mixed or hail [hail, small hail, snow pellets] at time of observation - Thunderstorm during the preceding hour but not at time of observation
		120	Manned Observation: Thunderstorm, slight or moderate, without hail [hail, small hail, snow pellets], but with rain and/or snow at time of observation - Thunderstorm at time of observation

		121	Manned Observation: Thunderstorm, slight or moderate, with hail [hail, small hail, snow pellets] at time of observation - Thunderstorm at time of observation
		122	Manned Observation: Thunderstorm, heavy, without hail [hail, small hail, snow pellets], but with rain and/or snow at time of observation - Thunderstorm at time of observation
		123	Manned Observation: Thunderstorm combined with duststorm or sandstorm at time of observation - Thunderstorm at time of observation
		124	Manned Observation: Thunderstorm, heavy, with hail [hail, small hail, snow pellets] at time of observation - Thunderstorm at time of observation
		125	Manned Observation: No present or recent weather
		126	Manned Observation: Slight or moderate blowing dust
		127	Manned Observation: Heavy blowing dust
		128	Manned Observation: Slight or moderate blowing snow
		129	Manned Observation: Slight or moderate blowing sand
		130	Manned Observation: Heavy blowing sand
		131	Manned Observation: Drifting sand
		132	Manned Observation: Drifting snow
		133	Manned Observation: Drifting dust
		134	Manned Observation: Funnel cloud(s)
		135	Manned Observation: Tornado
		136	Manned Observation: Waterspout
		137	Manned Observation: Tornado or waterspout
		138	Manned Observation: Fog (prevailing visibility < 5/8 miles)
		139	Manned Observation: Freezing fog (prevailing visibility < 5/8 miles, temperatures < 0 °C and ≥ -30 °C)
		140	Manned Observation: Shallow Fog
		141	Manned Observation: Ice Fog
		142	Manned Observation: Patchy fog
		143	Manned Observation: Fog covering part of the aerodrome
		144	Manned Observation: Smoke
		145	Manned Observation: Thunderstorm
		146	Manned Observation: Heavy Thunderstorm
		147	Manned Observation: Well-developed dust whirl(s) or sand whirl(s), but no duststorm or sandstorm
		148	Manned Observation: Very light snow pellet showers, or small hail (i.e. diameter of largest stone < 5mm)
		149	Manned Observation: Light snow pellet showers, or small hail (i.e. diameter of largest stone < 5mm)
		150	Manned Observation: Moderate snow pellet showers, or small hail (i.e. diameter of largest stone < 5mm)
		151	Manned Observation: Heavy snow pellet showers, or small hail (i.e. diameter of largest stone < 5mm)
		152	Manned Observation: Very light ice pellet showers
		153	Manned Observation: Light ice pellet showers
		154	Manned Observation: Moderate ice pellet showers
		155	Manned Observation: Heavy ice pellet showers

