

<p>WMO/IOC/UNEP/ICSU GLOBAL CLIMATE OBSERVING SYSTEM (GCOS)</p> <hr/> <p>GCOS/WCRP ATMOSPHERIC OBSERVATION PANEL FOR CLIMATE FOURTEENTH SESSION GENEVA, SWITZERLAND, 21-25 APRIL 2008</p>	<p>AOPC-XIV Doc. 9 (Rev. 1) (2.IV.08)</p> <hr/> <p>Item 4.6</p>
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## **GSN and GUAN**

### **Report from the WMO Observing Systems Division**

*(Submitted by the WMO Secretariat (Ondras))*

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#### **Summary and Purpose of Document**

This document presents CBS activities related to GSN and GUAN, especially the activities related to CBS Lead Centers for GCOS, their recommendations for CBS-XIV and the need for better harmonization of a list of RBCN stations vis-à-vis GSN/GUAN.

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#### **ACTION PROPOSED**

The meeting is invited to note the information contained in this document for discussions under Agenda Item 4.6.

#### **References:**

1. Abridged Final Report with Resolutions and Recommendations of the Thirteenth Session of the Commission for Basic Systems (2005), WMO-No. 955;
2. Abridged Final Report with Resolutions and Recommendations of the Extraordinary Session (2006) of the Commission for Basic Systems, WMO-No. 1017;
3. Final Report of the CBS Lead Centers for GCOS Coordination Meeting/Workshop, Iran, 5-8 November 2007.

## **GSN AND GUAN REPORT FROM THE WMO OBSERVING SYSTEMS DIVISION**

### **CBS Lead Centres for GCOS**

1. The CBS Lead Centres for GCOS is a relatively new tool aimed at improving the performance of GSN/GUAN and the quality of climate data. The Extraordinary session of the Commission for Basic Systems, Cairns, 2002 (CBS-Ext(02)) recognized 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. The Commission agreed with recommendations developed by the first meeting of the Expert Meeting on Coordination of the GSN and GUAN (Germany, May 2002) and requested that CBS Lead Centres for GCOS data (one for GUAN and one for GSN) be established on a trial basis to facilitate the exchange of that information directly with the NMHSs involved, with the terms of reference as presented in the final report of the Expert Meeting (see paragraph 6 below). CBS-Ext(02) noted that Japan would assume responsibility for the CBS Lead Centre for GSN as from 2003 on a trial basis. CBS-Ext(02) further requested that Points of Contact be nominated by each NMHS, who could be contacted directly by the Lead Centres and who would be tasked by the Permanent Representative to follow up with appropriate action within the NMHS concerned (see also paragraph 7 below).

2. The Thirteenth session of the Commission for Basic Systems, St. Petersburg, 2005 (CBS-XIII) recognized that a list of Focal Points for GCOS and related climate matters had been established (see also paragraph 8 below) and was being used by the GCOS Lead Centres to address problems of receipt of expected messages. CBS-XIII was also informed of Lead Centre efforts to collect historical GSN data and updated metadata for GUAN stations.

3. The Extraordinary session of the Commission for Basic Systems, Seoul, 2006 (CBS-Ext(06)) discussed the outcome of the Second Session of the CBS/GCOS Expert Meeting on Coordination of the GSN and GUAN (USA, September 2005). Based on the recommendations resulting from the Expert Meeting, a coordinated CBS Lead Centre training session was held, which included representatives from the CBS Lead Centres for GCOS in Japan, USA, Iran, Morocco and Australia. These Lead Centre representatives produced a working document that describes the steps to be taken to remedy the absence or misreporting of CLIMAT messages. Since the time of this Lead Centre training, Chile officially accepted to take on the role of Lead Centre for much of Region III and the British Antarctic Survey agreed to serve as Lead Centre for Antarctica. Negotiations were in progress to also establish Lead Centres in southern Africa and in Western Europe. CBS-Ext(06) was also informed that the CBS Lead Centres are working to improve CLIMAT report receipt from the GSN stations in their regions and that the GCOS Lead Centre/Archive Centre at NOAA/NCDC continues to request historical daily temperature data from GSN stations and historical metadata concerning instrument and location changes at GUAN stations.

