



# Technical Documentation

## Digital Archive of Canadian Climatological Data

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# 1.0 Record formats

Standard record formats exist for the Canadian climatological data which are archived at minutely, fifteen minute, hourly, daily or monthly intervals. These records are available in non-delimited American Standard Code for Information Interchange (ASCII) formatted files commonly called flat files. Each record consists of a climate identification number, a date and element number, followed by the data, which is available for each time interval indicated by that record's date. The datum for each time interval is recorded as a five (5) digit integer, preceded by a single field for the integer's sign, and followed by a single alphanumeric character for the datum's flag (see [Table of flags](#)). The units and decimal position are implied by the assigned element number, which denotes the data type (as defined in the tables below for each archive files type).

A single file may contain data from multiple stations, for multiple element types, and may include data from a range of dates.

The five (5) record formats are as follows:

## 1.1 Daily record of hourly data (HLY)

The standard line length for hourly data files is 186 characters, with each line containing one day's worth of data, i.e., one value and one flag for each hour in the day (24 values plus their flags, per line).

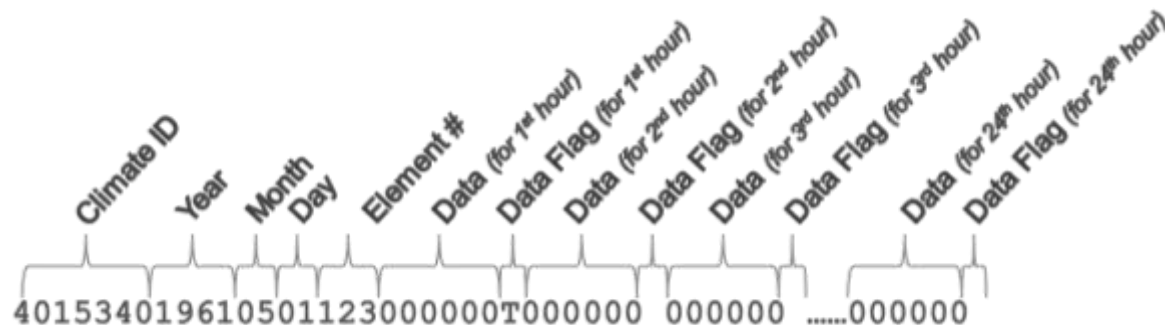


Figure 1: An illustration demonstrating how the ASCII characters are represented in a single line of hourly data.

An example of a single line of data from an HLY file is as follows:

```
401534019610501123000003H000000 000000 000000 000000 000000 000000 000000  
000000 000000 000000 000000 000000 000000 000000 000000 000000 000000 000000  
000000 000000 000000 000000 000000
```

- Position 1-7: Seven (7) digit climate identification number. See [Climate identifier](#) for more information.
- Position 8-11: Four (4) digit year, e.g. "1961".
- Position 12-13: Two (2) digit month, e.g. "05" indicates May.

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- Position 14-15: Two (2) digit day of month, e.g. “01” indicates the first day of the month.
- Position 16-18: Three (3) digit element number, e.g. “123” indicates “Hourly rainfall”. Details on various element numbers can be found throughout this document.
- Position 19-24: Five (5) digit value, plus a preceding character reserved for the datum’s sign, which is explicit (“-”) if negative and implicit (“0”) if positive. A missing field is indicated by “-99999”. In the above example, “3” indicates 0.3 mm of rainfall. See [Data value field](#) for more information.
- Position 25: An alphabetic flag for the value in position 20-24, where a blank space indicates no flag. For example, “H” indicates “freezing” precipitation. See [Table of flags](#) for more information.
- Position 26-32: Value and flag for the second hour of the day.

This pattern of data, preceded by a number sign and followed by a flag, repeats in the line 24 times, once for each hour in the day.

NOTE: In the daily record of hourly data (HLY), the 24 entries (for each hour) represent the observation taken during the hour 00h-23h, for elements 071-122, 156, 209-210, 219-230, 260, 262-280 and 311. For all other elements, the entries represent the observation for hours ending 01h-24h. For example, for element 123 (rainfall) the hour 12 represents the total rainfall recorded in the period between 1101h-1200h. All times are local standard with the exception of sunshine (element 133) and radiation (elements 061-068, 169-172) which are local apparent solar time. Note that the values for the sunshine and radiation elements are for the hour beginning at that time. For example, hour 12 represents the period between 1200h-1259h. One (1) minute solar radiation data (elements 200-208) are also in local apparent time.

## 1.2 Monthly record of daily data (DLY)

The standard line length for daily files is 233 characters, with each line containing one month’s worth of data.

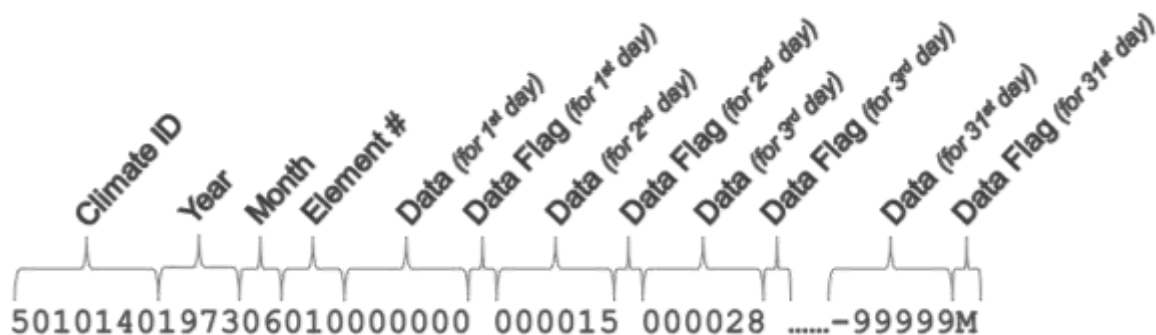


Figure 2: An illustration showing how the ASCII characters are represented in a single line of daily data.

An example of a single line of data from a DLY file is as follow:

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5010140197306010000000 000015 000028 000000T000000 000000 000000T000000  
 000104 000003 000000 000000 000000 000000T000295 000145 000000 000343  
 000076 000030 000005 000000 000000 000000T000013 000008 000000 000000  
 000000 000000 -99999M

- Position 1-7: Seven (7) digit climate identification number. See [Climate identifier](#) for more information.
- Position 8-11: Four (4) digit year, i.e. “1973”.
- Position 12-13: Two (2) digit month, i.e. “06” is June.
- Position 14-16: Three (3) digit element number, e.g. “010” is “Rainfall”. Details on various element numbers can be found throughout this document.
- Position 17-22: Five (5) digit value, plus a preceding character reserved for the datum’s sign, which is explicit (“-”) if negative and implicit (“0”) if positive. A missing field is indicated by “-99999”. In the above example, “00000” indicates zero rainfall. See [Data value field](#) for more information.
- Position 23: An alphabetic flag for the value in position 18-22, where a blank space indicates no flag. See [Table of flags](#) for more information.
- Position 24: Same as position 17.
- Position 25-29: Value for the second day of the month.

This pattern of sign, value and flag repeats to 31 days, once for each day of the month indicated in the “month” position. Months with less than 31 days will show missing values of “-99999” and “M” in place of a non-existent day, e.g. the last value and flag in the line for April (position 227-233) will be “-99999M”.

### 1.3 Annual record of monthly data (MLY)

The standard line length for monthly files is 98 characters, with each line containing one year’s worth of data. Each line includes space for 12 months of data.

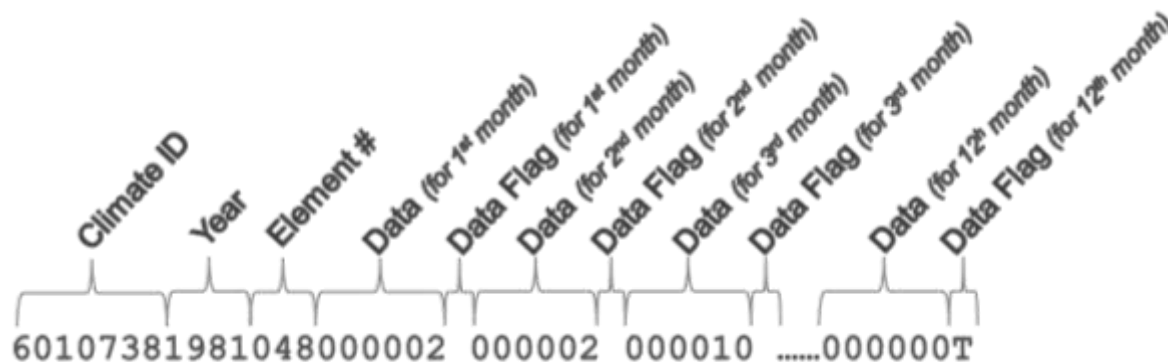


Figure 3: An illustration showing how the ASCII characters are represented in a single line of monthly data.

