CATCOS

CAPACITY BUILDING AND TWINNING FOR CLIMATE OBSERVATION SYSTEMS

REPORT ON EXTERNAL EVALUATION

BY

KR VISWANATHAN
PAOLO LAJ
CLARA ARIZA

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LIST OF ABBREVIATIONS

Abbreviation	Expanded form
BKMG	Bureau of Meteorology Climatology and Geophysics, Indonesia
CATCOS	Capacity Building and Twinning for Climate Observation Systems
CH4	Methane
CAIAG	Central Asian Institute for Applied Geosciences
CO2	Carbon Dioxide
DMC	Dirección Meteorológica de Chile
DRR	Disaster Risk Reduction
ECVs	Essential Climate Variables
EMPA	Swiss Federal Laboratories for Material Science and Technology
GAW	Global Atmospheric Watch
GCOS	Global Climate Observation Systems
GFCS	Global Framework on Climate Services
GHG	Greenhouse gases
GPCC	Global Programme on Climate Change (of SDC)
IDEAM	Instituto de Hidrología Meteorología y Estudios Ambientales
IPCC	Inter-Governmental Panel on Climate Change
KyrgyzHydromet	Kyrgyzstan Hydro Met Agency, Ministry of Emergency Situations
KMD	Kenya Meteorological Department
MeteoSwiss	Swiss Federal Office for Meteorology and Climatology
NHMS	National Hydro-Meteorological Services
OECD	Organisation for Economic Cooperation and Development
PSI	Paul Scherrer Institute
SENAMHI	Servicio Nacional de Meteorología e Hidrología
SDC	Swiss Agency for Development and Cooperation
SDG	Sustainable Development Goals

UFR	University of Fribourg
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention for Climate Change
UZH	University of Zurich
Uzbek Hydromet	Centre for Hydro-meteorological Services, Uzbekistan
WGMS	World Glacier Monitoring Services
WMO	World Meteorological Organisation

1. EXECUTIVE SUMMARY

1.1 The SDC supported project CATCOS aims at capacity building of selected emerging and developing countries (located in data sparse regions of the world), towards systematic global climate observations, with the intense engagement of Swiss scientific and research institutions. The scientific observations pertain to three essential climate variables (ECVs) of greenhouse gases (CO2, CH4 and ozone), aerosol properties and glacier mass balance. The project is operationalised through its main implementing partner MeteoSwiss, who collaborates with the national partners, many of whom are NHMS (national hydro meteorological services), in partnership with renowned Swiss scientific institutions and universities as well as the WMO (World Meteorological Organisation).

1.2 The evaluation team perceives CATCOS essentially as a technical and scientific cooperation project, the conceptualisation and design of which were done on the lines of a technology transfer project, bordering on scientific cooperation. Indeed, a minor development twist was added in the second phase. On the other hand, the project is now evaluated in the frame of OECD-DAC evaluation criteria, a framework which is essentially used for assessment of typical development project. The team adopted a methodology under which appropriate evaluation questions/ hypotheses were designed and tested on the basis of evidence collected. The DAC evaluation criteria of relevance, impact, efficiency, effectiveness and sustainability were super-imposed/overlaid on the evaluation hypotheses.

1.3 The team considers CATCOS to be a highly ambitious technical and scientific cooperation project, with key challenges that include diverse national contexts, ambitions, capacities and circumstances in the target countries, which are spread across eight time zones and three continents in South America, Africa, Central/ Southeast Asia. Besides geographic distances, there are cultural and linguistic diversities to contend with. Notwithstanding these, the project benefited from intense, highly committed and whole-hearted engagement of the Swiss institutions as well as most of national partners, despite complex mechanisms of coordination and oversight, in a scientific space which cannot be said to be crowded with donors.

1.4 The relevance of the project outcomes were assessed against several elements and parameters including the Dispatch of the Swiss Parliament (2013-17), overall development framework of SDC and the strategic framework of the Global Cooperation on Climate Change (2013-17), universally accepted Sustainable Development Goals, Global Framework on Climate Services, principles and orientation of the GCOS (Global Climate Observation Systems) and above all the climate policies, plans and priorities of the national governments of the participating countries. The project has posted substantial and commendable achievements in terms of contributing high quality atmospheric and terrestrial global climate observations to designated global data centres with regard to most of the target countries, through successful twinning and capacity building. With regard to the remaining outcomes which relate to promotion of (regional) cooperation and user capacities (second and third outcome objectives), the activities and outputs were very limited in scope and ambition even in the design and planning stage of the project.

1.5 The requisite scientific equipment have been commissioned in target countries, after careful process of site selection and are working satisfactorily in most, barring Kyrgyzstan and Uzbekistan where the instruments will be commissioned in the middle of 2016. The advanced equipment have been useful in the generation and dissemination of credible climate observation/ data, following stipulated standards and norms of data collection, analysis, processing and dissemination. This has been possible through highly professional, effective and responsive training support provided by the Swiss institutions concerned. The import of scientific equipment involved considerable efforts on the part of Swiss institutions as well as local Swiss missions in a number of countries. The national governments have contributed their own share to the project substantially through land, buildings, laboratory space, air conditioning equipment, power generators, electricity, internet facilities and local staff time and transport to stations.

1.6 The quality, comprehensiveness and thoroughness of the capacity building provided by Swiss institutions, through various mechanisms such onsite training, remote support, summer schools, regional workshops and specialised training, are appreciated immensely by the national partners. However, it was observed that project did not benefit from an overall concept on capacity building (or preferably human and institutional development) and an integrated action plan, recognising the diverse contexts, ambitions, capacities and circumstances of the national partners. This would have probably assured creation and maintenance of a cadre of dedicated trained technicians and operational staff having the right orientation, skillsets and capacities for global climate observations in respective countries.

1.7 Another key missed option relates to the organisation of trainings and seminars in scientific or academic organisations at the national level, which would have helped to make visible and arouse the interest of the institutions concerned in the data generated by CATCOS, besides building a wider pool of trained staff. On the other hand, the planned capacity building workshop on aerosols in Vietnam is a positive case in point. In the terrestrial domain, the joint visits by the Swiss and national partners to the glaciers have substantially enabled in building national capacities for glacier measurements, which have been further strengthened through participation in summer schools on glacier measurements. Of the three stages of capacity building envisaged under the project, the first stage (standard operating procedures) has been achieved by all national partners, the second stage (data processing and limited data analysis) by most and the third stage (scientific analysis and publication) by two or three countries. The overall the interest and motivation at the national level for publication of scientific data in peer-reviewed journals remained muted, possibly because capacity building was achieved more at the level of technicians and operational staff rather than scientists.

1.8 In the atmospheric domain, CATCOS has helped provide observations from regions of the world previously undocumented, addressing crucial information gaps at the global levels. In the terrestrial domain, CATCOS has helped to restore and reconstruct the glacier measurements in Kyrgyzstan and initiated new ways of documenting / validating glacier measurements in South America. Capacity building has also enabled better integration of scientists and researchers in the network of observers and national correspondents under WGMS (World Glacier Monitoring Service).

1.9 The dual domain approach was designed in the second phase of the project to be a synergistic and innovative way of taking both the domains towards effectiveness and efficiency of scientific

networks. However we observe that, with one-off events at the regional level and in the absence of structured platforms for sustained engagement and interactions at the national or regional, level the dual domain approach remained more at a conceptual platform confined largely to the Swiss institutions, without serious buy-in by the national partners.

1.10 As regards outcome 2 which is related to regional cooperation efforts, we are of the considered view that, barring the Aire Limpio workshop in Bolivia, most activities were anchored largely in the structure and potential needs of the various regional associations under WMO charter, rather than in SDC's own regional/ global cooperation strategies, programmes, mechanisms or activities. We understand there were internal constraints at SDC for GPCC to support CATCOS implementation in SDC's priority countries at the moment of inception but also realise that the regional cooperation part was added in the second phase, possibly with the intention to impart a development dimension to CATCOS, which was missing in the first phase. The workshops and events organised on a regional basis (GOCS, GFCS) did indeed help the users and producers of climate information to come together on a common platform, also attempting to spread and share the interest, awareness and motivation of regional stakeholders on global observations. These events would have probably yielded better dividends if there were more targeted towards core areas of CATCOS engagement, thus providing a more dynamic push to CATCOS efforts.

1.11 We are of the view that any regional ambition should invariably commence with a clear and unambiguous assessment of the needs and demands of the constituent national and regional entities in climate observations/ monitoring which could possibly be met through a more regional approach, and not just multi-country efforts. A regional effort should also start with a clear vision and strategy, together with identified advantages of engaging on a regional basis, with an action plan for systematic follow-up. Viewed in this context, perhaps CATCOS was just too ambitious in supporting 'regional cooperation' activities in as many as four out of six WMO regions, spreading its efforts thin. We are of the considered view that focussed cooperation engagement in one particular region (eg. Central Asia) could have been more purposeful and rewarding. Also, the regional cooperation efforts may stand a better chance of success if they ride on a flagship regional initiative in water/ food security/ DRR (preferably of SDC), which would help to demonstrate benefits and value addition of climate observations to the users.

1.12 On the user interface aspects, CATCOS engaged with potential users making use of all available opportunities including station inaugurations, GCOS/GFCS workshops, summer schools and launch of pilot user application. However, a question arises here as to whether the limited one-time activities under this outcome are sufficient to enhance user capacity or promote sustained engagement with the users at different levels in key thematic areas. Also, despite being an initiative under the GPCC, CATCOS missed influencing national policies, strategies or approaches in climate observations/ information in any significant manner, notwithstanding the fact that this was not thought of at the design stage of the project. The same could be said for (not) addressing gender related issues in climate services, as men and women are impacted differently by climate change and the special knowledge, skills and expertise possessed by girls and women could be put to constructive use in joining hands with men to address climate impact.

1.13 Through effective collaboration, partnerships, communication and outreach, CATCOS has ensured visibility of the Swiss efforts in the area of climate observations, also capitalising on the

goodwill of the local Swiss missions. What we miss here, however, is a clear communication vision and strategy aimed at not only conveying the engagement of CATCOS in climate observations, but more importantly sharing lessons and experiences with the stakeholders at different levels nationally/ regionally. In this connection, a six monthly newsletter regularly informing the stakeholders of the progress and achievements would have been very useful.

1.14 The team is of the view that CATCOS is anchored in the right organisations at the national level viz. NHMS who in most cases are also responsible for policy making in the area of climate services. Yet, CATCOS should additionally explore the option of involving academic/scientific institutions at the national level to ensure enhanced national ownership and use of climate information generated by the project. We suggest the concept of national platform as an instrument to engage with the producers, processors, intermediaries and users of climate information (at the level of policies, science and practice), coordinated by the national partner, towards enhanced national level use of CATCOS data as well as greater user-interface.

1.15 Although CATCOS activities did indeed suffer from late start in some countries owing to delays in the conclusion of the MoUs, such delays are not unusual for an ambitious project. The delays had occurred despite the best of efforts put in by the Swiss institutions. In terms of efficiency, we are of the view that the project was implemented with due care, including cost efficiency and they have been no audit observations or concerns.

1.16 We consider the elements/ criteria of sustainability under CATCOS to include availability of crucial scientific equipment with supporting infrastructure, sufficient annual budget for maintenance and upkeep of equipment, appropriately trained technicians and operational staff, system of continuous training leading to a cadre of trained technicians, continued demand at the global, regional and national levels for CATCOS data, national commitment and ownership of the observations, stable policy and strategy regime and most importantly eventual embedding of CATCOS activities in national mainstream programme.

1.17 Under CATCOS, all the trained staff are regular staff of the national partners which is a positive feature. The question of availability of sufficient funds at the national level for maintenance of climate observations (beyond CATCOS) continues to be a crucial one, which is difficult to answer at this point of time. However, there have been good examples of sustainable interventions. As for example, in Ecuador the national partner is strongly committed to provide staff and national funding (by leveraging additional funding resources) for continuation of CATCOS observations on glaciers, which is in high demand by others including Quito Water Company in the private sector. Similarly, in Indonesia there is a high local demand for the aerosol data generated under CATCOS, owing to its strong connection with forest fires, which has resulted in high motivation of the national partner concerned to continue with observations, post-CATCOS.

1.18 Thus, enhanced application and continued use of CATCOS data at the national level augurs well for the overall sustainability of the project interventions. On the other hand, we also realise that given the long term nature of the global observations, especially with regard to ECVs such as GHG and aerosol, the potential for 'development' related utility of such data in the short term may be rather limited. The importance of closer engagement and positive interface under CATCOS with the national level nodal organisations in climate change, such as the federal ministry/agency for environment should not be underestimated, for achieving the sustainability of

CATCOS initiatives. In its remaining period, CATCOS project can help the national partners in mobilising/ leveraging funds from national and international sources for continuation of global climate observations, long after SDC support has ceased. The evaluation team has come out with a table, which maps the relative sustainability of CATCOS interventions in different partner countries.

1.19 The partners of CATCOS inform us that it would take several years for the global climate observations in the partner countries to stabilise, owing to the very nature of the scientific initiative. And even after the observations have started flowing to the world data centres, it may take more time for the benefits to be fully realised at the national level, especially in respect of the ECVs in the atmospheric domain. This brings us to the 'development disconnect' of CATCOS. Do we wish to see the achievements of CATCOS through the lens of benefit to global level scientific monitoring of climate or should they be viewed through the development window, with local benefits. If the assessment is from the point of view of achievement of national capacities for global observations, CATCOS has substantially met its objectives, although it is still some distance from achieving sustainability.

2. CONTEXT AND BACKGROUND

2.1 The human influence on the climate systems is clear and recent anthropogenic emissions of greenhouse gases (GHG) are the highest in history. Recent climate changes have had widespread impact on human and natural systems. Warming of the climate systems is unequivocal and since 1950s many of the observed changes are unprecedented over decades to millennia. The atmosphere and oceans have warmed, the amount of snow and ice have diminished and sea level has risen.[1] According to UNISDR (United Nations Office for Disaster Risk Reduction), over 700'000 people have died in disaster events over the last ten years. A total of 1.7 billion people have had their lives disrupted in some way and the economic losses in major reported disaster events come to USD 1.4 trillion. Climate related disasters now account for over 80 per cent of all disaster events and contribute enormously to economic losses and short/long term population displacement.[2] Almost 90% of the recorded disasters are associated with weather and climate factors, such as flooding from heavy rains, droughts, heat and cold waves, strong winds etc. Climate change cuts across all development policies and programmes at the national, regional and global levels, thus intensifying existing development challenges. Climate change constitutes a major source of uncertainty and is likely to considerably accentuate development challenges, through high impact weather and climate events.

2.2 The 21st Session of the Conference of Parties of UNFCCC (United Nations Framework Convention on Climate Change), convened in Paris in December 2015, adopted an universal agreement whose aim is to keep the global temperature rise for this century well below 2 degree C and to drive efforts to limit the temperature increase even further to 1.5 degree C above pre-industrial levels. Under the framework of 2030 Agenda for Sustainable Development, the member States expressed their commitment to protect the planet from degradation and take urgent action on climate change. The Agenda identifies climate change as one of the greatest challenges of our time and expresses its concern on the adverse impact, undermining the ability of all countries to achieve sustainable development. Sustainable Development Goal No. 13, therefore, aims to take urgent action to combat climate change and its impact, while acknowledging that the UNFCCC is the primary international, intergovernmental forum for negotiating the global response to climate change. The key thrust areas under the goal call for improved education, awareness and human and institutional capacity for mitigation, adaptation, impact reduction and early warning.

2.3 The Swiss Strategy on International Cooperation focusses on sustainable global development aimed at reducing poverty and global risks through bilateral and multilateral cooperation. The Dispatch to the Swiss Parliament (2013-17), also called as the 0.5% bill, defines climate change as one of SDC's priority themes to be supported under the Global Programme on Climate Change (GPCC). In geographic terms, it mentions about supporting regions most affected by impact of climate change, but also those regions which play a key role in addressing climate change in respective region. The Strategic Framework of GPCC (2013-17) is an instrument of the Swiss Confederation to adapt to climate change at multiple levels and domains in the area of policy, innovation and knowledge. GPCC framework promotes climate change mitigation and adaptation as complementary elements to achieve climate compatible development. The framework resorts

[1] IPCC – Climate Change Report 2014: Synthesis Report. Summary for Policy makers
[2] http://www.unisdr.org/archive/42862

to combination of the three elements viz. policy influencing at different levels, promoting innovative solutions and knowledge sharing in pursuing climate objectives of SDC.

2.4 The importance of climate services in the climate sensitive sectors of economy, for achieving larger socio economic development has been acknowledged well by the international community. In response to the inevitable climate change impacts, the WMO-led Global Framework for Climate Services GFCS has been established to tackle the numerous challenges of the adaptation and disaster risk reduction processes, especially in the most vulnerable countries and regions of the world. Thus climate information/ services offer the best potential for facilitating science-based decision making at the sub-national, national and regional levels, thus enhancing safety and security of the communities, promoting socio economic development and mitigation and reduction of economic losses and support to adaptation and disaster risk reduction.

2.5 Climate observations provide data that are fundamental for evaluating, refining and initialising models that predict as to how climate systems will vary over months and seasons ahead and project how the climate will change in the longer term under different assumptions concerning GHG emissions and other human influences. Effective climate services require observations of various types and of adequate quality and quantity and at the right place and right time. Both surface and space based observations are required of physical and chemical variables of the atmosphere, land and oceans, including hydrologic and carbon cycles and the cryosphere. Owing to the cross border nature of weather and climate, this entails issues of standardization, data quality management and data exchange, all tied to international coordination. In order that all the climate related problems are fully and comprehensively addressed, high quality observations are needed of all components of the climate systems, plus systematic information of ecosystems and human societies.

2.6 Systematic observations of essential climate variables are the starting points for providing relevant, effective and efficient climate services. Observations needed for providing climate services include a range of Essential Climate Variables (ECVs)[3] as well as those directly related to user needs such as measurement of precipitation, soil moisture and surface air temperature and observations of phenomena (e.g. thunderstorms, hail, fog, dust, cloud type and amount). Systematic observations play a key role for IPCC in detecting and attributing climate change to get an estimation of the global, regional and local impacts and variability. Decision makers at different levels rely on such sound knowledge based climate services to take their decisions. Observations underpin the efforts by the Parties to UNFCCC to mitigate and adapt to climate change. The current status of systematic observations in each UNFCCC Member States are regularly reported through National Communications to UNFCCC in the chapter on Research and Systematic Observations. National and regional plans of adaptation are dependent on comprehensive, high quality observations and any current and future global policy formulation will rely on the knowledge gained from climate observations worldwide. With the increased availability of reliable and high quality data, the environmental policy decisions will be made on more credible data.

