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**GCOS SURFACE NETWORK (GSN) MONITORING CENTRE
IMPLEMENTATION MEETING**

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REPORT OF THE GCOS SURFACE NETWORK MONITORING CENTRE IMPLEMENTATION MEETING

1. OPENING

1.1 Welcome and Introduction of Participants

1.1.1 Mr Stefan Rösner, from the national Global Climate Observing System (GCOS) office in Germany and local organizer, welcomed the participants to the GCOS Surface Network (GSN) Monitoring Centre (MC) Implementation meeting, at the Headquarters of the German Meteorological Service (Deutscher Wetterdienst, DWD), in Offenbach, Germany, at 09 00 hrs, on 19 January, 1999. He extended his welcome particularly to Mr Hideheko Isobe, representative of the Japan Meteorological Agency (JMA), emphasising in this way the joint initiative of the JMA and DWD to establish GCOS Surface Network Monitoring Centres (GSNMCs). Mr Rösner noted that preliminary discussions about specific issues of the implementation had been held the day before and a final discussion between DWD and JMA was to be held the day after the meeting¹.

1.1.2 The meeting was officially opened by Dr Eberhard Müller, Head of Business Area Research and Development at the DWD, representing the President of the DWD. In his welcome note, Dr Müller stressed the importance of climate observations to improve climate modelling activities. The Global Precipitation Climatology Centre (GPCC), the Global Collecting Centre (GCC), the Baltic Sea Experiment (BALTEX) Meteorological Data Centre and the European Organization for the Exploration of Meteorological Satellites (EUMETSAT) Satellite Application Facility (SAF) for Climate Monitoring, all established at the DWD, are examples of the support given to the data component of climate research in Germany. Additionally, the national GCOS Office at the DWD played an active role in initiating this meeting. Dr Müller noted that one of the essential tasks of present climate research is to ensure the availability and reliability of observational data. The MCs in Japan and Germany will monitor the availability and quality of climatological data distributed as CLIMAT messages, focussing on precipitation at the DWD and on temperature at the JMA. He particularly welcomed the representatives from: the World Meteorological Organization (WMO) Secretariat; the operational international climate centres in Asheville, USA; Bracknell, UK; Norwich, UK; and from Offenbach and Hamburg, Germany.

1.1.3 Mr Peter Scholefield welcomed all attendees on behalf of the GCOS Secretariat and of WMO. He highlighted that the DWD and JMA demonstrated the first initiative to monitor GSN data at the WMO Commission for Climatology meeting in August 1997. The Working Group on Climate Change Detection strongly supports GSN and is hoping to use the GSN as a nucleus to build on a future, higher density network to totally fulfil global climate data requirements. Mr Scholefield wished the participants a successful meeting and said that he looked forward to a favourable outcome in the implementation.

1.1.4 After some organizational arrangements, the participants were invited to introduce themselves (Annex I).

¹ The minutes of the pre- and post session are available at the German GCOS Office, at DWD, in Offenbach.

1.1.5 The participants adopted the agenda given in Annex II.

2. THE GSN – STATUS AND BACKGROUND

Mr Rösner reviewed the status and background of the GSN. He summarized its development, starting from the proposal of the WMO Commission for Climatology (CCI) Working Group on Climate Change Detection to discuss a surface reference network at the first session of the Atmospheric Observation Panel in 1994², followed by the joint CCI and the Commission for Basic Systems (CBS) Expert Meeting on the GSN³, in March 1996. At the CCI-XII in August 1997, the JMA and DWD offered to establish GSNMCs. A carefully-reviewed list of selected GSN stations was submitted to the meetings of the WMO Regional Associations (RA) in 1998, but as yet has not been formally approved by all of the RAs⁴. A map of the selected GSN stations is shown in Annex III.

3. EXISTING MONITORING METHODS AND PRODUCTS

3.1 Monitoring Products needed in the Monitoring Centres

Prof. Phil Jones reviewed the data flow of monitoring products needed from the MCs. In general, the existing station network should be improved by replacing stations of low quality with higher quality stations. He referred to the Experts Meetings in 1996 and 1997 (see footnote 3) and to the agreed process which selected the best GSN stations, considering homogeneity, continuity and availability. At the 1996 meeting, the purpose of the GSN was elaborated as follows: *“to provide a homogeneous array of high quality stations of sufficient density and coverage over land to allow, with the inclusion of ocean surface observations, the detection of the spatial patterns and scales of global temperature change at the surface. This network will also provide a basis for detection of global atmospheric circulation changes. Additionally, the network will provide a framework for the denser set of stations that will be used in many climate change detection, climate change mechanisms, and climate change impact studies. The network could also be used as the basis for the quality control of denser temperature networks and for other variables (e.g., precipitation).”* Prof. Jones reported on the joint session of the Atmospheric Observation Panel for Climate (AOPC) and the Joint Data and Information Management Panel (JDIMP) in 1998⁵, where the monitoring and the control of both, the GSN and the GCOS Upper-Air Network (GUAN) networks were discussed. For scientific reasons the purposes of the GSN are twofold:

- (i) To improve the quality of climate data available;

² Report of the GCOS Atmospheric Observation Panel, first session, Hamburg, Germany, 25-28 April, 1994 (GCOS-6).

³ Report of the Joint CCI/CBS Expert Meeting on the GCOS Surface Network, Norwich, UK, 25-27 March, 1996 (GCOS-26).

Report of the Second Joint CCI/CBS Expert Meeting on the GCOS Surface Network, De Bilt, The Netherlands, 25-27 June, 1997 (GCOS-35).

⁴ As at 31 December 1998: RA II, RA III, RA IV and RA V have formally approved the selected GSN stations in their region.

⁵ Report of the Joint Meeting of the GCOS/WCRP Atmospheric Observation Panel for Climate and the GCOS/GOOS/GTOS Joint Data and Information Management Panel, Fourth Session, Honolulu, Hawaii, USA, 28 April - 1 May 1998 (GCOS-45).

- (ii) To improve the availability of climate data for various climatic change assessments.

