

WORLD METEOROLOGICAL ORGANIZATION



**COMMISSION FOR BASIC SYSTEMS
OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS**

CBS/GCOS EXPERT MEETING ON THE GSN AND GUAN

OFFENBACH, GERMANY

15-17 May 2002



FINAL REPORT

DISCLAIMER

Regulation 42

Recommendations of working groups shall have no status within the Organisation until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

Regulation 43

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation on behalf of the constituent body when the matter is, in his opinion, urgent, and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organisation for action in accordance with Regulation 9(5).

EXECUTIVE SUMMARY

The first CBS/GCOS Expert Meeting on Co-ordination of the GSN and GUAN was held at the DWD Headquarters in Offenbach from 15 to 17 May 2002. The meeting considered the major GCOS activities to implement and support GSN and GUAN.

The EM noted the two-stream strategy that takes into account the range of requirements for climate data. *Comprehensive global networks* provide data that are assimilated in global models to generate real-time predictions and delayed-mode reanalyses of global climate. These networks continue to extend in scope as the capabilities of models increase. Satellite data make a major contribution to the comprehensive networks, as they can provide true global coverage. *Baseline global networks* provide high-quality homogeneous data that are used to monitor global climate and to calibrate data from the comprehensive networks. These data are relatively sparse compared with the comprehensive networks. The baseline networks are also vital to reanalysis, as they provide the only means of ensuring temporal homogeneity in the comprehensive data. (See §2, below)

The EM reviewed the activities of some of the RSMCs. The meeting noted that both surface and upper-air data volume in RA I is low and dropping. This situation is reflective of problems such as poor data infrastructure, economical, and political problems facing many African countries. Provision of international assistance could address this problem. (See §3.1) Turning to Region III, the meeting heard a report on the current status of RBSN stations in Argentina and the availability of CLIMAT/CLIMAT TEMP reports. The statistical results showed a negative trend, validating the need for renewed co-ordination. The meeting keenly felt the need for improvement and participants discussed what actions could be taken or recommended to ensure more and higher quality observations are made available. (See §3.2)

The meeting heard a summary of the GUAN monitoring at ECMWF as a part of the Global Monitoring carried out on a monthly basis. For the UA network vertical statistics are computed daily and accumulated on a monthly basis for four cycles (00, 06, 12, 18 UTC). Post-processing of the vertical statistics files allows the computation of longer-term statistics, which can be displayed in many different ways (e.g., vertical profiles, time series and comparisons for temperature, wind and humidity). A review of year 2001 shows that no clear trend can be established globally, although there appear to be trends by hemisphere, and by observation time. With respect to QC, the main concern is in RA II; while for winds, the problem seems to be somewhat concentrated in the tropics. (See §4)

Pressure monitoring (SYNOP) shows a problem re: the station height catalogue. [e.g., SYNOP 60437, which in UKMO statistics is suspicious (UKMO applies a pressure bias correction of +6.8 hPa) appears unbiased in ECMWF statistics, while SYNOP 71819 is neither blacklisted nor bias corrected in UKMO but shows up with a strong positive bias and small STD in ECMWF statistics.]

The meeting was pleased to hear about progress in the software for monitoring, CLIMAT messages. The software was developed by Deutscher Wetterdienst in 1999 and is currently used by both DWD and JMA. The software, named FORMCHECK, is able to recognise all of the most common errors -- and some rather rare ones -- occurring in CLIMAT and CLIMAT/TEMP transmissions. It corrects many of them and flags others. (See §4.2)

A report was received on the performance of GSN and GUAN, based on results in the responsible Monitoring Centres A. (See §5)

Preliminary conclusions with respect to the GSN include:

- The number of stations that are meeting requirements of data transfer and CLIMAT provision is now 251 (26%).
- The number of stations that have transferred historical data increased from 198 to 314.

- The number of stations that provided CLIMATs (at least at a moderate level of frequency) increased from 624 to 688.
- In 2001, 194 stations improved performance as opposed to 41 stations with deteriorating performance.
- Many larger countries have transferred historical data, but smaller countries are still problematic, especially in Region III.

As concerns GUAN, for the 9 months June 2001 - March 2002:

- 50% are operating satisfactorily, whilst 13% provide acceptable observations.
- The number of stations lacking wind data having reduced to 3, the termination of Omega no longer seems significant.

The Met Office Hadley Centre is undertaking a number of activities as contributions to GUAN. A GUAN web site has been in place since 2000. The web site is linked to GCOS, NCDC, and ECMWF allowing GUAN users to access all relevant information. Routine monitoring of CLIMAT TEMP is conducted at the Hadley Centre including creation of an enhanced GUAN temperature database. Reception maps of monthly data are presented on the GUAN web.

