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Federal Office of Meteorology and Climatology MeteoSwiss

MeteoSwiss

GCOS Switzerland Strategy 2017-2026

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1 Rationale

1.1 Context

High quality systematic observation of the Earth's climate is the foundation for solid decision-making concerning climate change adaptation and mitigation. Therefore, the United Nations Framework Convention on Climate Change (UNFCCC)[i] adopted in 1992 calls on Parties to promote and cooperate in systematic observation of the climate system, including through support to existing international programs and networks, such as the Intergovernmental Panel on Climate Change (IPCC) or the Global Climate Observing System (GCOS) (c.f. Box 1).

Box 1 United Nations Framework Convention on Climate Change (1992)

Article 4 - Commitments

All Parties […] shall: […]

(g) Promote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of data archives related to the climate system […].

Article 5 – Research and Systematic Observations

In carrying out their commitments under Article 4, paragraph 1(g), the Parties shall:

(a) Support and further develop, as appropriate, international and intergovernmental programmes and networks or organizations aimed at defining, conducting, assessing and financing research, data collection and systematic observation, taking into account the need to minimize duplication of effort;

(b) Support international and intergovernmental efforts to strengthen systematic observation and national scientific and technical research capacities and capabilities, particularly in developing countries, and to promote access to, and the exchange of, data and analyses thereof obtained from areas beyond national jurisdiction; and

(c) Take into account the particular concerns and needs of developing countries and cooperate in improving their endogenous capacities and capabilities to participate in the efforts referred to in subparagraphs (a) and (b) above.

As a consequence, GCOS (c.f. Box 2) was established in 1992 to coordinate systematic climate observation internationally, and to ensure that the observations and information needed to address climate-related issues are obtained and made available to all potential users. In fulfilling this task, GCOS published its first Implementation Plan in support of the UNFCCC in 2004 (IP-04)[ii], followed by an update in 2010 (IP-10)[iii]. Both implementation plans were accompanied by a so-called satellite supplement[iv,v] specifying the role of satellites for observations of the Essential Climate Variables (ECVs) as defined in the GCOS Implementation Plans. In 2015, GCOS published the report Status of the Global Observing System for Climate (hereafter referred to as SR-15)[vi], assessing the adequacy of the global observing system and progress made in its implementation. The SR-15 was submitted to the 43rd session of the Subsidiary Body for Scientific and Technological Advice (SBSTA) at the UNFCCC Conference of the Parties (COP) 21 in Paris (December 2015).

Box 2 The Global Climate Observing System (GCOS)

GCOS is jointly sponsored by the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC of UNESCO) of the United Nations Educational Scientific and Cultural Organization (UNESCO), UN Environment (UNEP) and the International Council for Science (ICSU). The GCOS Secretariat is located at the WMO in Geneva, Switzerland.

GCOS is directed by a Steering Committee that provides guidance, coordination and oversight of the programme. Three science panels, reporting to the Steering Committee, have been established to identify priorities for observations in each domain of the climate system (atmosphere, oceans, and land), and to make recommendations for implementation:

- Atmospheric Observation Panel for Climate (AOPC)
- Ocean Observations Panel for Climate (OOPC)
- Terrestrial Observation Panel for Climate (TOPC).

GCOS builds, to the extent possible, on existing initiatives, such as WMO's Global Atmosphere Watch (GAW) Programme. It also depends on effective national and regional coordination mechanisms for the provision of systematic climate observation.

Recently, the fundamental importance of systematic climate observation was once again underscored at the international level: the IPCC in its Fifth Assessment Report[vii] states that "Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history", and that "warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented." Similarly, the Paris Agreement[viii] adopted at the COP 21 explicitly states (Article 7.7(c)) that "…Parties should strengthen scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision-making…".