These purposes are leading to two modes of products generation:

- a. The MCs will provide **real-time** monitoring and quality control of the data to the user community. The monitoring products will include information on availability, timeliness and quality. Furthermore, quality-controlled data will be made available to the National Meteorological and Hydrological Services (NMHSs) and World Data Centres (WDCs) and others for their use in a variety of climatic change assessment products. The MC products will help to assess how good the stations are, how many contribute to the data set, and visualize the data information of routinely-issued maps. In **near real-time**, GSN data and products from the MCs will be available at the WDCs, where it will reach users in **delayed mode**, i.e., after processing at the MC.
- b. For archiving both the monthly and the daily data, the WDCs will have to operate in **delayed-mode**. Monthly data updating the database will come from the MCs. Historic monthly data in the WDC will come from either data available at WDCs, e.g., from the Global Historical Climatology Network (GHCN), from data available, after quality control, at the MCs, or from data submitted, upon request, by the NMHSs. Access in real-time to the time series of historic monthly data is absolutely necessary for quality control. Historic daily data in the WDCs will come from either data available at WDCs, from data possibly available from MCs, or from data submitted, upon request, by the NMHSs.

The daily historical data will be likewise important to assess better the impact of extreme events and its relation to climate change. The historical data should be digitally available and updated on a routine basis, taking into account the quality control of the MCs.

3.2 Monitoring Products of the Global Precipitation Climatology Centre (GPCC)

Dr Bruno Rudolf gave an overview of the work of the GPCC, which is anchored within the Global Energy and Water Cycle Experiment (GEWEX) and the Arctic Climate System Study (ACSYS). The purpose of the GPCC is to generate a global gridded data set of monthly precipitation totals based on observational data. Specific GPCC functions are data collection, quality control and analysis. The GPCC has a four-step quality control procedure:

- (i) Careful control of recorded locations and identifiers of stations;
- (ii) Separate pre-control of precipitation data from CLIMATs and reports of surface observations from a land station (SYNOps) (from DWD, Offenbach and from the Climate Prediction Centre (CPC), Washington) and from additional national data centres. Monthly totals are merged into the precipitation database of the GPCC;
- (iii) Automatic quality pre-control of monthly precipitation data;
- (iv) Visual quality control of monthly precipitation data;

The current quality control is based on gridded area-means for the individual month and normals. This quality control will be improved in future by statistical evaluation of the time series. The database suffers from a high variability in data reception. Monthly precipitation data of 6000-7000 stations are derived from SYNOP and CLIMAT reports which are disseminated via the Global Telecommunication System (GTS) and received at the DWD in

Offenbach and at the National Centre for Environmental Prediction (NCEP) in Washington, D.C. Daily data with a full temporal coverage are available from about 3000 stations. Dr Rudolf stressed the problem in having globally time equivalent data with respect to the discussion on daily data. He warned that it will not be possible to have the same SYNOP and CLIMAT observation periods, because SYNOP is monitored in universal time coordinated (UTC), whereas CLIMAT is monitored in regional time zones.

3.3 Monitoring Activities at Hadley Centre

Ms Briony Horton presented decode and quality control procedures of the monthly surface CLIMAT messages at the Hadley Centre, UK. The Hadley Centre receives and archives 1300 stations of surface CLIMAT messages. Nine elements are currently quality controlled and archived, i.e., mean temperature, precipitation total, mean sea level pressure, station level pressure, rain days and rain quintile, vapour pressure, sunshine total and percentage of normal sunshine. Typical products derived are, e.g., land and sea-surface temperature (SST) differences from normal, annual global temperature differences and the annual land air and SST anomalies from 1860-1998. These climate monitoring products are published in various climate assessment reports of, e.g., the Intergovernmental Panel on Climate Change (IPCC), WMO, NCEP, the National Weather Service (NWS) or the National Oceanic and Atmospheric Administration (NOAA). The quality control process is divided into three steps. The first is an automatic cleaning mechanism, which mainly deals with consistent format errors and is supported by a manual cleaning-up for unpredictable problems. The clean-up mechanism is followed by a second step – a request procedure. In the succeeding discussion, it was stressed that the establishment of a co-ordinating mechanism to inform NMHSs regularly on missing data is highly desirable. The third step is to decode and to quality control messages using programmes for the old and new code. The quality control includes consistency checks and anti-correlation methods, e.g., between rainfall and pressure. A manual quality control includes checking and amending problems identified by the automatic quality control routine. The quality controlled data are always available by the 20th of the following month, sometimes earlier. The Hadley Centre is aiming to continuously improve its historical archives. The inclusion of late data improves the data set to about 1450 stations per month.

3.4 Monitoring Activities at the National Climatic Data Center (NCDC)

Dr Mike Changery reviewed the monitoring activities at the NCDC, which includes monitoring the Global Historical Climatology Network (GHCN) and NOAA's observing networks. The quality control routine of the GHCN is finished on the 8th of the following month, and all data are available on the 20th of the following month. The assessment of the health of NOAA's networks contains two steps: (a) to determine the suitability of these networks to measure multi-decadal climate variations; and (b) to provide feedback to fix the most critical problems. About a dozen networks are assessed and monitored by NCDC, e.g., the US Historical Climate Network on a monthly basis, the Co-operative Observer Network on a daily basis or the surface monitoring network on an hourly basis. The plan to monitor climate network health consists of developing a science-driven health assessment for each network, composed of seven performance indicators. These common characteristics of data and meta-data are:

- (i) Quality (percent of data with no quality issues);
- (ii) Timeliness (percent of data received on time);

- (iii) Completeness (percent of data present);
- (iv) Length of data record (number of stations open >100 yrs, >50 yrs, >25yrs, >10yrs);
- (v) Maintaining homogeneity (percent of stations with detectable homogeneity issues);
- (vi) Number of observing platforms (number of stations available);
- (vii) Spatial coverage of observing platforms (gridboxes or counties with stations).

The indicators are stored in a relational database and can be accessed by county, state or the entire network. The quality control routine can lead to the following actions with respect to the above-mentioned performance indicators:

- add (i) and (iii) : Feedback on stations with recurring problems;
- add (ii) : Feedback on recurring late stations;
- add (iv) : Analysis to determine long-term, quality stations;
- add (v) : Continuation of work given a high priority;
- add (vi) : Continue keying pre-1948 non-digital data;
- add (vii) : Analysis to determine critical areas without stations.