2.7 A network of measurement stations is the backbone of the Global Atmospheric Watch (GAW) programme of the World Meteorological Organisation. This network consists of GAW Global and

[3] Bojinski, S et. Al (2014) Concept of Essential Climate Variables in support of climate research, applications and policy. American Meteorological Society pp 1431-1443

Regional measurement stations with additional measurements from contributing stations. Both global and regional stations are operated by the host countries, either by the NHMS (national hydro-meteorological services) or by other national scientific organisations. More than eighty country actively host GAW stations. Globally, it has been recognised that more equal geographical distribution of the stations is required, to improve the input data for global climate models, to finally obtain more precise climate services by decision makers. The major data gaps exist particularly in developing/ least developed countries. Thus the plan for the observation and monitoring pillar of GFCS aims to address the gaps and shortcomings, building on existing observational, data management and exchange systems and initiatives and adding enhancements where needed to support provision of climate services.

2.8 It is clearly recognised that all countries will need reliable climate data. The global efforts for climate observations are coordinated by the Global Climate Observing Systems (GCOS), which is co-sponsored by the World Meteorological organisation (WMO), the UN Environment Programme (UNEP), the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) and the International Council for Science. The GCOS requires observations from all three domains, atmospheric, oceanic and terrestrial which are then transformed into products and information through analysis and integration in both time and space. GCOS, as a system of systems, relies on the WMO's Global Atmospheric Watch Programme for observations of atmospheric composition or terrestrial observations. GAW is supported by a number of international data centres eg. World Data Centre on GHGs, World Data Centre for Aerosols, World Glacier Monitoring Services (WGMS) and related quality assurance mechanisms.

2.9 CATCOS has been designed, planned and implemented as an initiative to improve the information and knowledge base related to climate change, as a major global risk. In the first phase (2011-14), CATCOS was designed to improve the capacity to measure ECVs in developing and emerging countries where climate data availability is limited. In the second phase (2014-17) CATCOS continued with enhancing development capacities, with further strengthening through a dual domain approach. Further, this phase was designed to build upon and expand the structure established during the first phase, ranging from local to regional to global capacity development, thereby targeting people, institutions and users.

2.10 Phase 1 of CATCOS was implemented by MeteoSwiss in collaboration with the Swiss and national institutions in seven countries, towards establishing a sound basis for systematic climate observations. The Swiss institutions involved are EMPA, PSI and the Universities of Fribourg and Zurich. Phase 2 (from April 2014 onwards) of CATCOS represents a continuation of Phase 1 towards development of capacities and twinning in the seven established countries, with three new partner countries through a dual domain approach. WMO joined as one of the partners of CATCOS in the second phase.

2.11 The impact level objective of CATCOS is to promote better decision making to mitigate and adapt to climate change based on sound information and knowledge, as a contribution to the reduction of global risks and poverty. The long term impact of the project was to be secured through the following outcomes, having both short and medium term effects.

a. Outcome 1: High quality data of atmospheric (aerosols, GHG) and terrestrial (glaciers) climate variables, measured according to international standards, are sustainably available in the target countries and at the designated international data centres.
b. Outcome 2: Relevant data providers, users and decision makers in the region are linked in a sustainable manner (both atmospheric and terrestrial domains)
c. Outcome 3: Decision makers and stakeholders are aware of the use and benefits of high quality climate data

3. SCOPE AND OBJECTIVES OF EVALUATION

3.1 The evaluation is of end of phase(s) nature, and aims to provide an objective assessment of SDC's engagement in enhancing climate data and services as a key component for effective climate change adaptation at different levels.

3.2 The evaluation is expected to provide

a. a critical external view of the ongoing implementation of the CATCOS project and its main achievements

b. strategic inputs into the formulation and design of a future programme of SDC's Global Programme on Climate Change, focusing on climate services for sustainable development

3.3 In practical terms the evaluation is expected to provide insights into the effectiveness and efficiency of the results, relevance and sustainability of the CATCOS project, together with lessons learnt and experiences gained.

3.4 Based on this , the evaluation is expected to:

a. provide evidence on the added value of high quality climate data and services for activities at different level (local-global)

b. highlight key components for sustainable data and service provision

c. provide guidance for designing a new programme on climate data and services for climate change adaptation with a particular focus on key SDC target regions (eg. Africa) and contexts (eg. mountains).

3.5 The evaluation was expected to be conducted between November 2015 and January 2016. It was also expected the project evaluation would apply the five evaluation criteria proposed by OECD-DAC), adapted to the context of CATCOS, responding (at least) to the following points

a. Relevance of project activities

b. Effectiveness: To what extent project objectives were achieved

c. Efficiency – Cost efficiency of project results

d. Impact of CATCOS work – qualitative and quantitative

e. Sustainability of the effects, benefits and changes

3.6 As part of the external evaluation, the team was also required to produce a Concept Note (5-7 pages max) for a potential follow up programme on climate data and services

3.7 During the process of evaluation, the team was clearly informed that CATCOS-2 will not lead to CATCOS-3; unlike the way in which the first phase was continued into the second phase. In the course of the evaluation, it was also learnt that the current phase (Phase 2) has been extended by four months viz. up to end of 2016.

4. METHODOLOGY

4.1 The evaluation team went about its task, following three major steps as indicated below:

a. Desk Study: Involving review of all available documentation and literature, including the project plan reports together with log frames and monitoring framework of both the phases, contracts/ memoranda of understanding, annual operational and financial plans and reports, phase completion reports, fact sheets, publicity material, scientific publications, dossiers, proceedings of the project steering committees, gist of discussions held at the various regional events/ workshops/ summer schools, key back to office reports/documents etc. Most of these documents were made available by the programme manager from SDC as well as by MeteoSwiss. In some cases, we had browsed the CATCOS and related contents from the websites of different organisations.

b. Structured interviews/ interactions with the national partners: With, MeteoSwiss as the implementing organisation, Swiss partner institutions concerned (EMPA, PSI, UFR and UZH) WMO, together with SDC elements /Swiss Missions and other key stakeholders in the partner countries, both face to face, email communications and through phone/ skype. The countries visited by the team members for extensive face to face interactions were Kyrgyzstan, Colombia, Peru and Vietnam. The interviews were held on the basis of questionnaires suitably tailored for different stakeholders. In case of Vietnam, in addition to the interviews, half a day workshop was organised during the course of evaluation, which brought together stakeholders from government, parastatal organisations, apex ministries responsible for climate change at the national level, user departments like agriculture, water, energy etc, academic/ research organisations, civil society organisations and universities. Considering the remoteness of the various observation stations (both atmospheric and terrestrial domain) and the time available, the team did not make an attempt to visit any of the stations. Instead, the submission of continuous and high quality data from the monitoring stations supported by CATCOS was verified and confirmed with the respective global data centres. In case of the national partners, interviews were organised separately for atmospheric and terrestrial domains. Wherever possible, the team attempted to obtain the perspectives/ views of the national partners at different levels viz. project coordination, scientists and technicians. The team also interacted with Swisscontact, which had been associated with the organisation of the Aire Limpio workshop in Bolivia, in the frame of CATCOS. At the Swiss missions in different countries, we had the benefit of interactions with the Swiss Ambassadors, deputy chief of missions, SDC directors of cooperation as well as national programme officers. As far as possible, we ensured the presence of at least two members of the evaluation team during the skype/ phone interviews, which helped to effectively share the tasks involved while at the same time made the interactions more productive, effective and efficient. The team had systematically documented, internally shared and maintained gist of discussions/ interactions with each of the contacts for future record/ reference and in order to impart requisite objectivity to the findings and analysis. The team also managed to interact with several SDC staffers, including

at the head office, representing regional cooperation as well as thematic subjects. All the interviews/ interactions were held with a spirit of learning and knowledge sharing.

c. Follow up interactions among the team members and with the stakeholders, where necessary, through email/ phone/ skype to triangulate the information, seek additional information as well as to obtain perspectives from different angles.

4.2 All the above interactions were organised in close coordination with the programme manager SDC and MeteoSwiss, taking into consideration the suggestions and feedback offered by them at every stage of the evaluation.

4.3 The detailed list of persons with whom the evaluation team had interacted in the course of its task is given vide Annexure 3. The schedule of the evaluation is also available in a separate annexure. Conscious of the need for process orientation and continuity of efforts, the members of the evaluation team interacted among themselves extensively, through over 30 phone/ skype conferences, also sharing different responsibilities and tasks based on the time availability and expertise of team members. The team members met face to face for one full day at Geneva on 7th March, 2016 to share different perspectives, ideas and information in order to ensure that there was an overall common understanding and consensus among all the team members, as regards the analysis, findings and recommendations. The team also met on a bilateral basis during face to face interviews in Switzerland (Paolo Laj/Clara Ariza) and in New Delhi (Paolo Laj/KR Viswanathan). The team maintained contact with the programme manager in SDC throughout, periodically briefing / updating him on the progress of various tasks performed by the team.

4.4 The team shared its provisional observations, analysis, findings and recommendations with the SDC, MeteoSwiss and Swiss implementing partners through two formal meetings; one was held at SDC head office in Bern on 8th March 2016 with the participation of the programme managers of SDC and MeteoSwiss. Also during this face to face interactions at Bern, the draft concept note on potential future engagement of SDC in climate services was presented independently to SDC.

4.5 On 9th March, 2016 the team presented its draft operational report to the members of the Project Steering Committee, at the meeting held in Zurich. The feedback provided by SDC, MeteoSwiss and the Swiss institutions/ WMO during the above interactions and subsequent written submissions were fully considered, while preparing the draft final report of the evaluation.

4.6 Summing up, the evaluation team followed the principles, strategies, approaches, methodologies and steps outlined in the OECD-DAC evaluation guidelines, in both letter and spirit. Special attention was focussed on elements/ principles such as objectivity, fairness, transparency and openness, participation, independence, empathy, spirit of enquiry, learning and knowledge sharing, compassion and respecting cultural diversity and sensitivities.

5. FINDINGS, CONCLUSIONS AND LESSONS LEARNT

5.1 We perceive CATCOS to be essentially a technical cooperation project with intense engagement of Swiss scientific/ research institutions of global repute, with the objective to support capacity development and twinning in selected developing/emerging countries, in data sparse regions of the world. This is intended to generate and disseminate systematic global observations with regard to three Essential Climate Variables viz. greenhouse gases (CO2, CH4, ozone), optical properties of aerosols and glacier mass balance, in accordance with prescribed world standards. Thus, the design, conceptualisation and planning of CATCOS had been done on the lines of a technology transfer project, bordering on scientific cooperation, of course with a small development twist added in the second phase.

5.2 On the other hand, the external evaluation of CATCOS is being organised in the frame of established OECD-DAC evaluation criteria, essentially a framework which is used for assessment of a typical 'development' project. In other words, the evaluation team is required to look and assess CATCOS through a development lens. This process brings with it certain complexities relating to the questions/ sub questions which should guide the team in their task. These evaluation questions had to be framed such that the impact, effectiveness, efficiency, relevance and sustainability of the CATCOS related interventions are assessed. While there are obvious advantages of following the OECD evaluation criteria, the downside is that there could be a perceived underestimation of the achievements of various objectives under this technical cooperation project.

5.3 The evaluation team decided to adopt a method under which we developed appropriate evaluation questions/ hypotheses and thereafter proceeded to test the available/ collected evidence against the hypotheses. The findings/ analysis of the evaluation team will need to be seen in that context. The evaluation hypotheses/ questions are given in bold italics.

Hypothesis 1 (Corresponding to Relevance)

The CATCOS programme is relevant to Swiss international development objectives, notably its engagement in the area of global cooperation on climate change, the overall goals and objectives of the UN/international organisations (WMO/GFCS/GCOS/ UNFCCC/IPCC) working in the area of climate change together with the national policies, strategies and action plans of respective partner countries in the area of climate change. The objectives are also consistent with the needs of beneficiaries and their requirements across different levels. The activities and outputs of CATCOS are consistent with the overall objectives, intended impact and effect. The results and outcome are consistent with the needs of the beneficiaries

5.4 Climate change is a serious threat to all development objectives and thus has immense potential to undermine all the dimensions of sustainability. Climate variability and climate change will have a direct bearing on the quality and quantity of economic and environmental resources of tomorrow. The Dispatch to the Swiss Parliament 2013-17 (0.5% bill) defines climate change as one of SDC's priority themes to be supported under the Global Programme on Climate Change (GPCC). Geographically it talks about supporting regions most affected by impact of climate change, but also those which play a key role in addressing climate change in the respective region. The Strategic Framework of 2013-17 of GPCC is in line with the current Dispatch to the Parliament. In fact, it is an instrument to adapt to climate change at multiple levels and domains

in the area of policy, innovation and knowledge. GPCC framework fosters climate change mitigation and adaptation as complementary elements to achieve climate compatible development. The framework also talks about the use of combination of the three elements viz. policy influencing at different levels, promoting innovative solutions and knowledge sharing in pursuing the climate objectives of SDC.

5.5 Component 4 of the GPCC framework substantially covers the aspects of promoting knowledge management, which *inter alia* includes sound state of the art foundations including establishment and availability of climate data and services through engagement of the Swiss universities, MeteoSwiss and other Swiss and international institutions. It also talks about the need for decision makers, relevant partners and other institutions to be aware of sound climate knowledge and experiences, so that they take this into account in their daily work. All this involves generation and sharing of climate relevant data and knowledge. The GPCC framework visualises shaping and application of knowledge and experiences in this area by SDC units and external partners. GPCC is also required to support enhancing thematic competence of climate change knowledge and support its integration into development cooperation. Component 2 among other things talks about contribution to tackling issues such as air pollution under climate mitigation and Component 3 mentions of promoting climate resilient livelihoods and ecosystems including global food security, integrated water management approaches etc. The overall objective of CATCOS thus is fully relevant to a key objective of SDC, expressed through the GPCC framework, in making available climate data through engagement of Swiss as well as international institutions.

5.6 The universally accepted Sustainable Development Goal 13, calls for urgent actions to combat climate change and its impact; the thrust area 13.3 talks about improved education, awareness and human and institutional capacity for mitigation, adaptation, impact reduction and early warning. A sound base of knowledge and information, derived from high quality climate data would be key to tackle the challenges associated with climate change. Systematic long term monitoring of climate system is not only a fundamental prerequisite to understand both the change and resulting consequences, but a pre requisite for making decisions at all levels. Given the fact that CATCOS aims at plugging important data gaps with regard to the three selected ECVs, especially in the data-deficient regions of the world, the objectives of CATCOS are thus fully and comprehensively relevant to the Sustainable Development Goals.

5.7 The World Climate Conference in 2009 decided to establish the Global Framework on Climate Services (GFCS) as a UN initiative, spearheaded by WMO and in 2012 the Intergovernmental Board of Climate Services adopted the GFCS implementation Plan. The GCFS vision envisages enabling the larger society towards better management of risks of climate change and climate variability and adaptation to climate change, through development and incorporation of science based information and prediction into planning, policy and practice at the global, regional and national scale. The primary focus of GFCS is better access and use of climate information by the users and one of the guiding principles relates to treating climate information primarily as international public goods and governments will have a central role in the framework. The priority areas of GFCS are agriculture and food security, DRR (disaster risk reduction), energy, health and water. The five components (pillars) of GFCS are user-interface platforms, climate service information systems, observation and monitoring, research, modelling and prediction and capacity development. Within the observation pillar, the ECV datasets provide empirical evidence needed to understand and predict evolution of climate to assess risk and enable attribution of

events to underlying causes and to guide mitigation and adaptation. The ECVs themselves have been identified on the basis of relevance, feasibility and cost effectiveness. Plans for the observation and monitoring pillar of GFCS aim to address the gaps and shortcomings, building on existing observational, data management and exchange systems and initiatives and adding enhancements where needed to support provision of climate services. Again, the objectives of CATCOS are consistent with principles and work priorities of the GCFS, as it relates to the observation and monitoring component. The collaboration should also be seen in the light of the long term engagement and partnership of SDC with WMO (World Meteorological Organisation in Geneva), especially in area of climate services for development related sectors. MeteoSwiss subsequently informed us that the proposed GFCS workshops in Southern Africa and South America will address the other pillars too.

5.8 Conclusions from the Seventeenth World Meteorological Congress stresses the need for enhancing the capacity of NHMSs to deliver on their mission by developing and improving competent human resources, technical and institutional capacities and infrastructure, particularly in countries where capability to maintain high standards of observations, data and metadata is problematic. Resolution 40 of the Congress urges members to strengthen their support to the framework of the ECVs of GCOS (Global Climate Observation Systems), in the collection and supply GFCS relevant data and products on a free and unrestricted basis. Annex to resolution 60 provides the general designation of GCOS ECVs necessary to resolve the statistics of climate, including trends and extremes. Among others, GCOS surface network data include data on the composition of the atmosphere including aerosols and greenhouse gas data together with climate relevant cryospheric data, including glacial monitoring

5.9 Each of the countries of interventions in the frame of CATCOS has their own climate change policies, strategies and action plan, which call for concerted and systematic efforts for integration of climate risk management in development efforts. In the estimation of climate risks through scenario development and vulnerability assessment, climate information at the national level plays an important part and all the countries are engaged in systematic observation and monitoring of climate, although the spread and intensity would vary depending upon the contexts, national circumstances, programmes, needs and capacities of different national entities. Thus the emphasis on capacity building and twinning for climate observation systems under CATCOS is very much relevant to the national goals for climate compatible development in all the countries, articulated in the various communications to UNFCCC, including the National Communications, INDCs (Intended Nationally Determined Contributions) etc.

5.10 Outcome 1 of CATCOS reads as follows: 'High Quality data of atmospheric (aerosols, greenhouse gases) and terrestrial (glaciers) climate variables, measured according to international standards, are sustainably available in the target countries and at the designated International Data Centres'. The activities and outputs fully and comprehensively consistent with Outcome 1.

5.11 The Outcomes 2 and 3 respectively are as follows: 'Relevant data providers, users and decision makers in the region are linked in a sustainable manner, both in the atmospheric and terrestrial domain.' 'Decision makers and stakeholders are aware of the use and benefits of high quality climate data'. The activities and expected outputs under both these two outcomes, in the view of the evaluation team, are limited in scope and ambition even at the design and planning stage. These definitely were the first steps required, however. Hence it is just not the question of

relevance, but the breadth and intensity of efforts and comprehensiveness of measures that were designed and planned to achieve the outcome which really do matter. The limited scope and ambition under the outcomes relating to 'cooperation capacity' (regional cooperation) and 'user capacity' and their impact on the project achievement are discussed at length in the succeeding paragraphs.

