

# Process for a network to be accredited as 'Part of the Global Climate Observing System (GCOS)'

## Background:

Annex A provides the decision by the 29th GCOS Steering Committee (GCOS SC-29, 7–9 December 2021) on recognizing GCOS Network. There are 3 designations of network: **GCOS Network**, **GCOS Affiliated Network** and **GCOS Recognized Network**. These designations differ only in their oversight and reporting relationship with GCOS (see Table 2 in Annex A) and in no way reflect differing quality or importance. It is also accepted that not all high-quality networks may wish to apply for this GCOS recognition.

## Process:

- 1) A network wishing to be accredited by GCOS as either a **GCOS Network**, **GCOS Affiliated Network** and **GCOS Recognized Network** shall approach the relevant GCOS Expert Panel<sup>1</sup> and must complete the proforma in Table 1. It is recommended that the panel is approached first as they can assist in completing the application and making the process more efficient.
- 2) The GCOS Expert Panel shall consider the application within 8 weeks. The panel may approach the network for additional information and/or clarifications. If the application meets the requirements agreed by the Steering Committee (see annex A) then they shall accept the proposal and forward it to the Steering Committee for information. In assessing an application, the panel shall:
  - a. Review the application to ensure that that the requirements laid down in Annex A are met;
  - b. Confirm the intent to produce long-term records, accepting that that long-term funding may not be guaranteed for a network or data centre;
  - c. Accept some partial exceptions to the requirements (e.g. some access restrictions to the data) provided there is clear evidence that these are being addressed. In this case a provisional acknowledgement should be recommended with a date to be reviewed again.
- 3) The Panel recommendation(s) shall then be reviewed and approved by a representative from each of the Panels and the GCOS Network Manager within 4 weeks.
- 4) Once approved the network can use the GCOS Network logo (Figure 1) on their website and all publications. Electronic copies of publications should be sent to the GCOS Secretariat. **GCOS Networks and GCOS Affiliated Networks** shall report to the appropriate panels and **GCOS Recognized Networks** are asked to copy reports on network performance to GCOS.

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<sup>1</sup> i.e. the panel responsible for the ECV(s) being monitored