A serious problem is the need to improve incoming data, due to the fact that observing forms are sent in post-card format that need to be digitized. A possible future solution might be to scan the reports. The network health report is prepared monthly and is distributed for analysis and comment. There will be access to the Climate Network Monitoring System via the Web in 1999.

3.5 Monitoring Activities at the Global Collecting Centre (GCC)

Dr Volker Wagner gave an overview of the GCC monitoring activities. The GCC, located at the DWD in Hamburg, Germany, is collecting marine meteorological surface data from Voluntary Observing Ships (VOS) in a non-real time mode. A second GCC is located at the UK Meteorological Office in Bracknell. Since 1994, both GCCs are part of the WMO Marine Climatological Summaries Scheme (MCSS). The 41 MCSS member countries receive the marine surface data by mail, in journals or on discs. The corresponding NMHSs have to ensure a minimum quality standard, as defined by the Commission for Marine Meteorology (CMM). The data are provided quarterly to the two GCCs, which will ensure that the monitoring and quality control procedures have been applied. The GCCs send the controlled data to eight Responsible Members (RM) on a quarterly basis, who then prepare climatological summaries for the ocean areas of their responsibility. The GCCs receive both identical data sets, in the same format, and use identical software for their monitoring routines. Typical monitoring results are, e.g., the identification of duplicate data sets or format errors. Necessary follow-up actions based on the exchange of results are, bilateral correspondence with the contributing Members or rejection of data. These actions are led by one centre and shared with the second centre via e-mail. The close contact to Members and RMs is maintained by sharing the responsibility between the two centres, i.e., each of the GCCs is co-operating with about 20 NMHSs and three RMs as clients for data delivery. The GCCs issue an annual monitoring report on the quality of their data sets to the CMM. A feedback and information mechanism to countries is provided through WMO.

3.6 Monitoring CLIMAT Messages – Experiences at the DWD

Ms Christiana Lefebvre presented examples of the experiences in monitoring CLIMAT messages at the Business Unit "Marine Shipping", in Hamburg. The incoming data are monitored on timeliness. An automatic format control is then performed manually in the first step, and visually, in the second. The final step is the monitoring of completeness and elements of "Section I". The monitoring of the GSN station list for March 1998 showed, e.g., that only about 40% of the stations have submitted CLIMAT reports. In particular, with regard to the GSNMC implementation, a new control programme has been developed to perform an automatic format control of all sections of the old and new CLIMAT code. Frequent errors are flagged and partly corrected. This routine is issuing protocols listing particular errors of the individual station. These lists are the basis for the future monitoring products. Typical frequent errors in CLIMAT reports detected by the monitoring routine are, e.g., no actual month, no end of message mark or incorrect "111" identifier. The format-controlled data are then automatically and manually quality controlled and temporarily archived in a data bank. The archive is updated every 2-3 months to include late reports, and serves in particular to produce the monthly review "Die Witterung in Übersee (Overseas Climate)" as well as the interest of the GPCC.

3.7 Monitoring Activities of the World Weather Watch (WWW)

Dr Gerhard Steinhorst, as representative of CBS and the WWW, reviewed the plan for monitoring the operation of the WWW. The monitoring objectives are to improve the performance of the WWW, in particular the operation of the Global Observing System (GOS), the Global Data-Processing System (GDPS) and the Global Telecommunication System (GTS) on a national, regional and global level. The WWW routine monitors the regularity of the observations at the observation site, the quality, completeness and timeliness of the collection and the evaluation of observations and processed information received at National MCs, Regional Telecommunication Hubs (RTH) and World Meteorological Centres (WMC). While the real-time monitoring provides mainly information on observations or bulletins not received by a specified time (less than one hour), the non-real time monitoring including the preparation of various statistics varies from a few hours to several months. In the first case, actions will be taken up immediately at the observation point or responsible centres. With respect to non-real time monitoring follow-up actions are taken by Members. The leading global monitoring centres in Reading, Bracknell and Washington are responsible for upper-air, surface marine and aircraft/satellite data, respectively. Six regional monitoring centres are responsible for land surface observations. The lead centres generate monthly and biannual reports on data quality. In addition, the European Centre for Medium-Range Weather Forecasts (ECMWF), the Canadian Meteorological Centre of Environment and Météo France provide regular reports on data quality. In October of each year, the Annual Global Monitoring (AGM) gives a report on quality of data from the Regional Basic Synoptic Networks (RBSNs). The Special Main Telecommunication Network (MTN) Monitoring (SMM) is performed every year in April, July and October at the MTN centres in Algiers, Offenbach and Tokyo. Dr Steinhorst referred to the Expert Meeting on the WWW Data Management and Monitoring⁶, where it was discussed to expand the SMM to all regions, four times a year. It is planned that the new monthly routine will distinguish between observation losses versus transmission losses. Additionally, a list of "quality control focal points" will be used as a feedback mechanism. Finally, the outcome of the CBS Extraordinary Session,

⁶ Expert Meeting on World Weather Watch Data Management and Monitoring, Geneva, 8 - 12 December 1997.

1998, in Karlsruhe, Germany⁷, was summarized to the following with respect to climate observations: the Commission recommended to develop a quality management concept for the WWW and to harmonise it with other WMO programmes. It supported the quality control of CLIMAT messages and recommended developing new monitoring procedures with respect to GCOS. Further, the CBS supported the extension of the AGM and SMM in assessing the availability of surface synoptic data before and after the adoption of WMO Resolution 40 (Cg-XII).

4. MONITORING/QUALITY CONTROL PROPOSAL FOR INITIAL IMPLEMENTATION

4.1 GSN Monitoring Centre Japan

Mr Hidehiko Isobe demonstrated the present data flow in JMA to give an example of similar procedures and activities applied to the MC at JMA. At present, CLIMAT messages are received via GTS. The output is a text file, containing the uncorrected original reports, which are manually corrected and flagged. He noted that those reports are still used in the old format. The CLIMAT messages, in a first quality control step, are passing through a loop of availability checks. The second quality control step consists of a visual check using as reference assistant data, the CLIMAT normal (1961-1990), station metadata, historical data, and monthly mean data derived from SYNOP data. At the moment, JMA is providing the following products: a list of CLIMATs, maps printed for the Monthly Report on the Climate System (from 1988 onwards) and maps in GRIB format for the WMO Distributed Database. The monthly report is available from the 10th of the following month.