Senior Staff of the Deutscher Wetterdienst provided briefings on the procedures currently being applied at this GSNMC. Subjects covered included quality checks for precipitation and temperature as well as the outlook for future developments in Climate data monitoring. (See §6)

Recalling that the need for the major *centres* to monitor the quality of observations, first confirmed by CBS in 1985, in accordance with Recommendation 8 (CBS-IX), had led the president of CBS to designate ECMWF, RSMC Bracknell, and WMC/NMC Washington as the lead centres for monitoring data quality. These three centres were later supplemented by RSMC Nairobi, RSMC Tokyo, RSMC Buenos Aires, RSMC Montreal, WMC/RSMC Melbourne, and RSMC Offenbach, for monitoring quality of land surface observations in their respective regions. The Expert meeting took note that in implementing the procedure for monitoring the quality of data, these centres are producing *monthly-* and *six-monthly* consolidated lists of suspect stations (stations reporting erroneous data). With the exception of RSMC Buenos Aires, the WMO secretariat has been regularly receiving quality-monitoring reports, which are then distributed accompanied by the request that any possible cause of error be corrected. (See §7)

Based upon the above discussions, the Expert Meeting generated the recommendations contained in Appendix III, concluding by recommending that such meetings be continued in the future.

1 ORGANIZATION OF THE MEETING

The first CBS/GCOS Expert Meeting on the GSN and GUAN was held at the DWD Headquarters in Offenbach from 15 to 17 May 2002. The list of participants is attached as Appendix I.

1.1 OPENING OF THE MEETING

The meeting was opened at 10 a.m. on 15 May. On behalf of the president of the DWD, Mr. U. Gärtner, the session was welcomed by Mr. S. Mildner, vice president of the DWD and former president of CBS. He recalled that the 12th session of CBS had identified the support to the GCOS components as one of their priority tasks, and that the GUAN and GSN were an integral part of the concept of integrated observing systems of the WMO World Weather Watch.

Mr. Mildner emphasised the need for the establishment of efficient network monitoring functions for GCOS making use of the experience gained by the designated monitoring centres under the WWW Programme. He underlined that this required substantial efforts and resources by the centres as well as by the NMHSs involved. These aspects needed to be carefully planned and considered by the session with a view to developing a realistic proposal for the extraordinary session of CBS in Cairns, December 2002.

In expressing his satisfaction for hosting this Expert Meeting with the attendance of representatives from all designated monitoring centres and highly competent individuals, Mr. Mildner pledged the full support of the DWD to the meeting and wished all participants the best of success for their discussions.

Mr Volker Vent-Schmidt, Head of DWD Department for Climate and Environment and vice-president of CCI also greeted the meeting. He recalled that the DWD was, in 1993, one of the first NMHSs to establish a national GCOS-Secretariat. Since then the German GCOS-Secretariat contributed to several GCOS-Panels and the Steering Committee and many GCOS meetings have already been held in Offenbach. In line with this engagement was the offer to run the GCOS Surface Network Monitoring Centre (GSNMC) jointly with the Japan Meteorological Agency. He also recalled that it is now up to the nations to take actions. As Mr. Vent-Schmidt is also vice-president of the WMO Commission for Climatology (CCI) he looks forward to the recommendations coming out of this meeting, and offered support from CCI as far as possible. However, the recommendations from this meeting eventually have to be accepted by WMO Congress.

1.2 ELECTION OF THE CHAIRMAN

Mr Stefan Rösner was unanimously elected chairman of the meeting.

1.3 ADOPTION OF THE AGENDA

The provisional agenda submitted for the meeting was adopted and is given in Appendix II.

1.4 WORKING ARRANGEMENTS

The meeting agreed on its working hours and on a tentative work plan

2 GCOS STRATEGY TO SUPPORT BASELINE OBSERVING SYSTEMS

Dr M. Manton, the chairman of AOPC, presented a summary of the major GCOS activities to implement and support GSN and GUAN. The EM noted that for meteorological observations, GCOS has developed a two-stream strategy that takes into account the range of requirements for climate data. There are *comprehensive* global networks and *baseline* global networks, and each stream has specific requirements.

2.1 *Comprehensive global networks* provide data that are assimilated in global models to generate real-time predictions and delayed-mode reanalyses of global climate. These networks continue to extend in scope as the capabilities of models increase. For example, the use of measurements of atmospheric constituents in reanalysis and prediction is expected to increase over the next few years as ozone, aerosols and carbon dioxide data are shown to explain sign-

ificant variance in the atmosphere. Satellite data make a major contribution to the comprehensive networks, as they can provide genuinely global coverage.