**Figure 1.** GCOS Network logos

**Table 1.** Application to become a GCOS Network

1 Name of Network	BASELINE SURFACE RADIATION NETWORK						
2 ECV(s) and ECV products(s) monitored	BSRN is measuring various ECVs, but with different efforts. Accordingly to the terminology used in the current GCOS ECV list ( <a href="https://gcos.wmo.int/en/essential-climate-variables/table">https://gcos.wmo.int/en/essential-climate-variables/table</a> ) BSRN main business is <b>Atmosphere:Radiation Budget</b> ; additionally <b>Atmosphere:pressure</b> , <b>Atmosphere:air temperature</b> and <b>Atmosphere:water</b> vapor (relative humidity) are reported as ancillary parameters (and nominally at a standard 2m level). A subset of BSRN stations reports also <b>Upper-air:Temperature</b> and <b>Water Vapor</b> (radiosoundings). <b>Biosphere:Albedo</b> and <b>Biosphere:Land Surface temperature</b> are calculated by the combination of down-welling and upwelling components of SW and LW, respectively. Through well- established algorithms based on SW and LW broadband components BSRN actively contributes to the monitoring of cloud amounts and COD at least in <b>Atmospheric Composition:Clouds</b> section. Most of the stations are also equipped with spectral radiometers for the definition of aerosol optical properties, and in particular the aerosol optical depth ( <b>Atmospheric Composition: Aerosols</b> ).						
3 Contact person (name, email and phone)	Christian Lanconelli, <a href="mailto:christian.lanconelli@ext.ec.europa.eu">christian.lanconelli@ext.ec.europa.eu</a> , +39 0332 78 6486 Laura Riihimaki, <a href="mailto:laura.riihimaki@noaa.gov">laura.riihimaki@noaa.gov</a> , +1 303 497-5244 Amelie Driemel, <a href="mailto:amelie.driemel@awi.de">amelie.driemel@awi.de</a> , +49 471 4831 1091  ( <a href="https://bsrn.awi.de/contact-persons/">https://bsrn.awi.de/contact-persons/</a> )						
4 Type of network designation proposed?	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%;"></td> <td style="text-align:center;"><i>GCOS Network</i></td> </tr> <tr> <td></td> <td style="text-align:center;"><i>GCOS Affiliated Network</i></td> </tr> <tr> <td></td> <td style="text-align:center;"><b>GCOS Recognized Network</b></td> </tr> </table>		<i>GCOS Network</i>		<i>GCOS Affiliated Network</i>		<b>GCOS Recognized Network</b>
	<i>GCOS Network</i>						
	<i>GCOS Affiliated Network</i>						
	<b>GCOS Recognized Network</b>						
5 Does the network abide to the 10 basic GCOS Monitoring principles? Please provide evidence for your answer in boxes 11 to 19?	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; text-align:center;"><b>FULLY</b></td> <td style="width:50%; text-align:center;"><b>PARTIALLY</b></td> </tr> </table>	<b>FULLY</b>	<b>PARTIALLY</b>				
<b>FULLY</b>	<b>PARTIALLY</b>						
6 Does the network provide, or contribute to, a worldwide <sup>2</sup> coverage <sup>3</sup> ?	Yes, over Land. An extension of BSRN coverage over ocean is under discussion through a joint effort carried on in the frame of OPBS initiative and a dedicated BSRN Ocean WG( <a href="https://www.oceanbestpractices.org/">https://www.oceanbestpractices.org/</a> ).						
7 How is network performance reported?	Network performance is reported on at the annual GEWEX meeting. The BSRN data quality WG developed a series of procedure to verify the Data Quality and the timeliness of the data release.						
8 Who has responsibility for oversight of the network?	GEWEX/GDAP						
9 Name & web address of Data repository	The data are stored in two formats, both accessible via the World Radiation Monitoring Centre WRMC ( <a href="https://bsrn.awi.de">https://bsrn.awi.de</a> ). <ul style="list-style-type: none"> <li>• ftp: The ftp-server contains one directory for each BSRN station. Within each directory GNU-zipped station-to-archive files (standardized txt files including all data of one month) are accessible;</li> <li>• PANGAEA: As an alternative to the ftp-access and the rather complex station-to-archive files the WRMC offers data access via the Data Publisher <a href="#">PANGAEA</a>. Within PANGAEA all monthly BSRN-files are split up into their different logical records. PANGAEA datasets are fully citable.</li> </ul>						
10 Is access to data free and unrestricted? If not, please briefly describe any restrictions.	Yes, for scientific research and climate monitoring, restricted for commercial usage						

<sup>2</sup> Worldwide: i.e everywhere the ECV in question occurs (e.g. permafrost is not global).

