



Workshop on climate data management,
data sharing and exchange.

DGM-WMO, 4-5 and 8 November 2021



Concept of and Calculation of Climatological Standard Normals for 1991-2020

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*Workshop on Climate Data Management, Data Sharing and
Exchange*
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- 1 Quick Introduction about the Climate Normals
- 2 WMO Guidelines on the Calculation of Climate Normals
- 3 WMO Submission and Collection Mechanisms for CLINO
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Resolution 16 (Cg-17) in 2015 approved the proposed amendments to the Technical Regulations (WMO-No. 49), Volume I, with respect to the definition of Climatological Standard Normals as follows:

Climatological Standard Normals: Averages of climatological data computed for the following consecutive periods of 30 years ending in '0': 1 January 1981–31 December 2010, 1 January 1991–31 December 2020, and so forth;

WMO Reference Period for long-term climate change assessment:
The consecutive period of 30 years from 1 January 1961 to 31 December 1990

It is noted that in the past Climatological Standard Normals had referred to non-overlapping 30-year periods: 1901-1930, 1931-1960 and 1961-1990.

Importance of Normals

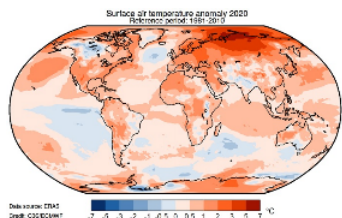
Climatological Standard Normals originates from the recognition that climatological data should be processed over agreed uniform periods, in order **to ensure comparability between data collected at stations all over the world** as well as **to provide a long-term reference value or 'normal' with which shorter** (e.g. monthly) **data can be compared.**

Climatological Standard Normals **serve as a valuable basis for climate research, monitoring, diagnostic studies and for climate applications and services.**



Climate normals are used for two principal purposes :

- They serve as a **benchmark against which recent or current observations** can be compared, including providing a basis for many anomaly-based climate datasets (for example, global mean temperatures : year yyyy was z degrees too warm/too cold).
- They are also widely used, implicitly or explicitly, as a **prediction of the conditions most likely to be experienced in a given location.**



Data source: ERA5
Data: CDS/ECMWF

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Members are asked to submit CLINO from **as many stations as possible**, including stations **registered in OSCAR/Surface** and **in particular** for stations that

- constitute the **Regional Basic Climatological Networks (RBCN)**,
- report monthly **CLIMAT** messages
- contribute to the **World Weather Records** collection.



Principal climatological surface parameters:

- Precipitation total
- Number of days with precipitation ≥ 1 mm
- Monthly mean values of maximum, minimum and daily mean temperatures
- Mean value of sea-level pressure
- Mean vapour pressure
- Total number of hours of sunshine

Secondary climatological surface parameters: ...

Other climatological surface parameters: ...



Climatological Standard Normals, by nature, constitute **high-quality data**.

Members will carefully **reject stations with doubtful time series data**.

Homogenised time series data are preferred, where available.

Large-scale automation of observational networks started in the 1990ies; this poses a special challenge and requires national wisdom. Processing of high-frequency data: **Conservative approach** (retrieve conventional times of observations) in case of doubt.



WMO-No. 1203 provides certain **high-level requirements regarding data completeness and data estimation** that should be observed.

National good practices and wisdom are preferred in cases, where global rules are not available or applicable (***the consistency of the national record(s) shall not be compromised***). Information exchange among Members is highly encouraged!

Consider **data rescue** prioritisation to generate sufficient time-series data for 1991-2020 CLINO calculation.





Annual normals should be calculated from the monthly normals, and not from the individual annual values. The two methods will produce identical results (apart, possibly, from small differences due to rounding) if there are no missing monthly values, but may differ if some monthly values are missing.

CLINO parameters

	Mean parameter	Extreme parameter	Sum parameter	Count parameter
Individual monthly value	The mean of the daily values during the month	The highest or lowest (as appropriate) value recorded during the month.	The sum of the daily values during the month	See next slide
Monthly normals	The mean of all non-missing values during the averaging period for the month in question.	The highest (or lowest) value during the averaging period for the month in question.	The mean of all non-missing values during the averaging period for the month in question.	
multi-months normals	The mean of the monthly normals for the months concerned	The highest/lowest of the monthly values for the months concerned.	The sum of the monthly normals for the months concerned	

	Count parameter
Individual monthly value	<p>For a count parameter, the number of days in which an event occurs (or a threshold that is exceeded) should be converted to a ratio or percentage of the number of days on which observations were made. For example, if the event occurred on 22 days and there were 25 days in the month with observations, this should be considered as 0.88 or 88%.</p>
Monthly normals	<p>Initially, a mean ratio/percentage for the month should be calculated from the ratio/percentage values for each month during the averaging period. The mean ratio/percentages should then be reconverted to a mean number of days for the month by multiplying it by the number of days in the month. For example, a mean ratio of 0.88 for January converts to $(0.88 \times 31) = 27.28$ days, or 27.3 days rounded (February values should be multiplied by 28.25 days).</p>