4.2 GSN Monitoring Centre Germany

Mr Rösner outlined the monitoring products and future activities of the MC at the DWD. He presented seven steps of monitoring principles and the involved activities:

- i) Collection of CLIMAT messages;
- ii) Harmonisation of CLIMAT database at JMA and DWD;
- iii) Application of basic Quality Control and Quality Assurance (QC/QA) procedures;
- iv) Exchange of QC/QA activities;
- v) Generation of products;
- vi) Exchange of products;
- vii) Delivery of products.

Mr Rösner stressed that both centres should work with an identical database and use the same software. The centres will use the CLIMAT messages collected up to the 20th day of the same month. The QC/QA will be performed by the GPCC and will deliver monitoring products on the 10th of the following month. Nevertheless, GSN CLIMAT data could be made available as early as possible. Annex IV shows an example set of monitoring products, whereas Annex V presents up-to-date monitoring results. To avoid duplication of work, the JMA and DWD agreed on individual areas of responsibility, i.e., RA II, RA III, RA V for

⁷ CBS – Ext.(98), Karlsruhe, 30 September to 9 October 1998 (Pink documents are available at WMO Homepage <http://www.wmo.ch>)

JMA; and RA I, RA IV, RA VI for DWD. During 1999, the MC will enter its test phase and plans to start its operation at the beginning of 2000.

5. DISCUSSION

5.1 The meeting attendees appreciated the thorough up-date and information on monitoring activities and procedures at the NMHSs in Germany and Japan. It was understood that the JMA and DWD are committed to work closely together to establish and implement monitoring and QC/QA procedures. In the succeeding discussion the objectives of the MCs were identified as follows:

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

Consequently, these objectives have been proposed as Terms of Reference for the GSNMC (Annex VI).

5.2 It was stressed that the MCs are not Data Archive Centres. The participants agreed that quality controlled data at a defined quality level should be made available to users (e.g., the Hadley Centre) and sent as early as possible to the WDCs. The MCs themselves will not archive the data, but could provide a link to the WDCs. The biannual monitoring report will be sent to the GCOS and WMO Secretariats, where it will be distributed to the NMHSs. (**Action 1, Recommendation 1.**)

5.3 The GCOS and WMO Secretariats will provide any feedback to the MCs, with respect to changes of metadata in the GSN station list, so that the MCs are kept informed on the status of the network. (**Action 2.**)

5.4 The participants discussed the free availability of GSN data. It was pointed out that under WMO Resolution 40 (Cg-XII), all CLIMAT messages including those from GSN stations are deemed as essential and can therefore be exchanged on a free and unrestricted basis. It was stressed that there should be a clear distinction between data in CLIMAT messages which are produced by WMO members and distributed on the GTS and the monitoring products prepared by the MCs which will not be distributed on the GTS. Monitoring products will include reports on the completeness and accuracy of the CLIMAT messages and corrected CLIMAT messages that will be made available through the WDCs.

5.5 Participants were concerned about the timeliness of the monitoring products. It was proposed that messages arriving at the centres later than the set deadline of the 20th of the month, will be flagged preliminary as "not checked" and will be included in the monitoring report. The MCs will start with the format check as CLIMAT messages appear on the GTS. They will be monitored in intervals by the MCs, including format checks, then forwarded to the WDCs where they will be made available. The 20th of the month is the threshold date when the monitoring statistics would be compiled and summarized on a routine monthly basis as a monitoring report so as to be able to compare monitoring results between different months. The data set will comprise a template of all GSN stations and all their monitoring products, which will carry indicators if already quality controlled or not. The monitoring

report will be regularly updated and in that way complete the missing information on QC results.

5.6 The meeting attendees discussed as well the request procedure for missing CLIMAT messages. It was proposed that after initial consultations between the two MCs, the distribution nodes (GTS Regional Telecommunication Hubs) for CLIMAT messages will be contacted. The next step would be to approach the designated focal points for each NMHS. The participants suggested confirming that the existing CBS list of GTS focal points for data communication and quality control could be used for climate data quality issues as well. Encouraging Members to submit messages regularly and correctly, following "best practices", can be facilitated by contact with the focal points. (**Action 3, Recommendation 2.**)

When approaching WMO members concerning the formal establishment of the GSN, the letter from WMO to all NMHSs should inform them that the international exchange of all CLIMAT messages are deemed as essential under Resolution 40 (Cg-XII). Based on the draft letter prepared at the fourth session of the Atmospheric Observation Panel for Climate (AOPC), the contents should specify as well the type of data needed, i.e., historical daily and monthly data. It should also explain and underline the importance of the role of focal points for climate data issues and encourage Members to send CLIMAT messages from GSN via GTS. The letter should contain as well information on the operation of the GSN Monitoring Centres, including the Web site where information on MC activities and GSN status can be found. Furthermore, the letter should express that it is anticipated to distribute contributed GSN CLIMAT data on CD-ROM, in order to help motivate Members to submit their data. (**Action 4.**)

5.7 In order to reduce erroneously formatted CLIMAT messages, it was proposed to include examples of correctly formatted CLIMAT messages into the biannual report and on the GSNMC Web site⁸. It was proposed that, if possible, unofficial channels should be used to inform the focal point at the NMHSs on faulty messages, as it is already common practice at the various climate or data collection centres. The participants appreciate that it would be appropriate or necessary, under certain situations to use official channels to improve network performance. Finally, it was recommended that both MCs use identical software and historical databases in their monitoring procedures. (**Action 5, Recommendation 3.**)

6. MEDIUM-TERM DEVELOPMENT PLANS

6.1 GSNMC Japan

Mr Isobe explained the present procedure at the JMA of analysis of individual station messages and their classification into "suspicious" or "not suspicious" categories. He demonstrated possible monitoring procedures for the GSNMCs and recommended that both centres use the temperature normals (available from NCDC and distributed on CD-ROM). Mr Isobe also referred to the NCDC Homepage where QC checks have been described, indicating that JMA will use the same checking procedures for the MC.

⁸ <http://www.dwd.de/research/klis/>

6.2 GSNMC Germany

Mr Tobias Fuchs elaborated on the QC/QA procedures at the GPCC, which will be applied to the GSNMC at the DWD. The QC, without QA, is available at the end of the same month. The control procedures for GSN stations will be done within the work of the GPCC. GSN stations will simply be added to the list of GPCC stations. The complete QC/QA results will be available within two months.

