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Naming convention for climate and observation data

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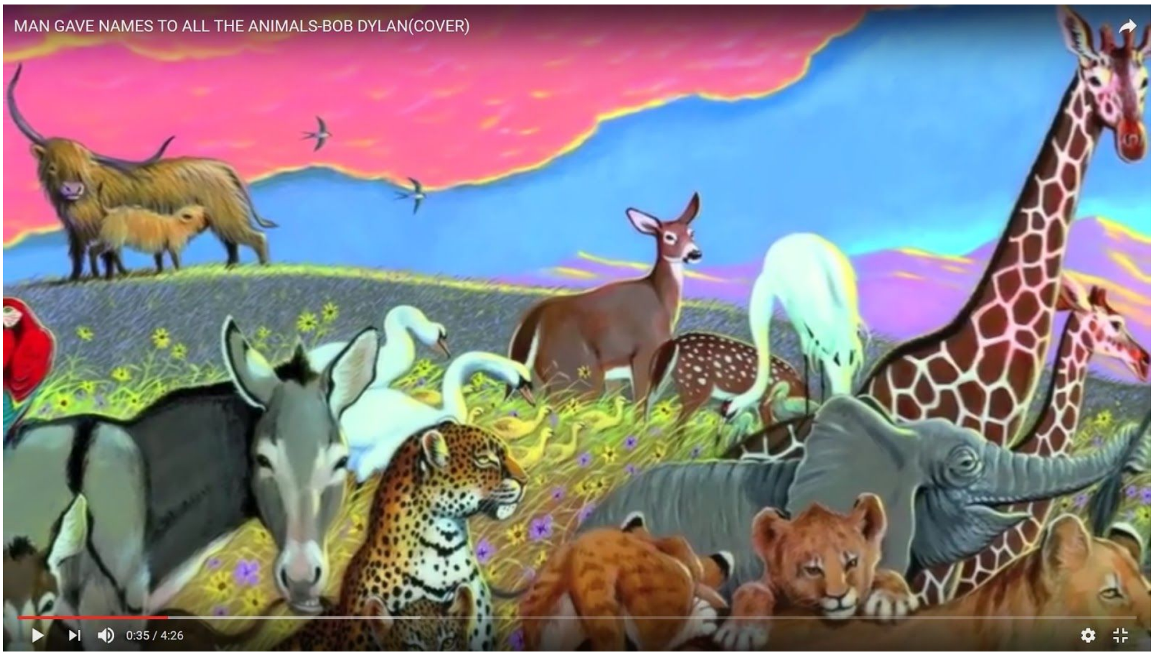

The illustration on the front page is a screen dump from YouTube[1] of the famous song of Bob Dylan "Man gave name to all the animals". The song came to our mind when constructing element identifiers in the new naming convention and became a humoristic way to see our work.

[1] https://www.youtube.com/watch?v=pdrkZU3jM3Y

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Abstract

A goal for the new naming convention for observations and climate data is to have names that are self-descriptive and easily understood. Therefore we decided to use the CF (Climate and Forecast) metadata convention if possible, and suggest new CF standard names whenever the convention does not cover the observed weather elements. The CF standard names do not cover our need of defining the time aspect of a phenomenon or how the statistical weather elements were generated, but the cell method and time aspect in the NetCDF format can be used. We therefore attempt to expand the naming convention with function based names to get unique element identifiers. The derived elements are therefore described with names as functions of standard names with respect to periods. The periods are named as an ISO-term. All in all the naming convention has a structure that makes us independent of observation station-specific installations as sensor number, sensor height- or depth and how the data are stored. The time series described by the metadata in the new convention can easily be stored as NetCDF files or distributed in other formats and can be used for interoperable solutions using international standards.

Keywords

Weather observations, climate data, weather data, element name, element identifier, parameter, element, metadata, observation, weather element, CF convention, name convention, naming convention.

Disciplinary signature

Responsible signature

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Background

Norwegian Meteorological Institute (MET Norway) has practiced a free data policy since 2007, meaning that all data are free with a license from Creative Common (CC By 4.0[2] to use, share and adapt if you give appropriate credit). Even though we have an open data policy, not all data are easily understood or easy to access for the users. To make a new naming convention which is self descriptive for all our observations and climate data is assumed to help the users to a broader use of the data and assumingly generate more benefit in the society.

All institutes seem to have their own naming convention for observed atmospheric and oceanographic elements (also called variables or parameters, but in this report we will use elements and element identifier). Even at MET Norway we have a few conventions for different kinds of data. This means that data are not so easy to combine because of the different names, and possibly gives a different understanding of what the elements represent. It is a very large variety of instruments and how the measurements are treated. For climate data elements it is even more complex, because of the different statistical functions that are used to derive the climate data.

The element identifiers are crucial to structure the data, and to discover the geophysical content of data. In the work to establish a new API (application programming interface) for the observations and climate data we had the opportunity to do something with this naming convention. The goal was also that this naming convention would be valuable as a metadata structure when the work on restructuring the database start.

This report is about the work on establishing a naming convention and establish element identifiers that are easy to use. Key issues are:

- Self-descriptive / readable for people: The user should be able to read an element identifier and understand what it means. This reduces the risk of misunderstanding and incorrect use of data.
- Consistency: The same name will always mean the same in all contexts, different names will always mean different things (i.e. not two names for the same thing).
- Dimensions like time, place and space for a parameter (observation) is not part of an element identifier (for example, the height temperature is measured in).
- User friendly for a variety of audiences, including people who are not professionals in geosciences.
- Generally keep the users and their API usage in mind.

[2] https://creativecommons.org/licenses/by/4.0/

Choosing a naming convention

There is no common international naming convention for all types of observations and climate data, but different standardisation initiatives exist and some are explored here.

The following naming conventions have been considered and discussed in this project:

- WMO conventions
    - "Codes registry"
    - BUFR element name
    - WIGOS
- Existing convention already in use at MET Norway
- Conventions used by other MET institutes
- The conventions for CF[3] (Climate and Forecast) metadata
    - As extended standard names where information as maximum and mean etc are added to the plain standard name, e.g. max_of_mean_air_temperature, date_of_max_of_mean_air_temperature.
    - As plain standard names, e.g. air_temperature, where additional information as maximum and mean, must be handled by one or two levels of cell_methods

"Pros and cons" of different conventions

WMO codes registry

WMO (World Meteorological Organisation) has a name convention for meteorological parameters called WMO codes registry[4].

At the time when we explored and selected a name convention, the WMO codes registry had only 20 standard names available. The convention was developing slowly, most likely due to lack of resources. 20 standard names covered very little of our need, and the convention had no guidelines for constructing new standard names that we could use.

[3] http://cfconventions.org/
[4] WMO codes registry: http://codes.wmo.int/_common

WMO BUFR element name

WMO BUFR format is a binary format for observation data. The BUFR table B[5] lists each element as a unique number with a short element description and a few other parameters. The element descriptions are not designed as unique keys, but in combination with other parameters in the BUFR format (unit, scale, reference value, and data width), it seems feasible to uniquely derive names for all elements.

The convention includes several important parameters

1. Level parameters, e.g. "Height of sensor".
2. Time period of the observation, e.g. "-12" for the sum of precipitation last 12 hours.
3. BUFR element identifier as text strings, which are practically unique. Sometimes they include footnotes. We have considered using the BUFR element identifier and set up some specific rules to handle footnotes and commas.

No template in the BUFR format covers observations from parallel sensors. However, we could define an additional efficient sensor identity/number that covers our need. (There may exist an efficient parameter as part of the parameters for instrumentation that could be used.)

Advantages of using the WMO BUFR elements as naming convention

1. BUFR is specifically designed to manage observation data. This is probably the convention that covers our need best, about 75 % of our data set
2. MET Norway will always relate to WMO and WMO standards
3. MET Norway already receives and sends observations in BUFR-format. These observations are processed and converted to MET Norway's internal format.
4. Several employees at MET Norway already has experience with mapping between the BUFR format and MET Norway's internal format, and therefore knows the BUFR format well.

Disadvantages of using the BUFR element identifiers as naming convention

1. Name needs to be derived from the element description.
2. The unique element number with 6 digits that specifies each element is not easily readable, and is inefficient for our purpose
3. There are no public guidelines for creating new element identifier

[5] http://www.wmo.int/pages/prog/www/WMOCodes/WMO306_vI2/LatestVERSION/LatestVERSION.html

4. It does not exist leement identifiers for statistically derived products such as monthly mean air temperature etc.
5. A naming convention based on BUFR would not harmonize with gridded data in netcdf format.

WIGOS

The WMO standardisation in WIGOS have done a quite large job in setting the standard of constructing identifiers for stations throughout the world. MET Norway has already implemented the WIGOS-identifiers for ground stations as an identifier. The standardisation principle in WIGOS about attributes that describe the observation system as for example the “performance” is also implemented.

The standardisation work in WIGOS for identifiers of the weather parameters have been developed on many of the remote sensing parameters. At the time we started to look for a standardized way of denoting the different type of surface sensor observations or derived statistical parameters we could not find enough proper information from WIGOS.

We concluded to construct a naming convention, that easily could link to other standards, where WIGOS seem to be the most important in the future.

Existing name convention at MET Norway

The identifiers which are currently used at MET Norway to denote the different type of surface sensor observations or derived statistical parameters are short codes (hereafter called old element codes). Examples are “RR” for precipitation amount and “FF” for wind speed (see more examples referenced to as old element code, in the Appendix “List of elements”). The old element codes are short and handy for those who already know the codes, but the codes are far from intuitive nor self-explaining.

The current element code convention at MET Norway consists of several parts, e.g.:

- The letter “M”, “N” and “X” in the end of the element code meaning the mean, minimum and maximum functions, but with limited access to information about the function i.e: “max over what”.
- For parallel sensors, the elements have an “X<parallel sensor number>” as prefix. If the valid time period of the element is not the default, the suffix “_<number of hours>” is added at the end of the name e.g“RR_1” means the precipitation sum last hour.