2.2 *Baseline global networks* provide high-quality homogeneous data that are used to monitor global climate and to calibrate data from the comprehensive networks. These data are relatively sparse compared with the comprehensive networks. However, they are required to be sufficiently dense to ensure that large-scale climate indicators can be generated from them for all key climate variables. Although the initial focus has been on *in situ* baseline data, it is important that baseline satellite data systems also be included in this stream. For example, baseline systems should be maintained for MSU radiances and the solar constant.

Each baseline network involves an end-to-end system to ensure data are collected, processed and archived effectively. *Monitoring Centres* are identified to provide real-time monitoring of the availability and basic quality of the collected data. *Analysis Centres* ensure the homogeneity and quality of the data and generate basic products. The data are archived at *World Data Centres*.

The baseline networks are also vital to reanalysis, as they provide the only means of ensuring temporal homogeneity in the comprehensive data. Thus the *in situ* baseline data, such as from the GCOS Surface Network (GSN) and the GCOS Upper Air Network (GUAN), provide calibration for more spatially dense datasets, including satellite data. Although the GSN and GUAN observing sites have been identified, a substantial number of stations are not meeting the basic standards required of baseline data. As most of the sites were selected on the basis of their historical records, the current deficiencies are generally associated with the world-wide decline in support for infrastructure. Thus, targeted funding is expected to resolve most of the current deficiencies.

2.3 Mr. Thigpen reported that, in a speech on 11 June 2001, President Bush announced the establishment of the U.S. Climate Change Research Initiative (CCRI). That initiative is currently in the budget review process in the U. S. Congress. The initiative includes a variety of elements such as the establishment of a climate modeling center, work towards the establishment of an ocean observing system, enhanced carbon monitoring and, of particular interest to the GCOS community, an element that funds work to improve the operation of GCOS stations. To that end, the U.S. has engaged a contractor (Mr. Thigpen) to begin the process of analyzing the causes of poor station performance, identify solutions, and estimate the cost and priority of those solutions. The objective of this analysis would be an action plan that would permit corrective action as soon as funds are available. The contractor is expected to work very closely with the various monitoring centers, the AOPC and the GCOS and WWW Secretariats of the WMO.

3 MONITORING ACTIVITIES WITHIN WWW WITH EMPHASIS ON CLIMAT AND CLIMAT TEMP

3.1 A review of monitoring activities being carried out by RSMC Nairobi in Region I was presented by Mr Ignatius Gitonga. Both surface and upper-air data volume in RA I are low and still falling. For the period 1999, 2000 and 2001, the percentage of availability CLIMAT TEMP reports showed a decrease of 63%, 53% and 53% respectively. For GSN CLIMAT records, the region shows a performance of below 40% for the same period of 1999-2001, which is the lowest percentage in all six WMO Regional Associations. This situation with data volume in the region may be attributed to a number of factors. The worst hit is Block 66, which hardly report any data. The major problems affecting the data volume are poor data infrastructure, economical and political problems facing many African countries. To address this data volume problem in the region, provision of international assistance is indispensable. The EM noted that the initiative currently being undertaken by the United States Climate Change Research Institute (USCCRI) to look into ways of funding the upper-air stations in the near future is a very good and promising point to reverse this alarming trend in the data availability in the Region. The EM also agreed that ways for improving the data infrastructure should also be explored.

3.2 Mr Mario Jorge Garcia informed the meeting on the current status of RBSN station performance in Argentina and the availability of CLIMAT/CLIMAT TEMP reports. The EM noted

that due to failure in the communication links, the La Quiaca station (87007) was not producing climate data. The problem will be solved in the near future utilising e-mail. It was also noted that station Pcia Roque Saenz Pena (97148) replaced closed station (87149) with the same name; station Lago Argentino (87903) was temporarily closed and a new station El Calafate (87904) was installed, the location of which is 20 km apart and 20 m below. Since 1996, for budgetary reasons, a plan for temporary reduction of quantity of radiosondes was applied that effected 50% reduction in radiosondes launches. From September 2001, the Servicio Meteorologico Nacional adopted the decision to maintain in operation on a temporary basis the stations Cordoba (87344), Ezeiza (87576) and Santa Rosa (87623) with daily launchings at 12 UTC.

The statistical results show a lack of positive trend, validating the need for renewed co-ordination. The meeting felt the need for improvement keenly and participants discussed what actions could be taken or recommended to ensure more and higher quality observations are made available.