		156	Manned Observation: Slight or moderate sandstorm
		157	Manned Observation: Severe sandstorm
		158	Manned Observation: Slight or moderate duststorm
		159	Manned Observation: Severe duststorm
		160	Manned Observation: Volcanic ash
		161	Manned Observation: Blowing dust in the vicinity
		162	Manned Observation: Blowing sand in the vicinity
		163	Manned Observation: Blowing snow in the vicinity
		164	Manned Observation: Duststorm in the vicinity
		165	Manned Observation: Fog in the vicinity
		166	Manned Observation: Dust/sand whirls in the vicinity
		167	Manned Observation: Showers in the vicinity
		168	Manned Observation: Sandstorm in the vicinity
		169	Manned Observation: Volcanic ash in the vicinity
		170	Manned Observation: Funnel cloud in the vicinity
		171	Manned Observation: Recent blowing snow
		172	Manned Observation: Recent duststorm
		173	Manned Observation: Recent Funnel Cloud, Tornado, Waterspout
		174	Manned Observation: Recent freezing drizzle
		175	Manned Observation: Recent freezing rain
		176	Manned Observation: Recent hail
		177	Manned Observation: Recent snow pellets
		178	Manned Observation: Recent ice pellets
		179	Manned Observation: Recent sandstorm
		180	Manned Observation: Recent volanic ash
		181	Manned Observation: Recent drizzle
		182	Manned Observation: Recent snow
		183	Manned Observation: Recent rain
		184	Manned Observation: Recent thunderstorm
		185	RESERVED
		186	RESERVED
		187	RESERVED
		188	RESERVED
		189	RESERVED
		190	RESERVED
		191	RESERVED
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		205	RESERVED
		206	RESERVED
		207	RESERVED
		208	RESERVED
		209	RESERVED
		210	RESERVED
		300	Automated Station Observation: No significant weather observed
		301	Automated Station Observation: Clouds generally dissolving or becoming less developed during the past hour
		302	Automated Station Observation: State of sky on the whole unchanged during the past hour
		303	Automated Station Observation: Clouds generally forming or developing during the past hour
		304	Automated Station Observation: Haze or smoke, or dust in suspension in the air, visibility equal to or greater than 1 km
		305	Automated Station Observation: Haze or smoke, or dust in suspension in the air, visibility less than 1 km
		306	RESERVED
		307	RESERVED
		308	RESERVED
		309	RESERVED
		310	Automated Station Observation: Mist
		311	Automated Station Observation: Diamond dust
		312	Automated Station Observation: Distant lightning
		313	RESERVED
		314	RESERVED
		315	RESERVED
		316	RESERVED
		317	RESERVED
		318	Automated Station Observation: Squalls
		319	RESERVED
		320	Automated Station Observation: Fog
		321	Automated Station Observation: PRECIPITATION at the station during the preceding hour but not at the time of observation
		322	Automated Station Observation: Drizzle (not freezing) or snow grains
		323	Automated Station Observation: Rain (not freezing)
		324	Automated Station Observation: Snow
		325	Automated Station Observation: Freezing drizzle or freezing rain

		326	Automated Station Observation: Thunderstorm (with or without precipitation)
		327	Automated Station Observation: BLOWING OR DRIFTING SNOW OR SAND
		328	Automated Station Observation: Blowing or drifting snow or sand, visibility equal to or greater than 1 km
		329	Automated Station Observation: Blowing or drifting snow or sand, visibility less than 1 km
		330	Automated Station Observation: FOG
		331	Automated Station Observation: Fog or ice fog in patches
		332	Automated Station Observation: Fog or ice fog, has become thinner during the past hour
		333	Automated Station Observation: Fog or ice fog, no appreciable change during the past hour
		334	Automated Station Observation: Fog or ice fog, has begun or has become thicker during the past hour
		335	Automated Station Observation: Fog, depositing rime. Freezing Fog for Nav Canada stations
		336	RESERVED
		337	RESERVED
		338	RESERVED
		339	RESERVED
		340	Automated Station Observation: PRECIPITATION
		341	Automated Station Observation: Light or moderate precipitation
		342	Automated Station Observation: Heavy precipitation
		343	Automated Station Observation: Light or moderate liquid precipitation
		344	Automated Station Observation: Heavy liquid precipitation
		345	Automated Station Observation: Light or moderate solid precipitation
		346	Automated Station Observation: Heavy solid precipitation
		347	Automated Station Observation: Light or moderate freezing precipitation
		348	Automated Station Observation: Heavy freezing precipitation
		349	RESERVED
		350	Automated Station Observation: DRIZZLE
		351	Automated Station Observation: Very light drizzle
		352	Automated Station Observation: Light drizzle (not freezing)
		353	Automated Station Observation: Moderate drizzle (not freezing)
		354	Automated Station Observation: Heavy drizzle (not freezing)
		355	Automated Station Observation: Very light freezing drizzle
		356	Automated Station Observation: Light freezing drizzle
		357	Automated Station Observation: Moderate freezing drizzle
		358	Automated Station Observation: Heavy freezing drizzle
		359	Automated Station Observation: Light drizzle and rain
		360	Automated Station Observation: Moderate or heavy drizzle and rain
		361	RESERVED
		362	Automated Station Observation: RAIN
		363	Automated Station Observation: Very light rain