	Single Monthly Value	Monthly Normals
Mean parameter	it should not be calculated if either of the following criteria are satisfied: -> Observations are missing for 11 or more days during the month;	It can be calculated where there are valid monthly values in at least 80% of the years in the averaging period (with no additional consecutive-years criterion);
Count parameter	-> Observations are missing for a period of 5 or more consecutive days during the month.	
Sum parameter	It can only be calculated if there are complete data over the month (exceptions: availability of cumulative values, potential for estimation; above 11/5 rule applies!)	
Extreme parameter	It should be calculated for a month, regardless of the amount of available data during that month.	where there are valid monthly values for the mean of the underlying element in at least 80% of the years in the averaging period

- In all cases, a normal value should be calculated only if **the data completeness criteria are met**.
- A value that is found to be **suspect or incorrect** after undergoing quality control should be considered to be missing.
- If the **monthly normal** for any of the constituent months of the period of interest is **missing**, then the **multi-month normal** should also be considered as **missing**.
- National good practices are preferred in cases, where global rules are not available or applicable (**the consistency of the national record(s) shall not be compromised**).



- Normals should be reported to a **precision of one decimal place**.
- **For rounding, “ties to even”** (where a value ending in .5 is rounded to the nearest even number) **is preferred**.



Metadata that should be included with climate normals include:

- Current **identifiers of each station** (WMO number, domestic identifiers and station name);
- The **latitude, longitude and elevation** of each station as at the end of the averaging period;
- **Information on any significant changes** at stations during, or after, the averaging period, and, if any adjustments have been carried out, the methods used for doing so;
- **The definition of the climatological day;**
- **The method of calculation** for daily means of temperature, pressure and vapour pressure.

It is expected that, over time, the uptake of the WMO Integrated Global Observing System (WIGOS) metadata platform will lessen the need for metadata to be provided separately in conjunction with climate normals.



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Submission channels and deadline

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU



WMO OMM

World Meteorological Organization
Organisation météorologique mondiale
Organización Meteorológica Mundial
Всемирная метеорологическая организация
المنظمة العالمية للأرصاد الجوية
世界气象组织

Secrétariat

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Our ref.: 16953/2021/S/CS/CMP/CLINO9120

4 August 2021

Annexes: 2 (available in English only)

Subject: WMO collection of the Climatological Standard Normals for 1991–2020

Action required: Submission of data at your earliest convenience from 1 October 2021,
but not later than 31 March 2022

To facilitate the publication of WMO Climatological Standard Normals for the period 1991–2020, I should be grateful if you could send your contribution at your earliest convenience from 1 October 2021 **but not later than 31 March 2022**, to the WMO Secretariat (wcdmp@wmo.int). Please use the following subject for your submission: "CLINO [name of country/territory]" (example: CLINO Germany).



Ref.: 16953/2021_S/CS/CMP

- **File names for single station files: StationName _ Number.xls (.csv) with no spaces or special characters.**
- If needed, submit compressed and zipped in a standard manner compatible with Windows. The file name should be **CountryName _ WMO _ Normals _ 9120.zip with no spaces.**
- ASCII submissions: **Each *.csv station file should be for only one station.**
- Excel submissions: **A country can submit files individually for each station, or using a single Excel file for all stations.** For files with multiple stations, do not put multiple stations in a single table. **Each station should have its own tab**, with the name of each tab constructed as: **StationName _ Number with no spaces or special characters.**
- If a value is **missing**, then leave the field **blank**. **Decimal points** are represented as **dots "."**. If precipitation is **zero**, the field should be **"0.0"**.



Excel file template

World Meteorological Organization Climate Normals for 1981-2010						
Single Station Data Sheet For All Climatological Surface Parameters						
Station Header Record						
Country Name	UNITED STATES OF AMERICA					
Station Name	FAIRBANKS_INTL					
WMO Number	Latitude	Longitude	Station Height			
70261	64 49 00 N	147 52 00 W	138			
WMO Integrated Global Observing System (WIGOS) Station Identifier (if available)						
0-20000-0-70261						
Principal Climatological Surface Parameters						
Parameter Code	Parameter Name	Units				
1	Precipitation_Total	mm				
WMO Number	Parameter Code	Calculation Name	Calculation Code	January	February	March
70261	1	Sum	4	11.9	10.2	9.4
70261	1	NOY	98	30.0	30.0	30.0
Parameter Code	Parameter Name	Units				
2	Number_of_Days_with_Precipitation_>= 1_mm	count_%				
WMO Number	Parameter Code	Calculation Name	Calculation Code	January	February	March
70261	2	Count %	5	12.3	9.9	9.7
70261	2	NOY	98	30.0	30.0	30.0



In the previous Normals collection in the 1990s, ASCII submissions were allowed in a variety of formats using a number of delimiters (blanks, multiple blanks, tabs, etc.). The current collection will reduce these possibilities to one, the use of **Comma Separated Values format (*.csv)**.