7. **AREAS NOT COVERED BY THE DWD AND JMA**

7.1 The participants discussed issues not embraced by routine activities of the two services and outside the objectives of the GSNMC. Both centres will monitor the availability of the global set of CLIMAT messages. The DWD will monitor in particular the quality of precipitation and the JMA will monitor temperature. The monitoring of pressure, as a third important parameter, is not covered by either of the two centres, although JMA expressed that it might extend its analyses to monitor the parameter of pressure as well. The MCs will consider if in future activities all CLIMAT stations, distributed over GTS, should be included into the monitoring procedures. It is currently planned that only the availability of the non-GSN stations, without any QC/QA, will be monitored.

7.2 The attendees discussed the role of the International Council for Science (ICSU) WDC A and B of Meteorology in being the repository of GSN data and metadata. For any data at the WDC A and B, free access is a mandate, whereas the WMO WDCs are operating under Resolution 40. The issue needs to be discussed and clarified directly with the WDCs. **(Action 6.)**

7.3 The participants discussed the need for historical data as an important control mechanism in the monitoring of GSN data in CLIMAT messages. Historical data are usually released by countries for special publications such as 30-year normals, often updated in decades and yearbooks, which can make access difficult to the most recent data. The MC would need to have access to climatological normals of temperature, precipitation and pressure from all GSN stations. "Normals" which are not available from the official WMO Climatological Normals for the period 1961-1990, will have to be requested from the Member countries. Furthermore, historical data need to be digitized, in order to enhance its availability and usefulness. The task of collecting historical data and metadata from GSN stations and making them widely available needs to be taken on as a responsibility by a data centre. **(Action 7, Action 8.)**

7.4 It was discussed that the MC results will get more visibility if published in the NCDC reports and the historical data and metadata from GSN stations should be provided additionally on CD-ROM.

8. **FORMALITIES OF INFORMATION DELIVERY**

8.1 Mr Scholefield gave an overview on information delivery formalities. He discussed the different types of information which could be provided by the MCs: (i) the description of the network; (ii) the physical state of the network; and (iii) the operational status of the network as described in the outgoing monitoring products. Potential receivers of the

information are the GCOS Secretariat (GCOS Steering Committee and the expert panels), the WMO Secretariat (WWW, WCRP, WCP, AREP, Regional Association Presidents, Permanent Representatives, Technical Commissions), operational climate centres (global, regional, national) and the operational focal points of Members. Methods of delivery that can be used include the Web, phone, fax, electronic mail and air mail. Mr Scholefield proposed the following recommendations: (a) to develop a set of prototype products and circulate them through the GCOS Secretariat for comments; (b) to make the prototype products available on the Web; and (c) to consult with potential receivers of information to determine their needs for information and refine and/or expand the suite of products as required. **(Recommendation 4, Recommendation 5.)**

9. FINAL DISCUSSION

Actions and Recommendations resulting from the preceding discussion were summarized as follows:

Actions

- 1 Explore the possibility at WDCs A and B of how the data can be made available to users, i.e., website, ftp-site, etc. (Dr Changery.)
- 2 Make arrangements to inform the MCs on a routine operational basis of any changes in the GSN metadata as well as changes of CLIMAT stations included in Volume A. Co-operation with the WWW, World Climate Data and Monitoring Programme (WCDMP) and CCI will be needed to help in establishing MC procedures. (GCOS Secretariat.)
- 3 Clarify with CBS if the focal points for data communication and quality can broaden their responsibilities to include climate data issues. (Dr Steinhorst.)
- 4 Draft a letter from WMO to Members urging their commitment to the GSN. Details of the letter content will be discussed at NCDC during the meeting on Climate Extremes, in Asheville, 9-10 March 1999. (Mr Scholefield, Dr Changery, Prof. Jones and the GCOS Secretariat.)
- 5 Investigate the feasibility of co-operating on an operational basis with the CBS focal points in order to request missing data. (Mr Isobe, Ms Horton, Ms Lefebvre.)
- 6 Clarify the issue of data exchange policy used at the WDC A and at the WDC of Meteorology. (Mr Scholefield and Dr Changery.)
- 7 Clarify the issue where the historical GSN data can be digitized and updated (Dr Changery and Mr Scholefield.)
- 8 Investigate the availability of historical daily and monthly data under Resolution 40. (Mr Scholefield.)

Recommendations

- 1 Send biannual monitoring report to the GCOS Secretariat and WMO Secretariat for distribution to NMHSs. (Monitoring Centres.)
- 2 Establish mechanism to facilitate implementation of the GSN "best practices" and the involvement of national focal points. (GCOS Secretariat, World Weather Watch.)
- 3 Use identical database and software for format checking. (DWD and JMA.)
- 4 Develop a set of prototype products and circulate through the GCOS Secretariat for comments. Make the prototype available on the Web. Establish a mechanism to interact with users in the development and delivery of monitoring information. (Monitoring Centres.)
- 5 Consult with potential receivers of information to determine their needs for information and refine and/or expand the suite of products as required. (Monitoring Centres.)

10. CLOSURE

The participants expressed their appreciation to the local organizer for a stimulating meeting and for the excellent hospitality. The meeting was closed at 14 00 hrs, on Wednesday, 20 January 1999.