		364	Automated Station Observation: Light rain (not freezing)
		365	Automated Station Observation: Moderate rain (not freezing)
		366	Automated Station Observation: Heavy rain (not freezing)
		367	Automated Station Observation: Very light freezing rain
		368	Automated Station Observation: Light freezing rain
		369	Automated Station Observation: Moderate freezing rain
		370	Automated Station Observation: Heavy freezing rain
		371	Automated Station Observation: Light rain (or drizzle) and snow
		372	Automated Station Observation: Moderate or heavy rain (or drizzle) and snow
		373	RESERVED
		374	Automated Station Observation: SNOW
		375	Automated Station Observation: Very light snow
		376	Automated Station Observation: Light snow
		377	Automated Station Observation: Moderate snow
		378	Automated Station Observation: Heavy snow
		379	Automated Station Observation: Light ice pellets
		380	Automated Station Observation: Moderate ice pellets
		381	Automated Station Observation: Heavy ice pellets
		382	Automated Station Observation: Snow grains
		383	Automated Station Observation: Ice crystals
		384	RESERVED
		385	Automated Station Observation: SHOWERS or INTERMITTENT PRECIPITATION
		386	Automated Station Observation: Light rain showers or light intermittent rain
		387	Automated Station Observation: Moderate rain showers or moderate intermittent rain
		388	Automated Station Observation: Heavy rain showers or heavy intermittent rain
		389	Automated Station Observation: Violent rain showers or violent intermittent rain
		390	Automated Station Observation: Light snow showers or light intermittent snow
		391	Automated Station Observation: Moderate snow showers or moderate intermittent snow
		392	Automated Station Observation: Heavy snow showers or heavy intermittent snow
		393	RESERVED
		394	Automated Station Observation: Hail
		395	Automated Station Observation: Very light hail
		396	Automated Station Observation: Light hail
		397	Automated Station Observation: Moderate hail
		398	Automated Station Observation: Heavy hail
		399	Automated Station Observation: THUNDERSTORM
		400	Automated Station Observation: Thunderstorm, slight or moderate with no precipitation
		401	Automated Station Observation: Thunderstorm, slight or moderate,

			with rain showers and/or snow showers
		402	Automated Station Observation: Thunderstorm, slight or moderate, with hail
		403	Automated Station Observation: Thunderstorm, heavy, with no precipitation
		404	Automated Station Observation: Thunderstorm, heavy, with rain showers and/or snow showers
		405	Automated Station Observation: Thunderstorm, heavy, with hail
		406	RESERVED
		407	RESERVED
		408	Automated Station Observation: Tornado
		409	Automated Station Observation: No precipitation
		410	Automated Station Observation: Very light unclassified precipitation
		411	Automated Station Observation: Light unclassified precipitation
		412	Automated Station Observation: Moderate unclassified precipitation
		413	Automated Station Observation: Heavy unclassified precipitation
		414	Automated Station Observation: Error in present weather determination, none could be reported
		415	Automated Station Observation: Light frozen precipitation
		416	Automated Station Observation: Moderate frozen precipitation
		417	Automated Station Observation: Heavy frozen precipitation
		418	Automated Station Observation: Other
		500	Not used
		501	Not used
		502	Not used
		503	Not used
		504	Manned or Automated Station Observation: Volcanic ash suspended In the air aloft
		505	Not used
		506	Manned or Automated Station Observation: Thick dust haze, visibility less than 1 km
		507	Manned or Automated Station Observation: Blowing spray at the station
		508	Manned or Automated Station Observation: Drifting dust (sand)
		509	Manned or Automated Station Observation: Wall of dust or sand in distance (like haboob)
		510	Manned or Automated Station Observation: Snow haze
		511	Manned or Automated Station Observation: Whiteout
		512	Not used
		513	Manned or Automated Station Observation: Lightning, cloud to surface
		514	Not used
		515	Not used
		516	Not used
		517	Manned or Automated Station Observation: Dry thunderstorm
		518	Not used
		519	Manned or Automated Station Observation: Tornado cloud (destructive) at or within sight of the station during preceding hour or at

