

NOTES ON GUIDELINES FOR REPORTING TO THE UNFCCC ON THE STATUS OF GLOBAL CLIMATE OBSERVING SYSTEMS

These notes are intended to provide some basic background information on the purpose underlying the “UNFCCC Reporting Guidelines on Global Climate Change Observing Systems” and some supplementary information that could be useful in compiling the requested information. They should be read in parallel with these Guidelines.

I. Background

1. *What are the UN Framework Convention on Climate Change (UNFCCC) Reporting Guidelines on Global Climate Observing Systems (“the Guidelines”)?*

The Guidelines are a set of general instructions that outline the preferred approach for reporting to the Conference of the Parties (COP) of the UNFCCC on the national status of meteorological and atmospheric, oceanographic, and terrestrial observing systems. The Guidelines were adopted in Decision 5 at the 5th COP in November 1999. They can be found on the Internet at the GCOS Web site, <http://www.wmo.ch/web/gcos/>, and then by clicking on “GCOS and UNFCCC.”

2. *Why has the COP requested that countries report on the status of their climate observing systems?*

The COP recognized the importance of systematic observation to further the understanding of climate change in Article 5 of the UNFCCC. Article 5 states, in part, that Parties shall support international and intergovernmental efforts to strengthen systematic observation and that Parties should take into account the particular concerns and needs of developing countries and cooperate in improving their endogenous capacities and capabilities to participate in systematic observation.

Decision 8 of the 3rd COP in Kyoto in December 1997 requested the Subsidiary Body for Scientific and Technological Advice, in consultation with the Intergovernmental Panel on Climate Change, to consider the adequacy of observational systems. The resulting ***Report on the Adequacy of the Global Climate Observing Systems*** was introduced at the 4th COP in Buenos Aires in November 1998. This influential report noted that it is commonly assumed that there are more than enough observations being collected to meet scientific needs related to the evolution of the climate and to guide mitigation and adaptation strategies to address the potential impacts of climate change. In practice, however, “available observations often have major deficiencies with respect to climate needs. These deficiencies have the potential seriously to undermine any decisions made concerning the mitigation of climate change. Problems with the observational record include a lack of consistent long-term records, many gaps in spatial coverage, changes in observational procedures which introduce bias and, for several important observational types, a decline in the quality and number of observations being made.”¹

¹ Global Climate Observing System, *Report on the Adequacy of the Global Climate Observing Systems*, GCOS-48, October 1998.

This important conclusion of the "*Adequacy*" report--that, in fact, observations in many parts of the world are inadequate for the needs of the Convention--led to Decision 14 at COP 4. Recognizing that good long-term climate data were essential to meet local, regional, and international needs, this Decision urges Parties to undertake programmes of systematic observation and requests them to submit information on national plans and programmes related to their participation in global observing systems for climate. Two important purposes of this request were to enable a better understanding of the needs of countries concerning observational networks and to provide information for assessing options for financial support to developing countries to reverse the decline of observational networks.

Decision 14/CP.4 was followed by Decision 5 at the 5th COP. This decision adopted the UNFCCC reporting guidelines that are the subject of this tutorial. It also invited all Parties to provide detailed reports to the Convention Secretariat on systematic observation in accordance with these guidelines. Significantly, Decision 5 also urges Parties to address deficiencies in climate observing networks and invites them, in consultation with the secretariat of the Global Climate Observing System (GCOS), to bring forward specific proposals for this purpose and to identify "the capacity-building needs and funding required in developing countries to enable them to collect, exchange, and utilize data on a continuing basis." Necessarily, the ability to draft specific proposals to address deficiencies will depend in large part on understanding what those deficiencies are, and it is the aim of national reporting on systematic observations to improve this understanding at national, regional, and global levels.