4. To assist countries in the production and transmission of climatological data over the GTS, WMO Secretariat developed guidelines for CLIMAT and CLIMAT TEMP Reporting and organized a series of training workshops to increase climate data availability worldwide. In this regard, the WMO Handbook on CLIMAT and CLIMAT TEMP Reporting, which specifically addresses the needs of technical personnel responsible for compiling and transmitting CLIMAT and CLIMAT TEMP messages at the national level, had been prepared and published in 2004 in four official WMO languages (WMO/TD No. 1188). In addition, the specialized climatological software CLIREP has been developed to fully automate the process of encoding the observations for CLIMAT and CLIMAT TEMP messages. Three training workshops were already held in RA I (Morocco, December 2005), RA II (Russian Federation, November 2004) and RA III (Argentina, October 2006) for countries facing problems in generating and exchanging climate data. The major goal of these seminars was to address national observing network managers or coordinators with training

and practical exercises that would improve the availability of climate data from those Regions. The training workshop for RA V is preliminary planned to be held in Fiji in late 2008.

5. The present Terms of Reference of the CBS Lead centers for GCOS:
  - (a) Evaluate the monitoring results of the GCOS Monitoring and Analysis Centres;
  - (b) Coordinate activities with other GCOS Centres and/or other centres as appropriate;
  - (c) Liaise with nominated Points of Contact for GCOS data to improve data availability and quality;
  - (d) Monitor and report to CBS and GCOS on action taken and progress achieved;
  - (e) Maintain the list of Points of Contact in cooperation with the WMO Secretariat.
6. The present Terms of Reference for Points of Contact for GSN and GUAN:
  - (a) Liaise within the NMHS on GSN and GUAN issues related to data availability and quality;
  - (b) Inform Lead Centres on current and potential problems that might impact data availability and quality;
  - (c) Respond to requests from CBS Lead Centres for GCOS Data regarding data availability and quality.

7. The list of National Focal Points for GCOS and related climatological data (RBCN) is on the WWW/GOS website: <http://www.wmo.int/pages/prog/www/FocalPoints.html>.

8. The first meeting of the CBS Lead Centers for GCOS Coordination was held at the Headquarters of the Islamic Republic of the Iran Meteorological Organization (IRIMO) in Teheran and in its Regional Office in Isfahan, Iran (5-8 November 2007). The Coordination Meeting/Workshop considered reports from individual Lead Centers' activities and of the GCOS Archive Center; it reviewed GUAN/GSN requirements and GCOS activities, results of monitoring performance reports and Terms of Reference (TOR) of the Lead Centers; it discussed migration to BUFR, troubleshooting procedures, metadata requirements; it was informed of additional GSN/GUAN stations and AOPC priorities, and of the availability of the Handbook on CLIMAT and CLIMAT TEMP Reporting.

9. The Coordination Meeting/Workshop was instrumental in summarizing existing experience and made recommendations for further enhancement of the Lead Centers functions to the next session of the Commission for Basic Systems (CBS). These recommendations related to: (a) Coordination among Lead Centers; (b) Revised TOR of the Lead Centers; (c) Benefits of Lead Centers; (d) Remedy action; (e) Metadata Guide; (f) Expanding scope of the work of Lead Centers; (g) Internet gateway for CLIMAT data entry; (h) Archive of historical data; (i) Modification of performance reports at NCDC; (j) Quality control reports; and (k) Verification of completeness of CLIMAT and TEMP reports. See [Annex I](#) for details. The meeting also updated a list of CBS Lead Centers for GCOS and their areas of responsibility for consideration by CBS-XIV (See [Annex IV](#)).

*The AOPC may wish to review these recommendations and provide further guidance.*

### **RBCNs/ABCN and GSN/GUAN**

10. The Regional Basic Climatological Networks (RBCNs) and the Antarctic Basic Climatological Network (ABCN), networks composed of selected climatological stations in the respective WMO Regions and in the Antarctic, were established by Regional Associations and the Executive Council (EC), respectively, as a minimum requirement to permit Members to fulfil their responsibilities in providing services for "Climate" users. The six RBCNs and the ABCN together form an integrated network that facilitates basic climate monitoring over the Globe. RBCNs are reviewed and revised at each session of Regional Associations. The ABCN is revised by the EC following the WMO Congress.

11. Each RBCN is based primarily on Regional Basic Synoptic Network (RBSN) stations and includes all GCOS (GSN and GUAN) stations, regardless of whether these report CLIMAT or CLIMAT TEMP. RBCNs also include all other stations that report CLIMAT or CLIMAT TEMP needed for description of regional climate features. These other stations should be selected under the same criteria used for GSN and GUAN stations. Non-RBSN stations reporting CLIMAT messages are considered, particularly those with long records, as well as any Reference Climatological Stations.