An example of a single line of data from a MLY file is as follow:

```
60107381981049000112 000222 000213 000136 000056 000000T000000 000000  
000117 000096 000338 000223
```

- Position 1-7: Seven (7) digit climate identification number. See [Climate identifier](#) for more information.
- Position 8-11: Four (4) digit year, e.g. “1981”.
- Position 12-14: Three (3) digit element number. e.g. “049” indicates “Total snowfall”. Details on various element numbers can be found throughout this document.
- Position 15-20: Five (5) digit value, plus a preceding character reserved for the datum’s sign, which is explicit (“-”) if negative and implicit (“0”) if positive. A missing field is indicated by “-99999”. In the above example, “000112” indicates 11.2 cm of snowfall for January. See [Data value field](#) for more information.
- Position 21: An alphabetic flag for the value in position 16-20, where a blank space indicates no flag. See [Table of flags](#) for more information.

This pattern of sign, value and flag repeats is repeated 12 times on each line, once for each month of the year indicated in the “year” position.

#### **1.4 Daily record of 15 minute data (FIF)**

The standard line length for 15 minute files is 691 characters, with each line containing one day’s worth of data, i.e., one value and one flag for each 15 minute period (96 values plus their flags per line).

NOTE: The 15 minute data are currently unavailable for distribution, pending further review in the archive.

#### **1.5 Hourly record of minutely data (MIN)**

The standard line length for minutely data is 440 characters, with each line containing one hour’s worth of data, i.e. one value and one flag for each minute in the hour (60 values plus their flags, per line).

NOTE: The minutely data are currently unavailable for distribution, pending further review in the archive. Additionally, only a small amount of data exists; only five (5) stations reported minutely data between 1997 and 2003.

## 2.0 Data field descriptions

### 2.1 Climate identifier

Also referred to as climate ID or station number, the climate identifier is a 7 digit number assigned by the Meteorological Service of Canada (MSC) to a site where official weather observations are taken, and serves as a permanent, unique identifier (ID).

The first digit of the number indicates the province in which the observing site is located; the second and third digits identify the climatological district within the province.

When observations are discontinued at a site, the number is not used for subsequent stations (which may, or may not, differ in name) unless it is judged that the records from the earlier and subsequent stations may be combined for most climatological purposes.

A station inventory which includes current and historic stations is available upon request at the [Regional Climate Services](#) or in any specific [Historical Data search](#) result by clicking “Get More Data” in the “Download Data” section.

### 2.2 Element number

An assigned element number uniquely identifies each data type and implies the units and decimal position.

Documentation for each element is organized by record format, unique to the observing frequency (e.g. HLY). In addition, a reference has been made to the system under which the data were acquired and quality controlled (e.g. HLY01). For more information about each element number, please refer to the tables located under the [Archive files types](#) section.

### 2.3 Data value field

This seven (7) character field records the datum for one time interval. The first character is reserved for the datum’s sign; explicit (“-”) if negative and implicit (“0”) if positive. Prior to the ASCII files being written, all value fields are initialized to -99999M (missing). If the values are missing for all the time intervals of a record, the record will not be written. However, if a value is available for at least one time interval within the record, the record will be written but with all remaining unavailable intervals coded as -99999M. In the Monthly record of daily data (DLY) files, records for days in excess of the number of days in the specified month are coded -99999M. For example, the 31<sup>st</sup> data position for the month of April is reported as missing.

The units and decimal position are determined by the element number. The flag position at the end of the field is a single alphanumeric character which is used to qualify the value and varies by element number. A blank value indicates valid data. See [Table of flags](#) for more information.

## 2.4 Day flag

If the time is uncertain within this record, 'N' will be entered in this field.

NOTE: This flag applies to 15 minute (FIF) data files only.

## 3.0 Archive files

The data are maintained in the National Archive System (NAS). The various files are identified by temporal format (e.g. Daily or “DLY”) and system number (e.g. “01”). The data set names are as follow:

Table 1: Definition of Archive files types

<b>Data Sets</b>	<b>Description</b>
HLY01	Hourly weather
HLY01.CLD	Hourly weather - Cloud layers
HLY03	Hourly rate of rainfall
DLY03	Daily rate of rainfall – Intensities
DLY04	Daily climatological data
DLY02	Daily climatological data
DLY44	Daily climatological data
MLY04	Monthly climatological data
HLY10	Hourly bright sunshine
HLY11	Hourly solar radiation
HLY12	Hourly soil temperature
MIN11	Minutely solar radiation*
DLY12	Daily soil temperature
DLY13	Daily pan evaporation
HLY15	Hourly wind
FIF21	Fifteen minute precipitation Fischer/Porter*
HLY21	Hourly precipitation Fischer/Porter
DLY21	Daily precipitation Fischer/Porter – Intensities

\*Small subset only

### 3.1 Hourly weather (HLY01)

See [Note 38](#) for additional information.

The following table presents the available element types for hourly weather and cloud layer (HLY01) data, with corresponding units, code, description, flags and numbered notes. Data for elements, such as rain (element 086) are reported as codes. For example, rain type may be reported as four (4) different codes: 0=none, 1=light, 2=moderate and 3=heavy. Detailed information on these codes, where not defined in the description

column, can be found in the [Notes](#) section of this document. The flags referenced in this table can be found in the [Table of flags](#) section of this document.

**Table 2: Element number, units, code, description, flags and notes for HLY01**

<b>Element</b>	<b>Units</b>	<b>Code</b>	<b>Description</b>	<b>Flags</b>	<b>Note</b>
071	30's of meters		Ceiling		<a href="#">6</a>
072	0.1 km		Visibility		<a href="#">7</a> , <a href="#">40</a>
073	0.01 kPa		Sea level pressure		
074	0.1°C		Dew point temperature		
075	10's of deg (see 156)		Wind direction - U2A (16 pts) to December 1970		<a href="#">5</a> , <a href="#">17</a>
156	10's of deg (see 075)		Wind direction - U2A (36 pts) from January 1971	<a href="#">E</a>	<a href="#">17</a>
076	km/h		Wind speed - U2A	<a href="#">E</a>	<a href="#">17</a>
077	0.01 kPa		Station pressure		
078	0.1°C		Dry bulb temperature		
079	0.1°C		Wet bulb temperature		
080	%		Relative humidity		
081	Tenths		Total cloud opacity		
082	Tenths		Total cloud amount		
083		1=Yes, 0=No	Weather indicator		<a href="#">1</a>
084		1, 2, 3	Tornado (TOR)=1, Waterspout=2, Funnel cloud=3		<a href="#">2</a>
085		2, 3	Thunderstorms (T)=2, Heavy thunderstorms (T+)=3		<a href="#">2</a>
086		1-3	Rain (R)		<a href="#">2</a> , <a href="#">3</a>
087		1-3	Rain showers (RW)		<a href="#">2</a> , <a href="#">3</a>
088		1-3	Drizzle (L)		<a href="#">2</a> , <a href="#">3</a>
089		1-3	Freezing rain (ZR)		<a href="#">2</a> , <a href="#">3</a>
090		1-3	Freezing drizzle (ZL)		<a href="#">2</a> , <a href="#">3</a>
091		1-3	Snow (S)		<a href="#">2</a> , <a href="#">3</a>
092		1-3	Snow grains (SG)		<a href="#">2</a> , <a href="#">3</a>
093		1	Ice crystals (IC)		<a href="#">2</a> , <a href="#">24</a>
094		1-3	Ice pellets (IP)		<a href="#">2</a> , <a href="#">3</a>
095		1-3	Ice pellet showers (IPW)		<a href="#">2</a> , <a href="#">3</a>
096		1-3	Snow showers (SW)		<a href="#">2</a> , <a href="#">3</a>
097		1-3	Snow pellets (SP)		<a href="#">2</a> , <a href="#">3</a>
098		1-3	Hail (A)		<a href="#">2</a> , <a href="#">3</a>
099		1	Fog (F)		<a href="#">2</a>
100		1	Ice fog (IF)		<a href="#">2</a> , <a href="#">23</a>
101		1	Smoke (K)		<a href="#">2</a>
102		1	Haze (H)		<a href="#">2</a>
103		1	Blowing snow (BS)		<a href="#">2</a>
104		1	Blowing sand (BN)		<a href="#">2</a>
105		1	Blowing dust (BD)		<a href="#">2</a>