One of the key attributes of this approach is that **vertical alignment** of data columns will **not be required** (as is needed in space and tab delimited files) as long as **commas are separating both existing and missing values**.

Files constructed like the provided template will easily import into Excel, so that the final formatted version made available for all normals will all be uniform.



World Meteorological Organization Climate Normals for 1981-2010
Single Station Data sheet For All Climatological Surface Parameters

Station Header Record

Country_Name,UNITED_STATES_OF_AMERICA
Station_Name,FAIRBANKS_INTL

WMO_Number,Latitude,Longitude,Station_Height
70261,64|49|00|N,147|52|00|W,133

WMO Integrated Global Observing System (WIGOS) Station Identifier (if available)
0-20000-0-70261

Principal Climatological Surface Parameters

Parameter_Code,Parameter_Name,Units
1,Precipitation_Total,mm

WMO_Number,Parameter_Code,Calculation_Name,Calculation_Code,January,February,March,April,May,
70261,1,Sum,4,11.9,10.2,9.4,8.1,15.5,34.8,47.5,49.8,24.1,22.9,20.3,21.6,276.1
70261,1,NOY,98,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0

Parameter_Code,Parameter_Name,Units
2,Number_of_Days_with_Precipitation_>=1_mm,count_%

WMO_Number,Parameter_Code,Calculation_Name,Calculation_Code,January,February,March,April,May,
70261,2,Count %,5,12.3,9.9,9.7,9.0,12.3,23.7,28.0,27.4,8.7,21.3,20.0,18.4,17.6
70261,2,NOY,98,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0,30.0



These Normals will be gathered and housed for global access at the U.S. National Oceanic and Atmospheric Administration as done during the mid-1990s, when 1961–1990 Climatological Standard Normals were collected for the WMO and are still available at the World Data Center for Meteorology Asheville website:

[https://www.ncei.noaa.gov/products/wmo-climate-normals.](https://www.ncei.noaa.gov/products/wmo-climate-normals)



Explanatory notes are strongly encouraged to be provided with the data submission in open text format (**WORD document or TEXT file**; file name: **CountryName_WMO_Normals_9120_Additional.doc**), ideally using one of the WMO languages.

Explanatory notes document information necessary to correctly interpret Climatological Standard Normals submitted. Examples for Explanatory notes include information on

- homogeneity of underlying time series,
- use of data estimation methods to fill data gaps in underlying time series,
- observing time constraints,
- implications of station automation,
- less than 30 years of observations,
- formula used for vapour pressure calculation
- etc.



The definition and use of climate normals need to be documented and communicated clearly and precisely to avoid misinterpretation. Climate normals, in particular, climatological standard normals and the reference period, are widely used as references against which climate anomalies, climate variability and climate change are assessed. **It is imperative to prominently quote the exact normal (period) used for any climate product and service, where applicable.**

The process for calculating CLINO shall be well documented internally. This includes datasets used, calculation methods, data adjustments etc. Such documentation is indispensable for future questions, evaluations, applications, re-calculation etc., bearing in mind the importance and validity period of Climatological Standard Normals.



In case of an update of the climatological standard normal, it is recommended to produce an explanatory note for all users of relevant products and services. Some National Meteorological and Hydrological Services issue internal documentation for the staff concerned, as well as a press release, explaining the nature of normals and their use, and changes in relevant products and services caused by application of the updated normals.

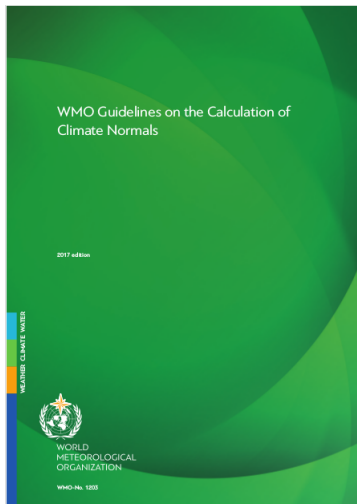
Implications of updating Climatological Standard Normals :

- **The need for the update:** To ensure a better representation of the average conditions at a given location, particularly for many sectoral operational climate applications and services.
- **The implications of the update:** Example: A region experienced a distinct warming over the last one to two decades. Operational climate monitoring using 1961–1990 Climatological Standard Normals has identified most of the past years as 'warmer than normal'. By switching to the 1991–2020 Climatological Standard Normal, which is likely higher than the 1961-1990 Climatological Standard Normal, the number of years characterized as 'warmer than normal' may be less and a greater number of 'normal' or 'cooler than normal' years may appear.
- **Stable reference for climate change assessments:** For long-term climate variability and change assessment (time scale of decades) it is recommended to use the (newly defined) WMO Reference Period 1961–1990 (to be used internationally in perpetuity or unless compelling scientific reasons suggest its modification).



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World Meteorological
Organisation

WMO No. 1203

**WMO Guidelines on the
Calculation of Climate Normals**

Edition 2017



World Meteorological
Organisation

WMO No. 100

**Guide to Climatological
Practices**

Edition 2018

THANK YOU

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