			the time of observation
		520	Manned or Automated Station Observation: Deposition of volcanic ash
		521	Manned or Automated Station Observation: Deposition of dust or sand
		522	Manned or Automated Station Observation: Deposition of dew
		523	Manned or Automated Station Observation: Deposition of wet snow
		524	Manned or Automated Station Observation: Deposition of soft rime
		525	Manned or Automated Station Observation: Deposition of hard rime
		526	Manned or Automated Station Observation: Deposition of hoarfrost
		527	Manned or Automated Station Observation: Deposition of glaze
		528	Manned or Automated Station Observation: Deposition of ice crust (ice slick)
		529	Not used
		530	Manned or Automated Station Observation: Duststorm or sandstorm with temperature below 0 degrees C
		531	Not used
		532	Not used
		533	Not used
		534	Not used
		535	Not used
		536	Not used
		537	Not used
		538	Not used
		539	Manned or Automated Station Observation: Blowing snow, impossible to determine whether snow is falling or not
		540	Not used
		541	Manned or Automated Station Observation: Fog on sea
		542	Manned or Automated Station Observation: Fog in valleys
		543	Manned or Automated Station Observation: Arctic or Antarctic sea smoke
		544	Manned or Automated Station Observation: Steam fog (sea, lake or river)
		545	Manned or Automated Station Observation: Steam fog (land)
		546	Manned or Automated Station Observation: Fog over ice or snow cover
		547	Manned or Automated Station Observation: Dense fog, visibility 60-90 m
		548	Manned or Automated Station Observation: Dense fog, visibility 30-60 m
		549	Manned or Automated Station Observation: Dense fog, visibility less than 30 m
		550	Manned or Automated Station Observation: Drizzle, rate of fall less than 0.10 mm/h
		551	Manned or Automated Station Observation: Drizzle, rate of fall 0.10-0.19 mm/h
		552	Manned or Automated Station Observation: Drizzle, rate of fall 0.20-0.39 mm/h
		553	Manned or Automated Station Observation: Drizzle, rate of fall 0.40-0.79 mm/h
		554	Manned or Automated Station Observation: Drizzle, rate of fall 0.80-1.59 mm/h