Element	Units	Code	Description	Flags	Note
106		1	Dust (D)		<a href="#">2</a>
214		1	Drifting Snow (DRSN)		<a href="#">2</a>
244		1-3	Precip. Unclassified Type (P)		<a href="#">3</a> , <a href="#">43</a>
260		1	Freezing fog (FZFG)		<a href="#">2</a> , <a href="#">23</a>
311	Hg (inches of mercury)		Altimeter setting		
107-110 Lowest cloud layer					
107	Tenths		Opacity	<a href="#">G</a>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
108	Tenths		Amount or condition	<a href="#">G</a>	<a href="#">12</a> , <a href="#">13</a> , <a href="#">19</a> , <a href="#">29</a> , <a href="#">44</a>
109		0-28	Type	<a href="#">G</a>	<a href="#">4</a> , <a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
110	30's of meters		Height	<a href="#">G</a>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
111-114 Second lowest cloud layer					
111	Tenths		Opacity	<a href="#">G</a>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
112	Tenths		Amount or Condition	<a href="#">G</a>	<a href="#">12</a> , <a href="#">13</a> , <a href="#">19</a> , <a href="#">29</a> , <a href="#">44</a>
113		0-28	Type	<a href="#">G</a>	<a href="#">4</a> , <a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
114	30's of meters		Height	<a href="#">G</a>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
115-118 Third lowest cloud layer					
115	Tenths		Opacity	<a href="#">G</a>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
116	Tenths		Amount or Condition	<a href="#">G</a>	<a href="#">12</a> , <a href="#">13</a> , <a href="#">19</a> , <a href="#">29</a> , <a href="#">44</a>
117		0-28	Type	<a href="#">G</a>	<a href="#">4</a> , <a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
118	30's of meters		Height	<a href="#">G</a>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
119-122 4 <sup>th</sup> Lowest cloud layer					
119	Tenths		Opacity	<a href="#">G</a>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
120	Tenths		Amount or Condition	<a href="#">G</a>	<a href="#">12</a> , <a href="#">13</a> , <a href="#">19</a> , <a href="#">29</a> , <a href="#">44</a>
121		0-16	Type	<a href="#">G</a>	<a href="#">4</a> , <a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
122	30's of meters		Height	<a href="#">G</a>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>

Element	Units	Code	Description	Flags	Note
219-222 4 <sup>th</sup> Cloud layer					
219	Tenths		Opacity	<u>G</u>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
220	Tenths		Amount or Condition	<u>G</u>	<a href="#">12</a> , <a href="#">13</a> , <a href="#">19</a> , <a href="#">29</a> , <a href="#">44</a> <a href="#">Top of Page</a>
221		0-28	Type	<u>G</u>	<a href="#">4</a> , <a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
222	30's of meters		Height	<u>G</u>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
223-226 5 <sup>th</sup> Cloud layer					
223	Tenths		Opacity	<u>G</u>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
224	Tenths		Amount or Condition	<u>G</u>	<a href="#">12</a> , <a href="#">13</a> , <a href="#">19</a> , <a href="#">29</a> , <a href="#">44</a>
225		0-28	Type	<u>G</u>	<a href="#">4</a> , <a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
226	30's of meters		Height	<u>G</u>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
227-230 6 <sup>th</sup> Cloud layer					
227	Tenths		Opacity	<u>G</u>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
228	Tenths		Amount or Condition	<u>G</u>	<a href="#">12</a> , <a href="#">13</a> , <a href="#">19</a> , <a href="#">29</a> , <a href="#">44</a>
229		0-28	Type	<u>G</u>	<a href="#">4</a> , <a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
230	30's of meters		Height	<u>G</u>	<a href="#">12</a> , <a href="#">19</a> , <a href="#">29</a>
Wind character and gust speed - at 10 m					
209	1, 2		Wind character at 10 m Gust (G)=1, Squall (Q)=2	<u>S</u>	<a href="#">32</a>
210	km/h		Wind gust speed at 10 m	<u>S</u> , <u>E</u>	<a href="#">32</a>
Reference Climate Surface weather stations (RCS) elements - Phase 1					
262	0.1 mm		Precipitation amount (minutes 00-60)		<a href="#">33</a>
263	0.1 mm		Precipitation amount (minutes 00-15)		<a href="#">33</a>
264	0.1 mm		Precipitation amount (minutes 15-30)		<a href="#">33</a>
265	0.1 mm		Precipitation amount (minutes 30-45)		<a href="#">33</a>
266	0.1 mm		Precipitation amount (minutes 45-60)		<a href="#">33</a>

Element	Units	Code	Description	Flags	Note
267	0.1 kg/m <sup>2</sup>		Precipitation gauge weight per unit area (at minute 15)		<a href="#">33</a>
268	0.1 kg/m <sup>2</sup>		Precipitation gauge weight per unit area (at minute 30)		<a href="#">33</a>
269	0.1 kg/m <sup>2</sup>		Precipitation gauge weight per unit area (at minute 45)		<a href="#">33</a> <a href="#">Top of Page</a>
270	0.1 kg/m <sup>2</sup>		Precipitation gauge weight per unit area (at minute 60)		<a href="#">33</a>
271	0.1 km/h		Wind speed at 2 m (minutes 00-15)		<a href="#">33</a>
272	0.1 km/h		Wind speed at 2 m (minutes 15-30)		<a href="#">33</a>
273	0.1 km/h		Wind speed at 2 m (minutes 30-45)		<a href="#">33</a>
274	0.1 km/h		Wind speed at 2 m (minutes 45-60)		<a href="#">33</a>
275	cm		Snow depth (at minute 60)		<a href="#">33</a>
276	cm		Snow depth (at minute 15)		<a href="#">33</a>
277	cm		Snow depth (at minute 30)		<a href="#">33</a>
278	cm		Snow depth (at minute 45)		<a href="#">33</a>
279	Degrees		Wind direction at 2 m (minutes 50-60)		<a href="#">33</a>
280	0.1 km/h		Wind speed at 2 m (minutes 50-60)		<a href="#">33</a>

### 3.2 Rate of rainfall (HLY03)

Also see section on [Fisher/Porter Precipitation \(HLY21\)](#) data.

The following table presents the available element type for hourly rate of rainfall (HLY03) data, along with corresponding units, description and flags. The flags referenced in this table can be found in the [Table of flags](#) section of this document.

Table 3: Element number, units, description and flags for HLY03

Element	Units	Code	Description	Flags	Note
123	0.1 mm		Hourly rainfall	<a href="#">H, I, J</a>	<a href="#">46</a>

### 3.3 Rate of rainfall (DLY03)

Also see section on [Fisher/Porter Precipitation \(DLY21\)](#) data.

The following table presents the available element types for rate of rainfall (DLY03) data, with corresponding units, description, flags and numbered notes. The flags and notes

referenced in this table can be found in the [Table of flags](#) and [Notes](#) sections of this document.

**Table 4: Element number, units, description, flags and notes for DLY03**

Element	Units	Code	Description	Flags	Note
124	0.01		Adjustment factor		<a href="#">20</a>
125-132 Since last chart change, greatest amount of rainfall in...					
125	0.1 mm		5 minutes	<a href="#">H, I, J</a>	<a href="#">36</a>
126	0.1 mm		10 minutes	<a href="#">H, I, J</a>	<a href="#">36</a>
127	0.1 mm		15 minutes	<a href="#">H, I, J</a>	<a href="#">36</a>
128	0.1 mm		30 minutes	<a href="#">H, I, J</a>	<a href="#">36</a>
129	0.1 mm		1 hour	<a href="#">H, I, J</a>	<a href="#">36</a>
130	0.1 mm		2 hours	<a href="#">H, I, J</a>	<a href="#">36</a>
131	0.1 mm		6 hours	<a href="#">H, I, J</a>	<a href="#">36</a>
132	0.1 mm		12 hours	<a href="#">H, I, J</a>	<a href="#">36</a>
160			Chart change hour (Local Standard Time)		<a href="#">36</a>
161	0.1 mm		24 hours	<a href="#">H, I, J</a>	<a href="#">36</a>

### 3.4 Daily climatological data (DLY02, DLY04)

DLY02 daily data are now derived from hourly observations and will no longer be restricted to synoptic observation stations effective the following dates:

May 14, 2018 – automatic climate weather stations

October 30, 2018 – human and automatic aviation weather stations

See Note 16 for additional information.

The following table presents the available element types for daily climatological data with corresponding units, code, description, flags and notes for DLY02 and DLY04 elements. The flags and notes referenced in this table can be found in the [Table of flags](#) and [Notes](#) sections of this document.