Hypothesis 2 (Corresponding to Effectiveness and Impact)
CATCOS has contributed effectively to climate observations with regard to three Essential Climate Variables (concentration of GHG, optical aerosol properties and glacier mass balance), to the World Data Centres, following established global standards of data collection and processing in the frame of WMO and GCOS, in data sparse regions of the world. This has been possible through:

a. *Supply and installation of all necessary instruments in the host countries/institutions and ensure their continued functionality, together with effective maintenance and technical backstopping, in order that climate observations are recorded in accordance with established standards.*

b. *Building national capacities (at the level of technicians, operational staff and in some cases scientist) for climate observations in different countries of CATCOS engagement*

c. *CATCOS generated observations are used effectively at both at international and national levels: towards generating climate information/ services – in responding to the needs and demands of the users, for decision making in adaptation, mitigation and DRR and there is national ownership of data generated by CATCOS.*

d. *The strategy of dual domain followed in the second phase has contributed positively to developing a multi-disciplinary approach to ECV observation strategies*

e. *CATCOS has a strong scientific and development impact in terms of innovation and development of new knowledge*

f. *Impact and Effectiveness of CATCOS: Factors influencing the effectiveness / Effectiveness in approach and strategy/ Reach at the regional level/ measurability of indicators proposed*

5.12 In almost all the partner countries of CATCOS, the requisite scientific equipment have been installed/ commissioned and the technicians/ scientists of the national partners have been effectively trained, the exceptions being Kyrgyzstan (for the atmospheric domain) and Uzbekistan (for the terrestrial domain). In both these countries, the requisite equipment have not been installed yet, although the implementation has been scheduled. The stations/ institutions have been generating, processing and transmitting data to world data centres of GHG and aerosols in accordance with established global norms and standards of data chain management, thanks to the highly professional, effective and responsive twinning support of the Swiss institutions concerned. This is a commendable and praiseworthy achievement of the project.

5.13 The site selection for location of observation equipment/ stations has been done by respective national institutions in close consultation and coordination with the Swiss partners,

mostly MeteoSwiss, taking into consideration the relative merits/demerits of the competing locations, based on objective criteria such as meteorological equipment already operating on site. For the atmospheric domain, selected sites are either already established GAW stations (in particular when a scientific framework for collaboration was already engaged with Swiss partners previous to CATCOS) or new locations. In some countries (eg. Vietnam), the site selection process involved travel of the Swiss scientists in the countries concerned for more than two weeks at a stretch. The import of equipment had to be organised without payment of customs duties in the countries, as no budget has been made for this purpose. Most of the partner countries have managed to get the equipment imported without paying customs duty, in some cases by making creative use of the diplomatic provisions (import as 'diplomatic goods'). This is perceived by us to be positive, considering the public goods nature of the equipment. On the other hand, we have heard that some of the Swiss missions (eg. Vietnam) had to spend highly disproportionate amount of time and resources to ensure that the equipment was imported without any duty. As the observation stations are located far away from the place of import, considerable efforts and logistics were involved in transportation of the equipment to the stations in remote areas. Chile was another country where sizeable efforts were required to be made by the local Swiss mission, also in coordination with SDC in Peru. If the equipment are needed to be shipped back to Europe for repairs in future, the re-import could become a potential issue. We have come across a case in Colombia where a probe, which is an essential piece, was required to be repaired in Switzerland. Although it took three months, the repair could be organised in Switzerland with the full support of the local Embassy. The national partner in Colombia is very pleased with the development, as it would not have been possible to continue the measurement without a functional probe.

5.14 The equipment for climate observations as regards GHG and aerosols have invariably been installed in the presence and with the support of the technical representatives/scientists of the Swiss partners concerned. We observe that this process has provided a good opportunity for the Swiss partners to familiarise themselves with the local context as well as with the technicians/scientists at the national partner organisations who will be operating these machines. This familiarity has in turn contributed to better and more efficient and responsive trouble-shooting and remote maintenance subsequently. The process of installation often takes considerable amount of time on the part of the senior EMPA/PSI staff as they have to physically visit the countries concerned and accompany the process of installation and commissioning. The national institutions have provided the requisite land, building, laboratory spaces, air conditioning equipment, power generators, UPS, electricity and internet facilities etc. They have also borne the costs related to staff time, expenses related to frequent visits of national personnel to the site, project management set up, supervisory functions at the national level etc. The evaluation team feels that this adds up significantly and we are of the view that the contribution of the national entities (not often costed accurately) should not be underestimated towards CATCOS.

5.15 As regards the installation of the scientific equipment at the stations, the national partner in Vietnam had suggested that this responsibility could be shifted to the manufacturer/ supplier, after the calibration of the equipment at EMPA/PSI. Another suggestion that emerged related to potential transfer of funds to the national partner who in turn could procure the equipment. We do not find any merits in any of these suggestions as the scientific equipment will need thorough testing and calibration in the labs of EMPA/PSI and this cannot be left to the supplier. We, therefore, suggest that the time- tested and existing practices/procedures should be maintained.

In addition to this, as explained above, time dedicated to maintain on-site was an essential part of the capacity building process.

5.16 There have, however, been a few hiccups/ delays in the installation of the equipment to measure GHG/aerosols/ glaciers in some countries. Delay in signing of MoUs is certainly one reason. In Uzbekistan, the agreement took a long time to come through, for various reasons. In Kenya the prolonged breakdown of power supply at Mount Kenya considerably delayed the process of commissioning/ continuation of the working of the equipment. This was attributed to the remote conditions of the station, together with forest fires, which had repeatedly destroyed the power lines to the Station, resulting in serious disruptions. In Vietnam, which was visited by one of the evaluation team members in Feb 2016, the Picarro equipment was not found to be functioning for well over a month (which alone will easily account for about 10 per cent data loss annually), interrupting GHG measurements at the GAW Regional Station at Pha Din. The malfunctioning in this case has been provisionally attributed to a glitch in the equipment-computer interface. Technical advice was being sought from EMPA remotely for trouble shooting and we now learn that the equipment is now back to its regular working condition. We were later informed by EMPA that Picarro equipment in Chile has been out of order since August 2015 due to a technical failure. Although the local station warden has immediately raised attention to this problem, the equipment could not resume measuring due to a more severe hardware failure. Reparation of the equipment could not be possible without support from Empa, acting as a communication partner between Picarro Inc. and DMC. We cannot rule out recurrence of failures of such nature in future. The issue of instrument failures was never clearly addressed at this stage of CATCOS, when the instruments installed are relatively new or well-maintained with the support of the Swiss advisors. However, it is to be expected that technical failures leading to replacement of parts or eventually the whole instrument, will become more and more frequent in future. Providing for this eventuality has not been addressed either by the Swiss partners or by the national partners. Consideration in the MoU that the responsibilities beyond CATCOS are fully with the national partners, may not have been fully integrated.

5.17 The quality and professional thoroughness of the world-class training provided by the Swiss institutions (onsite training, remote support and specialised training in Switzerland, participation in international events such as summer schools) has been greatly valued and perceived as excellent by all the national partners. In fact, many of them have been requesting for longer and more intense training activities in climate observations. At the level of the national organisations, the technicians and operational staff/ scientists are regular employees of the institution concerned (not on a short term contract basis), often engaging with CATCOS on a part time basis. We perceive this as a key element contributing to sustainability, as the personnel concerned are likely to continue in their position even after CATCOS comes to a close. However, we observe that the project did not probably have the benefit of an overall concept on capacity building or preferably human and institutional development (beyond just stating three stages of capacity development) or a well thought out action plan, especially at a national level, jointly articulated with the country level partner. Such a concept, in our view, could have covered the national level strategies (also recognising the circumstances and context in different nations) together with an integrated action plan, ensuring building capacity of minimum number of staff at the national level on a systematic basis annually, if required through small revision of available budget. This would ensure creation and maintenance of a cadre of trained technicians, who have the right orientation, skillset and capacities for CATCOS observation at the national level. This is perceived

to be one of the shortcomings under the project, the main remit of which was capacity building. Another important option would be to organise the training/ seminars etc. in academic institutions at the national level, which would have helped to arouse the interest of these organisations in the data generated by CATCOS. Such a measure would have also promoted better cooperation between the NHMS and the academic organisations, the latter being one of the key users of the observation data at the national level.

5.18 In the case of atmospheric domain, the higher level of training/ capacity building in the frame of CATCOS is currently provided only to a very limited number of technicians/ senior operational staff per country (in some cases just one), through short term stays in Switzerland. This has a couple of downsides too. In some countries, this is often perceived as an 'award' to select people. Further, if by chance the person trained in Switzerland leaves his/her position in the organisation for some reason or the other, the country loses a senior trainer, seriously impacting capacity building activities. In some countries like Vietnam or Kyrgyzstan, not a single person has so far been trained in Swiss institutions, although both aerosol and GHG measurements have been in progress (in Vietnam at least) for the last over two years. Another issue that was brought to our attention related to a potential trainee from Vietnam who was not found to be fit for training at PSI, owing to lack of requisite communication skills in English. However, the same person is now accepted for training at EMPA in the coming months. On this point, PSI provided us a feedback saying that the trainings in EMPA and PSI have entirely different scope with different candidate profiles and that to prepare scientific manuscript the communication skills had to be substantially higher than for technical training. The team was later informed by PSI that an aerosol course is scheduled to take place in the coming months in Vietnam, which will have the participation of several local participants including from Universities. We consider this as a key development in the right direction.

5.19 In the terrestrial domain, the joint visits by the Swiss and national partners to the glaciers concerned have enabled building up of national capacities in glacier measurements. This step has been fortified by the opportunities in participation of training events such as the summer schools, some of which involved visits to the glaciers etc. This also enabled the scientists to exchange knowledge, information and experiences in glacier measurements.

5.20 It would, therefore, be reasonable to say that the first of the three stages of capacity building (capacity to operate the equipment, standard operating procedures), has been achieved in all countries. The second stage of capacity building (data processing and limited data analysis) has been achieved in about three fourths of the countries and the third stage (scientific analysis of information and publication in leading journals, leading to recognition and empowerment) has been achieved only in two or three countries eg. Ecuador, Kyrgyzstan. It is possible that the expectation of the technicians or operational staff trained to produce scientific articles (stage three of capacity building) was far removed from the national realities[4]. Overall the interest and motivation for publication of scientific data in peer-reviewed journals has been quite low, especially in countries of Latin America. This can possibly be explained by the fact that capacity building was achieved essentially at the level of technicians and operational staff and not so much

[4] MeteoSwiss clarifies that every national partner was not expected to publish peer-reviewed, first author paper and that only two publications were envisaged, one in each domain

at the level of scientists. It is also a consequence of the fact that impact of publishing a simple report in Spanish is often much higher than a peer-reviewed publication in the meteorological institutions. On the other hand, in countries like Indonesia, the engagement of the operational and technical staff was very high, owing to recognition received at the national level for the data generated under CATCOS.

5.21 Another observation from our end is that stage 2 and stage 3 of capacity building were achieved by countries which already had the benefit of previous collaboration, either with the Swiss or with other European partners. For example, this is clearly the case in Ecuador for the terrestrial domain for which the added value of CATCOS was very efficiently perceived and integrated by well-trained personnel. In those countries, the fertile ground for CATCOS activities was prepared by development projects established in the long-term that are effectively recognized at all management levels of the partner institution. In particular, availability of PhD scholarships targeted at young scientists in the national partner countries was an essential tool to raise knowledge and expertise to the proper scientific level. This was not a tool offered in CATCOS. In the terrestrial domain, the collaboration with other European partners (involved in similar activities with the same CATCOS national partners) was extremely well appreciated at all levels

5.22 CATCOS observations indeed are fed into the World Data Centres for GHG, aerosols and World Glacier Monitoring Services (WGMS) systematically and regularly, in accordance with the laid down global quality standards and in the frame of GCOS. There was observation from Swiss institutions such as EMPA and PSI that the efforts that were required at their level for correction of data emanating from national centres was much higher than anticipated, consuming additional resources. The quality, timeliness and utility of CATCOS data received from the national partner institutions have been verified from the global data centres and this has been found to be uniformly good. Once in the World Data Centres, the data becomes accessible to anyone who may want to make use of the data. The data is currently being made use of by organisations and institutions such as UNFCCC, who use it to develop regional climate adaptation plans etc. IPCC (Intergovernmental Panel on Climate Change) has been using CATCOS data as a scientific basis for development of various climate scenarios/ modelling, articulated in scientific publications. This was confirmed by MeteoSwiss. Further, the latest publications of WMO/ GCOS have been making references to the data produced by CATCOS project. The use of the climate observations at the regional and national level is dealt with separately, in the chapter on sustainability.

5.23 In the atmospheric domain, CATCOS is now providing information from areas previously undocumented. CATCOS accounts for one out of three atmospheric stations operating in South America in the WMO context; one out of two in Africa and two out of six in Asia. This goes to show the crucial information gaps at the global level that CATCOS has managed to address in three of the continents.

5.24 In terrestrial domain, CATCOS has helped to restore and often reconstruct the glacier measurements in Kyrgyzstan, which were discontinued in 1991 following the breakup of the Soviet Union. The project enabled initiating of new ways of documenting glacier measurements, especially in South America, through digital terrain information and satellite imageries. Data collected on glacier measurements have been standardised before submission to WGMS in the

University of Zurich. Such measurements should potentially help assess the changes at glacier level, with impact on local hazards, seasonality of run off, hydro-power generation, impact on water supplies, ground water level in the lower reaches etc. The capacity building also enabled better integration of the scientists and researchers in the network of observers and national correspondents of the WGMS. On the other hand, we were informed that the remote sensing/ aerial survey activities in glaciers has not been achieved so far in Ecuador, although equipment provided for hydro-meteorological measurements have proved successful. In Colombia, the aerial component of the project turned out to be too expensive. Therefore the Swiss partners found an alternative and locally suitable methodology to obtain the required information. This was commended by the Colombian implementing partner.

5.25 The dual domain approach (tackling atmospheric and terrestrial domain in the same country) was evolved during the second phase of CATCOS. While this approach has been proposed as a synergistic and innovative way of addressing both the domains towards effectiveness and efficiency of scientific networks, the resultant gain actually achieved is not evident to the evaluation team. In the absence of any structured platforms at the national or regional levels, where these teams (terrestrial and atmospheric domains in the same country or the region) could come together and interact on a sustained basis, possibly with the objective of mutually enriching knowledge sharing and networking, it is not clear as to how this concept was operationalised to harness synergy. Although three countries have been listed in the project report for the second phase, for pursuing the dual domain approach, the actual potential for observing this approach, in our view was only in one country viz. Kyrgyzstan.

5.26 According to our observations, in Kyrgyzstan there are hardly any functional interactions or regular exchanges between the teams dealing with atmospheric domain (Kyrgyz Hydromet) and terrestrial domain (CAIAG). And for the dual domain approach to take effective roots in the countries concerned, we should go well beyond organising one-off events in two domains (eg. in Bolivia, summer school on glaciers and workshop for air quality monitoring). Closer home, however, there have been interactions between the two domains, in meetings convened by MeteoSwiss. On the other hand EMPA mentioned to us that their engagement with the University of Fribourg was purely from the logistical point of view eg. Kyrgyzstan where the terrestrial domain was implemented since the first phase. Possibly the benefits of dual domain approach was appreciated only from the Swiss side.

5.27 We also realise that the dual domain approach is more of a conceptual issue targeting the top management (raising awareness that climate change issues are required to be addressed through multi-disciplinary approaches) as well as potential users eg. aerosol black carbon is potentially impacting glacier mass balance. Clearly, personnel involved in the field during phase 1 of CATCOS were not those who might be receptive to the dual approach concept. Without identification of users outside CATCOS in the country, the benefits of dual domain approach remained more conceptual. The forthcoming GCOS meetings (since changed as GFCS workshops) planned in CATCOS phase II which will emphasize benefits of the dual-domain, must make sure the concept is passed on to the right audience.

5.28 In the light of the above observations and analysis, the Outcome No. 1 (data capacity) is fully and comprehensively achieved. This is clearly visible and recognized by both, the scientific

communities and the international institutions such as WMO who remained very supportive of CATCOS achievements related to this outcome.

5.29 Some activities in the frame of CATCOS were aimed to bring about promotion of cooperation capacities, specifically through a regional cooperation approach. These essentially related to contribution to the organisation of the GFCS workshops in South America/ Africa and GFCS workshop in Central Asia. The regional GCOS workshop in South America organised in the first phase, helped to bring several stakeholders in the region, notably the NHMS (national hydro-meteorological services) together and also helped underscore the significance of climate observations, towards commissioning effective and responsive climate services. Similarly, the GFCS workshop (co-organised by CATCOS, along with a few other actors) held in Bishkek in 2015 brought the potential users, producers and intermediaries of climate information in Central Asia on to a knowledge platform, in sharing the significance of climate observation and information as it relates to the GFCS priority areas of water, agriculture, DRR and health. In some ways, the workshop helped make connections among the technicians who are trained/ involved in measurements in different countries of the region. The technician from the Colombian partner informed us that for the forthcoming summer school on glaciers in Bolivia he had to propose a number of people who could be interested in training, but he (as a person who is already trained) should opt out of the workshop. This is positive in that the Swiss institutions are scaling up the pool of trainees and possibly helping to expand the collaboration network.

5.30 CATCOS also supported a week-long workshop (with the involvement of scientists from EMPA) held in Bolivia, in which of 16 technicians from the various cities of the country engaged in air quality assessment at the urban level were trained. This was organised in association with Swisscontact under the umbrella of another SDC supported programme called Aire Limpio. The workshop activities revolved around discussions and capacity building in the area of air quality legislation, data management, calibration, trouble shooting, maintenance etc. The feedback about the usefulness of the workshop seems very positive, attracting also a lot of positive publicity and visibility in mass media, including television at the national level. Perhaps this is on account of the fact that the air quality is emerging as a major issue in that country. Yet, in Bolivia it is the different municipalities which are in-charge of measuring air quality. The training in fact brought together people who have a position in the municipal government and come from diverse walks of life (business managers, lawyers etc.) not necessarily specialised technicians. Independently of considerations in para below, better twinning with other international initiatives (eg. aerosol workshop organised in the middle of 2015 at La Paz under another initiative) in this country could have been more beneficial.

5.31 While not meaning to belittle this achievement, the evaluation team wonders if it would have infused more synergy if such a workshop on air pollution monitoring were to be held in Chile, which attaches considerable significance to air quality measurements. And this is also the country, where aerosol and GHG observations are carried out under CATCOS. On the one hand, we realise that this workshop was held as an ADD-ON activity of CATCOS at the request of local SDC office. Yet, we are also left wondering if the workshop on urban air quality monitoring in Bolivia, which is not directly related to GAW measurements under GHG or aerosol, constituted low hanging fruits for CATCOS, in terms of promoting 'cooperation capacity'. The summer schools on glacier monitoring conducted during the first and second phase of CATCOS should be considered as positive step towards promoting knowledge sharing and regional networks in glacier monitoring, although there were several elements of capacity development present eg. mass balance measurements/ techniques and homogenization, mass balance series and its validation, calibration with geodetic methods and data submission to WGMS.