4 MONITORING OF GCOS ATMOSPHERIC NETWORKS

The meeting recalled that for both GCOS atmospheric networks monitoring centres have been designated. The GUAN performance is monitored by the European Centre for Medium Range Weather Forecast (ECMWF), and the GSN is monitored jointly by the Japan Meteorological Agency (JMA) and the Deutscher Wetterdienst (DWD). The monitoring centres provide reports on the monitoring results on a regular basis

4.1 MONITORING THE GUAN AT ECMWF

Mr Antonio Garcia-Mendez presented a summary of the GUAN monitoring at ECMWF as a part of the Global Monitoring carried out on a monthly basis. Once the raw data have been assimilated the ECMWF 4-DVAR produces the so-called feedback files (BUFR files). These files contain information about the raw data, departures from the background fields and analysis and a variety of flags showing whether the data has been used or rejected and in case of rejection the reason why. For the UA network vertical statistics are computed daily and accumulated on a monthly basis for four cycles (00, 06, 12, 18 UTC). Post-processing of the vertical statistics files allows the computation of longer-term statistics, which can be displayed in many different ways (vertical profiles, time series and comparisons for temperature, wind and humidity).

A review of year 2001 shows that the amount of GUAN reports received at ECMWF increased for NH, at 00 and 12 UTC compared to those received in 2000. At 06 and 18 UTC the reception rates increased since summer 1999. In the Tropics there is a decreasing trend for the reports at 00 UTC and an increase for the reports at 12 UTC, whereas in the Southern Hemisphere a decreasing trend in the number of reports received at 00 and 12 UTC can be noticed during the last year. As for QC the main concern is about Asian stations, the Consolidated list of suspect UA stations (geopotential) show a heavy cluster of GUAN stations in Asia. In the case of wind, the GUAN stations on the consolidated list are mostly located in the Tropics.

The monitoring of SYNOP pressure shows a problem related mainly to the station height catalogue. For example SYNOP 60437, which in UKMO statistics shows up as suspicious (UKMO applies a pressure bias correction of +6.8 hPa) appears unbiased in ECMWF statistics. The case of SYNOP 71819 is the other way round, the station is neither blacklisted nor bias corrected in UKMO but it shows up with a strong positive bias and small STD in ECMWF statistics. These are not isolated examples; therefore we are using different station height catalogues with errors on both sides.

The ECMWF has developed a web page to support GUAN monitoring. The GUAN web page is updated every third day of the month. It displays UA reception for three different parameters (temperature, wind and humidity), five different levels (700, 300, 100, 50 and 10 hPa) and ten different areas (Europe, North Atlantic, Africa, North America, South America, Siberia, Northeast Asia, South Asia, Australia and Antarctica) plus a global summary. All charts show the station id and the number of received data and gross errors at 00, 06, 12 and 18 UTC). The

exception is the summary charts; these charts show the percentage of available data at 00/12 UTC using a colour code for five different categories ranging from 0% to 100%. [URL for ECMWF:]

4.2 MONITORING AT THE GSNMCs JAPAN AND GERMANY

4.2.1 Mr Rösner introduced the background and historical development that led to the implementation of the GSNMC at JMA and DWD. He recalled the tasks of the GSNMC as agreed in the GSNMC implementation meeting (GCOS-53):

- To monitor the availability, timeliness and completeness of the CLIMAT messages distributed via GTS to improve the performance of the GSN;
- To perform basic quality control and assurance procedures for GSN stations to obtain high quality and completeness of the data set.

He described the data flow from GTS through the two GSNMCs, resulting in a final GSN monthly data set, which is regularly sent to the WDC-A. The deliverables of the GSNMCs are tables, listings of frequently detected format errors, performance indicators for all GSN stations and different figures illustrating availability, timeliness, completeness and correctness of the GSN CLIMAT messages. Finally he presented the recently compiled results for the sixth monitoring period July to December 2001, which will soon be published in the sixth GSNMC Monitoring Report.

Mr Rösner also showed how the GSNMC is implemented in the DWD. Overall at least 7 persons are involved in the operation of the GSNMC at DWD.

4.2.2 Mrs. Christiana Lefebvre provided a description of the software for monitoring CLIMAT messages. The first step in monitoring messages from GSN stations is to decode all incoming CLIMAT bulletins with the header code 'CS' received at the GSNMCs at a fixed cut-off date (21st, 00 UTC of the following month). This decoding is done using the software 'FORMCHECK', developed by Deutscher Wetterdienst in 1999 and currently used by DWD and JMA.

FORMCHECK takes into account that some countries still use the old CLIMAT code (FM71-V), although a new one was introduced in December 1994. Frequently different random and systematic format errors in the messages are detected. On average 30-45% of all received CLIMAT stations at DWD show at least one format error in the message.