**Table 5: Element number, units, code, description, flags and notes for DLY02 and DLY04**

Element	Units	Code	Description	Flags	Note
001	0.1°C		Daily max temperature	<a href="#">E</a>	
002	0.1°C		Daily min temperature	<a href="#">E, N, Y</a>	
003	0.1°C		Daily mean temperature	<a href="#">E</a>	
004	%		Daily max relative humidity		
005	%		Daily min relative humidity		
023	10's of deg (see 157)		Direction of extreme gust (16 pts) to December 1976	<a href="#">E, S</a>	<a href="#">5, 34</a>

Element	Units	Code	Description	Flags	Note
024	km/h		Speed of extreme gust	<a href="#">E</a> , <a href="#">S</a>	
025			UTC hour of extreme gust (earliest)		<a href="#">41</a>
157	10's of deg (see 023)		Direction of extreme gust (36 pts) from January 1977	<a href="#">E</a> , <a href="#">S</a>	<a href="#">Top of Page</a>
006-009 6 hourly precipitation (totals ending at the specified time)					
006	0.1 mm		1200 UTC	<a href="#">I</a>	<a href="#">15</a>
007	0.1 mm		1800 UTC	<a href="#">I</a>	<a href="#">15</a>
008	0.1 mm		0000 UTC	<a href="#">I</a>	<a href="#">15</a>
009	0.1 mm		0600 UTC	<a href="#">I</a>	<a href="#">15</a>
010	0.1 mm		Total rainfall	<a href="#">A</a> , <a href="#">C</a> , <a href="#">E</a> , <a href="#">F</a> , <a href="#">L</a> , <a href="#">I</a>	
011	0.1 cm		Total snowfall	<a href="#">A</a> , <a href="#">C</a> , <a href="#">E</a> , <a href="#">F</a> , <a href="#">L</a> , <a href="#">I</a>	<a href="#">37</a>
012	0.1 mm		Total precipitation	<a href="#">A</a> , <a href="#">C</a> , <a href="#">E</a> , <a href="#">F</a> , <a href="#">L</a> , <a href="#">I</a>	<a href="#">37</a>
013	cm		Snow on the ground	<a href="#">E</a> , <a href="#">I</a>	<a href="#">8</a> , <a href="#">37</a>
014-022 Day with... (DLY04 - also available for DLY44, elements 014-017)					
014		1=Yes, 0=No	Thunderstorms		<a href="#">14</a>
015		1=Yes, 0=No	Freezing rain or drizzle		<a href="#">14</a>
016		1=Yes, 0=No	Hail		<a href="#">14</a>
017		1=Yes, 0=No	Fog or Ice fog		<a href="#">14</a>
018		1=Yes, 0=No	Smoke or Haze		<a href="#">14</a>
019		1=Yes, 0=No	Blowing Dust or Sand		<a href="#">14</a>
020		1=Yes, 0=No	Blowing snow		<a href="#">14</a>
021		1=Yes, 0=No	Wind speed >= 28 Knots		<a href="#">14</a>
022		1=Yes, 0=No	Wind speed >= 34 Knots		<a href="#">14</a>
179	0.1 hrs		Daily bright sunshine		<a href="#">42</a>

### 3.5 Daily climatological data from COOL (DLY44)

See Note 16 for additional information.

The following table presents the available element types for daily climatological data from the COOL observing program (DLY44) with corresponding units, code, description and numbered notes. The notes referenced in this table can be found in the [Notes](#) section of this document.

Table 6: Element number, units, code, description and notes for DLY44

Element	Units	Code	Description	Flags	Note
001	0.1°C		Daily max temperature		<a href="#">31</a>
002	0.1°C		Daily min temperature		<a href="#">31</a>
003	0.1°C		Daily mean temperature		<a href="#">31</a>
010	0.1 mm		Total rainfall		<a href="#">31</a>

Element	Units	Code	Description	Flags	Note
011	0.1 cm		Total snowfall		<a href="#">31</a>
012	0.1 mm		Total precipitation		<a href="#">31</a>
013	cm		Snow on the ground		<a href="#">8</a> , <a href="#">31</a> , <a href="#">Top of Page</a>
014-017 Day with... (DLY04 & DLY44)					
014		1=Yes, 0=No	Thunderstorms		<a href="#">14</a>
015		1=Yes, 0=No	Freezing rain or Drizzle		<a href="#">14</a>
016		1=Yes, 0=No	Hail		<a href="#">14</a>
017		1=Yes, 0=No	Fog or Ice fog		<a href="#">14</a>

### 3.6 Monthly climatological data (MLY04)

See Note 16 for additional information.

The following table presents the available element types for monthly climatological data (MLY04), with corresponding element number, units, description, flags and numbered notes. The flags and notes referenced in this table can be found in the [Table of flags](#) and [Notes](#) sections of this document.

Table 7: Element number, units, code, description, flags and notes for MLY04

Element	Units	Code	Description	Flags	Note
026-038 Number of days with...					
026			Frost	<a href="#">I</a>	<a href="#">25</a>
027			Thunderstorms	<a href="#">I</a>	<a href="#">25</a>
028			Rain or Drizzle	<a href="#">I</a>	<a href="#">25</a>
029			Freezing rain or Drizzle	<a href="#">I</a>	<a href="#">25</a>
030			Hail	<a href="#">I</a>	<a href="#">25</a>
031			Snow	<a href="#">I</a>	<a href="#">25</a>
032			Measurable precipitation	<a href="#">I</a>	<a href="#">25</a>
033			Fog or Ice fog		
034			Smoke or Haze		
035			Blowing dust or Sand		
036			Blowing snow		
037			Wind speed >= 28 knots		
038			Wind speed >= 34 knots		
039	whole cm		Snow cover - Last day of month	<a href="#">E</a> , <a href="#">I</a>	
040	0.1°C		Mean max temperature	<a href="#">E</a> , <a href="#">I</a>	<a href="#">26</a>
041	0.1°C		Mean min temperature	<a href="#">E</a> , <a href="#">I</a>	<a href="#">26</a>
042	0.1°C		Mean monthly temperature	<a href="#">E</a> , <a href="#">I</a>	<a href="#">26</a>
043	0.1°C		Mean monthly temperature difference from normal	<a href="#">E</a>	<a href="#">18</a>
044	0.1°C		Extreme max temperature	<a href="#">B</a> , <a href="#">E</a> , <a href="#">I</a> , <a href="#">S</a>	<a href="#">25</a>

Element	Units	Code	Description	Flags	Note
045			Date of extreme max temperature (earliest)		
046	0.1°C		Extreme min temperature	<a href="#">B</a> , <a href="#">E</a> , <a href="#">I</a> , <a href="#">S</a>	<a href="#">25</a> <a href="#">Top of Page</a>
047			Date of extreme min temperature (earliest)		
048	0.1 mm		Total rainfall	<a href="#">E</a> , <a href="#">I</a> , <a href="#">I</a>	<a href="#">25</a>
049	0.1 cm		Total snowfall	<a href="#">E</a> , <a href="#">I</a> , <a href="#">I</a>	<a href="#">25</a>
050	0.1 mm		Total precipitation	<a href="#">E</a> , <a href="#">I</a> , <a href="#">I</a>	<a href="#">25</a>
051	0.1 mm		Total precipitation difference from normal	<a href="#">E</a> , <a href="#">I</a> , <a href="#">I</a>	<a href="#">18</a> , <a href="#">25</a>
052	0.1 mm		Greatest rainfall	<a href="#">B</a> , <a href="#">E</a> , <a href="#">I</a> , <a href="#">S</a> , <a href="#">I</a>	<a href="#">25</a>
053			Date of greatest rainfall (earliest)		
054	0.1 cm		Greatest snowfall	<a href="#">B</a> , <a href="#">E</a> , <a href="#">I</a> , <a href="#">S</a> , <a href="#">I</a>	<a href="#">25</a>
055			Date of greatest snowfall (earliest)		
056	0.1 mm		Greatest precipitation	<a href="#">B</a> , <a href="#">E</a> , <a href="#">I</a> , <a href="#">S</a> , <a href="#">I</a>	<a href="#">25</a>
057			Date of greatest precipitation (earliest)		
058	10's of deg		Direction of extreme gust (16 pts) to December 1976	<a href="#">B</a> , <a href="#">E</a> , <a href="#">S</a>	<a href="#">9</a>
059	km/h		Speed of extreme gust	<a href="#">B</a> , <a href="#">E</a> , <a href="#">S</a>	<a href="#">9</a>
060			Date of extreme gust (earliest)	<a href="#">B</a> , <a href="#">E</a> , <a href="#">S</a>	<a href="#">9</a>
158	10's of deg		Direction of extreme gust (36 pts) from January 1977	<a href="#">B</a> , <a href="#">E</a> , <a href="#">S</a>	<a href="#">9</a>

### 3.7 Bright sunshine (HLY10)

The following table presents the available element type for Bright sunshine (HLY10), with corresponding element number, unit, description, flag and note. The flag and note referenced in this table can be found in the [Table of flags](#) and [Notes](#) sections of this document.

Table 8: Element number, units, code, description, flags and notes for HLY10

Element	Units	Code	Description	Flags	Note
133	0.1 hrs		Sunshine	<a href="#">E</a>	<a href="#">21</a>

### 3.8 Solar radiation (HLY11)

The following table presents the available element types for solar radiation (HLY11), with corresponding element numbers, units, description, flags and numbered note. The flags

and note referenced in this table can be found in the [Table of flags](#) and [Notes](#) sections of this document.