5.32 In our considered assessment, the regional cooperation efforts pursued under Outcome 2 were essentially anchored not so much in SDC's own regional cooperation strategies, mechanisms or activities, but more in the structure and potential needs of the various regional associations under the WMO charter. The possible exception to this is the Aire Limpio workshop in Bolivia. We understand there were internal constraints at SDC for GPCC to support CATCOS implementation in SDC's priority countries at the moment of inception, but also realise that the regional cooperation part was added during the second phase, possibly with the noble intention of adding a 'development' dimension, which was missing in the first phase. No doubt, the workshops and events mentioned above (many of them held with regional level participation) helped to bring the users, producers and intermediaries of climate information on a common platform, also in attempting to spread and share the interest, awareness and motivation of the regional stakeholders on climate observations. Nevertheless, it should be remembered that the focus of the GCOS/GFCS workshops was more on 'relevance of climate / climate services' in general, as linked to water, agriculture, DRR, energy etc. We wonder if better purpose would have been served if the workshops were better targeted, oriented more towards core areas of CATCOS engagement, which may have provided better visibility and dynamic push to the CATCOS efforts.

5.33 Be that as it may, in our view, any regional cooperation efforts should invariably commence, with a clear and unambiguous assessment of the needs and demands of the constituent national and regional entities in climate observations/ monitoring, which could possibly be met through a more regional approach (and not just as multi-country efforts). This would be in the nature of advancing synergies and complementarities of the regional efforts to the fore. Any regional cooperation effort should also begin with a clear vision and strategy, together with identified advantages for engaging on a regional basis. Further, we get a feeling that a modest project like CATCOS was just too ambitious in supporting 'regional cooperation' activities in four of the six different WMO regions (RA I, II, III and IV), spreading its efforts pretty thin. The various recommendations made in the GCFS workshop in Bishkek with regard to the connect of climate information to the different priority areas (agriculture and food security, water, energy, health and DRR) appear to be non-specific in nature with no clear role or responsibilities assigned for any organisations to follow up the same systematically. In any case, no budget was provided for this purpose. This poses a question mark on the significance and impact of such one-off activity, which in any case was supported many organisations, blunting the potential visibility and regional stewardship possibilities for SDC as a bilateral donor.

5.34 The evaluation team is, therefore, of the view that the focussed cooperation engagement in one particular region, as for example in Central Asia covering countries such as Kyrgyzstan, Kazakhstan, Uzbekistan, Tajikistan etc. could have been more purposeful and rewarding. This could have been in the context of glacier observations and their implications for regional water resources planning and management or DRR. Another alternative would have been to align CATCOS' regional ambitions with the GPCC's 'regional' engagement through the Andes programme in South America, which could have helped in bringing national actors to cooperate with CATCOS. But as of now, CATCOS is not effectively inked to a programme like CLIMANDES which is supported by SDC and has the involvement of MeteoSwiss, nor with the IGAC-supported initiative for the assessment of impacts of black carbon and co-pollutant emissions in the Andean regions, closely related to both terrestrial and atmospheric domains of CATCOS. Another option could be that CATCOS GHG and aerosol measurements in Vietnam could be linked to the multi-country Mekong River Commission, whose activities are supported by SDC in the region. Of course, for such collaborations to take place, it is important for CATCOS to assign financial resources specifically.

5.35 The very limited links with regional initiatives mentioned are probably linked to the selection of the national partnership. While it is clearly strategic to have identified meteorological services or related institutions as key partners for implementing CATCOS phase I, it is not necessarily the case when building the user dimension of the project. Key partners in academics, that are involved in regional/international research initiatives, and are the first natural users of CATCOS data, have not been sufficiently informed about the project. It is not always expected that the national context in the CATCOS partner countries will always be suitable for extending cooperation beyond the initial partnership of CATCOS. Extending partnership in CATCOS phase II to additional key regional partners in the academics could have enhanced CATCOS visibility and impact.

5.36 As the subject of climate monitoring/ climate services effectively intersects key climate-sensitive sectors like water, agriculture, energy, DRR, and health, the regional cooperation will probably stand a better chance of success if it rides on a flagship regional initiative eg. Central Asian Water Resources Information Systems / Central Asia Energy and Water Development Programme, which will help to clearly demonstrate the benefits and value addition of climate observations to the users (translated to climate information and eventually user-relevant climate services).

5.37 For the reasons stated above, the OUTCOME 2 (cooperation capacity) is partly achieved, even considering the fact that the activities and expected outcomes under this head lack the requisite ambition and support.

5.38 Through effective collaboration, partnerships, communication and outreach, CATCOS has ensured some visibility of Swiss efforts in the area of climate observation, also capitalising on the goodwill of the local Swiss Embassy at the national level. CATCOS has also managed to link up with the SDC elements in respective countries for facilitating import of equipment etc. However, all this was only in the initial stages of the project (e.g. station inauguration) or during the organisation of GCOS/GFCS meetings. What we find missing is a clear communication vision and strategy, aimed not only at conveying the engagement of CATCOS in climate observations at different levels, but also sharing the lessons and experiences with the stakeholders. While the communication between the Swiss partners and the national partners was smooth and functional, the overall visibility of Swiss engagement at the national level, beyond the CATCOS partners, was very low. In a few cases, the very existence of CATCOS and the climate observations done were not known to the nodal agency in charge of climate change in the respective country (e.g. Kyrgyzstan)

5.39 Prior to CATCOS, some Swiss partners already had ongoing collaboration/ previous contacts with partners in some countries. In fact, this was one of the main criteria (the other being data deficient zones) for the final choice of countries under CATCOS. As for example, EMPA had ongoing/ past engagement in Kenya, Indonesia and probably Chile. MeteoSwiss was collaborating with Kenya in the context of balloon experiments etc. The UNIFR and UZH had been engaged with some countries in the context of glacier measurements. CATCOS could capitalise on these existing relationships and contacts, with the result it did not take much time for the projects to be agreed with the different national partners. The relationship and credibility that MeteoSwiss enjoyed with several of the NHMS (also in the context of the periodical visit of the senior representatives of national governments to Geneva to attend events including WMO Congress, Executive Committee etc) proved extremely handy in collaboration. Overall, the collaboration and partnership between the Swiss and the national partners have been relatively smooth, with jointly shared values, with good empathy and communication. On the other hand, in a few cases, the

observation stations did not receive explicit strong support from their own national hierarchy (eg. Chile) which has been contributing to some delays under the project.

5.40 We recall that at some point of time, the global cooperation projects of SDC were expected to have at least some elements of 'Swissness' in them. By Swissness we mean, among other things, the comparative advantage and merits of Swiss institutions and technologies. The project managed to fully capitalise on the global leading edge that the Swiss institutions concerned enjoyed, be it MeteoSwiss or EMPA or PSI or the UNIFR and UZH. From this perspective, CATCOS enjoyed an abundance of Swissness!

Hypothesis 3 (corresponding to Effectiveness)
CATCOS has managed to build effective producer-user interface systems in climate observation/monitoring, thus the data generated by CATCOS effectively responds to the needs and demands of users at various levels, also taking into account gender considerations.

The CATCOS programme has enabled creation of awareness at the national and regional levels, for climate observation systems/ climate monitoring, resulting in motivation, leveraging of funding and other support for climate observations towards decision making in adaptation, mitigation and DRR. The project has managed to create the necessary visibility by successfully presenting itself at various opportunities such as station inaugurations, country visits, workshops, conferences etc.

5.41 As both the above hypotheses are inter-connected and relate to one outcome (Outcome 3 on 'user capacity'), they are dealt with together. In the recent years, the user-producer interface in climate monitoring and services has assumed a significant dimension. This is one of the reasons as to why in the frame of the GFCS, the user-interface platform is one of the five key components. The relevant outcome under CATCOS says 'Decision makers and stakeholders are aware of the use and benefits of high quality climate data'. In terms of outputs, they are just two, one which relates to establishment of user interface forum in the form of pilot application for glaciers and the other on successful presentation of the project at relevant opportunities.

5.42 While CATCOS performed well in respect of both the above outputs, the question arises as to whether these two activities/ outputs are sufficient enough to enhance the user capacity or to promote sustained engagement with the users at different levels, to ensure that the supply from CATCOS responded to the nascent/ articulated demands and needs of the users in different thematic areas, at different levels. Obviously not entirely.

5.43 It is clearly the case that many NMHS institutions in charge of weather prediction may not have yet integrated the new GFCS framework (with its pillars including user interface) in their priority actions, which is perhaps a cause for some difficulties in promoting CATCOS activities.

5.44 Notwithstanding the above, CATCOS had engaged with some potential users, making use of available opportunities, be it the station inauguration events or the GCOS/GFCS workshops, summer schools, the launch of the pilot user application for glaciers, or the limited opportunity provided by the visits of the Swiss scientists to the participating countries. However, these were more in the nature of raising awareness of climate observations in general and CATCOS in particular and not so much in the nature of contributing to enhancing user capacity. Also the activities did not cater to any systematic interactions and sustained engagement with the user community at the national or regional level, as this was probably left to the national partners of

CATCOS. And the national organisations did not have the inclination or the funding support to organise this on their own. This probably is one of the reasons as to why CATCOS could not possibly influence national policies, strategies, thinking or approaches in climate observations in any way. Although influencing global, regional and national policies is an important attribute and characteristic of any project in the GPCC arena, the CATCOS project document did not also specifically articulate in the area of policy development at the national level (obviously because of the technical cooperation nature of the project?); yet there were/ are opportunities in this field (eg. national strategy on capacity building for climate observations), which should not have been allowed to let go. A couple of exceptions in this area have been discussed separately under the sustainability elements. At the same time, we will also need to do some self-reflection as to whether our expectations from CATCOS are not unreasonable, in that we anticipate building of capacities in developing countries to move from data observation to full-fledged climate services in a matter of just few years, without a user orientation and engagement strategy in place.

5.45 Thanks to the excellent rapport and goodwill enjoyed by MeteoSwiss and other Swiss partners, the visibility of the project remained high, but only at times. The opportunities for station inaugurations/station visits in countries like Chile, Indonesia and Ecuador were seized by CATCOS to give wide publicity, capitalising on the goodwill enjoyed by the Swiss Missions/ Ambassadors in the respective countries. Similarly, the fact sheets and information brochures by CATCOS were of high quality in that the crucial information on CATCOS could be presented to the general public in precise ways. EMPA was of the view that the use of fact sheets to the local partners was limited and probably this was the reason as to why it did not evoke the interest that we hoped for. The user app has been appreciated for its utility by different user groups. This said, it should also be mentioned that in one case (Chile), the station inauguration related in activities, which stretched the resources of the national partners (also at the request of MeteoSwiss) too high, which prompted them to articulate this point with the evaluation team. This experience holds a lesson for the future in that the cost-benefits/ trade-offs should be carefully weighed, before organising such high profile events.

5.46 A mention may be made here of the inability of CATCOS to make use of a 'Swiss' space in COP21 at Paris to launch the user application for glacier. Instead CATCOS had to settle for the space offered by UNESCO to launch the user application. Maybe there were valid reasons for this. Yet, we see a lost opportunity for SDC here to showcase the significance of Swiss expertise and far reaching contribution of Swiss scientific institutions towards a better global understanding and monitoring of climate information.

5.47 The Swiss missions in the countries of engagement were of the firm view that the initial enthusiasm shown in the organisation of the station inauguration etc. was not followed up by CATCOS. They emphasised the need for the missions to be kept systematically informed (twice a year at least) of the progress of CATCOS, which should help them to take up climate observation matters in respective countries, especially during their periodic meeting with the policy makers at the high level. We feel that this opportunity should be put to better use by CATCOS in that MeteoSwiss as the implementing partner, should endeavour to share six monthly updates with each of the Swiss mission and all others concerned on a regular basis, in order to capitalise on the goodwill and networks. As for example, the Swiss Ambassador in Ecuador, although appreciative of the initial inauguration event, suggested that the Swiss should learn from the example of the visibility and coverage that the similarly placed French Geophysical Mission receives in that

country. The evaluation team would like to suggest a six monthly newsletter to periodically inform the progress/ achievements, not only to the potential users, national organisations concerned, the wider public but also the larger SDC systems and the Swiss missions in the countries and regions concerned.

5.48 Given the fact that women often constitute the majority of the work force in climate sensitive sectors like water resources management, agriculture, forestry etc. climate services should take into account women's needs, priorities, experiences, livelihood activities and specialised knowledge. While recording climate observations or producing climate information is fundamental, but how this is shared and communicated equitably on a local scale is important. Presently, climate information and services are largely gender blind and thus unable to respond to the specific and differentiated needs of women and vulnerable groups. Given this, the evaluation team did not find any reference to gender issues in CATCOS. Even if gender is not included in the design and planning stage, we are of the view that it would be important (especially for a development agency like SDC) to pursue, during the implementation stage of CATCOS, aspects relating to gender sensitive approaches to climate information and services. There is also an encouraging observation. The technician in Colombia is currently training two young women on glacier work and these two have been recommended for participation in the forthcoming workshop in Bolivia.

5.49 The achievement of CATCOS with regard to Outcome No. 3 is moderate, also realising the fact that the scope of activities/ outputs under this outcome were quite restricted.

Hypothesis 4

CATCOS has ensured synergy and complementarity of Swiss engagement at the national/ regional level, with the result the climate information generated by CATCOS has added value to other engagements of SDC in climate sensitive sectors (such as water, sustainable agriculture, DRR, energy, health etc.).

5.50 It would be correct to say that the CATCOS project is rooted in the long history and traditions of Switzerland in providing quality climate observations. MeteoSwiss, as the implementer of CATCOS together with the Swiss implementing institutions had played a crucial role in the selection of different partners (therefore, countries) for execution of CATCOS. While doing so, a few key criteria such as the data deficient zones, existence of prior engagement of Swiss institutions with the national partners etc. were kept in view. On the other hand, SDC's priority countries for intervention in South/Central America are Bolivia, Honduras, Nicaragua, Cuba and Haiti. None of these countries could be considered for intensive interventions as regards atmospheric or terrestrial domain under CATCOS. At another level, while most of the countries chosen are either developing or emerging ones, it will be difficult to explain the engagement of Swiss development cooperation in an OECD country like Chile. Countries like Peru offered good potential for pursuing CATCOS observations in both atmospheric and terrestrial domain. Peru also provided excellent potential for harnessing synergy with SDC funded programmes in the area of Global Cooperation on Climate Change; however the leads could not be pursued possibly in view of the already heavy engagement of SDC in that country and the fact that when CATCOS was designed GPCC could not engage in the implementation of global projects in SDC priority countries.

5.51 In our assessment, in the initial stages CATCOS project certainly had the benefit of inputs and feedback from the various internal divisions within SDC, be it the Global Cooperation on water or food security or other territorial divisions. But sadly, continued engagement of the SDC entities with CATCOS was perhaps not possible, with the result CATCOS failed to capitalise on the strength of SDC's development oriented staffers, be at the head office or in the country offices. Efforts towards establishing bridges with SDC funded projects such as Aire Limpio or the mountain programme were pursued with often encouraging results, but these were not sufficient to exploit the goodwill and visibility that SDC enjoyed in some countries/ regions such as Kyrgyzstan, Uzbekistan, Vietnam and Peru. To be objective, it should be said that the SDC country offices too perceived CATCOS to be an autonomous stand-alone endeavour, driven jointly by the MeteoSwiss and the GPCC, with limited opportunities for development connect.

5.52 The evaluation team observes that in many of the countries, the national partners selected happen to be the NHMS, in preference to universities and academic/ research organisations). We think this was an initial strategic decision for CATCOS for several reasons. There is a widespread belief and thinking globally that NHMS in many developing and emerging countries functioned in their own shell and largely on a supply mode, without so much of an active user interface which is required to ensure that the provision of climate services is consistent with the demands and needs of the users at different levels. Thus the engagement with the NHMS, which are perceived as traditional/conventional agencies and slow thinking/slow moving bureaucratic organisations could be fraught with potential delays and protocols. Yet, in principle we support this strategy for the simple reason that NHMS often is the only agency in many countries which is legally mandated for collecting and analysing climate and weather related information. Looked this way, CATCOS was possibly anchored in the right government organisations, who are also responsible for policy informing/making in the area of climate services. This should prove a key element in sustainability of CATCOS. This said, we should also keep in view the fact that NHMS are institutions which are engaged essentially in service provision. Apart from investing in capacities at the NHMS level, CATCOS should explore the option of ADDITIONALLY involving an academic/scientific institution at the national level (by also involving them in the training activities), to ensure that enhanced national ownership of CATCOS observations. A positive example may be quoted of Vietnam here, where a national level aerosol workshop is planned or Chile where universities are planning to use CATCOS data for climate/ air quality modelling activities.

5.53 We are of the view that probably CATCOS at the national level did not set its vision beyond the NHMS. An opportunity for bringing about transformative changes in the orientation and mind set of NHMS (to make it demand and user oriented) is probably lost in that CATCOS neither had the inclination nor funds to look at the larger picture in the respective countries. There is still time left for CATCOS to link up with all the key national actors who could play a key role in climate observations and climate monitoring, be they producers, processors, intermediaries or users at different levels, both in policies, practice and science. The suggested national platform should be an instrument to engage in this activity on a sustained basis. Such a national platform should not only help in building the requisite awareness on climate observations at the user level (thus creating a demand), but also assist in exploring more opportunities for the national level use of climate observations generated by CATCOS. This will be one important step in linking the partners and the potential users including those at the Government level. A good example could be quoted

of the half day stakeholder workshop convened by NHMS in Vietnam, during the visit of one of evaluation team members to that country.

Hypothesis 5 (corresponding to Sustainability)

Sustainability has been an integral part of CATCOS engagement. The project has ensured sustainability in design, planning and implementation. Also sustainability of activities and in products and processes. The benefits of the project will continue long after the project has ended. Factors influencing sustainability of CATCOS:

5.54 In our considered view, the establishment of significant and long lasting national capacities on a sustainable basis will involve several important parameters/ elements. These will include continued availability of crucial scientific equipment together with requisite supporting infrastructure, sufficient annual budget for maintenance and upkeep of equipment, appropriately trained technicians/ operational staff who should be available for measurements, a system of continuous training leading to a cadre of trained technicians/ professionals in climate observations, continued demand/ need for the observations and information at the global/ national/ sub-national levels, mutually enriching producer-user interface resulting in enhanced demand, national level commitment and ownership of the observations and resultant information and services, a stable policy and strategy regime supportive of climate observations together with availability of financial resources. And finally, for the sustainability to be ensured, the activities under CATCOS should eventually be embedded in a national mainstream programme on climate observations/ climate monitoring.

