WORLD METEOROLOGICAL ORGANIZATION

_____

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

CBS/GCOS EXPERT MEETING ON COORDINATION OF THE GSN AND GUAN

OFFENBACH, GERMANY, 15-17 MAY 2002

Distr.: RESTRICTED
CBS/OPAG-IOS (EMCGG-1)/DOC.3
(30.IV.2002)

_____

Item : 2

Original: ENGLISH

GCOS STRATEGY TO SUPPORT BASELINE OBSERVING SYSTEMS

(Submitted by GCOS)

Summary and Purpose of Document

This document reviews the GCOS Strategy for the GSN and GUAN and other networks and systems. It identifies some current problems associated with the implementation of part of this strategy, notably the difficulties in ensuring that remedial action is taken in response to reporting and other deficiencies identified in the station monitoring process, and suggests some potential solutions to overcoming these difficulties.

ACTION PROPOSED

The meeting is invited to take into consideration the information contained in this document for discussion under Agenda Item 3 and related items.

1. GCOS STRATEGY FOR BASELINE AND COMPREHENSIVE NETWORKS

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.

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 significant variance in the atmosphere. Satellite data have a major contribution to the comprehensive networks, as they can provide genuinely 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. 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. DATA MANAGEMENT STRUCTURE

The GCOS Data Management Structure includes monitoring the availability of data, quality control, the analysis of the data (and product development) and archiving of the final data sets. Detailed responsibilities of the individual components are given below.

2.1 GCOS Monitoring Centre (DWD and JMA for GSN; ECMWF for GUAN)

The tasks of a GCOS Monitoring Centre are to:

- Monitor the availability, timelines and completeness of the incoming data and messages received via GTS or other communication medium with the objective of improving the performance of the network being monitored;

- Perform fundamental quality-control and assurance procedures on the incoming data (and metadata) to ensure the basic quality and completeness of the data set;

- Make basic quality-controlled data available to National Meteorological and Hydrological Services (NMHSs) and World Data Centres (WDCs) and others for their use in a variety of climate applications and products;

2.2 GCOS Analysis Centre (NCDC for GSN; Hadley Centre for GUAN)

A GCOS Analysis Centre will provide higher-level quality control of both the daily and monthly GCOS network data.

- For the daily data, this will include updating and quality-controlling the data, applying bias corrections, calculating monthly statistics from daily data; and providing daily and monthly data to users.

- For the monthly data, this will include analyzing the data; improving bias adjustments and the monthly station data base; creating global and regional monthly statistics; and developing and providing grid products with reduced biases.

- The centre will also provide products to users, improve the metadata, and report on historical and metadata reception.

2.3 GCOS Archive (WDC-Asheville for GSN and GUAN)

A GCOS Archive should be co-located with a World Data Centre (WDC) or recognized, established data centre, if possible.

- It will archive both the monthly and the daily data (in delayed-mode), as well as historical data, for each station.

- Historical monthly data in the WDC will come either from data available at WDCs (e.g., from the Global Historical Climatology Network (GHCN)); from quality-controlled data available at the MCs; or from data submitted, upon request, by national centres (e.g., NMHSs) and available digitally and updated on a routine basis. (Access in near real-time to the time series of historical monthly data is necessary for quality control.)

- The daily historical data are important to better assess the impact of extreme events and its relation to climate change.

3. CURRENT STATUS OF IMPLEMENTATION FOR GSN AND GUAN

Application of the GCOS strategy for the GSN and GUAN networks has resulted in the establishment and routine operation of the Monitoring, Analysis and Archiving Centres identified above. However, at least two problems have become increasingly clear from the operations to date:

(i) There is no clear and efficient mechanism in place to ensure that the information from the monitoring process is fed back to the operators of GSN and GUAN stations, and that remedial action is effected which will overcome the deficiencies identified;

(ii) There is no dedicated implementation or project office to oversee and co-ordinate the overall activities needed to ensure smooth and efficient operation of the GSN and

GUAN systems as a whole.