Table 9: Element number, units, code, description, flags and notes for HLY11

Element	Units	Code	Description	Flags	Note
061	0.001 MJ/m <sup>2</sup>		RF1 global solar radiation	<a href="#">D</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">22</a>
062	0.001 MJ/m <sup>2</sup>		RF2 sky (diffuse) radiation	<a href="#">D</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">22</a>
063	0.001 MJ/m <sup>2</sup>		RF3 reflected solar radiation	<a href="#">D</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">22</a>
064	0.001 MJ/m <sup>2</sup>		RF4 net all wave radiation	<a href="#">D</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	
067	0.01 Kilolux_hrs		RF7 daylight illumination	<a href="#">D</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">22</a>
068	0.001 MJ/m <sup>2</sup>		RF8 direct solar radiation	<a href="#">D</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">22</a>
169	0.001 MJ/m <sup>2</sup>		RF9 incident longwave radiation (shaded)	<a href="#">D</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	
170	0.001 MJ/m <sup>2</sup>		RFB emitted longwave radiation	<a href="#">D</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	
171	0.001 MJ/m <sup>2</sup>		RFC incident solar radiation – Green (PAR)	<a href="#">D</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">22</a>
172	0.001 MJ/m <sup>2</sup>		RFD incident solar radiation – Red (PAR)	<a href="#">D</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">22</a>

### 3.9 Solar radiation (MIN11)

The following table presents the available element types for solar radiation (MIN11), with corresponding element numbers, units, description, flags and numbered note. The flags and note referenced in this table can be found in the [Table of flags](#) and [Notes](#) sections of this document.

Table 10: Element number, units, description, flags and notes for MIN11

Element	Units	Code	Description	Flags	Note
200	0.1 W/m <sup>2</sup>		RF1 global solar radiation	<a href="#">D</a> , <a href="#">P</a> , <a href="#">R</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">35</a>
201	0.1 W/m <sup>2</sup>		RF2 sky (diffuse) radiation	<a href="#">D</a> , <a href="#">P</a> , <a href="#">R</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">35</a>
202	0.1 W/m <sup>2</sup>		RF3 reflected solar radiation	<a href="#">D</a> , <a href="#">P</a> , <a href="#">R</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">35</a>
203	0.1 W/m <sup>2</sup>		RF4 net all wave radiation	<a href="#">D</a> , <a href="#">P</a> , <a href="#">R</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">35</a>
204	0.1 W/m <sup>2</sup>		RF8 direct solar radiation	<a href="#">D</a> , <a href="#">P</a> , <a href="#">R</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">35</a>
205	0.1 W/m <sup>2</sup>		RF9 incident longwave radiation (shaded)	<a href="#">D</a> , <a href="#">P</a> , <a href="#">R</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">35</a>

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Element	Units	Code	Description	Flags	Note
206	0.1 W/m <sup>2</sup>		RFB emitted longwave radiation	<a href="#">D</a> , <a href="#">P</a> , <a href="#">R</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">35</a>
207	0.1 W/m <sup>2</sup>		RFC incident solar radiation - Green (PAR)	<a href="#">D</a> , <a href="#">P</a> , <a href="#">R</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">35</a>
208	0.1 W/m <sup>2</sup>		RFD incident solar radiation - Red (PAR)	<a href="#">D</a> , <a href="#">P</a> , <a href="#">R</a> , <a href="#">U</a> , <a href="#">V</a> , <a href="#">W</a> , <a href="#">X</a> , <a href="#">Y</a> , <a href="#">Z</a>	<a href="#">35</a>

### 3.10 Soil temperature (DLY12)

The following table presents the available element types for soil temperature (DLY12), with corresponding element numbers, units, description and numbered note. The note referenced in this table can be found in the [Notes](#) section of this document.

Table 11: Element number, units, description and notes for DLY12

Element	Units	Code	Description	Flags	Note
134-141 AM Soil temperatures at...					
134	0.1°C		1 cm		<a href="#">10</a>
135	0.1°C		5 cm		
136	0.1°C		10 cm		
137	0.1°C		20 cm		
138	0.1°C		50 cm		
139	0.1°C		100 cm		
140	0.1°C		150 cm		
141	0.1°C		300 cm		
142	whole cm		AM snow depth		
143-149 PM Soil temperatures at...					
143	0.1°C		1 cm		<a href="#">10</a>
144	0.1°C		5 cm		
145	0.1°C		10 cm		
146	0.1°C		20 cm		
147	0.1°C		50 cm		<a href="#">10</a>
148	0.1°C		100 cm		<a href="#">10</a>
149	0.1°C		150 cm		<a href="#">10</a>
150	whole cm		PM snow depth		<a href="#">10</a>

### 3.11 Pan evaporation (DLY13)

The following table presents the available element types for pan evaporation (DLY13), with corresponding element numbers, units, description and flag. The flag referenced in this table can be found in the [Table of flags](#) section of this document.

Table 12: Element number, units, description and flags for DLY13

Element	Units	Code	Description	Flags	Note
151	0.1 mm		Pan evaporation	<a href="#">E</a>	
152	km		Wind mileage	<a href="#">E</a>	
153	0.1°C		Water temperature	<a href="#">E</a>	
154	0.1°C		Air temperature	<a href="#">E</a>	
155	0.1 mm		Lake evaporation	<a href="#">E</a>	

### 3.12 Wind (HLY15)

The following table presents the available element types for wind (HLY15), with corresponding element numbers, units, description, flag and numbered notes. The flag and notes referenced in this table can be found in the [Table of flags](#) and [Notes](#) sections of this document.

The speed of motion of air in kilometres per hour (km/h) usually observed at 10 metres above the ground. It represents the average speed during the one- or two-minute period ending at the time of observation for aviation station.

For Aviation Weather Reports, a one minute mean of wind direction and speed was used until the late 1980s. The wind speed now represents the average speed during the two-minute period ending at the time of observation, for Aviation stations. The only historical 10 min mean wind are winds from the synoptic reports. Synoptic reports are only created four times a day: 12z, 18z, 00z, 06z.

Table 13: Element number, units, description, flags and notes for HLY15

Element	Units	Code	Description	Flags	Note
069	10's of deg		Direction - 45B anemometer (8 pts)	<a href="#">E</a>	<a href="#">11</a> , <a href="#">17</a>
070	km/h		Run per hour - 45B anemometer	<a href="#">E</a>	<a href="#">17</a>
076	km/h		Wind speed - U2A anemometer	<a href="#">E</a>	<a href="#">17</a>
156	10's of deg (see 075)		Direction - U2A anemometer	<a href="#">E</a>	<a href="#">17</a>

### 3.13 Precipitation (Fischer/Porter) data (FIF21)

The following table presents the available element types for precipitation (Fischer/Porter) data (FIF21), with corresponding element number, unit, description, flags and numbered note. The flags and note referenced in this table can be found in the [Table of flags](#) and [Notes](#) sections of this document.

Table 14: Element number, units, description, flags and note for FIF21

Element	Units	Code	Description	Flags	Note
159	0.1 mm		Precipitation	<a href="#">A</a> , <a href="#">K</a> , <a href="#">L</a>	<a href="#">39</a>

### 3.14 Precipitation (Fischer/Porter) data (HLY21)

The following table presents the available element types for precipitation (Fischer/Porter) data (HLY21), with corresponding element number, unit, description and flags. The flag referenced in this table can be found in the [Table of flags](#) section of this document.

Table 15: Element number, units, description and flags for HLY21

Element	Units	Code	Description	Flags	Note
123	0.1 mm		Hourly precipitation	<a href="#">H</a> , <a href="#">I</a> , <a href="#">J</a>	

### 3.15 Precipitation (Fischer/Porter) data (DLY21)

The following table presents the available element types for precipitation (Fischer/Porter) data (DLY21), with corresponding element numbers, units, descriptions and flags. The flags referenced in this table can be found in the [Table of flags](#) section of this document.

