

**WMO OMM**

World Meteorological Organization  
Organisation météorologique mondiale  
Organización Meteorológica Mundial  
Всемирная метеорологическая организация  
المنظمة العالمية للأرصاد الجوية  
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Annex: 1

Subject: Guidance on sharing historical data

Action required: Note the following guidance for sharing historical data

Dear Sir/Madam,

As you are aware, historical observations are critical to understanding the changes to the global climate driven by anthropogenic greenhouse gas emissions. They are also a necessary input for attributing extreme events to climate change. In this regard, I wish to refer to [Resolution 1 Cg-Ext\(2021\)](#) – WMO Unified Data Policy for the International Exchange of Earth System Data. .

In response to this important Resolution, the Global Climate Observing System, through its Atmospheric Observations Panel for Climate, has produced a note that provides guidance for Members as to the appropriate means by which to share historical data with recognized international data repositories (see [annex](#)). This includes data sourced from land meteorological stations, ships, buoys and radiosondes.

I would be grateful if you could kindly consider the guidance provided in the annex when sharing historical observations, including those data that, due to communications outages, were not exchanged in real-time when the measurements were recorded.

Yours faithfully,

Dr Wenjian Zhang  
for the Secretary-General

To: Permanent Representatives of Members with WMO

cc: Hydrological Advisers

## Guidance on the submission of historical meteorological holdings to international archives

Ref.: 27676/2022-151

Originating from the Global Climate Observing System's Atmospheric Observations Panel for Climate (GCOS AOPC), this note provides guidance for Members as to the appropriate means by which to share data arising from land meteorological stations, ships, buoys and radiosondes with recognized international data repositories. The note is limited to these data as they are the most common data types held by Members (NMHSs) in their archives. Two repositories that are recognized by the World Data System of the International Science Council are the World Data Centre for Meteorology, Asheville and the World Data Service for Oceanography at Silver Spring, both of which are hosted by the US National Oceanic and Atmospheric Administration (NOAA) National Centres for Environmental Information (NCEI). The Copernicus Climate Change Service also contributes to the activities of these repositories.

The submission process described here is applicable to both long-term data holdings (historical data) which were not exchanged when the measurements were recorded and short-term data reporting outages, at a station or country level, where for technical or other issues the data was not reported via the operational process (e.g. the Global Telecommunication System (GTS)).

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**Resolution 1 of Cg-Ext(2021)** - WMO Unified Policy for the International Exchange of Earth System Data, pertains to the sharing of historical data for climate applications and is available at <https://public.wmo.int/en/our-mandate/what-we-do/observations/Unified-WMO-Data-Policy-Resolution>. The following is the text reproduced verbatim, taken from the annex relating to Resolution 1 (Cg-Ext(2021)):

*Note that some core climate data are covered under the weather, cryosphere, hydrology, atmospheric composition and ocean sections. Core data includes current and historic time series data needed to understand climate change, assess the associated impacts and risks for lives, livelihoods, and property and support climate services. Data shall be made available in a timely manner, with a tentative maximum delay of one year.*

#### 2.1 Core observational data:

- (a) *Measurements provided by the GCOS Upper-Air Network (GUAN) and GCOS Surface Network (GSN) stations (see also 1.1.1 (a));*
- (b) *Climate data as defined in the Manual on High-quality Global Data Management Framework for Climate (WMO-No. 1238);*
- (c) *Essential Climate Variables (ECVs) as defined by the Global Climate Observing System (GCOS) in the Manual on the WMO Integrated Global Observing System (WMO-No. 1160) to the extent that the Member holds the data in a digital archive.*

#### 2.2 Other core data:

*Climate reanalysis fields provided by GDPFS centres, as listed in the Manual on the Global Data-processing and Forecasting System (WMO-No. 485).*

#### 2.3 Recommended data:

*Members should exchange all climate data defined in the Manual on the WMO Integrated Global Observing System (WMO-No. 1160) and encourage all data holders to share their climate data.*

The resolution does not, however, specify where and how to share this information in such a manner that it can be integrated into regional and global holdings to enable its exploitation by the climate community. This is critical if the benefits of the new data policy are to be fully realized in informing national and international decision-making and in service to society.

### Guidance on data to be exchanged

Data contributions must be accompanied by appropriate documentation and metadata. At a minimum, sufficient information must be provided to allow the user to:

- Identify the file format of each submitted file (e.g. comma-separated value (CSV), NetCDF, etc.);
- Unambiguously identify the meaning of each data field, including the type of variable being stored in it (e.g. temperature) and the measurement units in which the value is stored (e.g. tenths of degrees Celsius);
- Correctly interpret any special codes or data flags (e.g. a code used to identify a missing value);
- Associate each data value with the correct date, time, and observing location;
- Identify the name, elevation and coordinates of the observing site.