It is felt these problems have contributed in large part to the lack of significant improvement in the performance of the GSN and GUAN since their inception. This was recently recognized by the GCOS Steering Committee at it Tenth Session in April 2002, which endorsed the concept of a dedicated project office for GCOS networks: “The SC recognized the growing pressure for, and importance of, implementing GCOS networks and systems to meet user needs, including the UNFCCC, and the scope and complexity of the work required to oversee and co-ordinate them. It recommended to GCOS sponsors that a dedicated project office for GCOS Baseline Systems be established as soon as possible, focussing initially on the GSN and GUAN and extending eventually to other networks such as GTN-H.” Furthermore, it has also been suggested that the nomination of one or more of the GCOS Centres as CBS Lead Centres for GSN and GUAN could be a major positive step in overcoming the current difficulties. The EMCGG is invited to consider the possibilities for implementation of at least the latter of these approaches, perhaps on a pilot or trial basis.

ANNEX: GCOS STANDARDS

This Annex lists the principles and practices currently in place for GCOS networks.

1. GCOS Principles of Involvement*

P1. GCOS will deliver, on an operational basis, high-quality, well-calibrated, long-term observations of the climate system needed for: seasonal-to-interannual climate predictions; climate system monitoring; early detection of climate trends due to human action; improved understanding of the climate system; impact assessment and adaptation to current and future climates; and national economic and sustainable development applications. Climate observations are required in all three domains of the earth (atmospheric, oceanic and terrestrial).

P2. Contributions to GCOS will implement one or more components or parts of the overall systems plans developed and agreed on the basis of the above design principles.

P3. Contributions will recognize the GCOS requirement for long-term records that requires special attention to those aspects involving routine assessments of data quality, continuity and homogeneity as well as the need for permanent repositories for all contributed data.

P4. Contributing nations and organizations have the right to determine and limit their contributions to GCOS and have full autonomy in the management of those contributions while recognizing these principles.

P5. Use of the GCOS 'labels' implies acceptance to operate in accordance with the relevant principles of GCOS.

P6. All contributions of data and products pertinent to GCOS will be described in internationally-accessible, on-line computerized directories that conform to agreed-upon standards, including a reference to the originator of the data and their location.

P7. Contributions will be compliant with the GCOS data policies outlined below:

GCOS Data Policies:

D1. Internationally-agreed standards will be used to the greatest extent possible for the acquisition, processing, archiving, and distribution of data.

D2. All data should be processed to a level that is generally useful to user communities without a detailed knowledge of the observing instrument (i.e. geo-bio-physical rather than engineering measurements). However, for data from those instruments that utilize sophisticated algorithms for this processing, adequate archives must be maintained to permit recalculation of the geo-bio-physical data as improved processing techniques become available.

D3. The impact of new systems and technology or changes to existing systems or technology will be assessed prior to implementation and a suitable period of overlap for new and old observing systems will be followed upon implementation.

D4. Full and open sharing and exchange of data and products will be practised for all GCOS users.

D5. The exchange of data will occur as rapidly as possible (near-real-time) following the observation. Corrections arising as a result of further quality control will follow at a later time.

D6. Results of calibration, validation, algorithm changes, and data homogeneity assessments will be treated with the same care as the data themselves and will be made available to the user community and the designated international data centre.

D7. Data sets established as part of international research programmes and designated as required for the indefinite future will be archived with the appropriate international data centre.

D8. Information about the data holdings, including long-term quality assessments, supporting ancillary information (meta-data), and guidance and aids for locating and obtaining the data, should be readily available at both national and designated international data centres.

*From the GCOS Implementation Strategy, GCOS-67, June 2001

2. GCOS/GOOS/GTOS Climate Monitoring Principles**

Effective monitoring systems for climate should adhere to the following principles:

1. The impact of new systems or changes to existing systems should be assessed prior to implementation.

2. A suitable period of overlap of new and old observing is required.

3. The results of calibration, validation and data homogeneity assessments and assessments of algorithm changes should be treated with the same care as data.

4. A capability to routinely assess the quality and homogeneity of data on extreme events, including high-resolution data and related descriptive information, should be ensured.

5. Consideration of environmental climate-monitoring products and assessments, such as IPCC assessments, should be integrated into national, regional and global observing priorities.