- For shorter time spans the names use to end with an underscore and number of hours or a leading 0 in front of number of minuter, where e.g. “TA_010” means air_temperature with a time frequency of 10 minutes
- For time spans of days or longer, no suffix specifies the time span, and the element codes are the same for all these time spans. E.g. monthly mean and annual mean air temperature are both called “TAM”.
- If the same type of observation are measured at different heights or depths, the non-default height/depth is added at the end of the element code e.g. “FF2” wind speed in 2 meter height. Default height/depth may vary between observation sites (the user had to know the sensor system at the station)

The existing naming convention does not fulfill the goal of a new convention that the element identifiers should be intuitive, self-explaining and easily understood.

Naming conventions at other MET institutes

We have been in contact with some MET institutes in Europe, to learn about their naming convention for their climate and weather data. Some of them answered and gave us a valuable view of the different aspects to take into account. They all use different name conventions and gave us inspiration to building up a convention.

UK MetOffice[6] is adopting the CF convention as basis for their metadata for some climate variables. They have supplemented with their own more descriptive short names. The shortname is comprised of the temporal resolution (daily/monthly) and a simple variable name. The «historic name» are codes, but these are being retired in favour of more readable short names.

At MeteoSwiss[7] they use a systematic code with 8 letters corresponding to different meanings:

- The first (1.) letter for a certain category of observation
- 2.-3. letter for specific description of observation
- 4.-6. letter generally for height of sensor
- 7. letter for time resolution
- 8. letter for statistical method

At SMHI[8] they use descriptive names and time resolution for their public products[9], e.g.

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[6] Mark McCarthy and Dan Hollis, UK MetOffice, Great Britain.
[7] Estelle Gueter, MeteoSwiss, Switzerland.
[8] Sverker Hellström, SMHI (Swedish Meteorological and Hydrological Institute), Sweden.
[9] SMHI’s public data portal: http://opendata-download-metobs.smhi.se/explore/

"air temperature, mean, monthly value", "precipitation, monthly sum" etc. The WMO BUFR element names are used for the observations together with a lot of metadata regarding time stamps and different aspect of the observation. They map from the numerical "FXY code", to the parameter names, using the FM 94 BUFR code table B[10].

At FMI[11] they also use element identifiers based on a combination of codes. It is derived from <weather parameter>_<time span>_<method>. Examples are TA_PT1H_AVG for hourly mean temperature, and PRA_P1M_SUM for monthly sum of precipitation amount. The time specification follows the ISO 8601 standard. The interval of observations, e.g. observed every 6th hour, is not specified in the code name, but kept as separate information. The observation level/height and standard height is also stored in separate variables.

The naming convention used at FMI inspired us to represent the time span in the short and concise ISO 8601 format, and distinguish the method as a separate part of the element identifier.

CF convention and CF standard names

The Climate and Forecast (CF) convention as well as the data file format[12] NetCDF[13], are widely used at MET Norway and by geophysicists in general. It is typically used for gridded data in numerical weather prediction, climate modelling, data distribution and flexible data archives. It can also be used for time series from a specific point location.

We see several advantages of using the CF convention and CF standard names:

1. The CF standard name table[14] covers a significant part of our needs for element identifier, and more than WMO codes registry.
2. There are guidelines[15] for construction of new CF standard names.
3. There is an active community[16] where new CF standard names can be proposed. There is also an open list of proposal status[17].

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[10] WMO International Codes - Migration to Table-Driven Code Forms (TDCF) http://www.wmo.int/pages/prog/www/WMOCodes.html
[11] Anna Frey and Minna Huuskonen at Finnish Meteorological Institute (FMI), Finland.
[12] https://www.unidata.ucar.edu/software/netcdf/
[13] https://en.wikipedia.org/wiki/NetCDF
[14] http://cfconventions.org/standard-names.html Use the HTML link to search for names in the standard, currently (May 2017) version 44
http://cfconventions.org/Data/cf-standard-names/44/build/cf-standard-name-table.html
[15] http://cfconventions.org/Data/cf-standard-names/docs/guidelines.html
[16] Mailing list for discussions and proposals:
http://mailman.cgd.ucar.edu/mailman/listinfo/cf-metadata
[17] Status of CF standard name proposals:
http://cfeditor.ceda.ac.uk/proposals/1?status=all&namefilter=&proposerfilter=&descfilter=&unitfilt

4. CF standard name convention is already in use for gridded data in NetCDF format at MET Norway, giving us in-house-resources of experience.

For easier comparison of the default naming conventions, we have created a table to compare pros and cons of the conventions.

Table 1: Strengths and weaknesses of the naming conventions regarding different assessment criteria

Criteria	BUFR element name	CF standard names
Stick to the WMO community and their conventions	+	-
Reasonable size of community using the convention in similar ways	-	+
Development and activity in community	-	+
Available software tools for reading data	-	+
Guidelines for constructing new names	-	+
Official explicit standard convention	-	+
Commonly used in climate and forecast research community	-	+
Compatibility with Opendap and thredds server (used at MET Norway)	-	+
Compatibility with gridded data files used at MET Norway	-	+
Computer readability	-	+
Possible to construct new names that later could be a part of the standard	-	+

The table above quite clearly favor using the CF convention.

We have considered a few alternative ways to implement the CF convention. To illustrate the differences and challenges we describe the example of “monthly mean of daily maximum air temperature” (at MET Norway currently called TAXM). Such derived statistical products from observations, are generally not part of the CF standard names. (The time specification follows ISO-8601[18] where 1 day and 1 month is P1D and P1M, respectively.)

er=&yearfilter=&commentfilter=&filter+and+display=Filter

[18] https://en.wikipedia.org/wiki/ISO_8601#Durations

We have evaluated four alternatives:

1. air_temperature_monthly_mean_ of_daily_maximum
2. air_temperature_mean_of_maximum,
   time_span_1 = P1D, time_span_2 = P1M
3. air_temperature,
   cell_method = time: max within day, cell_method = time: mean over month,
   time_span_1 = P1D, time_span_2 = P1M
4. mean(max(air_temperature P1D) P1M)

Alternative 1 gives a quite long but readable element identifier. Neither the element name nor the term monthly_mean_of_daily_maximum are part of the CF standard names. The time specification is not easily readable for machines, although the time could also be set in separate time parameters (time bounds).

Alternative 2 gives a shorter element identifier and the time specification is moved to separate time parameters.

Alternative 3 has a CF standard name, air_temperature, and the classic cell_methods of the NetCDF format, that defines the time spans of “mean” and “maximum.

In alternative 2 and 3 the time specifications are put in separate time parameters apart from the name. This means that the user needs to keep track of which time parameter belongs to which statistical method, e.g. “mean of max”. We need to distinguish between “mean of max” and “max of mean”. We are sceptical whether two separate time parameters would be intuitive to the user.

Another consequence of two separate time parameters in alternative 2 and 3, is that the same time spans would apply to all elements in the same API request. Mixed sets of time spans would require separate API requests. We consider this lack of flexibility a disadvantage.

Alternative 4 contains the same information as 3, but the cell methods and time spans are included in the element identifier as functions and arguments. This gives a compact element identifier. It allows flexibility in API request, as elements with different time spans can be included in the same request. This is a missing functionality in the current convention. It makes it clear to the user which time span belongs to which (statistical) method. To specify by name what calculation method that has been applied to the element standard name, also seem to be an advantage when reconstructing the database, because the actual calculation method could be applied in the processing of the data itself.

Alternative 3 and 4 would make it feasible to adopt a lot more CF standard names as element identifiers although it would require a variety of cell methods to name all our climate data products. CF compliant cell methods are not allowed to change the unit of the standard name.

Conclusions

This chapter describes why we choose the CF convention and CF standard names, and the alternative 4 for how the identifiers of the elements are constructed.

No standard naming convention covers our entire need for weather elements in MET Norway's observation and climate database. Since no convention covers all the needs, guidelines for how to construct element identifiers are important.

Based on all the considerations discussed above, we believe that the CF standard name convention is the best choice. It has a large set of well defined elements with standard names, descriptions and guidelines for construction of new names and an active panel discussing and approving new standard names. We believe that the chances are high that proposals of new standard names according to the CF guidelines will be considered and approved in the future. Since the CF convention mainly focus on climate and forecast data, it is a good choice in order to ensure interoperability of data across different data sources.

We have considered alternative ways to apply the CF convention and CF standard names in the element identifier. Our view is that the best alternative is alternative 4; to use CF standard names as far as possible, and use functions with time span that corresponds to the CF cell_method and time bound. A schematic overview the naming convention according to alternative 4:

Combination	**Example**
<*base name*>	air_temperature
<*method*>(<*base name*> <*period*>)	mean(air_temperature PT1H) best_estimate_sum(precipitation_amount P1M)
<*method*>(<*inner method*>(<*base name*> < *inner period*>) <*period*>)	mean(max(wind_speed P1D) P1M)
<*method*>(<*inner method*>(<*base name*> < *inner period*>) <*period*> <*threshold*>)	integral_of_excess(mean(air_temperature P1D) P1M 17.0)

The components in the element identifier are defined as follows:

Component	Description
base name	The primary quantity. Normally this is a basic physical quantity. It is normally a standard name in accordance with the CF standard name table or CF guidelines for construction of standard names.
method	The main method (function), applied either directly to the primary quantity or indirectly via an inner method.
inner method	The inner method (function), applied directly to the primary quantity and used as argument to the main method.
period	The period over which the main method is applied. This is an ISO 8601[19] duration such as P1D (one day) or P1M (one month).
inner period	The period over which the main method is applied. Also an ISO 8601 duration.
threshold	A threshold applicable to the main method.

Functions with parentheses are formally not part of the CF convention and standard names. We recommend to use an algorithm replacing the parentheses and white-spaces with underscore to produce CF compliant unique variable names. The necessary denotation of cell_methods has been implemented and time bounds could be derived from the identifier.

At this stage, MET Norway will use this element naming convention in a JSON API to make a data discovering service, so right now we don't have all the CF specific attributes specified. If the user wants to generate a CF compliant product based on data using this convention, they have to set the correct time bounds.

