Activities of Lead Centre for GCOS Networks for the WMO RA VI in the year 2024

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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 former Regional Basic Climatological Network (RBCN) and the former Antarctic Observing Network (AntON). A transition of these deprecated networks to RBON has not yet been performed for the GCOS monitoring, because decisions regarding the registering of CLIMAT reporting stations are still pending.

The automatic quality control includes checks regarding the formal compliance of the messages. 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. Furthermore, DWD checks the associated metadata and the quality of the observed geophysical parameters.

The Lead Centre 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 informing in the course of a month about missing CLIMAT reports, severe errors or in case of receiving an incorrect data month,
- by distributing monthly monitoring results to all Lead Centres and the GCOS Network Manager. The results contain information about missing GSN stations and format problems of CLIMAT reports received by the 20th of a month.

DWD informs the concerned NMHS directly by addressing the respective National Focal Points (WMO RA VI). For other WMO regions the relevant 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).

The NMHS of nearly 70 countries were contacted in 2024 with the request to send or rectify their CLIMAT reports. For RA VI the respective NHMS was contacted directly. For a NMHS associated with a different RA, the responsible Lead Centre was informed.

The NMHS of 24 countries were contacted in 2024 due to general issues, e.g. no CLIMAT messages at all, no BUFR, repeatedly incorrect messages, submission problems.

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

The number of GSN stations in RA VI increased from 138 to 141 stations by the end of 2024. The annual average of received CLIMAT reports (evaluation of performance indicators CA for availability) was 90,2 %. The performance indicators CC reveal a rate of correct CLIMAT messages of 93,8 %. The validness rate is 99,8 % for temperature values and 97,0 % for precipitation values.

Silent GSN stations in RA VI are:

Iceland:	04048 Vestmannaeyjar reported up to April 2013. Its current status in OSCAR/Surface is closed.
Macedonia:	13577 Lazaropole since January 2014
Albania:	13615 Tirana since September 2010
Croatia:	14236 Zagreb since March 2020. Observations continued quickly after an earthquake, but there are issues with the homogeneity of the time series. DHMZ is working on this.
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 Rwashed since March 2020. Traditional weather station was closed in June 2018, since then AWS, also closed now.

The GSN Monitoring Centre cannot yet process CLIMAT reports from stations without a WMO station number. This currently affects the new GSN station Pogány repülőtér (Hungary, WSI 0-348-1-39115), which is therefore missing in the GSN monitoring results.

Performance of GSN stations 2024 in RA VI by country (performance indicators CA and CC range between 0 and 1):

Country	CA	CC
Albania	0,00	-
Armenia	1,00	1,00
Austria	1,00	1,00
Azerbaijan	0,42	0,20
Belarus	1,00	1,00
Belgium	1,00	1,00
Bosnia and Herzegovina	1,00	0,83
Croatia	0,00	-
Cyprus	0,50	1,00
Czech Republic	1,00	1,00
Denmark	1,00	1,00
Estonia	1,00	1,00
Faroe Islands	1,00	0,58
Finland	1,00	1,00
France	1,00	1,00
Georgia	0,50	1,00
Germany	1,00	1,00
Greece	1,00	1,00
Greenland	1,00	0,95
Hungary	1,00	1,00
Iceland	0,67	1,00
Ireland	1,00	1,00
Israel	0,67	1,00
Italy	0,75	0,69
Jordan	0,92	0,32
Latvia	1,00	1,00
Lithuania	1,00	1,00
Luxembourg	1,00	1,00
Malta	1,00	1,00
Moldova, Rep. Of	1,00	0,75
Netherlands	1,00	1,00
North Macedonia, Rep. Of	0,00	-
Norway	1,00	1,00
Poland	0,92	1,00
Portugal	1,00	1,00
Romania	1,00	1,00
Russian Federation	0,92	0,92
Slovakia	1,00	1,00
Spain	1,00	1,00
Sweden	1,00	1,00
Switzerland	1,00	1,00
Syrian Arab Rep.	0,00	-
Turkey	1,00	0,99
Ukraine	0,93	0,77
U. Kingdom of Great Britain and N.-Ireland	1,00	1,00

1.2. Availability of CLIMAT messages in BUFR

Most of the RA VI countries provide CLIMAT reports in BUFR as well as in TAC format. By the end of 2024 eleven NMHS disseminated CLIMAT reports only in TAC format and eight NMHS only in BUFR format.