3. *Why has the COP adopted **standard** guidelines?*

Standard guidelines provide a format that will help the Convention secretariat and GCOS easily understand and assess the status of key observing system attributes. Standard guidelines also enable the information submitted by individual countries in national reports to be easily amalgamated or synthesized so that an overall picture of the status of global observing systems can be constructed. Decision 5 invites the Convention secretariat, in conjunction with GCOS, to develop a process for synthesizing and analysing the material submitted in national reports. Information provided using a standard format makes this task easier. A synthesis report will be produced once enough national reports have been received to make the exercise meaningful. Although Decision 5 does not mention it, additional synthesis reports may be produced as the database consisting of the information provided in national reports grows.

4. *Who has to report?*

Decision 5 *invites* all Parties to provide detailed reports on systematic observation in accordance with the guidelines. Parties included in Annex I to the Convention should do so in conjunction with their national communications. The third national communication of Annex I Parties is due by 30 November 2001. Parties not included in Annex I, that is, developing countries, are not required to submit reports but can do so on a voluntary basis. The COP has not specified when voluntary reports are due. Such reports would be accepted at any time; however, to be included in the first synthesis report, it would be desirable for non-Annex I Parties to submit their reports by the end of November 2001 along with Annex I Parties, or, if that is not feasible, as soon after that date as possible.

5. *Why is reporting important even for those Parties for whom it is voluntary?*

The COP believes that it is important that as many countries as possible undertake national reports on the status of their observing systems. Individually and collectively, these reports will provide essential information that can be used in making the case for upgrading climate observing systems. Moreover, the final synthesis report(s) will only be as good as the amount and quality of the information on which it is based. If few countries submit national reports, the synthesis report will be of little value as a guide for supporting future improvements in observing systems. It is especially important that countries experiencing problems in maintaining or upgrading observing systems prepare and submit reports. The availability of a quality synthesis report will also help to raise the level of awareness among the delegates to UNFCCC meetings of the importance to them of systematic observation. Although quality information is fundamental to sound decision-making, observations *per se* are sometimes not a priority concern among UNFCCC delegates or an issue about which many of them have much expertise.

II. General Reporting Considerations²

The Reporting Guidelines call for a combination of quantitative data in tabular form and narrative material. The Guidelines thus recognize that some material can be quantified but that other relevant information is best conveyed in words. GCOS regards both types of information as important. The goal is to compile a concise report that accurately depicts the status of national observing networks, including gaps and deficiencies in those networks. Box 1 gives guidance on the report structure as discussed in Guidelines Section IB.

Section IIA of the Guidelines addresses general reporting considerations. These deal with issues of existing national plans, additional information to that sought in the Guidelines, exchange of data with other Parties, capacity-building activities, actions since the publication of the latest national communication, and difficulties encountered in providing information.

Box 1: Report structure

- Information to be communicated in a single document; electronic version should also be provided
- Report to be submitted to COP through the UNFCCC secretariat
- To be written in one of the official UN languages
- Length of report at discretion of Party; long reports to be avoided
- To facilitate follow up, contact details, such as a person or position name, and, if available, an email address and web site should be provided

² Numbers and letters in parentheses refer to the numbered paragraphs in the Guidelines.

1. Existing national plans (Guideline Section IIA4(a))

If a national plan for systematic observations currently exists, this should be noted, and a summary of the plan and of the timeframe for its implementation should be appended to the national report. If the plan is available on the web, the location should be cited. Any specific commitments in the plan to address GCOS requirements should be noted. Finally, this section asks Parties to list and describe the ministries and agencies responsible for implementing the plans. In most cases, different agencies will be responsible for different types of observations or elements of the plan. The footnote in this section refers to the 1995 *Plan for the Global Climate Observing System*. This report is useful mainly as background information on the creation of GCOS. The online version of this report can be found at: <http://www.wmo.ch/web/gcos>, and then by clicking on GCOS-14 in the Publications section. Among other things, the report discusses the scientific priorities, benefits, and principal components of GCOS. A summary of current GCOS networks for which information is requested is given in Box 2 (most countries, of course will be concerned only with a subset of these networks).