The climate observing system has evolved steadily, not only with regard to, e.g., measurement techniques, but also the requirements of different stakeholders at international, regional and national level. Therefore, following the SR-15, an updated implementation plan (hereafter referred to as IP-16)[ix], was submitted to and adopted by the UNFCCC COP 22 in 2016 in Marrakech. IP-16 takes into account the latest developments in Earth observation and climate policy and provides guidance on the future evolution of GCOS. The COP noted that GCOS considered the outcomes of the Paris Agreement when preparing the implementation plan and encouraged Parties, Switzerland being one, to work towards the full implementation of the IP-16, and to consider what actions they can take to contribute towards its implementation[x].

1.2 GCOS Switzerland

Switzerland has a long tradition of climate observation. Temperature and precipitation series of more than 150 years, the world's longest total ozone series, glacier measurements dating back to the end of the 19th century and the 30-year anniversary of the World Glacier Monitoring Service (WGMS) form some of the highlights of the Swiss contribution to global and regional climate monitoring. The Swiss GCOS Office at the Federal Office of Meteorology and Climatology MeteoSwiss is responsible for the coordination of the national climate observation system (GCOS Switzerland) and was formally established as the national focal point for GCOS at MeteoSwiss on 1 February 2006, following the Federal Council's dispatch concerning the ratification of the Kyoto Protocol[xi] (c.f. Box 3).

Box 3 Definition of GCOS Switzerland

GCOS Switzerland encompasses the entirety of systematic climate observation and international data centers in Switzerland, operated and owned by a wide range of national partner institutions in support of GCOS. Based on the mandate of the Federal Council1 , the Swiss GCOS Office, hosted at MeteoSwiss, coordinates systematic climate observation in Switzerland, in support of its national partner institutions.

Since its establishment in 2006, the Swiss GCOS Office, together with its partner institutions, has undertaken a number of activities to coordinate climate observation in Switzerland and to ensure that a high-quality Swiss contribution to GCOS will continue to be made in the future. Activities included, for example, the compilation of an inventory of the most important climate observations and international data centers in Switzerland (hereafter referred to as "inventory report")[xii]. In particular, the inventory report identified time series and international data centers whose future was at risk at the time of writing.

1.3 Finances

Based on the report, a request was made to the Federal Council for funding of these climate observations and data centers at risk. On 6 June 2008, the Federal Council agreed with the request and granted 1.6 MCHF per year, starting in 2010, to ensure their long-term continuation. MeteoSwiss was tasked with the coordination of this funding mechanism.

1.4 Approach

Ten years after the formal establishment of GCOS Switzerland and aligned with the schedule of the international GCOS program with its IP-16, MeteoSwiss in 2016 initiated the process towards the elaboration of a new strategy for the GCOS Switzerland program for the period 2017-2026. The Swiss GCOS Office at MeteoSwiss was tasked to elaborate this new strategy in collaboration with its national partner institutions. The process was started with the national GCOS Roundtable in January 2016, introducing the idea of a strategy update, and included the following main activities:

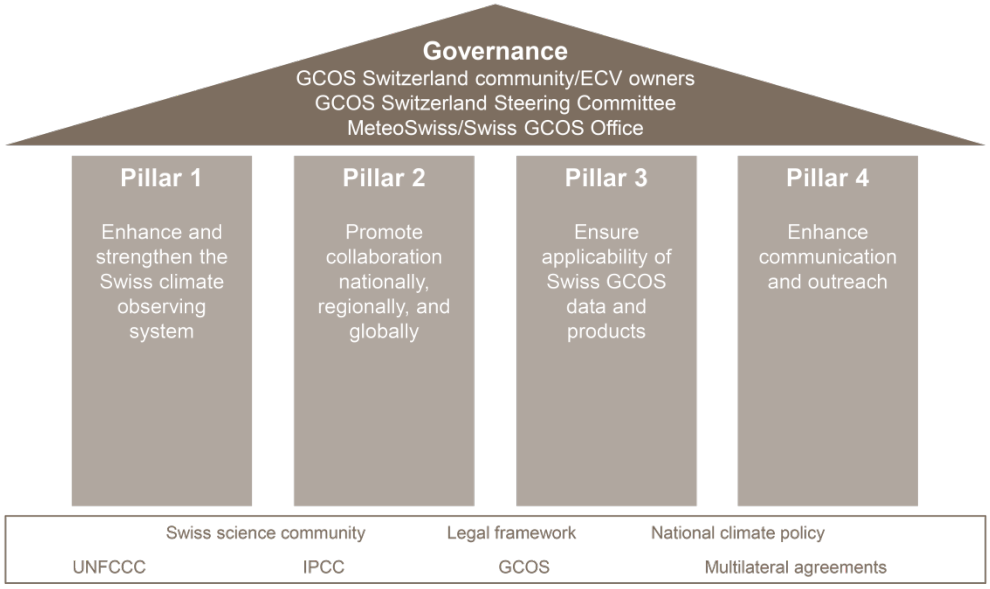
- Review of the activities of the Swiss GCOS Office in the period 2006 – 2016 by the newly established GCOS Switzerland Steering Committee (GCOS Switzerland StC);
- Consultations with the Swiss climate observation community at the occasion of the National GCOS Roundtables in 2016 and 2017;
- Strategic discussions by the GCOS Switzerland StC;
- Review of the latest developments within the GCOS program at international level and assessment of their relevance for GCOS Switzerland;
- Update of the inventory report to reflect the current state of the National Climate Observing System (GCOS Switzerland);
- Elaboration of strategic priorities for the period 2017 – 2026.
- The governance through which this strategy will be implemented includes the GCOS Switzerland community (ECV owners), a newly established GCOS Switzerland StC, and the Swiss GCOS Office (c.f. Annex 2).

2 Strategy for the National Climate Observing System (2017-2026)

The result of the process as described above is a strategy for GCOS Switzerland for the period 2017-2026, consisting of four strategic pillars. Each pillar is built upon a number of strategic priorities (cf. Figure 1).

Vision

GCOS Switzerland serves as the national framework in which all national partner institutions involved in climate monitoring engage to provide the state-of-the-art observations required for climate change adaptation and mitigation efforts in Switzerland, and to contribute to this endeavor globally, through a high-quality contribution to the international GCOS program.



Strategic Pillar 1: Enhance and strengthen the Swiss climate observing system

Strategic Priority 1.1

Regular review of the list of “Swiss” ECVs and the most important long time series

Environmental monitoring, and climate monitoring as part of it, is constantly evolving. Internationally, the GCOS defines the requirements for a climate observing system fulfilling the requirements of key stakeholders such as the UNFCCC and the IPCC. The backbone of GCOS is the set of Essential Climate Variables (ECVs) that shall be observed according to recognized international standards as defined in the GCOS Implementation Plan. Switzerland has a long tradition in climate observation, and serves as an international role model in climate monitoring. However, to comply with international standards and recommendations to the extent possible, the list of ECVs and the most important long time series compiled in the national inventory report must be reviewed regularly.

Strategic Priority 1.2

Regular evaluation of the monitoring networks and strategy of Swiss ECVs

In line with Strategic Priority 1.1, also the monitoring networks of Swiss ECVs shall undergo a regular evaluation. As an example, scientific progress over the past years has shown that the selection of the most important phenological time series in Switzerland, as reflected in the GCOS Switzerland Report 2007, must be revisited (detected inhomogeneities, lack of regional representativeness). Regular evaluation of the monitoring network and observing strategies is therefore needed to ensure that the observation network is fit for purpose thus serving climate science but also the society in general.

Strategic Priority 1.3

Promote the integration of existing and emerging observation methods

In line with the technological progress made in recent years, also climate observation methods are rapidly evolving, e.g. satellite- or ground-based remote sensing. Hence, new opportunities for climate observation arise from the integration of these newly available observing systems into national monitoring strategies. While ensuring the continuation of existing long-time series using proven concepts and methodologies, the increasing role of new measurement technologies and concepts (e.g. crowd sourcing) must be acknowledged.