In early 2024 the Lead Centre contacted eleven NMHS in the RA VI region that didn't provide BUFR reports. Four of them migrated to BUFR in the course of the year and four NMHS announced the transition for the near future. Two NMHS answered that they are not able to perform the migration and would need support.

To encourage and support NMHS in transitioning to BUFR the head of the GCOS Lead Centre RA VI addressed the relevant WMO INFCOM/SERCOM counterparts with the suggestion to implement a CLIMAT BUFR encoding tool in wis2box analogue to the already existing synop2bufr.

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.

In contrast to JMA the evaluations from NCEI categorize GSN stations reporting with an incorrect or missing month-year indicator as not received. CLIMAT messages consisting of only "NIL" are included as not received in both evaluations.

After Austria had switched to BUFR in April 2024, JMA and NCEI no longer received any CLIMAT reports from there, probably caused by an incorrect routing. The receipt could be reestablished. A similar issue might be the reason for the non-receipt of BUFR CLIMAT from station 26406 (Latvia) and 78954 (Barbados) at JMA and NCEI.

2. Availability of GUAN Stations

The number of GUAN stations in RA VI remained at 24. The basis for the following information are the GUAN summaries from NCEP (https://www1.ncdc.noaa.gov/pub/data/gcos/). With an update of the Integrated Global Radiosonde Archive (IGRA) in February 2023 the radiosonde reports back to 2014 have been augmented with BUFR data. This also applies to the GUAN summaries. The WMO WDQMS monitoring (https://wdqms.wmo.int/gcos/land_upper-air) shows only the availability of observations in BUFR format.

The yearly totals mostly reached from approx. 650 to 1000 observations per station. More soundings (ca. 1450) were reported by station 10393 Lindenberg (Germany). The NCEP GUAN summaries showed that most stations performed soundings at 00 and 12 UTC. 08508 Lajes (Azores/Portugal), 15614 Sofia (Bulgaria) and 17607 Athalassa (Cyprus) didn't provide reports for 00 UTC. No observations were available from station 33345 Kiev (Ukraine), 37789 Yerevan (Armenia) and 40265 Mafraq (Jordan).

Most stations provide upper air observations in TAC and BUFR format. From station 04270 Mittarfik Narsarsuaq (Greenland) and 03808 Camborne (UK) no BUFR reports were available.

Nearly all soundings reached 10 hPa and above. However, the soundings from station 15420 Bucuresti (Romania) and station 27459 Nizhnij Novgorod (Russ. Fed.) only partly reached 10 hPa. From station 17130 Ankara (Turkey) almost no sounding reached 10 hPa.

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. Both networks were migrated to the WIGOS Regional Basic Observing Network (RBON) in June 2022 and are therefore deprecated now. The GSN monitoring has not yet been adapted in this regard. Within RBON an identification mechanism for stations which are expected to report CLIMAT is still missing.

An extract of the GSN monitoring results (number of daily observations, CLIMAT section 1, groups 8 and 9) serves as a basis for the GCOS surface monitoring within the WIGOS Data Quality Monitoring System (https://wdqms.wmo.int/gcos/land_surface).

4. Further Activities

Upon request from the Met. Service BMKG Indonesia an evaluation of errors in CLIMAT reports from Indonesia for the year 2023 was prepared.

For the WMO Secretariat the receipt of DAYCLI messages for 12/2023 (incl. template usage and encoding of WSI) was summarized.

For a training course at the Paraguay Met Service WMO SERCOM was provided with information about the CLIMAT messages from Paraguay (reporting stations, particular errors).

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