		555	Manned or Automated Station Observation: Drizzle, rate of fall 1.60-3.19 mm/h
		556	Manned or Automated Station Observation: Drizzle, rate of fall 3.20-6.39 mm/h
		557	Manned or Automated Station Observation: Drizzle, rate of fall 6.4 mm/h or more
		558	Not used
		559	Manned or Automated Station Observation: Drizzle and snow
		560	Manned or Automated Station Observation: Rain, rate of fall less than 1.0 mm/h
		561	Manned or Automated Station Observation: Rain, rate of fall 1.- 1.9 mm/h
		562	Manned or Automated Station Observation: Rain, rate of fall 2.- 3.9 mm/h
		563	Manned or Automated Station Observation: Rain, rate of fall 4.- 7.9 mm/h
		564	Manned or Automated Station Observation: Rain, rate of fall 8.-15.9 mm/h
		565	Manned or Automated Station Observation: Rain, rate of fall 16.0-31.9 mm/h
		566	Manned or Automated Station Observation: Rain, rate of fall 32.0-63.9 mm/h
		567	Manned or Automated Station Observation: Rain, rate of fall 64.0 mm/h or more
		568	Not used
		569	Not used
		570	Manned or Automated Station Observation: Snow, rate of fall less than 1.0 cm/h
		571	Manned or Automated Station Observation: Snow, rate of fall 1.0-1.9 cm/h
		572	Manned or Automated Station Observation: Snow, rate of fall 2.0-3.9 cm/h
		573	Manned or Automated Station Observation: Snow, rate of fall 4.0-7.9 cm/h
		574	Manned or Automated Station Observation: Snow, rate of fall 8.0-15.9 cm/h
		575	Manned or Automated Station Observation: Snow, rate of fall 16.0-31.9 cm/h
		576	Manned or Automated Station Observation: Snow, rate of fall 32.0-63.9 cm/h
		577	Manned or Automated Station Observation: Snow, rate of fall 64.0 cm/h or more
		578	Manned or Automated Station Observation: Snow or Ice crystal precipitation from a clear sky
		579	Manned or Automated Station Observation: Wet snow, freezing on contact
		580	Manned or Automated Station Observation: Precipitation of rain
		581	Manned or Automated Station Observation: Precipitation of rain, freezing
		582	Manned or Automated Station Observation: Precipitation of rain and snow mixed.
		583	Manned or Automated Station Observation: Precipitation of snow
		584	Manned or Automated Station Observation: Precipitation of snow pellets or small hall
		585	Manned or Automated Station Observation: Precipitation of snow pellets or small hail, with rain
		586	Manned or Automated Station Observation: Precipitation of snow

			pellets or small hail, with rain and snow mixed
		587	Manned or Automated Station Observation: Precipitation of snow pellets or small hail, with snow
		588	Manned or Automated Station Observation: Precipitation of hail
		589	Manned or Automated Station Observation: Precipitation of hail, with rain
		590	Manned or Automated Station Observation: Precipitation of hall, with rain and snow mixed
		591	Manned or Automated Station Observation: Precipitation of hail, with snow
		592	Manned or Automated Station Observation: Shower(s) or thunderstorm over sea
		593	Manned or Automated Station Observation: Shower(s) or thunderstorm over mountains
		594	Not used
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		808	Manned or Automated Station Observation: No significant phenomenon to report, present and past weather omitted
		809	Manned or Automated Station Observation: No observation, data not available, present and past weather omitted
		810	Manned or Automated Station Observation: Present and past weather missing, but expected
		811	Missing value
		812	Automated Station Observation: Rain, hail detected
		813	Automated Station Observation: Snow, rain detected
		814	Automated Station Observation: Snow, hail detected
		815	Automated Station Observation: Snow, rain, hail detected
		816	Automated Station Observation: Unclassified precipitation detected
		817	Automated Station Observation: Rain, unclassified precipitation detected
		818	Automated Station Observation: Hail, unclassified precipitation detected
		819	Automated Station Observation: Rain, hail, unclassified precipitation detected
		820	Automated Station Observation: Snow, unclassified precipitation detected
		821	Automated Station Observation: Snow, rain, unclassified precipitation detected
		822	Automated Station Observation: Snow, hail, unclassified precipitation detected
		823	Automated Station Observation: Snow, hail, rain, unclassified precipitation detected
		824	Automated Station Observation: Light snow grains
		825	Automated Station Observation: Moderate snow grains
		826	Automated Station Observation: Heavy snow grains
		827	Automated Station Observation: Snow pellets
		828	Automated Station Observation: Thunderstorm in vicinity
		829	Automated Station Observation: Sand
		830	Automated Station Observation: Dust
		831	Automated Station Observation: Haze
		832	Automated Station Observation: Smoke
		833	Automated Station Observation: Volcanic ash
		834	Automated Station Observation: Blowing snow
		835	Automated Station Observation: Blowing sand
		836	Automated Station Observation: Light unclassified freezing precipitation
		837	Automated Station Observation: Moderate unclassified freezing precipitation
		838	Automated Station Observation: Heavy unclassified freezing precipitation
		839	Automated Station Observation: No precipitation detected