[19] https://en.wikipedia.org/wiki/ISO_8601#Durations

Implementation

The element construction process

In this chapter we give a short outline of the procedure when constructing element identifiers.

When we attempted to use existing CF standard names, the procedure was to:

- Explore the standard names in the database using a dump of the CF standard names into our own database, or by using the WEB user interface: http://cfconventions.org/standard-names.html, and find reasonable names.
- Check that the original elements and the standard names had comparable units.

If it is not possible to use existing CF standard names we construct new standard names:

- Using the construction guide http://cfconventions.org/Data/cf-standard-names/docs/guidelines.html
- Exploring the standard names in the CF database to find similar terms used already by other elements, striving to construct names that could be approved by the CF panel.

The new naming convention should also cover statistical parameters, and not only instantaneous observations. We decided to construct functions to make the element identifier readable and understandable for the users, adopt as many CF standard names as possible.

The *cell_method* in the CF convention describes what type of method that has been applied to the element over time (or another dimension as area), like *time: maximum*, and *time: mean of maximums* over a time period. Our naming convention is first of all a convention to discover the elements, both covering the instantaneous observations and the statistical and derived climate variables. We therefore consider the time period itself, as an important part of the element identifiers. In this way the element identifier is unique and therefore more like the unique variable names in a NetCDF file. The functions, also called calculation methods, do not have exact CF cell method format, but we have mapped most of them to CF cell methods, (see chapter "List of the calculation methods" in the Appendix).

It was also necessary to create other attributes to construct unique specifications for the time series:

- *Sensor level* with corresponding *sensor level unit* and *default sensor level*
- *Time offset* relative to midnight UTC. E.g. time offset T06H means that observation reference time is 6 hours after midnight UTC.
- *Parallel sensors,* as a part of the station's sensor system, (instead of as separate elements e.g. X1TA). The metadata information now follows the observing site as a *parallel sensor number*, where *main sensor = 0*, and *parallel sensors >= 1*.

We also found that the CF convention covered the quality information of a data value[20], using the *flag_values* and *flag_meanings*, as a matrix of a bit-set. At MET Norway we use a five-digit code, where the digits indicate the result of different quality control tests that the data value has passed. We also use a one-digit code for the final overall quality level, which is derived from the original five-digit quality code.

Construction of specific element identifiers

This section outlines the construction of specific element identifiers by giving sets of examples. Element identifier names are printed in ***bold/italic*** font.

Precipitation

We decided to use the CF standard name ***precipitation_amount*** with the unit *kg m-2*, which is (in practice) equivalent to *mm* (millimeter). We could have used the standard name *lwe_thickness_of_precipitation_amount* with unit *m*, but from an end user perspective we found the latter name long and less intuitive for searching, when the user is interested in precipitation observations.

There is an extensive variation of time spans for precipitation measurements, so we chose to add the calculation method *sum()*, e.g.:

- Monthly value: ***sum(precipitation_amount P1M)***
- Daily value: ***sum(precipitation_amount P1D)***
- Hourly value: ***sum(precipitation_amount PT1H)***
- 10 minute value: ***sum(precipitation_amount PT10M)***

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20 http://cfconventions.org/Data/cf-conventions/cf-conventions-1.6/build/cf-conventions.html#flags

There are also precipitation measurements with irregular or unknown time spans, e.g. irregularly visited manual observing sites in remote areas. The time span then depends on the period since the last observation. The solution was to use the calculation method *sum_over_undefined_period()* with the time denoted as the minimum time span expected, e.g.: ***sum_over_undefined_period(precipitation_amount PT1H)***, meaning >= 1 hour (old element code RR_X)

Two types of precipitation amounts are considered instantaneous. The first is the minimal "unit" of precipitation amount measured by tipping bucket-pluviometers:

- The plain standard name ***precipitation_amount*** is used for the specific amount of precipitation that triggers and records a new timestamp, normally 0.1 mm. Instead of measuring the total precipitation over a specific time span, this kind of sensor measures a specific small precipitation amount and records the timestamp every time this threshold (normally 0.1 mm) is passed. The old element code is RRVIPP)

The second instantaneous element is accumulated precipitation at automatic observing sites:

- ***accumulated(precipitation_amount)***: The old element code is RA. At an automatic ground station this observation is recorded e.g. every hour or every 10 minute. But time varies when the accumulated(precipitation_amount) restarts from zero (e.g. when the bucket is emptied). This kind of time series is raw data, and the data are used to derive time series with regular time spans, e.g. the element identifier sum(precipitation_amount PT1H) .

Wind

The CF standard name ***wind_speed*** (old element code = FF) was chosen as the element identifier for the "official" WMO standard type of wind observation, i.e. mean wind speed over ten minutes. The standard height of 10 meters is described by *sensorLevelValue* = 10, *sensorLevelUnit* = "m", *sensorLevelType* = "height_above_ground".

The element identifier ***wind_speed*** is handled as an instantaneous value, (although it is strictly a mean value over 10 minutes). This is consistent with the WMO standard definition. We regard it as unlikely that we will need to describe a mean value over a slightly different time span than the WMO standard period. Wind speed of gust have a separate CF standard name ***wind_speed_of_gust***.

Simply using ***wind_speed*** also allows use of only two levels of calculation methods, instead of three. An example is ***mean(max(wind_speed P1D) P1M)*** vs. *mean(max(mean(wind_speed PT10M) P1D) P1M)* for the old element code FXM.

The corresponding direction of the wind speed is the CF standard name ***wind_from_direction*** (old element code = DD), where "from" means the direction which the vector of the wind speed comes from. The standard name ***wind_from_direction*** is an example where the CF is not consistent; it should have been called *wind_speed_from_direction*.

The mean wind last hour has the element identifier ***mean(wind_speed PT1H)***. The corresponding mean wind direction is simply named ***mean(wind_from_direction PT1H)***.

For gust wind the standard name ***wind_speed_of_gust*** (old element code FG) was chosen. The corresponding direction of the gust is not a part of CF, but is proposed: ***wind_speed_from_direction_of_gust***

For the maximum wind speed we needed to describe the time span in which the maximum value is found, so the name was set to ***max(wind_speed PT1H)*** (old element code FX). 1 hour is the minimum time span, depending on the station's observation program.

According to the CF convention, a (cell) method should not change the unit. This means that the base name of our element identifiers should have the same unit as the element identifier itself. We introduced the calculation method *max_wind_speed()*, used with ***wind_from_direction*** to make clear that the unit is the direction, but corresponding to the maximum value of the wind speed. Hence, the corresponding direction of ***max(wind_speed PT1H)*** (old element code FX) is named ***max_wind_speed(wind_from_direction PT1H)*** (old element code DX). It is not named *from_direction_of_max(wind_speed PT1H),* because the base name *wind_speed* has a different unit, *m/s*, than wind direction.

Maximum wind speed in a day or month (old element code FFX) was given the element identifiers: ***max(wind_speed P1D)*** and ***max(wind_speed P1D)***, meaning the maximum of all available wind speed observations (10 minutes mean values at the observation time) in the period.

The maximum of the maximum wind speeds (old element code FXX) got the element identifier ***max(max(wind_speed P1D) P1M)*** meaning the maximum of all available maximum wind speeds (maximums over a period and not only at the time of the observation) in the period. The time of this event got the element identifier ***over_time(time_of_maximum_wind_speed P1M)*** (old element code FXXDT)

Observations of wind in the beaufort scale (old element code FFB) existed already as a CF standard name ***beaufort_wind_force*** where the maximum beaufort value observed in a period got the element identifier ***max(beaufort_wind_force PT6H)*** (old element code FXB).

Temperature elements

There are several kinds of weather elements based on temperature, in air, soil, grass etc. For most of these we were able to use existing CF standard names as base names and add calculation methods for derived statistical products:

- Air temperature: element identifier ***air_temperature*** (old element code TA at 2 m standard sensor level height). Derived statistical elements based on air temperature:
  - ***mean(air_temperature P1D)*** arithmetic mean daily air temperature (old element code = TAM) (timeOffset = 18 UTC)
  - ***mean_k(air_temperature P1D)*** mean value, using a predefined K-value as a weight, when calculating the daily mean (old element code = TAM_K)
  - ***best_estimate_mean(air_temperature P1M)*** The monthly homogeneous mean temperature.
  - ***mean(air_temperature_anomaly P1M)*** (old element code TAMA) Monthly mean deviation from the normal value of mean air temperature.
  - ***mean(air_temperature_anomaly P3M)***: Season value for mean air temperature
  - ***mean(air_temperature P1D)*** (old element code = TAMRR), meaning that the daily value spans from timeOffset = 06 UTC in the 24 hour time span that are used for the precipitation_amount measurements (RR)
  - ***mean(max(air_temperature P1D) P1M)*** (old element code = TAXM) Meaning the mean of daily maximum air temperature values for a month.
- Dew point: ***dew_point_temperature*** (old element code TD) using the calculation method *mean()* for diurnal and monthly values of mean dew point temperature during the period, as decided in the convention.
- Number of days above a threshold was given the calculation method *number_of_days_gte()*, where gte is a common short form for “greater than or equal”. The threshold itself is put at the end in the parentheses, like this example: ***number_of_days_gte(sum(precipitation_amount P1D) P1M 1.0)*** (old element code DRR_GE1) meaning number of days in a month with a precipitation sum of 1 mm or more.

- Degree days:
    - ***integral_of_deficit(mean(air_temperature P1D) P1M 17.0)*** (old element code GD17) “Heating degree days” is computed from daily mean temperatures (how many degrees below 17 ºC)
    - ***integral_of_excess(mean(air_temperature P1D) P1M 0.0)*** (old element code VSUM) “Heat sum” is computed from daily mean temperatures (how many degrees above 0 ºC)
- ***soil_temperature*** (old element code TJ) and ***mean(soil_temperature PT1H)*** (old element code TJ) exists in various depths, and has to be discovered as a dataset together with the sensor level *depth_below_surface*.

