

Activities of CBS Lead Centre for GCOS for the WMO RA VI in the year 2021

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1. Evaluation of availability, completeness and correctness of CLIMAT reports

On a routine basis, DWD applies a near real-time quality control regarding availability and correctness of CLIMAT reports. This refers to all CLIMAT stations worldwide included in the GCOS Surface Network (GSN), the Regional Basic Climatological Network (RBCN) and the Antarctic Observing Network (AntON). TAC format is checked as well as BUFR format, if TAC is not available. The results of the quality control are the basis for various monitoring products.

DWD continued to increase the availability of CLIMAT data:

- by ingesting CLIMAT reports into the GTS received via e-mail from NMHS that are not or not well connected,
- by pointing NMHS to missing CLIMAT reports in the course of a month,
- by informing in case of receiving an incorrect month,
- by informing about severe errors in the reports,
- by distributing the monthly monitoring results to the CBS Lead Centres and the GCOS Network Manager. They contain information about missing GSN stations and format problems of CLIMAT reports received by the 20th of a month.

DWD informed the concerned NMHS directly by addressing the respective national Focal Points (FP). Alternatively, the relevant CBS Lead Centre is approached with the request to contact the NMHS in charge.

Most errors belonged to the following categories:

- no or incorrect month-year indicator (TAC and BUFR),
- other errors in section 0 (incorrect spelling of code name CLIMAT, other invalid characters) (TAC),
- invalid text/characters within the other sections (TAC),
- format errors (e.g. too short/too long groups, usage of “-“ for negative temperature values), blanks within groups (TAC),
- content errors (e.g. extreme temperature values instead of mean values, incorrect numeric scales) (TAC and BUFR),
- binary code errors (BUFR),
- correct month-year indicator, but data from a different month (mostly TAC),
- other types of data submitted with CS header, e.g. decadal values (Armenia), forecasts (Myanmar), unknown messages (Tuvalu) (TAC).

The NMHS of approx. 50 countries were contacted in 2021 either directly or via the responsible CBS LC with the request to send or rectify their CLIMAT reports.

1.1. Availability and correctness of GSN Stations in the RA VI

The GSN stations list of 2021 included 139 stations in RA VI. The annual average of received stations was 87 %.

Silent GSN stations in RA VI are:

- Iceland: 04048 Vestmannaeyjar reported up to April 2013. Its current status in OSCAR/Surface is closed.
- Portugal: 08506 Horta since February 2008
- Spain: 08181 Barcelona since October 2015
- Macedonia: 13577 Lazaropole since January 2014
- Albania: 13615 Tirana since September 2010
- Cyprus: 17600 Paphos
- Russian Fed.: 26359 Puskinskiy Gory since August 2018
34927 Krasnodar-Kruglik since July 2017
- Azerbaijan: 37989 Astara since October 2020
- Syria: 40001 Kamishli since October 2012
40022 Latakia since November 2013
40061 Palmyra since November 2013
- Jordan: 40250 H-4 Rwashd since March 2020. Traditional weather station was closed in June 2018, since then AWS, also closed now. Efforts to reopen the AWS. In the GSNMC monitoring product "CLIMAT Availability" the station was shown as received, but the contents of the messages were "NIL".

The silent Greek station 16734 (Methoni) was replaced by station 16627 (Alexandroupoli). Station 26554 (Verkhnedvinsk, Belarus) was added to the GSN in 2021.

1.2. Availability of CLIMAT stations in BUFR

In 2021 there were still countries, e.g. the Russian Federation, Iceland, Finland, which didn't provide CLIMAT reports in BUFR format. Most of the RA VI countries provide CLIMATs in BUFR as well as in TAC. For several years the BUFR CLIMATs of Norway, Sweden and some other countries had been transformed to TAC and re-ingested into the GTS by an (to date) unknown centre. Every month these erroneous TACs had been detected by the quality control. With the support from NCEI the CBS Lead Centre could identify the source of these messages, they originated from the GISC Exeter. The TAC bulletins were then removed from the GTS data feeds.

1.3. Comparison of the receipt of GSN stations at JMA/DWD and NCEI

JMA, NCEI and DWD continued evaluating the receipt status of GSN stations. This fulfilment of an action item from the 2016 GCOS Lead Centres Meeting bases on JMA's monthly GSN differ lists. They include GSN stations, which were only received by either DWD or JMA and those, which were missing by both.

The category of not received stations comprises also GSN stations reporting with an incorrect or missing month-year indicator. Other format errors prohibiting a correct automatic storage of the CLIMAT report are included as well as CLIMAT messages consisting of only "NIL".