12. Regional Associations have authorized their presidents to approve, at the request of the Member concerned, on the advise of the Rapporteur on the Regional Aspects of the GOS, and in consultation with the Secretary-General, minor amendments to the lists of RBCN stations without a formal consultation with the Members of the respective Association, following similar procedures to those specified for the RBSN. Any change is communicated to Members through the WMO Operational Information Service.

13. In practice, Members propose changes to the regional and global networks due to changes in the design of their national networks or due to the other operational or financial constraints. Therefore, the WMO Secretariat, in collaboration with the Rapporteurs on the Regional Aspects of the GOS, ensures that the list of RBCN is kept up-to date. In this regard, difficulties were encountered in the past in harmonizing the lists of RBCN with those of GSN/GUAN maintained by GCOS. The main reason for discrepancies being the different approval process of the list of RBCN and those of GSN/GUAN stations. Therefore, it is proposed that a new procedure be developed for the approval/updating of the lists of RBCN/GSN/GUAN stations with one unique reference list.

*A proposal for consideration by the AOPC is enclosed as [Annex V](#).*

#### **GCOS Matters related to CBS and CIMO**

14. In 1998, the CBS established a Rapporteur on GCOS matters with a responsibility for the preparation and maintenance of reviews of observing systems that are being designed under the auspices of GCOS (e.g., GUAN, GSN and space based observing systems (GOSSP and CGMS)) and for the provision of feedback to members in maintaining the quality of the networks. Since CBS-XIII in 2005, Mr Matthew Menne (NOAA, USA) serves as Rapporteur. The Rapporteur normally participates in the session of the CBS OPAG-IOE Expert Team on the Evolution of the GOS and in the OPAG-IOE Implementation Coordination Team and ensures linkage to the GCOS community. The Rapporteur also pursued the cross-coordination and represented CBS at GCOS relevant events/projects, such as CBS Lead Centers for GCOS, GRUAN, etc. The TOR of the Rapporteur is likely to be amended at CBS-XIV in order to encompass other areas, such as GRUAN, WIGOS vis-à-vis to GSN/GUAN/GRUAN, etc.

15. To assist in the implementation of the CBS recommendations in the Regions, the Regional Associations have established Rapporteurs on Regional Aspects of the GOS within their Working Groups on Planning and Implementation of World Weather Watch in the Region. The TOR of the Regional Rapporteurs changes from Region to Region, however, one of the core functions is: To monitor performance, review, update and advise on the design of observing systems in the Region, in particular the RBSN and RBCN. Therefore, issues related to implementation of GSN/GUAN as well as to the RBCN design, may be consulted by GCOS with the Regional Rapporteurs. The list of Rapporteurs is provided in the Abridged Final reports of the RAs' sessions.

16. The Commission for Instruments and Method of Observation (CIMO) regularly performs instrument intercomparisons with the aim to improve the performance of instruments, increase instrument interoperability and data compatibility and homogeneity. Intercomparisons provide a link among different types (and principles) of instruments and as such support GCOS Climate Monitoring Principles. The intercomparisons: (a) Provide information to Members on the impact of new systems to existing systems; (b) Significantly reduces a period of overlap for new and old observing systems; (c) Increase the quality and homogeneity of data.

17. Several instrument intercomparisons were, or are carried out in the last four years:
  - a. Laboratory Intercomparisons of Rainfall Intensity Gauges (Sep. 2004-Sep. 2005);
  - b. Intercomparison of the High Quality Radiosonde Systems (Feb. 2005);
  - c. Tenth International and Regional Pyrheliometer Comparisons (Sep.-Oct. 2005);
  - d. Field Intercomparisons of Rainfall Intensity Measuring Instruments (started in Sep. 2007); and
  - e. Combined screen/shield and humidity sensor intercomparisons (about to start).
  
18. CIMO-XIII (December 2006) noted the importance of observations for climate change studies. Taking account of the need for more representative and typical characteristics of climate observations as well as their requirements for instruments and methods of observation, the Commission requested that further work be done to support intercomparisons of observation instruments for climate, and to strengthen research on climate observation methods. *GCOS should consider stronger involvement in the planning and/or conducting the instrument intercomparisons in order to enhance their benefits for the climate community.*
  
19. CBS and CIMO collaborate with GCOS in planning and design of the networks, such as GRUAN, by providing necessary technical advice and by the development of best practices. A transparent and technically/scientifically viable selection of instruments for GRUAN stations is facilitated through instrument intercomparisons.
  