Box 2: GCOS Networks

Meteorological and Atmospheric

- GCOS Upper Air Network (GUAN) (150 stations, ~80 countries)
- GCOS Surface Network (GSN) (989 Stations, ~145 countries)
- Global Atmosphere Watch (GAW) (22 global, 300+ regional stns)

Oceanographic (in cooperation with GOOS)

- Ships of Opportunity Programme (SOOP) (~120 ships , ~25,000 XBTs per year, 7 countries)
- Data Buoy Cooperation Panel (DBCP) (~1250 drifting buoys, 21 countries; plus fixed buoys)
- Tropical Atmosphere Ocean (TAO) Array (70 moored buoys, 4 countries; part of ENSO Observing System)
- Voluntary Observing Ships (VOS) (~6000)
- Automated Shipboard Aerological Programme (ASAP)
- Argo (3000 profiling floats planned)

Terrestrial (in cooperation with GTOS)

- Global Terrestrial Network for Glaciers (GTN-G)
- Global Terrestrial Network for Permafrost (GTN-P)
- Global Terrestrial Network for Ecology (GTN-E) (ILTER, Fluxnet, TEMS)
- Global Terrestrial Network for Hydrology (GTN-H)

2. Additional information (Section IIA4(b))

The request for “additional information” in 4b refers to any information, *in situ* or satellite, that Parties may deem relevant to include in their reports that will complement and/or complete the basic information requested. Such information may include both tabular and narrative data; maps showing station locations; relevant programmes in which the Party participates (such as the Integrated Global Observing Strategy), etc. Tables 1 and 3 in part B each have a column for “other” networks that may be added. For example, one additional network that would fall under the “other” category in Table 3 (concerning terrestrial observing networks) is the newly established Global Terrestrial Network for Hydrology (GTN-H). Although a global catalogue of GTN-H stations has not yet been established, Parties may wish to provide climate-related information on stations in their countries that belong to the Global Precipitation Climatology Centre, the Global Runoff Data Centre, or the World Hydrological Cycle Observing System.

3. Extent to which national data on systematic observations are exchanged (Section IIA5)

The COP has urged Parties to undertake free and unrestricted exchange of data to meet the needs of the UNFCCC. The global nature of climate and climate change requires ongoing cooperation among all nations to freely exchange and share climate data in order to understand, monitor, and predict climate phenomena. To facilitate data exchange, Parties are encouraged to provide data on systematic observations to international data centres. These include, for example, the World Data Centre A for Meteorology at the U.S. National Climatic Data Centre in Asheville, North Carolina. A list of international data centres may be found on the WMO web site (<http://www.wmo.ch>). Once connected to this site, click “Links,” then “Links to Environmental Data and Processing Centres.” Oceanographic and terrestrial data centres are listed in addition to meteorological ones. Additional information may be found by clicking on the WMO link to “ICSU World Data Centres” and then on the “WDC Guide” link. In addition to reporting on what data are provided to these data centres, the COP would like to know what barriers, if any, have been encountered in reporting to them. Further, the Guidelines call for a brief description of national policies pertaining to the exchange of data relevant to the needs of the UNFCCC.

4. Capacity-building activities (Section IIA6)

Developed (Annex I) countries should list the capacity-building activities related to systematic observation that they have held or are planning to hold in developing countries or to which participants from developing countries have been or will be invited. Developing countries can list national or regional capacity-building activities held or to be held in their countries or in which they have participated. It would be relevant, for example, to list participation in a GCOS Regional Workshop. Developing country Parties may also wish to add a statement on what additional capacity-building activities related to systematic observation are needed in their countries. Such information will help both the COP and GCOS to promote and encourage these activities.

5. Actions since the publication of the latest national communication (Section IIA7)

If actions to strengthen national and international programmes related to systematic observations have been taken since the publication of the most recent national communication submitted to the UNFCCC, these actions should be reported. Such actions

may have been taken to implement recommendations contained in the national communication or may represent recent actions not discussed in the latest communication. Knowledge of such actions will help the COP and GCOS to gauge progress and better assess needs.