Strategic Priority 1.4

Extend time series in the past through promoting data rescue, incl. development of QA/QC tools

In Switzerland, some observations of ECVs date back to the mid-19th century (or even earlier). However, there is still a significant amount of observational data from earlier periods available that is not currently easily accessible for climate analyses. Reasons include that it has not been digitized, homogenized, or systematically archived. Promoting the rescue of such data and making it available to climate research is important. This will also include the development of quality assurance and quality control tools.

Strategic Priority 1.5

Ensure that standardized observations of all ECVs are archived and made freely available to all interested users

The observed climate data (raw data as well as processed data) must be archived for future climate analyses. There exist national (e.g. Data Warehouse of MeteoSwiss) and international data repositories (e.g. designated GCOS international data centers such as the World Glacier Monitoring Service), where Swiss climate data are currently submitted. In accordance with the requirements defined by GCOS, the data stored in these archives must be openly accessible to all interested users so that they can be easily and widely exploited. The submission of Swiss climate data to international

data centers will be further promoted. In addition, the continued operation of such data centers in Switzerland must be ensured.

Strategic Priority 1.6

Ensure traceability/transparency along the “chain”: raw data > processed data > analysis > archives

According to the GCOS Implementation Plan, a global climate observing system must address the full chain from raw observations to processed observations to data analysis and finally to the archiving of the datasets. Along this entire chain, high-quality metadata are a prerequisite to ensure full traceability concerning applied processing methods, data formats used, station history, uncertainties a.s.o. As an example, Switzerland shall foster the collaboration between metrological and meteorological institutions to introduce and establish traceability in current and future atmospheric data records. The WMO Integrated Global Observing System (WIGOS) meta data standard must be implemented and the efforts to support WIGOS shall be continued. This traceability is needed not only for scientists working with data, but also to enable credible communication of the climate data to the public.

Strategic Priority 1.7

Foster the referencing of climate datasets as a contribution to traceability and recognition of the copyrights of the data owners

One aspect of traceability concerns the proper referencing of climate datasets. Scientific and technological progress increasingly allows for re-processing of long-term climate datasets. To ensure that different versions becoming available over time can be easily discerned, a consistent referencing must be applied. As an example, the World Glacier Monitoring Service (WGMS) assigned so-called Digital Object Identifiers (DOI) to its datasets. Similarly, MeteoSwiss has recently started to follow this procedure for its climate datasets. Finally, this also ensures the recognition of the copyrights of the data owners and contributes to improved transparency in communication.

Strategic Pillar 2: Promote collaboration nationally, regionally, and globally

Strategic Priority 2.1

Enhance collaboration at national level: make better use of existing infrastructure and identify new partner institutions

Monitoring of environmental parameters in Switzerland is often performed at different levels, e.g. national to cantonal to communal. As an example, river temperatures are measured at cantonal level, but also under the responsibility of the Federal government. Another example are the strong synergies between the standard product portfolio of Swisstopo and the requirements of ECV owners for topographical information, e.g. the glacier community. It is therefore important that climate

observation efforts are well coordinated between different responsible entities, to make best use of the available funding and to avoid duplication of efforts.

Strategic Priority 2.2

Enhance collaboration at regional and global level with regard to national GCOS coordinators outside Switzerland

Challenges and opportunities concerning the monitoring of ECVs are often not limited to one specific country but are likely to exist also on a regional scale. High quality observations of ECVs are also performed outside of Switzerland, e.g. in our neighboring countries. Swiss climate monitoring therefore benefits from an exchange of knowledge with partners outside Switzerland, as it is for example done in the framework of the Glacier Monitoring Switzerland (GLAMOS), where an evaluation workshop including international experts was recently organized. Additional benefit could arise from an enhanced exchange of the national GCOS coordinators at a regional level.

Strategic Priority 2.3

Continue and further strengthen Swiss contributions to international initiatives on climate monitoring

To ensure Swiss efforts in climate observation are visible at international level, Swiss institutions should continue and enhance their engagement in international initiatives on climate monitoring. For example, during the past decade significant contributions by several national institutions have been made to flagship international programs, such as the Climate Change Initiative (CCI) of the European Space Agency (ESA) or the Satellite Application Facilities (SAF) of the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT). Similarly, Switzerland has made significant efforts related to the GCOS Reference Upper-Air Network GRUAN, providing upper-air atmospheric data of highest quality for climate change detection. Continuing such contributions to key international endeavors should be a high priority for GCOS Switzerland.