5.55 The requisite scientific equipment has since been installed in almost all the countries and these have been functioning satisfactorily, barring the odd problems related to electricity supplies (eg Kenya) or occasional breakdown (Vietnam) or software updates etc. The requisite infrastructure (land, building, laboratory space, air conditioning, power generators, electricity and internet connectivity) for establishing the scientific observations have been provided by all the national host institutions. So far, there have been no serious maintenance issues and funding support is provided to this in a limited way from national resources. The communication between the national and the Swiss partners is flowing smoothly, which helps in technical backstopping and effective problem resolution.

5.56 As already indicated in the preceding paras, the national capacities (both technical and to some extent scientific) have been built up substantially for climate observations with regard to the three ECVs. In most cases, the technical persons/ engineers who are associated with CATCOS at the national level are permanent staff of the national institutions, who work part time for CATCOS. They receive continued and highly responsive support from Swiss institutions in terms of preventive/ breakdown maintenance, establishment of data chain, data cleaning, data processing etc. often with remote support through email and WhatsApp. In many cases, the national staff are highly committed and motivated which augur well for overall sustainability. On the other hand, there are question marks as to whether the local funding support will continue to be available on a timely basis for climate observations, in case CATCOS comes to a stop. The various stipulations contained in the MoUs, regarding sustainability of operations by the national entities beyond CATCOS, do not have any legal enforceability. In any case, we are not clear as to whether the responsibilities for sustainability as outlined in the MoUs have been correctly understood by the national partners. The funding issue is especially relevant for calibration, repair, spare parts, staff time, internet packages and for travel costs involved in visiting the far off stations. As the scientific equipment age in time, the maintenance requirements are expected to increase in the next few years. In the atmospheric domain, having additional stations in the same country which

are engaged in collecting observations similar to CATCOS would have been advantageous. We feel that CATCOS could have encouraged and motivated the governments concerned to set up additional stations, funded out of national resources.

5.57 Having said this, we observed a good example of sustainable interventions in Ecuador, which may be worth replicating in other countries, as potential good practice. INAMHI, the international partner in Ecuador, perceives the support extended by CATCOS for training in glacier monitoring as excellent, effective and relevant. The hydro-meteorological equipment supplied in the frame of the project is put to good use. They have four staff members whose capacities were built under CATCOS and who are committed to continue the glacier measurements. Even at the technical/ coordination level, there is backup support, just in case one of the two persons associated with CATCOS leaves the organisation at some point of time. INAMHI feels they are now not only more confident, but are also autonomous in glacier measurements in terms of being capable to share the measurements with WGMS, directly. The data that they generate, with strong national ownership, is used in academic studies/ research at the national level in a limited way.

5.58 INAMHI are confident of continuing the good work, even if CATCOS comes to a halt in the near future. This is possible by potentially embedding CATCOS activities into one of their national glacier programme on glaciers. They have a clear vision and road map of sustainability, in also extending the measurements to other glaciers within the country. Apart from meeting the costs of current CATCOS staff (who in any case are only partly engaged), they also have a budget for the field missions of the staff. Because of the global visibility and credibility that CATCOS has brought them (as in many other countries), INAMHI has been able to leverage additional national funding and they are also in the process of seeking funding from Inter-American Development Bank for continuing their work not only in Ecuador, but also in offering technical support to other countries such as Peru, Colombia, Bolivia etc. Their confidence levels are high, in that in 2014 they trained a group of professionals from South Asia on glacier monitoring. One of the most notable features of sustainability is that the project/ INAMHI has been able to generate considerable interest of Quito Water Company (which captures water from the glacier concerned) in the glacier data generated, towards systematic planning processes for estimation of water supply and use. The only sticking point in Ecuador is that the National Department of Environment / National Planning Department are not seeking any data from INAMHI for use at the national level. That said, it may not be fair to attribute all good results only to CATCOS, as Ecuador has over 20 years of international engagement in glacier research, including with France. It will be fair to say that CATCOS managed to germinate in a relatively fertile Ecuador soil. The other CATCOS countries with engagement in terrestrial domain may take a few more years to achieve the progress which is currently visible in Ecuador.

5.59 Except for the example quoted above and the experience in Indonesia (quoted elsewhere), the available evidence is sparse as regards the application and use of CATCOS observations at the national level, although the national partners often talk of the potential for effective use of CATCOS data at the national and regional levels. Under normal circumstances, besides the academic research communities, one would expect one of the primary users/ beneficiaries would be the nodal agency/ Ministry for climate change (in many countries Ministries of Environment). However, we did not find any reference to CATCOS generated observations in any of the respective countries' communications to UNFCCC or the National Adaptation or Mitigation Programme/ Plan of Action. It is interesting to note that CATCOS activities cannot be found

through searching in the internet pages of many national partners, showing that implementation of resolutions 40 and 60 of the WMO congress may not be yet considered priority actions of those partners

5.60 On the contrary, in the case of Kyrgyzstan, the National Agency for Environment Protection (which is responsible for interface with the UNFCCC etc.) maintained that they were not even aware of / not getting any glacier related data from CAIAG which could otherwise go into the national level planning documents. This observation of the national agency was made in the presence of a representative of CAIAG.

5.61 In countries such as Ecuador or Chile, we were informed that there is no specific demand or request for CATCOS data at the national level, especially by agencies such as the Ministry of Environment. These national institutions are otherwise heavily engaged in coordinating activities relating to climate compatible development. This relative lack of interest or motivation does not portend too well for the sustainability of CATCOS observations. This would be partly understandable with regard to GHG or aerosol data, given the very long term nature of the changes involved. On the other hand, the inability of the nodal agencies to access climate observations under CATCOS as for the glacier related data (from CAIAG in Kyrgyzstan) was very difficult to explain. One of key reasons for this, in our view, is the failure of CATCOS project at the national level (either by the national organisations or by visiting Swiss scientists) to engage meaningfully and productively with key actors at the national level on a consistent basis, Maybe a well thought out communication strategy could be of help, together with more intensive and productive engagement at the national level. On the other hand, MeteoSwiss was of the view that the national partner is/ should be responsible for effective communication, user interface and engagement at the national level. Apparently, some clarity is required here on the specific roles and responsibilities of the various partners under CATCOS.

5.62 To be fair, it should be stated that in a few countries (Vietnam, Kenya, Ecuador, and Chile) there could be potential for the CATCOS data to be used by the research and academic organisation/universities or by donor assisted projects (eg. World Bank assisted projects in Kyrgyzstan). But this potential is yet to be fully realised, although in case of Chile there are some strong signals to this effect. On the other hand, if the academic and research organisations in some of these countries were to procure the data from the NHMS (eg. Kyrgyzstan, Kenya), they will need to 'buy' the same. As for example, the person in-charge of the nodal agency for climate change In Kyrgyzstan mentioned (again in the presence of CAIAG representative) that when they had sought some data from CAIAG in the past, they were asked to pay up for this. According to them (the national agency), this was simply unacceptable. We also have evidence to show that in a few cases, there are simply no takers for the data at the national level. In case of Kyrgyzstan, CAIAG informed us that in spite of pro-active efforts from their end, they are unable to create demand for their glacier data nationally or regionally. In case of Chile, we were told that they have not been using CATCOS data at the national level, except providing this to University of Chile (Centre for Climate Resilience) occasionally. All this is not to imply that there is no 'need or use' for the CATCOS data at the national level; it is just that the project has not managed to fully identify the users or generate value for CATCOS data or catalyse the conversion of the latent demand into an articulated demand.

5.63 One of the observations made by all CATCOS partners was that it normally takes around ten years for the glacier related measurements to stabilise. While the glacier related data can be put to good use in the short/medium term for water resources planning at the country or at the regional level (including the downstream countries), the potential for 'development' related utility of GHG and aerosol data in the short/ medium term was stated to be rather limited, by the very long term nature of the observations/changes involved. This remark of ours should also be seen against the observation of one of the Swiss partners dealing with glaciers 'Glacier monitoring is purely a scientific activity and therefore there are issues of funding'[5]. All this clearly shows that the Swiss partner organisations themselves, though convinced of the multiple applications of CATCOS observations, were not fully on board with regard to the 'development' related applications of CATCOS.

5.64 In some countries like Kyrgyzstan, the reason for the nodal agencies for climate change not making effective use of the climate observations generated by CATCOS (or simply not acknowledging the existence of standard data on glacier measurement in their own country) could also be attributed to the respective national laws/ legislations/ regulations. As for example, we were told that it was the mandate of the Kyrgyz Hydromet and not any other organisation to produce the glacier data in Kyrgyzstan, whereas under CATCOS, it is CAIAG which is engaged in glacier measurements. Actually CAIAG may be one among the several national correspondents/ observers accredited by WGMS for quality controlled data on glaciers. We are of the view that in this case, efforts could be intensified under CATCOS to convince the Kyrgyz Agromet to delegate this responsibility to CAIAG, which would ensure that the observations produced by CAIAG would be accepted as 'legitimate' and thereby nationally owned.. All this goes to highlight the importance and significance of the national level nodal organisations (for climate change/climate observations) to be fully engaged in the frame of CATCOS, to ensure adequate ownership, which will ensure sustainability and effective use of the information at the national and sub-national level. A similar situation for glacial monitoring was reported in Peru (although not a CATCOS country for observations) where ANA (the National Water Authority) and a new institute on hydrology were in a conflict situation with SENAMHI, which is NHMS.

5.65 It will be fair to say that the value of atmospheric observations (or for that matter environmental observations in general) will go up with increase in spatial/ geographic coverage of the measurements. CATCOS measurements are relatively recent and are organised in countries where the capacity to use this information is still developing. In the long term, the users are likely to be motivated to invest time and resources to develop tools and methodologies for making effective use of the observation data. Till that time, the users could be expected to be research groups, who get their model outputs from the world data centres.

5.66 The efficient use of GCOS information by Ministries / Governmental Agencies requires some level of integration to transfer data into potential services to society. To be fair, it is not straightforward and, in most countries including in Europe, often requires specific unfortunate circumstances such as environmental crisis to be put in place. A good example is the capacity of

[5] MeteoSwiss, after consultation with the implementation partners for the glaciers, provided a feedback on this to the effect that while the mass balance measurements themselves are clearly scientific work, the Swiss as well as the national partners are well aware of the fact that glacier data can and will be used for eg. hydrological models or DRR.

the Indonesian partner to communicate CATCOS results during biomass burning episodes affecting the region. Wherever CATCOS measurements were monitoring background conditions, throwing light on the project and potential for supporting national responses under GFCS were more difficult.

5.67 The dual domain approach (tackling atmospheric and terrestrial domain in the same country) was evolved during the second phase of CATCOS. We have already commented on this approach elsewhere in the document. In the absence of any established platforms at the national or regional levels, where the teams could come together and interact regularly and systematically, it is not clear as to how the concept of dual domain was practically operationalised. In fact, in Kyrgyzstan we found that both the domains did not interact that well, beyond just knowing that they are all part of CATCOS project.

5.68 What if CATCOS comes to a close tomorrow? It could be true that in some countries CATCOS activities are well established and they will (at least in theory) be able to continue generating the data, analyse the same to the extent possible and share it with the world data centres. However, the devil lies in the details. If CATCOS were to stop tomorrow, the observations in Chile may get discontinued in the next few years[6], as they do not have a strong ownership for this data nor this activity is stated as their area of priority; additionally the relationship of the local stations with the management in Santiago is not on strong pedestals. In Vietnam, there is a strong interest in continuation of climate observations beyond the life of CATCOS; yet there are several obstacles to it, both financial and institutional. The national partner had indicated that raising new funding for CATCOS from within the country is a tough proposition, especially considering the huge costs involved for the periodic visits of the technicians (the station is located over 400 kms/10 hours away from the national capital in a remote area). The Vietnam partners were of the view that without calibration support and periodical trouble shooting from Swiss partners, the sustainability is weak. Also, they may not have local funds to support in case some expensive part of the equipment needs to be replaced in future. The story is the same in Kyrgyzstan as regards terrestrial domain as indicated below. As regards atmospheric domain in Kyrgyzstan, the equipment will be installed only in the middle of this year, which means the national partner will go without or with very limited EMPA support after initial installation.

5.69 In Kenya, we were told that CATCOS observations will continue at Mt Kenya (for aerosols), because the Government is committed to continue the activity. However, the representative of the partner institution in Kenya indicated that there could be delays in receipt national funding, which may hamper the observation process in the interim. Even now (when CATCOS is still ongoing) there are problems relating to funding delays in timely purchase of internet (3G services) packs, often impeding the real time transmission of data. CAIAG, the Kyrgyz partner for measurement of glacier data has the requisite skills, capacity and motivation to continue the measurements and even mentioned that the work will continue, CATCOS or no CATCOS. But during detailed discussions and on close questioning, they admitted that the glacier measurements are now possible because of the periodic visits from scientists of UNIFR, who do the measurements on behalf of CATCOS. If CATCOS stops funding CAIAG, the local scientists do not have requisite funding for undertaking visits to the glaciers every year. CAIAG had indicated

[6] MeteoSwiss subsequently informed us that the issue of continuation of national support of Chile for CATCOS observations is being taken up with the Peruvian authorities, through the good offices of WMO.

that even if a fraction of money that is now spent on visits of UNIFR scientists to Kyrgyzstan is passed on to CAIAG instead, they will be in a position to continue the glacier measurements without any interruption. In Colombia the measurements will continue, as the Met Service understands and commits itself to the same. However, the budgets assigned have been cut drastically, making it very difficult to repair anything that could break down in future.

5.70 All the evidence goes to prove that barring a couple of countries (eg. Indonesia, Ecuador), the systematic long term climate observation and process of transmission of data to world data centres may suffer a big jolt if CATCOS is discontinued without embedding the same in a suitable national programme. In Indonesia, there is a good possibility of CATCOS observations not only continuing, but also being strengthened, even without external support. This is not only due to the motivation and interest of the Government, but their keenness, need and desire to observe aerosol and black carbon which has close links to forest fires. The national partners have been producing black carbon graphs, which are in demand even by the media. Thus any discontinuation of the aerosol observation process may invite negative criticism from several quarters, including the Government.

5.71 Swiss institutions (EMPA/PSI and the Universities) have made it clear to us that their support to observations in the framework of CATCOS so far, has been in far excess of what is expected of them based on the financial support received. Many of them have indicated that their current level of support to the national partners under CATCOS will not continue if funding comes to a stop. As for example, it will not be possible for EMPA to organise support visits/ audit visits to countries nor provide instrument repair support as being done presently. If CATCOS concludes, probably EMPA and PSI may still offer some occasional help/ remote advice on backstopping on a sporadic basis or help conclude a tie up that may be available under GAW-TEC. However, we realise that this alone will not be sufficient to sustain and continue CATCOS observations at the national level.

5.72 Mobilisation of resources for continuation of observations post-CATCOS: We observe that many of the national partners do not currently have any plans to organise mobilisation of funds from alternate sources, for continuation of CATCOS observations. We also found that there is a realisation among some national partners that CATCOS may not continue beyond the current phase. This impression was supported from the observations made by Swiss partners. Some countries like Vietnam have already started looking for support through alternate/ additional funding resources and in fact they requested us (the evaluation team) to connect them with the other potential donors. Some national partners like CAIAG may still be in a positon to mobilise funds from other sources, owing to their diverse 'donor basket' in Central Asia, especially in sectors such as glaciers, water resources management etc. CATCOS could explore the potential for joint proposal writing to seek funds for climate observations by the national stations. This could facilitate some of the national institutions to advance credible proposals to donors/ international funding organisations, for climate observations. This could be even thought of as a regional level (as for example, Uzbekistan and Kyrgyzstan joining hands for glacier monitoring). It is clear that the lack of demand for using CATCOS data by academic institutions in many countries may/will limit the willingness of national partners to take up responsibilities, whenever additional investment will be needed at observation sites. As mentioned in preceding paragraphs, this will inevitably occur in the next 5 to 10 year, given the expected lifetime of instrumentation.

5.73 CATCOS and Institutional Anchoring: The Evaluation Team also observed that in some countries the institutional anchoring of CATCOS was relatively weak. In countries such as Vietnam and Chile, the progress of work of CATCOS largely depended on specific individuals (who had strong commitment to CATCOS) being in place, which again is not a good situation for developing sustainability. In Chile, we were told that the observations would probably continue only so long as two specific technicians/ engineers remained in their current positions. It is, therefore, vital that CATCOS should look for strong institutional anchoring in mainstream Government programmes in order to ensure sustainability of the efforts initiated under CATCOS.

5.74 Development disconnect of CATCOS? This question can also be asked in a different way which is 'What is the 'development' related appetite of the Swiss and national level partners under CATCOS'? We realise that SDC started funding CATCOS at a time when additional funding support (to climate change) started flowing into the Swiss system through 0.5% bill, with the mandate to develop initiatives with true global dimensions in the area of climate change, also possibly with high content of Swissness. MeteoSwiss capitalised on this opportunity to lead CATCOS project. The project benefited a great deal from the familiarity and credibility of MeteoSwiss, which helped in the choice of (in most cases) NHMS as partner in most countries. Except possibly for SDC, CATCOS was driven by global as well as national institutions, outside the familiar circle of development cooperation.

5.75 In fact, the Swiss institutions perceived CATCOS primarily as technical assistance venture in capacity building, bordering on scientific cooperation, with some weak development connections. In the second phase, some development components were sought to be added in the form of 'cooperation capacity and 'user capacity', but then it was a case of too less and perhaps too late. Even in the case of glaciers, where the measurements would have been of direct significance to determining vulnerability to extreme events and estimating the run off and thereby designing and planning for water and energy resources in the larger river basins at a regional level, the development connections were not pursued to their logical end, probably because the overriding emphasis given to capacity building activities for ECV measurements.

5.76 While the project was primarily anchored in the overall GPCC objective of contributing to innovative knowledge and information in the area of climate change, the agenda of WMO (especially as it related to the more scientific observation pillar and not the entire range of activities in the area of climate services) was taking precedence. With the result, the cooperation and user elements remained subdued and were pursued only to a very limited extent in the second phase, with extremely limited scope and ambition in both the cases. An important exception is the development of the user application related to glaciers which certainly has created huge awareness among the experts as well as the general public.

5.77 And finally we come back to the same question that we asked earlier. Which lens should we use to observe CATCOS? The evaluation team has learnt from several of the partner organisations that it would take several years for climate observations in respect of the three variables to stabilise. Further, even after the observations have started flowing to the world data centres, it will take at least 4-5 years for the benefit to be fully realised at the country level, especially in respect of the ECVs of the atmospheric domain. This brings us to the point as to whether the achievements of CATCOS should be seen through the lens of benefit to global level scientific monitoring of climate or should they be pursued through the development window with local

benefits. If the assessment is from the point of view of achievement of national capacities for global scientific observations, CATCOS has fully and comprehensively met its objectives, although the project in its second phase is still some distance from achieving sustainability. No doubt, immediate beneficiaries are the implementing scientific institutions which publish the results and the benefit to the national institutions will be perceived to be relatively low in the short term.