Table 16: Element number, units, description and flags for DLY21

Element	Units	Code	Description	Flags	Note
012	0.1 mm		Total precipitation	<a href="#">A</a> , <a href="#">C</a> , <a href="#">E</a> , <a href="#">F</a> , <a href="#">L</a> , <a href="#">I</a>	
127-132,161	Greatest amount of precipitation in...				
127	0.1 mm		15 minutes	<a href="#">H</a> , <a href="#">I</a> , <a href="#">J</a>	
128	0.1 mm		30 minutes	<a href="#">H</a> , <a href="#">I</a> , <a href="#">J</a>	
129	0.1 mm		1 hour	<a href="#">H</a> , <a href="#">I</a> , <a href="#">J</a>	
130	0.1 mm		2 hours	<a href="#">H</a> , <a href="#">I</a> , <a href="#">J</a>	
131	0.1 mm		6 hours	<a href="#">H</a> , <a href="#">I</a> , <a href="#">J</a>	
132	0.1 mm		12 hours	<a href="#">H</a> , <a href="#">I</a> , <a href="#">J</a>	
161	0.1 mm		24 hours	<a href="#">H</a> , <a href="#">I</a> , <a href="#">J</a>	

### 3.16 Soil temperature (HLY12)

The following table presents the available element types for soil temperature (HLY12), with corresponding element numbers, units, description and numbered note. The note referenced in this table can be found in the [Notes](#) section of this document.

Table 26: Element number, units, description and notes for HLY12

Element	Units	Code	Description	Flags	Note
320-326 Soil temperatures at...					
320	0.1°C		5 cm		<a href="#">45</a>
321	0.1°C		10 cm		
322	0.1°C		20 cm		
323	0.1°C		50 cm		
324	0.1°C		100 cm		
325	0.1°C		150 cm		
326	0.1°C		300 cm		

## 4.0 Upper air data (UAS/UAW)

### 4.1 Record formats and field description

Up until 2012, standard ASCII record formats exist for upper air data. These data are, archived at pressure levels, minute intervals or significant wind levels. Beyond 2012, upper air data are archived in a non-ASCII format, which is currently under review. For further information, contact [Regional Climate Services](#).

Each value in the standard record format is recorded as a five (5) digit integer preceded by a single field for the integer's sign field followed by a single alphabetic character for the datum's flag. The units and decimal positions are implied by the element number assigned to the record (see Table 18 below).

Each record consists of climate identification number, date, time and element number followed by the data, repeated for each level or time interval, from the lowest level to the termination of the ascent.

File organization is element within date and time (usually hours 00,06,12,18 UTC).

The two (2) types of record formats are as follows:

1. Ascent Record of Interspersed significant and Standard Level Data (UAS)





## 4.3 List and description of elements

### UAS Record

Table 17: Element number, units, description and notes for UAS

Element	Units	Description	Notes
181	0.01 kPa	Pressure	<a href="#">27</a> , <a href="#">30</a>
182	whole meters	Altitude above sea level	<a href="#">27</a> , <a href="#">30</a>
183	0.1 deg C	Temperature	<a href="#">27</a> , <a href="#">30</a>
184	%	Relative humidity	<a href="#">27</a> , <a href="#">30</a>
185	degrees	Wind direction	<a href="#">27</a> , <a href="#">30</a>
186	meters per second	Wind speed	<a href="#">27</a> , <a href="#">30</a>

### UAW Record

Table 18: Element number, units, description and notes for UAW

Element	Units	Description	Notes
187	0.01 kPa	Pressure	<a href="#">28</a> , <a href="#">30</a>
188	whole meters	Altitude above sea level	<a href="#">28</a> , <a href="#">30</a>
189	degrees	Wind direction	<a href="#">28</a> , <a href="#">30</a>
190	meters per second	Wind speed	<a href="#">28</a> , <a href="#">30</a>

## 5.0 Table of flags

Table 19: Flag, definition and applicable elements

Flag	Definition	Elements
blank	Valid data	all except 061-068, 169-172, 200-208
A	Accumulated amount; previous value C or L for elements 010, 011, 012 and K or L for elements 159	010, 011, 012, 159
B	More than one occurrence & estimated	044, 046, 052, 054, 056, 058, 059
C	Precipitation occurred, amount uncertain; value is 0	010, 011, 012
D	Derived	061-068, 169-172, 200-208
E	Estimated	all except 061-068, 169-172, 200-208, 262-280
F	Accumulated and estimated	010, 011, 012
G	Uncorrected	107-122, 219-230
H	Freezing	123, 125-132, 161
I	Unadjusted	123, 125-132, 161



Flag	Definition	Elements
I	Incomplete; month contains at least one missing value	026-032, 044, 046, 048-052
I	Incomplete; month contains 3 consecutive or 5 random missing values	040, 041, 042
J	Freezing and unadjusted	123, 125-132, 161
K	First occurrence when precipitation. May or may not have occurred; value is 0	159
L	Precipitation may or may not have occurred; value is 0 or 0.1	010, 011, 012, 159
M	Missing	all
N	Time uncertain	159
N	Temperature missing, but known to be ABOVE freezing	002
O	Not assigned	
P	Identified by automatic QC as suspect	200-208
Q	Not assigned	
R	Identified by automatic QC as erroneous	200-208
S	More than one occurrence	023, 024, 044, 046, 052, 054, 056, 058, 059, 157, 158, 209, 210
T	Trace; value is zero	006-013, 039, 048-052, 054, 056
U	Valid datum, unknown snow	061-068, 169-172, 200-208
V	Valid datum, no snow cover	061-068, 169-172, 200-208
W	Valid datum, with snow cover	061-068, 169-172, 200-208
X	Estimated, unknown snow	061-068, 169-172, 200-208
Y	Estimated, no snow cover	061-068, 169-172, 200-208
Y	Temperature missing, but known to be BELOW freezing	002
Z	Estimated, with snow cover	061-068, 169-172, 200-208

## 6.0 Notes

### Note 1: Element 083

This element indicates the presence or absence of any type of weather or obstruction to vision. This record will always be available with a code of 0 indicating no weather for the hour. When 1 is entered, one or more of elements 084-106,260 will be available. Records for elements 084-106,260 will be included only if the phenomena occurred on one or more hours. Some automatic climate stations used by Environment and Climate Change Canada are incapable of recording this element. For these climate stations, a value of zero is entered into the database as a default.

### Note 2: Elements 084-106 and 260

A '0' indicates the phenomena did not occur.

### Note 3: Elements 086-092, 094-098 and 244

1=Light; 2=Moderate; 3=Heavy

### Note 4: Elements 109, 113, 117, 121, 221, 225 and 229

Until 1994 the cloud types available for elements 109, 113, and 117, were limited to codes 0-16.

Table 20: Code, symbol and cloud type

<b>Code</b>	<b>Symbol</b>	<b>Cloud Type</b>
0		None
1	AC	Alto cumulus
2	ACC	Alto cumulus castellanus
3	AS	Alto stratus
4	CC	Cirro cumulus
5	CS	Cirro stratus
6	CI	Cirrus
7	CB	Cumulonimbus
8	CU	Cumulus
9	CF	Cumulus fractus
10	SF	Stratus fractus
11	TCU	Towering cumulus
12	NS	Nimbostratus
13	SC	Stratocumulus
14	ST	Stratus
15	F	Fog
16		Obstruction other than fog
17	R	Rain (any form including RW and ZR)
18	A	Hail
19	IP	Ice pellets (including ice pellet showers)
20	L	Drizzle (including freezing drizzle)
21	IC	Ice crystals
22	S	Snow (snow showers, snow pellets and snow grains)
23	BS	Blowing snow
24	D	Dust, blowing dust or duststorm
25	H	Haze
26	N	Sand, blowing sand or sandstorm
27	K	Smoke
28	VA	Volcanic ash

## Note 5: Elements 023 and 075

Table 21: 16 point, range and 10s of deg

16 point	Direction/Range	10s of Degrees
NNE	(012-033)	02
NE	(034-056)	05
ENE	(057-078)	07
E	(079-101)	09
ESE	(102-123)	11
SE	(124-146)	14
SSE	(147-168)	16
S	(169-191)	18
SSW	(192-213)	20
SW	(214-236)	23
WSW	(237-258)	25
W	(259-281)	27
WNW	(282-303)	29
NW	(304-326)	32
NNW	(327-348)	34
N	(349-011)	36
CALM		00

## Note 6: Element 071

Unlimited Ceiling has been assigned a value of 888.

## Note 7: Element 072

Table 22: Value in km and statute miles

Value (km)	Statute Miles
25.0	15+
15.0	9
0.0	0
0.2	1/8
0.4	1/4
0.6	3/8
0.8	1/2
1.0	5/8
1.2	3/4
1.6	1
2.0	1 1/4
2.4	1 1/2

<b>Value (km)</b>	<b>Statute Miles</b>
2.8	1 3/4
3.2	2
3.6	2 1/4
4.0	2 1/2
4.8	3
ETC	
159.3	99

### **Note 8: Element 013**

Daily snow depth is available since 1955 for about 300 primary and selected climate stations.

The record for this element will not be available if snow on the ground is reported only on the last day of the month. Last day snow depth is available from element 039 on the MLY04 file.

In 1981 many non-primary climate stations began to observe daily snow depth. Frequently, zero amounts are not entered on the document and are archived as missing. This deficiency is most evident after the last measured depth in the spring.