Strategic Priority 2.4

Identify opportunities to strengthen climate observation outside of Switzerland

The GCOS Status Report 2015 identified gaps in the global climate monitoring system, as many countries lack the financial and technical capacity to establish and maintain state-of-the art climate observing systems. GCOS through its GCOS Cooperation Mechanism supports the implementation of systematic climate observation in regions where significant gaps in GCOS exist. Here, Switzerland has a potential role to play to enhance capacities in partner countries, e.g. through twinning and the provision of appropriate training. In addition, Switzerland should promote the concept of national GCOS coordination in an overall effort to strengthen GCOS.

Strategic Pillar 3: Ensure applicability of Swiss GCOS data and products

Strategic Priority 3.1

Ensure that requirements of the Swiss science community, policy makers, and the public are taken into account

A recent report by the Swiss Academy of Sciences, providing an overview of the most relevant results from IPCC AR5 from a Swiss perspective, stated that “despite the progress, additional, longer, and improved series of observations are necessary for an even better understanding of the physical relationships and the changes projected with climate models.” In other words, GCOS Switzerland has contributed to the findings of this national flagship report, however, it was unable to fully comply with the needs imposed on the national climate observing system by the Swiss science community. Specific requirements for high-quality climate data are likely to arise also from other perspectives, examples being policies for mitigation (e.g. emission reduction) and adapatation (e.g. sector-specific climate services). Regardless of the context, GCOS Switzerland will need to ensure that its data and products are “fit for purpose”, not least to maximize the benefit from the investments made in the national climate observing system.

Strategic Priority 3.2

Enhance process understanding through a more integrative monitoring approach, e.g. across Earth system cycles

Earth system cycles (energy, water and biogeochemical cycles) play a fundamental role in the Earth’s climate. Current climate change is driven by the interaction of the gaseous phases, of the carbon and nitrogen cycles, and radiative properties of the atmosphere. While the original ECVs were to some extent selected against their individual significance for climate research, in recent years the use of ECV-based climate records to close budgets of energy, carbon, and water cycles, or to study interactions between land and atmosphere in a more integrated way, has increased. As an example, ESA in its new CCI programme to be launched in 2017 (CCI+) allocates a significant amount of the available resources to so-called cross-ECV applications, with the goal to maximize scientific consistency between ECV products. Similarly, GCOS Switzerland shall enhance process understanding at the national scale through a more integrative monitoring approach, with the aim to provide an integrated climate perspective and to ensure cross-disciplinary scientific exploitation of the GCOS Switzerland observations.

Strategic Pillar 4: Enhance communication and outreach

Strategic Priority 4.1

Raise the awareness and showcase the usefulness of GCOS Switzerland through targeted communication, education and enhanced engagement with stakeholders

Raising awareness of the value of climate observation among key stakeholders and the public is crucial. It is through a high level of awareness that GCOS Switzerland can be put on a firm and sustainable basis needed to provide high quality observations in the long run. Targeted and coherent outreach activities shall ensure that scientific results based on Swiss GCOS data are widely communicated (e.g. documenting and explaining extreme events such as heat waves), with the goal to highlight the fundamental value and societal relevance of climate monitoring.

3 Conclusion

In 2007, the Swiss GCOS Office compiled the first inventory of systematic climate observations and international data centers in Switzerland, together with partners from universities, research institutes, federal offices, and private companies. This inventory report clearly highlighted the long tradition of climate observation in Switzerland in support of the Global Climate Observing System (GCOS).