<p>11 (GCOS Monitoring Principle #1): How is the impact of new systems or changes to existing systems assessed prior to implementation?</p>	<p>Intercomparison Campaigns (C. Wang et al., presentation 20218 BSRN workshop: <a href="#">example</a>); A not exhaustive list of the instruments adopted by BSRN is reported <a href="#">here</a>; Currently, only secondary standards (ISO9060) or primary standards (for direct only, ACR) are accepted. Any instrument potentially satisfying the "secondary standard" performances can be deployed.</p>
<p>12 (GCOS Monitoring Principle #2): What period of overlap for new and old observing systems is required?</p>	<p>This is not explicitly defined in BSRN. Nevertheless, due to the high standard requirements of BSRN described in the previous point 11), any instrument involved in BSRN have been likely subject to satisfactory period of testing (sufficient to be flagged as secondary standards) from either the manufacturer and the scientific community.</p>
<p>13 (GCOS Monitoring Principle #3): How are the metadata (details and history of local conditions, instruments, operating procedures, data processing algorithms and other factors pertinent to interpreting data) documented and treated?</p>	<p>Textual Metadata are structured and subdivided into different logical records, and reported in the station-to-archive files (sta_MMYYY.dat.gz) distributed through the BSRN FTP archive. <a href="#">GCOS-174</a> document describes all the Logical Records content. In particular, we highlight the following available information (from Table A.1 of the linked document):</p> <ul style="list-style-type: none"> <li>• LR0001 identify the station, month of data collection and data version;</li> <li>• LR0002 provides information about the station scientists/deputy and institution;</li> <li>• LR0003 contains commentary section to report on any specific information (instrument setting, weather, icing or dust problems, alignment, levelling, tracker problem, calibration information that cannot be stored in formatted sections, etc.), relevant to the station operations;</li> <li>• LR0004 provides geographical information (lat, lon, alt), surface and topography types, horizon status and its eventual variations, link to SYNOP station identifier (if relevant);</li> <li>• LR0005 provides a link to radiosonde information (if relevant);</li> <li>• LR0006 provides a link to ozonsonde information (if relevant);</li> <li>• LR0008 provides information on all radiometers their traceability to standards (calibration infos);</li> </ul> <p>PANGAEA datasets abide to the Open Archives Initiative Protocol for Metadata Harvesting and other metadata standards (e.g. instrument infos, instrument changes, contact info, station info, specific comments etc.) and additionally link to the respective ftp files. Additionally, the <a href="#">BSRN-Toolbox</a> can be used to extract metadata as well as distinct logical records.</p>
<p>14 (GCOS Monitoring Principle #4): How is the quality and homogeneity of data regularly assessed as a part of routine operations?</p>	<p>The BSRN community has established through years a common set of best practices and procedures for the radiation data quality assessment. Automatic computer routines based on physically/extremely rare limits and cross consistencies between various quantities, as well as visual inspection of data are responsibility of the station scientists and double checked at the archive level. These routines are maintained and reviewed by the BSRN Data Quality Working Group.</p> <p>Statistics of data submitted by month and year are monitored (timeliness). Stations are contacted when more than 2 years behind and are reported as inactive on the website. Before data is accepted to the archive it goes through an automated QC screening and any problems are discussed between the site scientists and the Data Quality Working Group.</p>

<sup>3</sup> The network can either operate at a global scale or be a regional contribution to global coverage.

<p>15 (GCOS Monitoring Principle #6): How is the operation of historically uninterrupted stations and observing systems maintained?</p>	<p>BSRN relies on National Efforts to maintain and fund networks.</p>
<p>16 (GCOS Monitoring Principle #7): How is high priority for additional observations focused on data-poor regions, poorly-observed parameters, regions sensitive to change, and key measurements with inadequate temporal resolution?</p>	<p>BSRN puts a high priority to include stations from data-poor regions. However, this also depends on receiving solid applications from such stations.</p> <p>For what concerns regions particularly prone to climate variability, polar coverage is performed currently by eight stations distributed evenly in the Antarctic and Arctic.</p>
<p>17 (GCOS Monitoring Principle #8): How have Long-term requirements, including appropriate sampling frequencies, been specified to network designers, operators and instrument engineers at the outset of system design and implementation?</p>	<p>All BSRN standard procedures are outlined in the Operation Manual. Candidate stations must apply to become BSRN stations with a description of their setups. Current station scientists review their setup and BSRN leadership works with prospective stations to make sure that they meet standards before approving them as new operational stations.</p> <p>Once accepted, stations are considered in candidate status for at least 6 months until sufficient quality data has been submitted.</p>
<p>18 (GCOS Monitoring Principle #9): Is this an observing system based on limited term funding (e.g. research)? How can long-term operations be assured?</p>	<p>Long term commitment (10 years+) is currently required to any new participants, though only informally.</p> <p>Of the 16 stations closed in the past 30 years of BSRN operations, only three of them submitted less than 10 years of data (2, 51 and 52 months). The others submitted a minimum of 117 (~10y) to 305 (~25y) monthly files to the archive.</p>
<p>19 (GCOS Monitoring Principle #10): What data management systems that facilitate access, use and interpretation of data and products are part the climate monitoring systems?</p>	<p>As described in point 13), all data is archived in the PANGAEA archive and on an ftp server by the World Radiation Monitoring Center. PANGAEA also distributes software that can be downloaded to support data manipulation and QC flag creation: <a href="https://bsrn.awi.de/software/">https://bsrn.awi.de/software/</a>.</p> <p>Different methods of retrieving the data and the BSRN toolbox, software that can be used to do quality checks of BSRN data, are available here <a href="https://bsrn.awi.de/data/data-retrieval-via-pangaea/">https://bsrn.awi.de/data/data-retrieval-via-pangaea/</a>.</p> <p><u>A Value Added Product WG has been recently established to produce Level 2 products such as daily to monthly averages, cloud screening and cloud radiative effects at time resolutions and format to satisfy community requirement of analysis ready data (ARD).</u></p>