The software FORMCHECK analyses the CLIMAT messages word by word (a word is defined as characters separated by a blank). This technique allows for checking if the format of every group of the CLIMAT code was correct. If differences are detected, the software automatically tries different options to identify the kind of error or the reason for the discrepancy. It is able to decide if the message was reported in the old code or if there was an error and if this error can be rectified. FORMCHECK generates listings of decoded CLIMAT messages, sorted by different features like old/new code or different types of format errors as well as protocol lists, which include flags indicating the kind of format errors detected. The flags in the protocol lists are used to monitor the correctness and completeness of the CLIMAT reports. Additionally, for every bulletin the time of receipt is stored to monitor the timeliness of the received reports.

With supplementary software, information about errors detected from individual countries can be extracted from the protocol lists and listed in separate files.

For each country an error list was sent as Annex IX together with the third GSN Monitoring Report by the GCOS Secretariat in March 2001. Starting with the 5th GSN Monitoring Report, all Annex IX files are now available on the GSNMC homepage. Distributing the lists to the countries was very effective. Several countries reacted directly. Some were able to eliminate their systematic errors and others switched to the current CLIMAT code.

4.2.3 Mr. Isobe introduced the contribution of JMA to the GSNMC. After installing the common decoding software FORMCHECK, JMA developed software to compare and merge monitoring results from the two GSNMCs. In producing the GSNMC Monitoring Report, the section of timeliness is allotted to JMA. It is noted that monitoring of timeliness measured by reception rate of CLIMAT messages until the 5th or 8th day of the month is needed for near real-time monitoring of

global climate. JMA is responsible for the quality monitoring of temperature reported in GSN-CLIMAT messages.

As an example of collaboration between the GSNMC and the WWW activities within JMA, he stated that GSNMC monitoring results had been used for the initial nomination of the Regional Basic Climatology Network (RBCN) in Regional Association II. Mr. Isobe proposed that the RBCN should be monitored within the GSNMC activities in future. Additionally, he informed the EM that the focal point of GSNMC at JMA would be replaced by a successor after this meeting.

Further information about the GSNMC including latest news can be found on the home page of the GSNMC (<http://www.gsnmc.dwd.de/>).

5 DIFFERENCES AND MATCHES IN THE COLLECTION/DISSEMINATION OF CLIMATE DATA

A review of the performance of GSN and GUAN stations was reported by Mr Daan. Based on results in the responsible Monitoring Centres A, the following preliminary conclusions may be drawn:

5.1 GSN

- The number of stations that are meeting requirements of data transfer and CLIMAT provision is now 251 (26%).
- The number of stations that transferred historical data increased from 198 to 314.
- The number of stations that provided CLIMATs (at least at a moderate level of frequency) increased from 624 to 688.
- In 2001, 194 stations improved performance as opposed to 41 stations with deteriorating performance.
- The larger countries are principally responsible for the increased transfer of historical databases. Whilst many smaller countries have not yet done so. This could be a major problem for further progress in the near future. Region 3 is a problematic Region in this respect.

5.2 GUAN

From the monthly reports provided by ECMWF, an analysis was made on the types of insufficiencies for the 150 GUAN stations and 18 standby stations over the 9 months from June 2001 through February 2002. The following preliminary conclusions may be drawn.

- About 50% of the network stations are operating at a satisfactory level, another 13% provide acceptable observations.
- The number of stations lacking wind data has reduced to 3. The effect of the termination of the Omega system seems to have been minimised.
- Two stations became silent recently. In particular 68110 Windhoek (Namibia) should get attention. This station was one of the best in Africa some years ago. The expertise is there, and probably funds for consumables is the only problem.
- It should be noted that the silent stations include two stations that have been replaced. These changes should be effected in the GUAN list now.

6 STATUS AND DEVELOPMENT OF SOFTWARE FOR MONITORING (See also §4.2.2)

6.1 THE MET OFFICE HADLEY CENTRE.

Hadley Centre is undertaking a number of activities as contributions to GUAN. The GUAN web site has been in place since 2000. This has successfully promoted interest in Hadley Centre radiosonde products from other academic institutions. The web site is well connected to pages at

GCOS, NCDC, and ECMWF, allowing GUAN users to freely access all relevant information. [URL for Hadley Centre: <http://www.metoffice.com/research/hadleycentre/guan/index.html>]

6.1.1 Routine monitoring of CLIMAT TEMP is conducted at the Hadley Centre. Reception maps of monthly data are presented on the GUAN web site updated on the 1st of each month. The current map (March 2002) was presented at the meeting showing that 30% of the network still fails to report regularly. South America and Africa are regions of particular concern.

6.1.2 Six-monthly and longer-term statistics are provided on request. Station reliability and reporting percentage statistics were presented for the period 1999-2001. The complete network has remained stable at 69% reporting during this time. Regionally Africa, Asia and South America have seen a decline in reporting, while Central America has improved.

6.1.3 Hadley Centre has created an enhanced GUAN temperature database. Historical data are available for up to 90% of the network in recent decades, suggesting that near real time data problems do not imply that observations have not been made.