These efforts were based on the first implementation plan for a global climate observing system. Since then, climate observation evolved significantly, not only in terms of methodologies applied, but also in terms of requirements by the users of such observations. The latest GCOS Implementation Plan, published in 2016, provides recommendations for actions at national to global scale, to ensure that GCOS continues to meet the needs of its users. This implementation plan was endorsed at the highest political level – at the UNFCCC COP 22 in Marrakech – where all parties were encouraged to work towards the full implementation of the recommended actions. Switzerland, having a leading role in the implementation of a national climate observing system, is committed to comply to the extent possible with the request by the UNFCCC, aiming to continue to provide state-of-the art climate observations in the future.

The new GCOS Switzerland strategy as outlined in this document builds the basis to reach this ambitious goal. While maintaining a priority on securing the most important long measurement series, emphasis will be put on promoting e.g. the integration of new measurement techniques, an integrative monitoring approach across Earth system cycles, and enhanced communication with stakeholders. The GCOS Switzerland Strategy 2017-2026 will serve as the foundation for the elaboration of actions to be implemented by the entirety of the Swiss GCOS community, under the guidance of the GCOS Switzerland Steering Committee.

Annex

A Abbreviations

AOPC	Atmospheric Observation Panel for Climate	**NMHS**	National Meteorological and Hydrological Services
COP	Conference of the Parties	**OOPC**	Ocean Observations Panel for Climate
ECV	Essential Climate Variable	**SBSTA**	Subsidiary Body for Scientific and Technological Advice
GCM	GCOS Cooperation Mechanism	**SDFRR**	Sendai Framework for Disaster Risk Reduction
GCOS	Global Climate Observing System	**SDG**	Sustainable Development Goal
GFCS	Global Framework for Climate Services	**SR**	Status report
GHG	Greenhouse gases	**TOPC**	Terrestrial Observation Panel for Climate
ICSU	International Council for Science	**UNEP**	United Nations Environment Programme
IOC	Intergovernmental Oceanographic Commission	**UNESCO**	United Nations Educational Scientific and Cultural Organization
IP	Implementation Plan	**UNFCCC**	United Nations Framework Convention on Climate Change
IPCC	Intergovernmental Panel on Climate Change	**WCC**	World Climate Conference
MEA	Multilateral environmental agreement	**WMO**	World Meteorological Organization

B References

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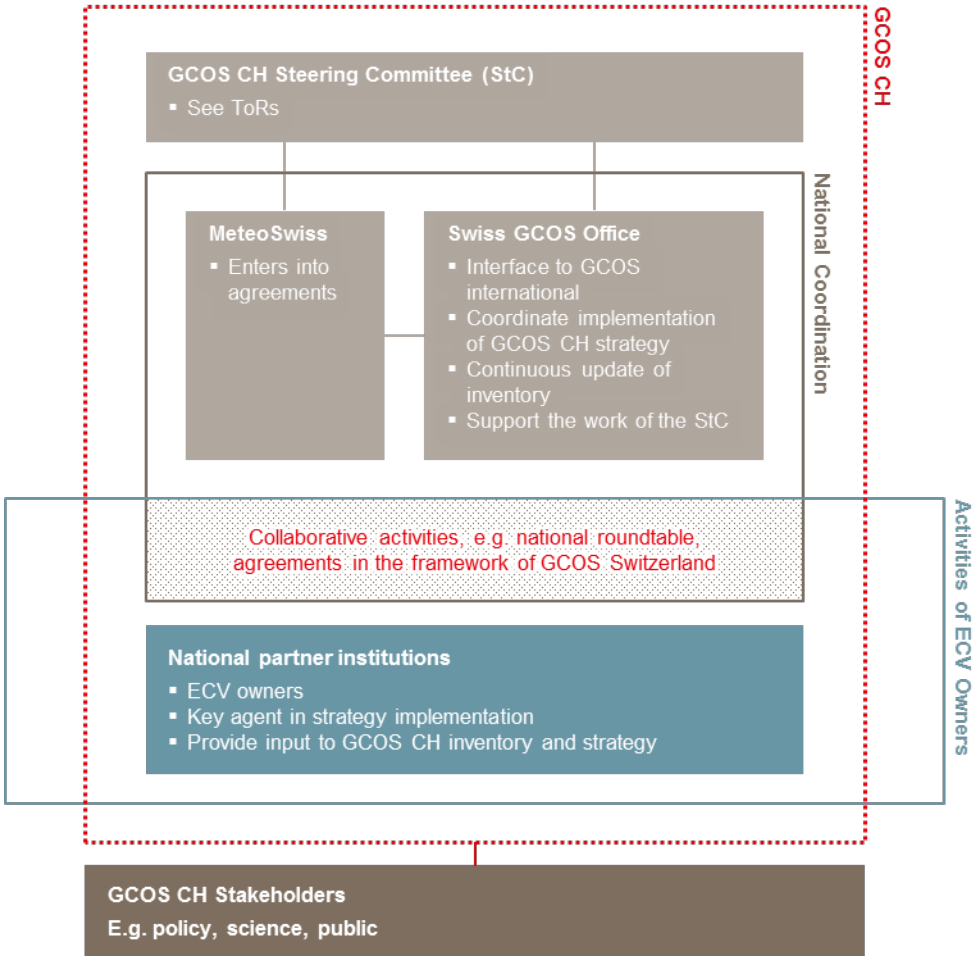
C GCOS Switzerland Set-Up