Grass temperature is so far not part of the CF convention, but it is a very common type of observation in agriculture. We plan to propose ***grass_temperature*** as a new standard name to the CF panel with a the description like: “*The temperature registered by a thermometer with its bulb at the level of the top of the grass blades in short turf.*”[21]

- ***grass_temperature*** (old element code = TG)
- ***mean(grass_temperature PT1H)*** (old element code = TGM)
- ***min(grass_temperature P1D)*** (old element code = TGN)
- The mean value of all the hourly minimum values in a month: ***mean(min(grass_temperature PT1H) P1M)*** (old element code = TGNM)

Time of events

We first discussed to use a calculation method *time_of_event_of_min()* e.g. *time_of_event_of_min(air_temperature P1M)*, (old element code = TANDT) to point out that the element identifier was the corresponding time stamp to the standard name (here ***air_temperature***). However, we realized that this calculation method returned a different unit (a Date/Time value) than the standard name (base name), which is a problem in the CF convention. We therefore concluded to construct some new standard names for these types of element identifiers like:

- ***over_time(time_of_minimum_air_temperature P1M)*** (old element code = TANDT)
- ***over_time(time_of_maximum_air_temperature P1M)*** (old element code = TAXDT)
- ***over_time(sum(time_of_maximum_precipitation_amount P1D) P1M)*** (old element code = RR_24XDT)
- ***over_time(time_of_maximum_wind_speed P1M)*** (old element code = FXXDT)

[21] https://definedterm.com/grass_temperature

Air pressure

- Surface air pressure: ***surface_air_pressure*** (old element code = PO). The observations from this measurement is at the height of the ground station. This ***surface_air_pressure*** corresponds to the prognostic variable in the numerical weather prediction models.
- Air pressure reduced to sea level (QFF): ***air_pressure_at_sea_level*** (old element code = PR. Is a standard name in CF.
- Air pressure (QNH) reduced to sea level according to the ICAO standard - (rounded down to nearest hPa) [22]: ***air_pressure_at_sea_level_qnh*** (old element code = PH) using the same standard name as above,***air_pressure_at_sea_level***.
- Barometer tendency, i.e. change over given period: ***over_time(tendency_of_surface_air_pressure PT1H)*** and *PT3H* (old element code = PP). In this element we discussed the use of a standard name using per second, as a "rate", but we found that using the *over_time()* function for a specific period, the rate is easy to calculate. Alternatively we would have suggested *change_in_surface_air_pressure*, but we are unsure whether the CF panel would support this. The chosen standard name ***tendency_of_surface_air_pressure*** also relates to the corresponding parameter for the *type* of barometer tendency, described below.
- Type of barometer tendency: ***tendency_of_surface_air_pressure_type*** (old element code = AA), using a code table for the observed types. We decided to use *type* and not *code*, since the word *code* does not appear in any CF standard names, while type is used in e.g. *area_type*.

Weather type

There are also many types of observations of the weather as a phenomenon in itself. The instantaneous observation of the precipitation type (old element codes V1 - V3), is manually observed:

- ***precipitation_type_primary_significance***
- ***precipitation_type_secondary_significance***
- ***precipitation_type_tertiary_significance***

The observations of the precipitation type over time, since last observation:

[22] https://no.wikipedia.org/wiki/QNH

- ***over_time(precipitation_type_primary_significance PT6H)*** (old element code V4) and the corresponding type of precipitation intensity ***over_time(precipitation_type_primary_significance_intensity PT6H)*** (old element code V4S). This logic is also adopted to the secondary and tertiary significance.

For the synop stations and reports of the weather, we decided to use:

- ***over_time(weather_type_primary_significance PT3H)*** (old element code W1), WMO code[23] 4561: Past weather[24], and the corresponding ***over_time(weather_type_secondary_significance PT3H)*** (old element code W2)

For the additional information about the weather we decided to use:

- ***over_time(weather_type_additional1 PT6H)*** (old element code WD1, and the same logic for WD2 and WD3)

For the instantaneous observation of the weather type from manned stations we recommend:

- ***weather_type*** (old element code WW using WMO code 4677: Present weather reported from a manned station[25].)
- ***weather_type_automatic*** (old element code WAWA). Since the observation of present weather from an automatic ground station has a slightly different code table, we choose to add the "*automatic"* to the element identifier.

Cloud cover

- Fraction:
    - ***cloud_area_fraction*** is used for the old element code = NN (measurement in eighths could be a source of misunderstanding if the user expects percentage). It is a CF standard name and is used as a base for other element identifiers e.g. minimum cloud cover over a time span: ***min(cloud_area_fraction P1D)*** (old element code = NNN)

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[23] https://badc.nerc.ac.uk/data/surface/code.html
[24] Corresponds to "Past weather (1)", code table 20004 in BUFR Reference Manual, https://software.ecmwf.int/wiki/display/BUFR/BUFRDC+Home Link to pdf document: https://software.ecmwf.int/wiki/pages/viewpage.action?pageId=35752427&preview=%2F35752427%2F36012655%2Fbufr_reference_manual.pdf
[25] Corresponds to "Present weather, code table 20003 in BUFR Reference Manual, https://software.ecmwf.int/wiki/display/BUFR/BUFRDC+Home

    - Another example is ***low_type_cloud_area_fraction*** (CF standard name) (old element code = NH) where the identifier refers to the area fraction of lower layer clouds.
- Type of cloud: The corresponding cloud type has the element identifier ***low_type_cloud*** without *area_fraction* since this refers to the type of cloud. A corresponding code table describes the meaning of the code values.
- Height of clouds: ***cloud_base_height*** (old element code = HL): We use "*_height*" since the alternative "*_altitude*" is used with respect to the geopotential height). This is not a CF standard name, although the CF standard name *convective_cloud_base_height* exists.

To get an easy statistical overview of the diurnal and monthly cloud cover, there are derived elements that indicate the extent to which the day/month have been clear, fair and overcasted:

- ***boolean_clear_sky_weather(cloud_area_fraction P1D)*** (old element code NN04)
- ***boolean_fair_weather(cloud_area_fraction P1D)*** (old element code NN09, following the "Birkeland formula") and a sum of all fair weather days in the month: ***sum(boolean_fair_weather(cloud_area_fraction P1D) P1M)***
- ***boolean_overcast_weather(cloud_area_fraction P1D)*** (old element code NN20) and a sum of days with overcast weather: ***sum(boolean_overcast_weather(cloud_area_fraction P1D) P1M)***

Visibility

visibility_in_air is a CF standard name, but it does not indicate in which direction the visibility is observed. We therefore included the direction in the element identifier, using the CF standard name as a "base":

- ***visibility_in_air_vertical*** (old element code VVZ for vertical visibility)
- ***visibility_in_air_poorest_direction*** (old element code VV) meaning the horizontal direction as default. We discussed to use "horizontal" instead of poorest direction, but decided that "horizontal" was more implicit than "poorest", such that poorest_direction was the most descriptive element identifier.
- Corresponding minimum and maximum values: ***min(visibility_in_air_poorest_direction P1D)*** (old element code VV) and ***max(visibility_in_air_poorest_direction P1D)*** (old element code VVX)

Snow

- The snow coverage is observed as a code (-1,1-4) which denotes the extent of snow cover on the ground. We chose to use the element identifier ***snow_coverage_type*** (old element code = SD), although we also discussed the longer name *surface_snow_area_fraction_type*. The latter would have been more consistent with element identifiers of cloud coverage, (***cloud_area_fraction***). However, snow cover observation is not strictly an area fraction of fourths, contrary to cloud area fraction in eighths (octas). Snow coverage is a common term, and we quite consistently use "*_type*" to denote that the element identifier has set of codes as unit. This means that the observations have corresponding metadata explaining the meaning of the code values.
- The corresponding statistical elements for monthly snow coverage values are:
    - ***min(snow_coverage_type P1M)*** (old element code = SDN)
    - ***max(snow_coverage_type P1M)*** (old element code = SDX)
    - ***mean(snow_coverage_type P1M)*** (old element code = SDM)
- For the amount of snow on the ground: ***surface_snow_thickness*** (old element code = SA). We discussed to use *snow_amount* (unit *kg m-2*), but we found that ***surface_snow_thickness*** (unit *m*) was a better alternative.
- The corresponding statistical elements for monthly surface snow thickness values are:
    - ***min(surface_snow_thickness P1M)*** (old element code = SAN)
    - ***max(surface_snow_thickness P1M)*** (old element code = SAX)
    - ***mean(surface_snow_thickness P1M)*** (old element code = SAM)

Observations that come from a type of instruments that measures only the thickness of a *snowfall*, and not the accumulated amount, i.e. *thickness* of snow on the ground, got the element identifier ***over_time(thickness_of_snowfall_amount P1D)*** (old element code = SS_24). From the CF convention description: *"Amount" means mass per unit area. The construction thickness_of_[X_]snowfall_amount means the accumulated "depth" of snow which fell i.e. the thickness of the layer of snow at its own density.*

Temperature in snow: ***snow_temperature*** is an alias for temperature_in_surface_snow (old element code = TSS). Since the observations from MET are valid for different depths (*depth_below_surface* in *cm*) we decided to use ***snow_temperature***. The corresponding minimum and maximum values are:

- ***min(snow_temperature PT1H)***
- ***max(snow_temperature PT1H)***

If *depth_below_surface* = 125, *unit* = *cm*, these correspond to the old element codes TSN125 and TSX125 respectively, at 125 cm depth.

Radiation

The term surface albedo is a CF standard name and is a mean value over time: ***mean (surface_albedo PT1H)*** (old element code QA).