ANNEX I

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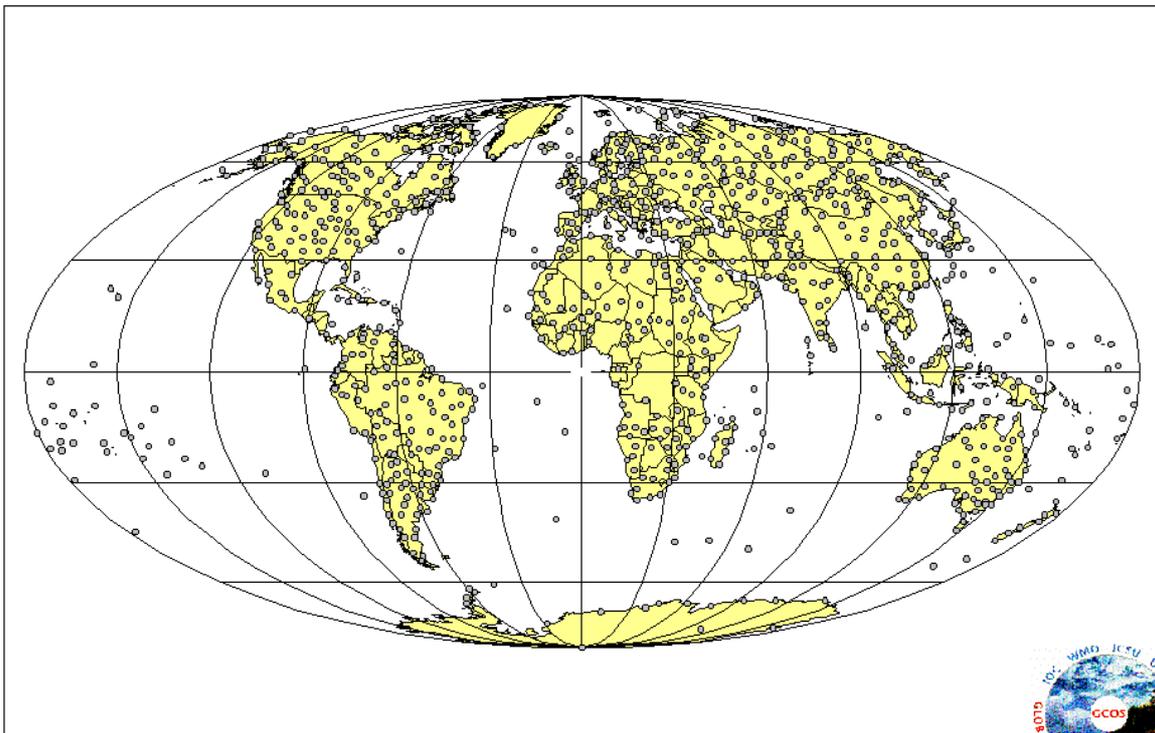
ANNEX II

AGENDA

1. OPENING
 - 1.1 Welcome and Introduction of Participants
2. THE GSN – STATUS AND BACKGROUND
3. EXISTING MONITORING METHODS AND PRODUCTS
 - 3.1 Monitoring Products Needed in the Monitoring Centres
 - 3.2 Monitoring Products of the Global Precipitation Climatology Centre (GPCC)
 - 3.3 Monitoring Activities at Hadley Centre
 - 3.4 Monitoring Activities at the National Climatic Data Center (NCDC)
 - 3.5 Monitoring Activities at the Global Collecting Centre (GCC)
 - 3.6 Monitoring CLIMAT Messages – Experiences at the DWD
 - 3.7 Monitoring Activities of World Weather Watch (WWW)
4. MONITORING/QUALITY CONTROL PROPOSAL FOR INITIAL IMPLEMENTATION
 - 4.1 GSN Monitoring Centre Japan
 - 4.2 GSN Monitoring Centre Germany
5. DISCUSSION
6. MEDIUM-TERM DEVELOPMENT PLANS
 - 6.1 GSNMC Japan
 - 6.2 GSNMC Germany
7. AREAS NOT COVERED BY DWD AND JMA
8. FORMALITIES OF INFORMATION DELIVERY
9. FINAL DISCUSSION
10. CLOSURE

ANNEX III

GCOS Surface Network (GSN)



GCOS Secretariat, as at June 1998

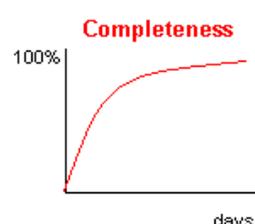
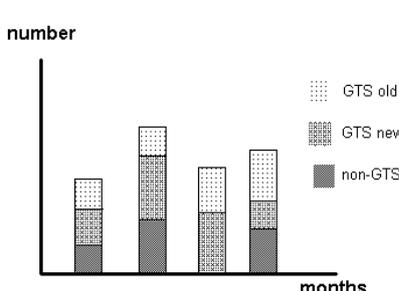
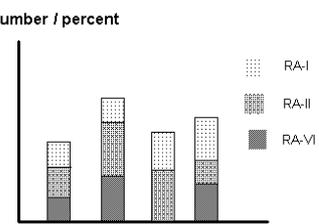


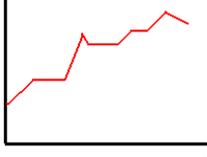
ANNEX IV

EXAMPLE OF MONITORING PRODUCTS

At the pre-session of the GSNMC meeting, the following strategy for monitoring products was proposed: The GSN monitoring centres will generate uniform monitoring products. All monitoring products will have the same layout to be used in the monitoring reports. Products with global coverage will be generated only once by one responsible MC. The following table shows the number, category (all CLIMATs or GSN only), name and description of the product, responsible centre, delivery time table, and recipients of monitoring products:

#	Category		Available as ... on ... scale		Name and Description of the Products	Responsible Centre	Delivery Day	Recipients															
	ALL	GSN	Graph Table Globe	Global Regional National Station																			
1	A	GSN	G,T,O	g,r,n,s (s: per period)	Number of CLIMATs received. 	JMA (g) DWD	A & GSN: • 15 th Jul. • 15 th Jan.	<ul style="list-style-type: none"> • WMO (G,T,O g,r) • Pres. RA's (G,T,O r) • PRs (G,T,O n,s) • WWW (G,T,O g,r(?)) 															
2	A	GSN	G	g,r,n,s	As #1 but percent. 	As #1	As #1	As #1															
2a	A	GSN	T	g,r,n,s	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Month</th> <th>Number</th> <th>Percent</th> </tr> </thead> <tbody> <tr> <td>Jan.1999</td> <td>2000</td> <td>80%</td> </tr> <tr> <td>Feb.1999</td> <td>1800</td> <td>75%</td> </tr> <tr> <td>Mar.1999</td> <td>1850</td> <td>77%</td> </tr> <tr> <td>Apr.1999</td> <td>2200</td> <td>95%</td> </tr> </tbody> </table>	Month	Number	Percent	Jan.1999	2000	80%	Feb.1999	1800	75%	Mar.1999	1850	77%	Apr.1999	2200	95%	As #2	As #2	As #2
Month	Number	Percent																					
Jan.1999	2000	80%																					
Feb.1999	1800	75%																					
Mar.1999	1850	77%																					
Apr.1999	2200	95%																					