D List of Strategic Pillars and Priorities

Strategic Pillar/Priority		Example	Institution(s) primarily responsible
Pillar 1: Enhance and strengthen the Swiss climate observing system			
1.1	Regular review of the list of “Swiss” ECVs and the most important long time series	→ i.e. update of national inventory report	Swiss GCOS Office
1.2	Regular evaluation of the monitoring networks and strategy of Swiss ECVs	→ PERMOS	ECV owners, Swiss GCOS Office
1.3	Promote the integration of existing and emerging observation methods	→ GCOS Switzerland lake ice project	ECV owners, Swiss GCOS Office
1.4	Extend time series in the past through promoting data rescue, incl. development of QA/QC tools	→ GCOS Switzerland phenology project	ECV owners, Swiss GCOS Office
1.5	Ensure that standardized observations of all ECVs are archived and made freely available to all interested users	→ WGMS; Data Warehouse of MeteoSwiss	ECV owners
1.6	Ensure traceability/transparency along the “chain”: raw data > processed data > analysis > archives	→ satellite-based climate data records	ECV owners
1.7	Foster the referencing of climate datasets as a contribution to traceability and recognition of the copyrights of the data owners	→ i.e. Data citation (DOI)	ECV owners

Pillar 2: Promote collaboration nationally, regionally and globally

2.1	Enhance collaboration at national level: make better use of existing infrastructure and identify new partner institutions	→ lakes observed at federal and cantonal level; products of swisstopo	ECV owners, Swiss GCOS Office
2.2	Enhance collaboration at regional and global level with regard to national GCOS coordinators outside Switzerland	→ i.e. D-A-CH	Swiss GCOS Office
2.3	Continue and further strengthen Swiss contributions to international initiatives on climate monitoring	→ ESA CCI	ECV owners, Swiss GCOS Office
2.4	Identify opportunities to strengthen climate observation outside of Switzerland	→ i.e. capacity building (e.g. CATCOS), e-learning tools	Swiss GCOS Office, ECV owners

Pillar 3: Ensure applicability of Swiss GCOS data and products

3.1	Ensure that requirements of the Swiss science community, policy makers, and the public are taken into account	→ i.e. are we “fit for purpose”?	Swiss GCOS Office, ECV owners
3.2	Enhance process understanding through a more integrative monitoring approach, e.g. across Earth system cycles	→ water cycle	ECV owners, Swiss GCOS Office

Pillar 4: Enhance communication and outreach

4.1	Raise the awareness and showcase the usefulness of GCOS Switzerland through targeted communication, education and enhanced engagement with stakeholders	→ use extreme events such as heat waves; GCOS Switzerland label; planetary vital signs	Swiss GCOS Office, ECV owners

E National Climate Observing System (GCOS Switzerland)

Available at www.gcos.ch > National Climate Observing System

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