5.78 Even if the development mandate of SDC restricts it from freely funding technical scientific cooperation projects such as CATCOS, the initiative has made sincere attempts to fill in significant knowledge gaps in the area of climate observation, focussing on three key ECVs. The importance of CATCOS can be gauged from one of the observations that Mount Kenya is the only global GAW station which is currently functioning for the whole of eastern and southern Africa and this station may go silent if SDC's current contribution to CATCOS is brought to a close now. For wholly understandable reasons, there are not many bilateral or multilateral development organisations which would be coming forward to support activities in climate observations for ECVs, especially if the return on investment on such observations take a few years to realise. Also, SDC will need to assess and if required recalibrate, its engagement with WMO (on whom Switzerland has invested substantial resources) in the context of climate services, which has emerged as an important cross cutting area globally in the frame of climate change. A significant achievement of CATCOS as regards SDC is the opportunity to work together with WMO, in a productive and rewarding relationship. And how would SDC want it to take this to the next level?

Hypothesis 6 (corresponding to Efficiency)

CATCOS activities were efficient and the objectives were achieved in time. CATCOS related interventions remained efficient compared to alternatives

5.79 It should be admitted that the CATCOS activities did indeed suffer from late start in some countries, owing to delays in the conclusion of agreements/ MOUs, especially in the first phase. For an ambitious project in the new area of climate observation, spanning several countries, such delays are not completely unusual. The delay had occurred despite the best of efforts put in the Swiss implementing agencies and therefore was beyond the control of the project management. Our discussions with SDC and MeteoSwiss revealed that CATCOS was implemented with due care for efficiency, including cost efficiency and there are no audit observations or concerns.

6. RECOMMENDATIONS

6.1 The various recommendations of the evaluation team will have to be seen in the context of the findings, analysis and lessons learnt outlined in the previous chapter. The evaluation team is given to understand from SDC that there will not be CATCOS III, in the sense of continuation of CATCOS II. Hence, under normal circumstances one could consider any 'recommendations' from the evaluation team to be of value and utility, as less than a year is left for the extended CATCOS II to conclude. Notwithstanding this situation, we wish to highlight and provide here key recommendations emanating from the review, as we are of the opinion that many of the suggestions would be useful to any successor programme of CATCOS or in the event of continuation of CATCOS activities in the frame of another programme on climate services.

6.2 We are of the considered view that the CATCOS project has been addressing significant information and knowledge gaps in the area of global scientific observations of climate, by enhancing the capacity of the national institutions of developing and emerging countries in data-sparse regions of the world. At the same time, CATCOS has also been motivating the national partners to make effective use of the observations/ climate information at the country level. Notwithstanding the shortcomings witnessed in a few areas, we recommend that CATCOS should be pursued to its sustainable and logical end, riding on the back of the high competence of the Swiss science institutions as well as the achievements made so far, while effectively addressing sustainability issues relating to user interface, enhanced national anchorage, ownership and engagement in more focussed ways.

6.3 If the ambitions of CATCOS for promoting regional cooperation (cooperation capacity) and user capacities are to be fully realised, the breadth and intensity of efforts and comprehensiveness of measures designed to achieve these will need to be pursued at a much higher level. If regional cooperation efforts are to succeed, they should ALSO be embedded in the context of regional strategies and engagement of SDC (either under GPCC or under Regional Cooperation), say in the Andes or in Central America or in Africa, in thematic areas of water resource management or food security/ sustainable agriculture or more importantly DRR.

6.4 It is also for consideration and decision if the regional cooperation ambitions of CATCOS could be restricted (at least for the time being) to just one or two regions at the most. Efforts in the direction of promoting regional cooperation should actually begin with a regional vision and clear and unambiguous assessment of regional requirements and needs of constituent national entities in climate monitoring, which can be met through value addition in regional engagement (and not just multi-country efforts).

6.5 The evaluation team is of the view that more focussed engagement in one particular region should be considered, as for example in Central Asia in the context of glacier observations and even atmospheric observations and their implications for water resources planning and management at the regional level. Such an effort, extending to countries such as Kyrgyzstan, Kazakhstan, Uzbekistan, Tajikistan etc. could be more purposeful and mutually rewarding. An alternative would be to ensure that CATCOS aligns itself with the GPCC's engagement in Andes region in South America, which should help CATCOS to get better connected regionally, including Peru. Among other things, this step will help in ensuring that the various initiatives supported by

SDC in a particular region mutually enrich and potentiate each other, making full use of the already established networks and contacts.

6.6 The subject of climate observations/ climate information intersect key climate-sensitive sectors like water, agriculture, energy, DRR, health etc., hence the regional cooperation efforts on climate monitoring/climate services will probably stand a better chance of success if they ride on flagship regional initiatives in areas such as water, food security or DRR. As for example, Central Asian Water Resources Information Systems / Central Asia Energy and Water Development Programme. This will help in clearly demonstrating the value and utility of climate observations/ services to the users concerned and help focus more on user orientation and demand side.

6.7 CATCOS should explore more efficient and effective means of installing the sophisticated scientific equipment in the respective countries, stretching the resources of the Embassy/SDC offices minimally. We refrain from making any generalised suggestions in this regard as various options will need to be developed and evaluated based on the national laws, contexts and circumstances. In any case, the equipment has been installed in most countries already, barring Kyrgyzstan and Uzbekistan. Any follow up programme will face the issue of instrument failure/replacement, which hasn't been provisioned in CATCOS 1 and II.

6.8 In countries where minor/ major interruptions have been witnessed (eg. Kenya, Vietnam, Chile) to the ongoing measurements, MeteoSwiss should take this up with their counterparts in the partner countries expeditiously, not only through the umbrella of WMO based interactions, but also making effective use of the goodwill of local Swiss missions (who often have high Ministerial level contacts) as well as the SDC elements in the respective country.

6.9 CATCOS should consider developing a vision/ concept for capacity building/ human and institutional development, in the area of global climate observations, in coordination and with inputs from the national partners concerned and potentially in cooperation with other initiatives. Such a concept should be accompanied by a well thought out action plan at the national level, also keeping in view the special circumstances and context of different nations. This should result in the creation and maintenance of a specialised cadre of trained technicians and operational staff, with the right orientation, attitude, motivation, skillset and capacities. CATCOS should organise training (just not on-site) courses at the country level with the participation of the Swiss scientists, benefiting more technicians/ operational staff. The option of offering stay visits in Switzerland could still be maintained, but in exceptional cases where a clear value addition is seen.

6.10 Independent of selecting only one or two regions for climate observations supported by SDC in the future, for ensuring the sustainability of its current investment in CATCOS, MeteoSwiss/ other Swiss institutions should continue to closely hand-hold the national institutions and support monitor the quality, completeness and timeliness of the data that goes into the world data centres, till the time the national entities feel fully confident and empowered to organise this on their own.

6.11 The Swiss institutions should support the national partners more intensely in the latter's effort to proactively reach out to the other national stakeholders, notably networks in climate observations/ climate information. The stakeholders in climate sensitive sectors like water,

agriculture, DRR, energy and health at different levels should be selectively targeted, as potential users of climate information and climate services. Two of the most important organisations to engage with at the national level will be the nodal agency/ Ministry concerned for climate change, which in most cases is the Ministry of Environment as well as the national planning ministry. Such an engagement with the stakeholders should be on a systematic and sustained basis, which should also enable CATCOS to contribute to policy development elements at the national level towards climate observations/climate information (eg. policy on climate services). CATCOS should cater to provide funding support to such activities, with equal/ matching counterpart contribution coming in from national level partners.

6.12 Stimulating the demand for climate observations/ climate information of the kind provided by CATCOS at the user level in the countries concerned would be crucial and towards this end, CATCOS institutions should keep a close watch to ensure that climate observations are put to good use in all the national level communications on climate change eg. national adaptation plan, national adaptation plan of action, national mitigation plan, national communication to UNFCCC etc.)

6.13 A dialogue platform at the national level has been proposed by us, with the national partner leading the process that should help CATCOS to intensify its efforts to link up with producers, processors and potential users of climate observations/information at the national level on a sustained basis. And this should cover the policy, science/research and practice arenas. Such a national platform should help in building up the requisite awareness at the user level and help in articulating the needs/ demands of the users better in terms of climate observations/ climate information.

6.14 The Swiss partners of CATCOS would do well to organise some self-reflection on the utility of dual domain approach in different countries and take practical measures to selectively exploit the synergy and complementarities of the two domains with mutual enriching of knowledge and networking. A number of issues could be used for implementing dual-domain approaches in pragmatic manner eg. black carbon as climate forcer.

6.15 The concept of summer schools on glacier/atmospheric monitoring held during the first and second phase of CATCOS should continue, as a measure for promoting capacity building, lessons learning, knowledge exchange, sharing of expertise and networks. High impact is expected if summer schools are held in association with regional programmes and not as stand-alone CATCOS activities.

6.16 We recommend a clear communication and outreach strategy to be developed under CATCOS to ensure effective sharing of lessons, experiences and knowledge with stakeholders across the nation/ region, but also to ensure maximum visibility of Swiss efforts in the area, capitalising on the goodwill of the local Swiss missions as well as SDC elements. CATCOS could come out with regular six monthly newsletters, providing information about the achievements and progress, aimed at a wide range of stakeholders globally and nationally, including wider SDC thematic networks, Swiss missions, public and policy makers, wider public and potential users at the national level. We also recommend to maintain good level of cooperation with the other international partners involved in capacity building/development activities in the country.

6.17 Although the station inauguration visits have resulted in visibility, rapport and goodwill for CATCOS, the cost benefit aspects (including for host governments) of such high profile events will need to be carefully evaluated before proceeding to organise them. This suggestion is also keeping in view the ephemeral and effervescent nature of the visibility often created out of such high profile events.

6.18 We all agree that CATCOS is a complex project, functioning in diverse national contexts and circumstances, spread across the regions of South America, Africa, and Central/Southeast Asia. At the formal level, the Steering Committee, consisting essentially of the Swiss partners, meets on a six monthly basis to provide a broad direction and guidance to the project and approves annual plans/ progress reports etc. We are of the view that the project stands to benefit a great deal from a project advisory group, which should be drawn from several stakeholders in Switzerland/Europe, with the view to provide advice and suggestions and help promote learning and knowledge sharing. Such an advisory group should include representatives from the other domains of SDC (water, agriculture, health, DRR) as well as regional cooperation, capitalising on the strength and expertise of SDC staffers. This process should also help to establish effective bridges with ongoing SDC programmes and their networks at the country level, which can benefit CATCOS immensely.

6.19 At the national level, CATCOS is currently engaged with the NHMS as a partner in most countries. However, CATCOS should explore the option of additionally involving the academic/scientific institutions in its training activities, which will help in enhanced availability of scientific advisory support at the national level, long after CATCOS has concluded.

6.20 There are question marks in some countries as regards provision of adequate budget at the national level for repairs/ spare parts, internet connectivity, maintenance, staff time, travel costs etc. for continuation climate observations on a sustained basis. MeteoSwiss should take this issue up, wherever required, with the respective national partners/ Governments, especially in the context of the national responsibilities and commitment towards WMO related activities and ensure provision of requisite financial resources by the national governments.

6.21 CATCOS should go about building the capacity of the national partners in preparing suitable proposals, seeking funding from national/ regional / multilateral development organisations/ banks engaged in climate information/ services. Thus CATCOS should actively support the national partners in mobilisation of funding support for continuation of climate observations. We recommend that any follow-up programme investigates as to how funding can be raised through post-COP21 agenda.

6.22 One of the best measures that CATCOS can think of in ensuring sustainability is to see if climate observations currently done under the project can be suitably embedded on an ongoing national programme on climate observation/ climate information. CATCOS should make special efforts in this direction. The platform of CATCOS has enabled SDC to develop meaningful, productive and rewarding relationship with WMO in the larger area of climate services, which is gaining considerable importance in the context of climate change. How would SDC want it to take this relationship to the next level?

TABLE1. RELATIVE SUSTAINABILITY OF CATCOS ACTIVITIES ACROSS DIFFERENT COUNTRIES AND PARTNERS

WMO region	Country	Domain (AD/TD)	Name of the partner(s)	Swiss Partner	Capacity Building indicator	Dual Domain	Strenghts	Opportunities	Weaknesses	Threats	Overall relative sustainibility ranking
II	**Uzbekistan**	TD	UZHydromet	MS/ UF	NA	NA	• Willingness to cooperate	• Lack of observations despite large glacierized areas • Impact on Aral sea • Potential to collaborate with Kyrgyz Republic	• Training is only planned at this stage	• Implementation of CATCOS comes at a late stage • Training may not be completed before end of current phase	★★
	Kyrgyzstan	AD	Kyrgyzhydromet	MS/ EMPA	NA	Dual domain was only discussed towards the end of phase II; also has not taken roots. Too late for practical actions to be measurable	• Willingness to cooperate	• Lack of observations in the area • Possibility to implement dual-domain approach	• on-site Implementation not initiated. Equipment yet to be installed. • Training yet to commence	• Limited training of technical staff • No clear indication for continuing support to AD operations	★★
		TD	CAIAG	MS/ UF	★★★		• High-level training both technical and scientific, established institution • long-term cooperation with CH. • Motivated scientists with intense engagement. • Cooperation with international partners	• Linkage with societal challenges in the country. • The country's role in water supplies in Central Asia most crucial • Possibility to implement dual-domain approach	• Difficult access to some areas; may lead to abandoning of observations of some glacier monitoring, post-CATCOS. • Difficult relationship with nodal agency for climate change	• Difficulties between KG partner institutions in the country. No clarity on roles and responsibilities. • Need for country level mandate from Govt.	★★★★

	Vietnam	AD	NHMS	MS/ PSI/EMPA	★★	NA	• Good technical training • Willingness to cooperate • Keen to set up additional stations	• Lack of observations in the area • Air pollution is a major issue.	• Technical training performed but limited scientific training of NHMS operator	• No clear information about national funding in support of CATCOS. • Clear benefits of CATCOS yet to emerge at national level	★★★
V	**Indonesia**	AD	BMKG	MS/ PSI	★★	NA	• Strong technical knowledge • GCOS recognized as a priority in BMKG agenda. • Clear benefits seen of aerosol data nationally. • Long-term collaboration with Swiss institutions	• Atmospheric hazards (forest fires in Indonesia) provided the right opportunities to communicate about CATCOS. • Established demand for CATCOS data	• Technical training performed but limited scientific training of NHMS operator	• No clear roadmap for National support in the medium to long-term	★★★★
III	**Colombia**	TD	IDEAM	MS/ UZ	★★		• Strong technical capacity • Importance of glaciers for water resources	• User-communities identified • Potential cooperation with other Andean countries • Potential cooperation with international initiatives	• Difficulties to access some glacier areas • Only one glaciologist in the country	• Difficulties to proceed monitoring of some glaciers without additional national partnerships	★★★
	Ecuador	TD	INAMHI	MS/ UZ	★★★	Missed opportunities to implement dual-domain approach	• Strong scientifc and technical background • Capacity to raise funding at regional scale. • Clear demand for CATCOS data eg. Quito Water Company • Good collaboration with other international partners	• Capacity to use advanced exploration techniques • Capacity to act as a regional center for training • User-communities identified. • Potential cooperation with international initiatives	• Limited number of national research institutions involved besides INAMHI	• No real threat identified besides potential budget restriction	★★★★★

	Chile	AD	DMC	MS/ EMPA/P SI	★★	Dual domain approache s could have been proposed given the advanced communit ies working in TD	• Strong technical capacity to operate the station • Good number of staff trained	• Very few observations are avaialble from this area	• Academic partners could have been involved in Phase II. • Poor rapport between station and headquarters, • Low level of interest in the CATCOS observations at headquarters	• National commitment not available yet for continuation of CATCOS activities	★★
I	**Kenya**	AD	KMD	MS/ PSI	★	NA	• Long-term cooperation with EMPA and MS. • Academic organisations showing interest in CATCOS data	• Government committed to pursue observations • Very few observations available from this area • Link to air pollution issues in East Africa	• Limited number of people trained for CATCOS. • Recurring infrastructure issues • Communication constraints	• No clear idea of the willingness of KMD to maintain CATCOS operation in the medium to long-term	★★

NA : **not applicable**

Capacity building level

★ Capacity building First stage achieved (capacity to operate the equipment, standard operating procedures)

★★ Second stage of capacity building achieved (data processing and limited data analysis)

★★★ third stage (scientific analysis of information and publication in leading journals, leading to recognition and empowerment)

Overall relative sustainability ranking

★ poor chances of sustainability

★★ unlikely to be sustainable

★★★ Reasonable chances of sustainability

★★★★ good chances of sustainability

★★★★★ Excellent prospects for sustainability

ANNEXES

ANNEX 1. TERMS OF REFERENCE OF THE CONSULTANCY ASSIGNMENT

External Evaluation of the Project CATCOS (2011-2016)

Project Title:	CATCOS
Country:	Global
Organisation:	SDC
Duration of Evaluation:	40 days (tbc)

1. Purpose of the evaluation

This end-of-phase evaluation aims at providing an objective assessment of SDC's engagement on enhancing climate data and services as a key component for effective climate change adaptation at different levels. It is expected to provide

(1) a *critical external view* on the ongoing implementation of the CATCOS project and its main achievements, as well as

(2) *strategic inputs* into the formulation and design of a future programme of SDC's Global Programme Climate Change focusing on climate services for sustainable development (2017 ff)

In practice, the evaluation is expected to provide insights into the effectiveness and efficiency of results, relevance and sustainability of the CATCOS project, together with lessons learnt and experiences gained.

Based on this, the evaluation will

(1) provide evidence on the added value of high-quality climate data and services for activities at different levels (local-global)
(2) highlight key components for sustainable climate data and service provision
(3) provide guidance for designing a new programme on *climate data and services for climate change adaptation* with a particular focus on key SDC target regions (e.g. Africa) and contexts (e.g. mountains)

2. Context

Climate change is seen as one of the greatest threats to all development objectives as it has the potential to undermine all three dimensions of sustainability, not least due to the fact that climate and environmental changes have a direct influence on the resources of tomorrow. According to IPCC's latest assessment report, the human influence on the climate system is clear and the continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. This is particularly worrying, since the expected impact of a changing climate is thought to be worst for the poor and the vulnerable: Developing and emerging countries are among the most vulnerable to climate change, and according to the World Bank, climate change is thought to increase the costs of development in the poorest countries by between 25 and 30 percent. It is thus evident that building climate resilience should be a key element of the development agenda.