Comparison of CLIMAT TEMP data from the Hadley Centre with monthly statistics from the NCDC CARDS project highlight significant differences between data based on source and time of observation. Hadley centre is actively working to resolve these issues.

6.1.4 The ability for the analysis centres to confidently correct historical biases in data time series depends critically on the availability of station history information. It was suggested that metadata be given equivalent status as the observational data.

6.1.5 The Hadley Centre actively produces global gridded radiosonde products (HadRT). A project is underway to produce a new version of HadRT considering spatial and temporal homogeneity with reference to GUAN stations.

6.1.6 Near real-time climate monitoring and research is conducted at the Hadley Centre. Current research projects include analysis of differences in temperature trends between the surface and the troposphere. Zonal mean radiosonde data suggest this difference is largest in the tropical troposphere highlighting the importance of data availability in this region.

6.2 GSNMC

6.2.1 The quality check procedures for precipitation

Dr. Rudolf, head of the Global Precipitation Climatology Centre (GPCC) operated by the DWD, presented an overview on the quality check and quality assurance procedures applied by the GPCC. He recalled that the GPCC was established at the DWD on invitation of WMO in 1988 and is now seen as a contribution *inter alia* to GEWEX and GCOS. The task of the GPCC is to collect and analyse land-surface precipitation data on a global scale. He described the different steps necessary to end up with precipitation values quality-controlled on a high level. Examples illustrated the difficulties encountered during this process, such as erroneous metadata, errors in coding, etc. He showed that on average 600 out of 7000 monthly precipitation values received via GTS and included in the GPCC Monitoring Product are marked as questionable by the automatic QC procedures, requiring manual investigation. The flags for the monthly precipitation amount set in the monthly GSN data set are directly derived from the semiautomatic quality-control procedure for the GPCC Monitoring Product. Further information about the GPCC is available on the home page of GPCC at DWD [URL for DWD: <http://www.dwd.de/>]

6.2.2 The quality check procedures for temperature

Mr Isobe explained the quality-check procedures for temperature applied by JMA. In the quality-check work, the software compares monthly mean temperatures reported in CLIMAT messages with one derived from SYNOP data and it also compares the normalised anomaly of reported monthly mean temperature with those at nearest stations. JMA has started developing a new quality-check method using statistical relationships between actual surface monthly mean temperature and 850hPa monthly mean temperature of objective numerical analysis. Future plans call for extending the number of quality-checked parameters (e.g., the number of summer days & frost days).

6.2.3 The GSNMC - an outlook

Mr Rösner presented prototypes of end-to-end information systems for the GSNMC developed in the DWD Intranet. In order to reduce the manual effort necessary to present the GSN monitoring results, this procedure needs to be automated as far as possible. Therefore an Internet based user interface is planned, which will allow to access the GSNMC information database and select tables, figures and listings based on the latest GSN monitoring information available. He also demonstrated the ability of one of the prototypes for generating a simplified monitoring report on the fly. DWD together with JMA plans to implement components of these two prototypes once basic problems such as a secure Internet access to the operational database are solved.

Prior to such a solution, the GSNMCs at JMA and DWD agreed to reduce the frequency for the GSN Monitoring Report to once a year. The 7th issue of the GSNMC MR will be available only after April 2003.

7 FOCAL POINTS AND LINKING OF ACTIVITIES

7.1 MONITORING CENTRES

The Expert meeting recalled that the Commission for Basic Systems agreed, in 1985, that there was a need for the major *Numerical Weather Prediction centres* to monitor the quality of climate observations. This was achieved by comparing the model first guess with the observation at the station and exchanging monthly lists of stations that are persistently in error. The model first guess fields are obtained by interpolating to the observation point. The procedure for monitoring the quality of data by centres and nomination of lead centres is given in the Manual on the Global Data-Processing System (WMO-No. 485).

In accordance with Recommendation 8 (CBS-IX), the following three centres were appointed in November 1988 by the president of CBS as the lead centres for monitoring data quality:

ECMWF	for upper-air observations;
RSMC Bracknell	for marine surface observations and
WMC/NMC Washington	for aircraft and satellite observations.

Following recommendations of CBS and after consultations with the presidents of Regional Associations concerned, the president of CBS designated the following lead centres for monitoring quality of land surface observations in their respective regions:

RSMC Nairobi	Regional Association I;
RSMC Tokyo	Regional Association II;
RSMC Buenos Aires	Regional Association III;
RSMC Montreal	Regional Association IV;
WMC/RSMC Melbourne	Regional Association V;
RSMC Offenbach	Regional Association VI.