Ideally, site coordinates and names apply to the time at which the observation was taken. However, in the absence of such information for individual observations, a history of known changes in location or name of each observing site is sufficient. Information on the instrumentation used is also helpful, but not required.

### Land meteorological data

Land meteorological data are analysed in a variety of contexts by the climate science community at synoptic, daily and monthly aggregations. Data shared at synoptic or daily scales can be aggregated to coarser temporal resolutions, although it would still be preferable to receive data at all available aggregations.

Data should be shared in as close to originally transmitted or recorded form as possible without application of additional post-processing quality control (QC) and homogenization procedures. If data has been digitalized from its original recorded form, it is recommended that the scanned images are also included, if available. This enables subsequent reprocessing of holdings and their use in reanalyses. Optionally, holdings with QC applied can also be supplied as well as data that is homogenized, but these different levels of post-processing should be clearly differentiated in the file naming and documentation.

Data reports should be shared in a collated form such that multiple variables are associated with a given observation collection. As many variables as were measured should be shared to enable subsequent analyses, i.e. the full synoptic reports should be shared rather than an abridged version.

## Marine meteorological data

Marine surface observations, principally from ships, buoys or fixed platforms are generally reported at the observation resolution of hourly or sub-hourly. Given that almost all marine observations are taken from moving platforms the geolocation information for each observation must be included, ideally transmitted or reported from the observing platform.

Original data, as recorded, should be shared for the ability to reprocess in the future or to investigate issues with data detected later. This includes observations taken in near-real-time and delayed mode.

Individual marine reports for a given time and location, containing all observed parameters, should be shared.

## Upper-air soundings

Upper-air soundings from the global radiosonde network should be shared in order to achieve a vertical profile that is as full as is available. At a minimum this consists of standard and significant levels. However, if the original data have been stored at a higher vertical resolution closer to modern-day full BUFR profiles, this high-resolution data should be provided. The full suite of measured parameters should be included.

## Data formats

Historical data should be submitted, if available, in the original reporting code formats as documented by WMO. These are the Traditional Alphanumeric Codes (TAC) and more recently the Binary Universal Form for the Representation of meteorological data (BUFR) as detailed in the WMO *Manual on Codes* (WMO-No. 306). The BUFR code is the preferable option but if the TAC is the only format available, then sufficient metadata needs to be supplied in addition due to the limited metadata information available in the TAC reports.

However, data can be provided in any format, if sufficient metadata and a detailed description of the format used is also provided, but it would be preferred if one of the following formats were used:

**Land:** Data can be exchanged using the Standard Exchange Format (SEF) jointly developed by the Copernicus Climate Change Service and NOAA NCEI. The SEF includes an R code package to read and write the SEF (documentation, code and examples at: <https://github.com/C3S-Data-Rescue-Lot1-WP3/SEF/wiki>).

**Marine:** Data can be exchanged in the International Maritime Meteorological Archive (IMMA) format. Format documentation is available at: [https://icoads.noaa.gov/e-doc/imma/R3.0-imma1\\_short.pdf](https://icoads.noaa.gov/e-doc/imma/R3.0-imma1_short.pdf).

Marine data can alternatively be sent to the relevant Global Data Assembly Centres in International Maritime Meteorological Tape (IMMT) format on which these data will be shared.

**Upper-air:** Data can be submitted in a text or CSV format, preferably with one file per ascent or observing location, at the maximum resolution of recorded data (2 seconds, 10 seconds or 1 minute). Minimum alternative is the significant and standard levels. Each level in an ascent must be identified by one or more of the following parameters identifying its vertical position: atmospheric pressure, geometric or geopotential height, or time since launch.

## Data submission

Data can be submitted to the Global Data Centre NCEI, or to the Copernicus Climate Change Service (C3S). These entities shall regularly exchange data received, thus ensuring a failsafe backup.

### World Data Centre submissions

Send2NCEI (S2N): For one-time data submissions that are less than 20 gb in total size, data providers can use the Send2NCEI (S2N) submission interface <https://www.ncei.noaa.gov/archive/send2ncei/> to submit data.

Advanced Tracking and Resource tool for Archive Collections (ATRAC): For one-time data submissions larger than 20 gb or data submissions recurring regularly on a daily to monthly basis, data providers can use the ATRAC interface <https://www.ncdc.noaa.gov/atrac/index.html>.

### Copernicus Climate Change Service submissions

To promote and encourage data provider contributions, C3S has instigated the Data Upload Server <https://datadeposit.climate.copernicus.eu/home/>, where data providers can upload and share their data. C3S also requires all available supporting metadata and documentation, including information on any quality control checks and any known historical station or instrumental changes or moves. All source QC flags will be incorporated with internally generated QC flags and provided to the end data user of the C3S. A link to step-by-step instructions on how a data provider can register for an account and upload data is available at : <https://datadeposit.climate.copernicus.eu/home/>.

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