A sound information and knowledge base, derived from high-quality climate data, is essential to tackle the challenges related to climate change. Systematic, long-term monitoring of the climate system is not only a fundamental prerequisite to understand both its change and the resulting consequences, but it is a key prerequisite for decision making at all levels. On the one hand, all major climate

projections are derived from simulation models which rely on observed global climate data. Thus, any climate projection, on whatever level it might be, finally depends on the level of accuracy achieved by the collection of the used global climate data sets. On the other hand, climate data is directly relevant to local decision making, since it provides the basis for adaptation plans and implementation at all levels, including natural hazard, risk and vulnerability assessments as well as early warning systems. Thus it has a direct link to highly relevant policy areas such as water management, agriculture, disaster risk reduction (DRR) and health.

Given the importance of such high-quality climate data, systematic and long-term observations are indispensable, focusing on a subset of the most relevant Essential Climate Variables (ECVs) as defined by the Global Climate Observing System *GCOS*[7]. These ECVs include greenhouse gases and aerosols (atmospheric) and glaciers (terrestrial) as key indicators and support i.a. the work of the UNFCCC and the IPCC. However, the availability of high-quality climate data including ECVs is currently limited, particularly in developing and emerging countries. As an example, the global coverage of key glacier measurement series is currently biased towards the Northern hemisphere. Whereas in some regions of the world, glacier measurements have only started recently, other regions like Central Asia once had a system of high quality measurements in place, which, due to the political changes in this region, was abandoned at the end of the last century. Since such glacier measurements can provide an extremely useful basis for local adaptation planning, the re-establishment of long-term data series responds to a primary demand of local and regional decision makers. Additionally, such data contributes to a better understanding of climate variability and change at the global level, including extreme value statistics and can be used as a major indicator for climate change at global, regional and local level.

There is thus a *clear need to improve the data base* on ECVs in developing and emerging countries, which can be achieved by supporting such countries in developing both the operational and institutional capacity of target institutions to make more reliable, high-quality measurements in the long run. Moreover, there is a *need to strengthen their national capabilities* to more adequately assess their own situation in terms of vulnerability due to climate change, including health risks (e.g. decreasing air quality), glacier changes affecting natural hazards, and the water cycle. These needs provide the starting point of *CATCOS* (Capacity Building and Twinning for Climate Observing Systems), which aims at *better decision-making to mitigate and adapt to climate change based on sound information and knowledge as a contribution to the reduction of global risks and poverty*.

During its first phase, CATCOS contributed to the filling of important data gaps and raised the awareness of the value of systematic climate monitoring in a multitude of countries. The network of national and international partners established during the first phase provided a solid basis for phase 2, allowing the continuation of the investment made through further support to the partners in targeted countries on their way to become independent, sustainable and reliable climate data providers. In the second phase of CATCOS, the scope was broadened to address needs on the regional to local level, as evidenced by two concrete activities related to ongoing SDC initiatives in Central Asia and South America. In this way, CATCOS responds to needs on different levels, from global (e.g. improving the network of Global Atmosphere Watch GAW stations) down to very local (e.g. enhanced knowledge on air pollution in Bolivia).

With the CATCOS project, Switzerland stays at the top flight of an alliance of like-minded actors: The lack of sound high-quality climate data for proper decision making has recently been acknowledged at

[7] GCOS is an internationally coordinated network of observing systems designed to meet evolving national and international requirements for climate observations.

the international level, as evidenced by many ongoing initiatives related to climate data, including the WMO-led *Global Framework for Climate Services GFCS*, the *GFCS for Adaptation and Disaster Risk Reduction in Africa* (funded by Norway), the *Data and Information Management for Adaptation to Climate Change* project (Germany), and the *Observing Programme Support for Pacific Island Countries and Territories* (US, UK).

Lastly, CATCOS corresponds to the overall strategy of WMO, aiming at improving the quality of climate data at different levels through several initiatives including GCOS. It also represents an important Swiss contribution to the observation pillar of the emerging GFCS.

3. Scope and focus of the evaluation

The external evaluation of Project CATCOS (2011-2016) is expected to be conducted between November 2015 and January 2016. The following issues are to be considered:

1. Conduct the **Project Evaluation**, applying the five evaluation criteria proposed by the OECD-DAC (www.oecd.org), adapted to the context of CATCOS, responding (at least) to the following points:

1.1 Relevance
- 1.1.1 Relevance of the project objectives: How consistent are the achieved effects with the needs of the beneficiaries and the requirements at (a) the global-regional level (b) the national-local level? To what extent are the objectives of the project still valid?
- 1.1.2 Are the activities and outputs of the project consistent with the overall goal and the attainment of its objectives?
- 1.1.3 Are the activities and outputs of the project consistent with the intended impacts and effects?

1.2 Effectiveness
- 1.2.1 To which extent have the objectives been achieved?
- 1.2.2 What were the major factors influencing the achievement or non-achievement of the objectives?
- 1.2.3 Effectiveness in the approach and strategy proposed by the project
- 1.2.4 Effectiveness in the reach at regional level with special focus on Latin America and Central Asia
- 1.2.5 Special review of proposed indicators (suitability, effectiveness, measurability)

1.3 Efficiency
- 1.3.1 Were activities cost-efficient?
- 1.3.2 Were objectives achieved on time?
- 1.3.3 Was the project implemented in the most efficient way compared to alternatives?

1.4 Qualitative and quantitative impact of the CATCOS project
- 1.4.1 Which positive, lasting effects and behavioural changes can be perceived?
- 1.4.2 What are the developed capacities of stakeholders in the target regions to address Climate Change (after the project)
- 1.4.3 What is the importance/relevance of climate services for decision makers (What real difference has the activity made to the beneficiaries?)
- 1.4.4 Is there an increased use of climate data and services (How many people use it? How?)
- 1.4.5 Are the climate services improved (quality and improvement of the type of services)

1.4.6 Feedback from users and the impact on public policy

1.5 Sustainability
- 1.5.1 Sustainability of the activities
- 1.5.2 Sustainability of effects or changes promoted
- 1.5.3 To what extent will the benefits of the project continue after donor funding ceased?
- 1.5.4 What were the major factors which influenced the achievement or non-achievement of sustainability of the project?

2. Formulate a **Concept Note (5-7 pages)** for a follow up programme on climate data and services for climate change adaptation with a particular focus on SDC target regions and contexts based on the evaluation and a SWOT analysis of the CATCOS project as well as a context analysis of the current international setup related to climate data and services. The concept note should including at least the following elements:
   1. *Background* including an analysis of the global context (policy agenda, key actors etc.) and *rationale* (why should SDC continue to work on strengthening climate data and services)
   2. Potential future strategic orientation and objectives (what could be the future focus, target regions/context, what are opportunities/gaps that could be filled by SDC and Swiss expertise)
   3. Potential link(s) to other relevant ongoing key activities related to climate serviceson different levels (e.g. GFCS, CREWS[8], …)
   4. indication on potential key partners and their role (e.g. MeteoSwiss, WMO, …)and duration of such a programme

The evaluation team will present the Evaluation Report of the CATCOS Project, and the Concept Note for a potential follow up project to CATCOS in a meeting between SDC and MeteoSwiss. Based on the Evaluation Report and the Concept Note, SDC will prepare a management response and start the design of a new climate services programme.

4. Methodology

The evaluation team will undertake the evaluation through the proposed following 3 main steps: 1) review of documentation (desk study); 2) interviews with stakeholders (mission to Latin America); and 3) follow-up interviews by phone/email and develop final products (home-based). The consultant will thereby triangulate information to to get answers from different sources/perspectives. Before the mission, the consultant will closely coordinate with responsible project manager at MeteoSwiss and the respective SDC programme manager to get necessary documents for home-based desk review and schedule mission appointments.

Review of Documents

1. Project Document (incl. monitoring and evaluation framework)
2. Annual financial and operational plans
3. Annual financial and operational reports
4. Relevant meetings minutes and workshop reports
5. Mission reports, publications (scientific articles, dossiers, factsheets, etc.)
6. Any other documents deemed necessary (to be specified between consultants, SDC and MeteoSwiss)

[8] CREWS: Climate Risk and Early Warning System, initiative driven by FR together with WMO, UNISDR and GFDRR.

Interviews to be conducted, including at least:

1. MeteoSwiss
2. SDC (Head office and SDC's cooperation offices in the target region)
3. WMO (GFCS, GCOS)
4. Partners in target regions
5. Beneficiaries in the target regions (level of beneficiaries to be specified by SDC and MeteoSwiss; e.g. local governments??)

5. Deliverables and documentation

1. Work Plan, taking the proposed timeline below as a reference
2. Evaluation Report of the CATCOS Project, as in ToR point 1 (max. 30 pages and annexes, including a DAC-abstract). Presentation and discussion of the report
3. Concept Note, as in ToR point 2
4. Infographs illustrating the main findings

6. Composition and Profile of the Evaluation Team

SDC proposes to have a three member evaluation team. The composition of the review team would include two international experts, and one representative of SDC's Climate Change and Environment Network (GPCC team or other). The evaluation team should combine the necessary expertise on climate science, data and services, climate change adaptation and sustainable development as well as on monitoring and evaluation/Review of donor funded projects. Independency (i.e. non-association with the project) of the three experts is a precondition for eligibility.

The first team member will be an acknowledged international expert on climate data and services with in-depth knowledge of the current global context related to climate data and services and with relevant and methodological competence in project monitoring and evaluation of donor funded projects. S/he should possess coordination, communication, writing and reporting skills of a very high order. Experts with experience in climate science/climate change adaptation or sustainable development will have an added advantage. S/he will be designated as the Team Leader. S/he will also be vested with the responsibility of submission of the inception/ draft and final reports.

The second team member will be an international expert on climate science, data and services with specific knowledge on both terrestrial and atmospheric ECVs. S/he is expected to have a sound scientific knowledge on climate science, data and services and the use/implementation thereof in activities at different levels.

The third member of the review team will be a member of SDC's CCE network who has not been associated with the project, but has strong experience in climate change and sustainable development projects. S/he will ensure the evaluation of the link between the scientific aspects of climate data and services and their implementation on a national-local level as well as of the benefit thereof. The inclusion of a network member is intended to enhance the capacities of the CCE network related to climate data and services and help to promote the importance of this topic within SDC.

It is important that the skills, expertise and experiences of the three members are highly complementary.

7. Budget and duration of the review

It is estimated that the total number of person-days required for the review could be 60 (25 days for the team leader, 5-15 days for the expert, 15days for CCE representative, and 10 days as reserve). This will include preparation, briefings, consultation, travel, field visits, workshops, debriefing, report writing, etc.

8. Proposed Timeline (tbc)

The evaluation will take place between November 2015 and end of March 2016 and is mandated by the Global Programme on Climate Change of SDC. It is suggested to follow the proposed timeline below. Field visits, interviews, and meetings in the target region and Switzerland will be arranged with the heads of each entity after prior coordination with SDC and MeteoSwiss in Switzerland.

15.11.2015	Kick off
20.11.2015	Internal assessment team meeting (SDC, MeteoSwiss, discussion of work plan)
23.11.-27.1.	Evaluation
til 22.1.16	Report and Concept Note finalised
39.1.2016	Meeting with SDC and MeteoSwiss in Switzerland: Presentation of, and Agreement on, the Evaluation Report, the Concept Note

ANNEX 2. LOGICAL FRAMEWORK FOR CATCOS II

Hierarchy of objectives Strategy of Intervention	Key Indicators	Data Sources Means of Verification	
Impact (Overall Goal)	**Impact Indicators**	**Impact Verification**	
Better decision-making to mitigate and adapt to climate change based on sound information and knowledge as a contribution to the reduction of global risks and poverty	***Indicator:*** Number of National Communications under UNFCCC of international partner countries with a separate chapter on systematic climate monitoring	Check National Communications at the UNFCCC website	
Outcomes	**Outcome Indicators**	**Sources & Means of Verification**	**Assumptions**
Outcome 1: High-quality data of atmospheric (aerosols, greenhouse gases) and terrestrial (glaciers) climate variables, measured according to international standards, are sustainably available in the target countries and at the designated International Data Centers	***Indicator:*** Number of quality-controlled, complete (i.e. 70% of annual data) data sets available at the designated International Data Centers at the end of a calendar year ***Baseline (Q1 2014):*** *6* ***Target (Q3 2016):*** *9* ***Indicator:*** Number of scientific peer-reviewed publications (based on high-quality data) as first author by representative of target country (i.e. accepted) ***Baseline (Q1 2014):*** *0* ***Target (Q3 2016):*** *2*	Check data availability at the data bases of the International Data Centers World Data Centre for Aerosols (WDCA), World Data Centre for Greenhouse Gases (WDCGG), and World Glacier Monitoring Service (WGMS) Count peer-reviewed scientific publications (based on high-quality data) with first author by representative of target country	Infrastructure and adequate personnel are allocated by the organization for operation, maintenance, and data handling Continued open and fair-use data policy permitting unrestricted use of final data

Outcome 2: Relevant data providers, users and decision-makers in the region are linked in a sustainable manner (both atmospheric and terrestrial domain)	***Indicator:*** Number of national institutions (from host country Kyrgyzstan / Kenya / Colombia) attending the GCOS Regional Workshops ***Baseline (Q1 2014):*** *Number of Participants at former GCOS Regional Workshop* ***Target (Q3 2016):*** *+20% Participants (vs. Baseline)*	List of participants of GCOS Regional Workshops	Regional partners are willing to cooperate in meetings to improve the regional coordination of climate monitoring
Outcome 3: Decision-makers and stakeholders are aware of the use and benefits of high-quality climate data	***Indicator:*** Number of political statements made by international partners about the impact of the project on national climate policies ***Baseline (Q1 2014):*** *1* ***Target (Q3 2016):*** *10*	Review press releases, political documents and speeches	Stakeholders show interest in climate relevant data Partners are motivated in co-organizing the country visits and allocate sufficient resources (time, human and financial) Partners cooperate in the production of outreach material and in the promotion of the project Data are available and of adequate quality, data chain is working

Outputs (per outcome) and costs	Output Indicators	Output Verification	Output Assumptions & Risks
For outcome 1: High Quality Data Capacity			
Output 1: Infrastructure for climate monitoring AD (greenhouse gases, aerosols) and TD (glaciers) functioning according to international standards INFRASTRUCTURE	***Indicator:*** Number of countries with climate monitoring AD (greenhouse gases, aerosols) and/or TD (glaciers) by the end of project ***Baseline (Q1 2014):*** *3 AD, 3 TD, 0 Dual* ***Target (Q3 2016):*** *3 AD, 3 TD, 2 Dual* ***Indicator:*** Number of on-site interventions until the end of project ***Baseline (Q1 2014):*** *0* ***Target (Q3 2016):*** *6* ***Indicator:*** Number of station audits until the end of project ***Baseline (Q1 2014):*** *0* ***Target (Q3 2016):*** *6*	Review annual Operational Reports Station audits	Instrumentation is operated and maintained according to international guidelines Necessary consumables are held in stock and are available at all times
Output 2: Local Operators and Scientists trained technically and scientifically, as basis for successful long-term operation of the measurements TRAINING	***Indicator:*** Training level of chief local operator/ scientist from the target countries for quality analysis of data, after obtaining aerosol science training at Swiss implementing partner ***Baseline (Q1 2014):*** *knowledge not adequate for station operation* ***Target (Q3 2016):*** *knowledge trained and adequate for station operation* ***Indicator:*** Number of participants per CATCOS country (Bolivia, Chile, Colombia, Ecuador, and Peru) to regional Summer School in South America (glaciers). ***Baseline (Q1 2014):*** *1-2* ***Target (Q3 2016):*** *2-3 (i.e. +1 participant per country vs. baseline)*	Test of the training level at the end of training, as basis for final certificate	Qualified participants of international partners are identified Agreed quality assurance procedures are given adequate attention

Output 2: Local Operators and Scientists trained technically and scientifically, as basis for successful long-term operation of the measurements TRAINING	***Indicator:*** Number of participants per CATCOS country (Kyrgyzstan, Uzbekistan) to regional Summer School in Central Asia (glaciers) (i.e. average participants per CATCOS country). ***Baseline (Q1 2014): 0-2*** ***Target (Q3 2016): 2-3 (i.e. minimum +1 participant per country vs. baseline)*** ***Indicator:*** Number of scientific publications as first author by representative of international partners submitted to a peer-reviewed journal ***Baseline (Q1 2014): 0*** ***Target (Q3 2016): 2***	Evaluation after regional Summer School in Central Asia	
			Costs of outputs for outcome 1: 1'648 kCHF
For outcome 2: Cooperation Capacity			
Output 3: Relevant data providers, users and decision-makers in the region identified and collaboration established WORKSHOPS	***Indicator:*** Number of participants at GCOS Regional Workshops ***Baseline (Q1 2014): 0*** ***Target (Q3 2016): >30 per workshop*** Africa (WMO RA I), South America (WMO RA III) ***Indicator:*** Number of recommendations from the GFCS Observation Workshop in Central Asia on the use of climate data for the 3 user sectors water, DRR and health ***Baseline (Q1 2014):*** *0* ***Target (Q3 2016):*** *5 recommendations per user sector (water, DRR, health), total 15 recommendations*	Review participants list Review GFCS Observation Workshop report	Partners are interested in organizing the workshops Stakeholders show interest in the workshops and in its results Operators and Scientists participate actively in sessions
			Costs of outputs for outcome 2: 470 kCHF

For outcome 3: User Capacity			
Output 4: User interface platform established USER INTERFACE	***Indicator:*** *Number of feedback reports from regional partner countries (i.e. minimum one feedback report per partner country expected) after release of beta version* ***Baseline (Q1 2014): 0*** ***Target (Q3 2016): 2 CA, 5 SA*** Countries CA: Kyrgyzstan, Uzbekistan; SA: Ecuador, Colombia, Peru, Bolivia, Chile ***Indicator:*** *Number of downloads per partner country* ***Baseline (Q1 2014): 0*** ***Target (Q3 2016): 100/ per partner country*** Countries CA: Kyrgyzstan, Uzbekistan; SA: Ecuador, Colombia, Peru, Bolivia, Chile	Evaluation after release of beta version Evaluation one year after release of version 1.0 (for each partner country)	Pilot mobile application (GlacierApp) is useful for bringing the monitoring of glacier changes to the attention of beta users in the target countries Pilot mobile application (GlacierApp) is useful for bringing the monitoring of glacier changes to the attention of a wider public
Output 5: Project successfully presented at different relevant opportunities OUTREACH	***Indicator:*** Number of presentations at scientific and political meetings until the end of the project ***Baseline (Q1 2014): 0*** ***Target (Q3 2016): 10*** ***Indicator:*** Number of media articles in the target countries until the end of the project ***Baseline (Q1 2014): 0*** ***Target (Q3 2016): 10***	Reviews Annual Operational Reports	Regional scientific and political authorities support and participate in respective implementations or workshops
			Costs of outputs for outcome 3: 472 kCHF