6. Difficulties encountered in providing information (Section IIA8)

One purpose behind the request to Parties to submit national reports is to encourage them to focus in a “systematic” way on actions they are taking with respect to climate-related observations. If difficulties are encountered in obtaining the information requested in the Guidelines, such difficulties may then be addressed and improved reporting will result. If Parties can determine *why* certain information cannot be provided, the answer may lead to corrective action.

The concern here with difficulties encountered in providing information is different than the even more basic concern about *deficiencies* in observing system networks and *needs* for improvement in networks. The information requested in Tables 1, 2, and 3 does not directly address deficiencies and needs (such as stations not reporting due to lack of funding, non-functioning equipment, etc.). However, to the degree that this information is available, it would be especially useful to help characterize network problems. GCOS suggests that such information be provided in narrative form, where possible, under sections IIB, IIC, IID, and IIE of the Reporting Guidelines.

7. The GCOS/GOOS/GTOS Climate Monitoring Principles

Ten climate monitoring principles have been approved by the COP to the UNFCCC (see Appendix 1 of these Notes and Appendix 2 of the Guidelines). GCOS considers adherence to these principles, to the extent possible, vitally important for effective monitoring of climate. Parties are asked to describe the extent to which their observation practices within terrestrial, oceanographic, and meteorological/atmospheric domains are able to comply with these principles. Parties may wish to note, for example, if changes made in observing systems have led to problems, what the period of overlap was when switching from older to newer observing systems, and/or whether stations were able to maintain uninterrupted operations (and, if not, what the reasons for interruption were). The Climate Monitoring Principles are the foundation for guidance on Best Practices that individual networks have established to govern how observations are made.

III. Meteorological and Atmospheric, Oceanographic, and Terrestrial Observations

1. Meteorological and atmospheric observations (Section IIB)

The principal networks for which narrative and tabular information is requested are the GCOS Surface Network (GSN), the GCOS Upper Air Network (GUAN), and the Global Atmosphere Watch (GAW). These baseline networks define a minimum requirement for characterizing global climate and, as such, it is especially important that stations in these networks operate continuously. In this and the following 2 sections (oceanographic and terrestrial observations) the COP is requesting descriptive material on the respective networks. It is intended that this material then be summarized and quantified, to the degree possible, in Tables 1, 2, and 3. Thus, descriptive information is sought on:

1. The Party's participation in GCOS meteorological/atmospheric networks
2. The extent to which observations conform with the GCOS/GOOS/GTOS climate monitoring principles and best practices
3. The extent of international data exchange
4. The provision of Metadata to World Data Centres, and
5. Participation in quality control and archiving programmes.

For information about the initial selection of stations for the GCOS Surface Network, Parties may consult the report GCOS-34 on the GCOS web site (<http://www.wmo.ch/web/gcos>). Lists of both GSN and GUAN stations organized by individual countries can also be found at the GCOS web site, as can maps of all three principal networks. In addition, countries may wish to consult the GSN Monitoring Center web site (http://www.dwd.de/research/kliis/gsn_mc/), run jointly by the Deutscher Wetterdienst and the Japan Meteorological Agency, for the latest GSN monitoring report, and the Hadley Centre (<http://www.metoffice.gov.uk/research/hadleycentre/guan>) for additional information about GUAN and GUAN products.

Table 1 asks the following quantitative questions (mirroring the qualitative ones) for the three principal networks (and for any additional networks on which the Party wishes to report):

- How many stations are the responsibility of the Party?

Some countries may operate stations beyond national borders and/or in countries other than their own--they should include these extraterritorial stations as well.

- How many of those are operating now?

Operating means taking measurements--whether or not such measurements are provided to and received by international data centres

- How many of those are operating to GCOS standards now?