### **Note 9: Elements 058, 059, 060 and 158**

When no gusting occurs, the direction and speed are coded -99999M and the date shows as 000000b (b means blank).

### **Note 10: Elements 134, 143 and 147-150**

Elements 134 and 143 were gradually phased out beginning June 1966.

Elements 147-150 were discontinued June 1966.

### **Note 11: Element 069**

Table 23: 8 point, range and 10s of deg

<b>8 point Compass</b>	<b>Direction/Range</b>	<b>10s of Degrees</b>
N	336 -025	34 35 36 01 02
NE	026 -065	03 04 05 06
E	066 -115	07 08 09 10 11
SE	116 -155	12 13 14 15
S	156 -205	16 17 18 19 20
SW	206 -245	21 22 23 24
W	246 -295	25 26 27 28 29
NW	296 -335	30 31 32 33
CALM	000	00

## Note 12: Elements 107-122, 219-230

Effective May 1977, cloud layer data which failed quality control were not subjected to review or corrective action unless ceiling, total opacity and/or total amount was affected. Any failure caused all values to be flagged.

## Note 13: Elements 108, 112, 116, 120, 220, 224 and 228

Effective January 1977, the layer amount (in tenths) was replaced by a sky condition code.

Table 24: Code, sky condition, term and equivalent in tenths for codes from 0 to 10

Code	Sky Condition	Term	Equivalent in tenths
0	CLR	Clear	The sky condition when no cloud or obscuring phenomenon is present
1	-X	Partially Obscured	A surface-based layer with summation opacity of at least 1/10 but less than 10/10
2	-SCT*	Scattered (thin)	
3	SCT	Scattered	A layer aloft with a summation amount of 4/10 to 5/10 inclusive
4	-BKN*	Broken (thin)	
5	-OVC*	Overcast (thin)	
7	BKN	Broken	A layer aloft with a summation amount of 6/10 to 9/10 inclusive
9	X	Obscured	A surface-based layer with summation opacity of 10/10
10	OVC	Overcast	A layer aloft with a summation amount of 10/10

\*A layer aloft shall be described as "thin" when both:

- (a) The summation amount of the layer exceeds the summation opacity of the layer by 1/10 or more of the whole sky, and
- (b) The summation opacity of the layer is 5/10 or less of the whole sky.

## Note 14: Elements 014-022

At primary climate stations since 1955.

Elements 021 and 022 are available only if climate stations observe wind hourly.

Elements 014-016 are seldom available at other than primary climate stations prior to 1977. Since 1977 they are available but may be unreliable.

### **Note 15: Elements 006-009**

Six hourly precipitation totals ending at:

Table 25: Element number, to June 1961 and from July 1961

<b>Element</b>	<b>to June 1961</b>	<b>from July 1961</b>
006	1800z	1200z
007	0000z	1800z
008	0600z	0000z
009	1200z	0600z

### **Note 16: Elements of sections DLY02, DLY04, MLY04 and DLY44**

The following guidelines can be used to determine the times of observations and the endpoint of the climatological day for temperature and precipitation elements:

For climate stations operating on a 24 hour basis, since July 1, 1961, the climatological day for temperature and precipitation ends at 0600Z of the following day. From June 1, 1957 to June 30, 1961, the climatological day for precipitation and maximum temperature ended at 1200Z of the following day. The climatological day for minimum temperatures ended at 0000Z of the following day. Before June 1, 1957, the climatological day for precipitation and maximum temperature ended at 1230Z of the following day. The climatological day for minimum temperatures ended at 0030Z of the following day.

At locations with no hourly observations, observation times are generally morning and evening. In general, the climatological day for precipitation and maximum temperature ends at the morning observation of the following day. The climatological day for minimum temperatures ends at the afternoon observation of the current day. For sites reporting only once per day, the calendar day rather than climatological day applies.

In cases where knowing time-of-observation is critical, the best approach is to check the historical inspection reports for the climate station. For further information on climate station inspection reports, please contact the regional applied climatology services office for the location of interest: [https://climate.weather.gc.ca/contactus/climate\\_services\\_e.html](https://climate.weather.gc.ca/contactus/climate_services_e.html)

### **Note 17: Elements 069, 070, 075, 076 and 156**

Wind data are available in either the HLY01 or HLY15 data sets. U2A anemometer winds, from climate stations which also observe other elements, are archived in the HLY01 data

sets. Currently, these data are from the SA type message or form 2322. The HLY15 data sets are primarily 45B anemometer winds. However, climate stations equipped with U2A and reporting only winds are included.

The speed of motion of air in kilometres per hour (km/h) usually observed at 10 metres above the ground. It represents the average speed during the one- or two-minute period ending at the time of observation for aviation station.

For Aviation Weather Reports, a one minute mean of wind direction and speed was used until the late 1980s. The wind speed now represents the average speed during the two-minute period ending at the time of observation, for Aviation stations. The only historical 10 min mean wind are winds from the synoptic reports. Synoptic reports are only created four times a day: 12z, 18z, 00z, 06z.

### **Note 18: Elements 043 and 051**

These differences from normal are available from 1977 to 1993. The 1941-1970 normals were replaced by the 1951-1980 normals with the processing of January 1982 data.

### **Note 19: Elements 107-122 and 219-230**

If a cloud observation is taken, the four elements of the lowest (or only) layer are entered in the archive. If there is no cloud, the height is assigned a value of 888 and the other elements of the layer are zero. The second to fourth/sixth (see [Note 29](#)) layers are archived only if cloud is reported.

### **Note 20: Element 124**

A factor applied to the hourly and duration amounts to bring them in line with the daily total measured with a standard MSC precipitation gauge. This element is available since 1978.

### **Note 21: Element 133**

Records are not included during the periods of polar night.

### **Note 22: Elements 061-063, 067, 065-068, 171 and 172**

Periods of polar night are indicated by a data value of -00000 (literally: minus zero).

### **Note 23: Elements 100 and 260**

Observations of Element 100 (IF) discontinued November 1, 1999. Observations of Element 260 (FZFG) commenced November 1, 1999.

## **Note 24: Element 093**

Between February 20<sup>th</sup>, 1995 and November 2000, observations of IC (ice crystals) at temperatures greater than -16°C were automatically changed to S- (light snow). Thus, archived occurrences of S- at temperatures >-16°C may have originally been reported as IC.

## **Note 25: Elements 026-032, 044, 046, 048-052, 054 and 056**

Beginning in 1994, values derived for these elements were flagged with "I" for incomplete if the month contained one or more missing daily values.

## **Note 26: Elements 040-042**

Beginning in 1994, values derived for elements 040, 041 and 042 were flagged with "I", denoting incomplete, if the month contained more than 3 consecutive missing daily values or more than 5 missing daily values in total for the month.

## **Note 27: Elements 181-186**

- Data for significant and standard levels are interspersed in descending pressure sequence.
- If any data are available for an ascent, all six (6) records are included.
- The first level at which temperature is available represents the surface weather observation.
- For standard pressure levels exceeding the station pressure, only the altitude is given, and may be negative.
- The termination of an ascent is indicated by a value of -99999M in the pressure record (element 181).
- Prior to ADRES, wind direction and speed (elements 185 and 186) are only available for standard levels.
- Prior to 1969 the surface pressure is in tenths of kilopascals.
- ADRES was implemented between June 1980 and May 1981. Each record carries a code indicating the source of the data.
- Prior to ADRES the altitude is available for standard pressure levels only.
- After the installation of ADRES, pressures for significant levels are in hundredths of kilopascals.
- The available standard levels vary, but will be from the following list:

100.00, 95.00, 90.00, 85.00, 80.00, 75.00, 70.00,

65.00, 60.00, 55.00, 50.00, 45.00, 40.00, 35.00, 30.00,

25.00, 20.00, 17.50, 15.00, 12.50, 10.00, 8.00, 7.00,

6.00, 5.00, 4.00, 3.00, 2.50, 2.00, 1.50, 1.00,



0.70, 0.40, 0.30, 0.20 kPa.

- 2.50 kPa surface available since mid-1957
- 7.00, 0.30, 0.20 kPa surfaces available from January 1961
- 95.00, 75.00, 65.00, 55.00, 45.00, 0.30, 0.20 kPa surfaces are not available after ADRES installed at the station.

### **Note 28: Elements 187-190**

Two types of data are available depending on the period. Before the implementation of ADRES at the station, significant wind level data are recorded with altitude, direction and speed available (elements 188, 189 & 190). After the implementation of ADRES, winds are recorded at minute intervals with pressure, altitude, direction and speed available (elements 187, 188, 189 & 190). The termination of the ascent is indicated by a value of -99999M in the altitude record (element 188).