20. Regular monitoring activities of the RBSN and RBCN (quantity and quality) are performed by the WMO Secretariat and participating monitoring centers, based on request from CBS. Through subsequent corrective measures, data of both RBSN and RBCN (including GSN & GUAN) stations are improved.
  
21. CIMO and GCOS identified an urgent need for training and capacity building in the area of upper-air measurements. In this regard, the WMO/GCOS Training Workshop on GUAN Upper-Air Observations for RA I (Africa) was held in Windhoek, Namibia, 8 - 12 October 2007. Representatives from all 18 GUAN stations in Africa participated in the event. The training was aimed at improving the knowledge and skills of the upper-air sounding operational personnel. The theory covered topics such as basic introduction to radiosonde soundings and all preparatory activities prior to the launching of radiosondes. The practical work dealt with all activities during and after the radiosonde launch, including safe handling of hydrogen and correct balloon inflation procedures. A number of multiple radiosonde flights were launched during the demonstrations. The workshop also addressed the operational problems experienced in RA I through country reports presented by the participants. Many common problems were identified by the participants, such as insufficient training for both hydrogen producing equipment and upper-air equipment, the high cost of radiosondes, poor quality of electrical power at their stations, the high-cost and difficulty in maintaining equipment and several operational problems such as signal drop outs. The host country provided the necessary infrastructure for the successful outcome of the workshop, complemented by additional lecturers, ground upper-air systems, radiosondes and other consumables for the practical training from the UK Met Office, the InterMet Systems (South Africa and USA), Sagim (France), Proton Energy Systems (USA), Modem (France) and Vaisala Oyj (Finland). The UK Met Office provided three lecturers that also prepared training lecture notes for the workshop. The CIMO lecturers were assisted by lecturers from the HMEI and GCOS. Training material was provided to the participants on CD to assist them in the follow-up training at national level. Similar training is planned to be held in India for RA II GUAN stations in early 2009.

## ANNEX I

**RECOMMENDATIONS  
of the CBS Lead Centers for GCOS Coordination Meeting/Workshop (First Session)**

1. The interaction and coordination within the group is very important, therefore it is recommended to organize CBS Lead Centers for GCOS Coordination Meeting/Workshop every two years.
2. The meeting recommended to update the Terms of Reference (TOR) of the CBS Lead Centers for GCOS as proposed in [Annex II](#) and the TOR of the National Focal Points for GCOS and Related Climatological Data [Annex III](#).
3. The meeting recommend that, following the approval of the revised TOR, WMO Secretariat and/or GCOS inform all Members by a letter on the TOR of the CBS Lead Centers for GCOS, informing them of the expected benefits of Lead Centers' activities for Members and GCOS, encouraging the Members to support the activities of the Lead Centers, and encouraging Members who have not done so to nominate a National GCOS Focal Point.
4. The WWW produces many useful GTS performance reports but there does not seem to be effective follow-up actions to actually resolve the observed problems. All of the Lead Centers have encountered data flow problems and there is a need to identify the entity who would resolve the problems. The Lead Centers believed that the WWW should be that entity. The GCOS Secretariat should cooperate and assist the WWW in that activity. Therefore, the meeting recommended that the World Weather Watch take proactive and specific actions to improve the receipt of data over the GTS.
5. The Lead Centers recognized the need for a "Guide to GSN and GUAN Meta Data" before collecting this information. The Guide should identify what information is needed, the accuracy of such information, and the format. The meeting recommended that the GCOS Secretariat prepares such a Guide using input from its relevant AOPC Advisory Panel.
6. It was felt that the scope of activities of the Lead Centers should be expanded to include the entire RBCN network in their areas of responsibilities. The meeting encouraged Lead Centers to expand their activities to entire RBCN on a voluntary basis, if feasible, and recommended that this matter be discussed at the next coordination meeting/workshop when more experience is gained by those volunteered Lead Centers.
7. The Lead Center in Germany has offered to act as an "internet gateway" ([joern.kallies@dwd.de](mailto:joern.kallies@dwd.de)) for CLIMAT reports in cases where the GTS is not working well. This is not seen by the Lead Centers as a substitute for correcting GTS problems but it is a very useful temporary method of ensuring continuity of the climate records. The meeting welcomed this offer and recommended that the next meeting is informed on the results of this approach. The monitoring centers were reminded that CLIMAT reports in BUFR are imminent and centers were requested to include monitoring of CLIMAT BUFR in their activities.
8. The Archive Center at NCDC has offered to send a yearly summary report of the increase of historical data going into the Archive to the Lead Centers. This is an important performance measure for the Lead Centers and the meeting recommended that NCDC proceed accordingly.
9. Several of the performance reports produced by the Lead/Analysis Center at NCDC will be modified to make them even more useful. Country names will be added to reports for example to make them easier to use. The meeting recommended that NCDC proceed accordingly.