Incoming radiation is referred to as "*downwelling*" in the CF convention and is also called "*irradiance*". This is most often a mean value over a time span and thus we decided to use:

- Longwave
  - Hourly value: ***mean(surface_downwelling_longwave_flux_in_air PT1H)*** (old element code QLI)
  - Minute value: ***mean(surface_downwelling_longwave_flux_in_air PT1M)*** (old element code QLI_01)
- Shortwave:
  - Hourly value: ***mean(surface_downwelling_shortwave_flux_in_air PT1H)*** (old element code QSI)
  - Minute value: ***mean(surface_downwelling_shortwave_flux_in_air PT1M)*** (old element code QSI_01)
  - Ten minute value: ***mean(surface_downwelling_shortwave_flux_in_air PT10M)*** (old element code QSI_010)

Outgoing radiation is referred to by the CF convention as "*upwelling*". This is most often a mean value over a time span and thus we use names in the same way as for *downwelling* (*longwave* and *shortwave*):

- Hourly value: ***mean(surface_upwelling_longwave_flux_in_air PT1H)*** (old element code QLO)
- Hourly value: ***mean(surface_upwelling_shortwave_flux_in_air PT1H)*** (old element code QSO)

For the maximum minute value within an hour we decided to use:

- ***max(mean(surface_downwelling_longwave_flux_in_air PT1M) PT1H)*** (old element code QLIX)
- ***max(mean(surface_downwelling_shortwave_flux_in_air PT1M) PT1H)*** (old element code QSIX)

Other relevant element identifiers regarding radiation that already exist as CF standard names:

- ***mean(surface_net_downward_radiative_flux PT1H)*** (old element code QNET)
- ***mean(surface_downwelling_photosynthetic_radiative_flux_in_air PT1H)*** (old element code QSF)

Maritime data

The speed of the current has the element identifier ***sea_water_speed*** (CF standard name) at different depths below sea level given by the parameter *depth_below_sea_surface*, (*unit* = *m*). The old element codes are e.g. CV147, where 147 means at the depth of 147 m). The corresponding direction of the current at different depths has the element identifier and CF standard name ***sea_water_to_direction*** (old element code e.g. CD147). In oceanography the standard direction of the sea water speed and waves are "to direction".

Other already existing CF standard names used as element identifiers:

- ***sea_surface_wave_energy_at_variance_spectral_density_maximum*** (old element code SDP1)
- ***sea_surface_temperature*** (old element code TW)
- ***sea_surface_wave_zero_upcrossing_period*** (old element code WTZ)
- ***sea_surface_swell_wave_significant_height*** (old element code HM0LF)
- ***sea_surface_wave_period_at_variance_spectral_density_maximum*** (old element code WTP)
    - We constructed the corresponding ***sea_surface_wave_period_at_variance_spectral_density_second_maximum*** (old element code WTP2)
- ***sea_surface_wave_significant_height*** (old element code HW)
    - We constructed the corresponding element identifiers
        - for automatic instruments: ***sea_surface_wave_significant_height_from_instrument*** (old element code HWA)
        - when calculated from a spectrum: ***sea_surface_wave_significant_height_from_spectrum*** (old element code WHM0)

Example of other constructed elements:

- ***sea_surface_swell_wave_first_mean_height*** (old element code HW1)
- Corresponding period: ***sea_surface_swell_wave_first_mean_period*** (old element code PW1)

List of all elements

A dynamic table of all the 370 element identifiers is available online at https://data.met.no/elementtable. The table contains descriptions, old element codes etc., and is part of the API Concepts and documentation of the MET API https://data.met.no/concepts. The element identifiers are essential in retrieving data from MET Norway's archive of historical weather and climate data available from the API.

The naming convention is exemplified in the Appendix by a comprehensive table of the element identifiers of wind, temperature, and precipitation amount.

Construction of the element database in data.met.no

The element convention is already in use in the new JSON API found at http://data.met.no. The element identifiers with corresponding information are therefore stored in a small database with the following information:

- element identifier
    - unit (the unit follows the standard of the stored observations and climate data at MET Norway)
- element name
    - The name exists in three languages:
        - English: 'en-US',
        - Norwegian: 'nb-NO' (bokmål)
        - Norwegian: 'nn-NO' (nynorsk, bilingual)
- element description
    - The description exists in three languages:
        - English: 'en-US',
        - Norwegian: 'nb-NO' (bokmål)
        - Norwegian: 'nn-NO' (nynorsk)
- description of the calculation method as a part of the element identifier
    - method identifier
    - unit of the method (if another unit then the base name (standard name)

    - The method description exists in three languages:
        - English: ‘en-US’,
        - Norwegian: ‘nb-NO’ (bokmål)
        - Norwegian: ‘nn-NO’ (nynorsk)
- element sensor level: used only for those elements that could have a variation of observation program at different heights or depths
    - element identifier
    - sensor level identifier.
        - The sensor level identifier has a unique corresponding unit
        - Three sensor level identifiers exists:
            - height_above_ground
            - depth_below_surface
            - depth_below_sea_surface
    - default sensor level height
    - list of sensor level values in an array. The values are always positive.
- element code table: used only for those element identifiers that have a corresponding code table to the observation (code table identifier):
    - Corresponding entries to the code table identifier:
        - values (codes), are usually serial numbers.
        - corresponding meaning and additional information to the value in three languages:
            - English: ‘en-US’,
            - Norwegian: ‘nb-NO’ (bokmål)
            - Norwegian: ‘nn-NO’ (nynorsk)
- element status
    - Four status identifiers exist:
        - CF-name: Already a name in the CF standard
        - CF-alias: The name is registered as an alias for another CF standard name. Some strict validators could give a warning when using an alias.
        - Proposal: The name is posted as a proposal to the CF-panel and MET Norway will be active in the discussion of including this name in the list of CF standard names
        - MET-name: The name has not been proposed to the CF panel yet or will be kept as a MET specific name. In a NetCDF compatible file such a name will be referred to as metno_name leaving the standard_name empty
        - MET-test: A preliminary name that is under discussion at MET Norway. The name may change.
    - status identifier is stored together with a description of the status in three languages:
        - English: ‘en-US’,

        - Norwegian: ‘nb-NO’ (bokmål)
        - Norwegian: ‘nn-NO’ (nynorsk)
- If the element has a CF compliant status, there will exist corresponding fields for the element identifier:
    - standard_name - a CF compliant standard name
    - cell_method - a valid CF compatible cell method
    - unit - the canonical unit, using the CF - convention
    - status - the last checked version of which the standard name exists
- Mapping from the new element identifier to the old convention by:
    - old element code
    - unit
    - old parameter id as a number
    - corresponding level value for the old element code

Outlook

The set of CF standard names does not provide suitable names for all our observations and derived products. We have solved this by constructing new names at MET (*status* = “*MET-name*”). The “MET-names” are, as far as possible, constructed according to the CF “*Guidelines for construction of CF Standard Names*”[26]. Most of these new names should be proposed as new CF standard names along with proper descriptions, and possibly with arguments why these names should be adopted by the CF convention[27]. If this is not done, we will probably have a significant number of these “MET-names” over time, which could have a different wording than the official CF standard names.

Some feedbacks indicate that the self-descriptive names suggested in this project is too long to use for e.g. table column titles, and that short names need to be created. Since we already use a set of very short element codes at MET Norway, these will be available as “old element codes”. These codes are not considered consistent in all dimensions of an element. The new convention is more consistent and is probably a better basis for a more general algorithm to construct short names. We will in the future discuss further whether construction of short element codes should be provided, but right now it seems too time consuming to construct an additional complete set of short names.

[26] http://cfconventions.org/Data/cf-standard-names/docs/guidelines.html
[27] Proposals are sent to CF Metadata Trac, https://cf-trac.llnl.gov/trac, or CF Metadata mailing list, http://mailman.cgd.ucar.edu/mailman/listinfo/cf-metadata. More info at http://cfconventions.org/discussion.html

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Appendix

List of calculation methods

1. *best_estimate_sum()*
    - Description: Best estimate sum values are homogenized sum values. This means a high quality dataset of sums with no kind of breaks in the timeseries.
    - CF: time: sum (best estimate)
2. *best_estimate_mean()*
    - Description: Best estimate mean values are homogenized mean values. This means a high quality dataset of mean values with no kind of breaks in the timeseries.
    - CF: time:mean (best estimate)
3. *number_of_days_gte()*
    - Description: Count of days with a measurement exceeding a given threshold.
    - CF: time: sum (counting a number of X)
4. *over_time()*

- CF: this function does not need a CF function, because the time period is implicit in the frequence of the values in the output

5. *sum_over_undefined_period()*
    - Description: Accumulated value since last observation, over undefined time periods greater than or equal (gte) the given time period. E.g. precipitation amounts from observations at irregular intervals.
    - CF: time: sum (unknown period)
6. *sum()*
    - Description: The arithmetic sum of data values or accumulated value in a given period.
    - CF: time: sum
7. *sum_until_day_of_year()*
    - Description: The arithmetic sum of data values in the period since 1. January to a day in the year.
    - CF: cell_method is not implemented.
8. *accumulated()*
    - Description: Accumulated from 0, which means the sum over an unknown period.
    - CF: time: sum (accumulated since the value was 0)
9. *min()*
    - Description: Minimum value observed or calculated in the given period
    - CF: time: minimum
10. *max()*
    - Description: Maximum value observed or calculated in the given period
    - CF: time: maximum
11. *mean()*
    - Description: Standard arithmetic mean value for the given period
    - CF: time: mean
12. *mean(max())* meaning mean of max values. Both description will be available as:
    - Method description of mean: Standard arithmetic mean value for the given period
    - *innerMethod* description of *max()*:Maximum value observed or calculated in the given period
    - CF remark that the order of the methods are opposite: time: maximum time: mean
13. *max(mean())* meaning the maximum of all mean values in the period.
    - CF remark that the order of the methods are opposite: time: mean time: maximum
14. *mean_k()*
    - Description: Mean value calculated with the Køppen formula, using a K-value as weight to calculate a corresponding mean value.