6. Historically-uninterrupted station operations and observing systems should be maintained.

7. A high priority should be given to additional observations in data-poor regions and regions sensitive to change.

8. Long-term requirements should be specified to network designers, operators and instrument engineers at the outset of new system design and implementation.

9. The conversion of research observing systems to long-term operations in a carefully-planned manner should be promoted.

10. Data management systems that facilitate access, use and interpretation should be included as essential elements of climate monitoring systems.

**Adopted by the Conference of the Parties to the UN Framework Convention on Climate Change through Decision 5/CP.5 of COP-5, Bonn, 1997.

3. BEST PRACTICES FOR GSN and GUAN

Best practices for GSN stations (WMO Manual on the Global Observing System, Section 2.10.3.17)

- Long-term continuity should be provided for each GSN station. This requires the provision of the necessary resources, including well-trained staff, and keeping changes of location to a minimum.

- In case of significant changes in sensor devices or station location, Members should provide for a sufficiently long period of overlap (at least one, but preferably two years) with dual operation of old and new systems to enable comparisons to be made and the identification of inhomogeneities and other measurement characteristics.

- CLIMAT data should be provided in an accurate and timely manner. CLIMAT reports should be transmitted by the fifth day of the month but not later than the eighth day of the month.

- Rigorous quality control should be exercised on the measurements and their message encoding. CLIMAT reports require quality control of the measurements themselves and their message encoding to ensure their accurate transmission to national, regional and world centres for their use. Quality control checks should be made on site and at a central location designed to detect equipment faults at the earliest stage possible. The Guide to Instruments and Methods of Observation (WMO No 8) provides the appropriate recommendations.

- The site layout should follow the recommended form (Guide on the GOS, WMO No 488).

- The site and instruments should be inspected regularly and maintained according to WMO recommended practices (Guide to Instruments and Methods of Observation (WMO No 8). As part of the maintenance, the necessary calibration practices should be traceable to the standards provide by the Guide.

- A national plan should be developed to archive daily data and metadata pertaining to each climate station. Metadata should include data concerning a station's establishment, subsequent maintenance, and changes in exposure, instrumentation and staff. The data and metadata should be in its original form as well as in digital format.

- Detailed metadata and historical climate data for each GSN station should be provided to the GSN Archive. Both data and metadata should be up-to-date.

Best practices for GUAN stations (WMO Manual on the Global Observing System, Section 2.10.4.9)

- Long-term continuity should be provided for each GUAN station. This requires the provision of the necessary resources, including well-trained staff, and keeping changes of location to a minimum.

- Changes of bias caused by changes in instrumentation should be evaluated by a sufficient overlapping period of observation (perhaps, as much as a year) or by making use of the results of instrument intercomparisons made at designated test sites.

- Soundings should preferably be made twice a day and should reach as high as possible, noting the GCOS requirements for ascents up to a height of 5 hPa. Because climate data are needed in the stratosphere to monitor changes in the atmospheric circulation, composition and chemistry, every effort should be made to maintain soundings regularly up to a level as high as possible noting the above GCOS requirement.

- CLIMAT TEMP data should be provided in an accurate and timely manner. CLIMAT TEMP reports should be transmitted by the fifth day of the month but not later than the eighth day of the month.

- Rigorous quality control should be exercised at each GUAN site. Periodic calibration, validation and maintenance of the equipment should be carried out to maintain the quality of the observations.

- Basic checks should be made before each sounding to ensure accurate data. Checks should also be made during and at the end of each sounding to assure corrections of incomplete soundings or errors before transmission.

- Back-up radiosondes should be released in cases of failure in order to maintain the record from the GUAN station.

- Detailed metadata should be provided. The batch identifier on the radiosondes should be logged for each flight, so that faulty batches can be identified and the data amended or eliminated from the climate records if necessary. Up-to-date records of metadata in a standard format should be provided to the GUAN Archive so that shifts in the data will not be mistaken for climate change. The metadata should include detailed information about the station such as location, elevation, operating instruments and their changes over time. Changes to operating and correction procedures should also be recorded. Both the corrected and uncorrected upper-air observation should be archived. Climate change studies require extremely high stability in the systematic errors of the radiosonde measurements.