



EXTENSION OF THE TRIAL PHASE OF THE INTERNATIONAL EXCHANGE OF DAILY CLIMATE DATA WITH THE AIM OF RECOMMENDING ITS OPERATIONAL IMPLEMENTATION IN 2021

1. Background, history and reasoning for the reporting of daily climate observations

The development of the principal measure of the state of the climate – the global temperature record – has extensively depended on monthly CLIMAT data provided by National Meteorological and Hydrological Services (NMHSs). Over the last 20 years, there has been a growing demand for indices and measures of the climate that also consider extremes. For many extreme measures, monthly data are insufficient and there is a need for operationally exchanged daily climate data. This need is not just for timeliness, but principally for data that is compatible with long historical daily series developed and made available by NMHSs. Attempts have been made to use SYNOP data for this purpose (e.g. by the European Climate Assessment and Dataset (ECA&D)) but there are serious issues of incompatibility of SYNOP data with traditional methods of climate measurement within NMHSs. Daily summaries in SYNOP messages are based on measurements that occur between synoptic reporting times and often over a period of less than 24 hours. For instance, in Europe, minimum temperatures are recorded usually over the 18 to 06 UTC 12-hour period and maximum temperatures during the 06 to 18 UTC 12-hour period. Measured in this way, the true daily minimum and maximum temperatures may not be reported because they may have occurred outside those particular 12-hour periods. As a result, SYNOP reports have been shown to significantly underestimate extremes: minimum temperatures measured in this way may be higher than the true daily minimum temperature, and maximum temperatures reported may be lower than the true daily maximum temperature reported as 24-hour climate observation. Similar problems occur for precipitation. In other regions of the world, SYNOP reporting practices can differ, but problems remain.

The Commission for Basic Systems (CBS) Open Programme Area Group on Integrated Observing Systems (OPAG-IOS), Implementation/Coordination Team on Integrated Observing Systems (ICT-IOS), recommended in 2012 that daily climate observations be included in monthly CLIMAT reports as a means of addressing the gap in the quality of daily climate observations. The U.S. National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI), in cooperation with WMO Inter-programme Expert Team on Data Representation Maintenance and Monitoring (IPET-DRMM) and NOAA National Centers for Environmental Prediction (NCEP), developed a BUFR template for transmission of daily climate observations in BUFR format. This template was approved by CBS for implementation in May 2015. It was subsequently tested in the United States, with the cooperation of the UK Met Office. A one-year trial phase for the monthly reporting of daily climate observations was accepted by delegates to the seventeenth session of the Commission for Climatology in April 2018 (see Recommendation 5 (CCI-17)). NOAA/NCEI, in cooperation with IPET-DRMM (taken over by the Inter-programme Expert Team on Codes Maintenance (IPET-CM) in 2016) and NOAA/NCEP, developed a BUFR template, 3 07 074 – Supplemental daily temperature and precipitation values, for daily climate observations in BUFR format, for monthly reporting. Please note that this does not replace the existing CLIMAT BUFR templates but offers complementary reporting of daily observations once per month.

BUFR template 3 07 074 enables NMHSs to provide 31 daily observations consistent with national climate databases for the following elements:

- Time of observation for temperature
- Daily maximum temperature
- Daily minimum temperature
- Daily mean temperature (if it differs from $(T_{max}+T_{min})/2$)
- Time of observation for precipitation
- Total daily precipitation
- Depth of new snowfall
- Depth of total snow on the ground

It was suggested, for the trial phase, to report daily climate data from those observing stations that prepare the traditional CLIMAT report.

2. Trial phase for the monthly reporting of daily climate data: Assessment report of March 2020

Notes:

- *Key conclusions and recommendations of the assessment are highlighted in **bold**.*
- *DAYCLI (daily climate data) is used as working title for the message exchanging daily climate data through GTS.*

2.1. Introduction

Members have been invited to participate, on a voluntary basis, in the trial phase for the monthly reporting of daily climate data via GTS (WMO letter of 30 July 2018, ref.: 20824/2018/CLW/CLPA/DMA/BUFR307074_1). This report provides an interim assessment of the trial phase, which started in February 2019 and lasted for one year.

2.2. Assessment of February 2019 to January 2020 trial phase

Following the above mentioned WMO call of July 2018, 20 Members expressed intent to participate in the trial phase (see [table](#) below). A quickly upcoming request from Members concerned the provision of software to encode the DAYCLI message. In response, NOAA/NCEI kindly provided – on a voluntary basis - access to its DAYCLI software demonstration package, noting that it will require some expertise on the part of the country using it, mainly to make some modifications specific to their input data formats.