#	Category		Available as ... on ... scale		Name and Description of the Products	Responsible Centre	Delivery Day	Recipients																					
	ALL	GSN	Graph Table Globe	Global Regional National Station																									
2b	A	GSN	O	g,r,n,s		As #2	As #2	As #2																					
3	A	GSN	G,T	g,r,n,s	Number +/- percent of incoming CLIMATs continuously or at days 5, 10 20. 	JMA DWD (g)	As #1	As #1																					
4	A	GSN (?)	G,T	g,r,n,s	Number +/- percent of incoming non-GTS CLIMATs including old format. 	JMA DWD	As #1	As #1																					
5	-	GSN	T	G	Table with changes in GSN-lists +/- station metadata. <table border="1" data-bbox="526 1500 957 1635"> <thead> <tr> <th>WMO #</th> <th>Lat</th> <th>lon</th> <th>Elev.</th> <th>Name</th> <th>GSN-list</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td> </td> </tr> <tr> <td> </td> </tr> </tbody> </table>	WMO #	Lat	lon	Elev.	Name	GSN-list	Comment															JMA DWD	As #1	As #1
WMO #	Lat	lon	Elev.	Name	GSN-list	Comment																							
6	-	GSN	G,T,O	g,r,n,s	Number of parameters reported, or percent of max. number of parameters reported (total CLIMAT or per section). 	JMA DWD	As #1	As #1																					

#	Category		Available as ... on ... scale		Name and Description of the Products	Responsible Centre	Delivery Day	Recipients
	ALL	GSN	Graph Table Globe	Global Regional National Station				
7	A	GSN	G,T,O	g,r,n,s	Completeness of CLIMAT messages in number or percent as a function of time (e.g. season, report period, year etc.) number / percent of reports for RA x Country Y Station Z 	JMA DWD	As #1	As #1
8	-	GSN	T	G	Quality checked data set. Table consisting of WMO-No., month and year, physical value, quality byte, and eventually corrected value.			

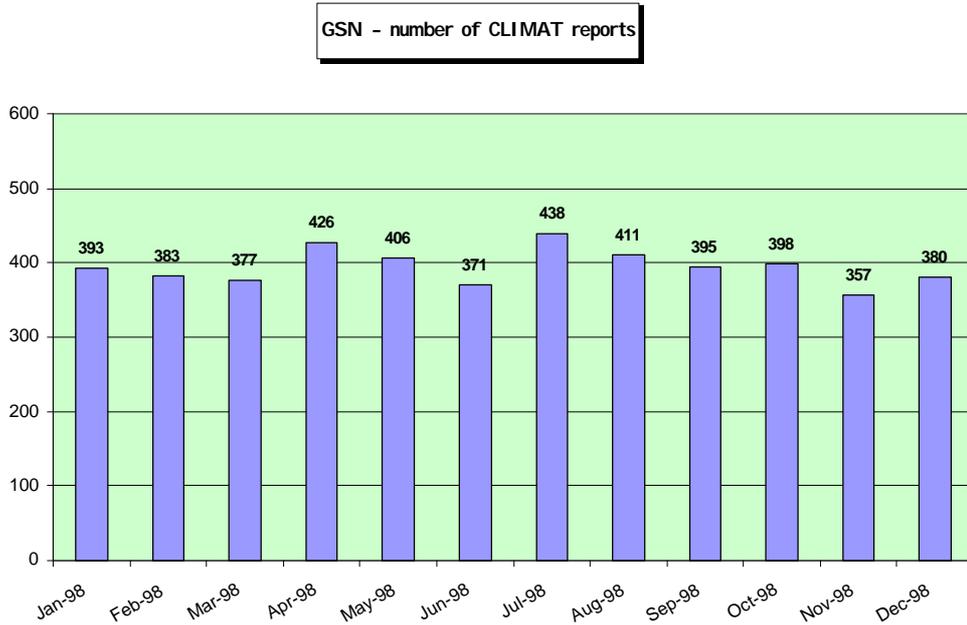
The responsible centre for any of the global products is either JMA or DWD. For regional, national or station-oriented products, JMA and DWD will have to generate products, each for its area of responsibility. Global and regional products will be included in the regular monitoring reports. National and station-oriented products are of secondary priority and will be delivered to the Permanent Representative of the NMHS, or the appropriate national focal points.

The following quality bytes will be used:

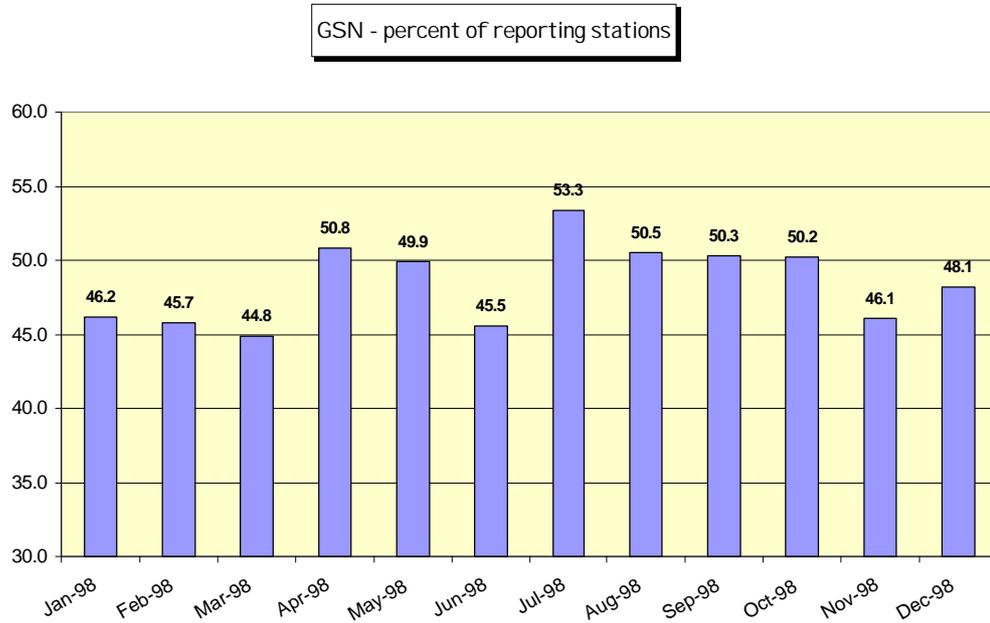
Quality byte	Valid for parameter	Comment
0	T, RR	Not checked
1	T, RR	Checked and okay
2	T, RR	Checked and suspicious
3	T, RR	Checked and corrected