7.2 IMPLEMENTATION OF MONITORING AT CENTRES

The Expert meeting took note that in implementing the procedure for monitoring the quality of data, these centres are producing *monthly* lists of observing stations that persistently report erroneous observations. They are also compiling *six-monthly* consolidated lists of suspect stations (stations reporting erroneous data). The EM also noted that, with the exception of RSMC Buenos Aires, the WMO secretariat has been regularly receiving quality-monitoring reports produced by these centres. These reports have then been distributed among Members concerned accompanied by the request that those Members investigate and correct any possible cause of error in accordance with paragraph 22 of the Manual on the GDPS (WMO-No. 485).

8 CONCLUSIONS AND RECOMMENDATIONS FOR SUBMISSION TO CBS

Based upon discussion under agenda Items 2 - 7, the EM developed and agreed upon specific proposals related to the maintenance and monitoring of GCOS atmospheric networks.

These proposals are presented in Appendix III. It is suggested that these recommendations be presented through existing GCOS and CBS procedures. In particular, Mr. S. Rössner, as CBS/OPAG/IOS Rapporteur will present a document summarising the results of the Expert Meeting to the upcoming session of the CBS/IOS Implementation/Co-ordination meeting scheduled for 14-18 October 2002. The EM also noted that the upcoming AOPC meeting (20-24 May 2002) will be informed accordingly on the results.

9 CLOSURE OF THE MEETING

There being no other business to come before the meeting, the chairman thanked the participants for their contribution and active work during the meeting. Mr Volker Vendt-Schmidt on behalf of the DWD management expressed appreciation to all participants for their lively discussions and the valuable input provided to the deliberations of the meeting. Following expressions of appreciation to the representatives of the DWD for providing excellent facilities, the meeting was closed at 1100 hrs on 17 May 2002.

APPENDIX I

EXPERT MEETING ON COORDINATION OF THE GSN AND GUAN
OFFENBACH, GERMANY, 15-17 MAY 2002LIST OF PARTICIPANTS

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APPENDIX II

AGENDA

1. ORGANIZATION OF THE MEETING

- 1.1. Opening of the meeting
- 1.2. Election of chairman
- 1.3. Adoption of the agenda
- 1.4. Working arrangements

2. GCOS STRATEGY TO SUPPORT BASELINE OBSERVING SYSTEMS

3. MONITORING ACTIVITIES WITHIN WWW WITH EMPHASIS ON CLIMAT AND CLIMAT TEMP

4. MONITORING OF GCOS ATMOSPHERIC NETWORKS

- 4.1 Monitoring the GUAN at ECMWF
- 4.2 Monitoring at the GSNMCs Japan and Germany
- 4.3 The GSNMC Software for monitoring CLIMAT

5. DIFFERENCES AND MATCHES IN THE COLLECTION/DISSEMINATION OF CLIMATE DATA

6. STATUS AND DEVELOPMENT OF SOFTWARE FOR MONITORING

- 6.1. Actions taken by GUAN Monitoring Centre
- 6.2. Actions taken by GSNMC

7. FOCAL POINTS AND LINKING OF ACTIVITIES

8. CONCLUSIONS AND RECOMMENDATIONS FOR SUBMISSION TO CBS

9. ANY OTHER BUSINESS

10. CLOSURE OF THE MEETING

EMCGG: DRAFT RECOMMENDATIONS

The Expert Meeting on the GSN and GUAN, proposes that the following actions be taken to improve the quality and quantity of data available for the Global Climate Observing System.

Rec. 1 Recognising the target requirement to reach an accuracy of 5 hpa height for GUAN stations, recommends that the GUAN MC include an indication of those stations which were reaching that target in its published performance results.

Rec. 2 Recalling that the GCOS MCs may request re-transmission of missing CLIMAT and/or CLIMAT TEMP messages through the GTS, encourages them to make use of this procedure for getting all the data to the maximum extent.

Rec. 3 Recommends that simple PC software should be made available to NMHSs for encoding and formatting national monthly data into CLIMAT and CLIMAT TEMP reports.

Rec. 4 Recommends that the GSN and GUAN Monitoring and Analysis Centres collaborate with the GCOS Archive to ensure that all relevant data and metadata that they have obtained or developed from all sources is provided to the archive to ensure that the archive has, and makes available to users, the most complete and reliable data sets possible.

Rec. 5 Recommends that the GCOS Monitoring Centres, Analysis Centres and Archives harmonise the categories used to determine and present performance results to the extent possible. It suggested in particular that the following categories be considered:

Category:	1	2	3	4	5	6
Performance (%):	100	76-99	51-75	26-50	1-25	0

Rec. 6 Recommends that appropriate action be taken to ensure that all RBCN CLIMAT and CLIMAT TEMP messages are tagged for global distribution and that deficiencies be brought to the attention of the RTHs.