## ANNEX A: GCOS Networks

### Decision of GCOS Steering Committee 2021

- 1) Being recognized as a GCOS Network should:
  - Impose little or no extra effort on the networks;
  - Recognize the contribution these networks make to global climate observations;
  - Allow the networks to clearly show their contribution to global climate observations.
- 2) It is clear that most, if not all, networks contributing to GCOS also serve other needs e.g. most atmospheric observations are made primarily for weather prediction and warnings. This proposal will not change the requirements on the observing stations but will clearly indicate those that are needed to contribute to the development of long-term climate data records.
- 3) Networks do not need to be acknowledged by GCOS – this proposal provides option for networks wanting to take part but there is no need for networks to do so if they do not wish.
- 4) To be acknowledged by GCOS, a network shall:
  - Abide by the GCOS Monitoring Principles (UNFCCC decision 11/CP.13, WIGOS Manual, Annex VIII);
  - Report regularly on the performance of the network;
  - Ensure there is a data repository allowing free and open access to all data and metadata. This can be a data centre associate with the network, or a separate institution. Data repositories should have a commitment to storing data indefinitely;
  - Have identified who has responsibility for oversight of the network. Oversight is the role of monitoring the performance of the network as a whole, identifying non-operational stations and keeping track of the opening and closing of stations. This distinct from the operation and management of individual stations which can be spread across many bodies in a single network (e.g. many NMHS operate stations in GSN);
  - Monitor one or more ECV Products;
  - Aim to provide, or contribute to, a worldwide<sup>4</sup> coverage. The network can either operate at a global scale or be a regional contribution to global coverage;
  - Meet specific climate needs, e.g.:
    - Commitment to provide long-term, historic data records;
    - Adequate accuracy and stability.
- 5) GCOS acknowledges three types of networks to be identified as: **GCOS Network**, **GCOS Affiliated Network** and **GCOS Recognized Network** (see Table 2). This classification is about who has oversight and how the network reports – NOT about quality or importance and is separate from the network tiers.
- 6) There are additional networks that may not want to be recognized by GCOS, or may not meet all the requirements in (18) above, that, nevertheless, make significant contributions to global climate observations.
- 7) Where a global coverage is achieved thorough combining several regional networks it may be appropriate for the regional networks to be *recognized* and the global network to be *affiliated*.

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<sup>4</sup> Worldwide: i.e everywhere the ECV in question occurs (e.g. permafrost is not global).

- 8) There is no need for an ECV product to be only measured by a single network.
- 9) Networks wishing to be acknowledged by GCOS should discuss this with the appropriate GCOS Expert Panel which will consider if they meet the requirements described in this document. If the panel agrees the proposal shall be forwarded to the Steering Committee for approval.