Activities (per output)	Inputs (means, resources)	Input Assumptions
For Output 1		
A.1.1. Kenya (AD) Installation of aerosol measurements and initial training of the operators	***Equipment:*** • Nephelometer, aethalometer, peripherals (transfer from CATCOS Phase 1 –value 140kCHF-) ***Personnel:*** • 2 Scientists from PSI in Kenya • Station operators from the Kenyan Meteorological Department (KMD)	Infrastructure (building, power, internet access and transportation) and adequate personnel are dedicated by the partner responsible for operation and maintenance
A.1.2. Kyrgyzstan (AD) Installation of greenhouse gas measurement instruments and initial training of the operators	***Equipment:*** • Empa: Cavity ring down spectrometer (CO2, CH4, CO, H2O analyzer) inclusive data acquisition, calibration unit, UV spectrometer (ozone analyzer), reference gases, regulators, periphery ***Personnel:*** • 2 Scientists from Empa in Kyrgyzstan • Stations operators from Kyrgyz Hydromet	Customs of partner countries allow the import of instruments for climate monitoring
A.1.3. Uzbekistan (TD) Installation of in-situ glacier measurement instruments and initial training of the operators	***Equipment:*** • Material for in-situ measurements ***Personnel:*** • 3 Scientists from UFR in Uzbekistan • Local operators from the Center of Hydrometeorological Service (UZHydromet)	
A.1.4. On-site and remote maintenance (AD and TD) International partners are constantly supported by Swiss partners	***Equipment:*** NA ***Personnel:*** • 1 Scientist and 1 Technician from PSI for Audits Chile, Indonesia, Vietnam, Kenya • 1 Scientist from Empa for Audits Kyrgyzstan, Chile, Vietnam • 2 Scientists from UFR in Kyrgyzstan • 1 Scientist from UZH • Station operators from target countries	

For Output 2		
A.2.1. Data Monitoring at International Data Centres to ensure the data chain	***Equipment:*** NA ***Personnel:*** • Scientist MeteoSwiss • Scientist from PSI, Empa, UFR, and UZH	Open and fair-use data policy
A.2.2. Train the Trainers AD (through chief local operator/ scientist exchange)	***Equipment:*** NA ***Personnel:*** • 2 Scientists each from Empa and PSI • Chief local operator/ scientists from partner countries	Interest of scientists from partner institutions to increase their own knowledge Institutions support scientists' stay abroad
A.2.3. Summer School in Bolivia (for South America) and in Kyrgyzstan (for Central Asia) on Glacier Mass Balance Measurements and Analysis (TD)	***Equipment:*** NA ***Personnel:*** • 1 Scientist from UFR in Kyrgyzstan • 1 Scientist from UZH in Bolivia • Glaciologists from IGEMA (Bolivia) • Glaciologists from CAIAG (Kyrgyzstan)	Partner institutions are interested in scientific training
A.2.4. Analysis and Publication (AD and TD)	***Equipment:*** • Software ***Personnel:*** • 1-2 Scientists each from PSI, Empa, UZH and UFR • PhD students from partner countries	PhD students are interested to publish analysed data in scientific journals Data are available for analysis
A2.5. Organize a training course for operators of urban/suburban air quality monitoring stations in Bolivia in coordination with Swisscontact and the "Aire Limpio" project	***Equipment:*** NA ***Personnel:*** • 2 Scientists from Empa in Bolivia • 1 Scientist from MeteoSwiss • Station operators of the air quality monitoring network Red MoniCA already built in the Aire Limpio project	Municipalities of La Paz, El Alto, Cochabamba and Santa Cruz de la Sierra rely on an effective air quality observation network in order to comply with laws in force

For Output 3		
A.3.1. Organization of a Regional GCOS Workshop in Africa	***Equipment:*** NA ***Personnel:*** • 1 Scientist from MeteoSwiss in Africa • 1 Scientist from PSI or Empa in Africa • Representatives from partner institutions in the region • GCOS Secretariat	Partners support the organization of the workshops (provision of space, infrastructure such as beamer etc.) The GCOS Secretariat supports (presence, promotion of the workshop etc.) the organization of the workshops Representatives from local partner institutions are allowed to travel
A.3.2. Organization of a Regional GCOS Workshop in South America	***Equipment:*** NA ***Personnel:*** • 1 Scientist from MeteoSwiss in South America • 1 Scientist from PSI or Empa in South America • 1 Scientist from UZH in South America • Representatives from partner institutions in the region • GCOS Secretariat	
A.3.3. Organize a GFCS Observation Workshop in Central Asia	***Equipment:*** NA ***Personnel:*** • 2 Scientists from MeteoSwiss • 1 Scientist from UFR • 1 Scientist from UZH • WMO representative • Representatives from partner institutions in the region	Partners support the organization of the workshops (provision of space, infrastructure such as beamer etc.) Representatives from local partner institutions are allowed to travel
For Output 4		
A.4.1. Elaboration of a Metadata User Service (Glaciers)	***Equipment:*** NA ***Personnel:*** • 1 Scientist from UZH • 2 Scientists from MeteoSwiss	Users are interested in a pilot mobile application of WGMS glacier metadata
For Output 5		
A.5.1. Elaboration of Print Material (webpage, factsheets, poster)	***Equipment:*** NA ***Personnel:*** • Scientist from MeteoSwiss, with input from Swiss and International project partners	Partners contribute content for outreach material

A.5.2. Communication and Presentation of project achievements to various stakeholders	*Equipment:* NA *Personnel:* • Project Owner, Project Coordinator, or Senior Scientists from MeteoSwiss	Stakeholders are interested in receiving information and participate in events
A.5.3. Country Visits Political platform for actors mapping and establishing supportive network	*Equipment:* NA *Personnel:* • Head of International Affairs Division (or Alternate), MeteoSwiss • 1 (Senior) Scientist from MeteoSwiss • PI from PSI in Kenya • PI from Empa in Vietnam, Kyrgyzstan/Uzbekistan, Indonesia • PI from UZH in Bolivia/ Ecuador/Peru • WMO Representative	International partners are motivated in co-organizing the country visits and invest sufficient time and human resources

ANNEX 3. EVALUATION WORKPLAN (PROVISIONAL)

Key Actions/ Activities	Week																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	9.11.15	16.11.15	23.11.15	30.12.15	7.12.15	14.12.15	21.12.15	28.12.15	4.1.16	11.1.16	18.1.16	25.1.16	1.2.16	8.2.16	15.2.16	22.2.16	29.2.16
Desk Study Consultation of background documents Seeking Additional documents from SDC Within team: Discussions on adequacy of background material for the tasks in hand																	
Evolving of Draft Work Plan/ Activity Plan with timelines																	
Consultations with SDC on the Draft Work Plan																	
Finalisation of the Draft Work Plan after integrating feedback from SDC																	
Within the team -Agree on the strategies and approaches of Evaluation -Agree on the Draft Evaluation Questions / sub questions based on OECD criteria of Impact, Relevance, Effectiveness, Efficiency and Sustainability -Cross cutting issues (eg. Poverty, Gender, Environment) - Preliminary Hypotheses -Methods/ Indicators, data required, sources, survey methods -Preliminary proposal on the list of institutions to be contacted for data and information -Agree on broad roles and responsibilities of the Team Members and mechanisms for coordination -Agree on the broad tasks and activities of team members																	

Development of draft questionnaire / interview schedule for the Swiss partners and international partners Fine tuning methodology for collection of data and information																	
Agree with SDC / Meteo Swiss / Swiss partners on the organisations to be contacted for information to be obtained through interview/ email / face to face interactions																	
Preliminary interactions with SDC • With the section implementing the project • With other sections dealing with the Global Programme on Climate Change																	
Preliminary round of interactions with the Swiss organisations (skype, phone) in Europe MeteoSwiss including GCOS PSI, EMPA, Univ Zurich, Univ Friburg, WDC – Aerosols, WDC – GHG, WGMS WMO, and others																	
Skype. Phone interviews/ interactions with the international partners and others in Chile, Ecuador, Colombia, Bolivia, Vietnam, Indonesia, Kenya, Peru, Kyrgyzstan, Uzbekistan?																	
First round of completion of data and information collection and preliminary analysis																	
Visit to the field implementation countries for stakeholder engagement and discussions Colombia and Chile (covered by Clara?)																	

Bolivia, Ecuador and Indonesia (covered by Vish?)																		
Second round of analysis of available data and new information																		
Second and Substantial round of interactions with the Swiss partners (phone, skype, face to face)																		
Within the team First draft of the Evaluation Report + Broad elements of the Concept Note																		
Discussions with SDC on the first draft of the evaluation report + Concept Note with strategic inputs for designing Climate Services programme for CCA																		
Integration of feedback from SDC																		
Final Debriefing of the Evaluation Team with SDC and other partners																		
Final submission of the Evaluation Report + Concept Note to SDC after integrating the feedback from SDC and the others																		

ANNEX 4. LIST OF KEY INFORMANTS

Country	Name	Position / Organisation	Remarks
BOLIVIA	Markus Andrade	LFA UMSA	Skype
	Sara Pauli	Swisscontact	Skype
CHILE	Frank Schurch	Chief of Mission, Embassy of Switzerland, Santiago	Telephone conference
	Guillermo Navarro	DMC Chile	Skype
	Enrique Garrido	DMC Chile	Skype
	Gabriela Daza Benavides	DMC Chile	Skype
COLOMBIA	Maria Saralux Valbuena Lopez	IDEAM	Face to face and skype
	Jorge Luis Ceballos Lievano	IDEAM	Face to face and skype
	Diana Quimbay	IDEAM	Face to face and skype
	Martin Jaggi	SDC Bogota	Face to face
	Daiana Rojas	SDC Bagota	Face to face
ECUADOR	Pascal Decosterd	Swiss Ambassador in Ecuador	Telephone
	Carlos Naranjo Jacome	INAMHI	Skype
	Anibal G Vaca	INAMHI	Skype
	Luis Maisincho	INAMHI	Skype
FRANCE	Antoine Rabatel	LGGE CNRS University of Grenoble	Skype and Face to face
INDONESIA	Edison Kurniawan	BKMG, Agency for Meteorology, Climatology and Geophysics	Skype
	Dodo Gunawan	BKMG, Same as above	Skype
	Widada Sulistya	BKMG	Skype
KENYA	Constance Okuku	Kenya Met Deptt (on training at PSI)	Skype
KYRGIZSTAN	Bakyt Makhmutov	SDC Regional Cooperation, Bishkek	Email/ skype
	Danielle Meuwly	Dy Head of Mission, Embassy of Switzerland	Face to face
	Bermet Ergeshbaeva	Embassy of Switzerland, Bishkek	
	Bolot Moldobekov	CAIAG	Face to face and skype

	Alexandir Mandychev	CAIAG	Same as above
	Ryskul Usubaliev	CAIAG	Same as above
	Jarkynai Usubalieva	CAIAG	Same as above
	Asankhodzhaev Ryskeldi	Kyrghyz Hydromet	Face to face and Skype
	Nyashenbaeva Liudmila	Kyrghyz Hydromet	Face to face and skype
	Sabira Tiuliundieva	Kyrghyz Hydromet	Face to face and skype
	Kajevnikova Tatina	Kyrghyz Hydromet	Face to face and skype
	Ekaterina	Kyrgyz Deptt of Water Resources, Ministry of Agriculture	Face to face
	Bekkulova Dzhyparkul	Kyrgyz Dy Head State Agency for Environmental Protection and Forestry	Face to face
PERU	John-Gabriel Duss	GPCC SDC Peru	Face to face and phone conference
	Jocelyn Ostolaza	GPCC SDC Peru	Face to face
	Gabriela Rosas	SENAMHI-Climandes	Face to face
	Karen Price	Proyecto Glaciares-CARE Peru	Face to face
	Fernando Chiock	National Water Authority – Peru	Face to face
	Jose Silva	SENAMHI	Face to face
	Teresa Garcia	SENAMHI – Climandes	Face to face
	Wilson Suarez	SENAMHI	Face to face
	Oswaldo Nique	SENAMHI	Face to face
SWITZERLAND	Andre Wehrli	GPCC SDC Head Office	Face to face
	Yuka Greiler	GPCC SDC Head office	Telephone
	Sergio Perez	SDC Regional Cooperation Latin America	Skype/ Phone
	Thomas Walder	SDC Head Office (Water-Central Asia)	Telephone
	Yves Guinand	SDC Head Office (Southern Africa Division)	Email
	Thierry Umbehr	Sr Water Advisor, SDC Uzbekistan	Telephone
	Bettina Durrer	MeteoSwiss	Face to face and skype
	Michelle Stalder	MeteoSwiss	Face to face and skype

	Fabio Fontana	MeteoSwiss	Face to face and skype
	Urs Baltensperger	PSI	Face to face
	Nicolas Bukowiecki	PSI	Face to face
	Martin Heolzle	University of Fribourg	Face to face
	Martina Barandun	University of Fribourg	Face to face
	Marlene Kronenberg	University of Fribourg	Face to face
	Thomas Saks	University of Fribourg	Face to face
	Michael Zemp	University of Zurich	Face to face
	Nico Moelg	University of Zurich	Face to face
	Martin Steinbacher	EMPA	Face to face and tele conference
	Brigitte Buchmann	EMPA	Face to face and tele conference
	Julien Anet	EMPA	Face to face and tele conference
	Mary Power	WMO	Face to face
	Oksana Tarasova	WMO	Face to face
UZBEKISTAN	Max Petrov	Uzbek Hydromet	Despite repeated attempts, could not contact
VIETNAM	My Lan Hoang	Sr Prog Office, Swiss Cooperation Office	Face to face and skype + Workshop
	Dinh Thai Hung	NHMS Science and Tech International Cooperation	Same as above
	Hui Hoa Thanh	NHMS	Same as above
	Nguyen Nhat Anh	NHMS	Same as above
	Duong Van Kanh	Hydromet and Environmental Station Network	Same as above
	Bui Hoi Thanh	Hymenet	Same as above
	Tran Thi Thanh Hai	Hymenet, Environmental Division	Same as above
	Tong Thi Thanh Ha	Hymenet environmental Division	Same as above
	Hoang Trang Thang	Expert Hymenet	Workshop
	Trang Quang Tien	National Centre for Hydromet Forecasting	Workshop
	Vee Duc Long	Met Department	Workshop
	Nguyen Dang Quang	Hydrological Department	Workshop
	Than Van Don	National Centre for Water Resources	Workshop

		Planning and Investigation IC	
	Nguyen Minh Truong	University of Natural Sciences, Head of Met and CC Department	Workshop
	Ngyyen A Hang	Official	Workshop
	Tong Thanh Ha	Official	Workshop
	Nguyen Quang	Official	Workshop
	Pham Thi Ngen	Official	Workshop
	Han Thi Nhan	Official	Workshop
	Tran Thi Hang	Official	Workshop
	Tinh Van Duang	Agri Met Centre	Workshop
	Le Trag Aglia	Agri Met Centre	Workshop
OTHERS	Markus Fiebig	NILU World Data Centre for Aerosols	Skype

KR VISWANATHAN

KR Viswanathan (Vish) works with the Practical Action group UK as International Climate Change Specialist. He has over 30 years of professional experience in development, covering a wide range of themes/ sectors; of which, thirteen years of engagement is in climate change adaptation, climate resilient agriculture, disaster risk reduction, climate services, natural resources management and green growth. For several years, he had been working in senior management/ operational positions in Government, both Government of India and SDC (Swiss Ministry of Foreign Affairs). He has experiences in conceptualisation, planning, steering and leading strategy country frameworks and portfolio of programmes in the area of climate change adaptation and climate resilient development. Vish has over three decades of experience in the field of (climate resilient) agriculture. He comes with good mix of administrative, conceptual, technical, management and financial skills and expertise. He has been a strategic thinker and continuous learner with long experiences in facilitating collaborative teams and cross-cultural networks. He has outstanding track record of performance at senior levels in diverse capacities, as a leader, technical expert, manager, and administrator and as a learner. In the recent past, he has been associated closely with the design, planning and execution of several key evaluation processes, notably the ones related to SDC's engagement in Development Sector in India (Richard Gerster), evaluation of collaboration on climate adaptation with WOTR-NABARD in Semi-Arid Areas, Impact evaluation of selected Swiss Supported Projects in India etc. He possesses the ability to work in multi-cultural teams, learn and deliver in challenging and complex set-ups. He was conferred with the coveted Vishist Seva Medal (VSM) by the President of India in 1985 for the exemplary services rendered while in the Armed Forces as Captain/Major.

PAOLO LAJ

Paolo Laj is a senior physicist with a PhD in Atmospheric Sciences. He currently works at Laboratory of Glaciology and Geophysics of the Environment (LGGE) in Grenoble. His research deals with variability of atmospheric composition and its impact on climate. . He has since 1990 more than 120 publications, in the field of atmospheric aerosols processes and variability, clouds physics and chemistry, precipitation chemistry, glaciochemistry (H factor of 35). As a former director of LGGE, he is also aware of challenges and research needs in the field of glaciology. He has been involved in many EU programs since FP4 and he is currently scientific co-coordinator the ENVRIplus cluster (H2020, 2015-2019) and IA-ACTRIS-2 (H2020-2015-2019). He served as thesis advisor for 10 PhD students since 2003, after he got his habilitation. These activities are paralleled with national responsibilities to coordinate projects for aerosol research and the construction of the national program for aerosol Aerosol, trace gases and cloud observations (ACTRIS-FR). He serves in the french scientific committee for Ocean and Atmosphere. Since 2015, he is co-directing a research consortium on the Environment in Rhône-Alpes region. Paolo Laj also has different responsibilities in international instances: member of the Scientific Committee of the initiative called "Sixth Global Environment Outlook", chairman of the SAG commission Global Atmosphere Watch OMM from 2015. He is also chief editor of "Atmospheric Measurement Technique. Finally he served as a scientific expert for research evaluation in several European countries (France, Italy, UK, USA,..).

CLARA ARIZA

Clara Ariza is a biologist specialized in climate change and desertification. In the past fifteen years, Clara has worked in climate change adaptation and disaster risk reduction research and development projects worldwide, always searching for the simplest and most effective strategies to improve local livelihood resilience to environmental change. Clara works as an independent consultant, however in the past years she has chaired global initiatives such as the Partnership for Environment and Disaster

Risk Reduction (PEDRR), has participated in technical cooperation programs on climate change for the World Bank, the Inter- American Development Bank and UNITAR, has coordinated international sustainable development initiatives linked to climate change in mountain regions for SDC, has worked on environmental vulnerability assessments and resilience-building projects for IOM (Darfur, Sudan) and for local communities in Madagascar. Clara has led knowledge-management projects on climate change and socioeconomic issues for IFAD, has participated in multiple research projects on biodiversity, climate change, drought and desertification and is author of over 15 publications, including peer reviewed articles, book chapters and review reports.