Rec. 7 Recognising the difficulties encountered in bringing results of monitoring the GSN and GUAN networks to the attention of station operators in order that remedial action could be taken in a timely manner, recommends that CBS Lead Centres for GCOS Data be established, on a trial basis, to facilitate the exchange of this information directly with the NMSs involved. These Lead Centres would have the Proposed Terms of Reference as presented in Table 1.

TABLE 1:

Proposed Terms of Reference for CBS Lead Centres for GCOS Data
• Evaluate the monitoring results of the GCOS Monitoring and Analysis Centres;
• Co-ordinate activities with other GCOS Centres and/or other centres as appropriate;
• Liaise with nominated Points of Contact for GCOS data to improve data availability and quality;
• Monitor and report to CBS and GCOS on action taken and progress achieved;
• Maintain the list of Points of Contact in co-operation with WMO Secretariat.

Rec. 8 Further recommends the nomination of Points of Contact by each of the NMSs who could be contacted directly by the Lead Centres and who would be tasked by the PR to follow up with appropriate action within the NMHS concerned. Proposed Terms of Reference for the POCs are given in Table 2.

TABLE 2:

Proposed Terms of Reference for Points of Contact for GSN and GUAN
<ul style="list-style-type: none"> • Liase within the NMHS on GSN and GUAN issues related to data availability and quality;
<ul style="list-style-type: none"> • Inform Lead Centres on current and potential problems that might impact data availability and quality;
<ul style="list-style-type: none"> • Respond to requests from CBS Lead Centres for GCOS Data regarding data availability and quality.

Rec. 9 Notes with appreciation the offer, subject to final confirmation, of the GSNMC (DWD and JMA) and the GSN/GUAN Analysis Centre (NCDC) to carry out the function of CBS Lead Centre for GCOS Data on a trial basis and recommends implementation of this responsibility.

Rec. 10 Recommends that all performance results from the GCOS Monitoring and Analysis Centres be made available without restrictions via their respective Web sites and other appropriate mechanisms.

Rec. 11 Notes with appreciation the ambitious plans of the GSNMC for making performance results readily available to all users through interactive access to the GSNMC Web site and strongly encourages the DWD and JMA to continue their activities in this regard at the highest possible level.

Rec. 12 Notes with appreciation the progress being made in identifying the detailed status of a number of underperforming GSN and GUAN stations through efforts being supported through the US NWS and encourages the continuation of these efforts to improve the availability and quality of GSN and GUAN data.

Rec. 13 Recognises the urgent need for overall co-ordination of GSN and GUAN implementation activities and strongly encourages the establishment of a project office dedicated to this task.

Rec. 14 Recognises the need for a single, centrally maintained list of GSN and GUAN stations and welcomes the activities currently being carried out toward this end.

Rec. 15 Notes the substantial progress achieved through the expert meeting and recommends that such meetings be continued in the future.

ABBREVIATIONS

4-D VAR	4- Dimensional Variational Analysis
AOPC	Atmospheric Observations Panel for Climate
BUFR	Binary Universal Form for data Representation
CARDS	Comprehensive Aerological Reference Data Set
CBS	Commission for Basic Systems (of WMO)
CCI	Commission for Climatology
CLIMAT/CLIMAT TEMP	Specially identified reports submitted by stations of the GSN and GUAN in support of GCOS
DWD	Deutcher Wetterdienst (The National Meteorological Service of the Federal Republic of Germany)
ECMWF	European Centre for Medium-range Weather Forecasts
EM	Expert Meeting
GCOS	Global Climate Observing System
GDPS	Global Data Processing System
GEWEX	Global Energy and Water Cycle Experiment
GPCC	Global Precipitation Climatology Center
GSN	GCOS Surface Network
GSNMC	GCOS Surface Network Monitoring Centre
GUAN	GCOS Upper Air Network
HadRT	Global gridded radiosonde products (Hadley Centre)
JMA	Japan Meteorological Agency
MC	Monitoring Centre(s)
Met Office	The UK NMS
MR	Monitoring Report(s)
NCDC	National Climatic Data Center
NH	Northern Hemisphere
NMC	National Meteorological Center (of the USA)
NMHS	National Meteorological and Hydrological Service(s)
NMS	National Meteorological Service (of a Member)
POC	Point(s) Of Contact
QC	Quality Control
RA I	Regional Association I (Africa)
RSMC	Regional Specialised Meteorological Centre
SYNOP	SYNOptic Operation
UA	Upper Air
UKMO	United Kingdom Met Office (now referred as The Met Office)
USCCRI	United States Climate Change Research Institute
UTC	Universal Time Coordinated
WMC	World Meteorological Centre