### **Note 29: Elements 107-122 and 219-230**

The Manual of Surface Weather Observations (MANOBS) allows up to six cloud layers from manned climate stations and five from Automated Weather Observing System (AWOS) stations (a ground-based layer plus four layers aloft). In the past, an algorithm was used to compress the layers into a maximum of four layers to be stored in the archive. With the introduction of elements 219-230, all layers are available in the archive since 1994. The compressed fourth layer (element 119-122) will continue to be populated to support legacy applications.

### **Note 30: Elements 181-190**

RS80 radiosondes have been replaced by RS92 radionsondes. The switchover began in October 2005 and was completed in June 2006.

The following GENOT was issued on October 14, 2005 reflecting the date/time as to when the switchover took place: NOCN01 CWAO 141830 and GENOT TLTP. NO. 139.

### **Note 31: Elements 001-003 and 010-013**

In 2004, the MSC developed a web-based application called COOL (DLY44) to collect climate information from volunteer and cooperative observers (originally part of the Temperature and Precipitation Climate Observer Network) with access to internet-enabled computers. Observers that do not have access to the internet enter their observations via a touch-tone reporting system called ONTAP-IVR.

COOL observations include maximum and minimum temperatures, rainfall, snowfall, and snow depth data. Observations are taken once or twice a day.

## Note 32: Elements 209 and 210

Wind character and wind gust speed are acquired at a height of 10 m. These elements are reported since 1994 and have been added to the archive in January 2006.

## Note 33: Elements 262-280

Additional RCS elements were added to the archive in January 2006. Prior to December 10<sup>th</sup>, 2013 quality checks were not performed at the ingest stage and the status of the data is "R" (raw). From December 10<sup>th</sup>, 2013 onward basic automatic quality assessment of the data is being performed at the ingest stage and the status of the data is "Q".

### Element description:

**262-270:** Prior to 2007 the precipitation gauge weight (elements 267-270) was derived by using a weighing type gauge. The weights are computed for each minute of the hour based on a 9-minute *boxcar*\* average. The precipitation gauge weight is computed for a given minute (15, 30, 45, 60) in units of kg/m<sup>2</sup> and stored with a resolution of 0.1 kg/m<sup>2</sup>. Units of kg/m<sup>2</sup> equate to mm. As of 2007 onward, 9-minute *boxcar*\* averages are no longer used and precipitation gauge weight is computed using 5-minute filtered averages ending at the four times listed above.

The quarter-hour total precipitation amounts (elements 263-266), are derived over 15-minute intervals (00-15, 15-30, 30-45, 45-60) by taking the difference of the gauge weight between the end and start of each period. The total hourly precipitation (element 262) is the total precipitation amount for minutes 00 through 60, inclusive, computed as the sum of the four 15-minute precipitation amounts. Precipitation amounts are stored in mm with a resolution of 0.1 mm.

**271-274, 279-280:** The 15-minute average wind speed at the height of the precipitation gauge (approximately 2 meters) (elements 271-274) is averaged over a 15-minute interval (00-15, 15-30, 30-45, 45-60). The average for the interval is computed as the mean of the 15 minutely averages. The wind speed is observed in m/s or nautical mile per hour and is archived in km/h with a resolution of 0.1 km/h. The average wind direction at the height of the precipitation gauge (element 279), at the top of the hour (minutes 50-60), is computed using a vector algorithm where the average north and east vectors are converted to a direction in degrees true, with a resolution of whole degrees. The average wind speed at the height of the precipitation gauge (element 280), at the top of the hour, is averaged over the interval of minutes 50-60. This element is observed in m/s or nautical mile per hour and will be archived in km/h with a resolution of 0.1 km/h.

**275-278:** Prior to 2007, the snow depth element was the depth of snow on ground computed for a given minute (15, 30, 45, 60) based on a 9-minute *boxcar*\* average for that minute. It is stored in whole cm with a resolution of 1 cm. As of 2007 onward, 9-minute *boxcar* averages are no longer used and snow depth fields are computed using 5-minute filtered averages ending at the four times listed above.

**boxcar\*** - (definition) A moving average computed for each minute, based on 9 minutely average values preceding each target minute.

### **Note 34: Element 023**

During the period of 1955 and 1966, “S” flags were used for element 023, direction of extreme wind gust. The “S” flag indicated that the hourly peak wind gust value occurred more than once within that day.

### **Note 35: Elements 200-208**

Flags P (suspect) and R (erroneous) only apply to minutely solar radiation data processed by a new automated solar radiation system implemented in 2005. These flags only apply to data that has a status of raw, meaning that suspect/error flags assigned to the data during automatic QC have not yet been cleared or corrected by manual interactive QC. These two flags allow the user to make their own determination of whether the data quality is appropriate for their application. Data values which have a status of Q (quality controlled), and therefore no P or R flag, have passed both automatic QC as well as any manual QC required to inspect and/or correct suspect/erroneous data.

### **Note 36: Elements 125-132**

Rate of rainfall data for the period 1996-1999, provided by the “[Ministère du Développement durable, Environnement et lutte contre les changements climatiques](#)”, presented a few irregularities. This only affects data for climate stations located in the province of Québec. These rare occurrences present rate of rainfall data (complete or partial) that are not supported by hourly precipitation for the corresponding period. The standard gauge value might also be missing. In these circumstances, the rate of rainfall data are flagged as "I" (unadjusted).

### **Note 37: Elements 011-013**

Because the sections of the synoptic message pertaining to elements 011, 012 and 013 are not mandatory, they may be omitted from the message. When the data are ingested into the database, the missing message is replaced by a zero. For these elements, a zero may therefore indicate that the observed value was zero or that the relevant portions of the synoptic message were not transmitted.

### **Note 38: HLY01 elements**

Special SPL01 observations, recorded at times outside the regular schedule, are made for HLY01 elements at some stations. Note that SPL01 observations are not reported for RCS elements (elements 262-280).

### **Note 39: Element 159**

Data for element 159 is formatted with a three (3) digit year in the ASCII files.

## Note 40: Element 072

Due to different observation standards, the maximum visibility that can be recorded by manned climate stations is 15 statute miles, while the maximum for AWOS stations is 9 statute miles. A value of 15 (for manned climate stations) or 9 (for AWOS stations) may mean that the actual visibility value exceeded that amount.

## Note 41: Element 025

This element is reported in UTC after 1961 and in LST prior to 1961. For information on the date a specific climate station switched from LST to UTC, please contact [Regional Climate Services](#).

## Note 42: Element 179

The program responsible for reporting daily bright sunshine was no longer operational as of July 1, 2005.

## Note 43: Element 244

The Precipitation – Unclassified type element was implemented in 2009 and exists for AWOS stations. It represents precipitation of varying intensities that has been detected by a sensor, however, the sensor was unable to classify the specific type as either a form of liquid, freezing or frozen precipitation. Basic quality control is not performed at the ingest stage. As a result, the status of the data is “R” (raw).

## Note 44: Elements 108, 112, 116, 120, 220, 224 and 228

Since 2010, manned climate stations that became NCHWOS stations report only individual cloud layer amount, i.e. not a total of the reporting layer amount and layers below. The amount is observed in octas and is converted to sky condition code for reporting. Also, reported layer amount excludes any obscuration which is reported under weather.

Element	Unit	Description	Flag	Note
108/112/116/120/220/224/228	Tenths/Code	Amount or condition	G	12, 13, 19, 29, 4

## Note 45: Element 320-326

On or before 2008, DLY12 stopped observing and created a gap in coverage, and then the HLY 12 began in 2020.

## Note 46: Element 123

There is a change in the archiving of the HLY03, in that the new hourly amounts come from the sum of the minutely amounts, and is missing if there are no observation over the hour, whereas in the past the value would have been 0 mm if the tipping bucket rain gauge was operating.

## 7.0 Document Version

Reference Number	Date of Edit Request	Date of Edit	Date of Release to Website	Details of Edit(s)
1.0	2016-11-01	2017-01-30	2017-02-15	To convert online Technical Document into a PDF document. This should also include revision of graphics, numbered sections, definitions and other updates for clarity.
2.0	2017-04-10	2017-04-10	2017-04-18	1. To add "Top of the page" links throughout the document for better navigation.  2. To modify the spacing after paragraphs so that the hyperlinks link directly to the titles.
3.0	2018-05-01	2018-10-30	2019-06-20	Updated for the new dailies. Reference mantis item 10727.
4.0	2019-07-18	2020-10-27	2021-01-14	Updated wind data information on Section 3.12 and Note 17.
5.0	2021-01-11	2021-02-18	2021-04-07	Added Section 7.0 Document Version, and edited Note 44.
6.0	2022-01-11	2022-01-11	2022-03-02	Updated Contacts on Note 16, Note 41, section 2.1 and 4.1.
7.0	2022-05-17	2022-06-28	2022-09-14	Added Section 3.16, Note 45 and Note 46.
8.0	2022-10-13	2023-01-16	2023-02-07	Added drifting snow (DRSN) element.