**Table 2.** Types of GCOS Networks

Network Oversight <sup>5</sup>		Reporting
<i>GCOS Network</i>	GCOS, oversight by GCOS Network Manager or GCOS panels	Annually to GCOS, represented at GCOS Meetings
<i>GCOS Affiliated Network</i>	Oversight exists but is not GCOS e.g. OCG for ocean networks or this is part of the network as in the GTN	
<i>GCOS Recognized Network</i>		Annual report available but no direct reporting to GCOS

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<sup>5</sup> Oversight is the role of monitoring the performance of the network as a whole, identifying non-operational stations and keeping track of the opening and closing of stations. This is distinct from the operation and management of individual stations which can be spread across many bodies in a single network (e.g. many NMHS operate stations in GSN).



## **ANNEX B: Climate Observing System monitoring principles**

(Revised Reporting Guidelines as agreed by the UNFCCC at Bali, December 2007, decision 11/CP.13, and adopted by Resolution 9, WMO Congress (Cg-XIV))

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

- a) The impact of new systems or changes to existing systems should be assessed prior to implementation;
- b) A suitable period of overlap for new and old observing systems is required;
- c) The details and history of local conditions, instruments, operating procedures, data processing algorithms and other factors pertinent to interpreting data (i.e. metadata) should be documented and treated with the same care as the data themselves;
- d) The quality and homogeneity of data should be regularly assessed as a part of routine operations;
- e) Consideration of the needs for environmental and climate-monitoring products and assessments, such as Intergovernmental Panel on Climate Change assessments, should be integrated into national, regional and global observing priorities;
- f) Operation of historically uninterrupted stations and observing systems should be maintained;
- g) High priority for additional observations should be focused on data-poor regions, poorly observed parameters, regions sensitive to change, and key measurements with inadequate temporal resolution;
- h) Long-term requirements, including appropriate sampling frequencies, should be specified to network designers, operators and instrument engineers at the outset of system design and implementation;
- i) The conversion of research observing systems to long-term operations in a carefully planned manner should be promoted;
- j) Data management systems that facilitate access, use and interpretation of data and products should be included as essential elements of climate monitoring systems.

Furthermore, operators of satellite systems for monitoring climate need to:

- a) Take steps to make radiance calibration, calibration-monitoring and satellite-to-satellite cross-calibration of the full operational constellation a part of the operational satellite system;
- b) Take steps to sample the Earth system in such a way that climate-relevant (diurnal, seasonal, and long-term interannual) changes can be resolved.

Thus, satellite systems for climate monitoring should adhere to the following specific principles:

- a) Constant sampling within the diurnal cycle (minimizing the effects of orbital decay and orbit drift) should be maintained;
- b) A suitable period of overlap for new and old satellite systems should be ensured for a period adequate to determine inter-satellite biases and maintain the homogeneity and consistency of time-series observations;
- c) Continuity of satellite measurements (i.e. elimination of gaps in the long-term record) through appropriate launch and orbital strategies should be ensured;

- d) Rigorous pre-launch instrument characterization and calibration, including radiance confirmation against an international radiance scale provided by a national metrology institute, should be ensured;
  - e) On-board calibration adequate for climate system observations should be ensured and associated instrument characteristics monitored;
  - f) Operational production of priority climate products should be sustained and peer-reviewed new products should be introduced as appropriate;
  - g) Data systems needed to facilitate user access to climate products, metadata and raw data, including key data for delayed-mode analysis, should be established and maintained;
  - h) Use of functioning baseline instruments that meet the calibration and stability requirements stated above should be maintained for as long as possible, even when these exist on decommissioned satellites;
  - i) Complementary in situ baseline observations for satellite measurements should be maintained through appropriate activities and cooperation;
  - j) Random errors and time-dependent biases in satellite observations and derived products should be identified.
-