6.5.6 rapid_pressure_change

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	rapid_pressure_change	0	not occurring
		1	Pressure rising rapidly
		2	Pressure falling rapidly
		3	missing

6.5.7 report_type

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	report_type	0	hourly regular report (SA)
		1	hourly special report (SP)
		2	hourly regular special report (RS)
		3	SA and SM reports
		4	SA and CS reports
		5	SA, CS and SM reports
		6	SA and SX reports
		7	SP and SX reports
		8	CS and SX reports
		9	SA, SX and SM reports
		10	SA, SX, SM and CS reports
		11	reserved
		12	reserved
		13	reserved
		14	reserved
		15	missing
		16	reserved
		17	SM (Synoptic) Reports, e.g. FM-12 LAND SYNOP (6 hr)
		18	SA + SM
		19	CS Reports
		20	SA + CS
		21	SM + CS
		22	SA + SM + CS
		23	SX (Soil) Reports
		24	SA + SX (Soil)
		25	SM + SX (Soil)
		26	SA + SM + SX(Soil)
		27	CS + SX (Soil)
		28	SA + CS + SX(Soil)
		29	SM + CS + SX (Soil)
		30	SA + SM + CS + SX (Soil)

		31	SX (UV) Reports
		32	SA + SX(UV)
		33	SM + SX (UV)
		34	SA + SM + SX(UV)
		35	CS + SX (UV)
		36	SA + CS + SX (UV)
		37	SM + CS + SX (UV)
		38	SA + SM + CS + SX(UV)
		39	SX(Soil + UV)
		40	SA + SX(Soil + UV)
		41	SM + SX(Soil + UV)
		42	SA + SM + SX(Soil + UV)
		43	CS + SX (Soil + UV)
		44	SA + CS + SX (Soil + UV)
		45	SM + CS + SX (Soil + UV)
		46	SA + SM + CS + SX (Soil + UV)
		47	SX (Unofficial) Reports
		48	SA + SX (Unoff)
		49	SM + SX(Unoff)
		50	SA + SM + SX(Unoff)
		51	CS + SX(Unoff)
		52	SA + CS + SX (Unoff)
		53	SM + CS + SX(Unoff)
		54	SA + SM + CS + SX(Unoff)
		55	SX(Soil + Unoff)
		56	SA + SX(Soil + Unoff)
		57	SM + SX(Soil + Unoff)
		58	SA + SM + SX(Soil + Unoff)
		59	CS + SX(Soil + Unoff)
		60	SA + CS + SX(Soil + Unoff)
		61	SM + CS + SX(Soil + Unoff)
		62	SA + SM + CS + SX(Soil + Unoff)
		63	SX(UV + Unoff)
		64	SA + SX(UV + Unoff)
		65	SM + SX(UV + Unoff)
		66	SA + SM + SX(UV + Unoff)
		67	CS + SX(UV + Unoff)
		68	SA + CS + SX (UV + Unoff)
		69	SM + CS + SX(UV + Unoff)
		70	SA + SM + CS + SX (UV + Unoff)
		71	SX(Soil + UV + Unoff)
		72	SA + SX (Soil + UV + Unoff)