- CF: time: mean (using the k value)

15. *estimated_by_spectral_moments_1()*
    - Description: Estimate of wave period by spectral moments
    - CF: time: sum (estimated by spectral moments)
16. *directional_spread()*
    - Description: Directional spread (standard deviation).
    - CF: time: standard_deviation (directional spread)
17. *boolean_fair_weather()*
    - Description: The sum of the cloud cover observations at 06 and 12 UTC where no single values above 4, (and at 18 utc is 9 or lower?). The sum should be below 9 (max 24 if all overcast), then it is fair weather and boolean is true, that means 1, else 0 (false).
    - CF: time: sum (algorithm for occurrences, boolean value 1 if found 0 if not)
18. *boolean_clear_sky_weather()*
    - Description: The sum of the cloud cover observations at 06, 12 and 18 UTC. The sum should be below 4 (max 24 if all overcast), then it is clear sky weather and boolean is true, that means 1, else 0 (false).
    - CF: time: sum (algorithm for occurrences, boolean value 1 if found 0 if not)
19. *boolean_overcast_weather()*
    - Description: The sum of the cloud cover observations at 06, 12 and 18 UTC. The sum should be 20 or more (max 24 if all overcast), then it is overcast weather and boolean is true, that means 1, else 0 (false).
    - CF: time: sum (algorithm for occurrences, boolean value 1 if found 0 if not)
20. *max_wind_speed()*
    - Description: Direction from where the maximum wind speed came from in the given period.
    - CF: time: maximum (meaning, the corresponding vector to the maximum value of the vector over a time period). Unit is always following the base name (CF standard name)
21. *integral_of_excess()*
    - Description: Accumulated deviation above a threshold over time. Temperature excess is defined as the sum over days, of the daily mean air temperatures minus the temperature threshold, taking only into account the temperatures above the threshold. This metric is often named after a specification and "degree-days", e.g. growing degree-days.
    - CF: does not have a corresponding cell method because the corresponding standard name is assumed to cover this alone: *integral_of_air_temperature_excess_wrt_time*

22. *integral_of_deficit()*
    - Description: Accumulated deviation below a threshold over time. Temperature deficit is defined as the sum over days, of temperature threshold minus the daily mean air temperatures, taking only into account the temperatures below the threshold. This metric is often named after a specification and "degree-days", e.g. heating degree-days.
    - CF: does not have a corresponding cell method because the corresponding standard name is assumed to cover this alone: "integral_of_air_temperature_deficit_wrt_time" This applies also to the function *integral_of_deficit_interpolated()*.
23. *integral_of_deficit_interpolated()*
    - Description: Accumulated deviation below a threshold over time. Interpolated temperature deficit is defined as the temperature threshold minus geographically interpolated air temperatures, taking only into account the temperatures below the threshold. This metric is often named after a specification and "degree-days", e.g. heating degree-days".
    - CF: does not have a corresponding cell method because the corresponding standard name is assumed to cover this alone: "*integral_of_air_temperature_deficit_wrt_time*" This applies also to the function *integral_of_deficit_interpolated()*.
24. *from_direction_of_mean()*
    - Description: Direction of mean of different wave elements
    - CF: Method will be changed, because this method returns a different unit than the base name.
25. *from_direction_of_peak()*
    - Description: Direction of peak of different wave elements
    - CF: Method will be changed, because this method returns a different unit than the base name

Complete element table for wind, temperature, and precipitation amount

The next table gives a comprehensive and detailed overview of how the naming convention is applied for wind, wind direction, temperature and precipitation amount.

ElementId	ElementCodes	Category	Name	Description	Unit	SensorLevels	Status
accumulated(precipitation_amount)	RA	Precipitation	Total precipitation	Automatic station: Total precipitation in container (accumulated since last emptying)	mm		CF-name
best_estimate_sum(precipitation_amount P1M)	RR	Precipitation	Precipitation	Daily or monthly total of precipitation (precipitation day 06-06 utc)	mm		CF-name
best_estimate_sum(precipitation_amount P1Y)	RR	Precipitation	Precipitation in year	Total of precipitation in year (precipitation day 06-06 utc)	mm		CF-name
best_estimate_sum(precipitation_amount P3M)	RR	Precipitation	Precipitation in season	Total of precipitation during a season (precipitation day 06-06 utc)	mm		CF-name
best_estimate_sum(precipitation_amount_anomaly P1M)	RRA	Precipitation	Precipitation in percent of normal	Precipitation in percent of present precipitation normal (1961-1990).	percent		MET-name
best_estimate_sum(precipitation_amount_anomaly P1Y)	RRA	Precipitation	Total precipitation in year in percent of normal	Precipitation in percent of present precipitation normal (1961-1990).	percent		MET-name
best_estimate_sum(precipitation_amount_anomaly P3M)	RRA	Precipitation	Precipitation for season in percent of normal	Precipitation in percent of present precipitation normal (1961-1990).	percent		MET-name
max(sum(precipitation_amount P1D) P1M)	RR_24X	Precipitation	Precipitation 24 hours	Highest sum of precipitation last 24 hours	mm		CF-name
number_of_days_gte(sum(precipitation_amount P1D) P1M 0.1)	DRR_GE1	Precipitation	Number of days with RR>=1	Number of days with 1 mm precipitation or more	number of		CF-name
number_of_days_gte(sum(precipitation_amount P1D) P1Y 0.1)	DRR_GE1	Precipitation	Number of days with RR>=1	Number of days with 1 mm precipitation or more	number of		CF-name
over_time(sum(time_of_maximum_precipitation_amount P1D) P1M)	RR_24XDT	Precipitation	Date for maximum precipitation	Date for maximum precipitation	Date		MET-name
precipitation_amount	RRVIPP	Precipitation	Precipitation	Pluviometervipp	mm		CF-name
sum(precipitation_amount P1D)	RR, RRTA, RR_24, X1RR_24	Precipitation	Precipitation	Amount of precipitation last 24 hours	mm		CF-name
sum(precipitation_amount P1M)	RR, RRTA	Precipitation	Precipitation	Daily or monthly total of precipitation (precipitation day 06-06 utc)	mm		CF-name
sum(precipitation_amount P1Y)	RR	Precipitation	Precipitation in year	Total of precipitation in year (precipitation day 06-06 utc)	mm		CF-name
sum(precipitation_amount P3M)	RR	Precipitation	Precipitation in season	Total of precipitation during a season (precipitation day 06-06 utc)	mm		CF-name
sum(precipitation_amount P6M)	RR	Precipitation	Precipitation in winter or summer	Total of precipitation during winter or summer (precipitation day 06-06 utc)	mm		CF-name
sum(precipitation_amount PT1H)	RR_1, X1RR, X1RR_1, X2RR_1	Precipitation	Precipitation (1 hour)	Amount of precipitation last hour	mm		CF-name
sum(precipitation_amount PT1M)	RR_01	Precipitation	Intensity of precipitation	Amount of precipitation last minute	mm		CF-name
sum(precipitation_amount PT3H)	RR_3	Precipitation	Precipitation 3 hours	Precipitation, increase last 3 hours in mm	mm		CF-name
sum(precipitation_amount PT6H)	RR_6	Precipitation	Precipitation (6 hours)	Amount of precipitation last 6 hours	mm		CF-name
sum(precipitation_amount PT10M)	RR_010	Precipitation	Precipitation	Amount of precipitation last 10 minutes	mm		CF-name
sum(precipitation_amount PT12H)	RR_12, X1RR_12	Precipitation	Precipitation (12 hours)	Amount of precipitation last 12 hours	mm		CF-name
sum(precipitation_amount PT30D)	RR_720	Precipitation	Precipitation 720 hours (last 30 days)	Precipitation last 30 days	mm		CF-name
sum(precipitation_amount_anomaly P1M)	RRA	Precipitation	Precipitation in percent of normal	Precipitation in percent of present precipitation normal (1961-1990).	percent		MET-name

sum(precipitation_amount_anomaly P1Y)	RRA	Precipitation	Total precipitation in year in percent of normal	Precipitation in percent of present precipitation normal (1961-1990).	percent		MET-name
sum(precipitation_amount_anomaly P3M)	RRA	Precipitation	Precipitation for season in percent of normal	Precipitation in percent of present precipitation normal (1961-1990).	percent		MET-name
sum(precipitation_amount_anomaly P6M)	RRA	Precipitation	Precipitation in winter or summer in percent of normal	Precipitation in percent of present precipitation normal (1961-1990).	percent		MET-name
sum_over_undefined_period(precipitation_amount P1D)	RRID	Precipitation	Accumulated precipitation	Precipitation from station with occasional (non-daily) observations. Amount for period since last measurement.	mm		CF-name
sum_over_undefined_period(precipitation_amount P1M)	RRID	Precipitation	Accumulated precipitation	Precipitation from station with occasional (non-daily) observations. Amount for period since last measurement.	mm		
sum_over_undefined_period(precipitation_amount PT1H)	RR_X	Precipitation	Precipitation	Amount of precipitation during a not specified time period	mm		CF-name
beaufort_wind_force	FFB	Wind	Wind force in Beaufort	Wind force in Beaufort scale 0-12. Based on visual observations, i.e. that the observer watches the effect of the wind on forrest, smoke, seawater etc.	code		CF-name
max(beaufort_wind_force PT6H)	FXB	Wind	Maximum mean wind speed (beaufort)	Maximum wind speed (10 meters above ground) - value FX according to the Beaufort scale.	code		CF-name
wind_speed	FF, FF2, X1FF, X2FF	Wind	Wind speed (10 meters above groud)	Wind speed (10 meters above ground) - standard value: mean value for last 10 minutes before time of observation	m/s	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
max(max(wind_speed P1D) P1M)	FXX	Wind	Highest mean wind value	Daily value: Highest of max 10 minute averages (FX) for the six hour periods before 0, 6, 12 and 18 utc. Monthly value: Maximum of daily FXXs.	m/s		CF-name
max(max(wind_speed PT1H) P1D)	FXX	Wind	Highest mean wind value	Daily value: Highest of max 10 minute averages (FX) for the six hour periods before 0, 6, 12 and 18 utc. Monthly value: Maximum of daily FXXs.	m/s		CF-name
max(wind_speed P1D)	FF2X, FFX	Wind	Maximum wind speed (main observations)	Daily value: Maximum of wind speeds (10 minutes mean, 2 meter above ground, FF2) at 0, 6, 12 and 18 utc.Monthly value: Maximum of daily FF2Xs.	m/s	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
max(wind_speed P1M)	FF2X, FFX	Wind	Maximum wind speed (main observations)	Daily value: Maximum of wind speeds (10 minutes mean, 2 meter above ground, FF2) at 0, 6, 12 and 18 utc.Monthly value: Maximum of daily FF2Xs.	m/s	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
max(wind_speed PT1H)	FX2_1, FX_1, X1FX, X1FX_1	Wind	Max Wind Speed (10 min mean)	Highest 10 minutes average wind for the last hour (10 meters above ground)	m/s	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
max(wind_speed PT3H)	FX, FX_3	Wind	Maximum mean wind speed	Highest 10 minutes average wind for the last 3 hours (10 meters above ground)	m/s		CF-name