Furthermore, the CBS LC performed a comparison of the BUFR CLIMAT messages received by DWD and JMA. Several differences were identified, e.g. no receipt of BUFR messages from Thailand by DWD, no receipt of BUFR messages from several countries by JMA, errors in BUFR decoding software at DWD and JMA. JMA was informed about the issues.

1.4. Comparison of CLIMATs in TAC and BUFR

In 2021 DWD restarted to compare the contents of CLIMAT messages from countries sending reports in both formats on a monthly basis. The LC contacted 10 NMHS worldwide via their FP or the LC in charge due to recurrent, partly large differences between TAC and BUFR reports. NMHS were supported in generating correct BUFR reports by checking trial messages and answering questions concerning code details, if necessary. 8 countries weren't able to fix the problems or didn't answer by the end of 2021. Canada sent test messages for a review by the CBS LC and subsequently started disseminating BUFR on a regular basis.

2. Availability of GUAN Stations

The number of GUAN stations in RA VI remained at 24 and all stations performed well. The basis for the following information are the GUAN summaries from NCEP (<https://www1.ncdc.noaa.gov/pub/data/gcos/>) for observation reports in TAC format and the WMO WDAQMS monitoring (https://wdqms.wmo.int/gcos/land_upper-air) for GUAN stations reporting BUFR. Information about the exact number of soundings per station is currently not available, because most stations submitted reports in TAC and BUFR formats and it is not possible to evaluate the number of redundant messages. NCEI is working on an updated version of the Integrated Global Radiosonde Archive (IGRA) process which incorporates GUAN BUFR data. Upon completion it will provide a full set of stations to the GUAN report.

Some stations have ceased or partially ceased their TAC GTS transmission. In 2021 station 01001 Jan Mayen (Norway) and 06610 Payerne (Switzerland) did not report in TAC format. 11035 Wien/Hohe Warte (Austria) reported some TAC in the 1st half-year and 02836 Sodankyla (Finland) as well as 17607 Athalassa (Cyprus) only in the 2nd. Station 33345 Kiev (Ukraine) did not report BUFR at all as the only in RA VI.

The NCEP GUAN summaries showed that most stations performed soundings at 00 and 12 UTC. The yearly totals reached from approx. 600 to 1000 observations per station. More soundings (ca. 1400) were reported by station 10393 Lindenberg (Germany). 37789 Yerevan (Armenia) and 40265 Mafraq (Jordan) reported only a small number of observations. Nearly all soundings reached 10 hPa and above.

3. GSN Monitoring Products

The redesigned GSNMC website www.gsnmc.dwd.de (published in March 2020) shows – besides the GSN – also the CLIMAT stations of the RBCN and AntON. The monitoring results (e.g. percentage of received CLIMAT reports) of these networks are not entirely correct due to an inaccurate affiliation of stations to the RBCN. Attempts to rectify the assignment of stations to the RBCN in the RA VI were only partly successful.

An extract of the GSN monitoring results (number of daily observations, CLIMAT group 8 and 9) has been implemented in the WIGOS Data Quality Monitoring System (WDQMS). While developing this feature the responsible WMO working group noticed some issues regarding the GSN monitoring files. Incorrect lat/lon values were rectified by the CBS LC. Furthermore, a problem with the BUFR CLIMAT reports processed by the GSNMC at JMA was identified. The reports don't contain the groups 8 and 9. This issue has not been resolved yet.

Due to an IT outage the U.S. CLIMAT BUFR reports for the time period May 2021 contain the values of April 2021. Corrected messages were disseminated via GTS after the cut-off-date for the GSN monitoring (21st of a month). TAC CLIMAT reports of the U.S. were not affected. But since BUFR messages have priority, the GSN monitoring results and datasets for May 2021 include incorrect data.

4. Data and Statistics Requests

Upon request of Denis Stuber (Météo-France, co-lead ET-DRC from SERCOM) a comprehensive evaluation about completeness and quality of worldwide CLIMAT messages for the years 2017-2020 was prepared.

Furthermore, the ET-DRC (Denis Stuber) requested a list that shows whether countries send CLIMAT messages in BUFR or TAC format.

5. Climate Normals

To increase the data basis of WMO reference period values 1961-1990 in DWD's Global CLIMAT Data Archive (<https://www.dwd.de/EN/ourservices/climat/climat.html?nn=565066>), section 2 data of CLIMAT reports from 1996 to 2020 were systematically re-evaluated. For almost all parameters the existing data basis in the DWD CLIMAT Data Archive could be extended. However, the QC-procedure during the analysis also revealed a considerable number of errors in the section 2 contents.

Furthermore, the CBS LC participated in the WMO Regional Consultations on CLINO 1991-2020.

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