Appendixes 2 and 3 to this note give the Best Practices for GSN and GUAN networks. A GAW Measurements Guide will be posted on the GAW web site (which can be reached through the GCOS web site) by mid-2001. Appendix 2 to the Reporting Guidelines provides the ten GCOS/GOOS/GTOS Climate Monitoring Principles. These appendixes should be consulted for information on GCOS standards

- How many are expected to be operating in 2005?

National commitments to continuing operations are critical to the success of GCOS. Most stations have been selected for inclusion in GCOS networks based on the continuity of the data record and on the expectation that continuity will be maintained. If problems can be foreseen concerning the continuous operation of stations in GCOS networks (i.e., if it is anticipated that less than the current number of stations will be operating in 2005), GCOS

would like to know about them. If a station is not expected to be operating in 2005, reasons should be given.

- How many are providing data to international data centres now?

A list of international data centres may be found on the WMO web site (<http://www.wmo.ch/>).

2. *Oceanographic observations (Section IIC)*

Where relevant (i.e., for coastal states with oceanographic observing programmes), Parties should provide the requested information. Note that the oceanographic element of GCOS corresponds to the climate element of the Global Ocean Observing System (GOOS). Hence, networks that measure sea surface temperature, sea level, temperature and salinity profiles, and energy and carbon flux data, for example, are part of both GCOS and GOOS. The descriptive information requested and quantitative questions asked parallel those for atmospheric observing systems. The GOOS/GCOS Action Plan for Global Physical Ocean Observations contains information about best practices for oceanographic observing systems. This report can be found at http://ioc.unesco.org/goos/act_pl.htm.

A significant proportion of oceanographic observations, especially those beyond national Exclusive Economic Zones, are implemented by a handful of the most developed countries. It is expected that the reports of these countries on oceanographic observations would be substantially more detailed than the reports of the majority of countries.

3. *Terrestrial observations (Section IID)*

The information requested for terrestrial observations parallels that requested for meteorological/atmospheric and oceanographic observations. Although Table 3 identifies only three networks explicitly [i.e., permafrost (GTN-P), glaciers (GTN-G), and carbon (FLUXNET)], the “Other” column may be especially important for terrestrial observations. As paragraph 15 in the Reporting Guidelines suggests, to the degree relevant, narrative and quantitative information concerning hydrological systems (see point II2 in this note); land-use, land-cover, land-cover change and forestry; fire distribution, etc. is important.

Some information is available on best practices for GTN-P, GTN-G, and FLUXNET. For GTN-P, Parties should consult <http://www.geography.uc.edu/~kenhinke/CALM/measure.html>. This site gives information on the measurement protocol for the Circumpolar Active Layer Monitoring system. For GTN-G, information on the monitoring strategy for the World Glacier Monitoring Service may be found at <http://www.geo.unizh.ch/wgms/>. For FLUXNET, Parties may wish to consult the science plan for the Ameriflux web site at <http://cdiac.esd.ornl.gov/programs/ameriflux/scif.htm>.

GCOS notes that, in general, global terrestrial networks are far less developed than meteorological networks. Hence, the information contained in national reports will be of great assistance in helping to focus attention on the further development of these networks.

IV. Space-Based Observing Programmes (Section IIE)

Few countries have independent satellite operations; however, many participate in international space-based observing programmes or use satellite data to derive climate-related information. Satellite data will be increasingly available in the future. The goal is to make such data available to all countries for use in their weather, climate, ocean, and terrestrial services and assessments. The information requested in the Guidelines is intended to illuminate what satellite data is currently available to and used by countries.

Owning and operating satellite systems is not the only way that countries can participate in satellite observations. In kind support can include operation of data reception centers, instrument development and deployment, maintenance of equipment, quality control and data analysis, data set construction, deployment of buoys, and provision of access to national territory (including land, air space, and Exclusive Economic Zones).