max(wind_speed PT6H)	FX	Wind	Maximum mean wind speed	Max. wind speed (10 m above ground) - standard value: Highest 10 minutes mean wind for the period after the station's last main observation (normally 6 hours, could be 12, especially at obs 06 utc).	m/s		CF-name
max(wind_speed PT10M)	FX, X1FX, X2FX	Wind	Max Wind Speed (10 min mean)	Max Wind Speed last 3 hours (10 min mean)	m/s		CF-name
max(wind_speed PT20M)	FX, FX_020, X1FX, X1FX_020, X2FX, X2FX_020	Wind	Max Wind Speed (10 min mean)	Highest 20 minutes average wind for the last hour (10 meters above ground)	m/s		CF-name
max(wind_speed_of_gust P1D)	FGX	Wind	Highest max gust	Daily value: Highest of maximum gusts (FG) for the six hour periods before 0, 6, 12 and 18 utc. Monthly value: Maximum of daily FGXs.	m/s		CF-name
max(wind_speed_of_gust P1M)	FGX	Wind	Highest max gust	Daily value: Highest of maximum gusts (FG) for the six hour periods before 0, 6, 12 and 18 utc. Monthly value: Maximum of daily FGXs.	m/s		CF-name
max(wind_speed_of_gust PT1H)	FG2_1, FG_1, X1FG_1	Wind	Maximum gust (2 meters above ground)	Maximum gust (3 seconds) last hour (10 meters above ground)	m/s	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
max(wind_speed_of_gust PT10M)	FG_010, X2FG_010	Wind	Gust wind speed	Highest gust wind speed (3 sec mean) last 10 min	m/s		CF-name
max(wind_speed_of_gust PT20M)	FG_010, FG_020, X1FG_020, X2FG_010, X2FG_020	Wind	Gust wind speed	Highest gust wind speed (3 sec mean) last 10 min	m/s		CF-name
max_wind_speed(wind_from_direction PT1H)	DX, DX2_1, DX_1, X1DX, X1DX_1	Wind	Wind direction (FX)	Wind direction at strongest middlewind last hour (FX2_1) at 2 meter	degrees	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
max_wind_speed(wind_from_direction PT3H)	DX_3	Wind	Wind direction (FX_3)	Wind direction of strongest 10 minutes wind last three hours (FX_3)	degrees		CF-name
max_wind_speed(wind_from_direction_of_gust PT1H)	DG2_1, DG_1	Wind	Wind direction (vectorised)	Wind direction, vectorised in degrees (belongs to FG2_1) at 2 m	degrees	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
max_wind_speed(wind_from_direction_of_gust PT10M)	DG_010, X1DG_010	Wind	Wind direction	Wind direction, related to the highest gustwind for the last 10 min	degrees		CF-name
mean(max(wind_speed P1D) P1M)	FXM	Wind	Average of highest mean wind values	Daily value: Arithmetic mean of highest wind averages (FX) for the 24 hour obs. (FX_1) or main obs. 0, 6, 12, 18 (depending on availability). Monthly value: Arithmetic mean of daily FXMs.	m/s		CF-name
mean(max(wind_speed PT1H) P1D)	FXM	Wind	Average of highest mean wind values	Daily value: Arithmetic mean of highest wind averages (FX) for the 24 hour obs. (FX_1) or main obs. 0, 6, 12, 18 (depending on availability). Monthly value: Arithmetic mean of daily FXMs.	m/s		CF-name
mean(max(wind_speed P1D) P1M)	FXM	Wind	Average of highest mean wind values	Daily value: Arithmetic mean of highest wind averages (FX) for the 24 hour obs. (FX_1) or main obs. 0, 6, 12, 18 (depending on availability). Monthly value: Arithmetic mean of daily FXMs.	m/s		CF-name

mean(wind_from_direction PT1H)	DDM, DDM2	Wind	Average wind direction (cf FM)	Average wind direction last hour (cf FM)	degrees	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
mean(wind_speed P1D)	FF2M, FFM	Wind	Average wind speed (main observations)	Daily value: Arithmetic mean of wind speeds (10 minutes mean at 2 meters above ground, FF2) at 0, 6, 12 and 18 utc. Monthly value: Arithmetic mean of daily FF2Ms.	m/s	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
mean(wind_speed P1M)	FF2M, FFM	Wind	Average wind speed (main observations)	Daily value: Arithmetic mean of wind speeds (10 minutes mean at 2 meters above ground, FF2) at 0, 6, 12 and 18 utc. Monthly value: Arithmetic mean of daily FF2Ms.	m/s	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
mean(wind_speed PT1H)	FM, FM2, X1FM	Wind	Mean wind last hour	Mean value of wind observations last hour (10 meters above ground)	m/s	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
mean(wind_speed_of_gust P1D)	FGM	Wind	Average of max gusts	Daily value: Arithmetic mean of maximum gusts (FG) for the six hour periods before 0, 6, 12 and 18 utc. Monthly value: Arithmetic mean of daily FGMs.	m/s		CF-name
mean(wind_speed_of_gust P1M)	FGM	Wind	Average of max gusts	Daily value: Arithmetic mean of maximum gusts (FG) for the six hour periods before 0, 6, 12 and 18 utc. Monthly value: Arithmetic mean of daily FGMs.	m/s		CF-name
min(max(wind_speed P1D) P1M)	FXN	Wind	Lowest of highest mean wind values	Daily value: Lowest of max 10 minute averages (FX) for the six hour periods before 0, 6, 12 and 18 utc. Monthly value: Minimum of daily FXNs.	m/s		CF-name
min(max(wind_speed PT1H) P1D)	FXN	Wind	Lowest of highest mean wind values	Daily value: Lowest of max 10 minute averages (FX) for the six hour periods before 0, 6, 12 and 18 utc. Monthly value: Minimum of daily FXNs.	m/s		CF-name
min(wind_speed P1D)	FF2N, FFN	Wind	Minimum wind speed (main observations)	Daily value: Minimum of wind speeds (10 minutes mean, 2 meter above ground, FF2) at 0, 6, 12 and 18 utc. Monthly value: Minimum of daily FF2Ns.	m/s	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
min(wind_speed P1M)	FF2N, FFN	Wind	Minimum wind speed (main observations)	Daily value: Minimum of wind speeds (10 minutes mean, 2 meter above ground, FF2) at 0, 6, 12 and 18 utc. Monthly value: Minimum of daily FF2Ns.	m/s	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
min(wind_speed_of_gust P1D)	FGN	Wind	Lowest max gust	Daily value: Lowest of maximum gusts (FG) for the six hour periods before 0, 6, 12 and 18 utc. Monthly value: Lowest of daily FGNs.	m/s		CF-name
min(wind_speed_of_gust P1M)	FGN	Wind	Lowest max gust	Daily value: Lowest of maximum gusts (FG) for the six hour periods before 0, 6, 12 and 18 utc. Monthly value: Lowest of daily FGNs.	m/s		CF-name
over_time(time_of_maximum_wind_speed P1M)	FXXDT	Wind	Date for maximum wind velocity	Date of event when maximum wind speed occurred	Date		MET-name
over_time(time_of_maximum_wind_speed PT1H)	KLFX, KLFX_1, X1KLFX_1	Wind	Time of max wind speed	Time of event when maximum wind speed occurred (HHmm)	time		MET-name
over_time(time_of_maximum_wind_speed_of_gust PT1H)	KLFG, KLFG_1, X1KLFG_1	Wind	Time of max wind gust	Time of event when maximum wind speed of gust occurred (HHmm)	time		MET-name

wind_from_direction	DD, DD06, DD12, DD18, DD2, X1DD, X2DD	Wind	Wind direction	Direction from which the wind blows at 06 utc observation	degrees	type: height_above_ground, unit: m, default: 10, values: 2, 10	CF-name
wind_from_direction_of_gust	DG	Wind	Wind direction (FG)	Wind direction at strongest gust (FG)	degrees		MET-name
wind_speed_of_gust	FG, X1FG, X1FG_010, X2FG	Wind	Gust wind speed	Highest gust wind speed (3 sec mean) last 10 min	m/s		CF-name
air_temperature	TA, TA10, TA25, X1TA, X2TA, X3TA, X4TA, X5TA, X6TA	Temperature	Air temperature	Air temperature (default 2 m), now value	degC	type: height_above_ground, unit: m, default: 2, values: 2, 10, 25	CF-name
air_temperature_vertical_difference	TA_DELTA	Temperature	Air temperature - vertical diff	Vertical differens i temperature	degC		MET-name
best_estimate_mean(air_temperature P1D)	TAM	Temperature	Mean temperature	Hourly value: Arithmetic mean of minute values.Daily value: Arithmetic mean of 24 hourly values (00-00 utc), or a formula based mean value computed from fewer observations (18-18 utc). Monthly value: Arithmetic mean of daily values.	degC		CF-name
best_estimate_mean(air_temperature P1M)	TAM	Temperature	Mean temperature	Hourly value: Arithmetic mean of minute values.Daily value: Arithmetic mean of 24 hourly values (00-00 utc), or a formula based mean value computed from fewer observations (18-18 utc).Monthly value: Arithmetic mean of daily values.	degC		CF-name
best_estimate_mean(air_temperature P1Y)	TAM	Temperature	Mean temperature	Hourly value: Arithmetic mean of minute values.Daily value: Arithmetic mean of 24 hourly values (00-00 utc), or a formula based mean value computed from fewer observations (18-18 utc). Values for a month, season or year: Arithmetic mean of daily values.	degC		CF-name
best_estimate_mean(air_temperature P3M)	TAM	Temperature	Mean temperature	Hourly value: Arithmetic mean of minute values.Daily value: Arithmetic mean of 24 hourly values (00-00 utc), or a formula based mean value computed from fewer observations (18-18 utc).Monthly and season value: Arithmetic mean of daily values.	degC		CF-name
best_estimate_mean(air_temperature_anomaly P1M)	TAMA	Temperature	Temperature, deviation from normal	Deviation from present temperature normal (1961-1990)	degC		CF-name
best_estimate_mean(air_temperature_anomaly P1Y)	TAMA	Temperature	Mean temperature in year, deviation from normal	Deviation from present temperature normal (1961-1990)	degC		CF-name
best_estimate_mean(air_temperature_anomaly P3M)	TAMA	Temperature	Mean temperature for season, deviation from normal	Deviation from present temperature normal (1961-1990)	degC		CF-name
integral_of_deficit(mean(air_temperature P1D) P1M 17.0)	GD17	Temperature	Heating degree days (base 17)	Figure computed from daily mean temperatures (how many degrees below 17 ºC)	degree-day		CF-name
integral_of_deficit(mean(air_temperature P1D) P1Y 17.0)	GD17	Temperature	Heating degree days (base 17)	Figure computed from daily mean temperatures (how many degrees below 17 ºC) in period.	degree-day		CF-name
integral_of_deficit(mean(air_temperature P1D) P3M 17.0)	GD17	Temperature	Heating degree days (base 17)	Figure computed from daily mean temperatures (how many degrees below 17 ºC) in period.	degree-day		CF-name
integral_of_deficit(mean(air_temperature P1D) P6M 17.0)	GD17	Temperature	Heating degree days (base 17)	Figure computed from daily mean temperatures (how many degrees below 17 ºC) in period.	degree-day		CF-name