		73	SM + SX (Soil + UV + Unoff)
		74	SA + SM + SX(Soil + UV + Unoff)
		75	CS + SX (Soil + UV + Unoff)
		76	SA + CS + SX(Soil + UV + Unoff)
		77	SM + CS + SX(Soil + UV + Unoff)
		78	SA + SM + CS + SX(Soil + UV + Unoff)
		79	Reserved
		80	FM-13 SHIP SYNOP
		81	DRIBU, DRIFTER, Ship
		82	Great Lakes obs
		83	FM-18 BUOY SYNOP
		84	FM-14 MOBIL SYNOP
		85	Quebec Co-op Partner data. Hourly report with optional multi-hour data (e.g. 6, 12, 24 hour intervals).
		86	Correction to a previously issued product (COR)
		87	Amendment to a previously issued product (AMD)
		88	Correction to a previously issued amended product (COR AMD)
		89	Cancellation of a previously issued product (CNL)
		90	No product available (NIL)
		91	Corrected special report (SPECI COR)
		92	Reserved
		93	Reserved
		94	Reserved
		95	Reserved
		96	Reserved
		97	Reserved
		98	Reserved
		99	Minutely message other than SPECI and METAR
		100	Any message type other than 1) a regular hourly message, 2) SPECI or 3) minutely messages other than SPECI and METAR
		101	Report for storm (wind) conditions encountered at sea
		102	Regular report (taken at 06:00 and 18:00 PST)
		103	Hourly regular report from an LWIS station

6.5.8 sky_condition

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	sky_condition	0	Clear (CLR) - The sky condition when no cloud or obscuring phenomena are present
		1	Thin scattered (-SCT)
		2	Scattered (SCT) - a layer aloft with a summation opacity of 4/10 to 5/10 (amount of 3/8 - 4/8 in METAR), inclusive
		3	Thin broken (-BKN)
		4	Broken (BKN) - a layer aloft with a summation opacity of 6/10 - 9/10 (amount of 5/8 - 7/8 in METAR), inclusive

		5	Thin overcast (-OVC)
		6	Overcast (OVC) - a layer aloft with a summation amount of 10/10 (amount of 8/8 in METAR)
		7	Obscured (X) - a surface-based layer with summation opacity of 10/10
		8	Partially obscured (-X) - a surface-based layer with summation opacity of at least 1/10 but less than 10/10
		9	Thin few (-FEW)
		10	Few (FEW) - a layer aloft with a summation opacity of 1/10 to 3/10 (amount of 1/8 - 2/8 in METAR)

6.5.9 station_type

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	station_type	0	AUTO 1 (MARS I)
		1	AUTO 2 (MARS II)
		2	AUTO 3 (MAPS I)
		3	AUTO 4 (MAPS II)
		4	AUTO 5 - MSC Automatic Weather Observing System (AWOS)
		5	AUTO 6 (Hurricane)
		6	AUTO 7 - Campbell Scientific data logger automatic weather station (Partner, non-MSC)
		7	AUTO 8 - Campbell Scientific data logger automatic weather station (MSC owned & operated)
		8	AUTO 9
		9	Generic AUTO station
		10	Limited Weather Information System (LWIS)—MSC or NavCan
		11	Nav Canada Human Weather Observing System (NC-HWOS)
		12	Nav Canada Automatic Weather Observing System (NC-AWOS)
		13	SAWR (Supplementary Aviation Weather Report—Manned); MSC or NavCan
		14	IHR (WinIDE - Manned hourly observations)
		15	MIDS (WinIDE-type interface for Manned hourly observations)
		16	Generic manual/manned station
		17	Generic hybrid: both Manned and Automatic
		18	Missing Value
		19	A station that reports temperature and precipitation
		20	A station that reports temperature only
		21	A station that reports precipitation only
		22	A station that reports precipitation twice in a day: once in the morning and once in the evening
		23	A station that reports precipitation once a day in the evening
		24	A station that reports temperature and precipitation once a day in the morning
		25	A station that reports temperature and precipitation once a day in the evening
		26	A station that reports temperature and precipitation twice a day in the morning and evening
		27	A station that reports temperature once a day in the morning, and reports precipitation twice a day in the morning and evening
		28	A station that reports temperature once a day in the evening, and reports precipitation twice a day in the morning and evening
		29	A station that reports precipitation once a day in the morning
		30	Quebec stations which observe precipitation 1-5 times a day