In the course of the trial, several countries shared their observations and challenges of methodological and technical nature with the Secretariat:

Methodological:

The current BUFR sequence suggests that

- 'Daily maximum temperature', 'Daily minimum temperature' and 'Daily average temperature' refer to the same observational time period, and
- Measurements of 'Total accumulated precipitation', 'Depth of fresh snow' and 'Total snow depth' refer to the same observational time period.

National observing practices, however, observe different time periods for the above temperature variables, assigned to different days. Also, snow depth measurements do not typically represent a time period such as accumulated precipitation.

Note: When introducing the new BUFR template, it has been recommended to use it for those stations that submit CLIMAT messages already. According to 'Handbook on CLIMAT and CLIMAT TEMP reporting' (WMO/TD-No. 1188), daily maximum and minimum temperatures are defined to reflect the 0000-2359 local time period.

The challenge of nationally differing definitions of 'climatological days' is well known including the fact that there is no easy solution to overcome these methodological differences. The implementation of the exchange of daily climate data may trigger discussions about scenarios for future solutions. For the time being, however, **it is suggested to reflect the differing observing practices in a new BUFR template by introducing additional metadata information regarding variable-specific observing times and/or observing periods, where appropriate.**

Technical (including organizational):

- A majority of NMHSs reported difficulties in determining the correct GTS header including its area designator, and few reported on difficulties in registering the new message in the WMO publication *Weather Reporting* (WMO-No. 9) and updating WIS discovery metadata; these issues can normally be solved at NMHS level itself by contacting the NMHS's internal telecommunication team;
- Various Members requested the provision of encoding software as well as a technical guidance document such as the *Handbook on CLIMAT and CLIMAT TEMP reporting* (WMO/TD-No. 1188) (WMO 2009) including samples of correctly formatted DAYCLI messages. Some Members requested consideration of providing general BUFR training;
- Guidance has been requested for data quality control requirements as well as rules for sending corrections to DAYCLI messages via GTS including potentially attached time limits;
- NOAA/NCEI intends to collect the data submitted through DAYCLI and make them available and to integrate them eventually by adding these data specifically to their Global Historical Climatology Network (GHCN) datasets. It is not yet specified, however, how RCCs can access and efficiently use DAYCLI data in quasi real time mode. Moreover, QC/QA procedures at regional (RCC) level and relevant interactions with NOAA/NCEI have not been addressed so far;
- Members may wish to receive information on the use of their data submitted through DAYCLI.

It is suggested to explore ways to draft further WMO guidance on DAYCLI, which addresses the above observations and requests.

The below table shows that 20 Members submitted written intents to participate in the trial phase February 2019 - January 2020 (first column). In February 2020, a test done at NOAA/NCEP Central Operations (USA) revealed that data from only six Members have been received through GTS.

A technical analysis is needed to fully understand the situation and to outline a process ensuring that DAYCLI messages submitted by Members are available through WIS/GTS globally.

The following Members submitted interest and/or written intents to the Secretariat to participate in the trial

Argentina
Australia (will join later)
Brazil
Chile
Egypt
Estonia
France
Hong Kong, China
Indonesia
Ireland
Japan
Kazakhstan
Korea
Latvia
Mexico
Norway
Pakistan
Russian Federation
Spain
Switzerland

Benefits:

An analysis of recent data received at NOAA/NCEI compared to data in its GHCN-Daily dataset showed the benefit of the DAYCLI messages. For the stations received, in comparison to summary of the day observations previously collected in near real-time via FM12 SYNOP messages, the DAYCLI daily climate observations are able to fill in previously missing values for approximately thirty percent of the observations and update with more accurate measurements another thirty percent of the observations. These improvements highlight the value of the DAYCLI messages and the importance of expanding the list of participating countries so that the benefits can be extended across all regions in the global climate record.

3. Way forward

Aim at initiation of the DAYCLI pre-operational phase in 2021.

Before initiating the start of the pre-operational phase,

- Strive to implement a basic GTS monitoring process for the exchange of DAYCLI messages,
- Establish a repository of DAYCLI use cases to promote Member participation in the exchange of DAYCLI messages and to inform the need for and specifications of a

new BUFR template for DAYCLI messages, and consider options to provide a user-friendly encoding tool including guidance for Members.

[Secretariat]