integral_of_deficit(mean(air_temperature PT1H) P1D 17.0)	GD17	Temperature	Heating degree days (base 17)	Figure computed from daily mean temperatures (how many degrees below 17 ºC)	degree-day		CF-name
integral_of_deficit_interpolated(mean(air_temperature P1D) P1M 17.0)	GD17_I	Temperature	Heating degree days - interpolated (base 17)	Monthly value computed from grid-interpolated daily mean temperatures (how many degrees below 17 ºC).	degree-day		CF-name
integral_of_deficit_interpolated(mean(air_temperature P1D) P1Y 17.0)	GD17_I	Temperature	Heating degree days - interpolated (base 17)	Values are computed from grid-interpolated daily mean temperatures (how many degrees below 17 ºC).	degree-day		CF-name
integral_of_excess(mean(air_temperature P1D) P1M 0.0)	VSUM	Temperature	Heat sum	Figure computed from daily mean temperatures (how many degrees above 0 ºC)	degree-day		CF-name
integral_of_excess(mean(air_temperature P1D) P1M 5.0)	VEKST	Temperature	Growth degree days	Figure computed from daily mean temperatures (how many degrees above 5 ºC)	degree-day		CF-name
integral_of_excess(mean(air_temperature PT1H) P1D 0.0)	VSUM	Temperature	Heat sum	Figure computed from daily mean temperatures (how many degrees above 0 ºC)	degree-day		CF-name
integral_of_excess(mean(air_temperature PT1H) P1D 5.0)	VEKST	Temperature	Growth degree days	Figure computed from daily mean temperatures (how many degrees above 5 ºC)	degree-day		CF-name
max(air_temperature P1D)	TAX, TAXD, TAX_24	Temperature	Air temperature	Highest noted temperature this hour/day (in 24 hours according to offset)	degC		CF-name
max(air_temperature P1M)	TAX	Temperature	Maximum temperature	Highest noted temperature this hour/day (from 18 to 18) /month.	degC		CF-name
max(air_temperature P1Y)	TAX	Temperature	Maximum temperature	Highest noted temperature this year (from 18 to 18).	degC		CF-name
max(air_temperature P3M)	TAX	Temperature	Maximum temperature	Highest noted temperature this season (from 18 to 18).	degC		CF-name
max(air_temperature P6M)	TAX	Temperature	Maximum temperature	Highest noted temperature this 6 months of summer or winter (from 18 to 18).	degC		CF-name
max(air_temperature PT1H)	TAX, X1TAX, X2TAX	Temperature	Maximum temperature	Highest noted temperature this hour/day (from 18 to 18) /month.	degC		CF-name
max(air_temperature PT10M)	TAX	Temperature	Maximum temperature	Highest noted temperature in period	degC		CF-name
max(air_temperature PT12H)	TAX_12, X1TAX_12	Temperature	Maximum temperature (12 hours)	Highest observed temperature last 12 hours	degC		CF-name
mean(air_temperature P1D)	TAM, TAMRR	Temperature	Mean temperature	Hourly value: Arithmetic mean of minute values.Daily value: Arithmetic mean of 24 hourly values (00-00 utc), or a formula based mean value computed from fewer observations (18-18 utc). Monthly value: Arithmetic mean of daily values.	degC		CF-name
mean(air_temperature P1M)	TAM, TAMRR	Temperature	Mean temperature	Hourly value: Arithmetic mean of minute values.Daily value: Arithmetic mean of 24 hourly values (00-00 utc), or a formula based mean value computed from fewer observations (18-18 utc).Monthly value: Arithmetic mean of daily values.	degC		CF-name
mean(air_temperature P1Y)	TAM	Temperature	Mean temperature	Hourly value: Arithmetic mean of minute values.Daily value: Arithmetic mean of 24 hourly values (00-00 utc), or a formula based mean value computed from fewer observations (18-18 utc). Values for a month, season or year: Arithmetic mean of daily values.	degC		CF-name
mean(air_temperature P3M)	TAM	Temperature	Mean temperature	Hourly value: Arithmetic mean of minute values.Daily value: Arithmetic mean of 24 hourly values (00-00 utc), or a formula based mean value computed from fewer observations (18-18 utc).Monthly and season value: Arithmetic mean of daily values.	degC		CF-name
mean(air_temperature P6M)	TAM	Temperature	Mean temperature	Hourly value: Arithmetic mean of minute values.Daily value: Arithmetic mean of 24 hourly values (00-00 utc), or a formula based mean value computed from fewer observations (18-18 utc).Monthly and season value: Arithmetic mean of daily values.	degC		CF-name

mean(air_temperature PT1H)	TAM, X1TAM, X2TAM	Temperature	Mean temperature	Hourly value: Arithmetic mean of minute values.Daily value: Arithmetic mean of 24 hourly values (00-00 utc), or a formula based mean value computed from fewer observations (18-18 utc).Monthly value: Arithmetic mean of daily values.	degC		CF-name
mean(air_temperature_anomaly P1M)	TAMA	Temperature	Temperature, deviation from normal	Deviation from present temperature normal (1961-1990)	degC		CF-name
mean(air_temperature_anomaly P1Y)	TAMA	Temperature	Mean temperature in year, deviation from normal	Deviation from present temperature normal (1961-1990)	degC		CF-name
mean(air_temperature_anomaly P3M)	TAMA	Temperature	Mean temperature for season, deviation from normal	Deviation from present temperature normal (1961-1990)	degC		CF-name
mean(air_temperature_anomaly P6M)	TAMA	Temperature	Mean temperature in winter or summer, deviation from normal	Deviation from present temperature normal (1961-1990)	degC		CF-name
mean(max(air_temperature P1D) P1M)	TAXM	Temperature	Average of maximum temperature	Monthly value: Arithmetic mean of the daily maximum temperatures	degC		CF-name
mean(max(air_temperature P1D) P1Y)	TAXM	Temperature	Average of maximum temperature	Monthly value: Arithmetic mean of the daily maximum temperatures	degC		CF-name
mean(min(air_temperature P1D) P1M)	TANM	Temperature	Average of minimum temperature	Monthly value: Arithmetic mean of the daily mimimum temperatures	degC		CF-name
mean(min(air_temperature P1D) P1Y)	TANM	Temperature	Average of minimum temperature	Monthly value: Arithmetic mean of the daily mimimum temperatures	degC		CF-name
mean_k(air_temperature P1D)	TAM_K	Temperature	Mean temperature calculated with Køppens formula	Mean temperature calculated with Køppens formula	degC		CF-name
mean_k(air_temperature P1M)	TAM_K	Temperature	Mean temperature calculated with Køppens formula	Mean temperature calculated with Køppens formula	degC		CF-name
min(air_temperature P1D)	TAN, TAND, TAN_24, X1TAN_12	Temperature	Air temperatur	Lowest observed temperature in the given period.	degC		CF-name
min(air_temperature P1M)	TAN	Temperature	Minimum temperature	Lowest noted temperature this hour/day (from 18 to 18) /month.	degC		CF-name
min(air_temperature P1Y)	TAN	Temperature	Minimum temperature	Lowest noted temperature this year (from 18 to 18).	degC		CF-name
min(air_temperature P3M)	TAN	Temperature	Minimum temperature	Lowest noted temperature this season (from 18 to 18).	degC		CF-name
min(air_temperature P6M)	TAN	Temperature	Minimum temperature	Lowest noted temperature this 6 months of summer or winter (from 18 to 18).	degC		CF-name
min(air_temperature PT1H)	TAN, X1TAN, X2TAN	Temperature	Minimum temperature	Lowest observed temperature in the given period.	degC		CF-name
min(air_temperature PT10M)	TAN	Temperature	Minimum temperature	Lowest observed temperature in the given period.	degC		CF-name
min(air_temperature PT12H)	TAN_12	Temperature	Minimum temperature (12 hours)	Lowest observed temperature last 12 hours	degC		CF-name
over_time(time_of_maximum_air_temperature P1M)	TAXDT	Temperature	Date for maximum temperature	Date for maximum temperature	Date		MET-name
over_time(time_of_minimum_air_temperature P1M)	TANDT	Temperature	Date for minimum temperature	Date for minimum temperature	Date		MET-name