ANNEX V

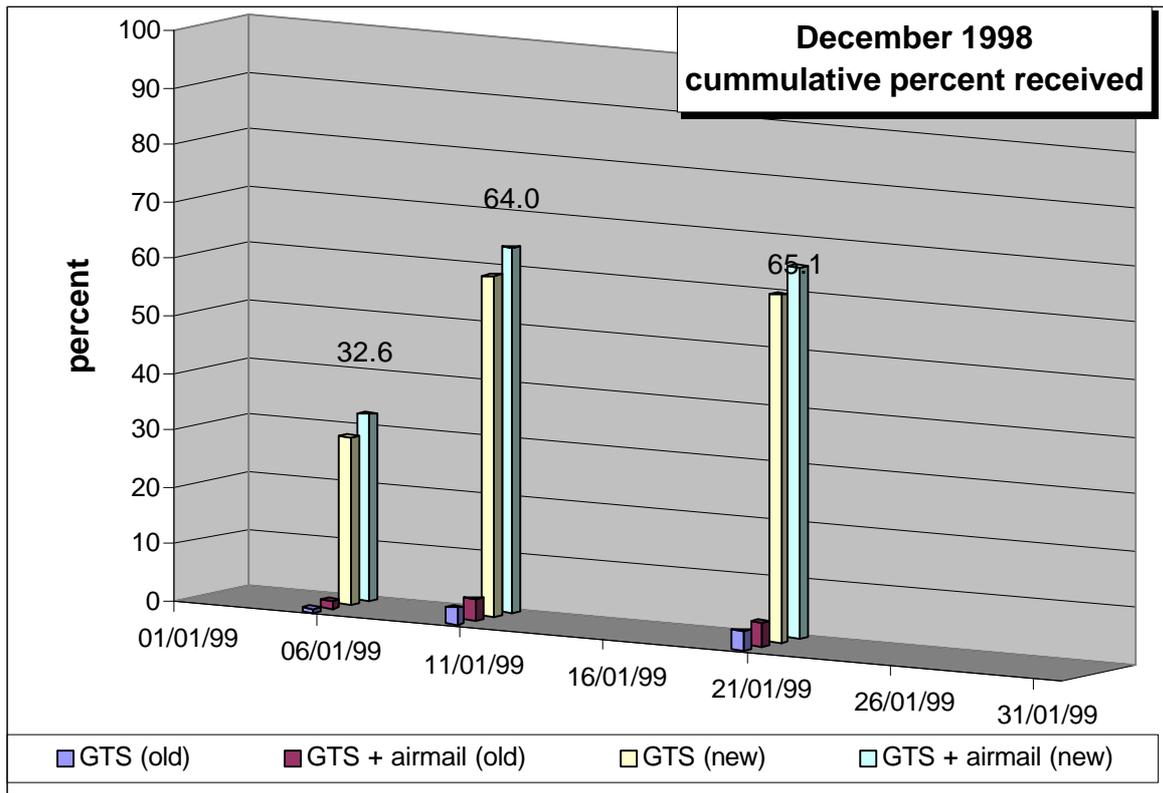
RESULTS OF GSN MONITORING FOR 1998 AND JANUARY 1999



Number of monthly reporting GSN stations (Jan – Dec 1998).



Percentage of CLIMAT stations reporting until the 20th of the month (Jan – Dec 1998).



Percentage of reporting GSN stations for January 1999.

ANNEX VI

TERMS OF REFERENCE

The proposed tasks of the GSN Monitoring Centres are:

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

ANNEX VII

ACRONYMS

ACSYS	Arctic Climate System Study
AGM	Annual Global Monitoring
AOPC	Atmospheric Observation Panel for Climate (GCOS)
AREP	Atmospheric Research and Environment Programme (WMO)
BALTEX	Baltic Sea Experiment
CBS	Commission for Basic Systems (WMO)
CCI	Commission for Climatology (WMO)
CMM	Commission for Marine Meteorology (WMO)
CPC	Climate Prediction Center (USA)
DWD	Deutscher Wetterdienst
ECMWF	European Centre for Medium-Range Weather Forecasts
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
GCC	Global Collecting Centre
GCOS	Global Climate Observing System
GDPS	Global Data-Processing System (WWW)
GEWEX	Global Energy and Water Cycle Experiment (WCRP)
GHCN	Global Historical Climatology Network
GOS	Global Observing System
GPCC	Global Precipitation Climatology Centre
GSN	GCOS Surface Network
GSNMC	GSN Monitoring Centre
GTS	Global Telecommunication System
GUAN	GCOS Upper-Air Network
ICSU	International Council for Science
IPCC	Intergovernmental Panel on Climate Change
JDIMP	Joint Data and Information Management Panel (GCOS)
JMA	Japan Meteorological Agency
MC	Monitoring Centre
MCSS	Marine Climatological Summaries Scheme
MTN	Main Telecommunication Network
NCDC	National Climatic Data Center (USA)
NCEP	National Centres for Environmental Prediction (USA)
NMC	National Monitoring Centre
NMHS	National Meteorological and Hydrological Service
NOAA	National Oceanic and Atmospheric Administration (USA)
NWS	National Weather Service
QA	Quality Assurance
QC	Quality Control
RA	Regional Association (WMO)
RBSN	Regional Basic Synoptic Network
RM	Responsible Member (GCC)
RTH	Regional Telecommunication Hub
SAF	Satellite Application Facility
SMM	Special MTN Monitoring
SST	Sea-Surface Temperature

VOS	Voluntary Observing Ship (WMO)
WCDMP	World Climate Data and Monitoring Programme (WMO)
WCP	World Climate Programme (WMO)
WCRP	World Climate Research Programme (WMO)
WDC	World Data Centre
WMC	World Meteorological Centre
WMO	World Meteorological Organization
WWW	World Weather Watch (WMO)