6.5.10 tendency_characteristic

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	tendency_characteristic	0	Increasing, then decreasing; atmospheric pressure the same or higher than three hours ago
		1	Increasing, then steady; or increasing, then increasing more slowly
		2	Increasing (steadily or unsteadily)
		3	Decreasing or steady, then increasing; or increasing, then increasing more rapidly
		4	Steady; atmospheric pressure the same as three hours ago
		5	Decreasing, then increasing; atmospheric pressure the same or lower than three hours ago
		6	Decreasing, then steady; or decreasing, then decreasing more slowly
		7	Decreasing (steadily or unsteadily)
		8	Steady or increasing, then decreasing; or decreasing, then decreasing more rapidly
		9	Reserved
		10	Reserved
		11	Reserved
		12	Reserved
		13	Reserved
		14	Reserved
		15	Missing value

6.5.11 total_cloud_amount

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	total_cloud_amount	0	Sky clear (cloud amount of 0 octas or 0/10) - Manned or Auto station
		1	FEW - cloud amount of 1 to 2 octas (1/10 to 3/10)
		2	Scattered (SCT) - cloud amount of 3 to 4 octas (cloud coverage of ≤49% for MSC AWOS observations)
		3	Broken (BKN) - cloud amount of 5 to 7 octas (cloud coverage of 50% to 89% for MSC AWOS observations)
		4	Overcast (OVC) - cloud amount of 8 octas (cloud coverage of ≥90% for MSC AWOS observations)
		5	Reserved
		6	Scattered/broken (Many forecasts use scattered/broken or broken/overcast
		7	Broken/overcast followed by cloud type(s))
		8	Isolated (Used on aviation charts to describe the cloud type Cb)
		9	Isolated embedded (Used on aviation charts to describe the cloud type Cb)
		10	Occasional (Used on aviation charts to describe the cloud type Cb)
		11	Occasional embedded (Used on aviation charts to describe the cloud type Cb)
		12	Frequent (Used on aviation charts to describe the cloud type Cb)
		13	Dense (Used on aviation charts to describe cloud that would cause sudden changes in visibility (less than 1 000 m))

		14	Layers
		15	Obscured (OBSC)
		16	Embedded (EMBD)
		17	Frequent embedded
		18	reserved
		19	reserved
		20	reserved
		21	reserved
		22	reserved
		23	reserved
		24	reserved
		25	reserved
		26	reserved
		27	reserved
		28	reserved
		29	reserved
		30	reserved
		31	missing
		32	1 okta or less, but not zero (1/10 or less, but not zero)
		33	2 oktas (2/10 - 3/10)
		34	3 oktas (4/10)
		35	4 oktas (5/10)
		36	5 oktas (6/10)
		37	6 oktas (7/10 - 8/10)
		38	7 oktas or more, but not 8 oktas (9/10 or more, but not 10/10)
		39	8 oktas (10/10)
		40	Sky obscured by fog and/or other meteorological phenomena
		41	Cloud cover is indiscernible for reasons other than for or other meteorological phenomena, or observation is not made
		42	Sky Clear reported from manned station.
		43	Nil Significant Cloud (clear below 1500 meters)
		44	Obscured Significance
		45	Sky Clear reported from auto station.
		46	Sky obscured by a surface-based layer of coverage ≥90%
		47	Sky partially obscured by a surface-based layer with coverage of <90%
		48	No clouds detected below 10000 ft
		49	Sky partially obscured by fog and/or other meteorological phenomena
		50	No cloud detected
		51	No clouds detected below 25,000 ft (NC-AWOS)
		52	Ceiling and Visibility OK
		53	No significant weather

6.5.12 wind_gust_squall_indicator

CodeSource	CodeType	CodeValue	CodeDescEng
std_code_src	wind_gust_squall_indicator	0	Gust from an autostation
		1	Gust
		2	Squall