The structure of the Guidelines in separating space-based observing programmes from the other observing regimes is somewhat artificial, as integrated (space and *in situ*) programmes are increasingly being adopted in modern observation programmes. Countries may therefore wish to treat information on satellite observations in the appropriate domain-based section of the Guidelines. Of special importance to GCOS concerning countries that participate in international space-based observing programmes is information on types of data accessed; mechanisms for accessing data and data products, and prospects for long-term continuity of access to data. Thus, GCOS would like to know what your current and planned future national contribution to satellite-based observations of the land surface, above the surface, and at sea is and will be, including the various types of in kind support noted above.

It is most important that continuity of the data themselves be maintained (i.e., that each new generation of space system takes care to ensure that climate-related observations are comparable with the previous generation).

Appendix 1: GCOS/GOOS/GTOS Climate Monitoring Principles

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

- The impact of new systems or changes to existing systems should be assessed prior to implementation.
- A suitable period of overlap of new and old observing systems should be required.
- The results of calibration, validation and data homogeneity assessments and assessments of algorithm changes should be treated with the same care as data.
- 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.
- Consideration of environmental climate-monitoring products and assessments, such as IPCC assessments, should be integrated into national, regional and global observing priorities.
- Uninterrupted station operations and observing systems should be maintained.
- A high priority should be given to additional observations in data-poor regions and regions sensitive to change.
- Long-term requirements should be specified to network designers, operators and instrument engineers at the outset of new system design and implementation.
- The carefully planned conversion of research observing systems to long-term operations should be promoted.
- Data management systems that facilitate access, use and interpretation should be included as essential elements of climate monitoring systems.

Appendix 2: Best practices for GUAN stations

The Commission for Basic Systems (CBS) at its Extraordinary session (Karlsruhe, Germany, September 1998) recommended that in implementing observing programmes at GUAN stations, Members should comply with the following best practices:

(a) 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;

(b) Soundings should preferably be made twice per day and should reach as high as possible, noting the GCOS requirements for ascents up to a height of 5hPa; since climate data are needed in the stratosphere to monitor changes in the atmospheric circulation and to study the interaction between stratospheric 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;

(c) CLIMAT TEMP data should be provided in an accurate and timely manner: CLIMAT TEMP reports should be transmitted by the fifth day of each month, but not later than the eighth day of the month;

(d) 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;

(e) Basic checks should be made before each sounding to ensure accurate data: the accuracy of a radiosonde's sensors should be checked in a controlled environment immediately before the flight. Checks should also be made during and/or at the end of each sounding to assure incomplete soundings, or soundings containing errors are corrected before transmission;

(f) Back-up radiosondes should be released in cases of failure: in the event of failure of a sounding instrument, incomplete sounding or resulting from difficult weather conditions, a second release should be made to maintain the record from the GUAN station;

(g) Detailed metadata for each GUAN station 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 Data Centre so those 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 observations should be archived. Climate change studies require extremely high stability in the systematic errors of the radiosonde measurements.

Appendix 3: Best practices for the GSN stations

As with GUAN stations, the CBS recommended that in implementing the observing programme at GSN stations, Members should comply with the following best practices:

(a) 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 the 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 inhomogeneties and other measurement characteristics;

(b) 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;

(c) 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 centers 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;

(d) The site layout should follow the recommended form: the layout of the site should follow the recommendations in the Guide on the Global Observing System (WMO-No. 488);

(e) The site and instruments should be inspected regularly and maintained according to WMO recommended practices: to obtain homogeneous data sets, maintenance should be carried out as is documented in the Guide to Instruments and Methods of Observation (WMO-No. 8). The quality of the measured variables should be guaranteed by appropriate inspection of sites, instruments and exposure to be based on the procedures given in the Guide. As part of the maintenance, the necessary calibration practices should be traceable to the standards provided by the Guide;

(f) A national plan should be developed to archive daily data from GSN stations for climate and climate research purposes: the archive should include both observational 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 digital format;

(g) Detailed metadata and historical climate data for each GSN station should be provided: GSN Data Center should have an up-to-date digital copy of the historical climate data and all types of metadata for GSN stations. A current copy of the long-term series of data and metadata from GSN stations should be made available.