10. As the Lead Centers in Germany and Japan are also GSN Monitoring Centers, responsible for quality monitoring of monthly total precipitation and mean temperature, respectively, the meeting recommended that those centers modify the performance reports to provide more detail about some of the quality control reports such as improved labelling, specific information about rejected reports, etc.

11. In many cases not all important sections of CLIMAT messages are being reported by the station operators. In the move from the initial primary focus on quantity of observations to a focus on quality of observations, the additional performance monitoring tools will be needed to assist the Lead Centers. The meeting recommended that the Lead Centers must also verify the “completeness” of the CLIMAT and the TEMP reports.

12. The meeting requested that GCOS Secretariat show examples of correct CLIMAT reports on its website.

**REVISED TERMS OF REFERENCE  
OF THE CBS LEAD CENTERS FOR GCOS FOR SUBMISSION TO CBS-XIV**

1. Diagnose problems in the GSN and GUAN by using the monitoring reports produced by the GCOS Monitoring and Analysis Centers;
2. Liaise with nominated National Focal Points for GCOS and related Climatological Data, and other responsible officials, to improve data and meta data availability and quality;
3. Co-ordinate activities with other GCOS Centers and/or other centers as appropriate;
4. Monitor and report to CBS and GCOS on actions taken, progress achieved, concerns and recommendations on a yearly basis in a time frame that corresponds to planned AOPC and CBS meetings;
5. Assist AOPC in the revisions of GSN and GUAN stations;
6. Assist the WMO Secretariat in maintaining the list of National Focal Points for GCOS and related Climatological Data.

**REVISED TERMS OF REFERENCE  
OF THE NATIONAL FOCAL POINTS FOR GCOS AND RELATED CLIMATOLOGICAL DATA**

1. Liaise within the NMHS on GSN and GUAN issues related to data and metadata availability and quality;
2. Inform Lead Centres on current and potential problems that might impact data and metadata availability and quality;
3. Respond to requests from CBS Lead Centres for GCOS Data regarding data and metadata availability and quality.

## THE LIST OF CBS LEAD CENTERS FOR GCOS AND THEIR AREAS OF RESPONSIBILITY

- **Morocco (RA I)** is responsible for GSN and GUAN Stations in : Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Côte d'Ivoire, Egypt, Gabon, Ghana, Gambia, Guinea, Guinea Bissau, Guinea Equatorial, Liberia, Libyan Arab Jamahiriya, Madagascar, Mali, Niger, Nigeria, Mauritania, Morocco, Senegal, Sierra Leone, Sao Tome and Principe, Sudan, Togo, Tunisia.
- **Mozambique (RA I)** is responsible for GSN and GUAN Stations in: Angola, Botswana , Burundi, Canary Island, Comoros Island, Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, the Ocean Islands (St. Helena Island, Ascension Island, Martin de Vivies, Iles Crozet, Iles Kerquelen), Rwanda, Seychelles, Somalia, South Africa, Swaziland, Uganda, United Republic of Tanzania, Zambia, Zimbabwe.
- **Iran (RA II and part of RA VI)** is responsible for GSN and GUAN Stations in: Afghanistan, Armenia, Azerbaijan, Bahrain, India, Iran, Jordan, Kazakhstan, Kyrgyzstan, Maldives, Nepal, Oman, Pakistan, Qatar, Russian Federation, Saudi Arabia, Sri Lanka, Syria, Tajikistan, Turkey, United Arab Emirates, Yemen.
- **Japan (RA II)** is responsible for GSN and GUAN Stations in: Brunei, Cambodia, China, Japan, Laos, Malaysia, Mongolia, Myanmar, Philippines, Republic of Korea, Singapore, Vietnam.
- **Chile (RA III)** is responsible for all GSN and GUAN Stations in RA III.
- **USA (RA IV)** is responsible for most GSN and GUAN Stations in RA IV plus Hawaii.
- **Australia (RA V)** is responsible for most RA V, except those countries noted for Japan and Hawaii (USA).
- **Germany (RA VI)** is responsible for most RA VI, except those countries noted for Iran.
- **UK (British Antarctic Survey)** is responsible for all GSN and GUAN stations in Antarctica.

**Proposal for the process of approval/update of the list of RBCN stations,  
with a special attention to GSN and GUAN stations**

